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October 28, 2025

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2520 West Iles Avenue
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Re: Duck Creek Power Plant
Log No. 2021-500; 2021-501; 2021-502
Bureau ID #W1798010001-01-02;-03;-04
Permit to Operate a Coal Combustion Residual Impoundment Review Letter Response

Mr. Rhoades:

Illinois Power Resources Generating, LLC (IPRG) received the Duck Creek Power Plant CCR Surface Impoundment Operating and Construction Permit Application Review Letter dated October 11, 2023. At this time, we submit the below responses to Illinois Environmental Protection Agency's (IEPA's) initial comments.

Several of the comments included below have been preliminarily discussed in a meeting between Illinois Power Resources Generating (IPRG), IEPA, and Ramboll Americas Engineering Solutions, Inc. (Ramboll) in a meeting on January 16, 2025, and a follow-up meeting between IPRG and IEPA on February 19, 2025. The responses provided below include details from those discussions where relevant.

Safety and Health Plan (35 IAC 845.540)

Comment 1: *The Safety and Health Plan addresses the training and safety requirements for contractors, it does not specifically address the training requirements for employees.*

The Safety and Health Plan indicates that contractors will have a pre-mobilization meeting and a site safety orientation. The Plan does not address the requirement for an annual review of the initial training in accordance with 35 Illinois Administrative Code (IAC) 845.530(e).

Response: The Safety and Health Plan submitted as Attachment S to the Duck Creek Power GMF Pond and Bottom Ash Pond Operating Permit Applications explicitly applies

to employees and further outlines safety and training requirements applicable to employees. See Duck Creek Power Plant Bottom Ash Basin Operating Permit Application, Attachment S at 4 (35 I.A.C. § 845 Safety and Health Plan Duck Creek Power Plant GMF Pond and Bottom Ash Basin).

The 2024 annual update to the Safety and Health Plan dated December 31, 2024, posted to the public website, includes reference to the requirement for annual review of the plan in Section 3.3 Safety and Health Plan Review.

Previous Investigations [35 IAC 845.210(d)(l)] and Hydrogeologic Site Characterization [35 IAC 845.620]

Comment 2: *Section 1.4 and Attachment H: The Hydrogeologic Site Assessment does not include the following:*

- *Discussion of Duck Creek Cooling Lake surface water elevations to include how surface elevations are controlled by the dam during precipitation events, events or explanation of what situations would initiate a rise above 565-feet amsl or decrease below 562.5-feet amsl in the lake surface water elevation, how long unexpected rises or decreases could last, and how the rise or decrease could impact AP1 and AP2.*

Response: Groundwater migrates toward the Duck Creek Cooling Lake (Pond) from Ash Pond No. 1 and No. 2 and changes in water elevation within the Duck Creek Cooling Pond would either increase (if water levels are low) or decrease (if water levels are high) the hydraulic gradient. It is expected that precipitation events that are temporally limited would not have a significant effect on groundwater beneath Ash Pond No. 1 and No. 2. In accordance with the Compliance Commitment Agreement dated December 28, 2022 (IEPA, 2022), IPRG has collected 8 quarters of groundwater monitoring data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. Based on an evaluation of the base of CCR the lowest elevations of CCR in Ash Pond No. 1 and No. 2 are well above the highest surface water elevations in the Duck Creek Cooling Pond referenced in the comment.

Comment 3: *General Comment: Dynegy must develop and submit a groundwater monitoring program that is compliant with 35 Ill. Admin. Code 845.630, 845.640, 845.650, 845.660, 845.670 and 845.680 for review and approval by the Agency.*

Response: IPRG's submitted groundwater monitoring program is compliant with Sections 845.630, 845.640, 845.650, 845.660, 845.670 and 845.680, as applicable. To the extent IEPA has noted specific alleged deficiencies in the initial review letters, IPRG has responded.

In addition, IPRG received and reviewed IEPA's December 28, 2023 letter regarding additional comments on statistical methods proposed in the initial operating permit applications. IPRG and IEPA met on May 2, 2024 to discuss the comments in this initial review letter and in the December 28, 2023 letter. A written response to the December 28, 2023 letter is included in **Attachment A**.

Unstable Areas [35 IAC 845.340(b) and 35 845.210(d)(2)]

Comment 4: *General Comment: Duck Creek Ash Pond 1 and Ash Pond 2 were constructed over a previous surface mined area. The surface mining was conducted prior to 1927 and extended until at least 1976 or 1984. The permit application does not address these potential unstable areas in accordance with 35 Ill. Admin. Code 845.340(b) and 35 Ill. Admin. Code 845.210(d)(2). The nature of the filling of the former strip mine is also not delineated. However, the former power plant is constructed outside of the formerly strip-mined areas indicating a potential for unstable conditions that would not support the plant. Dynegy must provide geotechnical data and geologic data collected from around AP1 and AP2 to show that the AP1 and AP2 load will not settle over time into the larger strip-mined area at Duck Creek.*

Response: IPRG has completed a significant geotechnical and geological data collection and geotechnical assessment of the mine spoil foundations for Ash Pond No. 1 and Ash Pond No. 2. The assessment was submitted to and subsequently approved by IEPA in 2016 (**Attachment B**). The geotechnical assessment demonstrated that the strength and consistency of the mine spoils beneath Ash Pond No. 1 and Ash Pond No. 2 indicate settlement is unlikely, and that the stability of the Ash Pond No. 1 and Ash Pond No. 2 embankments and foundations exceed the minimum 35 IAC 845.460(a)(1) criteria.

Geotechnical and geologic data collected to support the geotechnical assessment is provided within the "Supplemental Technical Documents Report" (**Attachment C**). The geotechnical assessment included post-closure settlement analyses and slope stability analyses. Both analyses considered the presence of mine spoils, and engineering parameters were assigned based on available site data. Slope stability analyses for static and seismic conditions calculated safety factors of 2.0 and 1.1, both of which are higher than the minimum acceptable values of 1.50 and 1.10 required by 35 IAC 845.460(a)(1) and (3).

Weekly inspections completed by IPRG and annual inspections completed by a qualified professional engineer have not identified any settlement-related issues in the 5 years since closure has been completed or since the construction of the impoundment in 1976. If settlement is observed, corrective measures will be implemented to ensure the continued integrity of the impoundment.

Initial Operating Permit Requirements [35 IAC 845.230(d)(3)]

Comment 5: *General Comment Dynegy must provide the following documents for the Agency to complete the review of the permit application:*

- *Emergency Action Plan (35 IAC 845.230(d)(3)(D)]*

Response: IPRG has provided as **Attachment D** a written Emergency Action Plan for the Ash Pond No. 1 and No. 2 and Gypsum Management Facility Pond containing the information specified in 35 Ill. Admin. Code § 845.520.

Comment 6: *General Comment: Dynegy must provide the following documents for the Agency to complete the review of the permit application:*

- *Groundwater Monitoring information did not include full Hydrogeologic Assessment Report and Addenda that comply with 35 IAC 845.230(d)(3)(E)(i) and 35 IAC 845.620. See next comments for further details.*

Response: IPRG responds to specific deficiencies alleged by the Agency in the following comments. Additional groundwater monitoring information can also be found in the 35 I.A.C. § 845 Hydrogeologic Characterization Report provided in the Operating Permit Modification submitted to IEPA on July 3, 2025.

Comment 7: *General Comment: Dynegy must provide the following documents for the Agency to complete the review of the permit application:*

- *Preliminary written closure plan; Dynegy references a Closure Plan but does not provide it in permit application [35 IAC 845.230(d)(2)(J) and 35 IAC 845.720(a)]*

Response: The Bottom Ash Pond, GMF Pond, and GMF Recycle Pond are required to close under 35 Ill. Admin. Code § 845.700. Therefore, a preliminary closure plan is not required for these units. Section 845.720(a)(1) requires a preliminary written closure plan only for those units "***not required to close under Section 845.700***." 35 Ill. Admin. Code § 845.720(a)(1) (emphasis added). Ash Pond No. 1 and No. 2 are closed units, and have received written approval on the previously submitted closure plan dated November 23, 2016.

Groundwater Monitoring Information [35 IAC 845.230(d)(3)(E); 35 IAC 845.600; 35 IAC 845.620; 35 IAC 845.630; 35 IAC 845.640; 35 IAC 845.650; 35 IAC 845.660; 35 IAC 845.670; 35 IAC 845.680]

Comment 8: *Section 1.4 and 2.5, Attachment H and Attachment I: Dynegy must provide the following documents for inclusion in the permit application documents:*

USEPA Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples, EQASOP-GW4, Revised September 19, 2017. Must be used to comply with 35 IAC 845.640(a) instead of other sampling protocol that may be out of date. [35 IAC 845.640(a)]

Response: 35 I.A.C. § 845 does not require the use of USEPA Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples, EQASOP-GW4, Revised September 19, 2017 to comply with Section 845.620(a). Nonetheless,

IPRG used generally accepted practices in the industry that are consistent with the referenced USEPA guidance and satisfies all requirements of Section 845.620(a).

Comment 9: *Section 1.4 and 2.5, Attachment H and Attachment I: Dynegy must provide the following documents for inclusion in the permit application documents:*

- *Groundwater analytical results for total metals for constituents listed in 35 IAC 845.600 to establish background for Agency review and approval. [35 IAC 845.600; 35 IAC 845.640(b), (d), and (e); 35 IAC 845.650(a)]*

Response: In accordance with the Compliance Commitment Agreement (CCA) (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. The requested information has been provided in the Annual Groundwater Monitoring and Corrective Action Report and the 35 I.A.C. § 845 Hydrogeologic Characterization Report in the Permit Modification dated July 3, 2025.

Groundwater monitoring for constituents listed in 35 IAC 845.600 was initiated in the 1st Quarter of 2023 in accordance with the Compliance Commitment Agreement dated December 28, 2022. A total of eight rounds of samples have been collected and were analyzed to establish background for inclusion in the proposed Groundwater Monitoring Plan in accordance with CCA section 5 (e).

Comment 10: *Section 1.4 and 2.5, Attachment H and Attachment I: Dynegy must provide the following documents for inclusion in the permit application documents:*

- *Groundwater potentiometric surface maps for the mine spoils, surficial bedrock (weathered zone at top of bedrock) and any potential uppermost aquifer. [35 IAC 845.620(b)(16)(E)]*

Response: Section 845.620(b)(16)(E) requires the following be included in a hydrogeologic site characterization: "[h]ydraulic characteristics of the geologic layers identified as migration pathways and geologic layers that limit migration, including [a] [m]ap of the potentiometric surface." 35 Ill. Admin. Code § 845.620(d)(16)(E). As an initial matter, a potentiometric map of the shale bedrock at Duck Creek is impractical and serves no technical purpose for a geologic layer of small permeability that severely limits migration of groundwater. Based on the very low permeability and the demonstration that it is a lower confining unit, very few wells have been installed into the bedrock. However, IPRG's initial operating permit does include potentiometric maps for the mine spoils, which is the only geologic layer identified as a potential migration pathway above the bedrock. Those maps are included in the initial operating permit at as Figure 2-1 and 2-2 (NRT, 2016) and satisfy the requirements of Section 845.620(d)(16)(E).

As discussed in the report, the bedrock was evaluated for permeability using in-situ pressure tests. The results indicated the upper portions of bedrock had a hydraulic conductivity of less than 4.1 x 10-9 cm/s and provide evidence that groundwater does not migrate within the bedrock. Mine spoils (varying compositions of

intermixed clay, shale, and coal) and weathered bedrock (shale and clay) are both monitored with existing monitoring wells. In general, the mine spoils can be subdivided into fine-grained mine spoils which occur nearer the surface, and coarse-grained mine spoils which are often encountered above the bedrock surface. However, there remains significant heterogeneity and indeterminable continuity of the coarser-grained mine spoils, but where present the coarser-grained mine spoils and weathered bedrock are in connection, share similar compositional and hydraulic characteristics and are considered a single hydrostratigraphic unit.

In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. The requested information (including a recent groundwater potentiometric surface map for the coarse-grained mine spoils and weathered bedrock hydrostratigraphic unit) has been evaluated and provided in the proposed Groundwater Monitoring Plan and the35 I.A.C. § 845 Hydrogeologic Characterization Report provided in the Operating Permit modification submitted to IEPA on July 3, 2025.

Comment 11: *Section 1.4 and 2.5, Attachment H and Attachment I: Dynegy must provide the following documents for inclusion in the permit application documents:*

- *An evaluation of CCR leaching potential from AP1 and AP2 to surficial weathered portion of bedrock aquifer, Duck Creek Cooling Lake, Long Lake and other nearby surface water bodies. [35 IAC 845.620(b)(2), (b)(3), (b)(10), (b)(11), and (b)(16); 35 IAC 845.630(d)]*

Response: As stated in the Closure Plan (AECOM, 2016, **Attachment B**), hydrostatic equilibrium will be reached 11 years after installation of the final cover. Percolation into the mine spoils will be reduced from 56 inches per year to approximately 5 inches per year (over a 90% reduction). The reduction in percolation will reduce the flux of contaminants and result in lower concentrations in groundwater both east (toward the Duck Creek Cooling Pond) and west (toward Long Lake). In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. This data set has been evaluated to determine the effects of Ash Pond No. 11 and Ash Pond No. 2 on groundwater.

In addition, porewater samples from existing porewater wells (OM26, OM27, and OM28) were also collected in the second, third, and fourth quarters of 2024 and a new porewater well, XPW01 (installed in 2024), was sampled in the first quarter of 2025, and used to further evaluate potential contributions from Ash Pond No. 1 and Ash Pond No. 2. Solid samples were collected from XSB01, XSB02, and XPW01 in 2024 for chemical analysis (totals). Additional information including the base of ash elevations and an evaluation of the phreatic surface elevations over time within Ash Pond No. 1 and Ash Pond No. 2 has been submitted to the IEPA in the 35 I.A.C. § 845 Hydrogeologic Characterization Report. This comprehensive data set resulted in a robust conceptual site model that describes the potential effects of Ash Pond No. 1 and No. 2 on groundwater.

If necessary, further evaluation will occur consistent with the CCA (IEPA, 2022) and *35 IAC 845.650(d), 845.660, and 845.670.*

Comment 12: *Section 1.4 and 2.5, Attachment H and Attachment I: Dynegy must provide the following documents for inclusion in the permit application documents:*

- *Determination of the impacts of vertical hydraulic gradients to nearby surface water bodies. [35 IAC 845.620(b)(2), (b)(3), (b)(10), (b)(11), and (b)(16); 35 IAC 845.630(d)]*

Response: The requested information was incorporated into the 35 I.A.C. § 845 Hydrogeologic Characterization Report and submitted to the IEPA on July 3, 2025.

Comment 13: *Section 1.4 and 2.5, Attachment H and Attachment I: Dynegy must provide the following documents for inclusion in the permit application documents:*

- *Geochemical assessment and quantification of the total amount of CCR interacting with groundwater, after adequate collection of total metals groundwater analytical data, of AP1 and AP2 contribution to groundwater system total metals. [35 IAC 845.620(b)(2), (b)(3), (b)(10), (b)(11), and (b)(16)]*

Response: In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. Samples from existing porewater wells have been collected and used to further evaluate hydrogeologic site characterization at Ash Pond No. 1 and No. 2. The results of the assessment are included in the 35 I.A.C. § 845 Hydrogeologic Characterization Report submitted to IEPA on July 3, 2025, which satisfies 35 IAC 845.620(b).

Comment 14: *Section 1.4 and 2.5, Attachment H and Attachment I: Dynegy must provide the following documents for inclusion in the permit application documents:*

- *Groundwater monitoring program must include details of how Dynegy will implement 35 IAC 845.650(d), 845.650(e), 845.660, 845.670, and 845.680. [35 IAC 845.610(e); 35 IAC 845.650(d), (e); 35 IAC 845.660; 35 IAC 845.670; and 35 IAC 845.680(a)(3)]*

Response: In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. A revised monitoring plan and requested details, as applicable, were included in the proposed Groundwater Monitoring Plan attached to the Operating Permit Modification submitted to the IEPA on July 3, 2025.

Corrective action requirements associated with the above cited sections will be addressed in submittals separate from the pending operating permit application for Ash Pond No. 1 and No. 2 and in accordance with the timelines outlined in the CCA and the above cited sections.

Comment 15: *General Comment: Low pH does not have a GWPS other than 6.5 in accordance with 35 Ill. Admin. Code 845.600(a)(2). Low pH at a background well must be evaluated for impacts on the CCRSIs if it is upgradient from the CCRSI. [35 IAC 845.600(a)(2)]*

Response: In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. Although the site-specific background pH is numerically lower, this reflects a higher *concentration* of hydronium (H^+) ions in solution. Additionally, low pH in general may be driven by a variety of natural factors, such as the occurrence and oxidation of pyrite or influence of peat materials. Therefore, using a site-specific pH for background lower than 6.5 SU is consistent with 35 I.A.C. § 845.600(a)(2) and principles of environmental chemistry. 35 I.A.C. § 845.600(a)(2) does not specify any requirements for investigation of groundwater influence on the surface impoundment based on background values.

Comment 16: *General Comment: Description of any structures that may or may not impede groundwater flow between the Illinois River and tributaries and the CCRSIs. Description of any structures that impede groundwater flow at any other location onsite to an offsite location. [35 IAC 845.620(b)(10) and (b)(11)]*

Response: Other than the liner systems present at the Gypsum Stack Pond and the Bottom Ash Basin, there are no known physical structures that would impede groundwater flow between the Illinois River, tributaries, and the CCR surface impoundments. The shoreline of the discharge flume contains interlocking sheet pile that does not appear to significantly influence groundwater flow from the BAB to the flume. In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. No additional structures were identified during preparation of the 35 I.A.C. § 845 Hydrogeologic Characterization Report submitted with the Operating Permit Modification.

Comment 17: *General Comment: DYNEGY must provide the boring logs and the well construction diagrams for the Agency to review the permit application.*

Dynegy must prove that they are monitoring the hydrostratigraphic units and evaluate the multiunit groundwater monitoring system to determine impacts of groundwater flow into Duck Creek Cooling Lake.

Response: Available boring logs and well construction forms were provided in Appendix D of the 2016 Supplemental Hydrogeologic Site Characterization Report and Groundwater Monitoring Plan. As discussed in response to Comment 10, the coarse-grained mine spoils and weathered bedrock are in contact with one another and compositionally similar. The two geologic units are a single hydrostratigraphic unit.

Results from monitoring wells located adjacent to the Duck Creek Cooling Pond (whether shallow or deep, because of generally upward gradients) are

representative of the potential impacts to the Pond. The requested boring logs and well construction diagrams are provided in the proposed Groundwater Monitoring Plan and the 35 I.A.C. § 845 Hydrogeologic Characterization Report submitted to IEPA on July 3, 2025.

Comment 18: *The Agency reviewed the cross sections identified in the Hydrogeologic Assessment Report dated March 31, 2016:*

- *Unlithified materials are mine spoils, loess and glacial till. While mine spoils are monitored, it is unclear if there are native soils between AP1 and AP2 and Duck Creek Cooling Lake and other surface water bodies. Characterization of groundwater flow must include nature and extent of the groundwater contamination from AP1 and AP2 and separately the mine spoils to determine the impact of the CCR.*

- *Shale bedrock unit. While packer testing has been conducted and RQD was logged in the bedrock boring log, the surficial weathered zone and nature and extent of any contamination from AP1 and AP2 remains uncharacterized.*

Response: The attached figure (Figure 1) illustrates the spatial extent of surface mining as presented by Illinois State Geological Survey Coal Section. As shown in the figure, there are no native soils between Ash Pond No. 1 and No. 2 and the Duck Creek Cooling Pond or Long Lake and therefore the groundwater was classified as Class IV: Other Groundwater (35 IAC 620.240(g)). As discussed in response to Comment 10 the mine spoils and weathered bedrock share similar characteristics and are monitored as a single hydrostratigraphic unit. Additional information regarding the occurrence and magnitude of potential impacts from Ash Pond No. 1 and No. 2 was included in the 35 I.A.C. § 845 Hydrogeologic Characterization Report.

If necessary, further evaluation, including defining the nature and extent of any contamination, will occur consistent with the timelines outlined in the CCA (IEPA, 2022) and *35 IAC 845.650(d), 845.660, and 845.670.*

Comment 19: *Given the aforementioned undefined lithologic units, DYNEGY must either install and monitor additional wells or provide boring logs and well installation diagrams with sufficient detail for the Agency to review. Well locations will be reviewed for the following:*

- *Vertical gradient and extent of contamination investigation: The loess, glacial till and weathered bedrock must be identified for locations and continuity. The loess and weathering bedrock must be characterized for nature and extent of groundwater contamination from AP1 and AP2. Dynegy must install one upgradient and three downgradient wells in the weathered surficial bedrock.*

- *Well installation must be conducted pursuant to 77 Ill. Admin. Code 920.170. Isolation casing must be installed where appropriate to prevent cross contamination during drilling and well installation.*

- *The upgradient or background monitoring wells chosen for bedrock monitoring must comply with Section 845.630(a). The upgradient or background monitoring wells must be as close to the upgradient side of the CCRSI that the background well is meant to monitor with the following conditions:*

    - *Must not be in similar source material to CCR.*

    - *Must be as close to the CCRSI and as far away from similar source material to adequately characterize the Section 845.600(a) constituents that are already present prior to entering the CCRSI groundwater.*

    - *If the background monitoring well is not hydraulically connected, the geochemical conditions must be similar to those onsite to ensure similar monitoring conditions.*

Response: As illustrated in the attached figure (Figure 1) all areas surrounding Ash Pond No. 1 and No. 2 are within the extent of the surface mining. Boring logs indicate heterogenous mine spoils consisting of varying amounts of clay, silt, shale, and coal are present between ground surface and the shale bedrock. The presence of shale and coal within the mine spoils are a potential source of inorganic contaminants to groundwater that are unrelated to potential impacts from Ash Pond No. 1 and No. 2.

As stated in previous comments, the 8 quarters of monitoring agreed to in the CCA (IEPA, 2022) have been completed and IPRG has evaluated the previously identified background locations. Three additional potential background locations were selected, and wells installed to characterize concentrations present in the mine spoils and weathered bedrock hydrostratigraphic unit. Temporary casing was used during drilling to prevent cross contamination, and wells were installed within the coarse grained mine spoil weathered bedrock hydrostratigraphic unit where present. Final selected background locations and groundwater quality are included in the proposed Groundwater Monitoring Plan and the 35 I.A.C. § 845 Hydrogeologic Characterization Report submitted with the Operating Permit Modification.

Comment 20: *<u>Attachment I</u>: Dynegy must update for previous comments on the groundwater monitoring system. For the Agency to complete a review of the Statistical Approach and Statistical Evaluation Summary, Dynegy must provide the following documents for the Agency to complete a review of the permit application:*

Background data inputs must be demonstrated to be total metals and not include any dissolved data. Laboratory data packages and analytical results utilized to

determine background must be singled out in a separate attachment to the appropriate document, likely the Statistical Approach and Post Closure Care Plan.

Details of how and when 35 Ill. Admin. Code 845.650, 845.660, 845.670 and 845.680 must be provided in the permit application. Details must include the following:

- *Time constraints on submittals and investigations for the purpose of meeting the technical requirements of 35 Ill. Admin. Code 845 Subpart F.*

Response: Closure of Ash Pond No. 1 and No. 2 application was accepted as part of the GMZ in a letter from the IEPA dated November 23, 2016. Since the unit had received approval for closure prior to 35 Ill. Admin. Code 845 was enacted additional investigation and submittals were not completed and documents prepared for closure were resubmitted with the Operating Permit (Burns & McDonnell, 2021). However, in accordance with the subsequent CCA (IEPA, 2022), IPRG collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. The data is required to evaluate background concentrations of total metals and the requested information was provided in the 35 I.A.C. § 845 Hydrogeologic Characterization Report.

Corrective action requirements associated with the above cited sections will be addressed in submittals separate from the pending operating permit application for Ash Pond No. 1 and No. 2 and in accordance with the timelines outlined in the CCA and the above cited sections.

Comment 21: *Attachment I: Dynegy must update for previous comments on the groundwater monitoring system. For the Agency to complete a review of the Statistical Approach and Statistical Evaluation Summary, Dynegy must provide the following documents for the Agency to complete a review of the permit application:*

- *Details of how and when 35 Ill. Admin. Code 845.650, 845.660, 845.670 and 845.680 must be provided in the permit application. Details must include the following:*
  - *Types of submittals and environmental data to be collected and analyzed including, but not limited to, Human Health Risk Assessments, Ecological Risk Assessments, Planning documents, Alternative Source Demonstrations, Hydrogeologic Characterization and how those submittals will comply with SW846 and established USEPA guidance specific to the submittal including types of media to be analyzed and details of assessments to be completed.*

Response: Corrective action requirements associated with the above cited sections will be addressed in submittals separate from the pending operating permit application for

Ash Pond No. 1 and No. 2 and in accordance with the timelines outlined in the CCA and the above cited sections.

While it is true that SW846 is incorporated by reference into 35 I.A.C. § 845 by Section 845.150, inclusion in the general "incorporations by reference" section of 35 I.A.C. § 845 does not create an affirmative obligation to use SW846 in all circumstances. The Board has explained that where Illinois rules incorporate analytical methods by reference via a "centralized listing of incorporations by reference" such as Section 845.150, "Illinois rules further indicate where each method is used *in the body of the substantive provisions*." *See In the Matter of: SDWA Update, USEPA Amendments (January 1, 2013 through June 30, 2013)*, R 2014-008, Opinion of the Board at 24–25 (Jan. 23, 2014) (emphasis added).

Further, Chapter 2 of SW846 states that the methods in that document are not "mandatory" unless specifically specified as such by regulation. United States Environmental Protection Agency ("USEPA"), *SW-846 Update V* at 1 (July 2014).[1] USEPA guidance also makes clear that SW846 is only legally required where "explicitly specified" in a regulation. USEPA, *Disclaimer for Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)* at 1 (July 2014).[2] The only substantive provision of 35 I.A.C. § 845 specifically requiring analysis using SW846 is Section 845.640(e), which applies to analyzing groundwater monitoring samples under a groundwater monitoring program and is not at issue here. 35 Ill. Admin. Code § 845.640(e). There is no requirement to use SW846 when meeting 35 I.A.C. § 845 requirements for Human Health Risk Assessments, Ecological Risk Assessments, Planning documents, Alternative Source Demonstrations, or Hydrogeologic Characterization.

Comment 22: *Attachment I: Dynegy must update for previous comments on the groundwater monitoring system. For the Agency to complete a review of the Statistical Approach and Statistical Evaluation Summary, Dynegy must provide the following documents for the Agency to complete a review of the permit application:*

- *Details of how and when 35 Ill. Admin. Code 845.650, 845.660, 845.670 and 845.680 must be provided in the permit application. Details must include the following:*
  - *Source characterization must be provided with the any representation of the mass transport equation. Details of the source characterization must comply with USEPA sampling guidance and provide an adequate characterization of the source based on the volume, total depth and interaction with groundwater.*

Response: In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. Porewater

[1] Available at https://www.epa.gov/sites/default/files/2015-10/documents/chap2_1.pdf.
[2] Available at https://www.epa.gov/sites/default/files/2015-10/documents/disclaim.pdf.

samples from existing porewater wells (OM26, OM27, and OM28) were also collected in the second, third, and fourth quarters of 2024 and new porewater well XPW01 (installed in 2024) was sampled in the first quarter of 2025, and used to further evaluate potential contributions from Ash Pond No. 1 and Ash Pond No. 2.

In addition, solid samples were collected from XSB01, XSB02, and XPW01 in 2024 for chemical analysis (totals). Additional information including the base of ash elevations and an evaluation of the phreatic surface elevations over time within Ash Pond No. 1 and Ash Pond No. 2 were provided in the 35 I.A.C. § 845 Hydrogeologic Characterization Report submitted to the IEPA on July 3, 2025.

If necessary, further evaluation will occur consistent with the CCA (IEPA, 2022) and *35 IAC 845.650(d), 845.660, and 845.670.*

Comment 23: *Attachment I, Attachment 1, Appendix A: Outlier analysis cannot be performed on any data set that has less than 32 samples that have been verified as sampled pursuant to 35 Ill. Admin. Code 845.640 criteria and groundwater flow direction in the same direction for all samples collected.*

Response: Details regarding data analysis may be found in the Statistical Analysis Plan (Appendix A to the Groundwater Monitoring Plan). Data are not excluded from the compliance well data set solely on the basis of being statistical outliers. The only circumstance in which a data point may be excluded without specific field or laboratory quality evidence that it is not representative of actual field conditions are rare, extreme cases in which a high outlier disproportionately affects the distribution of the background data and evaluation of background concentrations (USEPA 2009, p. 5-5). The exclusion of extremely elevated background data, even when no cause of the extreme observation in known, is a conservative measure intended to be protective of downgradient groundwater. This data would be retained in the database and in data presentation but would be marked as inappropriate for inclusion in statistical analysis.

Comment 24: *Attachment I, Attachment 1, Appendix A: Outlier testing must only be conducted after verification that the sample analytical data set is homogeneous and consists of all total recoverable metals data. The Agency cannot review this section due to the lack of verification at this time.*

Response: See response to Comment 23.

Comment 25: *Attachment I, Attachment 2: Dynegy must provide a detailed analysis of the constituents that may remain under the GMZ but are not listed in 35 Ill. Admin. Code 845.600(a) for monitoring purposes.*

Response: The GMZ application dated October 19, 2016, and approved by the IEPA in a letter dated November 23, 2016, included only dissolved boron and chloride as constituents released to the groundwater. No additional constituents were listed in the GMZ.

Post-Closure Care Plan [35 IAC 845.230(d)(3)(F); 35 IAC 845.780; 35 IAC 845.220(a)(1)(D), (a)(1)(E), (a)(1)(F), (a)(1)(G), (a)(1)(J)]

Comment 26: *Attachment K: Plan must contain details of actions to be taken to handle settlement, subsidence and erosion in particular due to AP1 and AP2 lying over mine spoils and former strip mine with a seeming undetermined engineering characteristics around the mine spoils potential to subside or settle due to the loads of AP1 and AP2. [35 IAC 845.780(d)(4); 35 IAC 845.780(b)(1); 35 IAC 845.220(a)(1)(D), (a)(1)(E), (a)(1)(F), (a)(1)(G), (a)(1)(J))]*

Response: The Post-Closure Care Plan contains the necessary details of actions to handle settlement, subsidence and erosion via repair and maintenance, listing examples of repair activities that may be necessary if visual observations are noted during frequent and routine inspections. No settlement, subsidence or erosion has been observed thus far during post-closure.

Comment 27: *Attachment K: Plan must contain proposed target background values for constituents listed in 35 IAC 845.600 for Agency review and approval. [35 IAC 845.780(d)(4) and 35 IAC 845.780(c)(2)]*

Response: 35 I.A.C. § 845 does not require the requested information. 35 I.A.C. § 845.780(c) requires that, following post-closure care period, groundwater monitoring data must show concentrations are below the groundwater protection standards in 35 I.A.C. § 845.600 and not increasing for those constituents over background. The Post Closure Care Plan includes a discussion of how groundwater monitoring will continue until groundwater monitoring data can demonstrate that concentrations are below the groundwater protection standards in 35 I.A.C. § 845.600 and are not increasing for those constituents over background.

Comment 28: *Attachment K: Plan must provide a demonstration that the potential for settlement, subsidence or erosion will not increase the risk to human health and the environment. Demonstration must include analytical data substantiating any recommendations or conclusions to the demonstration. [35 IAC 845.780(d)(1)(C)]*

Response: 35 I.A.C. § 845 does not require the requested information. See Comment 26 for additional information.

Comment 29: *Attachment K: Plan must contain details of amending the plan should there be a decision to dewater the Duck Creek Cooling Lake and surrounding area by removal of the dam or an unexpected event that compromises the dam in a manner that allows permanent or temporary dewatering of the surrounding surface water bodies. [35 IAC 845.780(d)(2)(B); 35 IAC 845.220(a)(1)(D), (a)(1)(E), (a)(1)(F), (a)(1)(G), (a)(1)(J))]*

Response: 35 I.A.C. § 845 does not require the requested information. Such an assessment would provide limited information and lead to assessing unknown risks. There are no plans to dewater the Duck Creek Cooling Pond and 35 I.A.C. § 845 does not

require IPRG assess every possible event that could impact ground and surface water elevations.

Comment 30: *Attachment K: Plan does not contain any methods to determine subsidence of the entire AP1 and AP2. The Agency requires a survey, benchmark, or other method to be documented in the annual inspection and reported in the annual consolidated report. The purpose of the survey, benchmark check or other method is to determine if subsidence has occurred for the entirety of the two ponds. [35 IAC 845.780(d)(1)(C); 35 IAC 845.220(a)(1)(D), (a)(1)(E), (a)(1)(F), (a)(1)(G), (a)(1)(J)]*

Response: 35 I.A.C. § 845 does not require the requested information. The geotechnical assessment demonstrated that the strength and consistency of the mine spoils beneath AP1 and AP2 indicate settlement is unlikely, and that the stability of the AP1 and AP2 embankments and foundations exceed the minimum 35 IAC 845.460(a)(1) criteria. There is no likelihood of subsidence as evidenced by no subsidence noted in annual inspections since constructing the pond in 1976 and the included analyses. See Comment 4 for more information.

Emergency Action Plan [35 IAC 845.230(d)(2)(G) and 35 IAC 845.520)

Comment 31: *General Comment: An Emergency Action Plan must be provided with the permit application documents. The EAP provided with the Bottom Ash Basin initial operating permit application covers AP1 and AP2 sufficiently.*

Response: This comment is duplicative. As noted in response to Comment 5, IPRG has provided a written Emergency Action Plan (**Attachment D**) for the Bottom Ash Pond, GMF Pond, Ash Pond No. 1, Ash Pond No. 2, and GMF Recycle Pond containing the information specified in 35 Ill. Admin. Code § 845.520.

Safety Plan [35 IAC 845.530)

Comment 32: *General Comment: A Safety Plan is required for the implementation of all work including groundwater sampling at AP1 and AP2 [35 IAC 845.530(a)].*

Dynegy must provide a Safety Plan that complies with 35 Ill. Admin. Code 845.530. OSHA regulations apply to the facility. DYNEGY must provide Safety Plan to adhere to 29 CFR 1910, specifically including the following but not limited to:

Safety data sheets for all chemicals found on site. (i.e. diesel fuel, hydraulic fluid, CCR leachate, coal, fly ash, gasoline, etc.) [35 IAC 845.530(b)]

Hazard identification and mitigation measures for all tasks associated with the operation and maintenance of the CCRSIs. (i.e. excavation equipment proper use, institutional controls, engineering controls, personal protective equipment, etc.; is the team working in Level D, when do upgrades occur?) [35 IAC 845.530(c)(2)]

Response: See Comment 1.

Comment 33: *General Comment: In the event that corrective action must occur for groundwater plume mitigation under 35 Ill. Admin. Code 845.680 and a construction permit, the Safety Plan and Emergency Action Plan must either be updated for Construction or the Construction Application must include a separate Safety Plan and Emergency Action Plan for the purpose of use during Construction that complies with all applicable sections and subsections of 35 Ill. Admin. Code 845.520 and 845.530 and 29 CFR 1926.*

Response: No response to this comment is necessary as it does not express any current deficiencies of the submitted application.

History of Construction [35 IAC 845.230(d)(3)(A); 35 IAC 845.220(a)(1); 35 IAC 845.780(b)(1)]

Comment 34: *General Comment: Ash Pond 1 and Ash Pond 2 are built on mine spoils in a formerly mined area of the site. Dynegy must provide documentation that the ponds will not settle over time in a manner that would change the structural stability of the cover installed at AP1 and AP2. [35 IAC 845.230(d)(3)(a) and 35 IAC 845.220(a)(1)(D), (a)(1)(E), (a)(1)(F), (a)(1)(G), (a)(1)(J)]*

Response: 35 I.A.C. § 845 does not require the requested information. See Comment 4 for more information.

Comment 35: *Bottom Ash Basin Initial Operating Permit Application, Attachment B: Ten geotechnical borings were drilled during the geotechnical investigation for the design of the BAB. Two of the ten borings had caving occur during drilling at approximately 565 feet amsl. Dynegy must address the nature of the caving and determine the following:*

Vertical and geospatial location of the caving in relation to man-made or naturally occurring unstable soils--mine spoils or native undisturbed soils

Response: The native material underlying the Bottom Ash Basin is not unstable or at risk of caving. The observed caving referenced in the comment is an artifact of the methods used to advance the borings and is unrelated to the stability of the foundation soils. Boring logs included in Attachment B of the Initial Operating Permit Application include entries recording the depth to the water table in the borehole at two separate times: 1) while drilling and 2) at end of boring. The caving

noted for the water level measurement at the end of boring is due to the drill tooling used to support the borehole being removed after reaching the target depth. Without drill tooling supporting the borehole walls, it is common for the boreholes to cave. Such observations in a boring log do not indicate unstable soils.

Comment 36: *Bottom Ash Basin Initial Operating Permit Application, Attachment B: Ten geotechnical borings were drilled during the geotechnical investigation for the design of the BAB. Two of the ten borings had caving occur during drilling at approximately 565 feet amsl. Dynegy must address the nature of the caving and determine the following:*

Provide investigation, data, recommendations and conclusions with a proposed method for monitoring subsidence and/or settlement issues and/or proposed corrective action.

Response: 35 I.A.C. § 845 does not require the requested information. Section 845.230(d)(3)(A) (incorporating Section 845.220(a)(1)) does not require specific investigations be performed or data be provided. See Comment 35.

Comment 37: *Attachment B: The History of Construction states that the mine spoils "consist of mixtures of native loess and glacial till and, to a lesser extent, the underlying (primarily shale) bedrock." Additionally, the History of Construction reports engineering properties of the mine spoils to be significantly different than the other soils which are not mine spoils. The Agency is aware that mine spoils are not known to typically be geotechnical suitable materials for building on (Zevgolis, et al, 2021). Dynegy must provide a manner in which to monitor subsidence or settlement aside from a yearly visual inspection. [35 IAC 845.230(d)(3)(a) and 35 IAC 845.220(a)(1)(D), (a)(1)(E), (a)(1)(F), (a)(1)(G), (a)(1)(J)]*

Response: See Comment 4.

History of Known Exceedances [35 IAC 845.230(d)(3)(G)]

Comment 38: *Section 2.7 and Attachment M: The Agency cannot review the historical exceedances without a full characterization of the CCR constituents present, geospatial details, horizontal and vertical hydraulic gradient and connection details and other hydrogeologic data to adequately review that the groundwater monitoring program satisfies 35 Ill. Admin. Code 845.630, 845.640 and 845.650.*

Response: In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of data to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. The sampling included total metals analysis for 35 I.A.C. § 845.600 parameters and groundwater elevations to assess the distribution of potential impacts from AP1 and AP2 as well as characterize groundwater flow and transport. A revised monitoring system was included in the proposed Groundwater Monitoring Plan, which was based on

information provided in the 35 I.A.C. § 845 Hydrogeologic Characterization Report, both of which were submitted to IEPA on July 3, 2025 in the Operating Permit Modification.

Comment 39: *Attachment M: The History of Potential Exceedances does not represent total metals data and provides inadequate number of data points after closure to support closure with a final cover as a sole remedial action that will need to occur at Duck Creek.*

Response: In accordance with the CCA (IEPA, 2022), IPRG has collected 8 quarters of groundwater data, which includes groundwater levels and total metals analysis to assess groundwater flow and quality at Ash Pond No. 1 and No. 2. The requested information was provided in an updated History of Potential Exceedances with the Operating Permit Modification submitted to IEPA on July 3, 2025.

Slope Maintenance [35 IAC 845.230(d)(3)(C) and 35 IAC 845.430]

Comment 40: *Attachment J: Dynegy does not account for the agricultural use of lands downstream of the Duck Creek Cooling Lake dam. If the spill way and dam are inundated there would be an economic impact to the agricultural lands. The entirety of the agricultural lands is in the FEMA Flood Zone AE*

Response: IPRG considers Attachment J (Slope Maintenance Documentation) to meet the intent of 35 IAC 845.430 pertaining to appropriate and protective slope maintenance. The mentioned Duck Creek Cooling Lake dam is a cooling reservoir dam and is not a surface impoundment regulated under 35 IAC 845.

Please contact Rhys Fuller at (618) 975-1799 or Rhys.Fuller@vistracorp.com with any questions or comments regarding the above responses.

Sincerely,

Phil Morris, P.E.
Sr. Director, Environmental

FIGURES

Figure 1 Coal Mine Coverage Area

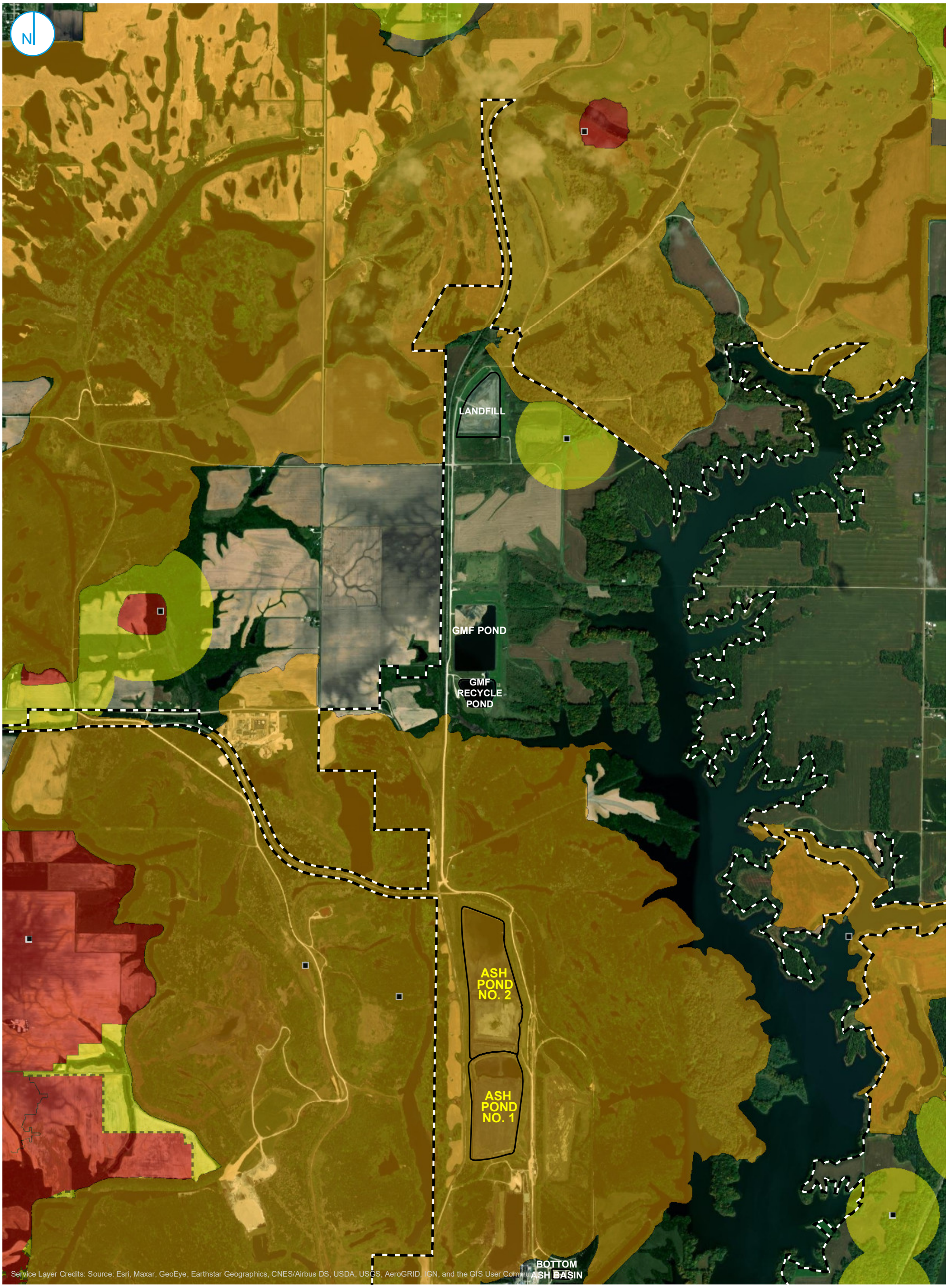
ATTACHMENTS

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Attachment B IEPA Approval Letter Dated November 23, 2016 and Closure and Post-Closure Care Plan for Duck Creek Ash Pond Nos. 1 &2
Attachment C Duck Creek 1 & 2 Supplemental Technical Documents Report
Attachment D Emergency Action Plan

FIGURES

PROJECT: 169000XXXX | DATED: 9/21/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Duck_Creek\GMF_Pond\Figure 2-3_Coal Mine Coverage Area.mxd



- COAL MINE SHAFT
- SURFACE COAL MINE
- UNDERGROUND COAL MINE
- UNDERGROUND MINE BUFFER REGION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- PROPERTY BOUNDARY

0 1,000 2,000 Feet

COAL MINE COVERAGE AREA

DUCK CREEK POWER PLANT
CANTON, ILLINOIS

FIGURE 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENTS

ATTACHMENT A
COMMENTS ON STATISTICAL METHODS PROPOSED IN INITIAL OPERATING PERMIT APPLICATION

October 28, 2025

Joshua Rhoades
Illinois Environmental Protection Agency
2520 West Iles Avenue
P.O. Box 19276
Springfield, IL 62794

Re: Duck Creek Power Plant Ash Pond No. 1, Ash Pond No. 2, Bottom Ash Basin, and GMF Pond; W0578010001-001 , W0578010001-002, W0578010001-03, and W0578010001-04
Comments on Statistical Methods Proposed in Initial Operating Permit Application

Mr. Rhoades:

Illinois Power Resource Generating (IPRG) received the Duck Creek Power Plant CCR Surface Impoundment Operating and Construction Permit Application Review Letter dated October 11, 2023. Additional letters were received by IPGC on December 22, 2023, and December 28, 2023, regarding the statistical methods proposed in the Statistical Analysis Plan. The Statistical Analysis Plan was submitted as Attachment A to the Groundwater Monitoring Plan, included as Attachment I to the Duck Creek Power Plant CCR Surface Impoundment Operating and Construction Permit Application for the Bottom Ash Basin, GMF Pond, and Ash Pond No. 1 and No.2. An updated Multi-Site Statistical Analysis Plan was resubmitted with Groundwater Monitoring Plans submitted in September 2025. We submit the below responses to IEPA, to directly address previous comments. The content of these responses was previously discussed with IEPA personnel in a meeting held May 2, 2024.

Comment 1a: *The statistical methods must define the following in order to review the statistical plan in accordance with Illinois EPA Quality Management Plan (A17-001), Guidance on Assessing Quality Systems (EPA QA/G-3), Data Quality Assessment: Statistical Methods for Practitioners EPA QA/G-9S, Data Quality Assessment: A Reviewer's Guide EPA QA/G-9R and/or Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8):*

a. The software program that is being used for statistical evaluation must be identified. If the software program is proprietary, software validation must be performed, documents, and signed off by at least the software validation draftee, senior reviewer, and project manager/quality manager. (EPA QA/G-3)

i. Software validation packages must include at least a known data set, empirical evaluation including formulas to prove the validity of the software, and outputs from both the software and the empirical calculations exhibiting that the software is producing the same output as the empirical evaluation. (EPA QA/G-3)

Response: All of the statistical results used in exceedance determinations were calculated using R. R is an open-source programming language with a strong focus on statistical analysis and is used by both the United States Environmental Protection Agency (USEPA)[1] and United States Geological Survey (USGS)[2] in various applications. The statistical calculations used to determine exceedances are described in detail in the Statistical Analysis Plan submitted as Attachment A to the Groundwater Monitoring Plan. Each analysis described in that plan is associated with calculations done in R according to equations presented in USEPA's Unified Guidance (USEPA 2009)[3]. Attachment A provides confirmation from USEPA that the Unified Guidance remains a valid reference for developing a statistical analysis plan despite being archived. Table 1 identifies R functions used for these calculations, the package that is the source of the function, and the alpha associated with a statistically significant result (if applicable).

Two functions used are from the EnvStats[4] package. This package is widely used, including in USGS recommendations for statistical analyses[5]. Two functions are not from a published package: the code used to compute the Kaplan-Meier adjusted mean and standard deviation, and the code used to calculate the confidence band around the Thiel-Sen trend line. The code used to calculate the Kaplan-Meier adjusted mean and standard deviation are directly based on the equations presented in the USEPA 2009, Chapter 15, Section 15.3. The code used to calculate the confidence band around the Thiel-Sen trend line is derived from Appendix C.3.2 of USEPA 2009.

These functions are used to calculate aspects of background (upper tolerance limit) and compliance (confidence interval) statistics, respectively. Figure 1 and Figure 2 present flow charts to clarify how the upper tolerance limit and confidence interval calculations, respectively, are performed. The outcomes of the statistical evaluates are provided quarterly to IEPA as part of the detection of exceedances of the GWPSs.

Comment 1b:

b. All input data sets for each constituent must be provide in a table in accordance with SW-846 chapter 1, incorporated by reference in 35 IAC 845. Chapter 1 of SW846 states that regulatory decisions must be made with environmental data.

---

[1] Examples include Tools for Automated Data Analysis (https://www.epa.gov/waterdata/TADA) and Causal Analysis/Diagnosis Decision Information System (https://www.epa.gov/caddis/download-r-scripts-and-sample-data).

[2] Examples include the many projects and tutorials listed here: https://waterdata.usgs.gov/blog/tags/r/.

[3] USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance. EPA 530-R-09-007.

[4] Documented in Millard, S.P. 2013. EnvStats: An R Package for Environmental Statistics. Springer, ISBN 978-1-4614-8455-4

[5] Helsel, D.R., Hirsch, R.M., Ryberg, K.R., Archfield, S.A., and Gilroy, E.J., 2020, Statistical methods in water resources: U.S. Geological Survey Techniques and Methods, book 4, chap. A3, https://doi.org/10.3133/tm4a3.

i. All data sets, used for statistical analysis, must be within the last eight consecutive quarterly sampling events in order to validate the statistical methods for recent activity (35 IAC 845.650(b)).

Response: Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.650(b)(A) specifies that exceedance evaluations must use a *minimum* of eight independent samples for each background and downgradient well. There are several statistical advantages to using larger sample sizes. In general, a minimum of eight samples is required to adequately characterize the statistical features of the data, but statistical evaluations uniformly benefit from larger sample sizes (USEPA 2009, 5-3). Larger sample sizes increase the power of statistical tests (USEPA 2009, p. 3-21). Appropriate use of parametric statistics also typically gives greater statistical power and predictive ability. Parametric statistics can only be used if the data are normally distributed, or if they can be transformed to achieve normality. Data with larger sample sizes are more likely to approximate a normal distribution (the Central Limit Theorem; see USEPA 2009, p. 3-16). A test with greater statistical power "translates into a greater probability of identifying contaminated groundwater when it really exists," (USEPA 2009, p. 3-18). For these reasons, it is appropriate to use all representative data when calculating background and compliance statistics.

ii. If an impoundment is considered closed by the Agency, the data sets must be used from the eight consecutive quarters after closure or most recent eight consecutive quarters.

Response: Once a unit has been closed, the data collected from compliance wells may represent a distinct population of data. After sufficient data has been collected following closure (at least eight data points, but potentially more if the groundwater flow and transport model indicates more than two years to observe an effect in compliance wells), data will be evaluated to determine if results collected post-closure represent a distinct sample population. If a distinct population is present, that post-closure population would be used in exceedance evaluations.

Comment 1c:

c. Illinois Power Generating Company (Illinois Power) must provide the laboratory reports or EDD to validate the data input sets are accurate and follow 845.640(i) and 845.640(j).

Response: IEPA has received the electronic data deliverables associated with all data used in statistical calculations, including those for data collected prior to the promulgation of 35 I.A.C. § 845, as part of previous responses to operating permit application comments.

Comment 1d:

d. Illinois Power must identify the assumptions being used to analyze the data sets and any other methods. (EPA QA/G-9S).

Response: The assumptions being used in analyzing the data sets is described in the Statistical Analysis Plan and are summarized below.

Statistical Independence – The primary means of ensuring statistical independence of groundwater samples is allowing sufficient time to elapse between sampling events to ensure that different volumes of groundwater are being sampled. However, the sampling schedules specified in 35 I.A.C. § 845.650(b) conflict with the ability to collect independent samples, and instead represents a successive sampling design.

The testing strategy presented in the Statistical Analysis Plan based on guidance in USEPA 2009 accounts for a lack of statistical independence that may be inherent in frequent sampling programs: "Tests constructed in this way at each successive evaluation period will not be statistically independent; instead, the proposed testing strategy falls into the realm of sequential analysis," (USEPA 2009, p. 7-14).

Lack of outliers: Rigorous data validation and review is used in lieu of formal outlier testing to ensure that all data used in statistical evaluations is representative of field conditions. Quality control/quality assurance data are collected and data validation is completed in accordance with the Quality Assurance Project Plan. Project staff familiar with the site and historical data review the data generated each quarter and facilitate additional validation as needed. Exclusion of potential outliers may be considered only for data and that could cause extremely elevated background concentrations (see response to Comment 1f).

Stationarity: Groundwater data would fulfill the assumption of stationarity if measurements are consistent over both time and space. Statistical analyses of trend are used to evaluate the assumption that groundwater quality values (i.e., constituent means) are stationary over time. A 99% confidence Mann-Kendall test was used to perform the trend analysis. For the calculation of upper tolerance limits (*i.e.*, background evaluation), if any data set exhibited a statistically significant trend, each scenario was investigated case-by-case. For the calculation of confidence intervals (*i.e.*, compliance evaluation), if any data exhibited a statistically significant trend, the confidence level around either the least squares linear regression line (when residuals of that regression met the assumption of data normality; see below) or the Thiel-Sen trend line (when residuals of the least squared linear regression did not meet the assumption of data normality) was calculated. Changes in concentrations over time may also be evaluated by analysis of variance tests. Although spatial variability may occur, it cannot be addressed by using intra-well comparisons (as recommended in USEPA 2009) due to an absence of groundwater data prior to unit operation.

Data normality: Data and log-transformed data is tested for normality using a 99% confidence Shapiro-Wilk test as recommended in the Unified Guidance: "If the normal distribution is rejected by a goodness-of-fit test, one should generally test the normality of the logged data, in order to check for lognormality of the original observations. If this test also fails, one can […] use a non-parametric technique," (USEPA 2009, p. 10-9). In cases where neither the data nor log-transformed data meet the normal distribution, a non-parametric technique is used (see response to Comment 1g).

Comment 1e:

e. Illinois Power must identify the non-detects within the data set. Illinois Power must review the statistical methods guidance for appropriate use of non-detects in the statistical methods provided and provide a detailed explanation of the rationale including empirical formulas for examples of the implementation of the statistical methods. (EPA QA/G-9S).

Response: Non-detect data processing is described in the Statistical Analysis Plan, submitted as Attachment A to the Groundwater Monitoring Plan, and is summarized below.

The treatment of non-detects is based on the percent of non-detected data relative to the total number of results. If the frequency of non-detect data is less than or equal to 15%, half of the reporting limit is substituted for these data. If the non-detect frequency is greater than 15% and less than or equal to 50% and the data are normally or log-normally distributed, the Kaplan-Meier is used to estimate the mean and standard deviation adjusted for the presence of left-censored values. If the non-detect frequency is greater than 15% and data cannot be normalized, or the non-detect frequency is greater than 50%, a non-parametric test is used. This is consistent with USEPA 2009 Section 15.6.

Comment 1f:

f. The Agency's position on outliers is that verified data from a NELAP certified laboratory is representative of the aquifer properties analyzed. Outliers cannot be evaluated for exclusion from any dataset without explicit data validation identifying discrepancies from the laboratory and/or field procedures that would qualify a data point to be considered an outlier. Illinois Power must use the USEPA data validation procedures to determine when or if a data point is to be excluded from a data set. (EPA QA/G-8).

Response: No data were excluded from any Duck Creek data set. Data are not excluded from the compliance well data set solely on the basis of being statistical outliers. The only circumstance in which a data point may be excluded without specific field or laboratory quality evidence that it is not representative of actual field conditions are rare, extreme cases in which a high outlier disproportionately affects the distribution of the background data and evaluation of background concentrations

(USEPA 2009, p. 5-5). The exclusion of extremely elevated background data, even when no cause of the extreme observation is known, is a conservative measure intended to be protective of downgradient groundwater. This data would be retained in the database and in data presentation but would be marked as inappropriate for inclusion in statistical analysis.

Comment 1g:

g. The agency does not approve of non-parametric statistical analysis for this permit application. If a non-parametric data set occurs the Agency must review and approve each of a non-parametric data set and statistical analysis individually.

Response: In accordance with 35 I.A.C. § 845.640(g)(1), "[n]on-normal distributions must use non-parametric methods." Non-parametric statistics are appropriate when data does not meet the assumptions for normality (see response to Comment 1d). The Statistical Analysis Plan, submitted as Attachment A to the Groundwater Monitoring Plan, describes in detail the circumstances in which non-parametric statistics are used. If the proportion of non-detected results in a data set is greater than 50%, non-parametric statistics are used (USEPA 2009, p. 8-2). Otherwise, the Shapiro-Wilk test for normality is conducted on the non-transformed and log-transformed data set with a significance level of 0.01. If the test concludes that the data set is neither normally distributed nor log-normally distributed, non-parametric statistics are used (per USEPA 2009, p. 10-9). This approach is applied consistently across all tests that have assumptions of data normality. We propose that IEPA approval of this approach may constitute approval of the use of non-parametric statistics moving forward.

ATTACHMENT B

IEPA APPROVAL LETTER DATED NOVEMBER 23, 2016 AND CLOSURE AND POST-CLOSURE CARE PLAN FOR DUCK CREEK ASH POND NOS. 1 & 2

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
BRUCE RAUNER, GOVERNOR ALEC MESSINA, ACTING DIRECTOR

November 23, 2016

Mr. Rick Diericx
Managing Director, Environmental Compliance
Dynegy Operating Company
1500 Eastport Plaza Drive
Collinsville, IL 62234

Re: Dynegy Midwest Generation, Inc. – Duck Creek Power Station: Ash Pond System Closure and Post Closure Care Plan and Ground Water Management Zone - NPDES Permit No. IL0055620

Dear Mr. Diericx:

The Illinois Environmental Protection Agency (Agency) has completed the review of the Groundwater Management Zone Application (GMZ) and document revisions for the Duck Creek Power Station Ash Pond System Closure and Post Closure Care Plan (Plan), which were both dated September 15, 2016. The Appendix D Confirmation of an Adequate Corrective Action Pursuant to 35 Ill. Adm. Code 620.250(a)(2) application (Appendix D GMZ) dated October 19, 2016, was also reviewed.

The Agency review of the Plan in conjunction with the Plan document revisions, the GMZ and the Appendix D GMZ, determined that the information provided represents an appropriate means by which to close Ash Pond #1 and Ash Pond #2, and control impacted groundwater onsite, at the Duck Creek Power Station.

If you have any questions concerning this letter please contact me or Carl Kamp of the Hydrogeology and Compliance Unit at 217-785-4787.

Sincerely,

William E. Buscher, P.G.
Supervisor, Hydrogeology and Compliance Unit
Groundwater Section
Division of Public Water Supplies
Bureau of Water

CC: Darin LeCrone
Carl Kamp
Records

AECOM

Submitted to
Illinois Power Resources
Generating, LLC
Duck Creek Power Station
17751 North Cilco Road
Canton, IL 61520

Submitted by
AECOM
1001 Highlands Plaza Drive West,
Suite 300
St. Louis, MO 63110
March 2016

Closure and Post-Closure Care Plan for Ash Ponds Nos. 1 and 2 at

Illinois Power Resources Generating, LLC
Duck Creek Power Station
17751 North Cilco Road
Canton, IL 61520

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Figure C-100 Overall Grading Plan and Sheet Layout
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Appendix B Hydrostatic Modeling Report
Appendix C Slope and Stability Calculations
Appendix D Construction Quality Assurance Plan

Executive Summary of Closure and Post-Closure Care Plan

Ash Ponds Nos. 1 and 2 are inactive Coal Combustion Residuals (CCR) surface impoundments located at the Duck Creek Power Station near Canton in Fulton County, Illinois. In November 2015, in accordance with 40 CFR Part 257, Subpart D (CCR Rule), Illinois Power Resources Generating, LLC (IPRG) submitted to the Illinois Environmental Protection Agency (IEPA) a notice of intent to close Ash Ponds Nos. 1 and 2.

Ash Ponds Nos. 1 and 2 will be closed by leaving CCR in place and constructing a final cover system of earthen material. The final cover system will have lower permeability than the subsoils underlying the CCR. This design will control the potential for water infiltration into the closed CCR unit and will allow drainage of water off of and water out of the closed CCR unit.

After closure activities are complete, post-closure activities, which include groundwater monitoring and maintenance of the final cover system, will occur. The closure and post-closure activities will be in accordance with 40 CFR §257.102 and §257.104, respectively.

This document contains both a closure plan and a post-closure care plan and was prepared in accordance with the outline approved by the IEPA on February 23, 2016. Closure construction activities may begin upon approval of this closure and post-closure care plan by the IEPA. The closure activities are planned to be completed by November 18, 2020.

1 Closure Plan

Following approval by IEPA and acquisition of required permits, closure activities for Ash Ponds Nos. 1 and 2 will be performed according to this plan. The locations of Ash Ponds Nos. 1 and 2 are shown on Figure G-100.

1.1 Description of Proposed Closure Activities

Closure in-place of Ash Ponds Nos. 1 and 2 will occur over a multi-year construction period and is planned to be completed by no later than November 18, 2020. Closure construction activities will include, but are not limited to, pumping to remove surface water, dewatering of the CCR, relocating and/or reshaping the existing CCR to achieve acceptable grades for closure, and constructing an earthen final cover system that complies with the CCR Rule.

Removal of free standing surface water in Ash Ponds Nos. 1 and 2 (each a “Pond” and, collectively, the “Ponds”) will begin early in the construction sequence. Dewatering of highly saturated areas may be required prior to the relocating and grading of CCR and fill material begins.

CCR from the Duck Creek Power Station and the Edwards Power Station (as approved by IEPA Water Pollution Control Permit No. 2015-EO-59369) and mounded CCR from the southern portion of Ash Pond No. 1 will be beneficially reused to fill in low areas of the northern portion of Ash Pond No. 2. Additionally, excavations for the let-down structures are estimated to create an excess volume of soil, which will be placed as fill material in Ash Pond No. 2. CCR also will be excavated from the southern portion of Ash Pond No. 2 and placed in the northern portion of the impoundment as fill. Finally, CCR will be excavated from the southern portion of Ash Pond No. 1 and will be placed and regraded to fill the two pond-like areas in the northern portion of Ash Pond No. 1.

Existing and transferred CCR will be regraded in both Ponds to establish design subgrade elevations needed for the final cover system. The final cover system will comply with the applicable design requirements of the CCR Rule, including establishment of a vegetative cover to minimize long-term erosion.

A non-contact stormwater management system will be constructed to convey non-contact stormwater runoff from the cover system to interior collection channels located along the perimeters of each Pond. Let-down structures will be constructed to convey non-contact stormwater to the previously clean-closed Recycle Pond and to an existing pond located to the north of the Ponds. Both of these ponds drain to the Duck Creek Cooling Pond.

The closure designs include raising the crest elevation of the western perimeter embankment of both Ponds to raise the flow line elevation of the perimeter non-contact stormwater channels and minimize the potential need for CCR dewatering during construction and leachate management after construction. Where the embankment is increased in elevation, the exterior slopes will be four horizontal to one vertical (4H:1V) and interior slopes will be 3H:V1. Grading plans for Ash Ponds Nos. 1 and 2 can be found on Figures C-100 through C-103.

1.2 Engineering Plans and Specifications for the Proposed Closure Activities

The engineering plans and design specifications for the final cover system and closure activities will meet the requirements of the CCR Rule for closure by leaving CCR in place.

1.2.1 Final Cover System

The final cover for each Pond will be constructed in direct contact with graded CCR. The design will meet the requirements of the CCR Rule for the final cover system permeability to be less than or equal to the permeability of the subsoils present (mine spoil), or a permeability no greater than 1x10-5 cm/sec, whichever is less. This will be achieved through construction of a cover that consists of a minimum 18-inch infiltration layer of compacted earthen material with permeability not greater than 1x10-6 cm/sec (the estimated permeability of the underlying

mine spoil). The earthen material for the infiltration layer will be placed, graded, and compacted to meet the thickness and permeability design criteria. An erosion layer consisting of no less than 6 inches of earthen material capable of sustaining native plant growth will be placed on top of the infiltration layer. Details of the final cover system can be found on Figure C-106.

The requirement for the cover system to have less permeability than the bottom layer allows water in the pore space of the CCR to drain into the foundation soils and not accumulate in the closed impoundment. The closure design also achieves the goals of the low permeability layer and a protective layer to limit accumulation of water in the impoundment. Final cover system sections can be found on Figures C-104 and C-105.

1.2.2 Final Slope Design

The geometry of the final cover will provide mounded surfaces for stormwater runoff control. The final cover for each Pond will have a minimum planar slope of 2% and will be graded to convey stormwater runoff to collection channels. The cover system design will feature cross-slopes ranging between 2 and 5%. The key design elements, including cover permeability, final cover slope and drainage channel slopes, will control the post-closure infiltration into the CCR left in-place and preclude the probability of future impoundment of water at the units. Grading plans for Ash Ponds Nos. 1 and 2 can be found on Figures C-101 through C-103.

1.2.3 Summary of Slope Stability Evaluations

Based on geotechnical analysis attached in Appendix C, the final slope of the perimeter berms and cover will meet the stability requirements of the CCR Rule to prevent sloughing or movement of the final cover system. The design allows for settlement as well as incidental, localized settling and subsidence.

1.3 Proposed Timeline for Implementation and Completion of Proposed Closure Activities

Closure of Ash Ponds Nos. 1 and 2 is planned to be completed by no later than November 18, 2020. Closure will commence following IEPA approval of this closure plan and upon receipt of applicable permits for closure construction activities. Closure activities are scheduled to begin in 2016. The construction schedule includes time for mobilization of contractors and setup of construction support facilities, setup of stormwater management system, site maintenance during construction activities, seasonal shutdowns and demobilization of contractors and construction support personnel.

Estimated timing for major activity phases are as follows:

- Years 1 – 2
  - Acquire applicable permits for construction activities
  - Begin construction activities; possibly including pumping to remove surface water, dewatering of the CCR, relocating and/or reshaping the existing CCR, construction of drainage structures and let-down structures and construction of the final cover system
- Years 2 – 4
  - Continue construction activities; possibly including pumping to remove surface water, dewatering of the CCR, relocating and/or reshaping the existing CCR, construction of drainage structures and let-down structures and construction of the final cover system
- Years 4 – 5
  - Complete construction activities; possibly including pumping to remove surface water, dewatering of the CCR, relocating and/or reshaping the existing CCR, construction of drainage structures, let-down structures and construction of the final cover system
  - Complete construction of final cover system
  - Establish final cover vegetation
  - Perform final grading and contouring of the storm water management system

- Perform regulatory compliance follow-up with state agencies

1.4 Description of the Construction Quality Assurance Program for Proposed Closure Activities

The Construction Quality Assurance (CQA) Plan describes the CQA program for the closure of Ash Ponds Nos. 1 and 2. The site-specific CQA Plan, which is included in Appendix D, contains procedures for inspecting, monitoring, testing, and sampling to confirm compliance with project plans and specifications.

Elements of the CQA Plan include:

- Establishment of several key project personnel roles and responsibilities, including a CQA consultant team to perform field tests and provide written documentation that the final cover system is constructed in accordance with the applicable plans and specifications. The CQA consultant team will include a CQA Officer who is an Illinois-licensed Professional Engineer and who will supervise inspections and testing, certify on-site activities, and review and approve weekly construction reports.
- Regular safety and construction progress meetings.
- Standards and inspection and testing procedures for the following materials: earth cover and CCR materials, aggregates, geotextiles, piping, concrete and grout.
- Requirements for surveying to verify that thickness and grades of construction components are in accordance with plans and specifications.
- Compilation of project documentation including plans, specifications, schedules, and inspection and testing logs in weekly summary reports certified by the CQA Officer. Additional progress reports at regular intervals are detailed in the CQA Plan.

1.5 Summary of Groundwater Monitoring Plan

The proposed groundwater monitoring plan is provided in the attached Natural Resource Technology (NRT) report in Appendix A. In summary, groundwater will be monitored to evaluate post-closure groundwater quality and trends and to demonstrate compliance with groundwater quality standards for Class IV: Other Groundwater throughout the post-closure care period. Due to the exceptions for groundwater within a previously mined area, Class IV standards are applicable and equal to the existing concentrations of constituents in groundwater. The proposed groundwater monitoring system is designed to enable detection and measurement of contaminants if they should enter the groundwater from either Ash Pond Nos. 1 or 2.

The proposed groundwater monitoring well network consists of a sufficient number of wells, installed at appropriate locations and depths, to monitor post-closure compliance with groundwater quality standards. The groundwater monitoring well network utilizes 31 previously installed groundwater monitoring wells. Nineteen of these monitoring wells will be used for compliance sampling and analytical testing. Groundwater elevation will also be measured in twelve additional wells (31 wells total). The proposed monitoring system uses previously installed groundwater monitoring wells on-site and proposes the abandonment of some existing wells. The locations of the proposed groundwater monitoring network are identified on Figure 4-1 of the NRT report in Appendix A.

Specifications for each monitoring well meet IEPA design and construction requirements. Monitoring wells will be inspected during each groundwater sampling event. Maintenance will be performed as needed to ensure that the monitoring wells provide representative groundwater samples.

Statistical analysis of the laboratory analytical data will be reported to IEPA as required. Compliance with applicable groundwater quality standards is achieved when there are no statistically significant increasing trends detected at the downgradient boundaries that are attributed to Ash Ponds Nos. 1 or 2. Details of the proposed groundwater monitoring plan are provided in the attached NRT report in Appendix A.

1.6 Professional Certification and Seal

CCR Unit: Illinois Power Resources Generating, LLC; Duck Creek Power Station; Ash Pond No. 1

CCR Unit: Illinois Power Resources Generating, LLC; Duck Creek Power Station; Ash Pond No. 2

I, Victor Modeer, PE, D.GE., being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this Closure Plan dated March 2016 has been prepared in accordance with the accepted practice of engineering.

Victor Modeer, PE, D.GE

Printed Name

04/01/2016

Date



2 Environmental Impacts of Proposed Closure Activities

The information referenced in this section was derived from various reports prepared by NRT. An Illinois licensed Professional Geologist signed the attached document prepared by NRT.

2.1 Summary of Pre-Closure Groundwater Conditions

Groundwater monitoring has been performed at the site since 1980. Samples are currently collected semi-annually from 20 of the site's 31 monitoring wells in accordance with Operating Permit 2010-EO-0296. Boron and chloride are the most likely indicators of the presence of CCR constituents in groundwater for Ash Pond Nos. 1 and 2. Changes in groundwater elevation and groundwater quality have occurred since closure of the Recycle Pond in 2010. Supplemental hydrogeologic site characterization and groundwater quality data are discussed in detail in the NRT report attached as Appendix A.

2.2 Summary of Modeled Post-Closure Groundwater Conditions

The Hydrologic Evaluation of Landfill Performance (HELP) model was used to calculate the time for groundwater beneath Ash Pond Nos. 1 and 2 to reach hydrostatic equilibrium. Model results, discussed in detail in the Hanson report attached as Appendix B, indicate equilibrium will be reached 11 years after installation of the final cover, designed and installed to CCR Rule requirements. A groundwater flow and transport model was not prepared for Duck Creek since shallow groundwater at the site occurs within coal mine spoils and this site cannot be numerically modeled with any degree of confidence. However, a conceptual model of groundwater flow was developed to evaluate the potential off-site extent of Ash Pond Nos. 1 and 2 constituents. Groundwater flow at the site and its relation to nearby surface waters is summarized in Section 2.3 below and discussed in detail in the NRT report attached as Appendix A.

2.3 Anticipated Effects of the Closed Impoundment on Nearby Surface Waters

Groundwater currently flows radially from mounding within Ash Pond Nos. 1 and 2 to the east toward the Duck Creek Cooling Pond, to lowland areas to the north and in a westerly direction toward a surface mining remnant known as Long Lake. Groundwater migration from the closed Ash Pond Nos. 1 and 2 is not anticipated to affect Duck Creek Cooling Pond (the cooling water impoundment for the Station) or lowland areas to the north.

Groundwater along the western-most portion of Ash Pond Nos. 1 and 2 flows to the west toward Long Lake. The lake is an end-cut or last-cut lake formed when a mine operator leaves the last mining excavation or cut open, instead of backfilling with earth or other mined spoils. Off-site migration of CCR constituents in groundwater to Long Lake has not been evaluated.

3 Post-Closure Care Plan

Following closure of Ash Ponds Nos. 1 and 2, post-closure care will be performed according to this plan. The closed impoundments will be monitored and maintained for a post-closure period that is anticipated to continue for 30 years. The post-closure period may extend beyond 30 years if additional groundwater monitoring is required to assess groundwater constituents as compared to background levels.

3.1 Description of Post-Closure Care Activities

Throughout the post-closure care period, periodic, typically annual, visual inspections of the final cover system for evidence of settlement, subsidence, erosion, or other damage that may affect the integrity of the final cover system will be performed. Noted damage will be repaired in order to maintain the effectiveness of the final cover system. Repair activities may include, but are not limited to replacing cover soil and repairing drainage channels that have been eroded, filling in depressions with soil, and reseeding areas of failed vegetation.

Groundwater samples will be collected and analyzed for inorganic chemical parameters that are indicator constituents for CCR leachate including dissolved boron and dissolved chloride. In addition, each groundwater sampling event will measure field parameters and groundwater levels. The proposed groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards for Class IV: Other Groundwater.

The end of the post-closure period will be documented in accordance with the CCR Rule. Post-closure documentation will be maintained in the operating record for at least five years in accordance with the CCR Rule.

3.2 Description of the Planned Use of the Property during the Post-Closure Care Period

Following closure, a notation will be recorded on the deed to the property or on some other instrument that is normally examined during a title search to identify that the land has been used as a CCR impoundment. The notation will provide notice that use of the land is restricted to activities that will not disturb the integrity of the final cover system or groundwater monitoring system.

The Duck Creek Power Station will continue to be used as a power generating facility after closure of Ash Ponds Nos. 1 and 2. Activity on and around the final cover and stormwater systems for the closed impoundments will include ongoing post-closure inspection, maintenance and monitoring activities. Planned post-closure use of the property will not disturb or damage the integrity of the final cover system or groundwater monitoring system.

3.3 Stormwater Management

The key design elements of the stormwater management system, including cover permeability, final cover slope and drainage channel slopes, will minimize post-closure infiltration of liquids into the CCR left in-place and will preclude the probability of future impoundment of water at the impoundments. The stormwater management system is designed for a 25-year, 24-hour storm event and will be constructed during closure and grading of the final cover system. Closure designs include raising the crest elevation of the western perimeter embankment to raise the flow line elevation of the perimeter non-contact stormwater channels. Where the embankment is increased in elevation, exterior slopes will be 4H:1V and interior slopes will be 3H:1V.

The final cover for Ash Ponds Nos. 1 and 2 will have a minimum slope of 2% and will be graded and contoured to allow for drainage of stormwater to interior collection channels located along the perimeter of each Pond. The non-contact stormwater channels are designed with a minimum slope of 0.5%. These slopes are designed to control maximum water velocities to 5 feet per second or less.

From the collection channels, let-down structures will be constructed along the eastern perimeter of both Ponds and also along the northern portion of Ash Pond No. 2 to convey non-contact stormwater from the interior collection channels to the former clean-closed Recycle Pond located to the east of the Ponds and to an existing pond north of Ash Pond No. 2, which both discharge to the Duck Creek Cooling Pond. The let-down structures include a combination of open channels and piping. Jack and bore pipe installations will be used where the alignment of the let-down structures extends beneath an existing access road and railroad spurs. Grading plans for Ash Ponds Nos. 1 and 2 are provided in Figures C-100 through C-103 and details of drainage channels are provided on Figure C-106.

3.4 Professional Certification and Seal

CCR Unit: Illinois Power Resources Generating, LLC; Duck Creek Power Station; Ash Pond No. 1

CCR Unit: Illinois Power Resources Generating, LLC; Duck Creek Power Station; Ash Pond No. 2

I, Victor Modeer, PE, D.GE., being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this Post-Closure Care Plan dated March 2016 has been prepared in accordance with the accepted practice of engineering.

Victor Modeer, PE, D.GE

Printed Name

04/01/2016

Date



Figures

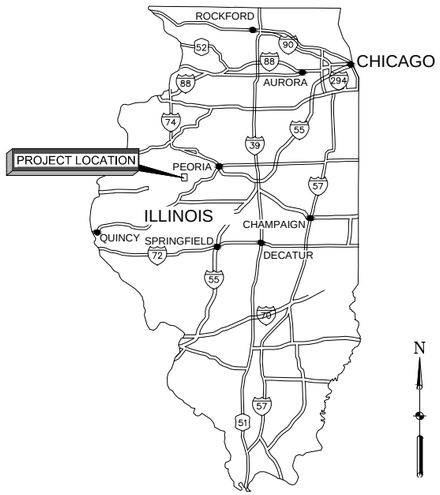
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DUCK CREEK POWER STATION

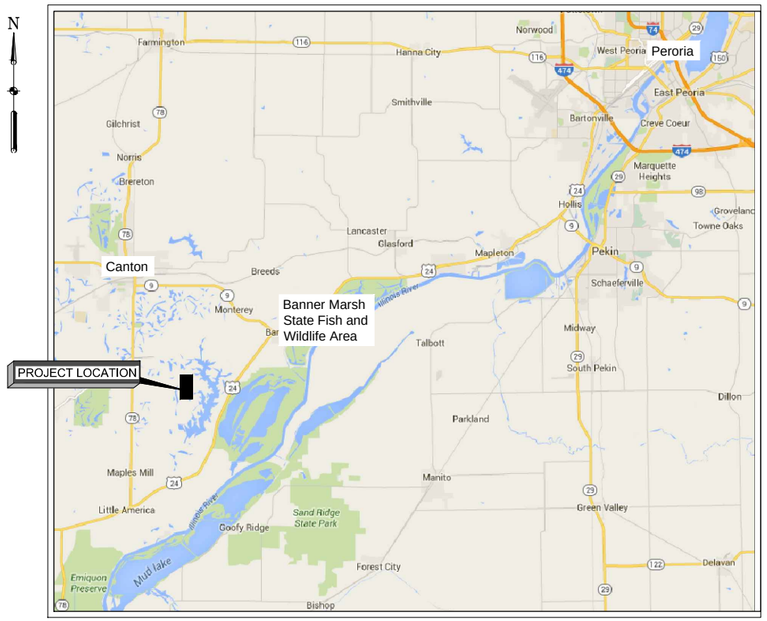
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PERMIT DRAWINGS

FOR CLOSURE OF ASH POND NO. 1 AND ASH POND NO. 2



STATE MAP
NOT TO SCALE



LOCATION MAP
NOT TO SCALE

DRAWING LIST		
SHEET NO.	DRAWING NO.	DRAWING TITLE
1	G-100	COVER SHEET AND LOCATION MAP
2	C-100	OVERALL GRADING PLAN AND SHEET LAYOUT
3	C-101	GRADING PLAN 1
4	C-102	GRADING PLAN 2
5	C-103	GRADING PLAN 3
6	C-104	SECTION N
7	C-105	SECTIONS P-Q-R
8	C-106	DETAILS

PRELIMINARY
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CANTON, IL

PERMIT DRAWINGS FOR CLOSURE OF ASH POND NO. 1 AND ASH POND NO. 2

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DRAWN BY:	LJS
DESIGNED BY:	WDS
CHECKED BY:	BDL
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PLOT DATE:	2016-03-24
SCALE:	AS SHOWN
ACAD VER:	2014

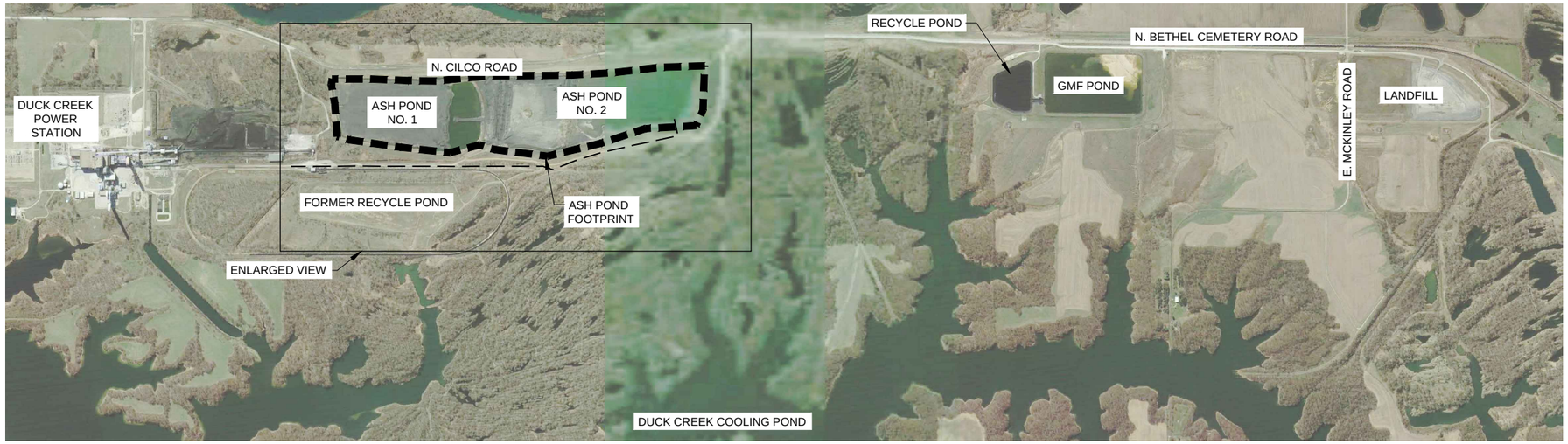
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COVER SHEET AND LOCATION MAP

G-100

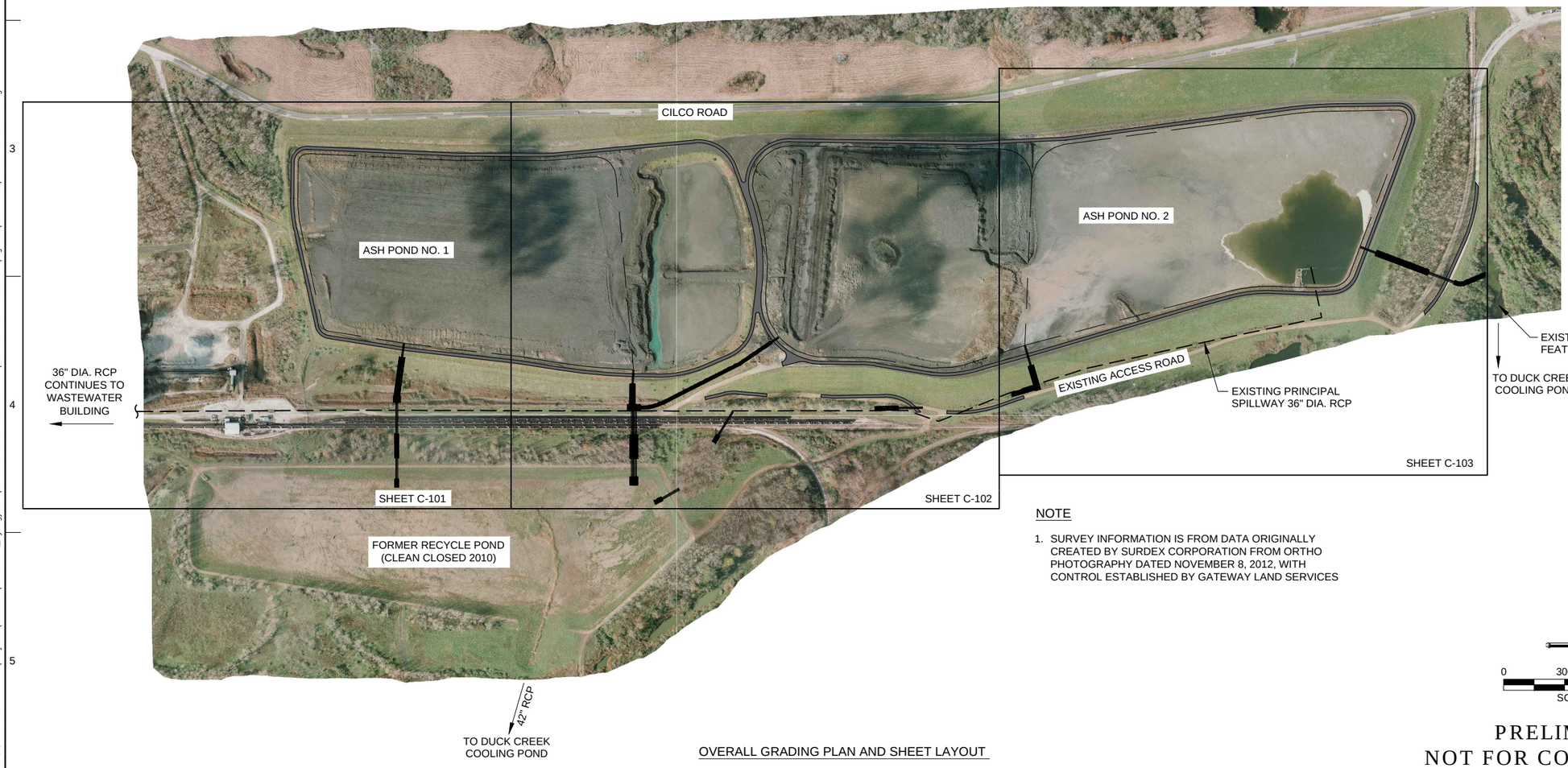
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GENERAL SITE MAP
SCALE: 1" = 1000'

SOURCE: GOOGLE EARTH PRO MAP DATED APRIL 2014.



OVERALL GRADING PLAN AND SHEET LAYOUT

NOTE

1. SURVEY INFORMATION IS FROM DATA ORIGINALLY CREATED BY SURDEX CORPORATION FROM ORTHO PHOTOGRAPHY DATED NOVEMBER 8, 2012, WITH CONTROL ESTABLISHED BY GATEWAY LAND SERVICES

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CANTON, IL

PERMIT DRAWINGS FOR CLOSURE OF ASH POND NO. 1 AND ASH POND NO. 2

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AECOM PROJECT NO:	60439301
DRAWN BY:	LJS
DESIGNED BY:	WDS
CHECKED BY:	BDL
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PLOT DATE:	2016-03-24
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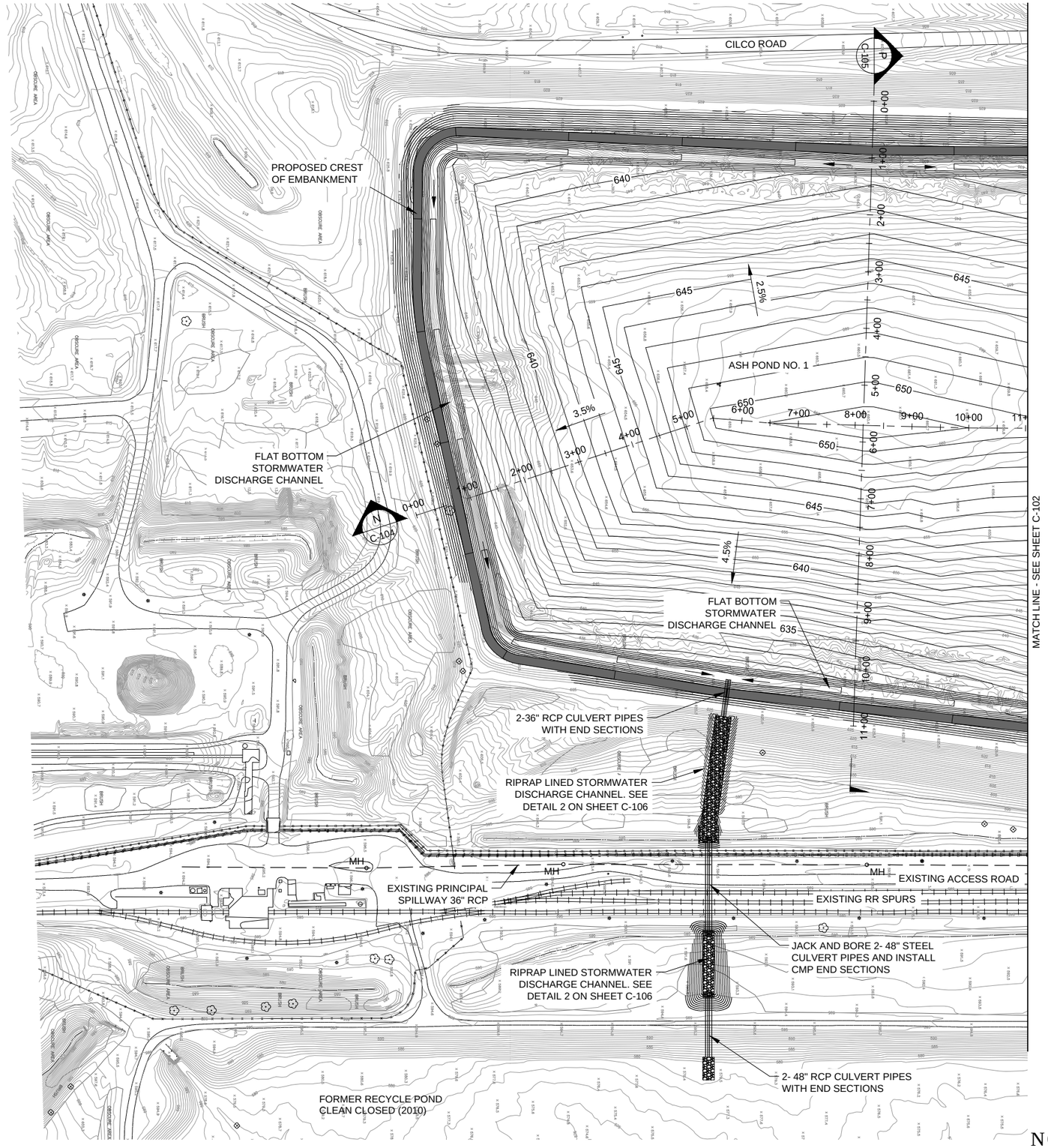
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OVERALL GRADING PLAN AND SHEET LAYOUT

C-100
SHEET 2 OF 8

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LEGEND:

- 600 EXISTING CONTOUR
- 640 PROPOSED CONTOUR (1 FT. INTERVAL)
- STORMWATER FLOW DIRECTION ARROW
- RIPRAP
- MH EXISTING MANHOLE

NOTES:

1. SURVEY INFORMATION IS FROM DATA ORIGINALLY CREATED BY SURDEX CORPORATION FROM ORTHO PHOTOGRAPHY DATED NOVEMBER 8, 2012, WITH CONTROL ESTABLISHED BY GATEWAY LAND SERVICES
2. EXISTING AND PROPOSED GRADE CONTOURS ARE SHOWN AT 1 FOOT ELEVATION INTERVALS
3. PROPOSED CONTOURS REPRESENT TOP OF COVER SYSTEM WITHIN THE CONFINES OF THE ASH PONDS
4. THE TYPICAL COVER SYSTEM HAS A MINIMUM OF 18" OF SOIL COVER AND 6" OF VEGETATIVE SOIL COVER. SEE DETAIL ON SHEET C-107

N

0 100 200 300

SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

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PERMIT DRAWINGS FOR CLOSURE OF ASH POND NO. 1 AND ASH POND NO. 2

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PLOT DATE:	2016-03-24
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GRADING PLAN 1

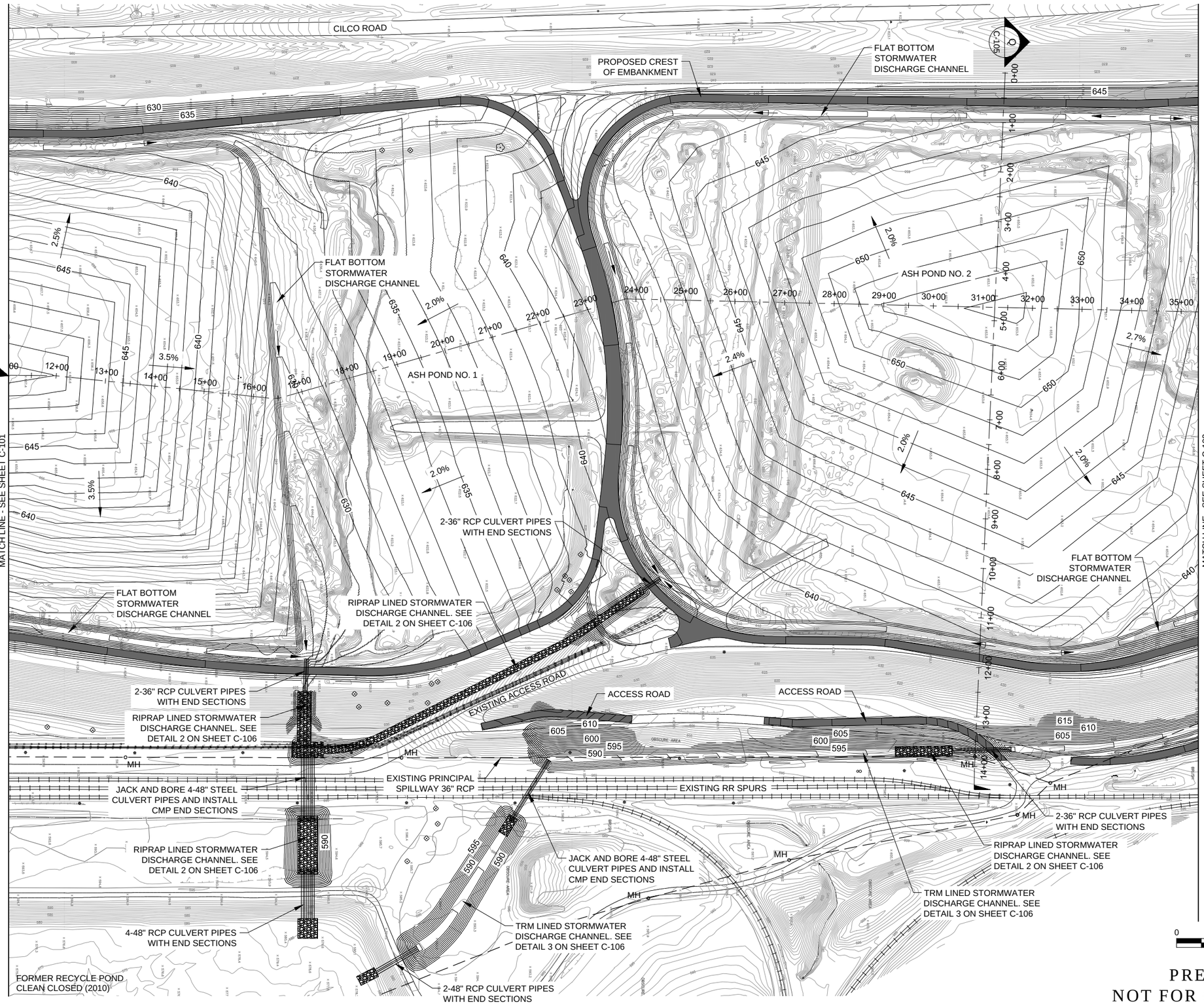
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- PROPOSED CONTOUR (1 FT. INTERVAL)
- STORMWATER FLOW DIRECTION ARROW
- RIPRAP
- MH EXISTING MANHOLE

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3. PROPOSED CONTOURS REPRESENT TOP OF COVER SYSTEM WITHIN THE CONFINES OF THE ASH PONDS
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CANTON, IL

PERMIT DRAWINGS FOR CLOSURE OF ASH POND NO. 1 AND ASH POND NO. 2

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REVISIONS

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SHEET TITLE

GRADING PLAN 2

C-102

SHEET 4 OF 8

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NOTES:

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2. EXISTING AND PROPOSED GRADE CONTOURS ARE SHOWN AT 1 FOOT ELEVATION INTERVALS
3. PROPOSED CONTOURS REPRESENT TOP OF COVER SYSTEM WITHIN THE CONFINES OF THE ASH PONDS
4. THE TYPICAL COVER SYSTEM HAS A MINIMUM OF 18" OF SOIL COVER AND 6" OF VEGETATIVE SOIL COVER. SEE DETAIL ON SHEET C-107
5. REFER TO GENERAL SITE MAP ON SHEET C-100 FOR THE LOCATION OF THE EXISTING DRAINAGE FEATURE TO THE DUCK CREEK COOLING POND

LEGEND:

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- STORMWATER FLOW DIRECTION ARROW
- RIPRAP
- MH EXISTING MANHOLE

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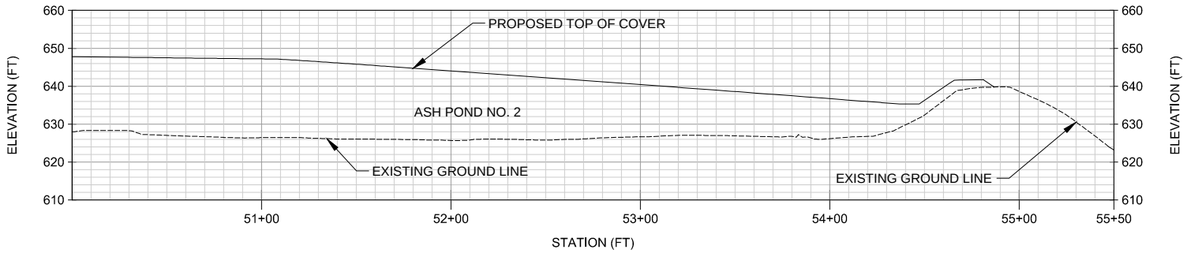
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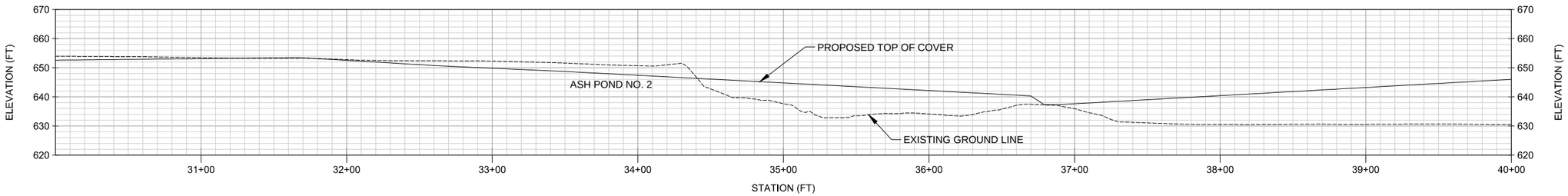
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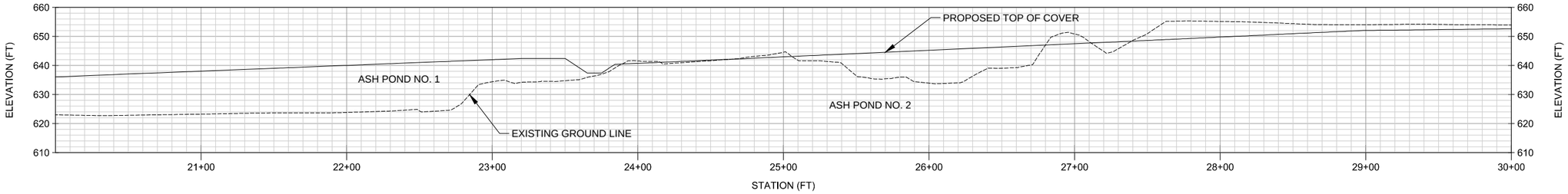
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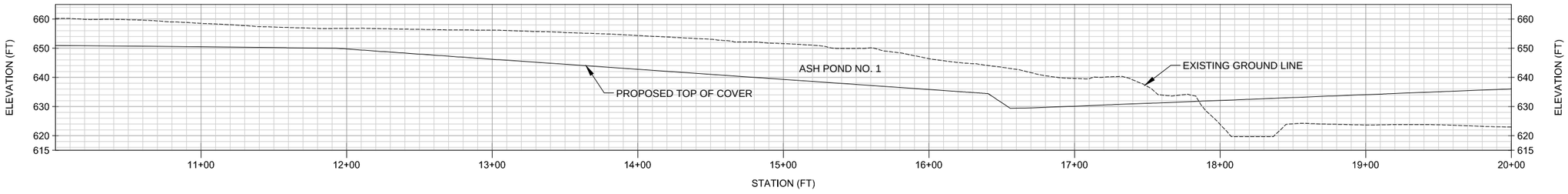
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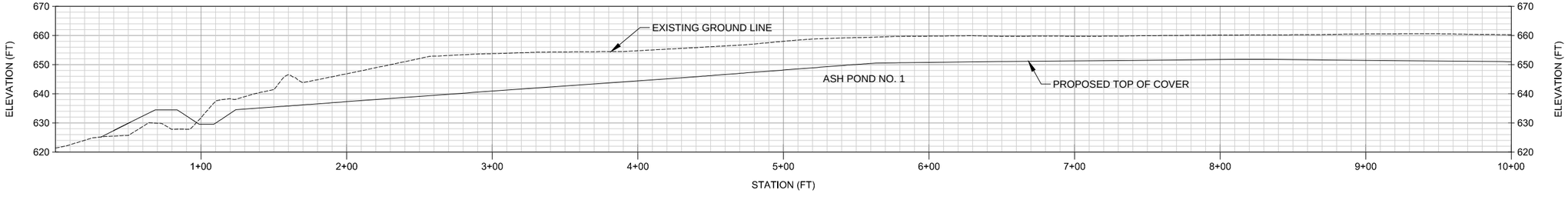
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3. PROPOSED GRADE ELEVATIONS REFLECT TOP OF COVER SYSTEM WITHIN ASH PONDS AND PROPOSED GROUND SURFACE ELEVATIONS OUTSIDE ASH PONDS

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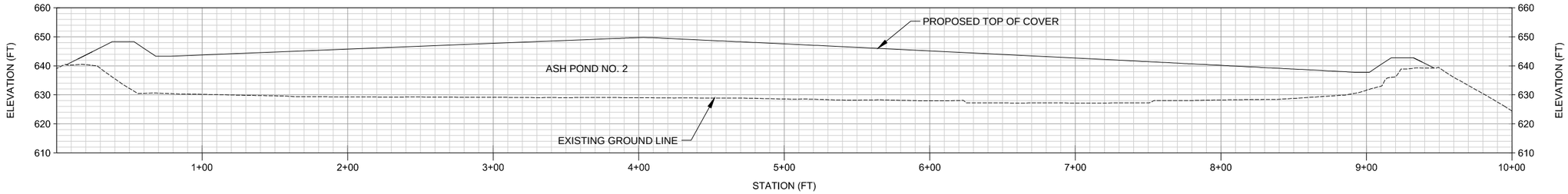
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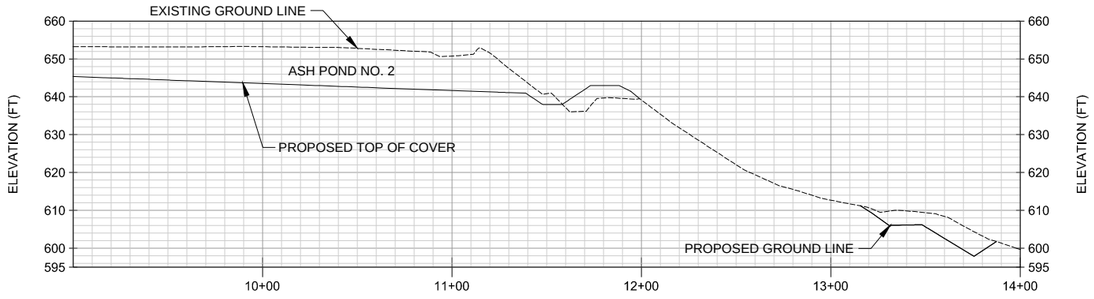
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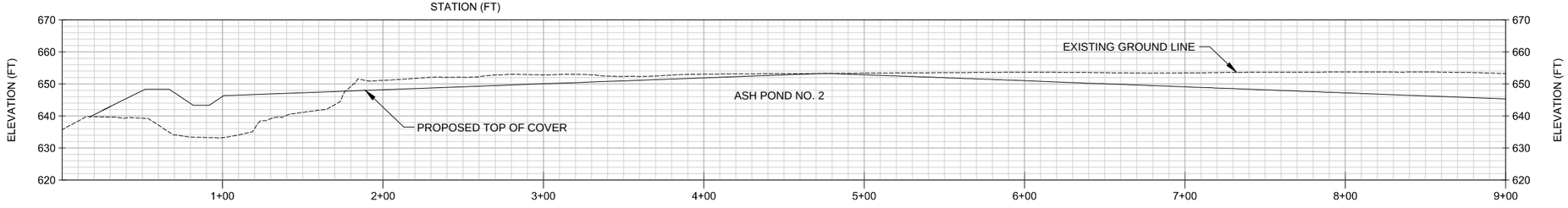
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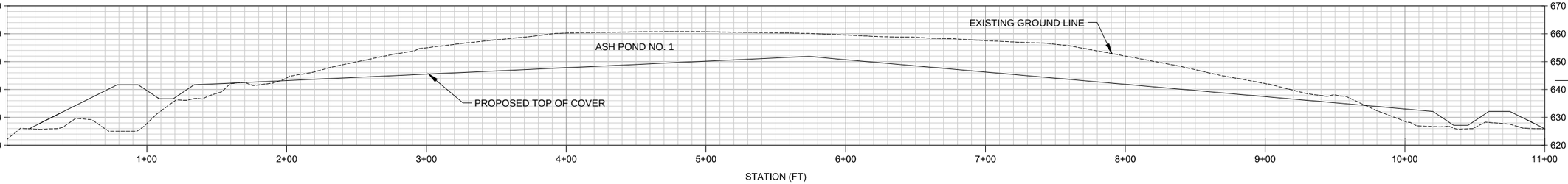


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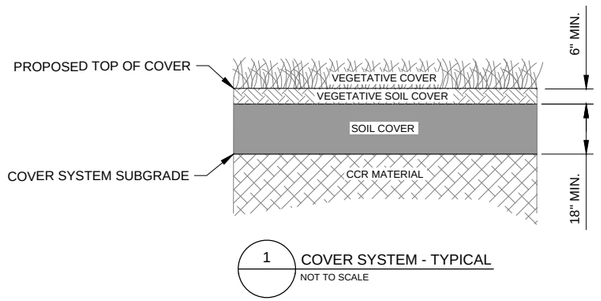
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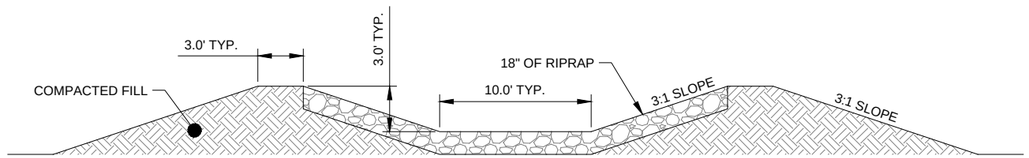
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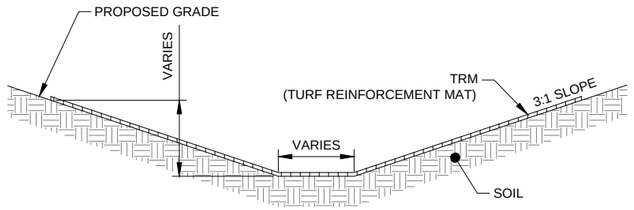
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3 TRM LINED STORMWATER DISCHARGE CHANNEL
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Appendices

Appendix A.
Supplemental Hydrogeologic Site Characterization Study and Groundwater Monitoring Plan

SMARTER SOLUTIONS

EXCEPTIONAL SERVICE

VALUE

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION AND GROUNDWATER MONITORING PLAN

Duck Creek Ash Ponds 1 and 2
Duck Creek Energy Center
Canton, Illinois

Project No: 2333

March 31, 2016

NATURAL RESOURCE TECHNOLOGY

ENVIRONMENTAL CONSULTANTS

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SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION AND GROUNDWATER MONITORING PLAN

DUCK CREEK ASH PONDS 1 AND 2
DUCK CREEK ENERGY CENTER
CANTON, ILLINOIS

Project No. 2333

Prepared For:

Illinois Power Resources Generating, LLC
1500 Eastport Plaza Drive
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Prepared By:

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2422 E. Washington Street, Suite 104
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March 31, 2016

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1 INTRODUCTION

1.1 Overview

This Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan was prepared for Illinois Power Resources Generating, LLC (IPRG) to develop hydrogeologic information in support of a Closure Plan for the Duck Creek Energy Center Ash Ponds 1 and 2.

Numerous site-specific subsurface investigations were performed at the Duck Creek Energy Center over the past 30 years, in compliance with various State and Federal environmental monitoring requirements. Hanson Professional Services, Inc., (Hanson) prepared a Hydrogeologic Report in March 2010, which Ameren[1] subsequently submitted to IEPA on March 25, 2010. The Hanson (2010) report provided documentation of background information, a description of subsurface geology, and discussions of groundwater analytical trends and hydrogeologic conditions while Ash Pond 1, Ash Pond 2, and Recycle Pond were in service.

The Hanson (2010) report is supplemented herein with additional information on the site geology and hydrogeology as well as groundwater analytical trends. The results of hydrostatic equilibrium modeling of the closure of Ash Ponds 1 and 2 will be submitted independent of this report.

1.2 Site Location and History

The Duck Creek Energy Center is located in Sections 19 and 30 of Township 6 North, Range 5 East, southeast of Canton, in Fulton County, Illinois. Figure 1-1 depicts the location, topography, and surrounding land use near the power plant. Figure 1-2 is an aerial photograph that identifies the locations of Ash Pond 1, Ash Pond 2, the previously clean-closed Recycle Pond (collectively referred to herein as the “ash ponds”), coal storage yard, generating facility, and nearby surface water bodies, including Duck Creek Cooling Pond, which is used as a source of cooling water for the Duck Creek power generation units, and Long Lake, a remnant of the area’s surface mining history.

Prior to construction of the power plant and associated facilities, strip mining of coal took place within the boundaries of the Duck Creek Energy Center, specifically in the area now occupied by the ash ponds, and on land immediately surrounding the ash ponds. Mining occurred at the Buckheart Mine No. 17, from

[1] IPRG has owned and operated the Duck Creek Energy Center since December 2, 2013. As relevant herein, Ameren Energy Resources Generating Company (Ameren) owned and operated the Duck Creek Energy Center up to December 2, 2013.

1937 to 1984, originally operated by United Electric Coal Company (1937 to 1975), and then later by Freeman United Coal Mining Company (1975 to 1984). As a result of these mining activities, subsurface investigations have encountered a mixture of mining spoils with native materials–mostly silt, clay, and broken shale bedrock–as evidence of past mining activities (Hanson, 2010).

Ash Pond 1 was constructed and permitted in 1976, concurrent with the commissioning of the Duck Creek Energy Center. The structure is as an above ground impoundment with raised berms covering approximately 60 acres. At an average depth of 21 feet, Ash Pond 1 has a design capacity of 1,230 acre feet (acre-ft). Ash Pond 2 was constructed in 1984, also as an above ground impoundment covering approximately 80 acres with an average depth of 40 feet. Ash Pond 2 has a design capacity of 3,200 acre-ft. The Recycle Pond was constructed below grade at an average depth of 3½ feet over approximately 40 acres resulting in a capacity of 140 acre-ft.

Fly ash was sluiced to Ash Pond 1 between 1976 and 1986, while Ash Pond 2 accepted fly ash beginning in 1984. Clean closure activities at the Recycle Pond were completed in 2010, when Ash Pond 1 and Ash Pond 2 were removed from service. Ash from the Recycle Pond was excavated and placed in Ash Ponds 1 and 2. AECOM Figures 2A and 2B (Appendix A) show the current topography of the ash ponds.

IPRG no longer sluices fly ash at the Duck Creek Energy Center, and has obtained permits and constructed landfill facilities to manage fly ash and FGD residue, and a new lined basin to treat bottom ash transport water and miscellaneous low volume wastewater.

2 SUMMARY OF SITE GEOLOGY AND HYDROGEOLOGY

2.1 Site Geology

The site-specific geology was described by Hanson (2010). Regionally, the upper unconsolidated materials consist of Wisconsinan Stage materials overlying Illinoian Stage deposits. The undisturbed unconsolidated materials near the Site consist of loess, diamictons, and lacustrine/alluvial deposits (Willman, 1975). These materials are present in the strip mine spoil material, but have been excavated and mixed due to the surface mining activities. The Site and surrounding area are part of several, large, surface coal mines that have since stopped mining operations (Berg and Kempton, 1988). AECOM Figure 1 (Appendix A) shows the approximate limits of mining activities within and surrounding the Site.

Previous site investigations completed and reports prepared for the Site indicate that bedrock in the area is overlain by mine spoil ranging in thickness from approximately 10 ft (at monitoring well OM24D) to 75 feet (at OM15). The mine spoil consists of excavated bedrock (weathered shale, shale fragments, and some coal fines) mixed with the sand, silts and silty clays of the unconsolidated glacial and aeolian deposits. In general, the depth to bedrock increases to the south and east. However, there appears to be a bedrock ridge that lies approximately midway (north-south axis) beneath Ash Pond 2 (Hanson, 2010).

AECOM (2015) completed a geotechnical investigation that included an additional 31 borings that were reported in the 30% design data package for theAsh Ponds 1 and 2. Soils encountered were typically described as mottled grey to reddish brown lean clay. Representative samples from the borings were submitted to Alpha-Omega Geotech, Inc. (Alpha-Omega) for laboratory determination of soil geotechnical properties, including, but not limited to, Atterberg Limits, natural moisture (%), unconfined compression strength, void ratio, hydraulic conductivity and triaxial compression tests. The geotechnical information is being submitted as a separate report for the ash pond closure plan.

The uppermost bedrock consists of a Carbondale Formation shale unit that lies stratigraphically beneath the Springfield (No. 5) Coal Member that was mined. The near surface bedrock at the Site generally consists of shale, siltstone, sandstone, and coal. Geologic cross-sections are shown on Hanson Figures 4 and 5 (Appendix A).

2.2 Site Hydrology

The Site topography and drainage is shown on Figure 1-1. Surface water drainage over much of the Site flows into the Duck Creek Cooling Pond, the cooling water impoundment for the Station. The

western-most portion of the Site (west of the ash ponds) slopes toward the west. Surface water runoff from this area of the Site drains to a surface mining remnant known as Long Lake. The lake is an end-cut or last-cut lake formed when a mine operator leaves the last mining excavation or cut open, instead of backfilling with earth or other mined spoils. Long Lake lies on property currently owned by Freeman United Coal Company.

2.3 Site Hydrogeology

2.3.1 Groundwater Flow within Coal Mine Spoils

As described in the Hanson (2010) report, shallow groundwater at the site occurs within coal mine spoils. During the period of operation of Ash Pond 1 and Ash Pond 2, the ponded surface water created mounding of the water table and generated a radial pattern of flow beneath the ponds. Groundwater flowed to the east toward the Duck Creek Cooling Pond, to lowland areas to the north and in a westerly direction toward Long Lake. A water table contour map for April 2007, prior to removal of service of the ash ponds, is shown on Figure 2-1.

Following closure of the Recycle Pond and removal of Ash Ponds 1 and 2 from service, changes in groundwater elevation were observed within the ash ponds (Table 2-1) and at multiple monitoring wells (Table 2-2). Porewater elevations measured in wells within the ash ponds decreased by 1.8 to 4.9 ft between November 2010 and May 2012. Large decreases in average groundwater elevation were recorded at wells adjacent to the ash ponds, with the largest average decreases (greater than 5 ft) occurring at wells located between the Recycle Pond and Ash Ponds 1 and 2 (OR05D, OM05S, OR06A, OM07, OR13D). Large decreases in groundwater elevations (3 to 7 ft) were also noted at wells OR11, OR19 and OM20/OR20 located immediately east of the Recycle Pond.

Increases in average groundwater elevation ranging from 0.5 to 5.0 ft were typically noted in wells located in lowland areas east of the ash ponds (Table 2-2, OM10, OM12, OR14D, OM15, OM16, OM17 and OR18). These increases are not related to closure of the Recycle Pond or removal of Ash Ponds 1 and 2 from service.

Representative hydrographs of wells between the closed Recycle Pond and Ash Pond 2 (OR6A), wells located immediately east of the Recycle Pond (OR20), and wells located in lowland areas east of the ash ponds (OM16) are shown below.

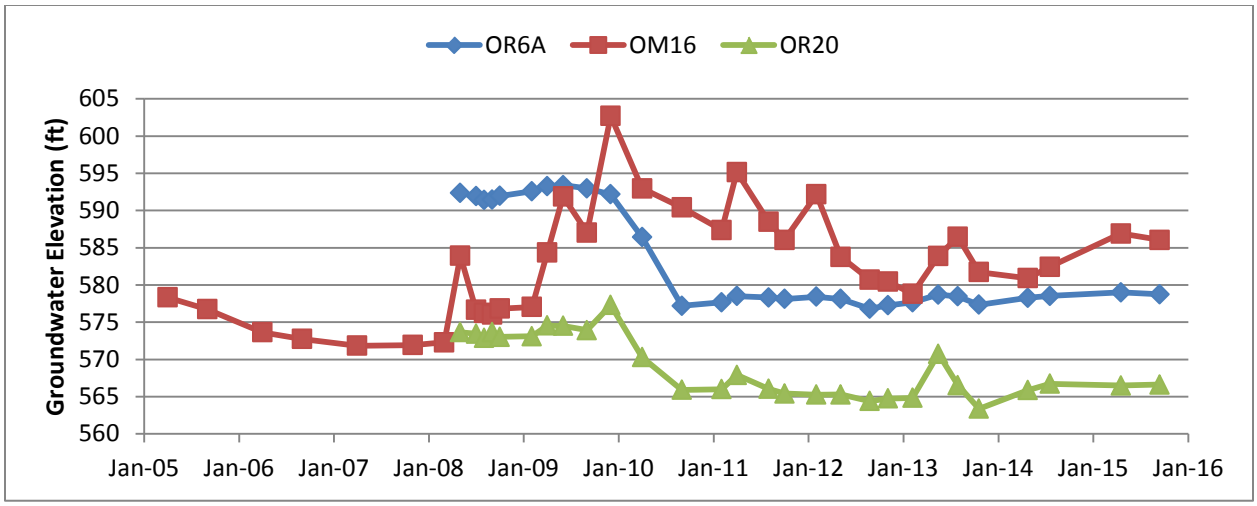


Figure 2-2 shows water table elevation contours and flow directions in September 2015, approximately five years following closure of the Recycle Pond and removal of Ash Ponds 1 and 2 from service in 2010. Comparison of the April 2007 and September 2015 water table elevation contour maps indicates that while the pond closure activities have lowered porewater heads within the ash, groundwater mounding within the ash ponds maintains a general radial flow pattern. However, the groundwater quality data (discussed in Section 3) suggests there may be an increased component of flow in a westerly direction toward Long Lake, based on increasing boron and/or chloride concentrations in selected wells.

2.3.2 Hydraulic Conductivity within Coal Mine Spoils

Hanson (2016a) completed hydraulic conductivity testing (slug testing) of the monitoring wells immediately surrounding Ash Pond 1 and Ash Pond 2. Analyses of the falling head and rising head tests performed at each well were performed using the Bower-Rice method [B-R] (Bouwer & Rice, 1976; Bouwer, 1989) and the Kansas Geological Survey method [KGS] (Butler, 1998) unconfined solutions. The geometric mean hydraulic conductivity for the 23 tests performed within mine spoil material was 2.0×10^{-4} cm/sec, with values ranging from 1.5×10^{-3} cm/sec at OR03D to 5.2×10^{-6} cm/sec at OM04S. Test methods and details are provided in Appendix B1 and the results are summarized below.

Field Hydraulic Conductivity Test Results (cm/sec)

Well Number	Falling Head	Rising Head	Geometric Mean	Analysis Method
OM01	0.00045	0.00065	0.00054	B-R
OR02	0.00037	0.00047	0.00042	B-R
OR03D	0.0015	0.00077	0.0011	B-R
OR03S	0.00039	0.00030	0.00034	B-R
OR04D	0.00015	0.00031	0.00021	B-R
OM04S	0.0000052	0.000055	0.000017	B-R
OR05D	0.000034	0.000034	0.000034	KGS
OM05S	0.000095		0.000095	B-R
OR06A	0.00018	0.00054	0.00031	B-R
OM07	0.00011	0.00024	0.00016	B-R
OM09	0.00031	0.00026	0.00028	KGS
OM21	0.00035	0.00036	0.00035	B-R
Geometric Mean =	1.7×10^{-4}	2.7×10^{-4}	2.0×10^{-4}	

Four falling head permeability tests (ASTM D5084 Method C) were also performed in the Alpha-Omega laboratory on undisturbed soil samples collected from the AECOM (2015) geotechnical borings B008, B015, B019 and B026. Sample locations are shown on AECOM Figures 2A and 2B Ash Pond Borehole Location maps in Appendix A. Test methods and details are provided in Appendix B2 and the results are summarized below.

Laboratory Hydraulic Conductivity Test Results (cm/sec)

Boring Number	Sample Depth (feet)	Hydraulic Conductivity
B008	16 – 17.5	6.8×10^{-8}
B015	56 – 57.5	8.1×10^{-8}
B019	43.5 - 45	3.7×10^{-7}
B026	33.5 – 35	1.5×10^{-7}
Geometric Mean =		1.3×10^{-7}

The geometric mean hydraulic conductivity of 1.3×10^{-7} for the 4 laboratory tests performed within mine spoil material was several orders of magnitude lower than the field test results. The falling head permeability tests on undisturbed soil samples measure hydraulic conductivity in a vertical orientation whereas the field tests measure a much larger section of saturated soil in a horizontal orientation. Slug

tests in the field at this site will encounter discontinuous lenses of sand and silt within the disturbed mine spoil that will exhibit localized higher hydraulic conductivity. Given this anisotropy of the mine spoil material, a range of horizontal hydraulic conductivities measured in the field that is several orders of magnitude higher than the range of vertical hydraulic conductivity measured in the laboratory is not unexpected. These results suggest groundwater will preferentially flow laterally through the mine spoils rather than vertically and that the rate of lateral groundwater flow will be highly variable.

2.3.3 Potential for Saturated Ash

As previously discussed, groundwater mounding within the ash ponds persists since the ponds have been removed from service in 2010. Porewater levels measured in piezometers screened within the coal ash (Table 2-1) indicate head fluctuations of about 3 ft. Boring logs for OM26, OM27, and OM28, which were drilled in the center of Ash Ponds 1 and 2, indicated an ash thickness of 60 to 63 ft below ash surface elevations of 650 to 660 feet. This places the base of ash at an elevation of approximately 590 feet. Given porewater elevations of 627 to 638 ft measured in December 2015, the current thickness of saturated ash is roughly 40 to 50 ft.

These porewater elevations are roughly 30 to 40 ft higher than in monitoring wells located in the surrounding berms. As previously noted, it appears groundwater levels in selected wells have been decreasing, due to the site regrading and the reduction of surface water in the ash ponds (Table 2-2). Groundwater elevations are expected to continue to dissipate after the cap is constructed. It is possible that ash will not be saturated once the cap is applied and the mound dissipates.

A more detailed analysis of the post-closure hydrostatic equilibrium groundwater elevations beneath the ash ponds is provided in the modeling report prepared by Hanson (2016b).

2.3.4 Groundwater in Bedrock

During September 2015, Hanson (2016a) completed boring OM26B to a depth of 355 ft below ground surface (bgs). Bedrock was encountered at a depth of 85 ft. At the completion of the coring operations, the lower 255 ft. of bedrock in the boring was pressure (packer) tested. The interval between the two packers was approximately 8.5 ft. Flow to the bedrock test interval (i.e. hydraulic conductivity) was measured at several increasing and decreasing pressures. As shown below, the mean hydraulic conductivity values decreased as pressure testing continued up the borehole. The greatest water uptake during the testing was noted in the bottom 20 ft. of the borehole with mean hydraulic conductivity values ranging from 2 to 9 x 10^{-6} cm /sec. The uppermost 100 ft. of bedrock tested had almost no water uptake during the pressure testing.

Field Packer Test Hydraulic Conductivity Results (cm/sec)

Test No.	Depth (ft.)	Arithmetic Mean of Hydraulic Conductivity	Median of Hydraulic Conductivity
A	351.57	1.7×10^{-6}	1.3×10^{-6}
B	331.64	8.5×10^{-6}	5.8×10^{-6}
C	321.54	5.7×10^{-8}	3.9×10^{-8}
D	300.77	5.0×10^{-7}	2.7×10^{-8}
E	279.77	0.0	0.0
F	269.17	7.1×10^{-9}	0.0
G	258.72	5.9×10^{-7}	4.6×10^{-8}
H	248.62	3.0×10^{-9}	0.0
I	227.61	0.0 *(no take)*	0.0 *(no take)*
J	217.05	3.6×10^{-8}	0.0 *(no take)*
K	206.51	1.5×10^{-9}	0.0
L	196.37	0.0 *(no take)*	0.0 *(no take)*
M	185.77	1.5×10^{-9}	0.0
N	175.55	0.0 *(no take)*	0.0 *(no take)*
O	165.39	4.1×10^{-9}	0.0
P	155.25	0.0 *(no take)*	0.0 *(no take)*
Q	144.75	1.5×10^{-9}	0.0
R	134.15	1.3×10^{-9}	0.0
S	124.04	0.0 *(no take)*	0.0 *(no take)*
T	113.86	0.0 *(no take)*	0.0 *(no take)*
U	103.41	0.0 *(no take)*	0.0 *(no take)*

Based on these results, the bedrock is acting as an aquitard to vertical migration of groundwater. Details of the packer testing and boring log are provided in the Hanson (2016a) report in Appendix B1.

2.3.5 Proximity of Potable Wells

Hanson (2010) identified one domestic water supply well approximately one mile north-northwest of Ash Pond 2 as shown on Hanson Figure 1 (Appendix A). This well is sufficiently distant that it cannot be considered downgradient of the site. The boring log for the potable well indicates that it was completed to a total depth of 50 feet bgs. Water is obtained from clay at a depth of 48 feet, and a reported pumping capacity of 10 gallons per minute. The well is located within an area where the unconsolidated deposits have not been disturbed by mining.

3 GROUNDWATER QUALITY

3.1 Summary of Groundwater Monitoring Activities

Groundwater monitoring has been performed at the site since 1980. Sampling was initially performed semi-annually for the parameters specified in the facility's IEPA, Subpart B permit. Samples are currently collected semi-annually from 20 of the site's 31 monitoring wells in accordance with Site Operating Permit 2010-EO-0296 for analysis of boron, chloride, hardness, iron, manganese, sulfate and total dissolved solids (TDS) as well as field parameters pH, specific conductance and temperature. Samples of porewater and surface water from the ash ponds were also historically collected and analyzed. Table 3-1 lists monitored parameters and the time interval over which the parameters have been sampled and analyzed. Table 3-2 is a list of existing monitoring wells at the facility and the period each well has been monitored for groundwater elevation and/or chemistry. Figure 3-1 shows the monitoring well locations and elevations of the bottom of the well screens.

3.2 Leachate Concentrations

Appendix C-1 lists leachate sample results for surface water from Ash Ponds 1 and 2 and former Recycle Pond, and Appendix C-2 provides porewater leachate sample analytical laboratory reports from two piezometers screened in the ash ponds. Table 3-3 lists the low, high and median concentrations for the constituents analyzed in Ash Ponds 1 and 2 and the Recycle Pond as well as the porewater leachate samples.

The leachate is characterized by boron concentrations greater than 100 mg/L, chloride, sulfate and hardness concentrations greater than 1,000 mg/L, and low concentrations for most trace metals. Boron and chloride are the most likely indicators of the presence of ash pond leachate constituents in groundwater for this site. As discussed further below, these constituents have high concentrations in leachate relative to background.

3.3 Background Groundwater Quality

Appendix C-3 lists groundwater analytical results for samples collected from all monitoring wells since 2000. Boron and chloride concentrations monitored in wells distant (more than 2,000 feet) from the ash ponds (OM10, OM16, OM17) are low with median concentrations less than 0.2 mg/L boron and 10 mg/L chloride (Table 3-4), indicating that these wells represent background groundwater quality within the mine spoils. Hardness, sulfate and TDS concentrations in these wells are high and occur within the concentration ranges of these constituents in leachate. Median iron and manganese concentrations are

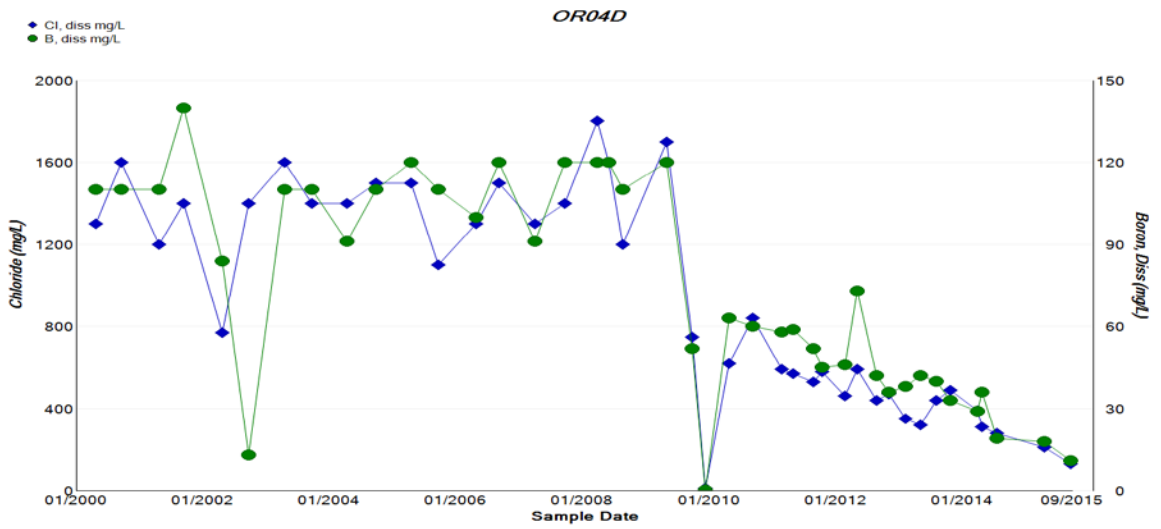
higher than leachate concentrations. These results indicate that hardness, sulfate, TDS, iron and manganese are not useful indicator constituents for determining the extent of leachate migration from the ash ponds.

Additional background samples were collected from the well nests OM50 and OM51 in 2009-2010, which were located 1.5 miles northwest and south, respectively, of the ash ponds in areas where no power plant activities occur. With the exception of boron in the deep wells, concentrations from these wells had ranges similar to the ranges observed in OM10, OM16, and OM17. Median boron concentrations in OM50D and OM51D (2.0 and 1.2 mg/L, respectively) were not within the range of values observed at OM10, OM16, and OM17 (Table 3-4). Inspection of geologic logs for these wells (Appendix D) showed that OM50D and OM51D were screened in mine spoils consisting largely of shale, which has been documented elsewhere as a source for boron concentrations greater than 1 mg/L in groundwater (Rowe, 1999). Data from OM50D and OM51D indicate that shale within the mine spoils at this site are capable of leaching boron at concentrations up to 2 mg/L. The OM50 and OM51 well nests have been abandoned.

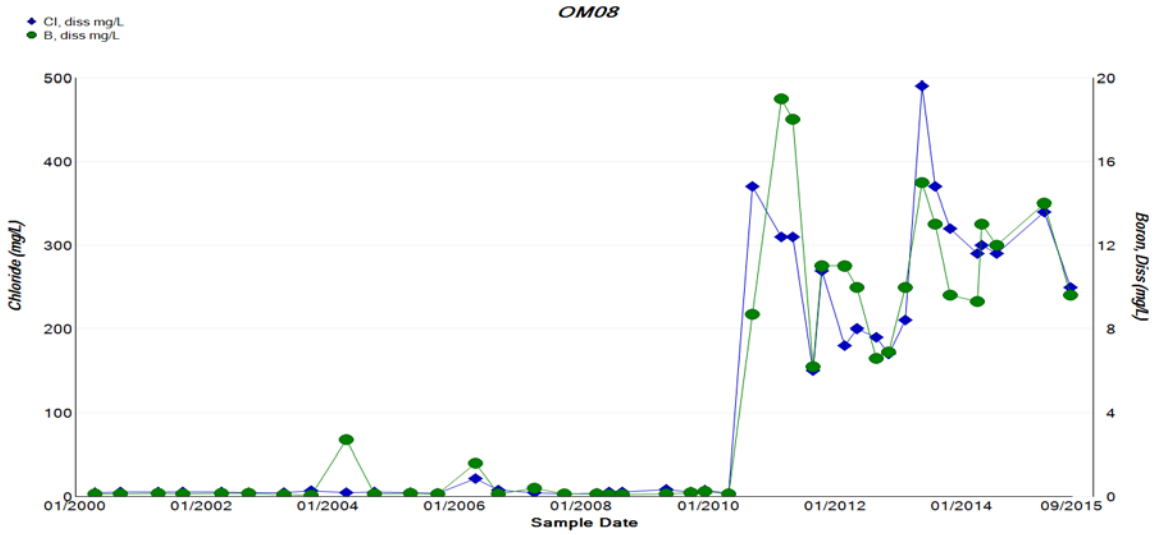
3.4 Changes in Groundwater Quality Since 2010

Table 3-5 compares average boron and chloride concentrations immediately before closure of the Recycling Pond and removal of Ash Ponds 1 and 2 from service (2008-2009) to the period March 2014 through September 2015 for wells sampled during both monitoring periods. Time-series plots of boron and chloride concentrations for all currently monitored wells are provided in Appendix C-4. The concentration averages during the two time periods and the time-series plots of boron and chloride concentrations indicate the following:

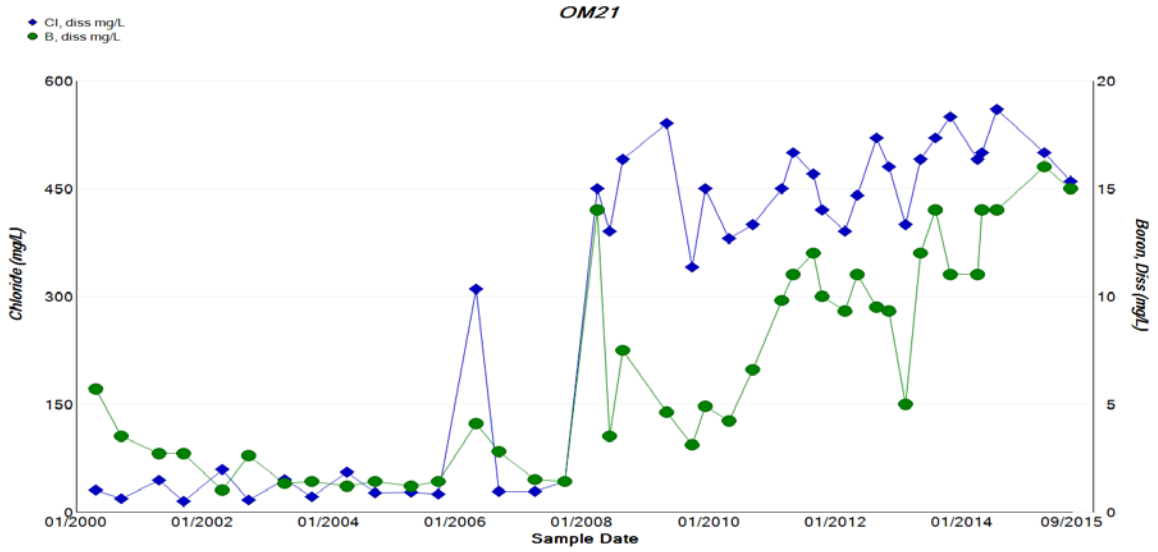
- Changes and trends in boron and chloride concentrations are closely aligned. The similarities in the trends of these constituents at all well locations (Appendix C-4) reinforce their usefulness as indicator parameters of ash leachate presence and migration in groundwater.
- Average concentration decreases of 28 to 98 percent were observed in seven monitoring wells (OR04D, OM07, OR13S, OR13D, OR14D, OR19, OR20) after closure of the Recycle Pond and removing Ash Ponds 1 and 2 from service. All of these wells are located east of the ash ponds and concentration trends suggest decreases will continue beyond 2015 (see plot for OR04D below).



- Concentrations increased at OM08 and OR11 following removal of the recycle pond. OM08 was side-gradient of the ash ponds prior to 2010 and is now upgradient of the ash ponds. There are no apparent groundwater flow mechanisms to explain the relatively large concentration increase observed at this monitoring point (see plot for OM08 below). In the case of OR11, the increase was relatively small in absolute value and temporary. Decreasing concentration trends were observed at OR11 beginning in 2013 and may represent a shift in groundwater flow direction caused by removal of the Recycle Pond.



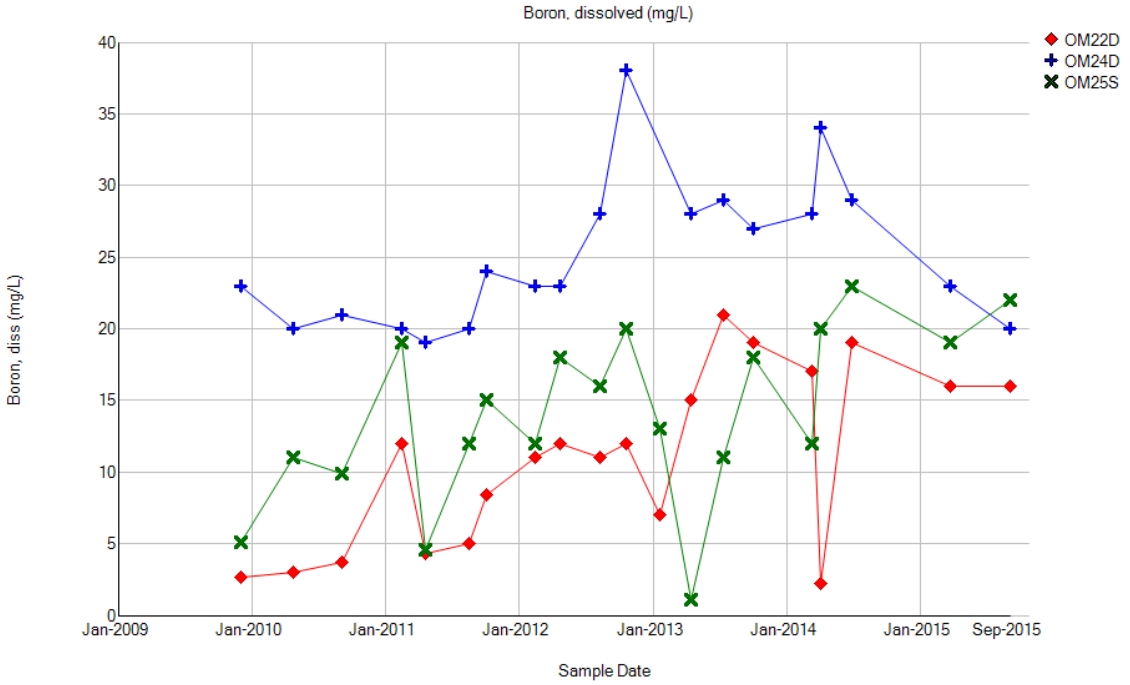
- Average concentration increases greater than 40% percent for boron and/or chloride were observed in monitoring wells OM21, OM22D, OM24D and OM25S. The plot for OM21 located east of the ash ponds, shown below, exhibits increasing concentration trends in 2008, prior to removing Ash Ponds 1 and 2 from service. Concentration trends suggest boron and chloride may stabilize or decrease beyond 2015. Similar observations cannot be confirmed at OM22D, OM24D and OM25S because sampling of these wells did not commence until December 2009. Additional discussion of these wells west of the ash ponds is provided below.

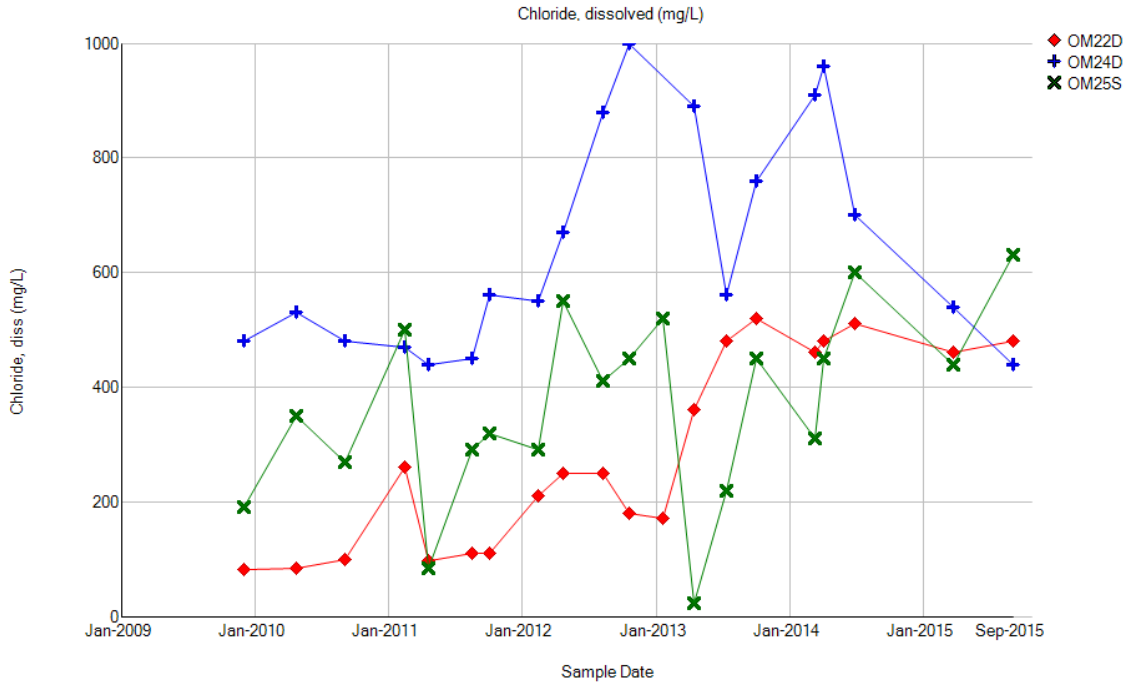


3.5 Potential for Off-Site Migration

Monitoring wells OM22D, OM22S, OM23D, OM23S, OM24D, OM25D, and OM25S are located west of the ash ponds along the west property boundary. Boron concentrations in these monitoring wells range from less than 2 to 38 mg/L and chloride concentrations range from less than 20 to 1,000 mg/L.

- Wells OM22S and OM23S are screened in mine spoils predominantly consisting of silt and clay. When last sampled in 2010, boron concentrations in these wells were lower than 2 mg/L and chloride concentrations were 21 mg/L or less, indicating that these wells are not measurably affected by leachate from the ash ponds.
- Wells OM23D and OM25D are screened beneath mine spoils containing shale. Boron concentrations in these wells are typically about 2 mg/L and chloride concentrations are typically about 35 mg/L at OM23D and 100 mg/L at OM25D. The boron concentrations are at levels similar to the background concentrations observed at OM50D and OM51D. Chloride concentrations are higher than background (10 mg/L), suggesting the possible presence of ash pond leachate.
- As previously noted, concentration increases of boron and/or chloride were observed in monitoring wells OM22D, OM24D, and OM25S. These wells have boron concentrations greater than 10 mg/L and chloride concentrations greater than 100 mg/L, suggesting that these wells are monitoring groundwater mixed with leachate from the ash ponds. Since hydraulic gradients previously mapped in this area are toward the west, boron concentrations may be higher than 2 mg/L west of these monitoring wells and the west property boundary (see plots below).





While the Class II groundwater quality standard for boron is 2 mg/L, this standard is not applicable for the site monitoring wells that sample groundwater within disturbed coal spoil fill. As previously noted in Section 3.3, background boron concentrations in the coal mine spoils can be as high as 2 mg/L.

Therefore, boron concentrations higher than 2 mg/L may indicate the presence of ash pond constituents in groundwater. Figure 3-2 shows the boron concentrations detected in samples collected during the September 2015 groundwater monitoring event. To the north, south, and east of the ash ponds, the extent of boron concentrations greater than 2 mg/L is limited to an area within the property boundary and within 1,000 feet of the boundaries of ash ponds. Along the west property boundary, concentrations higher than 2 mg/L are observed in at least one monitoring well at each monitoring well nest (OM22 through OM25), suggesting that concentrations may exceed 2 mg/L off-site towards Long Lake.

3.6 Conceptual Site Model

A groundwater model can be useful for estimating the time over which water quality will improve after closure and for evaluating the extent of ash pond constituents in areas that are otherwise inaccessible for groundwater monitoring.

The coal mine spoils at the Site are heterogeneous over a small scale, and any single boring log may encounter highly variable sequences of silt, clay, and shale fragments randomly placed over the former mine surface. This geologic heterogeneity results in a groundwater flow pathway that is complex and tortuous as well as an inconsistent distribution of boron and chloride concentrations. Even with the large number of boring logs available at this Site, calibrating a numerical flow and transport model to match the complex groundwater flow and concentration distribution at this Site will require estimation of hydraulic conductivity and effective porosity zones that will not be supported by field data, resulting in a low confidence level in the model results.

Since this Site cannot be numerically modeled with confidence, a conceptual model of groundwater flow was developed to evaluate the potential off-site extent of ash pond constituents. There are numerous small ponds surrounding the Site within the coal spoils that fill closed depressions. These ponds are typically surface expressions of the water table, and the elevations of these ponds, as depicted on topographic maps, are the elevations of the water table at the time that the map was generated. The most-recent USGS topographic map for this area was generated in 2012. Figure 2-3 shows the elevation of surface waters—as interpreted from the 2012 USGS topographic map—to the north, west, and south of the ash ponds. These elevations provide an approximate (±10 feet) elevation of the water table that can be used to interpret high points and low points in the water table, enabling interpretation of the flow paths that groundwater may follow through these deposits on a larger scale. Based on the surface and groundwater elevation data and information provided in this supplemental hydrogeologic site characterization, the conceptual model for groundwater flow at the Site is as follows:

- Groundwater flowing to the east from the ash ponds discharges to various small surface waters and ultimately to the Duck Creek Cooling Pond.

- Long Lake lies between the ash ponds to the east and a watershed divide to the west. Groundwater flowing to the west from the ash ponds discharges to Long Lake. As noted previously, the lake is an end-cut or last-cut lake formed when a mine operator leaves the last mining excavation or cut open, instead of backfilling with earth or other mined spoils.

- Surface waters to the north have elevations higher than Long Lake and the Duck Creek Cooling Pond. The groundwater mound and radial flow from the former ash ponds will cause groundwater from the north to flow either west or south toward Long Lake or east toward the Duck Creek Cooling Pond.

- Surface water flow out of Long Lake will likely migrate via groundwater southward, consistent with the regional drainage.

- Hydraulic conductivity testing indicates groundwater flow through the disturbed mine spoils will be preferentially horizontal. The shale bedrock unit underlying the Springfield Coal Member that was mined has been demonstrated by packer testing to be an aquitard that will minimize vertical migration of ash pond constituents.

4 GROUNDWATER MONITORING SYSTEM

A groundwater monitoring system is proposed for the site to monitor groundwater, evaluate post-closure groundwater quality and trends, and to demonstrate compliance with the applicable groundwater quality standards identifed in Section 5.

The proposed groundwater monitoring well network consists of a sufficient number of wells, installed at appropriate locations and depths to monitor post-closure compliance with groundwater quality standards for Class IV: Other Groundwater. The groundwater monitoring well network on-site utilizes 31 previously installed groundwater monitoring wells. Nineteen of these monitoring wells will be used for compliance sampling and analytical testing. Groundwater elevation will also be measured in twelve additional wells (31 wells total).

The proposed groundwater monitoring system has been modified from the system proposed by Hanson (2010) and the monitoring program currently being employed. The proposed groundwater monitoring system is summarized on Table 3-2 and is being modified as follows:

- Wells OR05D and OM05S are not currently used for monitoring groundwater quality and are in close proximity to the OR13 well nest. Wells OR05D and OM05S will be abandoned following IEPA approval of the proposed monitoring plan.
- Monitoring well OM08 is upgradient of the ash ponds (see Figure 2-2) and shows elevated groundwater concentrations that cannot be due to groundwater migration from the ash ponds. Therefore, groundwater sampling at this well will be discontinued and it will be used for measurement of elevation only, pending IEPA approval of the proposed monitoring plan.
- Wells OM26, OM27, OM28, OM30 and OM31 are located within or immediately adjacent to the ash ponds and have not been monitored since 2011. These wells will be abandoned following IEPA approval of the proposed monitoring plan.

Boring logs and monitoring well construction reports for the groundwater monitoring system are provided in Appendix D. Monitoring well locations are shown on Figure 4-1. Well screen intervals, total well depths and September 2015 groundwater elevations at the proposed monitoring well network locations are summarized in Table 4-1. The depth that the bottom of the monitoring well is screened below the water table is also shown. Monitoring wells that are screened within the upper 20 ft of groundwater will be utilized to construct water table contour maps. Deeper nested monitoring wells (designated by the suffix ‘D’) and wells screened at depths greater than about 20 ft below the water table are piezometers that will be utilized to monitor potential deeper migration pathways of ash pond constituents and vertical hydraulic gradients. Historical groundwater elevations for the period of 2014 and 2015 at the proposed monitoring well locations are provided in Appendix E.

The monitoring wells are designed and constructed in accordance with applicable standards, including the following:

- All monitoring wells are cased in a manner that maintains the integrity of the boreholes.
- Wells are screened to allow sampling only at the specified interval.
- All wells are covered with vented caps, unless located in flood-prone areas, and equipped with devices to protect against tampering and damage.

The monitoring well network fulfills the following goals:

- Enables the collection of groundwater samples that represent the quality of groundwater that has not been affected by the ash ponds
- Enables the collection of groundwater samples that represent the quality of downgradient groundwater
- Includes wells that are located within the stratigraphic unit(s) that may serve as potential chemical migration pathways

5 APPLICABLE GROUNDWATER QUALITY STANDARDS

5.1 Groundwater Classification

The Duck Creek Ash Ponds 1 and 2 are located within a previously mined area and monitoring has demonstrated that the groundwater is not capable of consistently meeting the standards for Class I: Potable Resource Groundwater (35 IAC 620.410) or Class II: General Resource Groundwater (35 IAC 620.420). Therefore, the applicable classification of groundwater at the site is Class IV: Other Groundwater (35 IAC 620.240(g)).

5.2 Applicable Groundwater Quality Standards

For groundwater within a previously mined area, the applicable groundwater quality standards for the site are the standards for Class IV: Other Groundwater. The groundwater quality standards for Class IV: Other Groundwater cannot be exceeded (35 IAC 620.440(c)) except as provided below:

- The groundwater quality standards for TDS, chloride, iron, manganese, sulfate, and pH, are the existing concentrations (35 IAC 620.440(c)).
- Groundwater quality standards for Class II General Resource Groundwater do not apply for pH, barium, boron, chloride, copper, iron, manganese, nickel, selenium, TDS, sulfate, and zinc when groundwater is either within fill or in parent material within 10 feet of fill, if the fill was placed prior to November 25, 1991 (35 IAC 620.420(a)(3)(A)). The coal spoils were placed prior to 1991 and all monitoring wells except for OM23D and OM25D are either screened within coal spoil or in native material within 10 vertical feet of coal spoil. Therefore, these analytical parameters are only applicable to monitoring wells OM23D and OM25D.
- Except as provided above, Class IV: Other Groundwater standards are equal to the existing concentrations of constituents in groundwater (35 IAC 620.440(c)).

The list of applicable groundwater quality standards for the site is shown on Table 3-1. Off-site groundwater also occurs within mine spoils, and is therefore Class IV: Other Groundwater. Applicable off-site groundwater quality standards will be the same as described above.

5.3 Proposed Exceptions to the Groundwater Quality Standards

Based on the results of groundwater monitoring performed at the site to date, the following exceptions to the above applicable Class II: General Resource Groundwater standards are proposed:

- Leachate (Appendices C-1, C-2) and groundwater (Appendix C-3) samples collected at the site do not indicate exceedances of the groundwater quality standards for Class II General

Resource Groundwater inorganic constituents listed in 35 IAC 620.420(a)(1). The analyzed constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, cyanide, fluoride, lead, mercury, nitrate, and thallium.[2] These constituents will not be monitored because they currently meet the standards for Class II General Resource Groundwater and are not associated with the chemical characteristics of the Duck Creek ash ponds.[3]

- Leachate (Appendices C-1, C-2) and groundwater (Appendix C-3) samples collected at the site do not indicate exceedances of the groundwater quality standards for Class II General Resource Groundwater for inorganic constituents copper, nickel, selenium, silver, and zinc listed in 35 IAC 620.420(a)(2). These constituents will not be monitored at wells OM23D and OM25D because they currently meet the standards for Class II General Resource Groundwater and are not associated with the chemical characteristics of the Duck Creek ash ponds.

The proposed groundwater monitoring parameters for the Duck Creek ash ponds are discussed in Section 6.1.

[2] Perchlorate and vanadium are parameters listed in 35 IAC 620.420(a)(1) but have not been analyzed.

[3] An anomalous arsenic concentration of 0.31 ug/L was observed on October 21, 2013 at OR13S; all other results (thirteen sampling events) at this location exhibited As concentrations below 0.015 ug/L, which are well below the Class II groundwater quality standard of 0.2 ug/L.

6 GROUNDWATER MONITORING PLAN

The groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards for Class IV: Other Groundwater[4]. The post-closure groundwater sampling network is proposed to consist of three background monitoring wells and 19 compliance monitoring wells. Table 4-1 provides a list of the wells and their intended use for the monitoring program.

6.1 Monitoring Parameters

Groundwater samples will be collected and laboratory-analyzed for the following parameters that are indicator constituents for coal ash leachate from the ash ponds:

- Boron (dissolved)
- Chloride (dissolved)

The following field parameters will be also measured for each groundwater sample:

- pH
- Specific conductance
- Temperature

The depth to groundwater and total well depth will also be recorded during each sampling event.

As discussed in Section 5, other parameters regulated under 35 IAC 620 will be not be monitored because either:

- Their Class II: General Resource Groundwater standard is the existing concentration of the constituent in groundwater (TDS, iron, manganese, sulfate), and they are not indicator constituents for leachate migration from the ash ponds; therefore, there is no basis to which compare the data
- There is no applicable standard for the constituent in groundwater monitored in fill placed prior to November 1991
- Groundwater monitoring results to date indicates that the inorganic constituents antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, cyanide, fluoride, lead, mercury, nickel, nitrate, selenium, silver, thallium and zinc currently meet the Class II:

[4] Based on the conclusions of the Hanson (2016a) report in Appendix B1, there is no Uppermost Aquifer as defined by the US EPA (2015) [40 CFR 257.53].

General Resource Groundwater standards and are not associated with the chemical characteristics of the Duck Creek ash ponds.

6.2 Sampling Schedule

Groundwater sampling will initially be performed quarterly according to the schedule provided in Table 4-2. Five years after approval of the Closure Plan, a request may be made to modify the post-closure care plan to reduce the frequency of groundwater monitoring to semi-annual sampling by demonstrating all of the following:

- Monitoring effectiveness will not be compromised by the reduced frequency of monitoring
- Sufficient data has been collected to characterize groundwater
- Concentrations of constituents monitored at the downgradient boundaries show no statistically significant increasing trends that can be attributed to the former ash ponds

If concentrations of parameters of concern at the downgradient boundaries of the site show no statistically significant increasing trends that can be attributed to the ash ponds for the five years after reducing the monitoring frequency to semi-annual, a request may be made to modify the post-closure care plan to reduce monitoring frequency to annual sampling by demonstrating the same items above as for the reduction to semi-annual monitoring.

Groundwater monitoring may be discontinued upon IEPA's approval of a certified post-closure care report. Specifically, when no statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for four consecutive years after changing to an annual monitoring frequency.

6.3 Groundwater Sample Collection

Groundwater samples will be collected according to the protocol included in Appendix F. The procedure is summarized below.

All groundwater elevations will be measured on a single day, in conjunction with sampling of the wells. Monitoring wells will be sampled using either a peristaltic pump or bladder pump. Each well will be purged utilizing low flow techniques, and until the measured pH, temperature, and specific conductance have stabilized within ±10 percent. If low-flow stabilization is not possible, either a submersible pump or bailer will be used to remove four well volumes and/or bail the well dry. Field parameters will be collected following purging of the well. Field parameters will be recorded in the logbook.

Boron samples will be field-filtered (using a 0.45 micron disposable filter); and the sample will be collected in laboratory-provided high-density polyethylene (HDPE) bottles with the appropriate preservatives. All

samples will be placed in a cooler with ice to maintain a temperature of less than 4º Celsius during transport to the analytical laboratory.

In addition to groundwater well samples, quality assurance samples will be collected as described in Section 5.5.

6.4 Laboratory Analysis

Laboratory analysis will be performed by a state-certified laboratory using methods approved by IEPA. The constituents to be monitored, analytical methods and the Practical Quantitation Limits (PQL) are as follows:

Parameter	USEPA Analytical Method	PQL (mg/L)
Boron	SW 6020	0.010
Chloride	EPA 300.0	1.0

Concentrations lower than the practical quantitation limit (PQL) will be reported as less than the PQL. The PQL for all parameters analyzed will be lower than the applicable groundwater quality standard. The Class IV Groundwater Quality Standards for the site are discussed in detail in Section 5.

6.5 Quality Assurance Program

Additional quality assurance samples to be collected will include the following:

- Two blind duplicate groundwater samples from randomly selected monitoring wells
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, than equipment blank samples will not be collected.

The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

- Regular generation of instrument calibration curves to assure instrument reliability
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
- Analysis of method blanks to assure that the system is free of contamination

6.6 Groundwater Monitoring System Maintenance Plan

Monitoring wells will be inspected during each groundwater sampling event. Maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring well inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented
- Annual measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well
- Checks that wells are clear of internal obstructions, and flow freely

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

6.7 Annual Statistical Analysis

Trend analysis will be performed annually for each of the parameters of concern. Sen's Estimate of Slope will be applied to a minimum of four consecutive quarterly monitoring results. If there are increasing trends during closure and post-closure care periods, they will be further investigated as described below.

- If the results of sampling and analysis show an increasing trend at any compliance monitoring well, a Mann-Kendall analysis will be performed at 95 percent confidence to determine whether or not the increasing trend is statistically significant.
- If a statistically significant increasing trend occurs during post-closure care, further investigation of monitored concentrations will be performed as well as more frequent inspections of the surface of the cover system.
- If the investigation attributes a statistically significant increasing trend to a source other than the Duck Creek Energy Center ash ponds, then the IEPA will be notified in writing, stating the cause of the increasing trend and providing the rationale used in such a determination.
- If there is not an alternative source causing the statistically significant increasing concentration and the sampling frequency had been reduced to semi-annual or annual sampling, a quarterly sampling schedule will be reestablished. The frequency of sampling will return to either semi-annual or annual, once four consecutive quarterly samples show no statistically significant increasing trend.

Notifications concerning statistically significant increasing trends and revisions of the sampling frequency will be reported to IEPA in writing within 30 days after making the determinations.

6.8 Data Reporting

Sampling and analysis data from quarterly, semi-annual and/or annual groundwater monitoring will be reported to IEPA within 60 days after completion of sampling.

Statistical analysis of the laboratory analytical data will be reported to IEPA with the annual report for the facility.

6.9 Compliance with Applicable On-Site Groundwater Quality Standards

Compliance with on-site groundwater quality standards will be achieved when there are no statistically significant increasing trends that are attributed to the Duck Creek Energy Center ash ponds for parameters detected at the downgradient boundaries.

6.10 Corrective Action

If a statistically significant increasing trend is observed to continue over a period of two or more years following completion of the final cover, and a subsequent hydrogeologic site investigation demonstrates that such exceedances are due to a release from the Duck Creek Energy Center ash ponds and corrective actions are appropriate to mitigate such releases, a corrective action plan will be proposed as a modification to the post-closure care plan. A corrective action plan will be submitted to IEPA within 180 days after completion of the investigation activities. The plan will propose corrective actions to be undertaken to mitigate the impacts associated with the constituents of concern which exceed applicable groundwater standards.

7 REFERENCES

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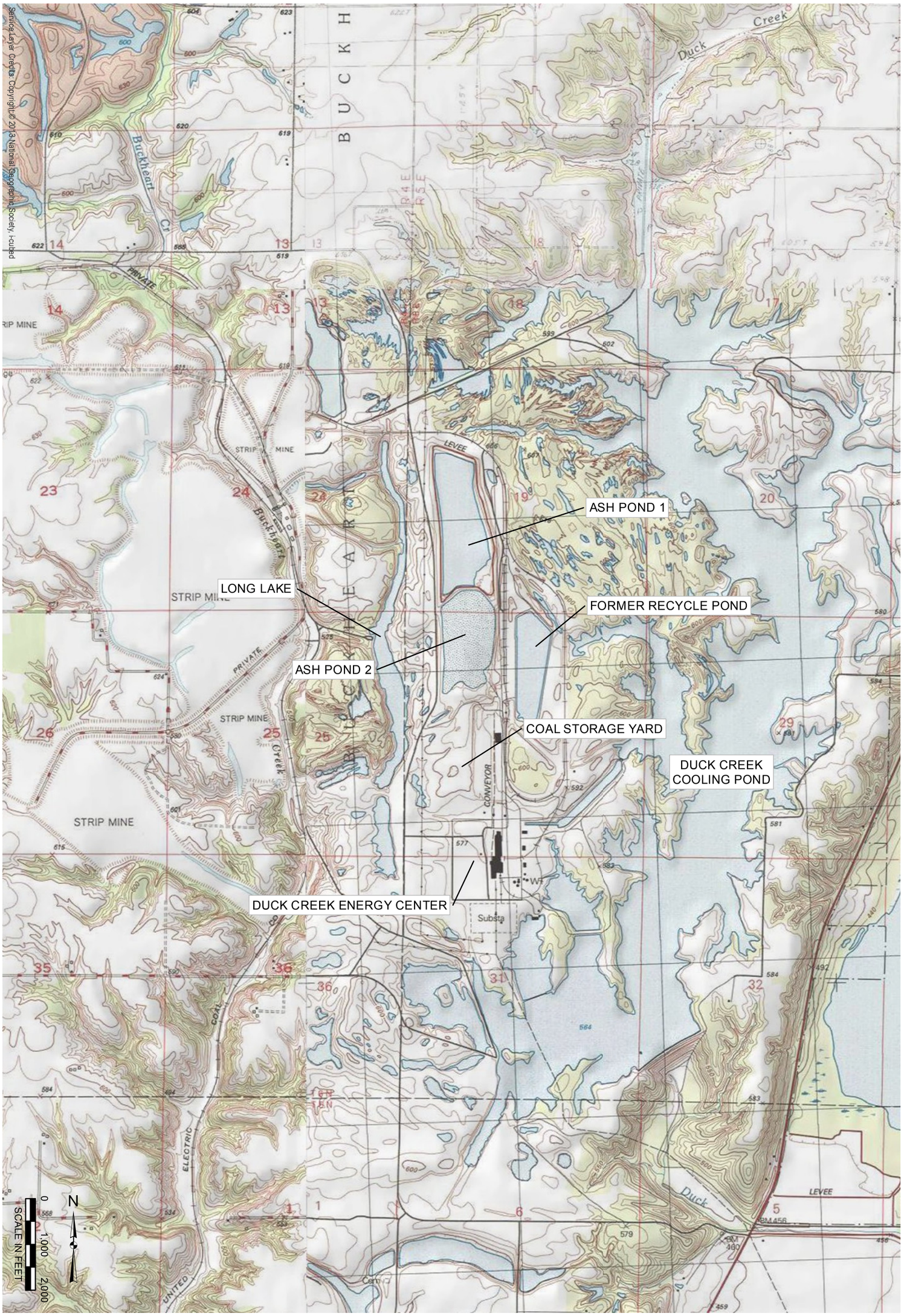
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US EPA, 2015. “Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule”. 40 Code of Federal Regulations, Parts 257 and 261, United States Environmental Protection Agency, Washington, DC, published in the Federal Register, Vol. 80, No. 74, p. 21302 – 21501.

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FIGURES

Y:\Mapping\Projects\23\2333\MXD\Supplemental Hydrogeo Site Char\Figure 1-1_Site Location Map.mxd Author: sstolz; Date/Time: 3/31/2016, 9:47:53 AM



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NATURAL RESOURCE TECHNOLOGY

PROJECT NO: 2333

FIGURE NO: 1-1

SITE LOCATION MAP

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

DRAWN BY/DATE:
DMD 1/5/2016
REVIEWED BY/DATE:
RJK 1/6/2016
APPROVED BY/DATE:
SJC 3/24/16

DUCK CREEK COOLING POND

DUCK CREEK COOLING POND

OM10

OM17

OM16

OR11

OR20

OM15

OM11

OM20

OM12

OR19

OM19

FORMER RECYCLE POND

OR18

OM08

OR14

OR13

OR13S

OR05

OM18

OM21

OM05

OR06A

OM07

OR14

OM14

OM05S

OR04

OM04S

OM30

OM06A

COAL STORAGE YARD

OM26

OM27

OM28

OM32

OM31

ASH POND 2

ASH POND 1

OM01

OR02

OM02

OR03

OM09

OM22

OR03S

OM25S

OM24

OM23S

OM23

OM22S

OM25

LONG LAKE

N

0 500 1,000

SCALE IN FEET

EXISTING MONITORING POINTS

NOTE:
See Table 3-2 for abandoned monitoring wells

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

DRAWN BY/DATE:
DMD 1/5/2016
REVIEWED BY/DATE:
RJK 1/6/2016
APPROVED BY/DATE:
SJC 3/24/16

SITE MAP

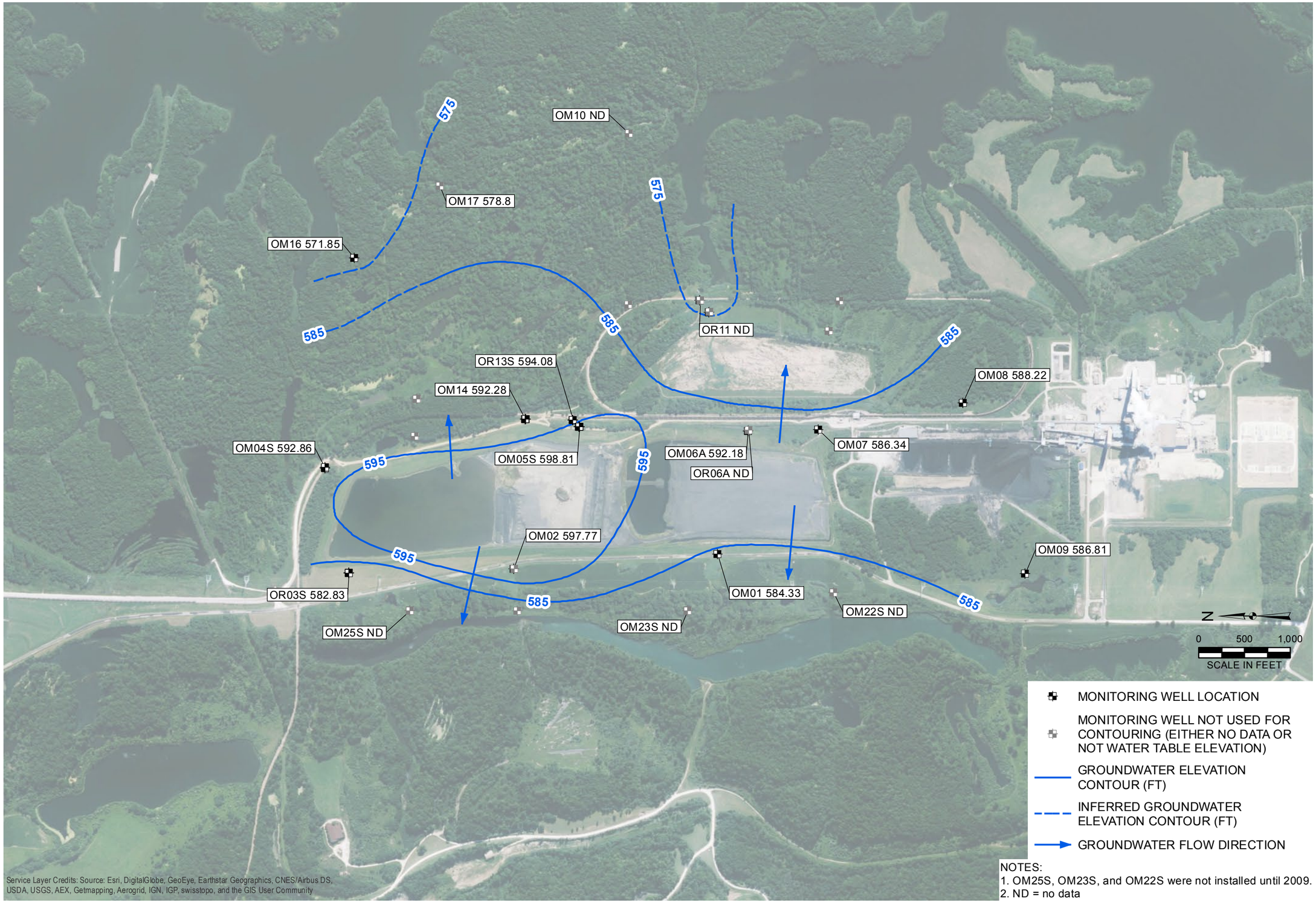
SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

PROJECT NO: 2333

FIGURE NO: 1-2

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2333\MXD\Supplemental Hydrogeo Site Char\Figure 1-2_Site Map.mxd Author: sstolz Date/Time: 3/31/2016, 9:49:56 AM



NOTES:
1. OM25S, OM23S, and OM22S were not installed until 2009.
2. ND = no data

DRAWN BY/DATE:
DMD 1/5/2016
REVIEWED BY/DATE:
RJK 1/6/2016
APPROVED BY/DATE:
SJC 3/24/16

SHALLOW GROUNDWATER ELEVATION CONTOURS - APRIL 2007

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

PROJECT NO: 2333

FIGURE NO: 2-1

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2333\MXD\Supplemental Hydrogeo Site Char\Figure 2-1_GW Elevation Contours_April 2007.mxd Author: toushman: Date/Time: 3/24/2016, 9:24:55 AM

DUCK CREEK COOLING POND

DUCK CREEK COOLING POND

OM10 579.56 FT

OM17 583.19 FT

OM16 585.90 FT

OR11 566.25 FT

FORMER RECYCLE POND

OM08 587.14 FT

OR14S 591.81 FT

OR13S 590.78 FT

OR06A 578.74 FT

OM07 584.54 FT

OM04S 588.30 FT

ASH POND 2

ASH POND 1

COAL STORAGE YARD

OM01 583.86 FT

OR03S 582.46 FT

OR02 594.98 FT

OM09 585.75 FT

OM22S 580.60 FT

OM25S 571.00 FT

OM23S 571.08 FT

LONG LAKE

585 580 575 570 590

N

0 350 700

SCALE IN FEET

MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Y:\Mapping\Projects\23\2333\MXD\Supplemental Hydrogeo Site Char\Figure 2-2_GW Elevation Contours_Sept 2015.mxd Author: sstolz; Date/Time: 3/31/2016, 9:52:56 AM

DRAWN BY/DATE: TDC 1/4/2016
REVIEWED BY/DATE: RJK 1/4/2016
APPROVED BY/DATE: SJC 3/24/16

SHALLOW GROUNDWATER ELEVATION CONTOURS - SEPTEMBER 2015

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

PROJECT NO: 2333

FIGURE NO: 2-1

NATURAL RESOURCE TECHNOLOGY

DUCK CREEK COOLING POND

DUCK CREEK COOLING POND

OM17 ND

OM10 578.59

575

OM16 595.16

OR11 567.25

585

OM05S 595.3

FORMER RECYCLE POND

OR13S 592.25

595

540-550

OR14S 594.04

570-580

OM08 595.08

OM04S 593.14

595

OM07 582.93

OR06A 578.51

COAL STORAGE YARD

570-580

590-600

ASH POND 2

ASH POND 1

OM01 589.69

580-590

600-610

OR02 598.2

595

OM09 588.45

OR03S 582.88

585

560-570

OM25S 583.23

OM23S 578.51

OM22S 578.51

570-580

LONG LAKE

590-600

590-600

570-580

570-580

630-640

550-560

580-590

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N

0 500 1,000

SCALE IN FEET

- MONITORING WELL LOCATION
- MONITORING WELL NOT USED FOR CONTOURING (EITHER NO DATA OR NOT WATER TABLE ELEVATION)
- SURFACE WATER DIVIDE (APPROXIMATE)
- CONCEPTUAL SURFACE WATER FLOW DIRECTION
- GROUNDWATER ELEVATION CONTOUR (FT)
- INFERRED GROUNDWATER ELEVATION CONTOUR (FT)
- GROUNDWATER FLOW DIRECTION
- SURFACE WATER
- 580-590 ESTIMATED SURFACE WATER ELEVATION (FT)

DRAWN BY/DATE: DMD 1/5/2016
REVIEWED BY/DATE: RJK 1/6/2016
APPROVED BY/DATE: SJC 3/24/16

CONCEPTUAL MODEL OF GROUNDWATER FLOW

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

PROJECT NO: 2333

FIGURE NO: 2-3

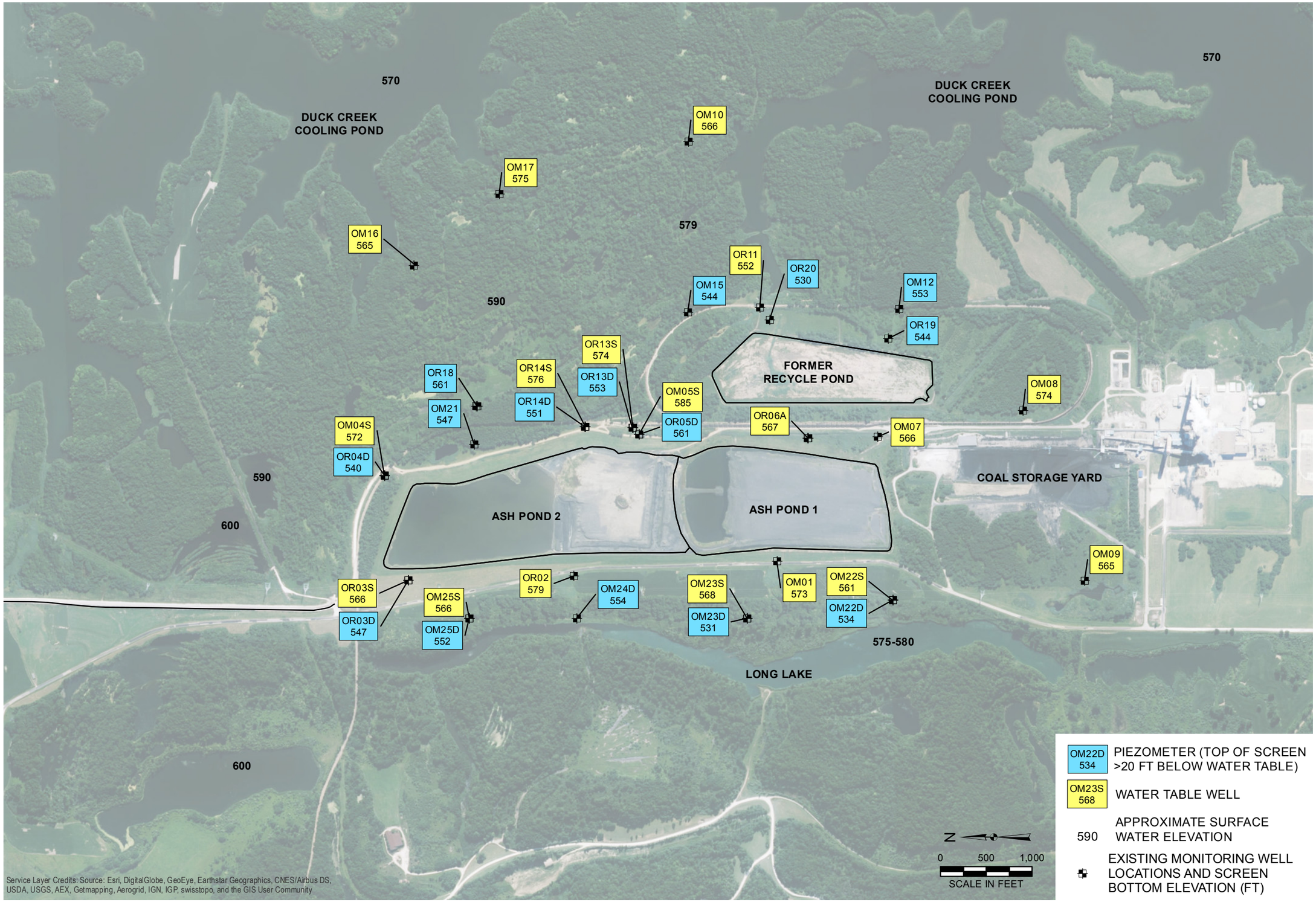
NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\2312333\MXD\Supplemental Hydrogeo Site Char\Figure 2-3_Conceptual Model of Groundwater Flow.mxd Author: sstolz Date/Time: 3/31/2016, 9:54:57 AM

MONITORING WELLS AND SCREEN BOTTOM ELEVATIONS

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

DRAWN BY/DATE: DMD 1/5/2016
REVIEWED BY/DATE: RJK 1/6/2016
APPROVED BY/DATE: SJC 3/24/16



OM22D 534 PIEZOMETER (TOP OF SCREEN >20 FT BELOW WATER TABLE)

OM23S 568 WATER TABLE WELL

590 APPROXIMATE SURFACE WATER ELEVATION

EXISTING MONITORING WELL LOCATIONS AND SCREEN BOTTOM ELEVATION (FT)

PROJECT NO: 2333

FIGURE NO: 3-1

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2333\MXD\Supplemental Hydrogeo Site Char\Figure 3-1_Mon Wells_Screen Elevations.mxd Author: sstolz Date/Time: 3/31/2016, 9:55:48 AM

DUCK CREEK COOLING POND

DUCK CREEK COOLING POND

OM10 (0.09)

OM17 (0.10)

OM16 (0.05)

OM15 (0.17)

OR11 5.8

OR20 65

OM12 0.07

OR19 14

FORMER RECYCLE POND

OM18 (0.51)

OR14D 6.3

OR13S 9

OM21 15

OR05D (6.7)

OR06A 1.4

OM07 0.43

OM08 9.6

OR04D 11

COAL STORAGE YARD

ASH POND 2

ASH POND 1

OM09 (0.55)

OR03D 5.0

OR02 4.6

OM01 0.19

OM22D 16

OM25S 22

OM24D 20

OM23D 22

LONG LAKE

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N

0 500 1,000

SCALE IN FEET

MONITORING WELL LOCATION AND BORON CONCENTRATION (mg/L)

BORON CONCENTRATION EXCEEDING 2 mg/L

INFERRED BORON CONCENTRATION EXCEEDING 2 mg/L

NOTES:
1. Boron concentrations in ( ) are from last sample taken at that well nest, in 2010.
2. Maximum concentration shown for nested wells.

BORON CONCENTRATIONS IN GROUNDWATER - SEPTEMBER 2015

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

DRAWN BY/DATE: DMD 1/5/2016
REVIEWED BY/DATE: RJK 1/6/2016
APPROVED BY/DATE: SJC 3/24/16

PROJECT NO: 2333

FIGURE NO: 3-2

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\23\2333\MXD\Supplemental Hydrogeo Site Char\Figure 3-2_Boron_Iscon_Feb 2012.mxd Author: sstolz Date/Time: 3/31/2016, 9:57:02 AM

DUCK CREEK COOLING POND

DUCK CREEK COOLING POND

OM10

OM17

OM16

OR11

OR20

OM15

OM12

OR19

FORMER RECYCLE POND

OR18

OR14S

OR13D

OR14D

OR13S

OR06A

OM08

OM21

OM07

OR04D

OM04S

COAL STORAGE YARD

ASH POND 2

ASH POND 1

OM01

OR03S

OR03D

OR02

OM22S

OM25D

OM23S

OM09

OM22D

OM25S

OM24D

OM23D

LONG LAKE

N

0 500 1,000

SCALE IN FEET

GROUNDWATER ELEVATION WELL

COMPLIANCE WELL

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Y:\Mapping\Projects\23\2333\MXD\Supplemental Hydrogeo Site Char\Figure 4-1_Proposed Groundwater Monitoring Network.mxd Author: sstolz Date/Time: 3/31/2016, 9:58:16 AM

DRAWN BY/DATE:
DMD 1/5/2016
REVIEWED BY/DATE:
RJK 1/6/2016
APPROVED BY/DATE:
SJC 3/24/16

PROPOSED GROUNDWATER MONITORING NETWORK

SUPPLEMENTAL HYDROGEOLOGIC SITE CHARACTERIZATION
DUCK CREEK ENERGY CENTER - ASH PONDS 1 & 2
CANTON, ILLINOIS

PROJECT NO: 2333

FIGURE NO: 4-1

NATURAL RESOURCE TECHNOLOGY

TABLES

Table 2-1
Changes in Porewater Elevation within the Ash Ponds
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Date	OM26	OM27	OM28
11/9/2010	635.00	628.76	628.08
11/19/2010	634.60	627.36	627.08
6/9/2011	635.90	626.06	626.98
5/16/2012	633.17	623.82	624.86
12/29/2015	637.89	627.57	626.93
Change 2010 to 2012	-1.83	-4.94	-3.22
Change 2012 to 2015	4.72	3.75	2.07

Ash Ponds were taken out of service in 2010
Piezometers installed in 2010
OM-26 located in Ash Pond 2 and OM-27 and OM-28 located in Ash Pond 1

Table 2-2
Changes in Groundwater Elevation
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Well	Average 2008-2009 [1]	Average 2014-2015 [2]	Change
OM01	584.6	583.8	-0.8
OR02	596.5	595.4	-1.1
OR03D	582.1	581.8	-0.3
OR03S	582.1	581.8	-0.3
OR04D	587.5	586.7	-0.8
OM04S	590.3	589.3	-1.0
OR05D	600.5	593.2	-7.3
OM05S	598.7	592.5	-6.2
OR06A	592.4	578.6	-13.7
OM07	588.7	582.9	-5.8
OM08	587.2	585.5	-1.7
OM09	586.3	586.0	-0.3
OM10	574.9	578.4	3.5
OR11	569.8	566.5	-3.3
OM12	578.3	581.8	3.5
OR13D	600.5	593.5	-7.0
OR13S	592.1	591.3	-0.8
OR14D	590.2	590.7	0.5
OR14S	594.2	592.2	-2.0
OM15	578.4	579.0	0.6
OM16	582.3	583.9	1.7
OM17	579.2	581.8	2.6
OR18	594.8	599.9	5.0
OR19	582.5	575.5	-7.0
OR20	574.0	566.4	-7.6
OM21	597.8	598.0	0.2
OM22D	582.4	580.5	-1.8
OM22S	582.3	580.3	-2.0
OM23D	576.9	575.8	-1.1
OM23S	572.3	571.6	-0.7
OM24D	574.7	573.8	-0.9
OM25D	571.1	572.0	0.9
OM25S	571.2	571.3	0.1

Average decreased by 3.0 feet or more
Average increased by 3.0 feet or more
Ash Ponds were taken out of service in 2010
Footnotes:
1. Obtained from Manages database.
2. Obtained from Hanson groundwater elevation table using April 2008 top of well casing survey data.

Table 3-1
Monitored Parameters and Groundwater Quality Standards
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Parameter	Time Interval Monitored	Applicable Standard	
		Wells Other than OM23D and OM25D	OM23D and OM25D
Antimony	2011 to 2014	Class II	Class II
Arsenic	2011 to 2014	Class II	Class II
Barium	2011 to 2014	(2)	Class II
Beryllium	2011 to 2014	Class II	Class II
Boron	1980 to Present	(2)	Class II
Cadmium	2011 to 2014	Class II	Class II
Chloride	1980 to Present	(1), (2)	(1)
Chromium	2011 to 2014	Class II	Class II
Cobalt	2011 to 2014	Class II	Class II
Copper	2011 to 2014	(2)	Class II
Cyanide	2011 to 2014	Class II	Class II
Fluoride	2011 to 2014	Class II	Class II
Hardness	1980 to Present	(3)	(3)
Iron	1980 to Present	(1), (2)	(1)
Lead	2011 to 2014	Class II	Class II
Manganese	1980 to Present	(1), (2)	(1)
Mercury	2011 to 2014	Class II	Class II
Nickel	2011 to 2014	(2)	Class II
Nitrate nitrogen	2011 to 2014	Class II	Class II
pH	1980 to Present	(1), (2)	(1)
Selenium	2011 to 2014	(2)	Class II
Silver	2011 to 2014	(3)	(3)
Specific Conductance	1980 to Present	(3)	(3)
Sulfate	1980 to Present	(1), (2)	(1)
Temperature	1980 to Present	(3)	(3)
Thallium	2011 to 2014	Class II	Class II
Total Dissolved Solids	1980 to Present	(1), (2)	(1)
Zinc	2011 to 2014	(2)	Class II

Notes

Except as noted below, Class II standards are applicable for Class IV groundwater in previously mined areas

(1) Per 35 IAC 620.440(c) the standard for this constituent is the existing concentration.

(2) Per 35 IAC 620.420(a)(3) there is no applicable standard for groundwater monitored in fill placed prior to November 1991.

(3) There is no Class II or Class IV standard for this constituent. Per 35 IAC 620.440(c) the standard for this constituent is the existing concentration.

Table 3-2
Monitoring Well Matrix
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Well ID (Permit)	Well ID (Site)	Replacement Well ID	Comments
OM-1	OM01		
OM-2	~~OM02~~	OR02	
OM-3D	~~OM03D~~	OR03D	
OM-3S	~~OM03S~~	OR03S	
OM-4S	OM04S		
OM-4A	OR04D		
OM-5D	OM05D	OR05D	These wells are adjacent to the OR13 well nest and will be abandoned following IEPA approval of the proposed monitoring plan
OM-5S	OM05S		
OM-6A	~~OM06/OM06A~~	OR06A	
OM-7	OM07		
OM-8	OM08		This well is upgradient of the ash ponds and will be used for measurement of elevation only, pending IEPA approval of the proposed monitoring plan.
OM-9	OM09		
OM-10	OM10		
OM-11	~~OM11~~	OR11	
OM-12	OM12		
OM-13D	~~OM13D~~	OR13D	
OM-13S	~~OM13S~~	OR13S	
OM-14	~~OM14~~	OR14D OR14S	Original well OM14 damaged during slurry line installation; replaced with wells OR14D and OR14S
MW-15	OM15		
MW-16	OM16		
MW-17	OM17		
n/a	~~OM18~~	OR18	
n/a	~~OM19~~	OR19	Original well OM19 (formerly OMA), replaced by OR19
n/a	OM20	OR20	Original well OM20 (formerly OMB)
n/a	OM21		Original well OM21 (formerly ORC)
n/a	OM22S		
n/a	OM22D		
n/a	OM23S		
n/a	OM23D		
n/a	OM24D		
n/a	OM25S		
n/a	OM25D		
n/a	OM26		Well used to monitor water level in Ash Pond 2; To be abandoned following IEPA approval of the proposed monitoring plan
n/a	OM27		Well used to monitor water level in Ash Pond 1; To be abandoned following IEPA approval of the proposed monitoring plan
n/a	OM28		Well used to monitor water level in Ash Pond 1; To be abandoned following IEPA approval of the proposed monitoring plan
n/a	OM30		Well used to monitor water level at edge of Ash Pond 2; To be abandoned following IEPA approval of the proposed monitoring plan
n/a	OM31		Well used to monitor water level at edge of Ash Pond 2; To be abandoned following IEPA approval of the proposed monitoring plan
n/a	~~OM50S~~		Monitoring well nest 1.5 miles northwest of Ash Pond 2
n/a	~~OM50D~~		Monitoring well nest 1.5 miles northwest of Ash Pond 2
n/a	~~OM51S~~		Monitoring well nest 1.5 miles south of Ash Pond 1
n/a	~~OM51D~~		Monitoring well nest 1.5 miles south of Ash Pond 1

OM99	Grey shading indicates wells monitored for groundwater elevation and chemistry as of 2012
OM99	Red shading indicates wells monitored for chemistry prior to 2011, and monitored for groundwater water elevation as of 2012
OM99	No shading indicates wells monitored for chemistry and groundwater elevation prior to 2011 that are no longer monitored
~~OM99~~	Strikethrough denotes well has been abandoned

Natural Resource Technology

Table 3-3
Low, High and Median Leachate Concentrations
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Parameter	Unit	Ash Pond			Recycle Pond			Porewater			Applicable Standard	Applicable Class II Standard Concentration
		Low	High	Median	Low	High	Median	Ash Pond 1 (AP-1N/OM27)	Ash Pond 2 (AP-2/OM26)	Mean		
Antimony	mg/L							0.0036	<0.003	0.0033	Class II	0.024
Arsenic	mg/L							0.023	0.031	0.027	Class II	0.2
Barium	mg/L							0.18	0.14	0.16	(2)	
Beryllium	mg/L							<0.001	<0.001	<0.001	Class II	0.5
Boron	mg/L	160	390	320	66	390	265	43	180	112	(2)	
Cadmium	mg/L							0.0073	<0.001	0.0042	Class II	0.05
Chloride	mg/L	2,000	4,600	3,900	1,700	4,900	3,550	1,300	2,300	1,800	(1), (2)	
Chromium	mg/L							0.033	0.059	0.046	Class II	1.0
Cobalt	mg/L							0.0020	0.0031	0.0026	Class II	1.0
Copper	mg/L							0.0046	0.0049	0.0048	(2)	
Cyanide	mg/L							<0.005	0.012	0.0085	Class II	0.6
Fluoride	mg/L							<2.5	<2.5	<2.5	Class II	4.0
Hardness	mg/L	3,800	13,000	5,900	2,600	8,516	5,400	3,300	5,000	4,150	(3)	No Standard
Iron	mg/L	<0.01	2.7	0.012	<0.01	1.9	<0.01	0.015	0.16	0.088	(1), (2)	
Lead	mg/L							0.013	<0.001	0.0070	Class II	0.1
Manganese	mg/L	0.07	1.8	0.59	0.033	1.5	0.67	0.012	0.04	0.026	(1), (2)	
Mercury	mg/L							0.00031	<0.0002	0.00026	Class II	0.01
Nickel	mg/L							0.074	0.1	0.087	(2)	
Nitrate	mg/L							<0.2	<0.2	<0.2	Class II	100
Selenium	mg/L							0.055	0.086	0.071	(2)	
Silver	mg/L							<0.005	<0.005	<0.005	(3)	No Standard
Total Dissolved Solids	mg/L	3,200	14,000	10,000	3,800	14,000	10,000	4,500	7,600	6,050	(1), (2)	
Sulfate	mg/L	1,300	2,100	1,600	1,000	2,200	1,500	1,100	1,300	1,200	(1), (2)	
Thallium	mg/L							<0.001	<0.001	<0.001	Class II	0.02
Zinc	mg/L							<0.006	0.0084	0.0072	(2)	

Notes:
Surface water samples were last analyzed for the Ash and Recycle ponds in 2009 and 2010, respectively. Ash ponds were taken out of service in 2010.
The porewater concentrations are based on one sample collected from each of OM27 (AP-1N) and OM26 (AP-2) in 2012.
Except as noted below, Class II standards are applicable for Class IV groundwater in previously mined areas
(1) Per 35 IAC 620.440(c) the standard for this constituent is the existing concentration.
(2) Per 35 IAC 620.420(a)(3) there is no applicable standard for groundwater monitored in fill placed prior to November 1991.
(3) There is no Class II or Class IV standard for this constituent. Per 35 IAC 620.440(c) the standard for this constituent is the existing concentration.

Table 3-4
Low, High and Median Background Groundwater Concentrations
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Parameter	Unit	OM10[1]			OM16[1]			OM17[1]		
		Low	High	Median	Low	High	Median	Low	High	Median
Boron	mg/L	0.024	1.5	0.12	0.025	1.1	0.075	0.05	2.8	0.14
Chloride	mg/L	3.3	26	7.3	4.7	49	7.5	2.0	8.7	2.9
Iron	mg/L	<0.01	13	0.8	0.052	18	5.1	<0.01	11	0.51
Hardness	mg/L	70	2200	1800	2000	3500	2600	460	1400	840
Manganese	mg/L	0.078	6.3	2.8	3.6	7.9	4.5	0.042	2.9	0.76
Sulfate	mg/L	5.5	1300	820	1100	2400	1850	230	820	370
Total Disssolved Solids	mg/L	100	2900	1900	980	3700	3400	330	3700	912

Footnotes:
1. OM10, OM16 and OM17 were last analyzed in September 2010.

Table 3-5
Changes in Average Boron and Chloride Concentration
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Well	Average Boron, mg/L (2008-2009)[1]	Average Boron, mg/L (2014-2015)	Boron Change	Average Chloride, mg/L (2008-2009)[1]	Average Chloride, mg/L (2014-2015)	Chloride Change	Trend Observations
OM01	0.25	0.32	26%	15	21	45%	Increases are relatively small in absolute values
OR02	4.1	4.9	20%	244	248	2%	No apparent trend
OR03D	2.9	2.9	3%	143	82	-42%	No apparent trend
OR04D	87	23	-74%	1177	264	-78%	Decreasing
OM04S	7.9	0.67	-92%	184	14	-92%	No apparent trend; Averages affected by anomalous points
OR06A	1.5	1.4	-8%	23	29	25%	Increasing for Cl, no apparent trend B
OM07	1.5	0.9	-43%	20	15	-28%	Decreasing
OM08	0.13	12	9164%	6	294	5181%	Increasing
OR11	9.5	7.2	-24%	121	55	-54%	Increasing to 2012, then decreasing
OM12	5.1	0.12	-98%	76	6.1	-92%	No apparent trend; Averages affected by anomalous points
OR13D	4.1	2.9	-30%	88	53	-40%	Decreasing
OR13S	8.3	5.0	-40%	224	107	-52%	Decreasing
OR14D	29	6.3	-78%	413	82	-80%	Decreasing
OR19	28	16	-43%	402	168	-58%	Decreasing
OR20	212	73	-65%	2960	774	-74%	Decreasing
OM21	6.3	14	123%	443	502	13%	Increasing, began before pond changes
OM22D [2]	2.7	14	420%	81	478	490%	Increasing
OM23D [2]	1.8	2.1	15%	41	35	-16%	No apparent trend, two anomalous points were excluded
OM24D [2]	23	27	17%	480	710	48%	Increasing to 2014, then decreasing
OM25S [2]	5.1	19	276%	190	486	156%	Increasing

Decreasing concentration trend >30%
Increasing concentration trend >30%

Refer to Appendix C4 for boron and chloride time series plots

Footnotes:

1. Ash ponds were removed from service in 2010
2. Averages for 2008-2009 includes only one round of sampling from December 2009 (wells installed August-September 2009).

Natural Resource Technology

Table 4-1
Proposed Monitoring Well Network
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Well ID (permit)	Compliance Monitoring Wells	Groundwater Elevation Wells	Installed	Ground Surface Elevation (ft) [1]	Top of Well Casing Elevation (ft) [1]	Top of Screen Elevation (ft)	Bottom of Screen Elevation (ft)	Well Depth (ft below ground surface)	Groundwater Elevation Sept 2015 (ft)	Water Level Above Bottom of Screen (ft)
OM01	X	WT	Sep-80	593.3	595.61	578	573	20.3	583.86	10.86
OR02	X	WT	Apr-08	599.2	601.41	589	579	20.2	594.98	15.98
OR03D	X	PZ	Apr-08	623.7	627.13	557	547	76.7	582.69	35.69
OR03S		WT	Apr-08	623.7	627.16	575	566	57.7	582.46	16.46
OM04S	X	WT	Oct-80	604.8	607.35	582	572	32.8	588.30	16.3
OR04D	X	PZ	Oct-97	604.8	607.58	550	540	64.8	586.97	46.97
OR06A	X	WT	Apr-08	591.6	595.31	576	567	24.6	578.74	11.74
OM07	X	WT	Nov-80	594.4	596.46	576	566	28.4	584.54	18.54
OM08		WT	Nov-80	599.1	601.74	584	574	25.1	587.14	13.14
OM09		WT	Nov-80	590.2	591.61	575	565	25.2	585.75	20.75
OM10		WT	Nov-80	584.1	585.11	576	566	18.1	579.56	13.56
OR11	X	WT	Mar-08	593.6	596.55	562	552	41.6	566.25	14.25
OM12	X	PZ	Nov-80	592.8	595.37	563	553	39.8	583.37	30.37
OR13D [2]	X	PZ	Mar-08	600.3	602.70	563	553	47.3	593.97	40.97
OR13S [2]	X	WT	Mar-08	600.2	602.71	584	574	26.2	590.78	16.78
OR14D	X	PZ	Mar-09	596.2	598.91	560	551	45.2	589.66	38.66
OR14S		WT	Mar-09	596.2	599.26	585	576	20.2	591.81	15.81
OM15		PZ	Jul-94	596.0	598.05	554	544	52.0	580.17	36.17
OM16		WT	Jul-94	605.4	607.93	575	565	40.4	585.90	20.9
OM17		WT	Oct-93	589.3	592.13	585	575	14.3	583.19	8.19
OR18		PZ	Apr-08	611.6	613.85	571	561	50.6	602.21	41.21
OR19	X	PZ	Mar-08	595.7	597.80	554	544	51.7	577.81	33.81
OR20	X	PZ	Mar-08	584.6	587.72	540	530	54.6	566.63	36.63
OM21	X	PZ	Oct-97	604.2	606.60	557	547	57.2	596.77	49.77
OM22S		WT	Aug-09	596.8	599.22	570	561	35.8	580.60	19.6
OM22D	X	PZ	Aug-09	597.1	598.87	539	534	63.1	581.38	47.38
OM23S		WT	Sep-09	610.4	613.14	577	568	42.4	571.08	3.08
OM23D	X	PZ	Sep-09	610.4	613.25	540	531	79.4	576.99	45.99
OM24D	X	PZ	Aug-09	573.9	576.79	563	554	19.9	573.39	19.39
OM25S	X	WT	Aug-09	627.0	629.11	575	566	61.0	571.00	5
OM25D		PZ	Aug-09	627.1	629.19	557	552	75.1	573.69	21.69
Total	19	31								

WT — WT and yellow shading indicates water table wells
PZ — PZ and no shading indicates piezometer wells

Footnotes:
1. Ground Surface and Top of Well Casing Elevation from April 2008, provided by Hanson. All wells will be resurveyed in 2016 and elevations updated on future reports.
2. Ground Surface at OR13D and OR13S are from Nov. 2015 survey to update the surface elevation change.

Natural Resource Technology

Table 4-2
Groundwater Monitoring Program Schedule
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Frequency	Duration
Quarterly	Begins: upon approval of this plan.
	Ends: 5 years after completion of cap and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to Ash Ponds 1 and 2.
Semiannual	Begins: after IEPA approves that quarterly monitoring requirements have been satisfied.
	Ends: 5 years after initiation of semiannual monitoring and upon demonstration that monitoring effectiveness is not compromised and that there are no increasing trends attributable to Ash Ponds 1 and 2.
Annual	Begins: after IEPA approves that semiannual monitoring requirements have been satisfied.
	Ends: upon IEPA approval of a certified post-closure care report.

APPENDIX A

SELECTED AECOM (2015) AND HANSON (2010) FIGURES

Canton
Dunfermline
Saint David
Bryant
Banner
LANDFILL
GMF POND
ASH POND NO. 2
ASH POND NO. 1
6N 4E
6N 5E
LOCUST
CHESTNUT
MAIN
4TH
NEW BRIGHTON RD
BETHEL CEMETERY RD
CILCO RD
BROWN RD
OSCAR LINN HWY
SALEM RD
STATE PARK RD
78
9
24

LEGEND:

- County
- Township
- Section
- Quadrangle study (Available on Website)
- Lake or river
- Coal mine - active
- Underground coal mine - abandoned
- Surface coal mine - abandoned
- Indefinite underground coal mine boundary - abandoned
- Underground industrial mine and surrounding buffer region
- 951, 951 Coal mine index number (polygon label, point label)
- Opening type unknown
- Uncertain location
- Active surface tipple
- Abandoned surface tipple
- Active shaft
- Abandoned shaft
- Active slope
- Abandoned slope
- Active drift
- Abandoned drift
- Underground industrial mine entrance or general location

N

5000 0 5000

SCALE IN FEET

AECOM
8300 College Boulevard, Suite 200
Overland Park, Kansas 66210

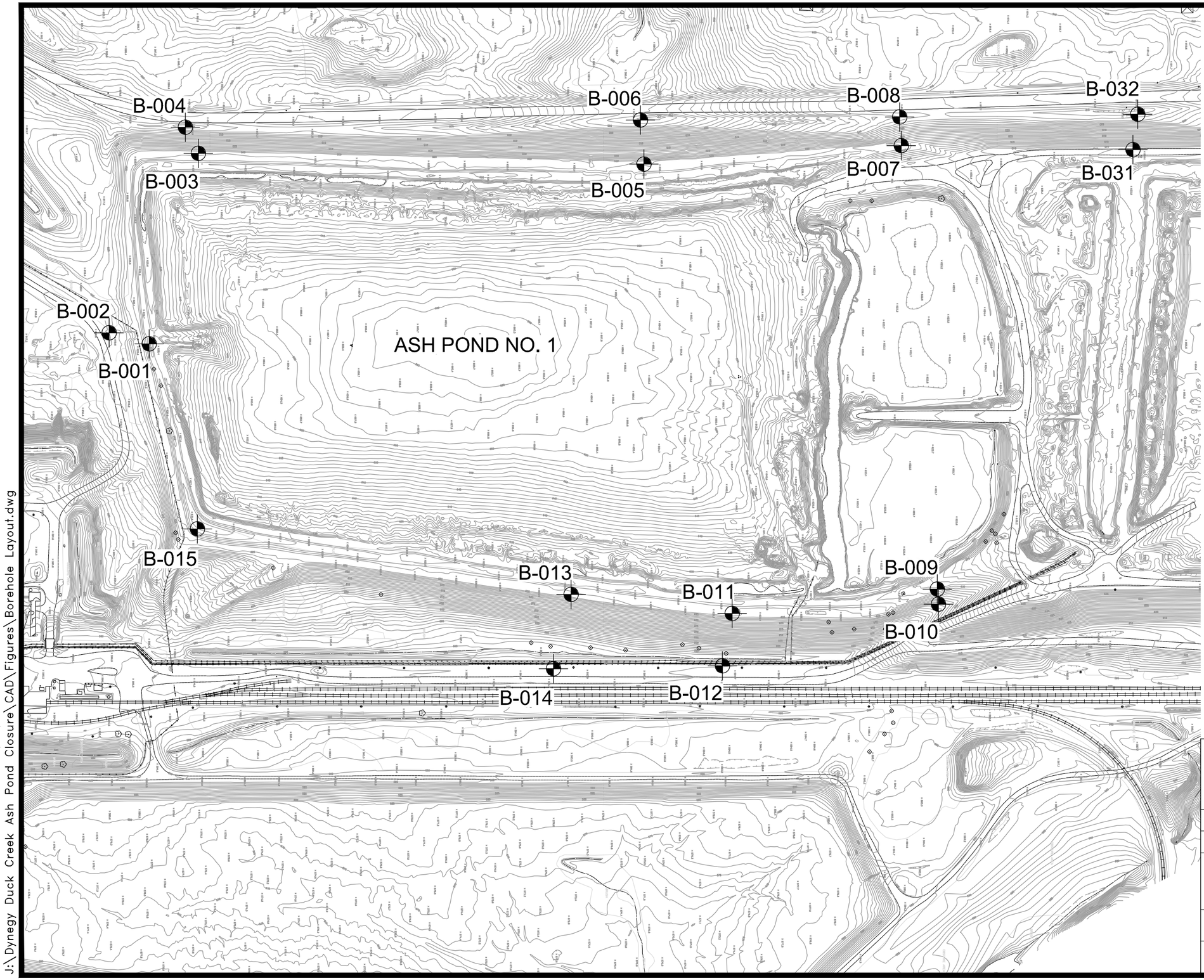
CLIENT: DYNEGY

LOCATION: DUCK CREEK STATION

TITLE: COAL MINES AND UNDERGROUND INDUSTRIAL MINES IN FULTON COUNTY, STATE OF ILLINOIS

DRAWN BY	CHECKED BY	APPROVED BY
TMS	JAA	WDS
PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	1

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LEGEND:

B-011 EXPLORATORY BORING LOCATION AND NUMBER

NOTE:

1. TEMPORARY GROUNDWATER LEVEL MONITORING WELLS (PIEZOMETERS) WERE INSTALLED IN BORING B-003 AND B-011. THE WELLS WERE ABANDONED UPON COMPLETION OF FIELD ACTIVITIES. REFER TO APPENDIX A FOR DETAILS.

N

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Overland Park, Kansas 66210

CLIENT: DYNEGY

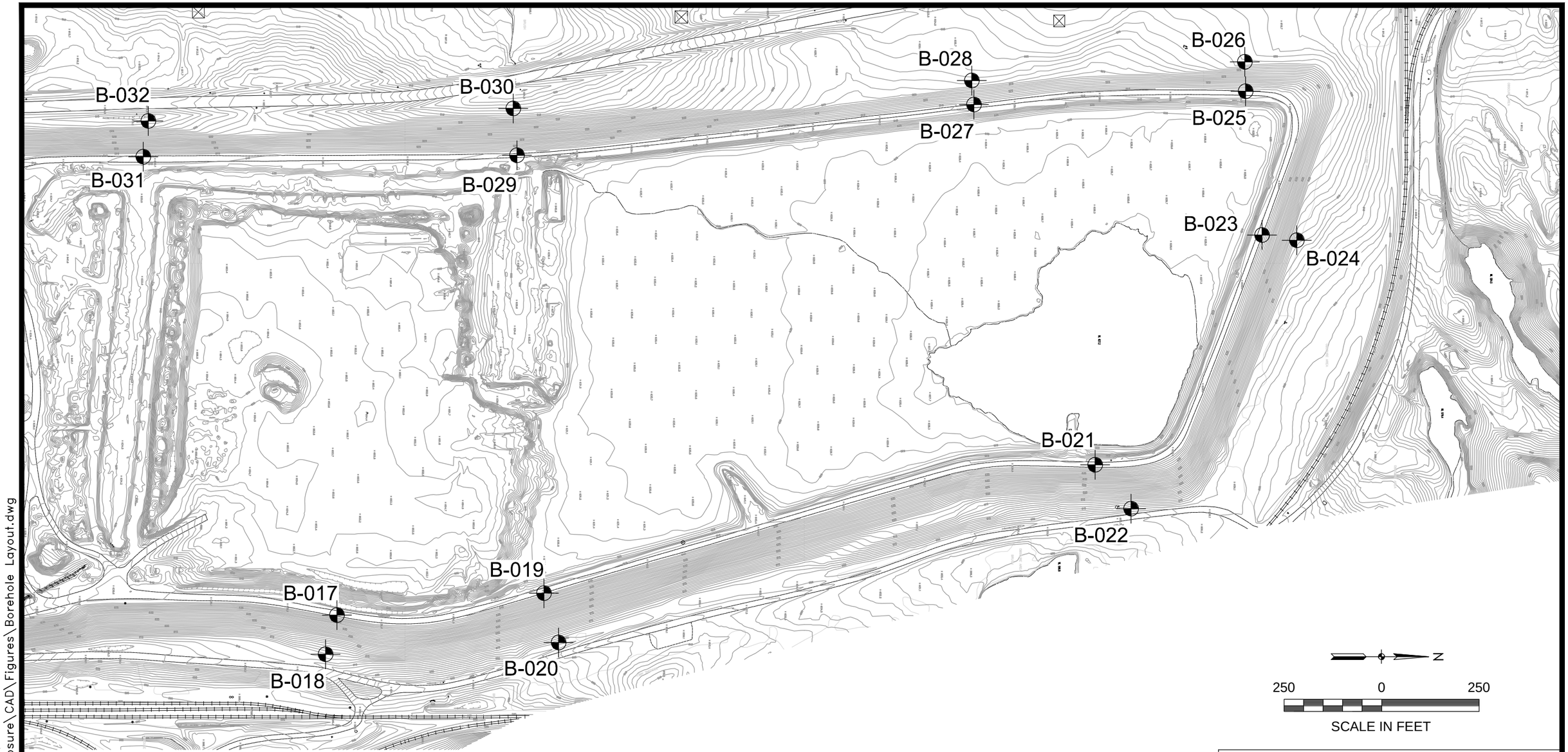
LOCATION: DUCK CREEK STATION - CANTON, IL

TITLE:

BORING LOCATION PLAN
DUCK CREEK ASH POND NO. 1

DRAWN BY	CHECKED BY	APPROVED BY
TMS	JAA	WDS
PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	2A

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Overland Park, Kansas 66210

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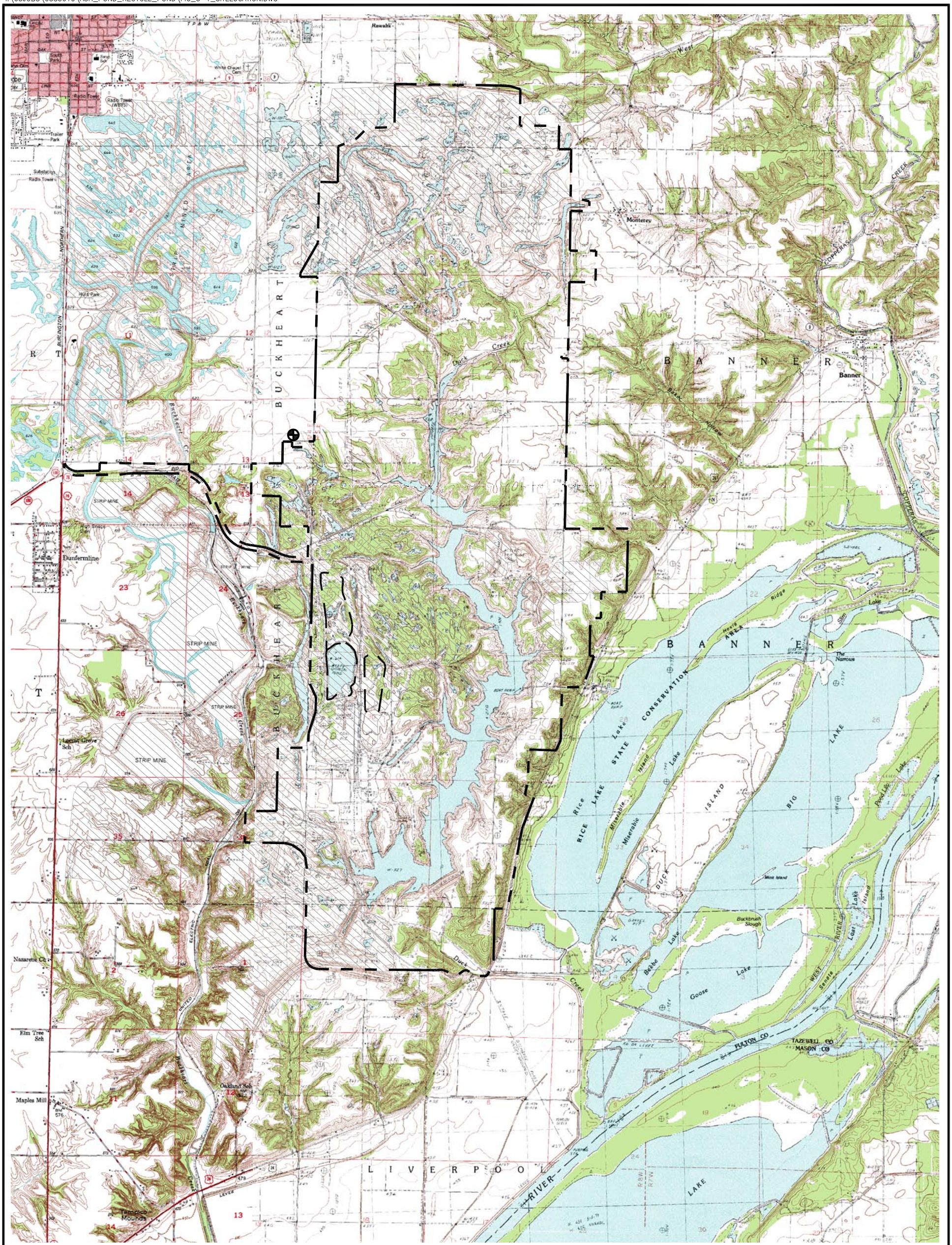
LOCATION: DUCK CREEK STATION

TITLE:
BORING LOCATION PLAN
DUCK CREEK ASH POND NO. 2

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PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	2B

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FEB 26, 2010 3:41 PM BRANS00939
I:\03JOBS\03S5010\ASH_POND_RECYCLE_POND\FIG_3-1_SITELOCATION.DWG



TOPO EXPLANATION

Ameren Property Boundary

Approx. Unit Limits (Pond)

Potable Water Well

Approximate Surface Mine Areas
Per ISGS Mapping (1998)

Approximate Site Location:
W ½ of Sections 19 & 30; T6N, R5E
Duck Creek 7 ½ minute Quadrangle Map

-N-

4,000' 0 4,000' 8,000'

Scale: 1 inch = 4,000 feet Contour interval = 10 feet

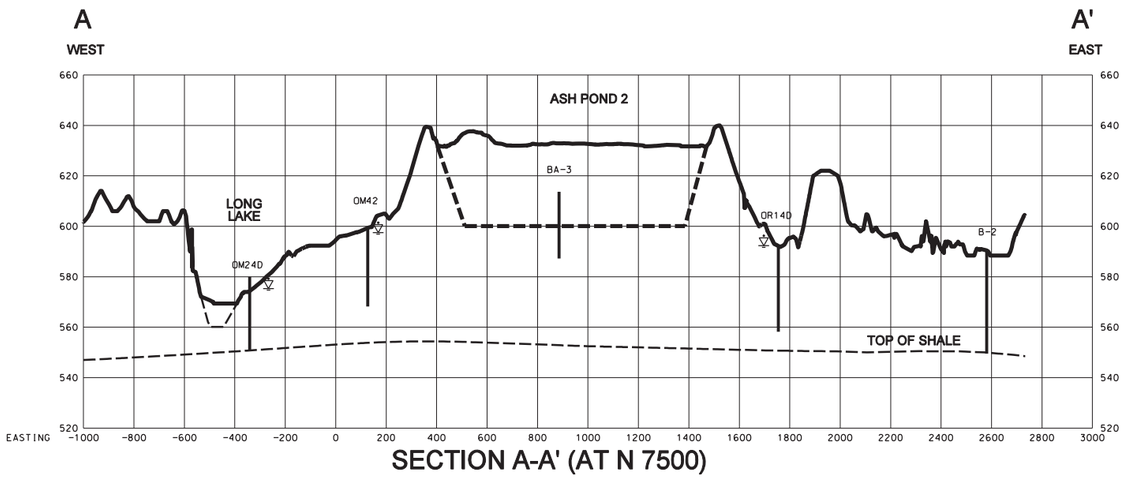
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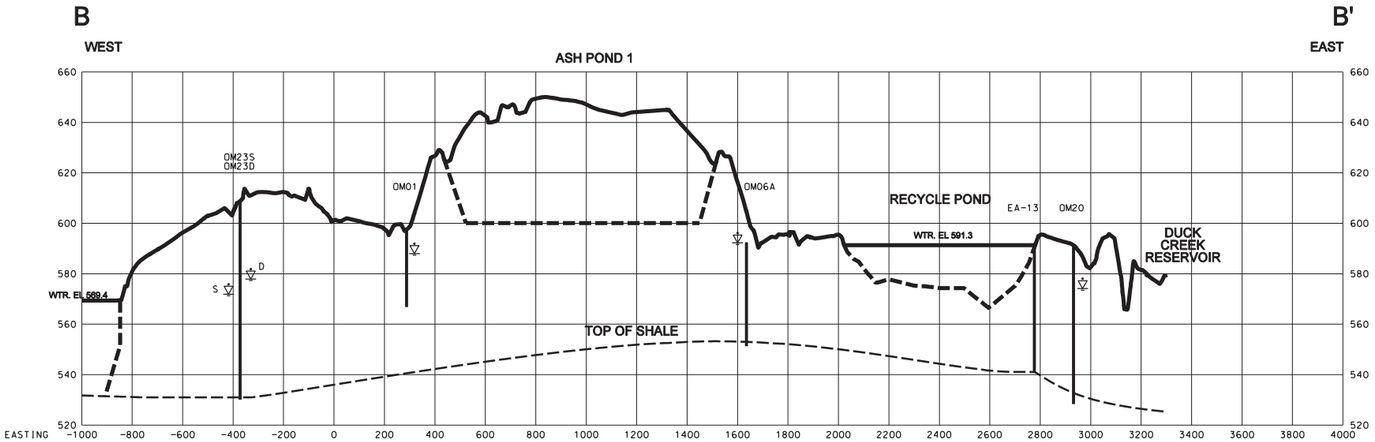
LOCATION MAP

SOLID WASTE MANAGEMENT FACILITY
DUCK CREEK POWER GENERATING STATION
CANTON, FULTON COUNTY, ILLINOIS

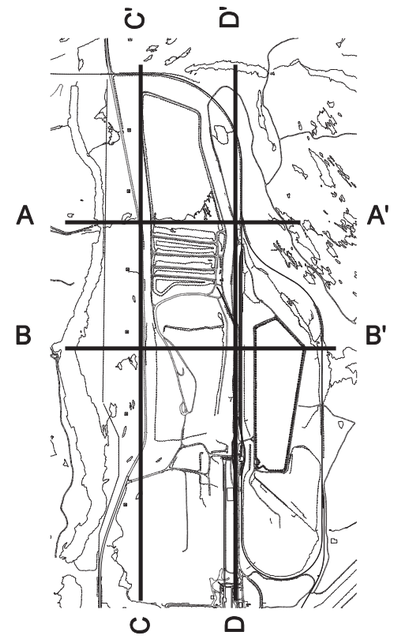
HANSON NO. 03S5010F FIGURE 1



SECTION A-A' (AT N 7500)



SECTION B-B' (AT N 5500)

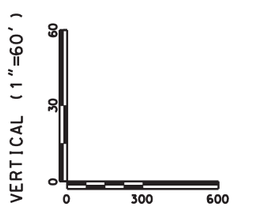


SECTION LOCATION MAP
NTS

(SECTIONS C-C' AND D-D' ARE SHOWN ON FIGURE 5)

NOTES:

1. WATER LEVELS FROM DECEMBER 2009
2. BORING LOCATIONS ARE PROJECTED ONTO CROSS SECTION. ACTUAL ELEVATIONS MAY VARY FROM ORIGINAL LOCATION.
3. NOT ALL GEOLOGIC DETAIL MAY BE SHOWN.



HORIZONTAL (1"=600')
VERTICAL ENHANCEMENT =10x
SCALES

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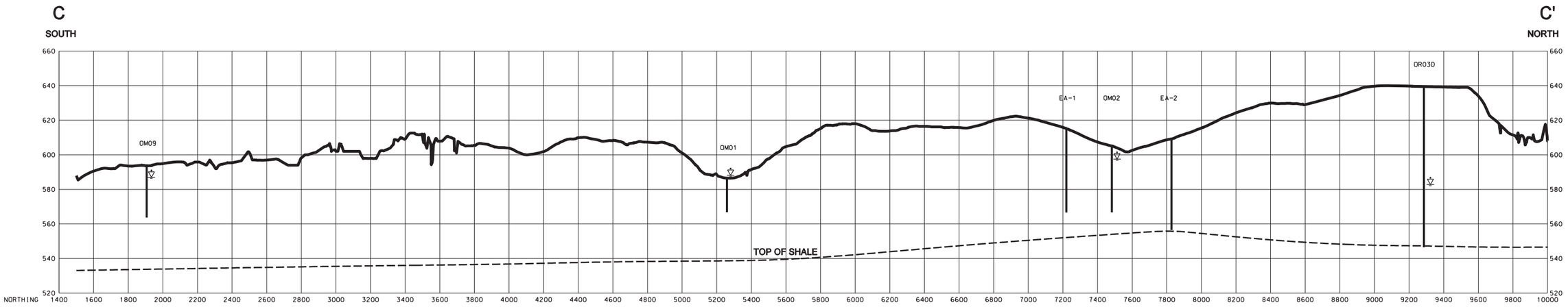
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Hanson Professional Services Inc.

CROSS SECTIONS A-A' AND B-B'

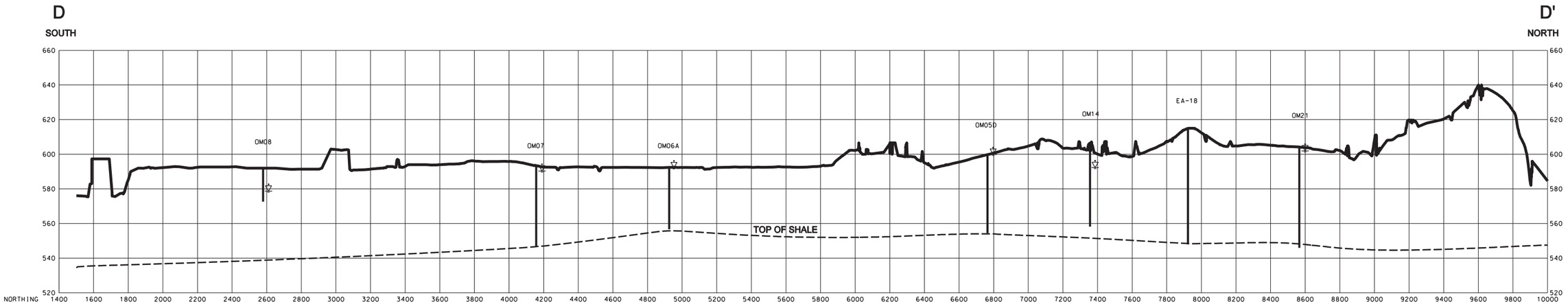
SOLID WASTE MANAGEMENT FACILITY
DUCK CREEK POWER GENERATING STATION
CANTON, FULTON COUNTY, ILLINOIS

HANSON NO. 03S5010F FIGURE 4

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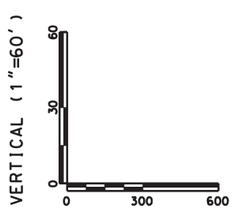
SECTION C-C' (AT E 200)



SECTION D-D' (AT E 1700)

NOTES:

1. WATER LEVELS FROM DECEMBER 2009
2. BORING LOCATIONS ARE PROJECTED ONTO CROSS SECTION. ACTUAL ELEVATIONS MAY VARY FROM ORIGINAL LOCATION.
3. NOT ALL GEOLOGIC DETAIL MAY BE SHOWN.
4. SEE FIGURE 4 FOR SECTION LOCATION MAP.



HORIZONTAL (1"=600')
VERTICAL ENHANCEMENT =10x

SCALES

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CROSS SECTIOS C-C' AND D-D'

SOLID WASTE MANAGEMENT FACILITY
DUCK CREEK POWER GENERATING STATION
CANTON, FULTON COUNTY, ILLINOIS

HANSON NO. 03S5010F FIGURE 5

Brans00939 03\02\2010
I:\03Jobs\03S5010F\CADD\Site\Sheet\Figures\FIG-5_XSC-C-D.dgn

APPENDIX B

HYDRAULIC CONDUCTIVITY TEST RESULTS

APPENDIX B1

ASH POND 1 AND ASH POND 2, AQUIFER EVALUATION IN THE SURFACE (STRIP) MINING AREA, HANSON, FEBRUARY 29, 2016

Ash Pond 1 and Ash Pond 2

Aquifer Evaluation in the Surface (Strip) Mining Area

Duck Creek Power Station
Illinois Power Resources Generating, LLC
Fulton County, Illinois

February 29, 2016

HANSON
Engineering | Planning | Allied Services

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Appendix A Hydraulic Conductivity (Slug) Test Results

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1. Description of Local Geology

Duck Creek Power Station Ash Pond 1 and Ash Pond 2 (Site) are located near Canton in Fulton County, Illinois (see Figure 1). The Site is positioned on the glacial uplands above the Illinois River in the Ancient Illinois Floodplain of the Till Plains Section of the Central Lowland Province (Leighton et al., 1948).

The Site and surrounding area are part of several, large, surface coal mines that have since stopped mining operations (Berg and Kempton, 1988).

Bedrock in the area is identified as Pennsylvanian-age shale deposits that underlie the removed Springfield (No. 5) Coal. The bedrock is typically found at an elevation of 550-555 ft. NGVD, but has been found as deep as 545 ft. NGVD in places.

2. Uppermost Aquifer Requirements

2.1 Definitions

The US Environmental Protection Agency (EPA), as part of its recent rulemaking regarding Disposal of Coal Combustion Residuals (CCR) from Electric Utilities, requires groundwater monitoring to yield groundwater samples from the uppermost aquifer that represent the quality of background groundwater and the quality of groundwater passing the CCR unit waste boundary. [40 CFR 257.90-94] (US EPA, 2015).

"Uppermost aquifer" is defined by US EPA (2015) [40 CFR 257.53] as:

> *the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.*

US EPA (2015) [40 CFR 257.53] further defines **"aquifer"** to be:

> *a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.*

US EPA guidance† concerning the CCR rule's definition of "aquifer" provides that:

> *the quality and value of an aquifer should be a site-specific determination. Usable water in an aquifer typically includes all groundwater currently used or potentially available for drinking water and other beneficial uses (e.g., industrial or agricultural use), whether or not it is particularly vulnerable to contamination. The Agency is unable to judge the resource value of an aquifer based on a generic scale of significance because of the variability of aquifers on a site-by-site basis.*

† US EPA, Top 20 Questions on EPA's CCR Final Rule, Answer to Question #9 (April 2015)

3. Site Hydrogeology

3.1 Shallow (Unlithified) Groundwater

The Hydrogeologic Report (Hanson, 2010) indicates that shallow groundwater at the Site moves through the disturbed mine spoils. The Site groundwater is classified as Class IV: Other Groundwater under the Illinois Groundwater Quality Standards at Title 35, Ill. Admin. Code, Part 620 [35 IAC 620] (IPCB, 1991).

3.1.1 Shallow Groundwater Quantity Evaluation

Hanson recently completed hydraulic conductivity testing (slug testing) of the monitoring wells immediately surrounding Ash Pond 1 and Ash Pond 2. Results of the tests are summarized in Table 1 and the analyses are located in Appendix A. Analyses of the falling head and rising head tests performed at each well (no rising head test at OM05S) were performed using AQTESOLV version 4.50. The Bower-Rice method [B-R] (Bouwer & Rice, 1976) (Bouwer, 1989) and the Kansas Geological Survey method [KGS] (Butler, 1998) unconfined solutions were used for the analyses. Of the 23 tests performed the geometric mean hydraulic conductivity for the mine spoil material is 2.0×10^{-4} cm/sec, with values ranging from 1.5×10^{-3} cm/sec at OR03D to 5.2×10^{-6} cm/sec at OM04S.

Table 1. Hydraulic Conductivity (Slug) Test Summary

Well ID	Falling Head	Rising Head	Geometric Mean	Analysis Method
OM01	0.00045	0.00065	0.00054	B-R
OR02	0.00037	0.00047	0.00042	B-R
OR03D	0.0015	0.00077	0.0011	B-R
OR03S	0.00039	0.0003	0.00034	B-R
OR04D	0.00015	0.00031	0.00022	B-R
OM04S	0.0000052	0.000055	0.000017	B-R
OR05D	0.000034	0.000034	0.000034	KGS
OM05S	0.000095		0.000095	B-R
OR06A	0.00018	0.00054	0.00031	B-R
OM07	0.00011	0.00024	0.00016	B-R
OM09	0.00031	0.00026	0.00028	KGS
OM21	0.00035	0.00036	0.00035	B-R
Geometric Mean =	0.000169	0.000267	0.000200	

Using the mean hydraulic conductivity value as being representative of water movement across the site, Hanson has calculated the capacity of the unlithified mine spoils to supply water to a hypothetical water well. Assuming a well with a 15-inch (1.25 ft.) radius and a screened interval of 50 feet (fully saturated) then using Darcy's Law (flow rate [Q] equals the hydraulic conductivity [k] times the gradient [i] times the area [A]), the groundwater supply rate to this hypothetical well is:

$k = 2.0 \times 10^{-6}$ m/sec,
i = 0.003 m/m (from site-specific potentiometric surface maps),
$A = 2\pi rh = 2*3.14*0.381\ m*15\ m = 35.9\ m^2$

$Q = kiA = 2.0 \times 10^{-6}$ m/sec * 0.003 * 35.9 $m^2 = 2.15 \times 10^{-7}\ m^3$/sec = 4.92 gal/day.

Several references were used to quantify "usable quantities" as that term is used in the US EPA definition of "aquifer" [40 CFR 257.53]. The US EPA WaterSense‡ web site indicates that an average American family uses over 300 gallons of water per day, and a United Nations study§ indicates that a typical American uses 575 liters (152 gallons) of water per day (so a household of two adults would use 304 gallons of water per day). Moreover, US EPA's RCRA regulations [40 CFR 260.10] define "aquifer" in terms of a geologic formation capable of a "significant yield" of groundwater to wells or springs**, with US EPA RCRA guidance further informing that some US EPA Regions have used local definitions or ranges to establish a significant yield figure, e.g., 5-50 gallons per day.†† Accordingly, based on the quantity of water that an average American household uses per day as the threshold for "usable quantities" under the US EPA definition of "aquifer" [40 CFR 257.53], as well as quantities identified in relevant US EPA RCRA guidance, the Mine Spoil at the Site would not be considered an aquifer.

3.1.2 Shallow Groundwater Quality Evaluation

Groundwater quality data has been collected at the Site since 1985. Since 2010, groundwater in the unlithified (mine spoils) material has had elevated concentrations of Boron (0.6 to 200 mg/L), Chloride (4 to 2100 mg/L), Iron (0.01 to 400 mg/L), Manganese (1.4 to 9500 ug/L), Sulfate (120 to 2900 mg/L), and Total Dissolved Solids (500 to 5800 mg/L). These Appendix III [40 CFR 257] constituents have concentrations that exceed Illinois [35 IAC 620] groundwater standards, US EPA MCLs, or US EPA secondary water quality standards. This water quality does not meet potable quality standards, and would also be difficult to use for industrial or agricultural purposes, without significant treatment, due to the potential caustic nature of the elevated Chloride and Sulfate concentrations.

‡ http://www.epa.gov/watersense/our_water/water_use_today.html

§ United Nations Development Program - Human Development Report 2006 at http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757

** US EPA Comment Summary and Response Document, Hazardous and Solid Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals from Electric Utilities: Proposed Rule, Docket # EPA-HQ-RCRA-2009-0640, Vol.3, C.2.b, at p. 38 (Dec. 2014) (explaining that the 40 CFR 257.53 definition of "aquifer" conforms to the definition of "aquifer" in 40 CFR 260.10).

†† US EPA RCRA/Superfund Hotline Monthly Summary, RCRA Online No. 12323, RPPC No. 9432.1984(06) (Nov. 1, 1984)

3.2 Bedrock Aquifer Evaluation

3.2.1 Pressure (Packer) Testing Methodology

Pressure testing equipment used at OM32 consisted of two pneumatic packers (rubber bladders) with a length of perforated steel pipe between them. The interval between the two packers was approximately 8.5 ft. Additional mild steel pipe (1 inch diameter) was added (or removed) to the packer assembly to reach the desired test interval. Nitrogen gas was used to inflate the packers, once they were lowered to the test depth. Inflation pressures were typically around 300 psi.

Water was pumped down to the test interval through a flow meter so that the amount of water "taken up" by the formation could be quantified. Flow to the sample interval was started before the packers were inflated, so that any leaks or other issues could be more easily identified. Although noted in the results for each sample interval, the first test increment listed is typically ignored. Each test "step" lasted approximately 15 minutes. Supply pressure to the test interval was increased at each step (i.e., 10 psi, 20 psi, and 30 psi). At the completion of the test, the pressures were reduced to the previous level and held for about 5 minutes. This "step down" portion of the test allows the geologist to determine if any water uptakes are real, or if the pressure only expanded the rock bedding/jointing.

3.2.2 Deep (Bedrock) Groundwater

Visocky et al. (1985) indicates that deeper strata in the bedrock can produce water that may be suitable (volume and quality) for a potable water supply. In fact, the Illinois Water Well (ILWATER) database (ISGS, 2015) identifies a bedrock well approximately 2 miles northeast of the Site that obtains water from a sandstone located 250-260 ft. bgs (below ground surface).

The bedrock immediately below the mined-out Springfield (No. 5) Coal at the Site is principally shale, with occasional sandstone, limestone and thin coal horizons. During September 2015, Hanson completed a bedrock boring (OM26B) to a depth of 355 ft. bgs. A boring log for OM26B, showing the unlithified and bedrock units, is included as Appendix B.

At the completion of the coring operations, Hanson pressure (packer) tested 255 ft. of bedrock in boring OM32. Results of the testing are summarized in Table 2, with the complete set of calculations included as Appendix C. The uppermost 100 ft. of bedrock had almost no take during the pressure testing. The only water uptake during the testing was noted (in the bottom 30 ft. of the borehole) at elevation 325-355 ft., with hydraulic conductivity (k) values in the 2 to 5 x 10^{-6} $cm^3/cm^2/sec$ range.

Pressure testing continued up the borehole, but no other (shallower) pressure test measurements exceeded 3 x 10^{-8} $cm^3/cm^2/sec$ (average k for test interval). Based on these results, Hanson concludes that the lowermost 55 ft. of bedrock is not "capable of yielding useable quantities of groundwater to wells or springs" due to the low hydraulic conductivities in the bedrock (low to mid 10^{-6} cm/s range at approximately 300 to 355 ft.) and, therefore, being 2-orders of magnitude lower than the mine spoil, bedrock is not an "aquifer" as defined by the US EPA (2015).

Additionally, the pressure testing indicates that there is almost 200 ft. of bedrock that is acting as a barrier to any potential contaminant migration from the mine spoil to any deeper water-bearing zones. Tests E through U typically had no take (formation was incapable of having any water injected during the tests).

Table 2. Pressure Test (Hydraulic Conductivity) Result Summary

Test No.	Depth (ft.)	Arithmetic Mean of Hydraulic Conductivity ($cm^3/cm^2/s$)	Median of Hydraulic Conductivity ($cm^3/cm^2/s$)
A	351.57	1.7×10^{-6}	1.3×10^{-6}
B	331.64	8.5×10^{-6}	5.8×10^{-6}
C	321.54	5.7×10^{-8}	3.9×10^{-8}
D	300.77	5.0×10^{-7}	2.7×10^{-8}
E	279.77	0.0	0.0
F	269.17	7.1×10^{-9}	0.0
G	258.72	5.9×10^{-7}	4.6×10^{-8}
H	248.62	3.0×10^{-9}	0.0
I	227.61	0.0 *(no take)*	0.0 *(no take)*
J	217.05	3.6×10^{-8}	0.0 *(no take)*
K	206.51	1.5×10^{-9}	0.0
L	196.37	0.0 *(no take)*	0.0 *(no take)*
M	185.77	1.5×10^{-9}	0.0
N	175.55	0.0 *(no take)*	0.0 *(no take)*
O	165.39	4.1×10^{-9}	0.0
P	155.25	0.0 *(no take)*	0.0 *(no take)*
Q	144.75	1.5×10^{-9}	0.0
R	134.15	1.3×10^{-9}	0.0
S	124.04	0.0 *(no take)*	0.0 *(no take)*
T	113.86	0.0 *(no take)*	0.0 *(no take)*
U	103.41	0.0 *(no take)*	0.0 *(no take)*

4. Conclusions

Hanson has reviewed available Site information and has performed additional hydraulic conductivity testing in both the Mine Spoil materials and the in situ bedrock formation(s). Based on the testing and analyses, Hanson concludes that the unlithified Mine Spoil materials are not an aquifer as defined by US EPA (2015) [40 CFR 257.53]. This material is incapable of producing "useable quantities" of groundwater, by both water quantity and quality analyses.

The bedrock formations were also tested, and determined to be incapable of producing "usable" quantities of groundwater. This testing further determined that the upper 200 ft. of bedrock is a barrier to any potential migration of the groundwater found within the Mine Spoil materials to deeper strata.

5. Licensed Professional Signature/Seal

The geological work product contained in this document has been prepared under my personal supervision and has been prepared and administered in accordance with the standards of reasonable professional skill and diligence.

Rhonald W. Hasenyager, P.G.
Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, IL 62703-2886
(217) 788-2450
Registration No. 196-000246

Seal:



Expires 3/31/2017

Signature: _____ Date: 29 February 2016

6. References

Berg, R.C. and J.P. Kempton, 1988. "Stack-unit Mapping of Geological Materials in Illinois to a Depth of 15 Meters" Circular 542, Illinois State Geological Survey, Urbana, IL, 23 pp. + 4 maps.

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Visocky, A.P., M.G. Sherrill, and K. Cartwright, 1985. “Geology, Hydrology and Water Quality of the Cambrian and Ordovician Systems in Northern Illinois”, Cooperative Groundwater Report 10, Illinois State Geological Survey and Illinois State Water Survey, Champaign, IL. 136 pp.



HANSON
Hanson Professional Services Inc.

SITE LOCATION MAP

ASH POND 1 AND ASH POND 2
DUCK CREEK POWER STATION
FULTON COUNTY, ILLINOIS

HANSON NO. 15E0030 FIGURE 1

I:\15Jobs\15E0030\Admin\14-Reports\DuckCreek\MAP_SiteLocation_151222.srf

FIGURE 2. Hydraulic Conductivity Testing Locations

Duck Creek Power Station

Legend

- Ash Pond Limits
- Bedrock Boring
- Monitoring Well

Long Lake

N Cilco Rd

OM09

OM01

OR02

OR03D/OR03S

OM32

Ash Pond 1

Ash Pond 2

OR04D / OM04S

OM07

OR06A

OR05D / OM05S

OR14D/OR14S

OM21

Closed Recycle Pond

Duck Creek Reservoir

2000 ft

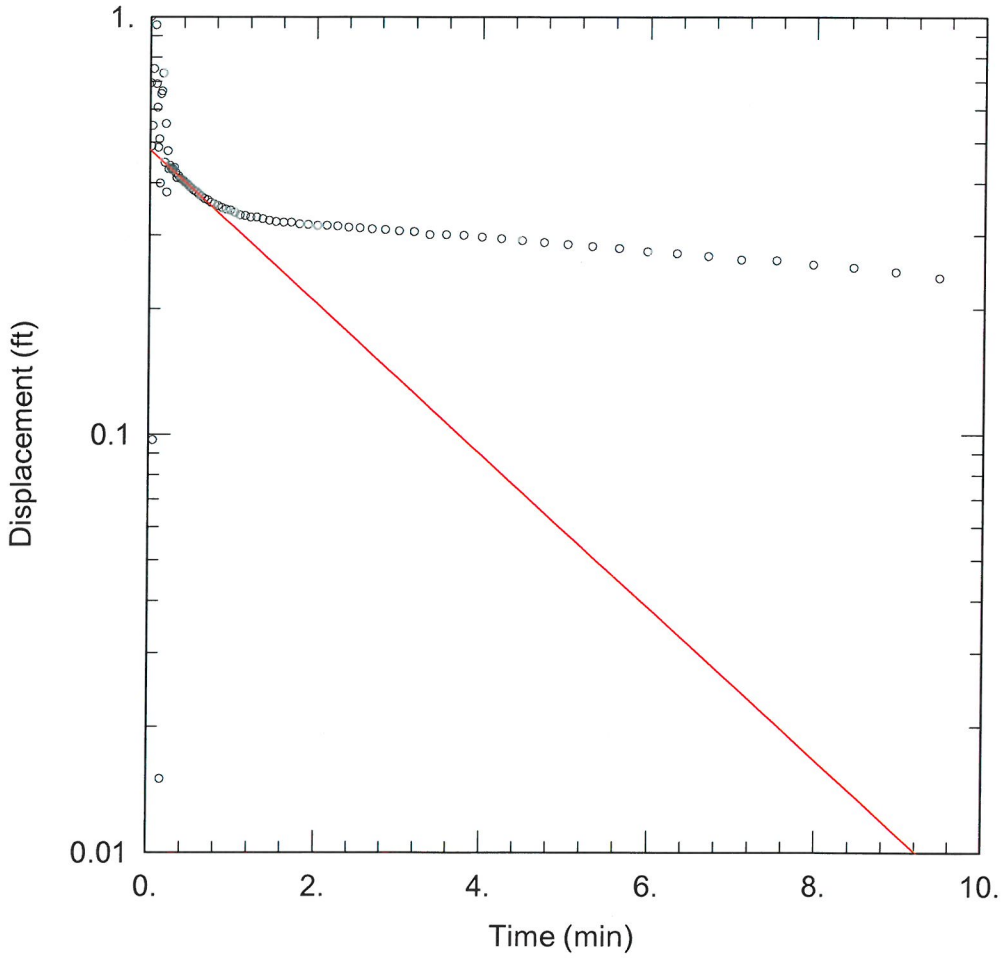
Google earth

© 2015 Google

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Appendix A

Hydraulic Conductivity (Slug) Test Results



OM01 FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM01fh.aqt
Date: 12/09/15 Time: 09:16:48

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM01
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 15.72 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM01)

Initial Displacement: 1. ft
Total Well Penetration Depth: 9.22 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 9.22 ft
Screen Length: 5. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00045 cm/sec
y0 = 0.48 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM01fh.aqt
Title: OM01 Falling Head Test
Date: 12/09/15
Time: 09:16:48

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OM01

AQUIFER DATA

Saturated Thickness: 15.72 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM01

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1. ft
Static Water Column Height: 9.22 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 5. ft
Total Well Penetration Depth: 9.22 ft

No. of Observations: 110

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0112	0.695	1.606	0.322
0.0223	0.49	1.7	0.322
0.0335	0.548	1.799	0.319
0.0447	0.751	1.904	0.318
0.0558	0.097	2.016	0.316
0.067	0.956	2.134	0.316
0.0782	0.691	2.259	0.315
0.0893	0.606	2.392	0.313
0.1005	0.486	2.532	0.312
0.1117	0.509	2.681	0.31
0.1228	0.399	2.838	0.309
0.134	0.654	3.005	0.307
0.1452	0.664	3.182	0.306
0.1563	0.733	3.369	0.301
0.1675	0.015	3.568	0.301
0.1787	0.448	3.778	0.3
0.1898	0.554	4.	0.297
0.201	0.38	4.236	0.294
0.2122	0.477	4.486	0.291

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.2233	0.432	4.751	0.288
0.235	0.441	5.031	0.285
0.2475	0.435	5.328	0.282
0.2607	0.431	5.643	0.279
0.2747	0.432	5.976	0.274
0.2895	0.435	6.329	0.271
0.3052	0.423	6.702	0.267
0.3218	0.411	7.098	0.262
0.3395	0.416	7.518	0.261
0.3582	0.41	7.962	0.255
0.378	0.408	8.433	0.251
0.399	0.405	8.931	0.245
0.4212	0.401	9.459	0.237
0.4447	0.398	10.02	0.231
0.4695	0.393	10.61	0.227
0.4958	0.389	11.24	0.219
0.5238	0.384	11.9	0.213
0.5535	0.381	12.61	0.206
0.5848	0.376	13.35	0.197
0.618	0.371	14.14	0.19
0.6532	0.367	14.98	0.182
0.6905	0.364	15.87	0.172
0.73	0.359	16.81	0.163
0.7718	0.356	17.8	0.155
0.8162	0.353	18.85	0.143
0.8632	0.349	19.97	0.134
0.913	0.346	21.15	0.123
0.9657	0.344	22.4	0.112
1.022	0.34	23.73	0.1
1.081	0.335	25.14	0.087
1.143	0.334	26.62	0.073
1.21	0.331	28.2	0.062
1.28	0.331	29.87	0.047
1.355	0.328	31.64	0.032
1.434	0.325	33.51	0.018
1.517	0.323	35.5	0.002

SOLUTION

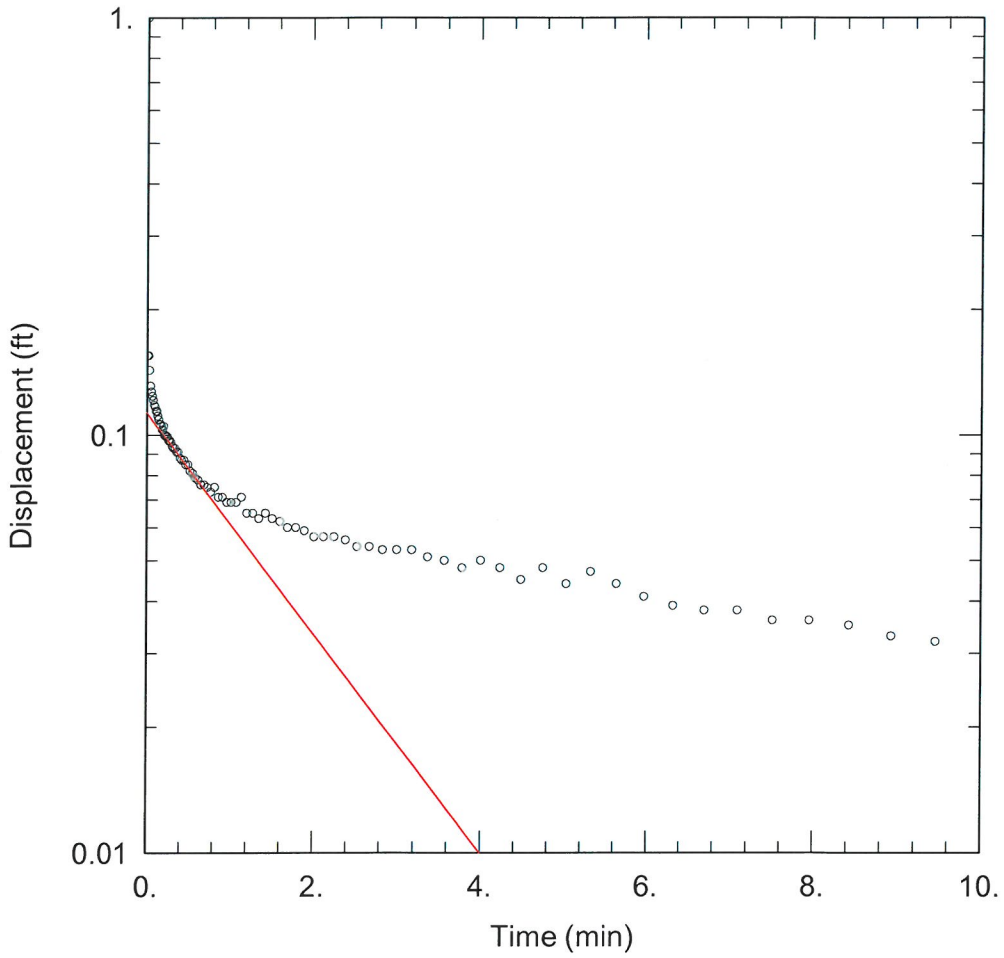
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.038

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00045	cm/sec
y0	0.48	ft

$T = K*b = 0.2156$ cm²/sec



OM01 RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM01rh.aqt
Date: 12/09/15 Time: 09:16:49

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM01
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 15.72 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM01)

Initial Displacement: 1. ft
Total Well Penetration Depth: 9.22 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 9.22 ft
Screen Length: 5. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00065 cm/sec
y0 = 0.113 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM01rh.aqt
Title: OM01 Rising Head Test
Date: 12/09/15
Time: 09:16:50

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OM01

AQUIFER DATA

Saturated Thickness: 15.72 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM01

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1. ft
Static Water Column Height: 9.22 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 5. ft
Total Well Penetration Depth: 9.22 ft

No. of Observations: 106

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0112	0.155	1.434	0.065
0.0223	0.155	1.517	0.063
0.0335	0.143	1.606	0.062
0.0447	0.131	1.7	0.06
0.0558	0.127	1.799	0.06
0.067	0.124	1.904	0.059
0.0782	0.121	2.016	0.057
0.0893	0.118	2.134	0.057
0.1005	0.117	2.259	0.057
0.1117	0.114	2.392	0.056
0.1228	0.114	2.532	0.054
0.134	0.111	2.681	0.054
0.1452	0.109	2.838	0.053
0.1563	0.106	3.005	0.053
0.1675	0.106	3.182	0.053
0.1787	0.105	3.369	0.051
0.1898	0.103	3.568	0.05
0.201	0.105	3.778	0.048
0.2122	0.1	4.	0.05

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.2233	0.1	4.236	0.048
0.235	0.099	4.486	0.045
0.2475	0.099	4.751	0.048
0.2607	0.097	5.031	0.044
0.2747	0.097	5.328	0.047
0.2895	0.096	5.643	0.044
0.3052	0.094	5.976	0.041
0.3218	0.093	6.329	0.039
0.3395	0.093	6.702	0.038
0.3582	0.091	7.098	0.038
0.378	0.091	7.518	0.036
0.399	0.088	7.962	0.036
0.4212	0.087	8.433	0.035
0.4447	0.087	8.931	0.033
0.4695	0.085	9.459	0.032
0.4958	0.085	10.02	0.032
0.5238	0.082	10.61	0.03
0.5535	0.081	11.24	0.029
0.5848	0.079	11.9	0.029
0.618	0.078	12.61	0.026
0.6532	0.076	13.35	0.026
0.6905	0.076	14.14	0.024
0.73	0.075	14.98	0.023
0.7718	0.073	15.87	0.021
0.8162	0.075	16.81	0.02
0.8632	0.071	17.8	0.018
0.913	0.071	18.85	0.017
0.9657	0.069	19.97	0.013
1.022	0.069	21.15	0.011
1.081	0.069	22.4	0.01
1.143	0.071	23.73	0.01
1.21	0.065	25.14	0.008
1.28	0.065	26.62	0.005
1.355	0.063	28.2	0.004

SOLUTION

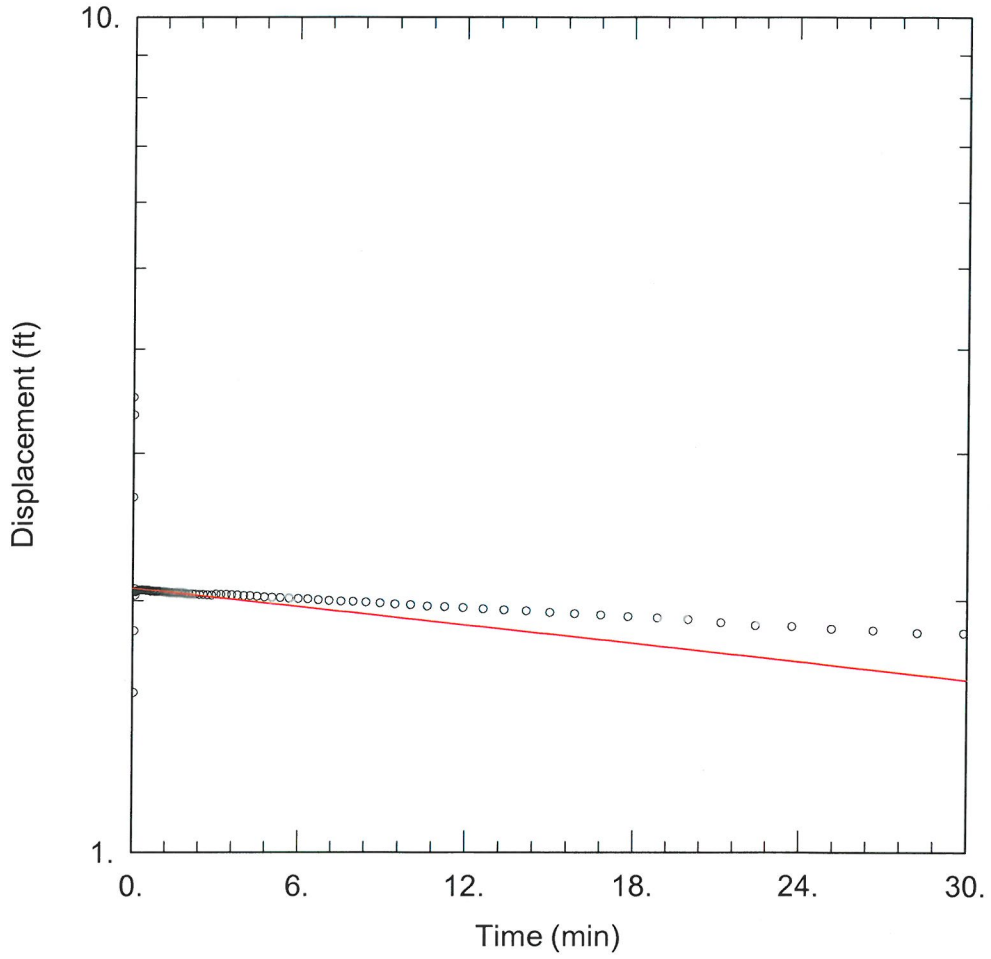
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.038

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00065	cm/sec
y0	0.113	ft

$T = K*b = 0.3114$ cm²/sec



OM04S FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM04Sfh.aqt
Date: 12/09/15 Time: 09:16:51

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM04S
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 50.52 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM04S)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 17.52 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 17.52 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 5.2E-6 cm/sec
y0 = 2.07 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM04Sfh.aqt
Title: OM04S Falling Head Test
Date: 12/09/15
Time: 09:16:51

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OM04S

AQUIFER DATA

Saturated Thickness: 50.52 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM04S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.5 ft
Static Water Column Height: 17.52 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 17.52 ft

No. of Observations: 102

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0165	2.659	1.824	2.042
0.033	3.335	1.929	2.039
0.0495	1.553	2.041	2.037
0.066	1.841	2.159	2.037
0.0825	2.066	2.284	2.036
0.099	2.03	2.416	2.034
0.1155	2.048	2.557	2.033
0.132	2.052	2.706	2.031
0.1485	2.054	2.863	2.03
0.165	2.055	3.03	2.036
0.1815	2.055	3.207	2.033
0.198	2.055	3.394	2.033
0.2145	2.057	3.592	2.031
0.231	2.058	3.803	2.03
0.2475	2.058	4.025	2.027
0.264	2.058	4.261	2.027
0.2805	2.058	4.511	2.023
0.297	2.058	4.776	2.02
0.3135	2.058	5.056	2.018

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.33	2.058	5.353	2.015
0.3467	2.058	5.667	2.012
0.3643	2.06	6.	2.011
0.383	2.058	6.353	2.008
0.4028	2.058	6.727	2.003
0.4238	2.058	7.123	2.
0.446	2.058	7.543	1.997
0.4695	2.058	7.987	1.994
0.4943	2.057	8.457	1.99
0.5207	2.058	8.956	1.985
0.5487	2.057	9.484	1.981
0.5783	2.058	10.04	1.976
0.6097	2.057	10.64	1.97
0.6428	2.055	11.26	1.966
0.678	2.052	11.93	1.961
0.7153	2.054	12.63	1.954
0.7548	2.054	13.38	1.949
0.7967	2.052	14.17	1.944
0.841	2.052	15.01	1.936
0.888	2.051	15.89	1.929
0.9378	2.051	16.83	1.921
0.9905	2.051	17.83	1.914
1.046	2.049	18.88	1.906
1.105	2.049	19.99	1.899
1.168	2.049	21.18	1.882
1.234	2.048	22.43	1.867
1.305	2.046	23.76	1.862
1.379	2.045	25.16	1.851
1.458	2.045	26.65	1.842
1.542	2.045	28.23	1.829
1.631	2.043	29.9	1.827
1.724	2.043	31.66	1.815

SOLUTION

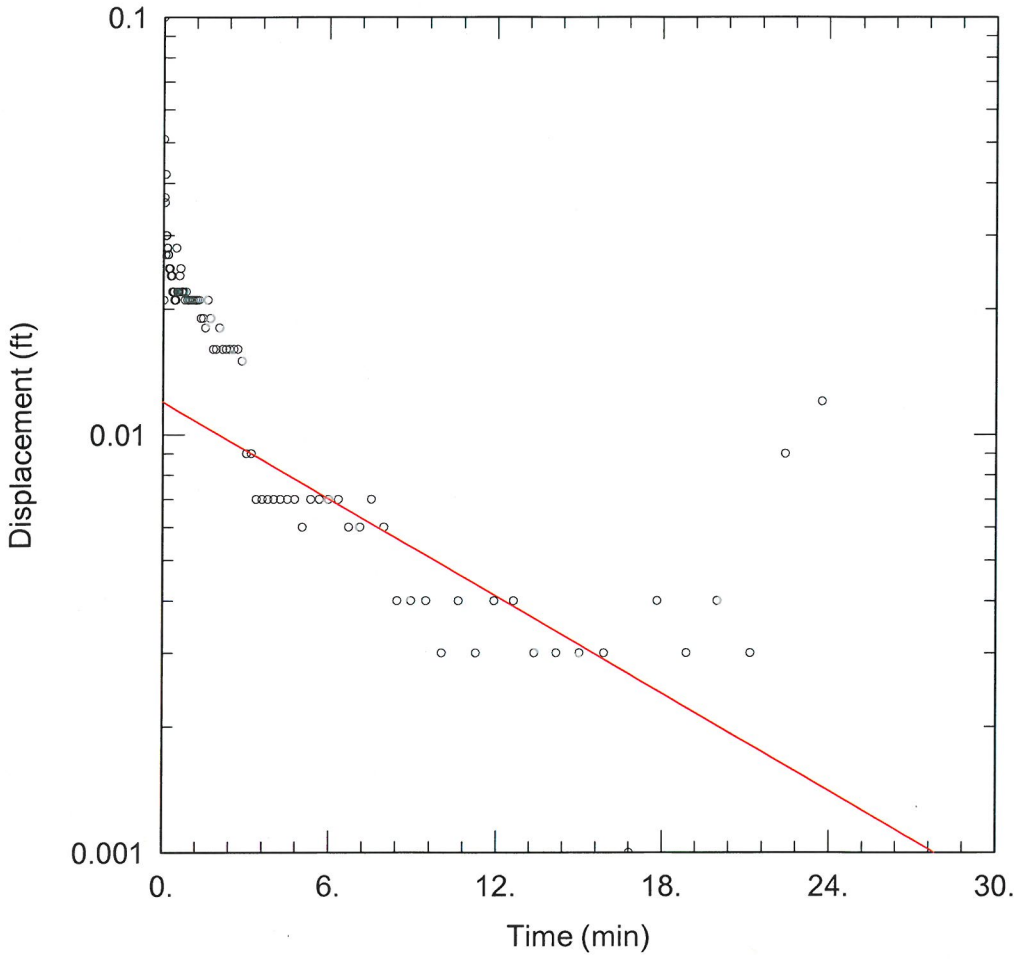
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.492

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	5.2E-6	cm/sec
y0	2.07	ft

$T = K*b = 0.008007$ cm²/sec



OM04S RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM04Srh.aqt
Date: 12/21/15 Time: 14:51:43

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM4S
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 50.52 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM04S)

Initial Displacement: 0.1 ft
Total Well Penetration Depth: 17.52 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 17.52 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 5.5E-5 cm/sec
y0 = 0.012 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM04Srh.aqt
Title: OM04S Rising Head Test
Date: 12/21/15
Time: 14:51:44

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OM4S

AQUIFER DATA

Saturated Thickness: 50.52 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM04S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.1 ft
Static Water Column Height: 17.52 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 17.52 ft

No. of Observations: 97

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0163	0.051	1.627	0.021
0.0327	0.021	1.721	0.019
0.049	0.037	1.82	0.016
0.0653	0.036	1.926	0.016
0.0817	0.042	2.037	0.018
0.098	0.027	2.155	0.016
0.1143	0.03	2.281	0.016
0.1307	0.03	2.413	0.016
0.147	0.028	2.554	0.016
0.1633	0.028	2.702	0.016
0.1797	0.027	2.86	0.015
0.196	0.027	3.027	0.009
0.2123	0.025	3.204	0.009
0.2287	0.025	3.391	0.007
0.245	0.025	3.589	0.007
0.2613	0.025	3.799	0.007
0.2777	0.024	4.022	0.007
0.294	0.024	4.258	0.007
0.3103	0.024	4.508	0.007

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3267	0.024	4.772	0.007
0.3433	0.022	5.053	0.006
0.361	0.022	5.349	0.007
0.3797	0.022	5.664	0.007
0.3995	0.022	5.997	0.007
0.4205	0.021	6.35	0.007
0.4427	0.021	6.724	0.006
0.4662	0.021	7.12	0.006
0.491	0.028	7.539	0.007
0.5173	0.022	7.984	0.006
0.5453	0.022	8.454	0.004
0.575	0.022	8.953	0.004
0.6063	0.024	9.481	0.004
0.6395	0.025	10.04	0.003
0.6747	0.022	10.63	0.004
0.712	0.022	11.26	0.003
0.7515	0.022	11.92	0.004
0.7933	0.021	12.63	0.004
0.8377	0.022	13.37	0.003
0.8847	0.021	14.16	0.003
0.9345	0.021	15.	0.003
0.9872	0.021	15.89	0.003
1.043	0.021	16.83	0.001
1.102	0.021	17.82	0.004
1.165	0.021	18.88	0.003
1.231	0.021	19.99	0.004
1.302	0.021	21.17	0.003
1.376	0.019	22.43	0.009
1.455	0.019	23.75	0.012
1.539	0.018		

SOLUTION

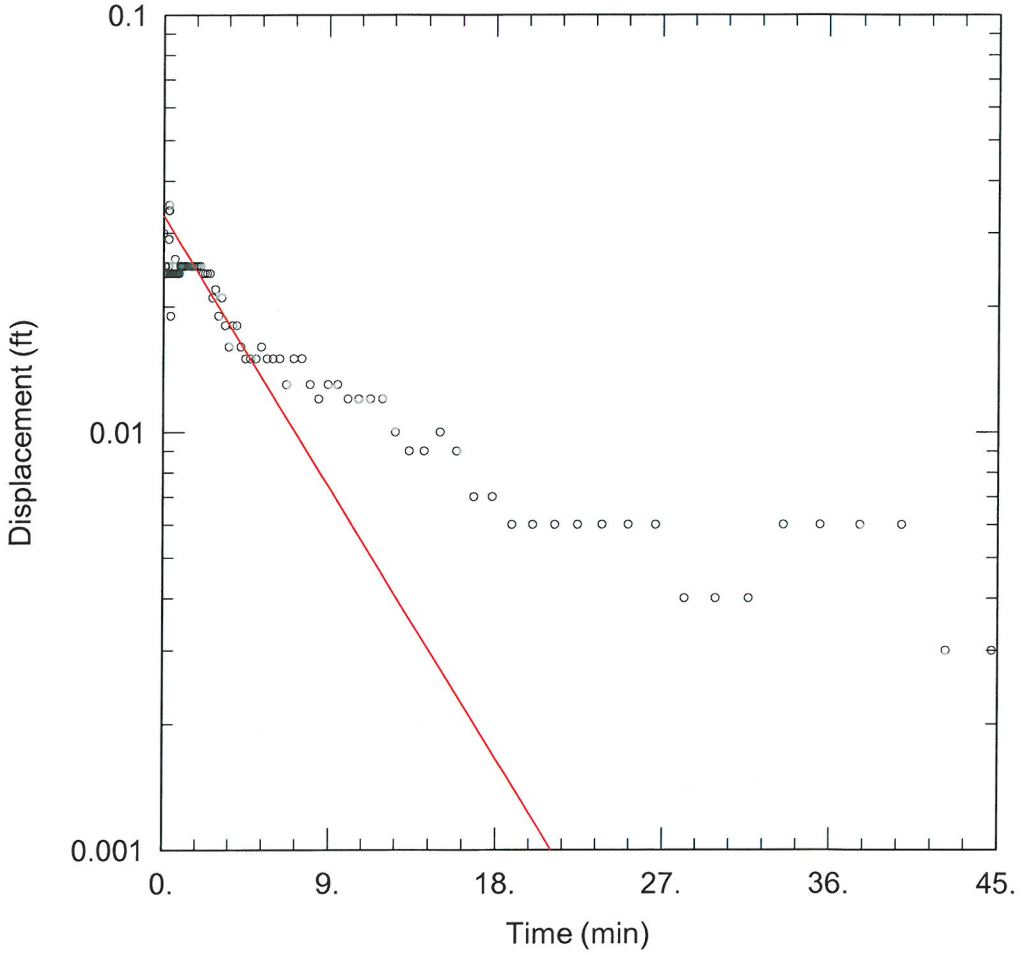
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.492

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	5.5E-5	cm/sec
y0	0.012	ft

T = K*b = 0.08469 cm²/sec



OM05S FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM05Sfh.aqt
Date: 12/09/15 Time: 09:16:54

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM05S
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 37.36 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM05S)

Initial Displacement: 0.03 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.86 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 9.5E-5 cm/sec
y0 = 0.033 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM05Sfh.aqt
Title: OM05S Falling Head Test
Date: 12/09/15
Time: 09:16:54

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM05S

AQUIFER DATA

Saturated Thickness: 37.36 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM05S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.03 ft
Static Water Column Height: 6.86 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10. ft

No. of Observations: 108

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0163	0.024	2.155	0.024
0.0327	0.024	2.281	0.024
0.049	0.024	2.413	0.024
0.0653	0.024	2.554	0.024
0.0817	0.025	2.702	0.021
0.098	0.024	2.86	0.022
0.1143	0.024	3.027	0.019
0.1307	0.025	3.204	0.021
0.147	0.024	3.391	0.018
0.1633	0.024	3.589	0.016
0.1797	0.024	3.799	0.018
0.196	0.024	4.022	0.018
0.2123	0.024	4.258	0.016
0.2287	0.024	4.508	0.015
0.245	0.024	4.772	0.015
0.2613	0.024	5.053	0.015
0.2777	0.025	5.349	0.016
0.294	0.034	5.664	0.015
0.3103	0.029	5.997	0.015

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3267	0.035	6.35	0.015
0.3433	0.034	6.724	0.013
0.361	0.024	7.12	0.015
0.3797	0.024	7.539	0.015
0.3995	0.019	7.984	0.013
0.4205	0.024	8.454	0.012
0.4427	0.024	8.953	0.013
0.4662	0.024	9.481	0.013
0.491	0.024	10.04	0.012
0.5173	0.024	10.63	0.012
0.5453	0.024	11.26	0.012
0.575	0.024	11.92	0.012
0.6063	0.024	12.63	0.01
0.6395	0.026	13.37	0.009
0.6747	0.024	14.16	0.009
0.712	0.024	15.	0.01
0.7515	0.024	15.89	0.009
0.7933	0.024	16.83	0.007
0.8377	0.024	17.82	0.007
0.8847	0.024	18.88	0.006
0.9345	0.025	19.99	0.006
0.9872	0.025	21.17	0.006
1.043	0.025	22.43	0.006
1.102	0.025	23.75	0.006
1.165	0.025	25.16	0.006
1.231	0.025	26.65	0.006
1.302	0.025	28.22	0.004
1.376	0.025	29.89	0.004
1.455	0.025	31.66	0.004
1.539	0.025	33.53	0.006
1.627	0.025	35.52	0.006
1.721	0.025	37.62	0.006
1.82	0.025	39.85	0.006
1.926	0.025	42.21	0.003
2.037	0.025	44.71	0.003

SOLUTION

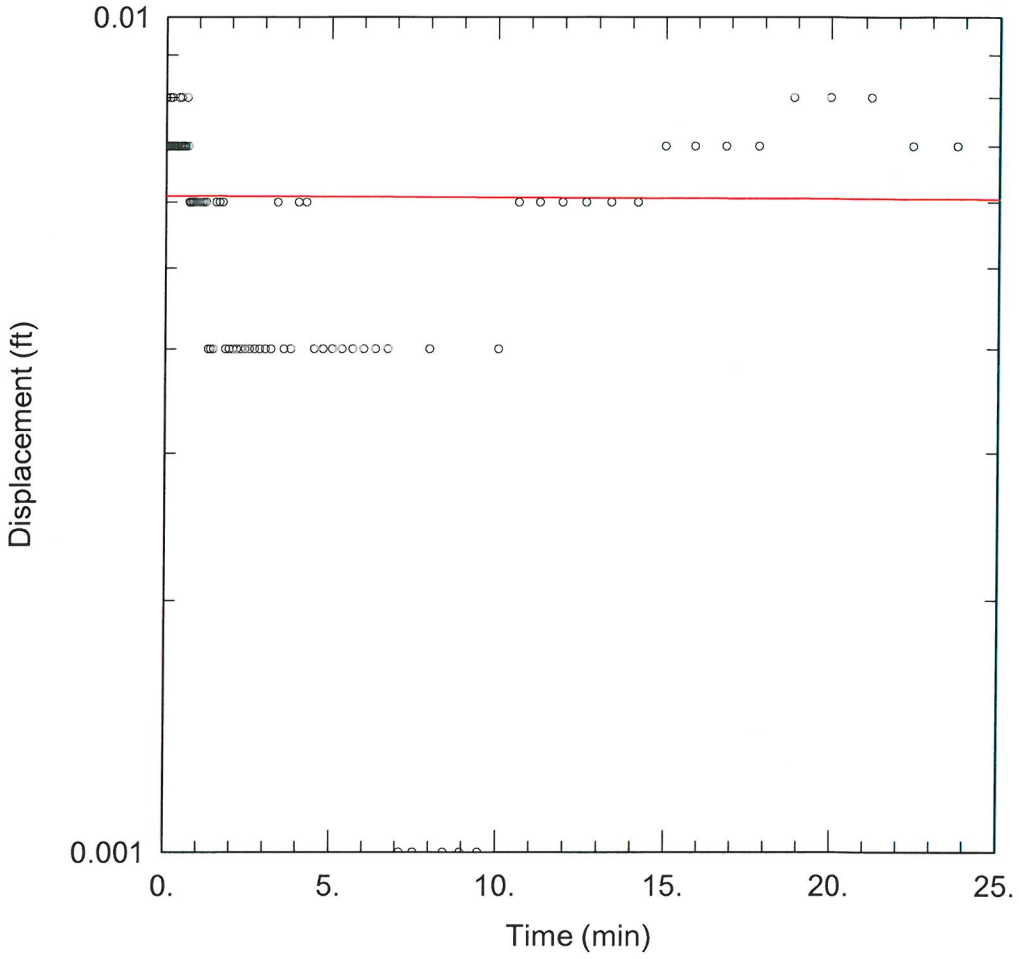
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.234

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	9.5E-5	cm/sec
y0	0.033	ft

$T = K*b = 0.1082$ cm²/sec



OM05S RISING HEAD TEST (NO DISPLACEMENT, TEST INVALID)

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM05Srh.aqt
Date: 12/09/15 Time: 09:37:40

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM05S
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 37.36 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM05S)

Initial Displacement: 0.008 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08333 ft
Static Water Column Height: 6.86 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
K = 2.0E-7 cm/sec
Solution Method: Bouwer-Rice
y0 = 0.0061 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM05Srh.aqt
Title: OM05S Rising Head Test (no displacement, test invalid)
Date: 12/09/15
Time: 09:37:41

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM05S

AQUIFER DATA

Saturated Thickness: 37.36 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM05S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.008 ft
Static Water Column Height: 6.86 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10. ft

No. of Observations: 107

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0165	0.007	2.159	0.004
0.033	0.007	2.284	0.004
0.0495	0.007	2.416	0.004
0.066	0.007	2.557	0.004
0.0825	0.007	2.706	0.004
0.099	0.007	2.863	0.004
0.1155	0.007	3.03	0.004
0.132	0.008	3.207	0.004
0.1485	0.007	3.394	0.006
0.165	0.007	3.592	0.004
0.1815	0.007	3.803	0.004
0.198	0.008	4.025	0.006
0.2145	0.007	4.261	0.006
0.231	0.007	4.511	0.004
0.2475	0.007	4.776	0.004
0.264	0.007	5.056	0.004
0.2805	0.007	5.353	0.004
0.297	0.007	5.667	0.004
0.3135	0.007	6.	0.004

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.33	0.007	6.353	0.004
0.3467	0.007	6.727	0.004
0.3643	0.007	7.123	0.001
0.383	0.007	7.543	0.001
0.4028	0.008	7.987	0.004
0.4238	0.007	8.457	0.001
0.446	0.007	8.956	0.001
0.4695	0.008	9.484	0.001
0.4943	0.007	10.04	0.004
0.5207	0.007	10.64	0.006
0.5487	0.007	11.26	0.006
0.5783	0.007	11.93	0.006
0.6097	0.007	12.63	0.006
0.6428	0.008	13.38	0.006
0.678	0.007	14.17	0.006
0.7153	0.006	15.01	0.007
0.7548	0.006	15.89	0.007
0.7967	0.006	16.83	0.007
0.841	0.006	17.83	0.007
0.888	0.006	18.88	0.008
0.9378	0.006	19.99	0.008
0.9905	0.006	21.18	0.008
1.046	0.006	22.43	0.007
1.105	0.006	23.76	0.007
1.168	0.006	25.16	0.008
1.234	0.006	26.65	0.008
1.305	0.004	28.23	0.01
1.379	0.004	29.9	0.007
1.458	0.004	31.66	0.008
1.542	0.006	33.54	0.01
1.631	0.006	35.52	0.01
1.724	0.006	37.62	0.01
1.824	0.004	39.85	0.011
1.929	0.004	42.21	0.013
2.041	0.004		

SOLUTION

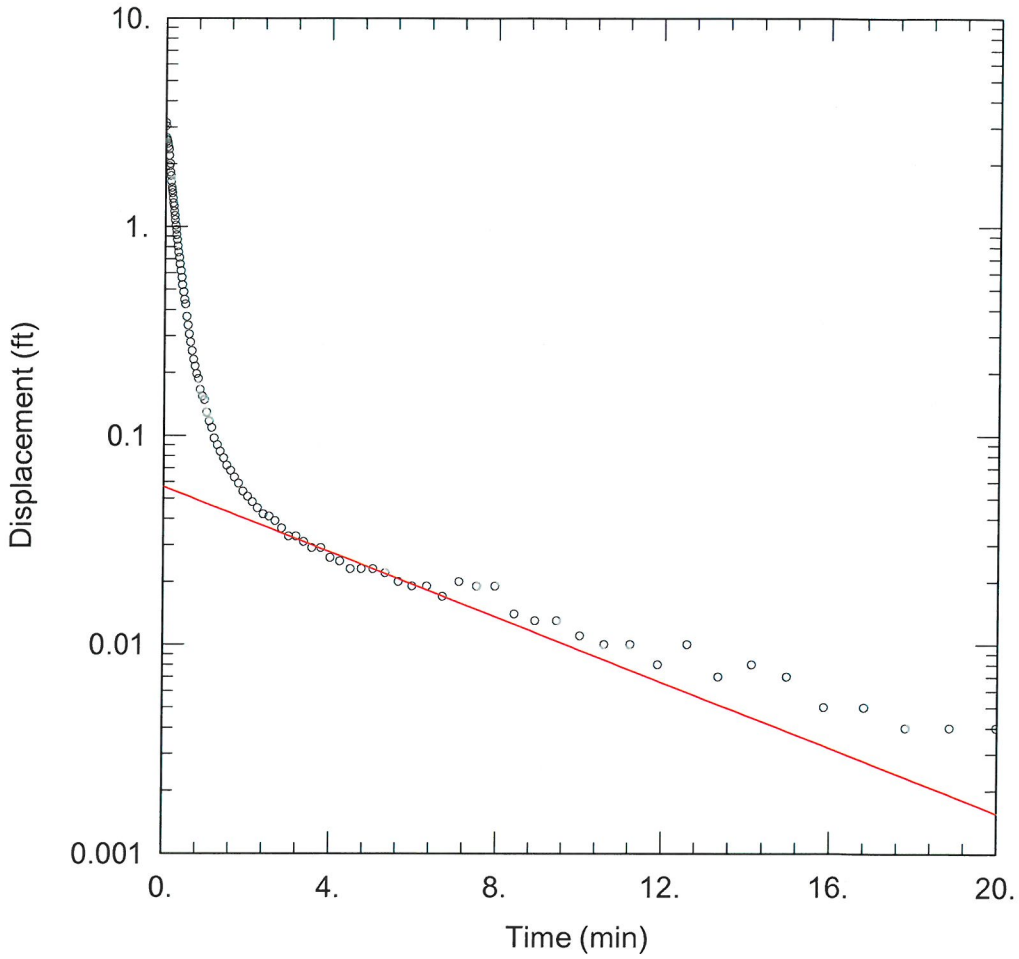
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.234

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	2.0E-7	cm/sec
y0	0.0061	ft

$T = K*b = 0.0002277$ cm²/sec



OM07 FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM07fh.aqt
Date: 12/09/15 Time: 09:16:56

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM07
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 36.37 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM07)

Initial Displacement: 3.15 ft
Total Well Penetration Depth: 15.37 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 15.37 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00011 cm/sec
y0 = 0.057 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM07fh.aqt
Title: OM07 Falling Head Test
Date: 12/09/15
Time: 09:16:57

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM07

AQUIFER DATA

Saturated Thickness: 36.37 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM07

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.15 ft
Static Water Column Height: 15.37 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.37 ft

No. of Observations: 103

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.011	3.034	1.288	0.09
0.022	2.665	1.362	0.084
0.033	2.61	1.441	0.078
0.044	2.578	1.525	0.072
0.055	2.5	1.613	0.068
0.066	2.418	1.707	0.063
0.077	2.346	1.807	0.059
0.088	2.191	1.912	0.054
0.099	1.95	2.023	0.051
0.11	2.001	2.142	0.048
0.121	1.825	2.267	0.045
0.132	1.752	2.399	0.042
0.143	1.642	2.54	0.041
0.154	1.538	2.688	0.039
0.165	1.493	2.846	0.036
0.176	1.447	3.013	0.033
0.187	1.365	3.19	0.033
0.198	1.3	3.377	0.031
0.209	1.252	3.575	0.029

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.22	1.184	3.785	0.029
0.231	1.129	4.008	0.026
0.2427	1.077	4.244	0.025
0.2552	1.016	4.494	0.023
0.2683	0.968	4.758	0.023
0.2823	0.911	5.039	0.023
0.2972	0.864	5.336	0.022
0.3128	0.807	5.65	0.02
0.3295	0.754	5.983	0.019
0.3472	0.709	6.336	0.019
0.3658	0.661	6.71	0.017
0.3857	0.614	7.106	0.02
0.4067	0.571	7.525	0.019
0.4288	0.527	7.97	0.019
0.4523	0.486	8.44	0.014
0.4772	0.447	8.939	0.013
0.5035	0.426	9.467	0.013
0.5315	0.371	10.03	0.011
0.5612	0.337	10.62	0.01
0.5925	0.306	11.25	0.01
0.6257	0.28	11.91	0.008
0.6608	0.254	12.62	0.01
0.6982	0.231	13.36	0.007
0.7377	0.215	14.15	0.008
0.7795	0.197	14.99	0.007
0.8238	0.187	15.87	0.005
0.8708	0.166	16.81	0.005
0.9207	0.154	17.81	0.004
0.9733	0.148	18.86	0.004
1.029	0.129	19.98	0.004
1.088	0.117	21.16	0.004
1.151	0.109	22.41	0.002
1.217	0.097		

SOLUTION

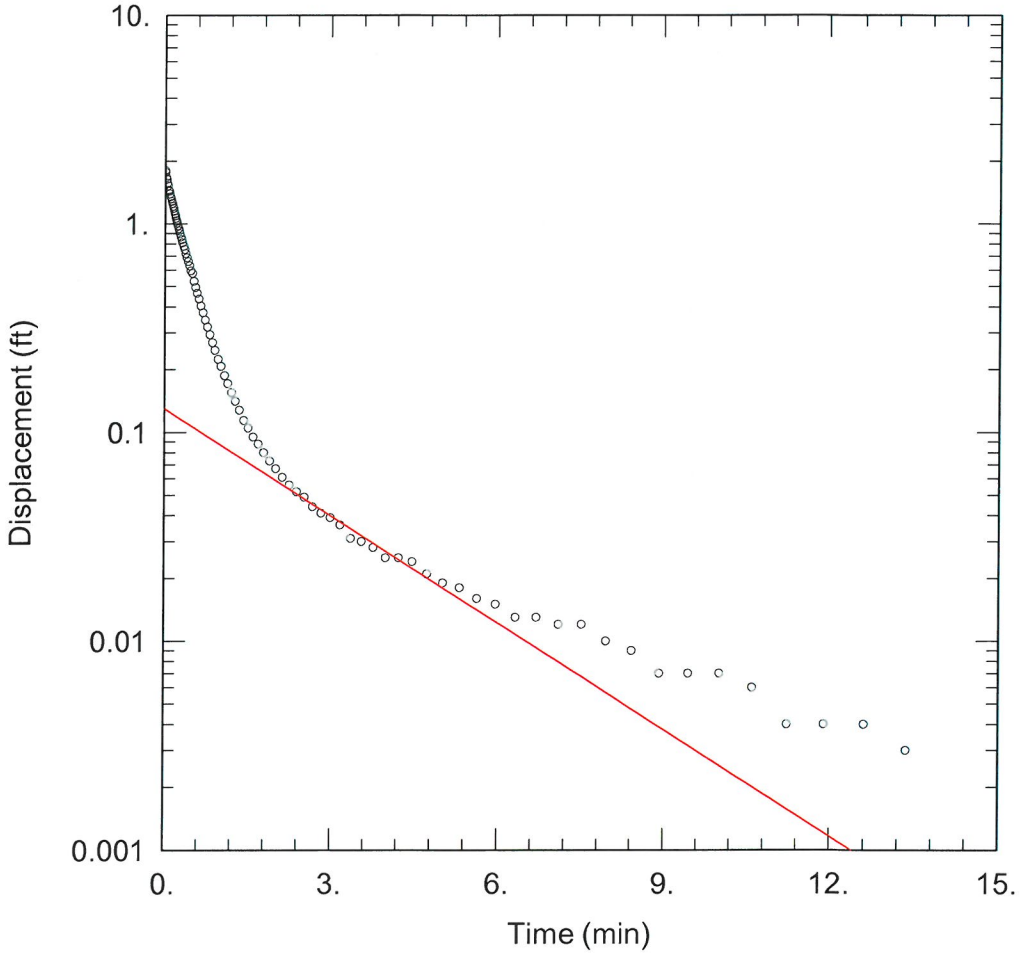
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.466

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00011	cm/sec
y0	0.057	ft

$T = K*b = 0.1219$ cm²/sec



OM07 RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM07rh.aqt
Date: 12/09/15 Time: 09:16:58

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM07
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 36.37 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM07)

Initial Displacement: 1.8 ft
Total Well Penetration Depth: 15.37 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 15.37 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00024 cm/sec
y0 = 0.13 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM07rh.aqt
Title: OM07 Rising Head Test
Date: 12/09/15
Time: 09:16:59

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM07

AQUIFER DATA

Saturated Thickness: 36.37 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM07

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.8 ft
Static Water Column Height: 15.37 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 15.37 ft

No. of Observations: 93

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0112	1.768	1.022	0.207
0.0223	1.673	1.081	0.187
0.0335	1.635	1.143	0.171
0.0447	1.568	1.21	0.155
0.0558	1.52	1.28	0.141
0.067	1.447	1.355	0.128
0.0782	1.432	1.434	0.114
0.0893	1.395	1.517	0.105
0.1005	1.352	1.606	0.095
0.1117	1.321	1.7	0.088
0.1228	1.279	1.799	0.08
0.134	1.254	1.904	0.073
0.1452	1.215	2.016	0.067
0.1563	1.188	2.134	0.061
0.1675	1.153	2.259	0.056
0.1787	1.117	2.392	0.052
0.1898	1.093	2.532	0.049
0.201	1.065	2.681	0.044
0.2122	1.035	2.838	0.041

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.2233	1.01	3.005	0.039
0.235	0.98	3.182	0.036
0.2475	0.95	3.369	0.031
0.2607	0.925	3.568	0.03
0.2747	0.897	3.778	0.028
0.2895	0.866	4.	0.025
0.3052	0.842	4.236	0.025
0.3218	0.811	4.486	0.024
0.3395	0.782	4.751	0.021
0.3582	0.753	5.031	0.019
0.378	0.721	5.328	0.018
0.399	0.687	5.643	0.016
0.4212	0.659	5.976	0.015
0.4447	0.629	6.329	0.013
0.4695	0.595	6.702	0.013
0.4958	0.579	7.098	0.012
0.5238	0.529	7.518	0.012
0.5535	0.495	7.962	0.01
0.5848	0.465	8.433	0.009
0.618	0.436	8.931	0.007
0.6532	0.404	9.459	0.007
0.6905	0.375	10.02	0.007
0.73	0.346	10.61	0.006
0.7718	0.32	11.24	0.004
0.8162	0.294	11.9	0.004
0.8632	0.269	12.61	0.004
0.913	0.247	13.35	0.003
0.9657	0.224		

SOLUTION

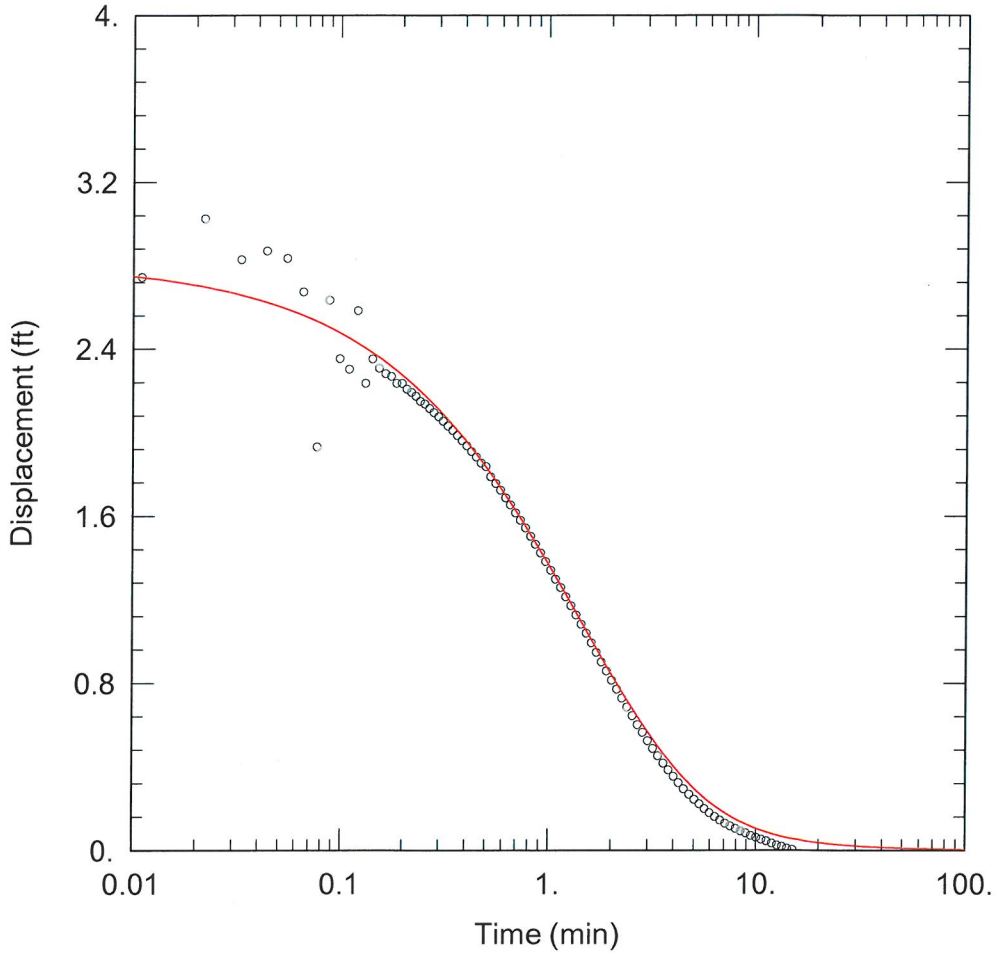
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.466

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00024	cm/sec
y0	0.13	ft

T = K*b = 0.2661 cm²/sec



OM09 FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM09fh.aqt
Date: 12/09/15 Time: 09:16:59

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM09
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 19.99 ft

WELL DATA (OM09)

Initial Displacement: 2.83 ft
Total Well Penetration Depth: 18.49 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 18.49 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.00031 cm/sec
Kz/Kr = 1.

Ss = 0.001 ft^{-1}

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM09fh.aqt
Title: OM09 Falling Head Test
Date: 12/09/15
Time: 09:17:00

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM09

AQUIFER DATA

Saturated Thickness: 19.99 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM09

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.83 ft
Static Water Column Height: 18.49 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 18.49 ft

No. of Observations: 96

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.011	2.744	1.029	1.34
0.022	3.024	1.088	1.298
0.033	2.828	1.151	1.257
0.044	2.869	1.217	1.213
0.055	2.834	1.288	1.17
0.066	2.674	1.362	1.126
0.077	1.931	1.441	1.081
0.088	2.633	1.525	1.038
0.099	2.354	1.613	0.992
0.11	2.302	1.707	0.947
0.121	2.583	1.807	0.901
0.132	2.235	1.912	0.858
0.143	2.351	2.023	0.813
0.154	2.308	2.142	0.77
0.165	2.281	2.267	0.727
0.176	2.269	2.399	0.685
0.187	2.236	2.54	0.643
0.198	2.235	2.688	0.6
0.209	2.208	2.846	0.563

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.22	2.192	3.013	0.524
0.231	2.174	3.19	0.487
0.2427	2.15	3.377	0.451
0.2552	2.137	3.575	0.416
0.2683	2.116	3.785	0.384
0.2823	2.096	4.008	0.353
0.2972	2.076	4.244	0.322
0.3128	2.055	4.494	0.293
0.3295	2.031	4.758	0.268
0.3472	2.01	5.039	0.243
0.3658	1.985	5.336	0.222
0.3857	1.961	5.65	0.198
0.4067	1.937	5.983	0.179
0.4288	1.909	6.336	0.16
0.4523	1.882	6.71	0.143
0.4772	1.854	7.106	0.128
0.5035	1.837	7.525	0.115
0.5315	1.787	7.97	0.103
0.5612	1.755	8.44	0.091
0.5925	1.723	8.939	0.082
0.6257	1.687	9.467	0.07
0.6608	1.653	10.03	0.06
0.6982	1.615	10.62	0.051
0.7377	1.58	11.25	0.043
0.7795	1.542	11.91	0.033
0.8238	1.502	12.62	0.024
0.8708	1.464	13.36	0.017
0.9207	1.423	14.15	0.009
0.9733	1.382	14.99	0.002

SOLUTION

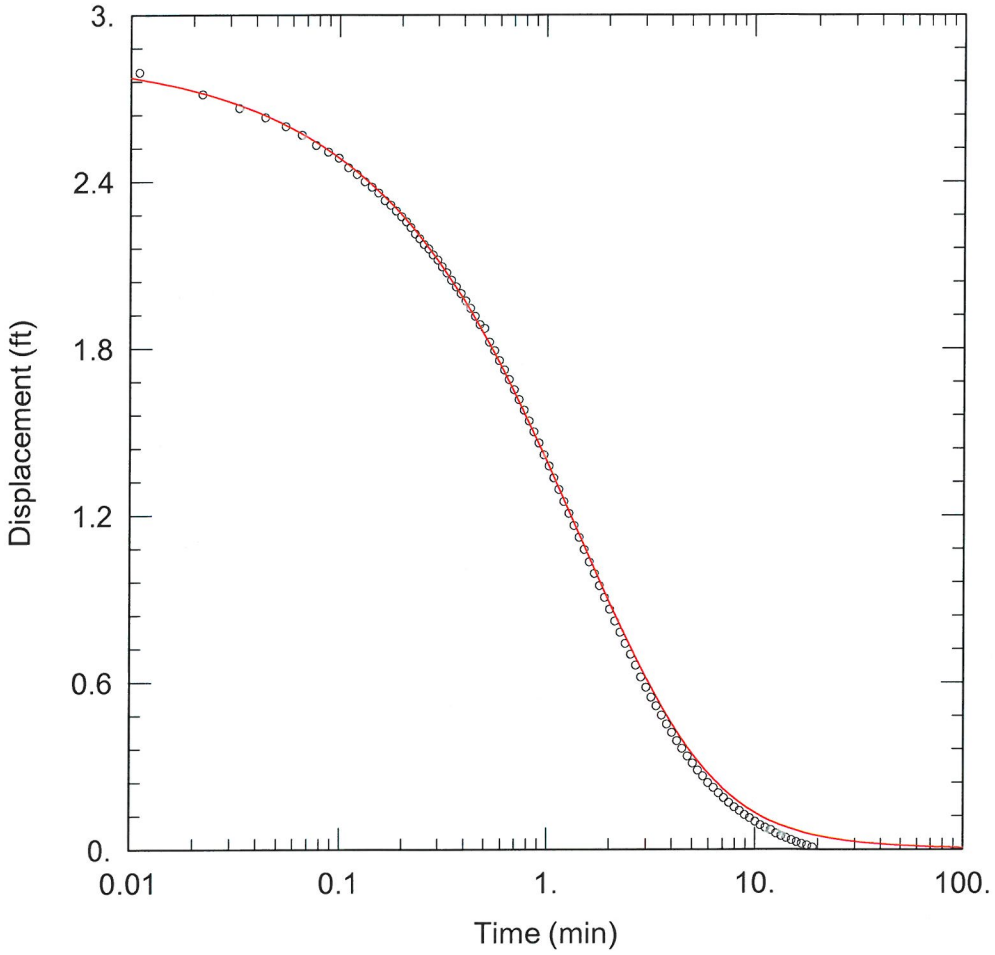
Slug Test
Aquifer Model: Unconfined
Solution Method: KGS Model

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
Kr	0.00031	cm/sec
Ss	0.001	ft^{-1}
Kz/Kr	1.	

T = K*b = 0.1889 cm^2/sec



OM09 RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM09rh.aqt
Date: 12/09/15 Time: 09:17:01

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM09
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 19.99 ft

WELL DATA (OM09)

Initial Displacement: 2.87 ft
Total Well Penetration Depth: 18.49 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 18.49 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined

Kr = 0.00026 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.002 ft^{-1}

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM09rh.aqt
Title: OM09 Rising Head Test
Date: 12/09/15
Time: 09:17:02

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM09

AQUIFER DATA

Saturated Thickness: 19.99 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM09

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.87 ft
Static Water Column Height: 18.49 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 18.49 ft

No. of Observations: 100

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.011	2.792	1.151	1.292
0.022	2.713	1.217	1.249
0.033	2.664	1.288	1.206
0.044	2.631	1.362	1.163
0.055	2.598	1.441	1.12
0.066	2.567	1.525	1.077
0.077	2.531	1.613	1.032
0.088	2.506	1.707	0.99
0.099	2.485	1.807	0.946
0.11	2.45	1.912	0.904
0.121	2.426	2.023	0.862
0.132	2.399	2.142	0.819
0.143	2.38	2.267	0.779
0.154	2.359	2.399	0.739
0.165	2.332	2.54	0.699
0.176	2.316	2.688	0.66
0.187	2.295	2.846	0.618
0.198	2.274	3.013	0.581
0.209	2.256	3.19	0.545

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.22	2.235	3.377	0.514
0.231	2.212	3.575	0.481
0.2427	2.195	3.785	0.449
0.2552	2.174	4.008	0.419
0.2683	2.158	4.244	0.389
0.2823	2.136	4.494	0.361
0.2972	2.118	4.758	0.334
0.3128	2.094	5.039	0.309
0.3295	2.072	5.336	0.283
0.3472	2.045	5.65	0.263
0.3658	2.021	5.983	0.239
0.3857	1.997	6.336	0.221
0.4067	1.971	6.71	0.202
0.4288	1.944	7.106	0.184
0.4523	1.916	7.525	0.167
0.4772	1.886	7.97	0.151
0.5035	1.872	8.44	0.138
0.5315	1.822	8.939	0.124
0.5612	1.791	9.467	0.112
0.5925	1.756	10.03	0.099
0.6257	1.722	10.62	0.087
0.6608	1.688	11.25	0.078
0.6982	1.651	11.91	0.069
0.7377	1.615	12.62	0.057
0.7795	1.578	13.36	0.048
0.8238	1.538	14.15	0.041
0.8708	1.499	14.99	0.033
0.9207	1.459	15.87	0.026
0.9733	1.417	16.81	0.02
1.029	1.377	17.81	0.014
1.088	1.334	18.86	0.007

SOLUTION

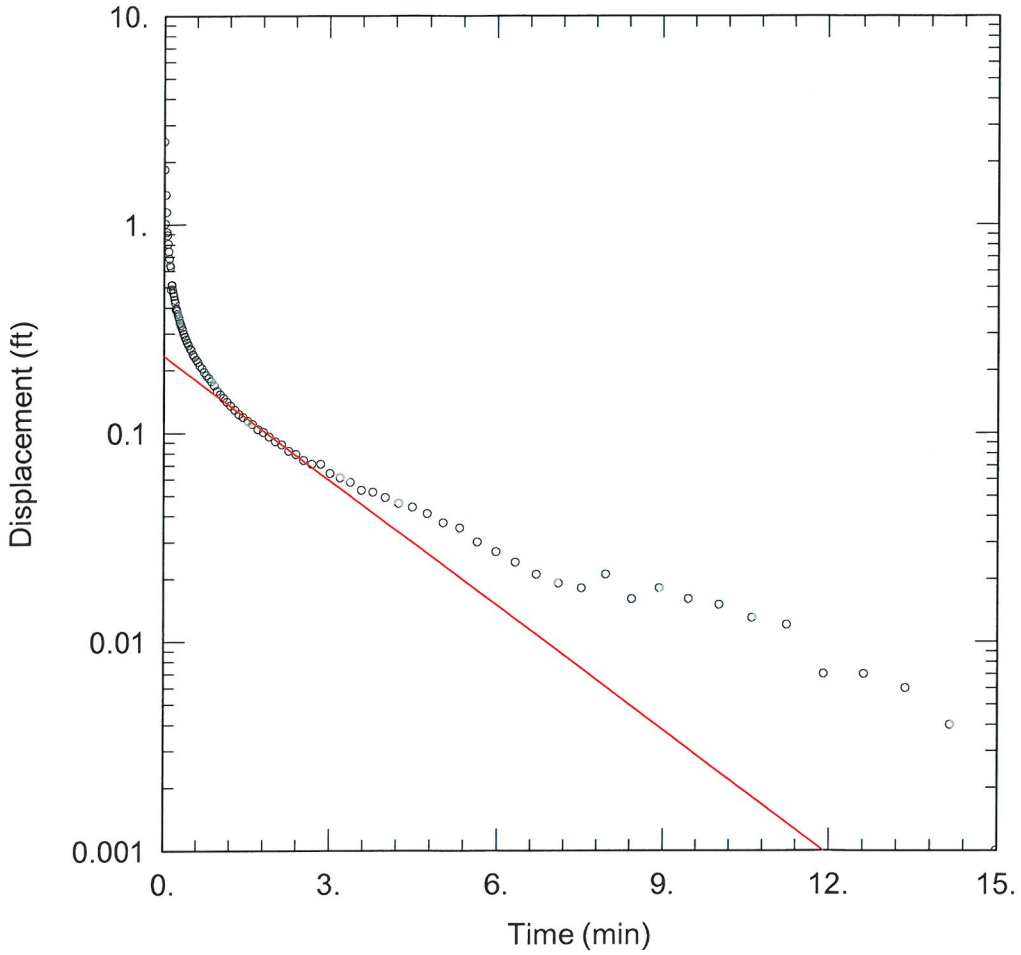
Slug Test
Aquifer Model: Unconfined
Solution Method: KGS Model

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
Kr	0.00026	cm/sec
Ss	0.002	ft^{-1}
Kz/Kr	1.	

T = K*b = 0.1584 cm^2/sec



OM21 FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM21fh.aqt
Date: 12/09/15 Time: 09:17:03

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM21
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 51.03 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM21)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 49.73 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 49.73 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00035 cm/sec
y0 = 0.235 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM21fh.aqt
Title: OM21 Falling Head Test
Date: 12/09/15
Time: 09:17:03

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM21

AQUIFER DATA

Saturated Thickness: 51.03 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM21

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.5 ft
Static Water Column Height: 49.73 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 49.73 ft

No. of Observations: 96

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.011	1.838	1.029	0.153
0.022	1.012	1.088	0.147
0.033	1.387	1.151	0.141
0.044	1.149	1.217	0.135
0.055	0.918	1.288	0.129
0.066	0.891	1.362	0.123
0.077	0.81	1.441	0.119
0.088	0.743	1.525	0.114
0.099	0.687	1.613	0.11
0.11	0.638	1.707	0.104
0.121	0.625	1.807	0.101
0.132	0.489	1.912	0.096
0.143	0.512	2.023	0.091
0.154	0.513	2.142	0.088
0.165	0.491	2.267	0.082
0.176	0.47	2.399	0.079
0.187	0.454	2.54	0.074
0.198	0.437	2.688	0.071
0.209	0.422	2.846	0.071

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.22	0.393	3.013	0.064
0.231	0.397	3.19	0.061
0.2427	0.384	3.377	0.058
0.2552	0.373	3.575	0.053
0.2683	0.363	3.785	0.052
0.2823	0.353	4.008	0.049
0.2972	0.339	4.244	0.046
0.3128	0.329	4.494	0.044
0.3295	0.32	4.758	0.041
0.3472	0.311	5.039	0.037
0.3658	0.299	5.336	0.035
0.3857	0.29	5.65	0.03
0.4067	0.281	5.983	0.027
0.4288	0.272	6.336	0.024
0.4523	0.263	6.71	0.021
0.4772	0.254	7.106	0.019
0.5035	0.25	7.525	0.018
0.5315	0.239	7.97	0.021
0.5612	0.232	8.44	0.016
0.5925	0.225	8.939	0.018
0.6257	0.219	9.467	0.016
0.6608	0.21	10.03	0.015
0.6982	0.204	10.62	0.013
0.7377	0.196	11.25	0.012
0.7795	0.189	11.91	0.007
0.8238	0.183	12.62	0.007
0.8708	0.177	13.36	0.006
0.9207	0.169	14.15	0.004
0.9733	0.159	14.99	0.001

SOLUTION

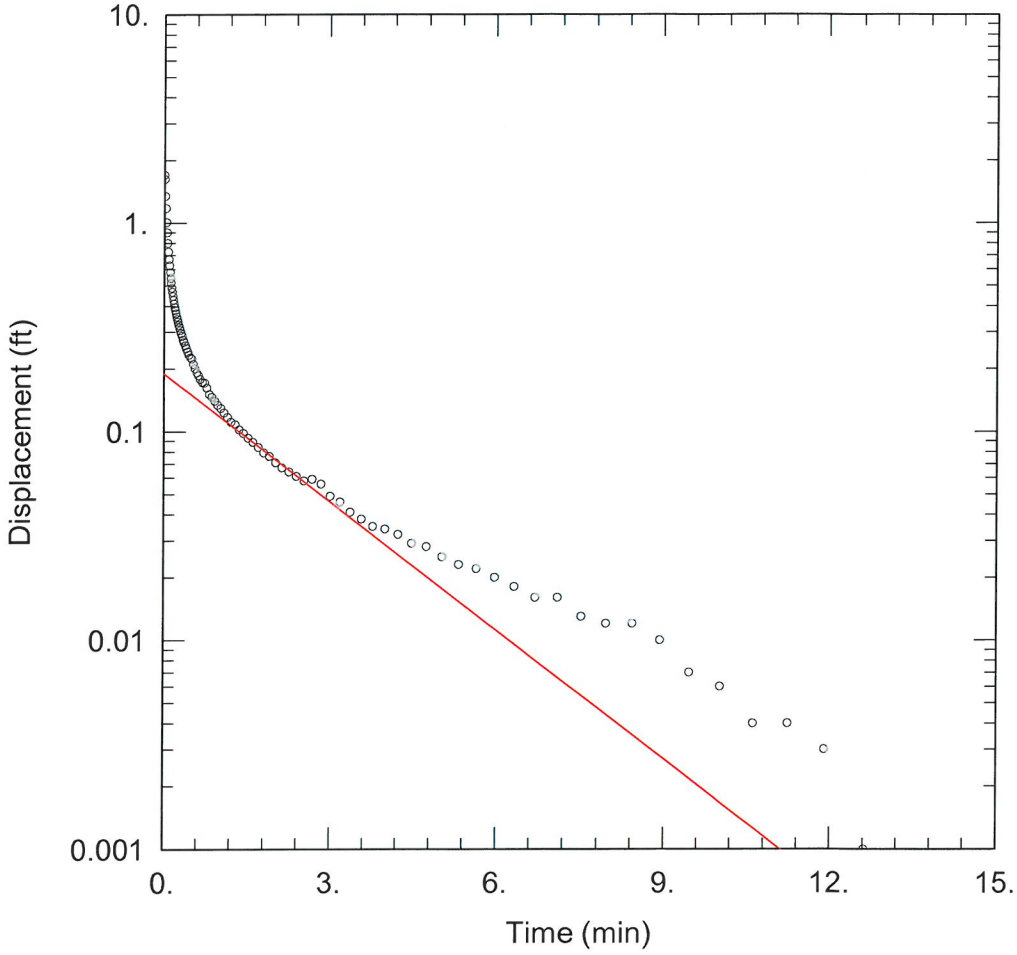
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.329

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00035	cm/sec
y0	0.235	ft

$T = K*b = 0.5444$ cm²/sec



OM21 RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM21rh.aqt
Date: 12/09/15 Time: 09:17:04

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OM21
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 51.03 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OM21)

Initial Displacement: 1.7 ft
Total Well Penetration Depth: 49.73 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 49.73 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00036 cm/sec
y0 = 0.19 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OM21rh.aqt
Title: OM21 Rising Head Test
Date: 12/09/15
Time: 09:17:05

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OM21

AQUIFER DATA

Saturated Thickness: 51.03 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OM21

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.7 ft
Static Water Column Height: 49.73 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 49.73 ft

No. of Observations: 93

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.011	1.623	0.9733	0.134
0.022	1.343	1.029	0.129
0.033	1.177	1.088	0.123
0.044	1.007	1.151	0.117
0.055	0.9	1.217	0.111
0.066	0.802	1.288	0.108
0.077	0.727	1.362	0.102
0.088	0.669	1.441	0.098
0.099	0.625	1.525	0.093
0.11	0.58	1.613	0.089
0.121	0.544	1.707	0.084
0.132	0.515	1.807	0.079
0.143	0.488	1.912	0.076
0.154	0.466	2.023	0.071
0.165	0.446	2.142	0.067
0.176	0.427	2.267	0.064
0.187	0.41	2.399	0.061
0.198	0.394	2.54	0.058
0.209	0.381	2.688	0.059

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.22	0.369	2.846	0.056
0.231	0.355	3.013	0.049
0.2427	0.346	3.19	0.046
0.2552	0.336	3.377	0.041
0.2683	0.324	3.575	0.038
0.2823	0.315	3.785	0.035
0.2972	0.306	4.008	0.034
0.3128	0.296	4.244	0.032
0.3295	0.287	4.494	0.029
0.3472	0.275	4.758	0.028
0.3658	0.268	5.039	0.025
0.3857	0.259	5.336	0.023
0.4067	0.251	5.65	0.022
0.4288	0.241	5.983	0.02
0.4523	0.233	6.336	0.018
0.4772	0.226	6.71	0.016
0.5035	0.223	7.106	0.016
0.5315	0.21	7.525	0.013
0.5612	0.201	7.97	0.012
0.5925	0.192	8.44	0.012
0.6257	0.186	8.939	0.01
0.6608	0.178	9.467	0.007
0.6982	0.172	10.03	0.006
0.7377	0.171	10.62	0.004
0.7795	0.162	11.25	0.004
0.8238	0.151	11.91	0.003
0.8708	0.146	12.62	0.001
0.9207	0.14		

SOLUTION

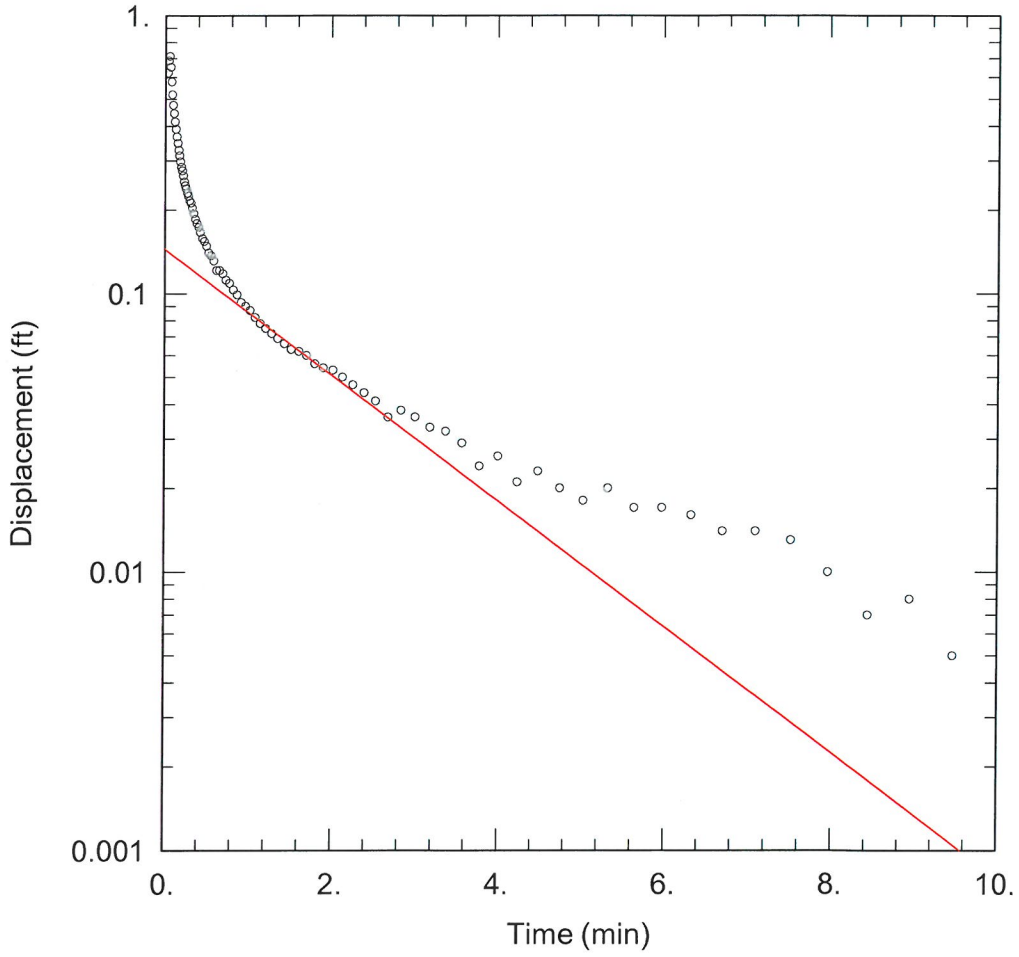
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.329

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00036	cm/sec
y0	0.19	ft

T = K*b = 0.5599 cm²/sec



OR02 FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR02fh.aqt
Date: 12/09/15 Time: 09:17:36

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR02
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 18.87 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR02)

Initial Displacement: 1.45 ft
Total Well Penetration Depth: 18.09 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 18.09 ft
Screen Length: 9.49 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00037 cm/sec
y0 = 0.145 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR02fh.aqt
Title: OR02 Falling Head Test
Date: 12/09/15
Time: 09:17:36

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR02

AQUIFER DATA

Saturated Thickness: 18.87 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR02

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.45 ft
Static Water Column Height: 18.09 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.49 ft
Total Well Penetration Depth: 18.09 ft

No. of Observations: 89

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.011	1.431	0.8708	0.099
0.022	1.163	0.9207	0.093
0.033	0.622	0.9733	0.09
0.044	0.687	1.029	0.087
0.055	0.713	1.088	0.082
0.066	0.653	1.151	0.078
0.077	0.577	1.217	0.075
0.088	0.519	1.288	0.072
0.099	0.476	1.362	0.069
0.11	0.444	1.441	0.066
0.121	0.415	1.525	0.063
0.132	0.39	1.613	0.062
0.143	0.366	1.707	0.06
0.154	0.347	1.807	0.056
0.165	0.328	1.912	0.054
0.176	0.313	2.023	0.053
0.187	0.298	2.142	0.05
0.198	0.285	2.267	0.047
0.209	0.277	2.399	0.044

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.22	0.265	2.54	0.041
0.231	0.252	2.688	0.036
0.2427	0.244	2.846	0.038
0.2552	0.238	3.013	0.036
0.2683	0.23	3.19	0.033
0.2823	0.224	3.377	0.032
0.2972	0.216	3.575	0.029
0.3128	0.212	3.785	0.024
0.3295	0.203	4.008	0.026
0.3472	0.194	4.244	0.021
0.3658	0.185	4.494	0.023
0.3857	0.179	4.758	0.02
0.4067	0.173	5.039	0.018
0.4288	0.166	5.336	0.02
0.4523	0.158	5.65	0.017
0.4772	0.154	5.983	0.017
0.5035	0.148	6.336	0.016
0.5315	0.14	6.71	0.014
0.5612	0.137	7.106	0.014
0.5925	0.131	7.525	0.013
0.6257	0.121	7.97	0.01
0.6608	0.121	8.44	0.007
0.6982	0.118	8.939	0.008
0.7377	0.112	9.467	0.005
0.7795	0.109	10.03	0.004
0.8238	0.103		

SOLUTION

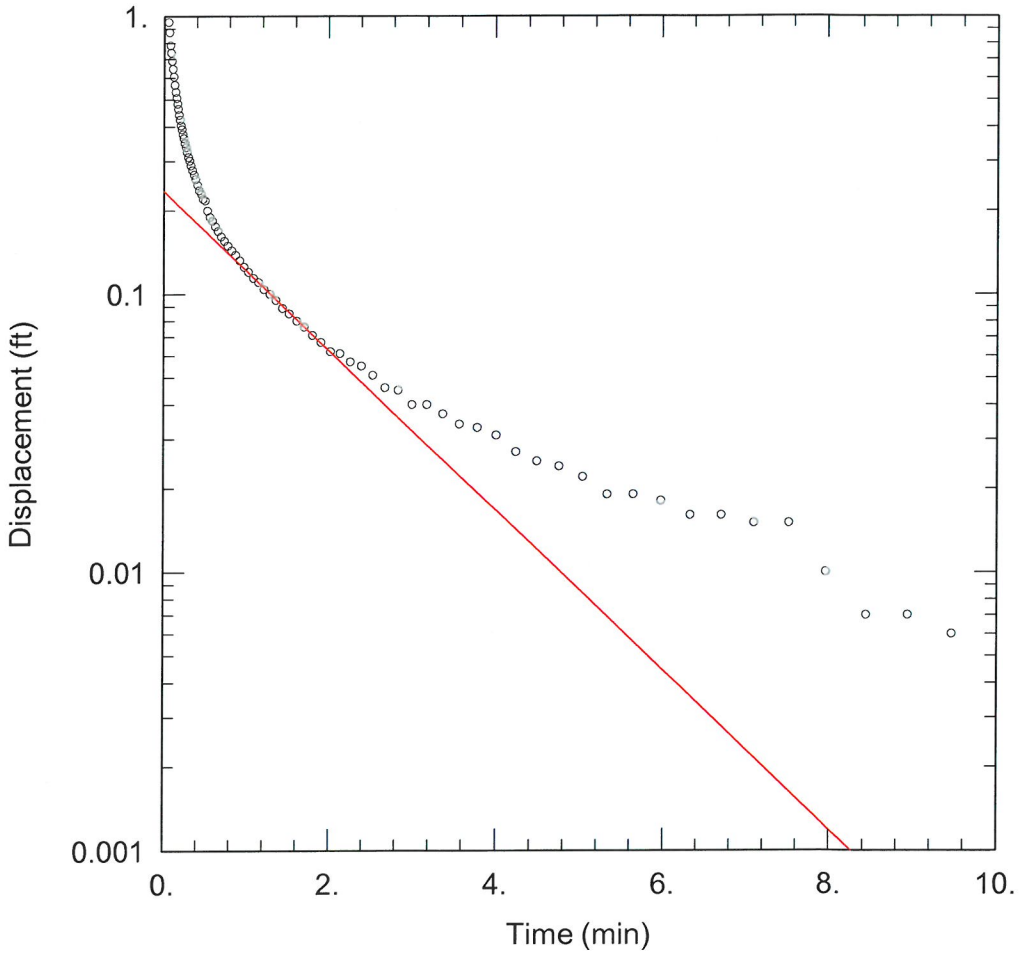
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.827

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00037	cm/sec
y0	0.145	ft

T = K*b = 0.2128 cm^2/sec



OR02 RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR02rh.aqt
Date: 12/09/15 Time: 09:17:37

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR02
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 18.87 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR02)

Initial Displacement: 1.75 ft
Total Well Penetration Depth: 18.09 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 18.09 ft
Screen Length: 9.49 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00047 cm/sec
y0 = 0.235 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR02rh.aqt
Title: OR02 Rising Head Test
Date: 12/09/15
Time: 09:17:38

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR02

AQUIFER DATA

Saturated Thickness: 18.87 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR02

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.75 ft
Static Water Column Height: 18.09 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.49 ft
Total Well Penetration Depth: 18.09 ft

No. of Observations: 92

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.011	1.523	0.9207	0.132
0.022	1.346	0.9733	0.125
0.033	1.19	1.029	0.12
0.044	1.071	1.088	0.114
0.055	0.951	1.151	0.11
0.066	0.874	1.217	0.104
0.077	0.785	1.288	0.1
0.088	0.739	1.362	0.095
0.099	0.69	1.441	0.089
0.11	0.645	1.525	0.085
0.121	0.605	1.613	0.08
0.132	0.566	1.707	0.076
0.143	0.534	1.807	0.071
0.154	0.507	1.912	0.067
0.165	0.483	2.023	0.062
0.176	0.464	2.142	0.061
0.187	0.441	2.267	0.057
0.198	0.424	2.399	0.055
0.209	0.404	2.54	0.051

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.22	0.391	2.688	0.046
0.231	0.375	2.846	0.045
0.2427	0.363	3.013	0.04
0.2552	0.349	3.19	0.04
0.2683	0.337	3.377	0.037
0.2823	0.324	3.575	0.034
0.2972	0.311	3.785	0.033
0.3128	0.302	4.008	0.031
0.3295	0.29	4.244	0.027
0.3472	0.279	4.494	0.025
0.3658	0.269	4.758	0.024
0.3857	0.259	5.039	0.022
0.4067	0.247	5.336	0.019
0.4288	0.236	5.65	0.019
0.4523	0.229	5.983	0.018
0.4772	0.22	6.336	0.016
0.5035	0.217	6.71	0.016
0.5315	0.199	7.106	0.015
0.5612	0.189	7.525	0.015
0.5925	0.183	7.97	0.01
0.6257	0.175	8.44	0.007
0.6608	0.168	8.939	0.007
0.6982	0.161	9.467	0.006
0.7377	0.155	10.03	0.006
0.7795	0.149	10.62	0.006
0.8238	0.143	11.25	0.006
0.8708	0.138	11.91	0.002

SOLUTION

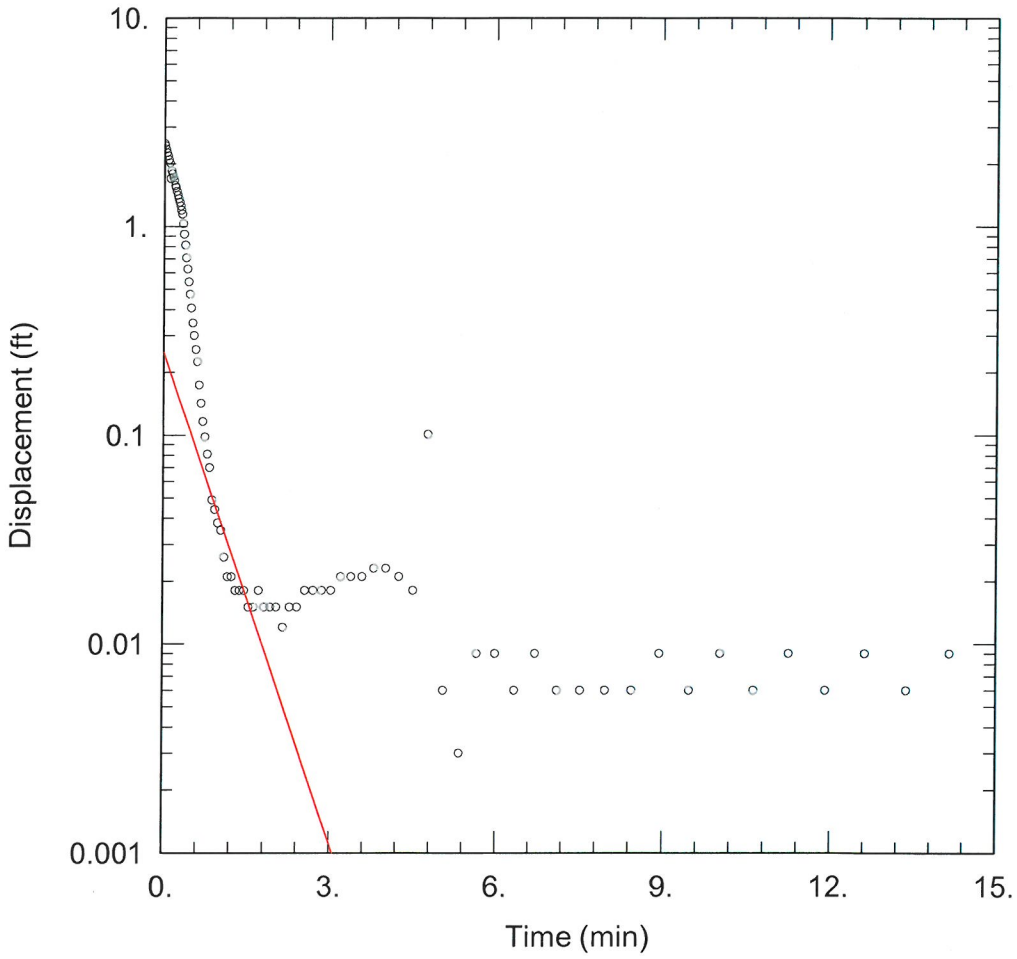
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.827

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00047	cm/sec
y0	0.235	ft

$T = K*b = 0.2703$ cm²/sec



OR03D FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Dfh.aqt
Date: 12/09/15 Time: 09:17:39

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR03D
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 34.69 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR03D)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 35.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 35.7 ft
Screen Length: 9.48 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0015 cm/sec
y0 = 0.25 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Dfh.aqt
Title: OR03D Falling Head Test
Date: 12/09/15
Time: 09:17:39

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR03D

AQUIFER DATA

Saturated Thickness: 34.69 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR03D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.5 ft
Static Water Column Height: 35.7 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.48 ft
Total Well Penetration Depth: 35.7 ft

No. of Observations: 91

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0163	2.445	1.376	0.018
0.0327	2.352	1.455	0.018
0.049	2.263	1.539	0.015
0.0653	2.179	1.627	0.015
0.0817	2.093	1.721	0.018
0.098	2.015	1.82	0.015
0.1143	1.7	1.926	0.015
0.1307	1.856	2.037	0.015
0.147	1.792	2.155	0.012
0.1633	1.726	2.281	0.015
0.1797	1.66	2.413	0.015
0.196	1.57	2.554	0.018
0.2123	1.536	2.702	0.018
0.2287	1.472	2.86	0.018
0.245	1.414	3.027	0.018
0.2613	1.359	3.204	0.021
0.2777	1.308	3.391	0.021
0.294	1.253	3.589	0.021
0.3103	1.198	3.799	0.023

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3267	1.146	4.022	0.023
0.3433	1.033	4.258	0.021
0.361	0.918	4.508	0.018
0.3797	0.814	4.772	0.101
0.3995	0.707	5.053	0.006
0.4205	0.626	5.349	0.003
0.4427	0.543	5.664	0.009
0.4662	0.474	5.997	0.009
0.491	0.407	6.35	0.006
0.5173	0.344	6.724	0.009
0.5453	0.3	7.12	0.006
0.575	0.257	7.539	0.006
0.6063	0.225	7.984	0.006
0.6395	0.174	8.454	0.006
0.6747	0.142	8.953	0.009
0.712	0.116	9.481	0.006
0.7515	0.098	10.04	0.009
0.7933	0.081	10.63	0.006
0.8377	0.07	11.26	0.009
0.8847	0.049	11.92	0.006
0.9345	0.044	12.63	0.009
0.9872	0.038	13.37	0.006
1.043	0.035	14.16	0.009
1.102	0.026	15.	0.006
1.165	0.021	15.89	0.006
1.231	0.021	16.83	0.006
1.302	0.018		

SOLUTION

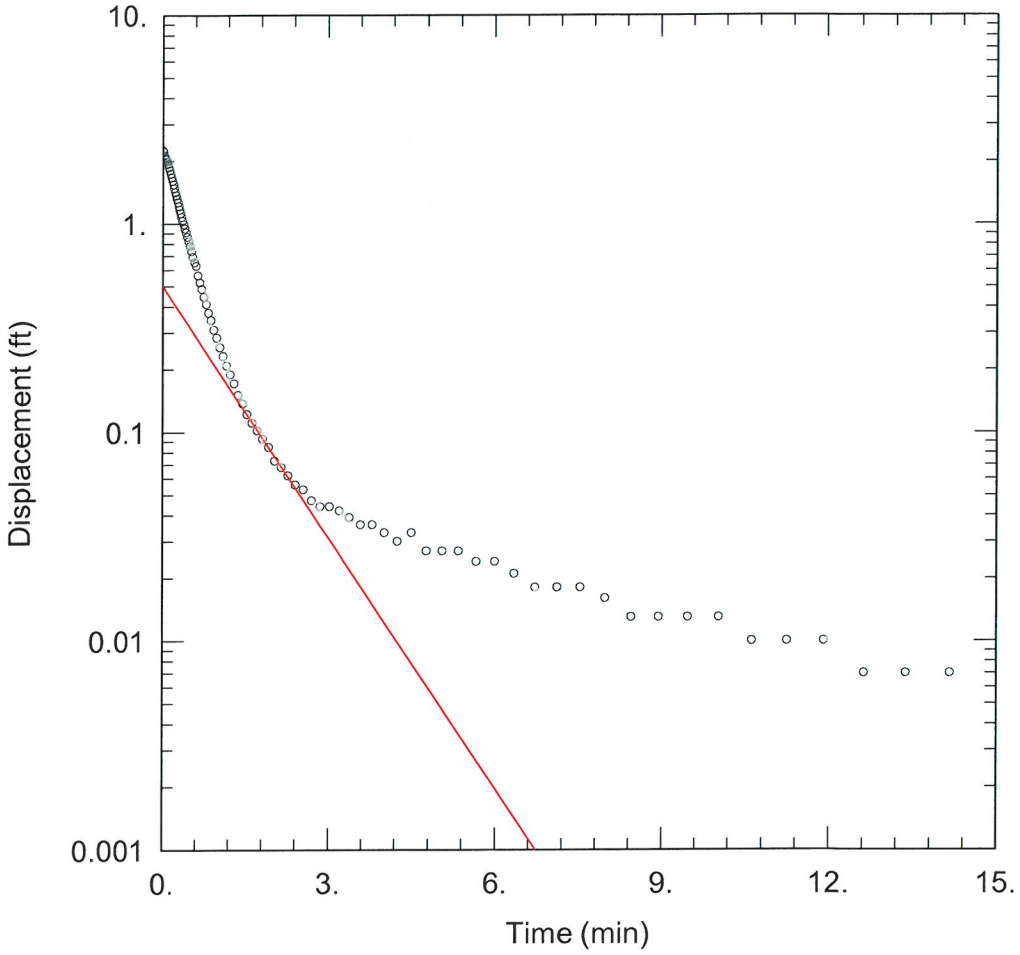
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.479

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0015	cm/sec
y0	0.25	ft

$T = K*b = 1.586$ cm²/sec



OR03D RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Drh.aqt
Date: 12/09/15 Time: 09:17:40

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR03D
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 34.69 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR03D)

Initial Displacement: 2.25 ft
Total Well Penetration Depth: 35.7 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 35.7 ft
Screen Length: 9.48 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00077 cm/sec
y0 = 0.5 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Drh.aqt
Title: OR03D Rising Head Test
Date: 12/09/15
Time: 09:17:41

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR03D

AQUIFER DATA

Saturated Thickness: 34.69 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR03D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.25 ft
Static Water Column Height: 35.7 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.48 ft
Total Well Penetration Depth: 35.7 ft

No. of Observations: 88

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0163	2.222	1.231	0.189
0.0327	2.13	1.302	0.171
0.049	2.066	1.376	0.151
0.0653	2.035	1.455	0.137
0.0817	1.988	1.539	0.122
0.098	1.934	1.627	0.111
0.1143	1.87	1.721	0.102
0.1307	1.801	1.82	0.093
0.147	1.735	1.926	0.085
0.1633	1.668	2.037	0.073
0.1797	1.602	2.155	0.068
0.196	1.541	2.281	0.062
0.2123	1.481	2.413	0.056
0.2287	1.42	2.554	0.053
0.245	1.368	2.702	0.047
0.2613	1.316	2.86	0.044
0.2777	1.265	3.027	0.044
0.294	1.216	3.204	0.042
0.3103	1.169	3.391	0.039

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3267	1.123	3.589	0.036
0.3433	1.077	3.799	0.036
0.361	1.034	4.022	0.033
0.3797	0.993	4.258	0.03
0.3995	0.95	4.508	0.033
0.4205	0.91	4.772	0.027
0.4427	0.864	5.053	0.027
0.4662	0.823	5.349	0.027
0.491	0.78	5.664	0.024
0.5173	0.737	5.997	0.024
0.5453	0.693	6.35	0.021
0.575	0.653	6.724	0.018
0.6063	0.627	7.12	0.018
0.6395	0.564	7.539	0.018
0.6747	0.523	7.984	0.016
0.712	0.486	8.454	0.013
0.7515	0.445	8.953	0.013
0.7933	0.411	9.481	0.013
0.8377	0.373	10.04	0.013
0.8847	0.344	10.63	0.01
0.9345	0.31	11.26	0.01
0.9872	0.284	11.92	0.01
1.043	0.255	12.63	0.007
1.102	0.232	13.37	0.007
1.165	0.209	14.16	0.007

SOLUTION

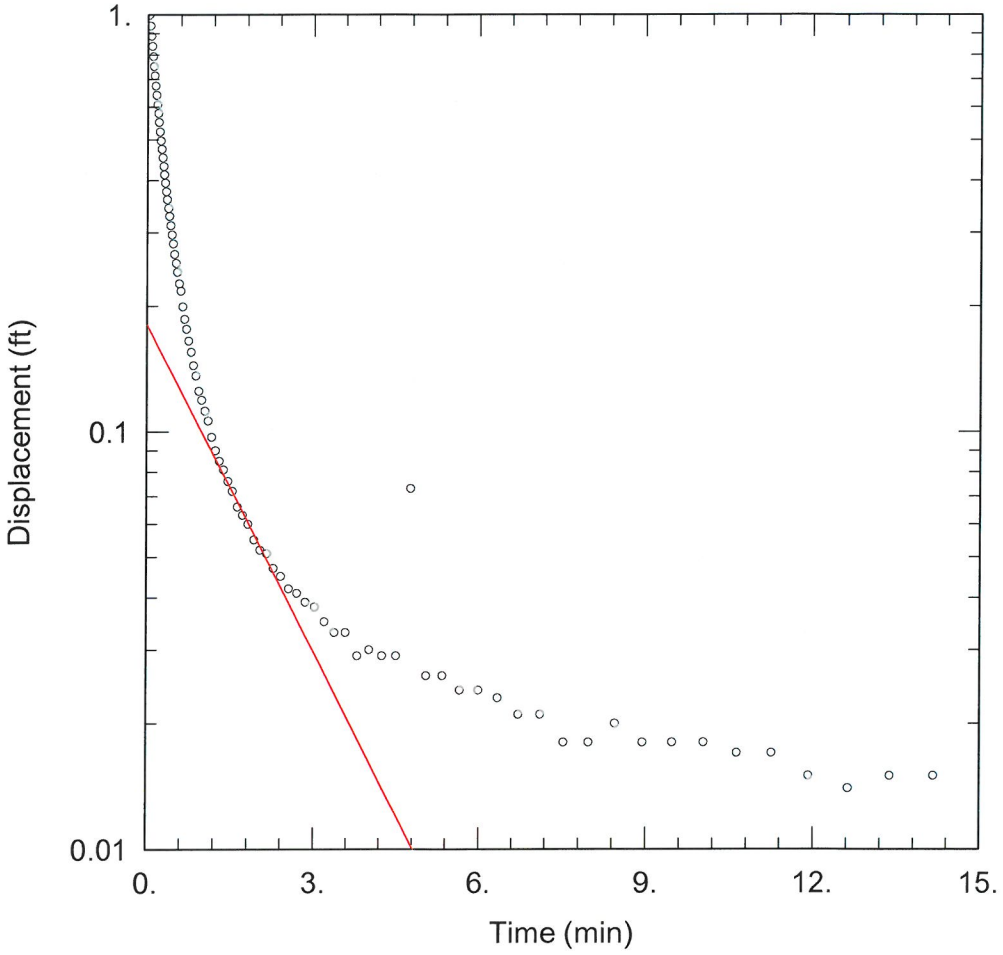
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.479

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00077	cm/sec
y0	0.5	ft

$T = K*b = 0.8142$ cm²/sec



OR03S FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Sfh.aqt
Date: 12/09/15 Time: 09:17:42

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR03S
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 34.49 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR03S)

Initial Displacement: 1.1 ft
Total Well Penetration Depth: 16.78 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16.78 ft
Screen Length: 9.5 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00039 cm/sec
y0 = 0.18 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Sfh.aqt
Title: OR03S Falling Head Test
Date: 12/09/15
Time: 09:17:42

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR03S

AQUIFER DATA

Saturated Thickness: 34.49 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR03S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.1 ft
Static Water Column Height: 16.78 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.5 ft
Total Well Penetration Depth: 16.78 ft

No. of Observations: 91

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0163	1.06	1.376	0.081
0.0327	0.998	1.455	0.076
0.049	0.94	1.539	0.072
0.0653	0.887	1.627	0.066
0.0817	0.839	1.721	0.063
0.098	0.793	1.82	0.06
0.1143	0.751	1.926	0.055
0.1307	0.713	2.037	0.052
0.147	0.674	2.155	0.051
0.1633	0.64	2.281	0.047
0.1797	0.608	2.413	0.045
0.196	0.579	2.554	0.042
0.2123	0.551	2.702	0.041
0.2287	0.523	2.86	0.039
0.245	0.498	3.027	0.038
0.2613	0.475	3.204	0.035
0.2777	0.453	3.391	0.033
0.294	0.432	3.589	0.033
0.3103	0.413	3.799	0.029

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3267	0.394	4.022	0.03
0.3433	0.376	4.258	0.029
0.361	0.36	4.508	0.029
0.3797	0.343	4.772	0.073
0.3995	0.328	5.053	0.026
0.4205	0.312	5.349	0.026
0.4427	0.296	5.664	0.024
0.4662	0.282	5.997	0.024
0.491	0.266	6.35	0.023
0.5173	0.253	6.724	0.021
0.5453	0.241	7.12	0.021
0.575	0.226	7.539	0.018
0.6063	0.217	7.984	0.018
0.6395	0.199	8.454	0.02
0.6747	0.186	8.953	0.018
0.712	0.176	9.481	0.018
0.7515	0.165	10.04	0.018
0.7933	0.155	10.63	0.017
0.8377	0.144	11.26	0.017
0.8847	0.136	11.92	0.015
0.9345	0.125	12.63	0.014
0.9872	0.119	13.37	0.015
1.043	0.112	14.16	0.015
1.102	0.106	15.	0.012
1.165	0.097	15.89	0.009
1.231	0.09	16.83	0.008
1.302	0.085		

SOLUTION

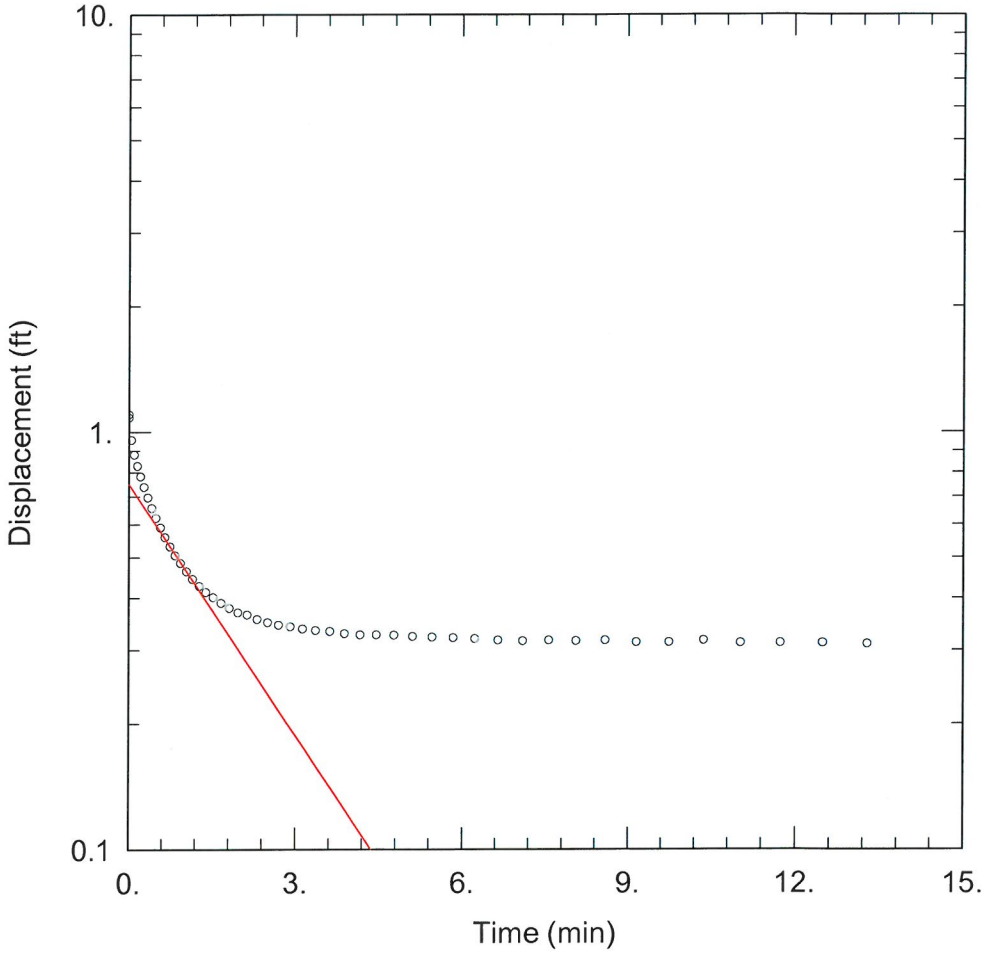
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.502

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00039	cm/sec
y0	0.18	ft

T = K*b = 0.41 cm²/sec



OR03S RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Srh.aqt
Date: 12/09/15 Time: 09:17:43

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR03S
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 34.49 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR03S)

Initial Displacement: 1.1 ft
Total Well Penetration Depth: 16.78 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 16.78 ft
Screen Length: 9.5 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003 cm/sec
y0 = 0.75 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR03Srh.aqt
Title: OR03S Rising Head Test
Date: 12/09/15
Time: 09:17:44

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR03S

AQUIFER DATA

Saturated Thickness: 34.49 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR03S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.1 ft
Static Water Column Height: 16.78 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.5 ft
Total Well Penetration Depth: 16.78 ft

No. of Observations: 50

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0001	1.082	2.705	0.344
0.0499	0.956	2.915	0.341
0.1026	0.881	3.137	0.337
0.1584	0.829	3.373	0.334
0.2176	0.782	3.623	0.332
0.2802	0.737	3.888	0.328
0.3466	0.696	4.168	0.326
0.4169	0.657	4.465	0.326
0.4914	0.622	4.779	0.325
0.5704	0.589	5.113	0.323
0.6541	0.559	5.465	0.322
0.7426	0.531	5.839	0.321
0.8364	0.506	6.235	0.319
0.9357	0.485	6.655	0.316
1.041	0.463	7.099	0.315
1.153	0.444	7.57	0.316
1.271	0.427	8.068	0.315
1.396	0.413	8.596	0.316
1.528	0.401	9.155	0.313

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.669	0.389	9.748	0.313
1.818	0.378	10.38	0.316
1.975	0.369	11.04	0.312
2.142	0.364	11.74	0.312
2.319	0.355	12.49	0.312
2.506	0.349	13.28	0.31

SOLUTION

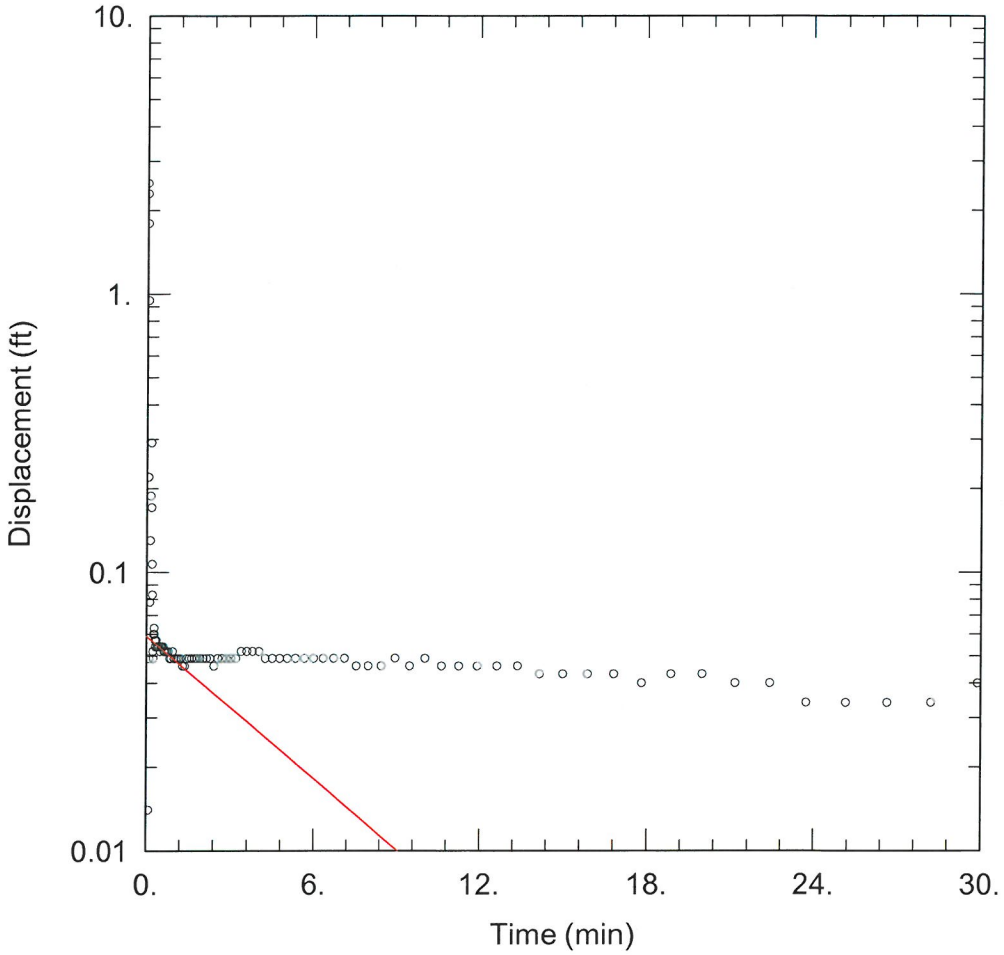
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.502

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.0003	cm/sec
y0	0.75	ft

T = K*b = 0.3154 cm²/sec



OR04D FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR04Dfh.aqt
Date: 12/09/15 Time: 09:17:45

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR04D
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 48.72 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR04D)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 47.72 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 47.72 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00015 cm/sec
y0 = 0.059 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR04Dfh.aqt
Title: OR04D Falling Head Test
Date: 12/09/15
Time: 09:17:45

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR04D

AQUIFER DATA

Saturated Thickness: 48.72 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR04D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.5 ft
Static Water Column Height: 47.72 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 47.72 ft

No. of Observations: 102

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0165	2.292	1.824	0.049
0.033	1.793	1.929	0.049
0.0495	0.948	2.041	0.049
0.066	0.22	2.159	0.049
0.0825	0.014	2.284	0.049
0.099	0.049	2.416	0.046
0.1155	0.078	2.557	0.049
0.132	0.13	2.706	0.049
0.1485	0.188	2.863	0.049
0.165	0.292	3.03	0.049
0.1815	0.171	3.207	0.049
0.198	0.107	3.394	0.052
0.2145	0.083	3.592	0.052
0.231	0.052	3.803	0.052
0.2475	0.049	4.025	0.052
0.264	0.06	4.261	0.049
0.2805	0.063	4.511	0.049
0.297	0.06	4.776	0.049
0.3135	0.057	5.056	0.049

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.33	0.054	5.353	0.049
0.3467	0.057	5.667	0.049
0.3643	0.057	6.	0.049
0.383	0.054	6.353	0.049
0.4028	0.054	6.727	0.049
0.4238	0.054	7.123	0.049
0.446	0.054	7.543	0.046
0.4695	0.054	7.987	0.046
0.4943	0.052	8.457	0.046
0.5207	0.054	8.956	0.049
0.5487	0.054	9.484	0.046
0.5783	0.054	10.04	0.049
0.6097	0.054	10.64	0.046
0.6428	0.052	11.26	0.046
0.678	0.052	11.93	0.046
0.7153	0.052	12.63	0.046
0.7548	0.052	13.38	0.046
0.7967	0.052	14.17	0.043
0.841	0.049	15.01	0.043
0.888	0.049	15.89	0.043
0.9378	0.052	16.83	0.043
0.9905	0.049	17.83	0.04
1.046	0.049	18.88	0.043
1.105	0.049	19.99	0.043
1.168	0.049	21.18	0.04
1.234	0.049	22.43	0.04
1.305	0.046	23.76	0.034
1.379	0.046	25.16	0.034
1.458	0.049	26.65	0.034
1.542	0.049	28.23	0.034
1.631	0.049	29.9	0.04
1.724	0.049	31.66	0.037

SOLUTION

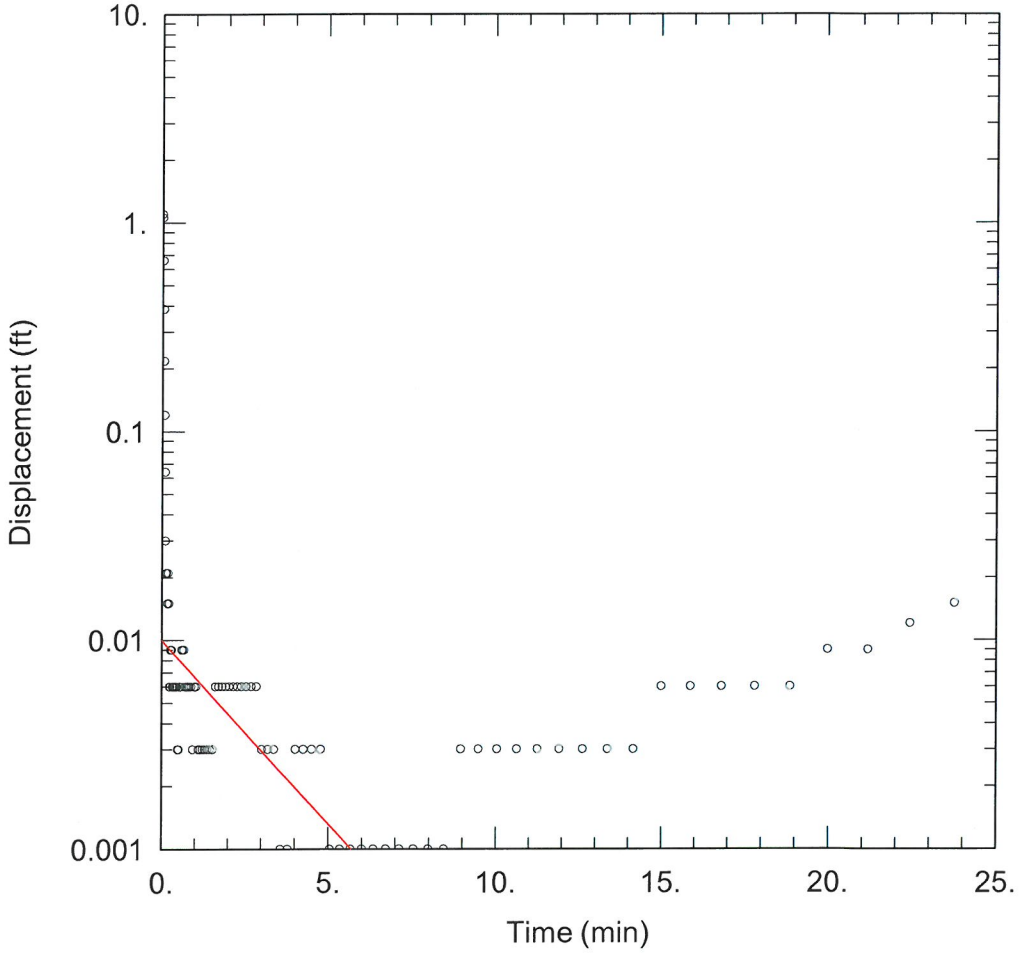
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.341

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00015	cm/sec
y0	0.059	ft

$T = K*b = 0.2227$ cm²/sec



OR04D RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR04Drh.aqt
Date: 12/09/15 Time: 09:17:46

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR04D
Test Date: 2 Dec 2015

AQUIFER DATA

Saturated Thickness: 48.72 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR04D)

Initial Displacement: 1.1 ft
Total Well Penetration Depth: 47.72 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 47.72 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00031 cm/sec
y0 = 0.01 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR04Drh.aqt
Title: OR04D Rising Head Test
Date: 12/09/15
Time: 09:17:47

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 2 Dec 2015
Test Well: OR04D

AQUIFER DATA

Saturated Thickness: 48.72 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR04D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.1 ft
Static Water Column Height: 47.72 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 47.72 ft

No. of Observations: 97

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0163	1.057	1.627	0.006
0.0327	0.659	1.721	0.006
0.049	0.386	1.82	0.006
0.0653	0.218	1.926	0.006
0.0817	0.12	2.037	0.006
0.098	0.064	2.155	0.006
0.1143	0.03	2.281	0.006
0.1307	0.021	2.413	0.006
0.147	0.021	2.554	0.006
0.1633	0.015	2.702	0.006
0.1797	0.015	2.86	0.006
0.196	0.021	3.027	0.003
0.2123	0.015	3.204	0.003
0.2287	0.015	3.391	0.003
0.245	0.006	3.589	0.001
0.2613	0.006	3.799	0.001
0.2777	0.009	4.022	0.003
0.294	0.009	4.258	0.003
0.3103	0.009	4.508	0.003

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3267	0.006	4.772	0.003
0.3433	0.006	5.053	0.001
0.361	0.006	5.349	0.001
0.3797	0.006	5.664	0.001
0.3995	0.006	5.997	0.001
0.4205	0.006	6.35	0.001
0.4427	0.006	6.724	0.001
0.4662	0.006	7.12	0.001
0.491	0.003	7.539	0.001
0.5173	0.003	7.984	0.001
0.5453	0.006	8.454	0.001
0.575	0.006	8.953	0.003
0.6063	0.009	9.481	0.003
0.6395	0.009	10.04	0.003
0.6747	0.009	10.63	0.003
0.712	0.006	11.26	0.003
0.7515	0.006	11.92	0.003
0.7933	0.006	12.63	0.003
0.8377	0.006	13.37	0.003
0.8847	0.006	14.16	0.003
0.9345	0.003	15.	0.006
0.9872	0.006	15.89	0.006
1.043	0.006	16.83	0.006
1.102	0.003	17.82	0.006
1.165	0.003	18.88	0.006
1.231	0.003	19.99	0.009
1.302	0.003	21.17	0.009
1.376	0.003	22.43	0.012
1.455	0.003	23.75	0.015
1.539	0.003		

SOLUTION

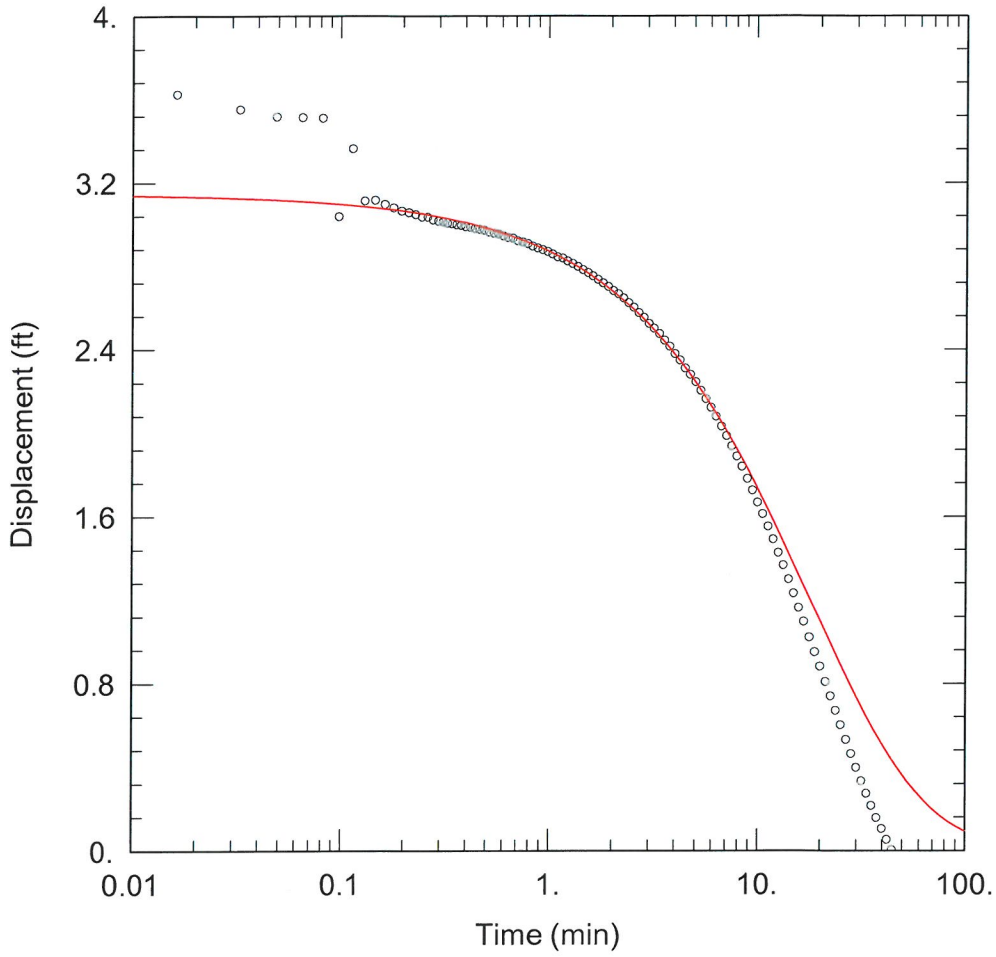
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 4.341

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00031	cm/sec
y0	0.01	ft

$T = K*b = 0.4603$ cm²/sec



OR05D FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR05Dfh.aqt
Date: 12/09/15 Time: 09:17:48

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR05D
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 38.33 ft

WELL DATA (OR05D)

Initial Displacement: 3.15 ft
Total Well Penetration Depth: 31.25 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 31.25 ft
Screen Length: 9.48 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model
Kr = 3.4E-5 cm/sec
Kz/Kr = 1.
Ss = 0.0002 ft^{-1}

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR05Dfh.aqt
Title: OR05D Falling Head Test
Date: 12/09/15
Time: 09:17:49

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OR05D

AQUIFER DATA

Saturated Thickness: 38.33 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR05D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.15 ft
Static Water Column Height: 31.25 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.48 ft
Total Well Penetration Depth: 31.25 ft

No. of Observations: 108

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0163	3.624	2.155	2.667
0.0327	3.551	2.281	2.647
0.049	3.517	2.413	2.624
0.0653	3.514	2.554	2.603
0.0817	3.511	2.702	2.577
0.098	3.038	2.86	2.554
0.1143	3.363	3.027	2.525
0.1307	3.114	3.204	2.502
0.147	3.117	3.391	2.476
0.1633	3.096	3.589	2.444
0.1797	3.079	3.799	2.415
0.196	3.064	4.022	2.38
0.2123	3.056	4.258	2.348
0.2287	3.047	4.508	2.311
0.245	3.035	4.772	2.279
0.2613	3.035	5.053	2.244
0.2777	3.021	5.349	2.203
0.294	3.015	5.664	2.163
0.3103	3.012	5.997	2.122

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.3267	3.006	6.35	2.079
0.3433	3.003	6.724	2.032
0.361	2.998	7.12	1.986
0.3797	2.995	7.539	1.937
0.3995	2.989	7.984	1.887
0.4205	2.986	8.454	1.838
0.4427	2.98	8.953	1.78
0.4662	2.977	9.481	1.725
0.491	2.972	10.04	1.667
0.5173	2.963	10.63	1.612
0.5453	2.957	11.26	1.551
0.575	2.954	11.92	1.49
0.6063	2.945	12.63	1.426
0.6395	2.937	13.37	1.366
0.6747	2.934	14.16	1.299
0.712	2.922	15.	1.232
0.7515	2.916	15.89	1.163
0.7933	2.908	16.83	1.096
0.8377	2.896	17.82	1.021
0.8847	2.887	18.88	0.951
0.9345	2.879	19.99	0.882
0.9872	2.87	21.17	0.809
1.043	2.858	22.43	0.74
1.102	2.844	23.75	0.67
1.165	2.838	25.16	0.601
1.231	2.824	26.65	0.531
1.302	2.812	28.22	0.464
1.376	2.798	29.89	0.398
1.455	2.783	31.66	0.334
1.539	2.769	33.53	0.273
1.627	2.754	35.52	0.215
1.721	2.737	37.62	0.157
1.82	2.719	39.85	0.105
1.926	2.702	42.21	0.053
2.037	2.682	44.71	0.004

SOLUTION

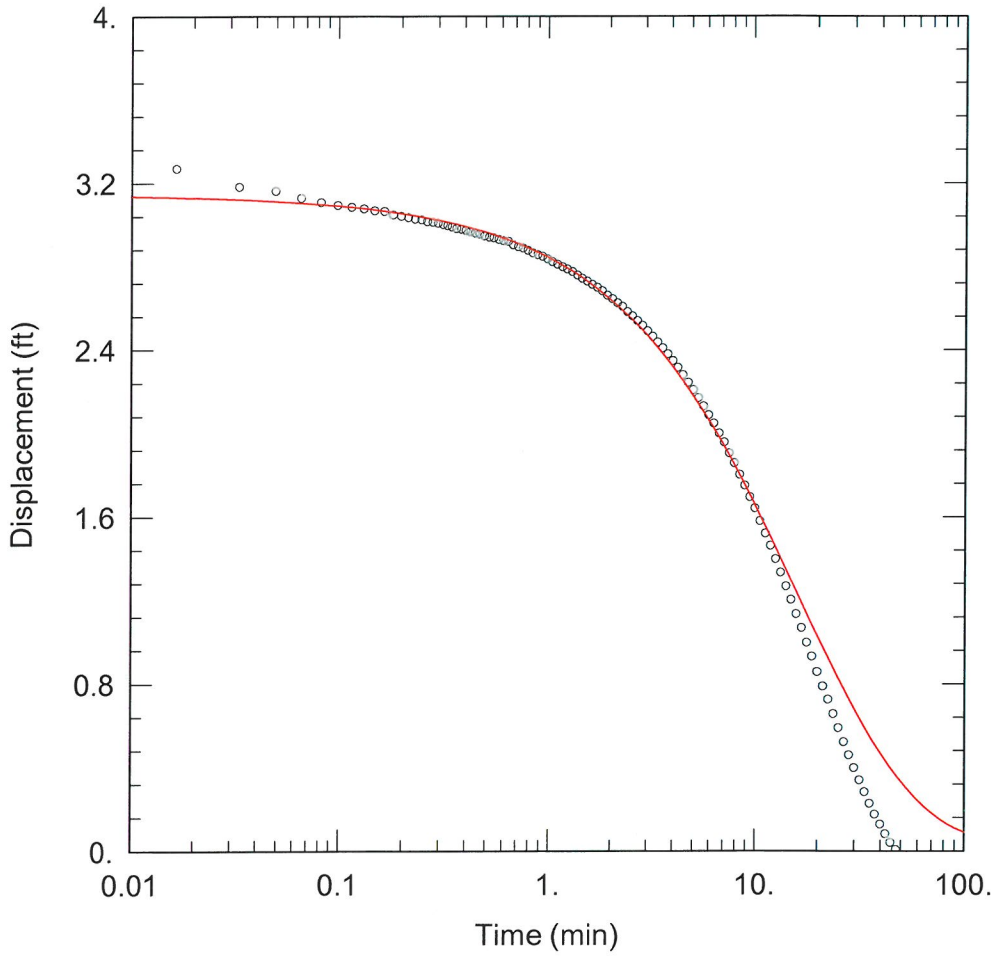
Slug Test
Aquifer Model: Unconfined
Solution Method: KGS Model

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
Kr	3.4E-5	cm/sec
Ss	0.0002	ft^{-1}
Kz/Kr	1.	

T = K*b = 0.03972 cm^2/sec



OR05D RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR05Drh.aqt
Date: 12/09/15 Time: 09:17:50

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR05D
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 38.33 ft

WELL DATA (OR05D)

Initial Displacement: 3.15 ft
Total Well Penetration Depth: 31.77 ft
Casing Radius: 0.08333 ft

Static Water Column Height: 31.25 ft
Screen Length: 10. ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined

Kr = 3.4E-5 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 0.00025 ft^{-1}

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR05Drh.aqt
Title: OR05D Rising Head Test
Date: 12/09/15
Time: 09:17:50

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OR05D

AQUIFER DATA

Saturated Thickness: 38.33 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR05D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.15 ft
Static Water Column Height: 31.25 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 31.77 ft

No. of Observations: 109

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0165	3.27	2.284	2.607
0.033	3.183	2.416	2.581
0.0495	3.163	2.557	2.561
0.066	3.128	2.706	2.538
0.0825	3.108	2.863	2.515
0.099	3.094	3.03	2.489
0.1155	3.085	3.207	2.463
0.132	3.076	3.394	2.436
0.1485	3.068	3.592	2.408
0.165	3.065	3.803	2.379
0.1815	3.047	4.025	2.347
0.198	3.042	4.261	2.315
0.2145	3.036	4.511	2.28
0.231	3.027	4.776	2.243
0.2475	3.024	5.056	2.208
0.264	3.015	5.353	2.17
0.2805	3.013	5.667	2.13
0.297	3.007	6.	2.086
0.3135	3.001	6.353	2.046

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.33	2.995	6.727	1.999
0.3467	2.989	7.123	1.956
0.3643	2.981	7.543	1.904
0.383	2.978	7.987	1.857
0.4028	2.972	8.457	1.802
0.4238	2.966	8.956	1.75
0.446	2.96	9.484	1.695
0.4695	2.955	10.04	1.64
0.4943	2.946	10.64	1.579
0.5207	2.94	11.26	1.519
0.5487	2.937	11.93	1.461
0.5783	2.929	12.63	1.397
0.6097	2.923	13.38	1.333
0.6428	2.92	14.17	1.267
0.678	2.903	15.01	1.203
0.7153	2.894	15.89	1.133
0.7548	2.888	16.83	1.067
0.7967	2.877	17.83	0.997
0.841	2.865	18.88	0.931
0.888	2.856	19.99	0.858
0.9378	2.848	21.18	0.789
0.9905	2.836	22.43	0.725
1.046	2.822	23.76	0.656
1.105	2.81	25.16	0.589
1.168	2.798	26.65	0.522
1.234	2.787	28.23	0.459
1.305	2.775	29.9	0.398
1.379	2.758	31.66	0.34
1.458	2.743	33.54	0.282
1.542	2.729	35.52	0.227
1.631	2.714	37.62	0.175
1.724	2.7	39.85	0.128
1.824	2.683	42.21	0.082
1.929	2.662	44.71	0.041
2.041	2.645	47.36	0.007
2.159	2.625		

SOLUTION

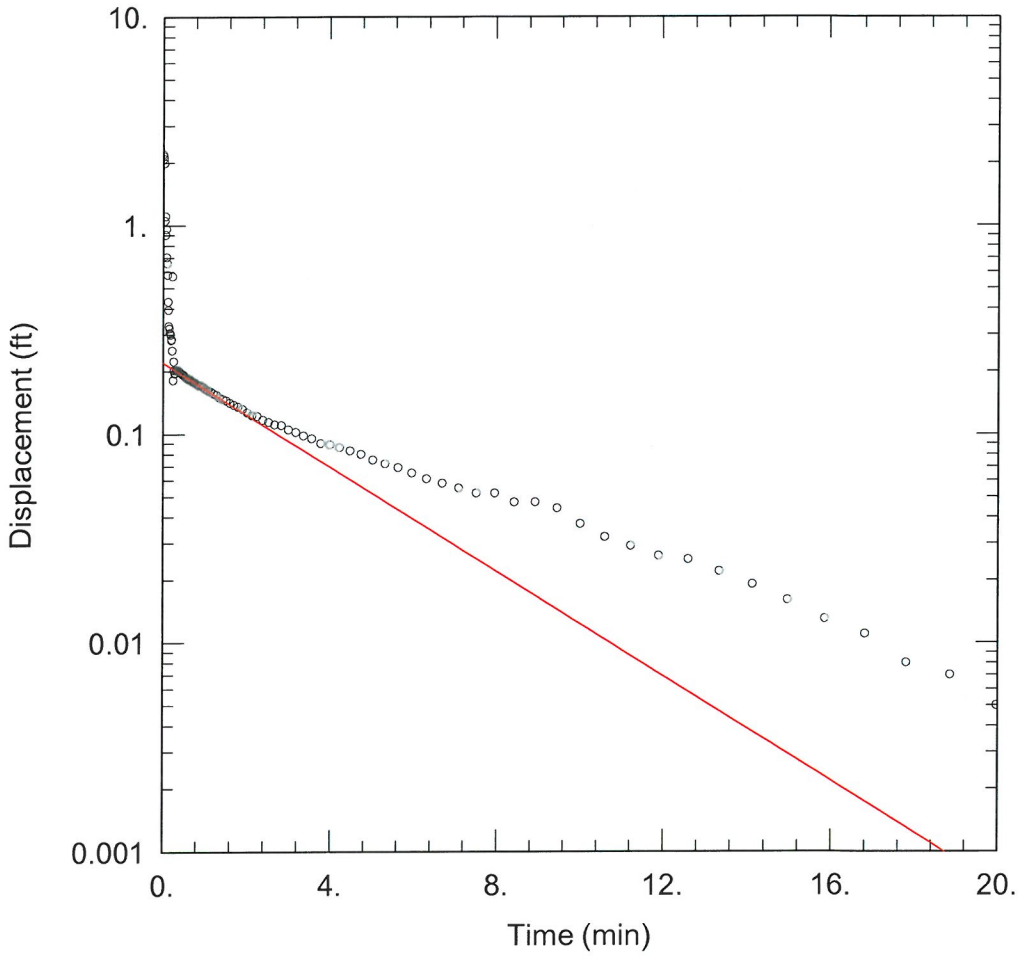
Slug Test
Aquifer Model: Unconfined
Solution Method: KGS Model

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
Kr	3.4E-5	cm/sec
Ss	0.00025	ft^{-1}
Kz/Kr	1.	

T = K*b = 0.03972 cm^2/sec



OR06A FALLING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR06Afh.aqt
Date: 12/09/15 Time: 09:17:51

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR06A
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 21.61 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR06A)

Initial Displacement: 2.2 ft
Total Well Penetration Depth: 11.64 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11.64 ft
Screen Length: 9.5 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00018 cm/sec
y0 = 0.22 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR06Afh.aqt
Title: OR06A Falling Head Test
Date: 12/09/15
Time: 09:17:52

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OR06A

AQUIFER DATA

Saturated Thickness: 21.61 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR06A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.2 ft
Static Water Column Height: 11.64 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.5 ft
Total Well Penetration Depth: 11.64 ft

No. of Observations: 101

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0112	2.15	1.28	0.154
0.0223	2.09	1.355	0.15
0.0335	1.989	1.434	0.147
0.0447	1.056	1.517	0.145
0.0558	1.107	1.606	0.141
0.067	0.904	1.7	0.138
0.0782	0.961	1.799	0.135
0.0893	0.706	1.904	0.132
0.1005	0.659	2.016	0.127
0.1117	0.581	2.134	0.123
0.1228	0.432	2.259	0.122
0.134	0.394	2.392	0.117
0.1452	0.33	2.532	0.114
0.1563	0.321	2.681	0.111
0.1675	0.306	2.838	0.11
0.1787	0.303	3.005	0.105
0.1898	0.299	3.182	0.102
0.201	0.282	3.369	0.098
0.2122	0.285	3.568	0.095

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.2233	0.252	3.778	0.09
0.235	0.571	4.	0.089
0.2475	0.181	4.236	0.086
0.2607	0.223	4.486	0.083
0.2747	0.203	4.751	0.08
0.2895	0.196	5.031	0.075
0.3052	0.196	5.328	0.072
0.3218	0.202	5.643	0.069
0.3395	0.203	5.976	0.065
0.3582	0.203	6.329	0.061
0.378	0.202	6.702	0.058
0.399	0.2	7.098	0.055
0.4212	0.197	7.518	0.052
0.4447	0.196	7.962	0.052
0.4695	0.194	8.433	0.047
0.4958	0.193	8.931	0.047
0.5238	0.19	9.459	0.044
0.5535	0.188	10.02	0.037
0.5848	0.185	10.61	0.032
0.618	0.184	11.24	0.029
0.6532	0.183	11.9	0.026
0.6905	0.18	12.61	0.025
0.73	0.178	13.35	0.022
0.7718	0.177	14.14	0.019
0.8162	0.174	14.98	0.016
0.8632	0.171	15.87	0.013
0.913	0.171	16.81	0.011
0.9657	0.168	17.8	0.008
1.022	0.165	18.85	0.007
1.081	0.162	19.97	0.005
1.143	0.16	21.15	0.004
1.21	0.157		

SOLUTION

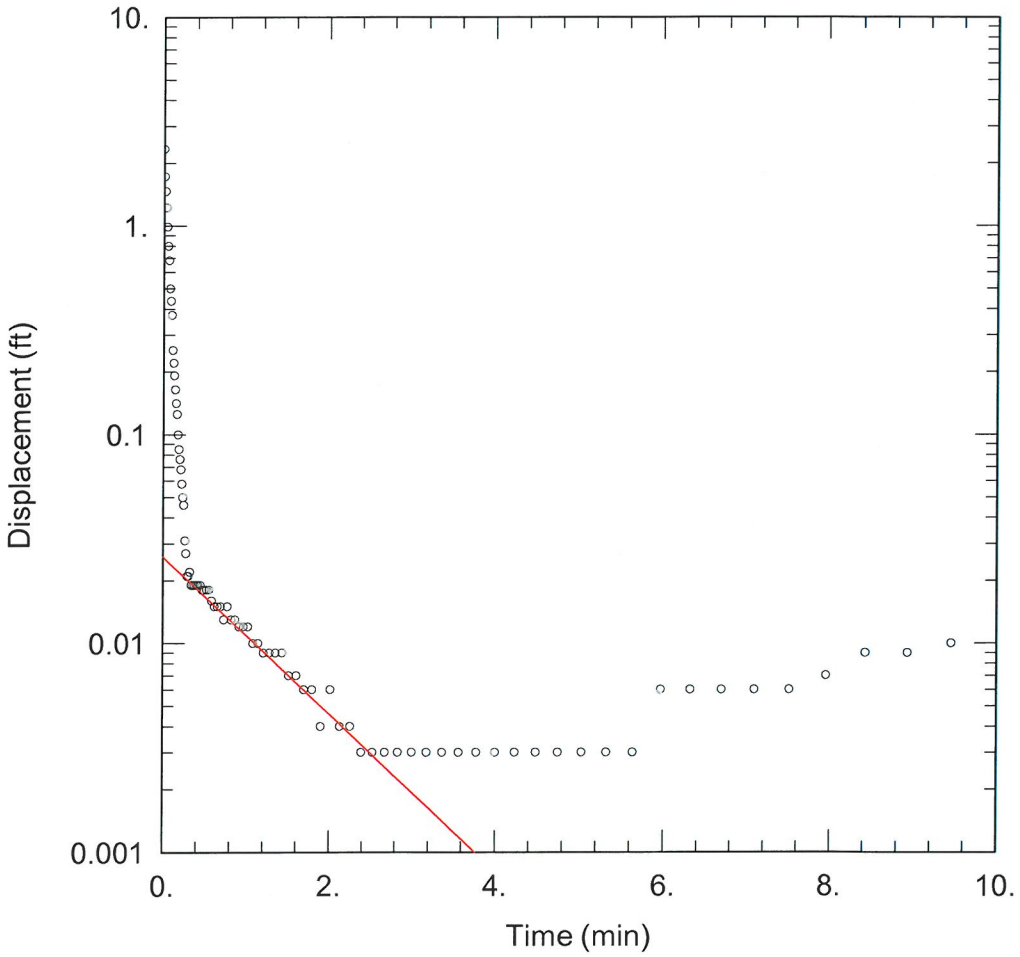
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.367

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00018	cm/sec
y0	0.22	ft

T = K*b = 0.1186 cm²/sec



OR06A RISING HEAD TEST

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR06Arh.aqt
Date: 12/09/15 Time: 09:17:52

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Well: OR06A
Test Date: 3 Dec 2015

AQUIFER DATA

Saturated Thickness: 21.61 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (OR06A)

Initial Displacement: 2.33 ft
Total Well Penetration Depth: 11.64 ft
Casing Radius: 0.08333 ft
Static Water Column Height: 11.64 ft
Screen Length: 9.5 ft
Well Radius: 0.08333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.00054 cm/sec
y0 = 0.026 ft

Data Set: I:\15Jobs\15E0030A\Admin\15-Field-Laboratory Data\SlugTests\OR06Arh.aqt
Title: OR06A Rising Head Test
Date: 12/09/15
Time: 09:17:53

PROJECT INFORMATION

Company: Hanson Professional Services
Client: NRT/Dynegy
Project: 15E0030A/0500
Location: Duck Creek Power Station
Test Date: 3 Dec 2015
Test Well: OR06A

AQUIFER DATA

Saturated Thickness: 21.61 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: OR06A

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.33 ft
Static Water Column Height: 11.64 ft
Casing Radius: 0.08333 ft
Well Radius: 0.08333 ft
Well Skin Radius: 0.333 ft
Screen Length: 9.5 ft
Total Well Penetration Depth: 11.64 ft

No. of Observations: 90

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.0112	1.721	0.913	0.012
0.0223	1.465	0.9657	0.012
0.0335	1.221	1.022	0.012
0.0447	0.991	1.081	0.01
0.0558	0.802	1.143	0.01
0.067	0.683	1.21	0.009
0.0782	0.5	1.28	0.009
0.0893	0.437	1.355	0.009
0.1005	0.373	1.434	0.009
0.1117	0.253	1.517	0.007
0.1228	0.22	1.606	0.007
0.134	0.192	1.7	0.006
0.1452	0.164	1.799	0.006
0.1563	0.141	1.904	0.004
0.1675	0.125	2.016	0.006
0.1787	0.1	2.134	0.004
0.1898	0.085	2.259	0.004
0.201	0.076	2.392	0.003
0.2122	0.068	2.532	0.003

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.2233	0.058	2.681	0.003
0.235	0.05	2.838	0.003
0.2475	0.046	3.005	0.003
0.2607	0.031	3.182	0.003
0.2747	0.027	3.369	0.003
0.2895	0.021	3.568	0.003
0.3052	0.021	3.778	0.003
0.3218	0.022	4.	0.003
0.3395	0.019	4.236	0.003
0.3582	0.019	4.486	0.003
0.378	0.019	4.751	0.003
0.399	0.019	5.031	0.003
0.4212	0.019	5.328	0.003
0.4447	0.019	5.643	0.003
0.4695	0.018	5.976	0.006
0.4958	0.018	6.329	0.006
0.5238	0.018	6.702	0.006
0.5535	0.018	7.098	0.006
0.5848	0.016	7.518	0.006
0.618	0.015	7.962	0.007
0.6532	0.015	8.433	0.009
0.6905	0.015	8.931	0.009
0.73	0.013	9.459	0.01
0.7718	0.015	10.02	0.012
0.8162	0.013	10.61	0.012
0.8632	0.013	11.24	0.012

SOLUTION

Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 3.367

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	0.00054	cm/sec
y0	0.026	ft

T = K*b = 0.3557 cm²/sec

Appendix B

Field Boring Log for OM32

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	19/24 *79%*	SS	*4-4 11-1* N=15			*4.50*	0			620	
1				11			2	Brown (10YR4/3), dry, hard, SILT with few clay, trace very fine- to fine-grained sand, trace roots, trace slag fragments - FILL.		618	
	0/36 *0%*	BD					4			616	
2											
3A	14/24 *58%*	SS	*3-2 2-2* N=4			*1.00*	6			614	
3				28				Yellowish brown (10YR5/6) with 40% gray (10YR5/1) mottles, moist, medium, SILT with few clay, trace very fine- to fine-grained sand, trace roots - FILL.			
	0/36 *0%*	BD					8			612	
4											
5A	10/24 *42%*	SS	*1-1 1-2* N=2			*1.00*	10			610	
5				25				Gray (10YR5/1) with 30% yellowish brown (10YR5/6) and 5% black (10YR2/1) mottles, moist, medium, SILT with few clay, trace very fine- to fine-grained sand - FILL.			
	0/36 *0%*	BD					12			608	
6											
7A	14/24 *58%*	SS	*1-2 2-2* N=4			*0.50*	14			606	
7				27							
	0/36 *0%*	BD					16	Gray (10YR5/1) and yellowish brown (10YR5/6), moist, medium, SILT with few clay, trace very fine- to fine-grained sand - FILL.		604	
8											
9A	14/24 *58%*	SS	*1-1 2-3* N=3			*0.50*	18			602	
9				24							
	0/36 *0%*	BD					20			600	
10											
11A	20/24 *83%*	SS	*2-3 5-5* N=8			*2.00*	22	Gray (10YR5/1) and yellowish brown (10YR5/6), moist, medium, SILT with few clay, trace very fine- to fine-grained sand, trace coal fragments - FILL.		598	
11				18							
	0/36 *0%*	BD					24			596	
12											
							26			594	
							28	Greenish gray (10G6/1), moist, stiff, SILT with few clay, trace very fine- to fine-grained sand - FILL.		592	
							30			590	

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
13A	19/24 79%	SS	3-4 4-5 N=8			2.00	32			588	
13				19							
	0/36 0%	BD					34			586	
14											
15A	14/24 58%	SS	5-8 6-7 N=14			2.00	36			584	
15				12				Gray (10YR5/1) with 10% yellowish brown (10YR5/6) mottles, moist, stiff, SILT with few clay, trace very fine- to fine-grained sand, trace coal fragments - FILL.			
	0/36 0%	BD					38			582	
16											
17A	2/24 8%	SS	6-6 6-8 N=12				40 ▼			580	
17				16							
	0/36 0%	BD					42			578	
18											
19A	18/24 75%	SS	3-5 8-9 N=13			2.75	44			576	
19				14							
	0/36 0%	BD					46			574	
20								Gray (10YR5/1), moist, very stiff, SILT with few clay, laminated (weathered shale), trace shale fragments - FILL.			
21A	20/24 83%	SS	1-3 6-7 N=9			1.50	48			572	
21				25							
	0/36 0%	BD					50			570	
22											
23A	20/24 83%	SS	2-3 7-7 N=10			2.25	52	Dark gray (10YR4/1) with 35% light yellowish brown (2.5Y6/4) mottles, moist, stiff, SILT with little clay, trace very fine- to medium-grained sand - FILL.		568	
23				21							
	0/36 0%	BD					54			566	
24											
							56	Gray (10YR5/1) with 40% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with trace clay and trace very fine- to fine-grained sand.		564	
							58	Dark gray (10YR4/1), moist, very stiff, SILT with few clay, trace very fine- to coarse-grained sand - FILL.		562	
							60			560	

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
25A	21/24 88%	SS	1-3 6-8 N=9			1.75	62	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) and 20% dark gray (10YR4/1) mottles, moist, stiff, SILT with little clay and trace very fine- to coarse-grained sand.		558	
25				21							
	0/36 0%	BD					64			556	
26											
27A	16/24 67%	SS	4-6 10-12 N=16			3.50	66			554	
27				19							
	0/36 0%	BD					68			552	
28											
29A	14/24 58%	SS	5-5 10-10 N=15			3.00	70	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) and 20% dark gray (10YR4/1) mottles, moist, very stiff, SILT with little clay and trace very fine- to coarse-grained sand, trace shale fragments.		550	
29				17						548	
	0/36 0%	BD					72			546	
30											
31A	21/24 88%	SS	4-7 10-11 N=17			3.00	76			544	
31				14							
	0/36 0%	BD					78			542	
32								Gray (10YR5/1) with 20% yellowish brown (10YR5/6) and 20% dark gray (10YR4/1) mottles, moist, very stiff, SILT with little clay and trace very fine- to coarse-grained sand and small to large gravel, trace shale and coal fragments.			
33A	24/24 100%	SS	5-6 7-9 N=13			1.75	80			540	
33				18						538	Switched to mud rotary at 82.0 ft bgs
	0/36 0%	BD					82			536	
34											
35A	12/24 50%	SS	19-34 50/2"				84			534	
35				17				Dark gray (10YR3/1), moist, hard, SHALE, moderately decomposed, slightly laminated.			Switched to rock core at 86.0 ft bgs
Run 36	36/36 100%	RC	RQD = 40%				86	Dark gray, SHALE with coal seams, moderately decomposed, moderate.		532	
							88	Dark gray, LIMESTONE with trace inclusions, slightly		530	
							90				

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								decomposed, slightly fractured, massive, strong.			
Run 37	60/60 *100%*	RC	**RQD = 52%**				92	Gray, LIMESTONE, slightly decomposed, stylolites, fossiliferous, slightly fractured, massive, strong.		528	
							94			526	
							96	Dark gray, SHALE with coal and clay seams, moderately decomposed, massive, moderate.		524	
Run 38	60/60 *100%*	RC	**RQD = 58%**				98			522	
							100			520	
							102	Dark gray, SHALE with clay seams, moderately decomposed, moderate.		518	
Run 39	60/60 *100%*	RC	**RQD = 67%**				104	Dark gray, LIMESTONE with clay seams, slightly decomposed, stylolites, small joints, vuggy, strong.		516	
							106			514	
Run 40	60/60 *100%*	RC	**RQD = 97%**				108	Dark gray, LIMESTONE, slightly decomposed, stylolites, slightly fractured, massive, strong.		512	
							110			510	
Run 41	60/60 *100%*	RC	**RQD = 88%**				112	Dark gray, LIMESTONE with thin shale interbeds, slightly decomposed, stylolites, slightly fractured, strong.		508	
							114			506	
							116	Dark gray, SHALE, competent, massive, strong.		504	
							118			502	
Run	120/120		**RQD =**				120			500	

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
42	*100%*	RC	**97%**				120			500	
							122			498	
							124			496	
							126			494	
							128	Dark gray, SHALE, competent, massive, strong. *[Continued from previous page]*		492	
Run 43	120/120 *100%*	RC	**RQD = 98%**				130			490	
							132			488	
							134			486	
							136			484	
							138			482	
Run 44	120/120 *100%*	RC	**RQD = 88%**				140	Dark gray, SHALE, fossiliferous, competent, massive, strong.		480	
							142			478	
							144			476	
							146			474	
							148	Dark gray, SHALE with clay seams, slightly decomposed, weak.		472	
Run	120/120		**RQD =**				150			470	

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
45	*100%*	RC	**43%**				152	Dark gray, SHALE with clay seams, slightly decomposed, weak. *[Continued from previous page]*		468	
							154			466	
							156			464	
							158			462	
Run 46	113/120 *94%*	RC	**RQD = 60%**				160	Black, SHALE with clay seams, slightly decomposed, moderate.		460	
							162			458	
							164			456	
							166			454	
							168	Black, SHALE, competent, blocky, massive, strong.		452	
Run 47	121/120 *101%*	RC	**RQD = 89%**				170			450	
								Black with 30% gray, SHALE with limestone nodules and seams, competent, massive, strong.			
							172			448	
							174			446	
							176	Dark gray, SHALE laminated with clay seams, competent, moderate.		444	
							178			442	
Run	118/120		**RQD =**				180			440	

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
48	*98%*	RC	**71%**				182	Black, COAL, vitreous, cleated.		438	
							184	Gray, SHALE, laminated, competent, moderate.		436	
							186	Gray, interlaminated SHALE and SANDSTONE, competent, calcareous, strong.		434	
							188			432	
Run 49	120/120 *100%*	RC	**RQD = 88%**				190	Gray, very fine- to fine-grained SANDSTONE, competent, strong.		430	
							192	Dark gray, SHALE with gray laminae, signs of dewatering structure.		428	
							194			426	
							196	Interbedded dark gray and gray SHALE and very fine- to fine-grained micaceous SANDSTONE, competent, strong.		424	
							198	Black, SHALE with grayish brown LIMESTONE seams and nodules, competent, strong.		422	
Run 50	120/120 *100%*	RC	**RQD = 94%**				200			420	
							202	Dark gray, SHALE with grayish brown LIMESTONE seams and nodules, competent, strong.		418	
							204			416	
							206	Dark gray SHALE with black coal seams, laminated, competent, moderate.		414	
							208	Gray, thinly bedded, very fine- to fine-grained SANDSTONE with clay and shale seams, competent, strong.		412	
Run	118/120		**RQD =**				210			410	

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
51	*98%*	RC	**84%**				212	Gray, thinly bedded, very fine- to fine-grained SANDSTONE with clay and shale seams, competent, strong. *[Continued from previous page]*		408	
							214	Dark gray, SHALE, laminated, competent, strong.		406	
							216	Dark gray, SHALE, slightly decomposed, laminated, moderate.		404	
							218	Black and gray, SHALE, slightly decomposed, laminated, moderate.		402	
Run 52	107/120 *89%*	RC	**RQD = 54%**				220			400	
							222	Dark gray, SHALE, slightly decomposed, massive, moderate.		398	
							224			396	
							226	Gray, SHALE with clay seams, moderately decomposed, massive, weak.		394	
								Gray, medium- to coarse-grained SANDSTONE, slightly decomposed, strong.			
							228	Gray, SHALE, moderately decomposed, massive, moderate.		392	
								Gray, very fine- to fine-grained SANDSTONE, competent, strong.			
Run 53	117/120 *98%*	RC	**RQD = 71%**				230			390	
							232			388	
							234	Dark gray, very fine- to fine-grained SANDSTONE, competent, massive, strong.		386	
							236			384	
							238			382	
Run	120/120		**RQD =**				240			380	

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
54	*100%*	RC	**87%**				242	Dark gray, very fine- to fine-grained SANDSTONE, competent, massive, strong. *[Continued from previous page]*		378	
							244	Dark gray, SHALE, slightly decomposed, massive, moderate.		376	
Run 55	60/60 *100%*	RC	**RQD = 90%**				246			374	
							248			372	
							250	Gray, very fine- to fine-grained SANDSTONE and black SHALE, thinly interbedded, slightly decomposed, strong.		370	
Run 56	60/60 *100%*	RC	**RQD = 93%**				252			368	
							254			366	
							256	Black, SHALE, slightly decomposed, laminated, moderate.		364	
								Black, COAL, vitreous, cleated.		362	
Run 57	120/120 *100%*	RC	**RQD = 86%**				258			360	
							260			358	
							262			356	
							264	Dark gray, very fine- to fine-grained SANDSTONE, competent, massive, strong.		354	
							266			352	
							268			350	
Run	120/120		**RQD =**				270				

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
58	*100%*	RC	**84%**				272	Gray, very fine- to fine-grained SANDSTONE with shale seams, competent, strong		348	
							274			346	
							276	Dark gray, SHALE, competent, massive, moderate.		344	
Run 59	62/72 *86%*	RC	**RQD = 0%**				278			342	
							280	Gray, SHALE, slightly decomposed, massive, moderate.		340	
							282			338	
Run 60	46/48 *96%*	RC	**RQD = 96%**				284			336	
							286	Black, SHALE, laminated, competent, strong.		334	
							288			332	
Run 61	118/120 *98%*	RC	**RQD = 86%**				290			330	
								Black, COAL.		328	
							292			326	
							294	Gray, SHALE, slightly decomposed, massive, moderate.		324	
							296			322	
							298	Dark gray, SHALE, slightly decomposed, laminated, strong.		320	
Run	115/120		**RQD =**				300				

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
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Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
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Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
62	*96%*	RC	**40%**				302			318	
							304			316	
							306	Dark gray, SHALE, slightly decomposed, laminated, strong. *[Continued from previous page]*		314	
							308			312	
Run 63	118/120 *98%*	RC	**RQD = 82%**				310			310	
							312	Dark gray, SHALE, fossiliferous, competent, massive, strong.		308	
								Dark gray, very fine- to fine-grained SANDSTONE and SHALE, thinly interbedded, competent, strong.		306	
							314	Gray, SHALE, slightly decomposed, massive, moderate.		304	
							316	Light greenish gray, very fine- to fine-grained SANDSTONE, competent, massive, strong.		302	
							318			300	
Run 64	120/120 *100%*	RC	**RQD = 95%**				320	Grayish green, SHALE, slightly decomposed, moderate.			
								Grayish green, SHALE with sandstone, limestone, and chert nodules (brecciated), slightly decomposed, blocky, strong.		298	
							322	Dark gray and dark green, SANDSTONE and SHALE with limestone lenses (dewatering structure), slightly decomposed, moderate.		296	
							324	Light gray, LIMESTONE, competent, massive, strong.		294	
							326	Grayish green, SHALE and SANDSTONE, thinly interbedded, calcareous, competent, strong.		292	
							328	Gray, LIMESTONE, slightly decomposed, slightly fractured, stylolites, vuggy, strong.		290	
Run	120/120		**RQD =**				330				

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Duck Creek Power Station
Location: Canton, Illinois
Project: 15E0030
DATES: **Start:** 08/26/2015
Finish: 09/15/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-750 ATV Drill
Drilling Method: 4 ¼" HSA, split spoon sampler; NQ core
FIELD STAFF: **Driller:** J. Dittmaier
Helper: M. Hill
Eng/Geo: S. Keim

BOREHOLE ID: OM32
Well ID: n/a
Surface Elev: 619.4 ft. MSL
Completion: 355.0 ft. BGS
Station: 3,949.89N
832.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.71 - 8/27/2015
▼ = 40.58 - 9/16/2015
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
65	*100%*	RC	**98%**				332	Gray, LIMESTONE, slightly decomposed, slightly fractured, stylolites, vuggy, strong. *[Continued from previous page]*		288	
							334			286	
							336	Gray, LIMESTONE, slightly decomposed, crystalline, slightly fractured, stylolites, strong.		284	
							338			282	
Run 66	120/120 *100%*	RC	**RQD = 100%**				340			280	
							342	Gray, LIMESTONE with greenish gray clay seams, slightly decomposed, crystalline, slightly fractured, stylolites, strong.		278	
							344			276	
							346			274	
							348	Gray, LIMESTONE with greenish gray clay seams, slightly decomposed, crystalline, vuggy, stylolites, strong.		272	
Run 67	120/120 *100%*	RC	**RQD = 93%**				350	Gray, LIMESTONE with greenish gray clay and sandstone seams, slightly decomposed, crystalline, vuggy, stylolites, strong.		270	
							352	Greenish gray, SANDSTONE with shale and limestone lenses, slightly decomposed, calcareous, strong.		268	
							354			266	

End of boring = 355.0 feet

NOTE(S): Borehole sealed with high-solids bentonite grout placed by tremie pipe from bottom of borehole.

Appendix C

Pressure Test Results for OM32

Duck Creek Power Station -- Bedrock Packer Test Calculations

Packer Test Solution

"Methods and procedures for defining aquifer parameters" (by John Sevee);
in Practical Handbook of Ground-Water Monitoring (ed. David Nielsen)

"Friction Losses in Pipe" (APPENDIX 17.A.);
in Groundwater and Wells (Fletcher G. Driscoll)

Site Duck Creek Power Station – South End of Ash Pond 1
Boring OM32
0.1250 Radius of test hole (in ft.)
8.4700 Length of test zone (in ft.)

Test #		Depth [Interval midpoint] (feet MSL)	Constant flow rate Q (in gal/min)	Static Head H_s (in feet)	Guage pressure p (in psi)	Pressure head $H_p = p*2.31$ (in feet)	Friction loss H_f (in feet)	Differential head $H_s + H_p - H_f$ (in feet)	Hydraulic Conductivity K (in cm/sec)	Comments
A	1	351.57	0.15000	40.58	10.00	23.07	0.120	63.527	1.742E-05	
	2	351.57	0.30500	40.58	10.00	23.07	0.245	63.402	3.550E-05	
	3	351.57	0.18000	40.58	10.00	23.07	0.145	63.502	2.092E-05	
	4	351.57	0.13000	40.58	10.00	23.07	0.104	63.543	1.510E-05	
	5	351.57	0.09500	40.58	10.00	23.07	0.076	63.571	1.103E-05	
	6	351.57	0.02300	40.58	10.00	23.07	0.018	63.629	2.667E-06	
	7	351.57	0.00600	40.58	10.00	23.07	0.005	63.642	6.957E-07	
	8	351.57	0.00800	40.58	10.00	23.07	0.006	63.641	9.276E-07	
	9	351.57	0.01800	40.58	10.00	23.07	0.014	63.633	2.087E-06	
	10	351.57	0.01100	40.58	10.00	23.07	0.009	63.638	1.275E-06	
	11	351.57	0.00800	40.58	10.00	23.07	0.006	63.641	9.276E-07	
	12	351.57	0.00840	40.58	10.00	23.07	0.007	63.640	9.740E-07	
	13	351.57	0.00760	40.58	10.00	23.07	0.006	63.641	8.812E-07	
	14	351.57	0.00300	40.58	20.00	46.13	0.002	86.712	2.553E-07	
	15	351.57	0.00180	40.58	20.00	46.13	0.001	86.713	1.532E-07	
	16	351.57	0.00840	40.58	20.00	46.13	0.007	86.707	7.149E-07	
	17	351.57	0.11080	40.58	30.00	69.20	0.089	109.692	7.454E-06	
	18	351.57	0.07320	40.58	30.00	69.20	0.059	109.722	4.923E-06	
	19	351.57	0.02880	40.58	30.00	69.20	0.023	109.758	1.936E-06	
	20	351.57	0.00840	40.58	30.00	69.20	0.007	109.774	5.646E-07	
	21	351.57	0.01920	40.58	30.00	69.20	0.015	109.766	1.291E-06	
	22	351.57	0.01920	40.58	30.00	69.20	0.015	109.766	1.291E-06	
	23	351.57	0.01760	40.58	20.00	46.13	0.014	86.700	1.498E-06	*Step down*
	24	351.57	0.01880	40.58	20.00	46.13	0.015	86.699	1.600E-06	*Step down*
	25	351.57	0.00080	40.58	10.00	23.07	0.001	63.646	9.275E-08	*Step down*
	26	351.57	0.00440	40.58	10.00	23.07	0.004	63.643	5.101E-07	*Step down*
B	1	331.64	0.03040	40.58	10.00	23.07	0.023	63.624	3.526E-06	
	2	331.64	0.10600	40.58	10.00	23.07	0.080	63.567	1.230E-05	
	3	331.64	0.17720	40.58	10.00	23.07	0.134	63.513	2.059E-05	
	4	331.64	0.06160	40.58	10.00	23.07	0.047	63.600	7.147E-06	
	5	331.64	0.01400	40.58	10.00	23.07	0.011	63.636	1.623E-06	
	6	331.64	0.05000	40.58	10.00	23.07	0.038	63.609	5.800E-06	
	7	331.64	0.04440	40.58	20.00	46.13	0.034	86.680	3.780E-06	
	8	331.64	0.11520	40.58	20.00	46.13	0.087	86.627	9.813E-06	
	9	331.64	0.27120	40.58	20.00	46.13	0.205	86.509	2.313E-05	
	10	331.64	0.24680	40.58	20.00	46.13	0.187	86.527	2.105E-05	
	11	331.64	0.17880	40.58	20.00	46.13	0.135	86.579	1.524E-05	
	12	331.64	0.02600	40.58	30.00	69.20	0.020	109.761	1.748E-06	
	13	331.64	0.01180	40.58	30.00	69.20	0.009	109.772	7.932E-07	
	14	331.64	0.02440	40.58	30.00	69.20	0.018	109.763	1.640E-06	
	15	331.64	0.02000	40.58	30.00	69.20	0.015	109.766	1.345E-06	
	16	331.64	0.01960	40.58	30.00	69.20	0.015	109.766	1.318E-06	
	17	331.64	0.00080	40.58	20.00	46.13	0.001	86.713	6.808E-08	*Step down*
	18	331.64	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
	19	331.64	0.01120	40.58	10.00	23.07	0.008	63.639	1.299E-06	*Step down*

Duck Creek Power Station -- Bedrock Packer Test Calculations

Site Duck Creek Power Station – South End of Ash Pond 1
Boring OM32
0.1250 Radius of test hole (in ft.)
8.4700 Length of test zone (in ft.)

Test #	Depth [Interval midpoint] (feet MSL)	Constant flow rate Q (in gal/min)	Static Head H_s (in feet)	Guage pressure p (in psi)	Pressure head $H_p = p*2.31$ (in feet)	Friction loss H_f (in feet)	Differential head $H_s + H_p - H_f$ (in feet)	Hydraulic Conductivity K (in cm/sec)	Comments
20	331.64	0.02840	40.58	10.00	23.07	0.022	63.625	3.294E-06	*Step down*
C 1	321.54	0.00080	40.58	10.00	23.07	0.001	63.646	9.275E-08	
2	321.54	0.00020	40.58	10.00	23.07	0.000	63.647	2.319E-08	
3	321.54	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
4	321.54	0.00120	40.58	10.00	23.07	0.001	63.646	1.391E-07	
5	321.54	0.00240	40.58	20.00	46.13	0.002	86.712	2.042E-07	
6	321.54	0.00120	40.58	20.00	46.13	0.001	86.713	1.021E-07	
7	321.54	0.00060	40.58	20.00	46.13	0.000	86.714	5.106E-08	
8	321.54	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	
9	321.54	0.00120	40.58	30.00	69.20	0.001	109.780	8.066E-08	
10	321.54	0.00040	40.58	30.00	69.20	0.000	109.781	2.689E-08	
11	321.54	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
12	321.54	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
13	321.54	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
14	321.54	0.00040	40.58	20.00	46.13	0.000	86.714	3.404E-08	*Step down*
15	321.54	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
16	321.54	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
D 1	300.77	0.03760	40.58	10.00	23.07	0.026	63.621	4.361E-06	
2	300.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
3	300.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
4	300.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
5	300.77	0.05900	40.58	20.00	46.13	0.041	86.673	5.023E-06	
6	300.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	
7	300.77	0.00040	40.58	20.00	46.13	0.000	86.714	3.404E-08	
8	300.77	0.00040	40.58	20.00	46.13	0.000	86.714	3.404E-08	
9	300.77	0.00440	40.58	30.00	69.20	0.003	109.778	2.958E-07	
10	300.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
11	300.77	0.00100	40.58	30.00	69.20	0.001	109.780	6.722E-08	
12	300.77	0.00040	40.58	30.00	69.20	0.000	109.781	2.689E-08	
13	300.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
14	300.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
15	300.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
16	300.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
E 1	279.77	0.00700	40.58	10.00	23.07	0.004	63.643	8.116E-07	
2	279.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
3	279.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
4	279.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
5	279.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	
6	279.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	
7	279.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*No take in 15 minutes*
8	279.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
9	279.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
10	279.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
11	279.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
12	279.77	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
13	279.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
14	279.77	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
						0.000			
F 1	269.17	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
2	269.17	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
3	269.17	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	

Duck Creek Power Station -- Bedrock Packer Test Calculations

Site Duck Creek Power Station – South End of Ash Pond 1
Boring OM32
0.1250 Radius of test hole (in ft.)
8.4700 Length of test zone (in ft.)

Test #		Depth [Interval midpoint] (feet MSL)	Constant flow rate Q (in gal/min)	Static Head H_s (in feet)	Guage pressure p (in psi)	Pressure head $H_p = p*2.31$ (in feet)	Friction loss H_f (in feet)	Differential head $H_s + H_p - H_f$ (in feet)	Hydraulic Conductivity K (in cm/sec)	Comments
	4	269.17	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*No take in 15 minutes*
	5	269.17	0.00040	40.58	20.00	46.13	0.000	86.714	3.404E-08	
	6	269.17	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	
	7	269.17	0.00020	40.58	20.00	46.13	0.000	86.714	1.702E-08	
	8	269.17	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	
	9	269.17	0.00040	40.58	30.00	69.20	0.000	109.781	2.689E-08	
	10	269.17	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	11	269.17	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	12	269.17	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
	13	269.17	0.00000	40.58	20.00	46.13	0.000	86.714	0.000E+00	*Step down*
	14	269.17	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
	15	269.17	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
G	1	258.72	0.24700	40.58	10.00	23.07	0.146	63.501	2.870E-05	
	2	258.72	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
	3	258.72	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
	4	258.72	0.00040	40.58	10.00	23.07	0.000	63.647	4.637E-08	
	5	258.72	0.02600	40.58	25.00	57.67	0.015	98.232	1.953E-06	
	6	258.72	0.00100	40.58	25.00	57.67	0.001	98.247	7.511E-08	
	7	258.72	0.00080	40.58	25.00	57.67	0.000	98.247	6.009E-08	
	8	258.72	0.00000	40.58	25.00	57.67	0.000	98.248	0.000E+00	
	9	258.72	0.07600	40.58	40.00	92.27	0.045	132.803	4.223E-06	
	10	258.72	0.00000	40.58	40.00	92.27	0.000	132.848	0.000E+00	
	11	258.72	0.00060	40.58	40.00	92.27	0.000	132.848	3.333E-08	
	12	258.72	0.00140	40.58	40.00	92.27	0.001	132.847	7.776E-08	
	13	258.72	0.00000	40.58	25.00	57.67	0.000	98.248	0.000E+00	*Step down*
	14	258.72	0.00080	40.58	25.00	57.67	0.000	98.247	6.009E-08	*Step down*
	15	258.72	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
	16	258.72	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
H	1	248.62	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
	2	248.62	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	
	3	248.62	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*No take in 15 minutes*
	4	248.62	0.00040	40.58	25.00	57.67	0.000	98.247	3.004E-08	
	5	248.62	0.00000	40.58	25.00	57.67	0.000	98.248	0.000E+00	
	6	248.62	0.00000	40.58	25.00	57.67	0.000	98.248	0.000E+00	
	7	248.62	0.00000	40.58	25.00	57.67	0.000	98.248	0.000E+00	
	8	248.62	0.00000	40.58	40.00	92.27	0.000	132.848	0.000E+00	
	9	248.62	0.00000	40.58	40.00	92.27	0.000	132.848	0.000E+00	
	10	248.62	0.00000	40.58	40.00	92.27	0.000	132.848	0.000E+00	*No take in 15 minutes*
	11	248.62	0.00000	40.58	25.00	57.67	0.000	98.248	0.000E+00	*Step down*
	12	248.62	0.00000	40.58	25.00	57.67	0.000	98.248	0.000E+00	*Step down*
	13	248.62	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
	14	248.62	0.00000	40.58	10.00	23.07	0.000	63.647	0.000E+00	*Step down*
I	1	227.61	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	2	227.61	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	227.61	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*No take in 15 minutes*
	4	227.61	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	5	227.61	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	227.61	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
	7	227.61	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	8	227.61	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	227.61	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*

Duck Creek Power Station -- Bedrock Packer Test Calculations

Site Duck Creek Power Station – South End of Ash Pond 1
Boring OM32
0.1250 Radius of test hole (in ft.)
8.4700 Length of test zone (in ft.)

Test #	Depth [Interval midpoint] (feet MSL)	Constant flow rate Q (in gal/min)	Static Head H_s (in feet)	Guage pressure p (in psi)	Pressure head $H_p = p*2.31$ (in feet)	Friction loss H_f (in feet)	Differential head $H_s + H_p - H_f$ (in feet)	Hydraulic Conductivity K (in cm/sec)	Comments
10	227.61	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
11	227.61	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
12	227.61	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
13	227.61	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
J 1	217.05	0.00080	40.58	15.00	34.60	0.000	75.180	7.852E-08	
2	217.05	0.00160	40.58	15.00	34.60	0.001	75.180	1.570E-07	
3	217.05	0.00160	40.58	15.00	34.60	0.001	75.180	1.570E-07	
4	217.05	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
5	217.05	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
6	217.05	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
7	217.05	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
8	217.05	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
9	217.05	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
10	217.05	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
11	217.05	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
12	217.05	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
13	217.05	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
14	217.05	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
15	217.05	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
K 1	206.51	0.00080	40.58	15.00	34.60	0.000	75.180	7.852E-08	
2	206.51	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
3	206.51	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
4	206.51	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
5	206.51	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
6	206.51	0.00020	40.58	30.00	69.20	0.000	109.781	1.344E-08	
7	206.51	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
8	206.51	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
9	206.51	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
10	206.51	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
11	206.51	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
12	206.51	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
13	206.51	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
14	206.51	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
L 1	196.37	0.00040	40.58	15.00	34.60	0.000	75.180	3.926E-08	
2	196.37	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
3	196.37	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
4	196.37	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
5	196.37	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
6	196.37	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
7	196.37	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
8	196.37	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
9	196.37	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
10	196.37	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
11	196.37	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
12	196.37	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
13	196.37	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
M 1	185.77	0.02080	40.58	15.00	34.60	0.009	75.172	2.042E-06	
2	185.77	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
3	185.77	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
4	185.77	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	

Duck Creek Power Station -- Bedrock Packer Test Calculations

Site Duck Creek Power Station – South End of Ash Pond 1
Boring OM32
0.1250 Radius of test hole (in ft.)
8.4700 Length of test zone (in ft.)

Test #		Depth [Interval midpoint] (feet MSL)	Constant flow rate Q (in gal/min)	Static Head H_s (in feet)	Guage pressure p (in psi)	Pressure head $H_p = p*2.31$ (in feet)	Friction loss H_f (in feet)	Differential head $H_s + H_p - H_f$ (in feet)	Hydraulic Conductivity K (in cm/sec)	Comments
	5	185.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	185.77	0.00020	40.58	30.00	69.20	0.000	109.781	1.344E-08	
	7	185.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	8	185.77	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	185.77	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	10	185.77	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
	11	185.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	185.77	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	13	185.77	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
	14	185.77	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
N	1	175.55	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	2	175.55	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	175.55	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	4	175.55	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*No take in 15 minutes*
	5	175.55	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	175.55	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	7	175.55	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
	8	175.55	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	175.55	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	10	175.55	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
	11	175.55	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	175.55	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	13	175.55	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
	14	175.55	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
O	1	165.39	0.19100	40.58	15.00	34.60	0.072	75.108	1.876E-05	
	2	165.39	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	165.39	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	4	165.39	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	5	165.39	0.00040	40.58	30.00	69.20	0.000	109.781	2.689E-08	
	6	165.39	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	7	165.39	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	8	165.39	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	165.39	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	10	165.39	0.00020	40.58	45.00	103.80	0.000	144.381	1.022E-08	
	11	165.39	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	165.39	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	13	165.39	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
	14	165.39	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
P	1	155.25	0.00300	40.58	15.00	34.60	0.001	75.179	2.945E-07	
	2	155.25	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	155.25	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	4	155.25	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	5	155.25	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	155.25	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	7	155.25	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
	8	155.25	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	155.25	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	10	155.25	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
	11	155.25	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	155.25	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	13	155.25	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*

Duck Creek Power Station -- Bedrock Packer Test Calculations

Site Duck Creek Power Station – South End of Ash Pond 1
Boring OM32
0.1250 Radius of test hole (in ft.)
8.4700 Length of test zone (in ft.)

Test #		Depth [Interval midpoint] (feet MSL)	Constant flow rate Q (in gal/min)	Static Head H_s (in feet)	Guage pressure p (in psi)	Pressure head $H_p = p*2.31$ (in feet)	Friction loss H_f (in feet)	Differential head $H_s + H_p - H_f$ (in feet)	Hydraulic Conductivity K (in cm/sec)	Comments
	14	155.25	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
Q	1	144.75	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	2	144.75	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	144.75	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*No take in 15 minutes*
	4	144.75	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	5	144.75	0.00020	40.58	30.00	69.20	0.000	109.781	1.344E-08	
	6	144.75	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	7	144.75	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	8	144.75	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	144.75	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
	10	144.75	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	11	144.75	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	144.75	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
	13	144.75	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
R	1	134.15	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	2	134.15	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	134.15	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	4	134.15	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	5	134.15	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	134.15	0.00020	40.58	30.00	69.20	0.000	109.781	1.344E-08	
	7	134.15	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
	8	134.15	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	134.15	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	10	134.15	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	11	134.15	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	134.15	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	13	134.15	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
	14	134.15	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
S	1	124.04	0.24000	40.58	15.00	34.60	0.068	75.113	2.358E-05	
	2	124.04	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	124.04	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	4	124.04	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	5	124.04	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	124.04	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	7	124.04	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
	8	124.04	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	124.04	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	10	124.04	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
	11	124.04	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	124.04	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	13	124.04	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
	14	124.04	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
T	1	113.86	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	2	113.86	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	113.86	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*No take in 15 minutes*
	4	113.86	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	5	113.86	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	113.86	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
	7	113.86	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	8	113.86	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	

Duck Creek Power Station -- Bedrock Packer Test Calculations

Site Duck Creek Power Station – South End of Ash Pond 1
Boring OM32
0.1250 Radius of test hole (in ft.)
8.4700 Length of test zone (in ft.)

Test #		Depth [Interval midpoint] (feet MSL)	Constant flow rate Q (in gal/min)	Static Head H_s (in feet)	Guage pressure p (in psi)	Pressure head $H_p = p*2.31$ (in feet)	Friction loss H_f (in feet)	Differential head $H_s + H_p - H_f$ (in feet)	Hydraulic Conductivity K (in cm/sec)	Comments
	9	113.86	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
	10	113.86	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	11	113.86	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	113.86	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
	13	113.86	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	*Step down*
U	1	103.41	0.06500	40.58	15.00	34.60	0.015	75.165	6.381E-06	
	2	103.41	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	3	103.41	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	4	103.41	0.00000	40.58	15.00	34.60	0.000	75.181	0.000E+00	
	5	103.41	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	6	103.41	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	
	7	103.41	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*No take in 15 minutes*
	8	103.41	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	9	103.41	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	
	10	103.41	0.00000	40.58	45.00	103.80	0.000	144.382	0.000E+00	*No take in 15 minutes*
	11	103.41	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	12	103.41	0.00000	40.58	30.00	69.20	0.000	109.781	0.000E+00	*Step down*
	13	103.41	-0.00120	40.58	15.00	34.60	0.000	75.181	-1.178E-07	*Step down*
	14	103.41	-0.00080	40.58	15.00	34.60	0.000	75.181	-7.852E-08	*Step down*

APPENDIX B2

AECOM ALPHA OMEGA 2015 PERMEAMETER DATA

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1) PROJECT NO.: 15-328T

LOCATION:

BORING NO.: B008 SAMPLE NO.: ST-2 DEPTH: 16' - 17.5'

SAMPLE TYPE: Undisturbed % COMPACTION:

	INITIAL DATA		FINAL DATA	
MOISTURE:	22.6	%	23.7	%
DRY UNIT WEIGHT:	103.2	pcf	103.2	pcf
HEIGHT:	2.69	inches	2.69	inches
DIAMETER:	2.86	inches	2.86	inches
WEIGHT:	573.8	grams	578.9	grams
SATURATION:	95.8	%	100.0	%

PERMEANT LIQUID: Deaired tap water "B" value = 98.0%

EFFECTIVE CONSOLIDATION STRESS: Maximum 3.4 psi Minimum 3.0 psi

BACK PRESSURE: 90 psi RANGE OF HYDRAULIC GRADIENT: 3.2 to 2.9

SAMPLE DESCRIPTION: Brown, mottled olive brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
10/12 - 10/13	1	81,720	22.0	20.0	26
10/13 - 10/14	2	81,720	22.0	20.0	26
10/14 - 10/15	3	81,720	22.0	20.0	26
10/15 - 10/16	4	81,720	22.0	20.0	26
AVERAGE		81,720	22.0	20.0	26

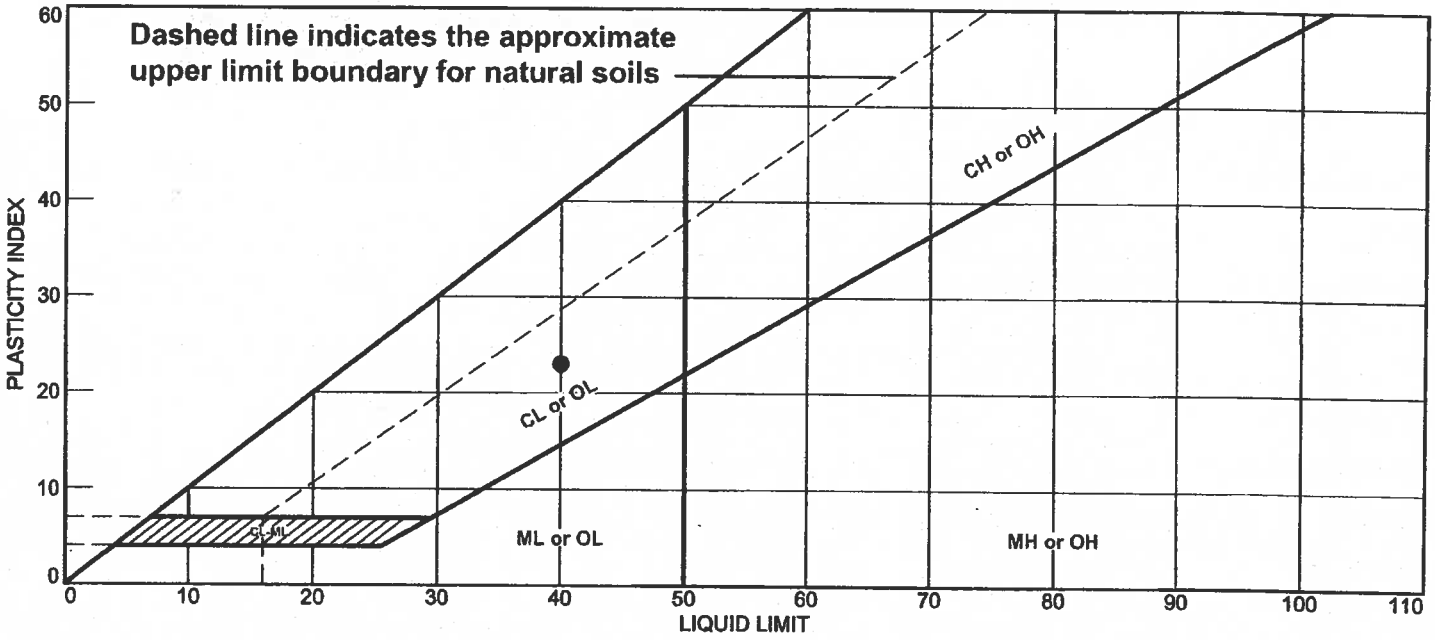
k= 7.8E-08 cm/s n/n20= 0.8694

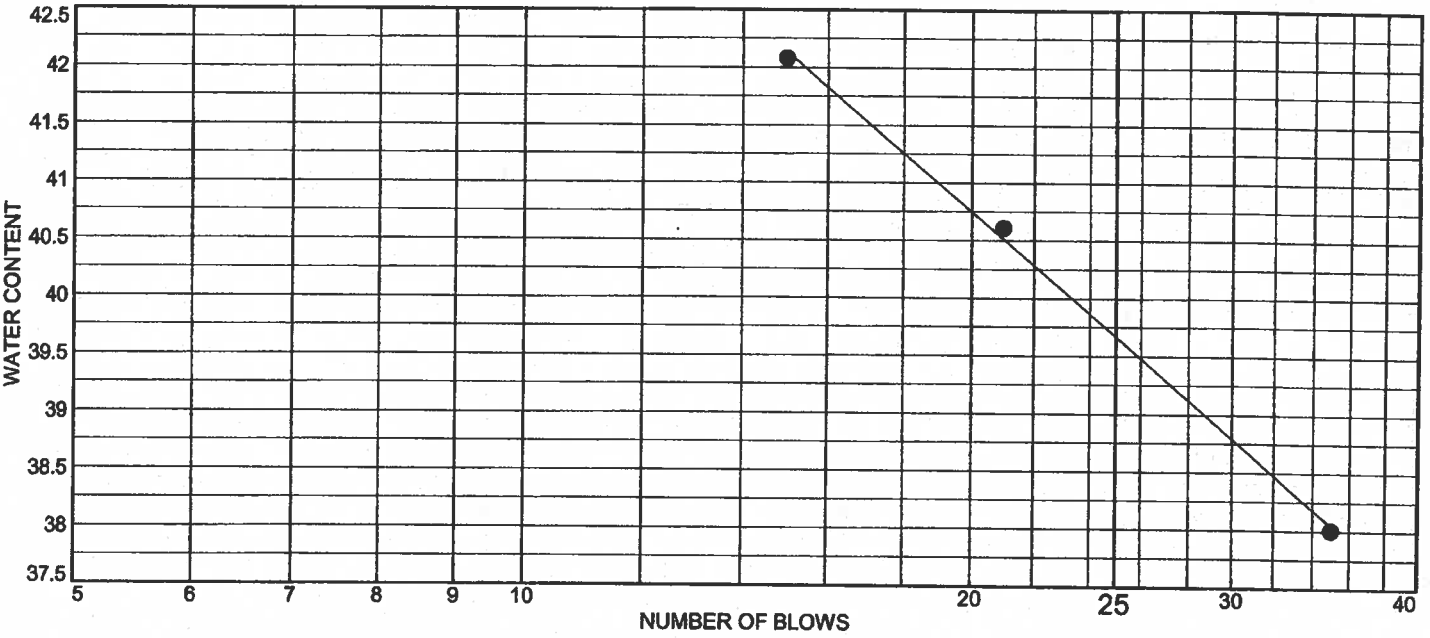
k20= 6.8E-08 cm/s

k = Hydraulic Conductivity before n/n20 correction factor
k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, mottled olive brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand	40	17	23			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B008 ST-2 **Depth:** 16'-17.5'

Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1) PROJECT NO.: 15-328T

LOCATION:

BORING NO.: B015 SAMPLE NO.: ST-6 DEPTH: 56' - 57.5'

SAMPLE TYPE: Undisturbed % COMPACTION:

	INITIAL DATA		FINAL DATA	
MOISTURE:	15.8 %	MOISTURE:	16.4	%
DRY UNIT WEIGHT:	118.4 pcf	DRY UNIT WEIGHT:	118.4	pcf
HEIGHT:	2.26 inches	HEIGHT:	2.26	inches
DIAMETER:	2.86 inches	DIAMETER:	2.86	inches
WEIGHT:	522.4 grams	WEIGHT:	525.1	grams
SATURATION:	99.9 %	SATURATION:	100.0	%

PERMEANT LIQUID: Deaired tap water "B" value = 98.0%

EFFECTIVE CONSOLIDATION STRESS: Maximum 3.4 psi Minimum 3.0 psi

BACK PRESSURE: 90 psi RANGE OF HYDRAULIC GRADIENT: 3.8 to 3.3

SAMPLE DESCRIPTION: Light gray, speckled black and reddish brown Silty clay with sand and trace of gravel

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
10/12 - 10/13	1	82,080	22.0	19.2	26
10/13 - 10/14	2	82,080	22.0	19.2	26
10/14 - 10/15	3	82,080	22.0	19.2	26
10/15 - 10/16	4	82,080	22.0	19.2	26
AVERAGE		82,080	22.0	19.2	26

k= 9.3E-08 cm/s n/n20= 0.8694

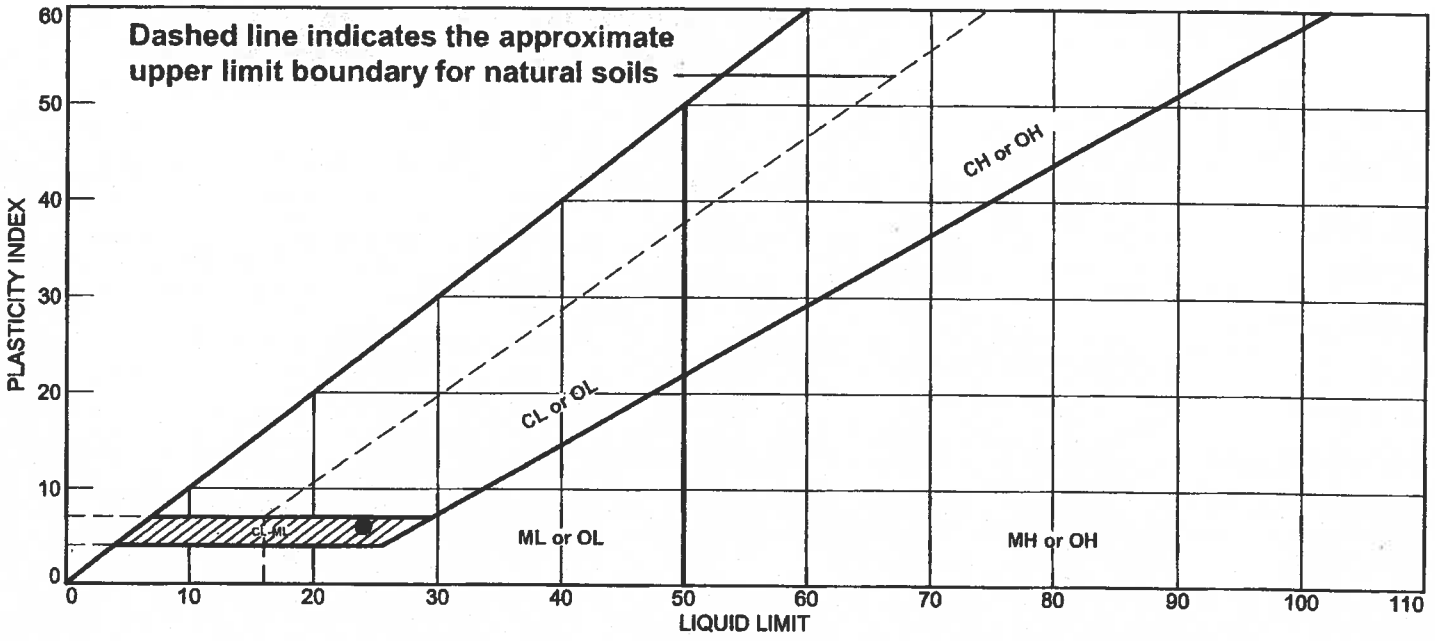
k20= 8.1E-08 cm/s

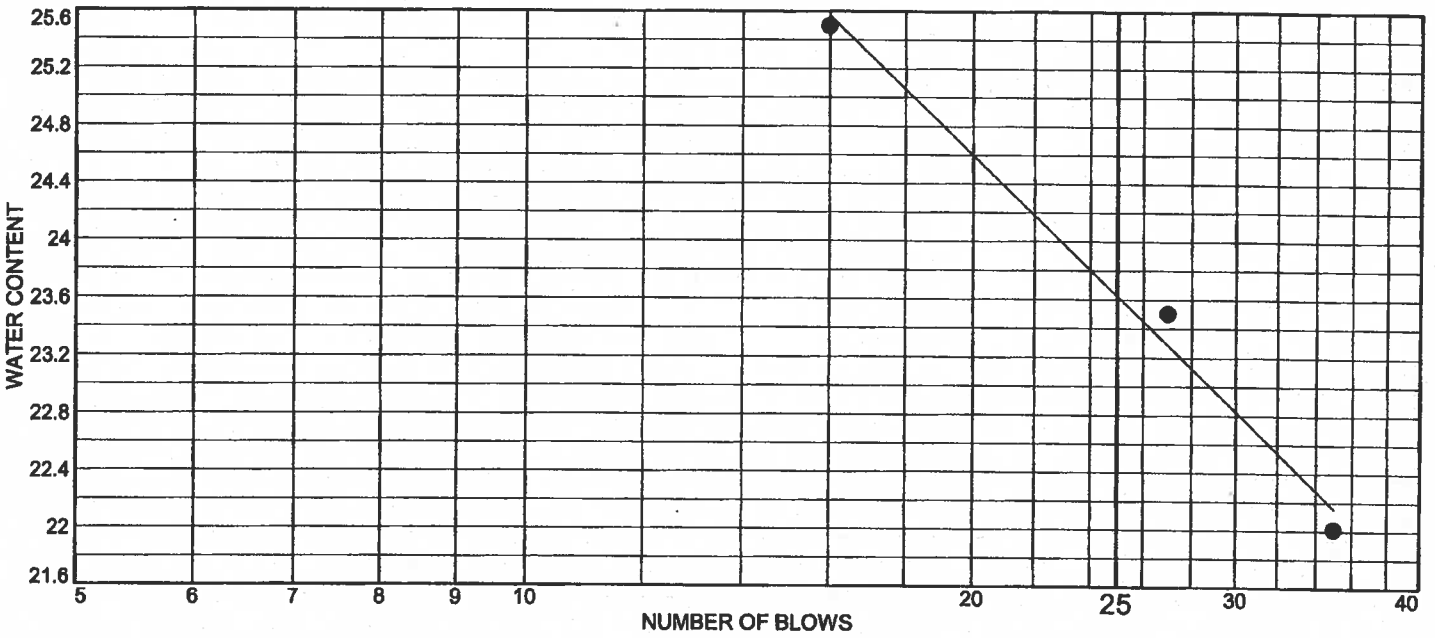
k = Hydraulic Conductivity before n/n20 correction factor

k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light gray, speckled black and reddish brown Silty clay with sand and trace of gravel	24	18	6			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B015 ST-6 **Depth:** 56'-57.5'

Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7 - Duck Creek (Ash Pond 2) PROJECT NO.: 15-328T

LOCATION:

BORING NO.: B019 SAMPLE NO.: ST-4 DEPTH: 43.5' - 45'

SAMPLE TYPE: Undisturbed % COMPACTION:

	INITIAL DATA		FINAL DATA	
MOISTURE:	17.7	%	26.8	%
DRY UNIT WEIGHT:	104.3	pcf	104.3	pcf
HEIGHT:	2.05	inches	2.05	inches
DIAMETER:	2.84	inches	2.84	inches
WEIGHT:	418.3	grams	450.6	grams
SATURATION:	77.6	%	100.0	%

PERMEANT LIQUID: Deaired tap water

EFFECTIVE CONSOLIDATION STRESS: Maximum 5.4 psi Minimum 5.0 psi

BACK PRESSURE: 90 psi RANGE OF HYDRAULIC GRADIENT: 4.2 to 3.8

SAMPLE DESCRIPTION: Gray, mottled dark brown LEAN CLAY with weathered shale

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
11/18/2015	1	12,720	22.0	19.8	26
11/18/2015	2	12,720	22.0	19.8	26
11/19/2015	3	12,720	22.0	19.8	26
11/19/2015	4	12,720	22.0	19.8	26
AVERAGE		12,720	22.0	19.8	26

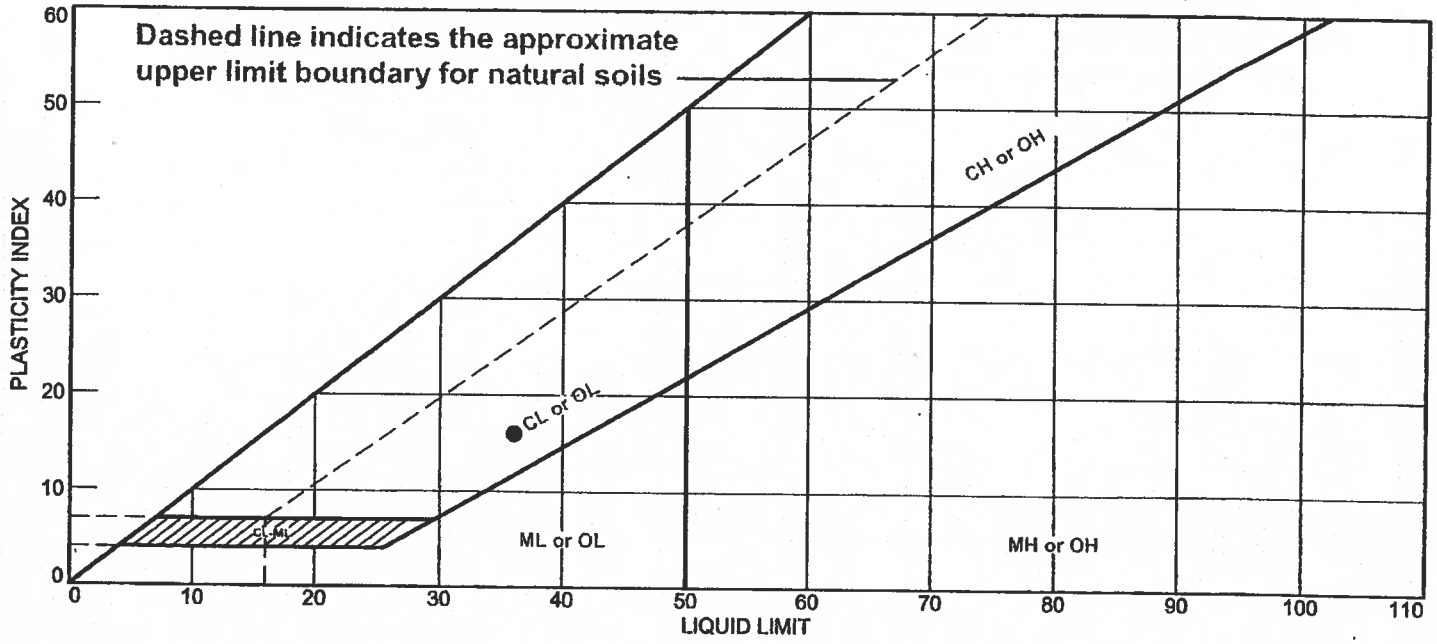
k= 4.3E-07 cm/s n/n20= 0.8694

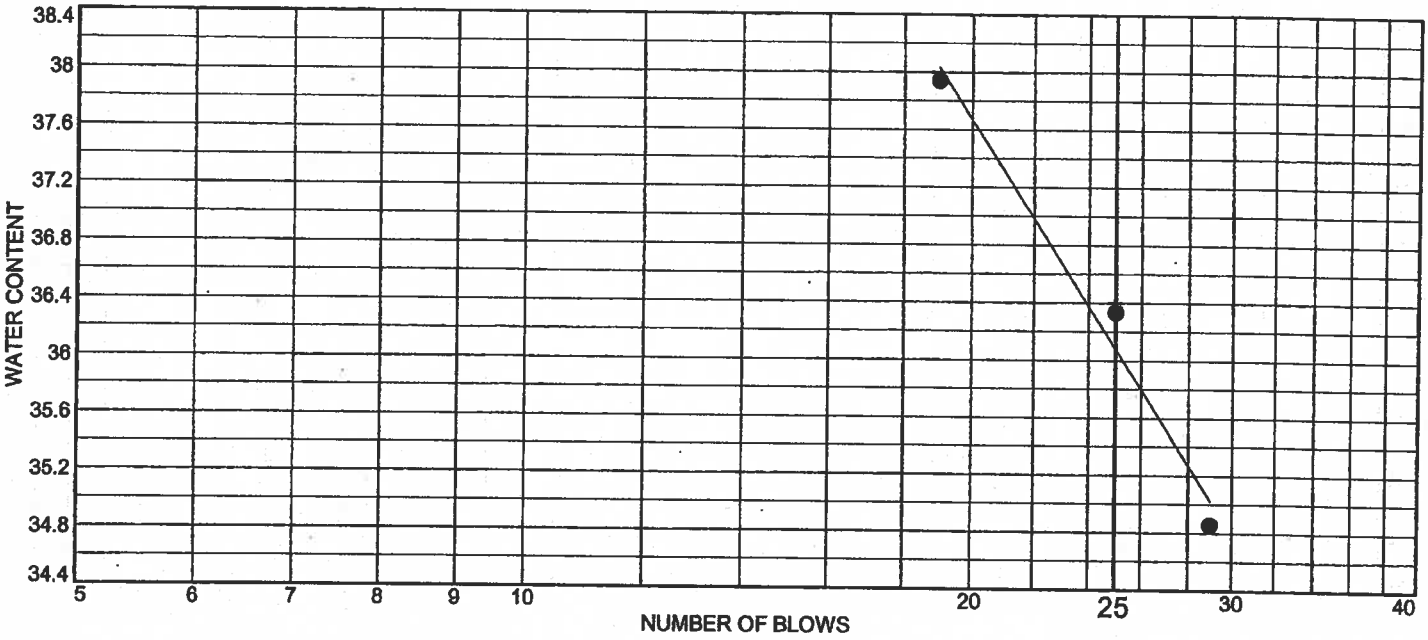
k20= 3.7E-07 cm/s

k = Hydraulic Conductivity before n/n20 correction factor
k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, mottled dark brown LEAN CLAY with weathered shale	36	20	16			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B019 ST-4 **Depth:** 43.5'-45'

Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7 - Duck Creek (Ash Pond 2) PROJECT NO.: 15-328T

LOCATION:

BORING NO.: B026 SAMPLE NO.: ST-4 DEPTH: 33.5' - 35'

SAMPLE TYPE: Undisturbed % COMPACTION:

INITIAL DATA			FINAL DATA	
MOISTURE:	21.0 %		MOISTURE:	22.5 %
DRY UNIT WEIGHT:	106.4 pcf		DRY UNIT WEIGHT:	106.4 pcf
HEIGHT:	2.73 inches		HEIGHT:	2.73 inches
DIAMETER:	2.85 inches		DIAMETER:	2.85 inches
WEIGHT:	588.3 grams		WEIGHT:	595.5 grams
SATURATION:	97.1 %		SATURATION:	100.0 %

PERMEANT LIQUID: Deaired tap water

EFFECTIVE CONSOLIDATION STRESS: Maximum 5.4 psi Minimum 5.0 psi

BACK PRESSURE: 90 psi RANGE OF HYDRAULIC GRADIENT: 3.2 to 2.7

SAMPLE DESCRIPTION: Brown, spotted gray, speckled black and reddish brown LEAN CLAY with weathered shale

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
11/12 - 11/13	1	63,480	22.0	18.8	26
11/13 - 11/14	2	63,480	22.0	18.8	26
11/14 - 11/15	3	63,480	22.0	18.8	26
11/15 - 11/16	4	63,480	22.0	18.8	26
AVERAGE		63,480	22.0	18.8	26

k= 1.7E-07 cm/s n/n20= 0.8694

k20= 1.5E-07 cm/s

k = Hydraulic Conductivity before n/n20 correction factor
k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

No AL Data Available
WDS

APPENDIX C

ANALYTICAL RESULTS

APPENDIX C1

SURFACE WATER LEACHATE ANALYTICAL RESULTS SINCE 2000

Appendix C-1
Surface Water Leachate Analytical Results Since 2000
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Sample	Sample Date	TDS (mg/L)	Hardness (mg/L)	Cl, diss (mg/L)	SO4, diss (mg/L)	B, diss (mg/L)	Fe, diss (mg/L)	Mn, diss (mg/L)
ASH POND	4/24/2000	7600	4400	2000	1700	220	0.17	1.4
ASH POND	9/18/2000	8200	4500	2400	1900	230	0.096	0.59
ASH POND	9/13/2001	10000	6900	3500	2100	380	2.7	1.5
ASH POND	4/25/2002	13000	13000	3400	1600	320	1.2	1.4
ASH POND	9/24/2002	10000	8400	3000	1500	380	0.14	1.3
ASH POND	4/18/2003	3200	5800	4000	1500	390	<0.01	1.8
ASH POND	9/24/2003	12000	7100	3900	1700	350	0.35	0.94
ASH POND	4/13/2004	12000	5100	4000	1300	260	<0.01	0.82
ASH POND	9/23/2004	14000	7300	4200	1600	380	<0.01	1.1
ASH POND	4/19/2005	14000	5900	4000	1600	340	<0.1	0.07
ASH POND	9/20/2005	13000	6800	4500	1800	390	0.2	0.27
ASH POND	4/28/2006	13000	5700	4500	1700	340	<0.01	0.086
ASH POND	9/7/2006	12000	7500	3900	1500	290	<0.01	0.23
ASH POND	4/2/2007	9600	6100	3900	1600	320	<0.01	0.17
ASH POND	9/19/2007	12000	5800	4200	1500	320	<0.01	0.079
ASH POND	3/27/2008	9200	5200	3800	1300	270	<0.01	0.082
ASH POND	8/19/2008	4700	6400	4600	1900	370	0.012	0.74
ASH POND	4/29/2009	6500	4600	3700	1400	230	0.021	0.16
ASH POND	9/23/2009	6300	3800	2300	1500	160	0.013	0.3
RECYCLE POND	4/24/2000	7800	4500	1700	2200	200	0.073	1.5
RECYCLE POND	9/18/2000	8200	4500	2700	2200	240	<0.01	0.62
RECYCLE POND	4/24/2001	8580	4700	2300	1700	230	0.88	1.5
RECYCLE POND	9/13/2001	10000	6400	3300	2100	73	1.9	0.4
RECYCLE POND	4/24/2002	13000	8516	3500	1700	310	0.23	1.5
RECYCLE POND	9/24/2002	11000	3600	3900	1900	390	0.33	1.1
RECYCLE POND	4/17/2003	10000	6700	3800	1600	380	<0.01	1.5
RECYCLE POND	9/23/2003	12000	7400	3700	1800	350	0.052	0.94
RECYCLE POND	4/12/2004	8800	6700	4200	1400	260	<0.01	0.78
RECYCLE POND	9/23/2004	13000	5600	2900	1400	180	<0.01	0.24
RECYCLE POND	4/18/2005	7100	5200	2800	1100	180	<0.05	0.47
RECYCLE POND	9/19/2005	14000	7800	4900	1500	380	<0.05	0.65
RECYCLE POND	4/28/2006	12000	6900	4700	1500	340	0.032	0.87
RECYCLE POND	9/7/2006	12000	7600	4400	1800	270	<0.01	0.72
RECYCLE POND	4/2/2007	11000	6800	4100	1400	330	<0.01	1.5
RECYCLE POND	9/19/2007	12000	2600	4400	1800	320	<0.01	0.13
RECYCLE POND	3/26/2008	11000	4000	3600	1100	290	<0.01	0.69
RECYCLE POND	8/19/2008	3800	5600	3700	1400	310	<0.01	0.06
RECYCLE POND	4/29/2009	6200	4000	3300	1400	180	0.016	0.42
RECYCLE POND	9/21/2009	6500	4000	3100	1400	66	0.01	0.033
RECYCLE POND	12/8/2009	6300	3900	2700	1100	180	0.027	0.038
RECYCLE POND	4/27/2010	6400	3500	2200	1000	170	<0.01	0.2

APPENDIX C2

POREWATER LEACHATE ANALYTICAL RESULTS

PDC Laboratories, Inc.
P.O. Box 9071 • Peoria, IL 61612-9071
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

ACCREDITED IN ACCORDANCE WITH nelac

Ameren Illinois Company - Duck Creek
17751 North Cilco Road
Canton, IL 61520-8761
Attn: John Berry

Date Received: 05/18/12 5:15
Report Date: 06/06/12
Customer #: 232857
PO#: 552820

Laboratory Results

Sample No: **2052527-01**

Collect Date: **05/16/12 10:00**
Matrix: **Ground Water Grab**

Sample Description: AP-1N

Parameters	Result	Qual	Prep Date	Analysis Date	Analyst	Method
General Chemistry - PIA						
Cyanide	< 0.0050 mg/L		05/21/12 07:12	05/22/12 16:17	lgtth	335.4
Solids - total dissolved solids (TDS)	4500 mg/L		05/22/12 08:32	05/22/12 09:37	BNS	SM 2540C 18Ed
Soluble Anions - PIA						
Chloride, Dissolved	1300 mg/L		06/04/12 15:46	06/04/12 15:46	PLI	EPA 300.0 R2.1
Fluoride, Dissolved	< 2.5 mg/L		05/21/12 21:39	05/21/12 21:39	SJW	EPA 300.0 R2.1
Nitrate, Dissolved	< 0.20 mg/L	H	05/21/12 21:39	05/21/12 21:39	SJW	EPA 300.0 R2.1
Sulfate, Dissolved	1100 mg/L		06/04/12 15:46	06/04/12 15:46	PLI	EPA 300.0 R2.1
Soluble General Chemistry - PIA						
Hardness	3300 mg CaCO3/L		05/29/12 15:35	05/29/12 15:35	SMP	SM 2340C 18Ed
Soluble Metals - PIA						
Antimony, Dissolved	3.6 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Arsenic, Dissolved	23 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Barium, Dissolved	180 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Beryllium, Dissolved	< 1.0 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Boron, Dissolved	43000 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Cadmium, Dissolved	7.3 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Chromium, Dissolved	33 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Cobalt, Dissolved	2.0 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Copper, Dissolved	4.6 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Iron, Dissolved	15 ug/L		05/24/12 10:28	05/24/12 14:37	JMW	SW 6010B
Lead, Dissolved	13 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Manganese, Dissolved	12 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Mercury, Dissolved	0.31 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Nickel, Dissolved	74 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Selenium, Dissolved	55 ug/L		06/01/12 11:51	06/04/12 07:53	JMW	SW 6020
Silver, Dissolved	< 5.0 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Thallium, Dissolved	< 1.0 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020
Zinc, Dissolved	< 6.0 ug/L		06/01/12 11:51	06/01/12 13:45	JMW	SW 6020

PDC Laboratories, Inc.
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ACCREDITED IN ACCORDANCE WITH nelac

Ameren Illinois Company - Duck Creek
17751 North Cilco Road
Canton, IL 61520-8761
Attn: John Berry

Date Received: 05/18/12 5:15
Report Date: 06/06/12
Customer #: 232857
PO#: 552820

Laboratory Results

Sample No: **2052527-02**

Collect Date: **05/16/12 10:35**
Matrix: **Ground Water Grab**

Sample Description: AP-2

Parameters	Result	Qual	Prep Date	Analysis Date	Analyst	Method
General Chemistry - PIA						X
Cyanide	0.012 mg/L		05/25/12 12:40	05/29/12 09:53	lgtth	335.4
Solids - total dissolved solids (TDS)	7600 mg/L		05/22/12 08:32	05/22/12 09:37	BNS	SM 2540C 18Ed
Soluble Anions - PIA						
Chloride, Dissolved	2300 mg/L		06/04/12 16:01	06/04/12 16:01	PLI	EPA 300.0 R2.1
Fluoride, Dissolved	< 2.5 mg/L		05/21/12 22:13	05/21/12 22:13	SJW	EPA 300.0 R2.1
Nitrate, Dissolved	< 0.20 mg/L	H	05/21/12 22:30	05/21/12 22:30	PLI	EPA 300.0 R2.1
Sulfate, Dissolved	1300 mg/L		06/04/12 16:01	06/04/12 16:01	PLI	EPA 300.0 R2.1
Soluble General Chemistry - PIA						
Hardness	5000 mg CaCO3/L		05/29/12 15:35	05/29/12 15:35	SMP	SM 2340C 18Ed
Soluble Metals - PIA						
Antimony, Dissolved	< 3.0 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Arsenic, Dissolved	31 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Barium, Dissolved	140 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Beryllium, Dissolved	< 1.0 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Boron, Dissolved	180000 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Cadmium, Dissolved	< 1.0 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Chromium, Dissolved	59 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Cobalt, Dissolved	3.1 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Copper, Dissolved	4.9 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Iron, Dissolved	160 ug/L		05/24/12 10:28	05/24/12 14:43	JMW	SW 6010B
Lead, Dissolved	< 1.0 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Manganese, Dissolved	40 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Mercury, Dissolved	< 0.20 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Nickel, Dissolved	100 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Selenium, Dissolved	86 ug/L		06/01/12 11:51	06/04/12 07:57	JMW	SW 6020
Silver, Dissolved	< 5.0 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Thallium, Dissolved	< 1.0 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020
Zinc, Dissolved	8.4 ug/L		06/01/12 11:51	06/01/12 13:51	JMW	SW 6020

PDC Laboratories, Inc.
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ACCREDITED IN ACCORDANCE WITH nelac

Ameren Illinois Company - Duck Creek
17751 North Cilco Road
Canton, IL 61520-8761
Attn: John Berry

Date Received: 05/18/12 5:15
Report Date: 06/06/12
Customer #: 232857
PO#: 552820

Laboratory Results

Notes

This report shall not be reproduced, except in full, without the written approval of the laboratory.

PDC Laboratories participates in the following accreditation/certification and proficiency programs at the following locations. Endorsement by Federal or State Governments or their agencies is not implied.

PIA PDC Laboratories - Peoria, IL
NELAC Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications: Kansas (E-10338); Missouri (870); Wisconsin (998284430); Indiana (C-IL-040); Iowa (240)
Wastewater Certifications: Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
Hazardous/Solid Waste Certifications; Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
UST Certification; Iowa (240)
SPM PDC Laboratories - Springfield, MO
EPA DMR-QA Program
STL PDC Laboratories - St. Louis, MO
NELAC Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS EPA Lab No. E-10389

X Sulfide positive. Treated.
H Test performed after the expiration of the appropriate regulatory/advisory maximum allowable hold time.

Gail J. Schindler

Certified by: Gail J. Schindler, Project Manager

PDC LABORATORIES, INC.
2231 WEST ALTORFER DRIVE
PEORIA, IL 61615

ASH POND WELLS

PHONE # 800-752-6651
FAX # 309-692-9689

State where samples collected IL.

CHAIN OF CUSTODY RECORD

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT) - (SAMPLE ACCEPTANCE POLICY ON REVERSE)

1 CLIENT	PROJECT NUMBER	P.O. NUMBER	MEANS SHIPPED
AMEREN - Dck Creek			
ADDRESS: 17751 N. CICCO ROAD.	PHONE NUMBER: 668-3868	FAX NUMBER	DATE SHIPPED
CITY, STATE, ZIP: CANTON, IL. 61520	SAMPLER (PLEASE PRINT): BRIAN CRUNG / JOHN BERRY		
CONTACT PERSON: JOHN BERRY	SAMPLER'S SIGNATURE:		

MATRIX TYPES: WW-WASTEWATER, DW-DRINKING WATER, GW-GROUND WATER, WWSL-SLUDGE, NAS-SOLID, LCHT-LEACHATE, OTHER:

3 ANALYSIS REQUESTED

4 (FOR LAB USE ONLY)
LOGIN #: 20528527-2
LOGGED BY:
LAB PROJ. #:
TEMPLATE: ASH Pond
PROJ. MGR.:

2 SAMPLE DESCRIPTION AS YOU WANT ON REPORT	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	REMARKS
AP-1N	5/16/12	10:00	X			3	RUN ASH POND PARAMETERS. SEE GAIL SCHNEIDER
AP-2	5/16/12	10:35	X			3	SEE GAIL SCHNEIDER

5 TURNAROUND TIME REQUESTED (PLEASE CIRCLE) (RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE) NORMAL RUSH DATE RESULTS NEEDED

RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE E-MAIL

FAX # PHONE # EMAIL ADDRESS

6 *The sample temperature will be measured upon receipt at the lab. By initialing this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.*

7	DATE	TIME		DATE	TIME
RELINQUISHED BY: (SIGNATURE)	5-18-12	1412	RECEIVED BY: (SIGNATURE)	5/18/12	1426
RELINQUISHED BY: (SIGNATURE)	5/17/12	1515	RECEIVED BY: (SIGNATURE)		
RELINQUISHED BY: (SIGNATURE)			RECEIVED AT LAB BY: (SIGNATURE)	5/18/12	10:15

8 COMMENTS: (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 4 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR N
SAMPLE(S) RECEIVED ON ICE Y OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION Y OR N
BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) Y OR N
(EXCLUDES TYPICAL FIELD PARAMETERS)
DATE AND TIME TAKEN FROM SAMPLE BOTTLE

Copies: white should accompany samples to PDC Labs. Yellow copy to be retained by the client.

PAGE _____ OF _____

APPENDIX C3

GROUNDWATER ANALYTICAL RESULTS SINCE 2000

Appendix C-3
Groundwater Analytical Results Since 2000
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM01	4/25/2000			0.25				10						3.4	2800		10						1900	3400		
OM01	9/19/2000			1.7				8.7						2.9	2500		9.1						2000	3500		
OM01	4/24/2001			0.36				11						6.7	2400		10						1900	3377		
OM01	9/13/2001			0.2				11						3.8	2600		11						2200	3400		
OM01	4/24/2002			0.24				11						1.3	1779		8.4						1600	2900		
OM01	9/24/2002			0.18				11						2.7	2700		11						2000	3300		
OM01	4/17/2003			0.16				13						2.4	2200		9.7						1900	3200		
OM01	9/23/2003			0.2				10						4.6	2500		10						2000	3500		
OM01	4/12/2004			0.15				10						6	3100		8.8						1900	3400		
OM01	9/23/2004			0.18				8.2						8	2900		8.2						1800	3700		
OM01	4/18/2005			0.14				10						5.3	2700		9.2						1800	3000		
OM01	9/19/2005			5.4				75						9.4	2500		10						1600	3700		
OM01	4/28/2006			0.17				10						9.8	2600		9.4						1900	3500		
OM01	9/7/2006			0.17				14						5.4	2300		7.7						1700	3100		
OM01	4/2/2007			0.27				14						5	2400		8.2						1800	3400		
OM01	9/19/2007			0.1				12						6.3	1900		5.6						1800	3200		
OM01	3/26/2008			0.46				12						7.5	1900		9.8						1800	3200		
OM01	6/2/2008			0.15				10						3.6	1700		8.7						1900	3400		
OM01	8/18/2008			0.23				14						6.7	2300		9.3						2000	3300		
OM01	4/29/2009			0.17				18						1.5	2600		8.5						2000	3200		
OM01	9/23/2009			0.18				16						7.2	2600		9.2						2400	3400		
OM01	12/11/2009			0.32				17						0.089	2400		8.1						2100	3300		
OM01	4/27/2010			0.16				16						5.2	2500		8.3						2000	3400		
OM01	9/9/2010			0.22				20						10	2700		9.5						2000	3400		
OM01	2/22/2011	<0.005	<0.001	0.18	0.019	<0.001	<0.001	21	<0.005	0.033	<0.004	<0.003	<0.25	1	2600	<0.0002	9.3	0.055	<0.02	<0.001	<0.003	0.002	1800	3300	<0.001	0.014
OM01	4/28/2011	<0.005	0.002	0.17	0.018	<0.001	<0.001	18	<0.005	0.026	<0.004	<0.003	0.28	3.9	2600	<0.0002	8.6	0.026	<0.02	<0.001	<0.003	0.004	2100	3500	<0.001	0.015
OM01	8/25/2011	<0.005	0.002	0.18	0.02	<0.001	<0.001	24	<0.005	0.035	<0.004	<0.003	<2.5	8.3	2700	<0.0002	9.3	0.054	0.04	<0.001	<0.003	0.007	2000	3200	<0.001	0.017
OM01	10/13/2011	<0.005	0.003	0.16	0.015	<0.001	<0.001	15	<0.005	0.023	<0.004	<0.003	<0.25	9.6	2100	<0.0002	7.7	0.03	0.16	<0.001	<0.003	0.007	1500	2400	<0.001	0.011
OM01	2/22/2012	<0.005	0.003	0.18	0.017	<0.001	<0.001	18	<0.005	0.032	<0.004	<0.003	<0.25	8.1	990	<0.0002	8.3	0.053	0.64	<0.001	<0.003	0.008	1800	3200	<0.001	0.015
OM01	5/3/2012	<0.005	<0.001	0.16	0.017	<0.001	<0.001	18	<0.005	0.032	<0.004	<0.003	<0.25	7.2	3300	<0.0002	9	0.042	<0.02	<0.001	<0.003	0.001	1900	3400	<0.001	0.025
OM01	8/24/2012	<0.005	0.001	0.19	0.015	<0.001	<0.001	9.5	<0.005	0.033	<0.004	<0.003	<0.25	10	2900	<0.0002	8.3	0.077	0.03	<0.001	<0.003	0.002	2400	3400	<0.001	0.01
OM01	11/2/2012	<0.005	0.002	0.67	0.014	<0.001	<0.001	34	<0.005	0.033	<0.004	<0.003	0.49	9.4	2600	<0.0002	8.5	0.04	0.11	<0.001	<0.003	0.004	1800	3200	<0.001	0.016
OM01	2/5/2013	<0.0025	0.001	0.23	0.015	<0.0005	<0.0005	17	<0.005	0.03	<0.002	<0.0015	<0.25	9.7	2700	<0.0001	8.8	0.018	0.05	<0.0005	<0.0015	<0.0005	2000	3400	<0.0005	0.011
OM01	5/2/2013	<0.005	0.003	0.21	0.041	<0.001	<0.001	20	<0.005	0.033	<0.004	<0.003	<0.25	9.3	2600	<0.0002	8.8	0.053	<0.02	<0.001	<0.003	<0.001	2900	3200	<0.001	0.025
OM01	7/29/2013	<0.005	0.002	1.6	0.019	<0.001	<0.001	21	<0.005	0.031	<0.004	<0.003	<0.25	10	2500	<0.0002	8.4	0.045	<0.02	<0.001	<0.003	<0.001	1900	3400	<0.001	0.018
OM01	10/18/2013	<0.005	0.002	0.22	0.017	<0.001	<0.001	21	<0.005	0.027	<0.004	<0.003		11	2200	<0.0001	7.7	0.016	<0.02	<0.001	<0.003	<0.001	2000	3100	<0.001	0.009
OM01	3/30/2014	<0.005	0.003	0.17	0.014	<0.001	<0.001	18	<0.005	0.018	<0.004	<0.003		8.7	1500	<0.0002	5.8	0.012	0.4	<0.001	<0.003	<0.001	1300	2000	<0.001	0.026
OM01	4/23/2014	<0.005	0.002	0.23	0.014	<0.001	<0.001	21	<0.005	0.032	<0.004	<0.003		11	2400	<0.0002	8.8	0.018	<0.02	<0.001	<0.003	0.004	2600	3200	<0.001	0.015
OM01	7/17/2014			0.25				23						10	2400		8.2						2000	3500		
OM01	4/17/2015			0.74				22						0.41	1900		4.5						1600	2500		
OM01	9/14/2015			0.19				21						12	2700		8.7						1800	3200		
OM02	4/25/2000			0.76				66						0.9	870		2.2						280	1100		
OM02	9/19/2000			3				140						1.4	970		2.2						320	1300		
OM02	4/24/2001			2				160						1.3	900		2.3						340	1323		
OM02	9/13/2001			2.4				140						1.5	1100		2.6						370	1300		
OM02	4/25/2002			4.5				110						1.3	897		2.3						280	1200		
OM02	9/24/2002			2.5				110						1.1	820		2.4						280	1100		
OM02	4/17/2003			2.1				150						0.23	890		2.8						290	1200		
OM02	9/23/2003			2.7				150						1.9	750		2.1						340	1400		
OM02	4/12/2004			2.4				170						0.33	920		2.4						320	1300		
OM02	9/23/2004			3.2				190						3.4	1100		1.8						330	1400		
OM02	4/18/2005			3				190						0.95	990		2.5						340	3000		
OM02	9/19/2005			3.6				150						2.2	880		2.8						260	1400		
OM02	4/28/2006			3.3				210						0.74	990		2.7						330	1400		
OM02	9/7/2006			5.3				260						1.9	900		2.4						370	1500		
OM02	4/2/2007			4.4				240						0.98	1000		2.5						380	1500		
OM02	9/19/2007			5.5				230						0.8	1100		2.7						350	1500		
OM02	3/26/2008			6.4				260						0.88	960		3						340	1400		
OM02	6/2/2008			6.6				260						1.3	1000		2.5						340	1500		
OM02	8/18/2008			7.4				270						1.4	940		2.6						350	1500		

Appendix C-3
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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM02	4/29/2009			6.9				290						2.1	1800		2.5						330	1400		
OM02	9/23/2009			7.3				230						1.4	930		2.3						360	1300		
OM02	12/11/2009			7.2				230						0.52	880		2.1						300	1300		
OM02	4/27/2010			6				240						1	940		2.5						310	1300		
OM02	9/9/2010			5.7				200						1.1	890		2.4						260	1300		
OR02	6/2/2008			4				230						1.4	1400		2.6						340	1500		
OR02	8/18/2008			5.2				240						2.2	930		2.8						320	1500		
OR02	4/29/2009			2.2				230						1.6	2400		2.8						330	1400		
OR02	9/23/2009			5.2				270						1.8	970		2.6						350	1400		
OR02	12/11/2009			3.9				250						1.8	1000		2.9						400	1400		
OR02	4/27/2010			3.2				230						3	1000		2.8						320	1500		
OR02	9/9/2010			3.9				250						2.7	1000		2.6						360	1400		
OR02	2/22/2011	<0.005	0.003	3.1	0.032	<0.001	<0.001	220	<0.005	0.007	0.006	<0.003	<0.25	2.8	1100	<0.0002	3.3	0.048	0.22	<0.001	<0.003	0.003	420	1500	<0.001	0.012
OR02	4/28/2011	<0.005	0.004	2.2	0.036	<0.001	<0.001	280	<0.005	0.008	0.01	<0.003	0.3	5.4	3600	<0.0002	3.5	0.035	<0.02	0.001	<0.003	0.007	350	1500	<0.001	0.013
OR02	8/25/2011	<0.005	0.005	4.3	0.054	<0.001	<0.001	250	<0.005	0.007	0.011	0.007	<0.25	4.1	1200	<0.0002	2.7	0.051	<0.02	0.004	<0.003	0.012	300	1300	<0.001	0.02
OR02	10/13/2011	<0.005	0.004	4.4	0.031	<0.001	<0.001	250	<0.005	0.004	0.005	0.003	0.29	1.6	920	<0.0002	2.8	0.036	<0.02	<0.001	<0.003	0.013	290	1300	<0.001	0.007
OR02	2/22/2012	<0.005	0.005	3.2	0.034	<0.001	<0.001	270	<0.005	0.005	0.007	<0.003	0.29	0.067	1200	<0.0002	2.9	0.043	0.43	<0.001	<0.003	0.018	320	1400	<0.001	0.009
OR02	5/3/2012	<0.005	0.003	3.4	0.031	<0.001	<0.001	250	<0.005	0.006	0.005	0.014	0.25	2.1	1200	<0.0002	3	0.039	<0.02	<0.001	<0.003	0.009	340	1400	<0.001	0.013
OR02	8/24/2012	<0.005	0.004	3.1	0.03	<0.001	<0.001	340	<0.005	0.006	0.01	<0.003	<0.25	2.4	1200	<0.0002	2.8	0.057	0.04	<0.001	<0.003	0.013	390	1500	<0.001	0.007
OR02	11/2/2012	<0.005	0.004	2.9	0.028	<0.001	<0.001	290	<0.005	0.007	<0.004	<0.003	<0.25	2.4	1200	<0.0002	3	0.038	0.06	<0.001	<0.003	0.006	430	1500	<0.001	0.009
OR02	2/5/2013	<0.0025	<0.0005	2.2	0.028	<0.0005	<0.0005	320	<0.005	0.006	<0.002	<0.0015	<0.25	0.21	1200	<0.0001	3.4	0.029	0.24	<0.0005	<0.0015	<0.0005	440	1400	<0.0005	0.007
OR02	5/2/2013	<0.005	0.003	3.9	0.021	<0.001	<0.001	370	<0.005	0.005	0.004	<0.003	<0.25	3.7	1200	<0.0002	2.2	0.032	<0.02	<0.001	<0.003	0.002	510	1500	<0.001	0.01
OR02	7/29/2013	<0.005	0.003	4.6	0.025	<0.001	<0.001	230	<0.005	0.005	0.007	<0.003	0.33	1.6	970	<0.0002	2.5	0.036	0.04	<0.001	<0.003	0.003	310	1400	<0.001	0.009
OR02	10/18/2013	<0.005	0.006	4.8	0.062	<0.001	<0.001	210	<0.005	0.006	0.007	0.004		6.4	850	<0.0001	2.3	0.031	<0.02	0.006	<0.003	<0.001	260	1300	<0.001	0.022
OR02	3/30/2014	<0.005	<0.001	4.2	0.033	<0.001	<0.001	240	<0.005	0.005	<0.004	<0.003		0.13	970	<0.0002	2.7	0.028	0.19	<0.001	<0.003	<0.001	330	1300	<0.001	<0.006
OR02	4/23/2014	<0.005	0.001	5	0.029	<0.001	<0.001	240	<0.005	0.005	<0.004	<0.003		2	890	<0.0002	2.7	0.027	<0.02	<0.001	<0.003	0.002	350	1300	<0.001	<0.006
OR02	7/17/2014			4.4				250						0.096	860		2.5						320	1400		
OR02	4/17/2015			6.3				280						0.044	870		2.5						340	1300		
OR02	9/14/2015			4.6				230						1.6	980		2.3						300	1200		
OM03D	4/25/2000			1.6				13						0.65	960		1.4						430	1300		
OM03D	9/19/2000			2				12						1.4	890		1.4						400	1300		
OM03D	4/24/2001			1.6				14						1.2	900		1.3						420	1298.5		
OM03D	9/13/2001			1.5				14						2.1	990		1.2						440	1200		
OM03D	4/24/2002			1.4				13						1.1	728		1.1						270	1200		
OM03D	9/24/2002			1.5				16						0.8	840		1.4						360	1200		
OM03D	4/17/2003			1.4				19						1.2	800		1.2						340	1200		
OM03D	9/23/2003			1.2				14						0.79	820		1.1						330	1200		
OM03D	4/12/2004			1.3				15						0.19	940		1.2						340	1100		
OM03D	9/23/2004			1.3				14						0.19	910		1						330	1200		
OM03D	4/18/2005			1.3				15						0.27	830		1.1						340	1200		
OM03D	9/19/2005			1.3				16						0.54	760		1.2						280	1200		
OM03D	4/28/2006			1.7				18						3.5	890		1.1						360	1200		
OM03D	9/7/2006			1.6				18						0.5	700		1						340	1200		
OM03D	4/2/2007			1.4				18						0.14	780		0.91						340	1100		
OM03D	9/19/2007			1.8				54						0.6	770		1.2						280	1100		
OM03D	3/26/2008			1.4				28						0.56	630		1						290	1100		
OM03S	4/25/2000			0.91				3.7						0.99	950		0.62						320	1100		
OM03S	9/19/2000			1.3				3.2						5.6	930		0.74						260	1100		
OM03S	4/24/2001			0.35				4.5						5.7	750		0.71						160	923		
OM03S	9/13/2001			0.39				6.7						3.5	830		0.62						310	920		
OM03S	4/25/2002			0.72				4.3						3.6	949		0.65						160	970		
OM03S	9/24/2002			0.4				17						3.4	770		0.68						200	920		
OM03S	4/17/2003			0.34				4.2						3.1	680		0.52						180	920		
OM03S	9/23/2003			0.35				<5						4.5	840		0.55						220	980		
OM03S	4/12/2004			0.41				7.9						5.1	880		0.61						310	1100		
OM03S	9/23/2004			0.28				3.3						4.3	880		0.52						170	910		
OM03S	4/18/2005			0.44				3.4						4.7	830		0.62						230	2800		
OM03S	9/19/2005			0.48				11						2.6	780		0.63						180	960		
OM03S	4/28/2006			0.26				4.2						3	780		0.5						150	810		
OM03S	9/7/2006			0.44				4.1						3.6	610		0.58						170	850		

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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM03S	4/2/2007			0.46				5.9						1.7	890		0.63						200	910		
OM03S	9/19/2007			0.48				2						3.4	710		0.59						220	970		
OM03S	3/26/2008			0.45				3						3.9	850		0.45						220	950		
OR03D	6/2/2008			3.8				140						1.8	770		1.3						340	1400		
OR03D	8/18/2008			3.5				110						0.94	820		1.6						330	1300		
OR03D	4/29/2009			2.3				280						2.2	1000		1.5						390	1100		
OR03D	9/23/2009			2.3				86						2.6	880		1.4						370	1200		
OR03D	12/11/2009			2.4				100						2.6	840		1.4						440	1200		
OR03D	4/27/2010			2.3				78						2.8	810		1.4						290	1200		
OR03D	9/9/2010			2.3				65						2.7	950		1.3						320	1200		
OR03D	2/22/2011	<0.005	0.005	2.3	0.058	<0.001	<0.001	62	<0.005	<0.002	<0.004	<0.003	<0.25	3.2	1500	<0.0002	1.3	0.017	<0.02	<0.001	<0.003	0.003	310	1200	<0.001	<0.006
OR03D	4/28/2011	<0.005	0.007	3.4	0.063	<0.001	<0.001	86	<0.005	<0.002	<0.004	<0.003	0.27	3.5	890	<0.0002	1.3	0.007	<0.02	<0.001	<0.003	0.004	330	1300	<0.001	<0.006
OR03D	8/25/2011	<0.005	0.008	3.6	0.063	<0.001	<0.001	71	<0.005	0.002	0.005	0.004	<0.25	2.9	1200	<0.0002	1.3	0.019	0.08	<0.001	<0.003	0.008	330	1200	<0.001	<0.006
OR03D	10/13/2011	<0.005	0.004	2.4	0.067	<0.001	<0.001	67	<0.005	<0.002	<0.004	0.009	0.3	1.3	870	<0.0002	1.2	0.013	<0.02	<0.001	<0.003	0.007	320	1100	<0.001	0.014
OR03D	2/22/2012	<0.005	0.007	2.8	0.07	<0.001	<0.001	79	<0.005	<0.002	<0.004	<0.003	<0.25	3.5	910	<0.0002	1.2	0.016	0.05	<0.001	<0.003	0.005	380	1200	<0.001	<0.006
OR03D	5/3/2012	<0.005	0.002	2.9	0.063	<0.001	<0.001	84	<0.005	<0.002	<0.004	0.003	<0.25	0.021	810	<0.0002	0.94	0.012	0.54	<0.001	<0.003	0.007	510	1200	<0.001	0.024
OR03D	8/24/2012	<0.005	0.004	2.5	0.051	<0.001	<0.001	82	<0.005	<0.002	0.004	<0.003	<0.25	0.064	860	<0.0002	1.1	0.022	0.22	<0.001	<0.003	0.008	460	1300	<0.001	<0.006
OR03D	11/2/2012	<0.005	0.005	3.6	0.048	<0.001	<0.001	84	<0.005	<0.002	<0.004	<0.003	<0.25	2.3	950	<0.0002	1.2	0.01	<0.02	<0.001	<0.003	0.003	360	1200	<0.001	<0.006
OR03D	2/5/2013	<0.0025	0.003	2.7	0.046	<0.0005	<0.0005	76	<0.005	0.002	<0.002	<0.0015	<0.25	1.4	930	<0.0001	1.2	0.003	0.13	<0.0005	<0.0015	<0.0005	380	1200	<0.0005	0.004
OR03D	5/1/2013	<0.005	0.001	2.6	0.049	<0.0005	<0.001	74	<0.005	<0.002	<0.004	<0.003	<0.25	0.72	890	<0.0002	1.2	<0.005	0.29	<0.001	<0.003	<0.001	410	1100	<0.001	0.008
OR03D	7/29/2013	<0.005	0.003	2.9	0.047	<0.001	<0.001	69	<0.005	<0.002	<0.004	<0.003	<0.25	0.57	860	<0.0002	1.2	0.012	0.19	<0.001	<0.003	<0.001	330	1200	<0.001	0.007
OR03D	10/18/2013	<0.005	0.002	2.4	0.043	<0.001	<0.001	64	<0.005	<0.002	<0.004	<0.003		0.85	780	<0.0001	0.95	<0.005	0.29	<0.001	<0.003	<0.001	330	1200	<0.001	0.008
OR03D	3/30/2014	<0.005	0.003	2.4	0.051	<0.001	<0.001	68	<0.005	<0.002	<0.004	0.016		0.62	890	<0.0002	1.2	0.008	0.07	<0.001	<0.003	<0.001	340	1200	<0.001	0.007
OR03D	4/23/2014	<0.005	0.005	2.6	0.054	<0.001	<0.001	68	<0.005	<0.002	<0.004	<0.003		2.2	840	<0.0002	1.3	<0.005	<0.02	<0.001	<0.003	<0.001	370	1200	<0.001	<0.006
OR03D	7/17/2014			1.6				44						0.51	1300		8.6						230	860		
OR03D	10/13/2014																1.2									
OR03D	4/17/2015			3.1				82						<0.01	900		1.1						390	1300		
OR03D	9/14/2015			5				150						3.3	11000		0.74						350	1400		
OR03S	6/2/2008			0.53				20						0.56	760		1						200	970		
OR03S	8/18/2008			0.98				17						0.57	740		0.95						210	940		
OR03S	4/29/2009			0.49				19						3	1100		0.7						170	830		
OR03S	9/23/2009			0.51				20						2.6	820		0.65						220	920		
OR03S	12/11/2009			0.52				13						1.6	750		0.61						190	880		
OR03S	4/27/2010			0.41				15						2.5	690		0.59						180	1200		
OR03S	9/9/2010			0.34				18						3.8	700		0.62						160	850		
OR04D	4/24/2000			110				1300						6.5	3200		1.1						1300	5000		
OR04D	9/18/2000			110				1600						6.8	2900		1.1						1600	5600		
OR04D	4/24/2001			110				1200						7.8	2800		1.1						1100	4570		
OR04D	9/13/2001			140				1400						6.8	3400		1.4						1300	5600		
OR04D	4/24/2002			84				770						6.5	3396		1						690	4900		
OR04D	9/24/2002			13				1400						6	3500		1.3						1200	5300		
OR04D	4/17/2003			110				1600						6.4	2900		1.2						1200	5200		
OR04D	9/23/2003			110				1400						6.8	3200		1.1						1200	5200		
OR04D	4/12/2004			91				1400						6.4	3400		1.1						1200	5300		
OR04D	9/24/2004			110				1500						7	3600		1.1						1200	5500		
OR04D	4/18/2005			120				1500						6.4	3100		1.1						1200	5400		
OR04D	9/19/2005			110				1100						5.8	3000		1.2						1000	5100		
OR04D	4/28/2006			100				1300						5.9	2800		1.1						1100	4800		
OR04D	9/7/2006			120				1500						6.6	3100		1.1						1300	5000		
OR04D	4/2/2007			91				1300						1.5	2800		0.8						1200	4800		
OR04D	9/19/2007			120				1400						0.51	3100		1.2						1200	5500		
OR04D	3/27/2008			120				1800						6.6	3000		1.1						1200	5300		
OR04D	6/2/2008			120				1600						6.4	2300		1.2						1200	6400		
OR04D	8/18/2008			110				1200						6.4	2900		1.1						1100	5200		
OR04D	4/29/2009			120				1700						5.7	3800		1.2						1800	5100		
OR04D	9/22/2009			52				750						0.058	1400		0.01						720	2700		
OR04D	12/8/2009			0.12				9.6						3.6	730		2.6						140	830		
OR04D	4/27/2010			63				620						6.4	2400		0.87						890	3500		
OR04D	9/8/2010			60				840						5.6	2300		0.94						1300	3700		
OR04D	2/22/2011	<0.005	0.006	58	0.06	<0.001	<0.001	590	<0.005	0.007	0.017	<0.003	<0.25	6.1	2500	<0.0002	0.84	0.076	<0.02	<0.001	<0.003	0.013	1000	3200	<0.001	<0.006

Appendix C-3
Groundwater Analytical Results Since 2000
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OR04D	4/29/2011	<0.005	0.006	59	0.063	<0.001	<0.001	570	<0.005	0.004	0.022	<0.003	0.38	4.1	1800	<0.0002	0.59	0.048	0.06	0.014	<0.003	0.02	970	3100	<0.001	<0.006
OR04D	8/25/2011	<0.005	0.007	52	0.12	<0.001	<0.001	530	<0.005	0.004	0.019	0.004	<0.25	1.4	2000	<0.0002	0.31	0.061	1.7	<0.001	<0.003	0.026	690	2300	<0.001	<0.006
OR04D	10/13/2011	<0.005	0.006	45	0.054	<0.001	<0.001	580	<0.005	0.005	0.013	<0.003	<2.5	3.3	1800	<0.0002	0.57	0.053	0.22	<0.001	<0.003	0.028	1100	2700	<0.001	<0.006
OR04D	2/22/2012	<0.005	0.009	46	0.064	<0.001	<0.001	460	<0.005	0.005	0.013	<0.003	<0.25	2.3	1800	<0.0002	0.45	0.061	0.63	<0.001	<0.003	0.03	820	2600	<0.001	0.007
OR04D	5/3/2012	<0.005	0.01	73	0.029	<0.001	<0.001	590	<0.005	<0.002	0.019	<0.003	<0.25	6.3	2600	<0.0002	0.95	0.056	0.04	<0.001	<0.003	0.024	1200	3200	<0.001	0.012
OR04D	8/24/2012	<0.005	0.008	42	0.033	<0.001	<0.001	440	<0.005	0.008	0.015	<0.003	0.41	7.1	2200	<0.0002	0.75	0.086	0.02	<0.001	<0.003	0.019	1200	2900	<0.001	<0.006
OR04D	11/2/2012	<0.005	0.007	36	0.028	<0.001	<0.001	470	<0.005	0.007	0.005	<0.003	<0.25	6.3	1900	<0.0002	0.69	0.053	0.15	<0.001	<0.003	0.009	1100	2700	<0.001	<0.006
OR04D	2/4/2013	<0.0025	<0.0005	38	0.048	<0.0005	<0.0005	350	<0.005	0.006	<0.002	<0.0015	<0.25	0.62	1800	<0.0001	0.58	0.038	0.26	<0.0005	<0.0015	<0.0005	950	2600	<0.0005	0.012
OR04D	5/2/2013	<0.005	0.007	42	0.058	<0.001	<0.001	320	<0.005	0.008	0.008	<0.003	<0.25	6.7	1800	<0.0002	0.7	0.057	<0.02	<0.001	<0.003	0.004	1000	2500	<0.001	<0.006
OR04D	7/31/2013	<0.005	0.007	40	0.031	<0.001	<0.001	440	<0.005	0.002	0.011	<0.003	<0.25	4.3	2000	<0.0002	0.72	0.041	0.07	<0.001	<0.003	0.008	1100	3100	<0.001	0.008
OR04D	10/21/2013	<0.005	0.005	33	0.033	<0.001	<0.001	490	<0.005	<0.002	<0.004	<0.003		4.8	1800	<0.0002	0.75	0.021	0.05	<0.001	<0.003	<0.001	1300	2800	<0.001	<0.006
OR04D	3/30/2014	<0.005	<0.001	29	0.071	<0.001	<0.001	390	<0.005	0.003	<0.004	<0.003		0.065	1600	<0.0002	0.37	0.032	1.6	<0.001	<0.003	<0.001	900	2200	<0.001	0.008
OR04D	4/24/2014	<0.005	<0.001	36	0.034	<0.001	<0.001	310	<0.005	0.005	<0.004	<0.003		3.8	1600	<0.0002	0.67	0.03	<0.02	<0.001	<0.003	0.001	1000	2600	<0.001	<0.006
OR04D	7/18/2014			19				280						0.016	920		0.03						680	1700		
OR04D	4/17/2015			18				210						0.018	730		0.018						610	1200		
OR04D	9/15/2015			11				130						3.2	1800		0.47						690	1700		
OM04S	4/24/2000			100				1900						4.4	3100		1.8						1900	4600		
OM04S	9/18/2000			0.32				9.6						0.61	950		3.2						310	1100		
OM04S	4/24/2001			1				15						0.67	910		3						280	1033		
OM04S	9/13/2001			0.097				8.7						2.1	1000		3.8						310	1100		
OM04S	4/25/2002			0.31				5.3						0.53	852		3						190	1000		
OM04S	9/24/2002			0.82				7.7						0.4	880		3.3						240	940		
OM04S	4/17/2003			0.12				9.4						0.27	760		3						250	1000		
OM04S	9/23/2003			0.74				7.8						1.5	910		3.4						290	1100		
OM04S	4/12/2004			0.97				6.5						1.1	1000		2.6						240	1000		
OM04S	9/23/2004			0.18				6.3						2.1	1100		3						240	1000		
OM04S	4/18/2005			1.4				7.8						1.3	850		2.8						240	980		
OM04S	9/19/2005			0.061				7.6						2	860		3.9						200	1000		
OM04S	4/28/2006			0.13				7.2						0.82	770		2.8						220	930		
OM04S	9/7/2006			0.078				7.8						2.6	700		3						260	990		
OM04S	4/2/2007			0.28				9.8						0.01	690		2.1						190	770		
OM04S	9/19/2007			0.18				5.2						0.9	490		2						140	600		
OM04S	3/27/2008			0.78				14						0.069	920		2.2						220	850		
OM04S	6/2/2008			0.076				8.6						0.011	690		2.5						210	910		
OM04S	8/18/2008			0.24				8.9						1.4	760		3.2						210	960		
OM04S	4/29/2009			0.15				280						<0.01	850		2.4						240	930		
OM04S	9/22/2009			0.095				12						3	740		2.8						190	880		
OM04S	12/8/2009			46				780						0.012	1600		0.012						700	2700		
OM04S	4/27/2010			0.11				10						0.024	700		2						170	820		
OM04S	9/8/2010			0.18				13						2.3	850		3						220	860		
OM04S	2/22/2011	<0.005	<0.001	0.15	0.046	<0.001	<0.001	9.8	<0.005	0.01	<0.004	<0.003	<0.25	3.2	770	<0.0002	3.2	0.02	<0.02	<0.001	<0.003	0.001	200	880	<0.001	0.008
OM04S	4/29/2011	<0.005	<0.001	0.14	0.035	<0.001	<0.001	15	<0.005	0.003	<0.004	<0.003	0.31	0.41	720	<0.0002	2.5	0.01	0.16	<0.001	<0.003	<0.001	160	800	<0.001	0.01
OM04S	8/25/2011	<0.005	<0.001	0.093	0.049	<0.001	<0.001	18	<0.005	0.01	<0.004	0.005	0.25	3.1	1100	<0.0002	3	0.018	<0.02	<0.001	<0.003	0.003	190	860	<0.001	0.006
OM04S	10/13/2011	<0.005	0.001	0.14	0.048	<0.001	<0.001	12	<0.005	0.009	<0.004	<0.003	0.33	3.7	790	<0.0002	3.3	0.014	0.45	<0.001	<0.003	0.002	200	820	<0.001	<0.006
OM04S	2/22/2012	<0.005	0.002	0.63	0.046	<0.001	<0.001	17	<0.005	0.009	<0.004	<0.003	<0.25	4.5	790	<0.0002	2.8	0.017	0.06	<0.001	<0.003	0.004	190	790	<0.001	<0.006
OM04S	5/3/2012	<0.005	<0.001	0.11	0.041	<0.001	<0.001	12	<0.005	0.008	<0.004	<0.003	0.26	3.3	710	<0.0002	2.6	0.011	0.06	<0.001	<0.003	0.002	190	810	<0.001	0.012
OM04S	8/24/2012	<0.005	<0.001	0.091	0.045	<0.001	<0.001	13	<0.005	0.01	<0.004	<0.003	0.26	4	820	<0.0002	3	0.024	0.03	<0.001	<0.003	0.002	190	880	<0.001	<0.006
OM04S	11/2/2012	<0.005	0.001	0.67	0.045	<0.001	<0.001	15	<0.005	0.011	<0.004	<0.003	<0.25	4.1	840	<0.0002	2.9	0.012	<0.02	<0.001	<0.003	<0.001	220	920	<0.001	<0.006
OM04S	2/4/2013	<0.0025	0.001	0.23	0.048	<0.0005	<0.0005	16	<0.005	0.008	<0.002	<0.0015	0.29	2	750	<0.0001	2.8	0.006	<0.02	<0.0005	<0.0015	<0.0005	160	780	<0.0005	<0.003
OM04S	5/2/2013	<0.005	<0.001	0.13	0.034	<0.001	<0.001	14	<0.005	0.008	<0.004	<0.003	0.28	0.25	710	<0.0002	2.2	0.012	<0.02	<0.001	<0.003	<0.001	160	730	<0.001	0.019
OM04S	7/31/2013	<0.005	0.002	0.46	0.043	<0.001	<0.001	14	<0.005	0.01	<0.004	<0.003	0.27	3.6	750	<0.0002	2.7	0.013	<0.02	<0.001	<0.003	<0.001	170	810	<0.001	<0.006
OM04S	10/21/2013	<0.005	0.001	0.26	0.042	<0.001	<0.001	16	<0.005	0.01	<0.004	<0.003		3.5	740	<0.0002	3	0.006	0.04	<0.001	<0.003	<0.001	210	840	<0.001	<0.006
OM04S	3/30/2014	<0.005	0.001	0.14	0.048	<0.001	<0.001	14	<0.005	0.008	<0.004	<0.003		4.3	730	<0.0002	2.8	0.005	<0.02	<0.001	<0.003	<0.001	170	820	<0.001	<0.006
OM04S	4/24/2014	<0.005	<0.001	0.2	0.042	<0.001	<0.001	13	<0.005	0.007	<0.004	<0.003	0.25	0.049	670	<0.0002	2.6	<0.005	0.14	<0.001	<0.003	<0.001	200	760	<0.001	0.007
OM04S	7/18/2014			0.8				18						2.9	660		2.4						170	750		
OM04S	4/17/2015			1.2				14						4.2	720		2.6						150	720		
OM04S	9/15/2015			1				13						6	750		2.8						160	870		
OM05D	4/24/2000			5.5				97						7	1600		0.73						440	1500		
OM05D	9/18/2000			4.8				120						7	970		0.8						530	1500		
OM05D	4/24/2001			4.6				120						7	960		0.72						460	1540		

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OM05D	9/13/2001			5.1				140						7.4	1100		0.79						520	1600		
OM05D	4/25/2002			4.6				110						3.7	784		0.41						350	1400		
OM05D	9/25/2002			5.1				160						6.7	1100		0.83						490	1700		
OM05D	4/17/2003			5				270						6.4	990		0.76						470	1200		
OM05D	9/23/2003			5				140						8	1000		1						480	1600		
OM05D	4/12/2004			5.1				160						7.3	1300		0.78						500	1100		
OM05D	9/23/2004			5				160						10	1100		0.99						480	1700		
OM05D	4/18/2005			4.8				150						5.6	980		0.57						470	1600		
OM05D	9/19/2005			5				120						6.6	950		0.9						410	1600		
OM05D	4/28/2006			4.6				150						0.029	1000		0.008						490	1500		
OM05D	9/7/2006			5				150						6.2	740		0.84						500	1500		
OM05D	4/2/2007			5				150						<0.01	1100		0.014						490	1500		
OM05D	9/19/2007			4.7				150						7.2	880		0.92						490	1500		
OM05D	3/27/2008			6.1				180						8.1	870		0.72						460	1500		
OM05D	6/3/2008			7.4				250						4.5	1000		1.2						490	1800		
OM05D	8/18/2008			9				230						8.2	1100		1.3						490	1800		
OM05D	4/30/2009			9.4				240						0.025	1100		0.009						480	1600		
OM05D	9/22/2009			8				280						6.2	1100		1.2						680	1800		
OM05D	12/8/2009			8				240						7.4	1100		1.3						540	1700		
OM05D	4/27/2010			7.8				240						0.075	1000		0.095						500	1700		
OM05D	9/8/2010			6.7				250						6.8	1100		0.94						570	1800		
OM05S	4/24/2000			3.1				13						12	830		0.73						240	1000		
OM05S	9/18/2000			0.73				5.8						13	640		0.78						280	990		
OM05S	4/24/2001			0.82				8						5.4	920		1.2						350	1150		
OM05S	9/13/2001			1				5.8						12	860		0.69						240	1000		
OM05S	4/25/2002			0.5				10						11	1100		0.94						310	1200		
OM05S	9/25/2002			0.62				6.2						12	860		0.73						240	1000		
OM05S	4/17/2003			0.59				6.2						11	700		0.73						240	1000		
OM05S	9/23/2003			0.78				7						12	780		0.67						250	990		
OM05S	4/12/2004			0.51				8.4						11	1100		0.68						290	910		
OM05S	9/23/2004			0.55				7.1						12	780		0.63						240	1000		
OM05S	4/18/2005			0.94				13						9.8	1200		1.4						580	1200		
OM05S	9/19/2005			0.56				7.4						11	740		0.73						210	990		
OM05S	4/28/2006			0.59				6.2						16	760		0.77						230	980		
OM05S	9/7/2006			0.64				8						11	670		0.63						220	930		
OM05S	4/2/2007			1.3				40						0.53	1500		0.86						870	2000		
OM05S	9/19/2007			0.58				6.8						9.4	890		0.64						240	1000		
OM05S	3/27/2008			0.63				7.7						9.3	2300		0.57						220	910		
OM05S	6/3/2008			2.1				8.8						10	960		0.6						250	940		
OM05S	8/18/2008			0.73				9.8						11	770		0.64						220	970		
OM05S	4/30/2009			0.56				59						4.5	2200		1						1100	2400		
OM05S	9/22/2009			0.69				27						10	800		0.63						270	1000		
OM05S	12/8/2009			0.58				32						14	1400		2.4						800	1900		
OM05S	4/27/2010			0.46				14						12	1000		2.4						450	1300		
OM05S	9/8/2010			0.55				13						11	960		1.3						300	1000		
OR05D	6/3/2008			6.5				220						8.9	1200		0.78						470	1700		
OR05D	8/18/2008			4.9				170						10	990		0.78						400	1500		
OR05D	4/30/2009			6.4				190						0.013	1000		0.4						380	1500		
OR05D	9/22/2009			6.3				240						0.062	1100		0.7						480	1600		
OR05D	12/8/2009			6.8				220						0.098	1100		0.73						510	1600		
OR05D	4/27/2010			5.7				180						0.31	980		0.54						440	1500		
OR05D	9/8/2010			3.9				140						5.7	1100		1.2						400	1300		
OM06	9/19/2000			2.1				16						1.8	660		0.97						350	1100		
OM06	4/24/2001			1.8				21						9.3	560		1.1						360	1447		
OM06A	4/24/2000			2.6				18						1.4	650		0.85						340	1200		
OM06A	9/13/2001			2.2				19						2.1	700		0.89						420	1100		
OM06A	4/24/2002			2.6				21						2	606		0.73						280	1100		
OM06A	9/24/2002			2.2				25						2.1	680		0.92						350	1100		
OM06A	4/17/2003			2				26						1	540		0.95						340	1200		
OM06A	9/23/2003			2				23						2	640		0.88						360	1100		

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OM06A	4/12/2004			1.8				23						0.2	700		0.63						350	1100		
OM06A	9/23/2004			1.9				22						2.2	816		0.78						350	1200		
OM06A	4/18/2005			1.8				22						0.92	590		0.98						330	1100		
OM06A	9/19/2005			1.9				23						3.3	550		0.87						330	1100		
OM06A	4/28/2006			1.8				22						0.18	570		0.59						330	1100		
OM06A	9/7/2006			1.9				21						1.6	510		0.83						350	1100		
OM06A	4/2/2007			1.9				23						0.21	600		0.86						350	1100		
OM06A	9/19/2007			1.8				17						1.5	490		0.89						340	1100		
OM06A	3/27/2008			1.8				22						1.7	530		0.69						320	1100		
OM06A	6/2/2008			1.9				23						1.2	1100		0.85						340	1100		
OM06A	8/18/2008			1.8				21						1.6	550		0.88						330	1100		
OM06A	4/30/2009			1.9				31						1.6	800		0.89						340	1100		
OM06A	9/22/2009			1.4				22						1.8	690		2.9						370	1100		
OM06A	12/8/2009			2				27						1.1	610		0.97						330	1100		
OM06A	4/27/2010			1.7				23						5.3	600		0.78						350	1200		
OM06A	9/8/2010			1.3				20						2	720		1.2						360	1100		
OR06A	6/2/2008			1.4				24						1	1500		2.6						360	1100		
OR06A	8/18/2008			1.6				23						1.3	650		2.6						350	1100		
OR06A	4/30/2009			1.3				24						0.54	780		2.6						340	1100		
OR06A	9/22/2009			1.9				25						2.4	600		1.2						450	1100		
OR06A	12/8/2009			1.4				21						0.68	660		1.6						360	1100		
OR06A	4/27/2010			1.2				20						1.6	1500		2.6						410	1100		
OR06A	9/8/2010			1.5				25						4.4	910		2.8						420	1200		
OR06A	2/22/2011	<0.005	0.004	1.7	0.067	<0.001	<0.001	28	<0.005	0.009	0.006	0.009	<0.25	11	1000	<0.0002	3.1	0.052	0.13	0.01	<0.003	0.002	370	1200	<0.001	0.032
OR06A	4/29/2011	<0.005	0.008	1.5	0.1	<0.001	<0.001	24	<0.005	0.009	0.006	0.008	<0.25	8	1100	<0.0002	3.1	0.042	<0.02	0.01	<0.003	0.002	370	1100	<0.001	0.025
OR06A	8/26/2011	<0.005	0.005	1.7	0.035	<0.001	<0.001	35	<0.005	0.006	0.005	0.003	<0.25	2.3	820	<0.0002	3	0.036	0.04	<0.001	<0.003	0.006	410	1200	<0.001	<0.006
OR06A	10/14/2011	<0.005	0.006	1.6	0.039	<0.001	<0.001	22	<0.005	0.005	<0.004	0.003	<0.25	2.6	750	<0.0002	3	0.035	<0.02	<0.001	<0.003	0.006	290	1100	<0.001	<0.006
OR06A	2/22/2012	<0.005	0.002	1.6	0.031	<0.001	<0.001	25	<0.005	0.004	<0.004	<0.003	<0.25	0.068	810	<0.0002	2.2	0.03	0.1	<0.001	<0.003	0.009	400	1200	<0.001	<0.006
OR06A	5/4/2012	<0.005	0.003	2.2	0.035	<0.001	<0.001	31	<0.005	0.004	0.005	<0.003	<0.25	0.77	810	<0.0002	2.6	0.032	0.06	<0.001	<0.003	0.002	400	1200	<0.001	0.008
OR06A	8/24/2012	<0.005	0.006	1.5	0.04	<0.001	<0.001	27	<0.005	0.005	<0.004	0.007	<0.25	3.1	890	<0.0002	2.6	0.043	0.02	0.001	<0.003	0.005	390	1200	<0.001	0.018
OR06A	11/1/2012	<0.005	0.006	1.6	0.045	<0.001	<0.001	27	<0.005	0.004	<0.004	<0.003	<0.25	2	800	<0.0002	2.5	0.03	0.03	<0.001	<0.003	0.003	450	1200	<0.001	<0.006
OR06A	2/4/2013	<0.0025	0.001	1.7	0.035	<0.0005	<0.0005	31	<0.005	0.004	<0.002	<0.0015	<0.25	0.16	830	<0.0001	2.5	0.022	<0.02	<0.0005	<0.0015	<0.0005	390	1100	<0.0005	<0.003
OR06A	5/3/2013	<0.005	0.002	1.6	0.041	<0.001	<0.001	30	<0.005	0.002	<0.004	<0.003	<0.25	0.041	840	<0.0002	2.2	0.035	0.13	<0.001	<0.003	0.001	390	1100	<0.001	<0.006
OR06A	7/31/2013	<0.005	0.004	1.7	0.04	<0.001	<0.001	30	<0.005	0.007	<0.004	<0.003	<0.25	2.3	860	<0.0002	2.9	0.028	<0.02	<0.001	<0.003	<0.001	410	1200	<0.001	<0.006
OR06A	10/18/2013	<0.005	0.004	1.6	0.032	<0.001	<0.001	30	<0.005	0.004	<0.004	<0.003		2.3	710	<0.0001	2.2	0.019	<0.02	<0.001	<0.003	<0.001	420	1100	<0.001	<0.006
OR06A	3/30/2014	<0.005	0.002	1.4	0.039	<0.001	<0.001	30	<0.005	0.003	<0.004	0.042		0.33	720	<0.0002	2	0.02	0.09	<0.001	<0.003	<0.001	360	1100	<0.001	<0.006
OR06A	4/24/2014	<0.005	<0.001	1.4	0.029	<0.001	<0.001	25	<0.005	<0.002	<0.004	<0.003	<0.25	0.069	730	<0.0002	1.9	0.017	0.18	<0.001	<0.003	<0.001	350	1100	<0.001	<0.006
OR06A	7/17/2014			1.3				28						2	860		2.5						370	1100		
OR06A	4/17/2015			1.5				32						0.043	2400		2.2						380	1100		
OR06A	9/14/2015			1.4				31						2.9	1600		2.3						320	1100		
OM07	4/24/2000			1.7				16						0.75	870		1.1						660	960		
OM07	9/19/2000			1.7				23						2.3	780		1						140	1600		
OM07	4/24/2001			1.8				23						2	760		1.1						660	1617		
OM07	9/13/2001			1.9				18						2.3	910		0.71						670	1600		
OM07	4/24/2002			1.9				12						2.2	755		0.62						340	1600		
OM07	9/24/2002			1.8				18						1.4	820		1						690	1600		
OM07	4/17/2003			1.7				18						2.2	720		0.73						650	1700		
OM07	9/23/2003			1.3				17						0.51	930		1.7						610	1500		
OM07	4/12/2004			1.5				19						2	840		0.72						680	1600		
OM07	9/23/2004			1.3				17						0.95	970		1.5						660	1600		
OM07	4/18/2005			1.1				15						<0.01	890		0.031						580	1500		
OM07	9/19/2005			1.6				19						0.81	830		1.7						650	1600		
OM07	4/28/2006			1.2				17						0.29	920		0.84						640	1600		
OM07	9/7/2006			1.4				16						0.19	920		2						640	1500		
OM07	4/2/2007			1.2				17						<0.01	870		0.034						620	1400		
OM07	9/19/2007			1.5				18						1.1	690		1.1						720	1700		
OM07	3/27/2008			1.5				19						1.7	700		0.75						690	1600		
OM07	6/2/2008			1.5				18						0.035	830		1.5						700	1600		
OM07	8/19/2008			1.4				20						0.63	1400		1.5						630	1600		
OM07	4/30/2009			1.5				23						0.02	960		0.97						660	1600		

Appendix C-3
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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM07	9/22/2009			1.6				22						0.69	890		2						730	1600		
OM07	12/8/2009			1.6				20						0.51	870		1.5						800	1600		
OM07	4/27/2010			1.5				27						0.017	820		1.2						670	1600		
OM07	9/8/2010			0.8				21						<0.01	940		0.23						530	1300		
OM07	2/22/2011	<0.005	<0.001	0.87	0.027	<0.001	<0.001	19	<0.005	<0.002	<0.004	<0.003	<0.25	0.027	770	<0.0002	0.22	0.014	0.26	<0.001	<0.003	0.001	410	1100	<0.001	0.01
OM07	4/29/2011	<0.005	<0.001	1	0.05	<0.001	<0.001	12	<0.005	<0.002	<0.004	<0.003	<0.25	0.45	820	<0.0002	1.3	0.006	0.12	<0.001	<0.003	0.003	420	1200	<0.001	<0.006
OM07	8/25/2011	<0.005	<0.001	1.5	0.028	<0.001	<0.001	15	<0.005	0.003	<0.004	0.004	0.29	0.46	930	<0.0002	1.4	0.014	<0.02	<0.001	<0.003	0.003	440	1100	<0.001	<0.006
OM07	10/14/2011	<0.005	<0.001	0.92	0.026	<0.001	<0.001	13	<0.005	<0.002	<0.004	0.003	0.29	0.7	780	<0.0002	1.5	0.013	<0.02	<0.001	<0.003	0.002	370	1100	<0.001	<0.006
OM07	2/22/2012	<0.005	0.001	0.75	0.026	<0.001	<0.001	14	<0.005	<0.002	<0.004	<0.003	<0.25	<0.01	790	<0.0002	0.23	0.012	0.24	<0.001	<0.003	0.004	390	1100	<0.001	<0.006
OM07	5/4/2012	<0.005	<0.001	0.8	0.028	<0.001	<0.001	13	<0.005	<0.002	<0.004	<0.003	0.29	0.012	780	<0.0002	1.3	0.009	0.13	<0.001	<0.003	0.003	280	1000	<0.001	<0.006
OM07	8/24/2012	<0.005	<0.001	0.58	0.026	<0.001	<0.001	18	<0.005	<0.002	<0.004	<0.003	0.26	0.027	770	<0.0002	0.65	0.019	0.1	<0.001	<0.003	0.003	390	1000	<0.001	<0.006
OM07	11/1/2012	<0.005	<0.001	0.75	0.028	<0.001	<0.001	15	<0.005	<0.002	<0.004	<0.003	0.26	0.07	760	<0.0002	1.2	0.007	0.05	<0.001	<0.003	0.001	430	1000	<0.001	<0.006
OM07	2/4/2013	<0.0025	<0.0005	0.53	0.026	<0.0005	<0.0005	18	<0.005	<0.001	<0.002	<0.0015	0.29	<0.01	780	<0.0001	0.19	<0.0025	0.26	<0.0005	<0.0015	<0.0005	310	960	<0.0005	<0.003
OM07	5/3/2013	<0.005	<0.001	0.72	0.025	<0.001	<0.001	15	<0.005	<0.002	<0.004	<0.003	0.26	0.074	740	<0.0002	0.92	0.011	0.1	<0.001	<0.003	<0.001	320	930	<0.001	<0.006
OM07	7/31/2013	<0.005	<0.001	0.72	0.03	<0.001	<0.001	12	<0.005	0.003	<0.004	<0.003	0.31	0.38	680	<0.0002	2	0.009	<0.02	<0.001	<0.003	<0.001	330	950	<0.001	<0.006
OM07	10/18/2013	<0.005	<0.001	0.72	0.028	<0.001	<0.001	13	<0.005	0.002	<0.004	<0.003		0.28	680	<0.0001	1.7	<0.005	0.11	<0.001	<0.003	<0.001	430	940	<0.001	0.007
OM07	3/30/2014	<0.005	<0.001	0.87	0.031	<0.001	<0.001	13	<0.005	<0.002	<0.004	<0.003		0.18	700	<0.0002	1.2	<0.005	0.09	<0.001	<0.003	<0.001	290	940	<0.001	<0.006
OM07	4/24/2014	<0.005	<0.001	0.71	0.029	<0.001	<0.001	10	<0.005	<0.002	<0.004	<0.003	<0.25	0.011	630	<0.0002	1.2	<0.005	0.18	<0.001	<0.003	<0.001	300	900	<0.001	<0.006
OM07	7/17/2014			1.3				18						0.14	620		1.6						310	960		
OM07	4/17/2015			1				19						1.2	750		2.9						280	960		
OM07	9/14/2015			0.43				13						1.2	850		2.7						240	940		
OM08	4/25/2000			0.1				4.3						2.6	2400		4.1						1900	3000		
OM08	9/18/2000			0.11				4.7						4	2400		3.7						2100	3200		
OM08	4/24/2001			0.14				5						5.9	2500		5.4						2000	3327		
OM08	9/13/2001			0.12				5.2						5.3	2900		4.7						1900	3500		
OM08	4/25/2002			0.15				5.1						5	2839		4.7						1200	3500		
OM08	9/25/2002			0.15				4.6						2.8	3000		4.9						2000	3600		
OM08	4/18/2003			0.063				4.4						5.5	2200		4.5						1800	3200		
OM08	9/23/2003			0.044				6.2						6.5	2400		4.5						1900	3200		
OM08	4/13/2004			2.7				4.5						5.7	3300		3.5						1800	3200		
OM08	9/23/2004			0.11				5						9.3	2600		3.9						1800	3300		
OM08	4/19/2005			0.13				4						8.9	2600		4.4						2000	3500		
OM08	9/20/2005			0.096				3.8						12	2400		5.2						1800	3400		
OM08	4/28/2006			1.6				21						5.5	2000		4.1						1700	3200		
OM08	9/7/2006			0.093				7.2						13	2400		3.8						1700	3000		
OM08	4/2/2007			0.39				4.4						10	2100		3.2						1700	2900		
OM08	9/19/2007			0.096				2.5						14	2200		4.6						1900	3300		
OM08	3/27/2008			0.099				3.3						9.1	5100		3.2						1600	2800		
OM08	6/3/2008			0.071				4.8						12	2400		4.6						1800	3200		
OM08	8/19/2008			0.09				4.7						13	2500		4.3						1800	3200		
OM08	4/29/2009			0.1				7.9						7.6	3500		4.8						2000	3200		
OM08	9/21/2009			0.17				5						4.8	2400		4.2						1800	3100		
OM08	12/11/2009			0.22				7.7						<0.01	2400		4.4						2000	3100		
OM08	4/27/2010			0.1				3.6						<0.01	2000		4.5						1400	2400		
OM08	9/7/2010			8.7				370						15	3100		4.3						1300	3100		
OM08	2/23/2011	<0.005	0.024	19	0.052	<0.001	<0.001	310	<0.005	0.018	0.022	0.016	0.52	31	2600	<0.0002	5.5	0.072	0.29	0.017	<0.003	0.007	1200	2600	<0.001	0.078
OM08	4/28/2011	<0.005	0.009	18	0.046	<0.001	<0.001	310	<0.005	0.012	0.015	<0.003	0.38	12	3000	<0.0002	5.2	0.026	0.4	<0.001	<0.003	0.015	1200	2900	<0.001	0.022
OM08	8/25/2011	<0.005	0.015	6.2	0.023	<0.001	<0.001	150	<0.005	0.006	0.006	<0.003	<0.25	8.1	1400	<0.0002	2	0.023	0.07	<0.001	<0.003	0.006	620	1400	<0.001	0.008
OM08	10/12/2011	<0.005	0.011	11	0.029	<0.001	<0.001	270	<0.005	0.012	0.009	<0.003	1.4	14	2600	<0.0002	5.6	0.033	0.05	<0.001	<0.003	0.014	1700	3300	<0.001	0.016
OM08	2/24/2012	<0.005	0.012	11	0.026	<0.001	<0.001	180	<0.005	0.011	0.008	<0.003	<0.25	9.9	2300	<0.0002	4.3	0.046	0.1	<0.001	<0.003	0.021	880	2500	<0.001	0.015
OM08	5/4/2012	<0.005	0.009	10	0.025	<0.001	<0.001	200	<0.005	0.012	0.006	<0.003	<2.5	14	2400	<0.0002	4.9	0.038	<0.02	<0.001	<0.003	0.008	1400	3500	<0.001	0.019
OM08	8/24/2012	<0.005	0.01	6.6	0.026	<0.001	<0.001	190	<0.005	0.012	0.007	<0.003	<0.25	14	2500	<0.0002	4.5	0.068	<0.02	<0.001	<0.003	0.01	2400	3300	<0.001	0.012
OM08	11/1/2012	<0.005	0.009	6.9	0.028	<0.001	<0.001	170	<0.005	0.011	<0.004	<0.003	<0.25	13	2400	<0.0002	4.9	0.029	0.03	<0.001	<0.003	0.006	2000	3200	<0.001	0.017
OM08	2/5/2013	<0.0025	0.009	10	0.046	<0.0005	<0.0005	210	<0.005	0.01	0.002	0.003	<0.25	16	2400	<0.0001	4.3	0.014	0.08	0.002	<0.0015	<0.0005	1700	3000	<0.0005	0.026
OM08	5/15/2013	<0.005	0.003	15	0.025	<0.001	<0.001	490	<0.005	0.013	<0.004	<0.003	<0.25	10	2600	<0.0002	5.5	0.016	0.11	<0.001	<0.003	<0.001	2100	3500	<0.001	0.025
OM08	7/26/2013	<0.005	0.011	13	0.039	<0.001	<0.001	370	<0.005	0.013	0.009	0.003	<0.25	13	2900	<0.0002	4.6	0.044	0.05	0.002	<0.003	0.004	1700	3300	<0.001	0.023
OM08	10/21/2013	<0.005	0.009	9.6	0.029	<0.001	<0.001	320	<0.005	0.01	<0.004	<0.003		10	2200	<0.0002	5	0.013	0.18	<0.001	<0.003	<0.001	1900	3200	<0.001	0.009
OM08	3/30/2014	<0.005	0.004	9.3	0.026	<0.001	<0.001	290	<0.005	0.01	<0.004	<0.003		15	2400	<0.0002	4.9	0.013	<0.02	<0.001	<0.003	<0.001	1700	3100	<0.001	0.01
OM08	4/24/2014	<0.005	0.003	13	0.022	<0.001	<0.001	300	<0.005	0.01	<0.004	<0.003		8.9	2300	<0.0002	4.7	0.012	<0.02	<0.001	<0.003	<0.001	1600	3500	<0.001	0.011
OM08	7/17/2014			12				290						11	2000		3.9						1600	3000		

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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM08	4/17/2015			14				340						<0.01	2500		4.3						1700	3200		
OM08	9/14/2015			9.6				250						12	2800		4.3						1500	3100		
OM09	4/25/2000			0.54				11						0.28	1100		2						100	1200		
OM09	9/19/2000			0.75				9						3.6	890		1.6						450	1300		
OM09	4/24/2001			0.61				10						1.7	930		1.8						460	1273		
OM09	9/13/2001			0.74				12						3.7	1200		1.8						490	1300		
OM09	4/25/2002			0.66				9.8						3.1	1153		1.6						410	1300		
OM09	9/24/2002			0.7				13						3	1000		1.8						400	1200		
OM09	4/17/2003			0.57				12						2.1	840		1.4						400	1300		
OM09	9/23/2003			0.55				13						3.3	930		1.4						410	1200		
OM09	4/13/2004			0.55				12						2.1	1100		1.4						440	1300		
OM09	9/23/2004			0.96				11						3.5	1100		1.9						400	1300		
OM09	4/18/2005			0.64				11						0.21	930		2.2						420	1300		
OM09	9/19/2005			0.59				14						3.2	910		1.6						380	1200		
OM09	4/28/2006			0.51				11						1.5	970		1.5						390	1200		
OM09	9/7/2006			0.79				12						3.4	720		1.4						410	1200		
OM09	4/2/2007			0.58				12						1.3	1000		1.3						410	1200		
OM09	9/19/2007			0.56				8.1						3	1600		1.4						400	1200		
OM09	3/27/2008			0.46				11						0.16	1200		1.2						360	1100		
OM09	6/3/2008			0.52				9.8						3	990		1.5						420	1200		
OM09	8/19/2008			0.56				12						3.5	2300		1.3						380	1200		
OM09	4/30/2009			0.59				14						1.8	1400		1.8						470	1200		
OM09	9/22/2009			0.57				12						3.8	940		1.5						370	1200		
OM09	12/11/2009			0.67				9.7						0.17	930		1.2						440	1200		
OM09	4/27/2010			0.53				11						4.8	920		1.4						390	1200		
OM09	9/8/2010			0.55				13						4.2	1100		1.4						470	1200		
OM10	4/25/2000			0.1				6.6						<0.01	1800		1.8						950	2000		
OM10	9/19/2000			0.071				7.2						1.6	1800		0.078						820	1900		
OM10	4/24/2001			0.09				11						0.66	1900		1.1						1100	2370		
OM10	9/13/2001			0.17				7.6						4.1	1800		5.7						1200	2100		
OM10	6/13/2002			0.032				6						0.29	1200		0.37						440	1300		
OM10	9/24/2002			0.12				6.9						0.4	1600		4.1						630	1900		
OM10	4/17/2003			0.18				7.3						0.56	1400		2.6						880	1700		
OM10	9/23/2003			0.18				6.5						13	1400		2.8						600	1600		
OM10	4/12/2004			0.54				23						<0.01	1200		1.3						570	1600		
OM10	9/23/2004			0.29				24						4	2200		3.2						1300	2900		
OM10	4/18/2005			0.29				9.3						0.036	1600		0.19						580	1800		
OM10	9/19/2005			1.5				26						0.04	1800		3.7						1100	2400		
OM10	6/2/2008			0.45				8.8						0.8	1800		1.7						1300	2800		
OM10	8/18/2008			0.12				8.6						3	2200		3.3						1000	2400		
OM10	4/29/2009			0.32				10						2.4	1600		3.1						430	1600		
OM10	9/21/2009			0.024				3.3						0.5	70		0.098						5.5	100		
OM10	12/11/2009			0.043				5.9						2.4	710		3.1						190	670		
OM10	4/27/2010			0.038				5.5						8.4	1900		5.8						1000	2400		
OM10	9/7/2010			0.091				4.6						13	2100		6.3						700	1800		
OM11	4/24/2000			47				440						0.57	1400		2.1						550	2000		
OM11	9/19/2000			56				450						0.71	1000		2.3						570	1900		
OM11	4/24/2001			44				400						0.67	1300		2.1						470	1697		
OM11	9/13/2001			53				440						0.3	1600		2.6						580	1900		
OM11	4/25/2002			20				180						1.4	679		1.1						200	810		
OM11	9/25/2002			41				380						0.38	1100		2.2						450	1600		
OM11	4/18/2003			55				610						0.81	1500		2.8						480	2300		
OM11	9/24/2003			58				610						0.46	1400		2.6						430	2000		
OM11	4/13/2004			54				650						0.22	1600		2.3						440	2300		
OM11	9/23/2004			69				590						0.35	1500		3.5						420	2300		
OM11	4/19/2005			38				390						1.6	990		1.7						330	1800		
OM11	9/20/2005			43				360						0.12	1100		2.2						370	1600		
OM11	4/28/2006			26				260						0.18	850		1.5						310	1300		
OM11	9/7/2006			30				290						0.31	750		1.4						330	1300		
OM11	4/2/2007			20				150						0.068	590		0.91						230	900		

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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM11	9/19/2007			17				130						0.8	450		1.2						220	980		
OM11	3/27/2008			17				130						0.095	540		1						190	850		
OM11	6/3/2008			9.3				150						0.13	570		1.1						180	850		
OM11	8/19/2008			12				150						0.082	540		0.68						150	820		
OM11	4/29/2009			9.5				130						0.028	520		0.45						130	630		
OM11	9/21/2009			5.8				95						<0.01	340		0.2						86	530		
OM11	12/8/2009			7.2				77						0.27	430		1.1						110	550		
OM11	4/27/2010			14				180						0.25	620		1.2						200	980		
OM11	9/7/2010			7.2				99						0.14	480		0.82						140	680		
OR11	6/3/2008			13				160						0.53	1400		0.92						190	910		
OR11	8/19/2008			12				150						0.33	730		0.81						140	800		
OR11	4/29/2009			8.7				150						0.27	920		0.68						120	570		
OR11	9/21/2009			7.5				100						<0.01	380		0.002						110	580		
OR11	12/8/2009			6.1				44						0.067	330		0.34						93	450		
OR11	4/27/2010			8.5				110						0.39	440		0.73						140	690		
OR11	9/7/2010			8.6				110						0.32	500		0.62						150	710		
OR11	2/23/2011	<0.005	0.003	16	0.052	<0.001	<0.001	180	<0.005	<0.002	0.007	<0.003	0.45	0.72	660	<0.0002	1.1	0.023	0.042	<0.001	<0.003	<0.001	210	970	<0.001	<0.006
OR11	4/28/2011	<0.005	0.006	16	0.08	<0.001	<0.001	170	<0.005	0.004	0.013	0.006	0.39	6.3	860	<0.0002	1.3	0.017	<0.02	0.005	<0.003	0.007	220	1000	<0.001	0.019
OR11	8/25/2011	<0.005	0.005	19	0.05	<0.001	<0.001	190	<0.005	<0.002	0.007	<0.003	0.34	1.2	980	<0.0002	1.1	0.019	<0.02	<0.001	<0.003	0.011	240	1100	<0.001	<0.006
OR11	10/12/2011	<0.005	0.005	19	0.039	<0.001	<0.001	200	<0.005	<0.002	0.007	0.008	0.39	1.3	800	<0.0002	1.2	0.06	<0.02	<0.001	<0.003	0.012	240	1100	<0.001	<0.006
OR11	2/24/2012	<0.005	0.007	17	0.043	<0.001	<0.001	150	<0.005	<0.002	0.005	<0.003	0.29	0.82	790	<0.0002	1.1	0.018	<0.02	<0.001	<0.003	0.014	270	1100	<0.001	<0.006
OR11	5/4/2012	<0.005	0.004	16	0.048	<0.001	<0.001	97	<0.005	<0.002	0.004	<0.003	0.37	0.88	760	<0.0002	1.2	0.023	<0.02	<0.001	<0.003	0.007	260	940	<0.001	0.007
OR11	8/24/2012	<0.005	0.005	17	0.035	<0.001	<0.001	220	<0.005	<0.002	0.007	<0.003	0.33	1.4	840	<0.0002	1.1	0.025	<0.02	<0.001	<0.003	0.012	290	1200	<0.001	<0.006
OR11	11/1/2012	<0.005	0.002	13	0.041	<0.001	<0.001	100	<0.005	<0.002	<0.004	<0.003	0.37	0.2	660	<0.0002	0.93	0.011	0.04	<0.001	<0.003	0.003	270	920	<0.001	<0.006
OR11	2/5/2013	<0.0025	0.002	17	0.044	<0.0005	<0.0005	180	<0.005	<0.001	<0.002	<0.0015	0.32	0.94	1200	<0.0001	1.1	0.008	<0.02	<0.0005	<0.0015	<0.0005	350	1000	<0.0005	<0.003
OR11	5/15/2013	<0.005	0.002	8.6	0.035	<0.001	<0.001	57	<0.005	0.002	<0.004	<0.003	0.33	0.46	570	<0.0002	0.8	<0.005	<0.02	<0.001	<0.003	<0.001	210	720	<0.001	<0.006
OR11	7/26/2013	<0.005	0.003	6.4	0.042	<0.001	<0.001	23	<0.005	0.002	<0.004	<0.003	0.44	1.6	500	<0.0002	0.83	0.01	0.03	0.002	<0.003	<0.001	170	540	<0.001	0.008
OR11	10/21/2013	<0.005	0.001	6.1	0.035	<0.001	<0.001	34	<0.005	<0.002	<0.004	<0.003	0.34	0.013	470	<0.0002	0.8	<0.005	0.11	<0.001	<0.003	<0.001	230	600	<0.001	<0.006
OR11	3/30/2014	<0.005	0.002	10	0.039	<0.001	<0.001	110	<0.005	<0.002	<0.004	<0.003		0.88	640	<0.0002	1.1	0.007	<0.02	<0.001	<0.003	<0.001	230	820	<0.001	<0.006
OR11	4/24/2014	<0.005	0.004	11	0.035	<0.001	<0.001	69	<0.005	<0.002	<0.004	<0.003	0.35	1.4	510	<0.0002	0.85	<0.005	<0.02	<0.001	<0.003	<0.001	210	820	<0.001	<0.006
OR11	7/17/2014			4.9				25						0.32	380		0.66						120	500		
OR11	4/17/2015			4.1				27						<0.01	440		0.55						140	540		
OR11	9/14/2015			5.8				46						0.64	660		0.7						140	590		
OM12	4/24/2000			0.19				4.7						21	1300		1.7						450	1500		
OM12	9/19/2000			0.44				3.4						23	1400		1.6						440	1500		
OM12	4/24/2001			0.63				4						22	1300		1.8						440	1490		
OM12	9/13/2001			0.36				6.2						24	1400		1.6						450	1600		
OM12	4/25/2002			0.29				4.7						20	1833		1.7						270	1600		
OM12	9/25/2002			0.34				5						20	1200		1.7						450	1400		
OM12	4/18/2003			0.63				5						25	1200		1.6						380	1400		
OM12	9/24/2003			0.94				5.8						25	1200		1.6						440	1500		
OM12	4/13/2004			1.1				4.6						22	1400		1.4						450	1500		
OM12	9/23/2004			0.77				4.5						22	1400		1.9						420	1600		
OM12	4/19/2005			0.58				5.4						24	1300		1.3						400	1600		
OM12	9/20/2005			0.11				6.2						25	1200		1.6						390	1500		
OM12	4/28/2006			0.058				4.2						24	1200		1.5						370	1500		
OM12	9/7/2006			0.13				5.6						16	1200		1.4						400	1400		
OM12	4/2/2007			3				38						17	1200		1.3						370	660		
OM12	9/19/2007			0.079				4.1						3.4	1100		1.5						380	1400		
OM12	3/27/2008			0.051				3.7						24	1500		1.3						380	1400		
OM12	6/3/2008			0.062				5.5						22	1200		1.5						390	1400		
OM12	8/19/2008			0.2				5.4						22	1300		1.4						380	1400		
OM12	4/29/2009			0.064				67						19	1400		1.4						420	1400		
OM12	9/21/2009			0.2				4.7						1.6	1300		1.3						410	1400		
OM12	12/8/2009			30				370						2.1	2200		0.88						2000	3200		
OM12	4/27/2010			0.17				4.6						0.15	1200		1.4						410	1400		
OM12	9/7/2010			0.12				4.1						25	1200		1.5						340	1400		
OM12	2/23/2011	<0.005	0.032	0.076	0.3	<0.001	<0.001	4.5	<0.005	0.002	<0.004	<0.003	0.32	27	1200	<0.0002	1.5	0.02	0.044	<0.001	<0.003	<0.001	400	1400	<0.001	<0.006
OM12	4/28/2011	<0.005	<0.001	0.39	0.14	<0.001	<0.001	8.3	<0.005	<0.002	<0.004	<0.003	<0.25	0.24	2100	<0.0002	1.4	0.006	1.3	<0.001	<0.003	0.004	370	1400	<0.001	0.012
OM12	8/25/2011	<0.005	0.029	0.086	0.28	<0.001	<0.001	4.8	<0.005	0.002	<0.004	<0.003	0.3	22	1600	<0.0002	1.5	0.021	<0.02	<0.001	<0.003	0.006	390	1300	<0.001	<0.006

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OM12	10/12/2011	<0.005	0.031	0.58	0.31	<0.001	<0.001	4.9	<0.005	<0.002	0.005	<0.003	<0.25	24	1300	<0.0002	1.6	0.01	<0.02	<0.001	<0.003	0.006	380	1400	<0.001	0.006
OM12	2/24/2012	<0.005	0.034	0.17	0.13	<0.001	<0.001	5.6	<0.005	<0.002	<0.004	<0.003	<0.25	19	990	<0.0002	1.4	0.018	0.03	<0.001	<0.003	0.009	350	1300	<0.001	<0.006
OM12	5/4/2012	<0.005	0.001	0.44	0.095	<0.001	<0.001	13	<0.005	<0.002	<0.004	<0.003	<0.25	0.027	990	<0.0002	0.8	0.013	4.4	<0.001	<0.003	0.005	320	1200	<0.001	0.02
OM12	8/24/2012	<0.005	0.018	0.3	0.22	<0.001	<0.001	6.2	<0.005	<0.002	<0.004	<0.003	0.26	16	1300	<0.0002	1.3	0.028	0.73	<0.001	<0.003	0.006	460	1400	<0.001	<0.006
OM12	11/1/2012	<0.005	0.029	0.18	0.32	<0.001	<0.001	5.4	<0.005	0.002	<0.004	<0.003	0.31	24	1300	<0.0002	1.6	0.016	0.09	<0.001	<0.003	0.003	400	1400	<0.001	<0.006
OM12	2/5/2013	<0.0025	0.028	0.3	0.28	<0.0005	<0.0005	6.5	<0.005	0.002	<0.002	<0.0015	0.29	26	1300	<0.0001	1.5	<0.0025	<0.02	<0.0005	<0.0015	<0.0005	390	1400	<0.0005	<0.003
OM12	5/15/2013	<0.005	0.009	0.31	0.2	<0.001	<0.001	5.8	<0.005	<0.002	<0.004	<0.003	<0.25	23	1300	<0.0002	1.7	<0.005	0.03	<0.001	<0.003	<0.001	440	1300	<0.001	0.006
OM12	7/26/2013	<0.005	0.026	0.24	0.26	<0.001	<0.001	6.1	<0.005	0.002	<0.004	<0.003	0.31	22	1300	<0.0002	1.6	0.016	0.05	<0.001	<0.003	<0.001	460	1400	<0.001	<0.006
OM12	10/21/2013	<0.005	0.013	0.16	0.19	<0.001	<0.001	6	<0.005	<0.002	<0.004	<0.003		17	1000	<0.0002	1.5	<0.005	0.06	<0.001	<0.003	<0.001	470	1400	<0.001	<0.006
OM12	3/30/2014	<0.005	0.01	0.17	0.19	<0.001	<0.001	7	<0.005	<0.002	<0.004	<0.003		12	1200	<0.0002	1.3	<0.005	0.99	<0.001	<0.003	<0.001	430	1300	<0.001	<0.006
OM12	4/24/2014	<0.005	<0.001	0.12	0.16	<0.001	<0.001	6	<0.005	0.002	<0.004	<0.003		0.03	1100	<0.0002	1.5	<0.005	0.46	<0.001	<0.003	<0.001	440	1400	<0.001	0.015
OM12	7/17/2014			0.1				5.9						0.062	1100		1.4						460	1400		
OM12	4/17/2015			0.16				6.4						24	1300		1.5						480	1400		
OM12	9/14/2015			0.074				5.4						24	3400		1.4						400	1400		
OM13D	4/24/2000			5.4				150						6	1000		0.73						440	1500		
OM13D	9/18/2000			5.7				130						6.2	920		0.73						480	1500		
OM13D	4/24/2001			5.7				140						6.8	860		0.76						430	1537		
OM13D	9/13/2001			5.5				140						6.2	1000		0.69						460	1600		
OM13D	4/25/2002			6.2				150						5.7	1062		0.81						340	1600		
OM13D	9/25/2002			6.9				140						5.7	1100		0.85						440	1400		
OM13D	4/17/2003			6.9				160						5.5	890		0.84						420	1600		
OM13D	9/23/2003			6.7				170						5.5	970		0.71						420	1500		
OM13D	5/13/2004			6.2				150						5.5	890		0.68						450	1600		
OM13D	9/23/2004			5.7				170						6.1	1000		0.67						420	1600		
OM13D	4/18/2005			6.4				170						5.8	950		0.7						420	1600		
OM13D	9/19/2005			6.9				170						4.1	900		0.81						410	1600		
OM13D	4/28/2006			7.2				190						5.3	1100		0.77						410	1600		
OM13D	9/7/2006			8.2				200						6.5	750		0.78						440	1600		
OM13D	4/3/2007			7.9				170						4.6	890		0.73						380	1400		
OM13D	9/19/2007			6.4				150						4.7	750		0.69						350	1400		
OM13S	4/24/2000			5.2				110						6.8	1100		0.76						440	1500		
OM13S	9/18/2000			5.8				140						7.1	860		0.75						480	1532		
OM13S	4/24/2001			5.4				130						7.5	1000		0.77						440	1540		
OM13S	9/13/2001			6.6				140						7.5	1200		0.85						470	1600		
OM13S	4/24/2002			5.4				86						7	1500		0.71						270	1500		
OM13S	9/25/2002			5.8				120						6.6	1000		0.8						480	1700		
OM13S	4/17/2003			6.2				150						7.2	930		0.85						430	1600		
OM13S	9/23/2003			6.5				180						7.4	1000		0.76						450	1600		
OM13S	5/13/2004			6.9				170						7.8	970		0.76						450	1600		
OM13S	9/23/2004			6.3				180						8.2	1100		0.74						450	1700		
OM13S	4/18/2005			6.8				180						16	1100		0.91						440	1700		
OM13S	9/19/2005			7.9				210						7	1000		0.93						440	1700		
OM13S	4/28/2006			7.4				220						7	1000		0.84						460	1700		
OM13S	9/7/2006			8.9				230						6.4	1100		0.84						470	1700		
OR13D	6/3/2008			4.4				93						3.8	620		0.46						270	1200		
OR13D	8/19/2008			4.2				90						3.7	610		0.42						260	1300		
OR13D	4/30/2009			4				89						3.3	770		0.44						220	1200		
OR13D	9/22/2009			3.8				80						3.6	620		0.45						380	1300		
OR13D	4/27/2010			3.5				67						3.3	580		0.42						250	1200		
OR13D	9/8/2010			3.1				72						3.2	690		0.41						330	1200		
OR13D	2/22/2011	<0.005	<0.001	3	0.026	<0.001	<0.001	54	<0.005	<0.002	<0.004	<0.003	<0.25	0.024	440	<0.0002	0.01	0.013	1.4	<0.001	<0.003	0.003	220	1000	<0.001	0.01
OR13D	4/28/2011	<0.005	0.001	3.1	0.028	<0.001	<0.001	53	<0.005	<0.002	<0.004	<0.003	0.31	0.047	440	<0.0002	0.009	<0.005	1.3	<0.001	<0.003	0.004	220	1100	<0.001	<0.006
OR13D	8/26/2011	<0.005	0.001	3.6	0.028	<0.001	<0.001	57	<0.005	<0.002	0.004	0.007	0.28	0.012	470	<0.0002	0.002	0.009	1.3	<0.001	<0.003	0.006	240	1100	<0.001	<0.006
OR13D	10/14/2011	<0.005	0.013	5.5	0.033	<0.001	<0.001	76	<0.005	<0.002	<0.004	0.005	<0.25	4.1	800	<0.0002	0.58	0.017	0.11	<0.001	<0.003	0.01	190	1200	<0.001	<0.006
OR13D	2/24/2012	<0.005	0.004	3.2	0.025	<0.001	<0.001	56	<0.005	<0.002	<0.004	0.004	<0.25	0.18	660	<0.0002	0.01	0.009	1.3	<0.001	<0.003	0.011	170	1000	<0.001	<0.006
OR13D	5/4/2012	<0.005	0.001	3.2	0.028	<0.001	<0.001	51	<0.005	<0.002	<0.004	0.003	0.28	<0.01	540	<0.0002	0.002	0.006	1.4	<0.001	<0.003	0.005	200	1100	<0.001	0.011
OR13D	8/24/2012	<0.005	0.003	2.9	0.027	<0.001	<0.001	61	<0.005	<0.002	<0.004	0.005	0.28	0.094	520	<0.0002	0.006	0.012	1.4	<0.001	<0.003	0.007	310	1100	<0.001	<0.006
OR13D	11/2/2012	<0.005	0.001	3.3	0.026	<0.001	<0.001	55	<0.005	<0.002	<0.004	0.004	<0.25	0.099	500	<0.0002	0.008	0.006	1.4	<0.001	<0.003	0.003	260	1200	<0.001	<0.006
OR13D	2/4/2013	<0.0025	0.001	2.9	0.02	<0.0005	<0.0005	54	<0.005	<0.001	<0.002	<0.0015	0.25	0.059	500	<0.0001	0.068	0.003	1.7	<0.0005	<0.0015	<0.0005	250	1100	<0.0005	<0.003
OR13D	5/2/2013	<0.005	0.002	3.1	0.031	<0.001	<0.001	46	<0.005	<0.002	<0.004	0.005	<0.25	0.085	530	<0.0002	0.013	0.009	1.5	0.004	<0.003	<0.001	270	1100	<0.001	<0.006

Appendix C-3
Groundwater Analytical Results Since 2000
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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OR13D	7/29/2013	<0.005	<0.001	3.1	0.028	<0.001	<0.001	41	<0.005	<0.002	<0.004	<0.003	<0.25	0.96	540	<0.0002	0.007	0.007	1.6	<0.001	<0.003	<0.001	270	1200	<0.001	<0.006
OR13D	10/21/2013	<0.005	<0.001	2.5	0.028	<0.001	<0.001	44	<0.005	<0.002	<0.004	<0.003		0.022	500	<0.0002	0.003	<0.005	1.8	<0.001	<0.003	<0.001	320	1100	<0.001	<0.006
OR13D	3/30/2014	<0.005	0.002	3.5	0.032	<0.001	<0.001	110	<0.005	<0.002	<0.004	<0.003		0.22	680	<0.0002	0.51	<0.005	0.08	<0.001	<0.003	<0.001	260	1200	<0.001	<0.006
OR13D	4/24/2014	<0.005	0.001	2.9	0.026	<0.001	<0.001	39	<0.005	<0.002	<0.004	<0.003		0.24	490	<0.0002	0.018	<0.005	1.6	<0.001	<0.003	<0.001	300	1200	<0.001	<0.006
OR13D	7/18/2014			2.7				42						0.12	500		0.032						320	1200		
OR13D	4/17/2015			3				41						0.12	540		0.04						330	1200		
OR13D	9/14/2015			2.3				34						0.14	1300		0.34						290	1200		
OR13S	6/3/2008			7.7				230						5.6	1300		0.8						400	1600		
OR13S	8/19/2008			8.3				240						11	2300		0.86						400	1600		
OR13S	4/30/2009			8.4				220						5.9	2000		0.8						400	1500		
OR13S	9/22/2009			8.4				220						3.6	970		0.8						420	1500		
OR13S	12/8/2009			8.5				210						4.9	950		0.8						370	1600		
OR13S	4/27/2010			6.9				170						7.3	840		0.73						360	1500		
OR13S	9/8/2010			5.8				150						2.8	940		0.61						360	1300		
OR13S	2/22/2011	<0.005	0.007	5.3	0.032	<0.001	<0.001	120	<0.005	<0.002	<0.004	<0.003	<0.25	4.3	770	<0.0002	0.59	0.02	<0.02	<0.001	<0.003	0.003	270	1200	<0.001	0.016
OR13S	4/28/2011	<0.005	0.07	5.2	0.054	<0.001	<0.001	100	<0.005	<0.002	<0.004	<0.003	0.29	14	740	<0.0002	0.66	0.01	<0.02	0.004	<0.003	0.006	270	1300	<0.001	0.009
OR13S	8/26/2011	<0.005	0.003	5.9	0.032	<0.001	<0.001	110	<0.005	<0.002	0.007	0.006	0.26	0.046	660	<0.0002	0.46	0.016	0.68	<0.001	<0.003	0.009	290	1200	<0.001	<0.006
OR13S	10/14/2011	<0.005	0.002	3.1	0.027	<0.001	<0.001	51	<0.005	<0.002	<0.004	0.006	0.26	0.016	570	<0.0002	0.003	0.011	1.3	<0.001	<0.003	0.007	220	1100	<0.001	<0.006
OR13S	2/24/2012	<0.005	0.012	5	0.037	<0.001	<0.001	88	<0.005	<0.002	<0.004	0.003	<0.25	4.5	760	<0.0002	0.54	0.016	<0.02	<0.001	<0.003	0.013	220	1200	<0.001	<0.006
OR13S	5/4/2012	<0.005	0.011	5	0.033	<0.001	<0.001	82	<0.005	<0.002	<0.004	<0.003	0.28	4.8	690	<0.0002	0.54	0.011	0.03	<0.001	<0.003	0.003	220	1200	<0.001	0.01
OR13S	8/24/2012	<0.005	0.014	4.4	0.032	<0.001	<0.001	99	<0.005	<0.002	<0.004	0.004	0.26	4.8	700	<0.0002	0.52	0.021	0.26	<0.001	<0.003	0.009	260	1200	<0.001	<0.006
OR13S	11/2/2012	<0.005	0.011	5	0.031	<0.001	<0.001	51	<0.005	<0.002	<0.004	0.003	<0.25	4.2	690	<0.0002	0.49	0.01	0.07	<0.001	<0.003	0.004	130	1200	<0.001	<0.006
OR13S	2/4/2013	<0.0025	0.006	4.6	0.029	<0.0005	<0.0005	90	<0.005	<0.001	<0.002	<0.0015	<0.25	0.92	710	<0.0001	0.52	0.005	0.05	<0.0005	<0.0015	<0.0005	260	1200	<0.0005	<0.003
OR13S	5/2/2013	<0.005	0.003	5.1	0.036	<0.001	<0.001	91	<0.005	<0.002	0.005	0.005	0.29	0.049	700	<0.0002	0.42	0.014	0.03	<0.001	<0.003	0.001	270	1200	<0.001	<0.006
OR13S	7/29/2013	<0.005	0.008	5.1	0.03	<0.001	<0.001	100	<0.005	<0.002	<0.004	<0.003	<0.25	3.7	690	0	0.54	0.011	<0.02	<0.001	<0.003	0.002	270	1200	<0.001	<0.006
OR13S	10/21/2013	<0.005	0.31	3.7	0.12	0.001	<0.001	100	<0.005	0.004	0.005	0.01		37	720	<0.0002	0.83	0.021	0.04	0.043	0.006	0.001	280	1200	<0.001	0.033
OR13S	3/30/2014	<0.005	<0.001	2.6	0.031	<0.001	<0.001	45	<0.005	<0.002	<0.004	<0.003		0.04	540	<0.0002	0.018	<0.005	1.6	<0.001	<0.003	<0.001	290	1200	<0.001	<0.006
OR13S	4/24/2014	<0.005	0.008	4.5	0.036	<0.001	<0.001	100	<0.005	<0.002	<0.004	<0.003		4.8	620	<0.0002	0.53	<0.005	<0.2	<0.001	<0.003	<0.001	270	1200	<0.001	<0.006
OR13S	7/18/2014			4.2				100						3.9	610		0.51						300	1200		
OR13S	4/17/2015			4.6				120						0.045	1200		0.47						290	1300		
OR13S	9/14/2015			9				170						5.4	5500		0.41						290	1300		
OM14	4/24/2000			0.61				5.1						2.3	790		0.61						240	920		
OM14	9/18/2000			0.65				6.9						2.3	640		0.65						200	800		
OM14	4/24/2001			0.63				6.5						2.7	630		0.57						190	807		
OM14	9/13/2001			0.71				7.5						9.5	830		1						210	870		
OM14	4/25/2002			0.57				6.8						2.3	674		0.56						170	830		
OM14	9/25/2002			0.54				6.8						2	700		0.6						170	750		
OM14	4/17/2003			0.58				7.4						2.2	660		0.62						160	770		
OM14	9/23/2003			0.47				7.3						2.2	640		0.68						150	710		
OM14	4/12/2004			0.5				6.2						1.5	860		0.54						160	740		
OM14	9/23/2004			0.54				6.1						2	720		0.59						130	730		
OM14	4/19/2005			0.77				16						2.7	752		0.71						290	970		
OM14	9/19/2005			0.51				7.9						0.97	570		0.36						150	720		
OM14	4/28/2006			0.63				7.6						0.19	650		0.16						160	690		
OM14	9/8/2006			0.59				13						1.8	670		0.63						210	800		
OM14	4/2/2007			1.4				16						<0.01	570		0.011						190	690		
OM14	9/19/2007			0.8				21						<0.01	500		0.005						240	840		
OM14	3/27/2008			14				290						0.023	1100		0.26						580	1900		
OM14	6/3/2008			130				1400						0.017	1700		0.085						950	5500		
OM14	8/19/2008			180				2400						0.035	3500		0.31						910	2500		
OR14D	4/30/2009			34				460						1.6	2200		2.5						980	3200		
OR14D	9/22/2009			27				470						1	1600		2.1						970	2500		
OR14D	12/8/2009			25				310						1.9	1700		2.6						1200	2600		
OR14D	4/27/2010			14				180						9.1	1700		2.5						990	2400		
OR14D	9/8/2010			17				260						0.026	1200		0.011						680	1900		
OR14D	2/22/2011	<0.005	0.001	17	0.038	<0.001	<0.001	230	<0.005	<0.002	0.008	<0.003	0.29	<0.01	1200	<0.0002	0.035	0.023	1.7	<0.001	<0.003	0.006	680	1800	<0.001	0.019
OR14D	4/29/2011	<0.005	0.001	16	0.028	<0.001	<0.001	200	<0.005	<0.002	0.007	<0.003	<0.25	0.026	1300	<0.0002	0.022	0.007	1.3	<0.001	<0.003	0.006	770	1800	<0.001	<0.006
OR14D	8/25/2011																									
OR14D	8/26/2011	<0.005	0.003	16	0.026	<0.001	<0.001	210	<0.005	<0.002	0.009	0.004	0.47	<0.01	1400	<0.0002	0.002	0.022	1.2	<0.001	<0.003	0.012	760	2000	<0.001	0.007
OR14D	10/13/2011	<0.005	0.002	13	0.023	<0.001	<0.001	170	<0.005	<0.002	0.005	<0.003	0.51	0.94	1500	<0.0002	1.6	0.023	0.2	<0.001	<0.003	0.012	940	2100	<0.001	0.009

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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OR14D	2/22/2012	<0.005	0.004	13	0.021	<0.001	<0.001	170	<0.005	<0.002	0.005	<0.003	<0.25	<0.01	1300	<0.0002	0.004	0.024	0.92	<0.001	<0.003	0.016	780	1800	<0.001	<0.006
OR14D	5/4/2012	<0.005	0.002	13	0.019	<0.001	<0.001	130	<0.005	<0.002	0.004	<0.003	0.41	<0.01	1500	<0.0002	0.002	0.014	0.74	<0.001	<0.003	0.008	670	1800	<0.001	0.007
OR14D	8/24/2012	<0.005	0.003	11	0.02	<0.001	<0.001	140	<0.005	<0.002	0.005	<0.003	0.29	0.017	1400	<0.0002	0.002	0.032	0.84	<0.001	<0.003	0.011	850	1800	<0.001	<0.006
OR14D	11/2/2012	<0.005	0.002	12	0.019	<0.001	<0.001	190	<0.005	<0.002	<0.004	0.004	<0.25	0.01	1400	<0.0002	0.001	0.012	1.1	<0.001	<0.003	0.005	740	1900	<0.001	<0.006
OR14D	2/4/2013	<0.0025	<0.0005	4.5	0.009	<0.0005	<0.0005	86	<0.005	<0.001	<0.002	<0.0015	0.41	0.011	1200	<0.0001	0.46	<0.0025	0.32	<0.0005	<0.0015	<0.0005	700	1600	<0.0005	<0.003
OR14D	5/2/2013	<0.005	0.002	8.7	0.018	<0.001	<0.001	88	<0.005	<0.002	<0.004	<0.003	0.25	0.013	1200	<0.0002	0.003	0.02	0.42	<0.001	<0.003	<0.001	670	1600	<0.001	<0.006
OR14D	7/29/2013	<0.005	0.001	8.9	0.019	<0.001	<0.001	95	<0.005	<0.002	<0.004	<0.003	0.35	<0.01	1200	<0.0002	0.001	0.015	0.4	<0.001	<0.003	<0.001	710	1700	<0.001	<0.006
OR14D	10/21/2013	<0.005	<0.001	7.2	0.02	<0.001	<0.001	120	<0.005	<0.002	<0.004	<0.003		<0.01	1100	<0.0002	0.002	<0.005	0.44	<0.001	<0.003	<0.001	840	1600	<0.001	<0.006
OR14D	3/30/2014	<0.005	<0.001	5.2	0.018	<0.001	<0.001	73	<0.005	<0.002	<0.004	<0.003		0.02	990	<0.0002	0.088	<0.005	0.28	<0.001	<0.003	<0.001	650	1300	<0.001	<0.006
OR14D	4/24/2014	<0.005	<0.001	6.7	0.017	<0.001	<0.001	71	<0.005	<0.002	<0.004	<0.003	0.38	0.045	910	<0.0002	0.007	<0.005	0.3	<0.001	<0.0015	<0.001	600	1400	<0.001	<0.006
OR14D	7/17/2014			6.3				76						<0.01	950		0.005						640	1400		
OR14D	4/17/2015			7.1				100						0.18	1100		0.056						690	1400		
OR14D	9/15/2015			6.3				92						0.031	1200		0.062						650	1600		
OR14S	4/30/2009			32				450						0.44	2300		3.2						1200	3100		
OR14S	9/22/2009			41				620						3.4	2200		3.4						1200	3200		
OR14S	12/8/2009			22				250						0.34	1700		3.2						1300	2500		
OR14S	4/27/2010			13				160						3.5	1700		2.6						1000	2400		
OR14S	9/8/2010			13				140						0.65	1600		2.8						750	2400		
OM15	4/25/2000			0.84				1.8						2	770		0.19						220	1000		
OM15	9/18/2000			0.78				9.4						2.2	620		0.2						240	970		
OM15	4/24/2001			0.73				8.4						2.5	660		0.18						220	980		
OM15	9/13/2001			0.46				8.3						2.5	820		0.2						260	1000		
OM15	4/24/2002			0.73				9.2						3.8	714		0.24						100	1000		
OM15	9/24/2002			0.71				9.2						2.5	630		0.24						220	1000		
OM15	4/17/2003			0.72				10						2.3	620		0.21						210	1000		
OM15	9/23/2003			0.65				10						0.6	640		0.13						220	950		
OM15	4/12/2004			0.63				9.1						2.2	840		0.19						220	980		
OM15	9/23/2004			0.73				7.5						2.6	940		0.21						210	1000		
OM15	4/18/2005			0.77				8.6						2.5	630		0.23						210	960		
OM15	9/19/2005			0.57				9.8						0.05	590		0.22						200	920		
OM15	4/28/2006			0.73				8.8						2.9	630		0.26						220	970		
OM15	9/8/2006			1.2				14						1.8	700		0.13						240	980		
OM15	4/3/2007			0.99				8.9						2.1	620		0.2						220	1500		
OM15	9/20/2007			0.75				7						0.12	850		0.23						220	970		
OM15	3/27/2008			0.57				7.9						1.2	540		0.33						160	910		
OM15	6/2/2008			0.86				8.5						2.2	900		0.22						200	910		
OM15	8/18/2008			0.85				9.3						2	1200		0.24						200	960		
OM15	4/29/2009			0.76				10						1.8	920		0.2						200	940		
OM15	9/21/2009			0.17				4.8						0.094	200		0.017						29	340		
OM15	12/11/2009			0.094				5.4						0.012	420		0.004						32	430		
OM15	4/27/2010			0.17				3.6						0.21	330		0.017						36	390		
OM16	4/25/2000			0.07				5.7						2.3	2900		4.1						2000	3700		
OM16	9/18/2000			0.065				6.1						2.1	2600		3.9						2400	3633		
OM16	4/24/2001			0.08				6.6						0.79	2000		6.6						1200	2503		
OM16	9/13/2001			0.1				18						0.35	2200		6.6						1500	2800		
OM16	4/24/2002			0.11				6.9						3.7	2412		5.4						1100	2900		
OM16	9/24/2002			0.041				7.4						6.2	2700		6.7						1600	3300		
OM16	4/17/2003			0.46				7.6						6.1	2300		7.9						1400	2800		
OM16	9/23/2003			0.065				8.4						2	2200		7						1400	2300		
OM16	4/12/2004			0.066				9.3						8.3	2400		5.3						1500	2800		
OM16	9/23/2004			0.09				9.9						8.8	2900		3.9						1800	3500		
OM16	4/18/2005			0.41				49						13	2500		4.2						2000	3400		
OM16	9/19/2005			0.025				6.4						11	2600		4.5						1300	3300		
OM16	6/7/2006			0.044				6.2						13	2600		4.3						1900	3600		
OM16	9/8/2006			1.1				26						8.3	2600		5.2						1800	3400		
OM16	4/3/2007			0.32				9.3						6.9	2600		3.6						2000	980		
OM16	9/20/2007			0.36				7.5						14	2200		4.3						1900	3600		
OM16	3/27/2008			0.12				17						18	2500		3.9						1800	3300		
OM16	6/2/2008			0.15				4.7						1.9	2400		3.8						2000	3500		
OM16	8/18/2008			0.048				6.3						5	3500		4.3						2000	3500		

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Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM16	4/29/2009			0.061				9.2						0.4	2800		4						2400	3400		
OM16	9/21/2009			0.042				7.6						3.7	2600		4.5						1900	3300		
OM16	12/11/2009			0.051				5.5						5.2	2700		5.5						2400	3600		
OM16	4/28/2010			0.088				5.9						0.052	2700		4.8						2000	3500		
OM16	9/7/2010			0.052				7.1						0.72	2900		6.1						1600	3400		
OM17	4/25/2000			0.12				2						3.9	890		0.49						460	330		
OM17	9/18/2000			0.17				3.1						4.2	1200		1.1						820	1573		
OM17	4/24/2001			0.05				2.1						8.2	1000		1.2						380	923		
OM17	9/13/2001			2.8				2.5						11	970		1.6						440	1200		
OM17	4/24/2002			0.14				2.6						0.16	1051		0.59						360	1300		
OM17	9/24/2002			0.12				3.2						5.5	1400		1.7						730	1700		
OM17	4/17/2003			0.22				8						1.2	680		0.28						330	860		
OM17	9/23/2003			0.12				3.4						0.59	820		0.93						290	1000		
OM17	4/12/2004			0.31				8.7						0.28	860		0.53						240	720		
OM17	4/18/2005			0.16				2.4						0.026	550		0.42						230	720		
OM17	4/3/2007			0.17				2.6						0.054	820		0.042						460	3700		
OM17	8/18/2008			0.14				2.1						0.21	460		2.9						290	680		
OM17	12/11/2009			0.1				6.9						<0.01	770		0.34						340	900		
OM17	9/7/2010			0.1				4.8						0.42	750		1.2						390	880		
OM18	4/25/2000			0.64				6.2						5.3	890		0.23						220	1000		
OM18	9/18/2000			0.56				4.6						5.8	720		0.22						240	1020		
OM18	4/24/2001			0.72				4.4						6.2	780		0.26						240	1050		
OM18	9/13/2001			0.28				5						5.7	970		0.23						200	1000		
OM18	4/24/2002			0.55				3.7						5.8	862		0.22						170	1000		
OM18	9/24/2002			0.52				4.2						5.5	810		0.24						170	1000		
OM18	4/17/2003			0.47				4						5.6	720		0.19						180	970		
OM18	9/23/2003			0.4				4						2.2	620		0.23						81	730		
OM18	4/12/2004			0.47				4.7						5.4	920		0.18						210	970		
OM18	9/23/2004			0.48				4.3						6	1100		0.21						190	1000		
OM18	4/18/2005			0.45				4						0.014	570		0.34						60	700		
OM18	9/19/2005			0.39				3.8						<0.01	580		0.22						64	680		
OM18	4/28/2006			0.53				4.7						4.9	730		0.16						190	940		
OM18	9/8/2006			0.4				4.3						<0.01	590		0.13						65	740		
OM18	4/3/2007			0.43				4.3						<0.01	510		0.11						62	1000		
OM18	9/20/2007			3.9				51						0.013	450		0.25						68	680		
OM18	3/27/2008			0.44				3.5						4.8	460		0.15						73	650		
OM18	6/2/2008			0.63				7.2						6.3	750		0.18						240	1000		
OM18	8/18/2008			0.66				6						5.4	1100		0.21						240	1000		
OM18	4/29/2009			0.42				26						9.3	810		0.27						110	740		
OM18	9/21/2009			0.43				5.3						<0.01	610		0.16						100	750		
OM18	12/11/2009			0.44				8.6						0.97	640		0.25						91	740		
OM18	4/27/2010			0.44				3.2						<0.01	590		0.19						75	730		
OM18	9/7/2010			0.4				4.9						0.034	610		0.18						91	690		
OR18	6/2/2008			0.76				9.8						4.5	670		0.21						300	1200		
OR18	8/18/2008			0.75				8						5.4	1400		0.21						280	1200		
OR18	4/29/2009			0.51				29						6.2	710		0.44						130	810		
OR18	9/21/2009			0.54				6.4						0.2	650		0.23						100	750		
OR18	12/11/2009			0.57				9						4.6	690		0.19						130	790		
OR18	4/27/2010			0.53				3.3						0.013	630		0.12						82	770		
OR18	9/7/2010			0.51				5						0.027	680		0.16						98	770		
OM19	4/24/2000			44				560						9.9	1600		0.68						1200	3700		
OM19	9/19/2000			54				680						11	2900		0.74						1400	3500		
OM19	4/24/2001			53				710						11	2200		0.77						1100	3520		
OM19	9/13/2001			50				550						10	2200		0.88						1300	4000		
OM19	4/24/2002			30				300						10	1682		0.68						750	3400		
OM19	9/24/2002			38				460						8.9	2000		0.69						1100	3500		
OM19	4/18/2003			41				520						9.8	2100		0.64						1200	3400		
OM19	9/24/2003			39				580						11	2000		0.6						1300	3400		
OM19	4/13/2004			42				640						10	2500		0.65						1200	3700		
OM19	9/23/2004			54				670						11	2500		0.89						1200	3900		

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OM19	4/19/2005			17				230						13	2000		0.55						1300	2900		
OM19	9/20/2005			14				140						8.6	1800		0.44						1100	2700		
OM19	4/28/2006			36				680						11	2200		0.67						1200	3700		
OM19	9/7/2006			13				260						2.2	840		0.26						920	2400		
OM19	4/2/2007			18				190						5	1700		0.55						1200	2600		
OM19	9/19/2007			5				96						<0.01	1700		0.028						1200	2600		
OM19	3/27/2008			19				380						7.1	3400		0.51						1200	3200		
OM19	6/3/2008			41				810						11	2000		0.69						1200	4100		
OM19	8/19/2008			10				150						9.3	1900		0.47						1200	2800		
OM19	4/29/2009			6.8				150						8.5	1900		0.46						1300	2600		
OM19	9/21/2009			11				160						<0.01	1800		0.36						1200	2500		
OM19	12/8/2009			13				180						3	1800		0.39						1200	2600		
OM19	4/27/2010			25				320						0.03	1700		0.14						1000	2800		
OM19	9/7/2010			17				270						8.1	1400		0.86						890	2200		
OR19	6/3/2008			68				1000						13	2300		1.3						1200	4800		
OR19	8/19/2008			25				360						12	2200		0.72						1300	3200		
OR19	4/29/2009			22				300						3	2200		0.85						1400	3000		
OR19	9/21/2009			24				340						0.01	2100		0.8						1400	3100		
OR19	12/8/2009			0.87				12						21	1200		1.4						430	1400		
OR19	4/27/2010			34				350						4.8	1700		0.96						1000	2800		
OR19	9/7/2010			18				220						8.8	1600		0.91						980	2200		
OR19	2/23/2011	<0.005	0.004	20	0.022	<0.001	<0.001	200	<0.005	<0.002	0.007	<0.003	0.3	16	1600	<0.0002	0.9	0.027	<0.02	<0.001	<0.003	0.006	830	2200	<0.001	0.007
OR19	4/28/2011	<0.005	0.004	18	0.018	<0.001	<0.001	160	<0.005	<0.002	0.005	<0.003	<0.25	8.5	1600	<0.0002	0.99	0.008	0.17	<0.001	<0.003	0.009	850	2200	<0.001	0.019
OR19	8/25/2011	<0.005	0.003	16	0.019	<0.001	<0.001	140	<0.005	<0.002	0.006	0.004	0.34	8.1	1800	<0.0002	0.87	0.024	<0.02	<0.001	<0.003	0.011	800	2000	<0.001	<0.006
OR19	10/12/2011	<0.005	0.004	16	0.036	<0.001	<0.001	150	<0.005	<0.002	0.005	<0.003	0.48	9.3	1500	<0.0002	0.94	0.015	<0.02	<0.001	<0.003	0.013	820	2000	<0.001	<0.006
OR19	2/24/2012	<0.005	0.006	17	0.037	<0.001	<0.001	130	<0.005	<0.002	0.005	<0.003	0.3	9.2	1600	<0.0002	0.83	0.025	<0.02	<0.001	<0.003	0.016	770	2100	<0.001	<0.006
OR19	5/4/2012	<0.005	0.004	22	0.024	<0.001	<0.001	180	<0.005	<0.002	0.006	<0.003	0.3	9.8	1500	<0.0002	0.74	0.017	<0.02	<0.001	<0.003	0.007	780	2200	<0.001	0.013
OR19	8/24/2012	<0.005	0.005	24	0.019	<0.001	<0.001	240	<0.005	<0.002	0.009	<0.003	<0.25	9.2	1700	<0.0002	0.69	0.037	0.24	<0.001	<0.003	0.016	930	2400	<0.001	<0.006
OR19	11/1/2012	<0.005	0.005	16	0.043	<0.001	<0.001	200	<0.005	<0.002	<0.004	<0.003	0.46	12	1500	<0.0002	0.88	0.015	0.08	<0.001	<0.003	0.005	900	2100	<0.001	0.025
OR19	2/5/2013	<0.0025	0.002	16	0.048	<0.0005	<0.0005	140	<0.005	<0.001	<0.002	<0.0015	0.31	3.1	1500	<0.0001	0.82	0.006	0.07	<0.0005	<0.0015	<0.0005	750	2000	<0.0005	0.026
OR19	5/15/2013	<0.005	<0.001	14	0.023	<0.001	<0.001	170	<0.005	<0.002	<0.004	<0.003	0.27	6.1	1500	<0.0002	0.86	<0.005	<0.02	<0.001	<0.003	<0.001	840	1900	<0.001	<0.006
OR19	7/26/2013	<0.005	0.002	13	0.023	<0.001	<0.001	130	<0.005	<0.002	<0.004	<0.003	0.31	0.47	1700	<0.0002	0.89	0.018	0.04	<0.001	<0.003	0.002	860	2000	<0.001	0.007
OR19	10/21/2013	<0.005	<0.001	12	0.015	<0.001	<0.001	160	<0.005	<0.002	<0.004	<0.003		1.5	1200	<0.0002	0.85	<0.005	<0.02	<0.001	<0.003	<0.001	980	2000	<0.001	<0.006
OR19	3/30/2014	<0.005	<0.001	12	0.025	<0.001	<0.001	140	<0.005	<0.002	<0.004	<0.003		1.4	1400	<0.0002	0.85	<0.005	0.11	<0.001	<0.003	<0.001	820	2000	<0.001	<0.006
OR19	4/24/2014	<0.005	<0.001	16	0.022	<0.001	<0.001	140	<0.005	<0.002	<0.004	<0.003		2.6	1400	<0.0002	0.85	<0.005	0.11	<0.001	<0.0015	<0.001	820	2000	<0.001	0.006
OR19	7/17/2014			18				190						0.015	1400		0.69						920	2200		
OR19	4/17/2015			20				240						0.14	1500		0.78						990	2000		
OR19	9/14/2015			14				130						7.7	1800		0.79						730	2000		
OM20	4/24/2000			210				1800						6.5	4500		2.3						1400	6700		
OM20	9/19/2000			220				1800						6.6	3800		2.4						1400	6500		
OM20	4/24/2001			190				1800						7.4	3800		2.4						1400	5993		
OM20	9/13/2001			210				2000						7	4100		2.6						1500	6600		
OM20	4/24/2002			190				1200						7.4	2991		2.3						790	7700		
OM20	9/24/2002			200				2000						6.9	4400		2.9						1300	7000		
OM20	4/18/2003			240				2400						7.8	4400		2.8						1300	6200		
OM20	9/24/2003			210				2600						8.1	4400		2.8						1400	8100		
OM20	4/13/2004			180				2600						8.1	4500		2.5						1300	9800		
OM20	9/23/2004			260				3000						8.7	5300		3.6						1300	11000		
OM20	4/19/2005			230				2400						5.5	4200		2.2						1300	9900		
OM20	9/20/2005			220				2100						2	4000		2.1						1200	6200		
OM20	4/28/2006			200				4900						8.3	4100		2.9						1300	8000		
OM20	9/7/2006			150				1800						2.2	3200		1.2						1100	5600		
OM20	4/2/2007			140				1400						0.031	2700		0.075						930	4800		
OM20	9/19/2007			220				2800						6.4	4100		2.5						1200	8400		
OM20	3/27/2008			260				3700						8.7	4200		2.7						1300	8600		
OM20	6/3/2008			230				3300						8.1	3500		3						1200	8300		
OM20	8/19/2008			240				3400						8.4	4900		2.9						1200	3200		
OM20	4/29/2009			200				2600						0.38	3900		0.39						1000	5200		
OM20	9/21/2009			45				690						<0.01	1700		<0.001						260	2800		
OM20	12/8/2009			240				3200						7.8	4800		3.1						1200	7200		

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OM20	4/27/2010			190				2600						7.5	4100		2.4						1100	8700		
OM20	9/7/2010			83				1200						4.2	2300		1.2						840	4000		
OR20	6/3/2008			240				3300						9.8	3300		3.7						1200	8800		
OR20	8/19/2008			250				3500						9	4500		3.4						1200	3300		
OR20	4/29/2009			260				3600						7.9	5700		3.1						1400	8100		
OR20	9/21/2009			90				1200						<0.01	1900		1.5						490	3400		
OR20	12/8/2009			220				3200						8.9	4700		4.2						1400	7300		
OR20	4/27/2010			210				2500						7.9	4600		2.7						1000	9200		
OR20	9/7/2010			130				2100						5.2	3600		1.8						1100	5800		
OR20	2/23/2011	<0.005	0.012	140	0.029	<0.001	<0.001	1700	<0.005	0.003	0.046	<0.003	0.73	5.3	5800	<0.0002	1.6	0.072	<0.02	<0.001	<0.003	0.033	860	4900	<0.001	0.007
OR20	4/28/2011	<0.005	0.014	150	0.026	<0.001	<0.001	1800	<0.005	0.002	0.058	<0.003	0.72	0.1	3000	<0.0002	1.5	0.035	1	<0.001	<0.003	0.059	1100	4900	<0.001	<0.006
OR20	8/25/2011	<0.005	0.02	130	0.029	<0.001	<0.001	1400	<0.005	0.003	0.048	0.008	<0.25	4.3	2600	<0.0002	1.4	0.07	<0.02	<0.001	<0.003	0.059	800	4400	<0.001	0.009
OR20	10/12/2011	<0.005	0.014	130	0.034	<0.001	<0.001	1600	<0.005	0.002	0.031	0.006	<2.5	4.4	2500	<0.0002	1.4	0.043	1.3	<0.001	<0.003	0.056	930	4100	<0.001	<0.006
OR20	2/24/2012	<0.005	0.019	110	0.024	<0.001	<0.001	950	<0.005	0.002	0.037	0.004	0.3	3.5	2400	<0.0002	1.2	0.06	0.08	<0.001	<0.003	0.066	590	3600	<0.001	<0.006
OR20	5/4/2012	<0.005	0.008	160	0.029	<0.001	<0.001	1000	<0.005	<0.002	0.025	0.003	0.67	0.071	2000	<0.0002	1.1	0.044	0.38	<0.001	<0.003	0.033	620	3700	<0.001	0.007
OR20	8/24/2012	<0.005	0.015	100	0.02	<0.001	<0.001	1300	<0.005	0.002	0.042	0.004	<0.25	4.7	2400	<0.0002	1.1	0.086	<0.02	<0.001	<0.003	0.051	960	3600	<0.001	<0.006
OR20	11/1/2012	<0.005	0.011	110	0.023	<0.001	<0.001	1100	<0.005	<0.002	0.013	0.004	<0.25	3.7	2100	<0.0002	1	0.037	<0.02	<0.001	<0.003	0.024	680	3400	<0.001	<0.006
OR20	2/5/2013	<0.0025	0.003	100	0.032	<0.0005	<0.0005	990	<0.005	0.001	<0.002	<0.0015	0.31	3.7	2100	<0.0001	1.1	0.02	<0.02	<0.0005	<0.0015	<0.0005	690	3000	<0.0005	0.003
OR20	5/15/2013	<0.005	<0.001	95	0.031	<0.001	<0.001	1000	<0.005	<0.002	<0.004	<0.003	0.25	0.037	1900	<0.0002	0.97	0.02	0.15	<0.001	<0.003	<0.001	680	3200	<0.001	<0.006
OR20	7/26/2013	<0.005	0.008	83	0.037	<0.001	<0.001	980	<0.005	0.002	0.022	<0.003	0.39	0.053	2100	<0.0002	0.99	0.041	0.12	<0.001	<0.003	0.015	710	3000	<0.001	<0.006
OR20	10/21/2013	<0.005	0.002	68	0.026	<0.001	<0.001	920	<0.005	<0.002	<0.004	<0.003		3	1500	<0.0002	1.1	0.02	<0.02	<0.001	<0.003	<0.001	820	2700	<0.001	<0.006
OR20	3/30/2014	<0.005	0.003	71	0.026	<0.001	<0.001	950	<0.005	<0.002	<0.004	<0.003		3.4	1600	<0.0002	1.1	0.02	<0.02	<0.001	<0.003	<0.001	830	2500	<0.001	<0.006
OR20	4/24/2014	<0.005	<0.001	75	0.022	<0.001	<0.001	710	<0.005	<0.002	<0.004	<0.003		0.033	1400	<0.0002	0.96	0.022	0.6	<0.001	<0.0015	<0.001	570	2900	<0.001	<0.006
OR20	7/17/2014			82				740						<0.01	1300		0.9						630	2700		
OR20	4/17/2015			74				740						0.02	1600		0.88						620	2600		
OR20	9/14/2015			65				730						0.056	1700		0.73						550	2800		
OM21	4/24/2000			5.7				30						10	2100		0.88						1600	3000		
OM21	9/18/2000			3.5				18						5.9	1300		0.32						1300	2400		
OM21	4/24/2001			2.7				44						10	2000		1.2						1500	3133		
OM21	9/13/2001			2.7				14						6.1	1400		0.36						1200	2600		
OM21	4/24/2002			1				59						11	1860		1.6						1200	3200		
OM21	9/24/2002			2.6				16						5.8	1400		0.41						1100	2600		
OM21	4/17/2003			1.3				45						7.2	1500		0.59						1800	2800		
OM21	9/23/2003			1.4				21						3.7	1300		0.31						1200	2500		
OM21	4/12/2004			1.2				55						8.1	1800		0.95						1400	2800		
OM21	9/23/2004			1.4				26						7.1	1800		0.33						1200	2600		
OM21	4/18/2005			1.2				27						0.62	1400		0.34						1100	2500		
OM21	9/19/2005			1.4				25						<0.01	1400		0.29						1000	2400		
OM21	4/28/2006			4.1				310						13	2000		2						1400	3300		
OM21	9/7/2006			2.8				28						<0.01	780		0.23						1100	2400		
OM21	4/2/2007			1.5				28						<0.01	1200		0.14						1200	2400		
OM21	9/19/2007			1.4				42						<0.01	1000		0.31						1100	2400		
OM21	3/27/2008			14				450						9.9	1800		0.94						1200	3200		
OM21	6/3/2008			3.5				390						7.4	1400		0.54						1200	3100		
OM21	8/19/2008			7.5				490						8.6	1900		0.47						1300	3400		
OM21	4/30/2009			4.6				540						11	2300		0.51						1300	3300		
OM21	9/22/2009			3.1				340						0.01	1600		0.43						1400	2800		
OM21	12/8/2009			4.9				450						0.88	1800		0.49						1500	3200		
OM21	4/27/2010			4.2				380						0.012	1800		0.42						1200	3200		
OM21	9/8/2010			6.6				400						0.22	1800		0.65						1200	3100		
OM21	2/22/2011	<0.005	0.003	9.8	0.028	<0.001	<0.001	450	<0.005	<0.002	0.014	<0.003	<0.25	9.3	1900	<0.0002	0.68	0.031	0.032	<0.001	<0.003	0.012	1200	3200	<0.001	0.012
OM21	4/29/2011	<0.005	0.003	11	0.021	<0.001	<0.001	500	<0.005	<0.002	0.018	<0.003	<0.25	7.6	2000	<0.0002	0.71	0.009	0.53	0.001	<0.003	0.014	1200	3200	<0.001	<0.006
OM21	8/25/2011	<0.005	0.004	12	0.019	<0.001	<0.001	470	<0.005	<0.002	0.02	0.009	<0.25	0.081	1900	<0.0002	0.74	0.026	1.1	<0.001	<0.003	0.019	1300	3200	<0.001	0.015
OM21	10/14/2011	<0.005	0.006	10	0.017	<0.001	<0.001	420	<0.005	<0.002	0.016	0.007	<0.25	8.8	1800	<0.0002	0.61	0.024	0.49	<0.001	<0.003	0.021	1000	3000	<0.001	<0.006
OM21	2/24/2012	<0.005	0.007	9.3	0.023	<0.001	<0.001	390	<0.005	<0.002	0.014	0.005	<0.25	0.034	1900	<0.0002	0.55	0.027	4.9	<0.001	<0.003	0.027	1100	3100	<0.001	0.017
OM21	5/3/2012	<0.005	0.003	11	0.019	<0.001	<0.001	440	<0.005	<0.002	0.013	0.004	<0.25	<0.01	1800	<0.0002	0.63	0.017	2.1	<0.001	<0.003	0.013	1200	3100	<0.001	0.018
OM21	8/24/2012	<0.005	0.005	9.5	0.016	<0.001	<0.001	520	<0.005	<0.002	0.018	0.006	0.45	0.019	2000	<0.0002	0.59	0.039	1.1	<0.001	<0.003	0.021	1300	3200	<0.001	<0.006
OM21	11/2/2012	<0.005	0.002	9.3	0.017	<0.001	<0.001	480	<0.005	<0.002	0.005	0.006	<0.25	0.014	2000	<0.0002	0.59	0.014	0.92	<0.001	<0.003	0.008	1300	3100	<0.001	0.012
OM21	2/4/2013	<0.0025	<0.0005	5	0.009	<0.0005	<0.0005	400	<0.005	<0.001	<0.002	<0.0015	0.28	0.017	1800	<0.0001	0.31	<0.0025	1	<0.0005	<0.0015	<0.0005	1200	3000	<0.0005	0.008
OM21	5/2/2013	<0.005	0.005	12	0.021	<0.001	<0.001	490	<0.005	<0.002	0.016	0.007	<0.25	0.029	2000	<0.0002	0.68	0.027	3.3	<0.001	<0.003	0.01	1300	3200	<0.001	0.014

Natural Resource Technology

Appendix C-3
Groundwater Analytical Results Since 2000
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

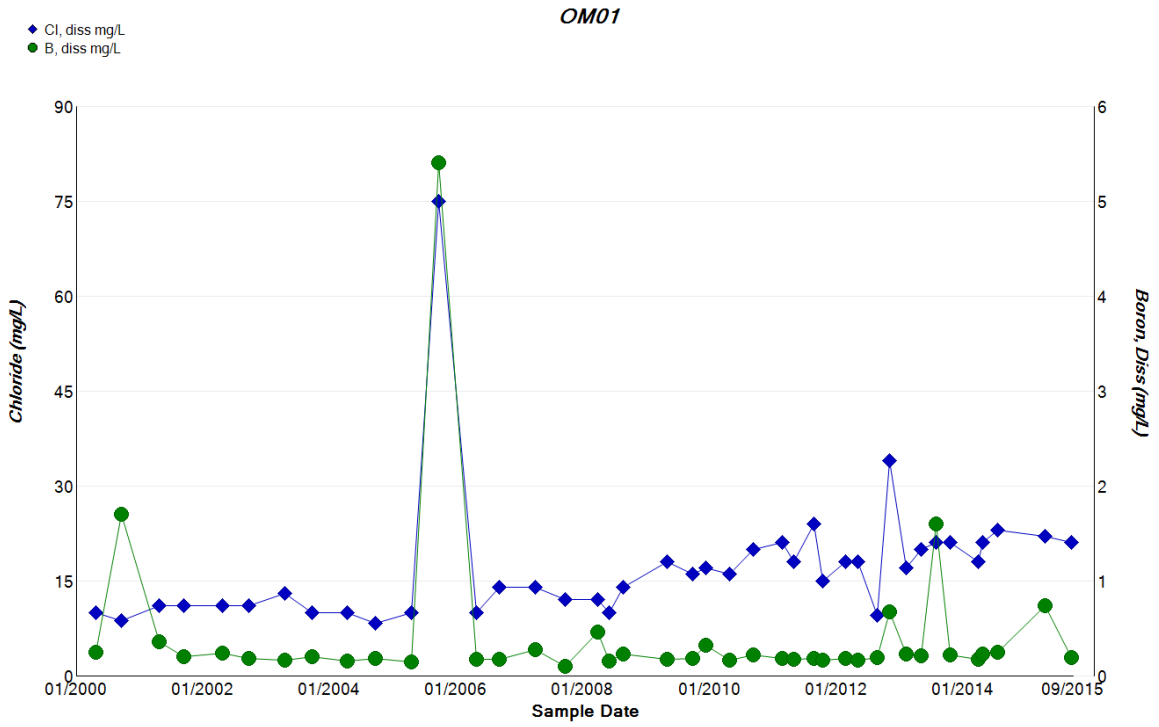
Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM21	7/29/2013	<0.005	0.004	14	0.019	<0.001	<0.001	520	<0.005	<0.002	0.012	0.004	<0.25	0.13	2000	<0.0002	0.57	0.021	1.5	<0.001	<0.003	0.009	1200	3300	<0.001	0.011
OM21	10/21/2013	<0.005	<0.001	11	0.02	<0.001	<0.001	550	<0.005	<0.002	<0.004	<0.003		0.96	1600	<0.0002	0.59	<0.005	1.3	<0.001	<0.003	<0.001	1400	3200	<0.001	<0.006
OM21	3/30/2014	<0.005	<0.001	11	0.02	<0.001	<0.001	490	<0.005	<0.002	<0.004	<0.003		<0.01	1900	<0.0002	0.54	<0.005	3.9	<0.001	<0.003	<0.001	1200	3200	<0.001	0.007
OM21	4/24/2014	<0.005	<0.001	14	0.02	<0.001	<0.001	500	<0.005	<0.002	<0.004	<0.003		0.018	1700	<0.0002	0.58	<0.005	4.4	<0.001	<0.0015	<0.001	1300	3300	<0.001	<0.006
OM21	7/18/2014			14				560						<0.01	1800		0.58						1400	3400		
OM21	4/17/2015			16				500						0.16	2000		0.45						1300	3200		
OM21	9/15/2015			15				460						0.028	2100		0.74						1300	3200		
OM22D	12/7/2009			2.7				81						0.024	310		0.24						94	460		
OM22D	4/28/2010			3				84						0.056	340		0.073						120	530		
OM22D	9/9/2010			3.7				100						0.02	370		0.1						170	600		
OM22D	2/22/2011	<0.005	0.002	12	0.05	<0.001	<0.001	260	<0.005	0.01	0.008	<0.003	<0.25	1.4	1200	<0.0002	2.1	0.043	<0.02	<0.001	<0.003	0.003	500	1700	<0.001	0.007
OM22D	4/28/2011	<0.005	<0.001	4.3	0.05	<0.001	<0.001	96	<0.005	<0.002	0.004	<0.003	0.62	0.01	300	<0.0002	0.031	0.009	2	<0.001	<0.003	0.004	150	600	<0.001	0.032
OM22D	8/25/2011																									
OM22D	8/29/2011	<0.005	0.001	5	0.058	<0.001	<0.001	110	<0.005	<0.002	0.004	0.004	0.82	<0.01	450	<0.0002	0.002	0.014	2	<0.001	<0.003	0.009	190	660	<0.001	0.02
OM22D	10/14/2011	<0.005	0.004	8.4	0.085	<0.001	<0.001	110	<0.005	<0.002	0.007	0.007	0.62	<0.01	740	<0.0002	0.56	0.026	1.5	<0.001	<0.003	0.012	180	810	<0.001	0.045
OM22D	2/24/2012	<0.005	0.006	11	0.083	<0.001	<0.001	210	<0.005	0.007	0.009	<0.003	0.31	0.71	1100	<0.0002	2	0.036	0.23	<0.001	<0.003	0.019	420	1400	<0.001	<0.006
OM22D	5/3/2012	<0.005	0.002	12	0.052	<0.001	<0.001	250	<0.005	0.004	0.009	<0.003	0.31	1.3	1100	<0.0002	1.4	0.028	0.11	<0.001	<0.003	0.007	470	1600	<0.001	0.017
OM22D	8/24/2012	<0.005	0.003	11	0.089	<0.001	<0.001	250	<0.005	0.006	0.01	<0.003	0.32	1.1	1100	<0.0002	1.8	0.042	0.17	<0.001	<0.003	0.012	470	1500	<0.001	<0.006
OM22D	11/2/2012	<0.005	0.003	12	0.052	<0.001	<0.001	180	<0.005	0.004	<0.004	<0.003	0.37	1.3	1200	<0.0002	1.4	0.028	1.1	<0.001	<0.003	0.005	330	1200	<0.001	0.007
OM22D	2/5/2013	<0.0025	<0.0005	7	0.068	<0.0005	<0.0005	170	<0.005	0.001	<0.002	0.003	0.76	0.015	650	<0.0001	0.013	0.011	2.6	<0.0005	<0.0015	<0.0005	280	820	<0.0005	0.031
OM22D	5/1/2013	<0.005	0.007	15	0.043	<0.001	<0.001	360	<0.005	0.006	0.009	<0.003	<0.25	3	1300	<0.0002	1.6	0.039	<0.02	<0.001	<0.003	0.006	550	1900	<0.001	<0.006
OM22D	7/29/2013	<0.005	0.007	21	0.027	<0.001	<0.001	480	<0.005	0.002	0.013	<0.003	<0.25	1.9	1500	<0.0002	1.2	0.036	0.03	<0.001	<0.003	0.007	530	2100	<0.001	0.008
OM22D	10/18/2013	<0.005	0.002	19	0.037	<0.001	<0.001	520	<0.005	<0.002	<0.004	<0.003		2	1300	<0.0001	1.1	0.018	<0.02	<0.001	<0.003	<0.001	690	2100	<0.001	<0.006
OM22D	3/30/2014	<0.005	0.002	17	0.025	<0.001	<0.0005	460	<0.005	<0.002	<0.004	<0.0015		2.3	1400	<0.0002	1.2	0.02	<0.02	<0.001	<0.003	<0.001	540	2000	<0.001	<0.006
OM22D	4/23/2014	<0.005	0.003	2.2	0.036	<0.001	<0.001	480	<0.005	<0.002	<0.004	<0.003		3.2	870	<0.0002	1.1	<0.005	0.04	<0.001	<0.003	<0.001	560	2100	<0.001	<0.006
OM22D	7/17/2014			19				510						0.01	1300		1.1						610	2300		
OM22D	4/17/2015			16				460						<0.01	1200		0.46						570	1800		
OM22D	9/28/2015			16				480						1.9	1400		0.97						540	2200		
OM22S	12/7/2009			0.11				4.3						0.013	720		3.7						100	840		
OM22S	4/28/2010			0.12				13						0.04	790		3.2						110	840		
OM22S	9/9/2010			0.19				6.1						0.61	790		3.1						140	800		
OM22S	2/23/2011																									
OM22S	4/28/2011																									
OM22S	8/25/2011																									
OM22S	10/14/2011																									
OM22S	2/24/2012																									
OM23D	12/7/2009			1.8				41						0.56	880		0.98						440	1300		
OM23D	4/28/2010			2.2				38						2.5	820		0.98						430	1400		
OM23D	9/9/2010			2				32						1.6	400		0.88						470	1400		
OM23D	2/22/2011	<0.005	0.002	2.4	0.053	<0.001	<0.001	38	<0.005	<0.002	<0.004	<0.003	0.6	2	800	<0.0002	0.93	0.019	0.02	<0.001	<0.003	<0.001	420	1400	<0.001	<0.006
OM23D	4/28/2011	<0.005	0.001	2.6	0.046	<0.001	<0.001	46	<0.005	<0.002	<0.004	<0.003	0.62	2	720	<0.0002	0.83	0.006	0.06	<0.001	<0.003	0.002	450	1400	<0.001	<0.006
OM23D	8/25/2011																									
OM23D	8/29/2011	<0.005	0.001	2.5	0.053	<0.001	<0.001	32	<0.005	<0.002	<0.004	0.005	0.68	1.9	700	<0.0002	0.86	0.014	0.05	<0.001	<0.003	0.003	400	1300	<0.001	<0.006
OM23D	10/14/2011	<0.005	0.002	2.3	0.047	<0.001	<0.001	37	<0.005	<0.002	<0.004	0.004	0.56	2.5	870	<0.0002	1	0.018	1.2	<0.001	<0.003	0.003	390	1300	<0.001	<0.006
OM23D	2/24/2012	<0.005	0.002	2.3	0.048	<0.001	<0.001	34	<0.005	<0.002	<0.004	<0.003	0.51	2.3	920	<0.0002	1	0.015	<0.02	<0.001	<0.003	0.001	460	1300	<0.001	<0.006
OM23D	5/3/2012	<0.005	0.002	2.7	0.063	<0.001	<0.001	32	<0.005	<0.002	0.004	<0.003	0.68	1.3	770	<0.0002	0.72	0.011	0.06	<0.001	<0.003	0.003	460	1200	<0.001	0.01
OM23D	8/24/2012	<0.005	0.002	2.3	0.031	<0.001	<0.001	33	<0.005	<0.002	<0.004	<0.003	0.34	0.035	1000	<0.0002	1.1	0.021	0.05	<0.001	<0.003	0.004	550	1400	<0.001	<0.006
OM23D	11/2/2012	<0.005	0.001	2.3	0.027	<0.001	<0.001	34	<0.005	<0.002	<0.004	<0.003	<0.25	2.8	1100	<0.0002	1.1	0.01	0.04	<0.001	<0.003	<0.001	400	1400	<0.001	<0.006
OM23D	2/5/2013	<0.0025	0.001	2.4	0.025	<0.0005	<0.0005	32	<0.005	<0.001	<0.002	<0.0015	0.33	3	980	<0.0001	1.1	0.005	0.09	<0.0005	<0.0015	<0.0005	570	1400	<0.0005	<0.003
OM23D	5/1/2013	<0.005	0.001	1.8	0.027	<0.0005	<0.001	30	<0.005	<0.002	<0.004	<0.003	<0.25	2.7	1000	<0.0002	1	<0.005	<0.02	<0.001	<0.003	<0.001	680	1300	<0.001	<0.006
OM23D	10/18/2013	<0.005	<0.001	2.1	0.021	<0.001	<0.001	33	<0.005	<0.002	<0.004	<0.003		2.7	810	<0.0001	0.82	<0.005	0.22	<0.001	<0.003	<0.001	640	1300	<0.001	0.011
OM23D	3/30/2014	<0.005	0.001	1.8	0.024	<0.001	<0.0005	34	<0.005	<0.002	<0.004	0.021		1.3	940	<0.0002	1.1	<0.005	0.19	<0.001	<0.003	<0.001	490	1300	<0.001	<0.006
OM23D	4/23/2014	<0.005	0.002	20	0.032	<0.001	<0.001	32	<0.005	<0.002	<0.004	<0.003		2.2	1300	<0.0002	1.4	0.02	<0.02	<0.001	<0.003	<0.001	530	1200	<0.001	<0.006
OM23D	7/17/2014			2.1				35						2.5	830		1.1						540	1300		
OM23D	4/17/2015			2.3				37						0.042	900		1.1						520	1300		
OM23D	9/28/2015			22				560						0.9	1800		1.3						720	2500		
OM23S	12/7/2009			0.69				19						6.2	1600		2.4						1000	2300		
OM23S	9/9/2010			0.64				21						0.023	410		2.5						1400	2600		
OM24D	12/7/2009			23				480						5.9	1700		2.2						760	2600		
OM24D	4/28/2010			20				530						10	2100		2.5						980	3100		

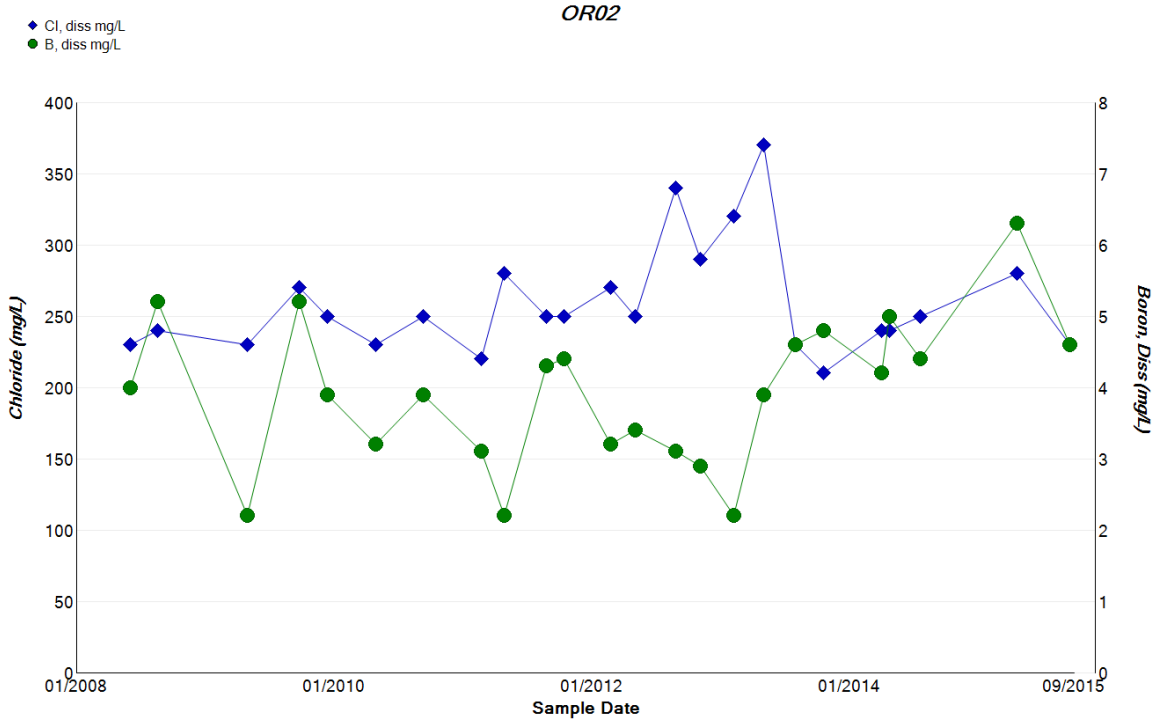
Appendix C-3
Groundwater Analytical Results Since 2000
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

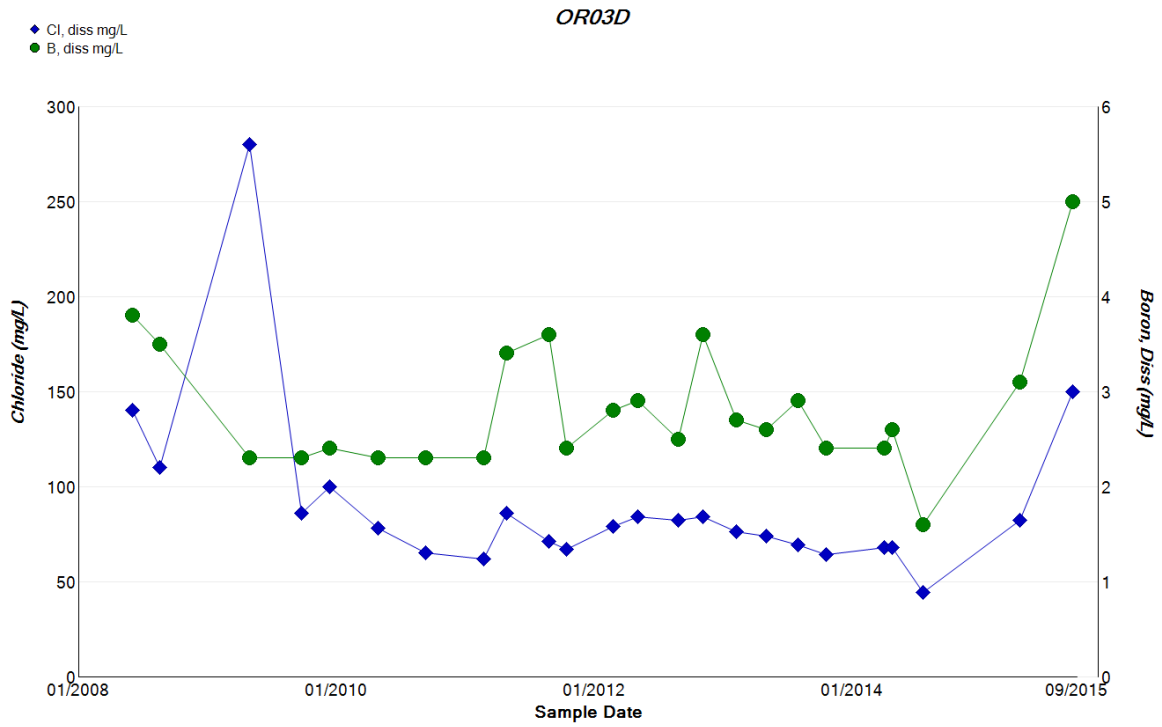
Well	Sample Date	Ag, diss (mg/L)	As, diss (mg/L)	B, diss (mg/L)	Ba, diss (mg/L)	Be, diss (mg/L)	Cd, diss (mg/L)	Cl, diss (mg/L)	CN, total (mg/L)	Co, diss (mg/L)	Cr, diss (mg/L)	Cu, diss (mg/L)	F, diss (mg/L)	Fe, diss (mg/L)	Hardness (mg/L)	Hg, diss (mg/L)	Mn, diss (mg/L)	Ni, diss (mg/L)	NO3, diss (mg/L)	Pb, diss (mg/L)	Sb, diss (mg/L)	Se, diss (mg/L)	SO4, diss (mg/L)	TDS (mg/L)	Tl, diss (mg/L)	Zn, diss (mg/L)
OM24D	9/9/2010			21				480						6.5	1900		1.8						900	2600		
OM24D	2/22/2011	<0.005	0.005	20	0.015	<0.001	<0.001	470	<0.005	<0.002	0.014	0.021	<0.25	6.1	1500	<0.0002	2	0.04	<0.02	<0.001	<0.003	0.007	680	2300	<0.001	0.016
OM24D	4/28/2011	<0.005	0.02	19	0.11	<0.001	<0.001	440	<0.005	0.011	0.022	0.011	<0.25	25	1900	<0.0002	2.8	0.053	<0.02	0.033	<0.003	0.017	740	2200	<0.001	0.032
OM24D	8/29/2011	<0.005	0.012	20	0.044	<0.001	<0.001	450	<0.005	0.003	0.025	0.005	0.34	6.7	1600	<0.0002	1.6	0.046	0.2	0.005	<0.003	0.028	800	2100	<0.001	0.01
OM24D	10/14/2011	<0.005	0.014	24	0.081	<0.001	<0.001	560	<0.005	0.005	0.021	0.009	<0.25	12	1800	<0.0002	2.5	0.057	0.4	0.009	<0.003	0.029	730	2200	<0.001	0.017
OM24D	2/24/2012	<0.005	0.037	23	0.036	<0.001	<0.001	550	<0.005	<0.002	0.019	0.004	<0.25	40	1800	<0.0002	2.1	0.046	0.45	0.004	<0.003	0.032	770	2600	<0.001	0.017
OM24D	5/3/2012	<0.005	0.007	23	0.016	<0.001	<0.001	670	<0.005	<0.002	0.014	<0.003	<0.25	7	1700	<0.0002	2.1	0.034	0.03	<0.001	<0.003	0.017	860	2600	<0.001	0.009
OM24D	8/24/2012	<0.005	0.013	28	0.018	<0.001	<0.001	880	<0.005	<0.002	0.031	<0.003	0.38	8.8	2300	<0.0002	2.3	0.069	0.04	<0.001	<0.003	0.039	790	3000	<0.001	<0.006
OM24D	11/2/2012	<0.005	0.012	38	0.019	<0.001	<0.001	1000	<0.005	<0.002	0.013	<0.003	<0.25	8.3	2600	<0.0002	2.7	0.041	0.32	<0.001	<0.003	0.022	830	3100	<0.001	<0.006
OM24D	5/1/2013	<0.005	0.004	28	0.037	<0.0005	<0.001	890	<0.005	<0.002	<0.004	<0.003	<0.25	8.2	2000	<0.0002	2.4	0.016	<0.02	<0.001	<0.003	<0.001	1200	2900	<0.001	<0.006
OM24D	7/29/2013	<0.005	0.008	29	0.016	<0.001	<0.001	560	<0.005	<0.002	0.016	<0.003	<0.25	6.2	1900	<0.0002	2.3	0.037	0.11	<0.001	<0.003	0.01	870	3000	<0.001	<0.006
OM24D	10/18/2013	<0.005	0.009	27	0.038	<0.001	<0.001	760	<0.005	<0.002	<0.004	<0.003		4.3	1600	<0.0001	2.3	0.017	0.11	<0.001	<0.003	<0.001	1200	2800	<0.001	<0.006
OM24D	3/30/2014	<0.005	0.003	28	0.027	<0.001	<0.0005	910	<0.005	<0.002	<0.004	<0.0015		4.2	2000	<0.0002	3.3	0.019	0.08	<0.001	<0.003	<0.001	1100	3000	<0.001	<0.006
OM24D	4/23/2014	<0.005	0.004	34	0.018	<0.001	<0.001	960	<0.005	<0.002	<0.004	<0.003		7.4	190	<0.0002	2.5	0.017	<0.02	<0.001	<0.003	<0.001	1100	3000	<0.001	<0.006
OM24D	7/17/2014			29				700						7.6	1700		2.6						910	3100		
OM24D	4/17/2015			23				540						0.014	1800		2						910	2300		
OM24D	9/28/2015			20				440						6.3	1700		2.2						770	2200		
OM25D	12/7/2009			1.7				61						<0.01	740		1.2						280	1100		
OM25D	4/28/2010			2.3				110						1.5	1000		1.4						470	1500		
OM25D	9/9/2010			1.9				81						<0.01	920		1.2						360	1300		
OM25S	12/7/2009			5.1				190						<0.01	690		0.77						280	1200		
OM25S	4/28/2010			11				350						0.016	1200		1.2						520	2000		
OM25S	9/9/2010			9.9				270						<0.01	1200		1.2						600	1900		
OM25S	2/22/2011	<0.005	0.003	19	0.056	<0.001	<0.001	500	<0.005	0.006	0.015	0.021	<0.25	0.028	1600	<0.0002	1.4	0.046	3.2	<0.001	<0.003	0.008	710	2300	<0.001	<0.006
OM25S	4/28/2011	<0.005	<0.001	4.6	0.053	<0.001	<0.001	83	<0.005	<0.002	0.006	<0.003	<0.25	0.032	820	<0.0002	0.49	0.01	0.19	<0.001	<0.003	0.006	250	1100	<0.001	<0.006
OM25S	8/25/2011																									
OM25S	8/29/2011	<0.005	0.004	12	0.049	<0.001	<0.001	290	<0.005	0.005	0.017	0.005	0.39	0.12	1400	<0.0002	1.3	0.035	0.08	<0.001	<0.003	0.02	540	1800	<0.001	0.007
OM25S	10/14/2011	<0.005	0.005	15	0.046	<0.001	<0.001	320	<0.005	0.005	0.013	0.006	<0.25	<0.01	1400	<0.0002	1.3	0.041	0.08	<0.001	<0.003	0.02	550	1900	<0.001	0.012
OM25S	2/24/2012	<0.005	0.005	12	0.049	<0.001	<0.001	290	<0.005	0.004	0.01	0.007	<0.25	0.14	1400	<0.0002	1.2	0.036	1.9	<0.001	<0.003	0.023	600	1900	<0.001	0.014
OM25S	5/3/2012	<0.005	0.003	18	0.047	<0.001	<0.001	550	<0.005	0.004	0.012	<0.003	<0.25	<0.01	1400	<0.0002	1.2	0.037	0.09	<0.001	<0.003	0.015	940	2100	<0.001	0.021
OM25S	8/24/2012	<0.005	0.006	16	0.041	<0.001	<0.001	410	<0.005	0.005	0.017	<0.003	<2.5	<0.01	1700	<0.0002	1.3	0.052	0.06	<0.001	<0.003	0.025	660	2200	<0.001	<0.006
OM25S	11/2/2012	<0.005	0.004	20	0.036	<0.001	<0.001	450	<0.005	0.005	0.007	<0.003	<0.25	0.86	1700	<0.0002	1.3	0.037	0.03	0.001	<0.003	0.012	710	2500	<0.001	0.01
OM25S	2/5/2013	<0.0025	<0.0005	13	0.031	<0.0005	<0.0005	520	<0.005	0.003	<0.002	<0.0015	<0.25	0.13	1400	<0.0001	0.94	0.02	2.9	<0.0005	<0.0015	0.001	900	2000	<0.0005	0.004
OM25S	5/1/2013	<0.005	<0.001	1.1	0.048	<0.0005	<0.001	22	<0.005	<0.002	<0.004	<0.003	0.27	<0.01	560	<0.0002	0.12	<0.005	0.56	<0.001	<0.003	0.003	190	690	<0.001	<0.006
OM25S	7/29/2013	<0.005	0.003	11	0.053	<0.001	<0.001	220	<0.005	0.005	0.008	<0.003	0.29	0.035	1100	<0.0002	1.1	0.025	0.05	<0.001	<0.003	0.003	430	1600	<0.001	<0.006
OM25S	10/18/2013	<0.005	<0.001	18	0.04	<0.001	<0.001	450	<0.005	0.005	<0.004	<0.003		0.13	1300	<0.0001	1.2	0.02	0.06	<0.001	<0.003	<0.001	640	2100	<0.001	0.008
OM25S	3/30/2014	<0.005	<0.001	12	0.047	<0.001	<0.0005	310	<0.005	0.003	<0.004	0.031		<0.01	1400	<0.0002	1	0.019	0.05	<0.001	<0.003	<0.001	560	1800	<0.001	<0.006
OM25S	4/23/2014	<0.005	<0.001	20	0.04	<0.001	<0.001	450	<0.005	0.004	<0.004	<0.003		<0.01	1300	<0.0002	1.1	0.021	0.05	<0.001	<0.003	0.001	640	2000	<0.001	<0.006
OM25S	7/17/2014			23				600						<0.01	1500		1.2						750	2500		
OM25S	4/17/2015			19				440						<0.01	1500		0.97						750	2100		
OM25S	9/28/2015			22				630						0.73	1900		1.1						770	2500		
OM50D	12/7/2009			1.8				13						<0.01	430		0.17						310	830		
OM50D	4/28/2010			2				13						2.1	460		0.38						260	780		
OM50D	9/9/2010			2.2				9.6						7	490		0.3						180	730		
OM50S	12/7/2009			0.11				7.4						0.022	890		0.084						520	1200		
OM50S	4/28/2010			0.096				6.5						0.059	1100		0.01						670	1300		
OM50S	9/9/2010			0.15				5.6						0.14	940		0.035						650	1100		
OM51D	12/7/2009			1.2				17						4	830		0.6						290	1200		
OM51D	4/28/2010			1				13						10	1100		0.71						560	1500		
OM51D	9/9/2010			1.2				22						0.074	630		0.17						220	920		
OM51S	12/7/2009			0.03				6.2						0.04	1100		3.1						410	1400		
OM51S	4/28/2010			0.029				4.3						0.19	1400		3.6						640	1700		
OM51S	9/9/2010			0.054				5.4						0.68	1300		5						690	1500		

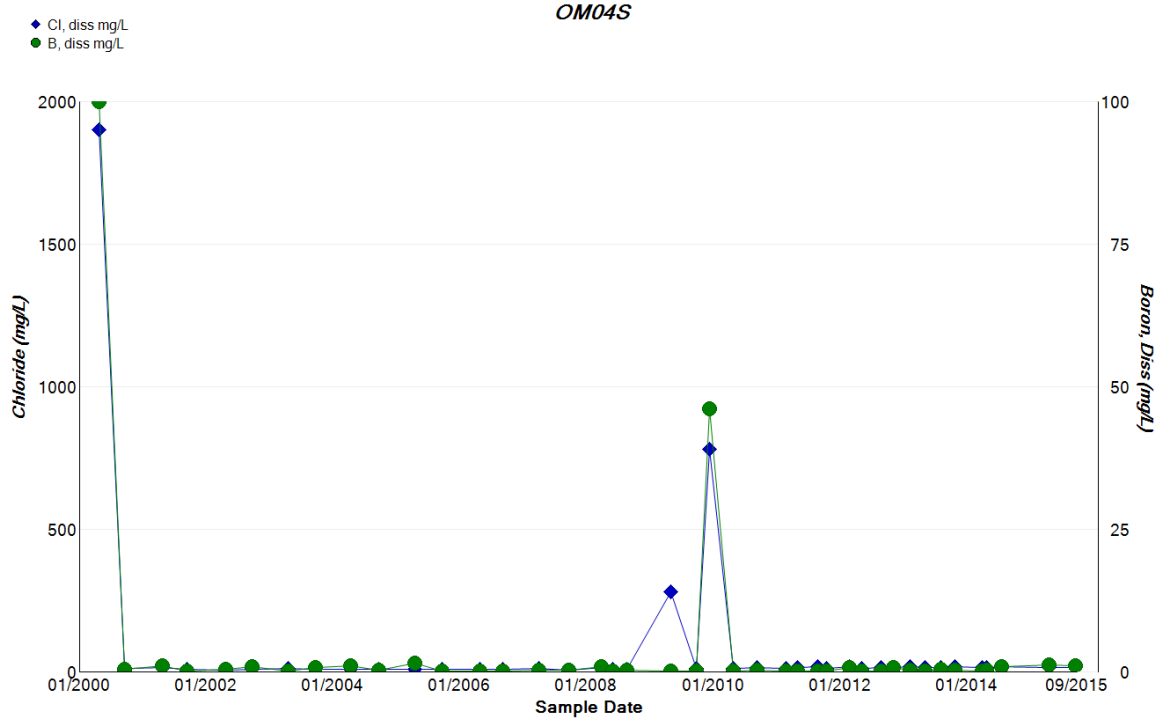
APPENDIX C4

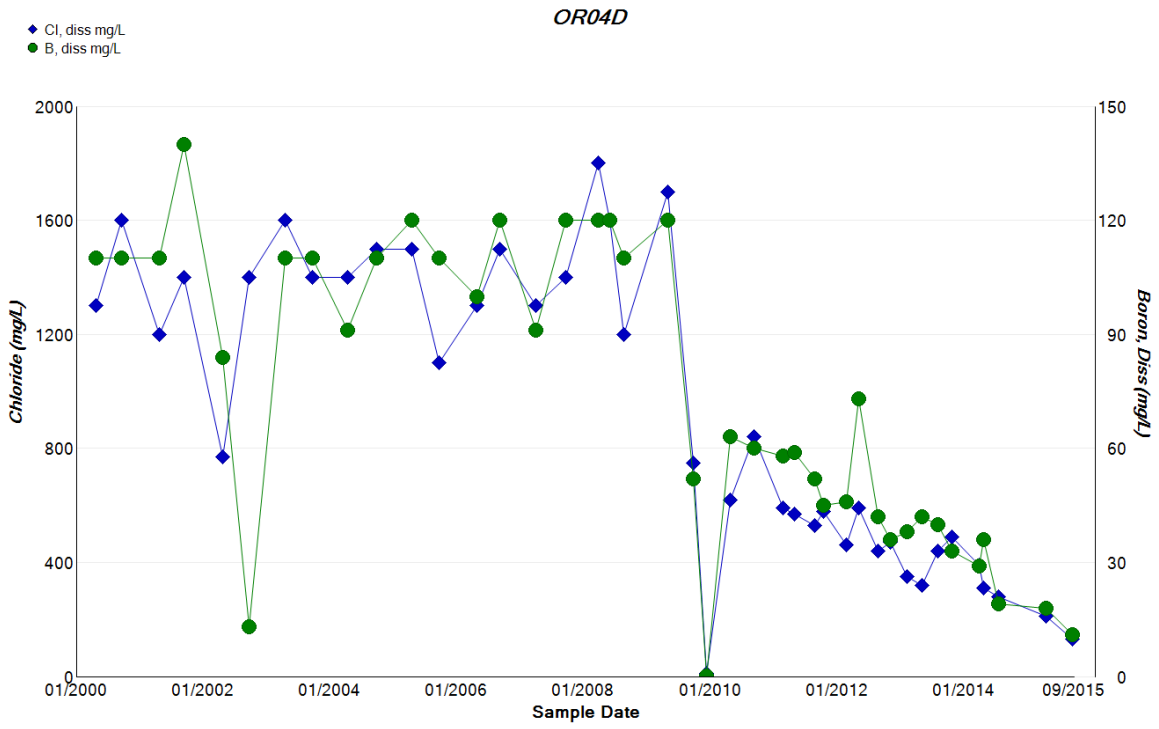
BORON AND CHLORIDE TIME SERIES PLOTS

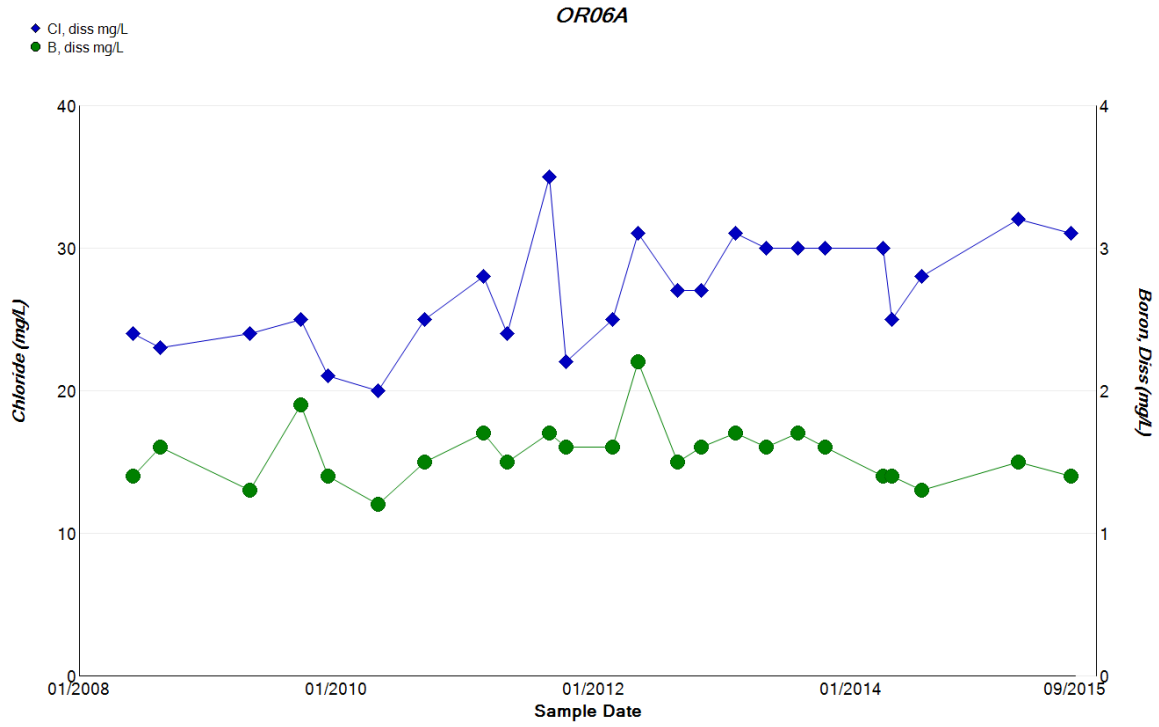

OM01
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
Sample Date
01/2000
01/2002
01/2004
01/2006
01/2008
01/2010
01/2012
01/2014
09/2015

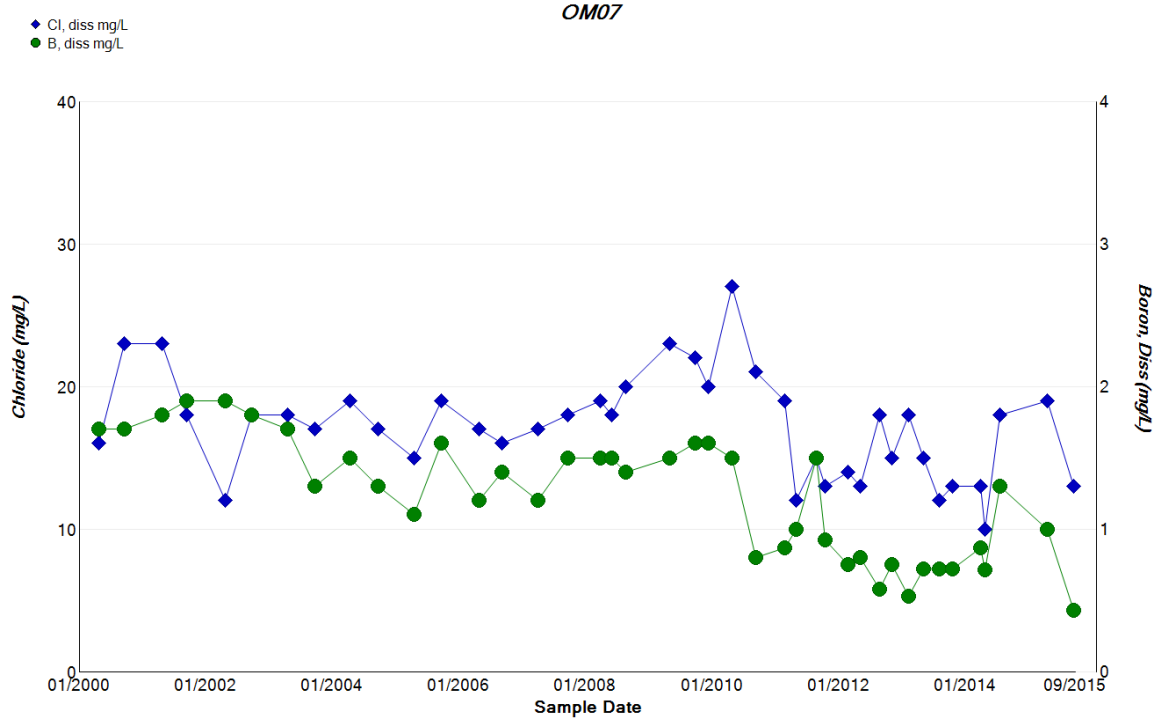

OR02
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
Sample Date
01/2008
01/2010
01/2012
01/2014
09/2015

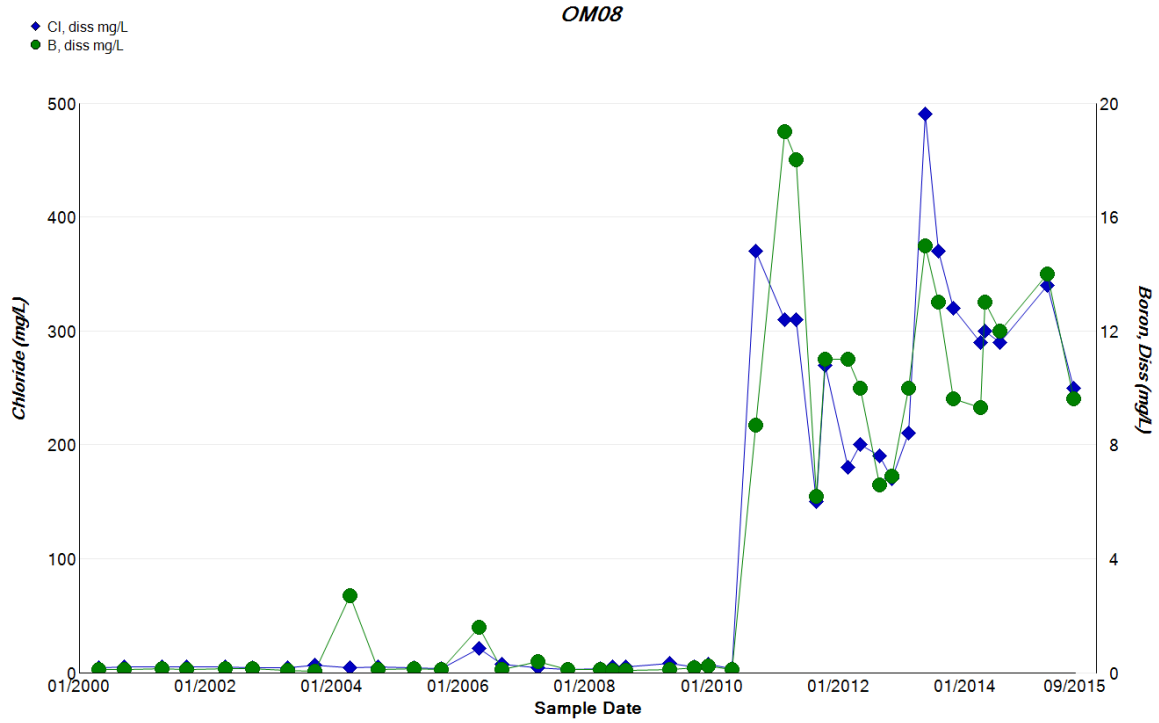

OR03D
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
300
250
200
150
100
50
0
6
5
4
3
2
1
0
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

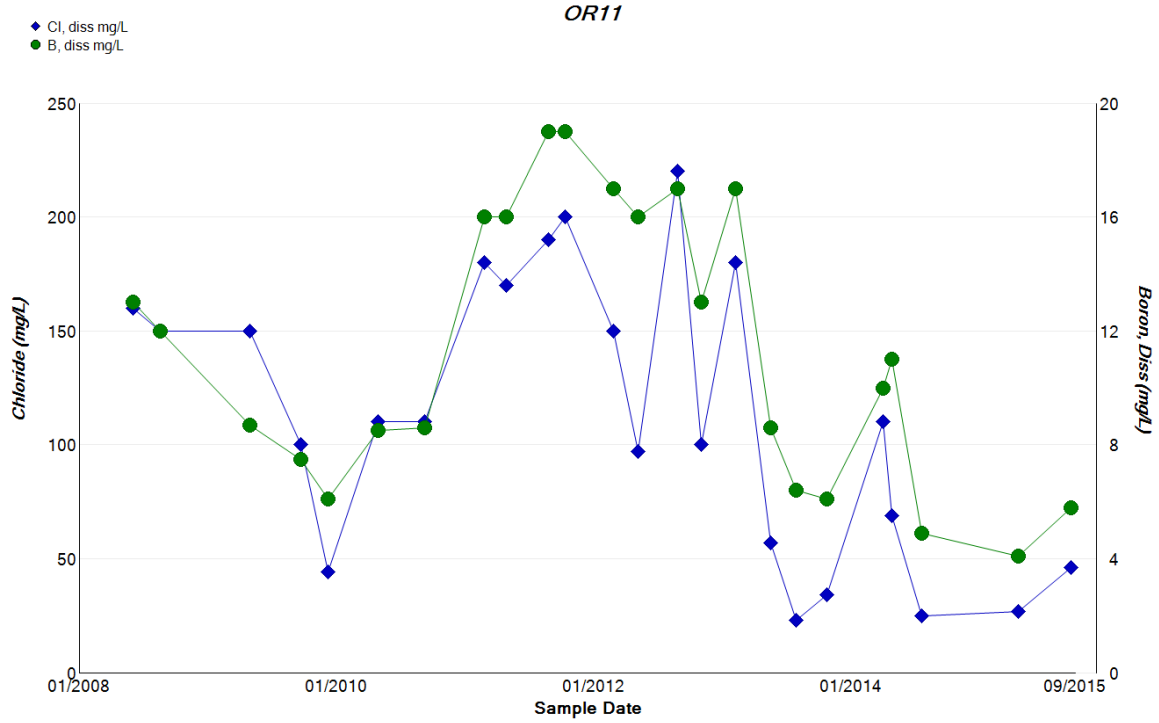

OM04S
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
2000
1500
1000
500
0
100
75
50
25
0
01/2000
01/2002
01/2004
01/2006
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

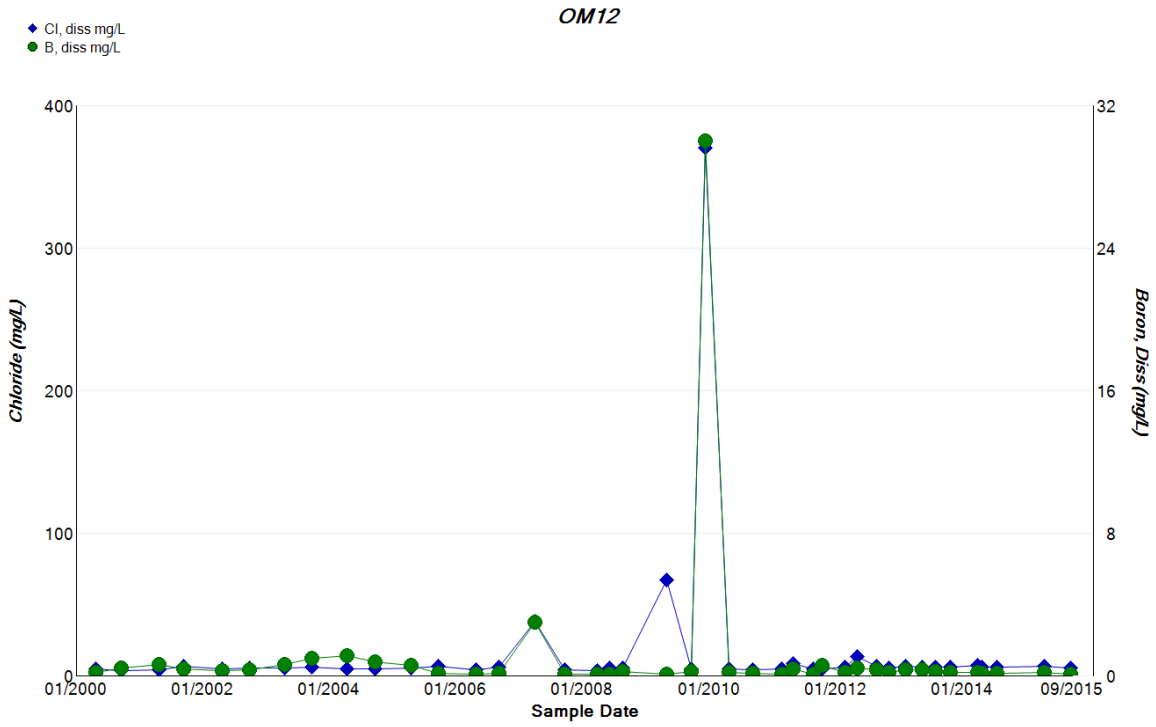

OR04D
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
Sample Date
2000
1600
1200
800
400
0
150
120
90
60
30
0
01/2000
01/2002
01/2004
01/2006
01/2008
01/2010
01/2012
01/2014
09/2015

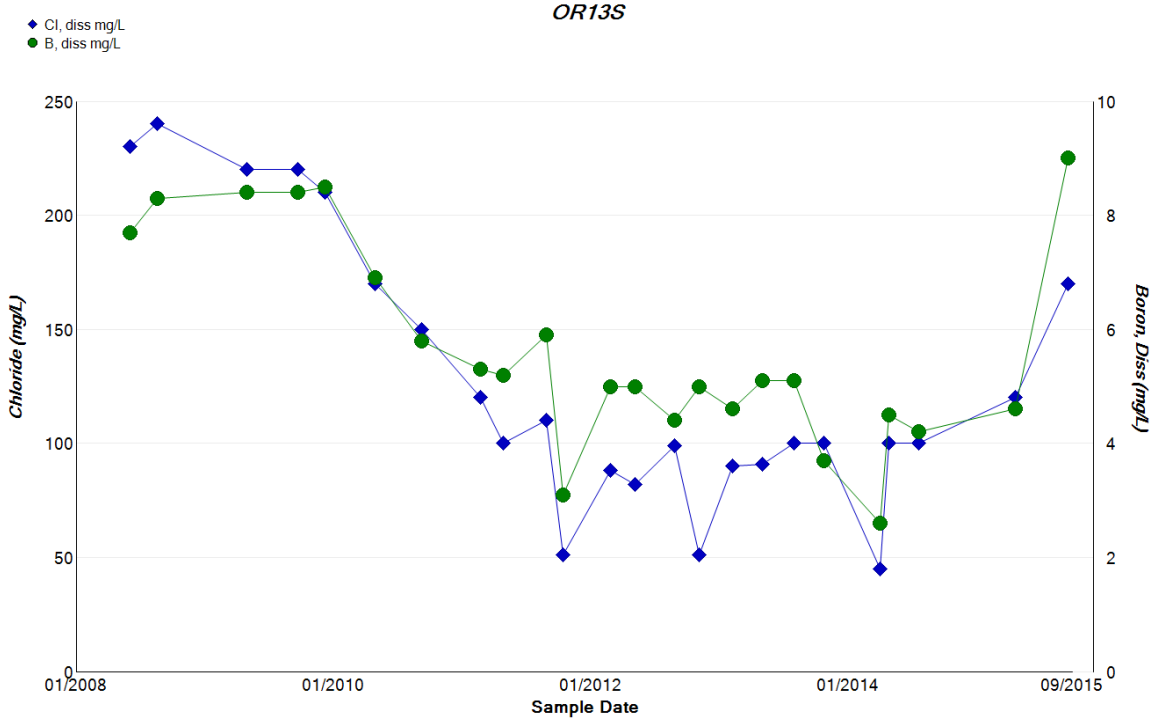

OR06A
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
40
30
20
10
0
4
3
2
1
0
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

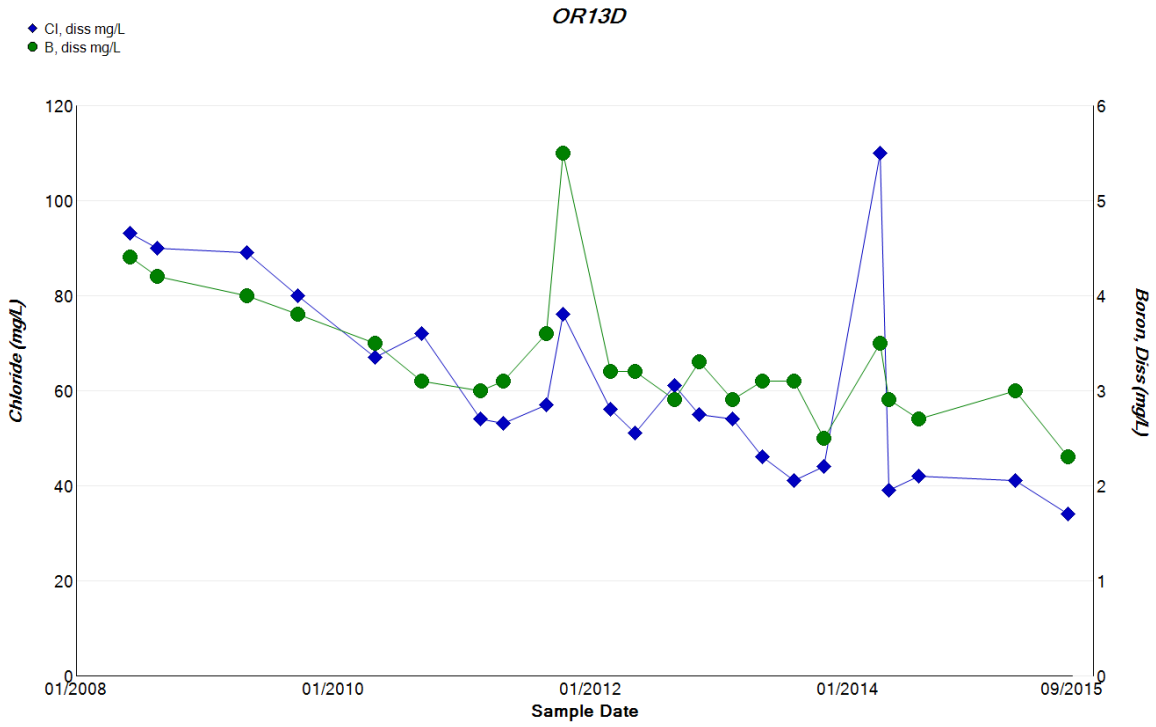

OM07
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
40
30
20
10
0
4
3
2
1
0
01/2000
01/2002
01/2004
01/2006
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

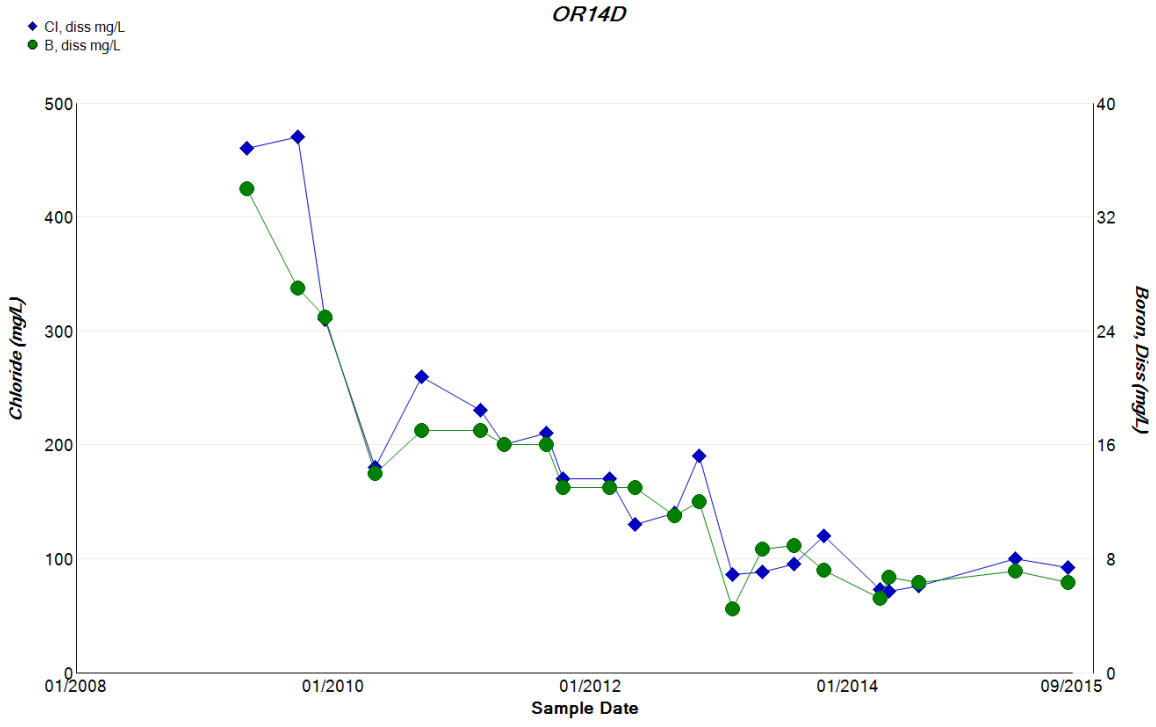

OM08
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
500
400
300
200
100
0
20
16
12
8
4
0
01/2000
01/2002
01/2004
01/2006
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

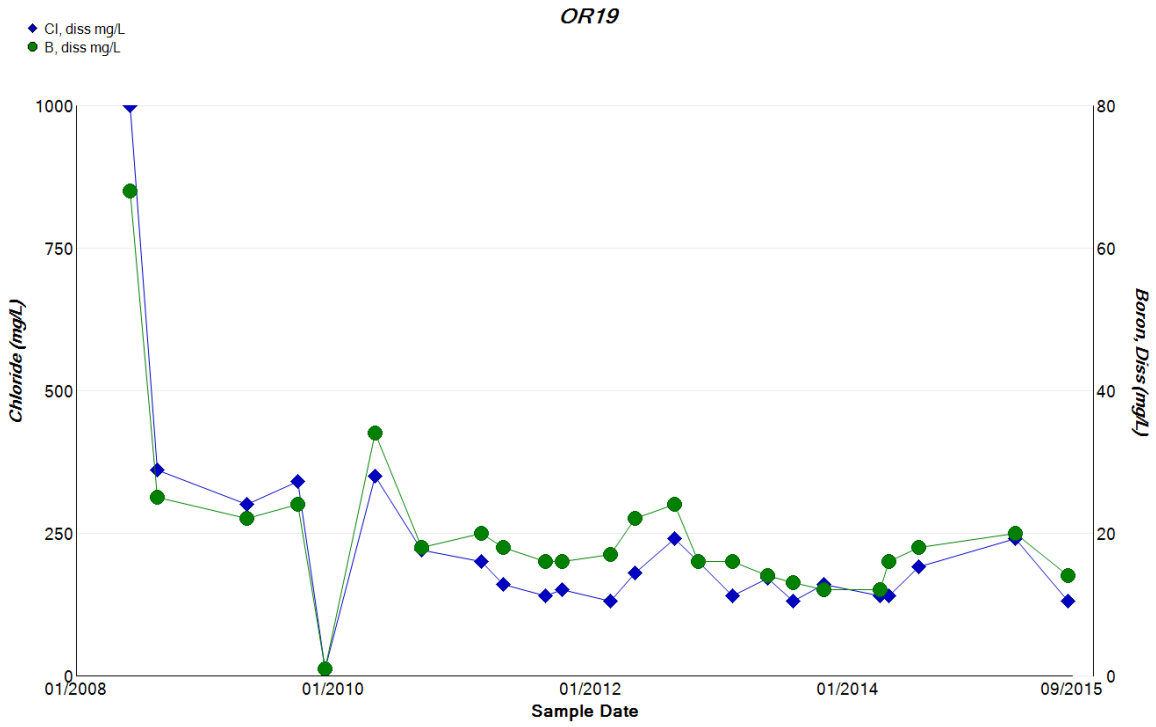

OR11
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
250
200
150
100
50
0
20
16
12
8
4
0
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

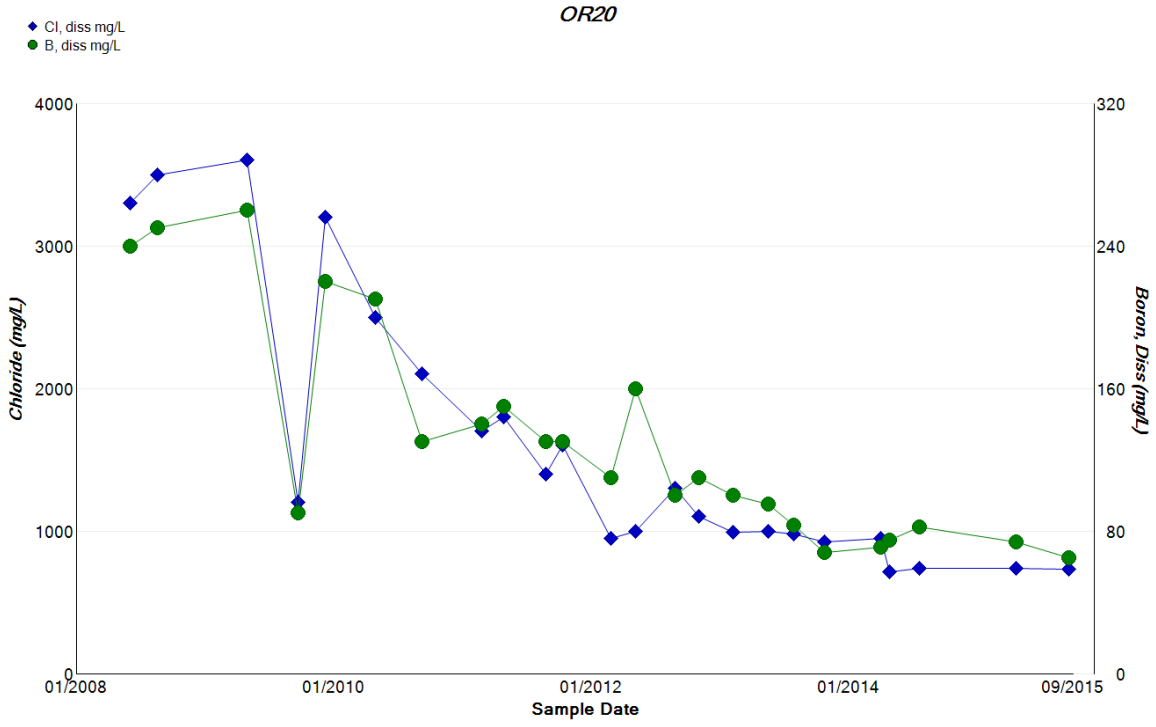

OM12
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
400
300
200
100
0
32
24
16
8
0
01/2000
01/2002
01/2004
01/2006
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

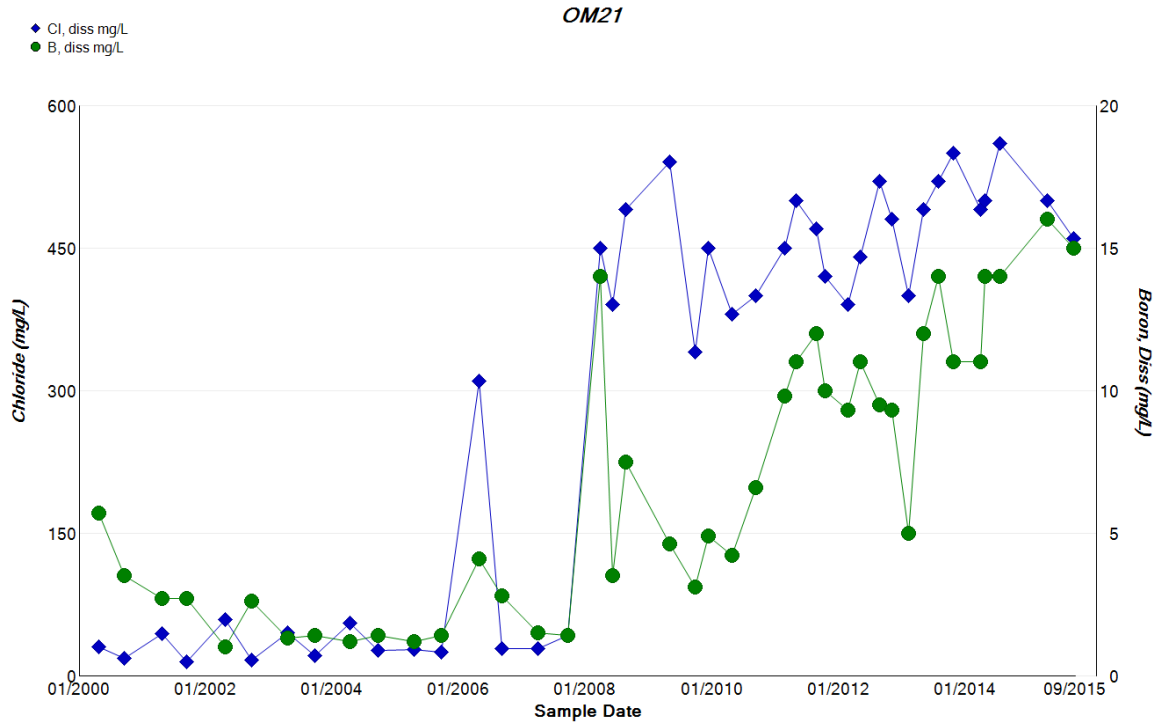

OR13S
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
250
200
150
100
50
0
10
8
6
4
2
0
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

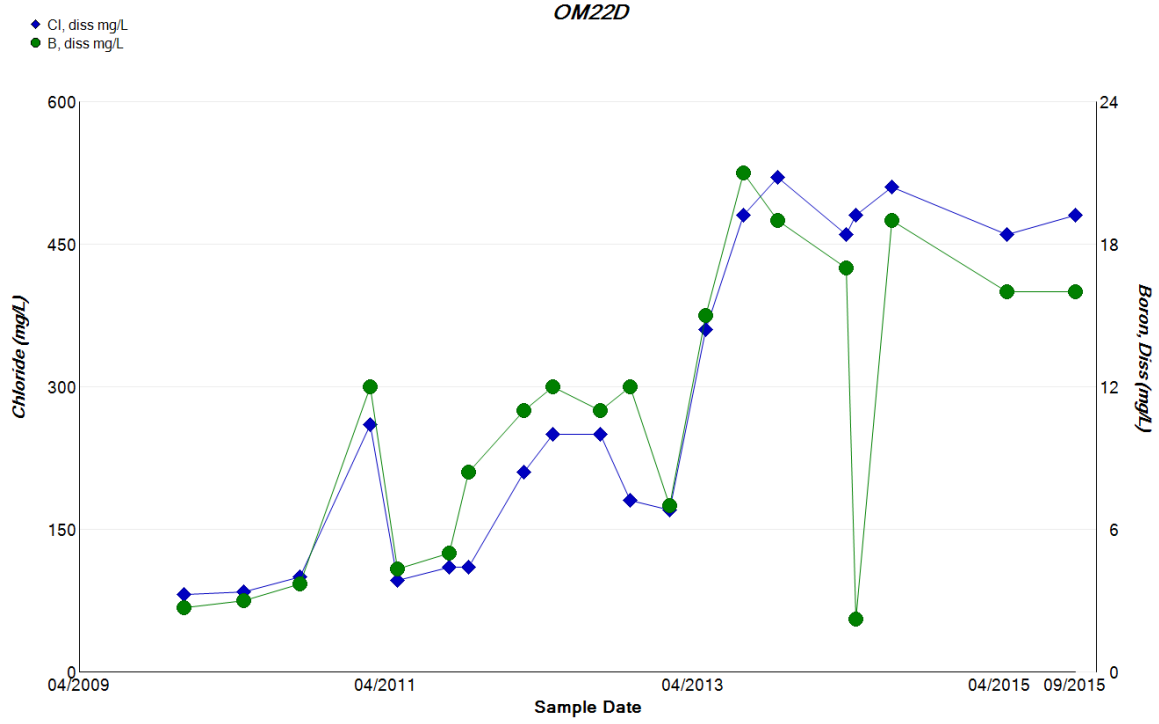

OR13D
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
120
100
80
60
40
20
0
6
5
4
3
2
1
0
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

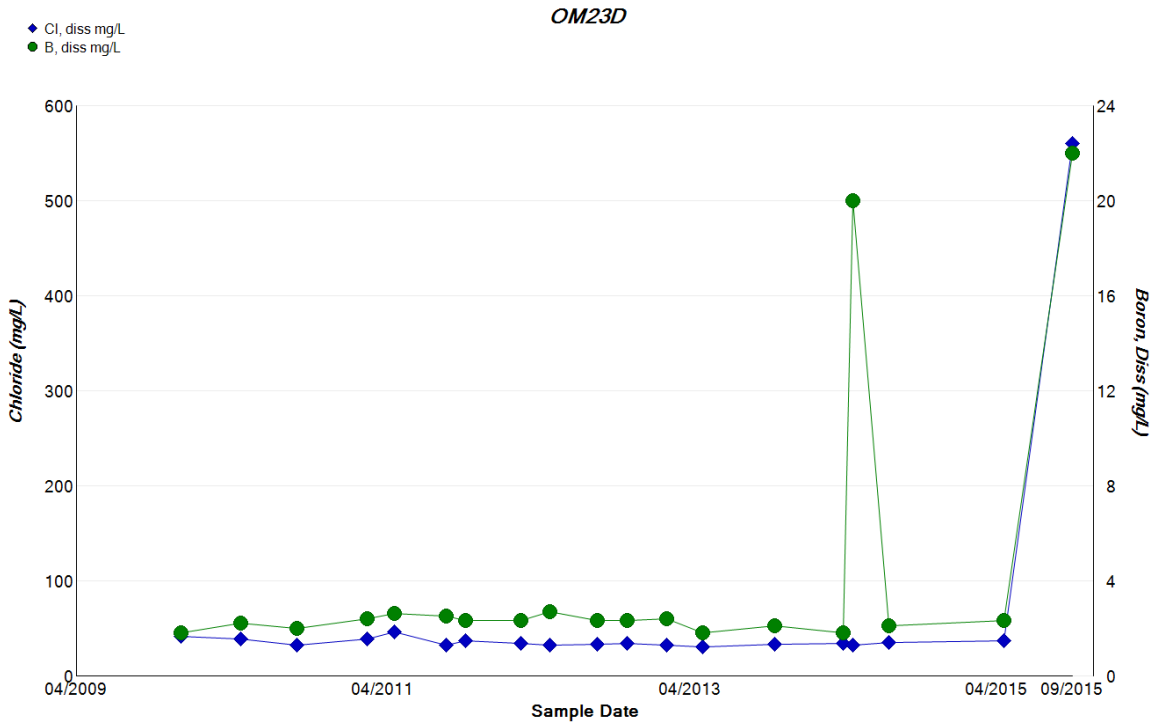

OR14D
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
500
400
300
200
100
0
40
32
24
16
8
0
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

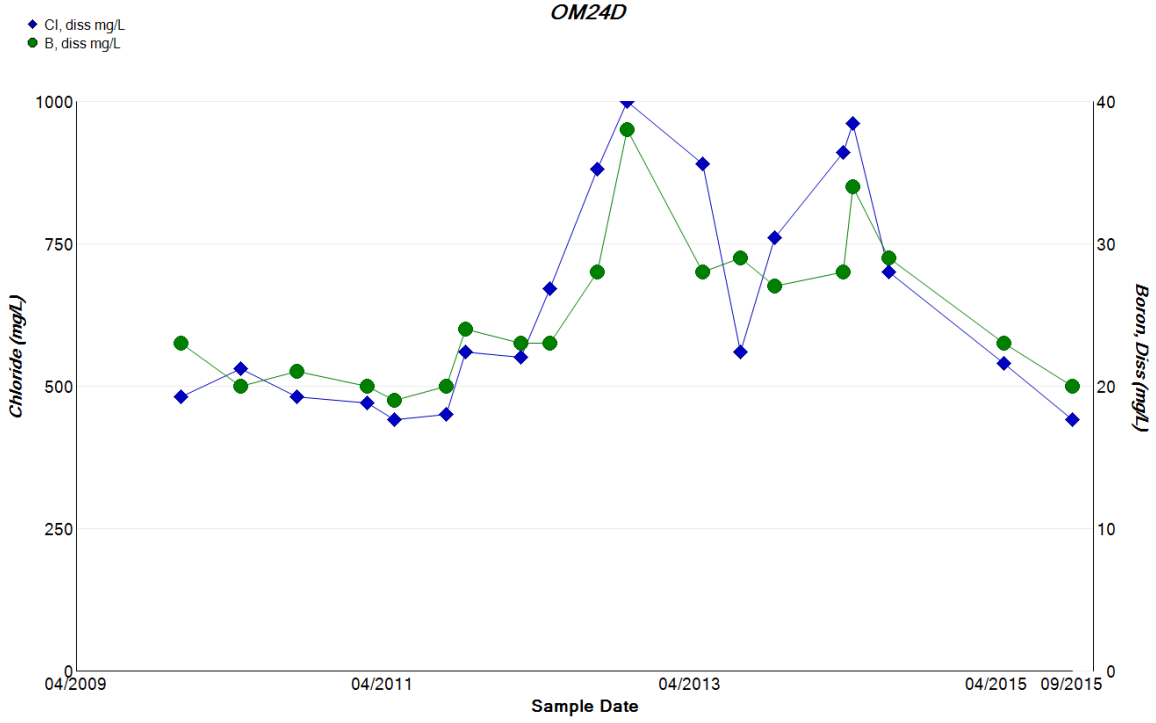

OR19
Cl, diss mg/L
B, diss mg/L
1000
750
500
250
0
80
60
40
20
0
Chloride (mg/L)
Boron, Diss (mg/L)
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date

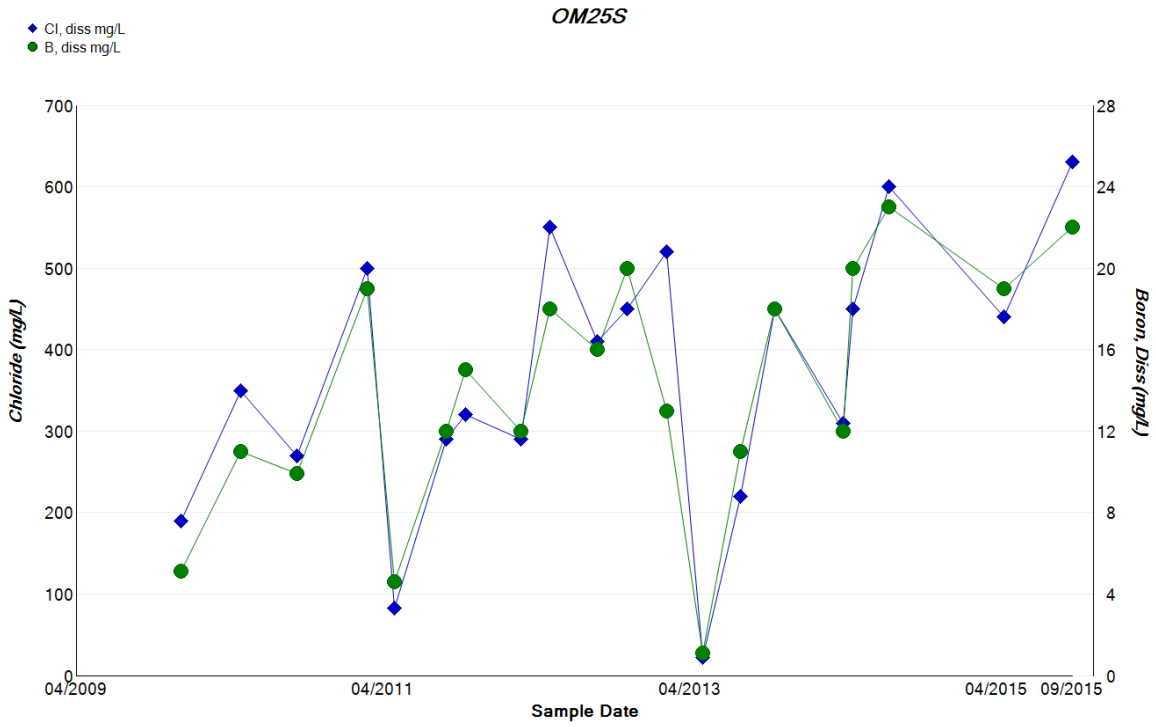

OR20
Cl, diss mg/L
B, diss mg/L
4000
3000
2000
1000
0
320
240
160
80
0
Chloride (mg/L)
Boron, Diss (mg/L)
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date


OM21
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
600
450
300
150
0
20
15
10
5
0
01/2000
01/2002
01/2004
01/2006
01/2008
01/2010
01/2012
01/2014
09/2015
Sample Date


OM22D
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
600
450
300
150
0
24
18
12
6
0
04/2009
04/2011
04/2013
04/2015
09/2015
Sample Date


OM23D
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
600
500
400
300
200
100
0
24
20
16
12
8
4
0
04/2009
04/2011
04/2013
04/2015
09/2015
Sample Date


OM24D
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
1000
750
500
250
0
40
30
20
10
0
04/2009
04/2011
04/2013
04/2015
09/2015
Sample Date


OM25S
Cl, diss mg/L
B, diss mg/L
Chloride (mg/L)
Boron, Diss (mg/L)
700
600
500
400
300
200
100
0
28
24
20
16
12
8
4
0
04/2009
04/2011
04/2013
04/2015
09/2015
Sample Date

APPENDIX D

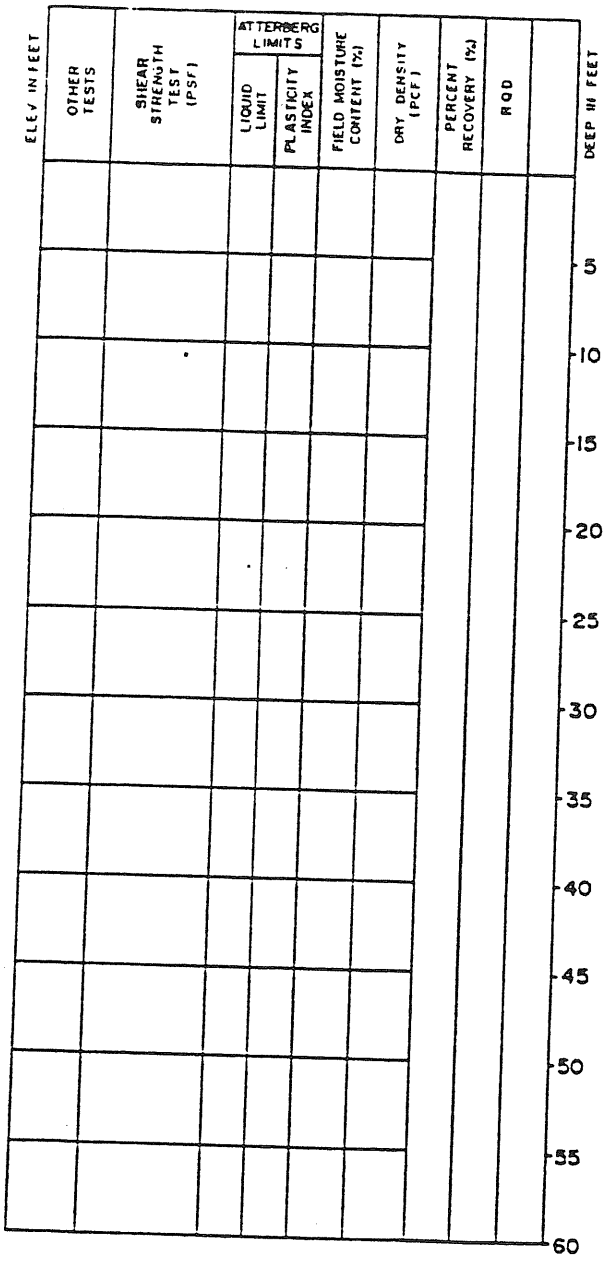
BORING LOGS AND MONITORING WELL CONSTRUCTION REPORTS

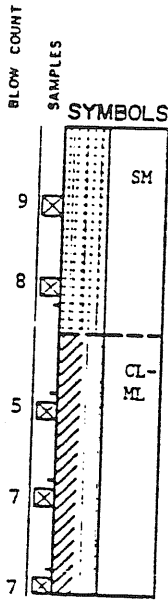
OM01

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-1

SURFACE ELEVATION 592.8'
COORDINATE 52+60 N
2+93 E





SYMBOLS	DESCRIPTION
	STRIP MINE SPOIL
SM	Brown silty SAND: Fine to medium sand with trace of clay, silt, and broken shale. Dry to 12'.
CL-ML	Brown silty CLAY: A mixture of reworked silty loess with some clay till, some organic material near the surface.

FEATURE: Observation and Monitoring Boring
Date Drilled: 9/25/80
Total Depth: 26.5'
Piezometer: Screen from 15.0' to 20.0'
Gravel pack from 13.0' to 26.5'.
Water Level Data: Elevation 579.9 on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

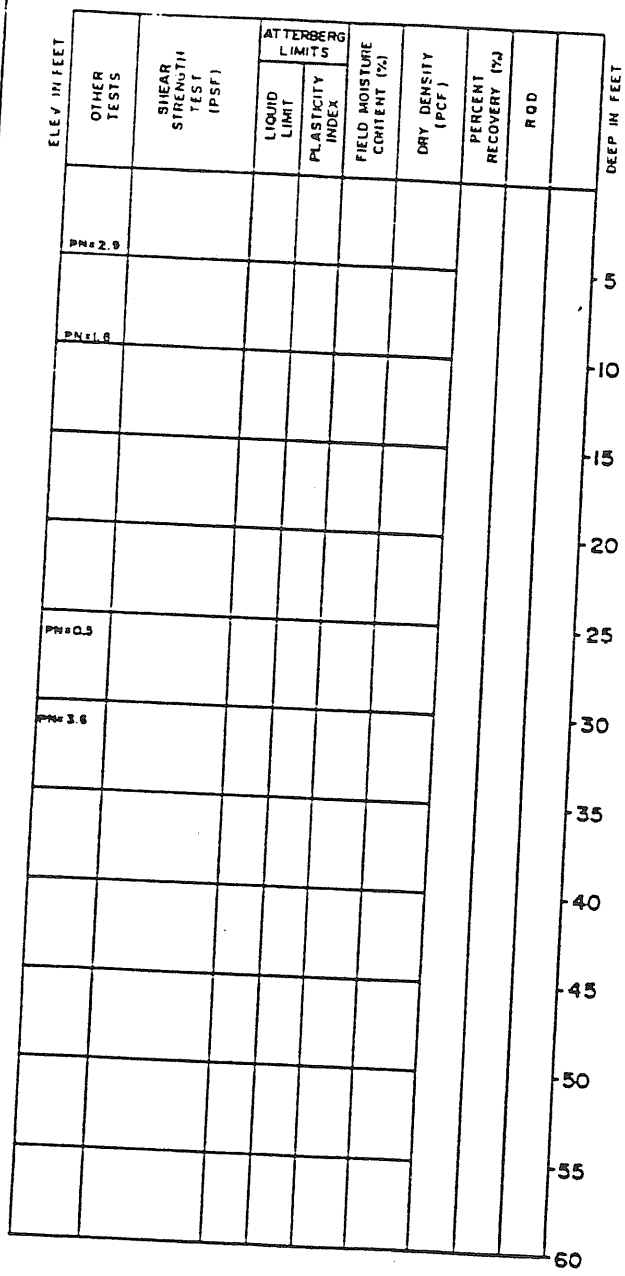
PLATE 2-1

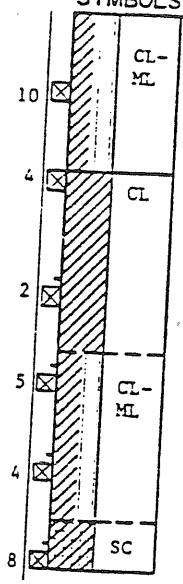
OM02

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-2

SURFACE ELEVATION 599.6'
COORDINATE 74+85 N
1+30 E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.

Dry from 0' to 6'.

Moist from 6' to 14'.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

Wet from 14' to 31.5'.

FEATURE: Observation and Monitoring Well
Date Drilled: 10/2/80
Total Depth: Screen from 10' to 20'.
Gravel pack from 8'to31.5'.
Water Level Data: Elevation 590.1' on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

PLATE 2-2

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR02

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR02

~~State~~ Plant ~~Plane~~ Coordinate: X 7,475.6 Y 130.6 (or) Latitude: ____° ____' ____" Longitude: ____° ____' ____"

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: R. Keady

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 4/2/2008 Date Finished: 4/2/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Installation Method: _____

Setting Time: _____

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: >24 hours

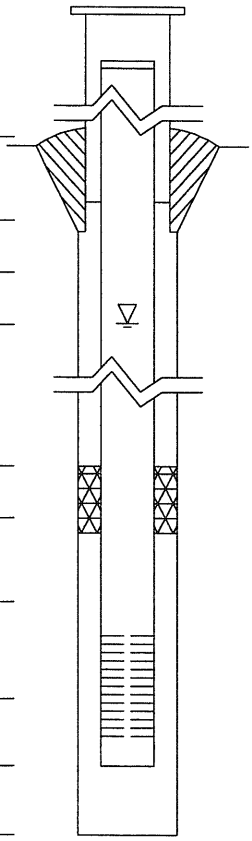
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
601.61	-2.42	Top of Protective Casing
601.41	-2.22	Top of Riser Pipe
599.19	0.00	Ground Surface
_____	_____	Top of Annular Sealant
596.60	2.59	Static Water Level (After Completion) 5/15/2008
596.64	2.55	Top of Seal
590.04	9.15	Top of Sand Pack
588.81	10.38	Top of Screen
579.32	19.87	Bottom of Screen
578.54	20.65	Bottom of Well
578.54	20.65	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	12.60
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.49
Total Length of Casing	(feet)	22.87
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

OM03

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-3

SURFACE ELEVATION 622.1'
COORDINATE 92+93N
0+88E

ELEV IN FEET	OTHER TESTS	SHEAR STRENGTH TEST (PSF)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FIELD MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT RECOVERY (%)	RQD	DEPTH IN FEET
	PN=1.5				22.6				
					17.0				5
	PN=1.3				23.5				
									10
	PN=0.8				19.3				
	PN=0.8		34	12	27.5				20
					23.3				25
	PN=0.7				23.5				
	PN=1.3				22.8				30
									35
									40
									45
	PN>4.5								50
	PN>4.5								55
									60

BLOW COUNT	SAMPLES	SYMBOLS	DESCRIPTION
			STRIP MINE SPOIL
6		CL-ML	Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface. Dry to 6'
6		CL	Moist from 6' to 75'.
		SM	
6		CL-ML	
7		CL	Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.
9		CL-ML	Brown silty Clay to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.
9			
12			
14		CL	Gray broken SHALE mine spoil mixed with some reworked clay till and loess, has a silty weathered appearance.
15			
25			
18			

FEATURE: Observation and Monitoring Well

Date Drilled: 9/18/80
Total depth: 85.7'

Installed a deep piezometer (OM-3D)
Screen from 63.5-73.5'
Gravel pack from 40-77.5'
Water level: Elevation 578.8 on 10/8/80

Installed a shallow piezometer (OM-3S) in an adjacent hole
Screem from 42-52'
Gravel pack from 40-52'
Water level: Elevation 579.1 on 10/8/80

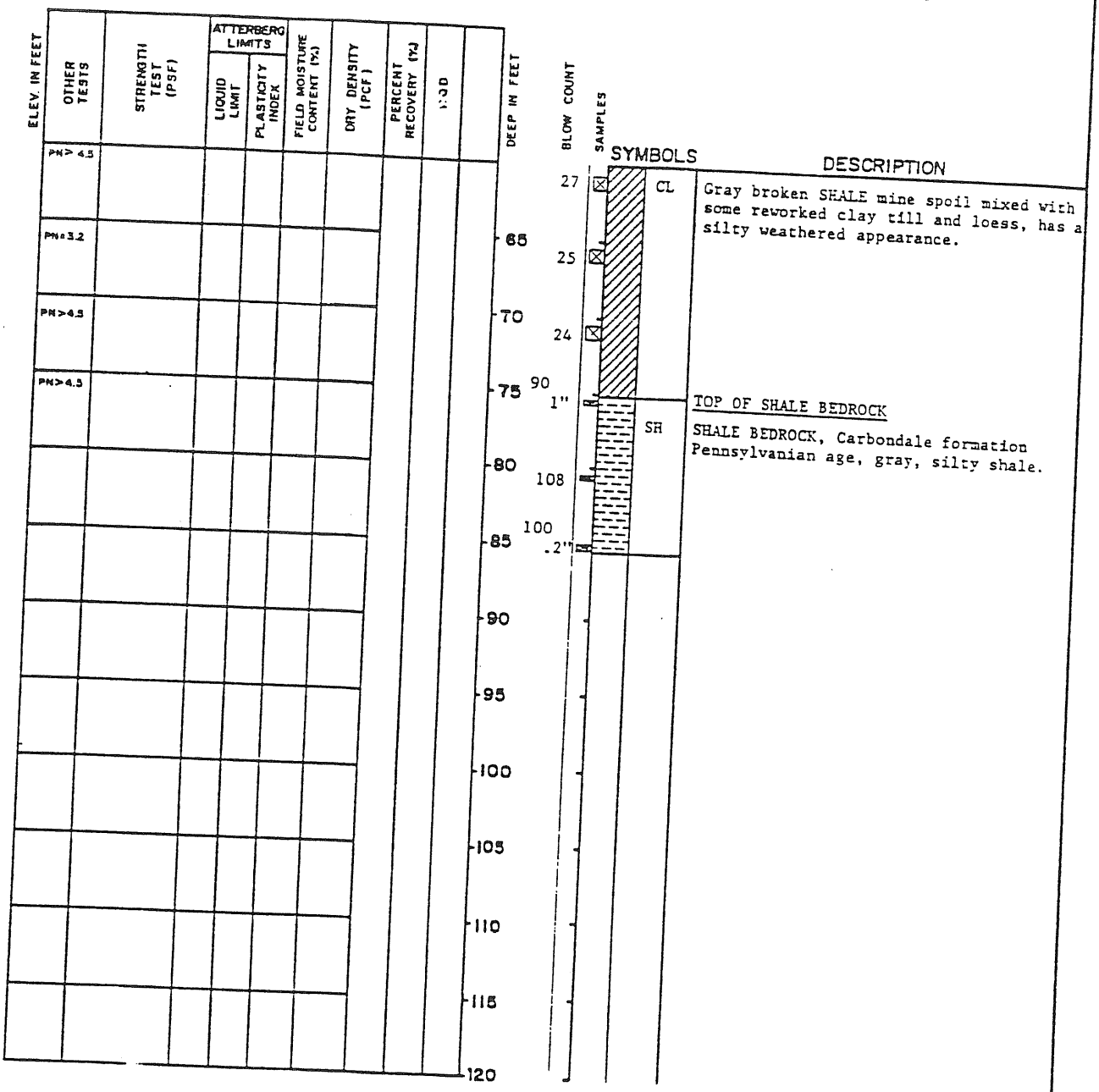
LOG OF BORING

Gilbert/Commonwealth

PLATE 2-3

OM03

BORING OM-3



LOG OF BORING

Gilbert/Commonwealth

PLATE 2-4

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR03S

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR03S

~~State~~ Plant ~~Plane~~ Coordinate: X 9,283.0 Y 82.3 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: R. Keady

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 4/3/2008 Date Finished: 4/3/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 28 minutes

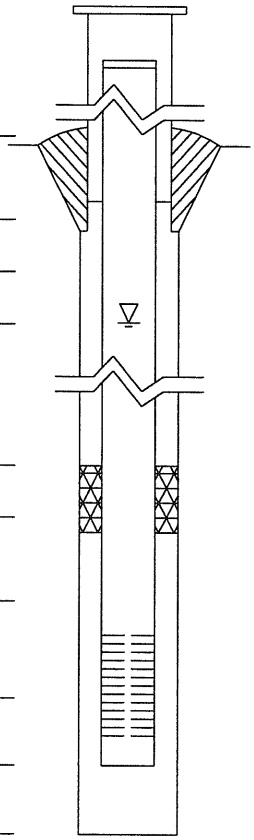
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Mine spoil (if applicable)

Installation Method: Slough



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
627.38	-3.69	Top of Protective Casing
627.16	-3.47	Top of Riser Pipe
623.69	0.00	Ground Surface
621.49	2.20	Top of Annular Sealant
581.91	41.78	Static Water Level (After Completion) 5/15/2008
579.29	44.40	Top of Seal
576.96	46.73	Top of Sand Pack
575.40	48.29	Top of Screen
565.90	57.79	Bottom of Screen
565.11	58.58	Bottom of Well
564.07	59.62	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	51.76
Bottom of Screen to End Cap	(feet)	0.79
Screen Length (1st slot to last slot)	(feet)	9.50
Total Length of Casing	(feet)	62.05
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR03D

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR03D

~~State~~ Plane Coordinate: X 9,286.1 Y 85.6 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: R. Keady

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 4/4/2008 Date Finished: 4/4/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 41 minutes

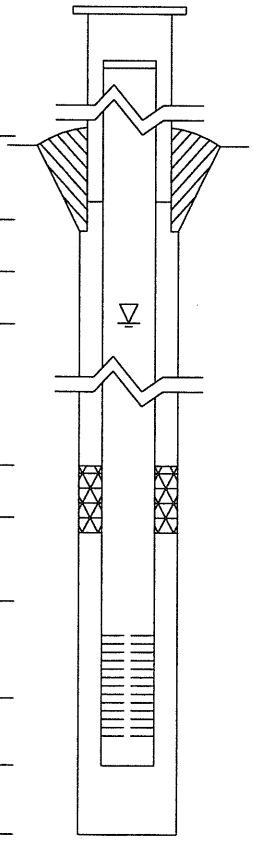
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
627.30	-3.58	Top of Protective Casing
627.13	-3.41	Top of Riser Pipe
623.72	0.00	Ground Surface
621.47	2.25	Top of Annular Sealant
581.98	41.74	Static Water Level (After Completion) 5/15/2008
560.89	62.83	Top of Seal
558.68	65.04	Top of Sand Pack
556.69	67.03	Top of Screen
547.21	76.51	Bottom of Screen
546.42	77.30	Bottom of Well
546.42	77.30	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	70.44
Bottom of Screen to End Cap	(feet)	0.79
Screen Length (1st slot to last slot)	(feet)	9.48
Total Length of Casing	(feet)	80.71
Screen Slot Size **	(inches)	0.010

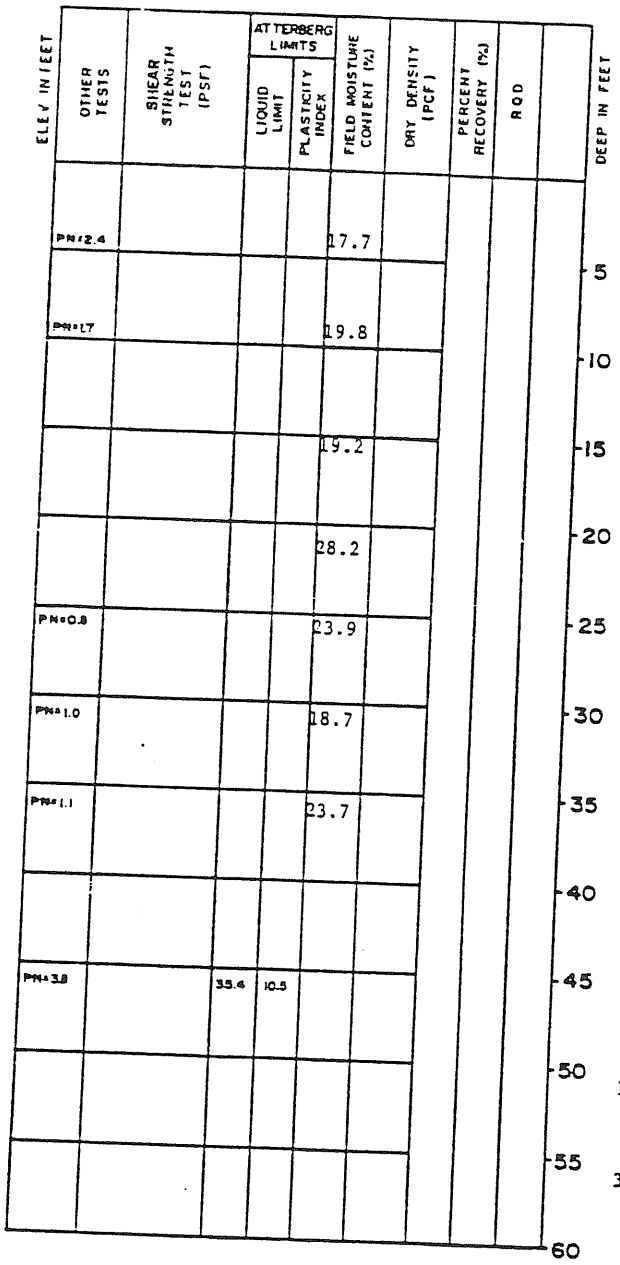
**Hand-Slotted Well Screens Are Unacceptable

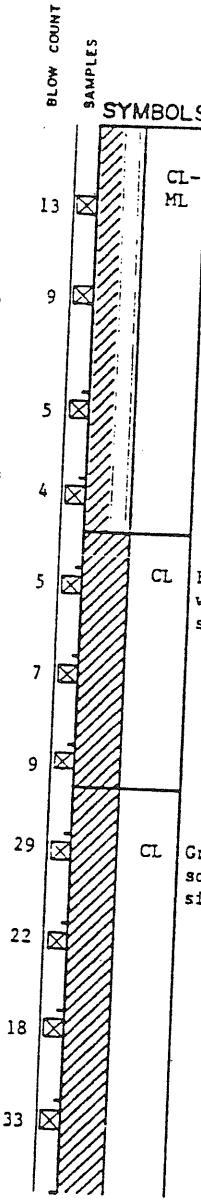
OM04D/S

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-4

SURFACE ELEVATION 604.9'
COORDINATE 95+50 N
12+27 E





SYMBOLS

DESCRIPTION

STRIP MINE SPOIL

CL-ML Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.

Moist to 66'.

CL Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

CL Gray broken SHALE mine spoil mixed with some reworked clay till and loess, has a silty weathered appearance.

FEATURE: Observation and Monitoring Well (OM-4D)
Date Drilled: 9/12/80
Total Depth: 68.0'
Piezometer: Screen from 51.0' to 61.0'.
Gravel pack from 44.0' to 65.0'.
Water level; Elevation 581.3' on 10/20/80

Installed a second shallow piezometer in an adjacent hole (OM-4S)
Screen from 23-33'
Gravel pack from 20-35'
Water level: Elevation 583.8 on 10/20/80

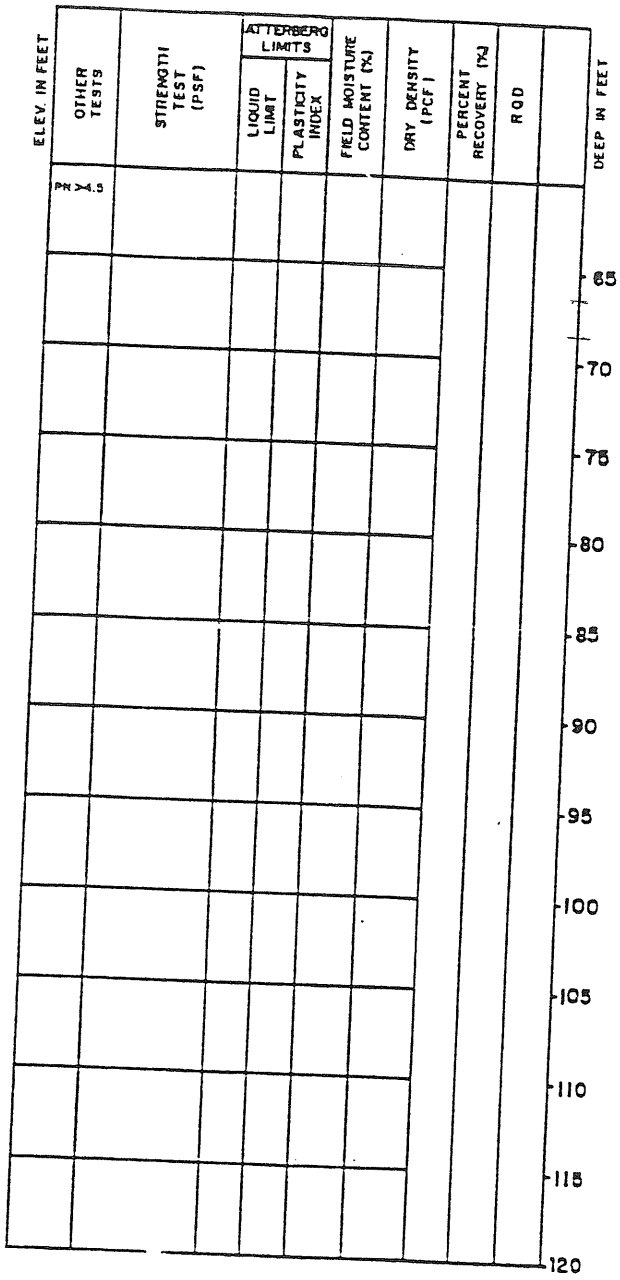
LOG OF BORING

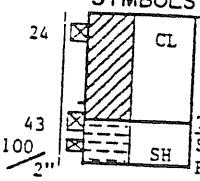
Gilbert/Commonwealth

PLATE 2-5

OM04

BORING OM-4





DESCRIPTION

TOP OF SHALE BEDROCK

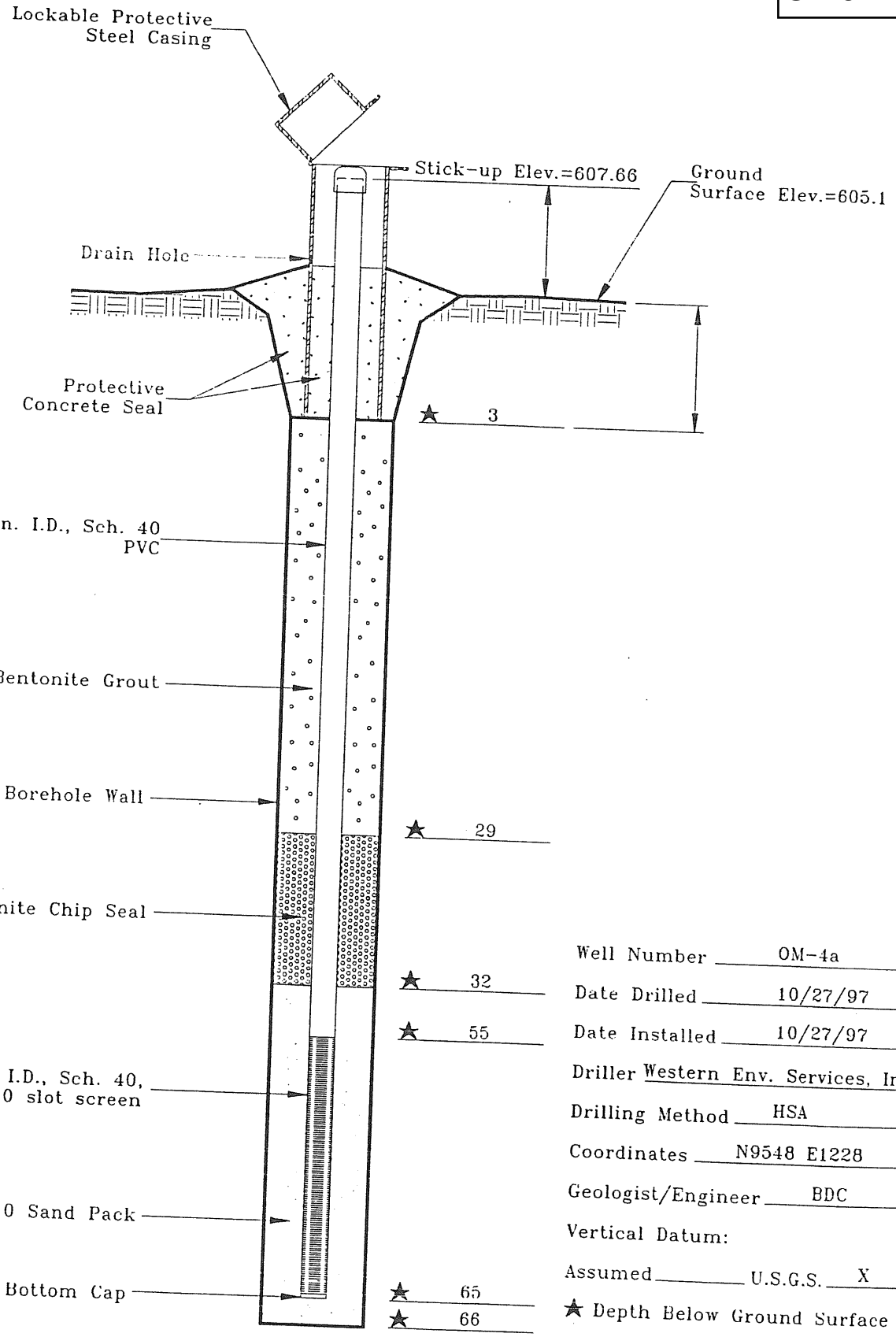
SHALE BEDROCK, Carbondale formation Pennsylvanian age, gray, silty shale.

LOG OF BORING

Gilbert/Commonwealth

PLATE 2-6

OR04D



Well Number OM-4a

Date Drilled 10/27/97

Date Installed 10/27/97

Driller Western Env. Services, Inc.

Drilling Method HSA

Coordinates N9548 E1228

Geologist/Engineer BDC

Vertical Datum:

Assumed _____ U.S.G.S. X

★ Depth Below Ground Surface

Not to Scale

MONITORING WELL OM-4a

HANSON ENGINEERS INCORPORATED

MONITORING WELL INSTALLATION
CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078A

I:\DRAWINGS\92S5078A\004.DWG 12/05/97 08:15 Oih

OR04D

DUCK CREEK STATION | BORING OM-4a | SHEET 1 of 2

DATE STARTED 10/27/97 | DATE COMPLETED 10/27/97 | LOGGED BY BDC | SURFACE EL. 605.1 (ft.)

DRILLING CONTRACTOR: WESTERN ENVIRONMENTAL, INC. | DRILL METHOD: HSA

Depth (ft)	Graphic Log	Penetrometer (TSF)	SOIL/ROCK DESCRIPTION
0		1.0 1.25	Brown clayey silt w/ tr. sand & gravel; tr. gray colored zones; roots at top.
5		– – 1.0 1.25	SAME; so. rust brown & gray mottles; pockets of silty clay. SAME; v. moist; v. little recovery (looks like pushed a cobble); variegated gray & rust brown colors; drilling very easy.
10		– – – –	CORE LOSS
			SAME; v. moist to wet; v. little recovery (cobble in tip); olive gray color; variegated colors; tr. shale frags; v. soft; drilling v. easy.
15		– – –	CORE LOSS
			SAME; v. moist to wet; v. little recovery big glacial cobble (w/ striations) in tip; zones which are mostly dk. gray.
20		– – –	CORE LOSS
25		0.5 0.25 0.25 0.25	SAME; highly variegated colors (dk. gray, gray, brown, & rust brown); moist; pockets of gray silt (blocky – may be weathered rock).
30		0.5 0.5 0.25	SAME; becomes all gray at 31 ft. w/ angular siltstone rock frags; wet in zones w/ more rock frags.
35			

VAPOR CONCENTRATION
Isobutylene Calibration
Gas Equivalent Units (ppm)
10^0 10^1 10^2 10^3

COMMENTS

▽ 13 ft.

▼ 22.99 ft. after 8 days.

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35

SOIL/ROCK BORING DATA

HANSON ENGINEERS INCORPORATED

ADY 12/5/97 REVIEWED DATE

BDC 12/5/97 APPROVED DATE

MONITORING WELL INSTALLATION
CILCO-DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078A

OR04D

DUCK CREEK STATION | BORING OM-4a | SHEET 2 of 2

DATE STARTED 10/27/97 | DATE COMPLETED 10/27/97 | LOGGED BY BDC | SURFACE EL. 605.1 (ft.)

DRILLING CONTRACTOR: WESTERN ENVIRONMENTAL, INC. | DRILL METHOD: HSA

Depth (ft)	Graphic Log	Penetrometer (TSF)	SOIL/ROCK DESCRIPTION	VAPOR CONCENTRATION Isobutylene Calibration Gas Equivalent Units (ppm) 10^0 10^1 10^2 10^3	COMMENTS	Depth (ft)
31		0.25 1.5 1.75 1.5	Gray silt w/ so. clay, sand & gravel; sand & gravel is composed mostly of gray siltstone rock; tr. rust brown mottles; wet in zones w/ rock frags.			31
41			SAME; rock frags v. common; wet in these zones; clayey silt in areas (v. sticky); siltstone frags are fissile.			41
			SAME; water in zones w/ abundant coarse rock; sticky.			
51			SAME; tr. brown mottled zones; v. wet; abundant rock; some rock has slickensides.			51
			CORE LOSS			
			SAME; coal & organic shale (black) frags from 53.6-53.9 ft; 55.6-55.8 ft. and 57.5-58.0 ft; wet; smaller pieces of black shale disseminated throughout.			
			SAME; black organic shale more common.			
61			SAME; coal frags v. common; refusal at 66 ft.			61
			End of Boring = 66.0'			
71			TILL SPOIL 0-31 ft. TILL/SHALE SPOIL 31-66 ft.			71

SOIL/ROCK BORING DATA

HANSON ENGINEERS INCORPORATED

REVIEWED 12/5/97 DATE

APPROVED BDC 12/5/97 DATE

MONITORING WELL INSTALLATION
CILCO-DUCK CREEK STATION
CANTON, ILLINOIS

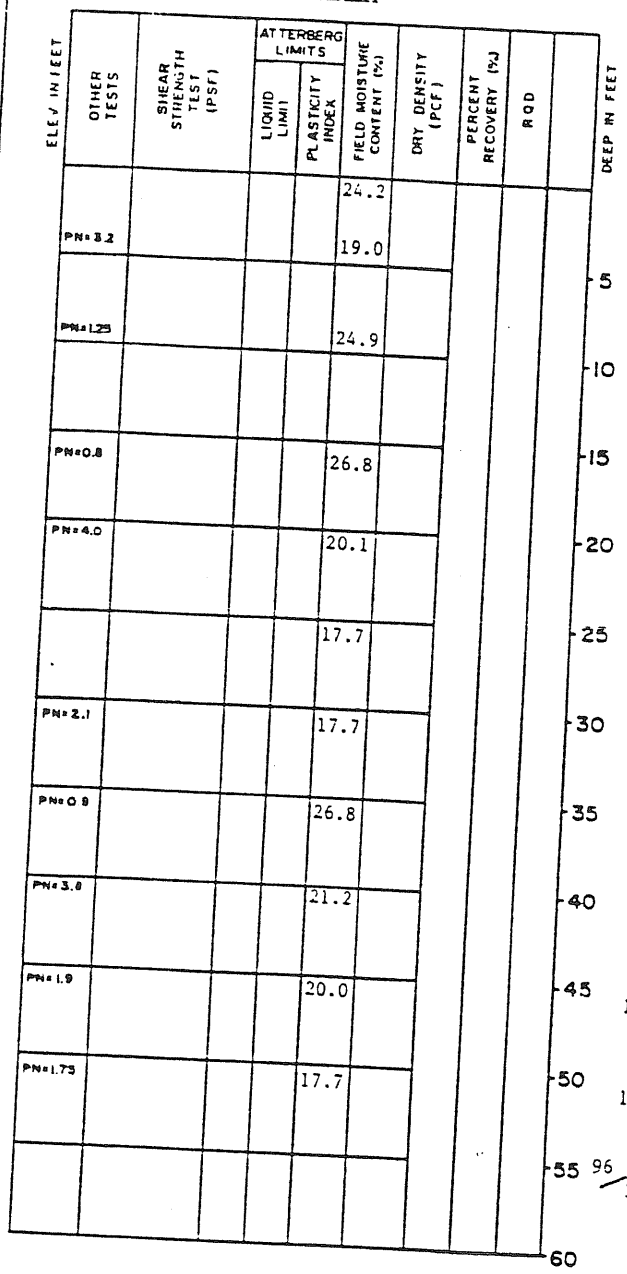
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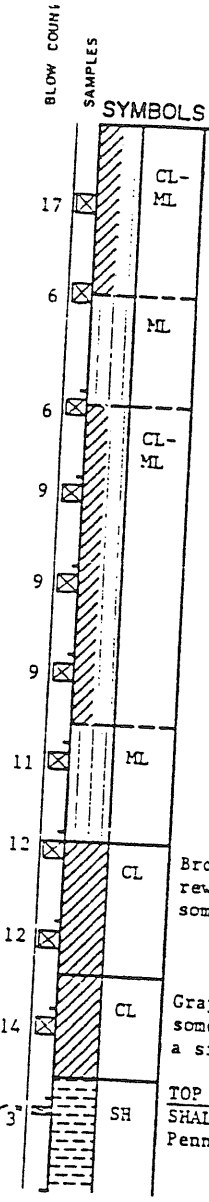
OM05

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-5

SURFACE ELEVATION 608.0'
COORDINATE 67+62 N
16+82 E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.

Damp to 14'.

Moist to 54'.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

Gray broken SHALE mine spoil mixed with some reworked clay till and loess, has a silty weathered appearance.
50% water loss.

TOP OF SHALE BEDROCK

SHALE BEDROCK, Carbondale formation Pennsylvanian age, gray, silty shale.

FEATURE: Observation and Monitoring Well (OM-5D)
Date Drilled: 9/5/80
Total Depth: 67.0'
Piezometer: Screen from 47.0' to 57.0'
Gravel pack from 45.0' to 67.0'.
Water level: Elevation 594.0' on 11/20/80

Installed a second shallow piezometer in an adjacent hole (OM-5S)
Screen from 13-23'
Gravel pack from 23.5-11'
Water level: 594.4' on 11/20/80

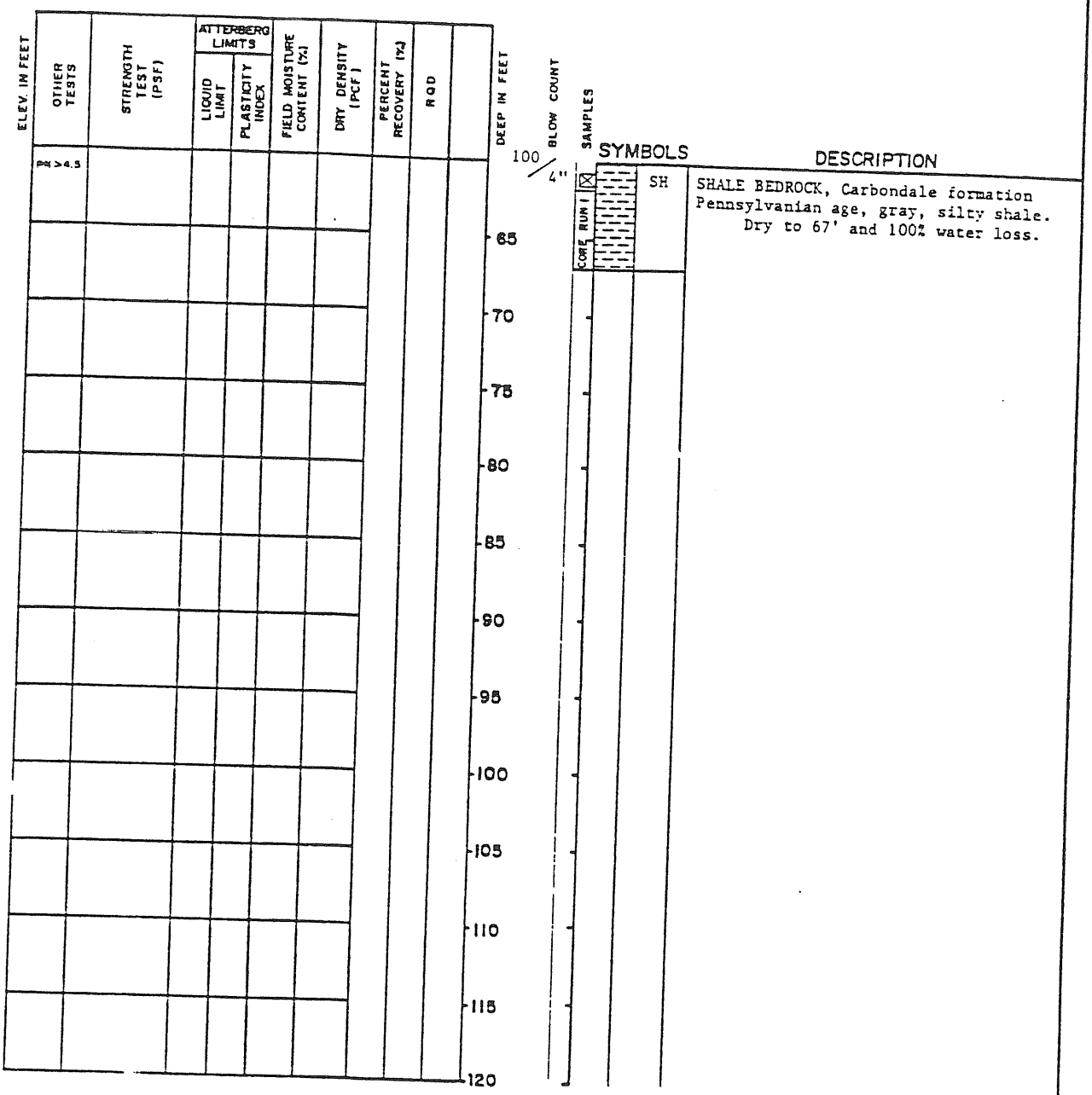
LOG OF BORING

Gilbert/Commonwealth

PLATE 2-7

OM05

BORING OM-5



LOG OF BORING

Gilbert/Commonwealth

PLATE 2-8

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR05D

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR05D

~~State~~ Plane Coordinate: X 6,766.3 Y 1,675.1 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/20/2008 Date Finished: 3/20/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry
(choose one)

Installation Method: Gravity

Setting Time: >24 hours

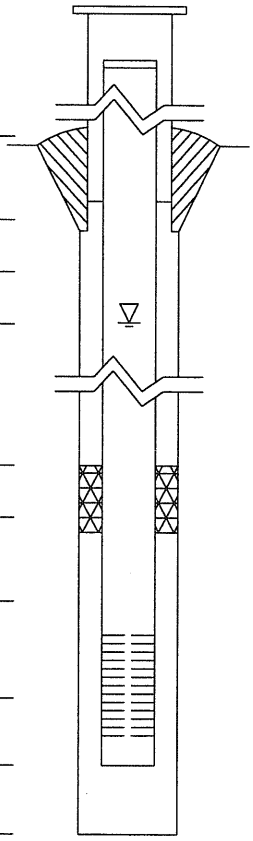
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz sand
(if applicable)

Installation Method: Gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
611.16	-3.25	Top of Protective Casing
610.96	-3.05	Top of Riser Pipe
607.91	0.00	Ground Surface
605.91	2.00	Top of Annular Sealant
600.77	7.14	Static Water Level (After Completion) 5/15/2008
575.91	32.00	Top of Seal
572.66	35.25	Top of Sand Pack
570.97	36.94	Top of Screen
561.49	46.42	Bottom of Screen
560.91	47.00	Bottom of Well
559.41	48.50	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	39.99
Bottom of Screen to End Cap	(feet)	0.58
Screen Length (1st slot to last slot)	(feet)	9.48
Total Length of Casing	(feet)	50.05
Screen Slot Size **	(inches)	0.010

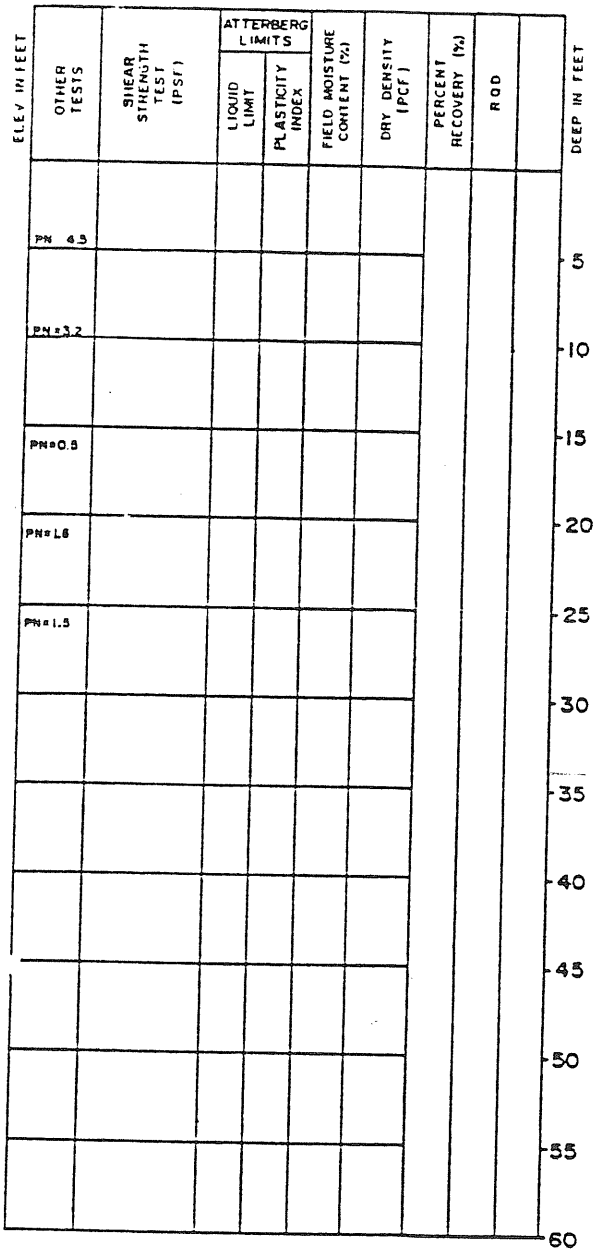
**Hand-Slotted Well Screens Are Unacceptable

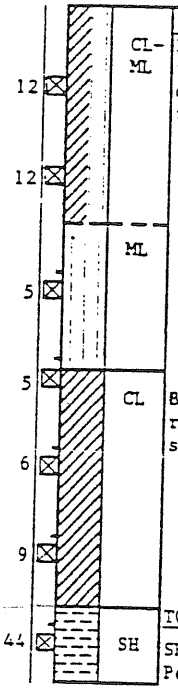
OM06

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-6

SURFACE ELEVATION 587.8'
COORDINATE 49+25 N
16+75 E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.

Dry to 12'.

Moist to 34'.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

TOP OF SHALE BEDROCK

SHALE BEDROCK: Carbondale formation Pennsylvanian age, gray, silty shale.

FEATURE: Observation and Monitoring Well
Date Drilled: 9/22/80
Total Depth: 38.0'
Piezometer: Screen from 15.0' to 25.0'.
Gravel pack from 13.0' to 33.0'.
Water Level Data: Elevation 576.8 on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

PLATE 2-9

OM06A

BORING OM-6A

SURFACE ELEVATION 590.67
COORDINATE 4925 N
1635 E

ELEV IN FEET	OTHER TESTS	SHEAR STRENGTH TEST (PSF)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FIELD MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING #200 SIEVE	RECOVERY (%)	RQD	DEPTH IN FEET
	PN	4.5								5
	PN	3.75-4.5+								10
										15
										20
										25
										30
										35
										40
										45
										50
										55
										60

BLOW COUNT	SAMPLES	SYMBOLS	DESCRIPTION
17		ML CL	MINE SPOIL. Brown clayey silt and silty clay, little fine to medium sand, trace fine gravel; moist, below plastic limit; grades with increasing moisture with depth.
12			
6			15.0 to 15.7 ft., Yellow-brown clayey silt and fine to medium sand, near saturated.
		SH	17.8 ft.,broken shale noted in drilling; water level at 17.8 ft. when pulled auger plug and at 4.0 ft. after ss-4 taken.
7		ML / ML • CL	20.2 ft.,Yellow-brown to brown silt (Loess) and clayey silt; some fine to medium sand, trace fine gravel (Till), broken shale noted, 21.0 to 24.5 ft.
7		ML • CL	24.5 ft. gray silty clay, little fine to medium sand, little fine to coarse gravel (Till mixed with broken shale fragments). Water at 4.0 ft.
16			32.0 ft., 6" shale cobble.
20		SH	35.0 ft., Black weathered broken shale, moist not saturated. Water level at 14.0 ft. Hard drilling noted
58/3"		SH	SHALE BEDROCK - 38.0 ft. Gray shale, weathered

MONITORING WELL INSTALLED 10/17/84
10' of #10 slot screen: 15.0 to 25.0 ft.
Gravel Pack : 12.0 to 40.3 ft.
Bentonite Seal : 10.0 to 12.0 ft.
Cement-Bentonite Grout: G.S. to 10.0 ft.

CILCO
DUCK CREEK STATION
WASTE DISPOSAL SYSTEM

Gilbert Commonwealth Companies

LOG OF
BORING OM-6A

PLATE

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR06A

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR06A

~~State~~ Plant ~~Plane~~ Coordinate: X 4,917.2 Y 1,635.8 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 4/1/2008 Date Finished: 4/1/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Installation Method: _____

Setting Time: _____

Type of Bentonite Seal -- (Granular) Pellet Slurry
(choose one)

Installation Method: Gravity

Setting Time: >24 hours

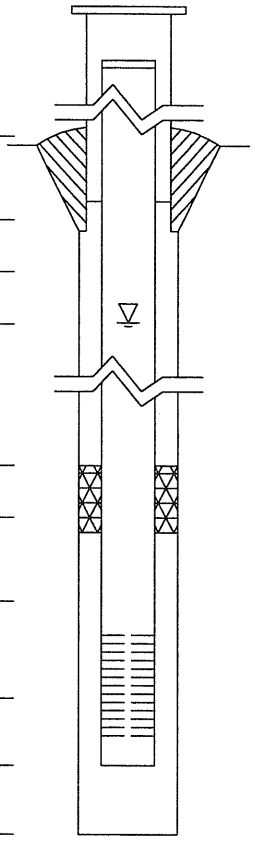
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a
(if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
_____	_____	Top of Protective Casing
595.31	-3.69	Top of Riser Pipe
591.62	0.00	Ground Surface
_____	_____	Top of Annular Sealant
592.37	-0.75	Static Water Level (After Completion) 5/15/2008
589.12	2.50	Top of Seal
577.50	14.12	Top of Sand Pack
576.09	15.53	Top of Screen
566.59	25.03	Bottom of Screen
565.81	25.81	Bottom of Well
565.81	25.81	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	19.22
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.50
Total Length of Casing	(feet)	29.50
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

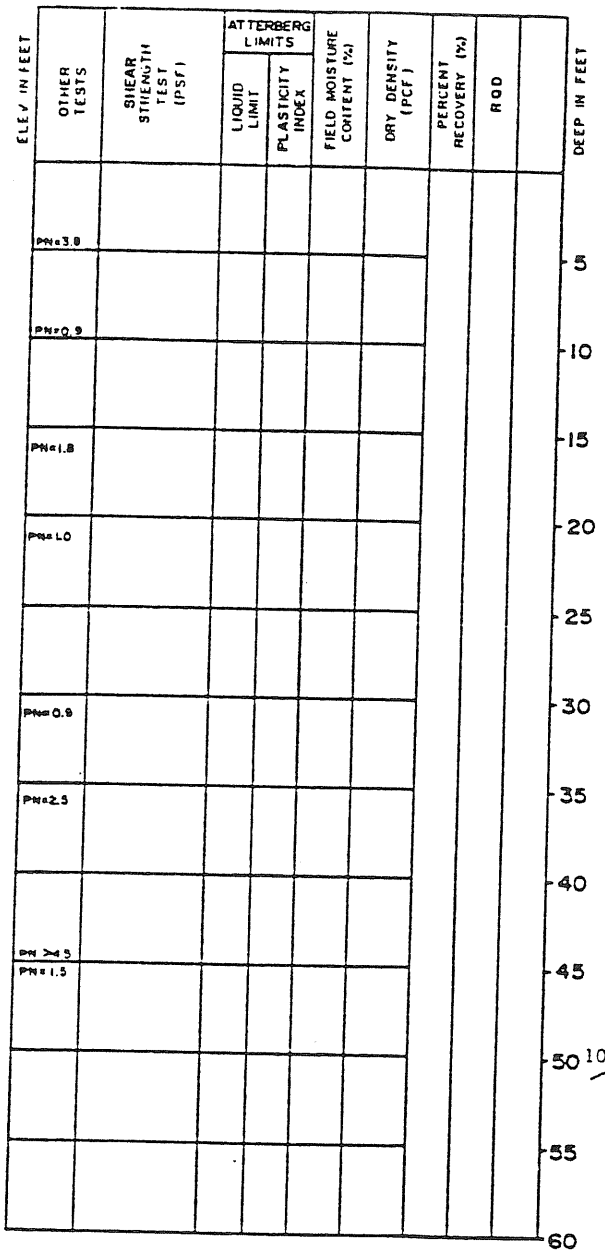
**Hand-Slotted Well Screens Are Unacceptable

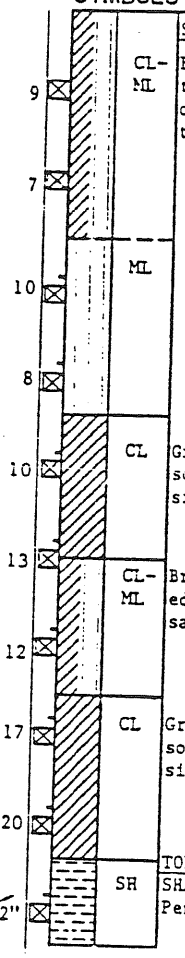
OM07

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-7

SURFACE ELEVATION 593.4'
COORDINATE 41+60 N
16+44 E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.

Dry to 12'.

Moist from 12' to 48'.

Gray broken SHALE mine spoil mixed with some reworked clay till and loess, has a silty weathered appearance.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

Gray broken SHALE mine spoil mixed with some reworked clay till and loess, has a silty weathered appearance.

TOP OF SHALE BEDROCK

SHALE BEDROCK, Carbondale formation Pennsylvanian age, gray, silty shale.

FEATURE: Observation and Monitoring Well
Date Drilled: 9/18/80
Total Depth: 53.0'
Piezometer: Screen from 17.0' to 27.0'.
Gravel pack from 15.0' to 46.0'
and 49.0' to 53.0'.
Water Level Data: Elevation 581.3 on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

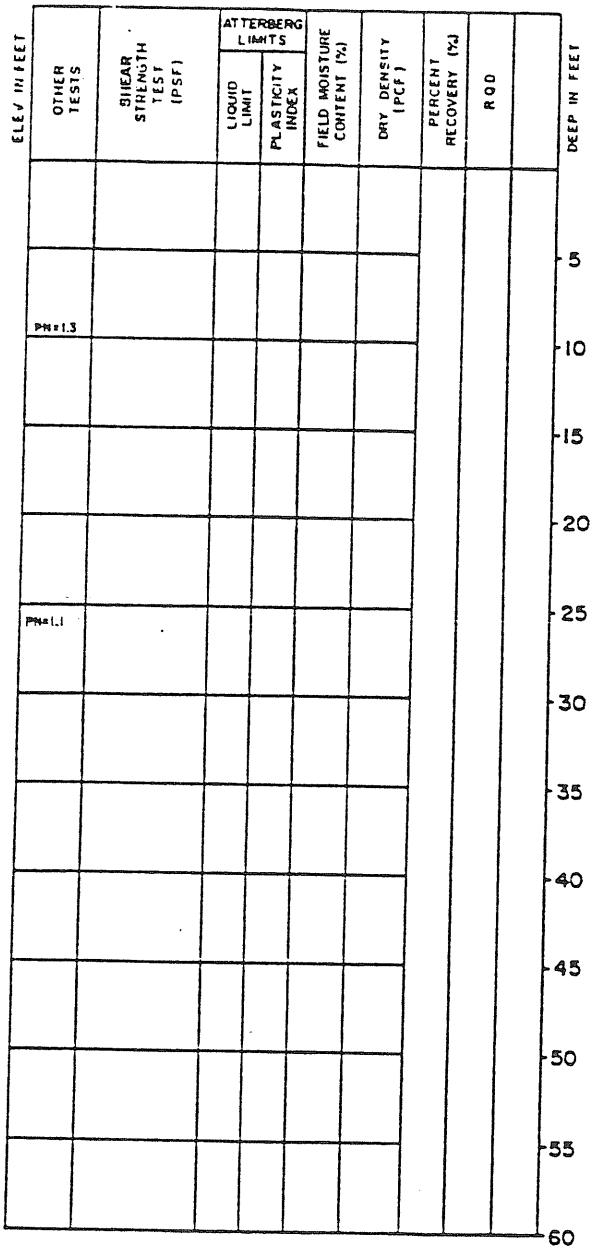
PLATE 2-10

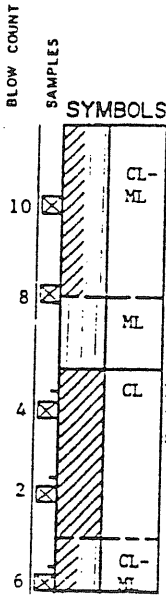
OM08

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-8

SURFACE ELEVATION 599.4'
COORDINATE 25+78' N
19+36' E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT:A mixture of reworked silty loess with some clay till, some organic material near the surface.

Damp to 11'.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand broken shale.

FEATURE: Observation and Monitoring Well
Date Drilled: 9/23/80
Total Depth: 26.5'
Piezometer; Screen from 15.0' to 25.0'.
Gravel pack from 13.0' to 26.5'.
Water Level Data: Elevation 587.4' on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

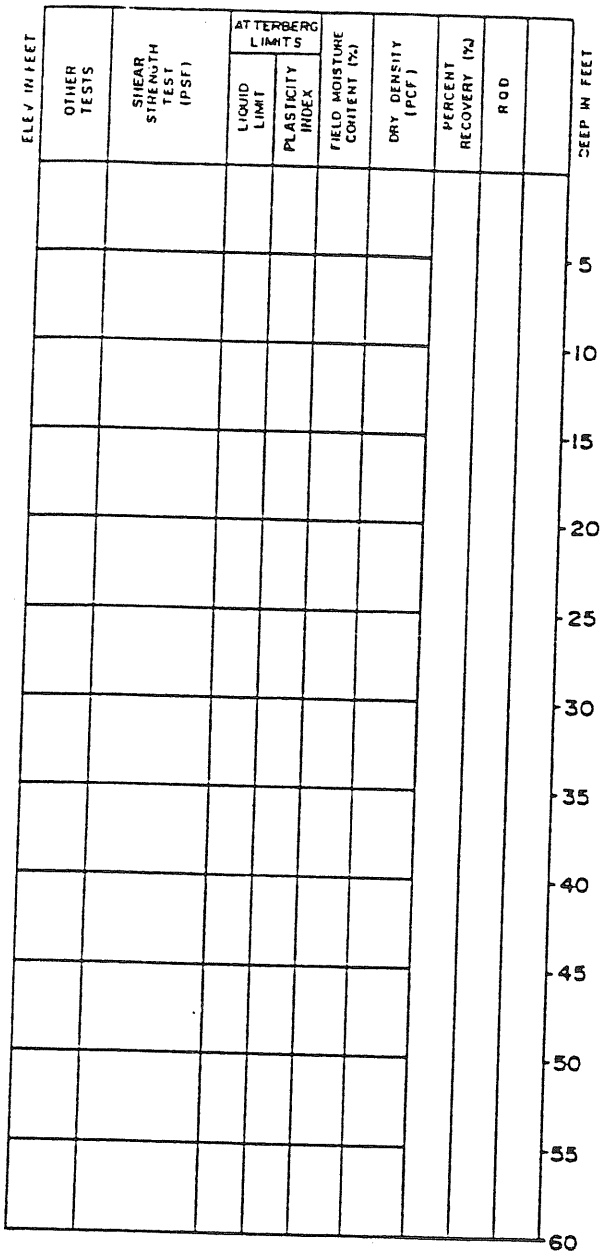
PLATE 2-11

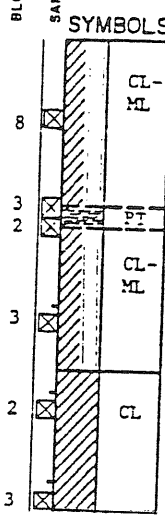
OM09

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-9

SURFACE ELEVATION 590.2'
COORDINATE 19+02 N
0+72 E





SYMBOLS

DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.

Damp to 9'.

Wet to 26'.

Dark gray PEAT.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

FEATURE: Observation and Monitoring Well
Date Drilled: 9/24/80
Total Depth: 26.5'
Piezometer: Screen from 15.0' to 25.0'
Gravel pack from 13.0' to 25.0'.
Water Level Data: Elevation 586.4' on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

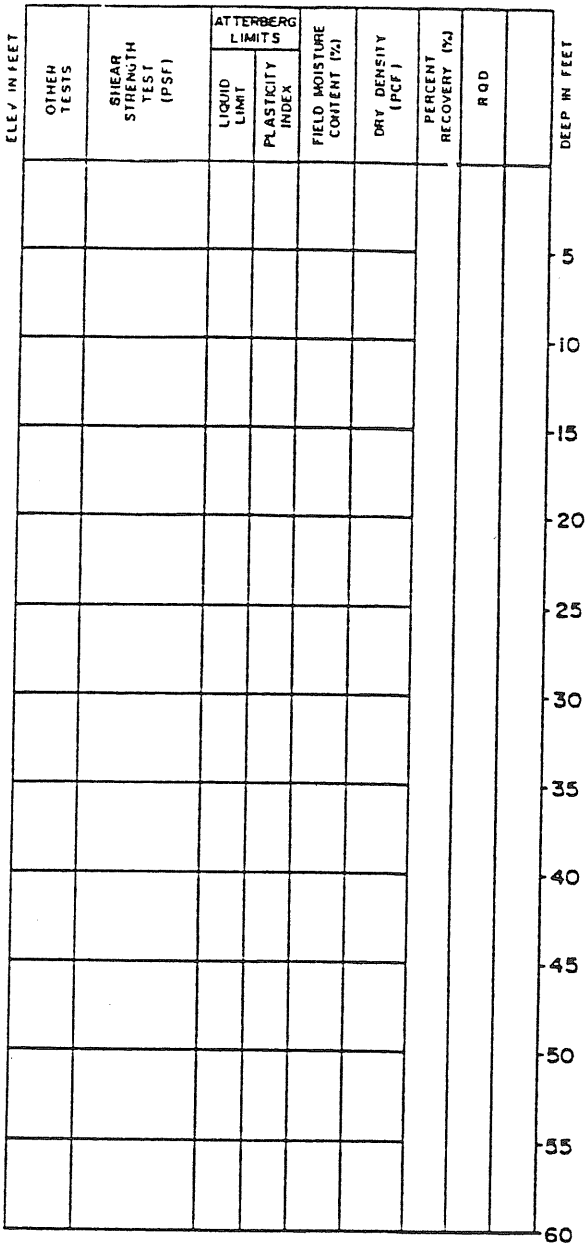
PLATE 2-12

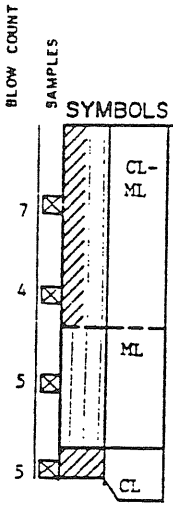
OM10

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-10

SURFACE ELEVATION 584.0'
COORDINATE 62+21'N
48+76'E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.
Dry to 7'.

Moist to 20'.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

FEATURE: Observation and Monitoring Well
Date Drilled: 10/1/80
Total Depth: 20.0'
Piezometer: Screen from 8.0' to 18.0'.
Gravel pack from 7.0' to 20.0'.
Water Level Data: Elevation 570.9' on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

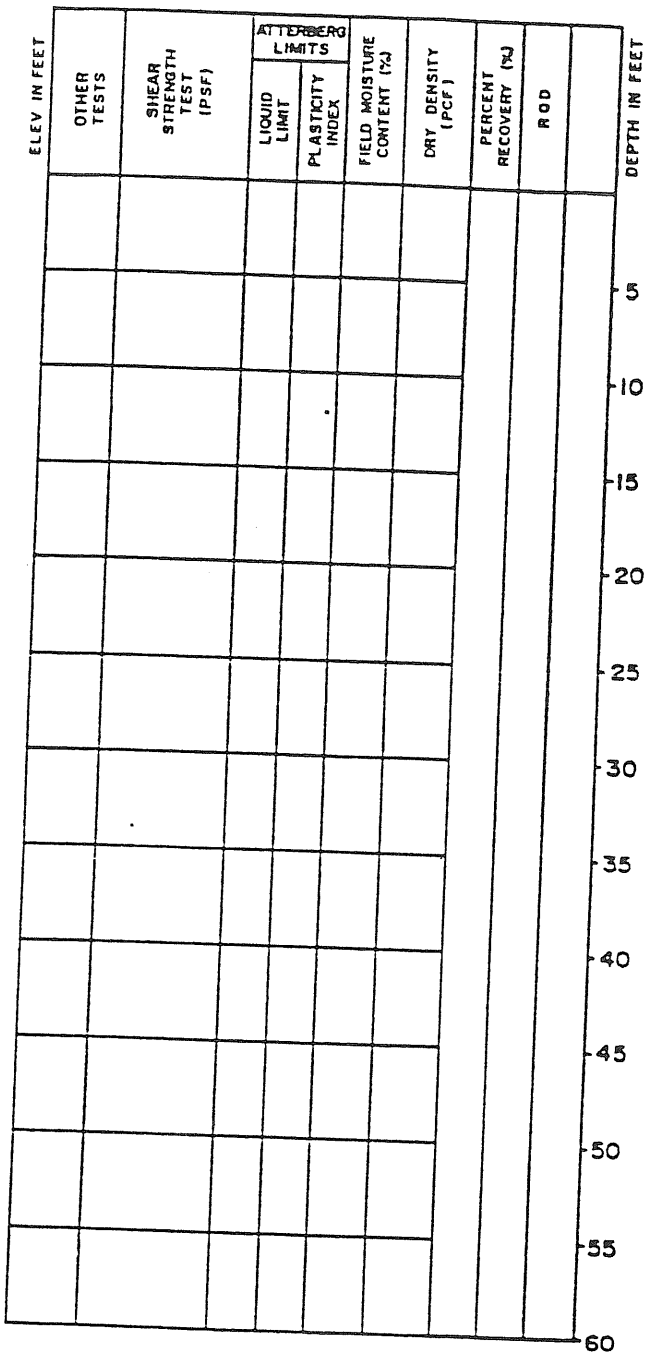
PLATE 2-13

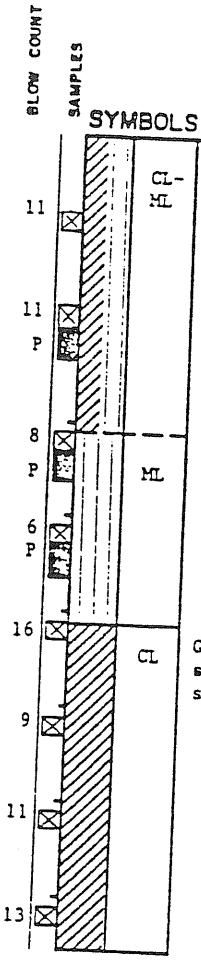
OM11

CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

BORING OM-II

SURFACE ELEVATION 594.0'
COORDINATE 54+38'N
30+61'E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till, some organic material near the surface.

Dry to 13'.

Moist to 43'.

Gray broken SHALE mine spoil mixed with some reworked clay till and loess, has a silty weathered appearance.

FEATURE: Observation and Monitoring Well
Date Drilled: 10/16/80
Total Depth: 43.0'
Piezometer: Screen from 30.0' to 40.0'
Gravel pack from 28.0' to 43.0'.
Water Level Data: Elevation 563.6' on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

PLATE 2-16

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR11

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR11

~~State~~ Plant ~~Plane~~ Coordinate: X 5,448.4 Y 3,059.0 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: B. WIlliamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/25/2008 Date Finished: 3/25/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

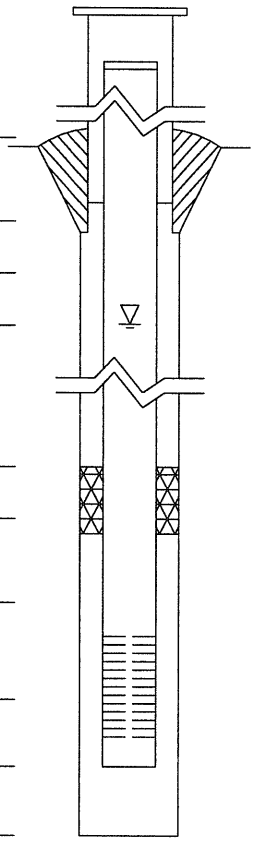
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz sand (if applicable)

Installation Method: Gravity



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
596.79	-3.15	Top of Protective Casing
596.55	-2.91	Top of Riser Pipe
593.64	0.00	Ground Surface
591.64	2.00	Top of Annular Sealant
569.42	24.22	Static Water Level (After Completion) 5/15/2008
564.86	28.78	Top of Seal
563.25	30.39	Top of Sand Pack
561.79	31.85	Top of Screen
552.34	41.30	Bottom of Screen
551.56	42.08	Bottom of Well
551.07	42.57	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	34.76
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.45
Total Length of Casing	(feet)	44.99
Screen Slot Size **	(inches)	0.010

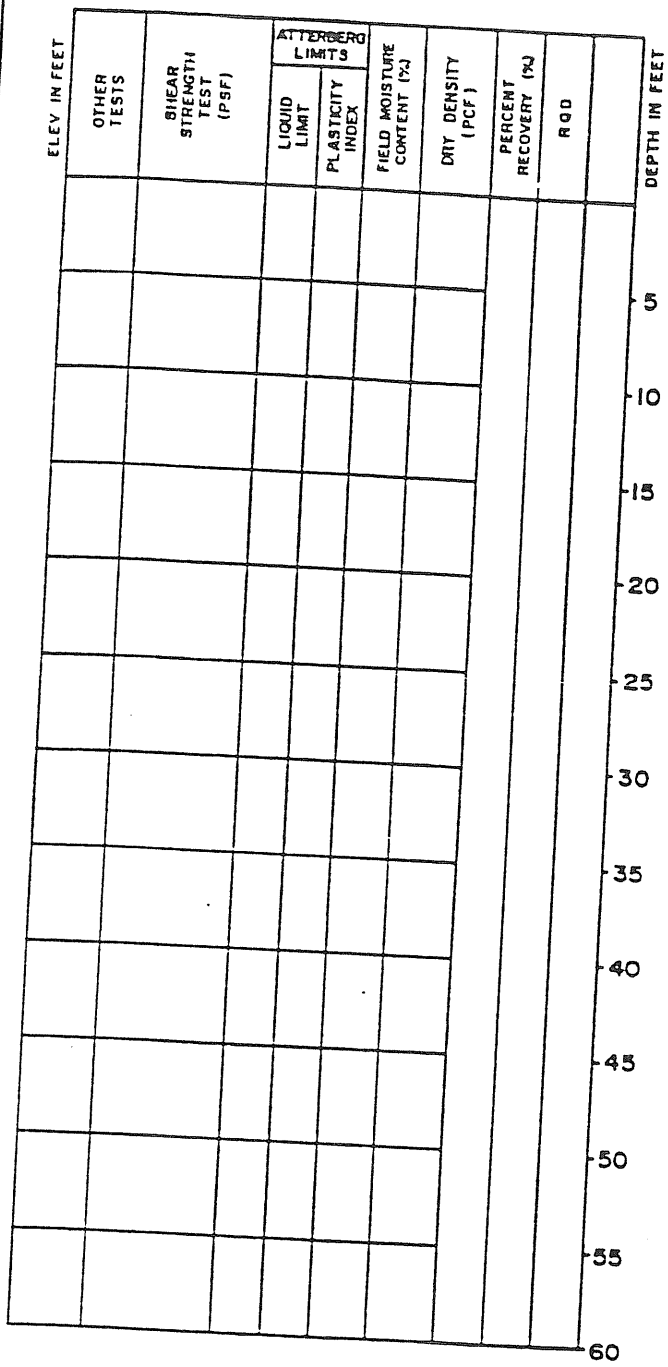
**Hand-Slotted Well Screens Are Unacceptable

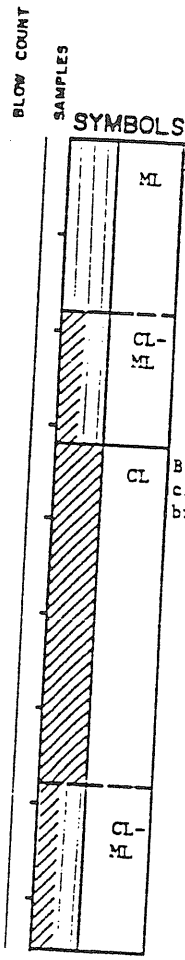
CENTRAL ILLINOIS LIGHT COMPANY
DUCK CREEK POWER STATION
WASTE DISPOSAL AREA

OM12

BORING OM-12

SURFACE ELEVATION 592.6'
COORDINATE 39+26'N
30+53'E





DESCRIPTION

STRIP MINE SPOIL

Brown silty CLAY to clayey SILT: A mixture of reworked silty loess with some clay till some organic material near the surface.

Brown and gray CLAY: A mixture of reworked clay till and silt, trace to some sand and broken shale.

FEATURE: Observation and Monitoring Well
Date Drilled: 10/17/80
Total Depth: 43.5'
Piezometer: Screen from 30.0' to 40.0'
Gravel pack from 28.0' to 43.5'.
Water Level Data: Elevation 576.2' on 11/20/80

LOG OF BORING

Gilbert/Commonwealth

PLATE 2-15

OM13

BORING OM-13

SURFACE ELEVATION 595.8
COORDINATE 6908 N
1632 E

ELEV IN FEET	OTHER TESTS	SHEAR STRENGTH TEST (PSF)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FIELD MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING #200 SIEVE	RECOVERY (%)	RQD	DEPTH IN FEET
	PN	2.25								5
	PN	0.7								10
	PN	0.65								15
	PN	1.2								20
	PN	2.25								
	PN	1.0								25
										30
	PN	3.75								35
										40
										45
										50
										55
										60

BLOW COUNT	SAMPLES	SYMBOLS	DESCRIPTION
			RAILROAD BALLAST: 0-2 ft.; 2.0 to 3.0 ft. Ballast mixed with brown clayey silt.
10		ML	FILL ? (Based on Penetrometer) 3.0 to 7± ft., brown and gray mottled, silty and clayey silt; saturated.
		ML	MINE SPOIL
3		ML	Brown and gray mottled silt and clayey silt
		CL	10.9 ft. grades to gray in color.
5			15.7 to 15.9 ft. black weathered shale, weathered to stiff clay.
			18 ft. brown and gray clayey silt (Loess and Till)
7		SH	20.8 to 22.5 ft. black broken shale, none to little soil; water flowing to surface.
9			22.5 ft. gray silty clay and clayey silt (Till), trace to little fine to medium sand, trace to no gravel. Not saturated. Water level dropping as advance boring. 30 ft. water 6 ft. below surface in augers.
7		CL	
9			
18			35.0 ft. water 16 ft. below surface. 35.0 ft. dark gray clay, weathered shale and till, broken shale fragment 35.3 to 35.4 ft.
7			40.0 ft. gray clayey silt and black broken shale fragments (saturated in shale)
60		SH	SHALE BEDROCK: 42.5 ft. Gray shale, weathered. Water flowing to surface after pulling auger plug. Flowing clear water at 3 gpm. Seep south stopped flowing.
			Boring completed at 45.5 ft. on 10/17/84.

MONITORING WELL INSTALLED 10/17/84
10' of #10 slot screen: 32.5 to 42.5 ft.
Gravel Pack : 17.5 to 45.5 ft.
Bentonite Seal : 15.0 to 17.5 ft.
Cement-Bentonite grout: G.S. to 15.0 ft.

CILCO
DUCK CREEK STATION
WASTE DISPOSAL SYSTEM

Gilbert Commonwealth Companies

LOG OF
BORING OM-13

PLATE

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR13S

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR13S

~~State~~ Plane Coordinate: X 6,834.3 Y 1,749.6 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: B. WIlliamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 3¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/22/2008 Date Finished: 3/22/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: _____

Installation Method: _____

Setting Time: _____

Type of Bentonite Seal -- (Granular) Pellet Slurry
(choose one)

Installation Method: Gravity

Setting Time: >24 hours

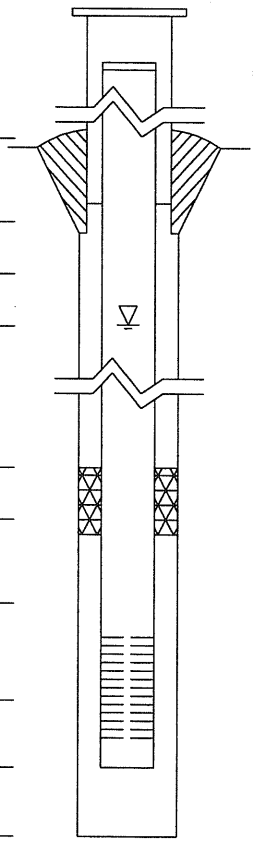
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz sand
(if applicable)

Installation Method: Gravity



	Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
	602.91	-7.16	Top of Protective Casing
	602.71	-6.96	Top of Riser Pipe
	595.75	0.00	Ground Surface
			Top of Annular Sealant
	592.15	3.60	Static Water Level (After Completion) 5/15/2008
	595.75	0.00	Top of Seal
	585.14	10.61	Top of Sand Pack
	583.81	11.94	Top of Screen
	574.33	21.42	Bottom of Screen
	573.54	22.21	Bottom of Well
	573.54	22.21	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	7.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	18.90
Bottom of Screen to End Cap	(feet)	0.79
Screen Length (1st slot to last slot)	(feet)	9.48
Total Length of Casing	(feet)	29.17
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR13D

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR13D

~~State~~ Plane Coordinate: X 6,840.3 Y 1,749.7 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: B. WIlliamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/22/2008 Date Finished: 3/22/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: >24 hours

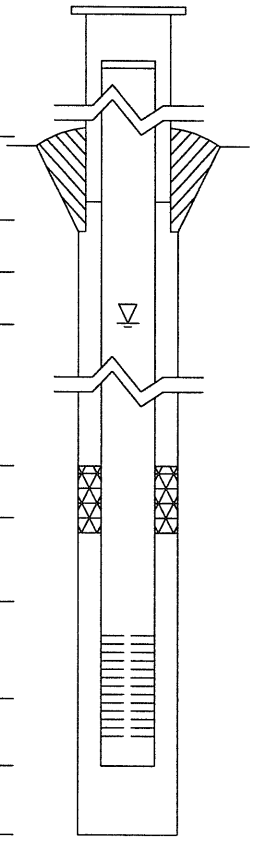
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
602.88	-7.13	Top of Protective Casing
602.70	-6.95	Top of Riser Pipe
595.75	0.00	Ground Surface
595.75	0.00	Top of Annular Sealant
600.79	-5.04	Static Water Level (After Completion) 5/15/2008
573.52	22.23	Top of Seal
564.51	31.24	Top of Sand Pack
562.73	33.02	Top of Screen
553.29	42.46	Bottom of Screen
552.51	43.24	Bottom of Well
552.51	43.24	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	39.97
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.44
Total Length of Casing	(feet)	50.19
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

OM14

BORING OM-14

SURFACE ELEVATION 596.74
COORDINATE 7371 N
1841 E

ELEV IN FEET	OTHER TESTS	SHEAR STRENGTH TEST (PSF)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FIELD MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING #200 SIEVE	RECOVERY (%)	RQD	DEPTH IN FEET
	PN	0.8								5
										10
	PN	1.0-1.5								15
										20
										25
	PN	1.8-2.0								30
	PN	1.5-2.0								35
										40
										45
										50
										55
										60

BLOW COUNT / SAMPLES / SYMBOLS

BLOW COUNT	SYMBOLS
10	ML
4	CL
6	
8	CL
7	
12	ML • CL
13	
20	
11	CL • SH
26	
27	

DESCRIPTION

MINE SPOIL.
Brown and gray silty clay to clayey silt, little to some fine to coarse sand, trace fine gravel, damp to moist (Loess and Till)

18.5 ft. gray silty clay, little fine to medium sand, trace fine gravel. 19.2 to 20.0 ft. and 24.5 to 25.0 ft. black broken shale fragments and gray till; saturated. Water level at 13.0 ft after ss-4 taken.

25.0 ft. Yellow-brown silty clay (till) and gray clayey silt to silt, some black topsoil type material noted, little fine to medium sand, trace fine gravel. Water level at 21.0 ft. before ss-6 taken.
34.0 to 34.5 ft., shale cobble
35.3 to 36.0 ft., gray silty clay and weathered gray shale. Water level at 33.0 ft.

37.0 to 38.4 ft. black broken shale fragments with gray till. Water level at 24.0 ft. for ss-8 and ss-9.
38.4 ft., gray silty clay and broken shale mixed, shale is saturated, highly weathered at 42.0 ft.

Boring completed at 46.0 ft. on 10/17/84.

MONITORING WELL INSTALLED 10/17/84
10' of #10 slot screen:
Gravel Pack : 17.0 to 46.0 ft.
Bentonite Seal : 15.0 to 17.0 ft.
Cement-Bentonite Grout: G.S. to 15.0 ft.

CILCO
DUCK CREEK STATION
WASTE DISPOSAL SYSTEM

Gilbert Commonwealth Companies

LOG OF
BORING OM-14

PLATE

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR14S

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR14S

~~State~~ Plant ~~Plane~~ Coordinate: X 1,760.0 Y 7,350.8 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 3¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/9/2009 Date Finished: 3/9/2009

Report Form Completed By: Suzanna L. Simpson Date: 3/18/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Chips

Installation Method: Gravity

Setting Time: >24 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: >24 hours

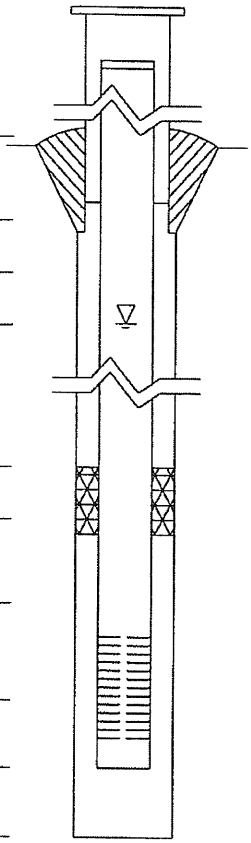
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
599.59	-3.37	Top of Protective Casing
599.26	-3.04	Top of Riser Pipe
596.22	0.00	Ground Surface
594.22	2.00	Top of Annular Sealant
		Static Water Level (After Completion)
594.22	2.00	Top of Seal
586.87	9.35	Top of Sand Pack
584.96	11.26	Top of Screen
575.60	20.62	Bottom of Screen
574.82	21.40	Bottom of Well
574.82	21.40	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	7.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	14.30
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	24.44
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR14D

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR14D

~~State~~ Plant ~~Plane~~ Coordinate: X 1,759.9 Y 7,356.5 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Testing Service Corporation Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/9/2009 Date Finished: 3/9/2009

Report Form Completed By: Suzanna L. Simpson Date: 3/18/2009

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 40 minutes

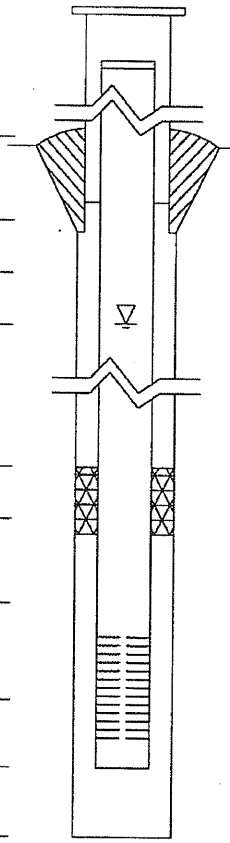
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
599.08	-2.86	Top of Protective Casing
598.91	-2.69	Top of Riser Pipe
596.22	0.00	Ground Surface
594.12	2.10	Top of Annular Sealant
_____	_____	Static Water Level (After Completion)
564.35	31.87	Top of Seal
562.25	33.97	Top of Sand Pack
560.20	36.02	Top of Screen
550.84	45.38	Bottom of Screen
550.36	45.86	Bottom of Well
550.36	45.86	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	38.71
Bottom of Screen to End Cap	(feet)	0.48
Screen Length (1st slot to last slot)	(feet)	9.36
Total Length of Casing	(feet)	48.55
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

OM15

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-20

SHEET 3 OF 3

ILLINOIS LIGHT COMPANY	PROJECT: DUCK CREEK NEW ASH POND			PROJECT NO.: 23283
LOCATION: COUNTY, ILLINOIS	COORDINATES: N 6240 E 3010	ELEVATION (DATUM): 595.7 (MSL)	TOTAL DEPTH: 75.20 FEET	DATE START: 7-12-94
CONDITIONS: ER ROAD, BETWEEN TWO PONDS, BRUSH AND REEDS		LOGGED BY: D.D. MARLOW		DATE FINISH: 7-12-94
	CHECKED BY: P.L. Nelson	APPROVED BY: L.J. Almaleh		

SAMPLING: RUN NUMBER	SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: RUN NUMBER	RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
S	18	11	15	26	1.5							61			Silty CLAY: gray; very stiff; moist; plastic; trace fine to medium sand intermixed with shale and coal fragments	
												62				
												63				
												64				
S	11	11	14	25	1.5							65				
												66				
												67				
												68				
												69				
												70				
	7	8	12	21	1.5							71				
												72				
												73				
												74				
	50/2			>100	0.2							75			SHALE: dark gray; firm; fissile (Bedrock)	End of borehole at 75.20 FT. Borehole backfilled with auger cuttings.
												76				
												77				
												78				
												79				
												80				
												81				
												82				
												83				
												84				
												85				
												86				
												87				
												88				
												89				

OM15

BLACK & VEATCH — LOG OF BORING — BORING NO. BV-20

SHEET 2 OF 3

ILLINOIS LIGHT COMPANY		PROJECT: DUCK CREEK NEW ASH POND		PROJECT NO. 23283
LOCATION: CENTY, ILLINOIS	COORDINATES: N 6240 E 3010	ELEVATION (DATUM): 585.7 (MSL)	TOTAL DEPTH: 75.20 FEET	DATE START: 7-12-94
CONDITIONS: ROAD, BETWEEN TWO PONDS, BRUSH AND REEDS		LOGGED BY: D.D. HARLOW		DATE FINISH: 7-12-94
		CHECKED BY: P.L. Nelson	APPROVED BY: L.J. Almaleh	

SAMPLING: SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
					6	4	3	7	1.0	31				
										32			CLAY: gray; firm; moist; plastic; some silt (Mine Spoil-Underclay)	
										33				
										34				
					3	3	5	8	0.7	35			Intermixed: Clayey SILT: gray; loose; moist; low plasticity: trace fine to medium sand and Underclay fragments (as above)	
										36				
										37				
										38				
										39				Seepage water at 37.5 FT.
										40				
						5	10	15	1.5	41			Silty CLAY: gray; stiff; moist; low to moderate plasticity: traces of fractured shale, coal, and fine sand	
										42				
										43				
										44				
										45				
						10	11	21	0.8	46				
										47			Silty CLAY: gray; very stiff; very moist; plastic; trace fine to medium sand	
										48				
										49				
										50				
						18	18	32	1.5	51			Fragmented Shale from 50.5 to 51.0 FT	
										52				
										53				
										54				
										55				
						8	0	10	1.5	56			As Above	
										57				
										58				
										59				

OM15

BLACK & VEATCH — LOG OF BORING

BORING NO. BY-20

SHEET 1 OF 3

ILLINOIS LIGHT COMPANY		PROJECT DUCK CREEK NEW ASH POND		PROJECT NO. 23283
LOCATION COUNTY, ILLINOIS	COORDINATES N 8240 E 3010	ELEVATION (DATUM) 585.7 (MSL)	TOTAL DEPTH 75.20 FEET	DATE START 7-12-84
CONDITIONS ROAD, BETWEEN TWO PONDS, BRUSH AND REEDS		LOGGED BY D.O. MARLOW		DATE FINISH 7-12-94
		CHECKED BY P.L. Nelson	APPROVED BY: L.J. Almaleh	

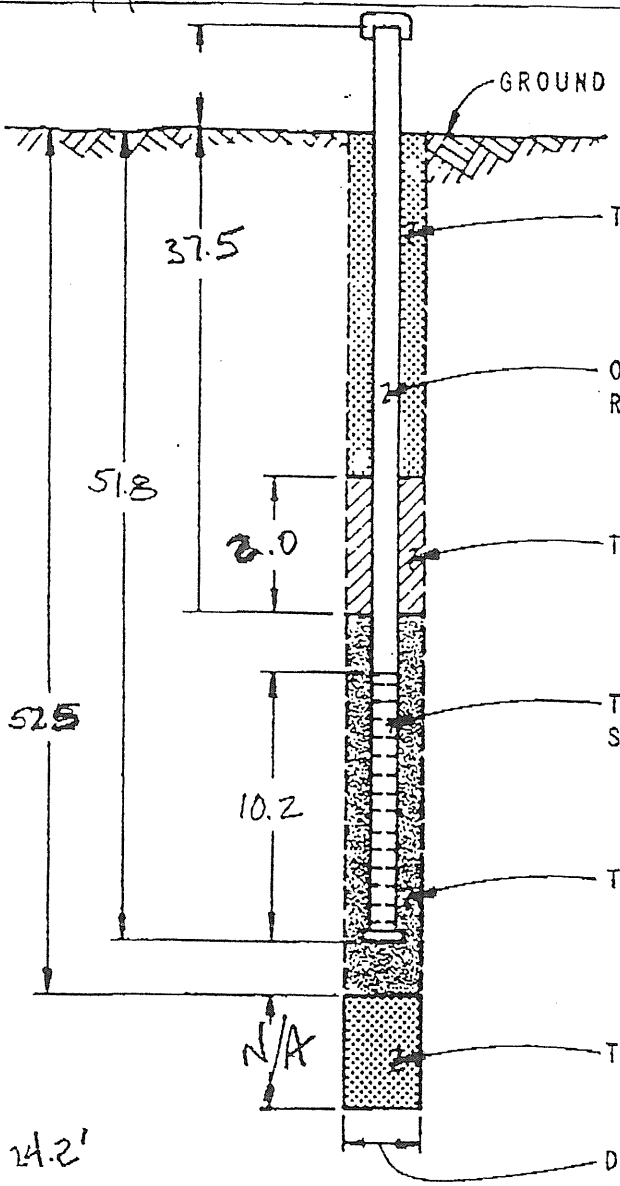
SAMPLING: SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
8	11	8	19	1.2						1			SILT: light brown; medium dense; dry; non-plastic; some fine to coarse sand; traces of gravel, cobbles, and cinders (Mine Spoil)	Boring advanced with 3 1/2" I.D. hollow stem augers.
5	5	5	10	1.5						2				
4	3	5	8	1.1						3				
										4				
										5			Clayey SILT: orangish brown; medium dense; moist; trace fine to coarse sand	
										6				
										7				
3	2	3	5	1.5						8			As Above; but brown and gray; loose	
										9				
									2.0	10				
										11				
										12				
										13				
										14				
										15				
3	2	2	4	1.5						16			Clayey SILT: brown, gray, and orange; very loose; moist; low plasticity; trace fine sand and fine gravel (occasional limestone fragments)	
										17				
										18				
										19				
										20				
3	2	4	8	1.5						21			As Above; but gray and brown; loose	
										22				
										23				
										24				
										25				
									2.0	26				
										27				
										28				
										29				

BLACK & VEATCH CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

MW-15 (OM-15)
PIEZOMETER NO.

CLIENT: CILCO	PROJECT: Duck CREEK - New Ash Pond		PROJECT NO.: Z3283
PROJECT LOCATION: Fulton Co, Illinois	COORDINATES:	GROUND ELEVATION: 595.7	DATE: 13 July 94
STRATUM MONITORED: Mine Spoil		INSPECTOR: D D Marlow	
CHECKED BY:	APPROVED BY:		
DRILLING CONTRACTOR: Whitney & Associates	DRILL RIG: CME 75	DRILLER: T. Fehl	



TYPE OF SEAL: 3/8" coarse bentonite Pureoid Hole plug

O.D. & TYPE OF RISER PIPE: Sch 40 PVC 2" DIA Flush Joint, Threaded

TYPE OF SEAL: Pureoid 3/8" Pellets

TYPE AND SIZE OF SCREEN OR OPENINGS: 0.10 slot 2". SCH40 PVC

TYPE OF FILTER: "Flint Shot 4.0" (Silica SAND)

TYPE OF SEAL: ____

DIAMETER OF BOREHOLE: 8" DIA

METHOD OF INSTALLATION:
Borehole Drilled using 4¼ ID Hollow stem Augers w/center plug, installed screen & Riser, Place sand pack and seals through hollow stem Augers, Remove augers from hole install surface seal and protective casing, Developed well by hand bailing

REMARKS:
GW @ 20.00 FT in BV-20 8:30A 13 July 94; dt set BV-20 - 10FT South
8" Dia 0.35 cuft/ft 2" casing 0.03 cuft/ft = 0.34 cuft/ft Cubic 4 Bags Sand
1 Bag = 0.65 cuft

OM16

BLACK & VEATCH — LOG OF BORING

BORING NO. BV-21

SHEET 1 OF 2

ILLINOIS LIGHT COMPANY	PROJECT: DUCK CREEK NEW ASH POND			PROJECT NO. 23283
LOCATION: COUNTY, ILLINOIS	COORDINATES: N 8225 E 3520	ELEVATION (DATUM): 805.8 (MSL)	TOTAL DEPTH: 51.50 FEET	DATE START: 7-13-94
CONDITIONS: BRUSH, AND WEEDS ON HILL SIDE		LOGGED BY: D.D. HARLOW		DATE FINISH: 7-14-94
	CHECKED BY: P.L. Nelson	APPROVED BY: L.J. Almaleh		

SAMPLING: SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: RUN LENGTH	RUN RECOVERY	RQD	PERCENT RECOVERY	RQD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
1	2	2	3	5					1.0	1			Clayey SILT; light brown; loose; dry; low plasticity; trace fine sand, shale fragments, and roots (Mine Spoil)	Boring advanced with 3 1/2" I.D. hollow stem augers.
8	5	5	10						1.3	4			As Above	
5	4	8	10						1.2	6			As Above; but with large shale and mudstone fragments	
7	8	7	13						1.0	8			As Above; but medium dense; trace medium gravel and coal fragments	
7	8	8	15						1.5	10			Clayey SILT; light brown; medium dense; dry; low plasticity; trace fine to medium sand; occasional seams of silty clay (2"max)	
									1.3	15			As Above	
4	3	4	7						1.5	20			Clayey SILT; light brown; medium dense; moist; low plasticity; trace fine to medium sand and shale fragments	
4	2	5	7						1.4	25				14 July 1994
										29				

OM16

BLACK & VEATCH LOG OF BORING

BORING NO. BY-21
SHEET 2 OF 2

ILLINOIS LIGHT COMPANY	PROJECT: DUCK CREEK NEW ASH POND			PROJECT NO. 23283
LOCATION: COUNTY, ILLINOIS	COORDINATES: N 8225 E 3520	ELEVATION (DATUM): 805.8 (MSL)	TOTAL DEPTH: 51.50 FEET	DATE START: 7-13-94
CONDITIONS: BRUSH, AND WEEDS ON HILL SIDE		LOGGED BY: O.D. MARLOW		DATE FINISH: 7-14-94
	CHECKED BY: P.L. Nelson	APPROVED BY: L.J. Almaleh		

SAMPLING: SET 6 INCHES	2ND 6 INCHES	3RD 6 INCHES	N VALUE	SAMPLE RECOVERY	CORING: RUN LENGTH	RUN RECOVERY	ROD RECOVERY	PERCENT RECOVERY	ROD	DEPTH IN FEET	SAMPLE TYPE	GRAPHIC LOG	CLASSIFICATION OF MATERIAL	REMARKS
3	4	5	9	0.5						31			Silty CLAY: brown; stiff; very moist; low plasticity; trace fine sand and roots	Seepage water at 26.0 FT.
										32				
										33				
										34				
										35				
5	7	10	17	1.5						36			As Above; but very stiff; intermixed shale fragments and seams of silt	
										37				
										38				
										39				
										40				
									1.8	41				
										42				
										43				
										44				
										45				
5	28	21	49	1.5						46			SHALE: dark gray; firm; fissile; slightly fractured; slightly weathered	Hard drilling from 45 to 50 FT.
										47				
										48				
										49				
2	81	68	149	1.5						50				
										51				
										52				End of borehole at 51.50 FT. Water at 22.0 FT inside the augers. Borehole backfilled with auger cuttings.
										53				
										54				
										55				
										56				
										57				
										58				
										59				

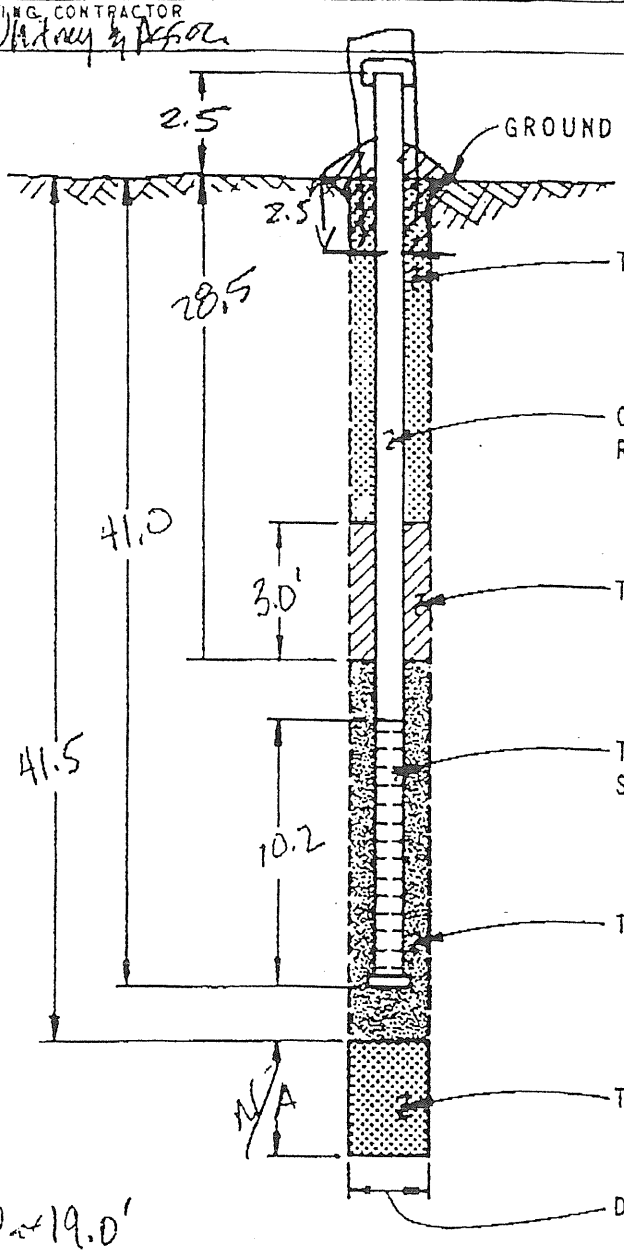
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BLACK & VEATCH
CONSULTING ENGINEERS

PIEZOMETER INSTALLATION LOG

PIEZOMETER NO. MW-16 (OM-16)

CLIENT: CILCO	PROJECT: Duck Creek New Ash Pond		PROJECT NO.: 23283
PROJECT LOCATION: Fulton Co Illinois	COORDINATES: 9230N 3510E	GROUND ELEVATION: 605.6 FT	DATE: 14 July 94
STRATUM MONITORED: Mine Spoil		INSPECTOR: D D Marlow	
CHECKED BY:	APPROVED BY:		
DRILLING CONTRACTOR: Whitney & Assoc	DRILL RIG: CME 75	DRILLER: T Fahl	



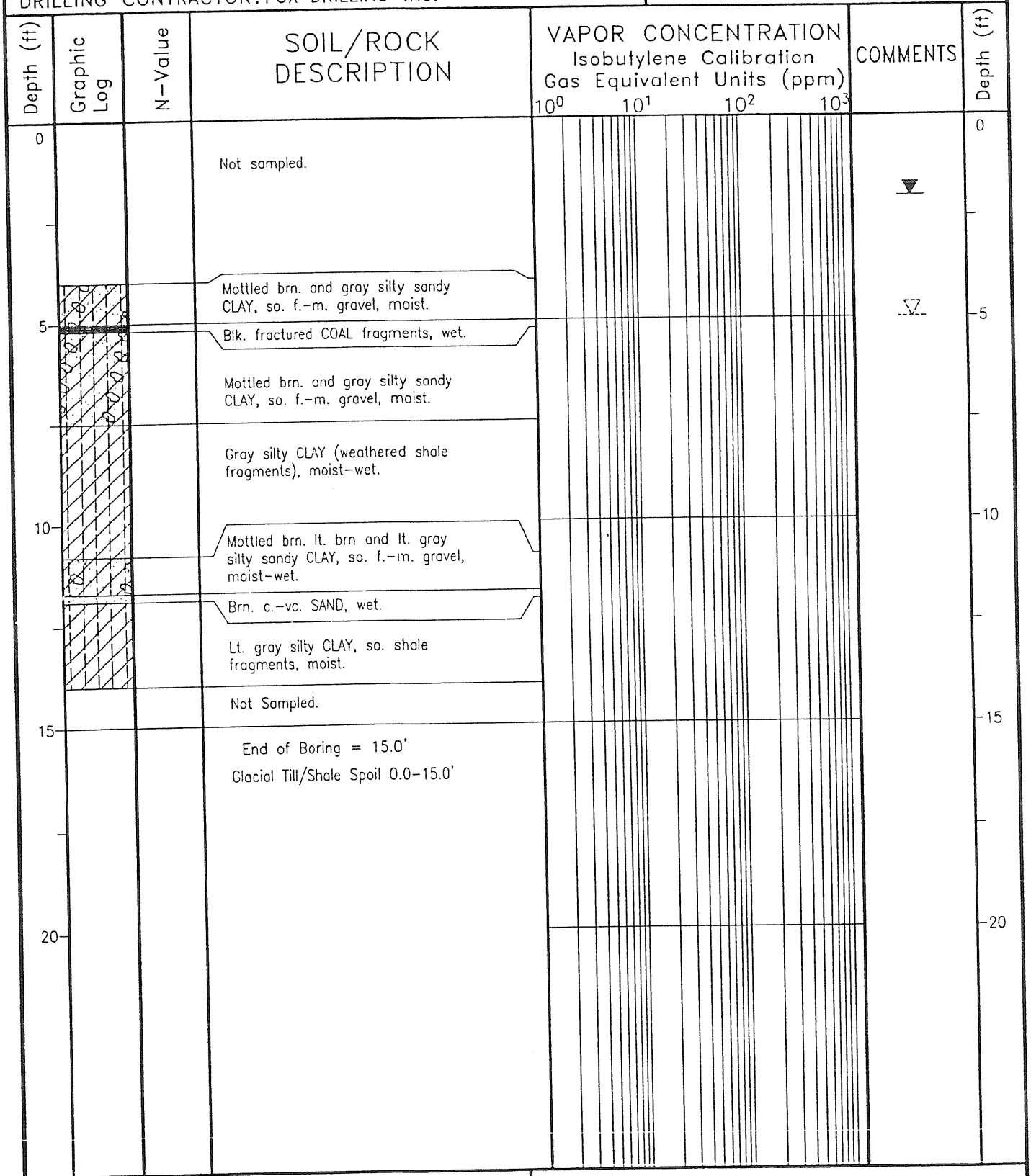
TYPE OF SEAL	Baroid Hole Plug 3/8 coarse bentonite
O.D. & TYPE OF RISER PIPE	2" Sch 40 Flush Joint threaded PVC
TYPE OF SEAL	Baroid 3/8" Bentonite Pellets
TYPE AND SIZE OF SCREEN OR OPENINGS	0.10 Slot Sch 40 PVC 2".
TYPE OF FILTER	Flint Shot 4.0 (Silica Sand)
TYPE OF SEAL	
DIAMETER OF BOREHOLE	8" DIA

METHOD OF INSTALLATION: Drill Borehole w/ 4" ID Hollow Stem Augers; install Riser, Screen & sand pack; seal and makes seal through Augers

REMARKS: 4 bags sand, 1 bucket Balls; Hole plug 1/2

OM17

DUCK CREEK STATION	BORING MW-1	SHEET 1 of 1
DATE STARTED 10/14/93	DATE COMPLETED 10/14/93	LOGGED BY RAB	SURFACE EL. 590.0 (ft.)
DRILLING CONTRACTOR: FOX DRILLING INC.	DRILL METHOD: HSA



SOIL/ROCK BORING DATA

HANSON ENGINEERS INCORPORATED

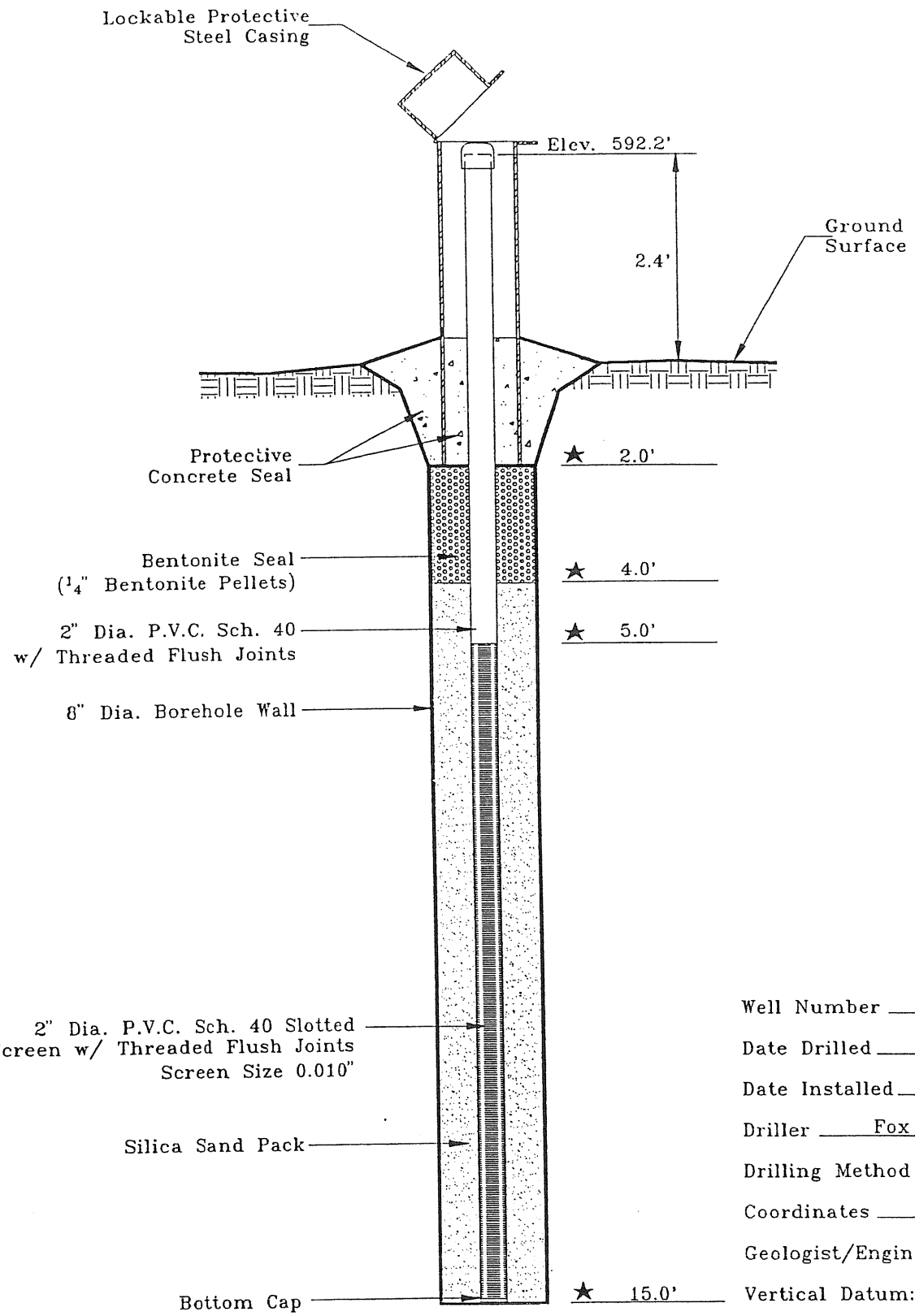
RAB 3/10/94 REVIEWED DATE

BDC 3/10/94 APPROVED DATE

PHASE II - HYDROGEOLOGICAL INVESTIGATION
CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078

OM17



Well Number MW-1 (OM-17)

Date Drilled 10/14/93

Date Installed 10/14/93

Driller Fox Drilling, Inc.

Drilling Method HSA

Coordinates

Geologist/Engineer Rich Boyer

Vertical Datum:

Assumed U.S.G.S. 590.0'

★ Depth Below Ground Surface

Not to Scale

MW-1 MONITOR WELL

HANSON ENGINEERS INCORPORATED

PHASE II-HYDROGEOLOGICAL INVESTIGATION
CILCO-DUCK CREEK STATION
CANTON, ILLINOIS

Job No. 92S5078

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OM18

DUCK CREEK STATION	BORING MW-2	SHEET 1 of 2
DATE STARTED 10/12/93	DATE COMPLETED 10/13/93	LOGGED BY RAB	SURFACE EL. 612.0 (ft.)
DRILLING CONTRACTOR: FOX DRILLING INC.	DRILL METHOD: HSA

Depth (ft)	Graphic Log	N-Value	SOIL/ROCK DESCRIPTION
0			Mottled brn. and lt. brn. clayey SILT, so. sand, roots, moist.
5			Mottled brn., lt. brn., lt. gray silty CLAY, moist.
10			Gray CLAY, moist.
			Dk. brn. silty CLAY, organic-rich, moist.
15			Mottled lt. brn. and lt. gray silty CLAY, moist.
			Mottled gray, lt. gray, and lt. brn. silty sandy CLAY, so. f gravel, moist.
20			Mottled lt. gray and gray CLAY, so. silt, sand, moist.
			Lt. gray silty sandy CLAY, so. f.-m. gravel, moist.
25			Dk. brown silty CLAY, moist, organic-rich.
			Mottled lt. gray and gray CLAY, so. sand, silt, tr. f. gravel, moist.
30			Lt. gray silty sandy CLAY, so. f.-m. gravel, moist.
35			

VAPOR CONCENTRATION
Isobutylene Calibration
Gas Equivalent Units (ppm)
10^0 10^1 10^2 10^3

COMMENTS

▼ after 14 hours.

Perm. Sample (7.1'-7.6')

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35

SOIL/ROCK BORING DATA

HANSON ENGINEERS INCORPORATED

RAB 3/10/94
REVIEWED DATE

BDC 3/10/94
APPROVED DATE

PHASE II - HYDROGEOLOGICAL INVESTIGATION
CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078

OM18

DUCK CREEK STATION	BORING MW-2	SHEET 2 of 2
DATE STARTED 10/12/93	DATE COMPLETED 10/13/93	LOGGED BY RAB	SURFACE EL. 612.0 (ft.)
DRILLING CONTRACTOR: FOX DRILLING INC.	DRILL METHOD: HSA

Depth (ft)	Graphic Log	N-Value	SOIL/ROCK DESCRIPTION	VAPOR CONCENTRATION Isobutylene Calibration Gas Equivalent Units (ppm) 10^0 10^1 10^2 10^3	COMMENTS	Depth (ft)
31			Gray sandy CLAY, moist.			31
			Lt. gray v.f. sandy SILT, moist.			
			Gray silty sandy CLAY, so. f.-m. gravel, moist.			
36						36
			Mottled lt. gray, gray, brn., lt. brn., silty sandy CLAY, so. f.-m. gravel, fractured silty shale fragments, fractured coal fragments, loose, wet.		▽	
41						41
			Gray CLAY, moist.			
			Lt. gray silty CLAY, (weathered shale fragments), hard, moist.			
			Blk. fractured bituminous COAL chunks, so. silty clay, wet.			
46						46
			Gray silty CLAY, moist.		Perm. Sample (49.1'-49.5')	
			Gray silty SHALE fragments, so. coal, clay, moist-wet.			
			Gray-brn. silty sandy CLAY, so. f.-m. gravel, moist.			
51						51
			Gray silty CLAY (weathered shale fragments), moist.			
56					Split-spoon refusal at 58.2'.	56
			Dk. gray silty SHALE, hard, moist-dry. (bedrock).			
			End of Boring = 58.2'			
			Glacial Till Spoil 0.0'-39.8'			
			Glacial Till/Shale Spoil 39.8'-56.5'			
61			Shale Bedrock 56.5'			61

SOIL/ROCK BORING DATA

HANSON ENGINEERS INCORPORATED

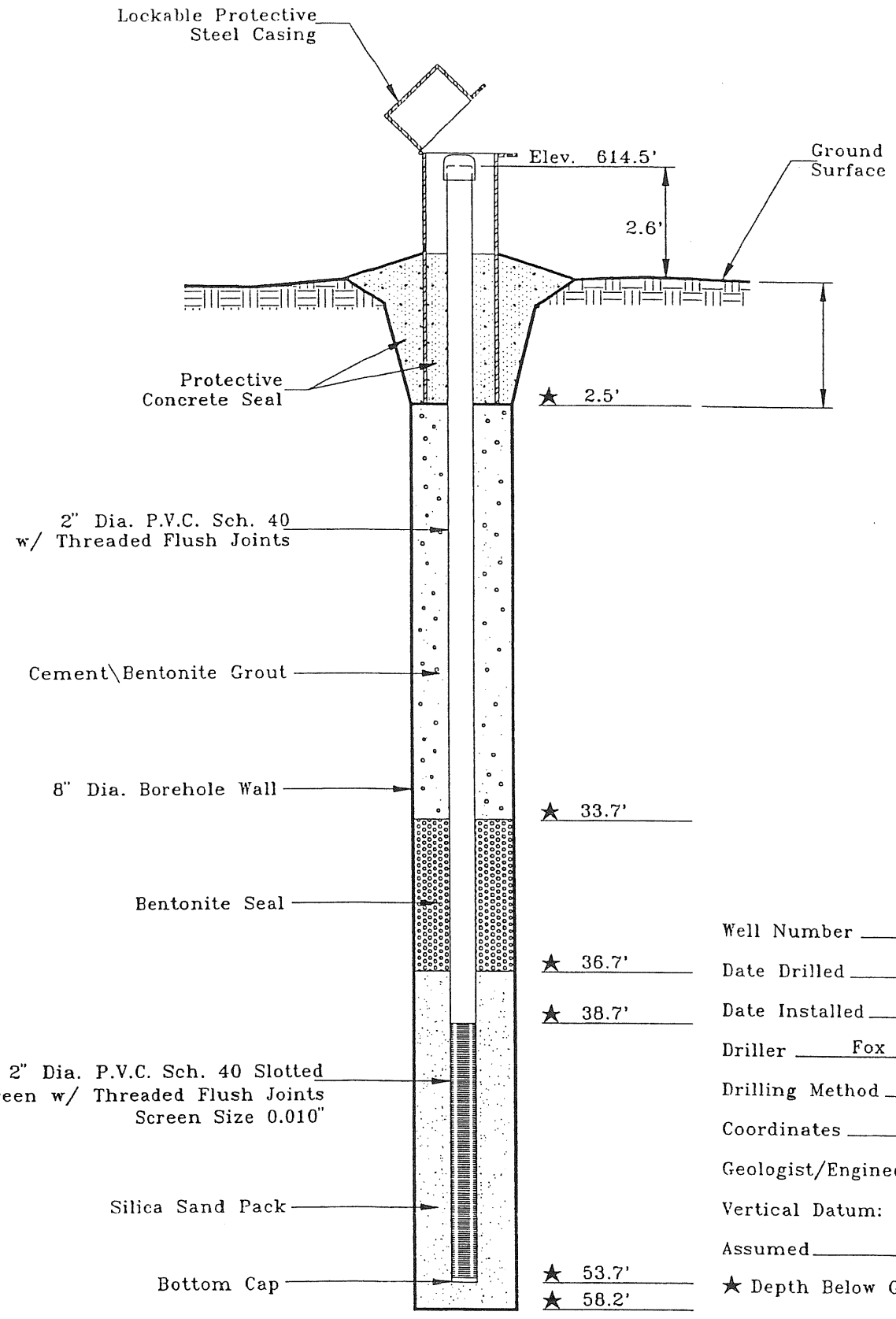
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BDC 3/10/94 APPROVED DATE

PHASE II - HYDROGEOLOGICAL INVESTIGATION
CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078

OM18



Well Number MW-2 (OM-18)

Date Drilled 10/13/93

Date Installed 10/13/93

Driller Fox Drilling, Inc.

Drilling Method HSA

Coordinates

Geologist/Engineer Rich Bover

Vertical Datum:

Assumed U.S.G.S. 612.0'

★ Depth Below Ground Surface

Not to Scale

MW-2 MONITOR WELL

HANSON ENGINEERS INCORPORATED

PHASE II-HYDROGEOLOGICAL INVESTIGATION
CILCO-DUCK CREEK STATION
CANTON, ILLINOIS

Job No. 92S5078

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Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR18

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR18

~~State~~ Plant ~~Plane~~ Coordinate: X 8,543.8 Y 1,979.0 (or) Latitude: ____ ° ____ ' ____ " Longitude: ____ ° ____ ' ____ "

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: R. Keady

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/31/2008 Date Finished: 4/1/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 32 minutes

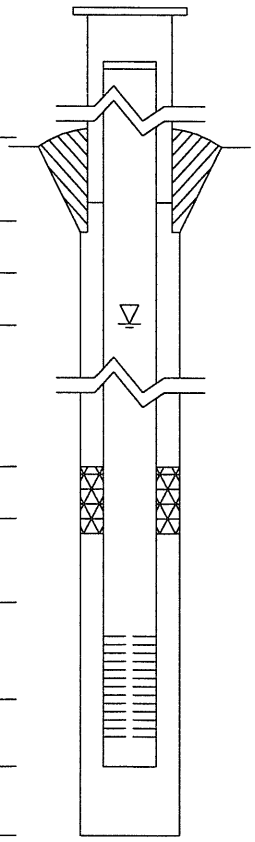
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
614.00	-2.44	Top of Protective Casing
613.85	-2.29	Top of Riser Pipe
611.56	0.00	Ground Surface
609.36	2.20	Top of Annular Sealant
592.53	19.03	Static Water Level (After Completion) 5/15/2008
576.09	35.47	Top of Seal
572.44	39.12	Top of Sand Pack
570.81	40.75	Top of Screen
561.30	50.26	Bottom of Screen
560.52	51.04	Bottom of Well
560.52	51.04	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	43.04
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.51
Total Length of Casing	(feet)	53.33
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

OR19

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR-A

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR19

~~State~~ Plane Coordinate: X 4,045.0 Y 2,725.2 (or) Latitude: ____° ____' ____" Longitude: ____° ____' ____"

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: B. WIlliamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/27/2008 Date Finished: 3/27/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry
(choose one)

Installation Method: Gravity

Setting Time: 28 minutes

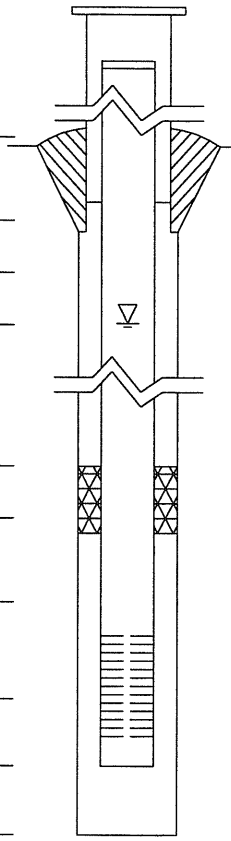
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a
(if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
597.96	-2.27	Top of Protective Casing
597.80	-2.11	Top of Riser Pipe
595.69	0.00	Ground Surface
593.59	2.10	Top of Annular Sealant
581.28	14.41	Static Water Level (After Completion) 5/15/2008
559.20	36.49	Top of Seal
555.61	40.08	Top of Sand Pack
553.65	42.04	Top of Screen
544.10	51.59	Bottom of Screen
543.31	52.38	Bottom of Well
543.31	52.38	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

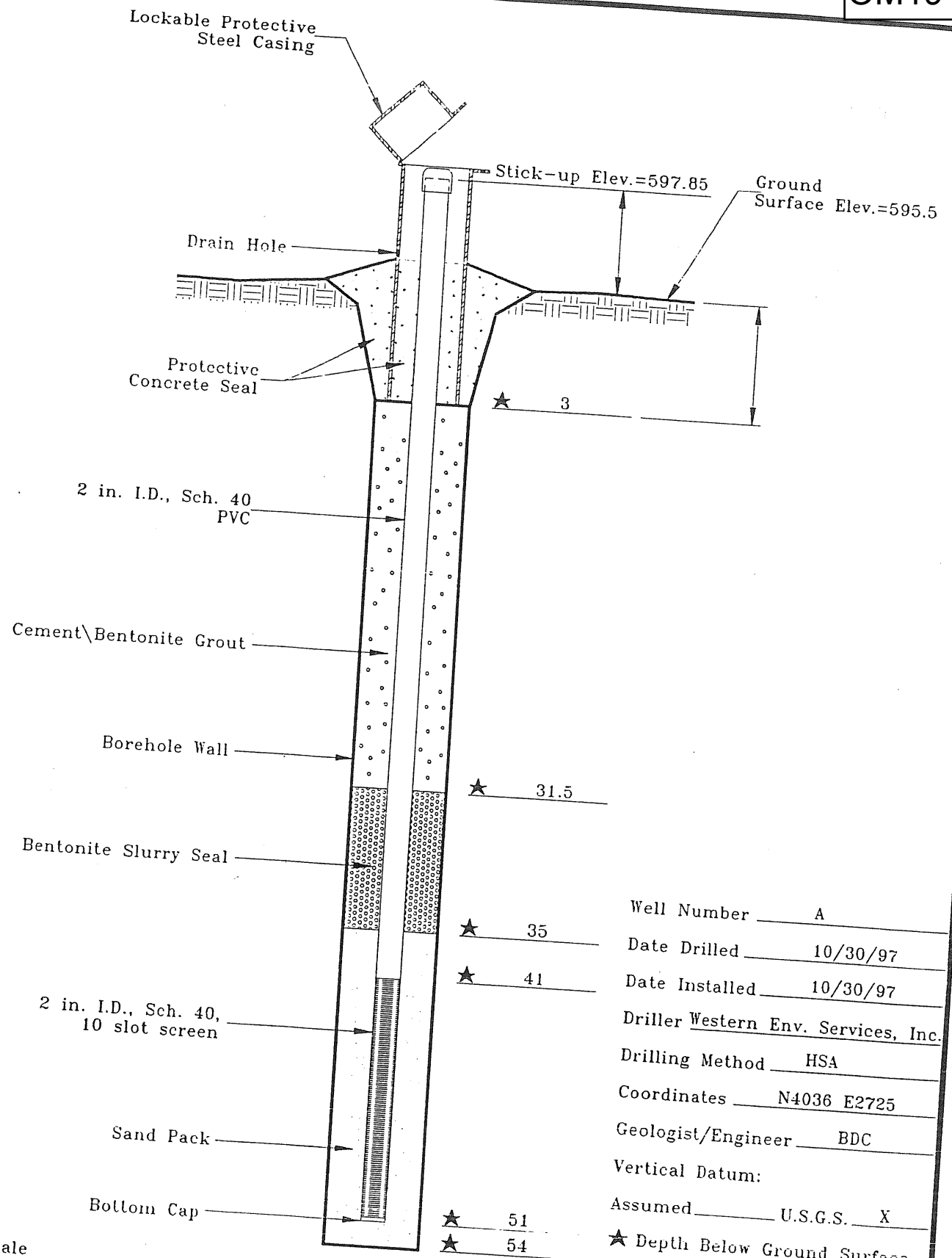
CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	44.25
Bottom of Screen to End Cap	(feet)	0.79
Screen Length (1st slot to last slot)	(feet)	9.45
Total Length of Casing	(feet)	54.49
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

OM19



Well Number A

Date Drilled 10/30/97

Date Installed 10/30/97

Driller Western Env. Services, Inc.

Drilling Method HSA

Coordinates N4036 E2725

Geologist/Engineer BDC

Vertical Datum:

Assumed _____ U.S.G.S. X

★ Depth Below Ground Surface

MONITORING WELL A

HANSON ENGINEERS INCORPORATED

MONITORING WELL INSTALLATION
CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078A

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OR20

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Fulton Well #: OR-B

Site Name: Ameren Energy Resources Generating Co. Duck Creek Ash Ponds 1 and 2 Borehole #: OR20

~~State~~ Plant ~~Plane~~ Coordinate: X 5,346.4 Y 2,926.8 (or) Latitude: ____° ____' ____" Longitude: ____° ____' ____"

Surveyed By: Steven P. Ford IL Registration #: 035-003653

Drilling Contractor: Testing Service Corporation Driller: B. WIlliamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: 4¼" hollow stem auger Drilling Fluid (Type): n/a

Logged By: Rhonald W. Hasenyager Date Started: 3/26/2008 Date Finished: 3/26/2008

Report Form Completed By: Rhonald W. Hasenyager Date: 5/22/2008

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry
(choose one)

Installation Method: Gravity

Setting Time: 25 minutes

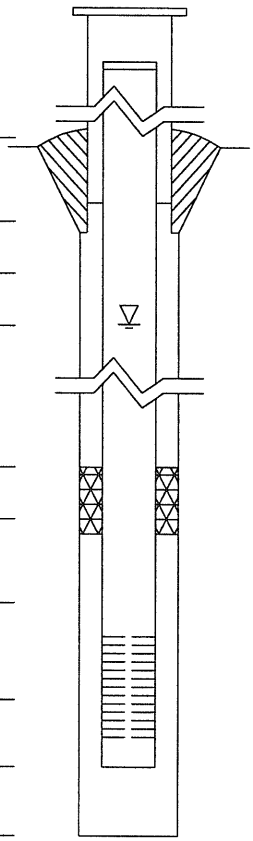
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a
(if applicable)

Installation Method: _____



	Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
	587.94	-3.31	Top of Protective Casing
	587.72	-3.09	Top of Riser Pipe
	584.63	0.00	Ground Surface
	581.83	2.80	Top of Annular Sealant
	573.64	10.99	Static Water Level (After Completion) 5/15/2008
	545.11	39.52	Top of Seal
	542.30	42.33	Top of Sand Pack
	539.85	44.78	Top of Screen
	530.40	54.23	Bottom of Screen
	529.62	55.01	Bottom of Well
	529.62	55.01	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS
(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

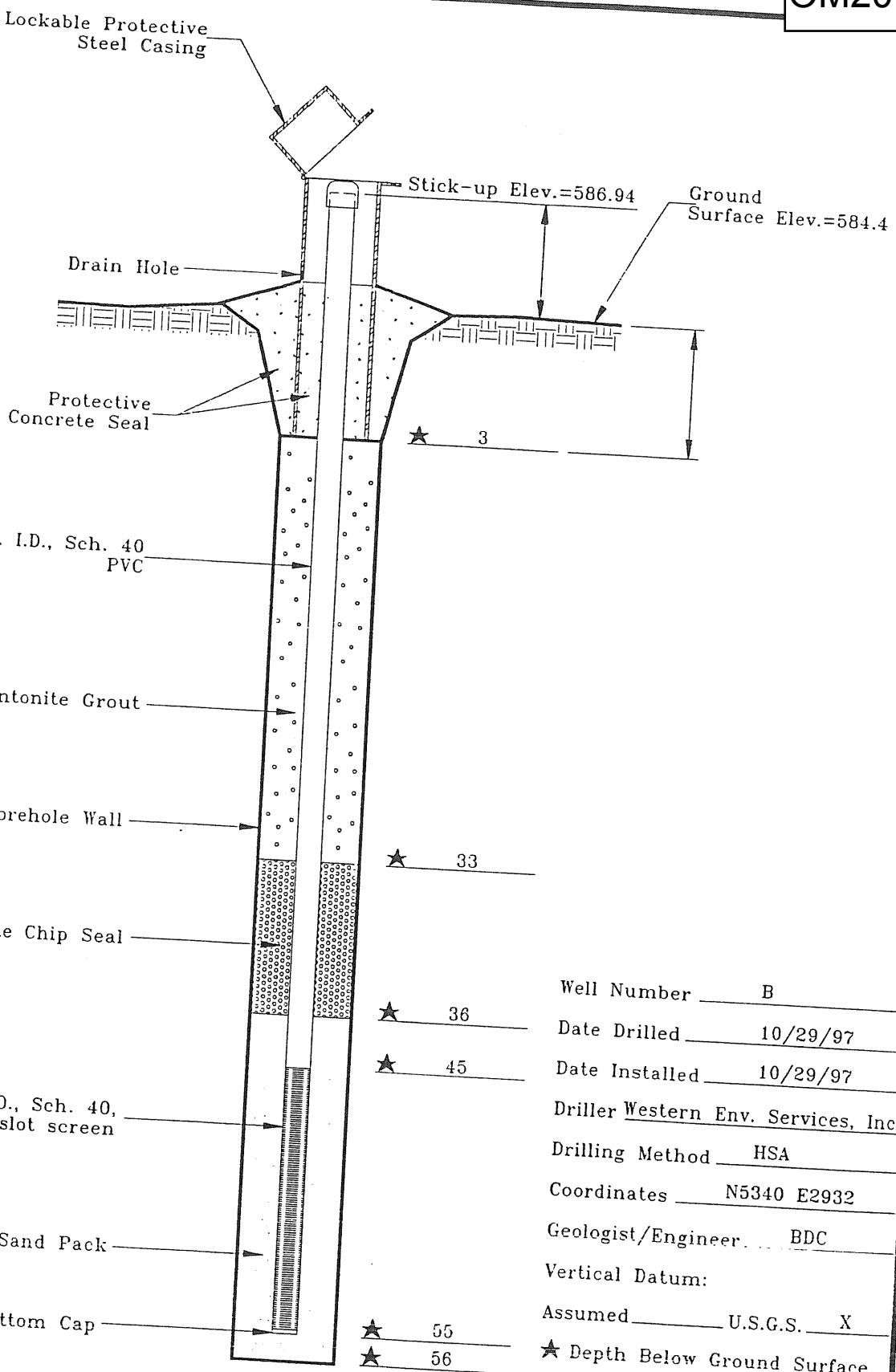
CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	47.87
Bottom of Screen to End Cap	(feet)	0.78
Screen Length (1st slot to last slot)	(feet)	9.45
Total Length of Casing	(feet)	58.10
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

OM20



Well Number B

Date Drilled 10/29/97

Date Installed 10/29/97

Driller Western Env. Services, Inc.

Drilling Method HSA

Coordinates N5340 E2932

Geologist/Engineer BDC

Vertical Datum:

Assumed _____ U.S.G.S. X

★ Depth Below Ground Surface

Not to Scale

MONITORING WELL B

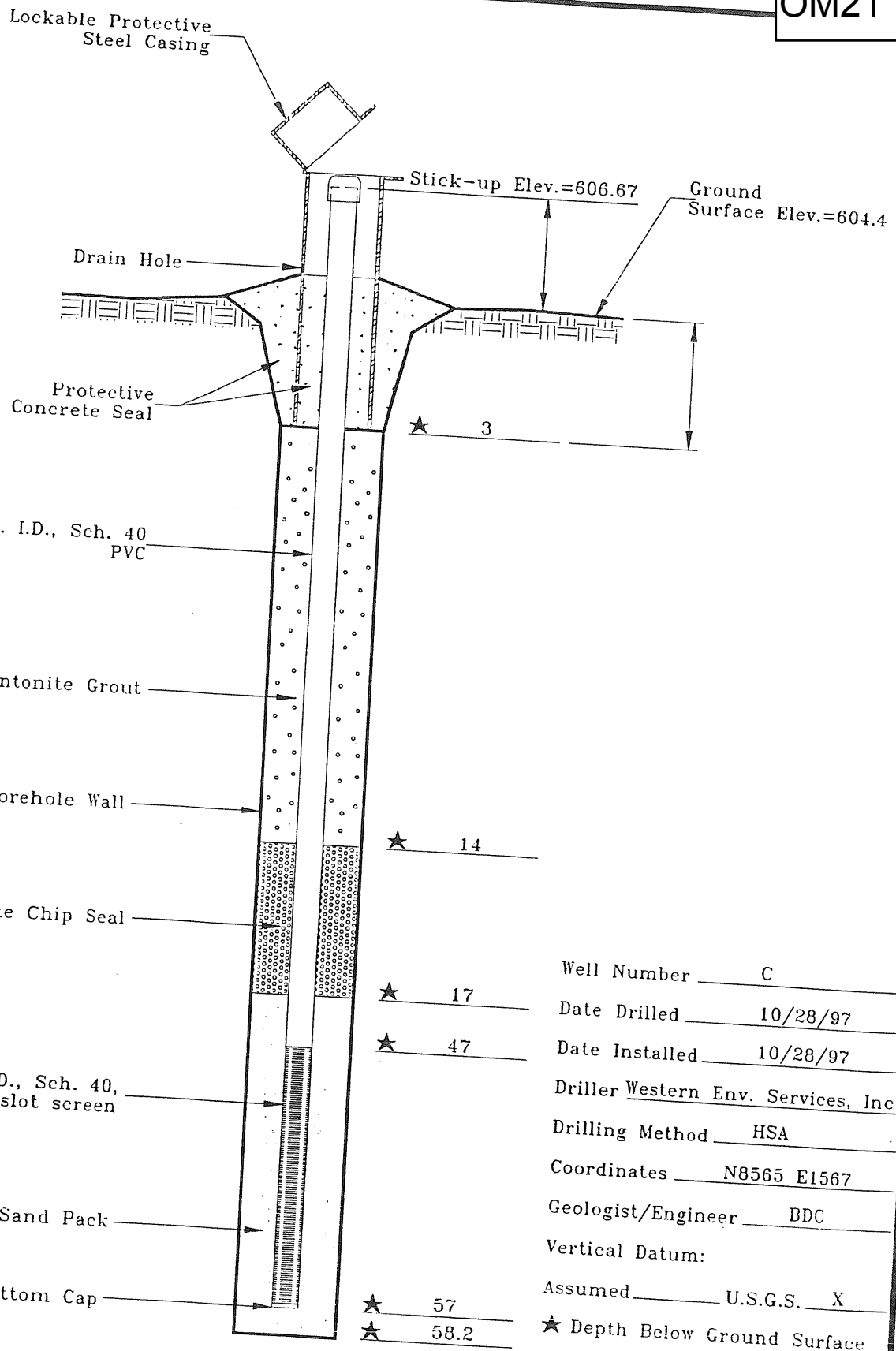
HANSON ENGINEERS INCORPORATED

MONITORING WELL INSTALLATION
CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078A

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OM21



Well Number C

Date Drilled 10/28/97

Date Installed 10/28/97

Driller Western Env. Services, Inc.

Drilling Method HSA

Coordinates N8565 E1567

Geologist/Engineer BDC

Vertical Datum:

Assumed _____ U.S.G.S. X

★ Depth Below Ground Surface

Not to Scale

MONITORING WELL C

HANSON ENGINEERS INCORPORATED

MONITORING WELL INSTALLATION
CILCO - DUCK CREEK STATION
CANTON, ILLINOIS

JOB NO. 92S5078A

I:\DRAWINGS\92S5078A\003.DWG 12/05/97 09:10 Dth

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: Start: 8/19/2009
Finish: 8/19/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM22a
Well ID: OM22S
Surface Elev: 597.07 ft. MSL
Completion: 37.38 ft. BGS
Station: 3,991.50N
-126.95E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 16.18 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0	TOPSOIL - Very dark grayish brown (10YR3/2), moist, soft, silty CLAY with slight trace sand, roots.		596	
							2	Dark grayish brown (10YR4/2) with 30% gray (10YR6/1) mottles, slightly moist, friable, clayey SILT with slight trace sand and gravel.		594	
							4			592	
							6	Brown (10YR5/3) with 15% gray (10YR5/1) mottles, moist, soft, clayey SILT.		590	
							8	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) and 15% brown (10YR4/3) mottles, moist, soft, clayey SILT.		588	
							10	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) and 15% brown (10YR4/3) mottles, moist, soft, silty CLAY with slight trace sand.		586	
							12	Brown (10YR4/3) with 10% gray (10YR5/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		584	
							14			582	
							▼ 16	Brown (10YR4/3) with 10% gray (10YR5/1) and 5% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with slight trace sand and gravel.		580	
							18			578	
							20				

NOTE(S): OM22S installed in blind drilled borehole within 10 ft of OM22D. See OM22 boring log for sample data.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: Start: 8/19/2009
Finish: 8/19/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM22a
Well ID: OM22S
Surface Elev: 597.07 ft. MSL
Completion: 37.38 ft. BGS
Station: 3,991.50N
-126.95E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 16.18 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/4) with 10% gray (N6/1) mottles, very moist, soft, silty CLAY with slight trace sand and gravel.		576	
							24			574	
							▼ 26			572	
							28	Brown (10YR5/3) with 10% gray (10YR5/1) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		570	
							30			568	
							32	Dark gray (N4/1), moist, firm, silty CLAY with trace coal and rock fragments.		566	
							34			564	
							36	Dark gray (N4/1), slightly moist, firm, silty CLAY (weathered SHALE) with trace coal.		562	
										560	

EOB = 37.4 ft bgs

NOTE(S): OM22S installed in blind drilled borehole within 10 ft of OM22D. See OM22 boring log for sample data.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/18/2009
Finish: 8/19/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM22
Well ID: OM22D
Surface Elev: 596.76 ft. MSL
Completion: 62.88 ft. BGS
Station: 3,994.82N
-127.08E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 15.82 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
								TOPSOIL - Very dark grayish brown (10YR3/2), moist, soft, silty CLAY with slight trace sand, roots.	596
1A	32/60 53%	cs		14			2	Dark grayish brown (10YR4/2) with 30% gray (10YR6/1) mottles, slightly moist, friable, clayey SILT with slight trace sand and gravel.	594
							4		592
2A				23			6	Brown (10YR5/3) with 15% gray (10YR5/1) mottles, moist, soft, clayey SILT.	
2B	28/60 47%	cs		25			8	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) and 15% brown (10YR4/3) mottles, moist, soft, clayey SILT.	590
							10		588
3A				24			12	Gray (10YR5/1) with 15% dark yellowish brown (10YR4/6) and 15% brown (10YR4/3) mottles, moist, soft, silty CLAY with slight trace sand.	586
3B	26/60 43%	cs		20			14	Brown (10YR4/3) with 10% gray (10YR5/1) and 5% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	584
									582
4A				19			▼ 16		
	16/60 27%	cs					18	Brown (10YR4/3) with 10% gray (10YR5/1) and 5% dark yellowish brown (10YR4/6) mottles, very moist, soft, silty CLAY with slight trace sand and gravel.	580
									578
							20		

NOTE(S): OM22D installed in borehole.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/18/2009
Finish: 8/19/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM22
Well ID: OM22D
Surface Elev: 596.76 ft. MSL
Completion: 62.88 ft. BGS
Station: 3,994.82N
-127.08E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 15.82 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
5A				28			22		576
	20/60 33%	cs						Yellowish brown (10YR5/4) with 10% gray (N6/1) mottles, very moist, soft, silty CLAY with slight trace sand and gravel.	574
							24		572
6A				26			▼ 26		
6B	30/60 50%	cs		11			28	Brown (10YR5/3) with 10% gray (10YR5/1) mottles, slightly moist, hard, clayey SILT with trace sand and slight trace gravel.	570
									568
7A				20			30		566
7B	36/60 60%	cs		15			32	Dark gray (N4/1), moist, firm, silty CLAY with trace coal and rock fragments.	564
							34		562
8A				18			36		
8B				11					560
	16/60 27%	cs					38	Dark gray (N4/1), slightly moist, firm, silty CLAY (weathered SHALE) with trace coal.	558
							40		

NOTE(S): OM22D installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: Start: 8/18/2009
Finish: 8/19/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM22
Well ID: OM22D
Surface Elev: 596.76 ft. MSL
Completion: 62.88 ft. BGS
Station: 3,994.82N
-127.08E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 15.82 - 9/14/09
▽ =

SAMPLE				TESTING						
Number	Recov / Total (in) *% Recovery*	Type	Depth ft. BGS	Lithologic Description	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Borehole Detail	Elevation ft. MSL	Remarks
9A	25/60 *42%*	CS	42	Dark gray (N4/1), very moist, soft, silty CLAY (weathered SHALE) with trace coal and rock fragments.		13				556	
			44							554	
10A			46			15				552	
10B	46/60 *77%*	CS	48	Dark gray (N4/1), very moist, firm, silty CLAY (weathered SHALE) with trace coal and rock fragments.		16				550	
11A	14/24 *58%*	SS	50			19				548	
12A	13/24 *54%*	SS	52	Gray (N5/1), moist, firm, silty CLAY (weathered SHALE).		19				546	
13A	14/24 *58%*	SS	54	Gray (N5/1), slightly moist, hard, slightly weathered SHALE.		17				544	
14A	8/24 *33%*	SS	56	Greenish gray (10GY6/1), slightly moist, firm, SANDSTONE. Gray (N5/1), slightly moist, hard, slightly weathered SHALE. Greenish gray (10Y5/2) with 10% yellowish brown (10YR5/4) mottles, moist, firm, clayey SILT.		16				542	
15A	13/24 *54%*	SS	58			13				540	
			60	Gray (N5/1), moist, firm, silty CLAY (weathered SHALE).						538	

NOTE(S): OM22D installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/18/2009
Finish: 8/19/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger w/split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM22
Well ID: OM22D
Surface Elev: 596.76 ft. MSL
Completion: 62.88 ft. BGS
Station: 3,994.82N
-127.08E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 26.00 - during drilling
▼ = 15.82 - 9/14/09
▽ =

SAMPLE				TESTING							
Number	Recov / Total (in) / % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
16A	7/24 29%	ss		14			62	Gray (N5/1), moist, firm, silty CLAY (weathered SHALE). *[Continued from previous page]*		536	
17A	6/6 100%	ss		14				Dark gray (N4/1), slightly moist, very hard, SHALE.		534	
18A	5/5 100%	ss		13				**EOB = 62.9 ft bgs**			

NOTE(S): OM22D installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 9/3/2009
Finish: 9/3/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: OM23a
Well ID: OM23S
Surface Elev: 610.40 ft. MSL
Completion: 43.38 ft. BGS
Station: 5,591.13N
-371.63E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.00 - during drilling
▼ = 38.59 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0	Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand, roots.		610	
							2	Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand, roots.		608	
							4			606	
							6	Yellowish brown (10YR5/4) with 5% gray (10YR6/1), 5% dark yellowish brown (10YR4/6) and 5% Very dark gray (10YR3/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		604
							8			602	
							10	Yellowish brown (10YR5/4) with 5% gray (10YR6/1), 5% dark yellowish brown (10YR4/6) and 5% Very dark gray (10YR3/1) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		600
							12			598	
							14	Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		596
							16			594	
							18	Greenish gray (10Y5/1), slightly moist, friable, clayey SILT with shale, sandstone, and coal fragments.		592	
							20				

NOTE(S): OM23S installed in blind drilled borehole within 10 ft of OM23D. See OM23 boring log for sample data.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 9/3/2009
Finish: 9/3/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM23a
Well ID: OM23S
Surface Elev: 610.40 ft. MSL
Completion: 43.38 ft. BGS
Station: 5,591.13N
-371.63E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.00 - during drilling
▼ = 38.59 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Greenish gray (10Y5/1), slightly moist, friable, clayey SILT with shale, sandstone, and coal fragments. *[Continued from previous page]*		590	
							24	Gray (N5/1), slightly moist, firm, laminated, weathered SHALE.		588	
							26	Greenish gray (10Y5/1), slightly moist, friable, clayey SILT with shale fragments.		586	
							28			584	
							30			582	
							32	Greenish gray (10Y6/1), slightly moist, friable, clayey SILT with shale and trace coal fragments.		580	
							34			578	
							36			576	
							38	Gray (N5/1), slightly moist, hard, laminated, weathered SHALE with coal fragments.		574	
							▼			572	
							▼ 40				

NOTE(S): OM23S installed in blind drilled borehole within 10 ft of OM23D. See OM23 boring log for sample data.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 9/3/2009
Finish: 9/3/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: OM23a
Well ID: OM23S
Surface Elev: 610.40 ft. MSL
Completion: 43.38 ft. BGS
Station: 5,591.13N
-371.63E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.00 - during drilling
▼ = 38.59 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							42	Greenish gray (10Y6/1), slightly moist, firm, clayey SILT with shale and coal fragments.		570 568	

EOB = 43.4 ft bgs

NOTE(S): OM23S installed in blind drilled borehole within 10 ft of OM23D. See OM23 boring log for sample data.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 9/1/2009
Finish: 9/2/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM23
Well ID: OM23D
Surface Elev: 610.41 ft. MSL
Completion: 80.32 ft. BGS
Station: 5,585.76N
-371.66E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.00 - during drilling
▼ = 34.69 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail / Elevation ft. MSL	Remarks
1A	35/60 *58%*	CS		24			0	Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand, roots.	610	
							2	Yellowish brown (10YR5/4) with 15% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand, roots.	608	
							4		606	
2A	47/60 *78%*	CS		16			6	Yellowish brown (10YR5/4) with 5% gray (10YR6/1), 5% dark yellowish brown (10YR4/6) and 5% Very dark gray (10YR3/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.	604	
2B				16			8		602	
3A				17			10	Yellowish brown (10YR5/4) with 5% gray (10YR6/1), 5% dark yellowish brown (10YR4/6) and 5% Very dark gray (10YR3/1) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	600	
3B	37/60 *62%*	CS		17			12		598	
4A				17			14	Yellowish brown (10YR5/4) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.	596	
4B	50/60 *83%*	CS		11			16		594	
							18	Greenish gray (10Y5/1), slightly moist, friable, clayey SILT with shale, sandstone, and coal fragments.	592	
							20		590	

NOTE(S): OM23D installed in borehole.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 9/1/2009
Finish: 9/2/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM23
Well ID: OM23D
Surface Elev: 610.41 ft. MSL
Completion: 80.32 ft. BGS
Station: 5,585.76N
-371.66E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.00 - during drilling
▼ = 34.69 - 9/14/09
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) / % Recovery	SAMPLE Type	TESTING Blows / 6 in N - Value RQD	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Greenish gray (10Y5/1), slightly moist, friable, clayey SILT with shale, sandstone, and coal fragments. *[Continued from previous page]*			
5A	49/60 *82%*	CS		10						588	
5B				9			24	Gray (N5/1), slightly moist, firm, laminated, weathered SHALE.			
										586	
							26	Greenish gray (10Y5/1), slightly moist, friable, clayey SILT with shale fragments.			
6A	38/60 *63%*	CS		10						584	
							28				
										582	
							30				
										580	
7A				11							
	34/60 *57%*	CS					32	Greenish gray (10Y6/1), slightly moist, friable, clayey SILT with shale and trace coal fragments.			
										578	
							34				
							▼			576	
8A				12							
							36				
										574	
	10/60 *17%*	CS						Gray (N5/1), slightly moist, hard, laminated, weathered SHALE with coal fragments.			
							38				
										572	
							▼ 40				
9A				15						570	
								Greenish gray (10Y6/1), slightly moist, firm, clayey SILT with shale and coal fragments.			
							42				

NOTE(S): OM23D installed in borehole.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 9/1/2009
Finish: 9/2/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM23
Well ID: OM23D
Surface Elev: 610.41 ft. MSL
Completion: 80.32 ft. BGS
Station: 5,585.76N
-371.66E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.00 - during drilling
▼ = 34.69 - 9/14/09
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in / N - Value / RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	5/60 8%	CS									
							44			568	
10A	10/12 83%	SS	3 6 N=9	21			46	Greenish gray (10Y6/1), slightly moist, firm, clayey SILT with shale and coal fragments. *[Continued from previous page]*		566	
11A	16/24 67%	SS	6-9 19-21 N=28	16						564	
							48				
12A	20/24 83%	SS	4-7 8-10 N=15	15						562	
							50	Gray (N5/1), slightly moist, hard, laminated, weathered SHALE.			
13A	18/24 75%	SS	4-5 9-12 N=14	11				Greenish gray (10Y6/1), slightly moist, firm, clayey SILT. Gray (N5/1), slightly moist, firm, weathered SHALE.		560	
							52	Dark gray (N4/1), slightly moist, firm, laminated, weathered SHALE.			
14A				14						558	
14B	14/24 58%	SS	9-8 8-9 N=16	16				Yellowish brown (10YR5/4) with 15% dark yellowish brown (10YR4/6) and 5% dark gray (10YR4/1) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.			
							54	Olive gray (5Y5/2), moist, soft, silty CLAY with trace sand and slight trace gravel.			
15A	8/24 33%	SS	6-9 13-20 N=22	12						556	
							56				
16A	7/24 29%	SS	7-14 18-14 N=32	12				Gray (N6/1), slightly moist, firm, weathered SHALE.		554	
							58				
17A	13/24 54%	SS	7-17 14-16 N=31	15						552	
							60	Gray (N6/1), slightly moist, firm, laminated, weathered SHALE.			
18A	18/24 75%	SS	4-10 10-13 N=20	16						550	
							62	Gray (N6/1), slightly moist, firm, weathered SHALE.			
19A	8/24		22-28	13						548	

NOTE(S): OM23D installed in borehole.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 9/1/2009
Finish: 9/2/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM23
Well ID: OM23D
Surface Elev: 610.41 ft. MSL
Completion: 80.32 ft. BGS
Station: 5,585.76N
-371.66E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 30, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 40.00 - during drilling
▼ = 34.69 - 9/14/09
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in / N - Value / RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	33%	SS	17-21 N=45				64	Gray (N6/1), slightly moist, firm, weathered SHALE. *[Continued from previous page]*			
20A	11/24 46%	SS	14-14 10-12 N=24	18				Gray (N6/1), slightly moist, firm, weathered SHALE with some coal.		546	
21A	12/24 50%	SS	9-9 12-13 N=21	14			66			544	
22A	17/24 71%	SS	2-6 12-16 N=18	14			68	Gray (N5/1) with 10% dark yellowish brown (10YR4/6) mottles, moist, firm, weahtered SHALE.		542	
23A	16/24 67%	SS	2-7 8-8 N=15	21			70	Dark gray (N4/1), slightly moist, firm, laminated, weathered SHALE.		540	
24A	14/24 58%	SS	10-13 34-16 N=47	15			72	Dark gray (N4/1), slightly moist, firm, weathered SHALE.		538	
25A	14/17 82%	SS	25-80 100/5"				74			536	
	0/52 0%	BD					76	Very dark gray (N3/1), slightly moist, very hard, SHALE.		534	
							78			532	
							80				

EOB = 80.3 ft bgs

NOTE(S): OM23D installed in borehole.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/25/2009
Finish: 8/25/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 3¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM24
Well ID: OM24D
Surface Elev: 573.90 ft. MSL
Completion: 23.00 ft. BGS
Station: 7,523.62N
-341.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ = -0.31 - 9/14/09
▽ =

SAMPLE				TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							▼ 0	TOPSOIL - Black (10YR2/1), moist, soft, silty CLAY with slight trace sand, roots.			
1A				16				Black (10YR2/1) with 30% gray (10YR5/1) and 20% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel, trace roots.			
1B	24/60 *40%*	CS		27			2			572	
							4	Dark greenish gray (10Y4/1) with 20% dark yellowish brown (10YR4/6), 10% greenish gray (5GY6/1), and 5% black (N 2.5/1) mottles, moist, soft, silty CLAY with slight trace sand, coal fragments, slight trace roots.		570	
2A				27			6			568	
	14/60 *23%*	CS					8			566	
							▼ 10	Light brownish gray (2.5Y6/2) with 5% dark yellowish brown (10YR4/6) mottles, moist soft, silty CLAY with trace sand and gravel.		564	
3A				21			12			562	
	10/36 *28%*	CS						Very dark gray (N3/1), slightly moist, friable, laminated, weathered SHALE.			
4A	16/18 *89%*	SS	*36-31 100/5"*	15			14			560	
5A	8/10 *80%*	SS	*25-100/4"*	9			16	Very dark gray (N3/1), slightly moist, hard, laminated, SHALE with coal interbeds.		558	
6A	22/24 *92%*	SS	*5-44 38-42* N=82	12			18	Dark gray (N4/1), slightly moist, hard, laminated, weathered SHALE.		556	

NOTE(S): OM24D installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: Start: 8/25/2009
Finish: 8/25/2009
WEATHER: Sunny, warm, humid, lo-80's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 3¼" hollow stem auger

FIELD STAFF: Driller: R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM24
Well ID: OM24D
Surface Elev: 573.90 ft. MSL
Completion: 23.00 ft. BGS
Station: 7,523.62N
-341.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 10.00 - during drilling
▼ = -0.31 - 9/14/09
▽ =

SAMPLE				TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
7A	16/24 *67%*	ss	*5-14* *32-34* N=46	12			20	Dark gray (N4/1), slightly moist, hard, laminated, weathered SHALE. *[Continued from previous page]*		554	
8A				17							
8B	18/24 *75%*	ss	*17-60* *68-79* N=128	16			22	Dark gray (N4/1), slightly moist, very hard, SHALE.		552	

EOB = 23.0 ft bgs

NOTE(S): OM24D installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/1/1937
Finish: 8/31/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM25a
Well ID: OM25S
Surface Elev: 627.14 ft. MSL
Completion: 61.67 ft. BGS
Station: 8,616.31N
-321.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.05 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0	Dark yellowish brown (10YR4/4) with 20% gray (10YR6/1) mottles, moist, soft, clayey SILT with slight trace sand and gravel, roots.		626	
							2	Grayish brown (10YR5/2) with 35% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel, slight trace roots.		624	
							4	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT with slight trace sand, slight trace roots.		622	
							6	Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		620	
							8	Greenish gray (10Y5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.		618	
							10	Yellowish brown (10YR5/4) with 30% greenish gray (10Y5/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		616	
							12			614	
							14	Yellowish brown (10YR5/4) with 25% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		612	
							16	Light brownish gray (10YR6/2) with 15% dark yellowish brown (10YR4/6) and 5% gray (10YR5/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		610	
							18			608	
							20				

NOTE(S): OM25S installed in blind drilled borehole within 10 ft of OM25D. See OM25 boring log for sample data.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/1/1937
Finish: 8/31/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM25a
Well ID: OM25S
Surface Elev: 627.14 ft. MSL
Completion: 61.67 ft. BGS
Station: 8,616.31N
-321.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.05 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/4) with 15% gray (10YR6/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		606	
							24	Gray (10YR5/1) with 20% yellowish brown (10YR5/4) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.		604	
							26	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT with slight trace sand.		602	
							28	Dark gray (10YR4/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.		600	
							30	Yellowish brown (10YR5/4) with 10% dark gray (10YR4/1) and 10% grayish brown (10YR5/2) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		598	
							32	Gray (N5/1), slightly moist, firm, silty CLAY with trace coal and rock fragments.		596	
							34			594	
							36			592	
							38	Gray (N5/1), slightly moist, hard, silty CLAY with shale and coal fragments.		590	
							40			588	

NOTE(S): OM25S installed in blind drilled borehole within 10 ft of OM25D. See OM25 boring log for sample data.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/1/1937
Finish: 8/31/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM25a
Well ID: OM25S
Surface Elev: 627.14 ft. MSL
Completion: 61.67 ft. BGS
Station: 8,616.31N
-321.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.05 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							42	Gray (N5/1), slightly moist, firm, friable, silty CLAY with trace shale and coal fragments.		586	
							44			584	
							46	Gray (N5/1), slightly moist, hard, silty CLAY with trace shale and coal fragments.		582	
							48	Gray (N5/1), slightly moist, hard, laminated, friable, weathered SHALE.		580	
							50	Gray (N5/1), slightly moist, firm, friable, weathered SHALE with coal fragments.		578	
							52			576	
							54	Gray (N5/1), slightly moist, hard, friable, laminated, weathered SHALE.		574	
							▼ 56	Gray (N6/1), slightly moist, firm, silty CLAY (weathered SHALE).		572	
							58	Gray (N5/1), slightly moist, very hard, laminated, SHALE.		570	
							60	Dark gray (N4/1), slightly moist, hard, friable, clayey SILT (weathered SHALE).		568	

NOTE(S): OM25S installed in blind drilled borehole within 10 ft of OM25D. See OM25 boring log for sample data.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/1/1937
Finish: 8/31/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM25a
Well ID: OM25S
Surface Elev: 627.14 ft. MSL
Completion: 61.67 ft. BGS
Station: 8,616.31N
-321.61E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.05 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Dark gray (N4/1), slightly moist, firm, friable, laminated, weathered SHALE.		566	

EOB = 61.7 ft bgs

NOTE(S): OM25S installed in blind drilled borehole within 10 ft of OM25D. See OM25 boring log for sample data.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/26/2009
Finish: 8/27/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM25
Well ID: OM25D
Surface Elev: 627.02 ft. MSL
Completion: 76.00 ft. BGS
Station: 8,620.05N
-321.35E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.21 - 9/14/09
▽ =

SAMPLE			TESTING							
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A				21			0	Dark yellowish brown (10YR4/4) with 20% gray (10YR6/1) mottles, moist, soft, clayey SILT with slight trace sand and gravel, roots.		626	
1B	36/60 *60%*	cs		23			2	Grayish brown (10YR5/2) with 35% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel, slight trace roots.		624	
2A				23			4	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT with slight trace sand, slight trace roots.		622	
2B	35/60 *58%*	cs		15			6	Yellowish brown (10YR5/4) with 10% gray (10YR5/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		620	
3A				14			8	Greenish gray (10Y5/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with trace sand and slight trace gravel.		618	
	5/60 *8%*	cs					10	Yellowish brown (10YR5/4) with 30% greenish gray (10Y5/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		616	
4A				21			12	Yellowish brown (10YR5/4) with 25% gray (10YR6/1) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		614	
4B	40/60 *67%*	cs		25			14	Light brownish gray (10YR6/2) with 15% dark yellowish brown (10YR4/6) and 5% gray (10YR5/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		612	
							16			610	
							18			608	
							20				

NOTE(S): OM25D installed in borehole.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/26/2009
Finish: 8/27/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

BOREHOLE ID: OM25
Well ID: OM25D
Surface Elev: 627.02 ft. MSL
Completion: 76.00 ft. BGS
Station: 8,620.05N
-321.35E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.21 - 9/14/09
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) / % Recovery	Type	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
5A				22				Yellowish brown (10YR5/4) with 15% gray (10YR6/1) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		606	
5B	37/60 62%	CS		26			22	Gray (10YR5/1) with 20% yellowish brown (10YR5/4) and 10% dark yellowish brown (10YR4/6) mottles, moist, soft, clayey SILT with slight trace sand.		604	
6A				21			24	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, very moist, soft, clayey SILT with slight trace sand.		602	
6B	38/60 63%	CS		18			26	Dark gray (10YR4/1) with 15% dark yellowish brown (10YR4/6) mottles, moist, firm, silty CLAY with trace sand and slight trace gravel.		600	
7A				20			28	Yellowish brown (10YR5/4) with 10% dark gray (10YR4/1) and 10% grayish brown (10YR5/2) mottles, moist, soft, silty CLAY with trace sand and slight trace gravel.		598	
7B	37/60 62%	CS		15			30			596	
8A				15			32	Gray (N5/1), slightly moist, firm, silty CLAY with trace coal and rock fragments.		594	
8B	40/60 67%	CS		13			34			592	
							36			590	
							38	Gray (N5/1), slightly moist, hard, silty CLAY with shale and coal fragments.		588	
							40				

NOTE(S): OM25D installed in borehole.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/26/2009
Finish: 8/27/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM25
Well ID: OM25D
Surface Elev: 627.02 ft. MSL
Completion: 76.00 ft. BGS
Station: 8,620.05N
-321.35E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.21 - 9/14/09
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
9A				10						586	
	14/60 23%	CS					42	Gray (N5/1), slightly moist, firm, friable, silty CLAY with trace shale and coal fragments.		584	
							44				
										582	
10A	13/18 72%	CS		12			46				
11A	12/18 67%	SS	17-40 26 N=66	12				Gray (N5/1), slightly moist, hard, silty CLAY with trace shale and coal fragments.		580	
							48				
12A	19/24 79%	SS	10-22 24-18 N=46	8				Gray (N5/1), slightly moist, hard, laminated, friable, weathered SHALE.		578	
							50				
13A	17/24 71%	SS	2-12 8-7 N=20	10						576	
							52	Gray (N5/1), slightly moist, firm, friable, weathered SHALE with coal fragments.			
14A	16/24 67%	SS	12-17 14-15 N=31	10						574	
							54				
15A	18/24 75%	SS	13-17 16-34 N=33	3				Gray (N5/1), slightly moist, hard, friable, laminated, weathered SHALE.		572	
							▼ 56				
16A	20/24 83%	SS	8-8 9-48 N=17	13				Gray (N6/1), slightly moist, firm, silty CLAY (weathered SHALE).		570	
							58	Gray (N5/1), slightly moist, very hard, laminated, SHALE.			
17A				10							
17B	17/24 71%	SS	75-30 27-24 N=57	12				Dark gray (N4/1), slightly moist, hard, friable, clayey SILT (weathered SHALE).		568	
							60				

NOTE(S): OM25D installed in borehole.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 & 2
Location: Canton, Fulton County, Illinois
Project: 03S5010F 6100
DATES: **Start:** 8/26/2009
Finish: 8/27/2009
WEATHER: Sunny, warm, humid, lo-70's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** R. Keedy
Helper: D. Crump
Eng/Geo: S. Simpson

HANSON

BOREHOLE ID: OM25
Well ID: OM25D
Surface Elev: 627.02 ft. MSL
Completion: 76.00 ft. BGS
Station: 8,620.05N
-321.35E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Duck Island
Township: Banner
Section 19, **Tier** 6N; **Range** 5E

WATER LEVEL INFORMATION:
▼ = 55.60 - during drilling
▼ = 56.21 - 9/14/09
▽ =

SAMPLE				TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
18A	19/24 *79%*	ss	*7-9* *12-9* N=21	8			62	Dark gray (N4/1), slightly moist, firm, friable, laminated, weathered SHALE.		566	
19A	16/24 *67%*	ss	*3-6* *9-30* N=15	12			64	Gray (N6/1), slightly moist, firm, clayey SILT (weathered SHALE).		564	
20A	14/24 *58%*	ss	*4-5* *4-6* N=9	17			66			562	
21A	14/24 *58%*	ss	*3-9* *61-36* N=70	14			68	Very dark gray (N3/1), slightly moist, hard, laminated, weathered SHALE.		560	
22A	19/24 *79%*	ss	*11-10* *34-19* N=44	17				Gray (N6/1), moist, firm, clayey SILT with shale fragments.		558	
22B				7			70	Gray (N5/1), slightly moist, hard, laminated, SHALE.			
23A	12/24 *50%*	ss	*14-27* *11-16* N=38	12			72			556	
24A	16/24 *67%*	ss	*7-10* *12-13* N=22	16			74	Gray (N5/1), moist, firm, clayey SILT with rock fragments.		554	
25A	12/24 *50%*	ss	*12-16* *20-17* N=36	11			76			552	

EOB = 76.0 ft bgs

NOTE(S): OM25D installed in borehole.

Surface Elevation: _____ Completion Date: 7/14/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Stiff, gray and black ASH			
5			3-4-8	SS1
	Soft, gray and black ASH			
10			1-2-2	SS2
	Soft to very soft, gray and black ASH			
15		▽	0-0-0	SS3
20			0-0-0	SS4
25			0-0-0	SS5
30			0-1-2	SS6
35			0-0-0	SS7
			2-1-2	SS8

WELL DIAGRAM

Flushmount

Depth (ft) / Elev. (ft)

Concrete 1.0

3.0

2" sch 40 PVC

Bentonite

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 15 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

LOG OF BORING: OM-26

Project No. J017150.01

LOG OF BORING 2002 WL J01750.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

Surface Elevation: _____ Completion Date: 7/14/10

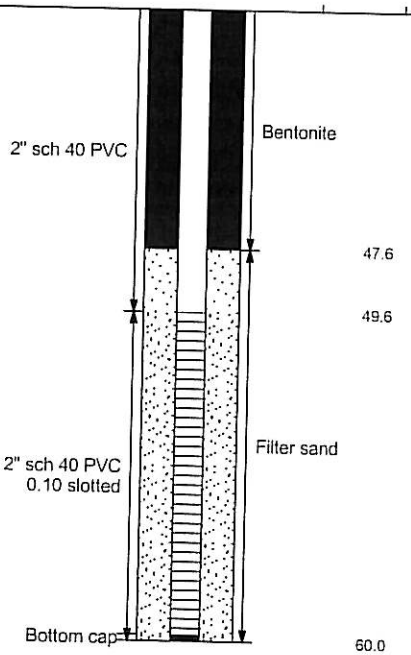
Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft to very soft, gray and black ASH *(continued)*			
45			0-0-1	SS9
50			0-0-1	SS10
55	Soft, gray ASH with brown, silty CLAY		0-0-1	SS11
60			0-0-2	SS12
65	Medium stiff, gray and black, silty CLAY with ash - CL			ST13
	Boring terminated at 66.5 feet.		3-3-5	SS14
70				
75				

WELL DIAGRAM

Flushmount

Depth (ft) / Elev. (ft)



GROUNDWATER DATA

ENCOUNTERED AT 15 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

CONTINUATION OF LOG OF BORING: OM-26

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

Surface Elevation: _____ Completion Date: 7/15/10

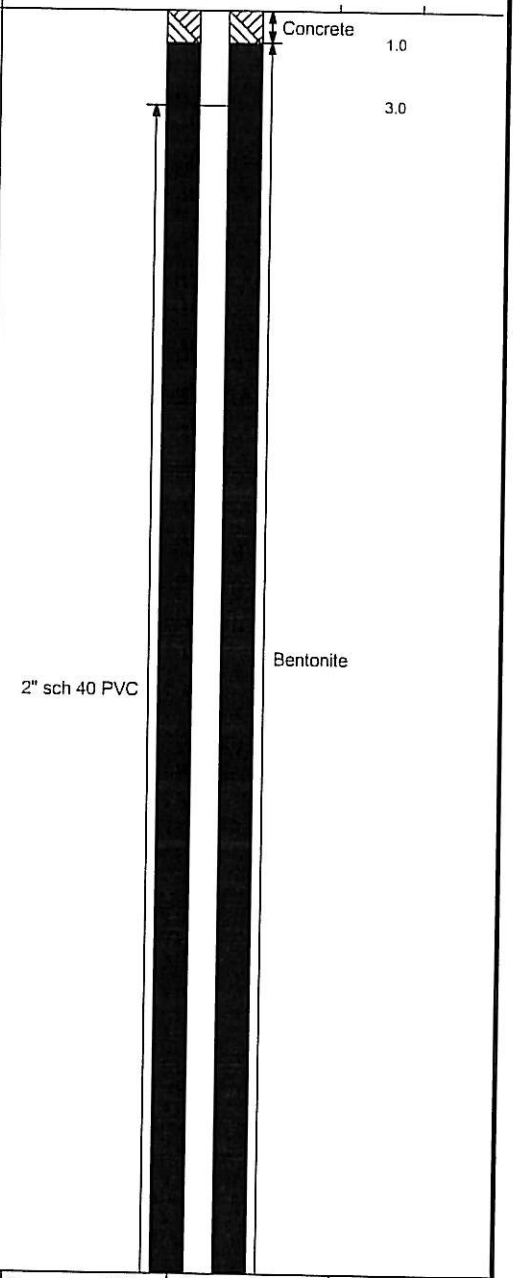
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DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Stiff, black ASH			
5			2-3-7	SS1
	Soft to very soft, black and gray ASH			
10			0-0-1	SS2
15			0-1-1	SS3
20			0-0-1	SS4
25			0-1-2	SS5
	Soft, black and gray ASH			
30		▽	1-1-3	SS6
35			0-1-2	SS7
			0-0-1	SS8

WELL DIAGRAM

Flushmount

Depth (ft) / Elev. (ft)



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 30 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

LOG OF BORING: OM-27

Project No. J017150.01

LOG OF BORING 2002 WL J01750.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

Surface Elevation: _____ Completion Date: 7/15/10

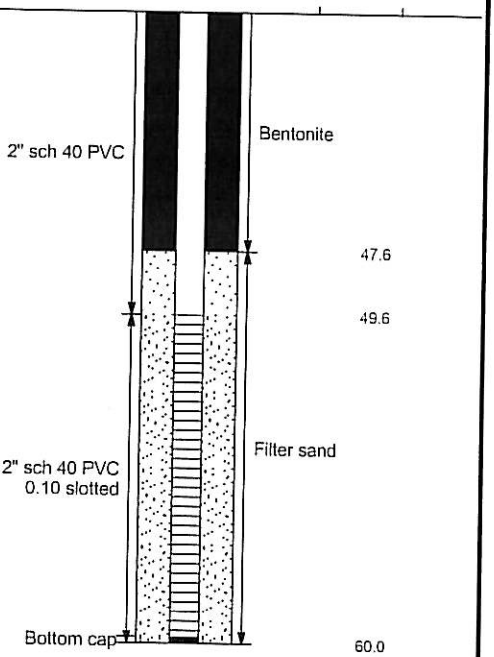
Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft, gray ASH			
45			0-0-2	SS9
50			0-0-3	SS10
55	Very soft, gray and black ASH with brown, silty CLAY		0-0-2	SS11
60			0-0-1	SS12
	Very stiff, brown and tan, silty CLAY - CL			ST13
65	Boring terminated at 65 feet.		3-8-12	SS14
70				
75				

WELL DIAGRAM

Flushmount

Depth (ft) Elev. (ft)



GROUNDWATER DATA

ENCOUNTERED AT 30 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

CONTINUATION OF
LOG OF BORING: OM-27

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J01750.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

Surface Elevation: _____ Completion Date: 7/16/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft to medium stiff, black ASH			
5			1-2-2	SS1
10			1-4-3	SS2
15			0-2-1	SS3
20			5-7-8	SS4
25	Very stiff to hard, black ASH		1-3-3	SS5
30			4-7-10	SS6
35	Soft to very soft, black and gray ASH		15-20-16	SS7
			0-1-1	SS8

WELL DIAGRAM

Flushmount

Depth (ft) / Elev. (ft)

Concrete 1.0

3.0

2" sch 40 PVC

Bentonite

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 40 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

LOG OF BORING: OM-28

Project No. J017150.01

LOG OF BORING 2002 WL J01750.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

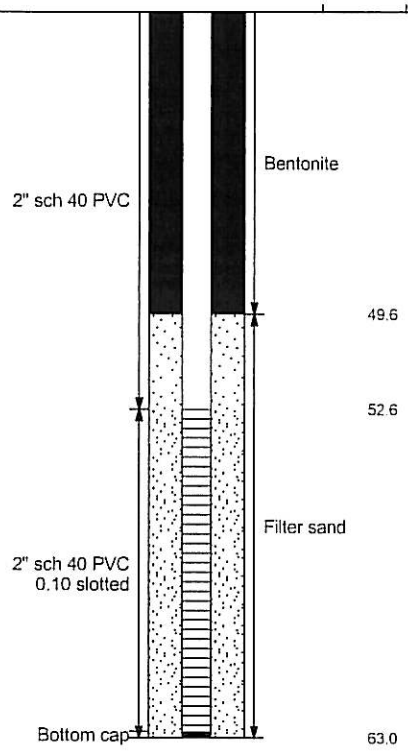
Surface Elevation: _____ Completion Date: 7/16/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Soft to very soft, black and gray ASH *(continued)*			
			0-1-1	SS9
45				
			1-1-2	SS10
50				
			0-0-1	SS11
55				
			0-0-1	SS12
60	Very stiff, brown, silty CLAY - CL			
			6-11-15	ST13
65				
	Medium stiff, brown, silty CLAY - CL			SS14
			1-2-5	SS15
70	Boring terminated at 70 feet.			
75				

WELL DIAGRAM

Flushmount



GROUNDWATER DATA

ENCOUNTERED AT 40 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

CONTINUATION OF
LOG OF BORING: OM-28

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J01750.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

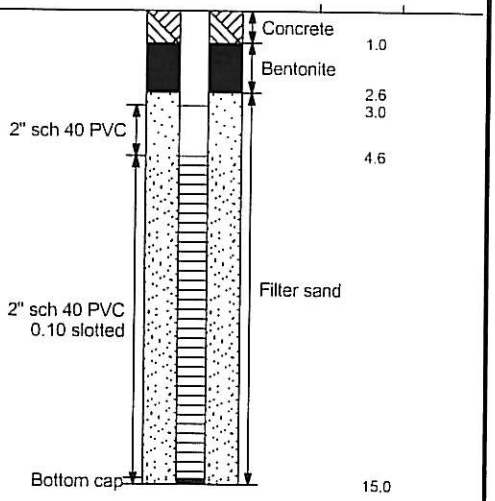
Surface Elevation: _____ Completion Date: 7/13/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: silty clay, some ash			
			1-3-5	SS1
5			3-3-5	SS2
	Black, clayey ASH			ST3
10	Medium stiff, gray, silty CLAY - CL			
			2-3-5	SS4
15	Boring terminated at 15 feet.			
20				
25				
30				
35				

WELL DIAGRAM

Flushmount



GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

LOG OF BORING: OM-30

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J01750.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

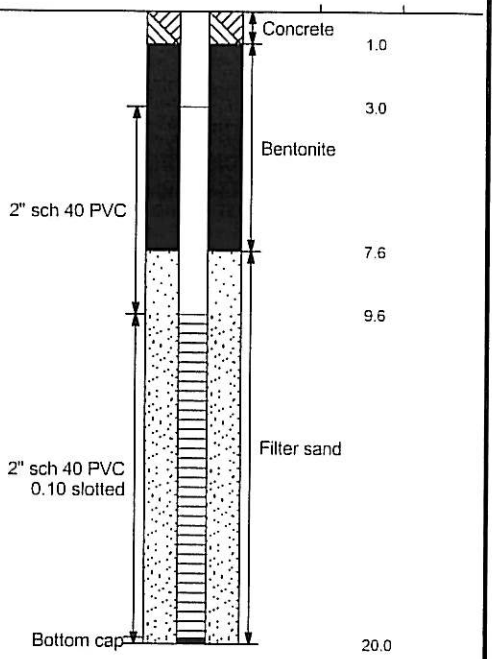
Surface Elevation: _____ Completion Date: 7/15/10

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Stiff to medium stiff, brown, silty CLAY, some fill - CL			
			3-7-6	SS1
5				
			3-3-5	SS2
10				
			3-3-3	SS3
15	Tan and gray, silty CLAY - CL			ST4
	Medium stiff, brown, silty CLAY, trace organics - CL		1-2-5	SS5
20	Boring terminated at 20 feet.			
25				
30				
35				

WELL DIAGRAM

Flushmount



GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by:	App'vd. by:
Date: 8/13/10	Date:	Date:

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Duck Creek, Illinois

LOG OF BORING: OM-31

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J01750.01 - DUCK CREEK.GPJ GTINC 0638301.GPJ 11/3/10

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: Start: 2/18/2009
Finish: 2/18/2009
WEATHER: cool, overcast, windy, mid-30's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: Driller: B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM50a
Well ID: OM50S
Surface Elev: 601.2 ft. MSL
Completion: 18.4 ft. BGS
Station: 13,557.77N
-6,682.00E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 14, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 10.30 - during drilling
▼ =
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0	Dark gray (10YR4/1), moist, firm, clayey SILT with trace sand and gravel.		600	
							2	Yellowish brown (10YR5/6), moist, hard, clayey SILT with trace sand and slight trace gravel.		598	
							4	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.		596	
							6	Light brownish gray (10YR6/2) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		594	
							8	Dark yellowish brown (10YR4/6) with 10% light brownish gray (10YR6/2) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		592	
							▼ 10	Yellowish brown (10YR5/6), moist, very soft, silty CLAY with slight trace sand and gravel.		590	
							12	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, wet, soft, clayey SILT.		588	
							14	Dark yellowish brown (10YR4/6), very moist, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.		586	
								Grayish brown (10YR5/2) with 20% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.			
							16	Gray (10YR5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		584	
							18				

EOB = 18.44 ft bgs

NOTE(S): OM50S was installed within 5' of OM50D. See OM50D boring log for sample and testing data.

FIELD BORING LOG

HANSON

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 2/17/2009
Finish: 2/18/2009
WEATHER: cool, overcast, windy, mid-30's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: OM50
Well ID: OM50D
Surface Elev: 601.2 ft. MSL
Completion: 46.6 ft. BGS
Station: 13,557.44N
-6,685.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 14, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 10.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value ROD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type
1A	14/24 58%	SS	5-6 11-13 N=17	6		
2A	17/24 71%	SS	7-40 21-6 N=61	7		
3A	19/24 79%	SS	3-2 3-3 N=5	23		
4A	20/24 83%	SS	4-5 4-6 N=9	21		
4B				24		
5A	17/24 71%	SS	6-2 2-1 N=4	20		
6A	19/24 79%	SS	0-1 3-4 N=4	25		
7A	22/24 92%	SS	5-5 12-12 N=17	25		
7B				15		
8A	19/24 79%	SS	5-7 12-13 N=19	12		
9A	20/24 83%	SS	10-17 14-18 N=31	10		
10A	19/24 79%	SS	4-6 12-13 N=18	12		

Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	Dark gray (10YR4/1), moist, firm, clayey SILT with trace sand and gravel.			
2	Yellowish brown (10YR5/6), moist, hard, clayey SILT with trace sand and slight trace gravel.		600	
4	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) mottles, moist, firm, clayey SILT.		598	
6	Light brownish gray (10YR6/2) with 10% dark yellowish brown (10YR4/6) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		596	
8	Dark yellowish brown (10YR4/6) with 10% light brownish gray (10YR6/2) mottles, moist, soft, silty CLAY with slight trace sand and gravel.		594	
▼ 10	Yellowish brown (10YR5/6), moist, very soft, silty CLAY with slight trace sand and gravel.		592	
12	Gray (10YR6/1) with 20% dark yellowish brown (10YR4/6) mottles, wet, soft, clayey SILT.		590	
14	Dark yellowish brown (10YR4/6), very moist, medium dense, silty, fine- to coarse-grained SAND with slight trace gravel.		588	
	Grayish brown (10YR5/2) with 20% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel.		586	
16	Gray (10YR5/1), slightly moist, hard, clayey SILT with trace sand and slight trace gravel.		584	
18	Yellowish brown (10YR5/4), very moist, medium dense, silty, fine- to coarse-grained SAND.		582	
20				

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 2/17/2009
Finish: 2/18/2009
WEATHER: cool, overcast, windy, mid-30's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM50
Well ID: OM50D
Surface Elev: 601.2 ft. MSL
Completion: 46.6 ft. BGS
Station: 13,557.44N
-6,685.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 14, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 10.30 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	23/24 96%	SS	4-7 11-8 N=18	10			22	Grayish brown (10YR5/2) with 20% dark yellowish brown (10YR4/6) mottles, slightly moist, firm, clayey SILT with slight trace sand and gravel. *[Continued from previous page]*		580	
12A	24/24 100%	SS	8-16 16-16 N=32	10			24			578	
13A	20/24 83%	SS	3-6 6-13. N=12	19			26	Gray (N5/1), slightly moist, hard, clayey SILT.		576	
14A	18/24 75%	SS	14-17 19-50 N=36	17			28	Gray (N6/1), slightly moist, very hard, SHALE.		574	
15A	18/24 75%	SS	17-13 21-23 N=34	16			30			572	Trace coal fragments.
16A	19/24 79%	SS	3-12 19-33 N=31	20			32	Gray (N5/1) with very dark gray (N3/1) laminae, slightly moist, hard, SHALE.		570	
17A	20/22 91%	SS	18-20 35-50/4" N=55	19			34	Gray (N5/1), slightly moist, hard, SHALE.		568	
18A	20/22 91%	SS	15-22 50-50/4" N=72	13						566	
19A	2/1 200%	SS	50/1"	14			36	Gray (N6/1), slightly moist, hard, SHALE.		564	
20A	10/9 111%	SS	33-50/3"	20			38	Dark gray (N4/1), dry, very hard, SHALE.		562	
							40				

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 2/17/2009
Finish: 2/18/2009
WEATHER: cool, overcast, windy, mid-30's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM50
Well ID: OM50D
Surface Elev: 601.2 ft. MSL
Completion: 46.6 ft. BGS
Station: 13,557.44N
-6,685.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 14, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 10.30 - during drilling
▼ =
▽ =

SAMPLE				TESTING						
Number	Recov / Total (in) % Recovery	Type	Depth ft. BGS	Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
21A	8/8 100%	SS		49-50/2"	7						
22A	9/9 100%	SS	42	10-50/3"	8			Dark gray (N4/1), dry, very hard, SHALE. *[Continued from previous page]*		560	
23A	8/8 100%	SS	44	39-50/2"	13					558	
24A	7/7 100%	SS	46	49-50/1"	7			Gray (N6/1), dry, very hard, SHALE.		556	
								EOB = 46.6 ft bgs			

NOTE(S):

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/16/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51
Well ID: N/A
Surface Elev: 583.8 ft. MSL
Completion: 59.7 ft. BGS
Station: N
E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 36.00 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	22/24 92%	SS	3-4 5-5 N=9					Dark yellowish brown (10YR4/6), moist, soft, silty CLAY with slight trace sand and roots.			
1B				24			2	Dark grayish brown (10YR4/2) with 20% yellowish brown (10YR5/6) mottles, moist, firm, silty CLAY with slight trace sand and roots.		582	
2A	20/24 83%	SS	2-4 4-6 N=8	21				Dark grayish brown (10YR4/2) with 30% very dark greenish gray (5BG3/1) mottles, moist, firm, silty CLAY.			
2B				23			4	Dark yellowish brown (10YR4/4), very moist, soft, clayey SILT with slight trace sand.		580	
	18/24 75%	SS	3-6 6-8 N=12								
3A				22			6			578	
	24/24 100%	SS	7-7 8-7 N=15								
4A				22			8	Very dark greenish gray (5BG3/1) with very dark gray (N3/1) mottles, moist, firm, silty CLAY.		576	
5A	23/24 96%	SS	2-1 2-3 N=3	23							
5B				24				Brown (10YR4/3), moist, soft, clayey SILT with slight trace sand.			
5C				25			10	Gray (N5/1), very moist, soft, silty CLAY with very dark gray (10YR3/1) peat.		574	
	16/24 67%	SS	woh-1 2-2 N=3					Very dark gray (N3/1) with 30% dark greenish gray (5BG4/1) mottles, moist, soft, silty CLAY.			
6A				24			12	Very dark gray (N3/1) with 20% yellowish brown (10YR5/6) mottles, moist, very soft, clayey SILT with slight trace sand.		572	
7A	24/24 100%	SS	4-4 5-4 N=9	27							
							14			570	
8A	20/24 83%	SS	1-1 2-2 N=3	32				Black (10YR2/1) moist, soft, clayey SILT with organics (peat).			
8B				42			16	Greenish gray (5BG5/1), moist, soft, silty CLAY.		568	
9A				29							
	24/24 100%	SS	3-3 4-5 N=7					Very dark gray (N3/1) with 30% yellowish brown (10YR5/6) mottles, very moist to wet, soft, clayey SILT with slight trace sand.			
9B				26			18			566	
								Greenish gray (5BG5/1), moist, soft, silty CLAY.			
10A	22/24 92%	SS	woh-2 2-3 N=4	24				Very dark gray (10YR3/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, clayey SILT with slight trace sand.			
10B				30			20			564	

NOTE(S): Borehole was abandoned using bentonite grout.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/16/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Scrvice Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51
Well ID: N/A
Surface Elev: 583.8 ft. MSL
Completion: 59.7 ft. BGS
Station: N
E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 36.00 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	18/24 75%	SS	1-1 2-3 N=3	31			22	Very dark gray (10YR3/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, clayey SILT with slight trace sand. *[Continued from previous page]*		562	
12A	24/24 100%	SS	2-2 3-4 N=5	34			24	Very dark gray (10YR3/1) with 25% yellowish brown (10YR5/6) and 5% greenish gray (5BG5/1) mottles, moist, soft, clayey SILT with slight trace sand and some intermittent very dark grayish brown (10YR3/2) peat.		560	
13A	23/24 96%	SS	2-2 4-5 N=6	30							
13B				24			26	Greenish gray (5BG5/1) with 10% very dark gray (N3/1) mottles, moist, firm, silty CLAY.		558	
14A	24/24 100%	SS	2-2 3-5 N=5	33			28	Very dark gray (10YR3/1) with 30% yellowish brown (10YR5/6) and 10% very dark gray (N3/1) mottles, very moist, soft, clayey SILT with slight trace sand and some intermittent very dark grayish brown (10YR3/2) peat.		556	
15A	24/24 100%	SS	1-1 2-4 N=3	44							
15B				30			30	Greenish gray (5BG5/1) with 10% very dark grayish brown (10YR3/2) peat, moist, firm, silty CLAY with sand.		554	
16A	22/24 92%	SS	2-2 3-3 N=5	21							
17A	24/24 100%	SS	6-7 8-11 N=15	23			32			552	
17B				18				Gray (N5/1), wet, firm, silty CLAY with coal and some shale fragments.			
18A				17			34			550	
18B	18/24 75%	SS	2-3 12-7 N=15	19				Gray (N6/1), dry, hard, SHALE.			
								Gray (N6/1) with black (N2.5/1) coal fragments, wet, hard, broken SHALE and coal.			
							▼ 36			548	
19A	24/24 100%	SS	15-34 25-32 N=59	13				Gray (N5/1), moist, hard, SHALE.			
							38			546	
								Gray (N6/1), SANDSTONE.			
20A	12/24 50%	SS	1-3 5-3 N=8	24				Gray (N6/1), moist, soft, SHALE.			
							40			544	

NOTE(S): Borehole was abandoned using bentonite grout.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/16/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51
Well ID: N/A
Surface Elev: 583.8 ft. MSL
Completion: 59.7 ft. BGS
Station: N
E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 36.00 - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
21A	11/24 46%	SS	2-2 4-4 N=6	17			42	Gray (N6/1), wet, soft, weathered SHALE and sandstone fragments.		542	
22A	5/5 100%	SS	50/5"	15			44	Gray (N6/1), very moist, firm, weathered SHALE with slight trace sand.		540	
23A	18/24 75%	SS	11-6 5-7 N=11	16			46	Light yellowish brown (2.5Y6/3), very moist, soft, clayey SILT with trace sand.		538	
24A	14/24 58%	SS	3-3 4-5 N=7	16				Gray (N6/1), SHALE.			
25A	18/24 75%	SS	4-5 4-8 N=9	13			48	Light yellowish brown (2.5Y6/3), very moist to wet, soft, clayey SILT with trace sand.		536	
26A	14/24 58%	SS	2-4 6-8 N=10	24				Gray (N6/1), wet, hard, SANDSTONE.			
27A	20/24 83%	SS	4-6 4-3 N=10	26			50	Gray (N6/1), wet, soft, weathered, sandy SHALE.		534	
28A	16/24 67%	SS	10-10 7-22 N=17	14			52	Light yellowish brown (2.5Y6/3) with 30% gray (N6/1) mottles, wet, soft, clayey SILT with trace sand and sandstone fragments.		532	
29A	17/24 71%	SS	44-11 17-27 N=28	13			54	Gray (N6/1), moist, hard, micaceous SHALE.		530	
30A	18/24 75%	SS	5-14 8-14 N=22	20			56	Gray (N5/1), moist, hard, SHALE with trace sand.		528	
30B				21			58	Gray (N6/1), moist, hard, micaceous SANDSTONE.		526	
								Gray (N5/1), moist, hard, weathered SHALE.			
								EOB = 59.7 ft bgs			

NOTE(S): Borehole was abandoned using bentonite grout.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/16/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51b
Well ID: OM51S
Surface Elev: 583.8 ft. MSL
Completion: 22.2 ft. BGS
Station: -4,231.82N
-488.56E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0	Dark yellowish brown (10YR4/6), moist, soft, silty CLAY with slight trace sand and roots.			
							2	Dark grayish brown (10YR4/2) with 20% yellowish brown (10YR5/6) mottles, moist, firm, silty CLAY with slight trace sand and roots.		582	
								Dark grayish brown (10YR4/2) with 30% very dark greenish gray (5BG3/1) mottles, moist, firm, silty CLAY.			
							4	Dark yellowish brown (10YR4/4), very moist, soft, clayey SILT with slight trace sand.		580	
							6	Very dark greenish gray (5BG3/1) with very dark gray (N3/1) mottles, moist, firm, silty CLAY.		578	
							8			576	
								Brown (10YR4/3), moist, soft, clayey SILT with slight trace sand.			
							10	Gray (N5/1), very moist, soft, silty CLAY with very dark gray (10YR3/1) peat.		574	
								Very dark gray (N3/1) with 30% dark greenish gray (5BG4/1) mottles, moist, soft, silty CLAY.			
							12	Very dark gray (N3/1) with 20% yellowish brown (10YR5/6) mottles, moist, very soft, clayey SILT with slight trace sand.		572	
							14			570	
								Black (10YR2/1) moist, soft, clayey SILT with organics (peat).			
							16	Greenish gray (5BG5/1), moist, soft, silty CLAY.		568	
								Very dark gray (N3/1) with 30% yellowish brown (10YR5/6) mottles, very moist to wet, soft, clayey SILT with slight trace sand.			
							18	Greenish gray (5BG5/1), moist, soft, silty CLAY.		566	
								Very dark gray (10YR3/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, clayey SILT with slight trace sand.			
							20			564	

NOTE(S): OM51S was installed within 5' of boring OM51. See OM51 boring log for sample and testing data.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/16/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51b
Well ID: OM51S
Surface Elev: 583.8 ft. MSL
Completion: 22.2 ft. BGS
Station: -4,231.82N
-488.56E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Very dark gray (10YR3/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, clayey SILT with slight trace sand. *[Continued from previous page]*			
							22	Very dark gray (10YR3/1) with 25% yellowish brown (10YR5/6) and 5% greenish gray (5BG5/1) mottles, moist, soft, clayey SILT with slight trace sand and some intermittent very dark grayish brown (10YR3/2) peat. **EOB = 22.18 ft bgs**		562	

NOTE(S): OM51S was installed within 5' of boring OM51. See OM51 boring log for sample and testing data.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/17/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51a
Well ID: OM51D
Surface Elev: 583.8 ft. MSL
Completion: 47.5 ft. BGS
Station: -4,226.56N
-488.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 36.00 - during drilling
▼ =
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) % Recovery	SAMPLE Type	TESTING Blows / 6 in N - Value RQD	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							0	Dark yellowish brown (10YR4/6), moist, soft, silty CLAY with slight trace sand and roots.			
							2	Dark grayish brown (10YR4/2) with 20% yellowish brown (10YR5/6) mottles, moist, firm, silty CLAY with slight trace sand and roots.		582	
								Dark grayish brown (10YR4/2) with 30% very dark greenish gray (5BG3/1) mottles, moist, firm, silty CLAY.			
							4	Dark yellowish brown (10YR4/4), very moist, soft, clayey SILT with slight trace sand.		580	
							6			578	
							8	Very dark greenish gray (5BG3/1) with very dark gray (N3/1) mottles, moist, firm, silty CLAY.		576	
								Brown (10YR4/3), moist, soft, clayey SILT with slight trace sand.			
							10	Gray (N5/1), very moist, soft, silty CLAY with very dark gray (10YR3/1) peat.		574	
								Very dark gray (N3/1) with 30% dark greenish gray (5BG4/1) mottles, moist, soft, silty CLAY.			
							12	Very dark gray (N3/1) with 20% yellowish brown (10YR5/6) mottles, moist, very soft, clayey SILT with slight trace sand.		572	
							14			570	
								Black (10YR2/1) moist, soft, clayey SILT with organics (peat).			
							16	Greenish gray (5BG5/1), moist, soft, silty CLAY.		568	
								Very dark gray (N3/1) with 30% yellowish brown (10YR5/6) mottles, very moist to wet, soft, clayey SILT with slight trace sand.			
							18	Greenish gray (5BG5/1), moist, soft, silty CLAY.		566	
								Very dark gray (10YR3/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, clayey SILT with slight trace sand.			
							20			564	

NOTE(S): OM51D was installed within 5' of boring OM51. See OM51 boring log for sample and testing data.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/17/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51a
Well ID: OM51D
Surface Elev: 583.8 ft. MSL
Completion: 47.5 ft. BGS
Station: -4,226.56N
-488.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 36.00 - during drilling
▼ =
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
								Very dark gray (10YR3/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, clayey SILT with slight trace sand. *[Continued from previous page]*			
							22			562	
								Very dark gray (10YR3/1) with 25% yellowish brown (10YR5/6) and 5% greenish gray (5BG5/1) mottles, moist, soft, clayey SILT with slight trace sand and some intermittent very dark grayish brown (10YR3/2) peat.			
							24			560	
								Greenish gray (5BG5/1) with 10% very dark gray (N3/1) mottles, moist, firm, silty CLAY.			
							26			558	
								Very dark gray (10YR3/1) with 30% yellowish brown (10YR5/6) and 10% very dark gray (N3/1) mottles, very moist, soft, clayey SILT with slight trace sand and some intermittent very dark grayish brown (10YR3/2) peat.			
							28			556	
								Greenish gray (5BG5/1) with 10% very dark grayish brown (10YR3/2) peat, moist, firm, silty CLAY with sand.			
							30			554	
							32			552	
								Gray (N5/1), wet, firm, silty CLAY with coal and some shale fragments.			
							34			550	
								Gray (N6/1), dry, hard, SHALE.			
								Gray (N6/1) with black (N2.5/1) coal fragments, wet, hard, broken SHALE and coal.			
							▼ 36			548	
								Gray (N5/1), moist, hard, weathered SHALE.			
							38			546	
								Gray (N6/1), SANDSTONE.			
								Gray (N6/1), moist, soft, weathered SHALE.			
							40			544	

NOTE(S): OM51D was installed within 5' of boring OM51. See OM51 boring log for sample and testing data.

FIELD BORING LOG

CLIENT: Ameren Energy Resources Generating Co.
Site: Duck Creek Ash Ponds 1 and 2
Location: Canton, Fulton Co., IL
Project: 03S5010 / 5500
DATES: **Start:** 3/16/2009
Finish: 3/17/2009
WEATHER: sunny, mild, 50's

CONTRACTOR: Testing Service Corporation
Rig mfg/model: CME 550 ATV Drill
Drilling Method: 4¼" hollow stem auger

FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

HANSON

BOREHOLE ID: OM51a
Well ID: OM51D
Surface Elev: 583.8 ft. MSL
Completion: 47.5 ft. BGS
Station: -4,226.56N
-488.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Banner
Township: Banner
Section 31, **Tier** 6N.; **Range** 5E.

WATER LEVEL INFORMATION:
▼ = 36.00 - during drilling
▼ =
▽ =

SAMPLE			TESTING				Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Failure Type*					
							42	Gray (N6/1), wet, soft, weathered SHALE and sandstone fragments.		542	
							44	Gray (N6/1), very moist, firm, weathered SHALE with slight trace sand.		540	
							46	Light yellowish brown (2.5Y6/3), very moist, soft, claycy SILT with trace sand.		538	
								Gray (N6/1), weathered SHALE.			
								EOB = 47.47 ft bgs			

NOTE(S): OM51D was installed within 5' of boring OM51. See OM51 boring log for sample and testing data.

APPENDIX E

GROUNDWATER ELEVATION DATA – 2014, 2015

Appendix E
Groundwater Elevation Data – 2014, 2015
Supplemental Hydrogeologic Site Characterization Report
Duck Creek Energy Center

	Well Location		Well Elevations		Groundwater Elevations			
Well ID	East (Apr 08)	North (Apr 08)	Gnd_Elev (Apr 08)	Pipe_Elev (Apr 08)	24-Apr-14	18-Jul-14	17-Apr-15	15-Sep-15
OM01	288.1	5259.0	593.30	595.61	582.90	585.05	583.57	583.86
OR02	130.6	7475.6	599.19	601.41	595.49	595.60	595.54	594.98
OR03D	85.6	9286.1	623.72	627.13	581.62	581.57	581.41	582.69
OR03S	82.3	9283.0	623.69	627.16	581.49	581.54	581.61	582.46
OM04S	1224.8	9551.1	604.81	607.35	590.64	588.96	589.23	588.30
OR04D	1229.1	9548.7	604.80	607.58	586.73	586.63	586.58	586.97
OR05D	1675.1	6766.3	607.91	610.96	593.24	593.08	592.96	593.32
OM05S	1679.1	6768.3	607.91	610.76	591.85	592.28	592.62	593.41
OR06A	1635.8	4917.2	591.62	595.31	588.26	578.53	579.00	578.74
OM07	1647.1	4157.2	594.38	596.46	581.46	582.32	583.40	584.54
OM08	1936.7	2579.0	599.11	601.74	586.89	580.59	587.41	587.14
OM09	77.8	1906.6	590.16	591.61	585.19		587.04	585.75
OM10	4875.2	6221.4	584.09	585.11	576.56		578.95	579.56
OR11	3059.0	5448.4	593.64	596.55	566.05	567.71	566.01	566.25
OM12	3052.2	3927.0	592.78	595.37	579.50	580.64	583.77	583.37
OR13D	1749.7	6840.3	595.75	602.70	593.32	593.17	593.72	593.97
OR13S	1749.6	6834.3	595.75	602.71	591.63	591.20	591.71	590.78
OR14D	1759.9	7356.5	596.22	598.91	590.46	590.26	592.30	589.66
OR14S	1760.0	7350.8	596.22	599.26	593.06	592.83	591.28	591.81
OM15	3011.1	6227.4	596.00	598.05	577.73	578.25	579.74	580.17
OM16	3518.2	9228.9	605.36	607.93	580.76	582.29	586.75	585.90
OM17	4301.7	8291.8	589.30	592.13	580.76	580.40	582.77	583.19
OR18	1979.0	8543.8	611.56	613.85	597.87	598.22	601.11	602.21
OR19	2725.2	4045.0	595.69	597.80	572.96	574.81	576.33	577.81
OR20	2926.8	5346.4	584.63	587.72	565.87	566.74	566.49	566.63
OM21	1567.7	8565.7	604.15	606.60	598.29	597.52	599.47	596.77
OM22D	-126.95	3991.5	597.07	598.87	579.73	581.13	579.91	581.38
OM22S	-127.08	3994.82	596.76	599.22	579.70	581.18	579.89	580.60
OM23D	-371.63	5591.13	610.4	613.25	574.91	576.01	575.23	576.99
OM23S	-371.66	5585.76	610.41	613.14	571.69	572.23	571.48	571.08
OM24D	-341.39	7523.62	573.90	576.79	574.08	573.66	574.17	573.39
OM25D	-321.61	8616.31	627.14	629.19	571.44	571.66	571.29	573.69
OM25S	-321.35	8620.05	627.02	629.11	571.40	571.52	571.18	571.00

APPENDIX F

GROUNDWATER SAMPLING PROTOCOL

GROUNDWATER SAMPLING PROTOCOL
ASH PONDS 1 AND 2 CLOSURE
DUCK CREEK POWER STATION

1.0 SAMPLING PROTOCOL

These procedures will be used during routine groundwater sampling at the above referenced facility. A worksheet will be used for recording relevant information regarding each monitoring well and will be submitted to the facility for their records.

If conditions at the time of groundwater sampling could influence the results, groundwater sampling will be postponed until a later date. However, sample collection will not deviate from the schedule provided in the site-specific Groundwater Monitoring Plan.

2.0 WATER LEVELS

Groundwater elevations shall be obtained in each monitoring well prior to purging and/or sampling. Groundwater elevations in the monitoring well will be obtained as close together of a timeframe as practical, to reduce time distortion of the water surface data. Groundwater elevation procedures follow:

1. Record the general monitoring well condition. This includes the condition of the casing, the lock, evidence of tampering, condition of the concrete pad, and any standing water.

2. Remove the lock and open the well. Note the condition of the interior of the casing and the condition of the well cap and riser. Open the cap, taking care not to allow dirt or foreign material into the well.

3. Decontaminate the water level indicator.

4. Slowly lower the water level indicator into the well until the water surface has been reached.

5. Record the time and depth to water (to the nearest 0.01 foot).

6. Lower the water level indicator to the bottom of the monitoring well. If a dedicated pump is installed in the well, perform this step during regularly scheduled maintenance of the monitoring wells. Record the depth of the monitoring well (to the nearest 0.01 foot). Monitoring well depth will be

measured on an annual basis at wells that do not contain dedicated pumps and once every five years for monitoring wells with dedicated pumps.

7. Slowly remove the water level indicator from the well.

8. Replace the cap. Close and lock the well.

3.0 LOW-FLOW PURGING

This facility uses low-flow sampling techniques to obtain groundwater samples from the monitoring well network. Each monitoring well will be purged using a dedicated pump prior to groundwater sample collection. The pumps will consist of inert materials consistent with the monitoring well construction (e.g., stainless steel pump bodies installed in stainless steel wells). Groundwater sampling will begin with the monitoring wells that have not been historically impacted before sampling impacted monitoring wells.

Each monitoring well will be purged prior to groundwater sampling. Flow rates for low-flow sampling typically are below 0.5 liters/minute, with a goal of less than 0.3 feet reduction in groundwater elevation. These goals may not be practical based on the hydrogeology at the facility.

Purging will continue until the measured pH, temperature, and specific conductance stabilize within ±10 percent over three consecutive readings. The equipment used to measure these indicator parameters will be calibrated daily and decontaminated before use at each monitoring well. If low-flow stabilization does not occur, four well volumes will be removed prior to sampling. Field indicator parameters used for stabilization will be recorded.

4.0 LOW-FLOW SAMPLING

Establish a “clean area” near the monitoring well where the sample containers and equipment can be stored while not in use. Sampling equipment and containers should not contact the ground surface. If needed, a disposable plastic tarp can be used as ground cover.

One blind duplicate and one equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.

Groundwater samples will be field-filtered (using a new 0.45 micron disposable filter for each monitoring well); and the groundwater sample will be collected in laboratory-provided sampling containers with preservatives as required by the USEPA. All groundwater samples will

be labeled, packed to reduce the chance of breakage, and placed in a cooler with ice to maintain a temperature of less than 4º Celsius during transport to the analytical laboratory.

The samples will be accompanied by a chain-of-custody record. The sampler retains a copy of the record and forwards the original with the samples to the analytical laboratory. Once the laboratory has received the samples, a representative from the laboratory will complete the record, retain the original, and return a copy with the chemical analysis reports to the sampler. The chain-of-custody contains the facility name, the wells sampled, time and date of sampling, members of sampling party, type of samples, number of sample bottles, and requested analyses.

Appendix B.
Closure Design Evaluation of Ash Pond 1 and Ash Pond 2 [Hydrogeologic Modeling Study]

Duck Creek Power Station

Closure Design Evaluation of Ash Pond 1 and Ash Pond 2

Illinois Power Resources Generating, LLC
Canton, Fulton County, Illinois

February 29, 2016

HANSON
Engineering | Planning | Allied Services

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1. Introduction

Hanson, as a sub-consultant to Natural Resource Technology, Inc. (NRT), has been tasked with assisting with the hydrostatic equilibrium calculations for the Duck Creek Power Station Ash Pond 1 and Ash Pond 2 (Site) Closure Plan Design. Hanson was provided the AECOM 30% Closure Plan and Drawings (AECOM, 2015) to provide a basis for the evaluation. Hanson use the Hydrologic Evaluation of Landfill Performance (HELP) model (Schroeder et al., 1994) to evaluate the design performance and determine when equilibrium is reached between the cover and base.

2. Model Design

The HELP model setup is based on the US Environmental Protection Agency (EPA) Disposal of Coal Combustion Residuals from Electric Utilities rules, 40 CFR 257 (US EPA, 2015), the 30% Closure Plan drawings (AECOM, 2015), and site-specific input values received from AECOM (via Natural Resource Technology, Inc.).

2.1 Soil and Design Inputs

The HELP model soil/design layout includes (default HELP model values unless otherwise noted):

1. 6 inches of protective (vegetative) soil (HELP model material #12 – silty clay),
    a. Porosity = 0.471 cm/cm
    b. Field Capacity = 0.342 cm/cm
    c. Wilting Point 0.210 cm/cm
    d. Hydraulic Conductivity = 4.2×10^{-5} cm/s
2. 18 inches of recompacted soil (HELP model material #16 – barrier soil),
    a. Porosity = 0.427 cm/cm
    b. Field Capacity = 0.418 cm/cm
    c. Wilting Point 0.367 cm/cm
    d. Hydraulic Conductivity = 1.0×10^{-6} cm/s *[NRT-directed apparent design criteria]*
3. 45 feet (540 inches) of fly ash divided into 13 layers (HELP model material #30 – coal fly ash) including 27.5 feet (330 inches) of saturated ash (approximate current saturated thickness),
    a. Porosity = 0.541 cm/cm
    b. Field Capacity = 0.187 cm/cm
    c. Wilting Point 0.047 cm/cm
    d. Hydraulic Conductivity = 5.0×10^{-5} cm/s
    e. Thickness of ash is based on boring logs for wells, OM26, OM27, and OM28 (Geotechnology, 2011). The average bottom elevation was approximately 595 ft. and the average cover elevation was assumed to be 640 ft.
    f. Saturated thickness was calculated from the average bottom elevation to a point 2½ ft. below the low elevation on the perimeter berm (about 625 ft.). This elevation represents drainage to a perimeter ditch used for dewatering during construction of the cover of Ash Pond 1.

4. 5 feet (60 inch) base layer consisting of in situ mine spoil (HELP model material #26 – compacted silty clay).
    a. Porosity = 0.445 cm/cm
    b. Field Capacity = 0.393 cm/cm
    c. Wilting Point 0.277 cm/cm
    d. Hydraulic Conductivity = 1.0 x 10^{-6} cm/s *[NRT-directed site-specific value].*

2.2 Weather Inputs

2.2.1 Precipitation (.D4 data)

Precipitation data was obtained from the Illinois State Water Survey station at Canton Illinois. Historic (monthly) data from 1941 through 2003 was used to generate 100 years of synthetic rainfall data.

2.2.2 Temperature (.D7 data)

Temperature data was obtained from the Illinois State Water Survey station at Peoria Illinois. Historic (monthly) data from 1950 through 2014 was used to generate 100 years of synthetic data.

2.2.3 Evapotranspiration (.D11 data)

Evapotranspiration data was obtained from the Illinois State Water Survey station at Peoria Illinois. Historic (daily) humidity and wind velocity data from 1989 through 2015 were used for this evaluation.

2.2.4 Solar Radiation (.D13 data)

Default solar radiation data for Chicago Illinois within the HELP model, adjusted for latitude, was used for this HELP model evaluation.

3. Findings and Conclusions

The HELP model was run for 100 years. This allows the full range of synthetic data to be applied to the model, representing long-term natural events. Findings of this evaluation show:

1. The US EPA (40 CFR 257) cover outperforms the mine spoil at the base of the model.
2. The model shows that CCR leachate does not buildup inside the closed ash ponds, and
3. Equilibrium is reached in 11 years (percolation through the cover approximately equals percolation out the bottom).

The HELP model output file is located in Appendix A and the data (percolation / head versus time) are presented in Figure 1.

4. References

AECOM, 2015. “30% Design Data Package for Dynegy Duck Creek Station; Ash Pond No. 1 and Ash Pond No. 2 Units”. AECOM, Overland Park, KS. 199 pp. + 11 dwgs.

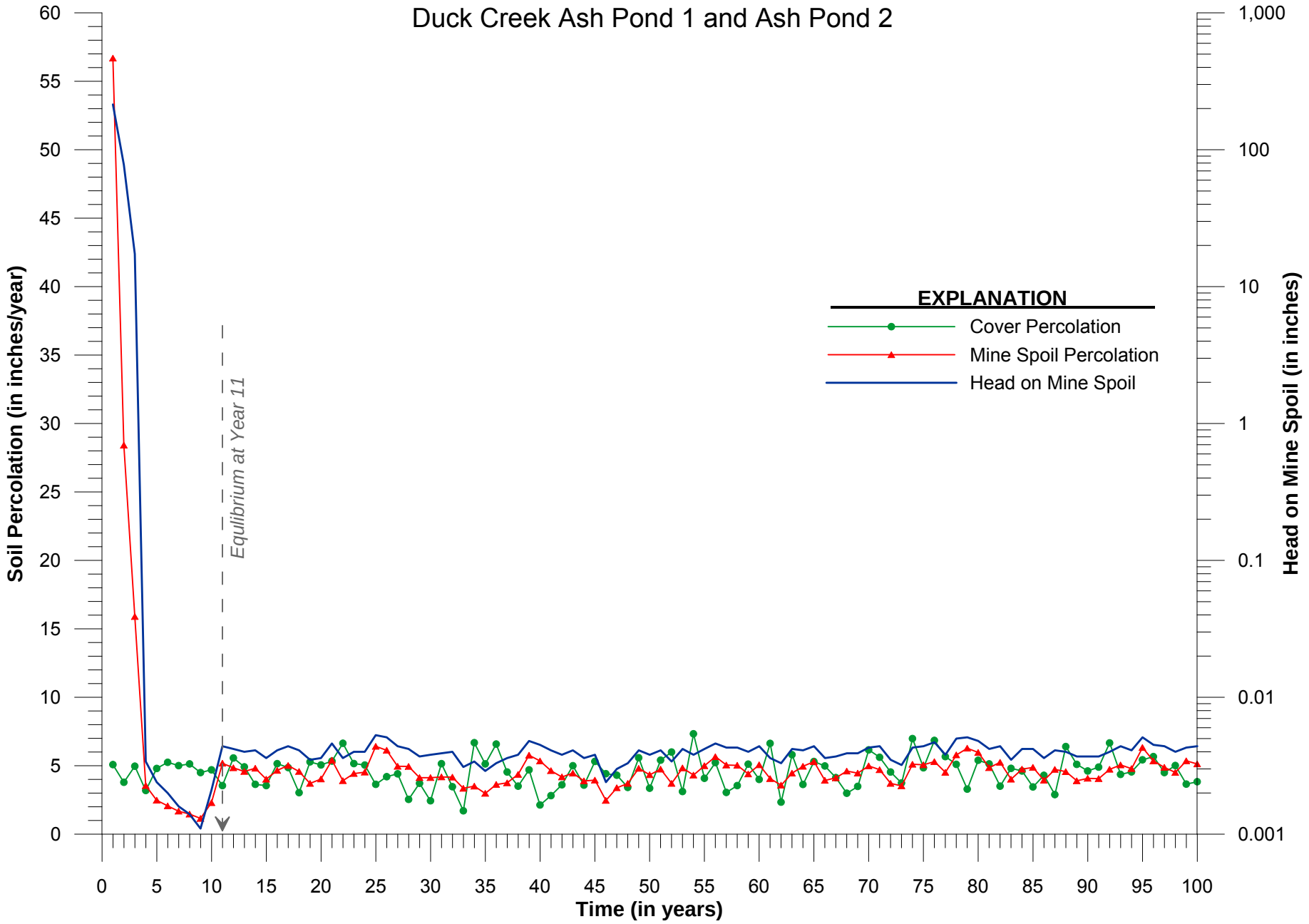
Geotechnology, 2011. “Global Stability Evaluation, Duck Creek Power Station, Ash Ponds 1 and 2, Canton, IL”. Geotechnology, Inc., St. Louis, Missouri, January 4, 2011. 49 pp.

Schroeder, P.R., C.M. Lloyd, and P.A. Zappi., 1994. The Hydrologic Evaluation of Landfill Performance (HELP) Model, User’s Guide for Version 3. Waterways Experiment Station, U.S. Army Corps of Engineers, Vicksburg, MI. 84 pp + App.

U.S. EPA, 2015. "40 CFR Parts 257 and 261 – Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities”. Federal Register vol. 80, no. 74, April 17, 2015. 21467-21501.

FIGURE 1. HELP Model Results

Duck Creek Ash Pond 1 and Ash Pond 2



I:\15Jobs\15E0030A\Admin\14-Reports\FIG_HELPResults_160125.grf

Appendix A

HELP Model Output File

```
**************************************************************************
 **************************************************************************
 **                                                                      **
 **                                                                      **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY               **
 **                    USAE WATERWAYS EXPERIMENT STATION                 **
 **             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
 **                                                                      **
 **                                                                      **
 **************************************************************************
 **************************************************************************


 PRECIPITATION DATA FILE:    E:\HELP307\DKCR.D4
 TEMPERATURE DATA FILE:      E:\HELP307\DKCR.D7
 SOLAR RADIATION DATA FILE:  E:\HELP307\DKCR.D13
 EVAPOTRANSPIRATION DATA:    E:\HELP307\DKCR.D11
 SOIL AND DESIGN DATA FILE:  E:\HELP307\DCAP12.D10
 OUTPUT DATA FILE:           E:\HELP307\DCAP12.OUT


 TIME:  10:14     DATE:   1/25/2016


 **************************************************************************

      TITLE:  Duck Creek Ash Ponds1&2 - 1E-6cm/s btm, 257 Cover @ 1E-6cm/s

 **************************************************************************


      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  12
           THICKNESS                    =      6.00   INCHES
           POROSITY                     =      0.4710 VOL/VOL
           FIELD CAPACITY               =      0.3420 VOL/VOL
           WILTING POINT                =      0.2100 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2840 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.419999997000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

```
                          LAYER  2
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                     =     18.00   INCHES
POROSITY                      =      0.4270 VOL/VOL
FIELD CAPACITY                =      0.4180 VOL/VOL
WILTING POINT                 =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.999999997000E-06 CM/SEC


                          LAYER  3
                          --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                     =      6.00   INCHES
POROSITY                      =      0.5410 VOL/VOL
FIELD CAPACITY                =      0.1870 VOL/VOL
WILTING POINT                 =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.1870 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.499999987000E-04 CM/SEC


                          LAYER  4
                          --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                     =      9.00   INCHES
POROSITY                      =      0.5410 VOL/VOL
FIELD CAPACITY                =      0.1870 VOL/VOL
WILTING POINT                 =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.1870 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.499999987000E-04 CM/SEC


                          LAYER  5
                          --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                     =     17.00   INCHES
POROSITY                      =      0.5410 VOL/VOL
FIELD CAPACITY                =      0.1870 VOL/VOL
WILTING POINT                 =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.1870 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.499999987000E-04 CM/SEC
```

```
                      LAYER  6
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                     =     34.00   INCHES
POROSITY                      =      0.5410 VOL/VOL
FIELD CAPACITY                =      0.1870 VOL/VOL
WILTING POINT                 =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.1870 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.499999987000E-04 CM/SEC


                      LAYER  7
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                     =     68.00   INCHES
POROSITY                      =      0.5410 VOL/VOL
FIELD CAPACITY                =      0.1870 VOL/VOL
WILTING POINT                 =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.1870 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.499999987000E-04 CM/SEC


                      LAYER  8
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                     =     76.00   INCHES
POROSITY                      =      0.5410 VOL/VOL
FIELD CAPACITY                =      0.1870 VOL/VOL
WILTING POINT                 =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.1870 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.499999987000E-04 CM/SEC


                      LAYER  9
                      --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                     =     60.00   INCHES
POROSITY                      =      0.5410 VOL/VOL
FIELD CAPACITY                =      0.1870 VOL/VOL
WILTING POINT                 =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT    =      0.5410 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.499999987000E-04 CM/SEC
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                        LAYER 10
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                    =    136.00   INCHES
POROSITY                     =      0.5410 VOL/VOL
FIELD CAPACITY               =      0.1870 VOL/VOL
WILTING POINT                =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.5410 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999987000E-04 CM/SEC


                        LAYER 11
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                    =     68.00   INCHES
POROSITY                     =      0.5410 VOL/VOL
FIELD CAPACITY               =      0.1870 VOL/VOL
WILTING POINT                =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.5410 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999987000E-04 CM/SEC


                        LAYER 12
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                    =     34.00   INCHES
POROSITY                     =      0.5410 VOL/VOL
FIELD CAPACITY               =      0.1870 VOL/VOL
WILTING POINT                =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.5410 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999987000E-04 CM/SEC


                        LAYER 13
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
THICKNESS                    =     17.00   INCHES
POROSITY                     =      0.5410 VOL/VOL
FIELD CAPACITY               =      0.1870 VOL/VOL
WILTING POINT                =      0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.5410 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999987000E-04 CM/SEC
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                          LAYER 14
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
   THICKNESS                  =      9.00   INCHES
   POROSITY                   =      0.5410 VOL/VOL
   FIELD CAPACITY             =      0.1870 VOL/VOL
   WILTING POINT              =      0.0470 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.5410 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.499999987000E-04 CM/SEC


                          LAYER 15
                          --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  30
   THICKNESS                  =      6.00   INCHES
   POROSITY                   =      0.5410 VOL/VOL
   FIELD CAPACITY             =      0.1870 VOL/VOL
   WILTING POINT              =      0.0470 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.5410 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.499999987000E-04 CM/SEC


                          LAYER 16
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              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER   0
   THICKNESS                  =     60.00   INCHES
   POROSITY                   =      0.4450 VOL/VOL
   FIELD CAPACITY             =      0.3930 VOL/VOL
   WILTING POINT              =      0.2770 VOL/VOL
   INITIAL SOIL WATER CONTENT =      0.4450 VOL/VOL
   EFFECTIVE SAT. HYD. COND.  =  0.999999997000E-06 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
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 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #12 WITH A
          FAIR STAND OF GRASS, A SURFACE SLOPE OF  3.%
          AND A SLOPE LENGTH OF  540. FEET.

SCS RUNOFF CURVE NUMBER             =     87.50
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =      6.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      1.704  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      2.826  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.260  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =    253.890  INCHES
TOTAL INITIAL WATER                 =    253.890  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
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EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Peoria Illinois

STATION LATITUDE	=	40.48 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	105
END OF GROWING SEASON (JULIAN DATE)	=	287
EVAPORATIVE ZONE DEPTH	=	6.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.50 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	73.70 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.60 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	75.10 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.40 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Canton Illinois

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.40	1.54	2.74	4.04	4.49	4.21
4.09	3.35	3.43	2.79	2.57	2.08

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Peoria Illinois

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
23.40	28.00	39.10	51.70	62.20	71.50
75.40	73.50	65.90	54.00	40.50	28.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Peoria Illinois
AND STATION LATITUDE = 40.48 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.21	120552.336	100.00
RUNOFF	3.917	14217.061	11.79
EVAPOTRANSPIRATION	23.221	84292.898	69.92
PERC./LEAKAGE THROUGH LAYER 2	5.079273	18437.762	15.29
AVG. HEAD ON TOP OF LAYER 2	0.8836		
PERC./LEAKAGE THROUGH LAYER 16	56.693966	205799.094	170.71
AVG. HEAD ON TOP OF LAYER 16	214.3804		
CHANGE IN WATER STORAGE	-50.622	-183756.781	-152.43
SOIL WATER AT START OF YEAR	253.890	921620.500	
SOIL WATER AT END OF YEAR	203.268	737863.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.069	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.08	145490.391	100.00
RUNOFF	12.375	44921.367	30.88
EVAPOTRANSPIRATION	21.390	77645.375	53.37
PERC./LEAKAGE THROUGH LAYER 2	3.794894	13775.466	9.47
AVG. HEAD ON TOP OF LAYER 2	0.8042		
PERC./LEAKAGE THROUGH LAYER 16	28.420855	103167.703	70.91
AVG. HEAD ON TOP OF LAYER 16	77.5550		
CHANGE IN WATER STORAGE	-22.106	-80244.023	-55.15
SOIL WATER AT START OF YEAR	203.268	737863.687	
SOIL WATER AT END OF YEAR	177.631	644800.125	

SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	3.532	12819.540	8.81
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.91	181173.266	100.00
RUNOFF	19.212	69739.797	38.49
EVAPOTRANSPIRATION	27.803	100924.992	55.71
PERC./LEAKAGE THROUGH LAYER 2	4.965379	18024.324	9.95
AVG. HEAD ON TOP OF LAYER 2	0.9082		
PERC./LEAKAGE THROUGH LAYER 16	15.900655	57719.375	31.86
AVG. HEAD ON TOP OF LAYER 16	17.3340		
CHANGE IN WATER STORAGE	-13.006	-47210.883	-26.06
SOIL WATER AT START OF YEAR	177.631	644800.125	
SOIL WATER AT END OF YEAR	167.327	607398.375	
SNOW WATER AT START OF YEAR	3.532	12819.540	7.08
SNOW WATER AT END OF YEAR	0.829	3010.410	1.66
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.18	120443.414	100.00
RUNOFF	7.280	26425.752	21.94
EVAPOTRANSPIRATION	23.728	86133.430	71.51
PERC./LEAKAGE THROUGH LAYER 2	3.185298	11562.634	9.60
AVG. HEAD ON TOP OF LAYER 2	0.5612		

PERC./LEAKAGE THROUGH LAYER 16	3.553502	12899.211	10.71
AVG. HEAD ON TOP OF LAYER 16	0.0034		
CHANGE IN WATER STORAGE	-1.382	-5015.008	-4.16
SOIL WATER AT START OF YEAR	167.327	607398.375	
SOIL WATER AT END OF YEAR	166.775	605393.812	
SNOW WATER AT START OF YEAR	0.829	3010.410	2.50
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.91	126723.289	100.00
RUNOFF	7.088	25730.664	20.30
EVAPOTRANSPIRATION	22.898	83119.578	65.59
PERC./LEAKAGE THROUGH LAYER 2	4.801193	17428.330	13.75
AVG. HEAD ON TOP OF LAYER 2	0.8173		
PERC./LEAKAGE THROUGH LAYER 16	2.479095	8999.115	7.10
AVG. HEAD ON TOP OF LAYER 16	0.0024		
CHANGE IN WATER STORAGE	2.445	8874.035	7.00
SOIL WATER AT START OF YEAR	166.775	605393.812	
SOIL WATER AT END OF YEAR	169.209	614228.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.011	39.038	0.03
ANNUAL WATER BUDGET BALANCE	0.0000	-0.104	0.00

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.91	141243.297	100.00
RUNOFF	6.738	24458.260	17.32
EVAPOTRANSPIRATION	27.012	98053.211	69.42
PERC./LEAKAGE THROUGH LAYER 2	5.248839	19053.287	13.49
AVG. HEAD ON TOP OF LAYER 2	1.0544		
PERC./LEAKAGE THROUGH LAYER 16	2.069877	7513.655	5.32
AVG. HEAD ON TOP OF LAYER 16	0.0020		
CHANGE IN WATER STORAGE	3.090	11218.111	7.94
SOIL WATER AT START OF YEAR	169.209	614228.750	
SOIL WATER AT END OF YEAR	172.271	625345.125	
SNOW WATER AT START OF YEAR	0.011	39.038	0.03
SNOW WATER AT END OF YEAR	0.039	140.772	0.10
ANNUAL WATER BUDGET BALANCE	0.0000	0.063	0.00

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.91	137613.281	100.00
RUNOFF	8.983	32608.088	23.70
EVAPOTRANSPIRATION	23.897	86744.312	63.03
PERC./LEAKAGE THROUGH LAYER 2	5.005309	18169.270	13.20
AVG. HEAD ON TOP OF LAYER 2	0.8253		
PERC./LEAKAGE THROUGH LAYER 16	1.683819	6112.264	4.44
AVG. HEAD ON TOP OF LAYER 16	0.0016		
CHANGE IN WATER STORAGE	3.347	12148.586	8.83
SOIL WATER AT START OF YEAR	172.271	625345.125	
SOIL WATER AT END OF YEAR	175.657	637634.500	
SNOW WATER AT START OF YEAR	0.039	140.772	0.10
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	0.034	0.00

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.42	143094.609	100.00
RUNOFF	10.968	39813.668	27.82
EVAPOTRANSPIRATION	21.879	79419.102	55.50
PERC./LEAKAGE THROUGH LAYER 2	5.128003	18614.650	13.01
AVG. HEAD ON TOP OF LAYER 2	1.0756		
PERC./LEAKAGE THROUGH LAYER 16	1.473887	5350.209	3.74
AVG. HEAD ON TOP OF LAYER 16	0.0014		
CHANGE IN WATER STORAGE	5.100	18511.527	12.94
SOIL WATER AT START OF YEAR	175.657	637634.500	
SOIL WATER AT END OF YEAR	179.142	650284.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.615	5861.640	4.10
ANNUAL WATER BUDGET BALANCE	0.0000	0.102	0.00

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.45	157723.500	100.00
RUNOFF	16.842	61135.867	38.76
EVAPOTRANSPIRATION	23.409	84973.203	53.87
PERC./LEAKAGE THROUGH LAYER 2	4.499304	16332.475	10.36
AVG. HEAD ON TOP OF LAYER 2	0.8066		
PERC./LEAKAGE THROUGH LAYER 16	1.152179	4182.411	2.65
AVG. HEAD ON TOP OF LAYER 16	0.0011		

CHANGE IN WATER STORAGE	2.047	7432.039	4.71
SOIL WATER AT START OF YEAR	179.142	650284.375	
SOIL WATER AT END OF YEAR	182.804	663578.062	
SNOW WATER AT START OF YEAR	1.615	5861.640	3.72
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.35	124690.547	100.00
RUNOFF	7.040	25556.410	20.50
EVAPOTRANSPIRATION	22.135	80349.047	64.44
PERC./LEAKAGE THROUGH LAYER 2	4.700157	17061.570	13.68
AVG. HEAD ON TOP OF LAYER 2	0.8720		
PERC./LEAKAGE THROUGH LAYER 16	2.300387	8350.404	6.70
AVG. HEAD ON TOP OF LAYER 16	0.0021		
CHANGE IN WATER STORAGE	2.875	10434.728	8.37
SOIL WATER AT START OF YEAR	182.804	663578.062	
SOIL WATER AT END OF YEAR	184.949	671365.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.729	2647.642	2.12
ANNUAL WATER BUDGET BALANCE	0.0000	-0.039	0.00

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ANNUAL TOTALS FOR YEAR 11

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.53	103563.906	100.00

RUNOFF	6.676	24235.678	23.40
EVAPOTRANSPIRATION	18.645	67680.117	65.35
PERC./LEAKAGE THROUGH LAYER 2	3.551589	12892.270	12.45
AVG. HEAD ON TOP OF LAYER 2	0.5599		
PERC./LEAKAGE THROUGH LAYER 16	5.180473	18805.117	18.16
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	-1.972	-7156.982	-6.91
SOIL WATER AT START OF YEAR	184.949	671365.187	
SOIL WATER AT END OF YEAR	183.165	664889.312	
SNOW WATER AT START OF YEAR	0.729	2647.642	2.56
SNOW WATER AT END OF YEAR	0.542	1966.513	1.90
ANNUAL WATER BUDGET BALANCE	0.0000	-0.029	0.00

ANNUAL TOTALS FOR YEAR 12

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.48	114272.398	100.00
RUNOFF	6.107	22168.225	19.40
EVAPOTRANSPIRATION	20.434	74175.539	64.91
PERC./LEAKAGE THROUGH LAYER 2	5.571956	20226.199	17.70
AVG. HEAD ON TOP OF LAYER 2	1.1482		
PERC./LEAKAGE THROUGH LAYER 16	4.854733	17622.682	15.42
AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	0.084	305.727	0.27
SOIL WATER AT START OF YEAR	183.165	664889.312	
SOIL WATER AT END OF YEAR	183.791	667161.562	
SNOW WATER AT START OF YEAR	0.542	1966.513	1.72
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	0.228	0.00

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ANNUAL TOTALS FOR YEAR 13

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.06	127267.805	100.00
RUNOFF	8.025	29130.479	22.89
EVAPOTRANSPIRATION	20.963	76097.180	59.79
PERC./LEAKAGE THROUGH LAYER 2	4.918638	17854.656	14.03
AVG. HEAD ON TOP OF LAYER 2	0.9256		
PERC./LEAKAGE THROUGH LAYER 16	4.577015	16614.564	13.05
AVG. HEAD ON TOP OF LAYER 16	0.0040		
CHANGE IN WATER STORAGE	1.495	5425.657	4.26
SOIL WATER AT START OF YEAR	183.791	667161.562	
SOIL WATER AT END OF YEAR	184.693	670437.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.592	2149.927	1.69
ANNUAL WATER BUDGET BALANCE	0.0000	-0.078	0.00

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ANNUAL TOTALS FOR YEAR 14

	INCHES	CU. FEET	PERCENT
PRECIPITATION	36.33	131877.922	100.00
RUNOFF	12.170	44177.316	33.50
EVAPOTRANSPIRATION	17.174	62343.281	47.27
PERC./LEAKAGE THROUGH LAYER 2	3.637822	13205.294	10.01
AVG. HEAD ON TOP OF LAYER 2	0.6105		
PERC./LEAKAGE THROUGH LAYER 16	4.823890	17510.721	13.28
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	2.162	7846.606	5.95
SOIL WATER AT START OF YEAR	184.693	670437.312	

SOIL WATER AT END OF YEAR	183.515	666157.937	
SNOW WATER AT START OF YEAR	0.592	2149.927	1.63
SNOW WATER AT END OF YEAR	3.933	14275.863	10.83
ANNUAL WATER BUDGET BALANCE	0.0000	-0.003	0.00

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ANNUAL TOTALS FOR YEAR 15

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.63	100296.922	100.00
RUNOFF	10.167	36905.590	36.80
EVAPOTRANSPIRATION	17.675	64161.437	63.97
PERC./LEAKAGE THROUGH LAYER 2	3.548130	12879.711	12.84
AVG. HEAD ON TOP OF LAYER 2	0.6890		
PERC./LEAKAGE THROUGH LAYER 16	4.015258	14575.386	14.53
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	-4.227	-15345.550	-15.30
SOIL WATER AT START OF YEAR	183.515	666157.937	
SOIL WATER AT END OF YEAR	183.172	664914.562	
SNOW WATER AT START OF YEAR	3.933	14275.863	14.23
SNOW WATER AT END OF YEAR	0.048	173.695	0.17
ANNUAL WATER BUDGET BALANCE	0.0000	0.061	0.00

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ANNUAL TOTALS FOR YEAR 16

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.72	126033.594	100.00
RUNOFF	7.355	26697.252	21.18
EVAPOTRANSPIRATION	22.263	80813.461	64.12

PERC./LEAKAGE THROUGH LAYER 2	5.151112	18698.537	14.84
AVG. HEAD ON TOP OF LAYER 2	0.9925		
PERC./LEAKAGE THROUGH LAYER 16	4.659567	16914.230	13.42
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	0.443	1608.626	1.28
SOIL WATER AT START OF YEAR	183.172	664914.562	
SOIL WATER AT END OF YEAR	183.663	666696.875	
SNOW WATER AT START OF YEAR	0.048	173.695	0.14
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.024	0.00

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ANNUAL TOTALS FOR YEAR 17

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.37	153803.094	100.00
RUNOFF	10.408	37780.043	24.56
EVAPOTRANSPIRATION	26.867	97525.727	63.41
PERC./LEAKAGE THROUGH LAYER 2	4.871623	17683.992	11.50
AVG. HEAD ON TOP OF LAYER 2	0.8021		
PERC./LEAKAGE THROUGH LAYER 16	5.022307	18230.977	11.85
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	0.073	266.422	0.17
SOIL WATER AT START OF YEAR	183.663	666696.875	
SOIL WATER AT END OF YEAR	183.680	666758.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.056	204.940	0.13
ANNUAL WATER BUDGET BALANCE	0.0000	-0.076	0.00

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ANNUAL TOTALS FOR YEAR 18

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.05	98191.523	100.00
RUNOFF	4.428	16075.129	16.37
EVAPOTRANSPIRATION	18.737	68016.680	69.27
PERC./LEAKAGE THROUGH LAYER 2	3.028351	10992.914	11.20
AVG. HEAD ON TOP OF LAYER 2	0.4653		
PERC./LEAKAGE THROUGH LAYER 16	4.580265	16626.361	16.93
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	-0.696	-2526.649	-2.57
SOIL WATER AT START OF YEAR	183.680	666758.375	
SOIL WATER AT END OF YEAR	181.871	660193.000	
SNOW WATER AT START OF YEAR	0.056	204.940	0.21
SNOW WATER AT END OF YEAR	1.169	4243.652	4.32
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

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ANNUAL TOTALS FOR YEAR 19

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.92	159429.578	100.00
RUNOFF	16.054	58274.879	36.55
EVAPOTRANSPIRATION	21.721	78846.281	49.46
PERC./LEAKAGE THROUGH LAYER 2	5.283711	19179.873	12.03
AVG. HEAD ON TOP OF LAYER 2	1.1749		
PERC./LEAKAGE THROUGH LAYER 16	3.707002	13456.419	8.44
AVG. HEAD ON TOP OF LAYER 16	0.0035		
CHANGE IN WATER STORAGE	2.439	8851.964	5.55
SOIL WATER AT START OF YEAR	181.871	660193.000	
SOIL WATER AT END OF YEAR	183.679	666753.500	
SNOW WATER AT START OF YEAR	1.169	4243.652	2.66

SNOW WATER AT END OF YEAR	1.800	6535.129	4.10
ANNUAL WATER BUDGET BALANCE	0.0000	0.032	0.00

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.22	138738.609	100.00
RUNOFF	14.014	50871.656	36.67
EVAPOTRANSPIRATION	20.915	75922.617	54.72
PERC./LEAKAGE THROUGH LAYER 2	5.064620	18384.568	13.25
AVG. HEAD ON TOP OF LAYER 2	1.0425		
PERC./LEAKAGE THROUGH LAYER 16	4.031031	14632.643	10.55
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	-0.741	-2688.390	-1.94
SOIL WATER AT START OF YEAR	183.679	666753.500	
SOIL WATER AT END OF YEAR	184.738	670600.250	
SNOW WATER AT START OF YEAR	1.800	6535.129	4.71
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.078	0.00

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ANNUAL TOTALS FOR YEAR 21

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.17	153077.125	100.00
RUNOFF	6.413	23280.730	15.21
EVAPOTRANSPIRATION	29.265	106231.203	69.40
PERC./LEAKAGE THROUGH LAYER 2	5.341256	19388.760	12.67
AVG. HEAD ON TOP OF LAYER 2	0.8149		

PERC./LEAKAGE THROUGH LAYER 16	5.410093	19638.637	12.83
AVG. HEAD ON TOP OF LAYER 16	0.0046		
CHANGE IN WATER STORAGE	1.082	3926.547	2.57
SOIL WATER AT START OF YEAR	184.738	670600.250	
SOIL WATER AT END OF YEAR	184.179	668571.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.641	5955.793	3.89
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

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ANNUAL TOTALS FOR YEAR 22

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.09	160046.687	100.00
RUNOFF	8.114	29453.547	18.40
EVAPOTRANSPIRATION	27.497	99814.648	62.37
PERC./LEAKAGE THROUGH LAYER 2	6.639588	24101.703	15.06
AVG. HEAD ON TOP OF LAYER 2	1.3323		
PERC./LEAKAGE THROUGH LAYER 16	3.911628	14199.211	8.87
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	4.567	16579.307	10.36
SOIL WATER AT START OF YEAR	184.179	668571.000	
SOIL WATER AT END OF YEAR	186.993	678783.500	
SNOW WATER AT START OF YEAR	1.641	5955.793	3.72
SNOW WATER AT END OF YEAR	3.395	12322.568	7.70
ANNUAL WATER BUDGET BALANCE	0.0000	-0.029	0.00

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ANNUAL TOTALS FOR YEAR 23

	INCHES	CU. FEET	PERCENT

PRECIPITATION	46.40	168431.953	100.00
RUNOFF	15.050	54631.707	32.44
EVAPOTRANSPIRATION	28.147	102172.336	60.66
PERC./LEAKAGE THROUGH LAYER 2	5.156218	18717.072	11.11
AVG. HEAD ON TOP OF LAYER 2	1.0461		
PERC./LEAKAGE THROUGH LAYER 16	4.433922	16095.136	9.56
AVG. HEAD ON TOP OF LAYER 16	0.0040		
CHANGE IN WATER STORAGE	-1.231	-4467.098	-2.65
SOIL WATER AT START OF YEAR	186.993	678783.500	
SOIL WATER AT END OF YEAR	187.494	680604.375	
SNOW WATER AT START OF YEAR	3.395	12322.568	7.32
SNOW WATER AT END OF YEAR	1.662	6034.599	3.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.130	0.00

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ANNUAL TOTALS FOR YEAR 24

	INCHES	CU. FEET	PERCENT
PRECIPITATION	36.40	132131.969	100.00
RUNOFF	12.001	43564.934	32.97
EVAPOTRANSPIRATION	20.495	74397.289	56.31
PERC./LEAKAGE THROUGH LAYER 2	5.048702	18326.787	13.87
AVG. HEAD ON TOP OF LAYER 2	0.9203		
PERC./LEAKAGE THROUGH LAYER 16	4.528364	16437.963	12.44
AVG. HEAD ON TOP OF LAYER 16	0.0040		
CHANGE IN WATER STORAGE	-0.625	-2268.175	-1.72
SOIL WATER AT START OF YEAR	187.494	680604.375	
SOIL WATER AT END OF YEAR	188.532	684370.812	
SNOW WATER AT START OF YEAR	1.662	6034.599	4.57
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.045	0.00

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ANNUAL TOTALS FOR YEAR 25

	INCHES	CU. FEET	PERCENT
PRECIPITATION	29.93	108645.891	100.00
RUNOFF	3.848	13969.058	12.86
EVAPOTRANSPIRATION	20.962	76090.758	70.04
PERC./LEAKAGE THROUGH LAYER 2	3.639828	13212.577	12.16
AVG. HEAD ON TOP OF LAYER 2	0.6188		
PERC./LEAKAGE THROUGH LAYER 16	6.422576	23313.953	21.46
AVG. HEAD ON TOP OF LAYER 16	0.0053		
CHANGE IN WATER STORAGE	-1.302	-4727.924	-4.35
SOIL WATER AT START OF YEAR	188.532	684370.812	
SOIL WATER AT END OF YEAR	185.263	672503.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.967	7139.809	6.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.050	0.00

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ANNUAL TOTALS FOR YEAR 26

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.85	126505.539	100.00
RUNOFF	7.735	28077.174	22.19
EVAPOTRANSPIRATION	23.947	86928.492	68.72
PERC./LEAKAGE THROUGH LAYER 2	4.197964	15238.608	12.05
AVG. HEAD ON TOP OF LAYER 2	0.6690		
PERC./LEAKAGE THROUGH LAYER 16	6.127802	22243.922	17.58
AVG. HEAD ON TOP OF LAYER 16	0.0051		

CHANGE IN WATER STORAGE	-2.960	-10744.040	-8.49
SOIL WATER AT START OF YEAR	185.263	672503.062	
SOIL WATER AT END OF YEAR	183.892	667529.687	
SNOW WATER AT START OF YEAR	1.967	7139.809	5.64
SNOW WATER AT END OF YEAR	0.377	1369.184	1.08
ANNUAL WATER BUDGET BALANCE	0.0000	-0.012	0.00

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ANNUAL TOTALS FOR YEAR 27

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.81	104580.312	100.00
RUNOFF	7.331	26612.588	25.45
EVAPOTRANSPIRATION	17.922	65055.922	62.21
PERC./LEAKAGE THROUGH LAYER 2	4.412205	16016.303	15.31
AVG. HEAD ON TOP OF LAYER 2	0.7963		
PERC./LEAKAGE THROUGH LAYER 16	4.957474	17995.629	17.21
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	-1.401	-5083.985	-4.86
SOIL WATER AT START OF YEAR	183.892	667529.687	
SOIL WATER AT END OF YEAR	182.869	663814.875	
SNOW WATER AT START OF YEAR	0.377	1369.184	1.31
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.158	0.00

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ANNUAL TOTALS FOR YEAR 28

	INCHES	CU. FEET	PERCENT
PRECIPITATION	30.10	109263.023	100.00
RUNOFF	9.626	34940.926	31.98

EVAPOTRANSPIRATION	16.072	58341.340	53.40
PERC./LEAKAGE THROUGH LAYER 2	2.544109	9235.115	8.45
AVG. HEAD ON TOP OF LAYER 2	0.4044		
PERC./LEAKAGE THROUGH LAYER 16	4.949898	17968.129	16.44
AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	-0.547	-1987.237	-1.82
SOIL WATER AT START OF YEAR	182.869	663814.875	
SOIL WATER AT END OF YEAR	180.506	655236.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.816	6591.031	6.03
ANNUAL WATER BUDGET BALANCE	0.0000	-0.138	0.00

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ANNUAL TOTALS FOR YEAR 29

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.33	117357.922	100.00
RUNOFF	9.342	33912.941	28.90
EVAPOTRANSPIRATION	19.097	69321.266	59.07
PERC./LEAKAGE THROUGH LAYER 2	3.717650	13495.070	11.50
AVG. HEAD ON TOP OF LAYER 2	0.6979		
PERC./LEAKAGE THROUGH LAYER 16	4.125914	14977.068	12.76
AVG. HEAD ON TOP OF LAYER 16	0.0037		
CHANGE IN WATER STORAGE	-0.235	-853.511	-0.73
SOIL WATER AT START OF YEAR	180.506	655236.625	
SOIL WATER AT END OF YEAR	180.568	655462.625	
SNOW WATER AT START OF YEAR	1.816	6591.031	5.62
SNOW WATER AT END OF YEAR	1.518	5511.476	4.70
ANNUAL WATER BUDGET BALANCE	0.0000	0.156	0.00

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ANNUAL TOTALS FOR YEAR 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	24.80	90024.008	100.00
RUNOFF	7.734	28074.646	31.19
EVAPOTRANSPIRATION	16.916	61403.379	68.21
PERC./LEAKAGE THROUGH LAYER 2	2.440217	8857.986	9.84
AVG. HEAD ON TOP OF LAYER 2	0.4308		
PERC./LEAKAGE THROUGH LAYER 16	4.125638	14976.064	16.64
AVG. HEAD ON TOP OF LAYER 16	0.0038		
CHANGE IN WATER STORAGE	-3.975	-14430.010	-16.03
SOIL WATER AT START OF YEAR	180.568	655462.625	
SOIL WATER AT END OF YEAR	177.780	645342.750	
SNOW WATER AT START OF YEAR	1.518	5511.476	6.12
SNOW WATER AT END OF YEAR	0.331	1201.387	1.33
ANNUAL WATER BUDGET BALANCE	0.0000	-0.074	0.00

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ANNUAL TOTALS FOR YEAR 31

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.00	141569.969	100.00
RUNOFF	12.069	43810.070	30.95
EVAPOTRANSPIRATION	21.771	79030.516	55.82
PERC./LEAKAGE THROUGH LAYER 2	5.153399	18706.838	13.21
AVG. HEAD ON TOP OF LAYER 2	0.8741		
PERC./LEAKAGE THROUGH LAYER 16	4.182502	15182.481	10.72
AVG. HEAD ON TOP OF LAYER 16	0.0039		
CHANGE IN WATER STORAGE	0.977	3546.925	2.51
SOIL WATER AT START OF YEAR	177.780	645342.750	

SOIL WATER AT END OF YEAR	179.088	650091.062	
SNOW WATER AT START OF YEAR	0.331	1201.387	0.85
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.019	0.00

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ANNUAL TOTALS FOR YEAR 32

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.59	114671.711	100.00
RUNOFF	4.016	14579.629	12.71
EVAPOTRANSPIRATION	20.166	73201.406	63.84
PERC./LEAKAGE THROUGH LAYER 2	3.474504	12612.450	11.00
AVG. HEAD ON TOP OF LAYER 2	0.4790		
PERC./LEAKAGE THROUGH LAYER 16	4.168636	15132.148	13.20
AVG. HEAD ON TOP OF LAYER 16	0.0040		
CHANGE IN WATER STORAGE	3.239	11758.459	10.25
SOIL WATER AT START OF YEAR	179.088	650091.062	
SOIL WATER AT END OF YEAR	179.080	650059.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	3.248	11789.644	10.28
ANNUAL WATER BUDGET BALANCE	0.0000	0.074	0.00

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ANNUAL TOTALS FOR YEAR 33

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.92	104979.625	100.00
RUNOFF	10.547	38285.512	36.47
EVAPOTRANSPIRATION	19.124	69418.742	66.13
PERC./LEAKAGE THROUGH LAYER 2	1.712412	6216.055	5.92

AVG. HEAD ON TOP OF LAYER 2	0.2057		
PERC./LEAKAGE THROUGH LAYER 16	3.352224	12168.573	11.59
AVG. HEAD ON TOP OF LAYER 16	0.0031		
CHANGE IN WATER STORAGE	-4.103	-14893.295	-14.19
SOIL WATER AT START OF YEAR	179.080	650059.875	
SOIL WATER AT END OF YEAR	176.921	642223.000	
SNOW WATER AT START OF YEAR	3.248	11789.644	11.23
SNOW WATER AT END OF YEAR	1.304	4733.173	4.51
ANNUAL WATER BUDGET BALANCE	0.0000	0.093	0.00

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ANNUAL TOTALS FOR YEAR 34

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.12	152895.625	100.00
RUNOFF	13.300	48277.910	31.58
EVAPOTRANSPIRATION	22.913	83172.680	54.40
PERC./LEAKAGE THROUGH LAYER 2	6.676349	24235.148	15.85
AVG. HEAD ON TOP OF LAYER 2	1.5730		
PERC./LEAKAGE THROUGH LAYER 16	3.505434	12724.725	8.32
AVG. HEAD ON TOP OF LAYER 16	0.0034		
CHANGE IN WATER STORAGE	2.402	8720.245	5.70
SOIL WATER AT START OF YEAR	176.921	642223.000	
SOIL WATER AT END OF YEAR	180.432	654967.750	
SNOW WATER AT START OF YEAR	1.304	4733.173	3.10
SNOW WATER AT END OF YEAR	0.195	708.704	0.46
ANNUAL WATER BUDGET BALANCE	0.0000	0.063	0.00

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ANNUAL TOTALS FOR YEAR 35

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.89	130280.711	100.00
RUNOFF	10.153	36855.129	28.29
EVAPOTRANSPIRATION	20.779	75427.828	57.90
PERC./LEAKAGE THROUGH LAYER 2	5.131505	18627.365	14.30
AVG. HEAD ON TOP OF LAYER 2	1.0905		
PERC./LEAKAGE THROUGH LAYER 16	2.980772	10820.201	8.31
AVG. HEAD ON TOP OF LAYER 16	0.0029		
CHANGE IN WATER STORAGE	1.977	7177.473	5.51
SOIL WATER AT START OF YEAR	180.432	654967.750	
SOIL WATER AT END OF YEAR	182.604	662853.937	
SNOW WATER AT START OF YEAR	0.195	708.704	0.54
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.077	0.00

ANNUAL TOTALS FOR YEAR 36

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.04	148975.203	100.00
RUNOFF	7.396	26846.889	18.02
EVAPOTRANSPIRATION	27.179	98661.508	66.23
PERC./LEAKAGE THROUGH LAYER 2	6.584330	23901.119	16.04
AVG. HEAD ON TOP OF LAYER 2	1.2015		
PERC./LEAKAGE THROUGH LAYER 16	3.632585	13186.284	8.85
AVG. HEAD ON TOP OF LAYER 16	0.0033		
CHANGE IN WATER STORAGE	2.832	10280.551	6.90
SOIL WATER AT START OF YEAR	182.604	662853.937	
SOIL WATER AT END OF YEAR	185.436	673134.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00

SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.031	0.00

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ANNUAL TOTALS FOR YEAR 37

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.53	125343.937	100.00
RUNOFF	9.466	34359.875	27.41
EVAPOTRANSPIRATION	18.989	68929.047	54.99
PERC./LEAKAGE THROUGH LAYER 2	4.544433	16496.293	13.16
AVG. HEAD ON TOP OF LAYER 2	0.8310		
PERC./LEAKAGE THROUGH LAYER 16	3.750087	13612.815	10.86
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	2.326	8442.232	6.74
SOIL WATER AT START OF YEAR	185.436	673134.500	
SOIL WATER AT END OF YEAR	186.128	675643.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.634	5932.871	4.73
ANNUAL WATER BUDGET BALANCE	0.0000	-0.033	0.00

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ANNUAL TOTALS FOR YEAR 38

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.96	137794.828	100.00
RUNOFF	14.433	52390.555	38.02
EVAPOTRANSPIRATION	21.195	76936.539	55.83
PERC./LEAKAGE THROUGH LAYER 2	3.507369	12731.748	9.24
AVG. HEAD ON TOP OF LAYER 2	0.6425		
PERC./LEAKAGE THROUGH LAYER 16	4.372883	15873.566	11.52

AVG. HEAD ON TOP OF LAYER 16	0.0038		
CHANGE IN WATER STORAGE	-2.040	-7405.896	-5.37
SOIL WATER AT START OF YEAR	186.128	675643.812	
SOIL WATER AT END OF YEAR	185.722	674170.812	
SNOW WATER AT START OF YEAR	1.634	5932.871	4.31
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.057	0.00

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ANNUAL TOTALS FOR YEAR 39

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.56	136342.844	100.00
RUNOFF	11.965	43433.637	31.86
EVAPOTRANSPIRATION	19.660	71367.352	52.34
PERC./LEAKAGE THROUGH LAYER 2	4.702495	17070.055	12.52
AVG. HEAD ON TOP OF LAYER 2	0.9651		
PERC./LEAKAGE THROUGH LAYER 16	5.772182	20953.021	15.37
AVG. HEAD ON TOP OF LAYER 16	0.0048		
CHANGE IN WATER STORAGE	0.162	588.796	0.43
SOIL WATER AT START OF YEAR	185.722	674170.812	
SOIL WATER AT END OF YEAR	184.652	670287.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.232	4471.759	3.28
ANNUAL WATER BUDGET BALANCE	0.0000	0.043	0.00

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ANNUAL TOTALS FOR YEAR 40

	INCHES	CU. FEET	PERCENT

PRECIPITATION	30.63	111186.930	100.00
RUNOFF	9.328	33862.234	30.46
EVAPOTRANSPIRATION	21.115	76647.312	68.94
PERC./LEAKAGE THROUGH LAYER 2	2.134399	7747.867	6.97
AVG. HEAD ON TOP OF LAYER 2	0.3269		
PERC./LEAKAGE THROUGH LAYER 16	5.348795	19416.127	17.46
AVG. HEAD ON TOP OF LAYER 16	0.0045		
CHANGE IN WATER STORAGE	-5.162	-18738.852	-16.85
SOIL WATER AT START OF YEAR	184.652	670287.812	
SOIL WATER AT END OF YEAR	180.722	656020.750	
SNOW WATER AT START OF YEAR	1.232	4471.759	4.02
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.113	0.00

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ANNUAL TOTALS FOR YEAR 41

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.77	122585.133	100.00
RUNOFF	8.563	31085.215	25.36
EVAPOTRANSPIRATION	20.079	72888.062	59.46
PERC./LEAKAGE THROUGH LAYER 2	2.822533	10245.795	8.36
AVG. HEAD ON TOP OF LAYER 2	0.4079		
PERC./LEAKAGE THROUGH LAYER 16	4.642647	16852.811	13.75
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	0.485	1759.041	1.43
SOIL WATER AT START OF YEAR	180.722	656020.750	
SOIL WATER AT END OF YEAR	179.618	652012.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.589	5767.240	4.70
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

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ANNUAL TOTALS FOR YEAR 42

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.42	143094.594	100.00
RUNOFF	16.326	59263.305	41.42
EVAPOTRANSPIRATION	21.588	78363.156	54.76
PERC./LEAKAGE THROUGH LAYER 2	3.610237	13105.161	9.16
AVG. HEAD ON TOP OF LAYER 2	0.6487		
PERC./LEAKAGE THROUGH LAYER 16	4.179426	15171.317	10.60
AVG. HEAD ON TOP OF LAYER 16	0.0038		
CHANGE IN WATER STORAGE	-2.673	-9703.117	-6.78
SOIL WATER AT START OF YEAR	179.618	652012.562	
SOIL WATER AT END OF YEAR	178.417	647654.500	
SNOW WATER AT START OF YEAR	1.589	5767.240	4.03
SNOW WATER AT END OF YEAR	0.116	422.162	0.30
ANNUAL WATER BUDGET BALANCE	0.0000	-0.069	0.00

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ANNUAL TOTALS FOR YEAR 43

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.57	136379.078	100.00
RUNOFF	8.545	31018.590	22.74
EVAPOTRANSPIRATION	23.936	86888.227	63.71
PERC./LEAKAGE THROUGH LAYER 2	4.998095	18143.086	13.30
AVG. HEAD ON TOP OF LAYER 2	0.8887		
PERC./LEAKAGE THROUGH LAYER 16	4.458355	16183.830	11.87
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	0.630	2288.395	1.68

SOIL WATER AT START OF YEAR	178.417	647654.500	
SOIL WATER AT END OF YEAR	178.910	649444.812	
SNOW WATER AT START OF YEAR	0.116	422.162	0.31
SNOW WATER AT END OF YEAR	0.254	920.260	0.67
ANNUAL WATER BUDGET BALANCE	0.0000	0.035	0.00

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ANNUAL TOTALS FOR YEAR 44

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.33	128247.922	100.00
RUNOFF	10.193	37001.211	28.85
EVAPOTRANSPIRATION	20.382	73987.258	57.69
PERC./LEAKAGE THROUGH LAYER 2	3.581392	13000.452	10.14
AVG. HEAD ON TOP OF LAYER 2	0.7154		
PERC./LEAKAGE THROUGH LAYER 16	3.885250	14103.459	11.00
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	0.869	3156.005	2.46
SOIL WATER AT START OF YEAR	178.910	649444.812	
SOIL WATER AT END OF YEAR	179.284	650802.687	
SNOW WATER AT START OF YEAR	0.254	920.260	0.72
SNOW WATER AT END OF YEAR	0.749	2718.394	2.12
ANNUAL WATER BUDGET BALANCE	0.0000	-0.011	0.00

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ANNUAL TOTALS FOR YEAR 45

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.10	127413.023	100.00
RUNOFF	7.459	27074.988	21.25

EVAPOTRANSPIRATION	23.819	86463.453	67.86
PERC./LEAKAGE THROUGH LAYER 2	5.316818	19300.049	15.15
AVG. HEAD ON TOP OF LAYER 2	0.9963		
PERC./LEAKAGE THROUGH LAYER 16	3.951323	14343.304	11.26
AVG. HEAD ON TOP OF LAYER 16	0.0038		
CHANGE IN WATER STORAGE	-0.129	-468.693	-0.37
SOIL WATER AT START OF YEAR	179.284	650802.687	
SOIL WATER AT END OF YEAR	179.717	652372.687	
SNOW WATER AT START OF YEAR	0.749	2718.394	2.13
SNOW WATER AT END OF YEAR	0.187	679.688	0.53
ANNUAL WATER BUDGET BALANCE	0.0000	-0.032	0.00

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ANNUAL TOTALS FOR YEAR 46

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.47	186836.125	100.00
RUNOFF	19.566	71023.289	38.01
EVAPOTRANSPIRATION	26.550	96375.820	51.58
PERC./LEAKAGE THROUGH LAYER 2	4.418087	16037.656	8.58
AVG. HEAD ON TOP OF LAYER 2	1.0157		
PERC./LEAKAGE THROUGH LAYER 16	2.469804	8965.389	4.80
AVG. HEAD ON TOP OF LAYER 16	0.0024		
CHANGE IN WATER STORAGE	2.885	10471.581	5.60
SOIL WATER AT START OF YEAR	179.717	652372.687	
SOIL WATER AT END OF YEAR	182.598	662831.750	
SNOW WATER AT START OF YEAR	0.187	679.688	0.36
SNOW WATER AT END OF YEAR	0.191	692.199	0.37
ANNUAL WATER BUDGET BALANCE	0.0000	0.037	0.00

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ANNUAL TOTALS FOR YEAR 47

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.81	129990.305	100.00
RUNOFF	8.915	32360.553	24.89
EVAPOTRANSPIRATION	22.753	82593.391	63.54
PERC./LEAKAGE THROUGH LAYER 2	4.312527	15654.474	12.04
AVG. HEAD ON TOP OF LAYER 2	0.7774		
PERC./LEAKAGE THROUGH LAYER 16	3.386856	12294.287	9.46
AVG. HEAD ON TOP OF LAYER 16	0.0030		
CHANGE IN WATER STORAGE	0.755	2741.962	2.11
SOIL WATER AT START OF YEAR	182.598	662831.750	
SOIL WATER AT END OF YEAR	183.486	666055.875	
SNOW WATER AT START OF YEAR	0.191	692.199	0.53
SNOW WATER AT END OF YEAR	0.058	210.055	0.16
ANNUAL WATER BUDGET BALANCE	0.0000	0.111	0.00

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ANNUAL TOTALS FOR YEAR 48

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.99	141533.750	100.00
RUNOFF	13.117	47615.090	33.64
EVAPOTRANSPIRATION	21.702	78777.687	55.66
PERC./LEAKAGE THROUGH LAYER 2	3.424130	12429.593	8.78
AVG. HEAD ON TOP OF LAYER 2	0.5197		
PERC./LEAKAGE THROUGH LAYER 16	3.708255	13460.965	9.51
AVG. HEAD ON TOP OF LAYER 16	0.0033		
CHANGE IN WATER STORAGE	0.463	1679.955	1.19
SOIL WATER AT START OF YEAR	183.486	666055.875	
SOIL WATER AT END OF YEAR	183.162	664879.250	

SNOW WATER AT START OF YEAR	0.058	210.055	0.15
SNOW WATER AT END OF YEAR	0.845	3066.648	2.17
ANNUAL WATER BUDGET BALANCE	0.0000	0.047	0.00

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ANNUAL TOTALS FOR YEAR 49

	INCHES	CU. FEET	PERCENT
PRECIPITATION	36.83	133692.937	100.00
RUNOFF	10.223	37107.945	27.76
EVAPOTRANSPIRATION	22.808	82794.086	61.93
PERC./LEAKAGE THROUGH LAYER 2	5.583453	20267.934	15.16
AVG. HEAD ON TOP OF LAYER 2	1.0373		
PERC./LEAKAGE THROUGH LAYER 16	4.807748	17452.127	13.05
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	-1.009	-3661.253	-2.74
SOIL WATER AT START OF YEAR	183.162	664879.250	
SOIL WATER AT END OF YEAR	182.999	664284.625	
SNOW WATER AT START OF YEAR	0.845	3066.648	2.29
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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ANNUAL TOTALS FOR YEAR 50

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.26	138883.812	100.00
RUNOFF	12.181	44216.340	31.84
EVAPOTRANSPIRATION	22.133	80341.266	57.85
PERC./LEAKAGE THROUGH LAYER 2	3.359707	12195.737	8.78

AVG. HEAD ON TOP OF LAYER 2	0.5052		
PERC./LEAKAGE THROUGH LAYER 16	4.343297	15766.168	11.35
AVG. HEAD ON TOP OF LAYER 16	0.0038		
CHANGE IN WATER STORAGE	-0.397	-1439.958	-1.04
SOIL WATER AT START OF YEAR	182.999	664284.625	
SOIL WATER AT END OF YEAR	182.602	662844.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

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ANNUAL TOTALS FOR YEAR 51

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.02	163422.609	100.00
RUNOFF	18.736	68011.250	41.62
EVAPOTRANSPIRATION	19.729	71615.687	43.82
PERC./LEAKAGE THROUGH LAYER 2	5.409091	19635.002	12.01
AVG. HEAD ON TOP OF LAYER 2	1.0547		
PERC./LEAKAGE THROUGH LAYER 16	4.748458	17236.902	10.55
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	1.807	6558.644	4.01
SOIL WATER AT START OF YEAR	182.602	662844.687	
SOIL WATER AT END OF YEAR	183.630	666577.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.778	2825.896	1.73
ANNUAL WATER BUDGET BALANCE	0.0000	0.130	0.00

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ANNUAL TOTALS FOR YEAR 52

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.78	169811.391	100.00
RUNOFF	18.037	65474.078	38.56
EVAPOTRANSPIRATION	23.755	86228.859	50.78
PERC./LEAKAGE THROUGH LAYER 2	5.997056	21769.312	12.82
AVG. HEAD ON TOP OF LAYER 2	1.3698		
PERC./LEAKAGE THROUGH LAYER 16	3.712987	13478.143	7.94
AVG. HEAD ON TOP OF LAYER 16	0.0034		
CHANGE IN WATER STORAGE	1.276	4630.263	2.73
SOIL WATER AT START OF YEAR	183.630	666577.437	
SOIL WATER AT END OF YEAR	185.345	672801.375	
SNOW WATER AT START OF YEAR	0.778	2825.896	1.66
SNOW WATER AT END OF YEAR	0.339	1232.218	0.73
ANNUAL WATER BUDGET BALANCE	0.0000	0.052	0.00

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ANNUAL TOTALS FOR YEAR 53

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.23	113364.922	100.00
RUNOFF	8.530	30963.100	27.31
EVAPOTRANSPIRATION	19.376	70336.148	62.04
PERC./LEAKAGE THROUGH LAYER 2	3.122948	11336.300	10.00
AVG. HEAD ON TOP OF LAYER 2	0.5051		
PERC./LEAKAGE THROUGH LAYER 16	4.836164	17555.277	15.49
AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	-1.512	-5489.429	-4.84
SOIL WATER AT START OF YEAR	185.345	672801.375	
SOIL WATER AT END OF YEAR	183.724	666917.437	
SNOW WATER AT START OF YEAR	0.339	1232.218	1.09
SNOW WATER AT END OF YEAR	0.448	1626.695	1.43

ANNUAL WATER BUDGET BALANCE	0.0000	-0.180	0.00

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ANNUAL TOTALS FOR YEAR 54

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.58	179975.437	100.00
RUNOFF	15.320	55611.379	30.90
EVAPOTRANSPIRATION	26.078	94661.414	52.60
PERC./LEAKAGE THROUGH LAYER 2	7.326015	26593.434	14.78
AVG. HEAD ON TOP OF LAYER 2	1.5670		
PERC./LEAKAGE THROUGH LAYER 16	4.318388	15675.748	8.71
AVG. HEAD ON TOP OF LAYER 16	0.0038		
CHANGE IN WATER STORAGE	3.864	14026.780	7.79
SOIL WATER AT START OF YEAR	183.724	666917.437	
SOIL WATER AT END OF YEAR	187.085	679117.250	
SNOW WATER AT START OF YEAR	0.448	1626.695	0.90
SNOW WATER AT END OF YEAR	0.951	3453.681	1.92
ANNUAL WATER BUDGET BALANCE	0.0000	0.116	0.00

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ANNUAL TOTALS FOR YEAR 55

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.44	117757.211	100.00
RUNOFF	7.657	27793.375	23.60
EVAPOTRANSPIRATION	20.987	76182.664	64.69
PERC./LEAKAGE THROUGH LAYER 2	4.081507	14815.871	12.58
AVG. HEAD ON TOP OF LAYER 2	0.6620		
PERC./LEAKAGE THROUGH LAYER 16	5.004468	18166.221	15.43

AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	-1.208	-4385.014	-3.72
SOIL WATER AT START OF YEAR	187.085	679117.250	
SOIL WATER AT END OF YEAR	185.989	675139.437	
SNOW WATER AT START OF YEAR	0.951	3453.681	2.93
SNOW WATER AT END OF YEAR	0.839	3046.458	2.59
ANNUAL WATER BUDGET BALANCE	0.0000	-0.035	0.00

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ANNUAL TOTALS FOR YEAR 56

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.87	159248.062	100.00
RUNOFF	11.564	41978.949	26.36
EVAPOTRANSPIRATION	25.031	90861.469	57.06
PERC./LEAKAGE THROUGH LAYER 2	5.226881	18973.576	11.91
AVG. HEAD ON TOP OF LAYER 2	1.0789		
PERC./LEAKAGE THROUGH LAYER 16	5.662199	20553.783	12.91
AVG. HEAD ON TOP OF LAYER 16	0.0046		
CHANGE IN WATER STORAGE	1.613	5853.904	3.68
SOIL WATER AT START OF YEAR	185.989	675139.437	
SOIL WATER AT END OF YEAR	185.836	674584.375	
SNOW WATER AT START OF YEAR	0.839	3046.458	1.91
SNOW WATER AT END OF YEAR	2.605	9455.419	5.94
ANNUAL WATER BUDGET BALANCE	0.0000	-0.040	0.00

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ANNUAL TOTALS FOR YEAR 57

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.67	122222.117	100.00

RUNOFF	13.345	48442.453	39.63
EVAPOTRANSPIRATION	19.802	71881.180	58.81
PERC./LEAKAGE THROUGH LAYER 2	3.050951	11074.950	9.06
AVG. HEAD ON TOP OF LAYER 2	0.5322		
PERC./LEAKAGE THROUGH LAYER 16	5.050273	18332.492	15.00
AVG. HEAD ON TOP OF LAYER 16	0.0043		
CHANGE IN WATER STORAGE	-4.527	-16433.984	-13.45
SOIL WATER AT START OF YEAR	185.836	674584.375	
SOIL WATER AT END OF YEAR	183.913	667605.812	
SNOW WATER AT START OF YEAR	2.605	9455.419	7.74
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

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ANNUAL TOTALS FOR YEAR 58

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.46	143239.844	100.00
RUNOFF	13.334	48402.016	33.79
EVAPOTRANSPIRATION	22.747	82571.391	57.65
PERC./LEAKAGE THROUGH LAYER 2	3.554739	12903.703	9.01
AVG. HEAD ON TOP OF LAYER 2	0.6489		
PERC./LEAKAGE THROUGH LAYER 16	5.026711	18246.959	12.74
AVG. HEAD ON TOP OF LAYER 16	0.0043		
CHANGE IN WATER STORAGE	-1.648	-5980.616	-4.18
SOIL WATER AT START OF YEAR	183.913	667605.812	
SOIL WATER AT END OF YEAR	182.266	661625.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.090	0.00

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                          ANNUAL TOTALS FOR YEAR   59
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                                          INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                          37.27         135290.109    100.00
  RUNOFF                                 12.600         45738.543     33.81
  EVAPOTRANSPIRATION                     19.200         69696.703     51.52
  PERC./LEAKAGE THROUGH LAYER  2          5.122972      18596.391     13.75
  AVG. HEAD ON TOP OF LAYER  2            1.0880
  PERC./LEAKAGE THROUGH LAYER 16          4.402639      15981.581     11.81
  AVG. HEAD ON TOP OF LAYER 16            0.0040
  CHANGE IN WATER STORAGE                 1.067          3873.322      2.86
  SOIL WATER AT START OF YEAR           182.266        661625.187
  SOIL WATER AT END OF YEAR             182.746        663366.875
  SNOW WATER AT START OF YEAR             0.000             0.000      0.00
  SNOW WATER AT END OF YEAR               0.587          2131.658      1.58
  ANNUAL WATER BUDGET BALANCE             0.0000           -0.031      0.00
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                          ANNUAL TOTALS FOR YEAR   60
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                                          INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                          39.31         142695.312    100.00
  RUNOFF                                 14.368         52156.453     36.55
  EVAPOTRANSPIRATION                     21.832         79251.320     55.54
  PERC./LEAKAGE THROUGH LAYER  2          3.999085      14516.680     10.17
  AVG. HEAD ON TOP OF LAYER  2            0.7031
  PERC./LEAKAGE THROUGH LAYER 16          5.069657      18402.854     12.90
  AVG. HEAD ON TOP OF LAYER 16            0.0044
  CHANGE IN WATER STORAGE                -1.960         -7115.307     -4.99
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SOIL WATER AT START OF YEAR	182.746	663366.875	
SOIL WATER AT END OF YEAR	181.327	658215.250	
SNOW WATER AT START OF YEAR	0.587	2131.658	1.49
SNOW WATER AT END OF YEAR	0.046	168.009	0.12
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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ANNUAL TOTALS FOR YEAR 61

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.73	158739.875	100.00
RUNOFF	8.980	32597.451	20.54
EVAPOTRANSPIRATION	27.628	100289.531	63.18
PERC./LEAKAGE THROUGH LAYER 2	6.629843	24066.330	15.16
AVG. HEAD ON TOP OF LAYER 2	1.3435		
PERC./LEAKAGE THROUGH LAYER 16	4.058207	14731.292	9.28
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	3.064	11121.626	7.01
SOIL WATER AT START OF YEAR	181.327	658215.250	
SOIL WATER AT END OF YEAR	184.437	669504.875	
SNOW WATER AT START OF YEAR	0.046	168.009	0.11
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.026	0.00

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ANNUAL TOTALS FOR YEAR 62

	INCHES	CU. FEET	PERCENT
PRECIPITATION	29.00	105269.992	100.00
RUNOFF	6.395	23212.951	22.05
EVAPOTRANSPIRATION	21.113	76641.516	72.80

PERC./LEAKAGE THROUGH LAYER 2	2.339826	8493.568	8.07
AVG. HEAD ON TOP OF LAYER 2	0.2788		
PERC./LEAKAGE THROUGH LAYER 16	3.580254	12996.323	12.35
AVG. HEAD ON TOP OF LAYER 16	0.0033		
CHANGE IN WATER STORAGE	-2.088	-7580.871	-7.20
SOIL WATER AT START OF YEAR	184.437	669504.875	
SOIL WATER AT END OF YEAR	182.348	661924.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.074	0.00

ANNUAL TOTALS FOR YEAR 63

	INCHES	CU. FEET	PERCENT
PRECIPITATION	47.28	171626.375	100.00
RUNOFF	16.839	61127.352	35.62
EVAPOTRANSPIRATION	23.026	83583.750	48.70
PERC./LEAKAGE THROUGH LAYER 2	5.813438	21102.781	12.30
AVG. HEAD ON TOP OF LAYER 2	1.2245		
PERC./LEAKAGE THROUGH LAYER 16	4.457775	16181.722	9.43
AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	2.957	10733.562	6.25
SOIL WATER AT START OF YEAR	182.348	661924.000	
SOIL WATER AT END OF YEAR	184.536	669865.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.769	2791.829	1.63
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

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                          ANNUAL TOTALS FOR YEAR   64
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                                      INCHES          CU. FEET     PERCENT
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  PRECIPITATION                       35.14         127558.187    100.00
  RUNOFF                               9.802         35582.969     27.90
  EVAPOTRANSPIRATION                  23.315         84634.211     66.35
  PERC./LEAKAGE THROUGH LAYER  2       3.630398      13178.344     10.33
  AVG. HEAD ON TOP OF LAYER  2         0.6860
  PERC./LEAKAGE THROUGH LAYER 16       4.961224      18009.242     14.12
  AVG. HEAD ON TOP OF LAYER 16         0.0041
  CHANGE IN WATER STORAGE             -2.939         -10668.241    -8.36
  SOIL WATER AT START OF YEAR        184.536         669865.750
  SOIL WATER AT END OF YEAR          182.039         660800.875
  SNOW WATER AT START OF YEAR          0.769          2791.829      2.19
  SNOW WATER AT END OF YEAR            0.327          1188.451      0.93
  ANNUAL WATER BUDGET BALANCE          0.0000            0.000      0.00
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                          ANNUAL TOTALS FOR YEAR   65
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                                      INCHES          CU. FEET     PERCENT
                                     --------        ----------    -------
  PRECIPITATION                       31.63         114816.891    100.00
  RUNOFF                               5.495         19945.229     17.37
  EVAPOTRANSPIRATION                  20.088         72921.172     63.51
  PERC./LEAKAGE THROUGH LAYER  2       5.311764      19281.705     16.79
  AVG. HEAD ON TOP OF LAYER  2         0.9787
  PERC./LEAKAGE THROUGH LAYER 16       5.298204      19232.482     16.75
  AVG. HEAD ON TOP OF LAYER 16         0.0044
  CHANGE IN WATER STORAGE              0.749          2718.079      2.37
  SOIL WATER AT START OF YEAR        182.039         660800.875
  SOIL WATER AT END OF YEAR          182.970         664182.875
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SNOW WATER AT START OF YEAR	0.327	1188.451	1.04
SNOW WATER AT END OF YEAR	0.144	524.508	0.46
ANNUAL WATER BUDGET BALANCE	0.0000	-0.076	0.00

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ANNUAL TOTALS FOR YEAR 66

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.76	137068.781	100.00
RUNOFF	7.156	25977.135	18.95
EVAPOTRANSPIRATION	25.477	92481.391	67.47
PERC./LEAKAGE THROUGH LAYER 2	4.984596	18094.082	13.20
AVG. HEAD ON TOP OF LAYER 2	0.8540		
PERC./LEAKAGE THROUGH LAYER 16	3.928488	14260.410	10.40
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	1.198	4349.815	3.17
SOIL WATER AT START OF YEAR	182.970	664182.875	
SOIL WATER AT END OF YEAR	184.313	669057.187	
SNOW WATER AT START OF YEAR	0.144	524.508	0.38
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.031	0.00

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ANNUAL TOTALS FOR YEAR 67

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.47	139646.109	100.00
RUNOFF	9.971	36194.312	25.92
EVAPOTRANSPIRATION	22.787	82718.500	59.23
PERC./LEAKAGE THROUGH LAYER 2	4.125896	14977.004	10.72
AVG. HEAD ON TOP OF LAYER 2	0.7407		

PERC./LEAKAGE THROUGH LAYER 16	4.122371	14964.206	10.72
AVG. HEAD ON TOP OF LAYER 16	0.0037		
CHANGE IN WATER STORAGE	1.589	5769.102	4.13
SOIL WATER AT START OF YEAR	184.313	669057.187	
SOIL WATER AT END OF YEAR	184.520	669809.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.382	5017.025	3.59
ANNUAL WATER BUDGET BALANCE	0.0000	-0.019	0.00

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ANNUAL TOTALS FOR YEAR 68

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.22	98808.609	100.00
RUNOFF	7.558	27436.504	27.77
EVAPOTRANSPIRATION	19.428	70522.062	71.37
PERC./LEAKAGE THROUGH LAYER 2	2.994993	10871.823	11.00
AVG. HEAD ON TOP OF LAYER 2	0.5303		
PERC./LEAKAGE THROUGH LAYER 16	4.608359	16728.344	16.93
AVG. HEAD ON TOP OF LAYER 16	0.0039		
CHANGE IN WATER STORAGE	-4.374	-15878.231	-16.07
SOIL WATER AT START OF YEAR	184.520	669809.250	
SOIL WATER AT END OF YEAR	181.502	658851.687	
SNOW WATER AT START OF YEAR	1.382	5017.025	5.08
SNOW WATER AT END OF YEAR	0.027	96.369	0.10
ANNUAL WATER BUDGET BALANCE	0.0000	-0.066	0.00

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ANNUAL TOTALS FOR YEAR 69

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.58	136415.453	100.00
RUNOFF	11.187	40607.734	29.77
EVAPOTRANSPIRATION	21.424	77769.070	57.01
PERC./LEAKAGE THROUGH LAYER 2	3.485959	12654.031	9.28
AVG. HEAD ON TOP OF LAYER 2	0.6387		
PERC./LEAKAGE THROUGH LAYER 16	4.464267	16205.288	11.88
AVG. HEAD ON TOP OF LAYER 16	0.0039		
CHANGE IN WATER STORAGE	0.505	1833.279	1.34
SOIL WATER AT START OF YEAR	181.502	658851.687	
SOIL WATER AT END OF YEAR	181.800	659934.000	
SNOW WATER AT START OF YEAR	0.027	96.369	0.07
SNOW WATER AT END OF YEAR	0.233	847.339	0.62
ANNUAL WATER BUDGET BALANCE	0.0000	0.076	0.00

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ANNUAL TOTALS FOR YEAR 70

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.07	174494.094	100.00
RUNOFF	15.733	57110.656	32.73
EVAPOTRANSPIRATION	24.472	88833.391	50.91
PERC./LEAKAGE THROUGH LAYER 2	6.156867	22349.428	12.81
AVG. HEAD ON TOP OF LAYER 2	1.2124		
PERC./LEAKAGE THROUGH LAYER 16	4.990830	18116.713	10.38
AVG. HEAD ON TOP OF LAYER 16	0.0043		
CHANGE IN WATER STORAGE	2.874	10433.388	5.98
SOIL WATER AT START OF YEAR	181.800	659934.000	
SOIL WATER AT END OF YEAR	182.849	663742.125	
SNOW WATER AT START OF YEAR	0.233	847.339	0.49
SNOW WATER AT END OF YEAR	2.059	7472.595	4.28

ANNUAL WATER BUDGET BALANCE	0.0000	-0.048	0.00

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ANNUAL TOTALS FOR YEAR 71

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.50	121605.000	100.00
RUNOFF	6.533	23716.160	19.50
EVAPOTRANSPIRATION	21.804	79149.398	65.09
PERC./LEAKAGE THROUGH LAYER 2	5.617808	20392.645	16.77
AVG. HEAD ON TOP OF LAYER 2	1.0282		
PERC./LEAKAGE THROUGH LAYER 16	4.706015	17082.834	14.05
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	0.456	1656.498	1.36
SOIL WATER AT START OF YEAR	182.849	663742.125	
SOIL WATER AT END OF YEAR	183.690	666795.687	
SNOW WATER AT START OF YEAR	2.059	7472.595	6.14
SNOW WATER AT END OF YEAR	1.674	6075.530	5.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.113	0.00

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ANNUAL TOTALS FOR YEAR 72

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.70	151371.000	100.00
RUNOFF	11.523	41826.973	27.63
EVAPOTRANSPIRATION	26.645	96721.625	63.90
PERC./LEAKAGE THROUGH LAYER 2	4.536075	16465.953	10.88
AVG. HEAD ON TOP OF LAYER 2	0.7435		
PERC./LEAKAGE THROUGH LAYER 16	3.714114	13482.235	8.91
AVG. HEAD ON TOP OF LAYER 16	0.0035		

CHANGE IN WATER STORAGE	-0.182	-659.706	-0.44
SOIL WATER AT START OF YEAR	183.690	666795.687	
SOIL WATER AT END OF YEAR	184.370	669262.000	
SNOW WATER AT START OF YEAR	1.674	6075.530	4.01
SNOW WATER AT END OF YEAR	0.813	2949.501	1.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.121	0.00

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ANNUAL TOTALS FOR YEAR 73

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.11	112929.305	100.00
RUNOFF	7.232	26251.885	23.25
EVAPOTRANSPIRATION	20.013	72648.852	64.33
PERC./LEAKAGE THROUGH LAYER 2	3.743066	13587.329	12.03
AVG. HEAD ON TOP OF LAYER 2	0.7045		
PERC./LEAKAGE THROUGH LAYER 16	3.525991	12799.349	11.33
AVG. HEAD ON TOP OF LAYER 16	0.0032		
CHANGE IN WATER STORAGE	0.339	1229.135	1.09
SOIL WATER AT START OF YEAR	184.370	669262.000	
SOIL WATER AT END OF YEAR	184.729	670567.750	
SNOW WATER AT START OF YEAR	0.813	2949.501	2.61
SNOW WATER AT END OF YEAR	0.791	2872.941	2.54
ANNUAL WATER BUDGET BALANCE	0.0000	0.081	0.00

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ANNUAL TOTALS FOR YEAR 74

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.29	186182.734	100.00

RUNOFF	17.549	63701.227	34.21
EVAPOTRANSPIRATION	26.936	97777.359	52.52
PERC./LEAKAGE THROUGH LAYER 2	6.976022	25322.961	13.60
AVG. HEAD ON TOP OF LAYER 2	1.6068		
PERC./LEAKAGE THROUGH LAYER 16	5.114842	18566.877	9.97
AVG. HEAD ON TOP OF LAYER 16	0.0043		
CHANGE IN WATER STORAGE	1.691	6137.246	3.30
SOIL WATER AT START OF YEAR	184.729	670567.750	
SOIL WATER AT END OF YEAR	186.310	676304.750	
SNOW WATER AT START OF YEAR	0.791	2872.941	1.54
SNOW WATER AT END OF YEAR	0.902	3273.174	1.76
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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ANNUAL TOTALS FOR YEAR 75

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.96	163204.781	100.00
RUNOFF	16.882	61281.340	37.55
EVAPOTRANSPIRATION	22.384	81255.602	49.79
PERC./LEAKAGE THROUGH LAYER 2	4.848675	17600.691	10.78
AVG. HEAD ON TOP OF LAYER 2	0.9146		
PERC./LEAKAGE THROUGH LAYER 16	5.070974	18407.635	11.28
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	0.623	2260.237	1.38
SOIL WATER AT START OF YEAR	186.310	676304.750	
SOIL WATER AT END OF YEAR	186.685	677664.875	
SNOW WATER AT START OF YEAR	0.902	3273.174	2.01
SNOW WATER AT END OF YEAR	1.150	4173.268	2.56
ANNUAL WATER BUDGET BALANCE	0.0000	-0.029	0.00

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ANNUAL TOTALS FOR YEAR 76

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.83	162732.906	100.00
RUNOFF	12.313	44695.363	27.47
EVAPOTRANSPIRATION	24.837	90156.945	55.40
PERC./LEAKAGE THROUGH LAYER 2	6.853171	24877.010	15.29
AVG. HEAD ON TOP OF LAYER 2	1.4640		
PERC./LEAKAGE THROUGH LAYER 16	5.299620	19237.619	11.82
AVG. HEAD ON TOP OF LAYER 16	0.0047		
CHANGE IN WATER STORAGE	2.381	8642.961	5.31
SOIL WATER AT START OF YEAR	186.685	677664.875	
SOIL WATER AT END OF YEAR	187.821	681789.312	
SNOW WATER AT START OF YEAR	1.150	4173.268	2.56
SNOW WATER AT END OF YEAR	2.394	8691.823	5.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.019	0.00

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ANNUAL TOTALS FOR YEAR 77

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.15	160264.531	100.00
RUNOFF	12.650	45919.285	28.65
EVAPOTRANSPIRATION	26.959	97859.984	61.06
PERC./LEAKAGE THROUGH LAYER 2	5.674557	20598.641	12.85
AVG. HEAD ON TOP OF LAYER 2	1.1731		
PERC./LEAKAGE THROUGH LAYER 16	4.520355	16408.889	10.24
AVG. HEAD ON TOP OF LAYER 16	0.0038		
CHANGE IN WATER STORAGE	0.021	76.276	0.05
SOIL WATER AT START OF YEAR	187.821	681789.312	

SOIL WATER AT END OF YEAR	189.392	687493.937	
SNOW WATER AT START OF YEAR	2.394	8691.823	5.42
SNOW WATER AT END OF YEAR	0.844	3063.434	1.91
ANNUAL WATER BUDGET BALANCE	0.0000	0.099	0.00

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ANNUAL TOTALS FOR YEAR 78

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.90	130317.047	100.00
RUNOFF	8.814	31995.756	24.55
EVAPOTRANSPIRATION	22.582	81971.172	62.90
PERC./LEAKAGE THROUGH LAYER 2	5.096438	18500.072	14.20
AVG. HEAD ON TOP OF LAYER 2	0.8064		
PERC./LEAKAGE THROUGH LAYER 16	5.793452	21030.232	16.14
AVG. HEAD ON TOP OF LAYER 16	0.0050		
CHANGE IN WATER STORAGE	-1.289	-4680.082	-3.59
SOIL WATER AT START OF YEAR	189.392	687493.937	
SOIL WATER AT END OF YEAR	187.941	682224.812	
SNOW WATER AT START OF YEAR	0.844	3063.434	2.35
SNOW WATER AT END OF YEAR	1.006	3652.491	2.80
ANNUAL WATER BUDGET BALANCE	0.0000	-0.033	0.00

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ANNUAL TOTALS FOR YEAR 79

	INCHES	CU. FEET	PERCENT
PRECIPITATION	29.01	105306.320	100.00
RUNOFF	9.026	32765.045	31.11
EVAPOTRANSPIRATION	17.377	63077.211	59.90

PERC./LEAKAGE THROUGH LAYER 2	3.289282	11940.093	11.34
AVG. HEAD ON TOP OF LAYER 2	0.5424		
PERC./LEAKAGE THROUGH LAYER 16	6.280495	22798.195	21.65
AVG. HEAD ON TOP OF LAYER 16	0.0051		
CHANGE IN WATER STORAGE	-3.673	-13334.172	-12.66
SOIL WATER AT START OF YEAR	187.941	682224.812	
SOIL WATER AT END OF YEAR	185.274	672543.125	
SNOW WATER AT START OF YEAR	1.006	3652.491	3.47
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.042	0.00

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ANNUAL TOTALS FOR YEAR 80

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.20	182225.969	100.00
RUNOFF	15.310	55574.098	30.50
EVAPOTRANSPIRATION	26.648	96731.086	53.08
PERC./LEAKAGE THROUGH LAYER 2	5.402963	19612.756	10.76
AVG. HEAD ON TOP OF LAYER 2	1.1080		
PERC./LEAKAGE THROUGH LAYER 16	5.970728	21673.744	11.89
AVG. HEAD ON TOP OF LAYER 16	0.0048		
CHANGE IN WATER STORAGE	2.272	8247.020	4.53
SOIL WATER AT START OF YEAR	185.274	672543.125	
SOIL WATER AT END OF YEAR	185.061	671772.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	2.484	9018.150	4.95
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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ANNUAL TOTALS FOR YEAR 81

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.90	137577.047	100.00
RUNOFF	11.344	41178.266	29.93
EVAPOTRANSPIRATION	20.286	73637.422	53.52
PERC./LEAKAGE THROUGH LAYER 2	5.126473	18609.098	13.53
AVG. HEAD ON TOP OF LAYER 2	0.9363		
PERC./LEAKAGE THROUGH LAYER 16	4.856489	17629.057	12.81
AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	1.414	5132.246	3.73
SOIL WATER AT START OF YEAR	185.061	671772.000	
SOIL WATER AT END OF YEAR	184.815	670878.375	
SNOW WATER AT START OF YEAR	2.484	9018.150	6.55
SNOW WATER AT END OF YEAR	4.144	15043.994	10.93
ANNUAL WATER BUDGET BALANCE	0.0000	0.055	0.00

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ANNUAL TOTALS FOR YEAR 82

	INCHES	CU. FEET	PERCENT
PRECIPITATION	32.54	118120.203	100.00
RUNOFF	12.138	44061.215	37.30
EVAPOTRANSPIRATION	20.879	75791.852	64.17
PERC./LEAKAGE THROUGH LAYER 2	3.505019	12723.218	10.77
AVG. HEAD ON TOP OF LAYER 2	0.5150		
PERC./LEAKAGE THROUGH LAYER 16	5.254338	19073.246	16.15
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	-5.732	-20806.010	-17.61
SOIL WATER AT START OF YEAR	184.815	670878.375	
SOIL WATER AT END OF YEAR	183.021	664366.250	
SNOW WATER AT START OF YEAR	4.144	15043.994	12.74

SNOW WATER AT END OF YEAR	0.207	750.116	0.64
ANNUAL WATER BUDGET BALANCE	0.0000	-0.097	0.00

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ANNUAL TOTALS FOR YEAR 83

	INCHES	CU. FEET	PERCENT
PRECIPITATION	45.35	164620.469	100.00
RUNOFF	14.415	52327.055	31.79
EVAPOTRANSPIRATION	25.413	92249.766	56.04
PERC./LEAKAGE THROUGH LAYER 2	4.805368	17443.488	10.60
AVG. HEAD ON TOP OF LAYER 2	0.9425		
PERC./LEAKAGE THROUGH LAYER 16	4.019767	14591.755	8.86
AVG. HEAD ON TOP OF LAYER 16	0.0035		
CHANGE IN WATER STORAGE	1.502	5451.795	3.31
SOIL WATER AT START OF YEAR	183.021	664366.250	
SOIL WATER AT END OF YEAR	184.443	669526.437	
SNOW WATER AT START OF YEAR	0.207	750.116	0.46
SNOW WATER AT END OF YEAR	0.287	1041.723	0.63
ANNUAL WATER BUDGET BALANCE	0.0000	0.095	0.00

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ANNUAL TOTALS FOR YEAR 84

	INCHES	CU. FEET	PERCENT
PRECIPITATION	36.93	134055.937	100.00
RUNOFF	13.149	47730.047	35.60
EVAPOTRANSPIRATION	20.123	73046.500	54.49
PERC./LEAKAGE THROUGH LAYER 2	4.623281	16782.510	12.52
AVG. HEAD ON TOP OF LAYER 2	0.9740		

PERC./LEAKAGE THROUGH LAYER 16	4.754133	17257.504	12.87
AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	-1.096	-3978.210	-2.97
SOIL WATER AT START OF YEAR	184.443	669526.437	
SOIL WATER AT END OF YEAR	183.355	665579.312	
SNOW WATER AT START OF YEAR	0.287	1041.723	0.78
SNOW WATER AT END OF YEAR	0.278	1010.673	0.75
ANNUAL WATER BUDGET BALANCE	0.0000	0.100	0.00

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ANNUAL TOTALS FOR YEAR 85

	INCHES	CU. FEET	PERCENT
PRECIPITATION	36.64	133003.203	100.00
RUNOFF	12.193	44260.695	33.28
EVAPOTRANSPIRATION	20.989	76191.695	57.29
PERC./LEAKAGE THROUGH LAYER 2	3.450245	12524.390	9.42
AVG. HEAD ON TOP OF LAYER 2	0.5251		
PERC./LEAKAGE THROUGH LAYER 16	4.877611	17705.727	13.31
AVG. HEAD ON TOP OF LAYER 16	0.0042		
CHANGE IN WATER STORAGE	-1.420	-5154.908	-3.88
SOIL WATER AT START OF YEAR	183.355	665579.312	
SOIL WATER AT END OF YEAR	182.214	661435.062	
SNOW WATER AT START OF YEAR	0.278	1010.673	0.76
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

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ANNUAL TOTALS FOR YEAR 86

	INCHES	CU. FEET	PERCENT

PRECIPITATION	35.77	129845.086	100.00
RUNOFF	10.428	37852.094	29.15
EVAPOTRANSPIRATION	20.563	74645.227	57.49
PERC./LEAKAGE THROUGH LAYER 2	4.303393	15621.316	12.03
AVG. HEAD ON TOP OF LAYER 2	0.6540		
PERC./LEAKAGE THROUGH LAYER 16	3.941212	14306.600	11.02
AVG. HEAD ON TOP OF LAYER 16	0.0036		
CHANGE IN WATER STORAGE	0.838	3041.031	2.34
SOIL WATER AT START OF YEAR	182.214	661435.062	
SOIL WATER AT END OF YEAR	182.774	663468.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.278	1007.907	0.78
ANNUAL WATER BUDGET BALANCE	0.0000	0.138	0.00

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ANNUAL TOTALS FOR YEAR 87

	INCHES	CU. FEET	PERCENT
PRECIPITATION	31.20	113255.984	100.00
RUNOFF	6.197	22494.734	19.86
EVAPOTRANSPIRATION	21.433	77802.391	68.70
PERC./LEAKAGE THROUGH LAYER 2	2.891656	10496.710	9.27
AVG. HEAD ON TOP OF LAYER 2	0.5060		
PERC./LEAKAGE THROUGH LAYER 16	4.732733	17179.820	15.17
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	-1.163	-4220.920	-3.73
SOIL WATER AT START OF YEAR	182.774	663468.187	
SOIL WATER AT END OF YEAR	181.279	658043.000	
SNOW WATER AT START OF YEAR	0.278	1007.907	0.89
SNOW WATER AT END OF YEAR	0.609	2212.158	1.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.047	0.00

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ANNUAL TOTALS FOR YEAR 88

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.86	184621.781	100.00
RUNOFF	16.381	59462.977	32.21
EVAPOTRANSPIRATION	27.175	98646.523	53.43
PERC./LEAKAGE THROUGH LAYER 2	6.401365	23236.955	12.59
AVG. HEAD ON TOP OF LAYER 2	1.1850		
PERC./LEAKAGE THROUGH LAYER 16	4.572701	16598.902	8.99
AVG. HEAD ON TOP OF LAYER 16	0.0040		
CHANGE IN WATER STORAGE	2.731	9913.400	5.37
SOIL WATER AT START OF YEAR	181.279	658043.000	
SOIL WATER AT END OF YEAR	183.026	664385.312	
SNOW WATER AT START OF YEAR	0.609	2212.158	1.20
SNOW WATER AT END OF YEAR	1.593	5783.250	3.13
ANNUAL WATER BUDGET BALANCE	0.0000	-0.012	0.00

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ANNUAL TOTALS FOR YEAR 89

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.25	120697.531	100.00
RUNOFF	6.403	23244.170	19.26
EVAPOTRANSPIRATION	23.208	84246.820	69.80
PERC./LEAKAGE THROUGH LAYER 2	5.097471	18503.820	15.33
AVG. HEAD ON TOP OF LAYER 2	0.9860		
PERC./LEAKAGE THROUGH LAYER 16	3.896293	14143.542	11.72
AVG. HEAD ON TOP OF LAYER 16	0.0037		

CHANGE IN WATER STORAGE	-0.258	-936.954	-0.78
SOIL WATER AT START OF YEAR	183.026	664385.312	
SOIL WATER AT END OF YEAR	184.361	669231.625	
SNOW WATER AT START OF YEAR	1.593	5783.250	4.79
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.052	0.00

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ANNUAL TOTALS FOR YEAR 90

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.41	157578.281	100.00
RUNOFF	11.434	41504.168	26.34
EVAPOTRANSPIRATION	26.622	96638.961	61.33
PERC./LEAKAGE THROUGH LAYER 2	4.615884	16755.660	10.63
AVG. HEAD ON TOP OF LAYER 2	0.7826		
PERC./LEAKAGE THROUGH LAYER 16	4.084929	14828.290	9.41
AVG. HEAD ON TOP OF LAYER 16	0.0037		
CHANGE IN WATER STORAGE	1.269	4606.996	2.92
SOIL WATER AT START OF YEAR	184.361	669231.625	
SOIL WATER AT END OF YEAR	184.374	669279.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.256	4559.583	2.89
ANNUAL WATER BUDGET BALANCE	0.0000	-0.128	0.00

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ANNUAL TOTALS FOR YEAR 91

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.30	153549.031	100.00
RUNOFF	10.444	37910.250	24.69

EVAPOTRANSPIRATION	26.795	97265.469	63.34
PERC./LEAKAGE THROUGH LAYER 2	4.899104	17783.746	11.58
AVG. HEAD ON TOP OF LAYER 2	0.9213		
PERC./LEAKAGE THROUGH LAYER 16	4.058542	14732.507	9.59
AVG. HEAD ON TOP OF LAYER 16	0.0037		
CHANGE IN WATER STORAGE	1.003	3640.743	2.37
SOIL WATER AT START OF YEAR	184.374	669279.062	
SOIL WATER AT END OF YEAR	185.568	673611.812	
SNOW WATER AT START OF YEAR	1.256	4559.583	2.97
SNOW WATER AT END OF YEAR	1.065	3867.545	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	0.057	0.00

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ANNUAL TOTALS FOR YEAR 92

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.10	160083.000	100.00
RUNOFF	11.808	42861.836	26.77
EVAPOTRANSPIRATION	24.441	88719.805	55.42
PERC./LEAKAGE THROUGH LAYER 2	6.666523	24199.479	15.12
AVG. HEAD ON TOP OF LAYER 2	1.5985		
PERC./LEAKAGE THROUGH LAYER 16	4.742084	17213.764	10.75
AVG. HEAD ON TOP OF LAYER 16	0.0040		
CHANGE IN WATER STORAGE	3.109	11287.459	7.05
SOIL WATER AT START OF YEAR	185.568	673611.812	
SOIL WATER AT END OF YEAR	187.217	679598.937	
SNOW WATER AT START OF YEAR	1.065	3867.545	2.42
SNOW WATER AT END OF YEAR	2.526	9167.907	5.73
ANNUAL WATER BUDGET BALANCE	0.0000	0.130	0.00

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ANNUAL TOTALS FOR YEAR 93

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.77	126215.102	100.00
RUNOFF	11.182	40588.918	32.16
EVAPOTRANSPIRATION	21.857	79339.219	62.86
PERC./LEAKAGE THROUGH LAYER 2	4.365524	15846.854	12.56
AVG. HEAD ON TOP OF LAYER 2	0.8480		
PERC./LEAKAGE THROUGH LAYER 16	5.057392	18358.334	14.55
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	-3.325	-12071.355	-9.56
SOIL WATER AT START OF YEAR	187.217	679598.937	
SOIL WATER AT END OF YEAR	186.380	676559.937	
SNOW WATER AT START OF YEAR	2.526	9167.907	7.26
SNOW WATER AT END OF YEAR	0.037	135.546	0.11
ANNUAL WATER BUDGET BALANCE	0.0000	-0.017	0.00

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ANNUAL TOTALS FOR YEAR 94

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.86	130171.789	100.00
RUNOFF	7.176	26050.176	20.01
EVAPOTRANSPIRATION	23.801	86397.656	66.37
PERC./LEAKAGE THROUGH LAYER 2	4.551587	16522.260	12.69
AVG. HEAD ON TOP OF LAYER 2	0.8297		
PERC./LEAKAGE THROUGH LAYER 16	4.788529	17382.361	13.35
AVG. HEAD ON TOP OF LAYER 16	0.0041		
CHANGE IN WATER STORAGE	0.094	341.688	0.26
SOIL WATER AT START OF YEAR	186.380	676559.937	

SOIL WATER AT END OF YEAR	186.015	675232.750	
SNOW WATER AT START OF YEAR	0.037	135.546	0.10
SNOW WATER AT END OF YEAR	0.497	1804.420	1.39
ANNUAL WATER BUDGET BALANCE	0.0000	-0.095	0.00

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ANNUAL TOTALS FOR YEAR 95

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.32	139101.641	100.00
RUNOFF	10.450	37931.758	27.27
EVAPOTRANSPIRATION	22.267	80827.398	58.11
PERC./LEAKAGE THROUGH LAYER 2	5.434979	19728.973	14.18
AVG. HEAD ON TOP OF LAYER 2	1.1340		
PERC./LEAKAGE THROUGH LAYER 16	6.328286	22971.678	16.51
AVG. HEAD ON TOP OF LAYER 16	0.0051		
CHANGE IN WATER STORAGE	-0.724	-2629.223	-1.89
SOIL WATER AT START OF YEAR	186.015	675232.750	
SOIL WATER AT END OF YEAR	185.787	674407.937	
SNOW WATER AT START OF YEAR	0.497	1804.420	1.30
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.031	0.00

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ANNUAL TOTALS FOR YEAR 96

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.21	160482.250	100.00
RUNOFF	12.795	46447.363	28.94
EVAPOTRANSPIRATION	25.316	91898.187	57.26
PERC./LEAKAGE THROUGH LAYER 2	5.666593	20569.732	12.82

AVG. HEAD ON TOP OF LAYER 2	0.9986		
PERC./LEAKAGE THROUGH LAYER 16	5.351912	19427.441	12.11
AVG. HEAD ON TOP OF LAYER 16	0.0045		
CHANGE IN WATER STORAGE	0.746	2709.216	1.69
SOIL WATER AT START OF YEAR	185.787	674407.937	
SOIL WATER AT END OF YEAR	185.870	674707.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.664	2409.947	1.50
ANNUAL WATER BUDGET BALANCE	0.0000	0.047	0.00

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ANNUAL TOTALS FOR YEAR 97

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.67	125852.109	100.00
RUNOFF	9.774	35478.922	28.19
EVAPOTRANSPIRATION	20.927	75964.094	60.36
PERC./LEAKAGE THROUGH LAYER 2	4.503162	16346.478	12.99
AVG. HEAD ON TOP OF LAYER 2	0.8749		
PERC./LEAKAGE THROUGH LAYER 16	4.880668	17716.824	14.08
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	-0.911	-3307.698	-2.63
SOIL WATER AT START OF YEAR	185.870	674707.187	
SOIL WATER AT END OF YEAR	185.622	673809.437	
SNOW WATER AT START OF YEAR	0.664	2409.947	1.91
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.036	0.00

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ANNUAL TOTALS FOR YEAR 98

	INCHES	CU. FEET	PERCENT
PRECIPITATION	36.29	131732.687	100.00
RUNOFF	9.987	36252.687	27.52
EVAPOTRANSPIRATION	20.855	75704.492	57.47
PERC./LEAKAGE THROUGH LAYER 2	5.018982	18218.904	13.83
AVG. HEAD ON TOP OF LAYER 2	0.9879		
PERC./LEAKAGE THROUGH LAYER 16	4.508518	16365.921	12.42
AVG. HEAD ON TOP OF LAYER 16	0.0040		
CHANGE IN WATER STORAGE	0.939	3409.546	2.59
SOIL WATER AT START OF YEAR	185.622	673809.437	
SOIL WATER AT END OF YEAR	185.797	674442.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.765	2776.667	2.11
ANNUAL WATER BUDGET BALANCE	0.0000	0.042	0.00

ANNUAL TOTALS FOR YEAR 99

	INCHES	CU. FEET	PERCENT
PRECIPITATION	27.65	100369.508	100.00
RUNOFF	6.627	24054.334	23.97
EVAPOTRANSPIRATION	17.037	61845.281	61.62
PERC./LEAKAGE THROUGH LAYER 2	3.659039	13282.310	13.23
AVG. HEAD ON TOP OF LAYER 2	0.6332		
PERC./LEAKAGE THROUGH LAYER 16	5.361317	19461.580	19.39
AVG. HEAD ON TOP OF LAYER 16	0.0043		
CHANGE IN WATER STORAGE	-1.375	-4991.689	-4.97
SOIL WATER AT START OF YEAR	185.797	674442.312	
SOIL WATER AT END OF YEAR	184.540	669878.500	
SNOW WATER AT START OF YEAR	0.765	2776.667	2.77

SNOW WATER AT END OF YEAR	0.647	2348.787	2.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

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ANNUAL TOTALS FOR YEAR 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.109	100.00
RUNOFF	11.932	43313.395	31.51
EVAPOTRANSPIRATION	20.976	76143.320	55.39
PERC./LEAKAGE THROUGH LAYER 2	3.827827	13895.013	10.11
AVG. HEAD ON TOP OF LAYER 2	0.6585		
PERC./LEAKAGE THROUGH LAYER 16	5.134336	18637.639	13.56
AVG. HEAD ON TOP OF LAYER 16	0.0044		
CHANGE IN WATER STORAGE	-0.173	-626.280	-0.46
SOIL WATER AT START OF YEAR	184.540	669878.500	
SOIL WATER AT END OF YEAR	183.348	665553.125	
SNOW WATER AT START OF YEAR	0.647	2348.787	1.71
SNOW WATER AT END OF YEAR	1.666	6047.865	4.40
ANNUAL WATER BUDGET BALANCE	0.0000	0.033	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.32	1.60	2.77	3.99	4.41	4.57
	4.52	3.44	3.33	2.85	2.78	2.06
STD. DEVIATIONS	0.57	0.81	1.19	1.74	2.04	2.13
	2.24	1.76	1.79	1.62	1.51	1.02

RUNOFF						
TOTALS	0.357	1.683	2.475	1.189	0.716	0.627
	0.788	0.424	0.536	0.542	0.712	0.626
STD. DEVIATIONS	0.531	1.175	1.681	1.354	1.062	0.925
	1.135	0.708	0.943	0.833	0.992	0.798
EVAPOTRANSPIRATION						
TOTALS	0.423	0.347	0.812	2.752	3.294	3.568
	3.433	2.808	2.169	1.411	0.885	0.459
STD. DEVIATIONS	0.096	0.094	0.526	0.764	1.082	1.169
	1.179	1.129	0.822	0.407	0.240	0.144
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	0.0085	0.0214	0.3005	0.6204	0.4675	0.3620
	0.3480	0.3017	0.3723	0.6321	0.7697	0.3662
STD. DEVIATIONS	0.0459	0.0503	0.3242	0.3232	0.2533	0.2109
	0.2212	0.2203	0.3069	0.3774	0.4136	0.3221
PERCOLATION/LEAKAGE THROUGH LAYER 16						
TOTALS	0.5064	0.4494	0.4711	0.4415	0.4533	0.4351
	0.4523	0.4356	0.3988	0.4095	0.3970	0.4356
STD. DEVIATIONS	0.7042	0.5962	0.6197	0.5740	0.5633	0.5174
	0.5102	0.4860	0.3983	0.3987	0.3753	0.3637

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2						
AVERAGES	0.0095	0.0307	0.7041	1.4892	0.9675	0.7250
	0.7029	0.5753	0.8688	1.4520	2.0595	0.7034
STD. DEVIATIONS	0.0806	0.1265	0.8759	1.0698	0.7078	0.5310
	0.5679	0.5258	0.8929	1.1932	1.4242	0.8682
DAILY AVERAGE HEAD ON TOP OF LAYER 16						
AVERAGES	4.7579	4.3753	4.0532	3.7949	3.4635	3.2126
	2.9962	2.7766	2.1666	1.9976	1.8511	1.7119
STD. DEVIATIONS	33.9717	31.4665	28.9964	27.1715	25.4128	23.9916
	22.6485	21.1772	16.0427	15.1400	14.1578	13.2514

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     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH  100
------------------------------------------------------------------------------
                                      INCHES            CU. FEET       PERCENT
                                  ------------------   ------------   ---------
 PRECIPITATION                    37.63    (   6.150)     136610.0     100.00

 RUNOFF                           10.675   (  3.6334)      38750.06     28.365

 EVAPOTRANSPIRATION               22.362   (  2.9223)      81172.93     59.419

 PERCOLATION/LEAKAGE THROUGH       4.57037 (  1.15688)     16590.461    12.14440
   LAYER  2

 AVERAGE HEAD ON TOP               0.857 (    0.294)
   OF LAYER  2

 PERCOLATION/LEAKAGE THROUGH       5.28572 (  5.91040)     19187.180    14.04523
   LAYER 16

 AVERAGE HEAD ON TOP               3.096 (   22.767)
   OF LAYER 16

 CHANGE IN WATER STORAGE          -0.689   (  6.0758)      -2500.19     -1.830
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               PEAK DAILY VALUES FOR YEARS    1 THROUGH  100
   ------------------------------------------------------------------------
                                                (INCHES)      (CU. FT.)
                                               ----------   -------------
      PRECIPITATION                              4.76         17278.801

      RUNOFF                                     3.282        11913.5703

      PERCOLATION/LEAKAGE THROUGH LAYER  2       0.045354       164.63403

      AVERAGE HEAD ON TOP OF LAYER  2            6.000

      PERCOLATION/LEAKAGE THROUGH LAYER 16       0.220966       802.10681

      AVERAGE HEAD ON TOP OF LAYER 16          329.766

      SNOW WATER                                 6.05         21966.1543


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                 0.4710

      MINIMUM VEG. SOIL WATER (VOL/VOL)                 0.2100
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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.6970	0.4495
2	7.6860	0.4270
3	1.4038	0.2340
4	2.4388	0.2710
5	4.9938	0.2938
6	8.7774	0.2582
7	18.2947	0.2690
8	20.3961	0.2684
9	16.0989	0.2683
10	37.5933	0.2764
11	18.4099	0.2707
12	9.3201	0.2741
13	4.8248	0.2838
14	2.5906	0.2878
15	1.1229	0.1871
16	26.7000	0.4450
SNOW WATER	1.666	

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Appendix C.
Slope and Stability Calculations

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This package summarizes the preliminary geotechnical analyses performed in support of the 30% Ash Pond No. 1 and Ash Pond No. 2 Closure Design submittal for the Duck Creek Plant. The following information and analyses are presented herein:

- Summary of Subsurface Investigation
- Summary of Subsurface Conditions
- Cover Settlement Analyses
- Embankment Slope Stability Analyses

Figures, calculation results, and computer program outputs are provided as attachments and are referenced herein.

I. Summary of Subsurface Investigation

A subsurface exploration was performed at Ash Pond No. 1 and Ash Pond No. 2, including 16 soil borings at Ash Pond No. 1 and 16 soil borings at Ash Pond No. 2. The borings were paired with one boring drilled at the crest of the embankment and the companion boring drilled near the toe of the embankment slope. In addition, two temporary groundwater level observation wells were installed at the crest of Ash Pond No. 1 and two such wells were installed at the crest of Ash Pond No. 2 to monitor groundwater levels. The borings were drilled by AECOM's subcontractor Frontz Drilling, of Wooster, Ohio, under the full-time supervision of AECOM geotechnical personnel. Frontz used a CME 750 All-Terrain Vehicle-mounted drill rig, in conjunction with 3-¼ inch inner diameter hollow stem augers to drill the borings.

Borings drilled on the crest of the embankments extended to depths ranging between 57 and 61.5 feet below ground surface. Borings drilled near the toe of the embankment extended to depths ranging between 40 and 42. 5 feet below ground surface. Boring locations are depicted in **Figure F-1** (Ash Pond No.1) and **Figure F-2** (Ash Pond No. 2).

Representative soil samples were collected from each of the borings for classification and/or testing. The soil samples were obtained by Standard Penetration Testing (SPT) with a split-spoon sampler, in general accordance with ASTM D 1586 and by pushing 3-inch outside diameter steel (Shelby) tubes.

The field investigation was complimented by a laboratory testing program. The program was designed to establish the index and engineering properties of the soils encountered at the site, with a focus on establishing the parameters pertinent to the pond closure design (including shear strength of the soils for use in slope stability analyses, and compressibility of the soils underlying the site, for use in cover settlement analyses). The program included the following tests:

Index Tests:

- Moisture Content
- Atterberg Limits
- Unit Weight

Strength Tests:

- Consolidated-Undrained Triaxial Testing
- Unconfined Compressive Strength

In addition to our investigation, AECOM reviewed historical geotechnical information that was available in the owner's files. This information included boring location map and boring logs for the subsurface investigation performed in 1985 by Gilbert/Commonwealth (Reference 1) to support the original design of Ash Pond No. 2. This information included 29 borings and 12 groundwater level observation wells. The information in the report includes boring logs and extensive laboratory test data. The report also includes stability analysis of the embankment. Historic information also includes a slope stability analysis conducted in April 2013 by Geotechnology (Reference 2) in support of the Ash Pond No. 1 and Ash Pond No. 2 closure design prepared jointly by Geotechnology and CDG Engineers. The subsurface profile revealed by the historical borings was similar to that encountered by AECOM in the current investigation, and the historical borings were therefore used to supplement the current data in our evaluations.

II. Summary of Subsurface Conditions

The historic topographic plans and borings show that both ash ponds are constructed over a thick layer of mine spoils. Historic construction plans show that the pond embankments were constructed using mine spoils excavated within the footprint of the ponds. Consequently, the texture of the embankment and underlying mine spoils is similar. The generalize soil profile at the pond sites is listed below (soil layers are listed from highest elevation to lowest):

Fine-Grained Embankment Fill Materials: The perimeter embankments at both ash ponds are largely comprised of fine-grained soil fills classified as lean clay (CL). The clays generally had a stiff to very stiff consistency and appeared to be well-compacted materials. Measured liquid limits on the embankment soils range between 32 and 40. Of the 49 samples tested for water content, all by two had water contents between 13 and 25.

Ponded Ash Materials: Sluiced ash materials are present in both ponds. CCR materials have been placed above the crest elevation of the embankment in approximately the southern 2/3 of Ash Pond No. 1 and in approximately the southern 1/3 of Ash Pond No. 2. CCR materials are not saturated above approximately the crest elevation of the embankments.

Foundation Soils: The foundation soils at the ponds are composed of mine spoils consisting of a mixture of the native loess and glacial till soils and, to a lesser extent, the underlying (primarily shale) bedrock. Measured liquid limits (from tests received to date) typically ranged between 24 and 49; thus, the great majority of the spoils classify as low plastic clay. The only boring where high plastic soils were encountered is Boring B-019. Samples from this boring obtained at depths of 34 and 54 feet below ground surface had liquid limits of 52 and 58, respectively. Measured water contents of the foundation soils ranged between 11 and 30 percent.

Bedrock: Few of the recent AECOM borings or historic borings extend to bedrock. Top of bedrock elevations are only available in the area of Ash Pond No. 2. A cross section prepared by Gilbert/Commonwealth (Reference 1) shows that top of bedrock elevations at this pond location range between approximately 540 and 555. The bedrock is described as gray silty shale.

Groundwater Table: Water from Ash Pond No. 1 is periodically pumped to Ash Pond No. 2. The existing principal spillway in Ash Pond No. 2 is blocked, so water is removed by a temporary pump. The existing pumping system is insufficient to unwater the ponds, so free water exists in the northern 1/3 of Ash Pond No. 1 and the northern 2/3 of Ash Pond No. 2. Water levels in the ash ponds vary with precipitation and pumping frequency and rates. For the purpose of the slope stability analysis, the water level in the ash pond was assumed to be at the flow line of the perimeter ditches on the inside of the embankments.

Information on groundwater levels in the mine spoils in the area of the ash ponds is available from periodic groundwater monitoring reports prepared for the owner by Hanson Engineering (Hanson). Piezometric levels from measurements made by Hanson on September 14 and 15, 2015 are shown in Figure 8 of their October 21, 2015 report (Reference 3). The data show that groundwater in the vicinity of the ash ponds flows toward the Duck Creek Cooling Pond located east of the impoundments or to Long Lake located west of the impoundments.

AECOM installed four temporary groundwater level observation wells in the crest of the embankments during our August 2105 subsurface investigation. Wells were installed at Borings DUC-003 and DUC-011 drilled for Ash Pond No. 1 and at Borings DUC-021 and DUC-029 for Ash Pond No. 2. The wells were screened from 10 to 40 feet below ground surface. The wells were installed between August 4 and 6, 2015 and were read daily until August 23, 2015. Water was not measured at any of the wells, and the wells were abandoned on August 23, 2015. Well abandonment included removing the well screen and casing and backfilling each boring with bentonite chips and soil cuttings.

III. Cover Settlement Analysis

The proposed crown fill and cap materials (which are to be up to approximately 20 ft thick in some areas) will surcharge the ash and mine spoil materials that they are placed over. These materials are expected to have a moderate (mine spoils) to high (sluiced ash) compressibility. Long-term settlement of the soil cover could alter the as-constructed surface slopes, and short-

term settlement (during construction) will affect the quantity of fill materials that are necessary to build the crown.

Settlements were calculated for each pond where the thickness of the crown fill is the greatest. These locations are located within the currently ponded area at the north end of Ash Pond No. 1 and in the vicinity of the principal spillway in Ash Pond No. 2. Recent bathymetric surveys show that the bottom of the ponded area in Ash Pond No. 1 is near elevation 623 feet. Final grades shown on the 30% complete closure plans are as high as 637 feet in this portion of Ash Pond No. 1, so the thickness of new material, including the two-foot thick soil cover is approximately 16 feet. A comparison between the recent bathometric survey of Ash Pond No. 2 and the final cover grades depicted in the 30% complete closure plans shows that thickness of new materials (including the soil cover) that will be placed in the vicinity of the principal spillway is approximately 20 feet. The locations described above were selected for settlement analysis since they represent the conditions that exist where the thickness of the material needed to achieve final grade elevations is greatest.

The following points summarize the methodology employed in the settlement analysis:

- The sources of the surcharge that will induce settlement are the weight of the crown fill and cover soil. The soil cover will be constructed of suitable borrow materials obtained from on-site. The CCR materials that will be placed to achieve the crown fill were conservatively assumed to have a total unit weight of 100 pcf, and cap soil was assumed to have a total unit weight of 120 pcf. The surcharge loading at any point from each material was taken as the unit weight of the material times its thickness above existing grades.

- Classical settlement theory was used herein to estimate settlements of each stratum. For ash and mine spoils materials, the following equation applies:

$$s_i = \frac{H_i C_c}{1+e_0} \log \frac{\sigma_0' + \Delta\sigma}{\sigma_p'}$$

Where,

H_i = Thickness of layer
C_c = Compression Index of layer
e_0 = Initial void ratio at layer
σ_0' = Effective overburden pressure at layer center
σ_p' = Effective preconsolidation pressure
$\Delta\sigma$ = Surcharge pressure at layer center, γz

- The various compressibility parameters were selected on the basis of laboratory tests, field borings, and using engineering judgment. The ash and mine spoils were conservatively

assumed to be normally consolidated. **Table F-1** below summarizes the parameters used in the calculations.

Table F-1: Compressibility Parameters Used In Settlement Analyses

Layer	γ (pcf)	e_0	C_r	C_c
Ponded Ash (above water table)	100	1.35	0.016	0.12
Mine Spoils	120	0.47	0.04	0.20

- Time rate of settlement analyses have not yet been performed at this 30% design stage. Herein, we have assumed that the sluiced fly ash materials within the ponds will consolidate relatively rapidly, and a majority of the settlement in the ash will occur during the course of crown and cap construction. Therefore, while the settlement of these layers will necessitate additional fill placement (to "recover" the grade lost to settlement), they will not contribute to long term reduction of slope grades of the surface cap. It is assumed that the mine spoils will experience slower consolidation, and the settlement from this stratum could contribute to long-term slope changes of the surface cover. The project specifications that will be prepared for subsequent submittals as the design advances should require a 6 to 8 week pause between the time that the crown fill is placed and the placement of the soil cover. The majority of the settlement of the mine spoil is expected to occur over this time period.

Results of Settlement Analysis

The results and conclusions of the settlement analysis are summarized as follows:

- Computed long-term settlements in the mine spoils range in Pond No. 1 are approximately 1/2 foot where the thickness of new material is greatest. Computed settlement of the mine spoils at Pond No. 2 is approximately 1.5 feet where the thickness of new materials is 20 feet and approximately 0.8 feet where the thickness of new materials in 10 feet. These magnitudes indicate that only a nominal loss of surface slope is expected to occur long-term provided that the pause described above is implemented.
- Calculated short-term settlement of the ponded CCR in Ash Pond No. 1 is approximately 1 foot. Calculated short-term settlement of ponded CCR in Ash Pond No. 2 is approximately 1 foot and 0.6 feet where the thickness of new material is 20 and 10 feet, respectively.

IV. Embankment Slope Stability Analyses

For the 30% design submittal, limit-equilibrium slope stability analyses have been performed at four representative cross-sections for each impoundment. The locations are identified as A through D for Ash Pond No. 1 and E through H for Ash Pond No. 2. The locations of the Cross Sections are shown in **Figures F-3** and **Figure F-4**.

Analyses were performed using Spencer's Method which is a limit equilibrium slope stability analysis procedure that satisfies all conditions of equilibrium. The computer program SLOPE/W by Geo-Slope International was utilized for analyzing the static operating case. Selected more critical sections were also analyzed using the computer program UTEXAS4 to check the results obtained using the SLOPE/W program. The UTEXAS4 program was used to analyze the seismic case since this program uses the two stage method needed for seismic screening analysis. Both programs analyze a large number of potential slip surface geometries and identify the geometry that results in a critical (i.e. lowest) factor of safety (FS). Each cross section was analyzed for the following cases:

Static Operating Case: This case models the closed ponds under static, long-term conditions. Drained (effective stress) shear strength parameters were used for all materials, and phreatic conditions were estimated based on the available piezometer data. The Programmatic Document (PD) target for this analysis case is a factor of safety greater than 1.5.

Seismic Case: This case is a screening analysis that models the closed ponds under horizontal seismic load (pseudo-static) conditions and is appropriate for sites where liquefaction and strength loss during seismic loading will not occur. The results are compared to criteria developed from deformation analysis of case histories of similar structures subjected to earthquake loading. The design earthquake is an event with 2% probability of exceedance in 50 years (recurrence interval of approximately 2500 years). The purpose of the seismic stability screening analysis is to assess whether more detailed deformation analyses should be performed. A two stage analysis is conducted in which the effective stress strength is used in the first stage to estimate effective normal stresses on the shear surface. These effective normal stresses are then used in the second stage analysis to estimate the appropriate consolidated undrained strength available during the seismic loading. The PD target for the pseudo-static (seismic) screening slope stability analysis is a factor of safety greater than 1.0.

The maximum height of new materials to be placed in the north end of both Ash Pond No. 1 and Ash Pond No. 2 will approximate 20 feet. This material will be placed over an approximately 3 year period; consequently, the end-of-construction (undrained analysis) case was not analyzed.

Models were established based on the following methodology:

- ***Surface Geometry:*** Surface topography corresponded to the proposed grades, as depicted in the 30% plans.

- ***Subsurface Stratigraphy:*** Stratigraphy for each cross-section was based on the pertinent borings (both new AECOM borings and high-quality historical borings) that are in the vicinity of each cross-section. Groundwater tables were modeled as piezometric lines in SLOPE/W, with elevations and configuration of the lines primarily established based on observed water levels in the pond and groundwater elevations present in the most recent groundwater monitoring report prepared by Hanson (Reference 3).

- ***Pseudo Static Analysis:*** A pseudo-static (seismic) screening slope stability analysis was performed using the following approach (after the PD) to select the seismic coefficient (k_h) for the analysis:

    - The peak ground acceleration on rock $(PGA)_{rock}$ was selected based on USGS seismic hazards maps corresponding to a 2% probability of exceedance in 50 years. The web site: http://earthquake.usgs.gov/hazards/apps/ and the 2008 Hazards Curves were used to obtain these values.

    - The free-field, peak ground surface horizontal acceleration $(PGA)_{design}$ was obtained from $(PGA)_{rock}$ using the site class from the 2003 IBC (Reference 4) and site class amplification factors from the National Earthquake Hazards Reduction Program (NEHRP 2009, Reference 5). Excerpts from IBC (2003) and NEHRP (2009) are provided in **Figures F-5** and **Figure F-6**, respectively. The Site Class for the free-field soils (i.e. soils below the toe of the dike) is based on the IBC procedure in **Figure F-5**. Once the Site Class from IBC has been determined, the F_{PGA} values from **Figure F-6** were used to calculate $(PGA)_{design}$ from $(PGA)_{rock}$ where:

    - $(PGA)_{design} = F_{PGA} \times (PGA)_{rock}$. The $(PGA)_{design}$ is also equal to the Peak Transverse Base Acceleration at the base of the dike noted in **Figure F-7**.

    - The Peak Transverse Acceleration at the dike crest, $(PGA)_{crest}$, was determined using **Figure F-7** developed by Idriss for $(PGA)_{crest}$ versus the Peak Transverse Base Acceleration (PGA_{design}) for screening level analyses (Reference 6)

    - The seismic coefficient k_h was selected from the Makdisi-Seed procedure (see **Figure F-8**) which is a function of the $(PGA)_{crest}$ and the depth of the failure surface below the crest of the dike (Reference 7). For full height failure surfaces (i.e. extending from the dike crest to the dike toe), $k_h = 0.34(PGA)_{crest}$

    - If the resulting screening pseudo-static analysis FS value is 1.0 or more, the seismic analysis is complete, per the PD.

- ***Material Properties:*** Unit weight and shear strength parameters were established on the basis of laboratory testing and on field test results from the borings. Drained strength test for the mine spoils and embankment fill were obtained from published correlations with plasticity index (Reference 8). Drained cohesion values were obtained from information gathered by the United States Bureau of Reclamation and published by Duncan et. al. (Reference 9). Strength properties for bedrock are based on direct shear tests provided in historic geotechnical reports prepared for Ash Pond No. 2. Undrained shear strengths for the embankment materials and mine spoils needed for the strength curves required for the two-stage seismic analysis were obtained for consolidated-undrained triaxial shear tests. **Table F-2** summarizes the shear strength parameters used in the slope stability analyses. For the two stage seismic analysis, procedures used for estimating the undrained strength relationship vs the normal stress were based on equations developed by Duncan, Wright, and Wong, 1990 (included in Duncan et.al, Ref 9).

Table F-2: Soil Parameters Used In Slope Stability Analyses

Layer	γ **(pcf)**	***Effective Stress Strength Envelope***		***Consolidated Undrained Strength Envelope***	
		ϕ***' (deg)***	***c' (psf)***	ϕ ***(deg)***	***c (psf)***
Embankment Fill and Soil Cap	125	30	225	15	500
Ponded Ash	100	27	0	25	20
Mine Spoils	120	30	100	15	250
Bedrock	130	26	300	13	600

Results of Stability Analysis

Table F-5 summarizes the results of the stability analyses for each section, and output figures from the slope models are provided at the back of this document.

Table F-3 – Results of Slope Stability Analysis – Ash Pond No. 1

Loading Case	**Program Criteria**	***Cross Section A***	***Cross Section B***	***Cross Section C***	***Cross Section D***
Static, Operating	FS ≥ 1.5	2.4	2.6	2.0	2.0
Seismic (screening)	FS ≥ 1.0	1.2	1.7	1.1	1.1

Table F-4 – Results of Slope Stability Analysis – Ash Pond No. 2

Loading Case	**Program Criteria**	**Cross Section E**	**Cross Section F**	**Cross Section G**	**Cross Section H**
Static, Operating	FS ≥ 1.5	2.4	2.1	2.0	2.7
Seismic (screening)	FS ≥ 1.0	1.1	1.1	1.2	1.4

The results indicate that all sections have acceptable factors of safety for all cases. Therefore, at the present design stage, we anticipate that slope stabilization measures will not be required for the closure design, and such measures are not depicted in the 30% plans.

V. References

1. Gilbert/Commonwealth Central Illinois Light Company Duck Creek Station Unit 1 Waste Disposal Extension Final Design January, 1985.

2. Geotechnology, Inc. Bid Package A&B Closure Plan Ash Ponds 1 and 2 Closure Duck Creek Power Station April 2013.

3. Hanson Professional Services, Inc. Second Period 2015 Groundwater Report Duck Creek Station – Ash Pond No. 1 and Ash Pond No. 2. October 21, 2015.

4. International Code Council, (2003), 2003 International Building Code.

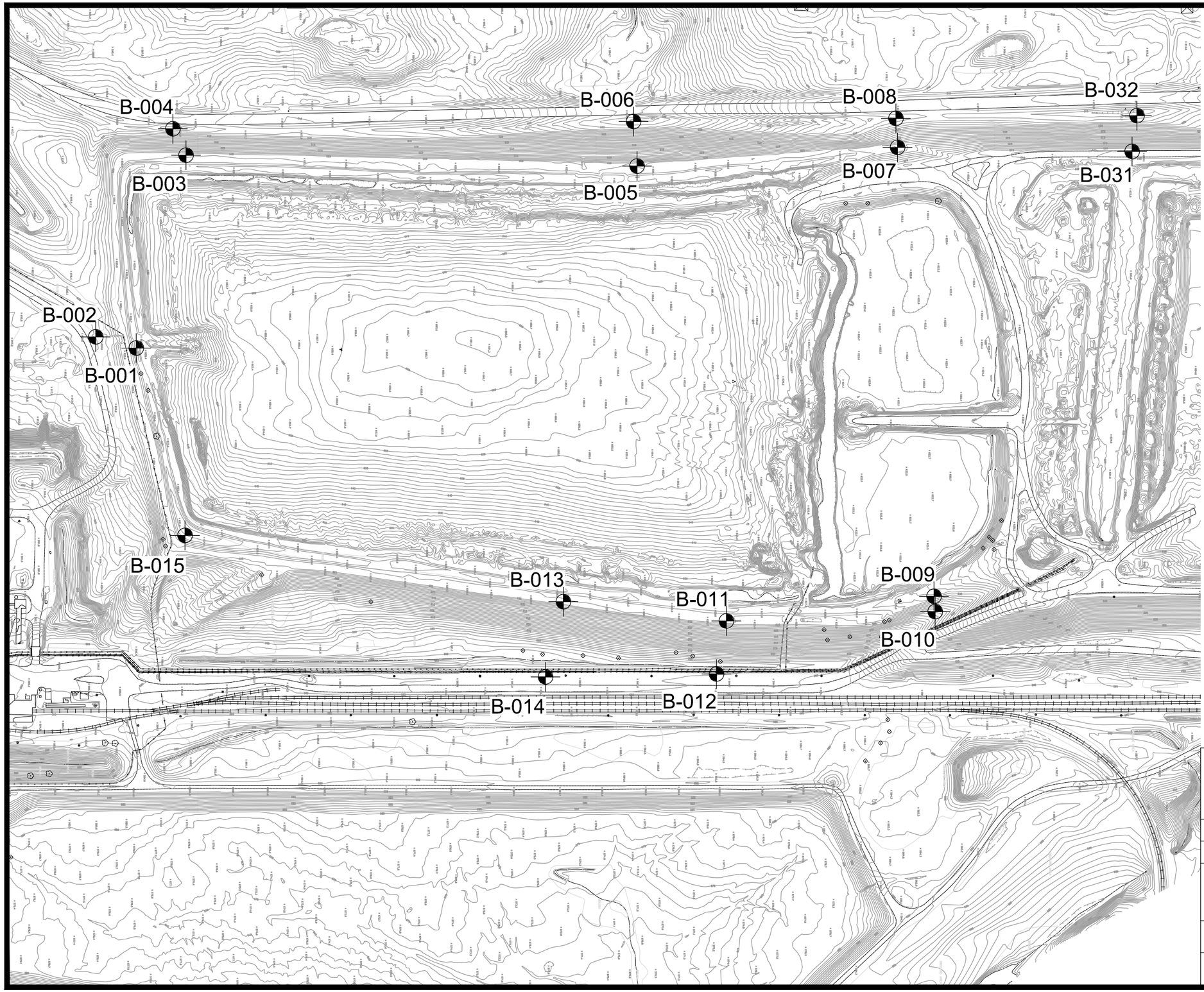
5. NEHRP (National Earthquake Hazards Reduction Program), (2009) Recommended Seismic Provisions for New and Other Structures, (FEMA P-750), 2009 Edition.

6. Idriss, I.M., (2015), Personal Communication.

7. Makdisi, F.I., Seed, H.B., (1977) "A Simplified Procedure for Estimating Earthquake Induced Deformation in Dams and Embankments", Report No. UBC-EERI-77/19, Earthquake Engineering Research Center, August, 1977.

8. Duncan, J.M., Horz, R.C., Yang, T.L. Shear Strength Correlations for Geotechnical Engineering, The Charles E. Via, Jr. Department of Civil Engineering, Virginia Polytechnic Institute and State University, 1989.

9. Duncan, M.J.; Wright, S.G.; Brandon, T.L. Soil Strength and Slope Stability, John Wiley, 2nd Edition, 2014.



N

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SCALE IN FEET

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8300 College Boulevard, Suite 200
Overland Park, Kansas 66210

CLIENT: ILLINOIS POWER RESOURCES GENERATING, LLC.

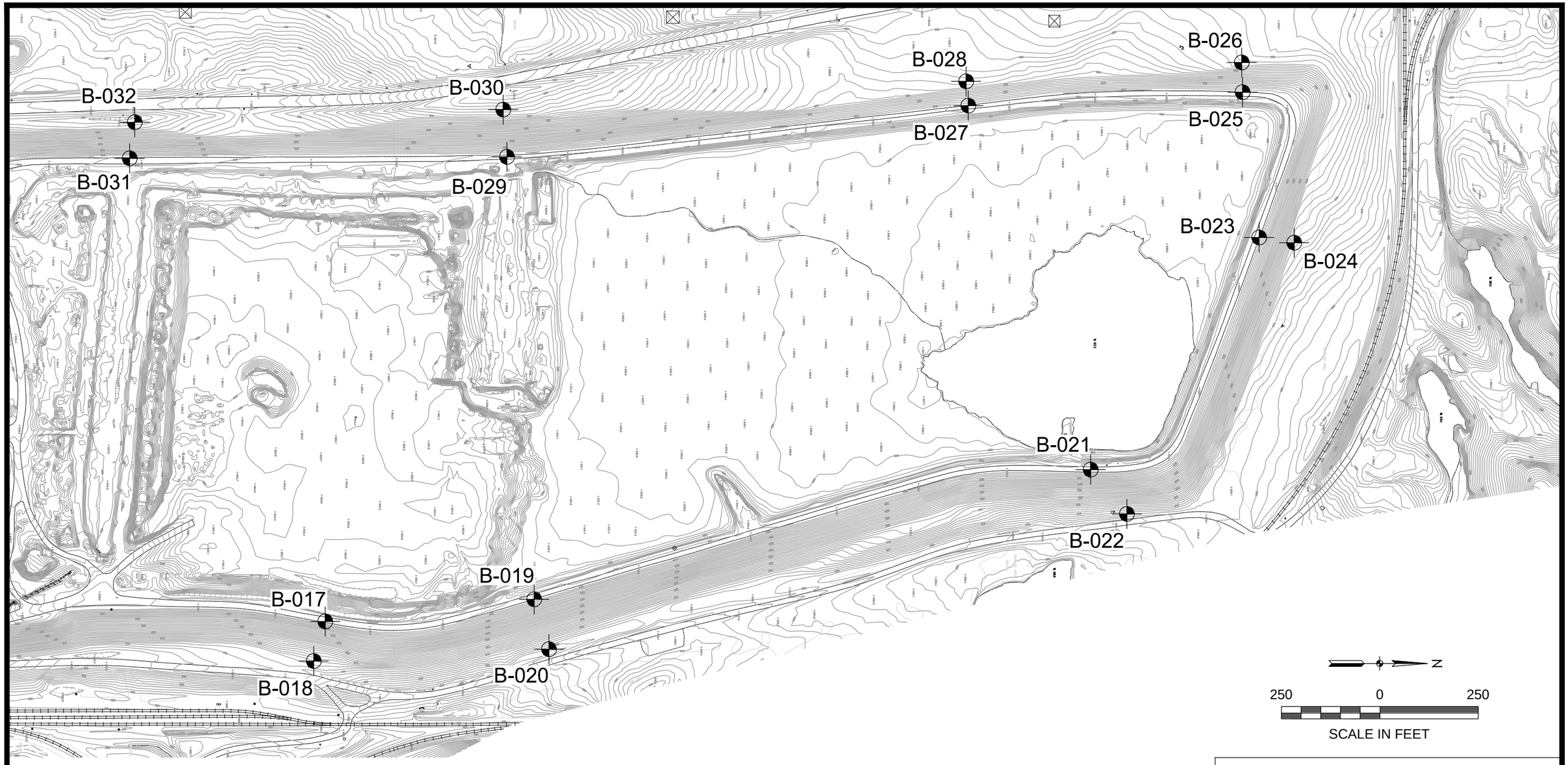
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PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	F-1

December 8, 2015 1:50.02 pm (mik)



December 8, 2015 4:00.58 pm (mik)

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8300 College Boulevard, Suite 200
Overland Park, Kansas 66210

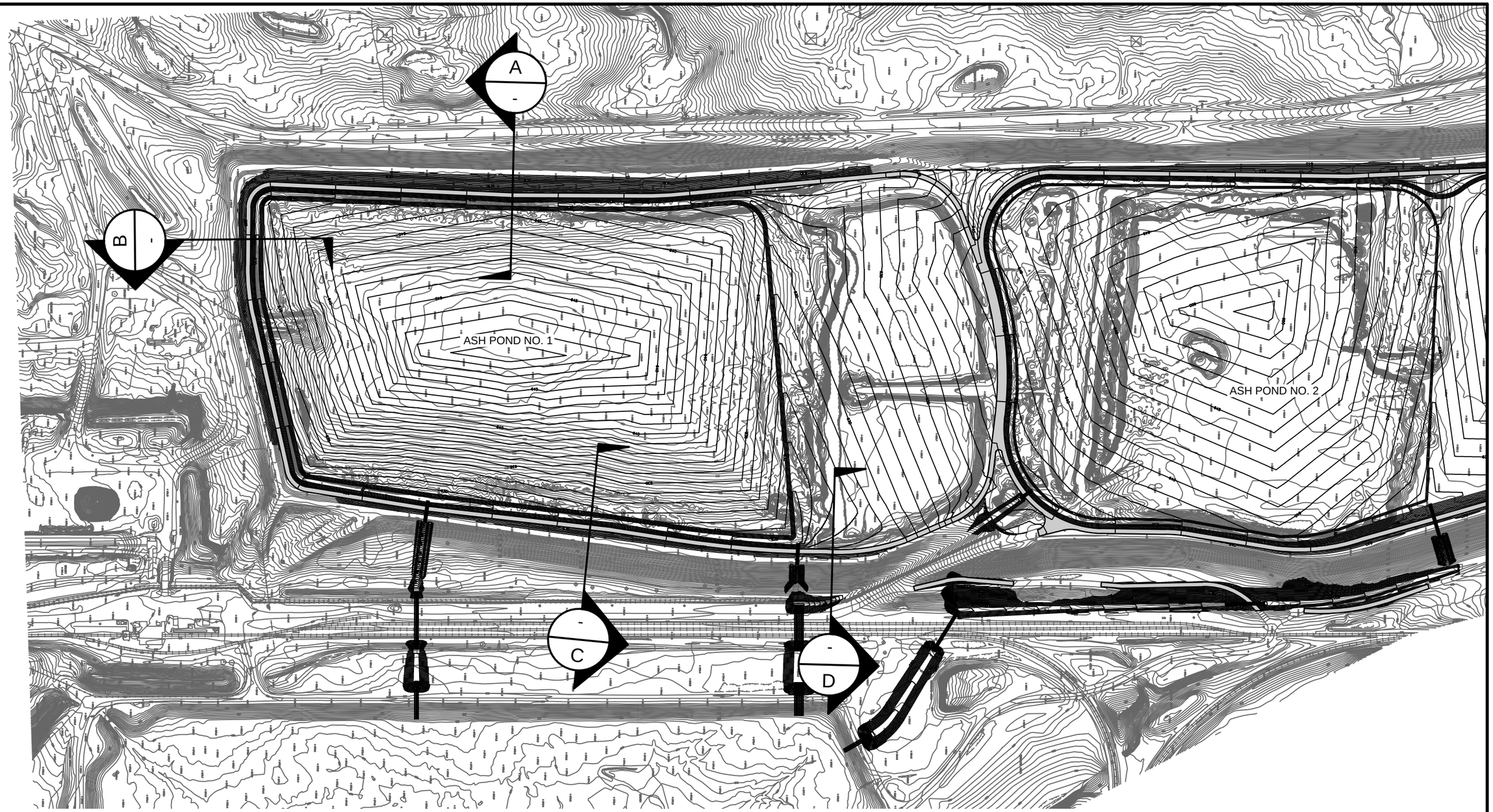
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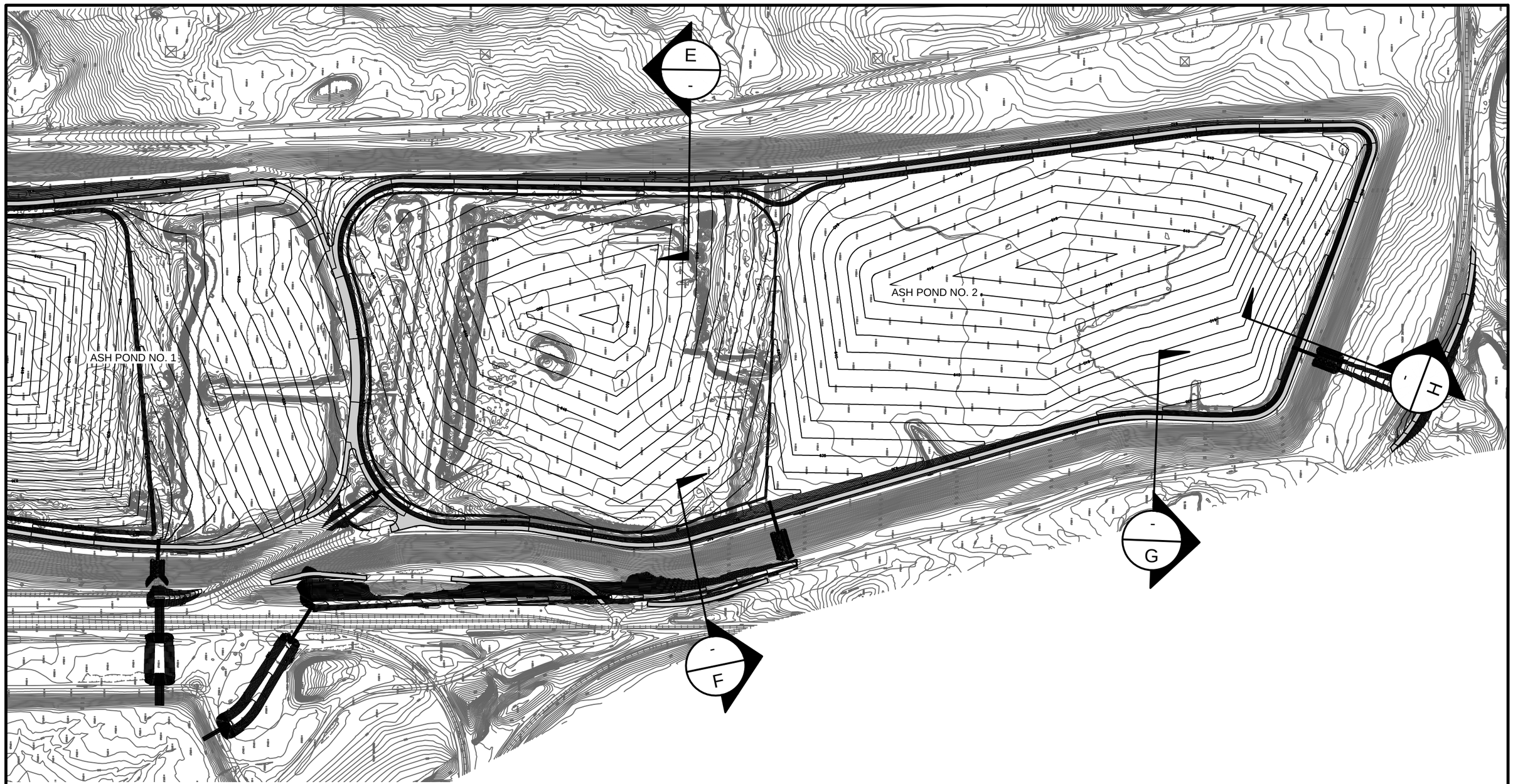
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ILLINOIS POWER
RESOURCES GENERATING, LLC.

DUCK CREEK ASH POND NO. 1
CROSS SECTION LOCATION MAP

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TMS	WDS	60439301	12/01/15	F-3



SCALE:
1" = 300'

AECOM

ILLINOIS POWER RESOURCES GENERATING, LLC.

DUCK CREEK ASH POND NO. 2
CROSS SECTION LOCATION MAP

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
TMS	WDS	60439301	12/02/15	F-4

1615.1.1 Site class definitions. The site shall be classified as one of the site classes defined in Table 1615.1.1. Where the soil shear wave velocity, $\overline{v}_s$, is not known, site class shall be determined, as permitted in Table 1615.1.1, from standard penetration resistance, $\overline{N}$, or from soil undrained shear strength, $\overline{s}_u$, calculated in accordance with Section 1615.1.5. Where site-specific data are not available to a depth of 100 feet (30 480 mm), appropriate soil properties are permitted to be estimated by the registered design professional preparing the soils report based on known geologic conditions.

When the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official determines that Site Class E or F soil is likely to be present at the site.

1615.1.2 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters. The maximum considered earthquake spectral response acceleration for short periods, S_{MS}, and at 1-second period, S_{M1}, adjusted for site class effects, shall be determined by Equations 16-38 and 16-39, respectively:

$$S_{MS} = F_a S_s \quad \textbf{(Equation 16-38)}$$

$$S_{M1} = F_v S_1 \quad \textbf{(Equation 16-39)}$$

where:

F_a = Site coefficient defined in Table 1615.1.2(1).

F_v = Site coefficient defined in Table 1615.1.2(2).

S_S = The mapped spectral accelerations for short periods as determined in Section 1615.1.

S_1 = The mapped spectral accelerations for a 1-second period as determined in Section 1615.1.

1615.1.3 Design spectral response acceleration parameters. Five-percent damped design spectral response acceleration at short periods, S_{DS}, and at 1-second period, S_{D1}, shall be determined from Equations 16-40 and 16-41, respectively:

$$S_{DS} = \frac{2}{3} S_{MS} \quad \textbf{(Equation 16-40)}$$

$$S_{D1} = \frac{2}{3} S_{M1} \quad \textbf{(Equation 16-41)}$$

where:

S_{MS} = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1615.1.2.

S_{M1} = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1615.1.2.

1615.1.4 General procedure response spectrum. The general design response spectrum curve shall be developed as indicated in Figure 1615.1.4 and as follows:

1. For periods less than or equal to T_O, the design spectral response acceleration, S_a, shall be determined by Equation 16-42.
2. For periods greater than or equal to T_O and less than or equal to T_S, the design spectral response acceleration, S_a, shall be taken equal to S_{DS}.

TABLE 1615.1.1
SITE CLASS DEFINITIONS

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 feet, AS PER SECTION 1615.1.5		
		Soil shear wave velocity, $\overline{v}_s$, (ft/s)	Standard penetration resistance, $\overline{N}$	Soil undrained shear strength, $\overline{s}_u$, (psf)
A	Hard rock	$\overline{v}_s > 5{,}000$	N/A	N/A
B	Rock	$2{,}500 < \overline{v}_s \le 5{,}000$	N/A	N/A
C	Very dense soil and soft rock	$1{,}200 < \overline{v}_s \le 2{,}500$	$\overline{N} > 50$	$\overline{s}_u \ge 2{,}000$
D	Stiff soil profile	$600 \le \overline{v}_s \le 1{,}200$	$15 \le \overline{N} \le 50$	$1{,}000 \le \overline{s}_u \le 2{,}000$
E	Soft soil profile	$\overline{v}_s < 600$	$\overline{N} < 15$	$\overline{s}_u < 1{,}000$
E	—	Any profile with more than 10 feet of soil having the following characteristics: 1. Plasticity index $PI > 20$, 2. Moisture content $w \ge 40\%$, and 3. Undrained shear strength $\overline{s}_u < 500$ psf		
F	—	Any profile containing soils having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays ($H > 10$ feet of peat and/or highly organic clay where H = thickness of soil) 3. Very high plasticity clays ($H > 25$ feet with plasticity index $PI > 75$) 4. Very thick soft/medium stiff clays ($H > 120$ feet)		

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kPa. N/A = Not applicable

Figure F-5. Site Classes from IBC 2003.

accordance with this section. An investigation shall be conducted and a report shall be submitted that shall include an evaluation of the following potential geologic and seismic hazards:

1. Slope instability;
2. Liquefaction;
3. Total and differential settlement; and
4. Surface displacement due to faulting or seismic-induced lateral spreading or lateral flow.

The report shall contain recommendations for appropriate foundation designs or other measures to mitigate the effects of the above hazards.

EXCEPTION: Where deemed appropriate by the authority having jurisdiction, a site-specific geotechnical report is not required when prior evaluations of nearby sites with similar soil conditions provide sufficient direction relative to the proposed construction.

11.8.3 Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F. The geotechnical investigation report for a structure assigned to Seismic Design Category D, E, or F shall include:

1. The determination of dynamic seismic lateral earth pressures on basement and retaining walls due to design earthquake ground motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude, and source characteristics consistent with the maximum considered earthquake geometric mean peak ground accelerations. Peak ground acceleration shall be determined based on either: (a) a site-specific study taking into account soil amplification effects as specified in Section 11.4.7 or (b) the peak ground acceleration, PGA_M, from Equation 11.8-1:

$$PGA_M = F_{PGA}\, PGA \qquad (11.8\text{-}1)$$

where

PGA_M = maximum considered earthquake geometric mean peak ground acceleration adjusted for Site Class effects;
PGA = mapped maximum considered earthquake geometric mean peak ground acceleration shown in Figures 22-8 through 22-11; and
F_{PGA} = site coefficient from Table 11.8-1.

3. Assessment of potential consequences of liquefaction and soil strength loss as computed in Item 2, including estimation of total and differential settlement, lateral soil movement, lateral soil loads on foundations, reduction in foundation soil-bearing capacity and lateral soil reaction, soil downdrag and reduction in axial and lateral soil reaction for pile foundations, increases in soil lateral pressures on retaining walls, and flotation of buried structures.
4. Discussion of mitigation measures such as selection of appropriate foundation type and depths, selection of appropriate structural systems to accommodate anticipated displacements and forces, ground stabilization, or any combination of these measures and how they shall be considered in the design of the structure.

Table 11.8-1 Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.1	PGA = 0.2	PGA = 0.3	PGA = 0.4	PGA ≥ 0.5
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7				

Note: Use straight-line interpolation for intermediate values of PGA.

Figure F-6. Site Class Amplification Factors for Calculating $(PGA)_{design}$ from $(PGA)_{rock}$, NEHRP2009

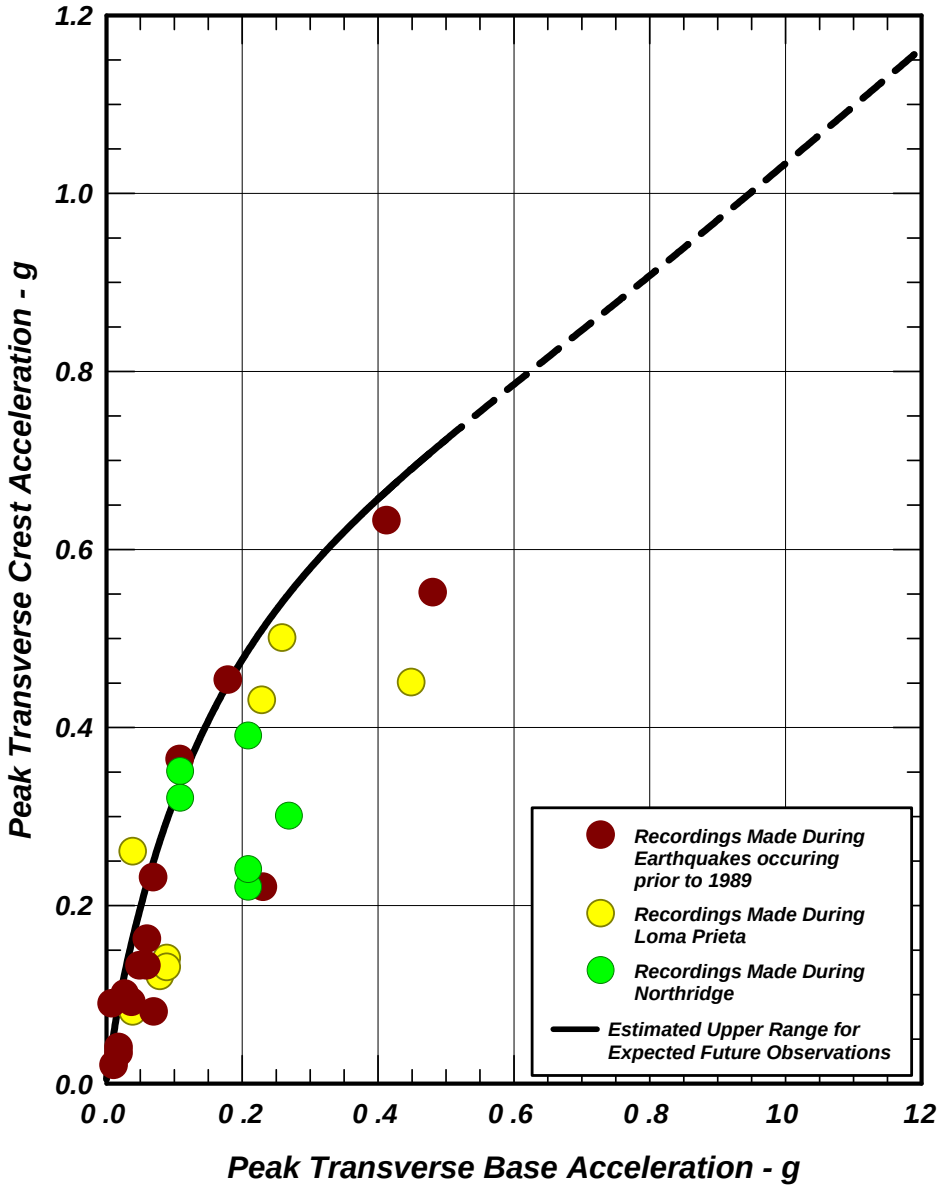


Figure F-7. Variations of Recorded Peak Crest Accelerations versus those Recorded at the Base of Earth and Rock Fill Dams by Idriss (2015). Source of recorded values for Loma Prieta Earthquake and prior earthquakes: Holzer, (1998).

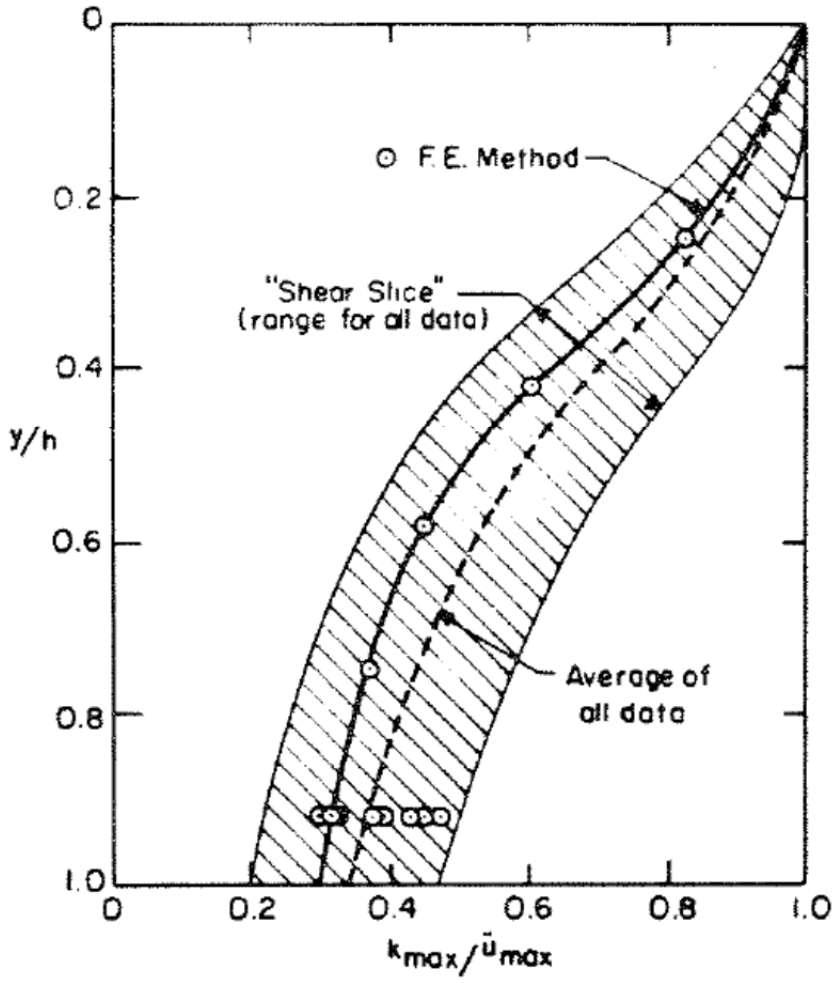
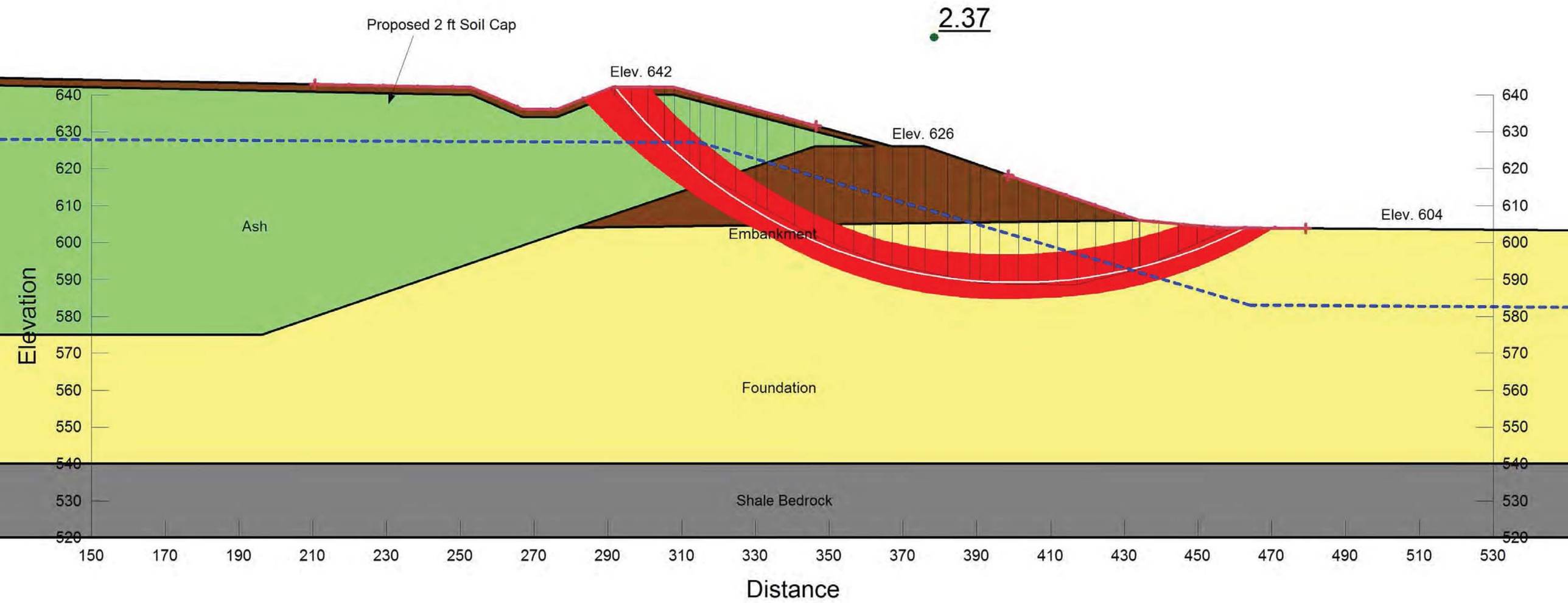


Figure F-8. Variations of Maximum Acceleration Ratio with Depth of Sliding Mass (Makdisi and Seed, 1977). Maximum Acceleration Ratio is the Ratio between $(PGA)_{base\ of\ slide\ mass}$ and $(PGA)_{crest}$.

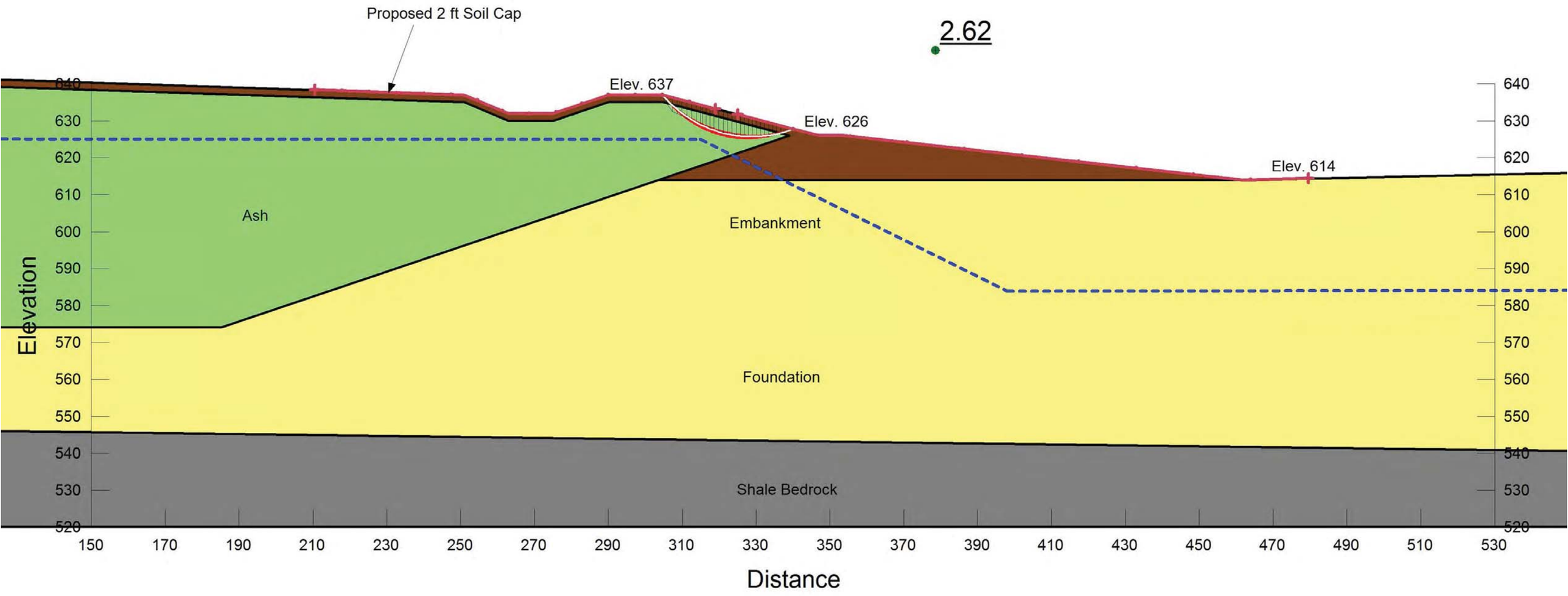
ATTACHMENTS

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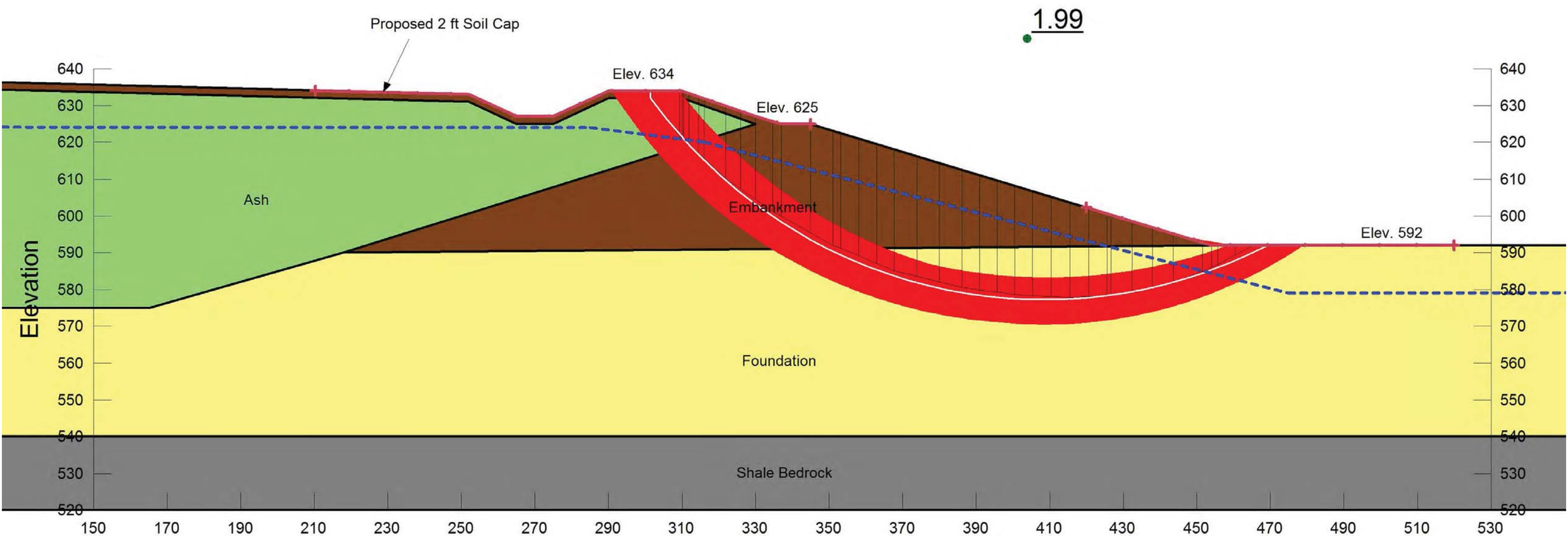
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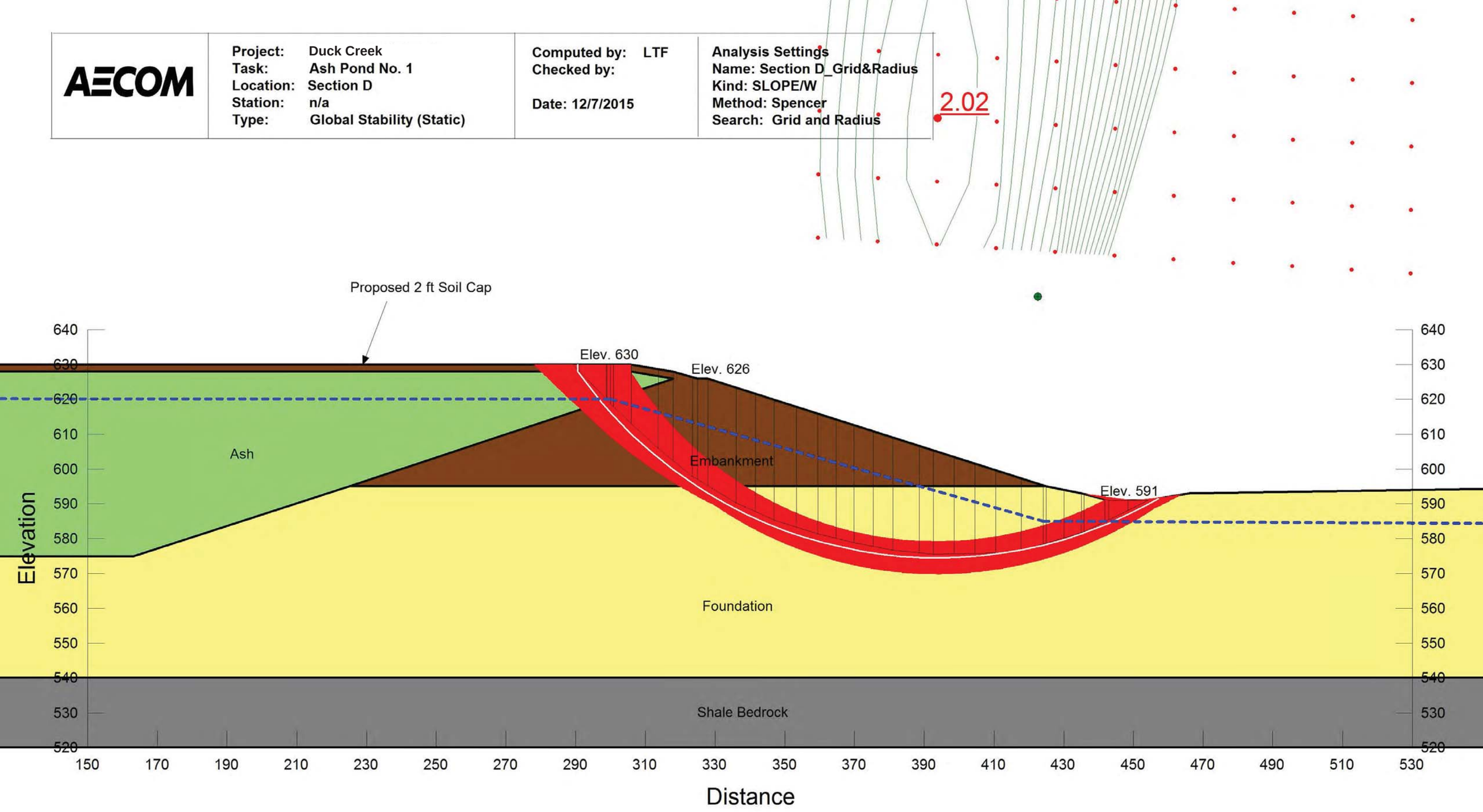
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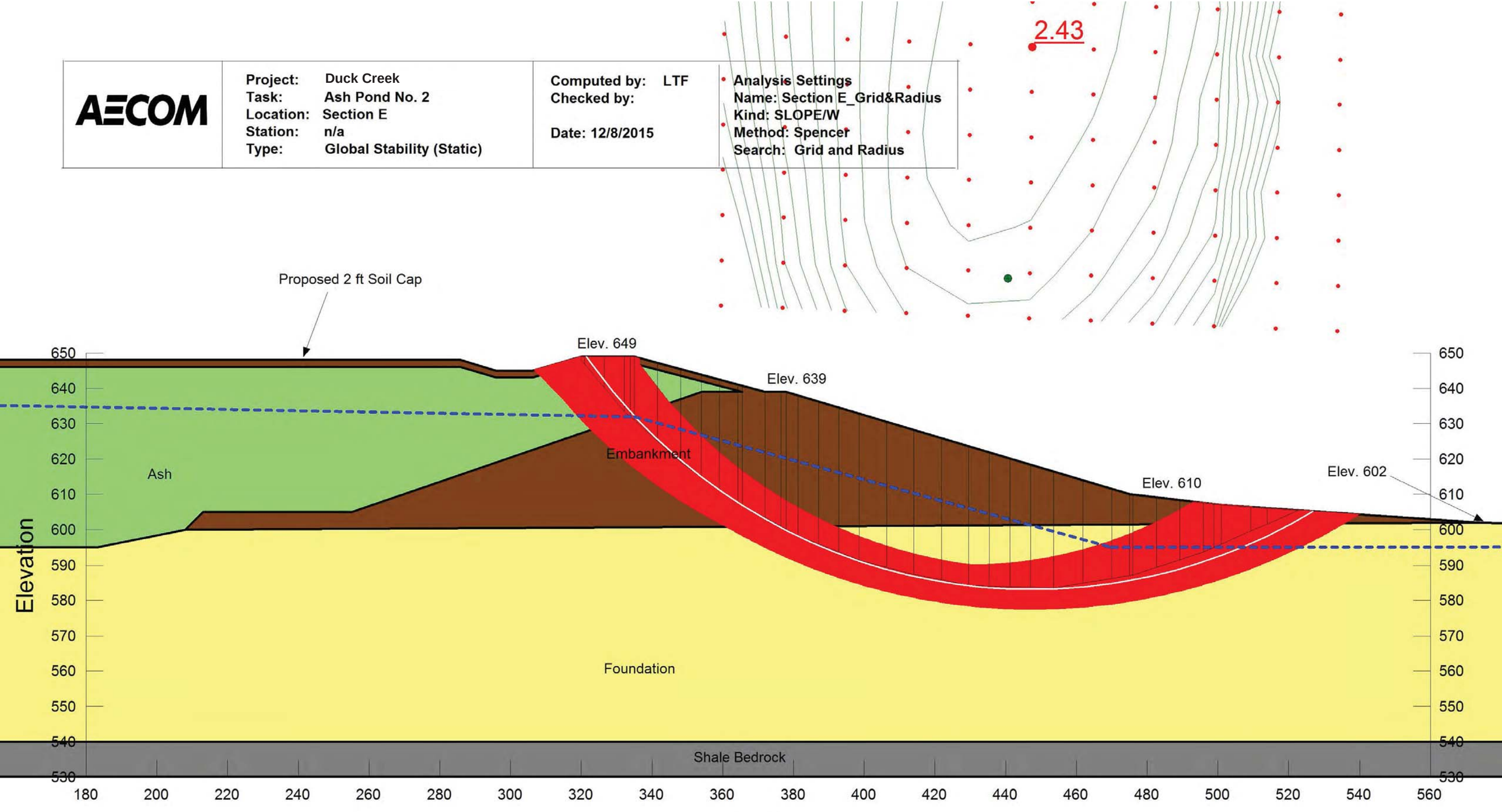
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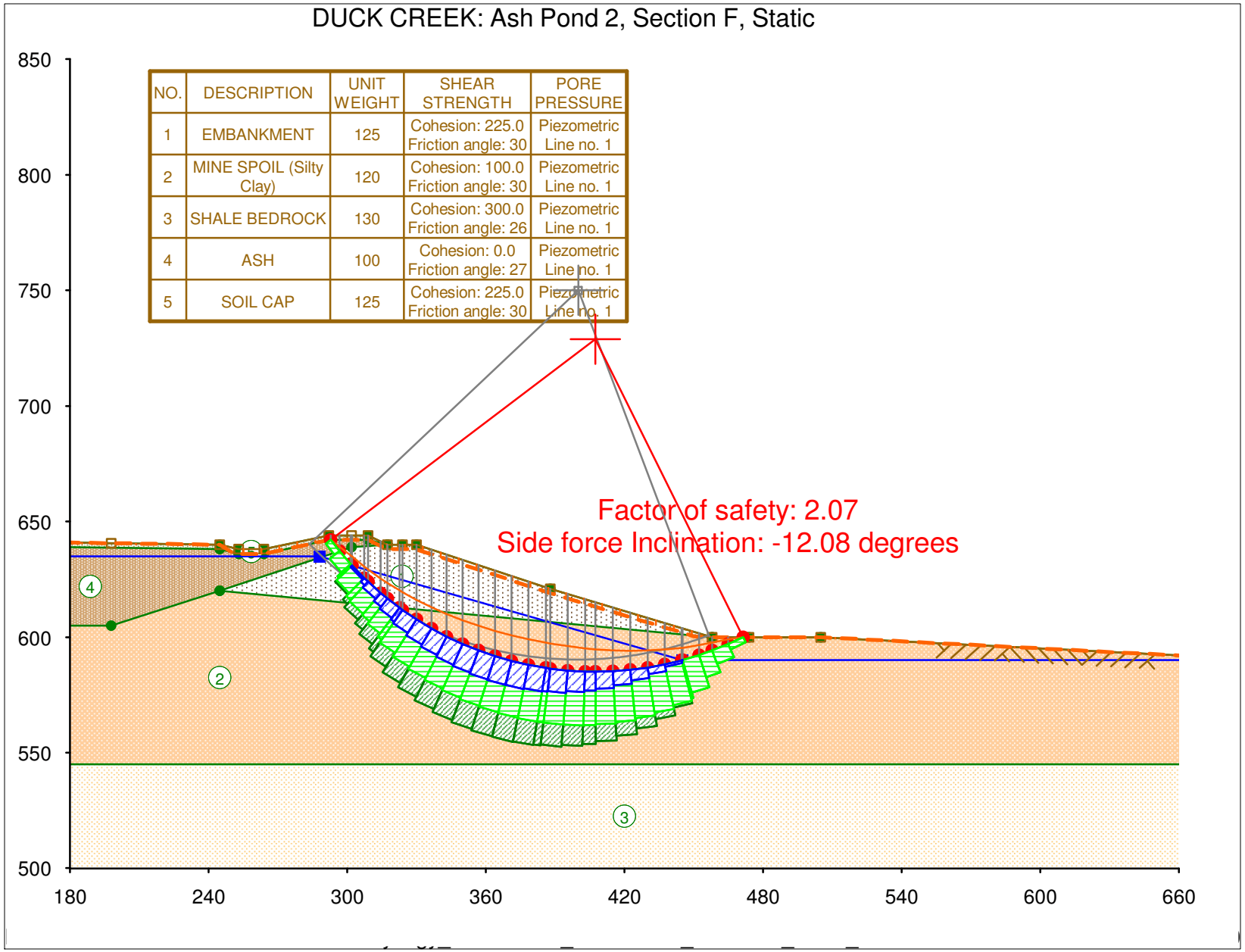


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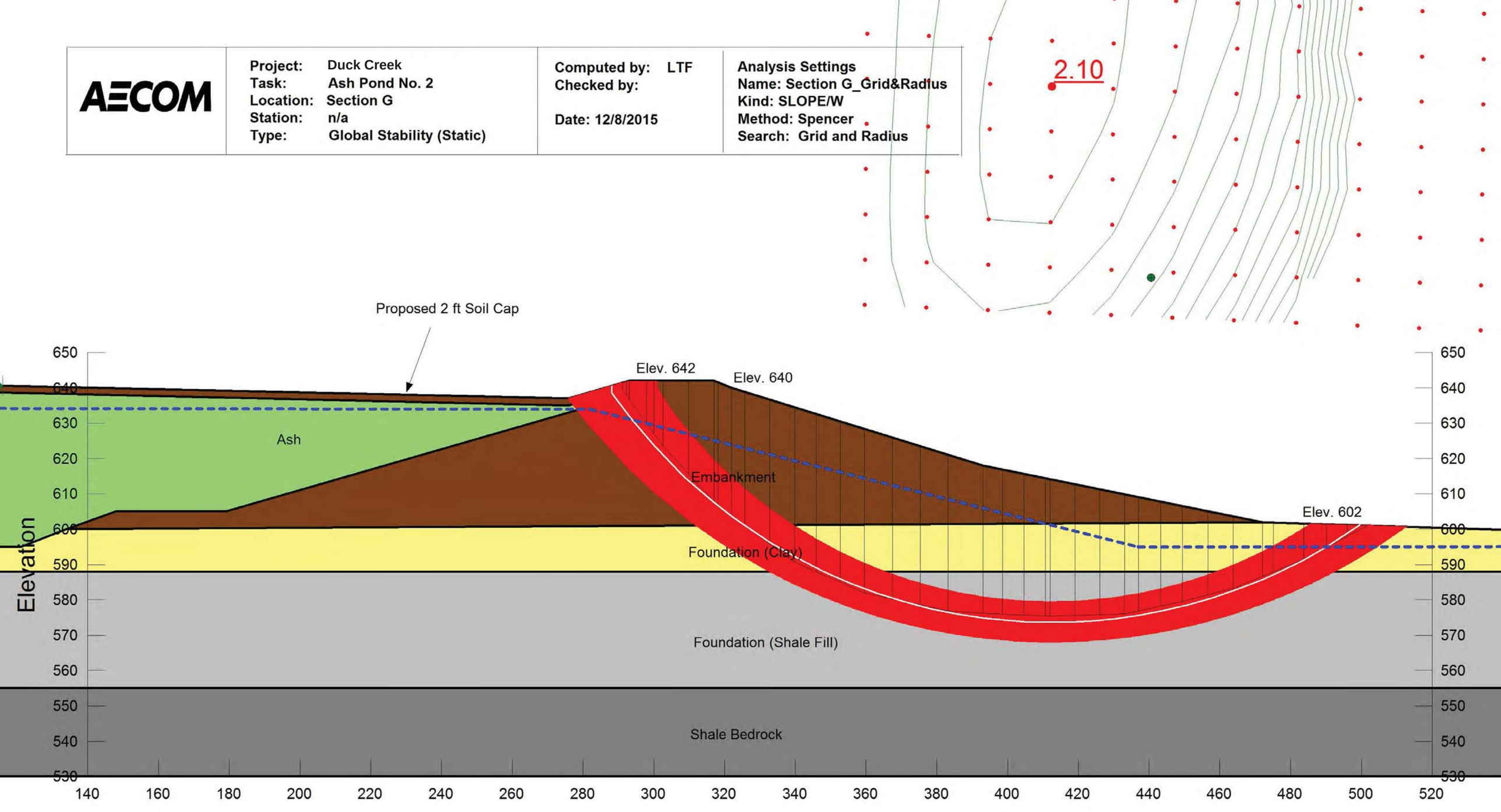
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Name: Shale Bedrock Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 300 psf Phi: 26 ° Phi-B: 0 ° Piezometric Line: 1
Name: Ash Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 27 ° Phi-B: 0 ° Piezometric Line: 1

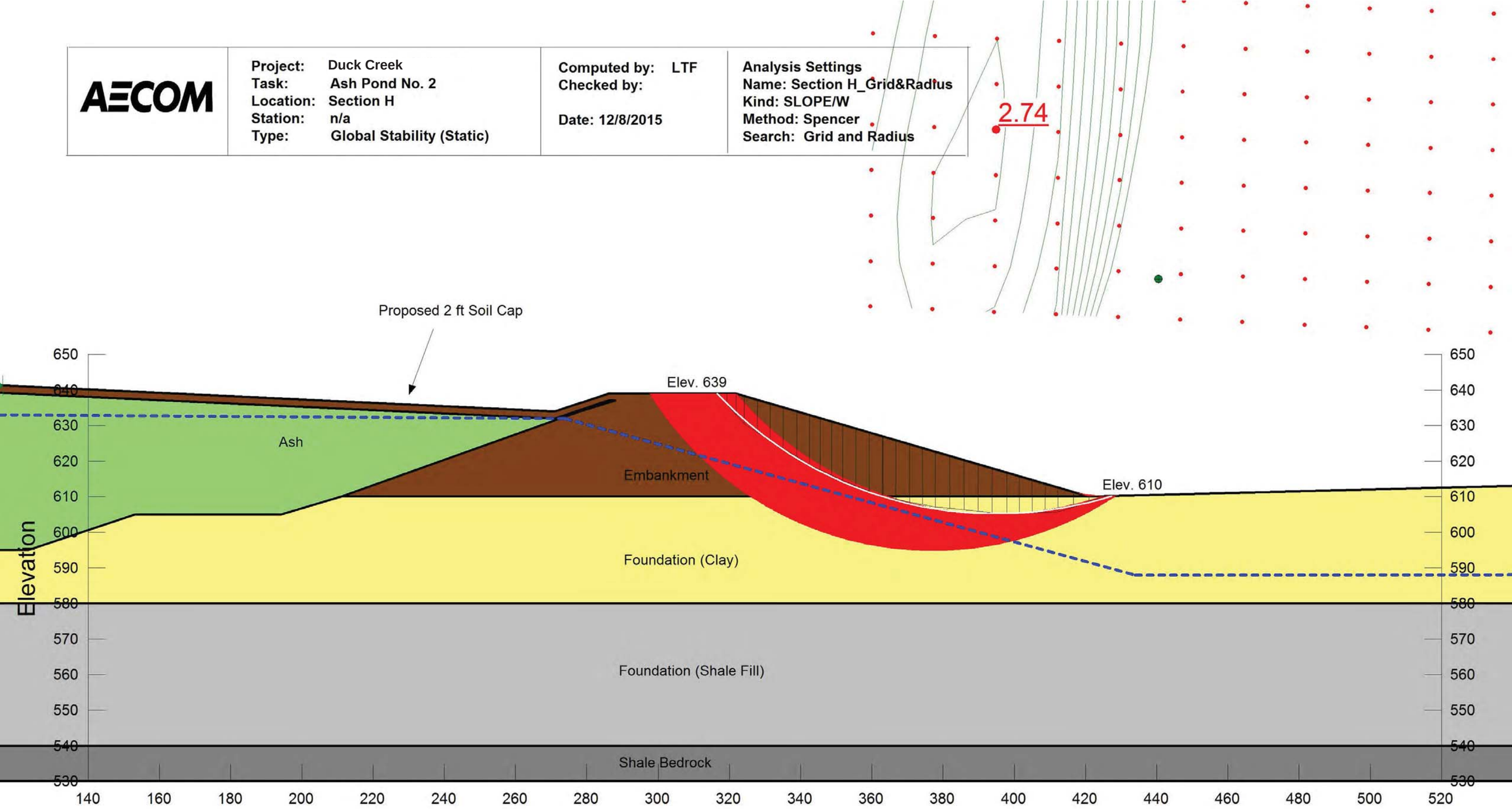

DUCK CREEK: Ash Pond 2, Section F, Static
NO. | DESCRIPTION | UNIT WEIGHT | SHEAR STRENGTH | PORE PRESSURE
1 | EMBANKMENT | 125 | Cohesion: 225.0 Friction angle: 30 | Piezometric Line no. 1
2 | MINE SPOIL (Silty Clay) | 120 | Cohesion: 100.0 Friction angle: 30 | Piezometric Line no. 1
3 | SHALE BEDROCK | 130 | Cohesion: 300.0 Friction angle: 26 | Piezometric Line no. 1
4 | ASH | 100 | Cohesion: 0.0 Friction angle: 27 | Piezometric Line no. 1
5 | SOIL CAP | 125 | Cohesion: 225.0 Friction angle: 30 | Piezometric Line no. 1
Factor of safety: 2.07
Side force Inclination: -12.08 degrees
850
800
750
700
650
600
550
500
180
240
300
360
420
480
540
600
660

AECOM	**Project:** Duck Creek **Task:** Ash Pond No. 2 **Location:** Section G **Station:** n/a **Type:** Global Stability (Static)	**Computed by:** LTF **Checked by:** **Date:** 12/8/2015	**Analysis Settings** **Name:** Section G_Grid&Radius **Kind:** SLOPE/W **Method:** Spencer **Search:** Grid and Radius



Name: Embankment Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 225 psf Phi: 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation (Clay) Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 100 psf Phi: 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Shale Bedrock Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 300 psf Phi: 26 ° Phi-B: 0 ° Piezometric Line: 1
Name: Ash Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 27 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation (Shale Fill) Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 100 psf Phi: 26 ° Phi-B: 0 ° Piezometric Line: 1

AECOM	**Project:** Duck Creek **Task:** Ash Pond No. 2 **Location:** Section H **Station:** n/a **Type:** Global Stability (Static)	**Computed by:** LTF **Checked by:** **Date:** 12/8/2015	**Analysis Settings** **Name:** Section H_Grid&Radius **Kind:** SLOPE/W **Method:** Spencer **Search:** Grid and Radius

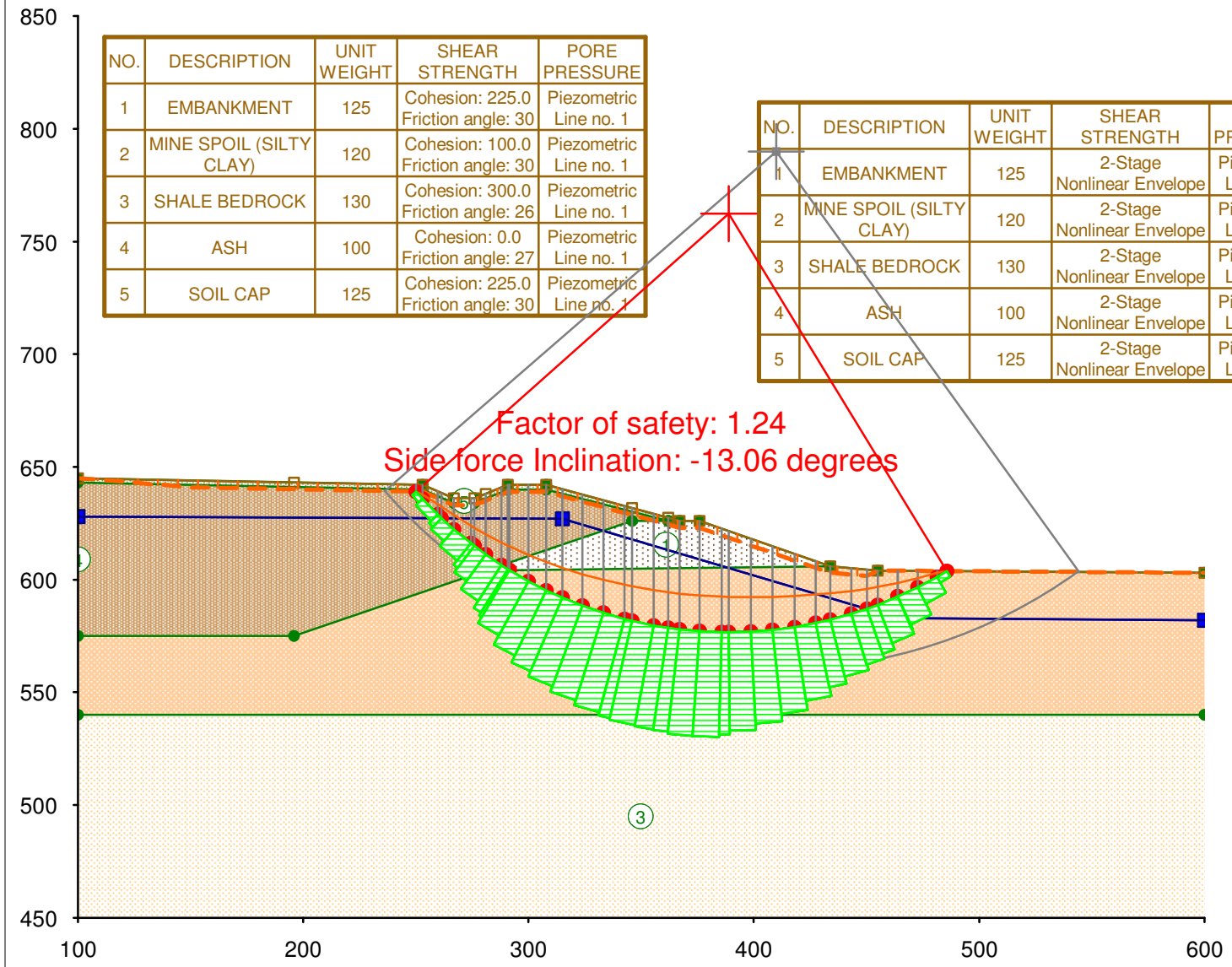


Name: Embankment Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion: 225 psf Phi: 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation (Clay) Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 100 psf Phi: 30 ° Phi-B: 0 ° Piezometric Line: 1
Name: Shale Bedrock Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion: 300 psf Phi: 26 ° Phi-B: 0 ° Piezometric Line: 1
Name: Ash Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion: 0 psf Phi: 27 ° Phi-B: 0 ° Piezometric Line: 1
Name: Foundation (Shale Fill) Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 100 psf Phi: 26 ° Phi-B: 0 ° Piezometric Line: 1

DUCK CREEK: Ash Pond 1, Section A, Two-Stage Seismic

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	MINE SPOIL (SILTY CLAY)	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1

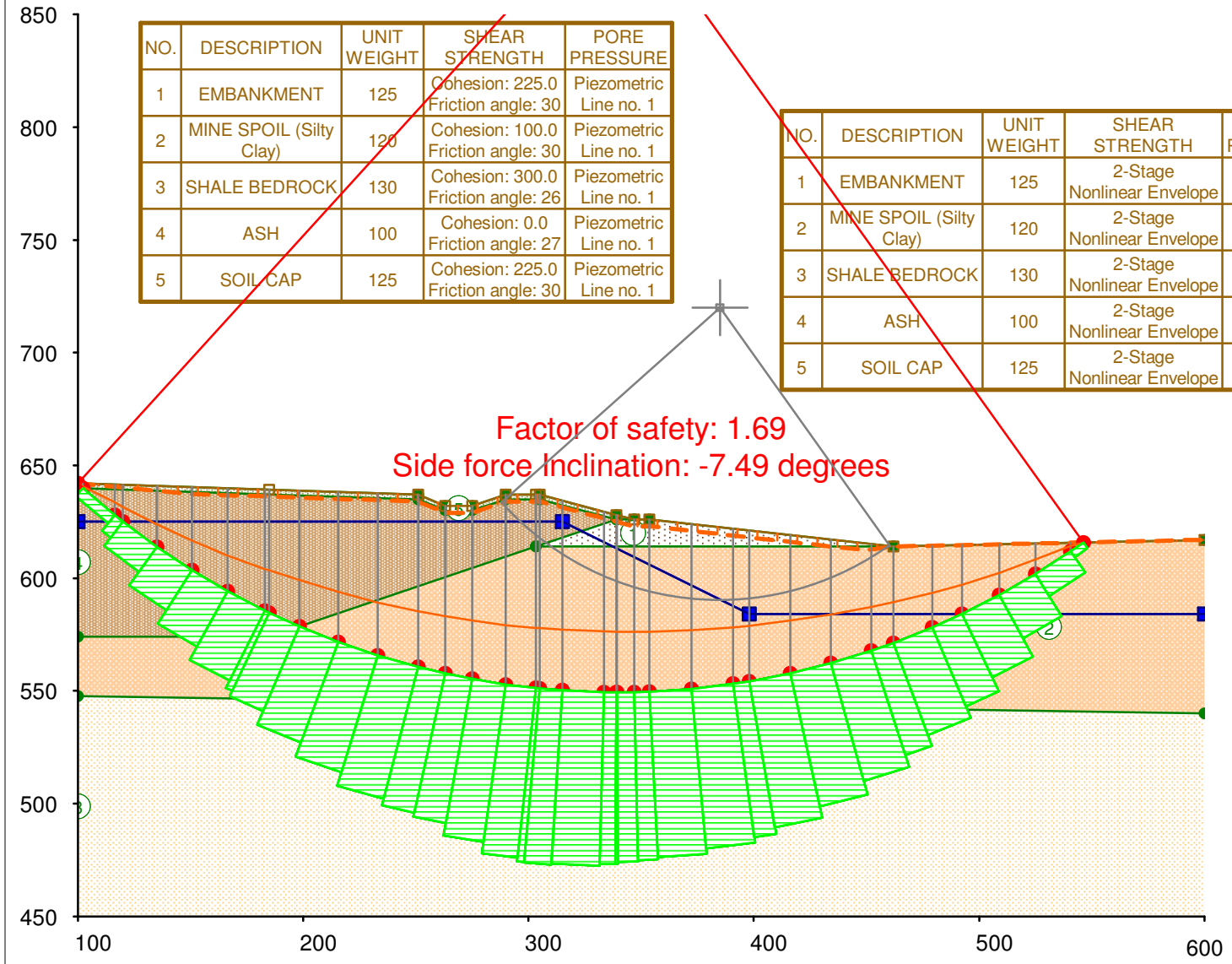
NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	MINE SPOIL (SILTY CLAY)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2



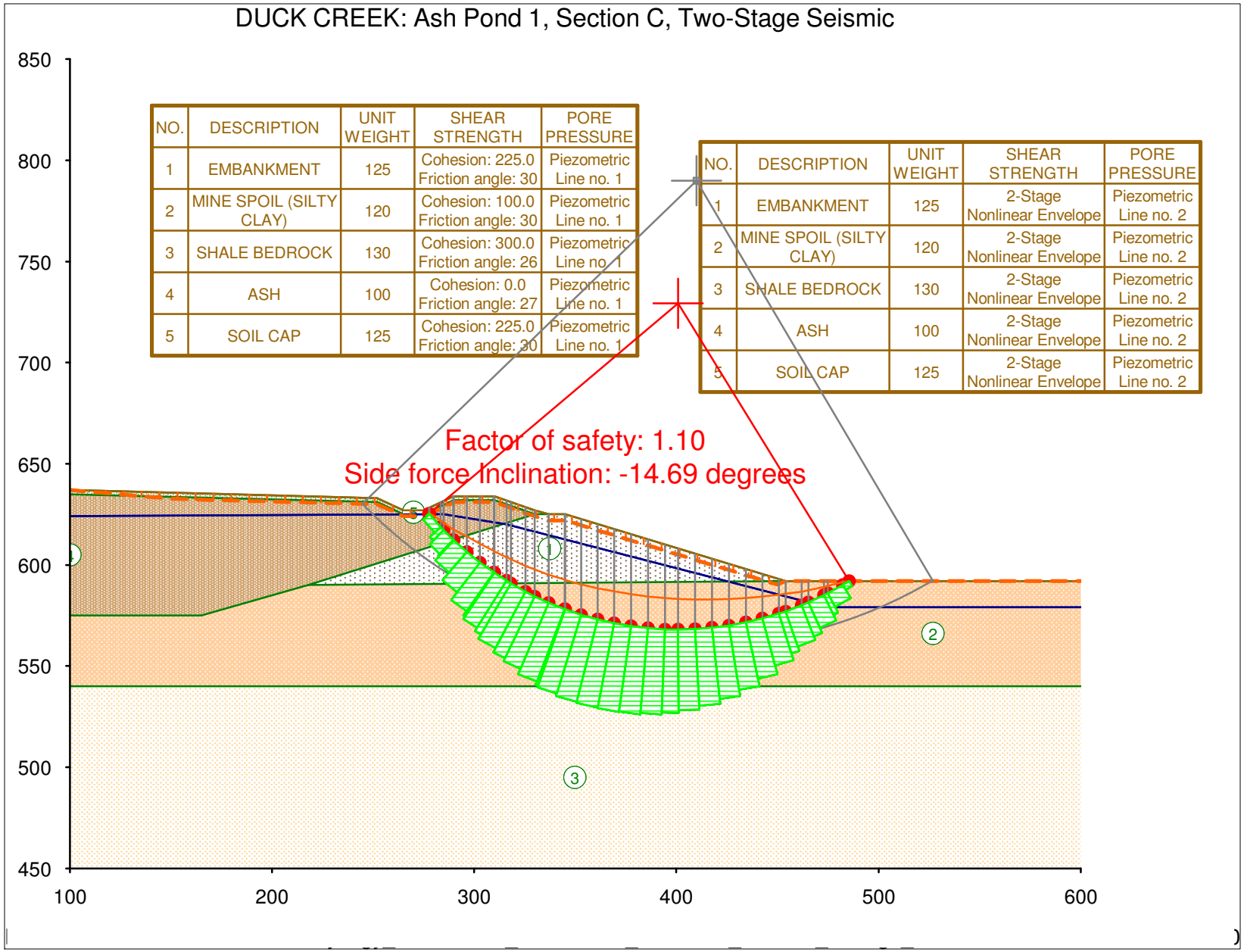
DUCK CREEK: Ash Pond 1, Section B, Two-Stage Seismic

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	MINE SPOIL (Silty Clay)	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	MINE SPOIL (Silty Clay)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2



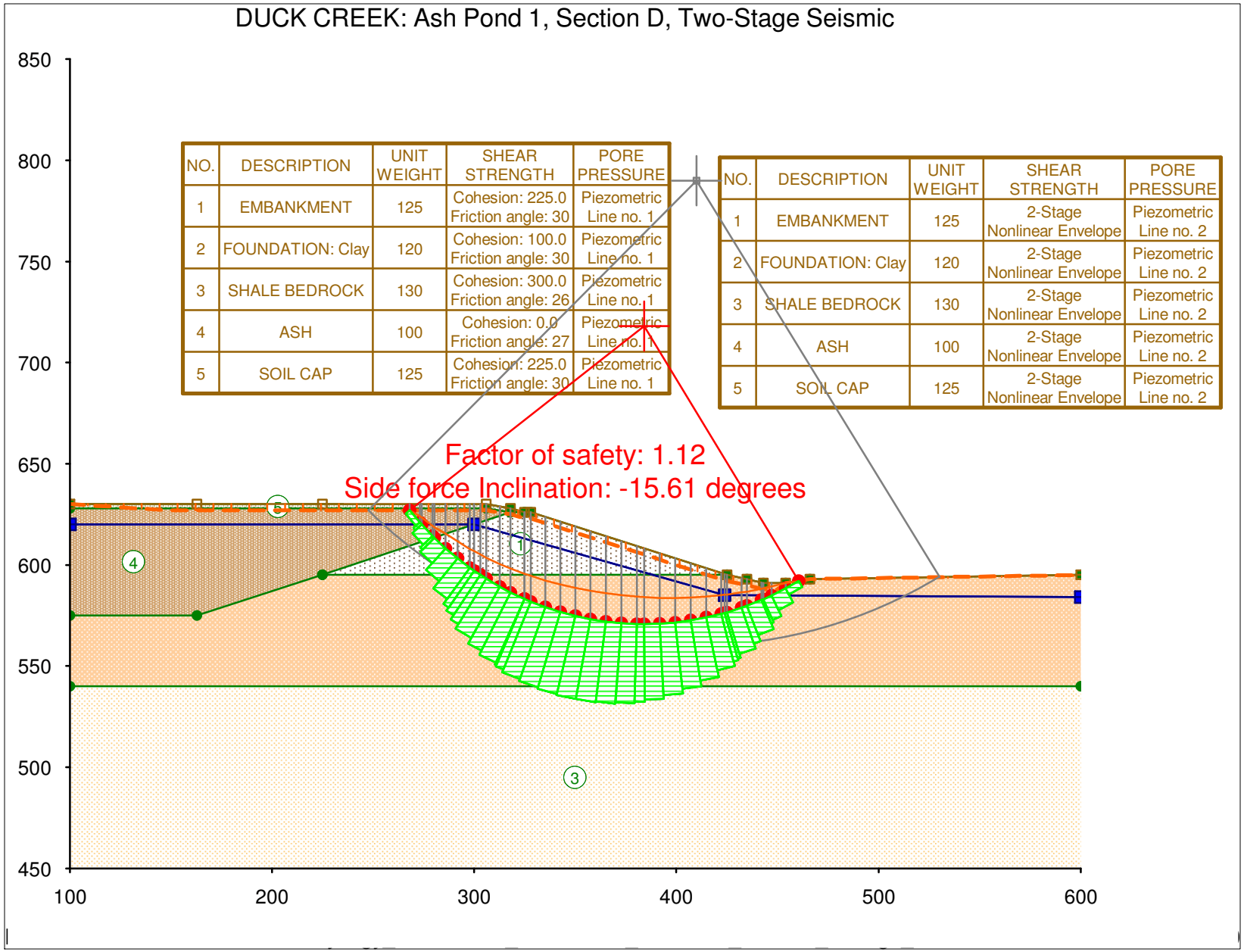
DUCK CREEK: Ash Pond 1, Section C, Two-Stage Seismic



NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	MINE SPOIL (SILTY CLAY)	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	MINE SPOIL (SILTY CLAY)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2

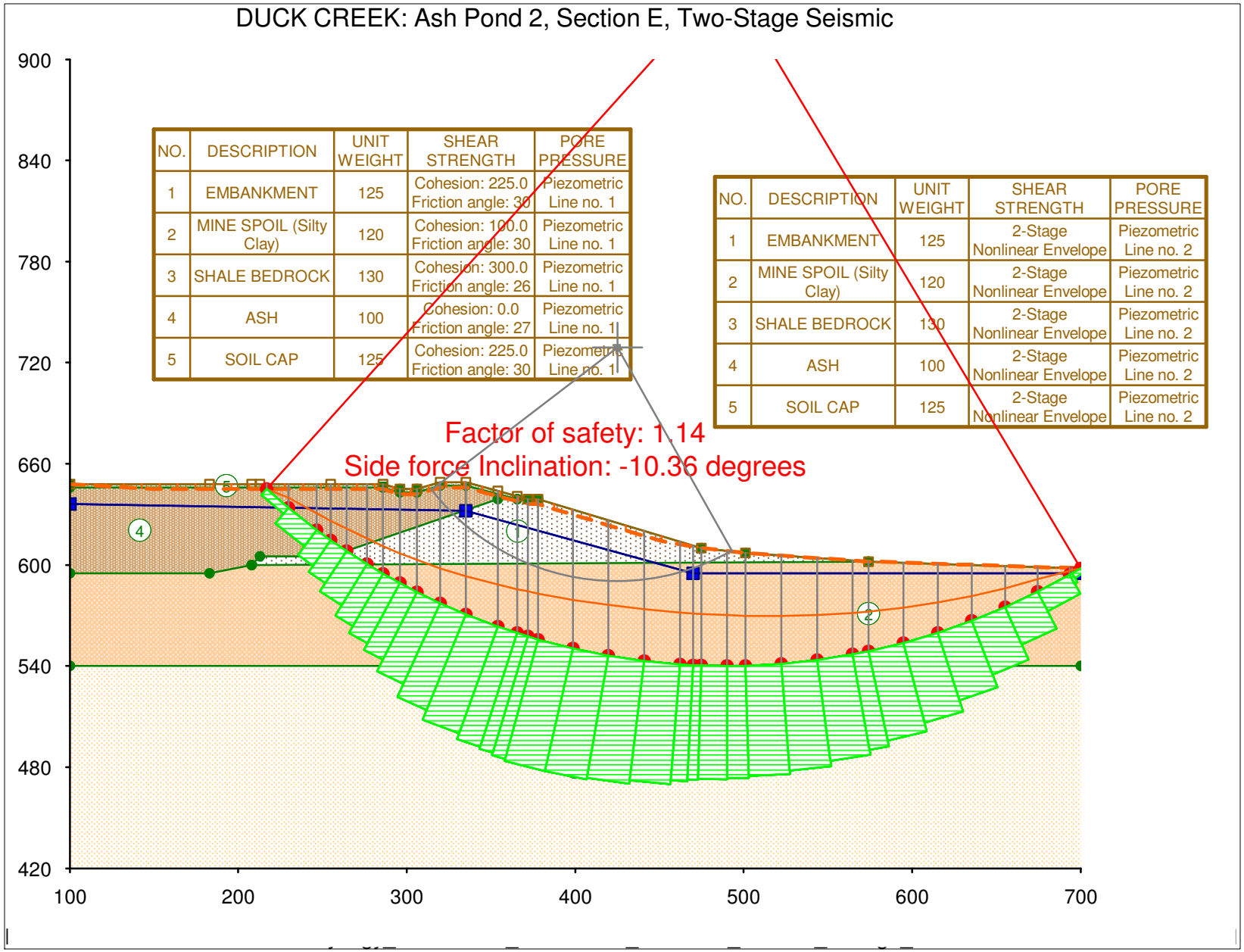
DUCK CREEK: Ash Pond 1, Section D, Two-Stage Seismic



NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	FOUNDATION: Clay	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	FOUNDATION: Clay	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2

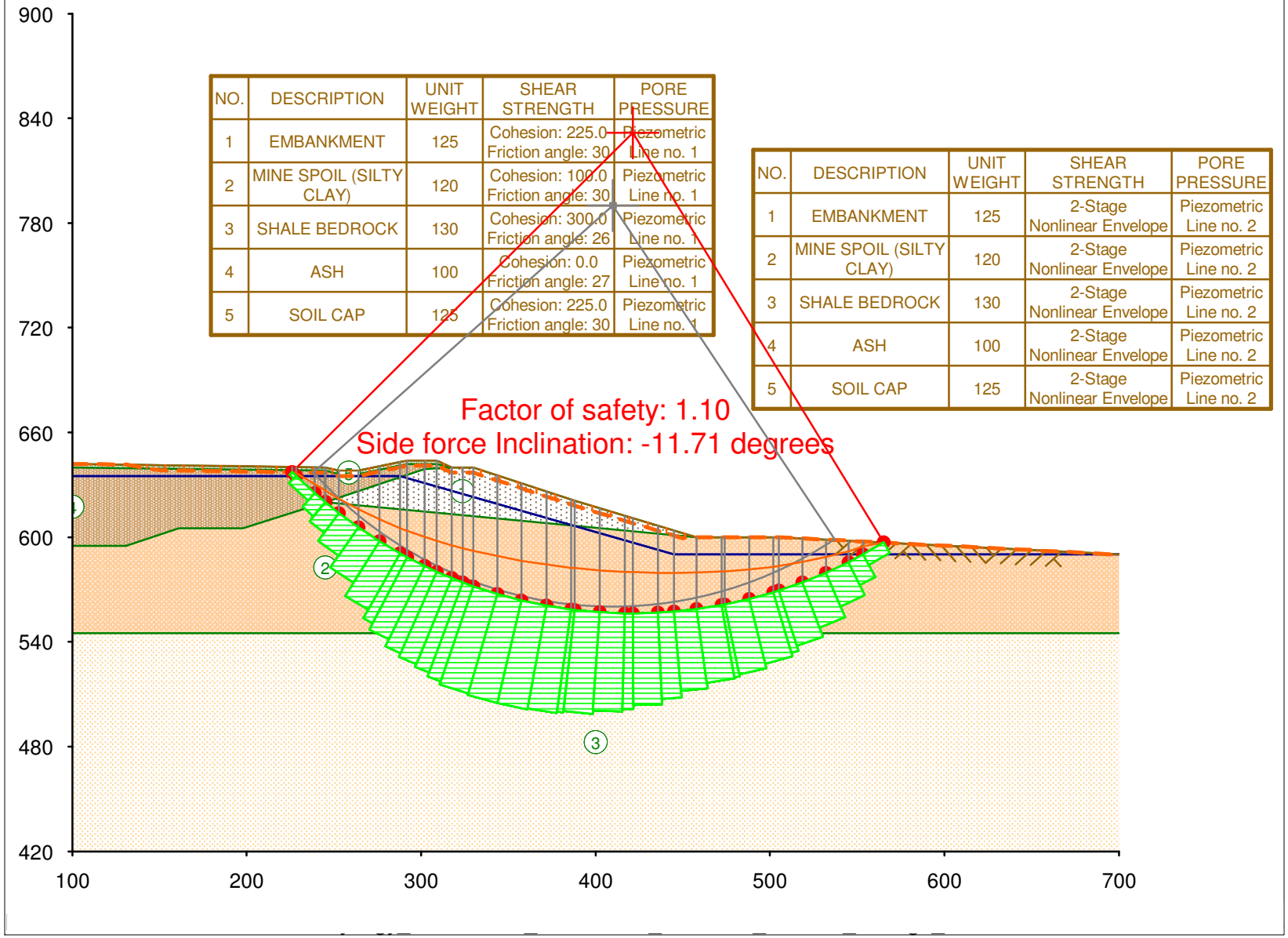
DUCK CREEK: Ash Pond 2, Section E, Two-Stage Seismic



NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	MINE SPOIL (Silty Clay)	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	MINE SPOIL (Silty Clay)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2

DUCK CREEK: Ash Pond 2, Section F, Two-Stage Seismic



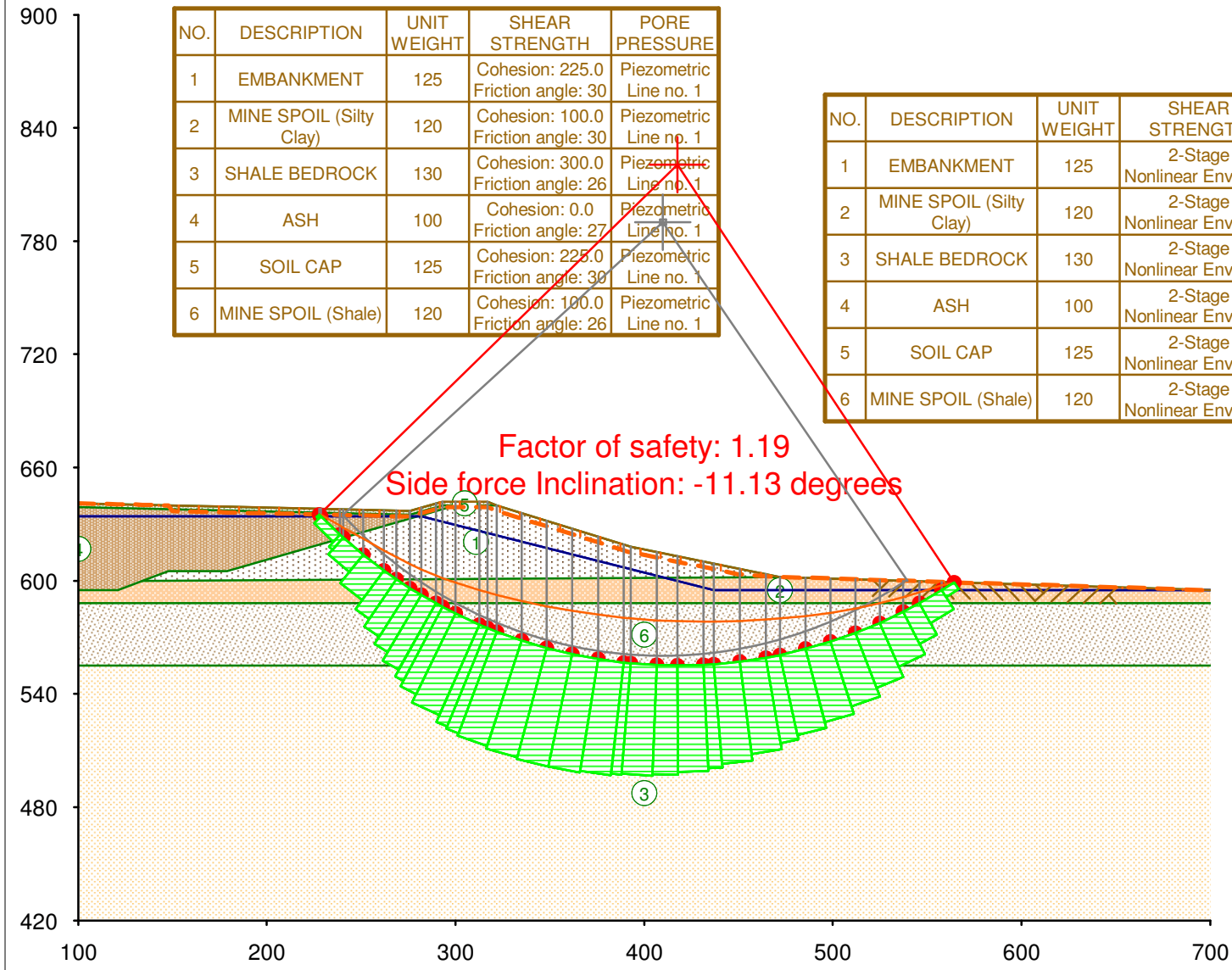
NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	MINE SPOIL (SILTY CLAY)	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	MINE SPOIL (SILTY CLAY)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2

DUCK CREEK: Ash Pond 2, Section G, Two-Stage Seismic

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	MINE SPOIL (Silty Clay)	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
6	MINE SPOIL (Shale)	120	Cohesion: 100.0 Friction angle: 26	Piezometric Line no. 1

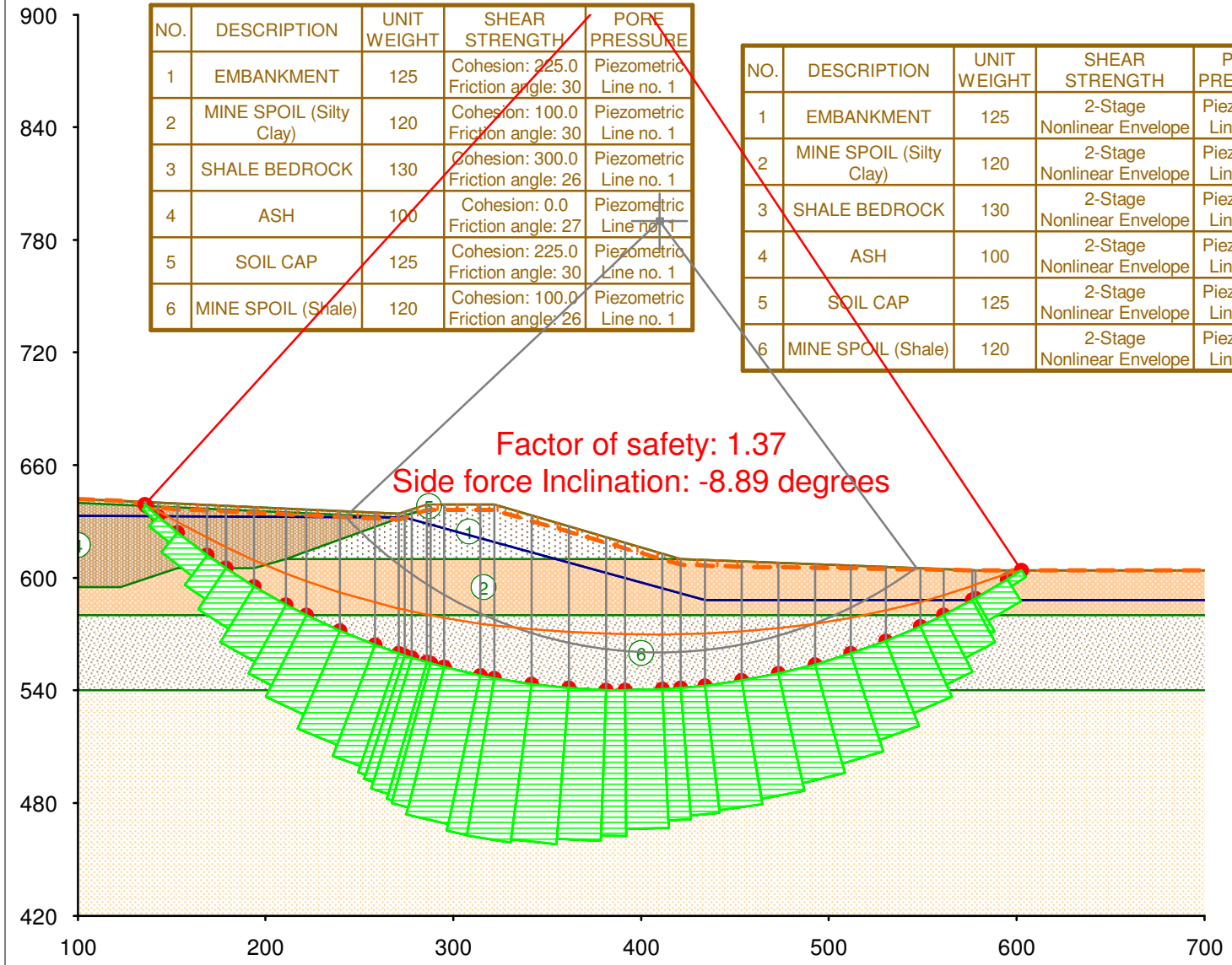
NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	MINE SPOIL (Silty Clay)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
6	MINE SPOIL (Shale)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2



DUCK CREEK: Ash Pond 2, Section H, Two-Stage Seismic

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
2	MINE SPOIL (Silty Clay)	120	Cohesion: 100.0 Friction angle: 30	Piezometric Line no. 1
3	SHALE BEDROCK	130	Cohesion: 300.0 Friction angle: 26	Piezometric Line no. 1
4	ASH	100	Cohesion: 0.0 Friction angle: 27	Piezometric Line no. 1
5	SOIL CAP	125	Cohesion: 225.0 Friction angle: 30	Piezometric Line no. 1
6	MINE SPOIL (Shale)	120	Cohesion: 100.0 Friction angle: 26	Piezometric Line no. 1

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	EMBANKMENT	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
2	MINE SPOIL (Silty Clay)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2
3	SHALE BEDROCK	130	2-Stage Nonlinear Envelope	Piezometric Line no. 2
4	ASH	100	2-Stage Nonlinear Envelope	Piezometric Line no. 2
5	SOIL CAP	125	2-Stage Nonlinear Envelope	Piezometric Line no. 2
6	MINE SPOIL (Shale)	120	2-Stage Nonlinear Envelope	Piezometric Line no. 2



Appendix D.
Construction Quality Assurance Plan

AECOM

Submitted to
Illinois Power Resources
Generating, LLC
Duck Creek Power Station
17751 North Cilco Road
Canton, IL 61520

Submitted by
AECOM
1001 Highlands Plaza Drive West,
Suite 300
St. Louis, MO 63110
March 2016

Construction Quality Assurance (CQA) Plan

for

Ash Ponds Nos. 1 and 2

at

Illinois Power Resources Generating, LLC
Duck Creek Power Station
17751 North Cilco Road
Canton, IL 61520

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List of Acronyms

ACI	American Concrete Institute
CQA	Construction Quality Assurance
DCPS	Duck Creek Power Station
IPRG	Illinois Power Resources Generating, LLC
CQA Plan	Construction Quality Assurance Plan
RCP	Reinforced Concrete Pipe
RFI	Request for Information

Executive Summary

The purpose of the Construction Quality Assurance (CQA) Plan is to provide a means by which observations and tests that assist in evaluating whether the construction has been performed in accordance with the approved plans and appropriately documented. This CQA Plan details the personnel qualifications, material requirements, sampling and testing procedures, testing frequency, testing parameters and sampling locations, surveying, required documentation, items to be certified by a professional engineer, and the procedures to follow in the case of a test failure.

The construction related procedures addressed in the following sections are presented to direct construction personnel for development of the site. The CQA Plan has been organized into the following Sections as listed below:

Section	Title
1.0	Project Description
2.0	QA/QC Program
3.0	Prequalification Testing / Test Pad
4.0	Fill
5.0	Final Cover Protective Soil and Vegetation
6.0	Aggregates
7.0	Geotextile
8.0	Pipes
9.0	Surface Water Control Structures
10.0	Survey
11.0	Meetings
12.0	Documentation

The following section addresses CQA activities associated with typical components of a Coal Combustion Residuals (CCR) impoundment closure project. These components will include some, but not necessarily all, of the following, based on final project designs:

- Soil Cover Materials
- Fill Materials (including Structural Fill, Crown Fill, CCR placement and grading)
- Aggregates
- Geotextile
- Piping
- Cast-in-Place Concrete and Grout
- Miscellaneous Items
- Surveys
- Meetings
- Documentation

1. Project Description

Illinois Power Resources Generating, LLC (IPRG) proposes to carry out the following activities at Ash Ponds Nos. 1 and 2 located at the Duck Creek Power Station (DCPS):

- Removing ponded surface water from Ash Ponds Nos. 1 and 2.
- Constructing let-down structures to convey non-contact stormwater to either the former Recycle Pond or north under the railroad tracks through culvert pipes to the Duck Creek Cooling Pond.
- Constructing a non-contact stormwater management system to convey stormwater from the cover system to the interior collection ditches located along the perimeter of the impoundments.
- Adding CCR from the Duck Creek Power Station and the Edwards Power station to Ash Ponds Nos. 1 and No. 2 and regrading the CCR surface to establish the design subgrade elevations needed for the final cover system.
- Compacting the final cover system subgrade to design parameters to create a firm base for final cover construction.
- Constructing the earthen final cover system in compacted lifts for low permeability soil layers.
- Final grading and contouring of the stormwater management system.
- Seeding the final cover system utilizing native grasses on the erosion layer.

2. CQA Program

2.1 Quality Assurance

Construction Quality Assurance starts at the beginning of the project during preparation of the engineering plans and specifications. At this stage, the CQA Plan outlines means and actions to be employed by IPRG through the CQA Consultant to evaluate and measure compliance with the design, supplier, and installation of equipment and materials in accordance with this CQA Plan as well as with the design plans and specifications.

2.2 Quality Control

Quality Control (QC) includes actions taken by the designer, contractor, supplier, and installer to document that their methods, materials, and workmanship are accurate and correct, meet regulatory requirements, and are in accordance with the approved plans and specifications. QC is provided by each party for its own work, product, or service.

2.3 Roles and Responsibilities

2.3.1 Owner and Operator

The Duck Creek Power Station is owned and operated by IPRG. IPRG will be responsible for overall management of construction activities including contracting and administration.

2.3.2 Contractor

The Contractor for this project will be selected by IPRG. The Contractor shall be responsible for construction activities associated with this project, including meeting the requirements for project quality as defined in the construction plans and specifications for his or her work as well as that of his or her subcontractors.

2.3.3 CQA Consultant

The CQA Consultant is responsible for making observations and performing field tests to provide written documentation that the CCR unit's final cover system is constructed in accordance with the applicable plans, specifications, and CQA Plan. The CQA Consultant will be a third party engineering firm retained by IPRG.

The following section provides a description of the typical CQA Consultant team including each member's roles and responsibilities.

2.3.3.1 CQA Officer

The CQA Officer is responsible for certifying to IPRG and the Illinois Environmental Protection Agency (IEPA) that, to the best of his or her knowledge based on the data provided, the construction activities observed, and the testing performed, the final cover system has been constructed in accordance with the plans, drawings, and the approved CQA Plan. The CQA Officer shall be an Illinois-licensed Professional Engineer for the project and certifies the construction record or certification report. The CQA Officer will review and approve construction reports. Construction reports will be prepared until construction is complete and will include: descriptions of the weather, locations where construction occurred during the previous week, materials used, results of testing, inspection reports, and procedures used to perform the inspections. The CQA Officer will certify reports, when applicable.

The CQA Officer must supervise and be responsible for inspections, testing and other activities required to be implemented as part of the CQA Program. The CQA Officer will need to visit the site on a routine and periodic basis, especially during times of critical work. The CQA Officer is

responsible for directing and supervising the on-site inspections and will provide supervision and assume responsibility for performing inspections of the following activities, when applicable:

- Grading and compaction of the subgrade materials;
- Dewatering activities (if applicable);
- Installation of geomembranes (if applicable);
- Placement and compaction of the cover soil;
- Placement of the topsoil (vegetative soil); and,
- Construction of stormwater features such as ponds, ditches, lagoons and berms.

2.3.3.2 CQA Officer-in-Absentia

If the CQA Officer is unable to be present to perform duties as required, the CQA Officer shall provide, in writing, reasons for his or her absence, a designation of a person who shall exercise professional judgement in carrying out the duties of a CQA officer as the designated CQA Officer-in-Absentia (CQAOA), and a signed statement that the CQA Officer assumes full personal responsibility for all inspections performed and reports prepared by the designated CQAOA during the absence of the CQA Officer.

Additional duties of the CQAOA include:

- Observe and document construction-related activities.
- Monitor delivery, handling, and on-site storage of construction materials.
- Evaluate conformance of borrow source materials.
- Observe material placement and testing.
- Coordinate material sampling and shipping for laboratory testing.

2.3.3.3 CQA Subcontractors

The CQA Consultant will subcontract with a construction materials testing and inspection firm for laboratory testing as needed. Anticipated laboratory testing may include, but not be limited to:

- Compressive strength testing of concrete cylinders,
- Pre-qualification of geomembranes (if applicable),
- Pre-qualification testing of soils, and
- Conformance testing of soils and aggregate materials.

2.3.4 Stop Work Authority

The Contractor is responsible for overall site safety, however, the CQA Consultant will advise IPRG and the Contractor when the Contractor should “stop work” in situations of safety, recognizable stability issues, deviations from design, and/or significant cost or schedule impacts. In situations where personnel safety is a concern, the CQA Consultant will advise the Contractor to stop work immediately and notify IPRG as soon as possible of that action.

2.4 Project Meetings

To achieve a high degree of quality during installation, clear, open channels of communication are essential. The following meetings should be held when appropriate.

2.4.1 Pre-Construction Meetings

Following the completion of the contract documents and selection of a CQA Consultant for the project, a Pre-Construction Meeting may be held. At a minimum, the meeting should be attended by the Project Manager, the CQA Consultant, the Contractor, and other involved parties. Two Pre-Construction Meetings may be held, one prior to earthwork construction and one prior to geomembrane placement (if applicable).

2.4.2 Daily Meetings

A daily meeting will be held, as necessary, between the CQAOA, the Contractor, and other involved parties. Those attending will discuss, plan, coordinate the work, and CQA activities to be completed that day.

2.4.3 Progress Meetings

Progress meetings will be held weekly, or as determined by the CQA Officer. Attendees should include the, the CQAOA, the Contractor, and other involved parties. Those attending will discuss current progress, planned activities for the next week, submittals, and new business or revisions to the work. The CQAOA will log problems, decisions, or questions arising at this meeting.

2.4.4 Problem or Work Deficiency Meeting

A special meeting may be held when and if a problem or deficiency, which would impact the construction schedule or other project requirements, is present or likely to occur. At a minimum, the meeting should be attended by the affected contractors, the Project Manager, and the CQA Consultant. The purpose of the meeting is to define and resolve the problem or work deficiency.

2.4.5 Safety Meetings

The Contractor will hold safety meetings in accordance with the Contractor's Site Health and Safety Plan. The Contractor's Site Health and Safety Plan must be submitted to IPRG for approval prior to commencing construction activities. Meetings will be held at the start of construction and then periodically as conditions change or as determined by the CQA Consultant.

2.5 Documentation

An effective CQA plan depends largely on recognition of construction activities that should be monitored, and on assigning monitoring responsibilities. This is most effectively accomplished and verified through quality assurance activities. The CQA Consultant will document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant will prepare and provide to the CQA Officer periodic signed reports which summarize construction activities and the results of observations and tests including descriptive remarks, data sheets, and logs to verify that quality assurance monitoring activities have been carried out.

2.5.1 Reports

Progress reports will be prepared at regular time intervals to document the status of the work by the CQA Consultant. Certifications will be prepared at the completion of major construction activities. At the completion of the work, final documentation will be prepared and will include a professional engineer's seal along with supporting field and laboratory test results.

2.5.1.1 Daily Summary Report

Standard reporting procedures must include preparation of a daily report which, at a minimum, will consist of:

- An identifying sheet number for cross referencing and document control

- Date, project name/number, location, and other identification
- A summary report including memoranda of meetings and/or relevant discussions with IPRG, CQA Consultant, and/or site contractors, observation logs, test data sheets, decisions reached, activities planned and their schedule
- Other forms of daily recordkeeping to be used as appropriate including construction problem and solution data sheets and photographic reporting data sheets

The daily summary report will also include the following information as needed:

- Weather conditions
- A reduced-scale site plan showing proposed work areas and test locations
- Descriptions and locations of ongoing construction
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets
- Calibrations or recalibration of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets
- Off-site materials received, including quality verification documentation
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality
- The CQAOA's signature

This information must be regularly submitted to and reviewed by the CQA Officer.

2.5.1.2 Observation Logs and Test Data Sheets

Observations of construction and QA-related activities will be recorded on project-specific logs and data sheets by the CQA Consultant. At a minimum, the logs and data sheets will include the following information:

- An identifying sheet numbered for cross referencing and document control
- Date, project name, location, and other identification
- Description or title of activity monitored
- Location of activity and locations of samples collected
- Locations of field tests performed and their results
- Results of laboratory tests received
- Results of monitoring activity in comparison to specifications
- The CQAOA’s signature

This information will be submitted with the Daily Summary Report during construction projects.

2.5.1.3 Construction Certification Report

At the completion of the work, a signed Construction Certification Report will be submitted by the CQA Consultant prepared in accordance with the project requirements

The Construction Certification Report will be prepared and signed and sealed by a professional engineer skilled in the appropriate discipline(s) and registered in the state in which the work was performed.

At a minimum, the Construction Certification Report will include:

1. A narrative section that identifies the engineered components that were constructed that includes the following:
    - A summary of the design and construction specifications and a comparison with the components that were constructed during the construction event
    - A summary of how construction was impacted by weather and equipment limitations and other difficulties encountered
2. All alterations and other changes that relate to the installation of any of the components to be certified and presented as follows:
    - A listing of applicable alteration requests/changes that were previously concurred with
    - All alteration requests/changes and supporting documentation which are proposed for concurrence
    - A list of any other changes made by IPRG which do not require regulatory concurrence but which affect construction or the record drawings

The alteration request will be equivalent or more protective than the applicable regulation or authorizing document.

3. Results of tests in accordance with the project specifications.
4. Results of surveys in accordance with the project specifications. Unless otherwise specified, the survey data will be reported in a table(s) displaying the northing and easting for each designated survey point established to be no more than one hundred feet apart based on the grid system coincident with the design drawings. Additional points will be established at grade breaks and other critical locations.
5. Record drawings of the constructed facility components showing the following:
    - The location of survey control points.
    - Plan views with topographic representation of engineered components depicted along with critical elevations such as pipe inverts, sump elevations, ditch flow lines, tops and toes of berms, locations of repairs, etc.
    - The location and as-built detail drawings of components to be certified.
    - If the Certification Report is submitted for the composite final cover system, cross sections showing the top elevations of the existing waste, top elevation of the composite cover system, and the elevations of the surface water management system. The cross sections will be taken at the same locations and using the same scale as in the approved permit to install. Otherwise, the cross sections will be taken at an interval no greater than every three hundred feet of length and width.
    - If the Certification Report is submitted for establishment of facility survey marks, the following information summarizing the activities performed to construct and establish the facility survey marks:

- An identification and description of the known control point(s) used to establish the horizontal and vertical coordinate(s) of the facility survey marks.
- The horizontal and vertical coordinates of the known control point(s) and facility survey marks.
- A summary of surveying activities performed in determining the coordinates of the facility survey marks.
- A copy of the 7.5 minute series quadrangle sheet(s) used in establishing the survey marks with the known control point(s) and the location of the facility survey marks clearly identified.
- A detailed drawing(s) illustrating the design of the facility survey marks, as constructed.

6. Qualifications of testing personnel that provided construction oversight and conducted the testing on the engineered components for which the Certification Report is submitted including a description of the experience, training, responsibilities in decision making, and other relevant qualifications.
7. A notarized statement that, to the best of the knowledge of IPRG, the Certification Report is true, accurate, and contains information required by this rule and by the CQA plan.

2.5.1.4 Progress Reports

Progress reports at time intervals established at the Pre-Construction meeting will be completed and submitted to IPRG by the CQA Consultant. At a minimum, this report will include the following information:

- A unique identifying sheet number for cross-referencing and document control
- The date, project name, location, and other information
- A summary of work activities during progress reporting period
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period
- The signature of the CQA Officer

Copies of progress reports will be distributed as decided at the Progress Meetings and as determined necessary by the CQA Officer.

2.5.1.5 Photographic Reporting Data Sheets

Photographic reporting data sheets, where used, will be cross-referenced with observation logs and test data sheets and/or construction problem and solution reports. These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file will contain color prints; negatives will be stored in a separate file in chronological order. These records will be presented to the IPRG upon completion of the project.

Design and/or specification changes may be required during construction. In such cases, the CQA Consultant evaluate the cause of the non-conformance and recommend appropriate changes in procedures or specifications to IPRG. After the IPGA's evaluation for the appropriateness of the change, a contract evaluation is performed to confirm the change is not included in the scope of the contract/project. Finally, IPRG will determine if the change order is financially justifiable for the approval. Once approved, IPRG will submit these changes for approval and, if necessary, to the IEPA.

When this type of evaluation is made, the results will be documented with a description of the changes by the CQA Consultant and cross-referenced to specific observation logs and test data sheets.

These reports must include the following information:

- An identifying sheet number for cross-referencing and document control
- A detailed description of the situation or deficiency
- The location and probable cause of the situation or deficiency
- How and when the situation or deficiency was found or located
- Documentation of the corrective action taken to address the situation or deficiency
- Final results of any responses
- Any measures taken to prevent a similar situation from occurring in the future
- The signature of the CQA Officer indicating concurrence

Design and/or specifications changes will be made only with the written agreement of IPRG and the CQA Officer, and will take the form of an addendum to the specifications.

2.5.2 Documentation Management

The Contractor will submit project documentation to the CQA Consultant on a weekly basis or an alternate frequency established by the project requirements.

Complete project CQA documentation must be collected and maintained on-site by the CQA Consultant in a safe repository. This includes (but is not limited to):

- A complete set of construction drawings and specifications
- The CQA Plan
- Project checklists, test procedures, and standards
- Project test procedures, daily logs, pertinent regulatory documents, and other necessary documents.

2.5.3 Storage of Records and Records Retention

All data sheet originals related to the CQA and Certification process, test results, daily logs, memorandums, etc., will be stored by the CQA Consultant in a safe repository on-site during the construction project.

Upon completion of the construction project, records will either be retained at the facility or alternately stored at the CQA Consultants office and be readily accessible by the facility if requested. Records will be maintained for a minimum period of five years from the project completion.

2.6 Failed Test Procedures and Alterations

A "failed test" occurs when a test performed on an engineered component yields a result that does not meet the specifications outlined in the applicable construction drawings or specifications. Testing performed on an engineered component which does not meet the specifications is not considered a failed test if the engineered component is undergoing construction or installation at the time of testing and the testing is performed for the purpose of gauging the effectiveness or completeness of construction. An “alteration” or “field change” is a change in construction materials, specifications, or CQA procedures from the project requirements that is necessary to perform the work or meet project requirements.

2.6.1 Failed Test Prior To Certification Report Submittal

If, prior to submission of the Construction Certification Report for the engineered component, the CQA Consultant determines that there is a "failed test," the CQA Consultant will perform the following:

- Retest or otherwise assess the engineered component or portion of the facility to determine if construction is in compliance with the construction plans and specifications or other project requirements and include the final results in the Certification Report.
- Implement measures to attain compliance with the construction plans and specifications or other project requirements. An area with a verified failure must be reconstructed. Reconstructed areas must be retested at a frequency acceptable to the CQA Consultant and at a frequency and location(s) sufficient to demonstrate that compliance has been achieved.

2.6.2 Alteration Prior to Submittal of Certification Report

If, prior to submission of the Construction Certification Report the CQA Officer determines that an alteration or field change is necessary to the construction drawings or specifications, the CQAOA will do the following:

- Include the applicable testing results and an assessment and justification for the necessary change(s) in an appropriate section of the Certification Report where the change is clearly identified.
- Provide a demonstration in the Certification Report that the change(s) are at least equivalent to the project requirements, the construction plans and specifications, and are at least as protective to human health and the environment.
- Submit the Certification Report as required by the CQA Officer.

2.6.3 Detection of the Change after Submittal of the Certification Report

If, after submission of the Construction Certification Report the CQA Consultant and/or CQA Officer determines that the Certification Report is in error due to improper documentation of an alteration or field change of the construction drawings or specifications, the CQA Consultant will do the following:

- Notify IPRG and/or CQA Officer of the change within twenty-four hours after discovery, by phone and within seven days after discovery in writing.
- Within fourteen days of submitting the written notification required above, do either of the following:

    a. Implement the failed test procedures outlined above (3.6.1) and amend and resubmit the Construction Certification Report to explain the circumstances and how compliance was achieved.

    b. Submit the Alteration information outlined above (Section 3.6.2).

3. PreQualification Testing / Test Pad

3.1 PreQualification Testing of Materials

The following section discusses the QA/QC requirements for prequalification conformance testing of the engineered components for the closure construction.

3.2 Prequalification Conformance Testing

Prequalification testing is necessary to establish that the materials used for the engineered components conform to the minimum specifications contained in this document for each component. Some prequalification testing is generally necessary for any engineered component comprised in whole or in part of aggregate, soils, or geomembranes. Conformance testing is performed on representative materials obtained from the location of origin and results submitted prior to arrival on site unless otherwise directed by the CQA Officer.

Prequalification conformance testing is material characteristics testing. Material characteristics' testing is contained in Tables 1 through 5 as applicable. Soil and aggregate laboratory and field testing methods and minimum testing requirements are provided in Table 1and 2. Minimum testing requirements and frequencies for geotextiles are provided in Table 3 and 7, and for pipes in Table 5. Calibration requirements for testing equipment are provided in Table 8.

3.3 Engineered Components Requiring Prequalification Conformance Testing

Engineered components that require some measure of prequalification are noted in the individual specifications under submittals. These materials are summarized as follows:

- Fill
- Soil Cover and Vegetation Layer
- Aggregates
- Geotextile
- HDPE Pipe

3.4 Submittals

Submit the results of required prequalification testing including interface friction testing, to the CQA Consultant for review and verification that the reported test results meet with project specifications at least 14 days prior to use of the material at the job site unless otherwise directed by the CQA Consultant.

3.5 Test Pad Construction

At a minimum, the following construction procedures should apply.

- The width of the test pad will be at least three (3) times the width of the compaction equipment.
- The length of the test pad will be equal to at least two (2) times the length of the compaction equipment, including any attachments.
- The test pad will be constructed using a sheepsfoot or padfoot roller with fully penetrating feet.
- The area underlying the test pad should be rolled with a smooth drum roller.
- The area underlying the test pad should be moisture conditioned prior to placement of soil material on the test pad.
- Each loose lift will have a maximum thickness of eight (8) inches.

- The test pad will consist of at least six (6) lifts, with a total compacted thickness of not less than thirty-six (36) inches. The maximum compacted thickness of each lift will be no greater than six (6) inches.
- The soil material should be graded and scarified into lifts approximately 8-inches loose prior to compaction.
- The loose lift should be cleaned/picked to remove particles in excess of two inches and other unsuitable material.
- The non-compacted surface of the loose lift should be moisture conditioned, if necessary, prior to compaction.
- The soil material shall be compacted with a minimum of four overlapping passes. One pass consists of a one-way coverage by the compactor.
- Lift thicknesses should be measured to be six inches or less compacted.
- After compaction, the moisture content and density of the soil material should be evaluated by visual inspection (check for pumping or rutting) and by using a Troxler® nuclear density moisture gauge (in accordance with ASTM D3017 and D2922). Each lift should be tested at a minimum of three locations for moisture content and dry density.
- Upon completion of the final lift, a smooth drum roller, on static mode should be used to seal the surface.
- The final lift should be covered with plastic sheeting (min. 4 mils) to maintain soil conditions and retain moisture.
- The test pad should be measured / surveyed to indicate that the test pad is a minimum 30 inches thick.

3.6 Duties of the CQA Consultant (Test Pad Construction)

A qualified CQAOA should be present during the test pad construction to certify the conformance test results and observe and document the construction techniques. The CQAOA shall be responsible for testing, surveying, and documentation necessary to verify that the test pad performs in accordance with the specifications and that the methods and materials utilized for the test pad construction can achieve the same results or better during soil liner construction. The following tasks shall be performed by the CQAOA during construction of the test pad:

- Observe, approve, and document the suitability of the prepared subgrade
- Observe, approve, and document the soil material, including the source, being utilized for test pad construction
- Observe and document the weather conditions including ambient temperature, winds, and precipitation
- Observe and document the type, brand, and model of the construction equipment being utilized
- Observe and document the construction techniques of the equipment including number of passes, orientation of the passes, and the speed of the equipment
- Observe and document methods used to control and adjust moisture content
- Observe, measure, and document the thickness of each lift
- Conduct nuclear moisture-density gauge tests to determine moisture percentage and dry density of the soil (3 tests per lift)
- Repair the holes left by the density testing (clay soil or bentonite plug)
- Create a drawing documenting configuration and dimensions of the test pad. Show location of density tests and Boutwells
- Document and photograph construction of the test pad
- Prepare a report documenting the test pad construction

3.7 Boutwell Installation

A minimum of five Boutwells shall be installed per ASTM D 6391-99. Each individual Boutwell requires an area that is approximately 13' x 13'. The Boutwells are not to be located closer than 40 test diameters center-to-center. A minimum of five Boutwells is required for a typical test pad.

3.8 Duties of the CQA Consultant (Boutwell Test)

The CQAOA shall observe and document the following:

- Check the Boutwell system to confirm there are no leaks
- Check to make sure the standpipes are properly filled
- Check to make sure the Temperature Effect Gage (TEG) is working properly
- Take readings and record information during Stage 1 according to the schedule developed
- Monitor the water level in the standpipes. If the water level becomes low, record the water level and refill per the original method
- Monitor that the test pad remains covered by the plastic sheeting to avoid desiccation, protect from precipitation, and protection from effects of freezing
- Protect Boutwell system from damage (people, animals, or nature)
- Perform calculations to determine termination of Stage 1
- Install Boutwells for Stage 2 per ASTM D 6391
- Take readings and record information during Stage 2
- Perform calculations to determine termination of Stage 2

3.9 Test Pad Report

The CQA Consultant shall prepare a soil liner test pad evaluation report that includes:

- A detailed description of the construction materials, equipment, and methods utilized for the test pad construction
- A summary of test data from the test pad construction
- Data analysis from the Boutwell Test
- Conclusions and recommendations regarding test pad performance and proposed liner construction techniques

4. Earth Cover and CCR Materials

4.1 Subgrade Excavation and Compaction of In-Situ Materials

Subgrade refers to the material on which the final cover system will be constructed. The subgrade may consist of CCR material or cover soil that has been placed over the CCR material to act as a temporary cover. The subgrade will be graded and shaped per the construction drawings to meet the design grades. The subgrade will be compacted in order to provide a stable base on which the final cover can be constructed.

If the existing subgrade is not sufficient to meet the minimum grades of the final cover system design, crown fill may be required to raise the existing grades. Crown fill may consist of additional CCR material either generated by the plant or relocated from another impoundment or soil materials from a borrow source. The crown fill shall be placed in lifts and compacted to meet the minimum standards as described in Table 1 of the CQA Plan. Crown fill shall be placed to raise sections of the impoundments to specified elevations as shown in the construction drawings. The CCR material will not contain organic materials, debris, frozen materials, vegetation, roots or other materials that could protrude into the soil cover. Unsuitable material located below the subgrade elevations shall be over-excavated or dewatered, as necessary, to a competent, stable surface at a lower elevation and replaced with suitable fill. In addition, significant protrusions shall be removed and replaced with suitable fill as appropriate such that the final subgrade surface is relatively smooth.

After preparation, adequacy of the subgrade materials to support the design loads will be verified through a proofroll by the Contractor that is observed and documented by the CQAOA or CQA Officer. Proofrolling should be performed with a pneumatic tire minimum tandem axle, filled dump truck vehicle. Proofrolling shall be performed with a minimum of two overlapping passes. If excessive pumping or rutting occurs during proof-rolling, the area will be reworked or undercut to more suitable material. Depending on the suitability of the crown fill material, the CCR may require dewatering and modification according to the construction techniques used to develop a suitable CCR surface. The CQA Officer of CQAOA shall document the subgrade construction was completed in conformance with the construction documents prior to the placement of the final cover soils.

4.1.1 Construction

Suitable fill will be placed in horizontal loose-lifts. Each lift shall be compacted using suitable equipment to achieve the minimum in-place density specified in Table 1. The Contractor shall adjust the moisture content of the fill material as needed to meet the specified moisture/density requirements.

4.1.2 Construction Testing

The CQA Consultant is responsible for pre-qualification testing of proposed sources of fill material. In-place moisture/density testing of suitable fill will be conducted by the CQAOA or CQA Subcontractor in accordance with the requirements listed in Table 1.

4.2 Cover Soil and Vegetation

Final cover protective soil will be used to establish final elevations within the limits of the impoundment, serve as a stormwater infiltration barrier, and provide erosion protection for the underlying material. The layer will also provide adequate soil for the establishment of vegetation on the final cover. The upper 6-inches of the cover layer is referred to as the vegetative cover soil and the lower 18-inches is called the protective cover soil. The 6-inch cover will be planted with vegetation consisting of grass species native to Illinois to prevent erosion of the final cover system.

The CQA Consultant is responsible for pre-qualification testing of proposed sources of fill material. In-place moisture/density testing of suitable fill will be conducted by the CQAOA or CQA Subcontractor in accordance with the requirements listed in Table 1. Soils for placement for the final cover from borrow sources as contained in the construction plans and/or as directed by IPRG will be used. The Contractor will remove excess or unsatisfactory material to designated on-site stockpiles as directed by the CQAOA.

Borrow source samples for soil qualification shall be evaluated for every 20,000 cubic yards of protective cover material or when visual observations indicate that a change has occurred in the borrow soils. The following testing shall be performed:

- Moisture-density relationship Standard Proctor (ASTM D698);
- Atterberg Limits, ASTM D4318; and
- Unified Soil Classification, ASTM D2487.
- Permeability, ASTM D5084 on representative samples remolded to 90 percent of maximum dry density

The CQA Officer shall determine if the soils meet the specification for protective cover based on the results of the laboratory testing.

Unsuitable material may include, but not be limited to: roots, rocks larger than 3-inches, debris, frozen soils, organic matter, topsoil, granular materials, and other deleterious materials.

Material for the 18-inch protective cover soil will have the following characteristics:

- Consist of well graded natural earth that is not excessively dry or saturated;
- Free of cobbles, stones, rock, gravel, or boulders greater than three (3) inches. No rocks greater than 1-inch, sharp edged rocks or other hard objects which could damage the geomembrane liner material will be allowed on the top layer of the cover at the time of protective cover system installation;
- Free of organic materials, debris, waste, frozen materials, vegetation, roots, and other deleterious materials,
  - Unsuitable materials shall be removed from the borrow source prior to transport;
- Meets one of the following USCS soil classifications: SC, CL, CH, GC, ML, CL-CH, or CL-ML;
- At a minimum, the material shall be compacted to at least 95 percent of the maximum dry density as determined by ASTM D698 (Standard Proctor), at a moisture greater than optimum;
- Be demonstrated to have a maximum permeability of $1x10^{-6}$ cm/sec when compacted to at least 95 percent of Standard Proctor maximum dry density.

Material for the vegetative cover soil will have the following characteristics:

- Consists of well-graded natural earth materials that are not excessively dry or saturated unless otherwise specified by the construction specifications
- Has sufficient fertility or can be amended to support vegetation in the top 6-inches of material

4.2.1 Construction

Prior to protective cover soil placement, the top surface of CCR subgrade shall be prepared by compacting the CCR to a smooth and consistent grade. The Contractor will place the final cover protective layer to the lines and grades shown on the construction drawings. The protective cover soil will be deposited and spread in two (2) 9-inch lifts (total of 18-inches) using low ground pressure equipment. The compactor will have a 6-inch minimum teeth length for soil compaction. The protective cover soil shall be compacted to the degree that no further appreciable consolidations are evidenced under the action of the compaction equipment. A minimum of four one-way passes with the compaction equipment will be performed on the lift.

The top vegetative cover soil layer will be deposited in a uniform 6-inch lift using low ground pressure equipment. The final cover protective soil will exhibit a smooth uniform surface free from ruts, depressions, and debris. Seeding of the final cover may begin after the area to be covered has been properly prepared and fertilized. Uniformly distribute seed to meet the application rate provided in the project specifications. Perform seeding only during periods of acceptable weather conditions. Protect seeded areas with temporary erosion control matting (ECM) as shown in the construction drawings, or as

necessary to prevent loss of seed and fertilizer. Complete ECM field installation in accordance with the manufacturer's recommended installation procedures and the construction specifications. Confirm that matting overlaps are shingled in the direction of flow.

4.2.2 Construction Testing

Protective cover soil lift thickness and source verification will be visually observed and confirmed by the CQAOA for compliance with the engineering design. Cover construction certification data shall include visual observations, compaction and moisture documentation, thickness confirmation for completed protective cover soil, and documentation of deviations from the plan. The following information shall be documented by the CQAOA with respect to soil compaction:

- The type and weight of compaction equipment;
- The method of surface preparation;
- The method of adjusting soil moisture, if any;
- The thickness of each lift after compaction;
- General observations of the number of passes and uniformity of compaction coverage;
- Observation of the reduction in clod size; and
- Documentation of repairs, including removal and replacement of frozen or desiccated soils.

For every 20,000 cubic yards of cover soil or when visual observations indicate that a change has occurred in the borrow soils, the CQAOA will obtain soil samples and perform the testing outlined in Section 3.2. In addition, the in-place moisture content and dry density of the prepared protective cover will be determined by nuclear methods following ASTM D6938, latest edition. In-place tests shall be performed at a minimum frequency of one test per acre per lift. Cover segment(s) rejected by the CQAOA shall be reworked or removed and replaced.

The CQAOA will verify the seed, application method, and application rates meet the construction specifications, and that seed has been uniformly distributed over the final cover. Testing requirements are included in Table 6. Total thickness will be verified by as-built survey on a 100-ft maximum grid.

5. Aggregates

Aggregates include materials used for the construction of the bedding/backfill of underdrains, slope and channel protection (rip rap), and stormwater control structures.

5.1 Material, Construction, and Design Specifications

Material and construction specifications for aggregates are set forth in Table 2.

5.2 Pre-Construction Manufacturer/Conformance Testing

Aggregate materials for use shall be obtained from approved off-site borrow sources and shall satisfy the requirements in the contract documents throughout delivery and use of the materials. The Contractor shall submit to the CQA Consultant certified laboratory test reports for each proposed aggregate source or supplier stating that the material meets or exceeds the quality and durability requirements for aggregates as set forth in Table 2.

5.3 Construction

Channels will be excavated to the lines and grades as shown on the construction drawings. Aggregate materials shall be placed using equipment and methods that protect underlying pipe materials, geotextiles and outlets of letdown structures. Aggregates for bedding and backfill of pipes and structures should be placed to the thickness and elevations shown on the plans and tamped in place to achieve compaction. Aggregates for underdrains shall be placed to the thickness and elevations shown on the plans and tamped in place to achieve compaction.

Rip rap shall be placed in a manner that will produce a reasonable well-graded mass of stone with smaller stone fragments filling the space between the larger ones, so as to result in the minimum practicable percentage of voids. The final section of stone filling shall be in conformance with the lines, grades, and thicknesses as shown on the Construction Drawings. Rip rap shall not be placed or dropped from a height greater than 24”.

5.4 Construction Testing

Observation of aggregate placement by the CQAOA will document that the correct materials are utilized and thicknesses of the layers are attained to meet the design intent. For aggregate used in bedding and backfill of structures, the aggregate will be field observed to document that it meets the project requirements.

6. Geotextiles

Geotextiles will be used as a permeable separation fabric in the construction letdown structures, drainage ditches and underdrains, and will be placed under rip rap protection of slopes and channels per the construction drawings.

6.1 Material, Construction, and Design Specifications

The geotextile is designed to separate dissimilar subsurface elements without retarding drainage through the materials. A summary of geotextile material requirements is provided in Table 7.

6.2 Pre-Construction Manufacturer/Conformance Testing

The Contractor shall submit the manufacturers' names and the materials intended for use as non-woven geotextiles. Certified test reports conforming to the requirements of standards and testing methods specified herein shall be submitted to the CQA Consultant for approval prior to delivery of geotextile. Upon delivery at the site, the Contractor will submit roll identification and quality control certificates issued by the manufacturer to the on-site CQA Consultant representative. Rolls without proper identification will be rejected. Geotextile materials will be handled in accordance with manufacturer’s recommendations utilizing handling equipment on-site that poses minimal risk of damage to the material.

6.3 Construction

Geotextile field installation will be performed in accordance with the manufacturer’s recommended installation procedures and the construction specifications. Complete the installation such that the geotextile is smooth, without wrinkles, tears, or holes. Installation will be performed in such a manner as to minimize damage and will comply with the following:

- On slopes, the geotextiles will be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension.
- In the presence of wind, geotextiles will be weighted with sandbags or the equivalent. Sandbags will be installed during the placement and will remain until replaced with the appropriate overlying material.
- Sandbags will be filled with the fine-grained material and must be handled with care to prevent rupture.
- Geotextiles will be cut using an approved geotextile cutter only (i.e., an upward cutting hook blade). If in place, special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.

The aggregate shall be placed in the same direction as the fabric is seamed. Extreme care is required by the Contractor so that the equipment operator does not cause damage to the geotextile. At no time will construction equipment be permitted to track directly on the fabric. Geotextile shall not be exposed to sunlight (UV) for more than 30 days. Damage to the geotextile fabrics shall be repaired by the Contractor (using acceptable methods) at no additional expense to IPRG.

7. Piping

7.1 Piping Systems and Stormwater Structures

All piping and stormwater structures used as part of the stormwater management system will be to the sizes and installed in locations as shown on the contract drawings.

7.1.1 Material, Construction, and Design Specifications

A summary of piping material and construction requirements is provided in the contract documents.

7.1.2 Pre-Construction Conformance Testing

Contractor must submit shop drawings and material samples for each type of pipe and each structure intended for installation for review and approval. The CQAOA will verify that the materials meet or exceed the minimum property values.

7.1.3 Construction

Care will be taken during transportation of the pipe such that it will not be cut, kinked, or otherwise damaged. Pipes will be handled and stored in general accordance with the manufacturer's recommendation. The handling of joined pipe will be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Slings for handling the pipe will not be positioned at joints. Sections of the pipes with deep cuts and gouges will be removed and the ends of the pipe rejoined using manufacturer-approved methods and equipment. Pipes and stormwater structures shall be installed to the elevations, lines, and grades shown in the contract documents. Pipes shall be bedded and backfilled as shown in the contract drawings.

The CQAOA will verify through delivery tickets and material bill of ladings that the material delivered to the site meets the project requirements.

As required by the construction specifications, the joints of non-perforated HDPE pipes will be tested using the pressure test procedures given in ASTM C924.

7.1.4 Construction Inspection

Pipe installation will be in accordance with the manufacturer's recommended installation procedures and the construction specifications. The CQAOA will monitor and document the following:

- The perforations or slots of the pipe conform to the requirements of the specifications.
- That pipe and fittings are joined by the methods indicated by the manufacturer or in the specifications.
- That pipes are properly bedded and covered per the specifications.
- That marker/warning tape is installed in the trench above the pipe to mark its location.
- Testing requirements for pipe and fittings are provided in Table 4.

During installation of the HDPE pipe, perform the following quality control tests and record the results for review and concurrence by the CQA Contractor:

- Non-destructive pressure test performance results
- Pipe repair logs

- The CQAOA will document observations during installation including damage, repair logs, test results, and conformance to specifications. The method and equipment used to fuse pipe joints and conduct pressure testing will also be noted.

The CQAOA will document the results of pressure testing. Additionally, should a failed test occur, the CQA Contractor will document the nature of leaks discovered and the details of their repair.

8. Concrete and Grout

8.1 Material, Construction, and Design Specifications

A summary of concrete and grout material and construction requirements is provided in Table 5.

8.2 Pre-Construction Conformance Testing

The Contractor shall submit a mix design for each type of concrete and grout and from each supplier. The Contractor shall submit a minimum of three 28-day compressive strength test results for each mix design.

8.3 Construction

8.3.1 Cast-in-Place Concrete

Mixing, transporting, and placement of concrete shall be in accordance with the American Concrete Institute (ACI) standard 301-96. In accordance with Section 1.4.3 of ACI 301-96, the Contractor shall keep a copy of ACI SP-15(95), Field Reference Manual: Standard Specifications for Structural Concrete on-site. SP-15 is a compilation of references on measuring, mixing, transporting, and placing concrete; concrete pumping methods; hot and cold weather concreting; and concrete formwork.

Cast-in-place concrete shall be cured in accordance with ACI 308. Surfaces not covered by forms shall be protected with membrane curing compound, dampened burlap, polyethylene film, cotton mats, or wetted sand. Unless membrane curing compound is used, curing materials shall be kept wet and remain in place for seven days.

8.3.2 Grout

Submit a grout mix design to the CQA Officer for review and approval.

8.4 Construction Observation and Testing

8.4.1 Cast-in-Place Concrete

Reinforcing shall be installed in accordance with the Contractor's shop drawings. Reinforcing shall not be covered or completely enclosed by formwork until the CQAOA has been given an opportunity to observe the reinforcing and installation of other embedded items. The Contractor shall provide the CQAOA with a minimum of 24 hours advance notice of concrete placement.

Construction testing of cast-in-place concrete will be performed by the CQAOA. Field testing will include tests for temperature, slump, and air content. Field testing will also include the preparation of test specimens for laboratory testing of compressive strength. Each test specimen will consist of a set of 4 cylinders to be tested in accordance with the following schedule:

- 1 Cylinder – 7 day compressive strength
- 2 Cylinders – 28 day compressive strength
- 1 Cylinder - Spare

Field and laboratory testing requirements are provided in Table 5.

8.4.2 Grout

Field and laboratory testing requirements for the grout are provided in Table 5.

9. Miscellaneous Items

The following section discusses the specific QA/QC requirements for miscellaneous items installed as part of the project.

9.1 Construction Observation and Testing

Contractor shall submit for review the following information as appropriate:

- Shop drawings
- Product data
- Manufacturer's certificates
- Design data and calculations
- Manufacturer's instructions

Installation of miscellaneous items will be observed and documented by the CQAOA to verify conformance with the construction documents and shop drawings.

10. Surveys

10.1 Surveying

CQA surveying will be performed by a third party surveyor retained by IPRG. The purpose of the surveys is to verify that actual thickness and grades of the construction components are in accordance with the construction drawings. Surveying of lines and grades will be conducted during construction of the soil layers. Surveying will be performed to provide documentation for record plans, verify quantities of soils and assist the Contractor in complying with the required grades. Review of the surveys conducted at the site will be part of the CQA program. The permanent benchmarks at the facility will be used for survey control. Surveying will be performed under the supervision of a qualified, professional Land Surveyor licensed in the State of Illinois.

Based on the control points provided by IPRG, the Contractor is to provide temporary and permanent benchmarks, monuments, and increments needed to control work. If during the work, control points set by IPRG are disturbed by the Contractor, the Contractor shall replace them at no cost to IPRG.

10.1.1 Survey Requirements

The following surfaces are required to be surveyed in order to certify the cover for the impoundment closure:

- Top of Subgrade
- Top of Compacted Soil Layer
- Top of Vegetative Layer
- Stormwater Controls

10.1.2 Record Surveys or As-Built Surveys

Record Surveys or As-Built Surveys shall obtain field measurements of vertical (where required) or horizontal dimensions. Each drawing shall clearly show by symbols, notations, or delineations, those constructed facilities located by the field survey. Survey data shall be reviewed and approved by a Professional Licensed Surveyor or a Professional Engineer. The Contractor shall complete as-built surveys in order to document the following:

- Quantities of materials placed.
- As-built line and grade of structures, piping, fills, and embankments.

10.2 Accuracy Requirements & Measurement Specifications

Every determination of distance shall be made either directly or indirectly in such a manner that the linear error in the distance between two points (not necessarily adjacent points) shall not exceed the reported distance divided by ten thousand (allowable linear error = reported distance divided by ten thousand) and every angular measurement shall be made in such a manner that the allowable (directional) error, in radians, shall not exceed the allowable linear error divided by the reported distance (allowable [directional] error = allowable linear error divided by reported distance). When the reported distance is less than two hundred feet, the linear error shall not exceed 0.02 feet.

10.3 Acceptable Construction Tolerances

Acceptable construction tolerances from plan dimensions, elevations, and grades shall be as shown on the drawings and as listed in Table 6.

10.4 Surveys by Owner

IPRG may conduct additional surveys to monitor or document the work.

10.5 Survey Deliverables

The Contractor shall provide As-Built Drawings in both electronic and hard-copy format. As-Built Drawings are surveys that document as-constructed conditions and/or confirm that a project has been constructed consistent with the provisions of the construction/contract documents. As-built surveys are typically finalized after construction is completed. However, these As-Built Surveys may be also commonly used during intermediate points in construction to confirm the construction project is achieving interim objectives and milestones. The following items shall be required when as-built surveys are delivered to the CQA Consultant:

- The As-Built survey drawings shall be accompanied by a three-dimensional surface model of the survey.
- When performing as-built surveys, the surveyor shall obtain field measurements of vertical or horizontal dimensions of permanent structures or constructed improvements so that the constructed facility can be delineated in such a way that the location of the construction may be compared with the construction plans.
- The as-built maps shall clearly show those constructed improvements by symbols, notations, or delineations, located by the survey.
- The as-built survey shall clearly depict the limits of constructed features such as fill, liner and drainage system, etc. When depicting pipelines, the as-built survey shall indicate the size and material of construction as well as invert (gravity) or top of pipe (non-gravity) elevations.
- The vertical and horizontal accuracy of the measurements shall be made such that it may be determined whether the improvements were constructed consistent with planned locations.
- The Contractor shall be required to conduct and submit verification for items shown in Table 6. Surveys shall be prepared in sufficient detail to document the cover 18-inch thick low permeability layer, and 6-inch thick erosion/vegetative layer. As such, data shall be depicted in tabular form, in cross-sections and/or in maps such that the CQAOA can compare the data with the specific design requirement. In addition to the above information, the source file (such as an Excel file) containing the tabular information should also be provided.

11. Meetings

The following meetings will be held during the course of the construction phase:

- Kick-Off Meeting – A project kick-off meeting will be held at the project site on a schedule established by IPRG. The kick-off meeting is to be attended by the Contractor and key subcontractor representatives, the CQA Officer, CQAOA, and other IPRG representatives as determined by IPRG. This meeting will be held to discuss construction responsibilities, safety, scheduling, design, QA/QC procedures, change orders, and Contractor submittals.
- Construction Progress Meetings – Construction progress meetings will be held at the project site on a schedule established by IPRG. A consistent day, time, and location will be established. The construction progress meetings are to be attended by the Contractor and key subcontractor representatives, the CQAOA, and other IPRG representatives as determined by IPRG. These meetings will be held to discuss construction progress, delays, design issues, QA/QC procedures, change orders, and Contractor submittals.
- Safety Meetings – The Contractor will hold safety meetings in accordance with its Site Health and Safety Plan including daily tailgate meetings. The Contractor's Site Health and Safety Plan must be submitted to IPRG prior to commencing construction activities. It is anticipated that these meetings will be held at the start of construction and then periodically as conditions change.

12. Documentation

12.1 Submittals

Submittals include shop drawings, material data, and samples. Product data submittals, samples, and shop drawings are required to verify that the correct products will be installed on the project. The shop drawing submittal is a drawing or set of drawings produced by the contractor, supplier, manufacturer, subcontractor, or fabricator typically for pre-fabricated components or construction procedures. The material data submittal usually consists of the manufacturer's product information. The sample submittal is a physical portion of a specified product, often required when several products are acceptable, to confirm the quality and aesthetic level of the material. The size or unit of sample material is usually specified.

For borrow sources to be used as cover material, the Contractor shall provide the location and a survey of the borrow source. Contractor shall provide access a minimum of two weeks prior to the scheduled start of cover material placement for the CQA Contractor to obtain samples for borrow source testing. If the borrow source fails to meet project specifications, the Contractor must provide another borrow source.

12.1.1 Submittal Procedures

The Contractor shall initially submit to the CQA Officer a minimum of 4 copies of submittals. One copy of the submittal will be returned to the Contractor. A letter of transmittal shall accompany each submittal. At the beginning of each letter of transmittal, a reference heading will be provided indicating the following:

- Owner's Name
- Project Name
- Contract No.
- Transmittal No.
- Specification or Drawing Reference

Shop Drawings shall be submitted a minimum of seven days prior to the intended use of the material or equipment for construction and with ample allowance for the time required to deliver the material or equipment after data covering such is reviewed. The Contractor shall assume the risk for materials or equipment which are fabricated or delivered prior to the approval of the Shop Drawings.

It is the Contractor's responsibility to review submittals made by his or her suppliers and subcontractors before transmitting them to the CQA Officer. The Contractor's review is intended to allow for the proper coordination of the Work, to determine that each submittal is in accordance with the Contractor's desires, and that there is sufficient information provided for the CQA Officer to determine compliance with the contract documents. Incomplete or inadequate submittals will be returned for revision without review.

12.1.2 Submittal Review and Approval

After the CQA Officer completes the review, Shop Drawings will be marked with one of the following notations:

- Conforms As Is
- Conforms As Noted
- Revise and Resubmit
- Does Not Conform / Resubmit
- See Attached Comments

If a submittal is acceptable, it will be marked "Conforms As Is" or "Conforms As Noted". Upon return of a submittal marked "Conforms As Is" or "Conforms As Noted", the Contractor may order, ship or fabricate the materials included on the submittal, provided they are in accordance with the corrections indicated. If a Shop Drawing marked "Conforms As Noted" has extensive corrections or corrections affecting other drawings or Work, the CQA Officer may require that the Contractor make the corrections indicated thereon and resubmit the Shop Drawings for record purposes. Such drawings will have the notation, "Conforms As Noted / Resubmit." If a submittal is unacceptable, 2 copies will be returned to the Contractor with the following notation: "Does Not Conform / Resubmit".

Upon return of a submittal marked "Revise and Resubmit", Contractor shall make the corrections indicated and repeat the initial procedure. The "Does Not Conform / Resubmit" notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial procedure utilizing acceptable material or equipment. Related work performed or equipment installed without a “Conforms As Is" or “Conforms As Noted” Shop Drawing will be at the sole responsibility of the Contractor.

The CQA Officer will review and process submittals promptly. A reasonable time should be allowed for initial review, for the Shop Drawings to be revised and resubmitted as necessary, and for subsequent review, approval, and return to the Contractor.

12.2 Project Schedules

The Contractor will be required to build a detailed project schedule to be approved by IPRG prior to the preconstruction meeting. The schedule shall, at a minimum, have the following attributes:

- Schedule narrative describing the logic for the work planned;
- Clearly defined starting point;
- Clearly defined completion date;
- Project milestones;
- Certification milestones;
- Mobilization and demobilization activities;
- Critical paths identified;
- Tasks that represent the performance of the work, including tangible deliverables or products;
- Specifies the resources required to perform the work (This shall include labor, equipment, and materials); and
- Can be easily measured during the performance of the detailed activity relating to the work.

All details in the project schedule will be logically tied to other activities. As a general guideline for generating schedules, the duration of an activity should be limited to 14 calendar days. In no case should an individual work activity be scheduled for a duration longer than 45 calendar days without approval from IPRG. If a portion of the project is to be accomplished during a plant outage, those scheduled activities should be incorporated into a separate hourly schedule. The work should be broken down into sufficient enough detail to allow the maximum use of start-to-finish relationships. In addition, start-to-start, finish-to-finish, or start-to-finish relationships shall be used at a minimum. In no case will negative lag values be allowed for relationships. Exceptions to the above criteria must have IPRG construction management’s approval.

Individual activities in the project schedule requiring identifiable labor to complete the project will be resource loaded with necessary engineering labor hours, project support labor hours, and/or craft labor hours consistent with the Contractor’s estimate, scope of work, and work assignments. Craft hour resource loading will include direct hours necessary to complete the specified scope of work, including foremen hours. Resource loading of necessary overhead or indirect hours will be determined by advanced consultation with and approval from IPRG. The Contractor

will provide written assurances that the man-hours included in the schedule reasonably represent the estimate for the work scope identified. In addition, the Contractor will resource load major equipment necessary for completion of the individual work activities where the approximate daily rental or ownership value exceeds $500 per day or provide an equipment utilization plan with actual usage indicated. Changes made to the project schedule's resource loading after the schedule has been submitted will be highlighted in the weekly and monthly reports along with a written explanation.

Progress for scheduled tasks will be tracked using physical percent complete. Physical percent complete will be calculated based on actual progress as measured by work effort or by installed quantities. When requested by IPRG, the Contractor will provide information and back up support to validate methods used to develop physical percent complete. In no case will physical percent complete be based solely on remaining duration compared to original durations or actual expenditures compared to budgeted expenditures. Significant reductions in physical percent complete will be reported in the weekly report along with an explanation.

12.3 Requests For Information

The purpose of this procedure is to define and detail the Request For Information (RFI) process. RFIs must be processed expeditiously in order to avoid the possibility of delay to the project. An RFI is a form established for the Contractor's use to request information and/or clarification related to the plans, specifications, or contract requirements. RFIs are also submitted to request approval for minor deviations from contract requirements that do not involve time or cost adjustment and to obtain directions on how to proceed when there are conflicting contract requirements. Please note that the RFI shall not be used as a substitute for items specifically requiring a submittal from the Contractor. RFIs shall not be used to change the design or price. If a change in the design or price is needed (i.e., based on an RFI response), then a change order must be issued.

12.3.1 RFI Procedures

The following procedures will be followed for filing, reviewing, and responding to RFIs:

- The Contractor completes, sequentially numbers, and submits the RFI form to the CQA Officer.
- The CQA Officer of CQAOA enters the RFI in a tracking log.
- The CQA Officer will review and respond to the RFI.
- If the RFI will lead to a Change Order, the CQA Officer will submit to IPRG for review.
- IPRG approval of each Change Order is required.
- If the RFI does not lead to a Change Order, the CQA Officer will sign and return the RFI to the Contractor.

The RFI form should be agreed upon prior to the start of construction. RFIs may be submitted electronically if the CQA Consultant and IPRG agree.

12.4 Project Documentation

Project documentation shall be collected and maintained on-site by the CQA Officer. The Contractor and CQA Officer shall submit project documentation to IPRG on a weekly basis. Copies will be maintained by the Contractor and the CQA Officer for back-up.

12.4.1 CQA Consultant Documentation

Construction Documentation Forms that will be developed prior to construction and used for CQA and will include the following:

- CQAOA’s Daily Report
- Submittal Log

- Requests for Information (RFI) Log
- Moisture Density Field Testing Log
- Concrete Placement Log
- Concrete Testing Log

These forms represent examples; however, they may be modified as deemed appropriate based on the requirements of the CQA Consultant or IPRG.

At the end of each week of construction of the final cover system until construction is complete, a summary report must be either prepared by the CQA Officer or under the supervision of the CQA Officer. The report must include descriptions of the weather, locations where construction occurred during the previous week, materials used, results of testing, inspection reports, and procedures used to perform the inspections. The CQA Officer must certify the report. IPRG shall retain weekly summary reports and must make those reports available at reasonable times for inspection by IEPA.

12.4.2 Contractor Documentation

The Contractor will submit a daily force report identifying the Contractor's and subcontractors' total manpower headcount performing the work with a breakdown of craft, by shift, along with a list of major equipment being employed on-site. The daily force report will also include a description of the work performed that day. The daily force report will identify separately scheduled tasks actually started or completed for the day, as well as daily weather conditions (temp, wind, precipitation) and schedule impacts or delays encountered due to weather. The report will include details of safety or environmental events. If there are no events, the report shall state that. The daily force report is due by 8:30am for the previous day worked.

The Contractor will provide a weekly schedule update and status report. Weekly schedule updates will include actual starts, actual finishes, remaining durations, physical percent complete, and other status items required by IPRG to be included in the log feature of each activity. The weekly schedule status report shall be prepared immediately following the schedule update and shall show changes made to the prior schedule file as a result of the weekly schedule update. The weekly schedule status report shall discuss the following items:

- The current critical path,
- all logical revisions that affect the critical path,
- all decreases in physical percent complete,
- all increases to the remaining durations,
- all revisions to original durations,
- all added schedule activities,
- actual man hours expended to date and for the prior week,
- actual equipment used, and
- actual quantity of material used.

Each weekly update must be accompanied by a detailed status report indicating the overall status of the work, problem areas, recovery plans, unresolved issues, change orders and their effect on the work progress, and manpower availability. Each weekly update must be accompanied by a material received report and a material status report. The weekly status report and schedule update is due by close of business Monday for the previous week worked.

The Contractor shall report on a weekly basis the information necessary for IPRG to establish and maintain IPRG's earned value management system performance indicators and indexes. This report shall be submitted no later than Wednesday for the prior work week. This would include period and cumulative planned hours, earned hours, and actual hours. Earned hours are defined as budgeted hours multiplied by the physical percent complete per each budget resource hour loaded in the individual scheduled activity. Actual hours can be reported at a level higher than individual schedule activities, but not less than by the resource detail provided (i.e., by craft or discipline, by subcontractor, by area) and will be the subject of source validation by IPRG. The form of the Contractor’s earned value management system reporting shall generally be in its native electronic form that can best be utilized by the IPRG.

Each month, the Contractor shall provide a more in-depth and detailed status report indicating the overall status of the work, major or significant changes made to the schedule, problem areas, recovery plans, unresolved issues, change orders and their effect on the work progress, and manpower availability. The monthly status report must include the following: Project Tracking System reports detailing planned, earned, and actual man hours and a monthly cost report including current budget, actual commitments, expenditures, and estimate-at-completions for construction activities. The monthly report will have a financial report included that shows actual cost vs. forecasted cost and details for variances.

Tables

TABLE 1 - SOIL REQUIREMENTS

Component	Required Test or Observation	Test Method	Minimum Frequency	Acceptance Criteria	Responsible Party
Closure Cover Soil 18-inch Layer	Moisture Content	ASTM D 2216	1 / 20,000 CY	Soil classified as CL, CH, CL-ML, SC, GC OR GM , free from organic material, waste material, angular stones greater than 2 inches, and rounded stones greater than 3 inches, adequate moisture before compaction	CQA Consultant to retrieve samples and perform testing
	Soil Classification	ASTM D 2487	1 / 20,000 CY		
	Atterberg Limits	ASTM D 4318	1 / 20,000 CY		
	Standard Proctor 90% in place minimum	ASTM D 698	1 / 20,000 CY		
	Hydraulic Conductivity	ASTM D 5084	1/10,000 CY	Maximum permeability of $1x10^{-6}$ cm/sec when compacted to 95% of Standard Proctor at or above optimum moisture content	CQA Consultant to retrieve samples and perform testing
	Visual Observation	NA	As required	Substantially free of debris, large rocks, plant material, or other deleterious material.	CQA Consultant to retrieve samples and perform testing
	In-place Moisture Content	ASTM D 6938	1 test acre per lift	Moisture content -2 to +2 % optimum	CQA Consultant
	In-Place Hydraulic Conductivity	ASTM D 5084	1/10,000 CY	Maximum permeability of $1x10^{-6}$ cm/sec when compacted to 95% of Standard Proctor at or above optimum moisture content	
	In-Place Visual Observation	NA	As required	Final surface firm, smooth and uniform	CQA Consultant
Closure Cover Soil 6-inch Vegetative Layer	In-Place Visual Observation	NA	As required	Final surface firm, smooth and uniform	CQA Consultant
	In Place Lift Depth Check	NA	As required	Thickness verified by as-built survey at 100-ft maximum grid interval	

Latest version of the applicable testing standards will be used when conducting tests.

TABLE 2 - AGGREGATE REQUIREMENTS

Component	Required Test or Observation	Test Method	Minimum Frequency	Acceptance Criteria	Responsible Party
No. 5 Stone for Finger Drains	Sieve Analysis	AASHTO T27	1 per supplier or source.	No. 5	Contractor/Supplier
C-33 Sand for Finger Drains	Sieve Analysis	ASTM C33	1 per supplier or source.	ASTM C33	Contractor/Supplier
Rip Rap	Percent Wear	AASHTO T96	1 per supplier or source	60% maximum	Contractor / Supplier
	Percent Soundness	AASHTO T104	1 per supplier or source	85% minimum	Contractor / Supplier
	Visual Inspection	N/A	All Rip Rap placed	Per the General Notes in the Construction Plans	CQA Consultant
Aggregate for filter gravel at underdrains	Sieve Analysis	AASHTO T27	1 per supplier or source.	Per the General Notes in the Construction Plans	Contractor / Supplier

Latest version of the applicable testing standards will be used when conducting tests.

TABLE 3 - MINIMUM TESTING REQUIREMENTS FOR GEOTEXTILES

Component	Required Test or Observation	Test Method	Minimum Frequency	Acceptance Criteria	Responsible Party
Woven or Non-woven Geotextile	Submit manufacturer's certified test results for Type II and Type III Geotextile Fabric	Various	1 per manufacturer/ supplier	Per the Construction Plans	Contractor
Geotextile seams	Observation of seam overlap	N/A	All seams	Minimum 18 inch overlap	CQA Consultant

TABLE 4 - MINIMUM TESTING REQUIREMENTS FOR PIPE

Component	Required Test or Observation	Test Method	Minimum Frequency	Acceptance Criteria	Responsible Party
HDPE Underdrain and Finger Drain Piping	Visual observation of pipe joining and installation	N/A	Each section of pipe	Per manufacturer's recommendations	CQA Consultant
Non-Perforated HDPE Piping	Pressure test of pipe joings	ASTM C924	As specified in construction specifications	Per manufacturer's recommendations	CQA Consultant

Latest version of the applicable testing standards will be used when conducting tests

TABLE 5 – MINIMUM TESTING REQUIREMENTS FOR CONCRETE AND GROUT

Component	Required Test or Observation	Test Method	Minimum Frequency	Acceptance Criteria	Responsible Party
Concrete Mix Design	Submit for review	N/A	1 per mix	N/A	Contractor / Supplier
	Compressive Strength	ASTM C 39	3 per mix design	4,000 psi at 28 days	Contractor / Supplier
Cast-in-Place Concrete	Temperature	ASTM C 1064	1 / 10 CY	≤ 95°	CQA Consultant
	Slump	ASTM C 143	1 / 20 CY	4 inches ± 1 inch	CQA Consultant
	Air Entrainment	ASTM C 231	1 / 20 CY	6 % ± 1%	CQA Consultant
	Test Cylinders	ASTM C 31	1 set (4) / 50 CY	N/A	CQA Consultant
	Compressive Strength	ASTM C 39	1 at 7 days 2 at 28 days 1 spare	Average of 2 tests ≥ 4,000 psi at 28 days and each test is ≥ 3,800 psi	CQA Consultant
Concrete reinforcing	Visual observation	N/A	All structures	Per Contractor's approved shop drawings	CQA Consultant
Grout Mix Design	Submit for review	N/A	1 per mix	N/A	Contractor / Supplier
	Compressive Strength	ASTM C 942	3 per mix design	1000 psi at 28 days	Contractor / Supplier

Latest version of the applicable testing standards will be used when conducting tests

TABLE 6 – CONSTRUCTION TOLERANCES FOR COVER THICKNESS VERIFICATION

Component	Acceptance Criteria	Responsible Party
Top of Fill	+ 0.10 Feet Vertical	Contractor
	± 1.0 Feet Horizontal	Contractor
Top of Cover Soil Layer	+ 0.10 Feet Vertical	Contractor
	± 1.0 Feet Horizontal	Contractor
Top of Vegetative Soil Layer	+ 0.10 Feet Vertical	Contractor
	± 1.0 Feet Horizontal	Contractor

Latest version of the applicable testing standards will be used when conducting tests

TABLE 7 – REQUIRED PROPERTIES FOR NONWOVEN GEOTEXTILES

Material Property	Value[(1)]	Units	Test Method	Frequency
10 oz/sy Nonwoven Geotextile				
Mass/Area (min. avg.)	10	oz/sy	ASTM D 5261	250,000 SF
Permittivity	0.94	sec^{-1}	ASTM D 4491	250,000 SF
Grab Tensile	260	lb	ASTM D 4632	250,000 SF
Grab Elongation	50	percent	ASTM D 4632	250,000 SF
CBR Puncture Resistance	725	lb	ASTM D 6241	250,000 SF
Trapezoidal Tear	100	lb	ASTM D 4533	250,000 SF
Apparent Opening Size	100	U.S. Sieve	ASTM D 4751	250,000 SF
8 oz/sy Nonwoven Geotextile				
Mass/Area (min. avg.)	8	oz/sy	ASTM D 5261	250,000 SF
Permittivity	1.26	sec^{-1}	ASTM D 4491	250,000 SF
Grab Tensile	220	lb	ASTM D 4632	250,000 SF
Grab Elongation	50	percent	ASTM D 4632	250,000 SF
CBR Puncture Resistance	575	lb	ASTM D 6241	250,000 SF
Trapezoidal Tear	90	lb	ASTM D 4533	250,000 SF
Apparent Opening Size	80	U.S. Sieve	ASTM D 4751	250,000 SF
6 oz/sy Nonwoven Geotextile				
Mass/Area (min. avg.)	6	oz/sy	ASTM D 5261	250,000 SF
Permittivity	1.50	sec^{-1}	ASTM D 4491	250,000 SF
Grab Tensile	160	lb	ASTM D 4632	250,000 SF
Grab Elongation	50	percent	ASTM D 4632	250,000 SF
CBR Puncture Resistance	435	lb	ASTM D 6241	250,000 SF
Trapezoidal Tear	65	lb	ASTM D 4533	250,000 SF
Apparent Opening Size	70	U.S. Sieve	ASTM D 4751	250,000 SF

(1) Minimum average roll values

TABLE 8 CALIBRATION OF TESTING EQUIPMENT

Equipment	Required Test	Minimum Frequency	Acceptance Criteria
Nuclear Density Gauge	Radioactive Source Wipe Testing and Systems Electronics Check	Annually by manufacturer or Specialty Testing firm qualified to inspect and calibrate nuclear source equipment	Certificate of Calibration and Safety by Testing Firm
Tensiometer	Tensile strength calibration to standard	Prior to arrival to project site. Tensionmeter to be field verified at the discretion of the CQA Consultant	+/- 3 psi
Air Pressure Gauges	Pressure in psi compared to standard	Prior to arrival to project site or documentation that the product is new	+/- 1 psi
Other	As Determined by the CQAOA	As Recommended by the manufacturer, or required by State Auditor of Measurement Devices	As Guaranteed by the manufacturer

ATTACHMENT C
DUCK CREEK 1 & 2 SUPPLEMENTAL TECHNICAL DOCUMENTS REPORT

Supplemental Technical Documents Report

Duck Creek Power Station
Ash Ponds 1 & 2 Closure
Canton, Illinois

Draft – 100% Submittal



Prepared for:
Illinois Power Resources
Generating, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

Prepared by:
Stantec Consulting Services Inc.
1859 Bowles Avenue, Suite 250
St. Louis, MO 63026

February 28, 2018

This document includes available background information associated with the Duck Creek Ash Ponds 1 and 2 at various points in time and should not be considered representative of conditions at the time of construction.

Table of Contents

LIST OF APPENDICES

APPENDIX A 30% DESIGN DATA PACKAGE FOR DYNEGY DUCK CREEK STATION; ASH POND NO. 1 AND ASH POND NO. 2 CCR UNITS, BY AECOM, DECEMBER 23, 2015 ..... A.1

APPENDIX B DUCK CREEK POWER STATION: ASH PONDS 1 AND 2 SUPPLEMENTAL FIELD WORK, BY STANTEC, DECEMBER 20, 2017 ..... B.1

APPENDIX C RECORD DRAWINGS C.1

February 28, 2018

Appendix A

30% Design Data Package for Dynegy Duck Creek Station; Ash Pond No. 1 and Ash Pond No. 2 CCR Units, by AECOM, December 23, 2015

AECOM

Attorney Client Privileged

AECOM
8300 College Boulevard
Suite 200
Overland Park, KS 66210
www.aecom.com

913 344 1000 Tel
913 344 1011 Fax

December 23, 2015

Mr. Matt Ballance, PE
Senior Project Engineer
Dynegy Inc.
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

RE: 30% Design Data Package for Dynegy Duck Creek Station; Ash Pond No. 1 and Ash Pond No. 2 CCR Units

Dear Mr. Ballance:

AECOM is pleased to provide this 30% Design Data Package for closure of the Ash Pond No. 1 and Ash Pond No. 2 of the Coal Combustion Residuals (CCR) units at Duck Creek Station (Canton, IL). The Data Package includes summary tables, field exploration plan, and laboratory data.

At Duck Creek, the geotechnical exploratory program included the following:

- 31 auger borings at Ash Pond No. 1 and Ash Pond No. 2
- 4 temporary piezometers installed at selected boring locations.

AECOM looks forward to providing continued support to Dynegy and working together on this important program. Please do not hesitate to call the undersigned if you have any questions or comments on this 30% Design Data Package.

Sincerely,
AECOM

Wayne D. Smith, PE
Senior Geotechnical Engineer
wayne.smith@aecom.com

Brian D. Linnan, PE
Senior Project Manager
brian.linnan@aecom.com

Victor Modeer, PE, D.GE
Program Manager
Victor.modeer@aecom.com

Attachments:

Tables

Table 1A	Exploratory Boring Summary – Duck Creek Ash Pond No. 1
Table 1B	Exploratory Boring Summary – Duck Creek Ash Pond No. 2

Figures

Figure 1	Coal Mines and Underground Industrial Mines in Fulton County, State of Illinois
Figure 2A	Boring Location Plan – Duck Creek Ash Pond No. 1
Figure 2B	Boring Location Plan – Duck Creek Ash Pond No. 2
Figure 3	1975 Site Topography (obtained from Dynegy archives)
Figure 4	Profile of Generalized Boring Logs – West Perimeter
Figure 5	Profile of Generalized Boring Logs – East Perimeter

Appendices

Appendix A	Boring Logs
Appendix B	Laboratory Test Results

Table 1A
Exploratory Boring Summary
Geotechnical Data Report
Duck Creek Ash Pond No. 1

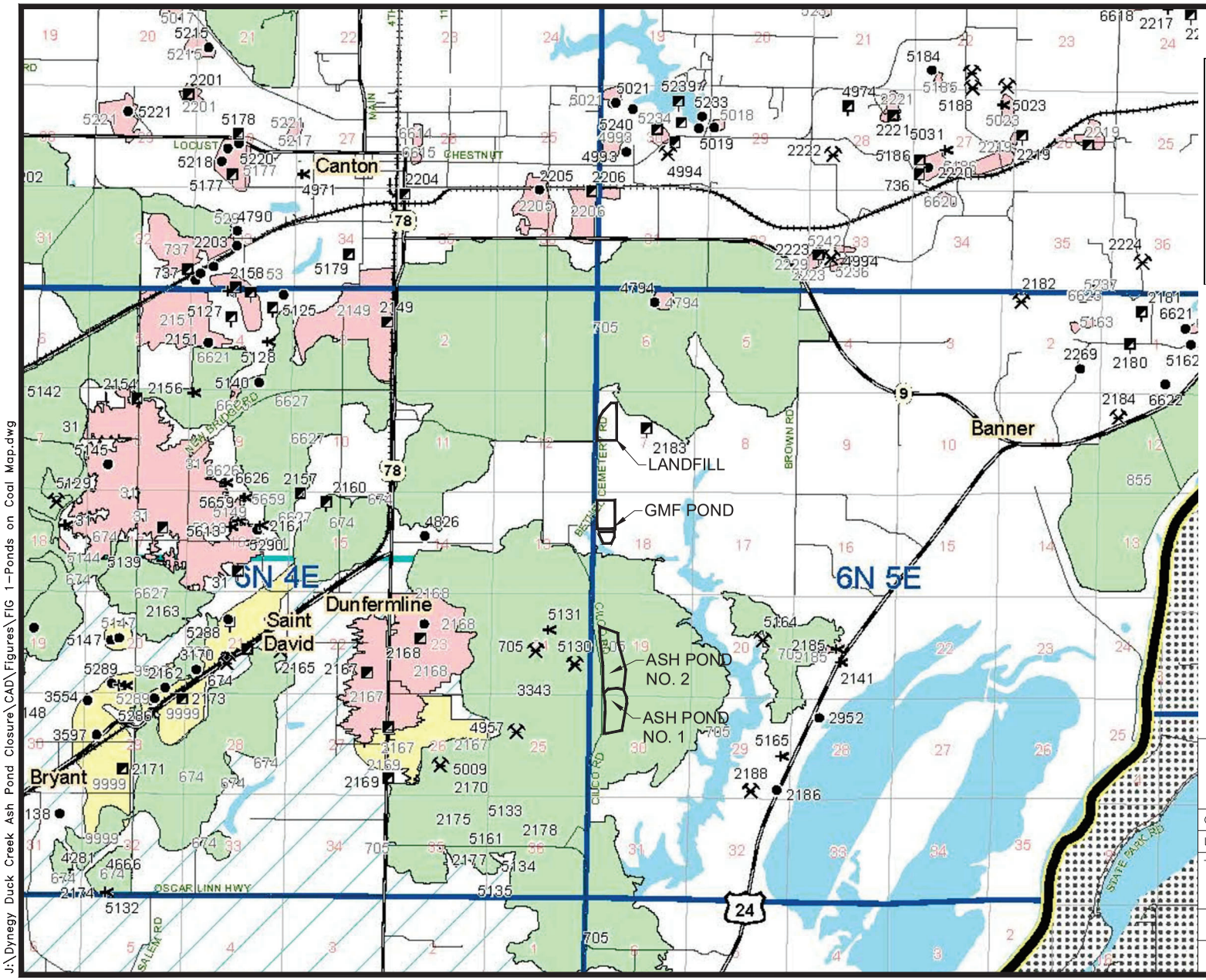
Boring Designation	Boring Location	Surface Elevation (ft)(1)	Northing(1)	Easting(1)	Boring Depth (ft)
DUC-B001	Crest of Embankment	629.0	1387095.378	2346416.182	61.5
DUC-B002	Toe of Embankment	619.0	1386991.203	2346387.289	40
DUC-B003	Crest of Embankment	625.7	1387223.459	2345920.234	60
DUC-B004	Toe of Embankment	604.9	1387189.821	2345852.49	40
DUC-B005	Crest of Embankment	625.6	1388382.788	2345948.348	61.5
DUC-B006	Toe of Embankment	592.6	1388373.733	2345833.677	42.5
DUC-B007	Crest of Embankment	628.7	1389052.45	2345900.067	57
DUC-B008	Toe of Embankment	614.2	1389048.163	2345825.647	42.5
DUC-B009	Crest of Embankment	630.0	1389146.042	2347054.014	57.5
DUC-B010	Upper Slope of Embankment	620.6	1389148.881	2347093.479	42.5
DUC-B011	Crest of Embankment	625.4	1388612.335	2347117.635	60
DUC-B012	Toe of Embankment	592.5	1388586.793	2347253.638	40
DUC-B013	Crest of Embankment	625.2	1388193.273	2347067.799	60
DUC-B014	Toe of Embankment	592.5	1388147.304	2347261.306	40
DUC-B015	Crest of Embankment	630.1	1387221.12	2346897.598	61.5

Note: (1) The boring elevations and locations were surveyed by others and the data was provided to AECOM by Dynegy

Table 1B
Exploratory Boring Summary
Geotechnical Data Report
Duck Creek Ash Pond No. 2

Boring Designation	Boring Location	Surface Elevation (ft) (1)	Northing(1)	Easting(1)	Boring Depth (ft)
DUC-B017	Crest of Embankment	639.0	1390151.626	2347085.9	61.5
DUC-B018	Toe of Embankment	612.5	1390122.383	2347186.407	42.5
DUC-B019	Crest of Embankment	639.9	1390682.545	2347029.854	60
DUC-B020	Toe of Embankment	603.6	1390719.712	2347156.352	40
DUC-B021	Crest of Embankment	639.1	1392095.524	2346700.624	61.5
DUC-B022	Toe of Embankment	606.7	1392187.469	2346813.183	42.5
DUC-B023(2)	Crest of Embankment	~640	~1392523	~2346111	60
DUC-B024(2)	Toe of Embankment	~615	~1392612	~2346125	40
DUC-B025	Crest of Embankment	639.1	1392481.361	2345742.801	58.5
DUC-B026	Toe of Embankment	620.3	1392479.342	2345667.279	40
DUC-B027	Crest of Embankment	639.6	1391784.872	2345776.961	57.5
DUC-B028	Toe of Embankment	626.5	1391779.275	2345715.208	42.5
DUC-B029	Crest of Embankment	639.1	1390613.262	2345906.855	61.5
DUC-B030	Toe of Embankment	605.9	1390603.474	2345787.058	42.5
DUC-B031	Crest of Embankment	640.0	1389655.067	2345910.722	60
DUC-B032	Toe of Embankment	614.5	1389667.714	2345818.774	40

Note: (1) The boring elevations and locations were surveyed by others and the data was provided to AECOM by Dynegy
(2) Boring not surveyed, northing/easting and elevation are approximate



LEGEND:

- County
- Township
- Section
- Quadrangle study (Available on Website)
- Lake or river
- Coal mine - active
- Underground coal mine - abandoned
- Surface coal mine - abandoned
- Indefinite underground coal mine boundary - abandoned
- Underground industrial mine and surrounding buffer region
- 951, 951 Coal mine index number (polygon label, point label)
- Opening type unknown
- Uncertain location
- Active surface tipple
- Abandoned surface tipple
- Active shaft
- Abandoned shaft
- Active slope
- Abandoned slope
- Active drift
- Abandoned drift
- Underground industrial mine entrance or general location

SOURCE:
ADAPTED FROM ILLINOIS STATE GEOLOGICAL SURVEY AND UNIVERSITY OF ILLINOIS COUNTY COAL MAP SERIES, ISGS COAL STATION.
MAP CONSTRUCTION: JANUARY 28, 2015

N

5000 0 5000

SCALE IN FEET

AECOM
8300 College Boulevard, Suite 200
Overland Park, Kansas 66210

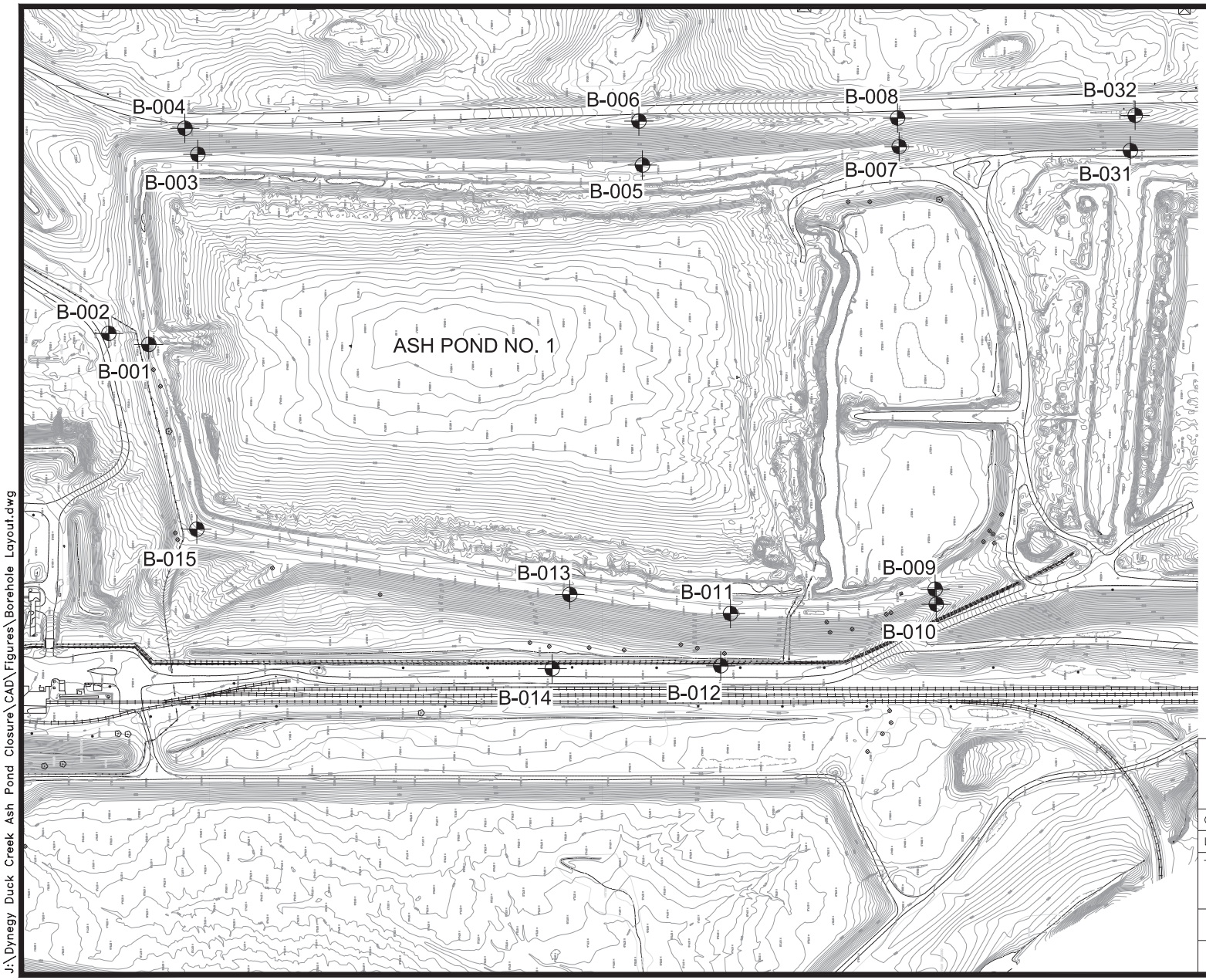
CLIENT: DYNEGY

LOCATION: DUCK CREEK STATION - CANTON, IL

TITLE: COAL MINES AND UNDERGROUND INDUSTRIAL MINES IN FULTON COUNTY, STATE OF ILLINOIS

DRAWN BY	CHECKED BY	APPROVED BY
TMS	JAA	WDS
PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	1

December 18, 2015 11:12.01 am (stu)
J:\Dynegy Duck Creek Ash Pond Closure\CAD\Figures\FIG 1-Ponds on Coal Map.dwg



LEGEND:

B-011 — EXPLORATORY BORING LOCATION AND NUMBER

NOTE:

1. TEMPORARY GROUNDWATER LEVEL MONITORING WELLS (PIEZOMETERS) WERE INSTALLED IN BORING B-003 AND B-011. THE WELLS WERE ABANDONED UPON COMPLETION OF FIELD ACTIVITIES. REFER TO APPENDIX A FOR DETAILS.

N

250 0 250

SCALE IN FEET

AECOM
8300 College Boulevard, Suite 200
Overland Park, Kansas 66210

CLIENT: DYNEGY

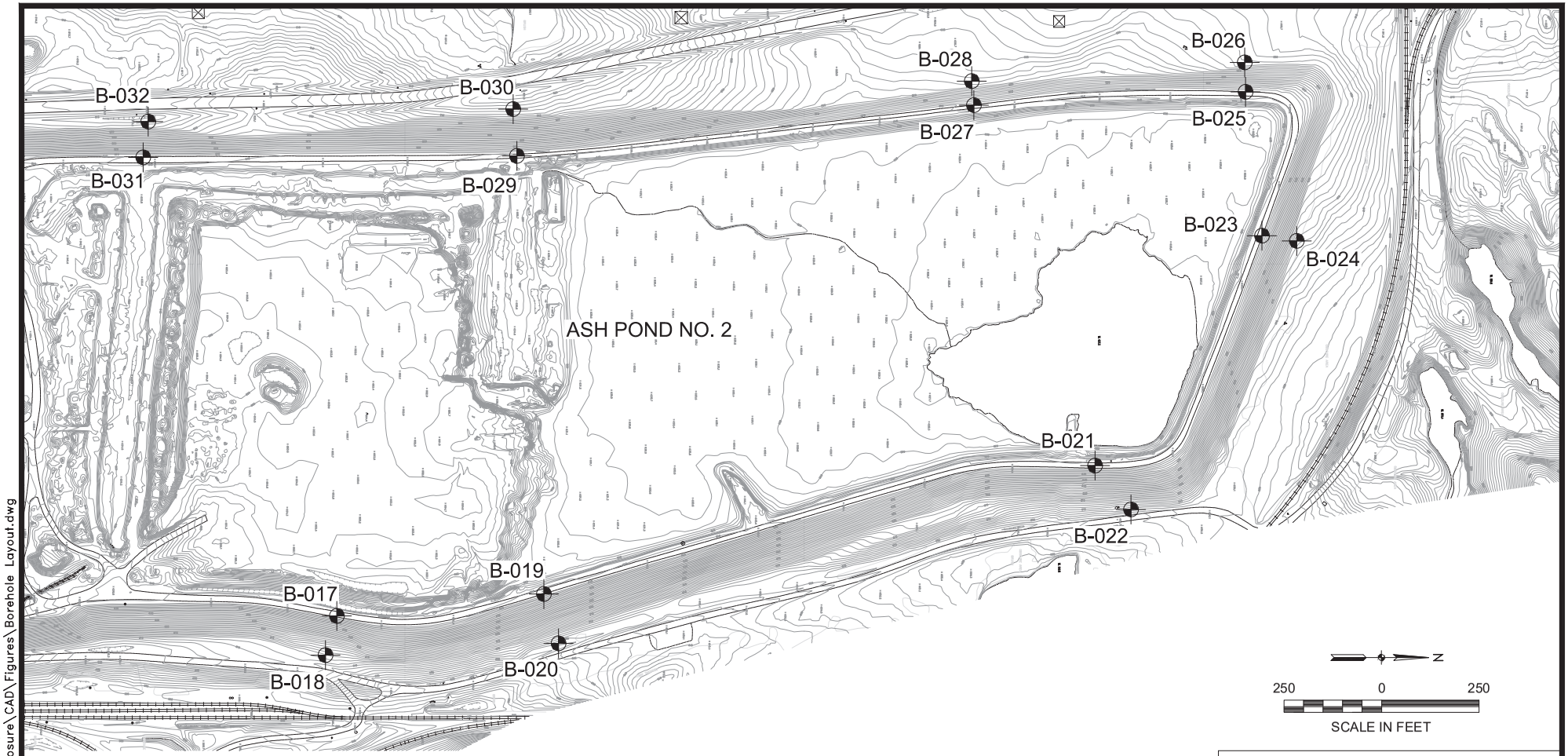
LOCATION: DUCK CREEK STATION - CANTON, IL

TITLE:

BORING LOCATION PLAN
DUCK CREEK ASH POND NO. 1

DRAWN BY	CHECKED BY	APPROVED BY
TMS	JAA	WDS
PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	2A

December 18, 2015 11:45:28 am (stu)
J:\Dynegy Duck Creek Ash Pond Closure\CAD\Figures\Borehole Layout.dwg



NOTE:
1. TEMPORARY GROUNDWATER LEVEL MONITORING WELLS (PIEZOMETERS) WERE INSTALLED IN BORING B-021 AND B-029. THE WELLS WERE ABANDONED UPON COMPLETION OF FIELD ACTIVITIES. REFER TO APPENDIX A FOR DETAILS.

2. THE LOCATIONS OF B-023 AND B-024 ARE APPROXIMATE.

LEGEND:

B-022 — EXPLORATORY BORING LOCATION AND NUMBER

AECOM
8300 College Boulevard, Suite 200
Overland Park, Kansas 66210

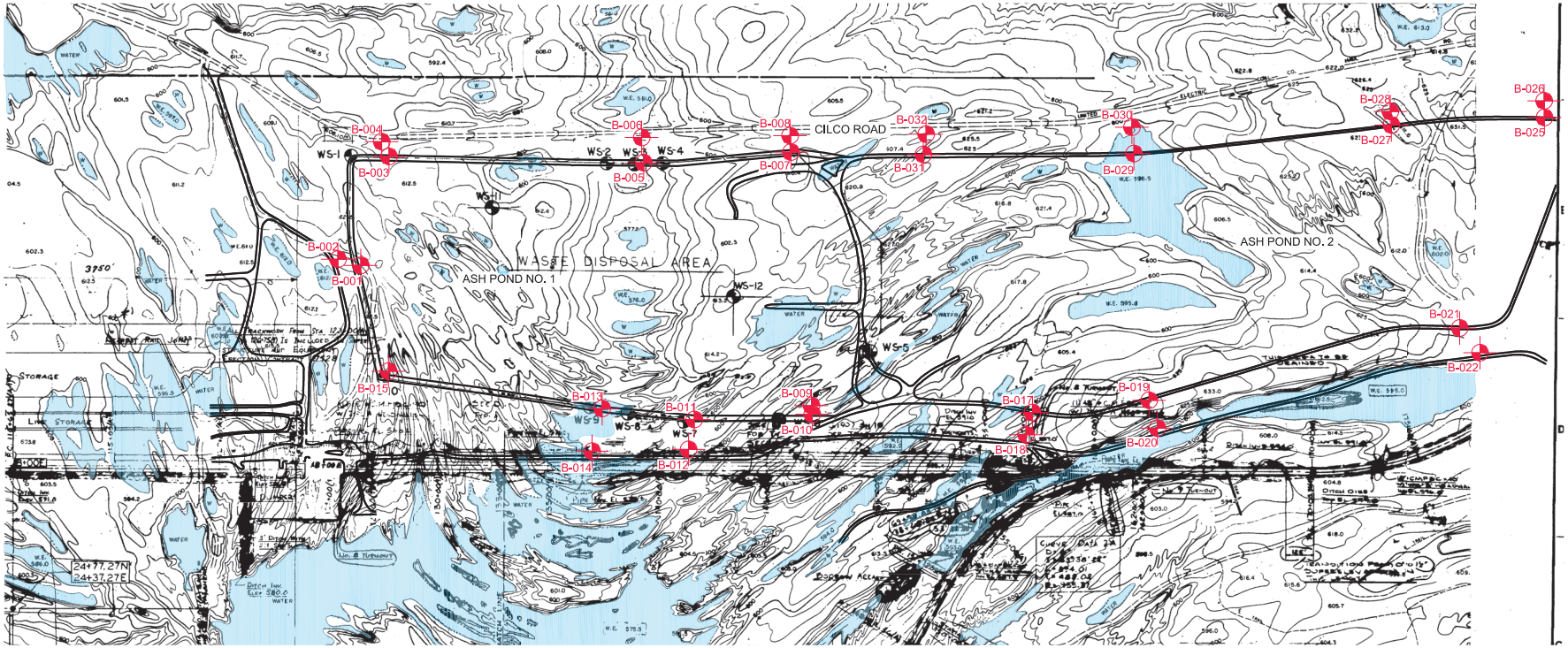
CLIENT: DYNEGY

LOCATION: DUCK CREEK STATION - CANTON, IL

TITLE:
BORING LOCATION PLAN
DUCK CREEK ASH POND NO. 2

DRAWN BY	CHECKED BY	APPROVED BY
TMS	JAA	WDS
PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	2B

December 18, 2015 11:46.24 am (stu)
J:\Dynegy Duck Creek Ash Pond Closure\CAD\Figures\Borehole Layout.dwg



NOTES:

1. THE WS SERIES BORINGS SHOW IN THIS FIGURE WERE DRILLED BY OTHERS AND ARE NOT AVAILABLE.

2. THIS FIGURE WAS PROVIDED BY DYNEGY FROM THEIR ARCHIVES.

LEGEND:

- B-022 — AECOM BORE HOLE LOCATION AND NUMBER
- 2012 EMBANKMENT CREST
- PONDED AREA

N

500 0 500

SCALE IN FEET

AECOM
8300 College Boulevard, Suite 200
Overland Park, Kansas 66210

CLIENT: DYNEGY

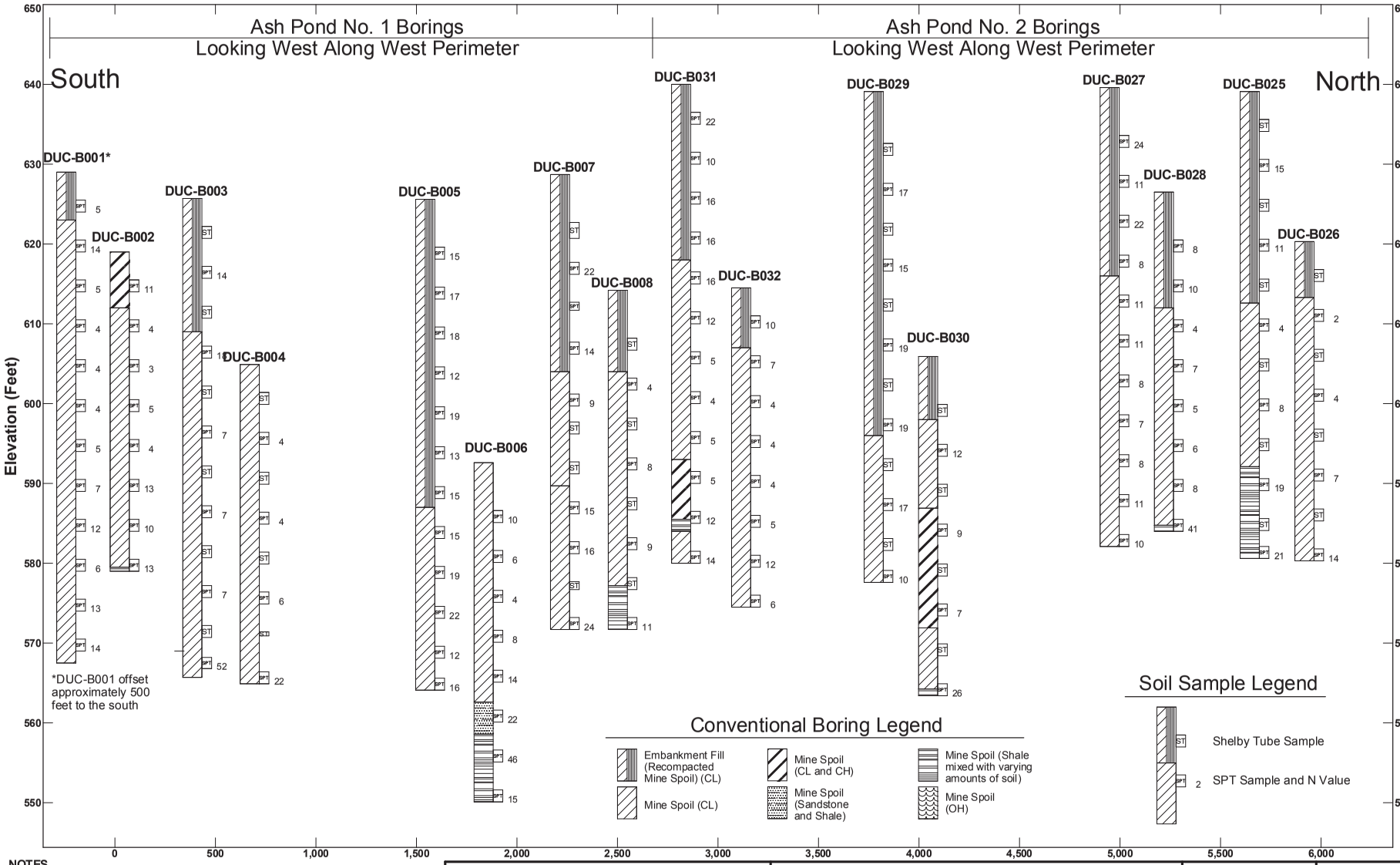
LOCATION: DUCK CREEK STATION - CANTON, IL

TITLE:

1975 SITE TOPOGRAPHY

DRAWN BY	CHECKED BY	APPROVED BY
SMS	JAA	WDS
PROJECT NO.	DATE	FIGURE NO.
60439301	DEC. 2015	3

December 21, 2015 8:03:28 am (stu)
J:\Dynegy Duck Creek Ash Pond Closure\CAD\Figures\FIG 3.dwg



NOTES

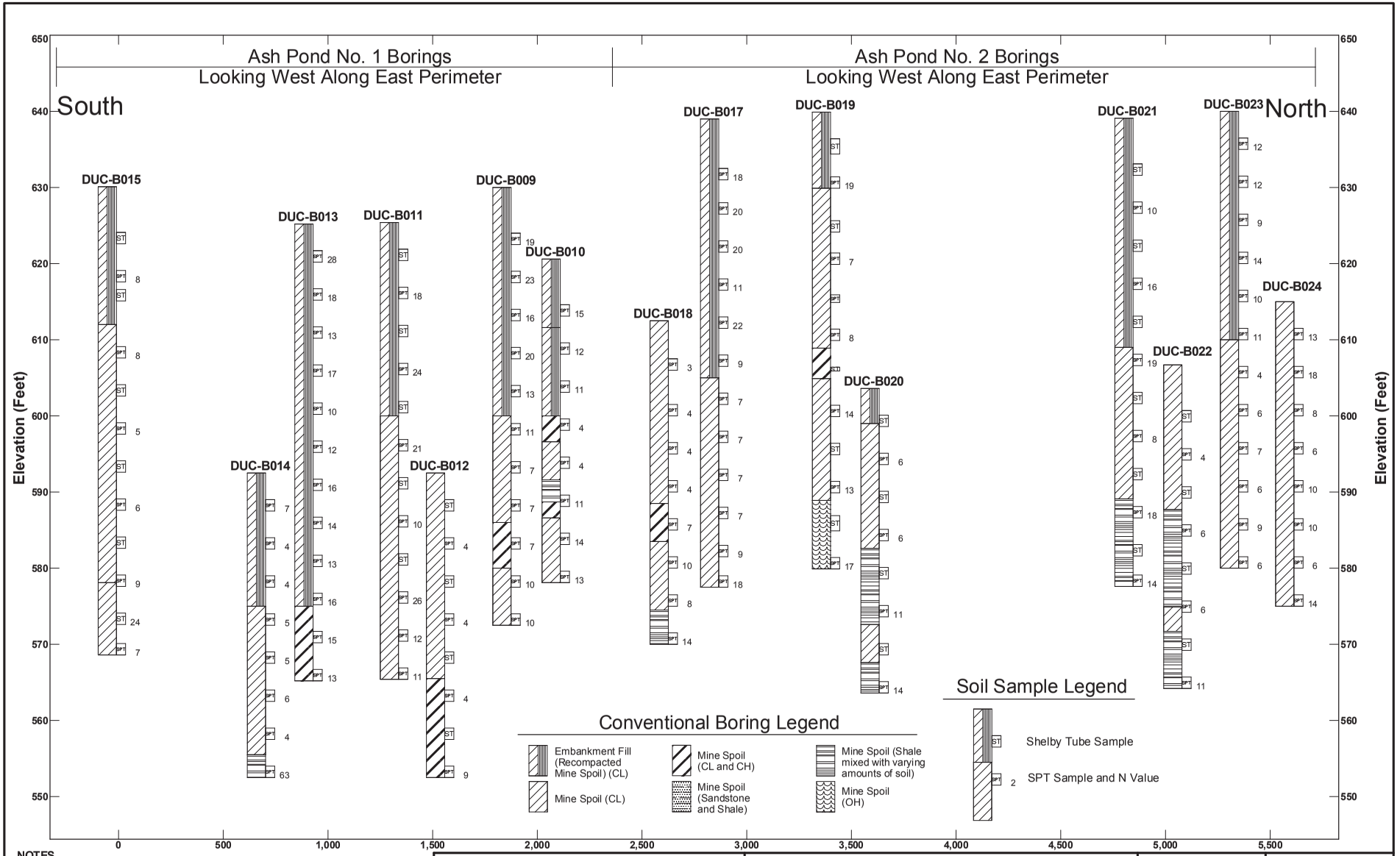
1. The crest borings (odd numbers) are plotted with accurate horizontal spacing. The corresponding toe borings are plotted to the right of the crest borings.
2. Refer to Figures 2a and 2b for boring locations.

AECOM
8300 College Blvd, Suite 200
Overland Park, Kansas 66210
Tel: 913-344-1000
Fax: 913-344-1011

Dynegy
Duck Creek Power Station, Canton, IL
Profile of Generalized Boring Logs
West Perimeter

Project Number	Date
60439301	12/18/2015
Checked By	Figure No.
WDS	4

11 X 17 WITH SAMPLER - DYNEGY DYNEGY_2015.GDT OVP1.GLB G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ joslyn_arthur 12/18/15



NOTES

1. The crest borings (odd numbers) are plotted with accurate horizontal spacing. The corresponding toe borings are plotted beside the crest borings.
2. Refer to Figures 2a and 2b for boring locations.

AECOM
8300 College Blvd, Suite 200
Overland Park, Kansas 66210
Tel: 913-344-1000
Fax: 913-344-1011

Dynegy
Duck Creek Power Station, Canton, IL
Profile of Generalized Boring Logs
East Perimeter

Project Number	Date
60439301	12/18/2015
Checked By	Figure No.
WDS	5

11 X 17 WITH SAMPLER - DYNEGY DYNEGY_2015.GDT OVP1.GLB G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ joslyn_arthur 12/18/15

The geotechnical investigation for Duck Creek Station Ash Pond No. 1 and Ash Pond No. 2 took place between August 4 and 23, 2015 and involved drilling exploratory borings and installing temporary piezometers. AECOM subcontracted Frontz Drilling to drill borings designated as DUC-B001 through DUC-B036. Ash Pond No. 1 borings included borings on the toe and crest of the pond embankment numbered DUC-B001 through DUC-B015. Ash Pond No. 2 borings include toe and crest borings numbered DUC-B017 through DUC-B032. The locations of the exploratory borings are shown on Figure 2A and 2B.

All of the exploratory borings were drilled by Frontz Drilling using an all-terrain Central Mine Equipment (CME-750) drill rig. The borings were advanced using hollow stem augers. Borings drilled on the crest of the embankment were drilled to termination depths ranging between approximately 57 and 61.5 feet below ground surface (bgs), while borings drilled at the toe of embankment were drilled to depths between approximately 40 and 42.5 feet bgs. All borings, with the exception of the four borings completed as temporary piezometers, were backfilled with cement-bentonite grout upon completion.

Relatively undisturbed samples of subsurface materials were obtained using thin-walled Shelby tubes that were advanced with a standard Shelby tube head in general accordance with ASTM D1587. Push lengths of the thin-walled tubes were generally 18 inches, unless materials such as fragmented rock prevented pushing the tube farther. Disturbed samples were obtained with a split barrel sampler in general accordance with ASTM D1586 (Standard Penetration Test – SPT).

Recovered soil samples were initially identified and field logged by a geologist by observing the drilling characteristics, cuttings, and soil samples. All soil samples were transported to the AECOM laboratory in Overland Park, Kansas for designation of testing. Portions of the samples were assigned to the Alpha-Omega laboratory located in Kansas City, Kansas, while others were assigned to the Terracon laboratory located in Lenexa, Kansas. The field boring logs were revised based on review of the laboratory test results.

The final boring logs presented in this appendix were generated using gINT geotechnical software by Bentley Systems. The gINT software tools utilize a geotechnical database and graphics package to present various geotechnical outputs (i.e., boring logs, test summaries, etc.). The gINT logs herein show the soil classification in accordance with Unified Soil Classification System (USCS), sampler type, sample depths, recovery, resistance, and drilling method, as well as presenting laboratory testing data such as moisture content, dry unit weight, Atterberg limits, and unconfined compression. The descriptions used to describe the consistency on the final logs are based on the strengths obtained by field testing and during laboratory testing conducted on undisturbed samples.

Ash Ponds No. 1 and No. 2 are located within a strip-mined area with a variable thickness of mine spoil overlying shale bedrock. The mine spoils consist of a mixtures of native loess and glacial till and, to a lesser extent, the underlying (primarily shale) bedrock. The mine spoils have been reshaped and recompacted to form the perimeter embankments of the ash ponds, making it difficult to delineate the interface between the embankment fill and underlying mine spoil. A 1975 topographic survey (refer to Figure 3) provided by Dynegy was used to estimate the thickness of the embankment fill. The fill thickness shown on the boring logs should be considered as approximate.

Temporary piezometers were installed in two of the Ash Pond No. 1 embankment borings, DUC-B003 and DUC-B011, and two of the Ash Pond No. 2 embankment borings, DUC-B021 and

DUC-B029. All four borings were logged to a depth of 60 feet bgs and then backfilled from a depth of 60 to 40 feet bgs with bentonite pellets. PVC casing consisting of 30 feet of 0.010-inch slotted PVC screen followed by solid PVC riser to the ground surface was set in the each boring. Sand was placed in the annular space around the screened portion of each temporary piezometer which extended upward from the top of the bentonite pellets at 40 feet bgs to two feet above the top of the screened section, 8 feet bgs. The annular space between the solid PVC riser and borehole wall was then backfilled with bentonite pellets from a depth of 8 feet bgs upward to a depth of 2 feet bgs. An expandable j-plug was used to close off the temporary piezometer so that rainwater would not enter the piezometer.

The borings for the temporary piezometers were drilled and the temporary piezometers were installed during the first few days of field activities at the site, August 4 through August 6, 2015. The temporary piezometers were abandoned on the last day of field work, August 23, 2015. The depths to groundwater were measured daily in each piezometer during this time. The steps taken for each measurement included opening the piezometer and allowing the piezometer to sit open approximately 15 minutes to allow the piezometer to equilibrate to the barometric pressure for the day. Measurements were then obtained and the piezometer was closed again using the j-plug. Water was never present in any of the piezometers. Abandonment of the piezometers involved pulling the PVC piping from each and backfilling the open portion of the borehole with cuttings.

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B001

Date(s) Drilled	08/08/2015 12:00 AM to 08/08/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	61.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	629 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1387095.4 E 2346416.2

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0						Elevation (feet) 629.0 / Depth (feet) 0.0 EMBANKMENT FILL: Medium stiff, gray, mottled black, spotted brown, silty low plastic CLAY (CL) with sand and trace gravel and trace coal fragments								*Embankment fill consists of recompacted mine spoil.*
625	5		1	1 1 4	78		becoming wet	36.6				< 2			
							Elevation (feet) 623.0 / Depth (feet) 6.0 MINE SPOIL: Stiff to medium stiff, brown, mottled reddish brown and gray, silty low plastic CLAY (CL), moist to wet								*Pre-Embankment Construction Ground Surface Elevation Estimated at 623 feet (1975 topo)*
620	10		2	5 6 8	83		with wood fragments at 8.5 feet					5			*Approximate toe of existing embankment slope at elevation 619 feet*
615	15		3	2 2 3	100			23.4				< 2			
610	20		4	2 2 2	100							2			
605	25		5	2 2 2	100		becoming light brown, spotted reddish brown and gray, with trace gravel	23.1				2			
600	30		6	2 2 2	94							2			

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:36 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B001

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): Stiff to medium stiff, light brown, mottled light gray and reddish brown, silty low plastic CLAY (CL), with trace gravel, moist to wet								
595		7	2 2 3	89			25.5				2			
	35													
590		8	2 2 5	78							3			
	40													
585		9	3 3 9	72		becoming gray, mottled black, spotted brown, with trace gravel and fragments of coal and shale	21.7				4			
	45													
580		10	3 3 3	56							2			
	50													
575		11	4 6 7	61		becoming brown, mottled gray, spotted reddish brown	15.5				4			
	55													
570		12	6 6 8	67							5			
	60					increasing shale fragments (567.5 / 61.5)								
						End of Boring at 61.5 ft								
565						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:36 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B002

Date(s) Drilled	08/23/2015 8:15 AM to 08/23/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	619 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1386991.2 E 2346387.3

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) 619.0 / Depth (feet) 0.0								
	0						MINE SPOIL: Medium stiff to stiff, brown, spotted reddish brown, low to high plastic CLAY (CL-CH), with coal, rock, and wood fragments, moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 618 feet (1975 topo)*
615		1		4 4 7	89			21.9				3			
	5						612.0 / 7.0								
							MINE SPOIL: Soft to medium stiff, light brown, mottled reddish brown, spotted gray, silty low plastic CLAY (CL), moist to wet								
610		2		1 2 2	78			26.7				2			
	10														
605		3		1 1 2	83		becoming wet, light brown, mottled gray	28.2				< 2			
	15														
600		4		1 2 3	78			25.7				< 2			
	20														
595		5		1 2 2	83		with rock fragments	25.4				2			
	25														
590		6		3 6 7	78		becoming stiff to very stiff, dry					8+			
	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:41 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B002

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): Stiff to very stiff, light brown, mottled gray, silty low plastic CLAY (CL), with rock fragments, dry								
585	35	7	4 5 5	78		becoming gray, mottled brown, with weathered shale and coal and rock fragments	16.9				4			
580	40	8	4 6 7	89		579.5 / 39.5 579.0 MINE SPOIL: SHALE, weathered, gray, dry / 40.0 End of Boring at 40 ft					4			
575	45													
570	50													
565	55													
560	60													
555	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:41 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B003

Date(s) Drilled	08/05/2015 10:00 AM to 08/05/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	60.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	625.7 ft NAVD88
Borehole Backfill	Temporary Piezometer (Abandoned 8/23/15)	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1387223.5 E 2345920.2

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
625	0						625.7 / 0.0 EMBANKMENT FILL: Stiff to very stiff, brown, silty low plastic CLAY (CL), with rock fragments, moist								*Embankment fill consists of recompacted mine spoil.*
			1	P	78			14.9	119.0			4	3.54		
620	5														
			1	5 6 8	83							4			
615	10														
			2	P	89			17.0	117.0	35	17	7	4.96		
610	15						609.0 / 16.7 MINE SPOIL: Stiff to very stiff, brownish gray, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 609 feet (1975 topo)*
			2	6 8 10	78							8+			*Approximate toe of existing embankment slope at elevation 607 feet*
605	20														
			3	P	94			15.6		33	17	7			
600	25														
			3	2 3 4	94		becoming medium stiff to stiff					3			
	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:46 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B003

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
595	30					MINE SPOIL (continued): Medium stiff to stiff, brownish gray, silty low plastic CLAY (CL), moist								
		4	P	67			15.7	114.0	27	9	2	2		
590	35													
		4	2 3 4	94							3			
585	40													
		5	P	100		with rock fragments	24.5	104.0			4	2.16		
580	45													
		5	2 3 4	83							3			
575	50													
		6	P	83			14.1	123.0			4	1.12		
570	55													
		6	2 2 50	35							6			
						with shale and coal fragments								*Sampler refusal at 58.9 feet*
565	60					565.7 / 60.0 End of Boring at 60 ft								
	65					Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:46 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B004

Date(s) Drilled	08/19/2015 3:45 PM to 08/19/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	604.9 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1387189.8 E 2345852.5

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0					604.9 / 0.0 MINE SPOIL: Soft to medium stiff, brown to gray, silty low plastic CLAY (CL), with rock fragments								*Pre-Embankment Construction Ground Surface Elevation Estimated at 605 feet (1975 topo)*
		1	P	100			23.9	102.0	38	19	4	1.3		
600	5													
		1	2 2 2	78							< 2			
595	10													
		2	P	78			14.0	120.0	24	9	3	2.6		
590	15													
		2	2 2 2	100							< 2			
585	20													
		3	P	100			22.7	106.0	33	17	2	1.7		
580	25					becoming medium stiff to stiff								
		3	3 3 3	44							2			*Large rock fragment in shoe of split spoon at 29.2 ft.*
575	30													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:51 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B004

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): Medium stiff to stiff, brown to gray, silty low plastic CLAY (CL), with rock fragments								
		4	P	100		becoming very stiff	18.0	100.0			8			
570	35													
		4	11 11 11	33							8			
565	40					564.9 / 40.0 End of Boring at 40 ft								
560	45													
555	50													
550	55													
545	60													
540	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:52 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B005

Date(s) Drilled	08/08/2015 1:50 PM to 08/08/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	61.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	625.6 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1388382.8 E 2345948.3

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
625	0						625.6 / 0.0 EMBANKMENT FILL: Stiff to very stiff, light brown, mottled reddish brown, spotted gray, silty low plastic CLAY (CL), with small rock fragments, dry								*Embankment fill consists of recompacted mine spoil.*
620	5		1	7 7 8	89			14.8				6			
615	10		2	6 6 11	83			15.7		33	14	8+			
610	15		3	3 8 10	72			15.4				7			
605	20		4	4 5 7	78			15.8		32	14	5.5			
600	25		5	7 8 11	78		with rock fragments	15.3				6			
	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:58 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B005

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
595	30						EMBANKMENT FILL (continued): Stiff to very stiff, light brown, mottled reddish brown, spotted gray, silty low plastic CLAY (CL), with rock fragments, dry								*Approximate toe of existing embankment slope at elevation 595 feet*
			6	5 5 8	89							5			
590	35														
			7	5 7 8	67			17.0		35	16	6			
							587.0 / 38.6								*Pre-Embankment Construction Ground Surface Elevation Estimated at 587 feet (1975 topo)*
585	40						MINE SPOIL: Stiff to very stiff, brown to light brown, mottled reddish brown and gray, silty low plastic CLAY (CL), dry								
			8	5 7 8	72							6			
580	45														
			9	5 7 12	78		with carbonized fragments and rock fragments	16.3				6			
575	50														
			10	5 12 10	89							8			
570	55														
			11	4 5 7	78		increasing moisture content	22.0				6			
565	60														
			12	5 5 11	78		564.1 / 61.5					5			
							End of Boring at 61.5 ft								*Shale in shoe of sampler*
	65						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:41:58 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B006

Date(s) Drilled	08/19/2015 1:00 PM to 08/19/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	42.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	592.6 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1388373.7 E 2345833.7

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) 592.6 / Depth (feet) 0.0								
	0						MINE SPOIL: Medium stiff to stiff, brown, spotted reddish brown and gray, silty low plastic CLAY (CL), with trace gravel, dry								*Pre-Embankment Construction Ground Surface Elevation Estimated at 595 feet (1975 topo)*
590															
	5														
		1	4 5 5		83			12.3				6			
585															
	10														
		2	2 3 3		100		becoming moist, with rock fragments	21.1				3			
580															
	15						becoming mottled reddish brown, speckled gray and black								
		3	2 2 2		89			25.9		34	12	2			
575															
	20														
		4	3 4 4		39		becoming stiff to very stiff, with rock fragments					8+			*Rock fragment jammed in shoe of split spoon. Wet at tip.*
570															
	25														
		5	6 7 7		67		becoming reddish brown, mottled gray, with trace gravel	13.4				8			
565															
	30						Elevation (feet) 562.6 / Depth (feet) 30.0								

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:03 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B006

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						MINE SPOIL: SANDSTONE/SHALE, highly weathered, gray								
			6	8 11 11	89							8+			
560															
							Elevation (feet) 558.6 Depth (feet) 34.0								
	35						MINE SPOIL: SHALE, highly weathered, gray								
			7	11 34 12	78			11.2				8+			
555															
	40														
			8	7 7 8	39		becoming gray to dark gray, with coal fragments					7			
							Elevation (feet) 550.1 Depth (feet) 42.5								
550							End of Boring at 42.5 ft								
	45														
545															
	50														
540															
	55														
535															
	60														
530															
	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:03 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B007

Date(s) Drilled	08/10/2015 7:50 AM to 08/10/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	57.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	628.7 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1389052.5 E 2345900.1

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) 628.7 / Depth (feet) 0.0								
	0						EMBANKMENT FILL: Very stiff, brown, mottled reddish brown, speckled black, silty low plastic CLAY (CL), dry								*Embankment fill consists of recompacted mine spoil.*
625	5		1	P	100			19.5	114.0	36	19	7.5	2		
620	10		1	6 11 11	78							8+			
615	15		2		100		with trace gravel and coal fragments	14.4				8+			*Approximate toe of existing embankment slope at elevation 615 feet* *Shelby tube broke off in hole. Pushed spoon into Shelby tube, drilled out.*
610	20		3	6 7 7	67		becoming stiff					6			
605	25						Elevation (feet) 604.0 / Depth (feet) 24.7 MINE SPOIL: Stiff, light brown, spotted reddish brown and black, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 604 feet (1975 topo)* *Lost Shelby tube at 26 ft.*
600	30		4	4 4 5	100			24.1		32	9	2			*Sampled from 27.5-29.5 with 3-inch spoon.*

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:08 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B007

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						MINE SPOIL (continued): Stiff, light brown, spotted reddish brown and black, silty low plastic CLAY (CL), moist								
			2	P	100			18.0	115.0			5	8.76		
595															
	35														
			3	P	100			18.0	116.0			5	2.28		
590							589.7 39.0								
	40						MINE SPOIL: SHALE, highly weathered, gray, mottled brown, dry								
			5	5 7 8	67			11.2				8+			
585															
	45														
			6	7 8 8	50		mixture of shale and silty clay (CL)	15.8				5			
580															
	50														
			4	P	100			17.9	113.0			8+			
575															
	55														
			7	13 11 13	67		becoming dry, thin coal seam					8+			
							571.7 57.0								
							End of Boring at 57 ft								
570							Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
	60														
565															
	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:08 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B008

Date(s) Drilled	08/19/2015 10:20 AM to 08/19/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	42.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	614.2 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1389048.2 E 2345825.6

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0					614.2 / 0.0 EMBANKMENT FILL: Medium stiff, brown, silty low plastic CLAY (CL), moist								*Embankment fill consists of recompacted mine spoil.*
610	5	1	P	33			22.8	103.0			2			
605	10					604.0 / 10.2 MINE SPOIL: Soft to medium stiff, light brown, mottled reddish brown, spotted dark gray, silty low plastic CLAY (CL), moist to wet								*Pre-Embankment Construction Ground Surface Elevation Estimated at 604 feet (1975 topo)*
		1	2 2 2	100			26.6		36	15	2			
600	15	2	P	100		becoming brown, mottled olive brown, spotted gray, speckled black and reddish brown, with trace sand	22.6	103.2	40	23	2			
595	20	2	3 4 4	67		becoming medium stiff to stiff, with shale fragments					6			
590	25	3	P	100			15.7	118.0			5			
585	30													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:13 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B008

Elevation (feet)	Depth (feet)	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						MINE SPOIL (continued): Medium stiff to stiff, brown, mottled olive brown, spotted gray, speckled black and reddish brown, silty low plastic CLAY (CL), with shale fragments, moist to wet								
		3	2 4 5		72							4			
580	35														
		4	P		100		577.2 / 37.0	20.1	114.0			6			
575	40						MINE SPOIL: SHALE, highly weathered, gray, dry								
		4	5 5 6		67		571.7 / 42.5					8+			
							End of Boring at 42.5 ft								
570	45						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
565	50														
560	55														
555	60														
550	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:13 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B009

Date(s) Drilled	08/04/2015 10:00 AM to 08/04/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	57.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	630 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1389146 E 2347054

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
630	0						Elevation (feet) 630.0 / Depth (feet) 0.0								
							EMBANKMENT FILL: Very stiff, brown, spotted reddish brown, silty low plastic CLAY (CL), dry								*Embankment fill consists of recompacted mine spoil.*
625	5		1	5 7 12	83			19.3				8			
620	10		2	10 11 12	78			17.1		34	13	7			
615	15		3	6 7 9	72		becoming brown, spotted black, with coal fragments	16.6				6			
610	20		4	8 8 12	89		becoming brown, spotted reddish brown and gray	17.9		32	12	8+			
605	25		5	6 6 7	89		becoming stiff, moist	20.6				5			
600	30						600.0 / 30.0								*Pre-Embankment Construction*

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:18 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B009

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
600	30						MINE SPOIL: Medium stiff to stiff, brown to light brown, mottled reddish brown, spotted gray, silty low plastic CLAY (CL), with trace sand, moist								*Ground Surface Elevation Estimated at 600 feet (1975 topo)*
			6	3 6 5	100			22.0		43	25	2			
595	35														*Approximate toe of existing embankment slope at elevation 596 feet*
			7	3 3 4	100			25.7				2			
590	40														
			8	2 3 4	100			25.6				2.5			
							Elevation (feet) 586.0 — Depth (feet) 44.0								
585	45						MINE SPOIL: Medium stiff, brown, mottled reddish brown, speckled gray, high plastic CLAY (CH), with trace sand, moist								
			9	3 3 4	89			22.5				3			
							Elevation (feet) 580.0 — Depth (feet) 50.0								
580	50						MINE SPOIL: Stiff, light brown, mottled reddish brown and gray, silty low plastic CLAY (CL)								
			10	3 4 6	72							2.5			
575	55														
			11	3 4 6	78			23.3				2			
							Elevation (feet) 572.5 — Depth (feet) 57.5								
							End of Boring at 57.5 ft								
570	60						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
565	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:18 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B010

Date(s) Drilled	08/21/2015 12:00 AM to 08/21/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	42.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	620.6 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Upper Slope of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1389148.9 E 2347093.5

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
620	0						620.6 / 0.0 — EMBANKMENT FILL: Stiff to very stiff, brown, spotted gray and reddish brown, low to high plastic CLAY (CL-CH), with rock fragments								*Embankment fill consists of recompacted mine spoil.*
	5		1	4 7 8	83			16.5				8			
615							611.6 / 9.0 — EMBANKMENT FILL: Stiff, brown, mottled gray and reddish brown, silty low plastic CLAY (CL), trace rock fragments								
	10		2	4 5 7	72							7			
610															
	15		3	4 5 6	83			17.8				6			
605															
	20		4	2 2 2	100		600.0 / 20.6 — MINE SPOIL: Medium stiff, brown, mottled gray and reddish brown, high plastic CLAY (CH), moist	24.5				3			*Pre-Embankment Construction Ground Surface Elevation Estimated at 600 feet (1975 topo)*
600							596.6 / 24.0 — MINE SPOIL: Medium stiff, light brown, mottled reddish brown and gray, silty low plastic CLAY (CL), moist								
	25		5	2 2 2	94			25.2				2			*Approximate toe of existing embankment slope at elevation 596 feet*
595							591.6 / 29.0 — MINE SPOIL: SHALE, highly weathered, gray								
	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:24 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B010

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
590	30						MINE SPOIL (continued): SHALE, highly weathered, gray								
			6	5 5 6	100							2			
							Elevation (feet) 588.7 — Depth (feet) 31.9								
							MINE SPOIL: Stiff, brown, high plastic CLAY (CH), moist								
							Elevation (feet) 586.6 — Depth (feet) 34.0								
585	35						MINE SPOIL: Stiff, gray, mottled reddish brown, silty low plastic CLAY (CL), dry								
			7	4 7 7	89			16.8				6			
580	40														
			8	4 6 7	67		becoming wet, with coal and shale fragments					6			
							Elevation (feet) 578.1 — Depth (feet) 42.5								
							End of Boring at 42.5 ft								
575	45						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
570	50														
565	55														
560	60														
	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:24 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B011

Date(s) Drilled	08/04/2015 1:30 PM to 08/04/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	60.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	625.4 ft NAVD88
Borehole Backfill	Temporary Piezometer (Abandoned 8/23/15)	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1388612.3 E 2347117.6

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
625	0					625.4 / 0.0 EMBANKMENT FILL: Very stiff, reddish brown, spotted gray and black, silty low plastic CLAY (CL), with sand								*Embankment fill consists of recompacted mine spoil.*
		1	P	89			16.5	113.8	35	16	8+		X	
620	5													
		1	6 8 10	72			14.6				8+			
615	10													
		2	P	100			15.9	117.6	34	18	8+		X	
610	15													
		2	6 10 14	100		becoming light brown, mottled reddish brown, spotted gray	14.9				5			
605	20													
		3	P	72			17.0	116.2	32	14	8		X	
600	25					600.0 / 25.4 MINE SPOIL: Stiff to very stiff, brown, spoted gray and reddish brown, silty low plastic CLAY (CL), with coal fragments, moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 600 feet (1975 topo)*
		3	4 9 12	78			16.4				6			
	30													

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Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B011

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
595	30					MINE SPOIL (continued): Stiff to very stiff, brown, spotted gray and reddish brown, silty low plastic CLAY (CL), with coal fragments, moist								
		4	P	89							6			*Approximate toe of existing embankment slope at elevation 593 feet*
590	35													
		4	4 5 5	83			14.2				5			
585	40													
		5	P	0			24.5		31	12				*Unable to sample - three attempts*
580	45													
		5	10 12 14	50		becoming light reddish brown, with weathered shale and coal fragments	19.1				6			
575	50													
		6	5 6 6	67							4			
570	55													
		7	4 6 5	56							< 2			
565	60					565.4 / 60.0 End of Boring at 60 ft Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:29 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B012

Date(s) Drilled	08/22/2015 1:30 PM to 08/22/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	592.5 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1388586.8 E 2347253.6

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0						592.5 / 0.0 MINE SPOIL: Medium stiff to stiff, reddish brown, mottled gray, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 600 feet (1975 topo)*
590															
	5		1	P	100			21.9	104.1	38	22	3		X	
585															
	10		1	1 2 2	67			21.9				3			
580															
	15		2	P	100		plasticity increasing	21.8	107.1	49	26	3		X	
575															
	20		2	1 1 3	72		plasticity decreasing, becoming brown, mottled black, with trace coal fragments	23.1				< 2			
570															
	25		3	P	100		with weathered shale fragments	23.7	105.1	32	14	6		X	
565							565.5 / 27.0 MINE SPOIL: Medium stiff to stiff, reddish brown, mottled gray, high plastic CLAY (CH), moist, with rock fragments								
	30		3	1 2 2	89			24.5				3			

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:34 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B012

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): Medium stiff to stiff, reddish brown, mottled gray, high plastic CLAY (CH), moist, with rock fragments								
560						with coal fragments								
		4	P	100			19.4	115.0	30	15	7			
	35													
555														
		4	4 4 5	89		with abundant rock fragments					5			
	40					552.5 / 40.0 End of Boring at 40 ft								
550														
	45													
545														
	50													
540														
	55													
535														
	60													
530														
	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:34 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B013

Date(s) Drilled	08/07/2015 11:15 AM to 08/07/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	60.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	625.2 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1388193.3 E 2347067.8

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
625	0						625.2 / 0.0 EMBANKMENT FILL: Stiff to very stiff, light reddish brown, spotted gray, silty low plastic CLAY (CL), dry to moist								*Embankment fill consists of recompacted mine spoil.*
			1	11 14 14	67			14.3				8+			
620	5														
			2	6 8 10	72							8+			
615	10														
			3	4 6 7	83		becoming brown	14.7		32	13	5			
610	15														
			4	5 8 9	89		with small rock fragments					7			
605	20														
			5	4 4 6	100			16.7		33	14	4			
600	25														
			6	4 5 7	72							6			
	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:39 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B013

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
595	30					EMBANKMENT FILL (continued): Stiff to very stiff, brown, spotted reddish brown and gray, silty low plastic CLAY (CL), dry to moist								
		7	5 7 9	89			15.3		32	13	8+			*Approximate toe of existing embankment slope at elevation 592 feet*
590	35													
		8	5 7 7	78		with carbonized materials					6			
585	40													
		9	5 6 7	72		with rock fragments	15.6		33	14	6			
580	45													
		10	4 7 9	78							6			*Pre-Embankment Construction Ground Surface Elevation Estimated at 575 feet (1975 topo)*
575	50					575.0 — 50.2								
						MINE SPOIL: Stiff to very stiff, brown, mottled reddish brown, spotted gray, low to high plastic CLAY (CL-CH)								
		11	4 7 8	72			19.3				7			
570	55													
		12	5 6 7	100							5			
565	60					565.2 — 60.0								
						End of Boring at 60 ft								
	65					Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:40 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B014

Date(s) Drilled	08/22/2015 3:50 PM to 08/22/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	592.5 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1388147.3 E 2347261.3

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
	0						592.5 / 0.0 EMBANKMENT FILL: Medium stiff, reddish brown to brown, mottled gray, silty low plastic CLAY (CL), moist									*Embankment fill consists of recompacted mine spoil.*
590															
	5		1	3 3 4	72			19.9				2			
585															
	10		2	1 2 2	83			23.3		36	14	< 2			
580															
	15		3	2 2 2	78			25.0				2			
575							575.0 / 17.5 MINE SPOIL: Medium stiff, brown, spotted reddish brown and gray, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 575 feet (1975 topo)*
	20		4	1 2 3	89			26.3		39	17	3			
570															
	25		5	1 2 3	100		with coal fragments	22.2				2			
565															
	30		6	3 3 3	100							2			

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:45 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B014

Elevation (feet)	Depth (feet)	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						MINE SPOIL (continued): Medium stiff, brown, spotted reddish brown and gray, silty low plastic CLAY (CL), with coal fragments, moist								
560															
			7	2 2 2	100		with rock fragments, sand, and trace gravel	17.4		25	8	2			
	35														
							555.5 / 37.0								
555							MINE SPOIL: SHALE, highly weathered, dark gray								*Potentially undisturbed shale below 37 feet*
			8	19 29 34	89							8+			
	40						552.5 / 40.0 coal seam at 39.8 feet								
							End of Boring at 40 ft								
550							Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
	45														
545															
	50														
540															
	55														
535															
	60														
530															
	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:45 PM

ATTORNEY-CLIENT PRIVILEGED & CONFIDENTIAL

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B015

Date(s) Drilled	08/07/2015 12:00 AM to 08/07/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	61.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	630.1 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #1 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1387221.1 E 2346897.6

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
630	0					630.1 / 0.0 EMBANKMENT FILL: Stiff to very stiff, brown, silty low plastic CLAY (CL), moist								*Embankment fill consists of recompacted mine spoil.*
625	5	1	P	100			18.2	113.0			7	2.92		
620	10	1	3 4 4	83							4			
615	15	2	P	100			16.5	119.0	34	15	8+	6.08		
						612.0 / 18.1 MINE SPOIL: Medium stiff to stiff, brown, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 612 feet (1975 topo)*
610	20	2	3 4 4	100							4			*Approximate toe of existing embankment slope on south side at elevation 612 feet*
605	25	3	P	100			25.2	101.2	36	18	4		X	
	30													

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B015

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
600	30					MINE SPOIL (continued): Medium stiff to stiff, brown, silty low plastic CLAY (CL), with coal pieces, moist								
		3	2 2 3	78			22.9				2			
595	35													*Approximate toe of existing embankment slope on east side at elevation 595 feet*
		4	P	100			24.5	100.8	33	14	3.5		X	
590	40													
		4	2 3 3	78			22.6				2			
585	45													
		5	P	72			16.9	109.1	31	15	6		X	
580	50													
		5	3 3 6	83		578.1 / 52.0					5			
575	55					MINE SPOIL: Stiff to very stiff, light gray, speckled black and reddish brown silty low plastic CLAY (CL-ML), with sand and trace gravel								
		6	P	100			15.8	118.4	24	6	5			
570	60													
		6	3 3 4	100							4			
						568.6 / 61.5								
	65					End of Boring at 61.5 ft								
						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:42:50 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B017

Date(s) Drilled	08/06/2015 7:50 AM to 08/06/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	61.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	639 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1390151.6 E 2347085.9

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0					639.0 / 0.0 EMBANKMENT FILL: Stiff to very stiff, brown, spotted grayish brown, silty low plastic CLAY (CL), dry to moist								*Embankment fill consists of recompacted mine spoil.*
635	5	1	5 7 11	61			18.0		40	19	7			
630	10	2	5 9 11	100		with rock fragments					5			
625	15	3	6 9 11	78			16.2		37	16	8+			
620	20	4	5 5 6	72							7			
615	25	5	7 11 11	78			16.1				8+			*Approximate toe of existing embankment slope at elevation 612 feet*
610	30													

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B017

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						EMBANKMENT FILL (continued): Stiff to very stiff, brown, spotted grayish brown, silty low plastic CLAY (CL), with rock fragments, dry to moist								
			6	4 4 5	39							3			
605							605.0 / 34.0								*Pre-Embankment Construction Ground Surface Elevation Estimated at 605 feet (1975 topo)*
	35						MINE SPOIL: Medium stiff to stiff, brown, mottled gray and reddish brown, silty low plastic CLAY (CL), with coal and wood fragments and trace organics, moist								
			7	3 3 4	100			24.4				2			
600	40														
			8	3 3 4	100							2			
595	45														
			9	2 3 4	100			26.3		36	14	2			
590	50														
			10	2 3 4	89							3			
585	55														
			11	2 3 6	94			17.3				4			
580							with shale fragments, decreasing moisture								
	60														
			12	6 7 11	72							6			
							577.5 becoming very stiff / 61.5								
							End of Boring at 61.5 ft								
575	65						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:00 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B018

Date(s) Drilled	08/20/2015 12:00 AM to 08/20/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	42.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	612.5 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1390122.4 E 2347186.4

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0					612.5 / 0.0 MINE SPOIL: Soft to medium stiff, brown, mottled dark brown, spotted reddish brown, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 615 feet (1975 topo)*
610														
	5	1	1 1 2	89			28.8				2			
605														
	10	2	2 2 2	100		with rock fragments					2			
600														
	15	3	1 2 2	94		becoming light brown, mottled reddish brown, spotted gray	25.8				2			
595														
	20	4	2 2 2	100							< 2			
590						588.5 / 24.0								
	25	5	3 3 4	89		MINE SPOIL: Medium stiff to stiff, brown, mottled gray, spotted reddish brown, high plastic CLAY (CH), moist	20.5				3			
585						583.5 / 29.0								
	30					MINE SPOIL: Stiff, brown, mottled gray, spotted reddish brown, silty low plastic								

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B018

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					CLAY (CL), moist								
		6	4 5 5	78							4			
580						coal at 32.1 feet and 32.7 feet								
	35													
		7	4 4 4	100			19.4				4			
575						574.5 / 38.0								
	40					MINE SPOIL: SHALE, highly weathered, gray								
		8	5 7 7	72							7			
570						570.0 / 42.5								
						End of Boring at 42.5 ft								
	45													
565														
	50													
560														
	55													
555														
	60													
550														
	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:05 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B019

Date(s) Drilled	08/06/2015 12:20 PM to 08/06/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	60.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	639.9 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1390682.5 E 2347029.9

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0						639.9 / 0.0 EMBANKMENT FILL: Very stiff, brown, mottled dark brown, spotted black and gray, silty low plastic CLAY (CL), with trace organics								*Embankment fill consists of recompacted mine spoil.*
635	5		1	P	100			19.1	108.4	40	17	8+	5.07		
			1	6 7 12	100			18.3				8+			
630	10						629.9 / 10.0 MINE SPOIL: Very stiff, brown, spotted light brown, silty low plastic CLAY (CL), dry								*Pre-Embankment Construction Ground Surface Elevation Estimated at 630 feet (1975 topo)*
625	15		2	P	50		becoming dark brown, spotted black, speckled reddish brown	17.7	107.6	40	18	6	8.642		
			2	3 3 4	100		becoming medium stiff to stiff, brown to light brown, spotted reddish brown and gray, moist	30.0				3			
620	20														
			3	3 4	50			24.5				< 2			*Attempted Shelby tube twice, allowing to set for 15 min each. Unable to get recovery. Drove spoon in place.*
615	25														
			4	4 4 4	72		with trace shale and rock fragments	19.3				3			
610	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:10 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B019

Elevation (feet)	Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist.	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): Medium stiff to stiff, brown, mottled gray, speckled reddish brown, silty low plastic CLAY (CL), with coal, shale, and rock fragments, dry (608.9 / 31.0)								
						MINE SPOIL: Gray, mottled black, speckled reddish brown, high plastic CLAY (CH), with weathered shale and coal fragments								
		3	P	100			17.6	114.4	52	26				
605	35					(604.9 / 35.0) MINE SPOIL: Stiff to very stiff, brown, mottled light gray, silty, low plastic CLAY (CL), moist								*Hit rock at 34 ft, could not push tube further. Approximate toe of existing embankment slope at elevation 604.5 feet*
		5	6 7 7	67		with rock and coal fragments	19.2				6			
600	40													
		4	P	67		becoming gray, mottled dark brown, with weathered shale	20.2	105.7	36	16	7	2.77		
595	45													
		6	5 6 7	89							7			
590	50					(588.9 / 51.0) MINE SPOIL: Stiff to very stiff, dark brown, mottled blue gray organic SILT (OH), with some weathered shale and coal fragments								
		5	P	100			39.7	75.8	58	21	7	3.285		
585	55													
		7	6 7 10	100							7			
580	60					(579.9 / 60.0) End of Boring at 60 ft								
						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
575	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:10 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B020

Date(s) Drilled	08/20/2015 2:15 PM to 08/20/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	603.6 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1390719.7 E 2347156.4

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0						603.6 / 0.0 EMBANKMENT FILL: Stiff, brown, mottled gray, spotted reddish brown, speckled black, silty low plastic CLAY (CL), with weathered shale fragments and trace organics, moist								*Embankment fill consists of recompacted mine spoil.*
600			1	P	100			27.2	95.4	36	16	4			
	5						599.0 / 4.6 MINE SPOIL: Medium stiff to stiff, gray, mottled brown, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 599 feet (1975 topo)*
595			1	2 3 3	100			18.2				2			
	10														
590			2	P	100		becoming light blue and gray, mottled light olive brown, speckled reddish brown and black, with trace weathered shale and coal fragments, increasing moisture	25.8	105.9	28	12	8+			
	15														
585			2	2 3 3	89		becoming grayish brown, mottled light gray, speckled reddish brown, trace rock fragments, decreasing moisture	15.7				2			
	20						582.6 / 21.0 MINE SPOIL: SHALE, soft, highly weathered, gray								
580			3	P	100			15.3	118.9	41	17	8+			
	25														
575			3	4 5 6	33			15.9				8+			*Shale jammed in shoe of split spoon.*
	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:15 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B020

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): SHALE, highly weathered, gray 572.6 / 31.0								
						MINE SPOIL: Stiff, light blue gray, spotted brown and reddish brown, silty low plastic CLAY, with trace fine sand								
570		4	P	100			19.5	112.2	43	23	3			
	35					567.6 / 36.0								
						MINE SPOIL: SHALE, highly weathered, gray								
565		4	6 7 7	44			15.9				8+			
	40					563.6 / 40.0								
						End of Boring at 40 ft								
						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
560	45													
555	50													
550	55													
545	60													
540	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:16 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B021

Date(s) Drilled	08/05/2015 4:40 PM to 08/06/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	61.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	639.1 ft NAVD88
Borehole Backfill	Temporary Piezometer (Abandoned 8/23/15)	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1392095.5 E 2346700.6

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0						639.1 / 0.0 EMBANKMENT FILL: Stiff to very stiff, brown to light brown, spotted reddish broan and gray, silty low plastic CLAY (CL), dry								*Embankment fill consists of recompacted mine spoil.*
635	5		1	P	100			17.5	112.0	36	17	6		X	
630	10		1	3 4 6	78		with rock fragments	20.2				6			
625	15		2	P	33		large coal fragment at 17.5 feet								
620	20		2	6 8 8	83			14.6				6			*Stop for day - 8/5/15* *Start for day - 8/6/15*
615	25		3	P	94			20.5	104.0	41	19	5.5		X	
610	30														*Pre-Embankment Construction*

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:21 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B021

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resist.	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						609.0 MINE SPOIL: Stiff to very stiff, Brown, speckled reddish brown, silty low plastic CLAY (CL), with rock fragments, dry to moist — 30.1								*Ground Surface Elevation Estimated at 609 feet (1975 topo)*
		3	4 8 11		83			17.9				8+			
605	35														*Approximate toe of existing embankment slope at elevation 604.5 feet*
		4	P		100			20.1	109.0			5		X	
600	40														
		4	3 3 5		89			19.9				3			
595	45														
		5	P		100							4			
590	50						589.1 MINE SPOIL: SHALE, highly weathered, brown and gray, with coal and rock fragments — 50.0								
		5	3 7 11		100			12.6				4			
585	55														
		6	P		89										
580	60														
		6	4 5 9		78			15.4				6			
575	65						577.6 End of Boring at 61.5 ft — 61.5								

Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:21 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B022

Date(s) Drilled	08/20/2015 11:45 AM to 08/20/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	42.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	606.7 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1392187.5 E 2346813.2

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) 606.7 / Depth (feet) 0.0								
605	0						MINE SPOIL: Very stiff, brown, spotted reddish brown, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 605-615 feet (1975 topo). The 1975 topo shows a large body of water in this area. The embankment fill may extend to greater depths than indicated.*
	5														
600		1		P	100			18.5	111.0			5		X	
	10														
595		1		2 2 2	89		becoming soft to medium stiff	28.1				2			
	15														
590		2		P	100			30.1	91.0			3		X	
							587.7 / 19.0								
	20						MINE SPOIL: SHALE, highly weathered, gray, spotted reddish brown and black, with coal fragments								
585		2		3 3 3	67			13.5				4			
	25														
580		3		P	100			20.3	111.0			4		X	
	30														

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B022

Elevation (feet)	Depth (feet)	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						MINE SPOIL (continued): SHALE, highly weathered, gray, spotted reddish brown and black, with coal fragments								
575		3		11 3 3	89		574.9 / 31.8	15.1				2			
							MINE SPOIL: Medium stiff, gray, spotted brown, silty low plastic CLAY (CL)								
	35						571.7 / 35.0								
570		4		P	72		MINE SPOIL: SHALE, highly weathered, brown, mottled gray, spotted light reddish brown					8+			
	40														
565		4		4 5 6	83		564.2 / 42.5	16.9				4			
							End of Boring at 42.5 ft								
	45														
560															
	50														
555															
	55														
550															
	60														
545															
	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:26 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B023

Date(s) Drilled	08/11/2015 1:00 PM to 08/11/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	60.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	640 ft NAVD88 (est from topo)
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	Not Surveyed

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
640	0						Elevation (feet) 640.0 / Depth (feet) 0.0 EMBANKMENT FILL: Stiff to very stiff, brown, silty low plastic CLAY (CL), with rock and coal fragments, dry to moist								*Embankment fill consists of recompacted mine spoil.*
			1	4 6 6	89			15.5				8+			
635	5														
			2	5 6 6	78							8			
630	10														*1975 topography is not available for the northern portion of Ash Pond #2. The embankment fill at this boring location appears to extend to a depth of 30 feet.*
			3	4 4 5	89			20.2				8			
625	15														
			4	5 7 7	89							8			
620	20														
			5	4 5 5	94			15.6				8			
615	25														
			6	6 5 6	67		Elevation (feet) 610.0 / Depth (feet) 30.0					7			*Approximate toe of existing embankment slope at elevation 613 feet*
610	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:31 PM

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Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B023

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
610	30						MINE SPOIL: Medium stiff to stiff, light brown to brown, spotted reddish brown, silty low plastic CLAY (CL), with coal and rock fragments, moist								
			7	2 2 2	100			24.3				2			
605	35														
			8	2 3 3	89							3			
600	40														
			9	3 3 4	78			16.6				4			
595	45														
			10	2 3 3	83							3			
590	50														
			11	3 3 6	78		becoming gray, mottled light brown, with weathered shale	21.6				< 2			
585	55														
			12	2 3 3	94							4			
580	60						580.0 / 60.0 End of Boring at 60 ft								
							Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
575	65														

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B024

Date(s) Drilled	08/20/2015 8:30 AM to 08/20/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	615 ft NAVD88 (est from topo)
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	Not Surveyed

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
615	0						Elevation (feet) 615.0 / Depth (feet) 0.0 MINE SPOIL: Stiff to very stiff, brown, speckled reddish brown, silty low plastic CLAY (CL), with rock fragments								*1975 topography is not available for the northern portion of Ash Pond #2. The mine spoil at this boring location appears to be moderately compact with water contents below the plastic limit.*
			1	4 6 7	83			15.3				7			
610	5														
			2	4 8 10	83							8+			
605	10														
			3	3 3 5	89		becoming medium stiff to stiff	15.7				5			
600	15														
			4	2 3 3	83							3			
595	20														
			5	4 5 5	67		becoming light gray and brown, with weathered shale	11.5				3			
590	25														
			6	4 5 5	67							5			
585	30														

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Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B024

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
585	30						MINE SPOIL (continued): Medium stiff to stiff, brown, mottled gray and reddish brown, silty low plastic CLAY (CL), with rock fragments								
			7	3 3 3	83			13.4				3			
580	35														
			8	4 7 7	78			19.1				6			
575	40						Elevation (feet) 575.0 Depth (feet) 40.0 End of Boring at 40 ft								
570	45														
565	50														
560	55														
555	60														
550	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:36 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B025

Date(s) Drilled	08/11/2015 8:30 AM to 08/11/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	58.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	639.1 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1392481.4 E 2345742.8

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0						639.1 / 0.0 EMBANKMENT FILL: Stiff to very stiff, brown, mottled dark brown, speckled black and reddish brown, silty low plastic CLAY (CL), with trace organics, dry								*Embankment fill consists of recompacted mine spoil.*
635	5		1	P	94			17.7	109.2				9.985		
630	10		1	4 6 9	100		with rock fragments					8			*1975 topography is not available for the northern portion of Ash Pond #2. The embankment fill at this boring location appears to extend to a depth of 25+ feet.*
625	15		2	P	100		becoming brown, spotted gray, speckled reddish brown, with trace gravel	15.4	116.8			8	7.685		
620	20		2	4 5 6	94							6			*Approximate toe of existing embankment slope at elevation 621 feet*
615	25		3	P	100		with trace sand	15.9	118.3			5	3.762		
							612.6 / 26.5 MINE SPOIL: Medium stiff to stiff, brown, spotted gray, speckled black and reddish brown, silty low plastic CLAY (CL), with trace sand and gravel								
610	30		3	2 2 2	89							2			

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:41 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B025

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): Medium stiff to stiff, brown, spotted gray, speckled black and reddish brown, silty low plastic CLAY (CL), with trace sand and gravel								
605	35	4	P	100		with trace organics	23.8	102.9			2	2.588		
600	40	4	3 4 4	89							3			
595	45	5	P	100		with weathered shale fragments	15.1	121.2			8+	2.506		
						592.1 / 47.0								
590	50	5	6 8 11	56		MINE SOIL: SHALE, highly weathered, gray, with minor amount of silty clay matrix					8			
585	55	6	P	50			8.0				8			
580	60	6	11 8 13	50							8			
						580.6 / 58.5								
						End of Boring at 58.5 ft								
575	65					Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:41 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B026

Date(s) Drilled	08/18/2015 8:30 AM to 08/18/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	620.3 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1392479.3 E 2345667.3

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) 620.3 / Depth (feet) 0.0								
620	0						EMBANKMENT FILL: Very stiff, brown, mottled dark brown, spotted gray, speckled black and reddish brown, silty low plastic CLAY (CL), with trace sand, dry								
		1		P	100			14.3	118.3			8+	4.009		
615	5						613.3 / 7.0								*1975 topography is not available for the northern portion of Ash Pond #2. The embankment fill at this boring location appears to extend to a depth of 7 feet.*
		1		1 1 1	100		MINE SPOIL: Soft, brown, spotted gray, black, and reddish brown, silty low plastic CLAY (CL), moist	23.3				< 2			
610	10														
		2		P	100		with some weathered shale fragments	20.5	109.4			2	1.367		
605	15														
		2		2 2 2	83		becoming medium stiff to stiff	18.2				2.5			
600	20														
		3		P	100			15.1	117.3			2.5	1.98		
595	25														
		3		2 3 4	89							4			
	30														

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B026

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
590	30					MINE SPOIL (continued): Medium stiff to stiff, brown, spotted gray, black, and reddish brown, silty low plastic CLAY (CL), with weathered shale fragments, moist								
		4	P	100		becoming stiff to very stiff	19.2	107.3			4	2.998		
585	35													
		4	5 7 7	78							5			
580	40					580.3 / 40.0 End of Boring at 40 ft Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
575	45													
570	50													
565	55													
560	60													
	65													

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Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B027

Date(s) Drilled	08/10/2015 12:00 AM to 08/10/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	57.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	639.6 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1391784.9 E 2345777

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
							Elevation (feet) 639.6 / Depth (feet) 0.0								
	0						EMBANKMENT FILL: Stiff to very stiff, brown, silty low plastic CLAY (CL), dry								*Embankment fill consists of recompacted mine spoil.*
635	5		1	7 11 13	83			12.9				8+			
630	10		2	4 5 6	100			15.7				8+			*Approximate toe of existing embankment slope at elevation 628 feet*
625	15		3	7 11 11	67		becoming brown, spotted reddish brown and gray, with rock fragments	14.8				8+			
620	20		4	4 4 4	94			17.2				5			
							616.0 / 23.6								*Pre-Embankment Construction Ground Surface Elevation Estimated at 616 feet (1975 topo)*
615	25		5	4 5 6	83		MINE SPOIL: Stiff to very stiff, light brown, mottled gray, silty low plastic CLAY (CL), moist					5			*Transition from embankment fill to mine spoil may extend to a depth of 35 feet*
610	30														

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Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B027

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30	6	4 4 7	100		MINE SPOIL (continued): Stiff to very stiff, light brown, mottled gray, silty low plastic CLAY (CL), moist	16.7				5			
605	35	7	3 3 5	100		becoming medium stiff to stiff					4			
600	40	8	3 3 4	94		becoming light brown, spotted reddish brown and black, with carbonized fragments	19.6				2			
595	45	9	2 3 5	100							3			
590	50	10	4 4 7	89			22.8				4			
585	55	11	4 4 6	100							3			
						582.1 / 57.5 End of Boring at 57.5 ft								
580	60					Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
575	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:51 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B028

Date(s) Drilled	08/18/2015 10:45 AM to 08/18/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	42.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	626.5 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1391779.3 E 2345715.2

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
626.5	0.0						EMBANKMENT FILL: Stiff, brown, silty low plastic CLAY (CL), with rock fragments and trace gravel, dry								*Embankment fill consists of recompacted mine spoil.*
625	5														
620			1	3 4 4	94			18.6				6			
615	10		2	4 4 6	89							5			
612.0	14.5						MINE SPOIL: Medium stiff to stiff, brown, spotted reddish brown and gray, silty low plastic CLAY (CL), moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 612 feet (1975 topo)*
610	15		3	2 2 2	89			20.1				3			
605	20		4	2 3 4	89							4			
600	25		5	2 2 3	100		becoming light brown, speckled gray, with rock fragments	21.5				2			
	30														

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Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B028

Elevation (feet)	Depth (feet)	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30						MINE SPOIL (continued): Medium stiff to stiff, light brown, speckled gray, silty low plastic CLAY (CL), with rock fragments, moist								
595			6	2 3 3	94							3			
	35														
590			7	2 3 5	100			23.2				3			
	40														
585			8	5 7 34	89		584.8 / 41.8 MINE SPOIL: SHALE, highly weathered, gray / 584.0 / 42.5					4			
							End of Boring at 42.5 ft								
	45						Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
580															
	50														
575															
	55														
570															
	60														
565															
	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:33:56 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B029

Date(s) Drilled	08/05/2015 1:00 PM to 08/05/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	61.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	639.1 ft NAVD88
Borehole Backfill	Temporary Piezometer (Abandoned 8/23/15)	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1390613.3 E 2345906.9

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0					639.1 / 0.0 EMBANKMENT FILL: Stiff to very stiff, brown, spotted gray, silty low plastic CLAY (CL), with rock and coal fragments and trace gravel, dry								*Embankment fill consists of recompacted mine spoil.*
635	5	1	P	72			14.2	118.0	35	17	6			
630	10	1	5 7 10	78			15.8				7			
625	15	2	P	100			17.4	114.0	33	15	6			
620	20	2	5 7 8	83		becoming brown, spotted gray and reddish brown	17.7				6			
615	25	3	P	100			17.3	113.8	37	20	7		X	
610	30													

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Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B029

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					EMBANKMENT FILL (continued): Very stiff, brown, mottled gray, spotted reddish brown, silty low plastic CLAY (CL), with rock fragments, dry								*Approximate toe of existing embankment slope at elevation 608.5 feet*
		3	6 8 11	72			15.4				6			
605	35													
		4	P	100							6			
600	40													
		4	5 8 11	72			16.7				6			
						596.0 / 43.1								*Pre-Embankment Construction Ground Surface Elevation Estimated at 596 feet (1975 topo)*
595	45					MINE SPOIL: Stiff to very stiff, light brown, mottled gray, spotted reddish brown, silty low plastic CLAY (CL), with rock fragments, dry								*The 1975 topo shows a large body of water in this area. The embankment fill may extend to greater depths than indicated.*
		5	P	100										
590	50													
		5	4 8 9	67		becoming moist	17.0				5			
585	55													
		6	P	100							7			
580	60													
		6	3 4 6	94			18.6				5			
						577.6 / 61.5								
575	65					End of Boring at 61.5 ft								

Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:34:02 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B030

Date(s) Drilled	08/18/2015 1:10 PM to 08/18/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	42.5 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	605.9 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon/Shelby Tube	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1390603.5 E 2345787.1

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
605	0						605.9 / 0.0 EMBANKMENT FILL: Very stiff, light brown, speckled reddish brown, silty low plastic CLAY (CL), dry								*Embankment fill consists of recompacted mine spoil.*
			1	P	100			17.4	113.0	33	15	8		X	
600	5						598.0 / 7.9 MINE SPOIL: Stiff to very stiff, light brown, speckled reddish brown, silty low plastic CLAY (CL), dry to moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 598 feet (1975 topo)*
			1	5 5 7	89			16.5				8			*The 1975 topo shows a large body of water in this area. The embankment fill may extend to greater depths than indicated.*
595	10														
			2	P	100			18.6	111.0	37	17	8		X	
590	15						586.9 / 19.0 MINE SPOIL: Medium stiff, brown, spotted reddish brown and gray, high plastic CLAY (CH), with trace gravel, moist								
			2	3 4 5	78			17.3				3			
585	20														
			3	P	100		becoming wet	22.6	102.0	42	22	4		X	
580	25														
	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:34:07 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B030

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
575	30	3	3 3 4	100		MINE SPOIL (continued): Medium stiff, brown, mottled reddish brown and gray, high plastic CLAY (CH), with coal fragments, wet	25.1				3			
						571.9 / 34.0								
570	35	4	P	72		MINE SPOIL: Very stiff, grayish brown and black, silty low plastic CLAY (CL), with coal fragments, wet					8			
565	40	4	5 13 13	67		564.2 / 41.7 MINE SPOIL: SHALE, highly weahered, dark gray 563.4 / 42.5	17.8				2-8			
560	45					End of Boring at 42.5 ft Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
555	50													
550	55													
545	60													
	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:34:07 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B031

Date(s) Drilled	to	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	60.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	640 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Top of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1389655.1 E 2345910.7

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
640	0						640.0 / 0.0 EMBANKMENT FILL: Stiff to very stiff, brown, spotted gray, speckled reddish brown and black, silty low plastic CLAY (CL), with trace gravel, dry								*Embankment fill consists of recompacted mine spoil.*
			1	8 11 11	89			14.8				6			
635	5														
			2	3 4 6	78		becoming brown, spotted light gray, with rock fragments, moist	16.1				6			
630	10														
			3	5 7 9	100							8+			
625	15														
			4	4 8 8	89			18.2				7			
620	20														
							618.0 / 22.0 MINE SPOIL: Stiff to very stiff, brown, spotted reddish brown, speckled gray, silty low plastic CLAY (CL), with rock fragments, moist								*Pre-Embankment Construction Ground Surface Elevation Estimated at 618 feet (1975 topo)*
			5	6 8 8	78							7			*Approximate toe of existing embankment slope at elevation 616 feet*
615	25														
			6	3 5 7	100		decreasing rock fragments	16.2				5			
610	30														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:34:12 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B031

Elevation (feet)	Depth (feet)	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
610	30						MINE SPOIL (continued): Stiff to very stiff, brown, speckled gray, silty low plastic CLAY (CL), trace rock fragments, moist								
			7	2 2 3	100		becoming soft to medium stiff, with rock fragments					2			
605	35														
			8	1 2 2	100		becoming light brown, mottled reddish brown, spotted light gray	20.1				< 2			
600	40						becoming moist to wet								
			9	2 2 3	100							2			
595	45						593.0 / 47.0								
			10	2 2 3	100		MINE SPOIL: Soft to medium stiff, light brown, mottled reddish brown and gray, high plastic CLAY (CH), with trace sand	23.7				2			
590	50														
			11	3 4 8	89		585.5 / 54.5					5			
585	55						MINE SPOIL: SHALE, highly weathered, gray								
							584.0 / 56.0								
							MINE SPOIL: Gray, mottled brown, spotted reddish brown, silty low plastic CLAY (CL), with shale fragments.								
			12	4 4 10	78			13.1				6			
580	60						580.0 / 60.0								
							End of Boring at 60 ft								
							Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.								
575	65														

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:34:12 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B032

Date(s) Drilled	08/19/2015 8:10 AM to 08/19/2015 12:00 AM	Logged By	Rick Horner	Checked By	JAA and WDS
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	Finger Bit	Borehole Depth	40.0 ft
Drill Rig Type	ATV-CME 750	Drilling Contractor	Frontz	Surface Elevation	614.5 ft NAVD88
Borehole Backfill	Cement/bentonite grout	Sampling Method(s)	Split Spoon	Hammer Data	Auto-Hammer, 140 Pound
Boring Location	Ash Pond #2 (Toe of Embankment)	Groundwater Level(s)	None Detected ATD	Coordinates	N 1389667.7 E 2345818.8

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist.	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	0					Elevation (feet) 614.5 / Depth (feet) 0.0 EMBANKMENT FILL: Stiff to very stiff, light reddish brown, spotted gray, silty low plastic CLAY (CL), dry								*Embankment fill consists of recompacted mine spoil.*
610	5	1	3 4 6	89			17.0				5			
						607.0 / 7.5 MINE SPOIL: Stiff, light brown, mottled reddish brown and gray, silty low plastic CLAY (CL), dry								*Pre-Embankment Construction Ground Surface Elevation Estimated at 607 feet (1975 topo)*
605	10	2	2 3 4	83			21.9				5			
600	15	3	2 2 2	89		becoming medium stiff, with rock fragments and trace gravel, moist	24.3				< 2			
595	20	4	2 2 2	94			24.8				2			
590	25	5	2 2 2	83		decreasing rock fragments	24.8				2			
585	30	6	2 2 3	83		trace carbonized fragments	25.0				2			

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:34:17 PM

Project: Dynegy

Project Location: Duck Creek Power Station, Canton, IL

Project Number: 60439301

Log of Boring DUC-B032

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist.	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Dry Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Field Reading (ksf)	Unconfined Compressive Strength (ksf)	TXCU (ksf)	REMARKS
	30					MINE SPOIL (continued): Medium stiff, light brown, mottled reddish brown and gray, silty low plastic CLAY (CL), with trace carbonized and rock fragments, moist								
580	35	7	5 6 6	83		becoming stiff to very stiff, gray and brown, spotted reddish brown, with shale and coal fragments	14.3				8+			
575	40	8	2 2 4	89		becoming medium stiff, with rock fragments and gravel 574.5 / 40.0 End of Boring at 40 ft Note: The delineation between the embankment fill and mine spoil has been estimated from 1975 topography and is considered approximate.	17.3				2			
570	45													
565	50													
560	55													
555	60													
550	65													

Report: GEO_SOIL2; File G:\GINTFILES\PROJECTS\60439301 DUCK CREEK DYNEGY_2015.GPJ; 12/18/2015 2:34:17 PM

Soil samples obtained during the geotechnical investigation were transported to the AECOM laboratory in Overland Park, Kansas for designation of testing in accordance with applicable ASTM standards. Portions of the samples collected were assigned to the Alpha-Omega laboratory located in Kansas City, Kansas, while others were assigned to the Terracon laboratory located in Lenexa, Kansas. Laboratory tests provide data for classification of soils and evaluation of their engineering properties. Test performed on the samples included those described below.

Basic Properties and Soil Classification Tests:

Index testing including water content, dry unit weight, and liquid and plastic (Atterberg) limits were performed on selected samples to further classify the soils in accordance with ASTM D2487 (Standard Practice for Classification of Soils for Engineering Purposes [Unified Soil Classification System]). The following test methods were used:

- ASTM D2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass;
- ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils;
- ASTM D7263 – Standard Test Method for Laboratory Determination of Density (Unit Weight) of Soil Specimens.

Shear Strength Tests:

Shear strength tests on thin-walled Shelby tube samples were used to evaluate the shear strength of selected samples. Test methods used for strength testing were as follows:

- ASTM D2166 – Standard Test Method for Unconfined Compressive Strength of Cohesive Soil;
- ASTM D4767 – Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils.

Hydraulic Conductivity Tests:

Falling Head Permeability Tests were performed on relatively undisturbed thin-walled Shelby tube samples to determine the hydraulic conductivity of selected samples. The following test method was used:

- ASTM D5084 – Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

Summary of Laboratory Testing

SLT 22205

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ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B001	SPT-1	3.5'-5'	Gray, mottled black, spotted brown LEAN CLAY with sand and trace gravel	36.6										
B001	SPT-3	13.5'-15'	Brown, mottled reddish brown and gray LEAN CLAY	23.4										
B001	SPT-5	23.5'-25'	Light brown, spotted reddish brown and gray LEAN CLAY with trace gravel	23.1										
B001	SPT-7	33.5'-35'	Light brown, mottled light gray and reddish brown LEAN CLAY	25.5										
B001	SPT-9	43.5'-45'	Gray, mottled black, spotted brown LEAN CLAY with trace of gravel and coal fragments	21.7										

Summary of Laboratory Testing

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Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B001	SPT-11	53.5'-55'	Brown, mottled gray, spotted reddish brown LEAN CLAY with trace of gravel	15.5										
B002	SPT-1	3.5'-5'	Brown, spotted reddish brown LEAN to FAT CLAY	21.9										
B002	SPT-2	8.5'-10'	Light brown, mottled reddish brown, spotted gray LEAN CLAY	26.7										
B002	SPT-3	13.5'-15'	Light brown, mottled gray LEAN CLAY	28.2										
B002	SPT-4	18.5'-20'	Brown, mottled reddish brown, spotted gray LEAN to FAT CLAY	25.7										
B002	SPT-5	23.5'-25'	Light brown LEAN CLAY	25.4										

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PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B002	SPT-7	33.5'-35'	Gray, mottled brown LEAN CLAY (weathered shale)	16.9										
B005	SPT-1	6'-7.5'	Light brown, mottled reddish brown, spotted gray LEAN to FAT CLAY	14.8										
B005	SPT-2	11'-12.5	Light brown LEAN CLAY	15.7		33	19	14						
B005	SPT-3	16'-17.5'	Brown, mottled reddish brown, spotted gray LEAN CLAY	15.4										
B005	SPT-4	21'-22.5'	Light brown, mottled reddish brown, spotted gray LEAN CLAY	15.8		32	18	14						
B005	SPT-5	26'-27.5'	Brown, mottled reddish brown LEAN CLAY	15.3										

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PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B005	SPT-7	36'-37.5'	Brown, mottled reddish brown, spotted gray LEAN CLAY	17.0		35	19	16						
B005	SPT-9	46'-47.5'	Light brown, mottled reddish brown, spotted gray LEAN CLAY	16.3										
B005	SPT-11	56'-57.5'	Brown, mottled reddish brown and gray LEAN to FAT CLAY	22.0										
B006	SPT-1	6'-7.5'	Brown, spotted reddish brown and gray LEAN to FAT CLAY with trace of gravel	12.3										
B006	SPT-2	11'-12.5'	Brown, mottled reddish brown, spotted gray LEAN to FAT CLAY	21.1										
B006	SPT-3	16'-17.5'	Light brown, mottled reddish brown, speckled gray and black LEAN CLAY	25.9		34	22	12						

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PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B006	SPT-5	26'-27.5'	Reddish brown, mottled gray LEAN CLAY with trace of gravel	13.4										
B006	SPT-7	36'-37.5'	Gray LEAN CLAY (weathered shale)	11.2										
B007	SPT-2	16'-17'	Brown, mottled reddish brown, speckled black LEAN CLAY with trace of gravel and coal fragments	14.4										
B007	SPT-4	27'-29'	Light brown, spotted reddish brown and black LEAN CLAY	24.1		32	23	9						
B007	SPT-5	41'-42'	Gray, mottled brown LEAN CLAY (shale)	11.2										
B007	SPT-6	46'-47.5'	Gray, mottled brown LEAN CLAY (shale)	15.8										

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PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B008	SPT-1	11'-12.5'	Light brown, mottled reddish brown, spotted dark gray LEAN CLAY	26.6		36	21	15						
B008	ST-2	16'-17.5'	Brown, mottled olive brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand	22.6	103.2	40	17	23						
B009	SPT-1	6'-7.5'	Brown, spotted reddish brown LEAN CLAY	19.3										
B009	SPT-2	11'-12.5'	Brown, mottled reddish brown, spotted gray LEAN CLAY	17.1		34	21	13						
B009	SPT-3	16'-17.5'	Brown, spotted black LEAN CLAY	16.6										
B009	SPT-4	21'-22.5'	Brown, spotted reddish brown and gray LEAN CLAY	17.9		32	20	12						

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PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B009	SPT-5	26'-27.5'	Brown, spotted reddish brown and gray LEAN CLAY	20.6										
B009	SPT-6	31'-32.5'	Light brown, mottled reddish brown, spotted gray LEAN CLAY with trace of sand	22.0		43	18	25						
B009	SPT-7	36'-37.5'	Brown, mottled reddish brown and gray LEAN CLAY	25.7										
B009	SPT-8	41'-42.5'	Light brown, spotted reddish brown and gray LEAN CLAY	25.6										
B009	SPT-9	46'-47.5'	Brown, mottled reddish brown, speckled gray FAT CLAY with trace of sand	22.5										
B009	SPT-11	56'-57.5'	Light brown, mottled reddish brown and gray LEAN CLAY	23.3										

Summary of Laboratory Testing

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ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B010	SPT-1	6'-7.5'	Brown, spotted gray and reddish brown LEAN to FAT CLAY	16.5										
B010	SPT-3	16'-17.5'	Brown, mottled gray and reddish brown LEAN CLAY	17.8										
B010	SPT-4	21'-22.5'	Brown, mottled gray and reddish brown FAT CLAY	24.5										
B010	SPT-5	26'-27.5'	Light brown, mottled reddish brown and gray LEAN CLAY	25.2										
B010	SPT-7	36'-37.5'	Gray, mottled reddish brown LEAN CLAY	16.8										
B011	SPT-1	8.5'-10'	Reddish brown, spotted gray and black LEAN to FAT CLAY	14.6										

Summary of Laboratory Testing

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PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B011	SPT-2	18.5'-20'	Light brown, mottled reddish brown, spotted gray LEAN CLAY	14.9										
B011	SPT-3	28.5'-30'	Brown, spotted gray and reddish brown LEAN CLAY	16.4										
B011	SPT-4	38.5'-39'	Brown, mottled reddish brown, spotted gray LEAN CLAY	14.2										
B011	SPT-6	48.5'-50'	Light reddish brown, mottled brown and gray LEAN CLAY with trace of weathered shale and coal fragments	19.1										
B012	SPT-1	8.5'-10'	Reddish brown, mottled gray LEAN CLAY	21.9										
B012	SPT-2	18.5'-20'	Brown, mottled black LEAN CLAY with trace of coal fragments	23.1										

Summary of Laboratory Testing

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ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B012	SPT-3	28.5'-30'	Reddish brown, mottled gray FAT CLAY	24.5										
B013	SPT-1	3.5'-5'	Light reddish brown, spotted gray LEAN CLAY	14.3										
B013	SPT-3	13.5'-15'	Brown LEAN CLAY	14.7		32	19	13						
B013	SPT-5	23.5'-25'	Brown LEAN CLAY	16.7		33	19	14						
B013	SPT-7	33.5'-35'	Brown, spotted reddish brown and gray LEAN CLAY	15.3		32	19	13						
B013	SPT-9	43.5'-45	Brown, speckled reddish brown LEAN CLAY	15.6		33	19	14						

Summary of Laboratory Testing

SLT 22205

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ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B013	SPT-11	53.5'-55	Brown, mottled reddish brown, spotted gray LEAN to FAT CLAY	19.3										
B014	SPT-1	3.5'-5'	Reddish brown, mottled gray LEAN CLAY	19.9										
B014	SPT-2	8.5'-10'	Brown, spotted light gray LEAN CLAY	23.3		36	22	14						
B014	SPT-3	13.5'-15'	Brown, spotted gray LEAN CLAY	25.0										
B014	SPT-4	18.5'-20'	Brown, spotted reddish brown and gray LEAN CLAY	26.3		39	22	17						
B014	SPT-5	23.5'-25'	Brown, mottled gray and reddish brown, spotted black LEAN CLAY with coal fragments	22.2										

Summary of Laboratory Testing

SLT 22205

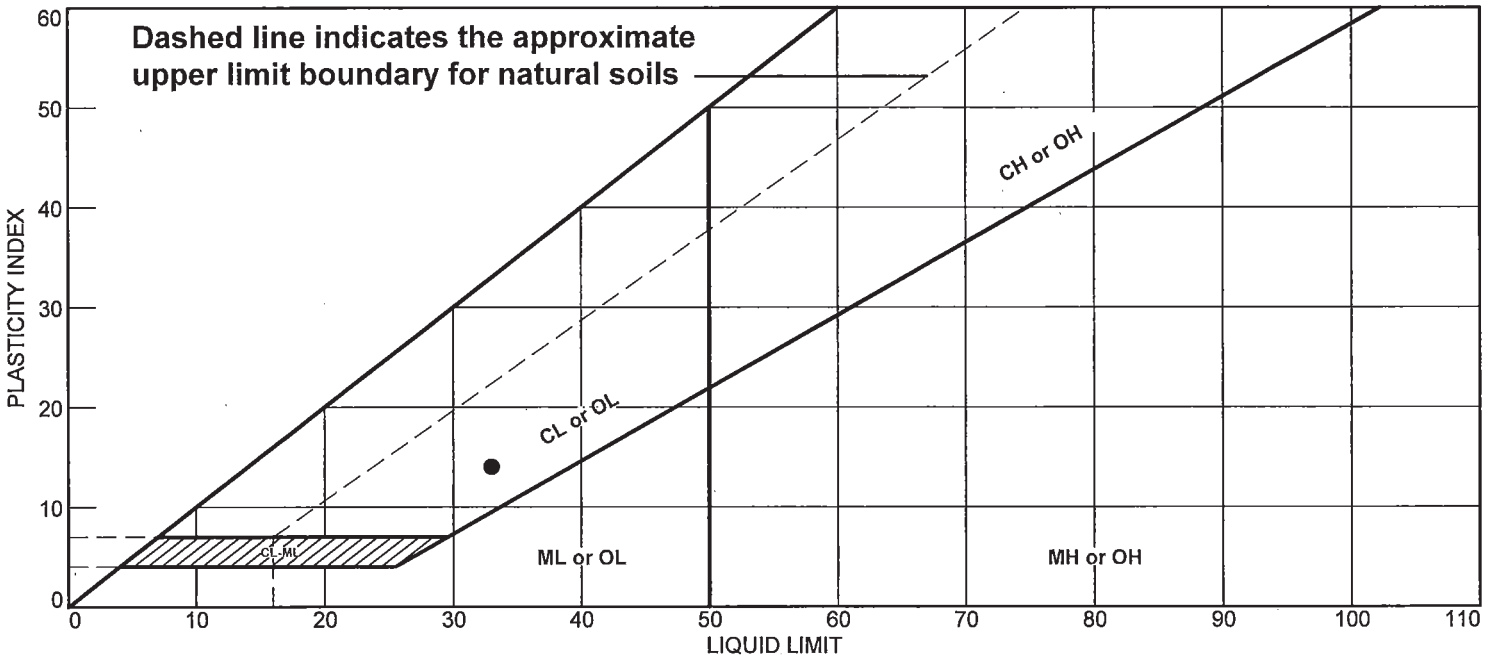
Alpha-Omega Geotech, Inc.
1701 State Avenue
Kansas City, KS 66102
Office: (913) 371-0000 Fax: (913) 371-6710
Website: www.aogeotech.com

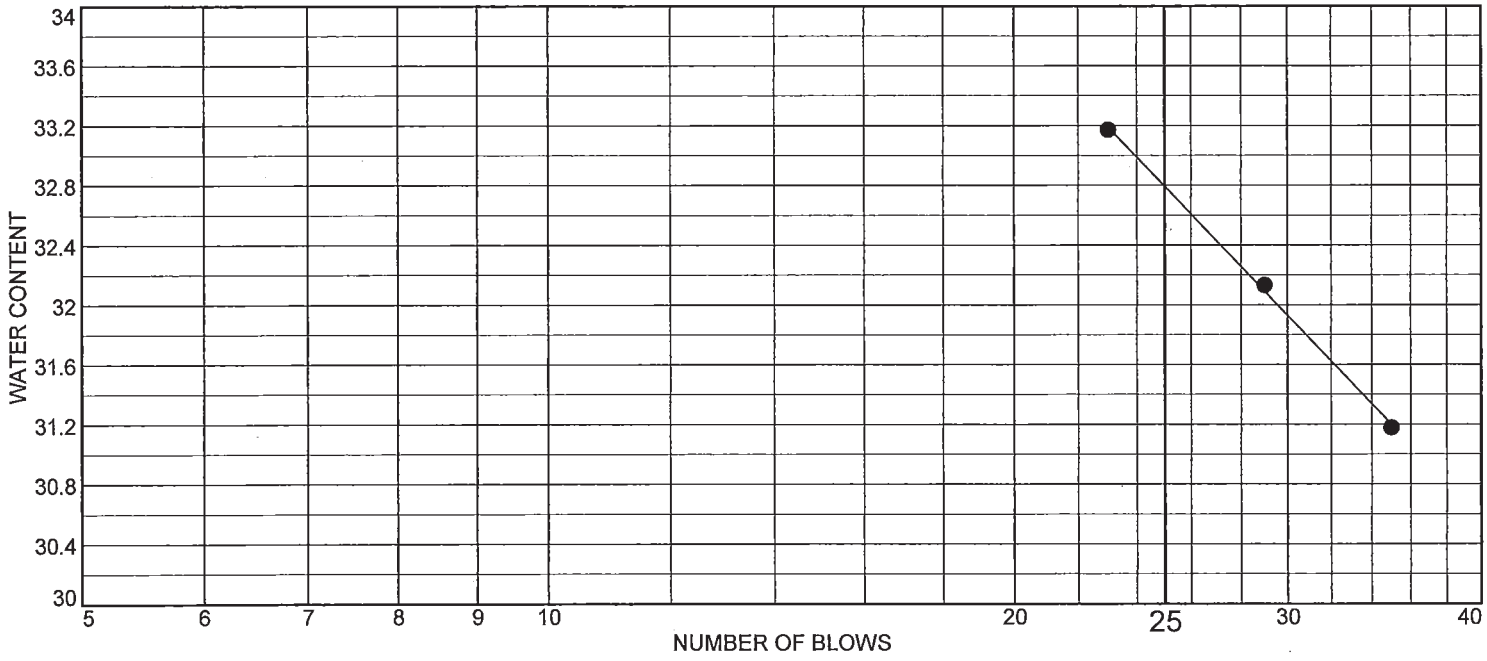
ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 9/22/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B014	SPT-7	33.5'-35'	Light reddish brown, spotted gray LEAN CLAY with sand and trace of gravel	17.4		25	17	8						
B015	SPT-3	31'-32.5'	Light reddish brown, mottled gray, spotted black LEAN CLAY	22.9										
B015	SPT-4	41'-42.5'	Light brown, mottled light reddish brown, spotted gray LEAN CLAY	22.6										
B015	ST-6	56'-57.5'	Light gray, speckled black and reddish brown Silty clay with sand and trace of gravel	15.8	118.4	24	18	6						

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown LEAN CLAY	33	19	14			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B005 SPT-2 **Depth:** 11'-12.5'

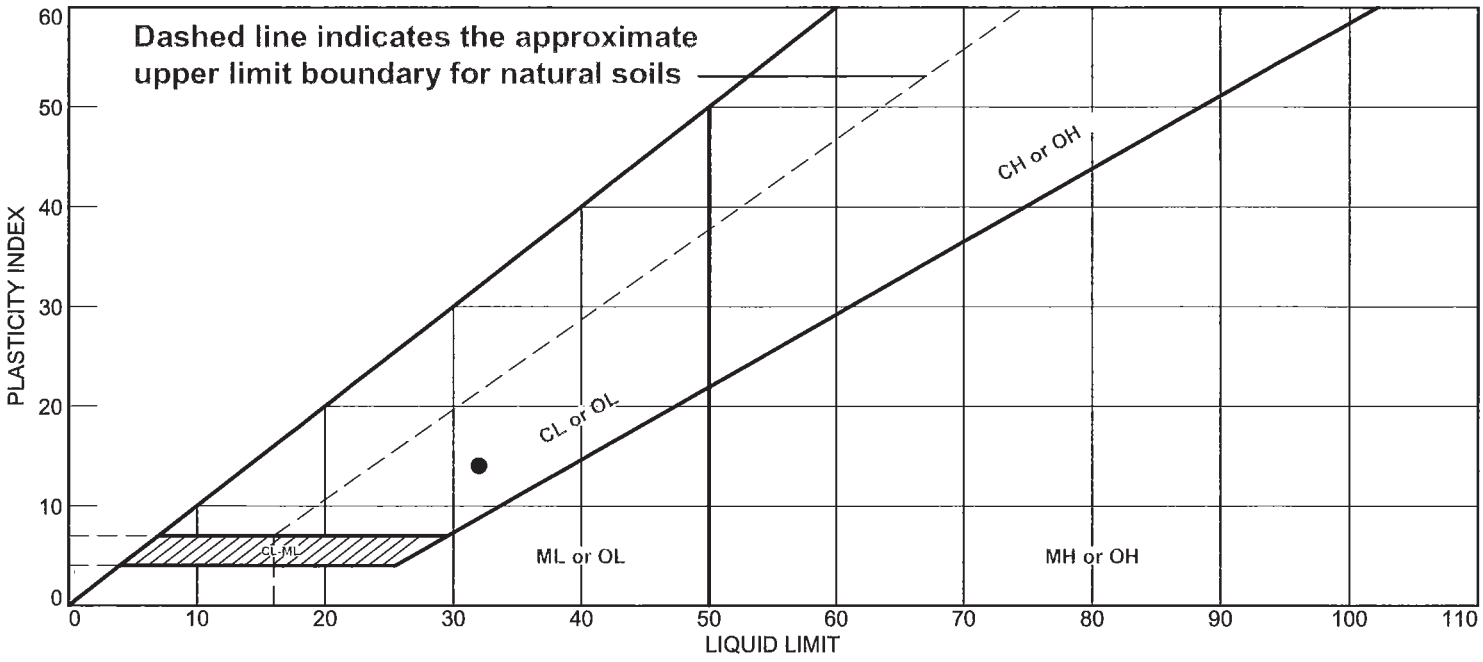
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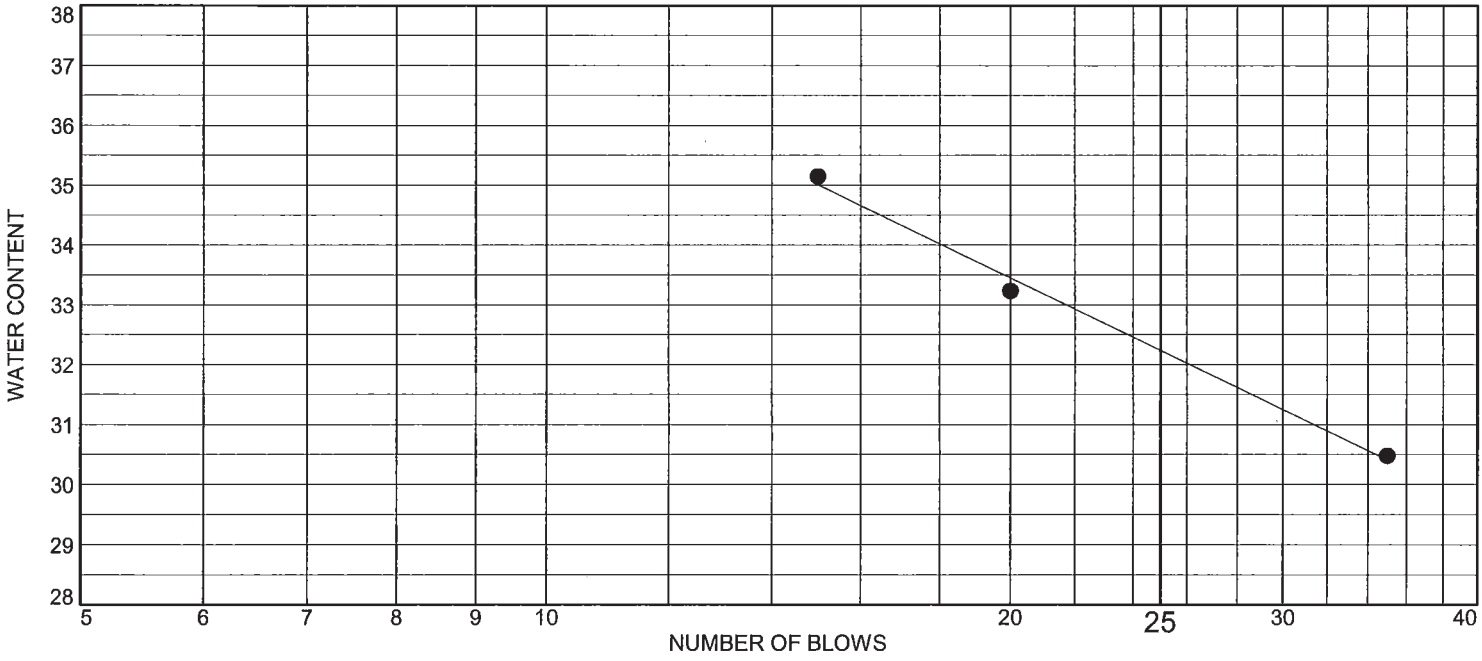
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown, mottled reddish brown, spotted gray LEAN CLAY	32	18	14			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B005 SPT-4 **Depth:** 21'-22.5'

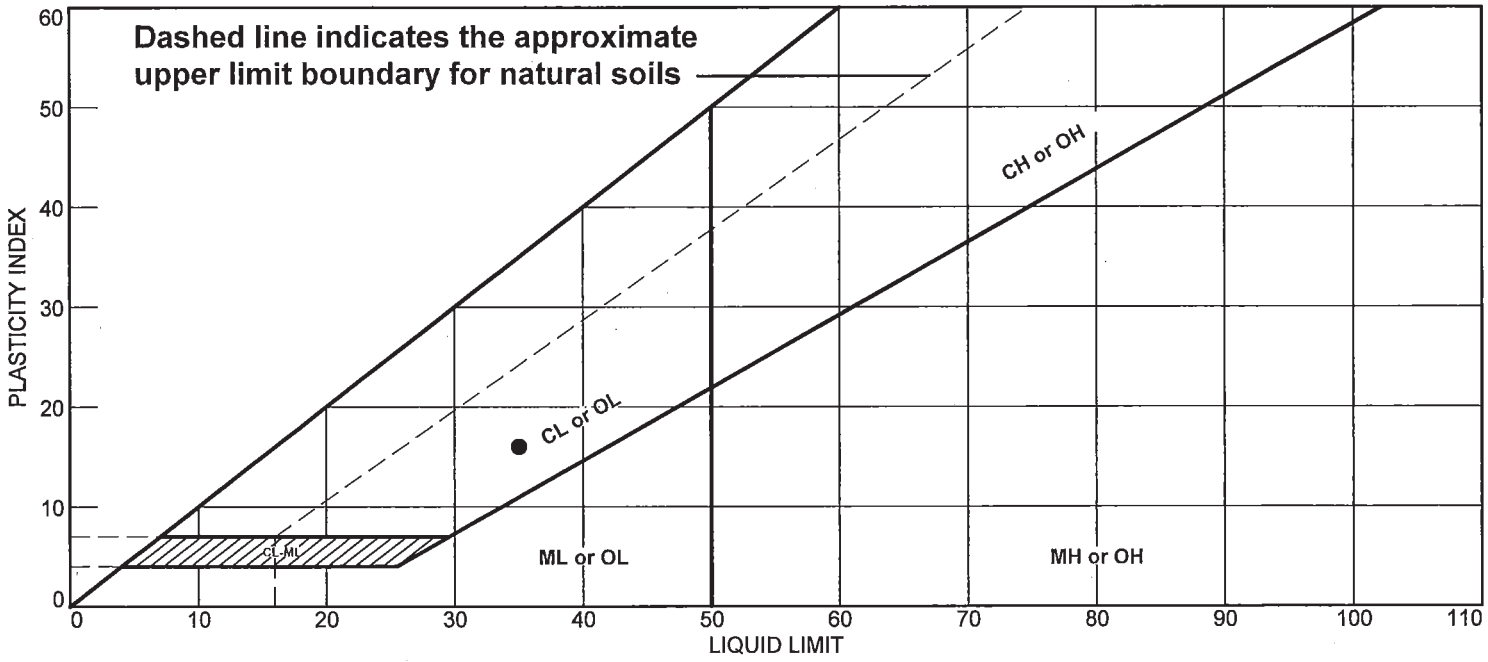
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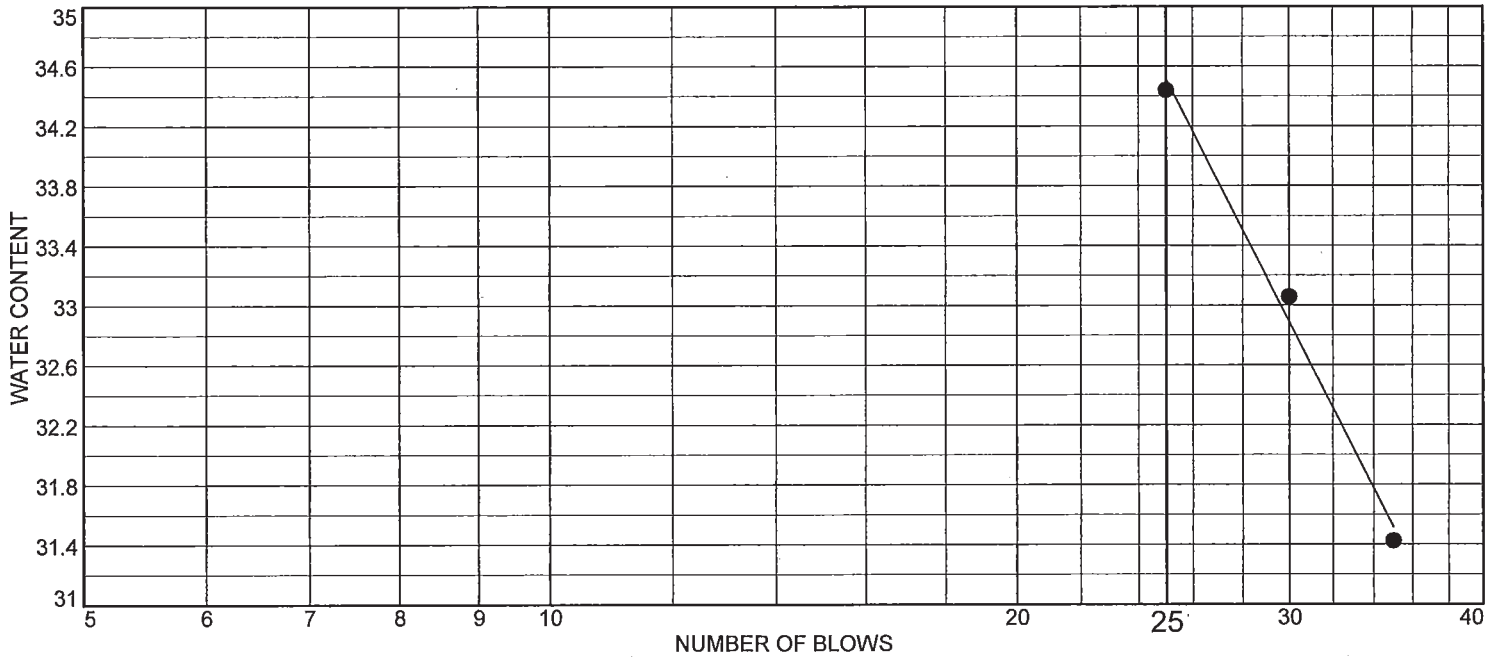
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, mottled reddish brown, spotted gray LEAN CLAY	35	19	16			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B005 SPT-7 **Depth:** 36'-37.5'

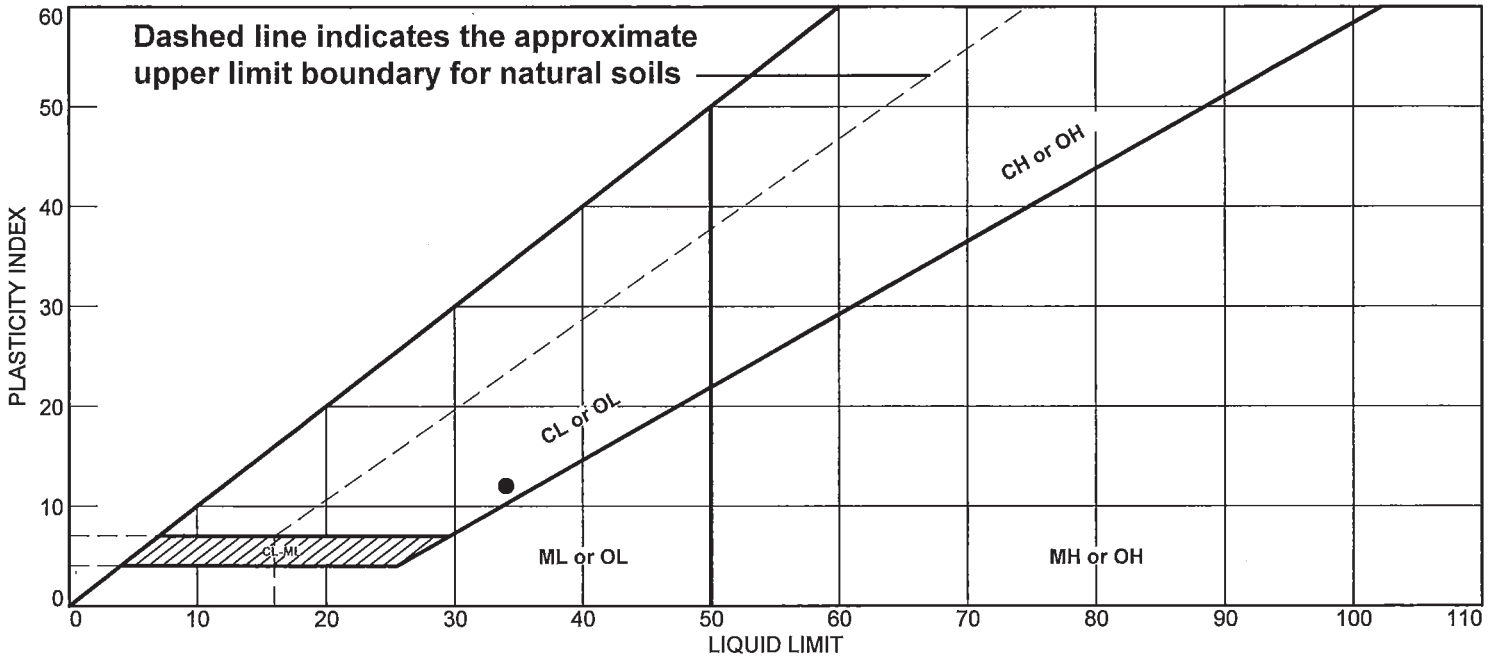
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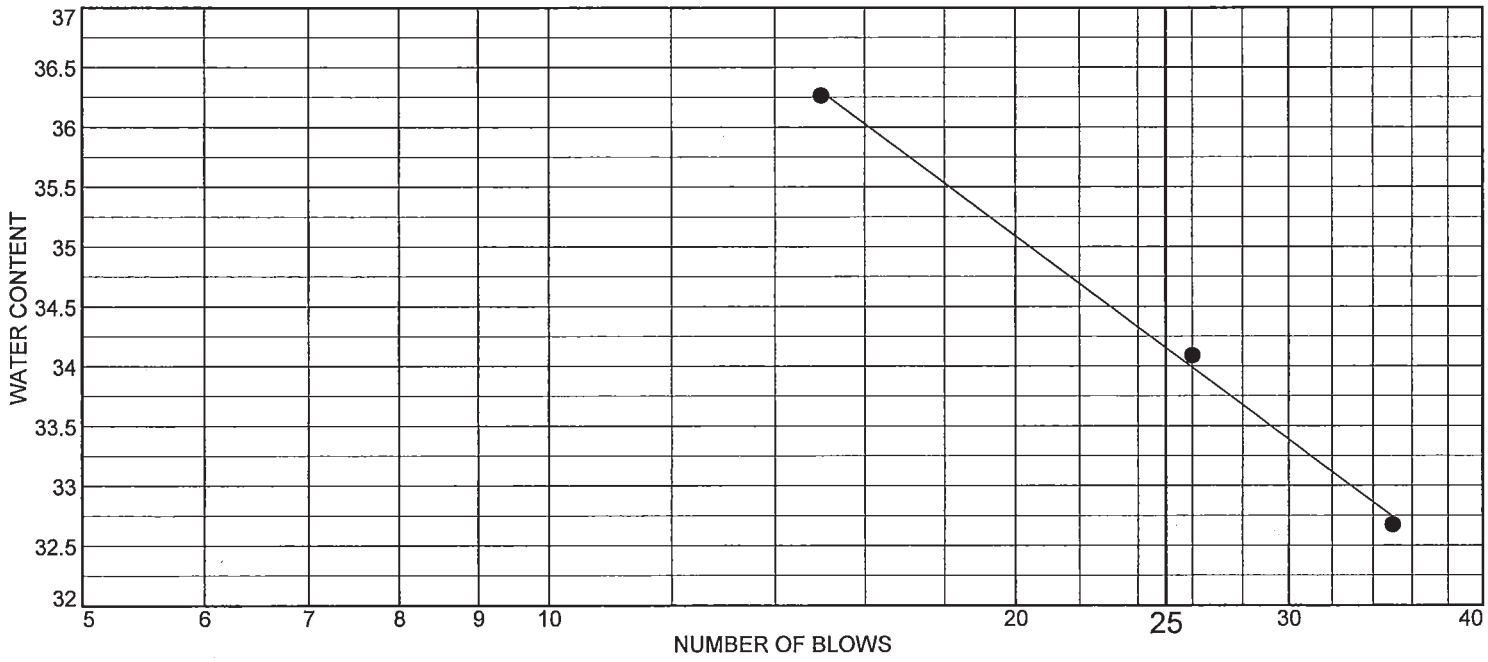
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown, mottled reddish brown, speckled gray and black LEAN CLAY	34	22	12			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B006 SPT-3 **Depth:** 16'-17.5'

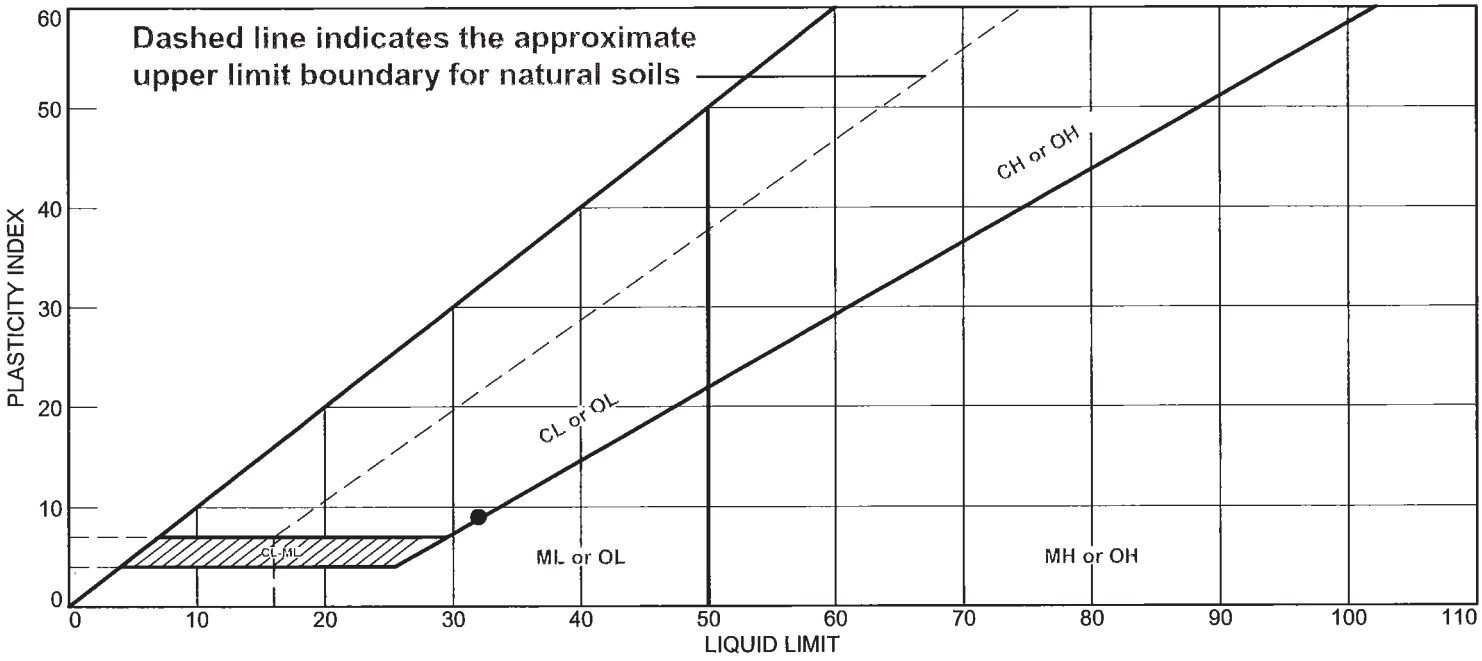
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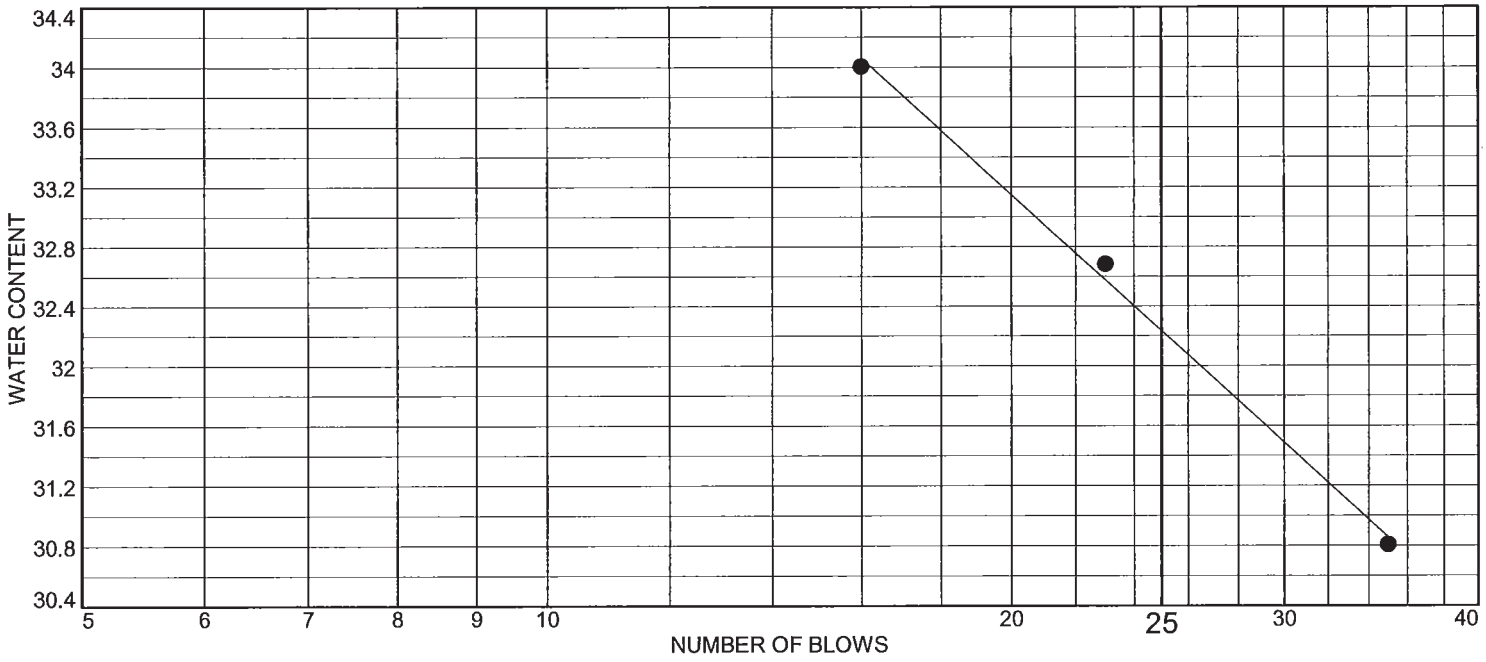
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown, spotted reddish brown and black LEAN CLAY	32	23	9			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B007 SPT-4 **Depth:** 27'-29'

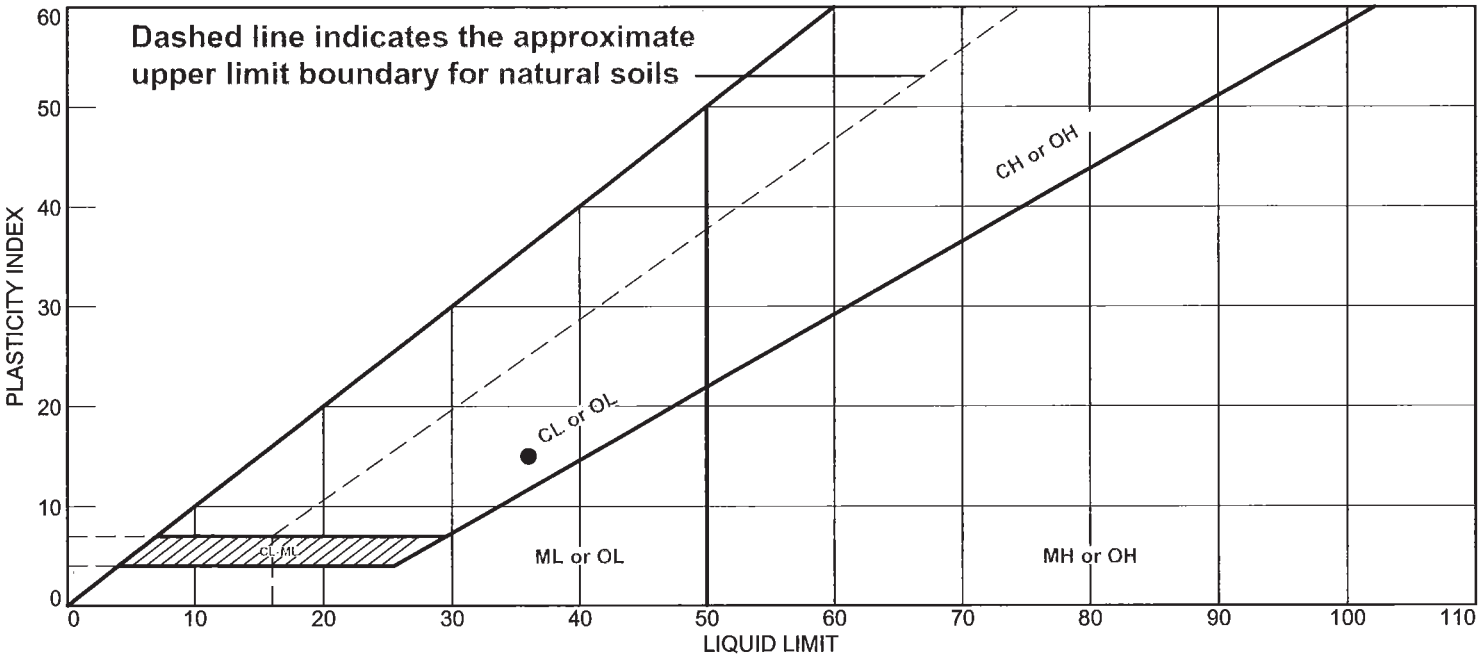
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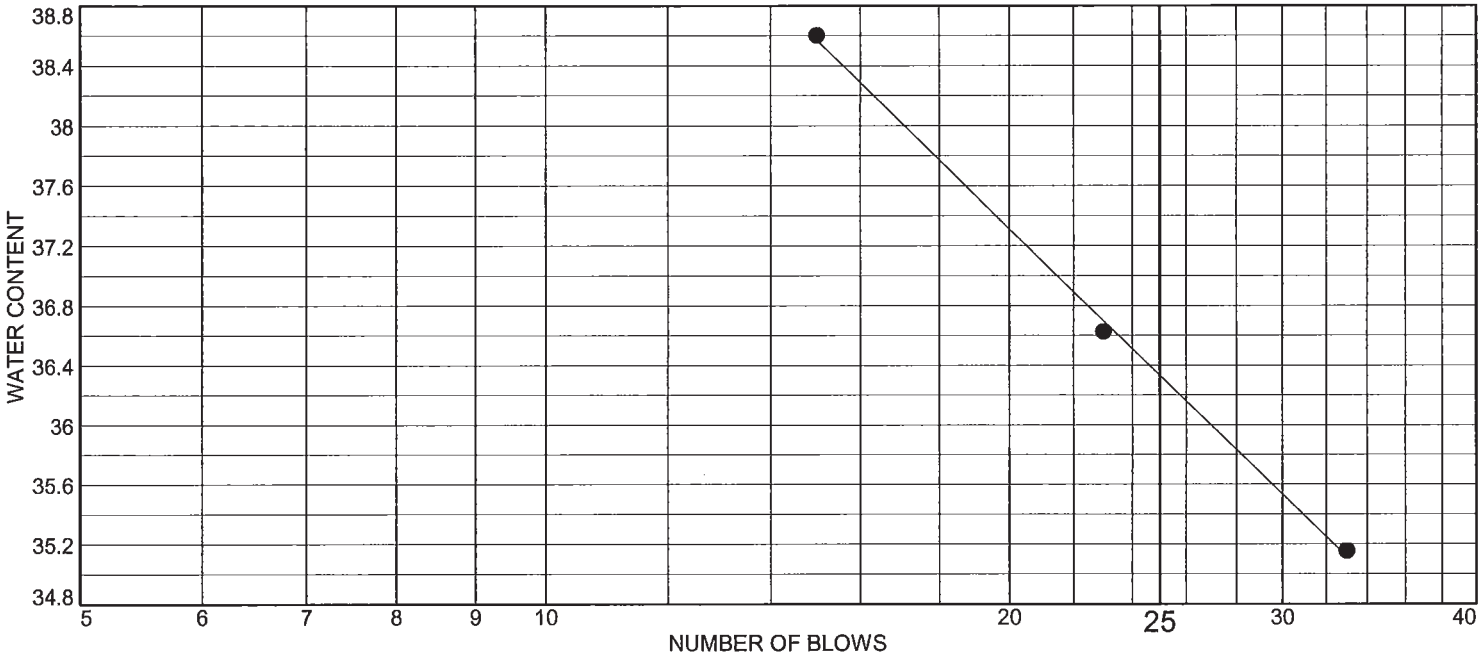
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown, mottled reddish brown, spotted dark gray LEAN CLAY	36	21	15			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B008 SPT-1 **Depth:** 11'-12.5'

Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: EB **Checked By:** TB

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1) PROJECT NO.: 15-328T

LOCATION:

BORING NO.: B008 SAMPLE NO.: ST-2 DEPTH: 16' - 17.5'

SAMPLE TYPE: Undisturbed % COMPACTION:

	INITIAL DATA		FINAL DATA	
MOISTURE:	22.6	%	23.7	%
DRY UNIT WEIGHT:	103.2	pcf	103.2	pcf
HEIGHT:	2.69	inches	2.69	inches
DIAMETER:	2.86	inches	2.86	inches
WEIGHT:	573.8	grams	578.9	grams
SATURATION:	95.8	%	100.0	%

PERMEANT LIQUID: Deaired tap water "B" value = 98.0%

EFFECTIVE CONSOLIDATION STRESS: Maximum 3.4 psi Minimum 3.0 psi

BACK PRESSURE: 90 psi RANGE OF HYDRAULIC GRADIENT: 3.2 to 2.9

SAMPLE DESCRIPTION: Brown, mottled olive brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
10/12 - 10/13	1	81,720	22.0	20.0	26
10/13 - 10/14	2	81,720	22.0	20.0	26
10/14 - 10/15	3	81,720	22.0	20.0	26
10/15 - 10/16	4	81,720	22.0	20.0	26
AVERAGE		81,720	22.0	20.0	26

k= 7.8E-08 cm/s n/n20= 0.8694

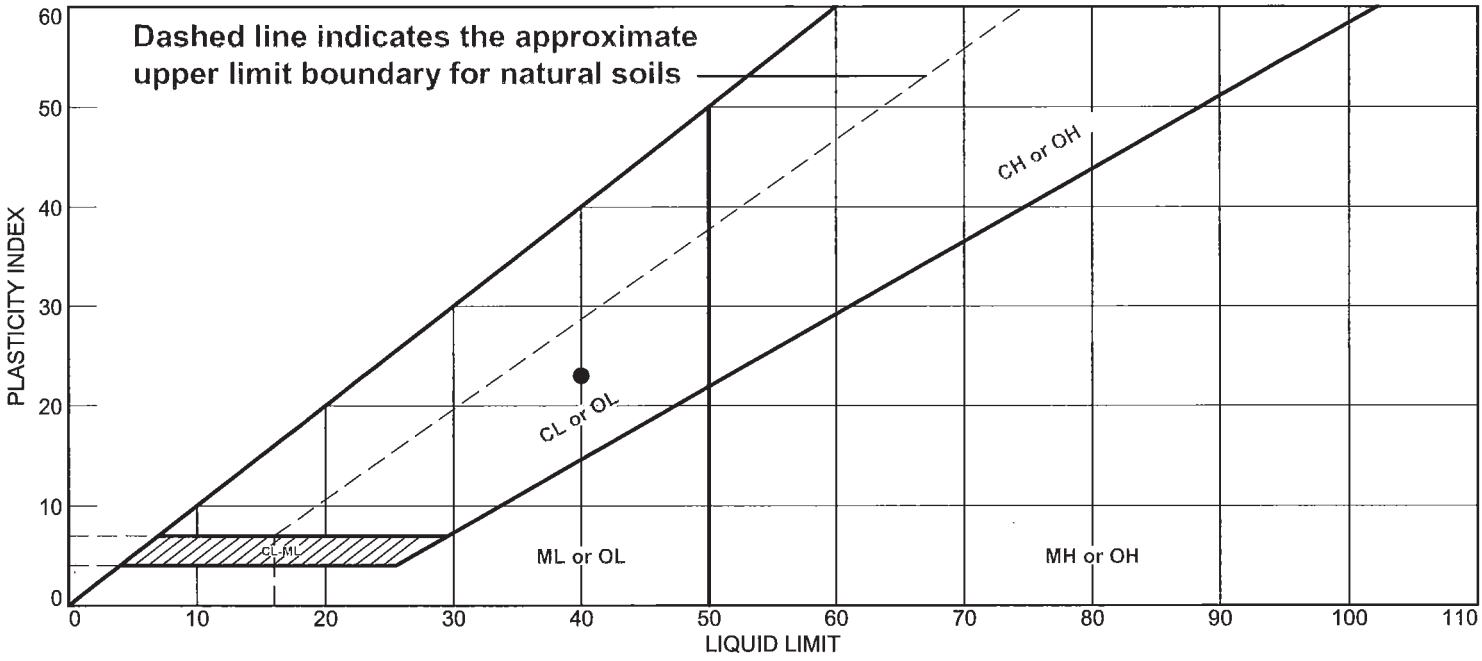
k20= 6.8E-08 cm/s

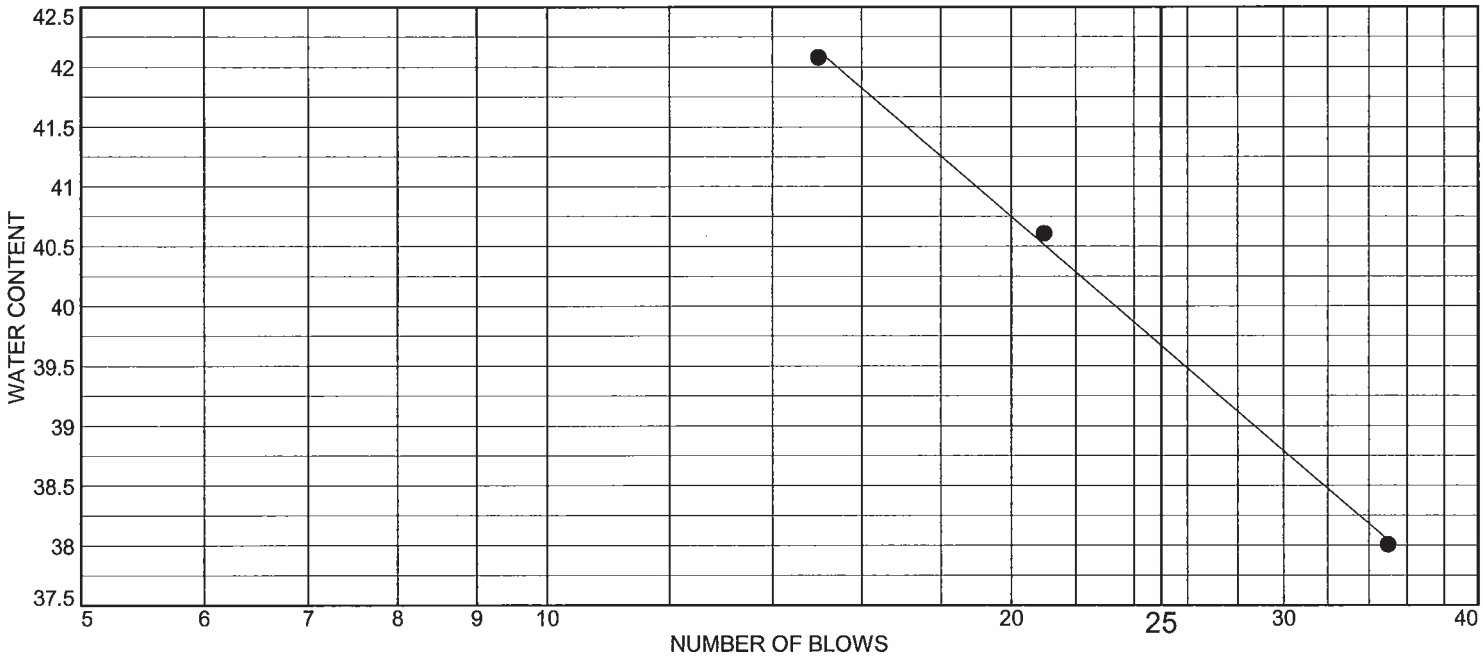
k = Hydraulic Conductivity before n/n20 correction factor

k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, mottled olive brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand	40	17	23			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B008 ST-2 **Depth:** 16'-17.5'

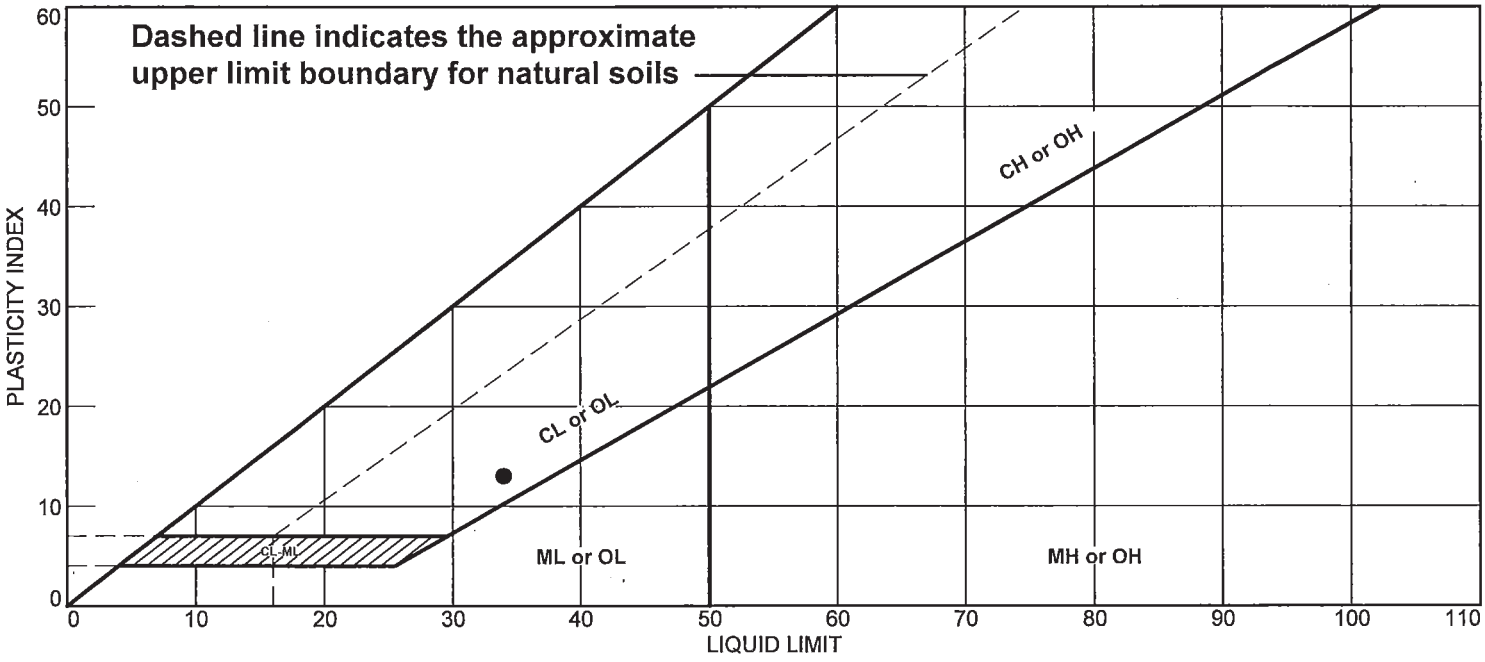
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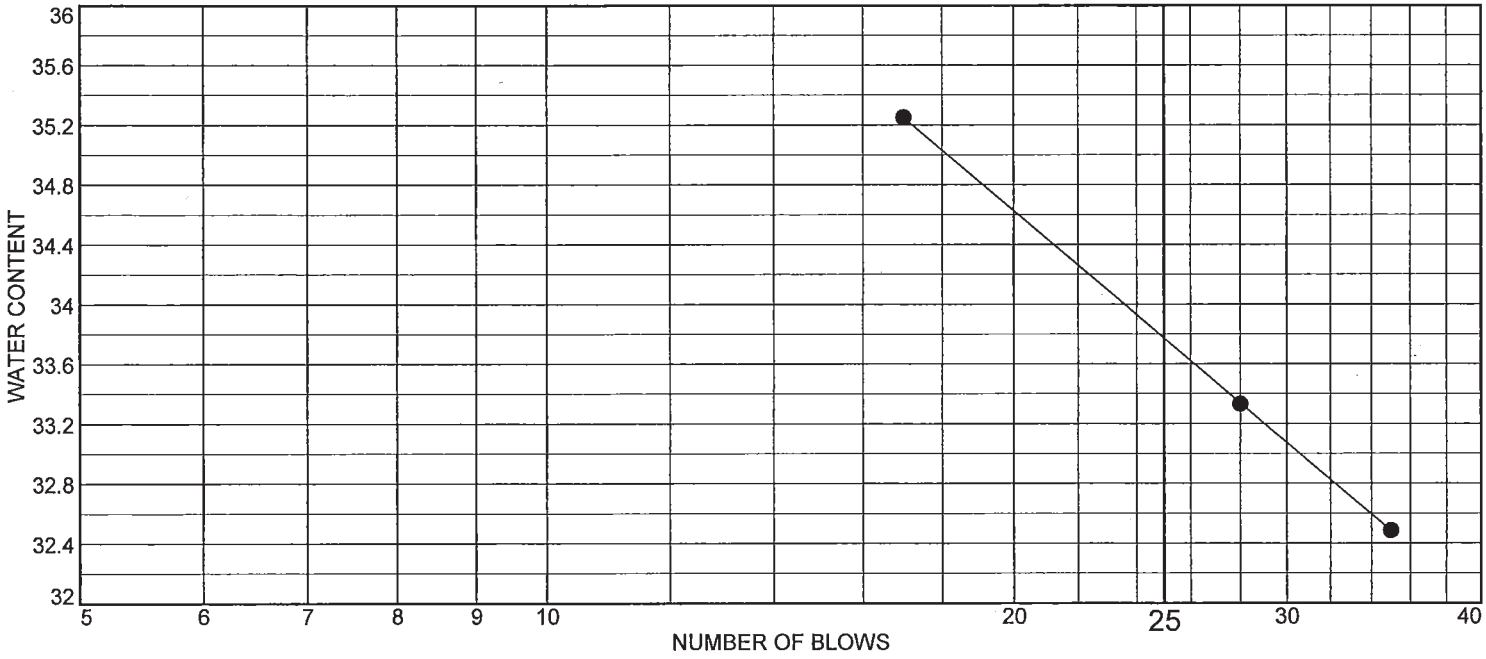
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, mottled reddish brown, spotted gray LEAN CLAY	34	21	13			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B009 SPT-2 **Depth:** 11'-12.5'

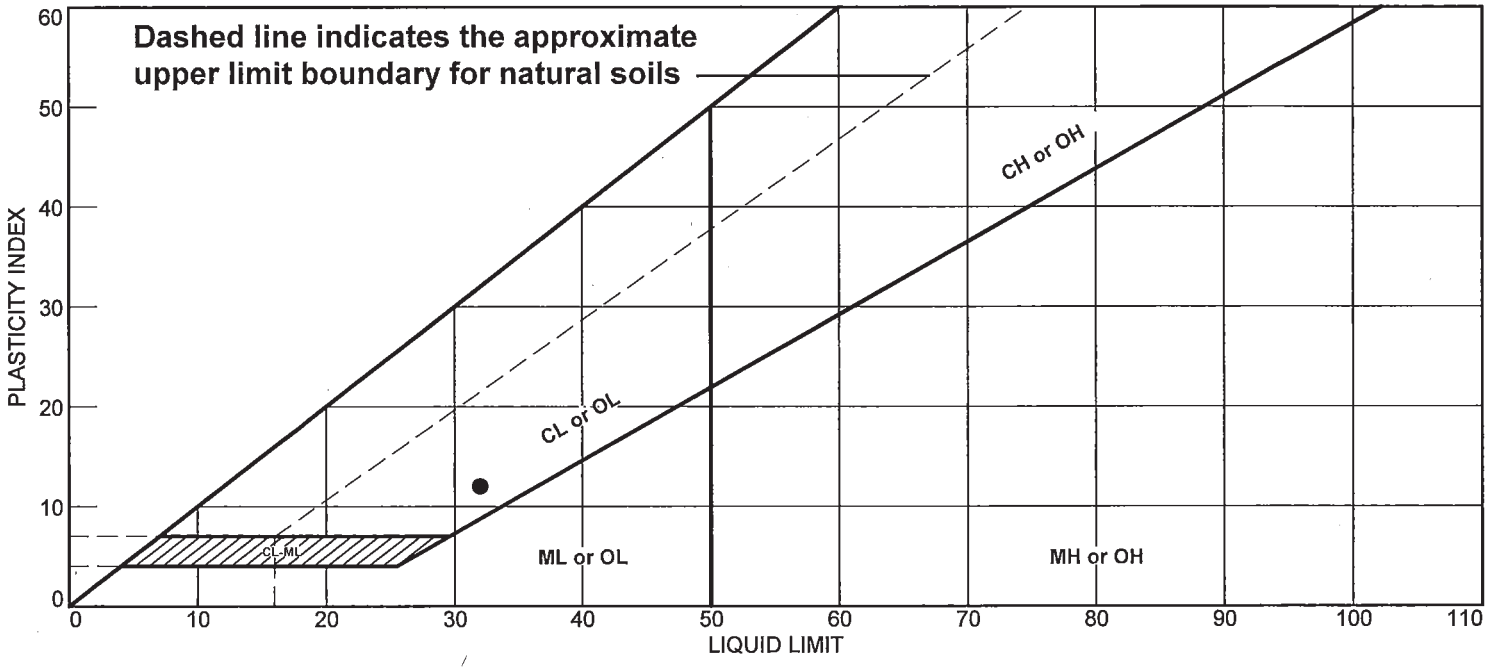
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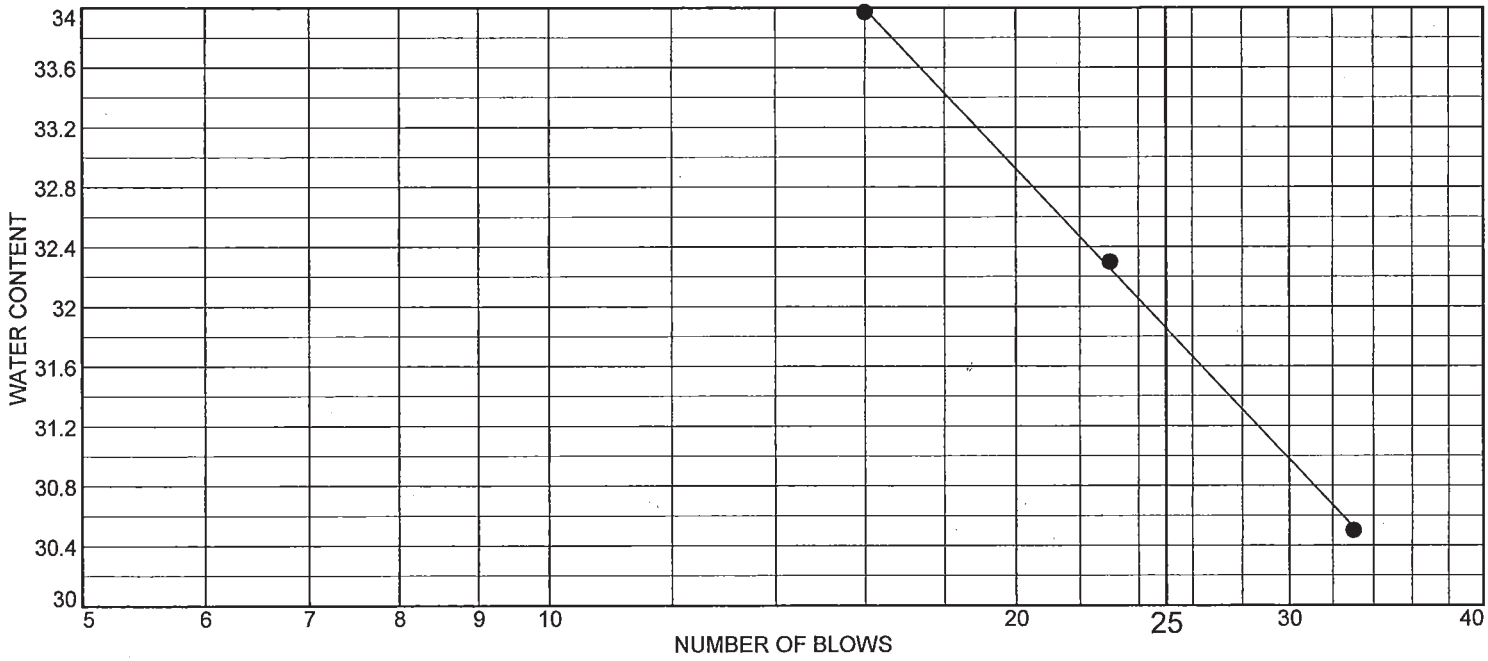
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, spotted reddish brown and gray LEAN CLAY	32	20	12			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B009 SPT-4 **Depth:** 21'-22.5'

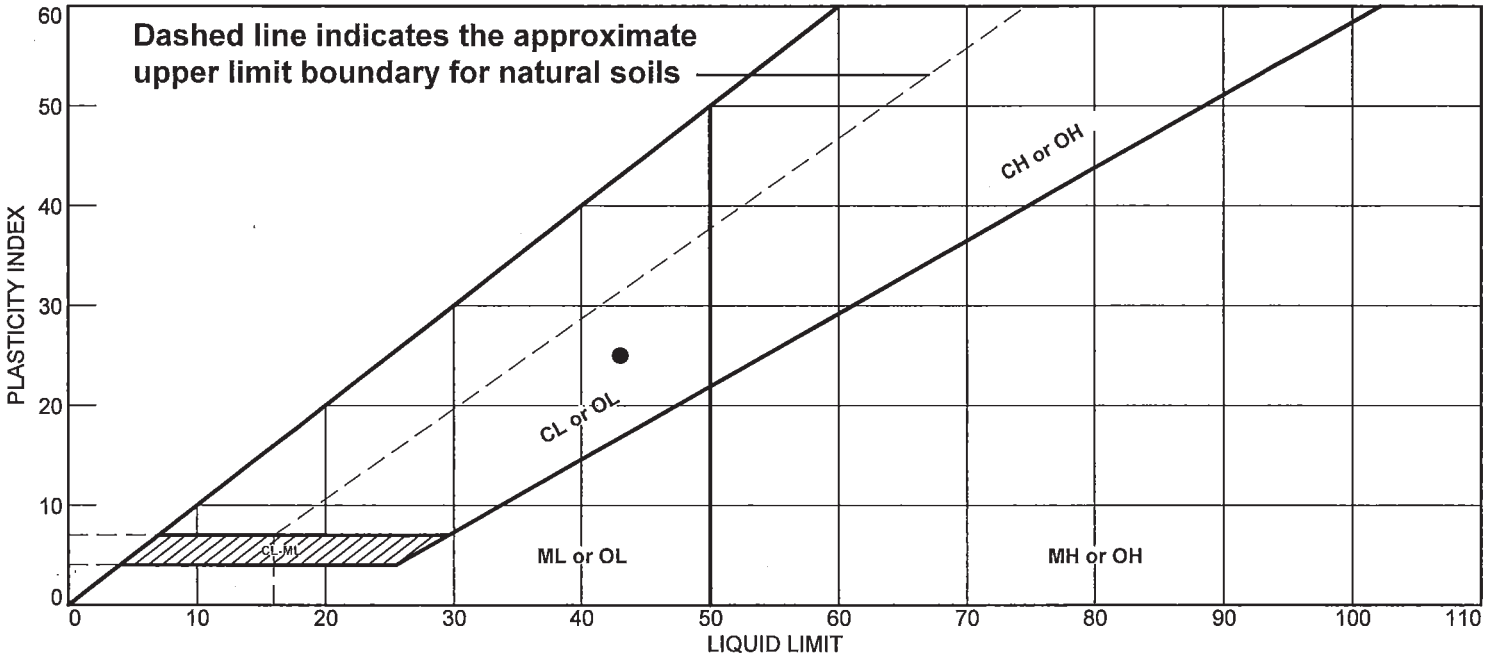
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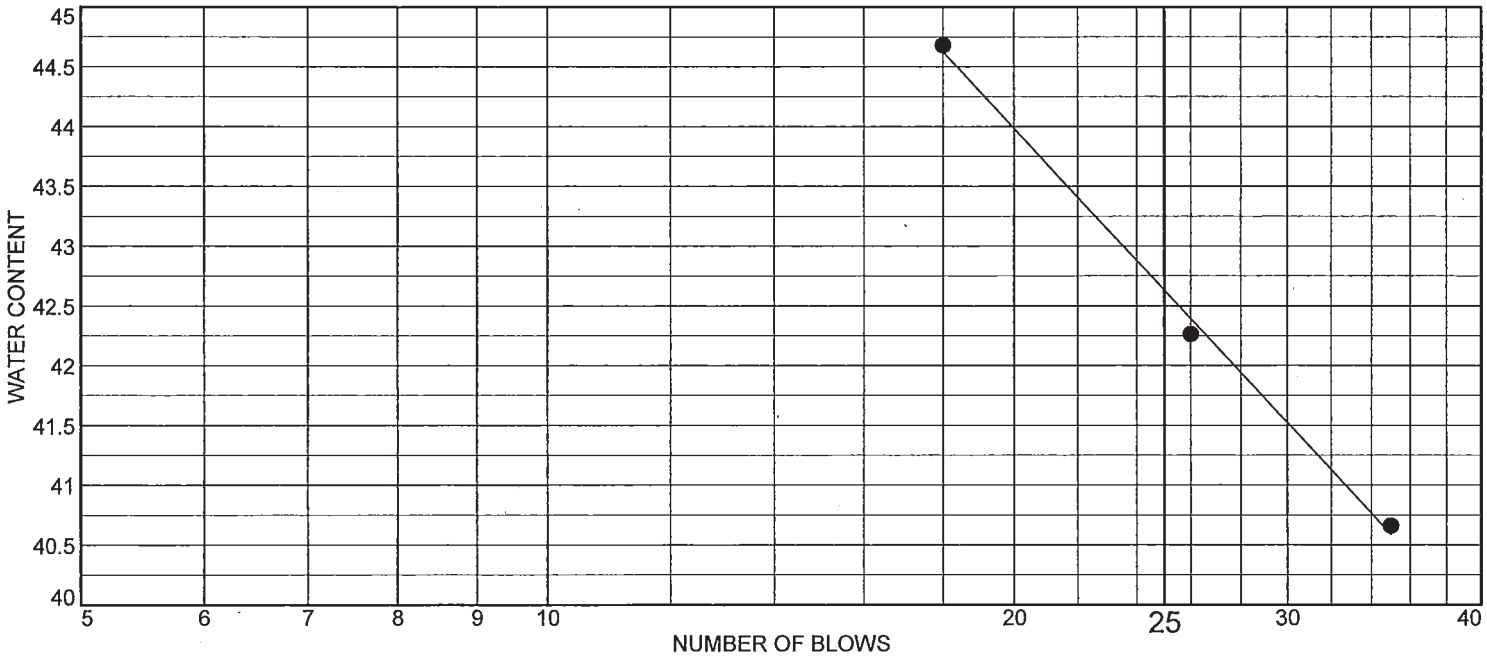
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown, mottled reddish brown, spotted gray LEAN CLAY with trace of sand	43	18	25			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B009 SPT-6 **Depth:** 31'-32.5'

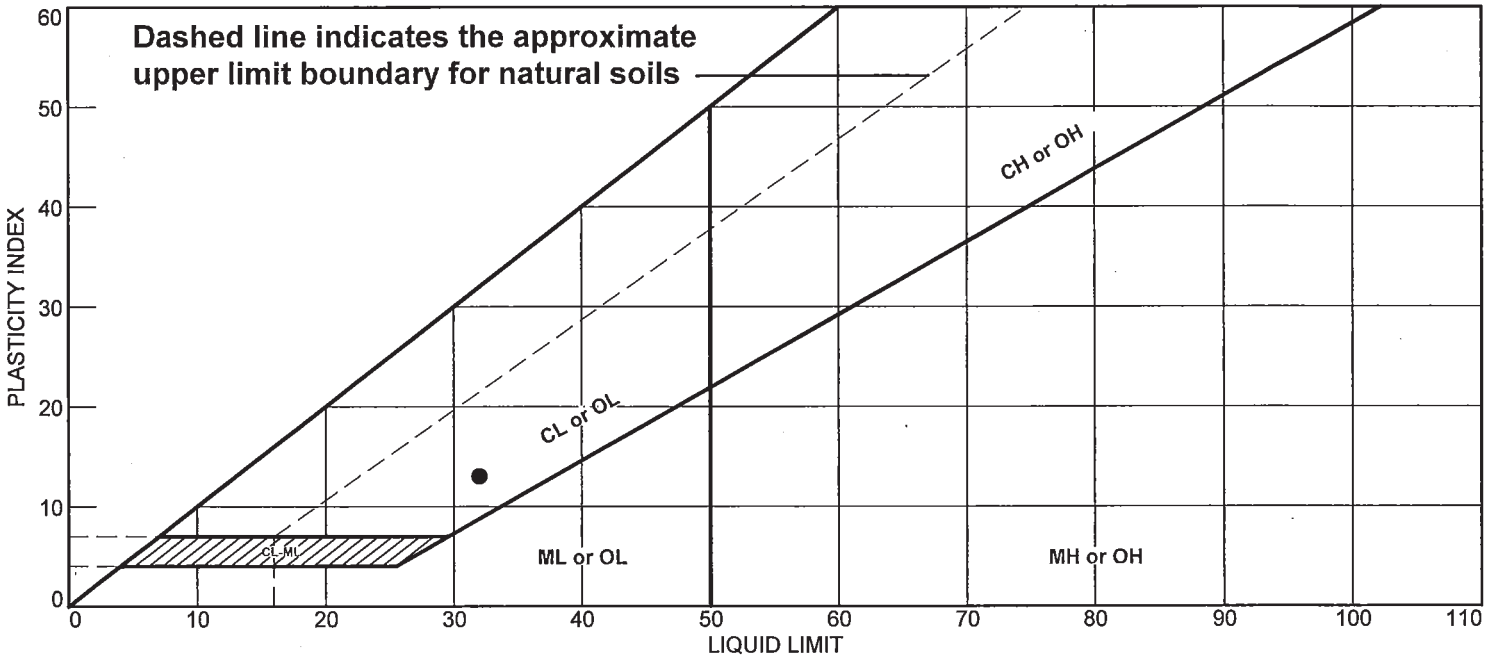
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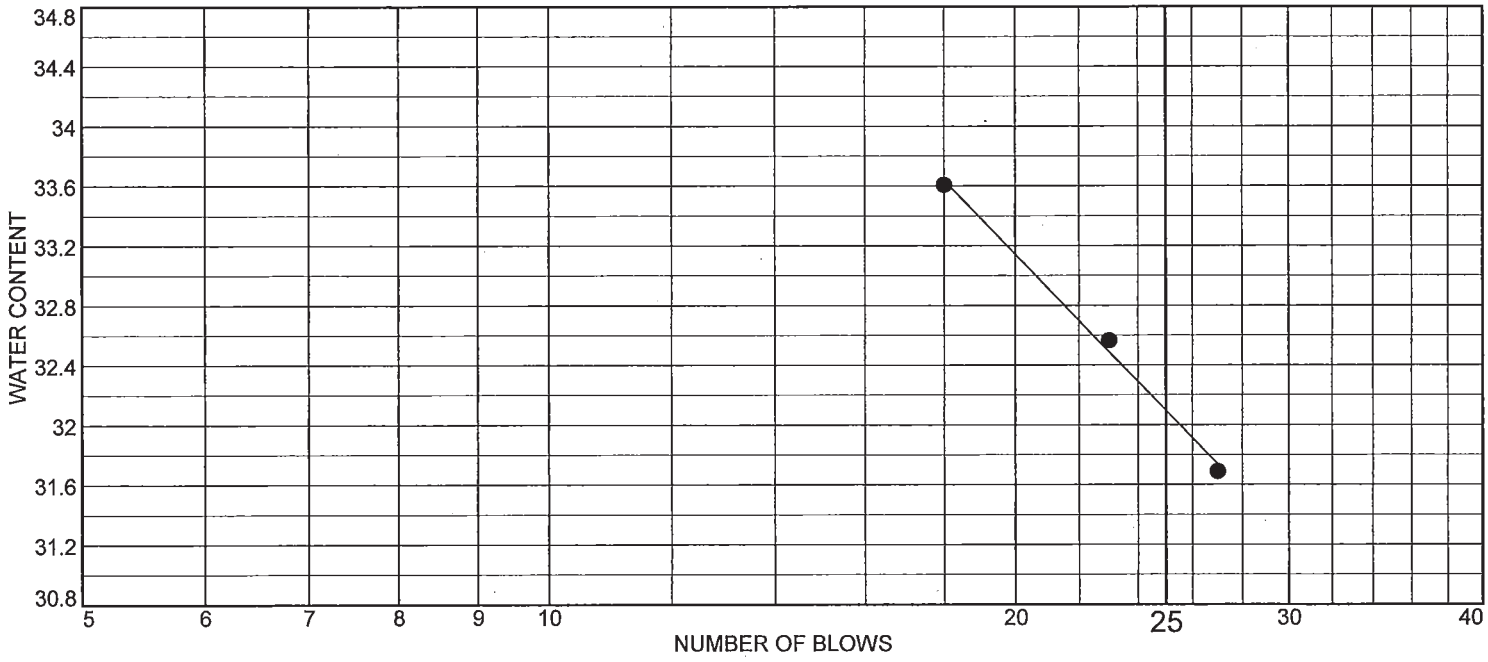
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown LEAN CLAY	32	19	13			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B013 SPT-3 **Depth:** 13.5'-15'

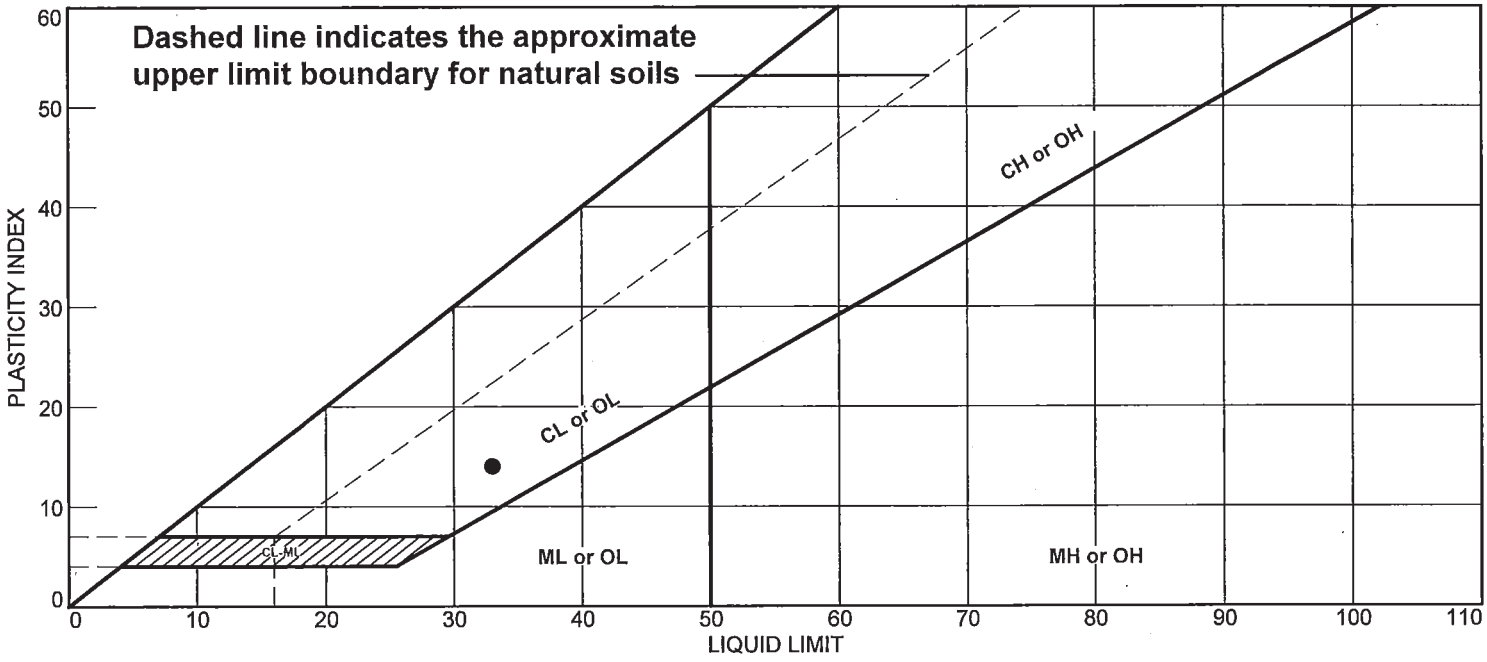
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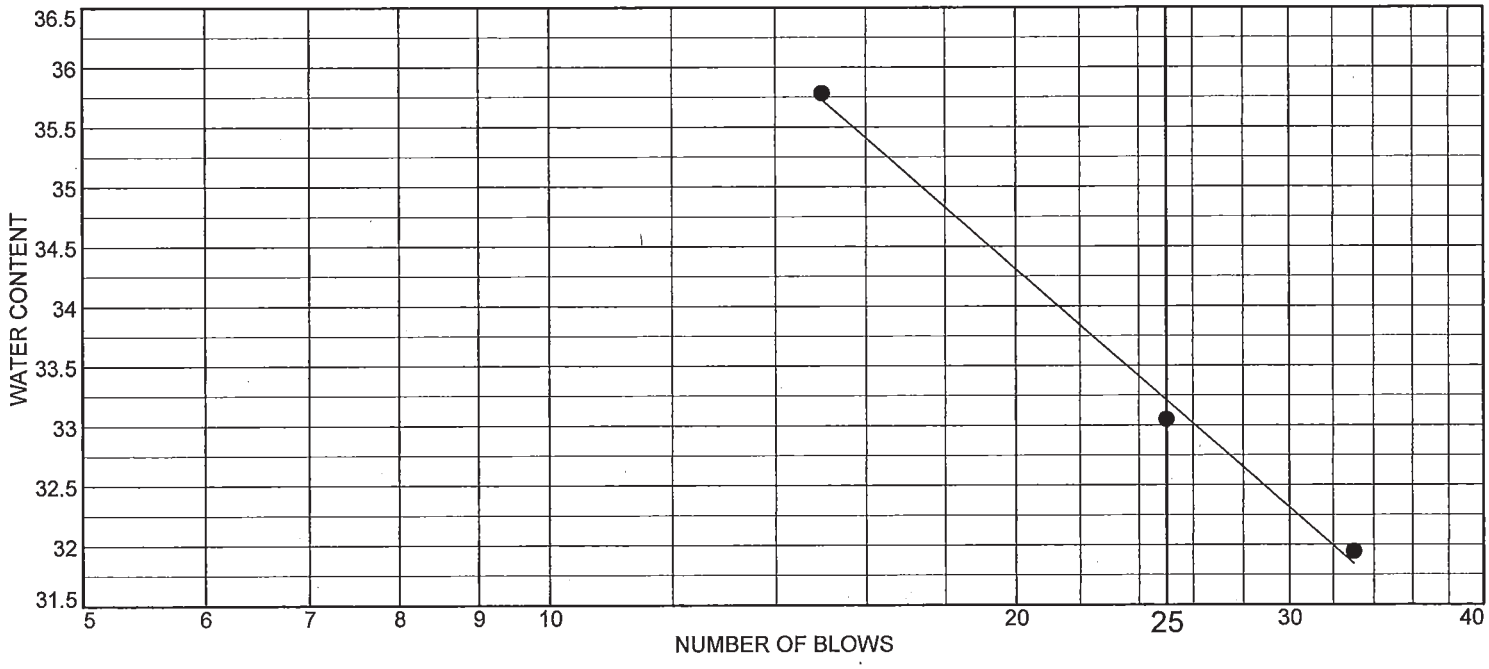
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown LEAN CLAY	33	19	14			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B013 SPT-5 **Depth:** 23.5'-25'

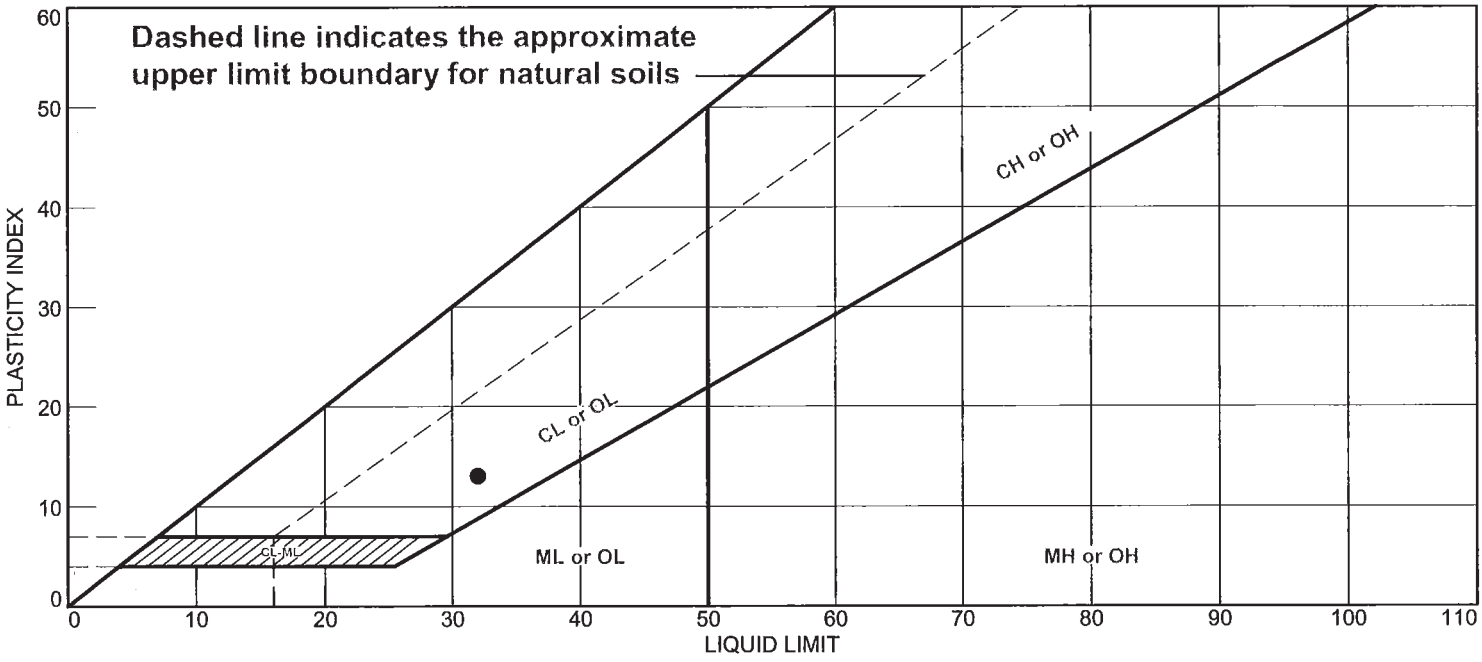
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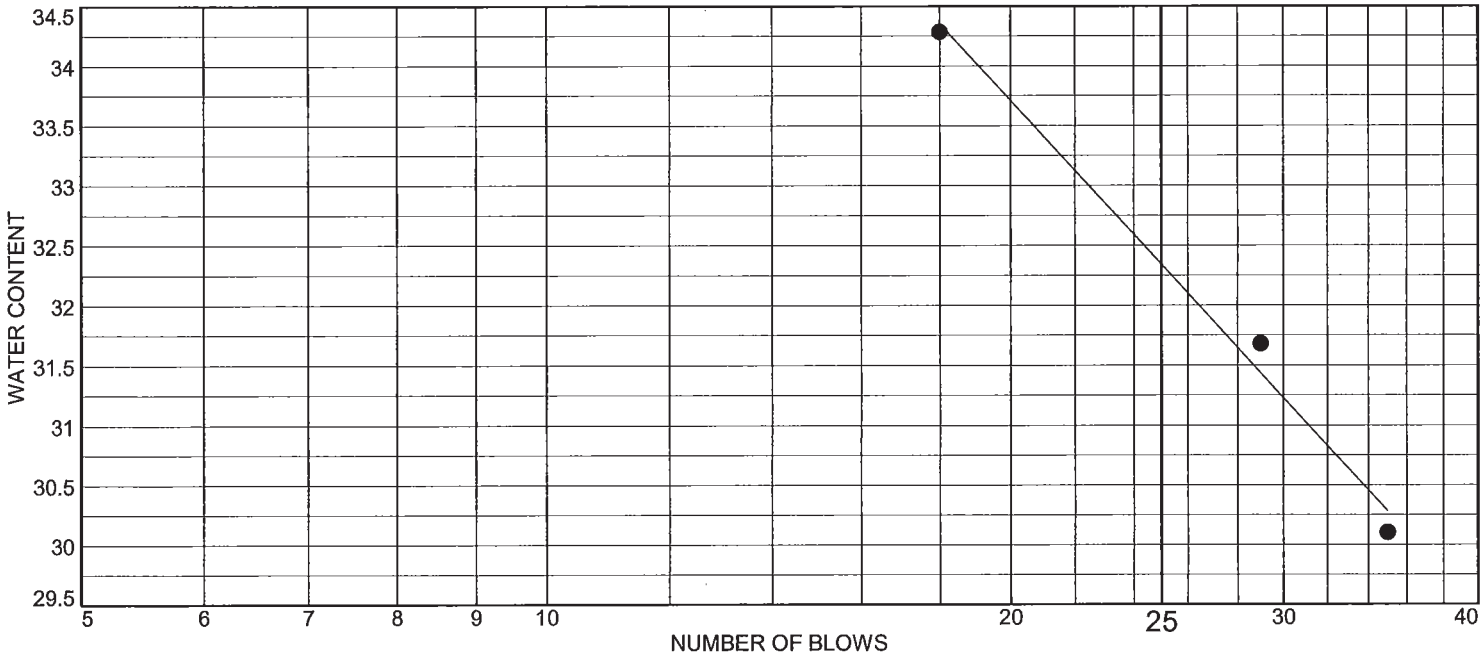
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, spotted reddish brown and gray LEAN CLAY	32	19	13			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B013 SPT-7 **Depth:** 33.5'-35'

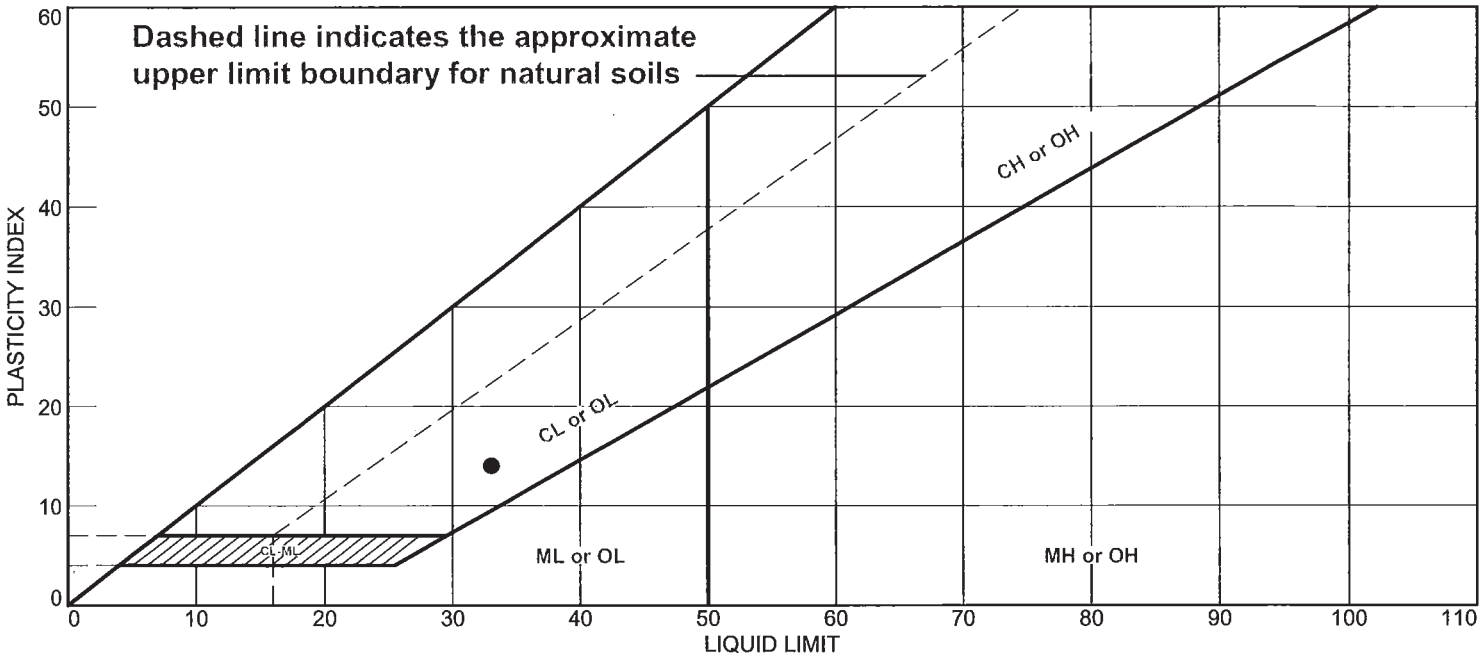
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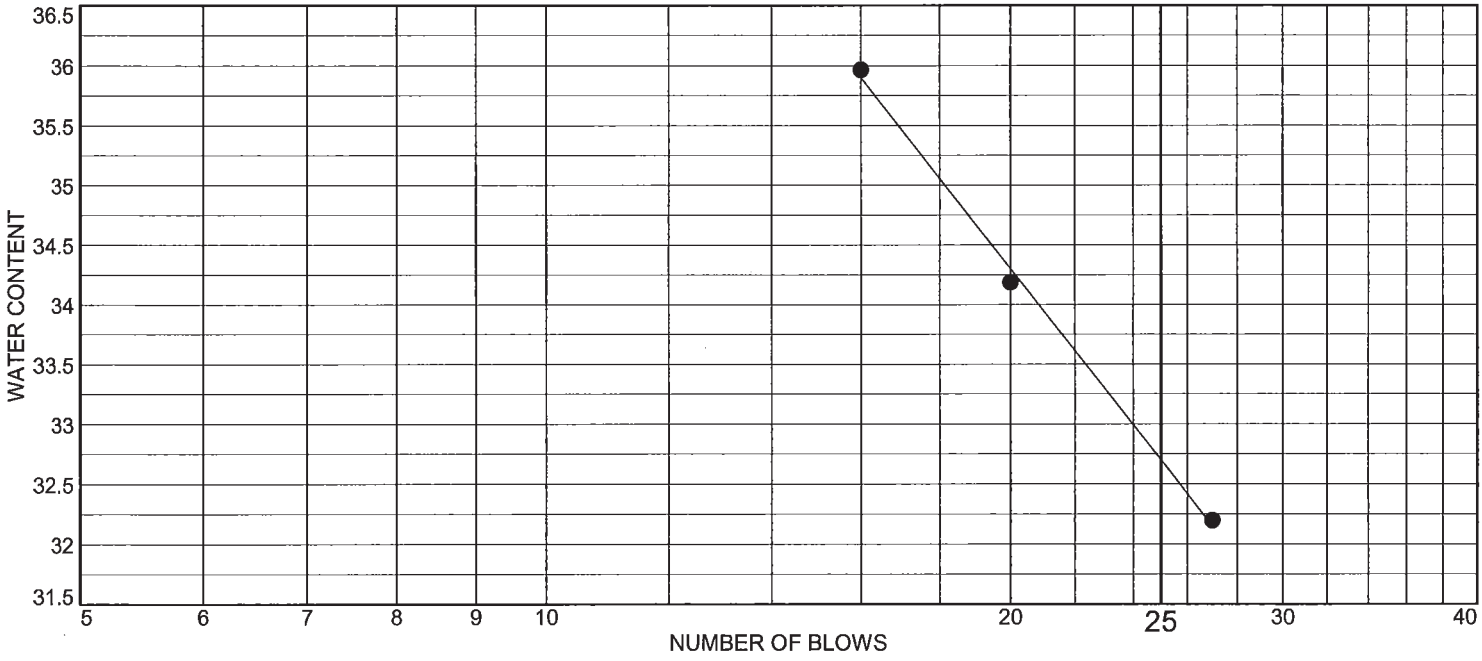
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, speckled reddish brown LEAN CLAY	33	19	14			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B013 SPT-9 **Depth:** 43.5'-45'

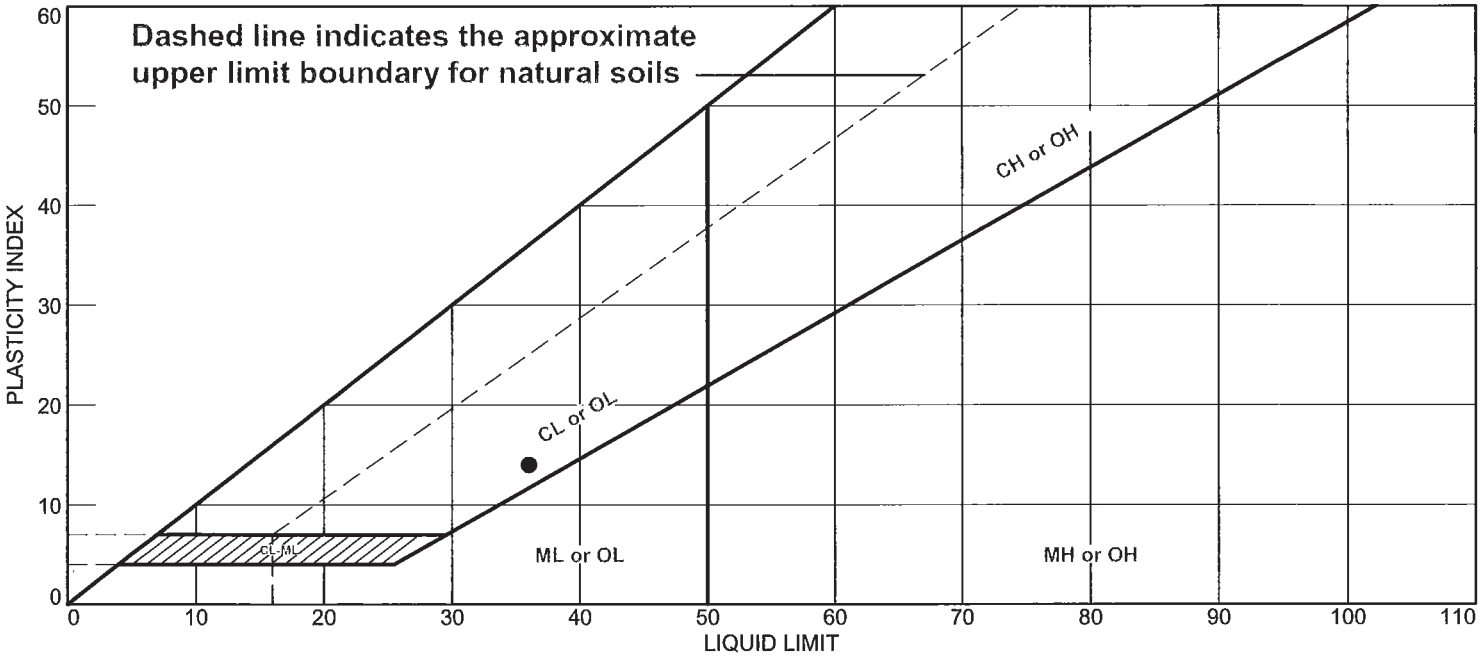
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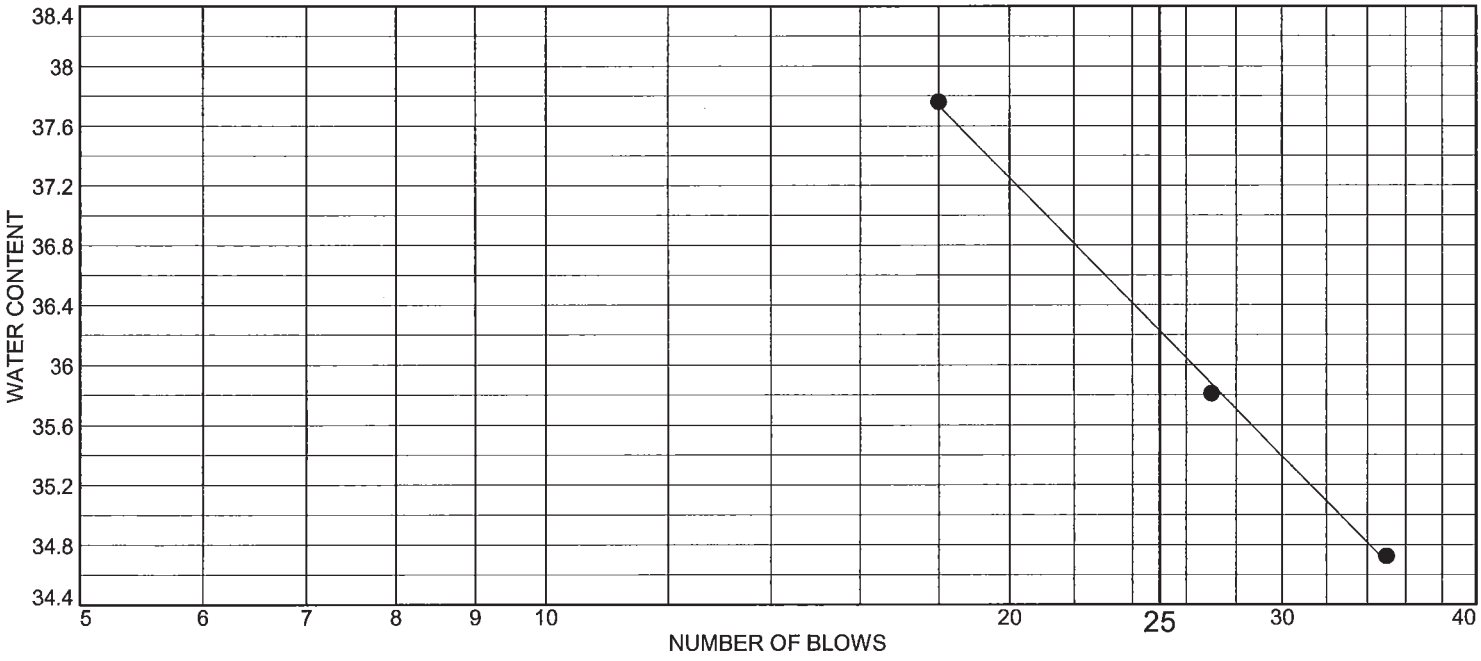
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, spotted light gray LEAN CLAY	36	22	14			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B014 SPT-2 **Depth:** 8.5'-10'

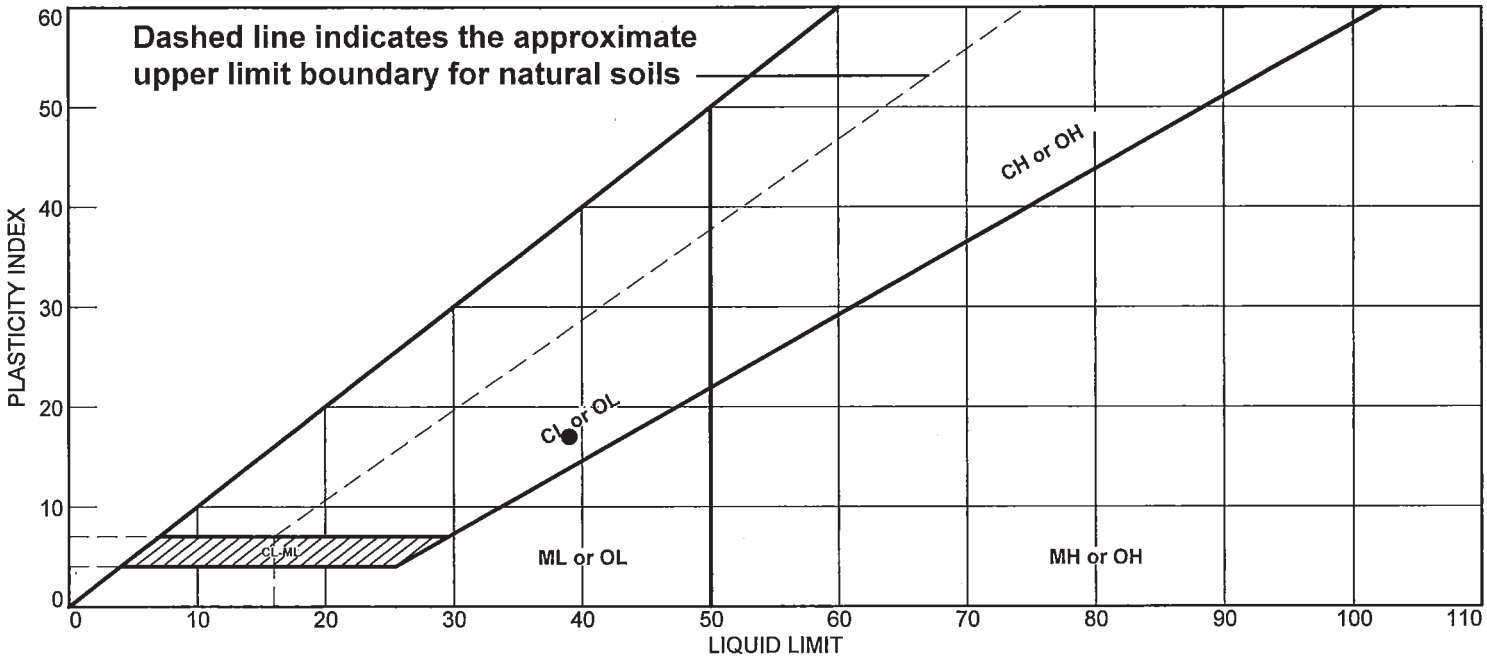
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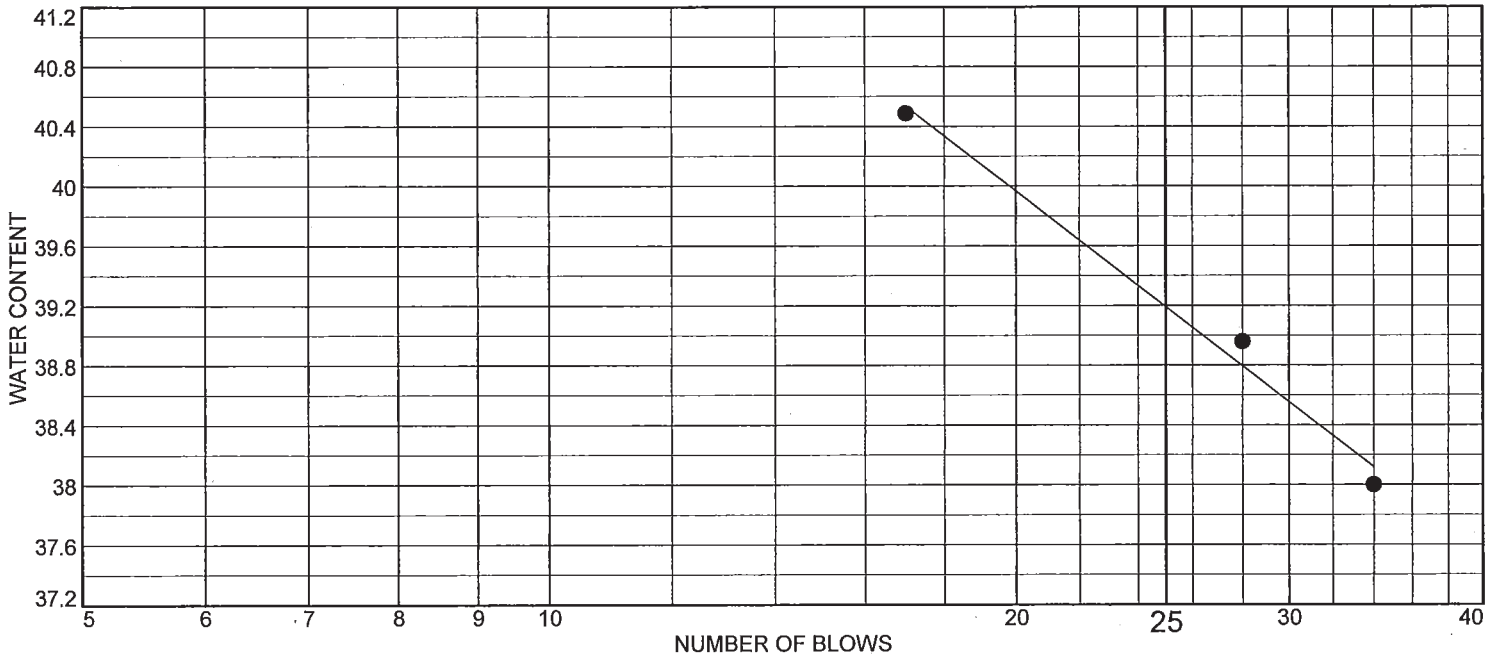
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, spotted reddish brown and gray LEAN CLAY	39	22	17			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B014 SPT-4 **Depth:** 18.5'-20'

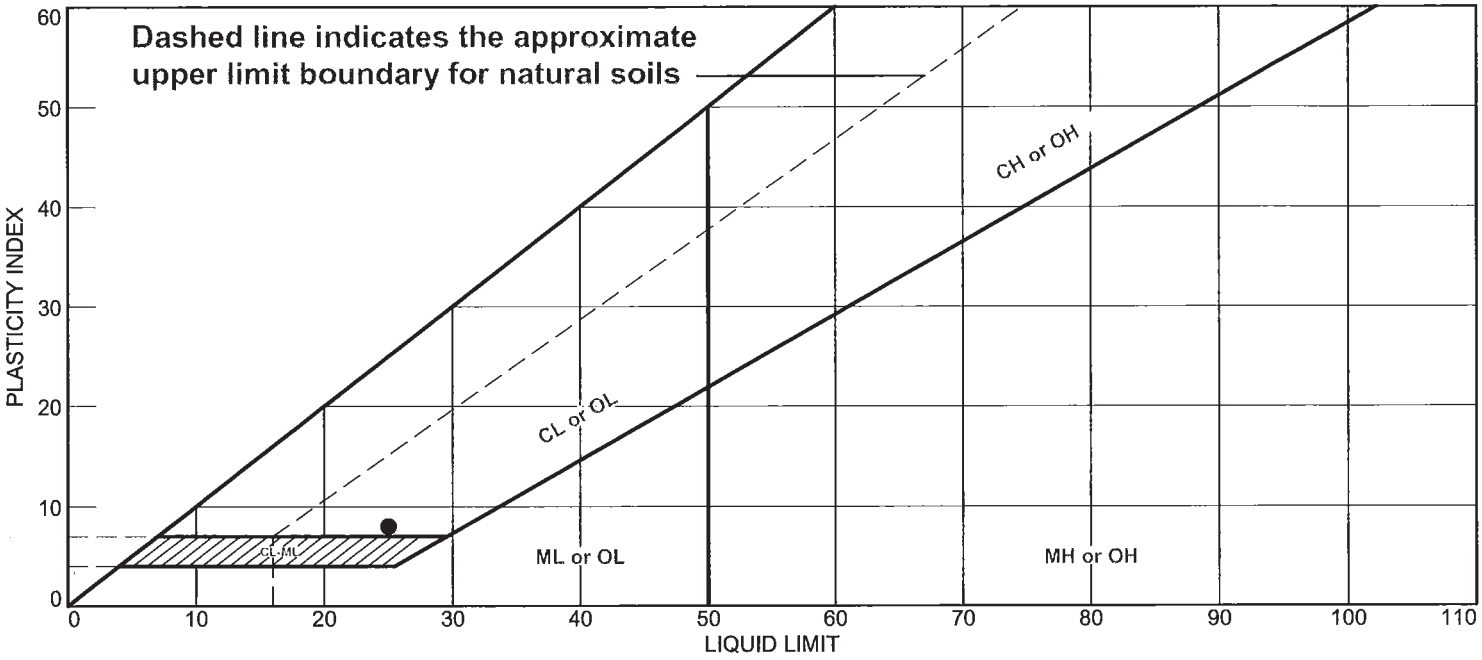
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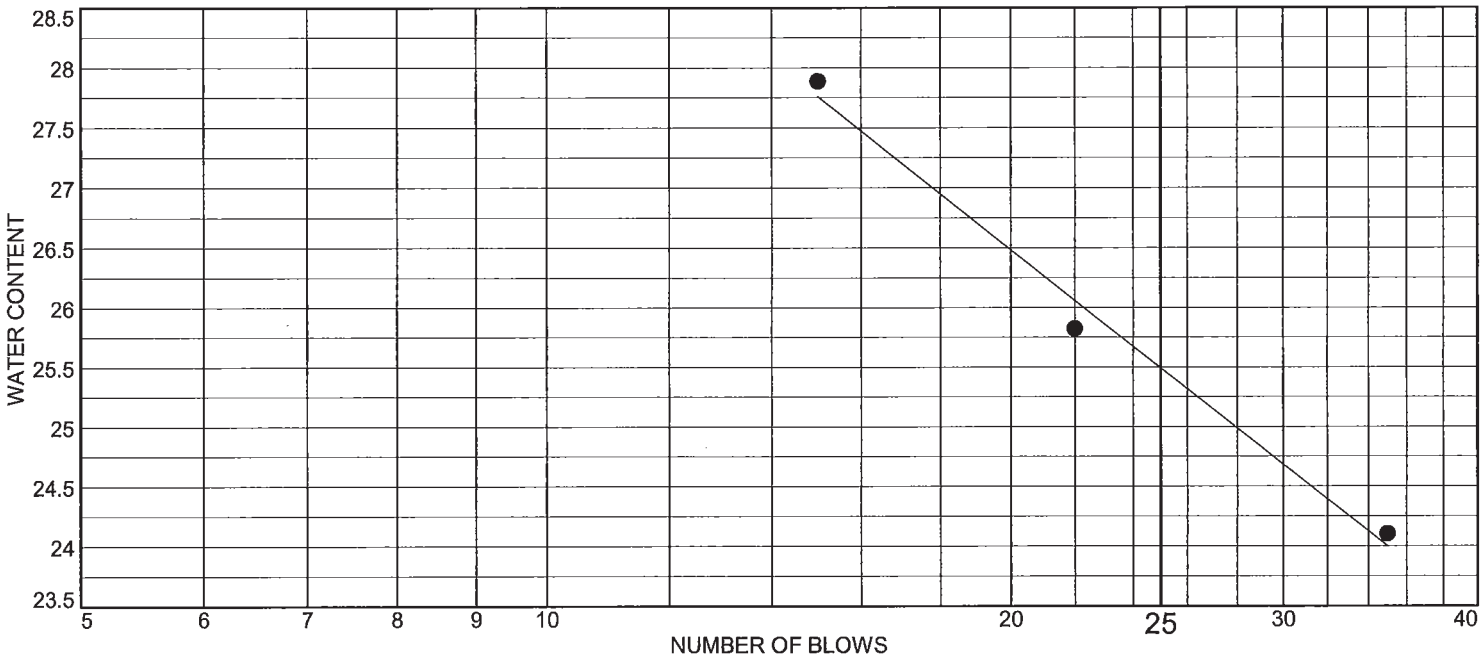
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown, spotted gray LEAN CLAY with sand and trace of gravel	25	17	8			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B014 SPT-7 **Depth:** 33.5'-35'

Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 1) PROJECT NO.: 15-328T

LOCATION:

BORING NO.: B015 SAMPLE NO.: ST-6 DEPTH: 56' - 57.5'

SAMPLE TYPE: Undisturbed % COMPACTION:

	INITIAL DATA		FINAL DATA	
MOISTURE:	15.8	%	16.4	%
DRY UNIT WEIGHT:	118.4	pcf	118.4	pcf
HEIGHT:	2.26	inches	2.26	inches
DIAMETER:	2.86	inches	2.86	inches
WEIGHT:	522.4	grams	525.1	grams
SATURATION:	99.9	%	100.0	%

PERMEANT LIQUID: Deaired tap water "B" value = 98.0%

EFFECTIVE CONSOLIDATION STRESS: Maximum 3.4 psi Minimum 3.0 psi

BACK PRESSURE: 90 psi RANGE OF HYDRAULIC GRADIENT: 3.8 to 3.3

SAMPLE DESCRIPTION: Light gray, speckled black and reddish brown Silty clay with sand and trace of gravel

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
10/12 - 10/13	1	82,080	22.0	19.2	26
10/13 - 10/14	2	82,080	22.0	19.2	26
10/14 - 10/15	3	82,080	22.0	19.2	26
10/15 - 10/16	4	82,080	22.0	19.2	26
AVERAGE		82,080	22.0	19.2	26

k= 9.3E-08 cm/s n/n20= 0.8694

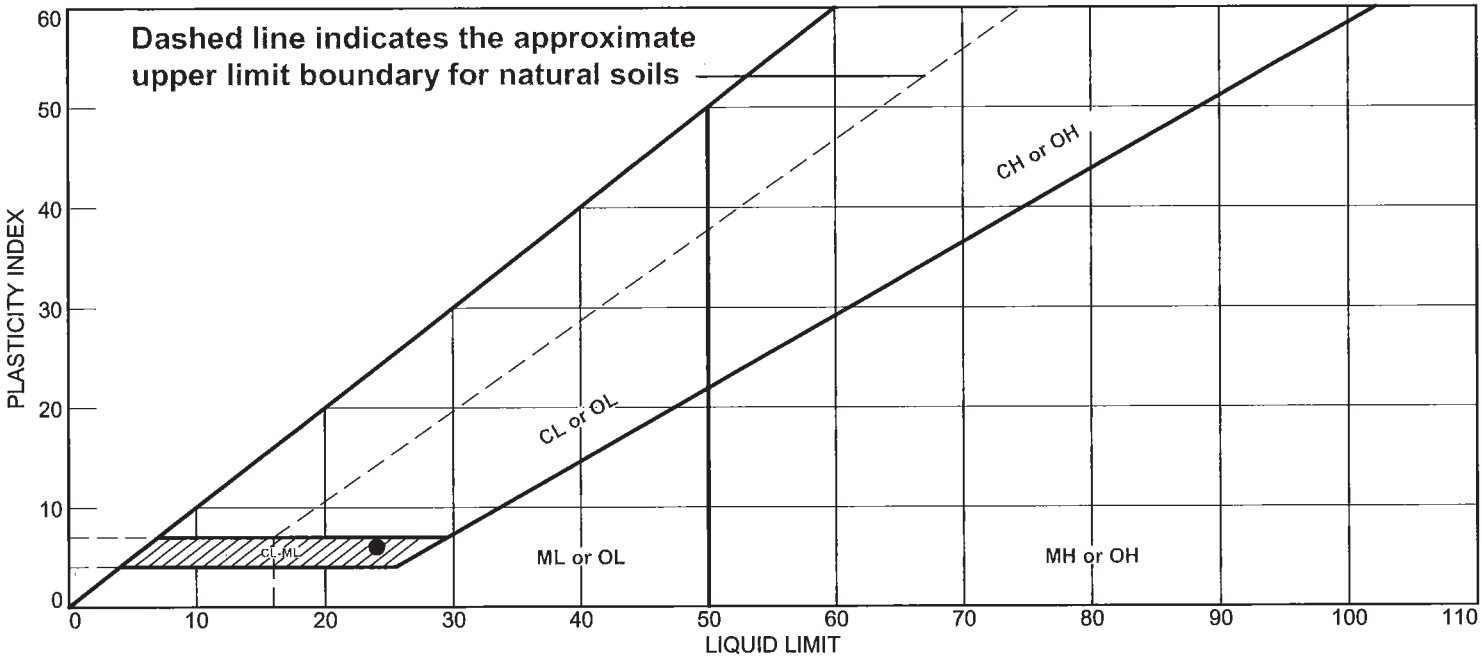
k20= 8.1E-08 cm/s

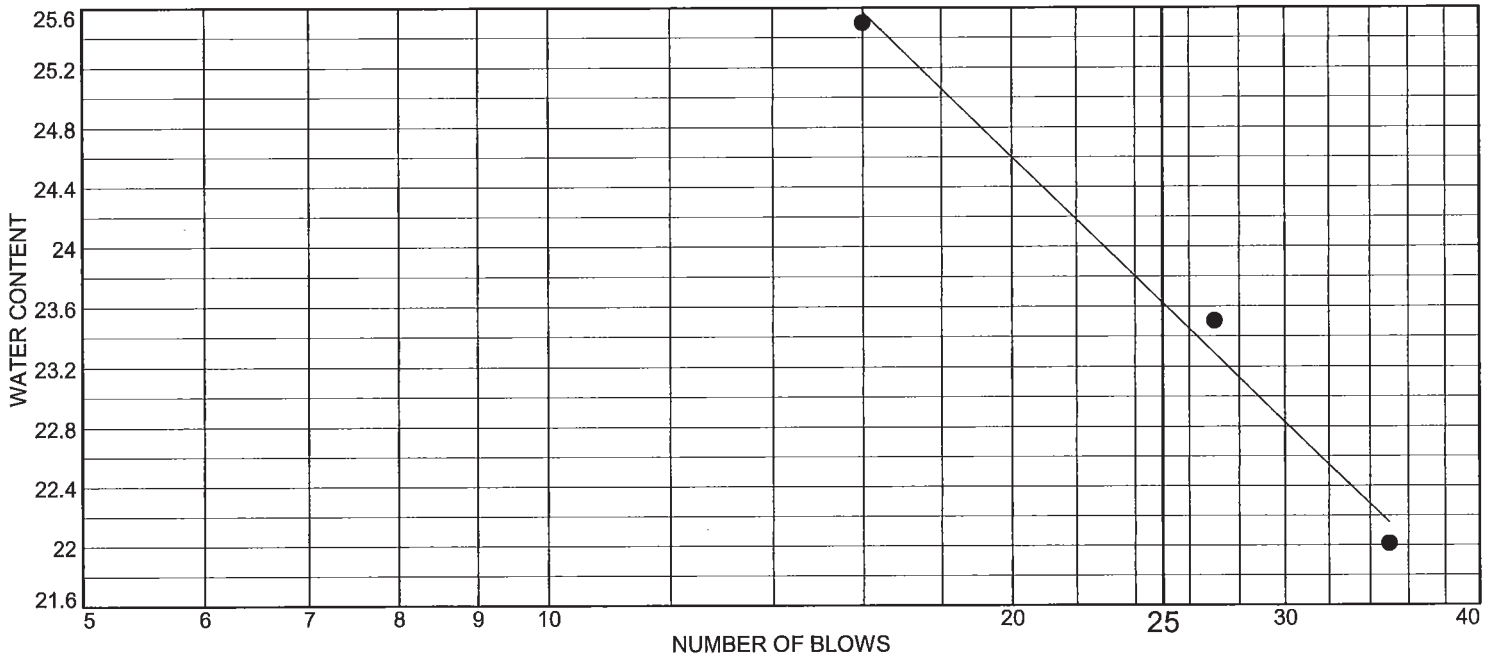
k = Hydraulic Conductivity before n/n20 correction factor

k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light gray, speckled black and reddish brown Silty clay with sand and trace of gravel	24	18	6			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7 Duck Creek (Ash Pond 1)

Sample Number: B015 ST-6 **Depth:** 56'-57.5'

Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND1) PO 64673 ACM
02156344
11/17/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Unconfined Compression psf NOTE*	CU Triaxial NOTE*	USCS Symbol					
B003	ST-1	3.5	5.0	14.9	119					3540*							
	Color		brown							**Visual Classification**		Lean Clay with Sand					
	ST-2	13.5	15.0	17.0	117	35	18	17		4960*							
	Color		brown with yellowish brown							**Visual Classification**		Lean Clay					
	ST-3	23.5	25.0	15.6	**	33	16	17		**							
	Color		brown							**Visual Classification**		Lean Clay with Sand					
	ST-4	33.5	35.0	15.7	114	27	18	9		2000*							
	Color		brown & reddish brown							**Visual Classification**		Lean Clay with Sand					
	ST-5	43.5	45.0	24.5	104					2160*							
	Color		light bluish gray with yellowish brown							**Visual Classification**		Lean Clay with Sand					
	ST-6	53.5	55.0	14.1	123					1120*							
	Color		light gray with dark bluish gray							**Visual Classification**		Fat Clay with Sand					
B004	ST-1	3.5	5.0	23.9	102	38	19	19		1300*							
	Color		brown with yellowish brown & light reddish brown							**Visual Classification**		Lean Clay					
	ST-2	13.5	15.0	14.0	120	24	15	9		2600*							
	Color		yellowish brown with gray & dark gray							**Visual Classification**		Lean Clay with Sand (Weathered Shale)					
	ST-3	23.5	25.0	22.7	106	33	16	17		1700*							
	Color		brown & reddish brown							**Visual Classification**		Lean Clay					
	ST-4	33.5	35.0	18.0	100												
	Color		yellowish brown & dark gray							**Visual Classification**		Lean Clay with Sand					

NOTE*: SEE ATTACHED DATA SHEETS.
** Testing not Possible

Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND1) PO 64673 ACM
02156344
11/17/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Unconfined Compression psf NOTE*	CU Triaxial NOTE*	USCS Symbol					
B007	ST-1	6.0	8.0	19.5	114	36	17	19		2000*							
	Color		olive with yellowish brown & light bluish gray							**Visual Classification**		Lean Clay with Sand					
	ST-2	31.0	32.5	18.0	115					8760*							
	Color		brown with yellowish brown							**Visual Classification**		Lean Clay with Sand					
	ST-3	36.0	37.5	18.0	116					2280*							
	Color		light bluish gray with yellowish brown							**Visual Classification**		Fat Clay with Sand (Weathered Shale)					
	ST-4	51.0	52.0	17.9	113												
	Color		gray with bluish gray & yellowish brown							**Visual Classification**		Fat Clay (Shale)					
B008	ST-1	6.0	7.5	22.8	103												
	Color		brown with yellowish brown							**Visual Classification**		Fat Clay					
	ST-3	26.0	27.5	15.7	118												
	Color		bluish gray with reddish brown & yellowish brown							**Visual Classification**		Fat Clay with Sand (Shale)					
	ST-4	36.0	37.5	20.1	114												
	Color		bluish gray with light gray							**Visual Classification**		Fat Clay (Highly Weathered Shale)					
B011	ST-1	3.5	5.0	16.5	114	35	19	16			NOTE*						
	Color		yellowish brown with grayish brown							**Visual Classification**		Lean Clay with Sand					
	ST-2	13.5	15.0	15.9	118	34	16	18			NOTE*						
	Color		yellowish brown with grayish brown							**Visual Classification**		Lean Clay with Sand					
	ST-3	23.5	25.0	17.0	116	32	18	14			NOTE*						
	Color		yellowish brown with grayish brown							**Visual Classification**		Lean Clay with Sand					
	ST-5	43.5	44.0	24.5	**	31	19	12									
	Color		grayish brown with yellowish brown & gray							**Visual Classification**		Lean Clay with Sand					

NOTE*: SEE ATTACHED DATA SHEETS.
** Testing not Possible

Terracon

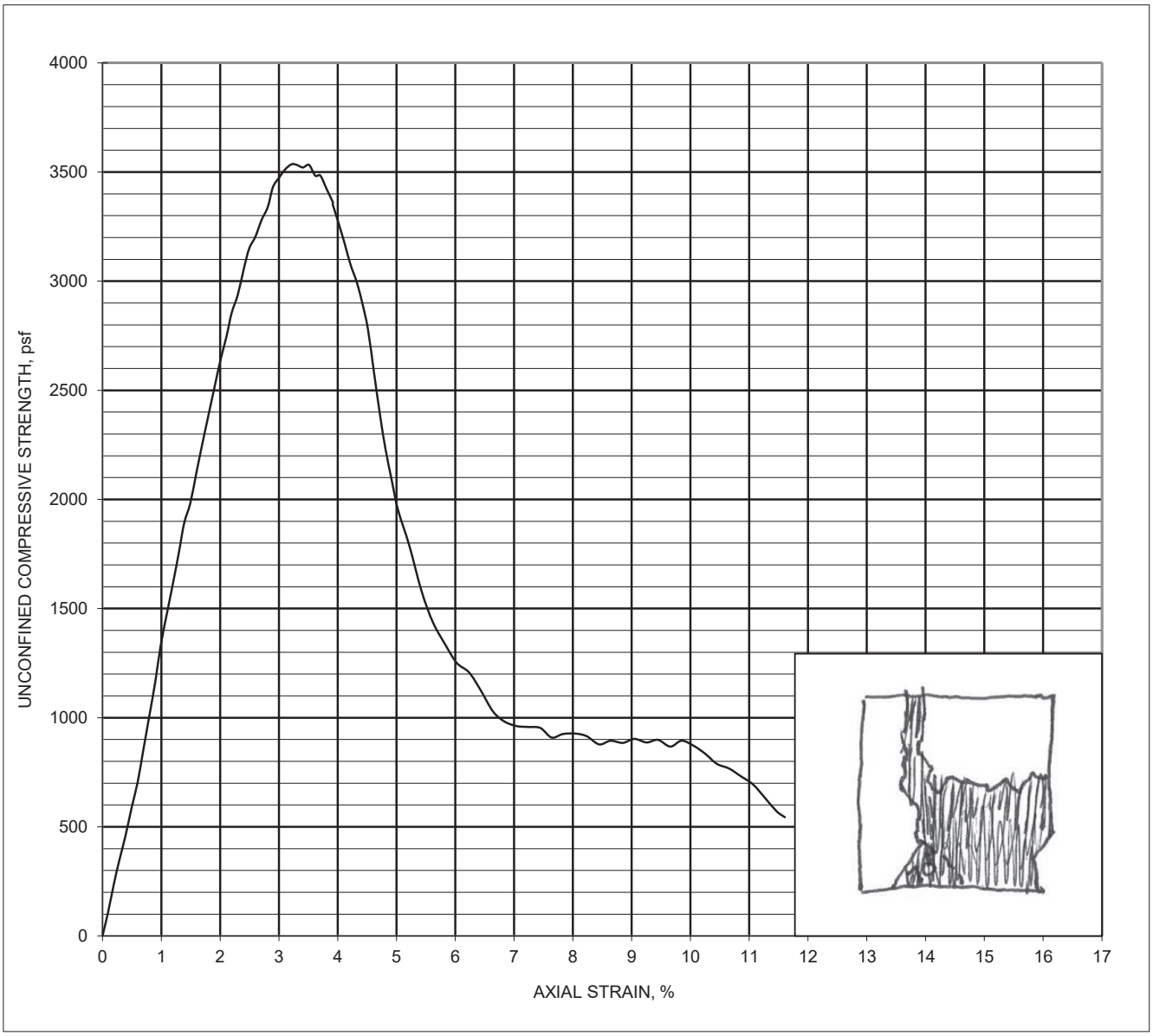
DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND1) PO 64673 ACM
02156344
11/17/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Unconfined Compression psf NOTE*	CU Triaxial NOTE*	USCS Symbol					
B012	ST-1	3.5	5.0	21.9	104	38	16	22			NOTE*						
	Color		yellowish brown with grayish brown							**Visual Classification**		Lean Clay with Sand					
	ST-2	13.5	15.0	21.8	107	49	23	26			NOTE*						
	Color		olive gray with yellowish brown							**Visual Classification**		Lean Clay with Sand					
	ST-3	23.5	25.0	23.7	105	32	18	14			NOTE*						
	Color		gray							**Visual Classification**		Lean Clay (Highly Weathered Shale)					
	ST-4	33.5	35.0	19.4	115	30	15	15									
	Color		olive with bluish gray & yellowish brown							**Visual Classification**		Lean Clay					
B015	ST-1	6.0	7.5	18.2	113					2920*							
	Color		brown with yellowish brown & reddish brown							**Visual Classification**		Lean Clay					
	ST-2	13.5	15.0	16.5	119	34	19	15		6080*							
	Color		brown & yellowish brown with gray							**Visual Classification**		Lean Clay with Sand					
	ST-3	26.0	27.5	25.2	101	36	18	18			NOTE*						
	Color		grayish brown with light brown							**Visual Classification**		Lean Clay with Sand					
	ST-4	36.0	37.5	24.5	101	33	19	14			NOTE*						
	Color		yellowish brown with light brown trace dark gray							**Visual Classification**		Lean Clay with Sand					
	ST-4	46.0	47.5	16.9	109	31	16	15			NOTE*						
	Color		yellowish brown with light grayish brown trace dark gray							**Visual Classification**		Lean Clay with Sand					

NOTE*: SEE ATTACHED DATA SHEETS.
** Testing not Possible

Terracon

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL
ASTM D2166



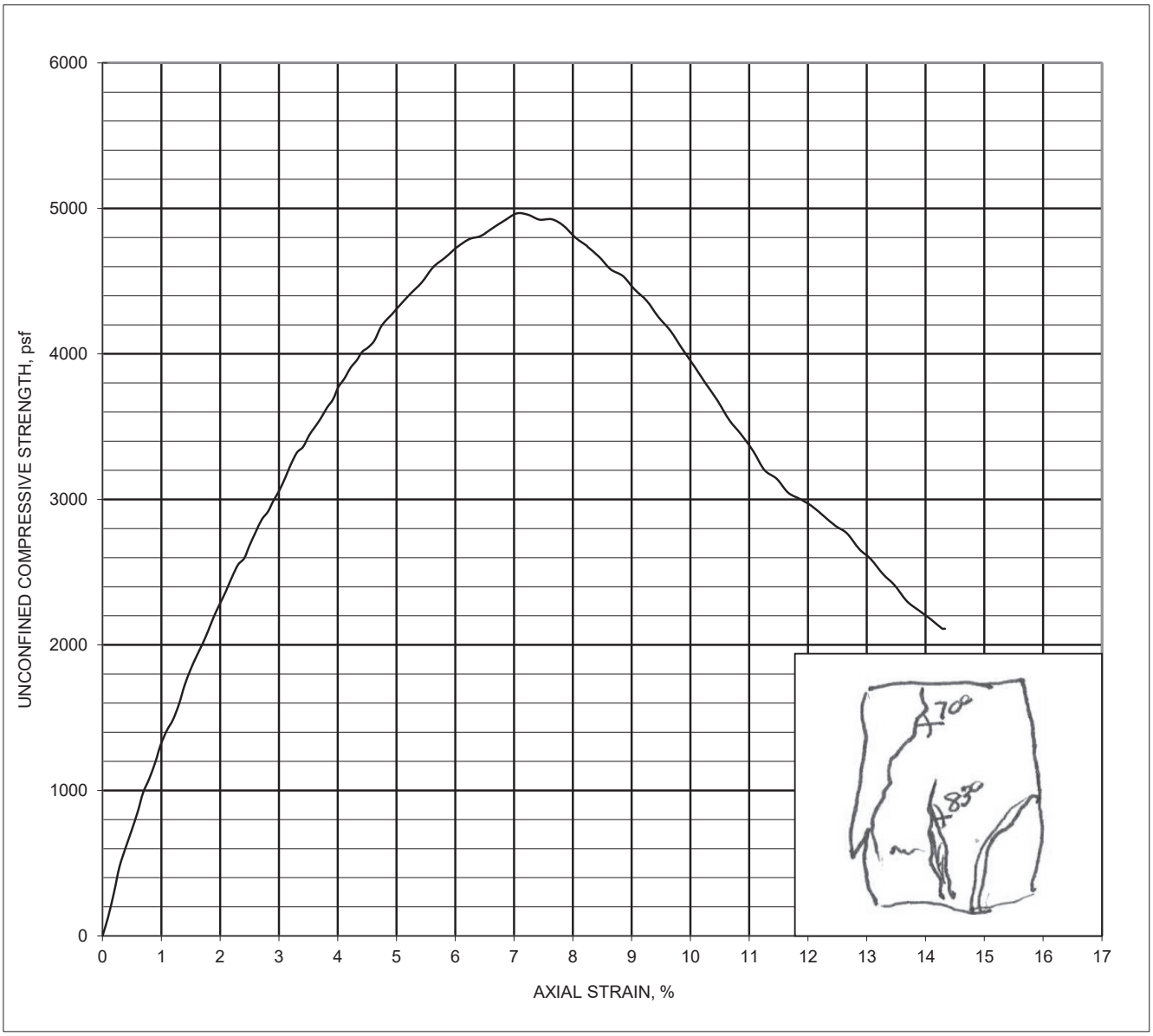
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	3540
WATER CONTENT, %	14.9	STRAIN AT FAILURE, %	3.2
DRY DENSITY, pcf	118.7	TIME TO FAILURE, minutes	1.6
VOID RATIO	0.42	RATE OF LOADING, %/min	2.0
SATURATION, %	96	SHEAR STRENGTH, psf	1770
INITIAL DIAMETER, inch	2.81	INITIAL LENGTH, inch	5.81
LENGTH TO DIAMETER RATIO	2.07	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT		PLASTIC LIMIT		PLASTICITY INDEX		SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B003	SAMPLE NO.	ST-1	DEPTH, feet	3.5 - 5		

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)
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11/6/2015

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ASTM D2166

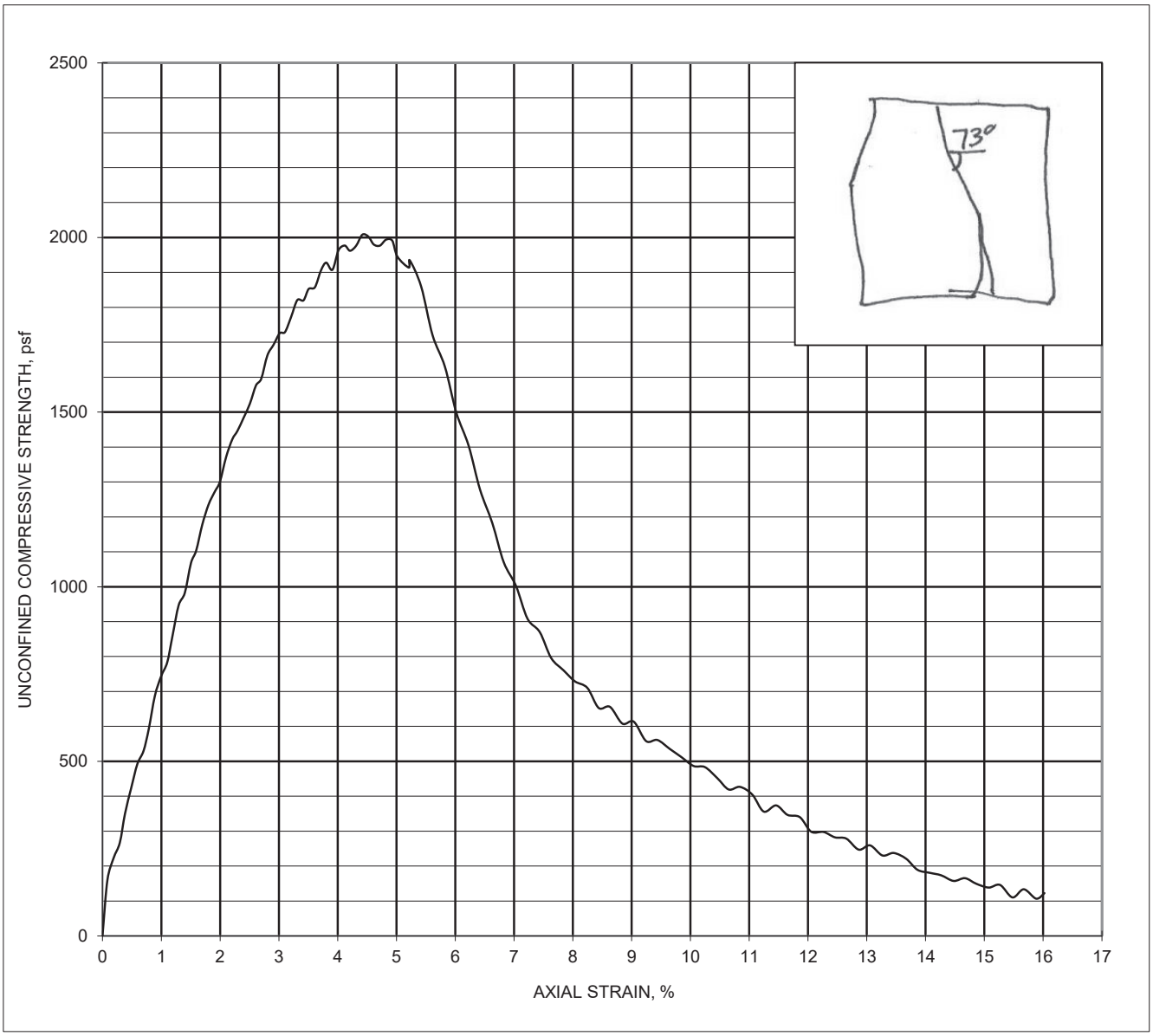


NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166			COMPRESSIVE STRENGTH, psf	4960		
WATER CONTENT, %	17.0			STRAIN AT FAILURE, %	7.0		
DRY DENSITY, pcf	117.4			TIME TO FAILURE, minutes	3.5		
VOID RATIO	0.44			RATE OF LOADING, %/min	2.0		
SATURATION, %	105			SHEAR STRENGTH, psf	2480		
INITIAL DIAMETER, inch	2.82			INITIAL LENGTH, inch	5.58		
LENGTH TO DIAMETER RATIO	1.98			SAMPLE TYPE	UNDISTURBED		
LIQUID LIMIT	35	PLASTIC LIMIT	18	PLASTICITY INDEX	17	SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B003	SAMPLE NO.	ST-2	DEPTH, feet	13.5 - 15		

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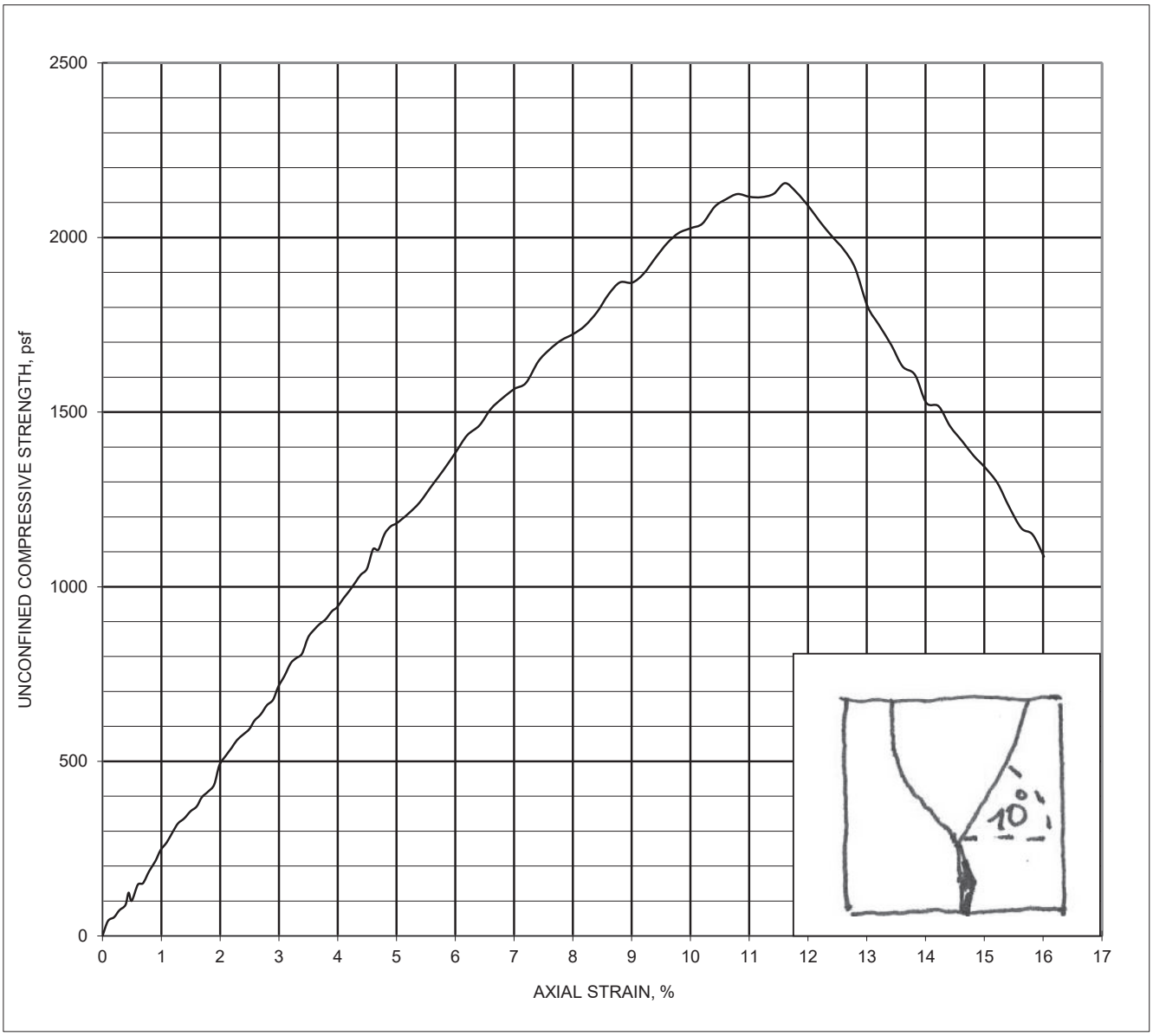


NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166			COMPRESSIVE STRENGTH, psf		2000	
WATER CONTENT, %	15.7			STRAIN AT FAILURE, %		4.4	
DRY DENSITY, pcf	113.6			TIME TO FAILURE, minutes		2.2	
VOID RATIO	0.48			RATE OF LOADING, %/min		2.0	
SATURATION, %	88			SHEAR STRENGTH, psf		1000	
INITIAL DIAMETER, inch	2.83			INITIAL LENGTH, inch		5.82	
LENGTH TO DIAMETER RATIO	2.06			SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	27	PLASTIC LIMIT	18	PLASTICITY INDEX	9	SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B003	SAMPLE NO.	ST-4	DEPTH, feet	33.5 - 35		

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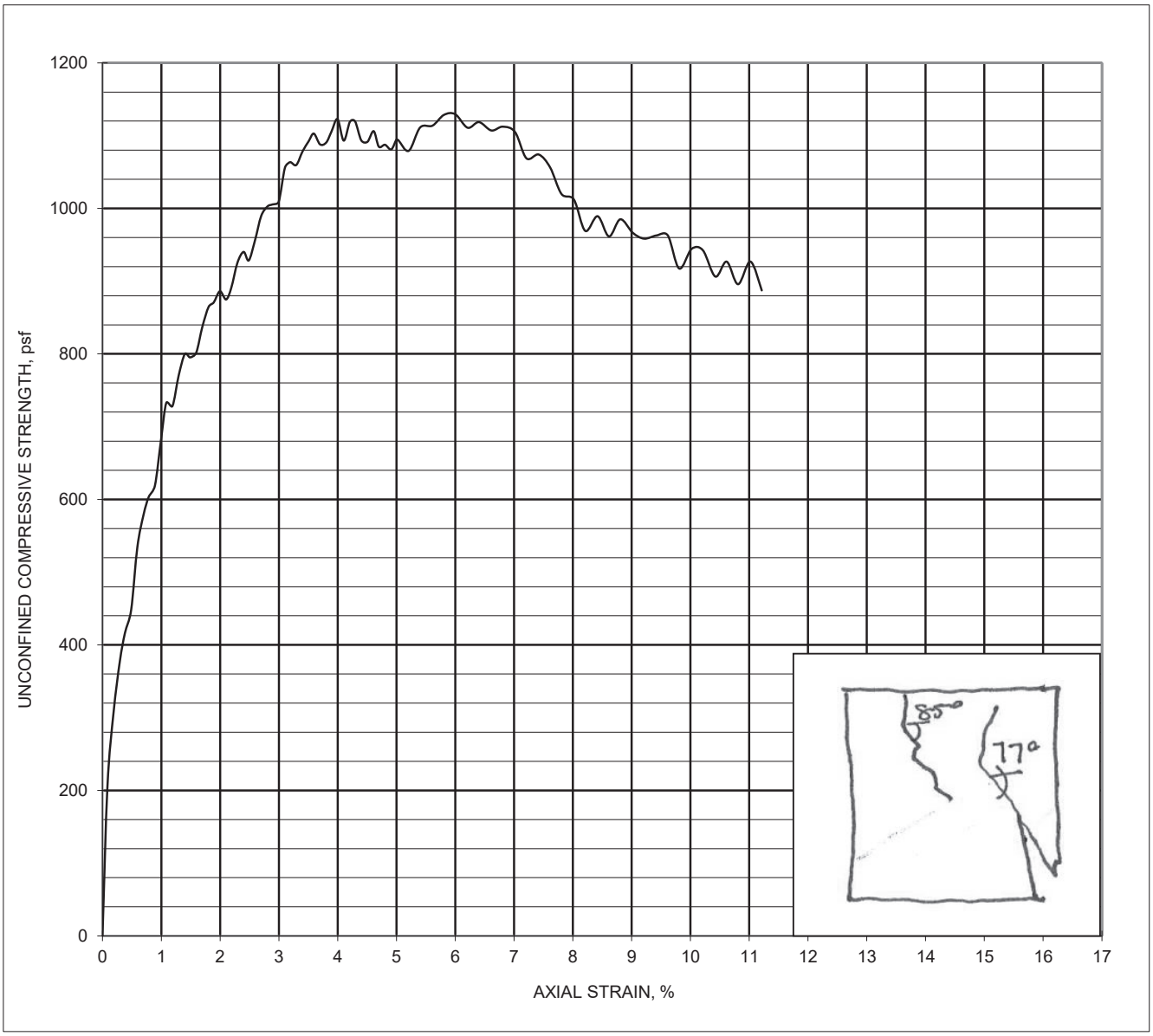
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	2160
WATER CONTENT, %	24.5	STRAIN AT FAILURE, %	11.6
DRY DENSITY, pcf	104.2	TIME TO FAILURE, minutes	5.8
VOID RATIO	0.62	RATE OF LOADING, %/min	2.0
SATURATION, %	107	SHEAR STRENGTH, psf	1080
INITIAL DIAMETER, inch	2.80	INITIAL LENGTH, inch	5.81
LENGTH TO DIAMETER RATIO	2.07	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT		PLASTIC LIMIT		PLASTICITY INDEX		SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B003	SAMPLE NO.	ST-5	DEPTH, feet	43.5 - 45		

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NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	1120
WATER CONTENT, %	14.1	STRAIN AT FAILURE, %	6.0
DRY DENSITY, pcf	123.4	TIME TO FAILURE, minutes	3.0
VOID RATIO	0.37	RATE OF LOADING, %/min	2.0
SATURATION, %	104	SHEAR STRENGTH, psf	560
INITIAL DIAMETER, inch	2.81	INITIAL LENGTH, inch	5.79
LENGTH TO DIAMETER RATIO	2.06	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT		PLASTIC LIMIT		PLASTICITY INDEX		SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B003	SAMPLE NO.	ST-6	DEPTH, feet	53.5 - 55		

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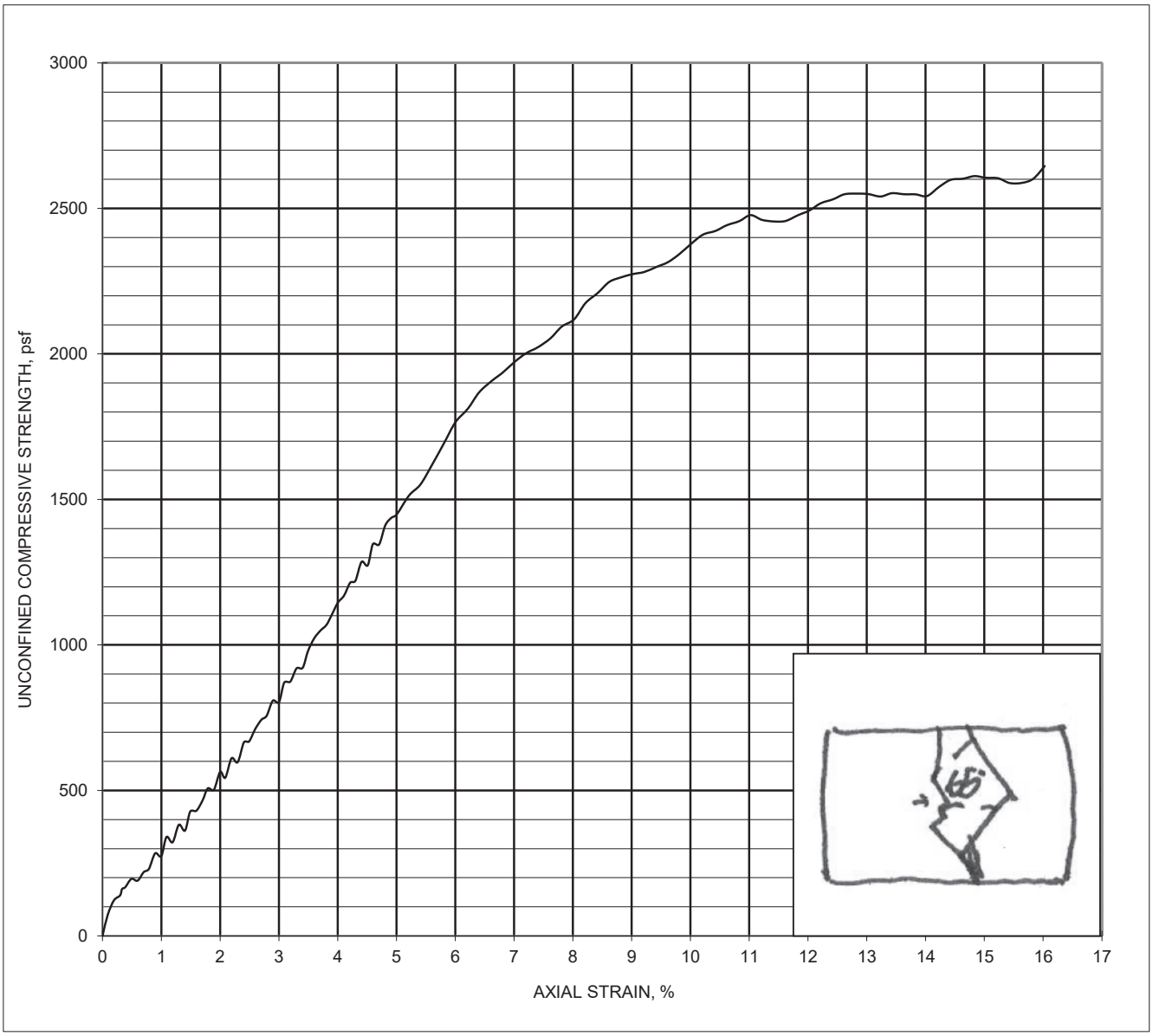


NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID		GeoJack1972 / 235166		COMPRESSIVE STRENGTH, psf		1300	
WATER CONTENT, %		23.9		STRAIN AT FAILURE, %		5.0	
DRY DENSITY, pcf		101.8		TIME TO FAILURE, minutes		2.5	
VOID RATIO		0.66		RATE OF LOADING, %/min		2.0	
SATURATION, %		98		SHEAR STRENGTH, psf		650	
INITIAL DIAMETER, inch		2.85		INITIAL LENGTH, inch		5.86	
LENGTH TO DIAMETER RATIO		2.06		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	38	PLASTIC LIMIT	19	PLASTICITY INDEX	19	SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION		SEE SUMMARY					
BORING NO.	B004	SAMPLE NO.	ST-1	DEPTH, feet		3.5 - 5	

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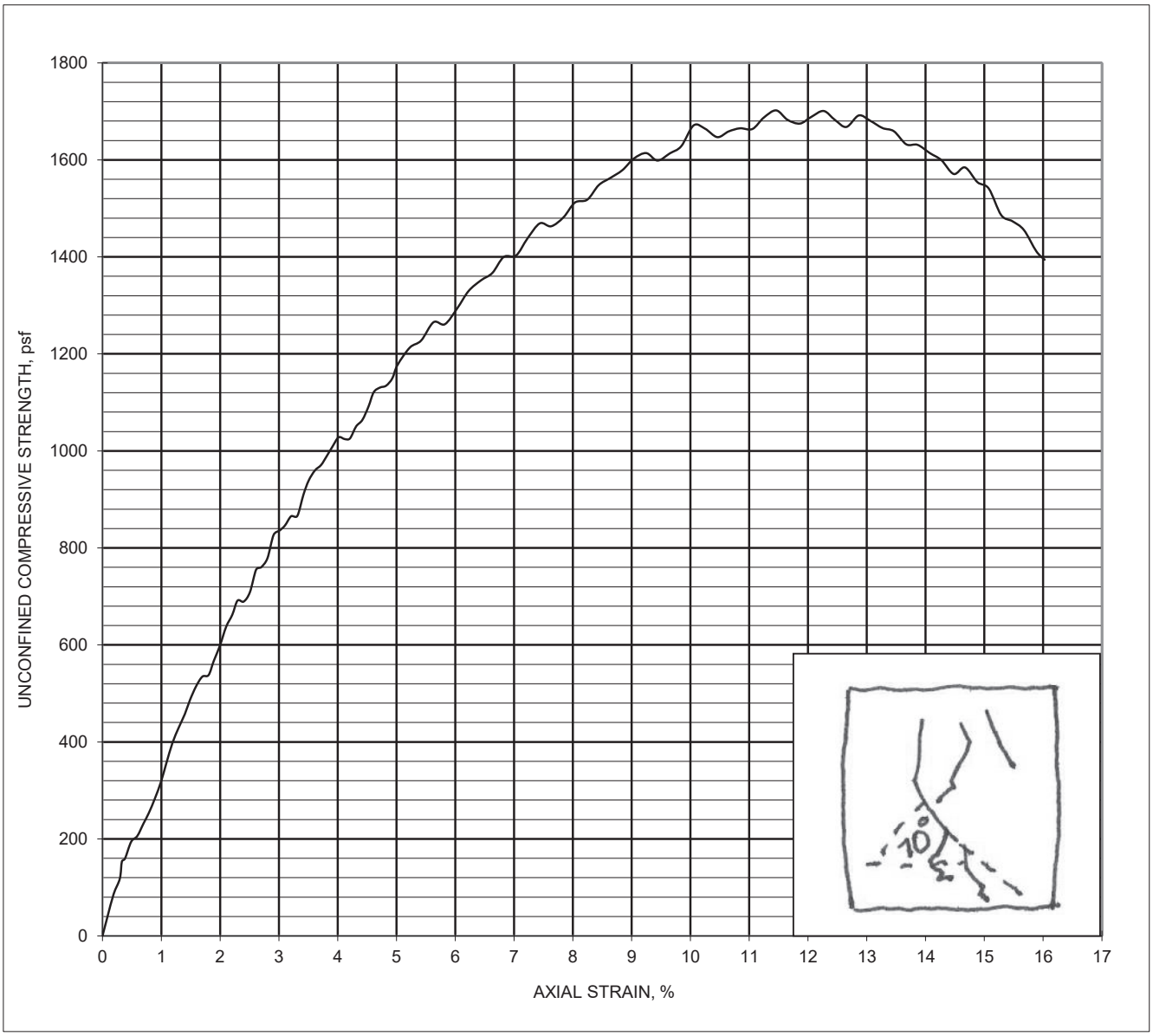
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID		GeoJack1972 / 235166		COMPRESSIVE STRENGTH, psf		2600	
WATER CONTENT, %		14.0		STRAIN AT FAILURE, %		15.0	
DRY DENSITY, pcf		120.3		TIME TO FAILURE, minutes		7.5	
VOID RATIO		0.40		RATE OF LOADING, %/min		2.0	
SATURATION, %		94		SHEAR STRENGTH, psf		1300	
INITIAL DIAMETER, inch		2.80		INITIAL LENGTH, inch		2.43	
LENGTH TO DIAMETER RATIO *		0.87		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	24	PLASTIC LIMIT	15	PLASTICITY INDEX	9	SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION		SEE SUMMARY					
BORING NO.	B004	SAMPLE NO.	ST-2	DEPTH, feet		13.5 - 15	

* The length ot diameter ratio is less that 2:1 as required by ASTM D2166

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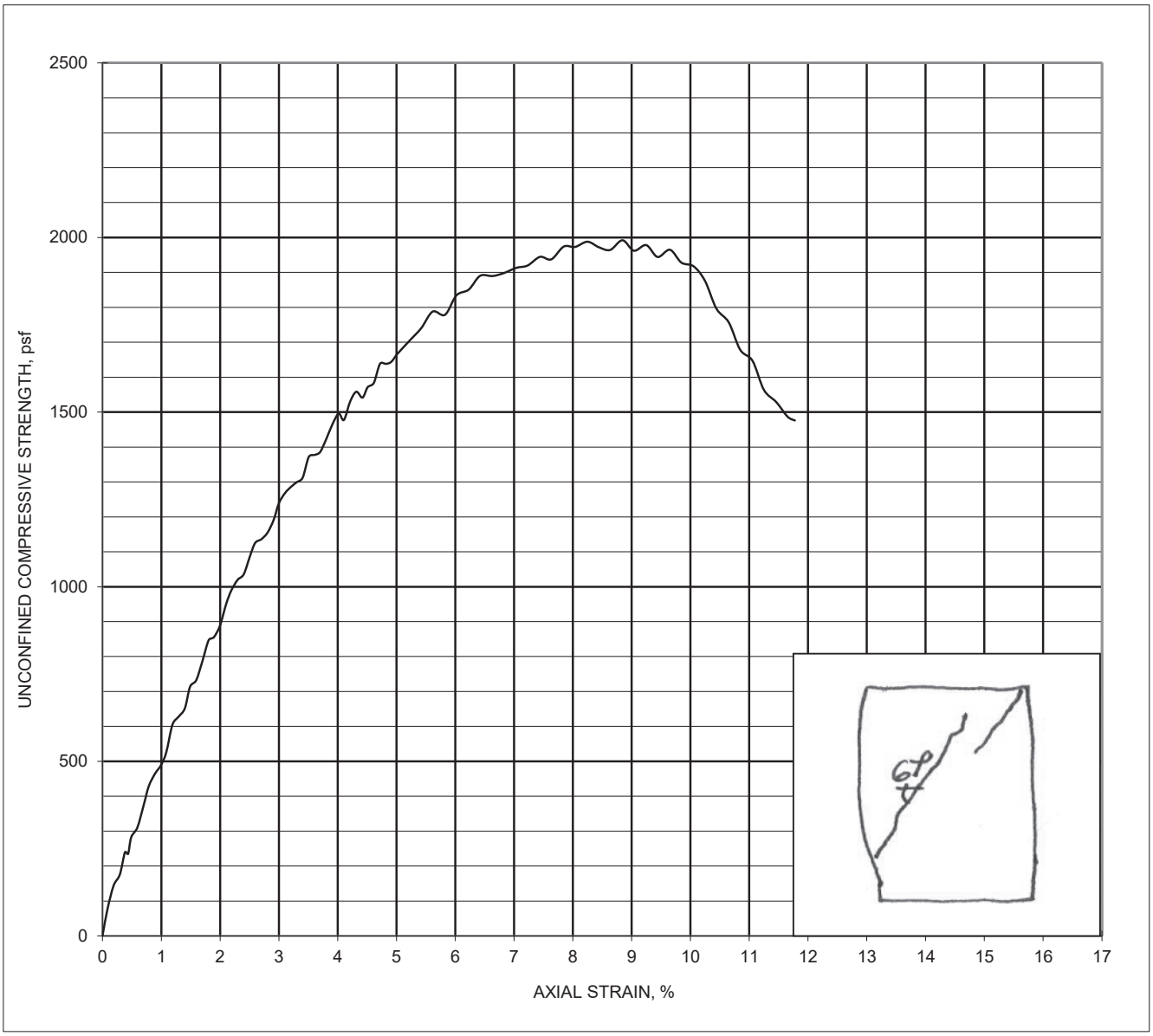
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	1700
WATER CONTENT, %	22.7	STRAIN AT FAILURE, %	11.5
DRY DENSITY, pcf	105.8	TIME TO FAILURE, minutes	5.7
VOID RATIO	0.59	RATE OF LOADING, %/min	2.0
SATURATION, %	103	SHEAR STRENGTH, psf	850
INITIAL DIAMETER, inch	2.83	INITIAL LENGTH, inch	5.87
LENGTH TO DIAMETER RATIO	2.07	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT	33	PLASTIC LIMIT	16	PLASTICITY INDEX	17	SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B004	SAMPLE NO.	ST-3	DEPTH, feet	23.5 - 25		

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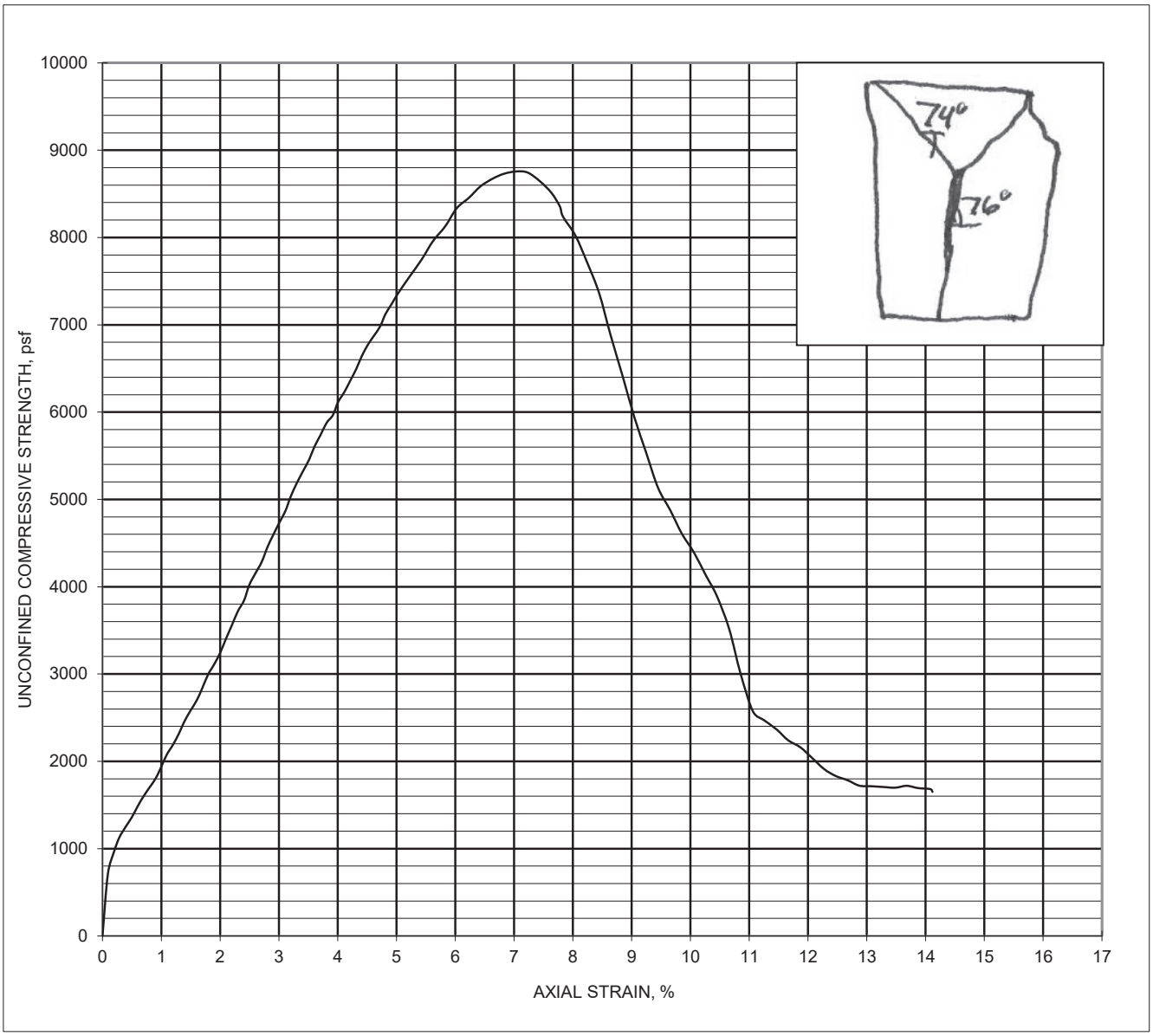
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	2000
WATER CONTENT, %	19.5	STRAIN AT FAILURE, %	8.8
DRY DENSITY, pcf	114.0	TIME TO FAILURE, minutes	4.4
VOID RATIO	0.48	RATE OF LOADING, %/min	2.0
SATURATION, %	110	SHEAR STRENGTH, psf	1000
INITIAL DIAMETER, inch	2.78	INITIAL LENGTH, inch	5.72
LENGTH TO DIAMETER RATIO	2.06	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT	36	PLASTIC LIMIT	17	PLASTICITY INDEX	19	SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B007	SAMPLE NO.	ST-1	DEPTH, feet	6 - 8		

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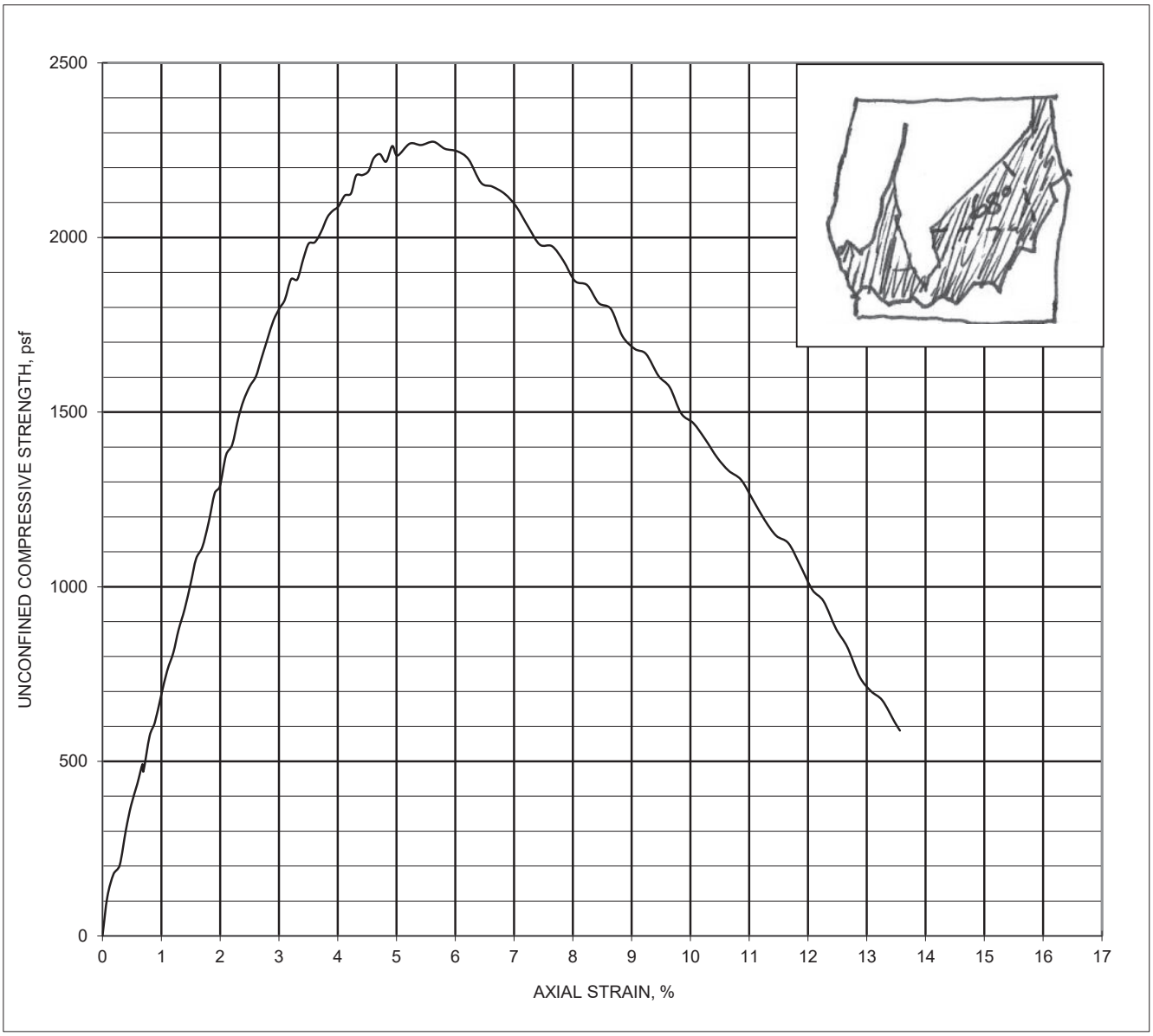
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	8760
WATER CONTENT, %	18.0	STRAIN AT FAILURE, %	7.0
DRY DENSITY, pcf	114.5	TIME TO FAILURE, minutes	3.5
VOID RATIO	0.47	RATE OF LOADING, %/min	2.0
SATURATION, %	103	SHEAR STRENGTH, psf	4380
INITIAL DIAMETER, inch	2.82	INITIAL LENGTH, inch	5.88
LENGTH TO DIAMETER RATIO	2.09	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT		PLASTIC LIMIT		PLASTICITY INDEX		SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B007	SAMPLE NO.	ST-2	DEPTH, feet	31 - 32.5		

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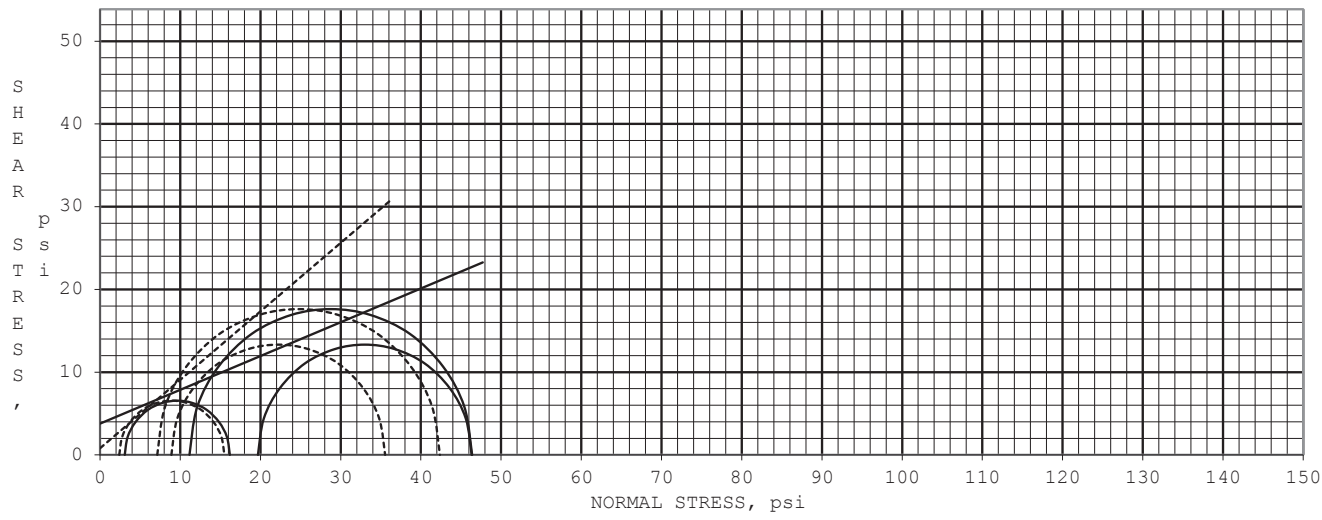


NOTE: CONTROLLED STRAIN

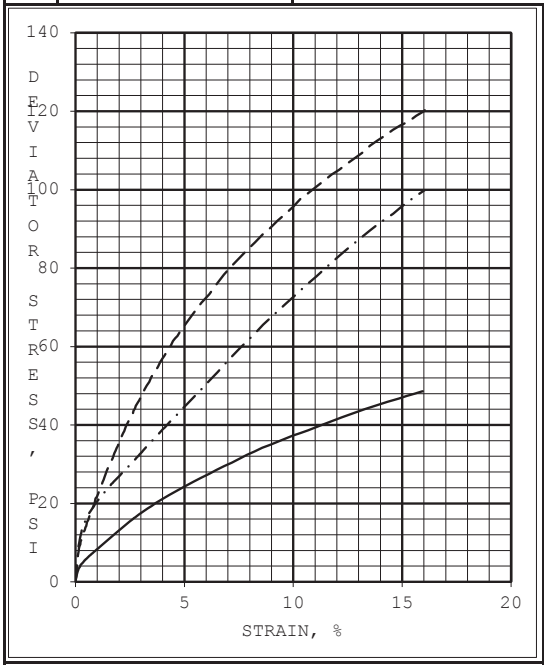
MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	2280
WATER CONTENT, %	18.0	STRAIN AT FAILURE, %	5.6
DRY DENSITY, pcf	115.9	TIME TO FAILURE, minutes	2.8
VOID RATIO	0.45	RATE OF LOADING, %/min	2.0
SATURATION, %	107	SHEAR STRENGTH, psf	1140
INITIAL DIAMETER, inch	2.81	INITIAL LENGTH, inch	5.84
LENGTH TO DIAMETER RATIO	2.08	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT		PLASTIC LIMIT		PLASTICITY INDEX		SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B007	SAMPLE NO.	ST-3	DEPTH, feet	36 - 37.5		

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)
PO 64673ACM
02156344
11/6/2015



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**39.6**	COHESION, psi	**0.8**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**22.2**	COHESION, psi	**3.8**



SPECIMEN ID:		ST-1	ST-2	ST-3
INITIAL	WATER CONTENT, %	16.5	15.9	17.0
	DRY DENSITY, pcf	113.8	117.6	116.2
	SATURATION, %	93	99	102
	VOID RATIO	0.48	0.43	0.45
BEFORE SHEAR	WATER CONTENT, %	17.7	15.5	15.6
	DRY DENSITY, pcf	113.9	118.8	118.5
	SATURATION (B PARAMETER)	0.99	1.00	0.96
	VOID RATIO	0.48	0.42	0.42
	FINAL BACK PRESSURE, psi	100.1	100.6	99.7
MINOR PRINCIPAL STRESS, psi		3.1	11.2	19.7
EFFECTIVE STRESS PEAK AT % STRAIN		2.0	2.0	2.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		13.1	35.2	26.6
TOTAL STRESS PEAK AT % STRAIN		2.0	2.0	2.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		13.1	35.2	26.6
ULTIMATE DEVIATOR STRESS (15% STR), psi		47.0	116.6	95.8
TIME TO 50% PRIMARY CONSOLIDATION, min		3.50	3.30	6.20
STRAIN RATE, % / hour		3.98	3.98	2.34
INITIAL DIAMETER, inch		2.878	2.861	2.866
INITIAL HEIGHT, inch		5.865	5.861	5.865
AREA AFTER CONSOLIDATION, inch2		6.488	6.388	6.364

CONTROLLED - STRAIN TEST

SAMPLE TYPE: 3" SHELBY TUBE

DESCRIPTION OF SPECIMENS:

LL	PL	PI	Gs 2.7 EST.

PROJECT NO. 02156344

LABORATORY: TERRACON - LENEXA

DATE: 10/13/2015

PROJECT: DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)
PO 64673ACM

BORING #: B011

SAMPLE #: ST-1, ST-2 & ST-3

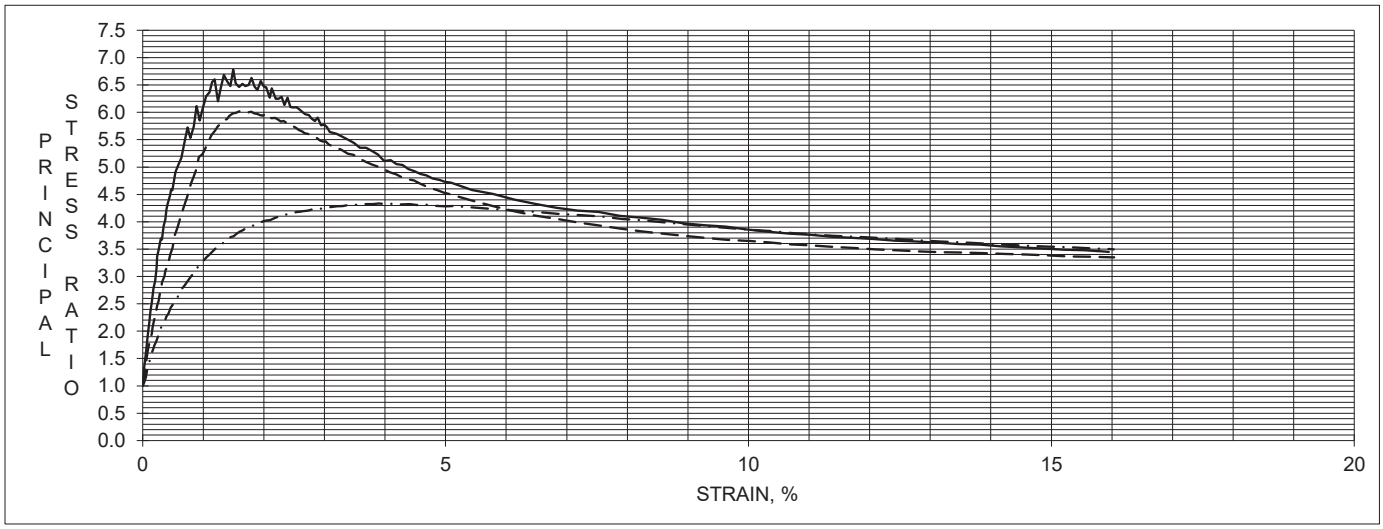
DEPTH, feet: 3.5 - 25.0

PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

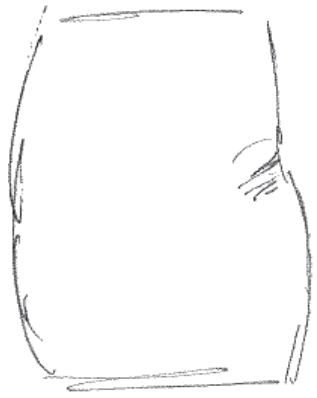
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)

02156344 B011 ST-1, ST-2 & ST-3 3.5 - 25.0

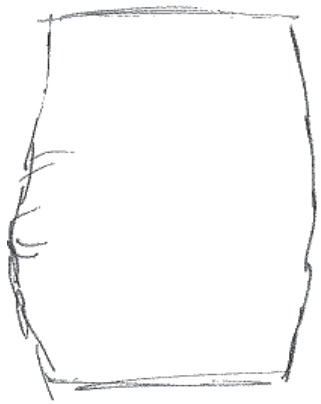


FAILURE SKETCH



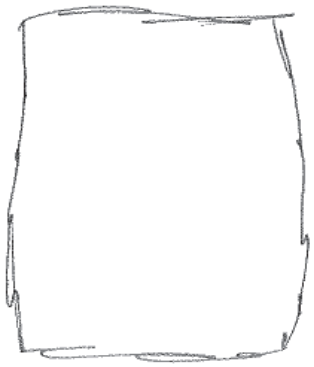
SPECIMEN A

FAILURE SKETCH



SPECIMEN B

FAILURE SKETCH



SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 2 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 2 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

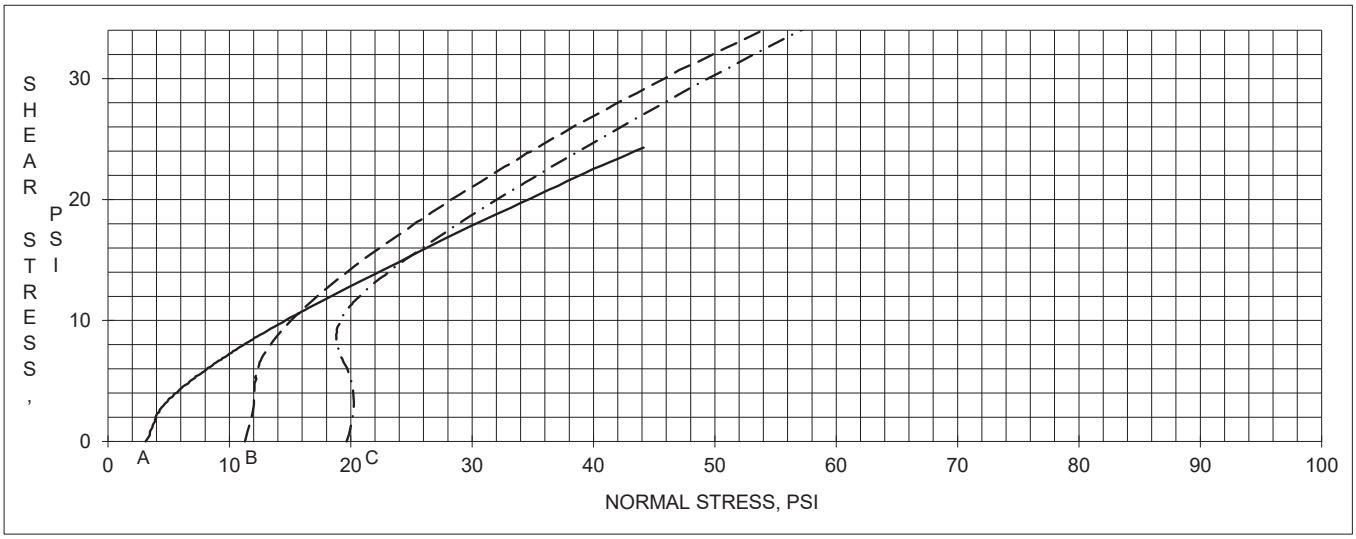
DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

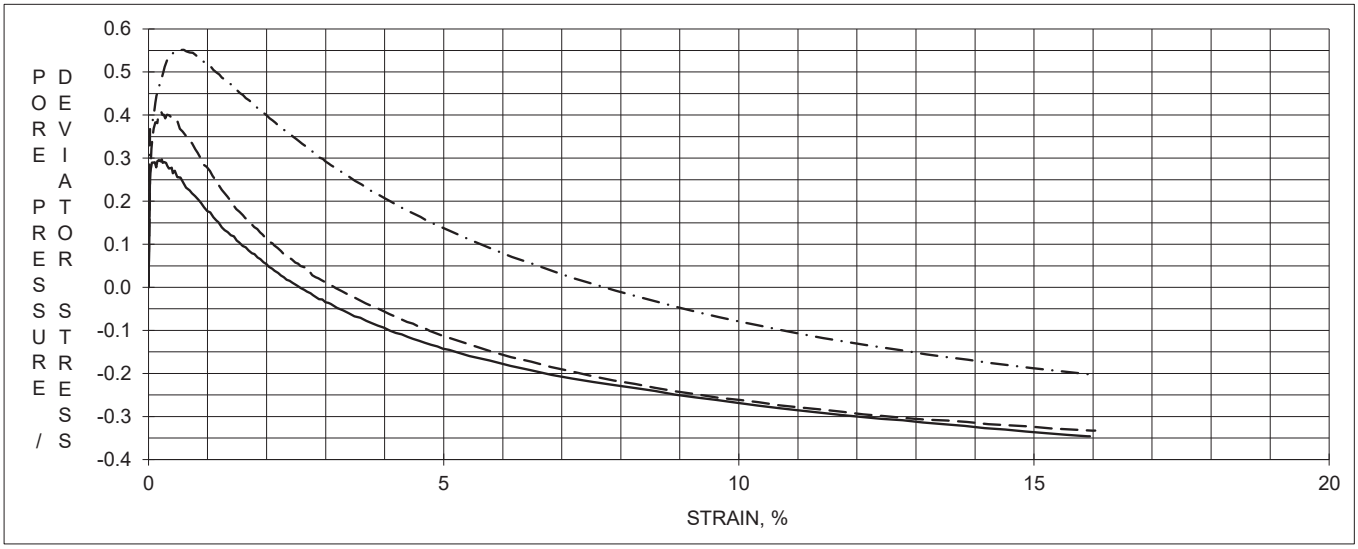
AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

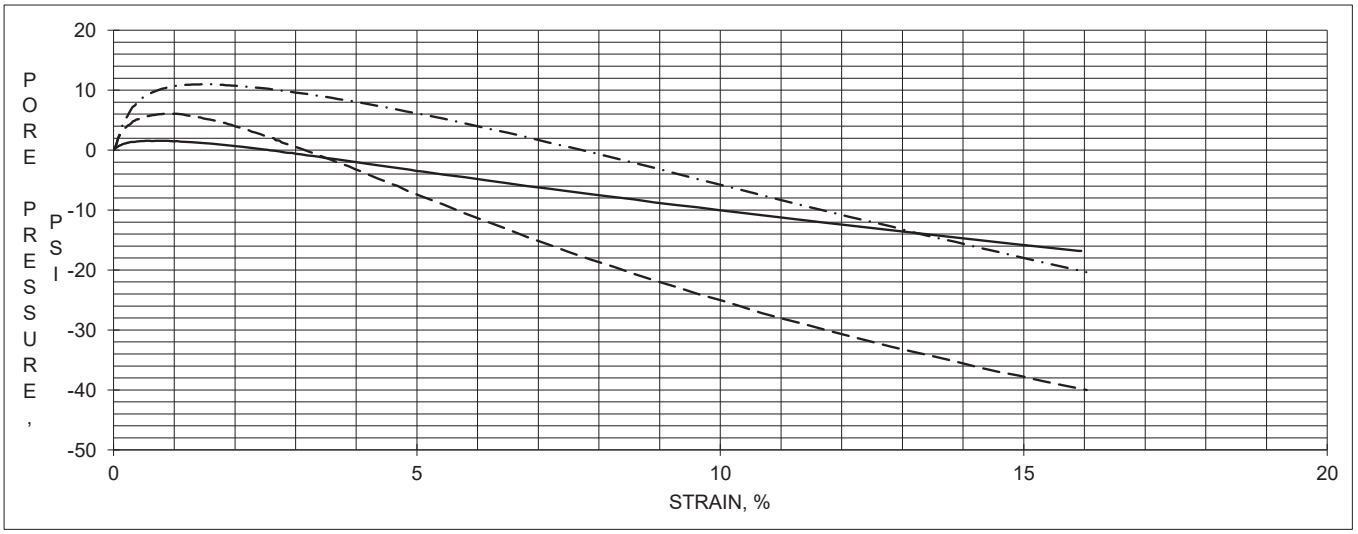
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)

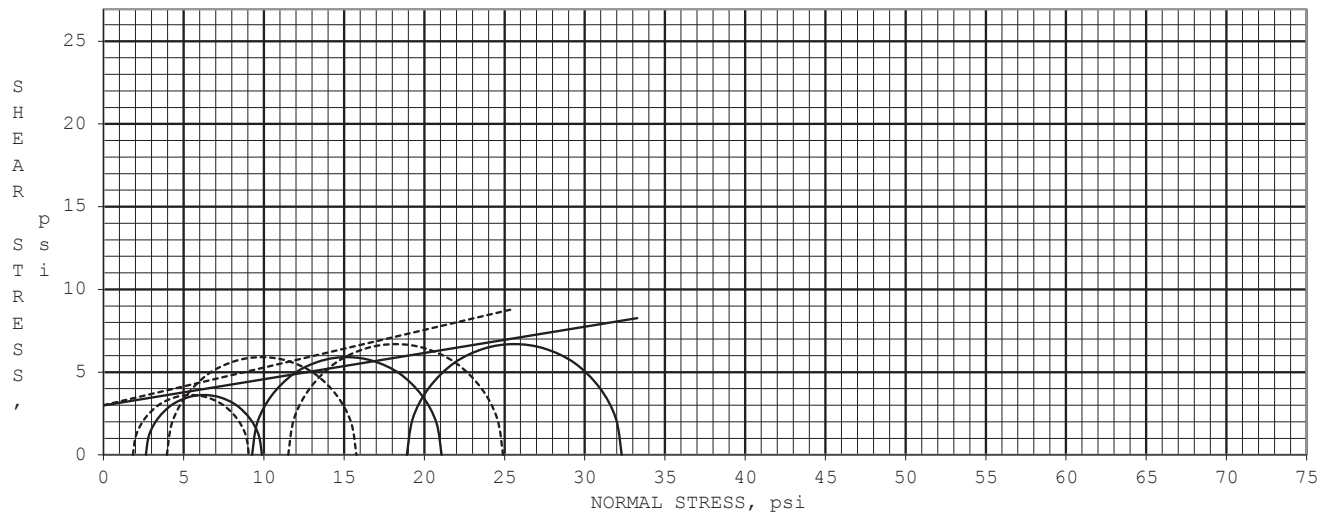
02156344 B011 ST-1, ST-2 & ST-3 3.5 - 25.0



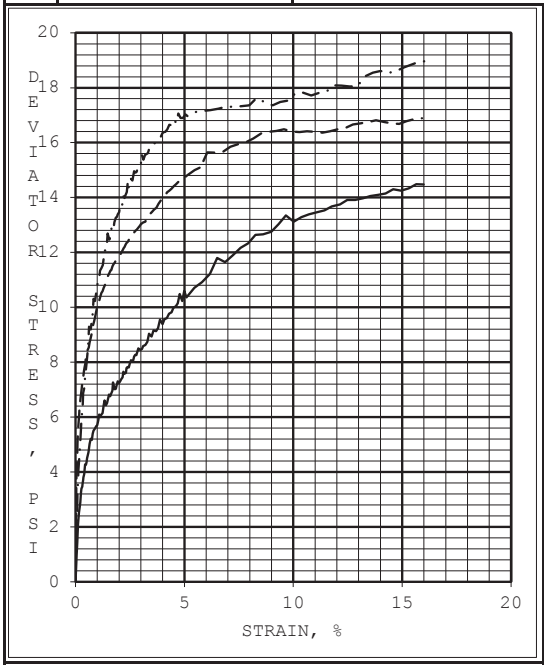




Terracon



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**12.8**	COHESION, psi	**3.0**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**9.0**	COHESION, psi	**3.0**



SPECIMEN ID:		ST-1	ST-2	ST-3
INITIAL	WATER CONTENT, %	21.9	21.8	23.7
	DRY DENSITY, pcf	104.1	107.1	105.1
	SATURATION, %	96	103	106
	VOID RATIO	0.62	0.57	0.60
BEFORE SHEAR	WATER CONTENT, %	22.7	17.1	19.8
	DRY DENSITY, pcf	104.4	115.2	109.8
	SATURATION (B PARAMETER)	1.00	1.00	0.97
	VOID RATIO	0.61	0.46	0.53
	FINAL BACK PRESSURE, psi	100.3	103.0	100.7
MINOR PRINCIPAL STRESS, psi		2.6	9.3	18.9
EFFECTIVE STRESS PEAK AT % STRAIN		2.0	2.0	2.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		7.2	11.8	13.4
TOTAL STRESS PEAK AT % STRAIN		2.0	2.0	2.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		7.2	11.8	13.4
ULTIMATE DEVIATOR STRESS (15% STR), psi		14.3	16.7	18.7
TIME TO 50% PRIMARY CONSOLIDATION, min		18.00	68.00	24.00
STRAIN RATE, % / hour		0.96	0.27	0.77
INITIAL DIAMETER, inch		2.872	2.851	2.824
INITIAL HEIGHT, inch		5.804	5.850	5.862
AREA AFTER CONSOLIDATION, inch2		6.460	5.967	6.056

CONTROLLED - STRAIN TEST

SAMPLE TYPE: 3" SHELBY TUBE

DESCRIPTION OF SPECIMENS:

LL	PL	PI	Gs 2.7 EST.

PROJECT NO. 02156344

LABORATORY: TERRACON - LENEXA

DATE: 10/16/2015

PROJECT: DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)
PO 64673ACM

BORING #: B012

SAMPLE #: ST-1, ST-2 & ST-3

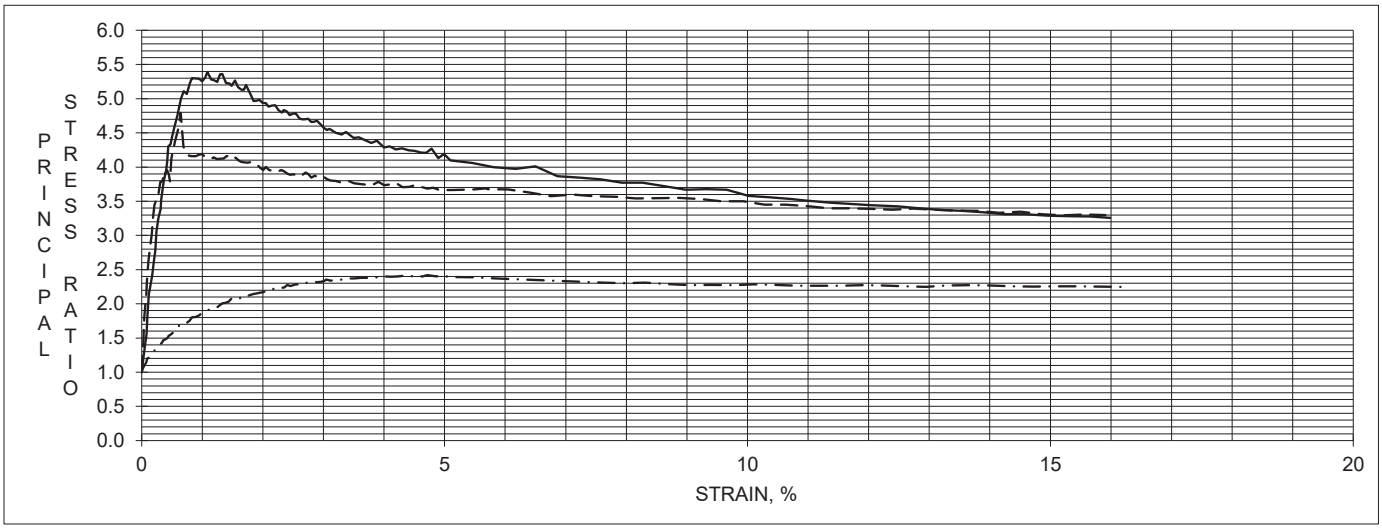
DEPTH, feet: 3.5 - 25.0

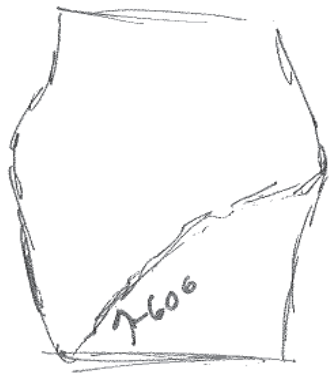
PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)

02156344 B012 ST-1, ST-2 & ST-3 3.5 - 25.0



FAILURE SKETCH	FAILURE SKETCH	FAILURE SKETCH
		
SPECIMEN A	SPECIMEN B	SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 2 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 2 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

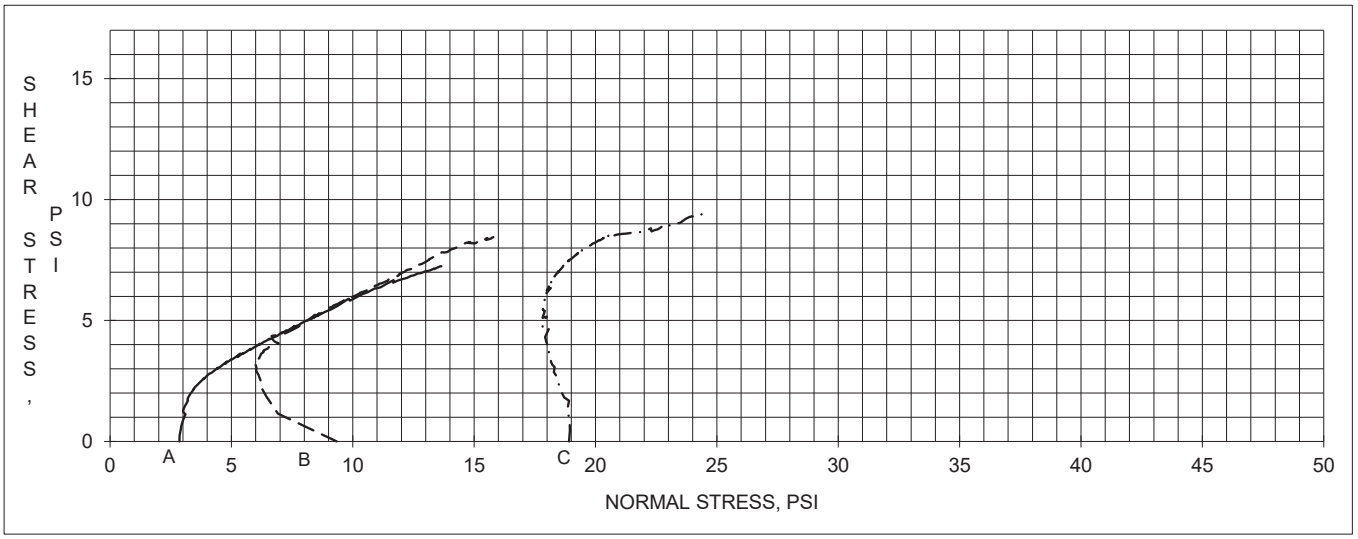
DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

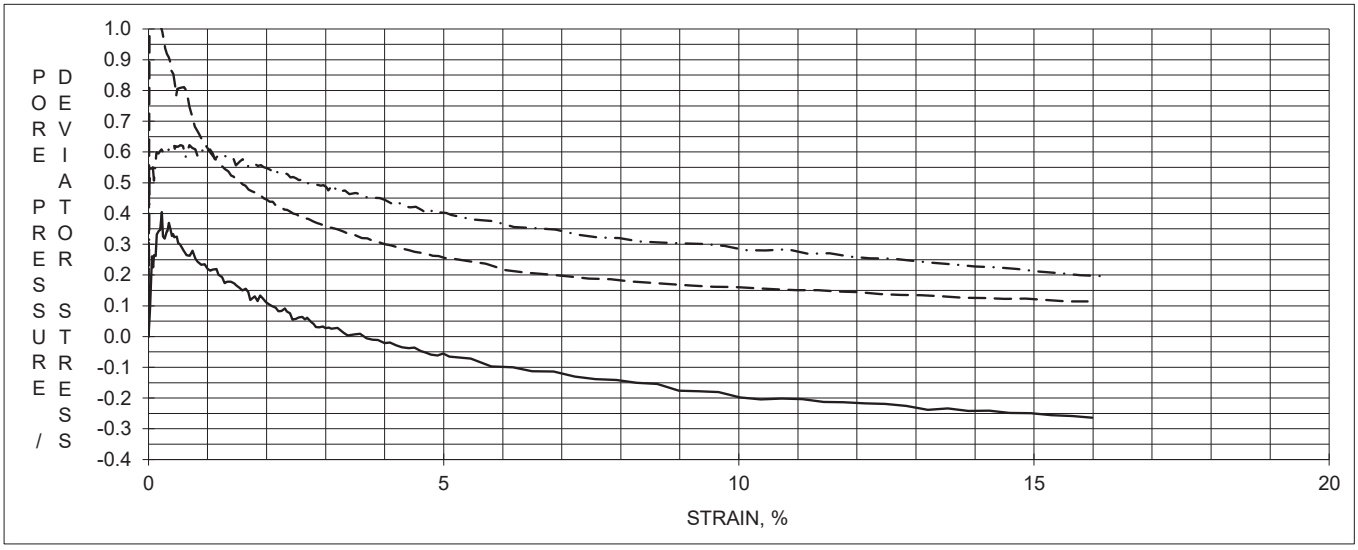
AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

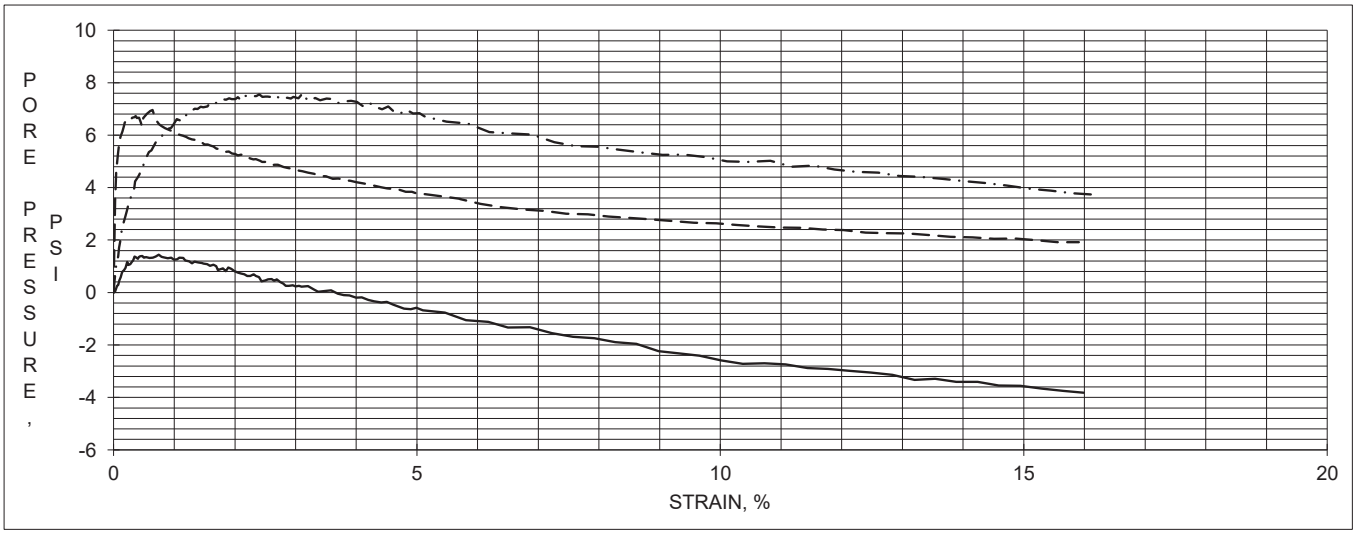
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)

02156344 B012 ST-1, ST-2 & ST-3 3.5 - 25.0

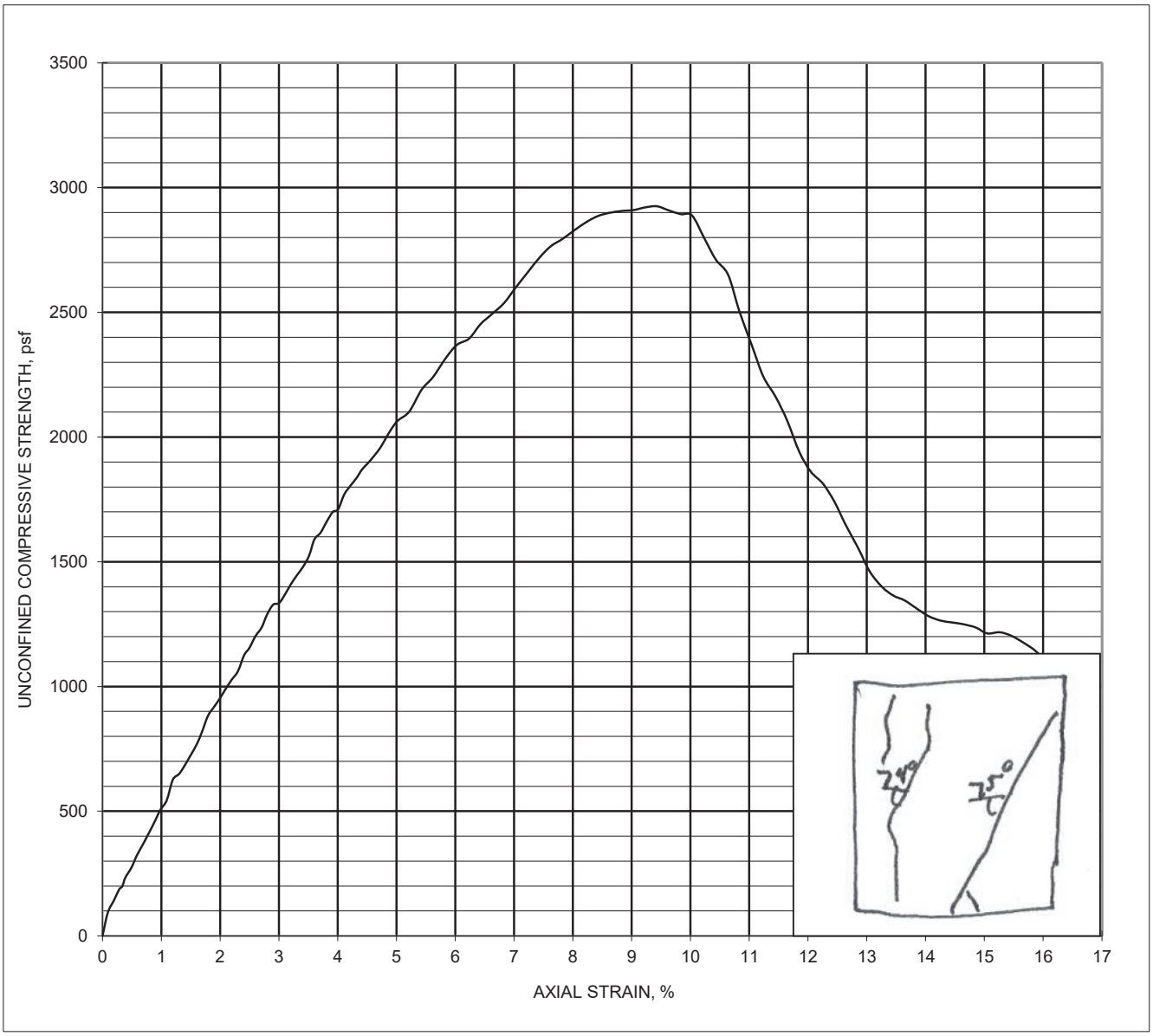






Terracon

UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL
ASTM D2166



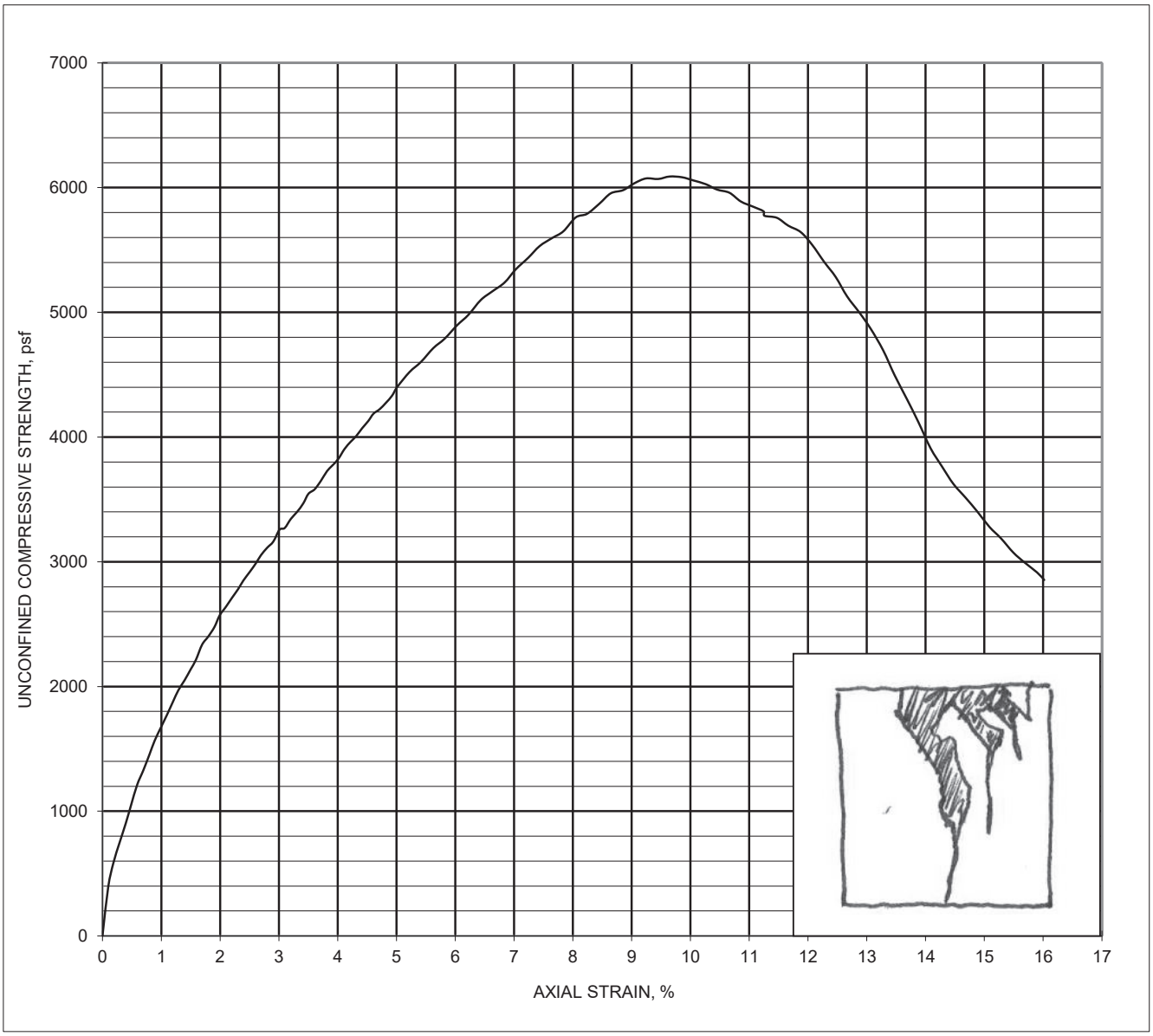
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166	COMPRESSIVE STRENGTH, psf	2920
WATER CONTENT, %	18.2	STRAIN AT FAILURE, %	9.4
DRY DENSITY, pcf	112.6	TIME TO FAILURE, minutes	4.7
VOID RATIO	0.50	RATE OF LOADING, %/min	2.0
SATURATION, %	99	SHEAR STRENGTH, psf	1460
INITIAL DIAMETER, inch	2.82	INITIAL LENGTH, inch	5.58
LENGTH TO DIAMETER RATIO	1.98	SAMPLE TYPE	UNDISTURBED

LIQUID LIMIT		PLASTIC LIMIT		PLASTICITY INDEX		SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B015	SAMPLE NO.	ST-1	DEPTH, feet	6 - 7.5		

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)
PO 64673ACM
02156344
11/6/2015

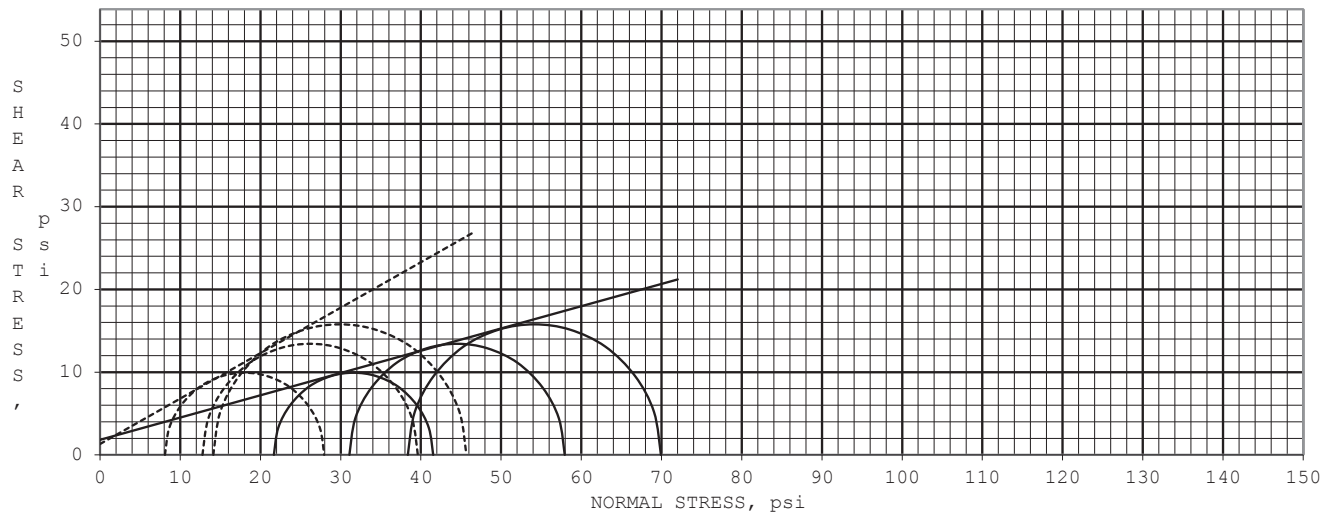
UNCONFINED COMPRESSION STRENGTH OF COHESIVE SOIL
ASTM D2166



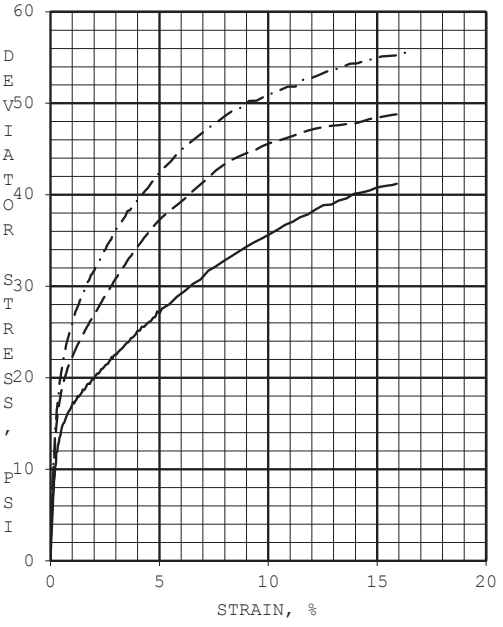
NOTE: CONTROLLED STRAIN

MACHINE ID / LOAD CELL ID	GeoJack1972 / 235166			COMPRESSIVE STRENGTH, psf		6080	
WATER CONTENT, %	16.5			STRAIN AT FAILURE, %		9.6	
DRY DENSITY, pcf	118.6			TIME TO FAILURE, minutes		4.8	
VOID RATIO	0.42			RATE OF LOADING, %/min		2.0	
SATURATION, %	106			SHEAR STRENGTH, psf		3040	
INITIAL DIAMETER, inch	2.81			INITIAL LENGTH, inch		5.88	
LENGTH TO DIAMETER RATIO	2.09			SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	34	PLASTIC LIMIT	19	PLASTICITY INDEX	15	SPECIFIC GRAV.	2.70 ASSUMED
SAMPLE DESCRIPTION	SEE SUMMARY						
BORING NO.	B015	SAMPLE NO.	ST-2	DEPTH, feet	13.5 - 15		

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)
PO 64673ACM
02156344
11/6/2015



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**28.8**	COHESION, psi	**1.3**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**15.1**	COHESION, psi	**1.8**



		ST-1	ST-2	ST-3
SPECIMEN ID:				
INITIAL	WATER CONTENT, %	25.2	24.5	16.9
	DRY DENSITY, pcf	101.2	100.8	109.1
	SATURATION, %	102	98	84
	VOID RATIO	0.67	0.67	0.54
BEFORE SHEAR	WATER CONTENT, %	23.0	23.1	18.2
	DRY DENSITY, pcf	103.9	103.8	113.0
	SATURATION (B PARAMETER)	0.97	0.99	1.00
	VOID RATIO	0.62	0.62	0.49
	FINAL BACK PRESSURE, psi	100.5	99.7	100.5
MINOR PRINCIPAL STRESS, psi		21.7	31.1	38.4
EFFECTIVE STRESS PEAK AT % STRAIN		2.0	2.0	2.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		19.9	26.8	31.6
TOTAL STRESS PEAK AT % STRAIN		2.0	2.0	2.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		19.9	26.8	31.6
ULTIMATE DEVIATOR STRESS (15% STR), psi		40.7	48.4	55.0
TIME TO 50% PRIMARY CONSOLIDATION, min		4.00	2.20	4.30
STRAIN RATE, % / hour		4.26	3.98	4.08
INITIAL DIAMETER, inch		2.861	2.863	2.871
INITIAL HEIGHT, inch		5.854	5.872	5.875
AREA AFTER CONSOLIDATION, inch2		6.291	6.323	6.358

CONTROLLED - STRAIN TEST

SAMPLE TYPE: 3" SHELBY TUBE

DESCRIPTION OF SPECIMENS:

LL	PL	PI	Gs 2.7 EST.

PROJECT NO. 02156344

LABORATORY: TERRACON - LENEXA

DATE: 10/16/2015

PROJECT: DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)
PO 64673ACM

BORING #: B015

SAMPLE #: ST-3, ST-4 & ST-5

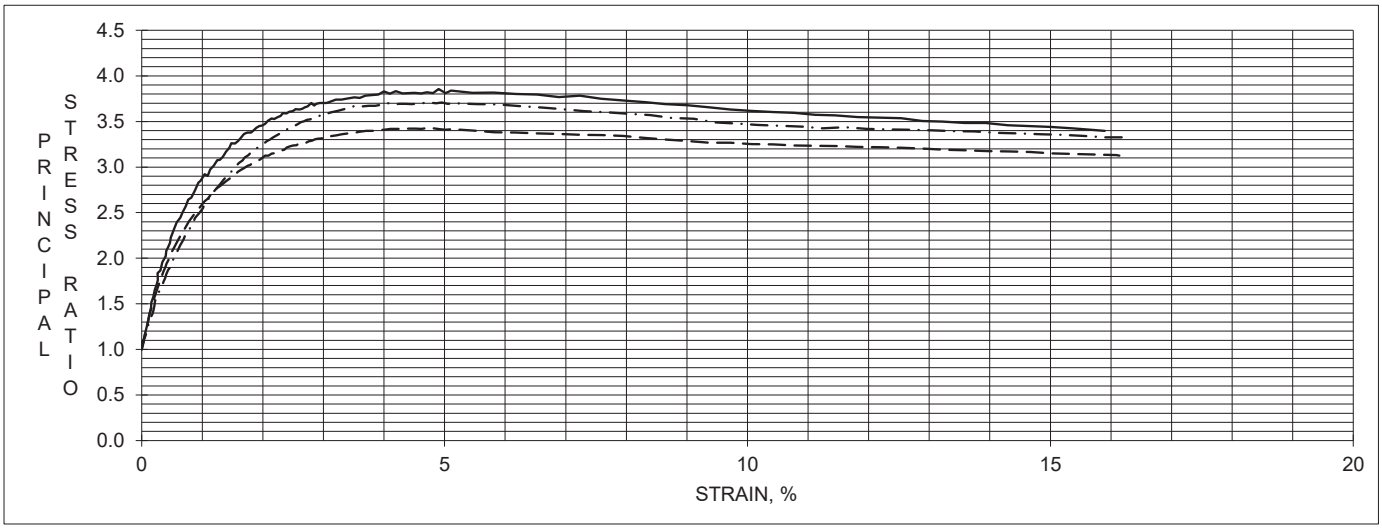
DEPTH, feet: 26.0 - 47.5

PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

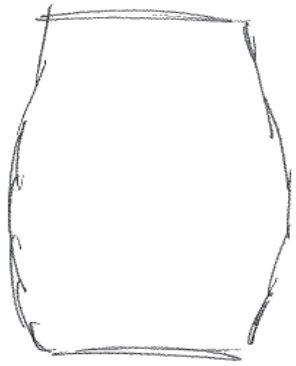
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)

02156344 B015 ST-3, ST-4 & ST-5 26.0 - 47.5



FAILURE SKETCH



SPECIMEN A

FAILURE SKETCH



SPECIMEN B

FAILURE SKETCH



SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 2 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 2 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

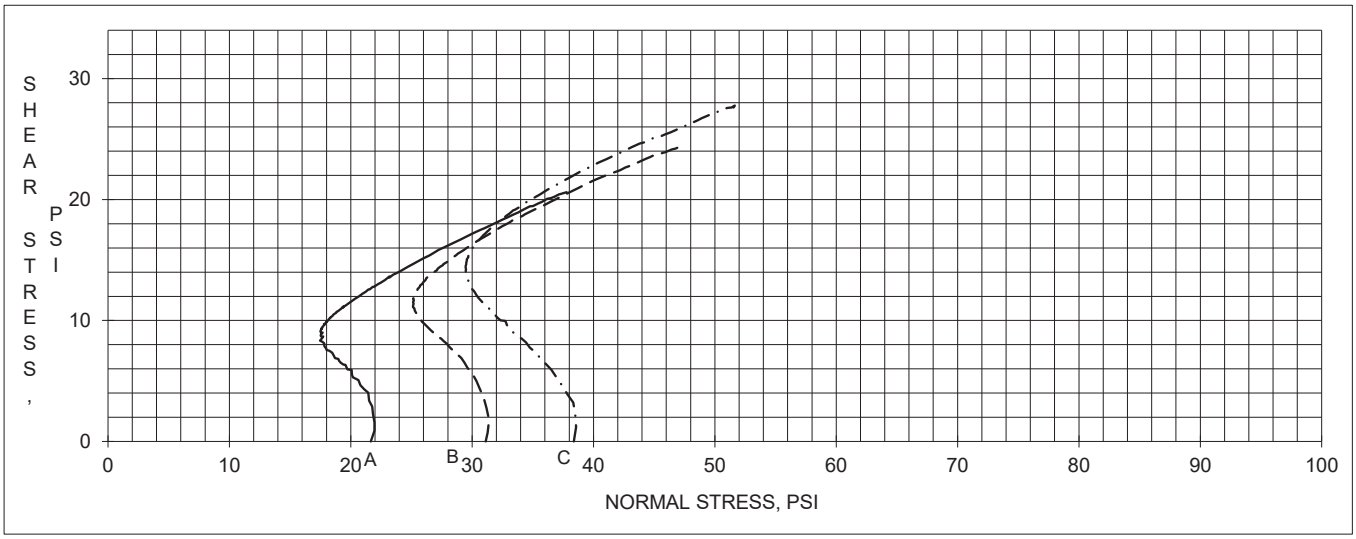
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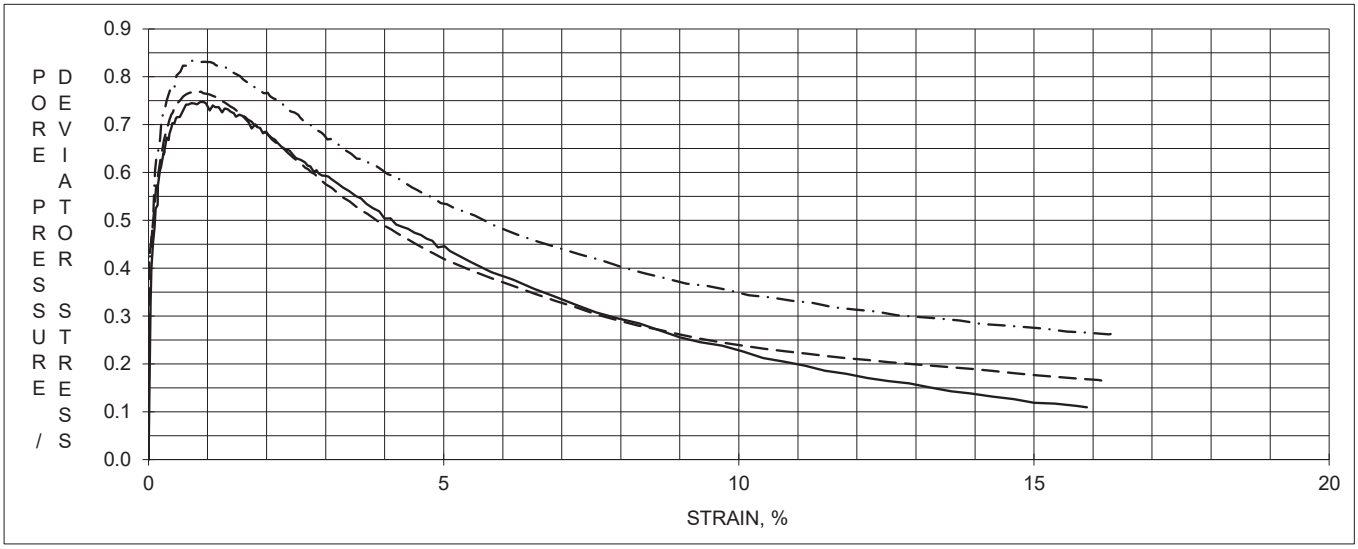
AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

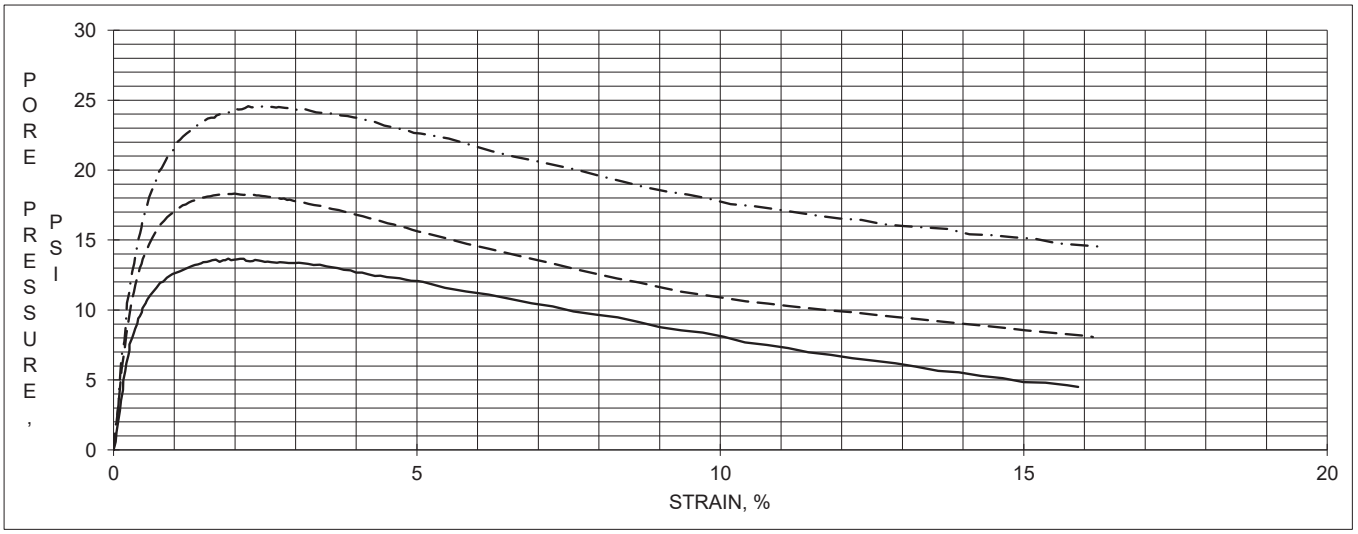
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 1)

02156344 B015 ST-3, ST-4 & ST-5 26.0 - 47.5







Terracon

Summary of Laboratory Testing

SLT 22205

Alpha-Omega Geotech, Inc.
1701 State Avenue
Kansas City, KS 66102
Office: (913) 371-0000 Fax: (913) 371-6710
Website: www.aogeotech.com

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B017	SPT-1	6.5'-7'	Brown, spotted grayish brown LEAN CLAY	18.0		40	21	19						
B017	SPT-3	16'-17.5'	Brown, mottled light brown LEAN CLAY	16.2		37	21	16						
B017	SPT-5	26'-27.5'	Brown, speckled reddish brown LEAN CLAY	16.1										
B017	SPT-7	36'-37.5'	Brown, mottled gray and reddish brown LEAN CLAY with trace of organics	24.4										
B017	SPT-9	46'-47.5'	Light brown, mottled reddish brown, speckled gray LEAN CLAY	26.3		36	22	14						
B017	SPT-11	56'-57.5'	Brown, mottled gray and reddish brown LEAN CLAY with trace of shale	17.3										

Summary of Laboratory Testing

SLT 22205

Alpha-Omega Geotech, Inc.
1701 State Avenue
Kansas City, KS 66102
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Website: www.aogeotech.com

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)
PROJECT LOCATION:

PROJECT NUMBER: 15-328T
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B018	SPT-1	6'-7.5'	Brown, mottled dark brown, spotted reddish brown LEAN CLAY	28.8										
B018	SPT-3	16'-17.5'	Light brown, mottled reddish brown, spotted gray LEAN CLAY	25.8										
B018	SPT-5	26'-27.5'	Brown, mottled gray, spotted reddish brown FAT CLAY	20.5										
B018	SPT-7	36'-37.5'	Brown, mottled gray, spotted reddish brown LEAN CLAY	19.4										

Summary of Laboratory Testing

SLT 22205

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ALPHA-OMEGA GEOTECH

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PROJECT LOCATION:

PROJECT NUMBER: 15-328T
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B019	ST-1	3.5'-5'	Brown, mottled dark brown, spotted black and gray LEAN CLAY with trace of organics	19.1	108.4	40	23	17			5070	10.6		PP = 4.0 tsf
B019	SPT-1	8'-10'	Brown, spotted light brown LEAN CLAY	18.3										
B019	ST-2	14.25'-15'	Dark brown, spotted black, speckled reddish brown LEAN CLAY	17.7	107.6	40	22	18			8624	5.9		PP = >4.25 tsf
B019	SPT-2	18.5'-20'	Brown, spotted reddish brown and gray LEAN CLAY	30.0										
B019	SPT-3	24'-25'	Light brown, mottled dark brown, speckled gray LEAN CLAY	24.5										
B019	SPT-4	28.5'-30'	Brown, mottled gray, speckled reddish brown LEAN CLAY with a trace of shale	19.3										
B019	ST-3	33.5'-34'	Gray, mottled black, speckled reddish brown FAT CLAY with weathered shale and coal fragments	17.6	114.4	52	26	26						PP = 2.75 tsf *Unable to perform compression testing.
B019	SPT-5	38.5'-40'	Brown, mottled light gray LEAN CLAY	19.2										
B019	ST-4	43.5'-45'	Gray, mottled dark brown LEAN CLAY with weathered shale	20.2	105.7	36	20	16			2770	7.7		PP = 1.5 tsf
B019	ST-5	53'-55'	Dark brown, mottled blue gray organic silt with some weathered shale	39.7	75.8	58	37	21			3285	4.1		PP = 3.5 tsf

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PROJECT LOCATION:

PROJECT NUMBER: 15-328T
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B020	ST-1	3.5'-5'	Brown, mottled gray, spotted reddish brown, speckled black LEAN CLAY with weathered shale fragments and trace of organics	27.2	95.4	36	20	16						PP = 1.5 tsf
B020	SPT-1	8.5'-10'	Gray, mottled brown LEAN CLAY	18.2										
B020	ST-2	13.5'-15'	Light blue and gray, mottled light olive brown, speckled reddish brown and black LEAN CLAY with trace of weathered shale and coal fragments	25.8	105.9	28	16	12						PP = 1.25 tsf
B020	SPT-2	18.5'-20'	Grayish brown, mottled light gray, speckled reddish brown LEAN CLAY	15.7										
B020	ST-3	23.5'-25'	Gray, spotted reddish brown LEAN CLAY (weathered shale)	15.3	118.9	41	24	17						PP = >4.5 tsf
B020	SPT-3	28.5'-30'	Gray LEAN CLAY (weathered shale)	15.9										
B020	ST-4	33.5'-35'	Light blue gray, spotted brown and reddish brown LEAN CLAY with trace of fine sand	19.5	112.2	43	20	23						PP = 1.5 tsf
B020	SPT-4	38.5'-40'	Gray, mottled brown LEAN CLAY (weathered shale)	15.9										

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DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B021	SPT-1	11'-12.5'	Brown, spotted reddish brown and gray LEAN CLAY	20.2										
B021	SPT-2	21'-22.5'	Light brown, mottled reddish brown LEAN CLAY	14.6										
B021	SPT-3	31'-32.5'	Brown, speckled reddish brown LEAN CLAY	17.9										
B021	SPT-4	41'-42.5'	Brown, spotted light brown LEAN CLAY	19.9										
B021	SPT-5	51'-52.5'	Brown and gray LEAN CLAY (weathered shale)	12.6										
B021	SPT-6	60'-61.5'	Gray, mottled brown LEAN CLAY (weathered shale)	15.4										

Summary of Laboratory Testing

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PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B022	SPT-1	11'-12.5'	Brown, spotted reddish brown LEAN CLAY	28.1										
B022	SPT-2	21'-22'	Gray, spotted reddish brown and black LEAN CLAY (weathered shale)	13.5										
B022	SPT-3	31'-32.5'	Gray, spotted brown LEAN CLAY	15.1										
B022	SPT-4	41'-42.5'	Brown, mottled gray, spotted light reddish brown LEAN CLAY (weathered shale)	16.9										

Summary of Laboratory Testing

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PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B023	SPT-1	3.5'-5'	Brown LEAN CLAY	15.5										
B023	SPT-3	13.5'-15'	Brown, speckled reddish brown LEAN CLAY	20.2										
B023	SPT-5	23.5'-25'	Brown LEAN CLAY	15.6										
B023	SPT-7	33.5'-35'	Light brown, spotted reddish brown LEAN CLAY	24.3										
B023	SPT-9	43.5'-45'	Brown, mottled gray, spotted reddish brown LEAN CLAY	16.6										
B023	SPT-11	53.5'-55'	Gray, mottled light brown LEAN CLAY with weathered shale	21.6										

Summary of Laboratory Testing

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PROJECT LOCATION:
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B024	SPT-1	3.5'-5'	Brown, speckled reddish brown LEAN CLAY	15.3										
B024	SPT-3	13.5'-15'	Brown, speckled reddish brown LEAN CLAY	15.7										
B024	SPT-5	23.5'-25	Light gray,and brown LEAN CLAY with weathered shale	11.5										
B024	SPT-7	33.5'-35'	Brown, mottled gray and reddish brown LEAN CLAY	13.4										
B024	SPT-8	38.5'-40'	Brown, spotted gray and reddish brown LEAN CLAY	19.1										

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DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B025	ST-1	3.5'-5'	Brown, mottled dark brown, speckled black and reddish brown LEAN CLAY with trace of organics (finger roots)	17.7	109.2						9985	10.2		PP = >4.5 tsf
B025	ST-2	13.5'-15'	Brown, spotted gray, speckled reddish brown LEAN CLAY with trace of gravel	15.4	116.8						7685	8.8		PP = 4.0 tsf
B025	ST-3	23.5'-25'	Brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand and gravel	15.9	118.3						3762	6.8		PP = 2.50 tsf
B025	ST-4	33.5'-35'	Brown, mottled dark gray, speckled black and reddish brown LEAN CLAY with trace of organics	23.8	102.9						2588	14.7		PP = 1.50 tsf
B025	ST-5	43.5'-45'	Brown, spotted gray, speckled reddish brown LEAN CLAY with weathered shale fragments	15.1	121.2						2506	6.9		PP = 4.0 tsf
B025	ST-6	43.5'-45'	Gray LEAN CLAY (weathered shale)	8.0										*Unable to perform density testing.

Summary of Laboratory Testing

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PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B026	ST-1	3.5'-5'	Brown, mottled dark brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand	14.3	118.3						4009	5.1		PP = >4.5 tsf
B026	SPT-1	8.5'-10'	Brown, spotted gray and reddish brown LEAN CLAY	23.3										
B026	ST-2	13.5'-15'	Brown, spotted gray, dark gray, black and reddish brown LEAN CLAY with some weathered shale particles	20.5	109.4						1367	16.5		PP = 1.0 tsf
B026	SPT-2	18.5'-20'	Brown, mottled gray LEAN CLAY	18.2										
B026	ST-3	23.5'-25'	Brown, spotted gray, speckled reddish brown LEAN CLAY with some weathered shale	15.1	117.3						1980	8.6		PP = 2.0 tsf
B026	ST-4	33.5'-35'	Brown, spotted gray, speckled black and reddish brown LEAN CLAY with weathered shale	19.2	107.3						2998	6.5		PP = 2.5 tsf

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PROJECT NAME: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)
PROJECT NUMBER: 15-328T
PROJECT LOCATION:
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B027	SPT-1	6'-7.5'	Brown LEAN CLAY	12.9										
B027	SPT-2	11'-12.5'	Brown LEAN CLAY	15.7										
B027	SPT-3	16'-17.5'	Brown, spotted reddish brown and gray LEAN CLAY	14.8										
B027	SPT-4	21'-22.5'	Brown, mottled reddish brown and gray LEAN CLAY	17.2										
B027	SPT-6	31'-32.5'	Light brown, mottled gray LEAN CLAY	16.7										
B027	SPT-8	41'-42.5'	Light brown, spotted reddish brown and black LEAN CLAY	19.6										
B027	SPT-10	51'-52.5'	Light brown LEAN CLAY	22.8										

Summary of Laboratory Testing

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PROJECT LOCATION:

PROJECT NUMBER: 15-328T
DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B028	SPT-1	6'-7.5'	Brown LEAN CLAY with trace of gravel	18.6										
B028	SPT-3	16'-17.5'	Brown, spotted reddish brown and gray LEAN CLAY	20.1										
B028	SPT-5	26'-27.5'	Light brown, speckled gray LEAN CLAY	21.5										
B028	SPT-7	36'-37.5'	Light brown and light gray LEAN CLAY	23.2										

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B029	SPT-1	11.5'-2'	Brown, spotted gray LEAN CLAY with trace of gravel	15.8										
B029	SPT-2	21'-22.5'	Brown, spotted gray and reddish brown LEAN CLAY	17.7										
B029	SPT-3	31'-32.5'	Brown, mottled gray, spotted reddish brown LEAN CLAY	15.4										
B029	SPT-4	41'-42.5'	Light brown, mottled gray, spotted reddish brown LEAN CLAY	16.7										
B029	SPT-5	51'-52.5'	Light brown and reddish brown, spotted gray LEAN CLAY	17.0										
B029	SPT-6	60'-61.5'	Light brown, mottled reddish brown and gray LEAN CLAY	18.6										

Summary of Laboratory Testing

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DATE: 11/20/2015

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B030	SPT-1	11'-12.5'	Light brown, speckled reddish brown LEAN CLAY	16.5										
B030	SPT-2	21'.22.5'	Brown, spotted reddish brown and gray FAT CLAY with trace of gravel	17.3										
B030	SPT-3	31'-32.5'	Brown, mottled reddish brown and gray FAT CLAY	25.1										
B030	SPT-4	41'-42.5'	Grayish brown and black LEAN CLAY with coal fragments	17.8										

Summary of Laboratory Testing

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Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B031	SPT-1	3.5'-5'	Brown, spotted gray, speckled reddish brown and black LEAN CLAY with trace of gravel	14.8										
B031	SPT-2	8.5'-10'	Brown, spotted light gray LEAN CLAY	16.1										
B031	SPT-4	18.5'-20'	Brown, spotted reddish brown, speckled gray LEAN CLAY	18.2										
B031	SPT-6	28.5'-30'	Brown, speckled gray LEAN CLAY	16.2										
B031	SPT-8	38.5'-40'	Light brown, mottled reddish brown, spotted light gray LEAN CLAY	20.1										
B031	SPT-10	48.5'-50'	Light brown, mottled reddish brown and gray FAT CLAY with trace of sand	23.7										
B031	SPT-12	58.5'-60'	Gray, mottled brown, spotted reddish brown LEAN CLAY	13.1										

Summary of Laboratory Testing

SLT 22205

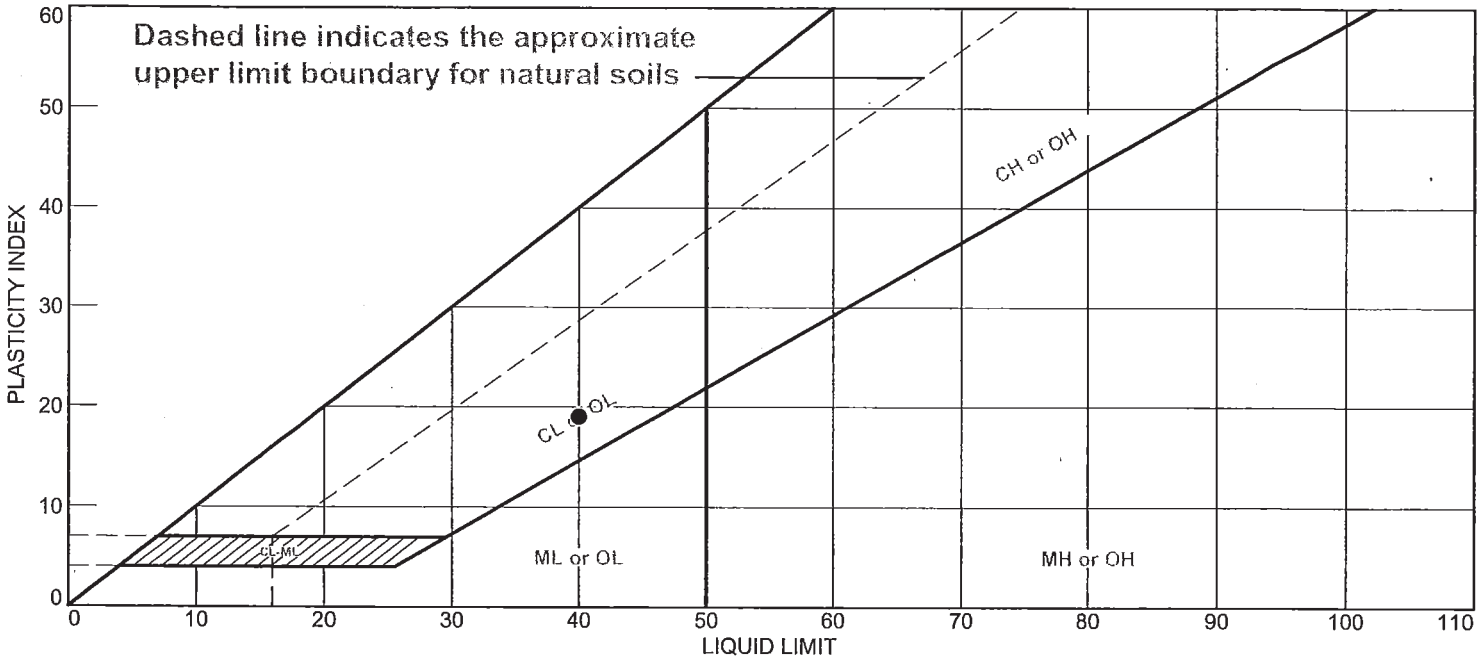
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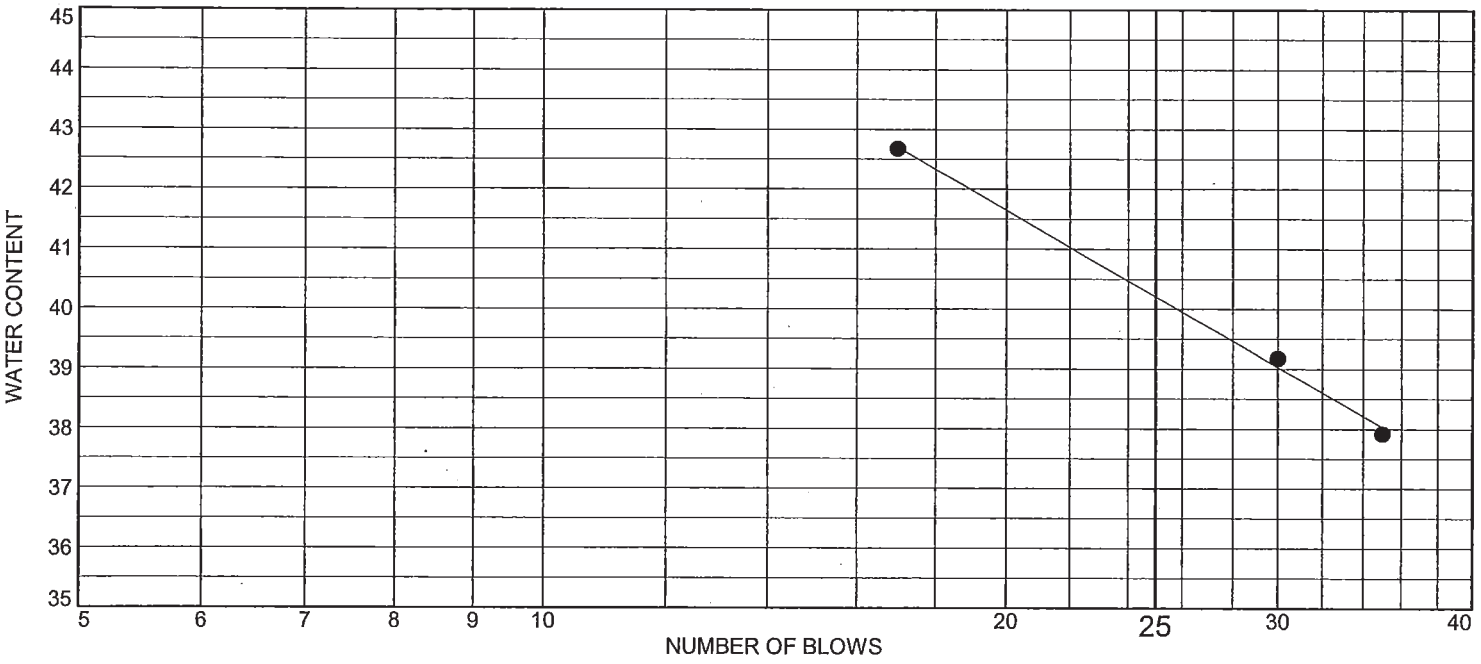
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Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL	PL	PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression PSF	%e	% Swell	Remarks
B032	SPT-1	3.5'-5'	Light reddish brown, spotted gray LEAN CLAY	17.0										
B032	SPT-2	8.5'-10'	Light brown, mottled reddish brown LEAN CLAY	21.9										
B032	SPT-3	13.5'-15'	Light brown, spotted reddish brown and gray LEAN CLAY with trace of gravel	24.3										
B032	SPT-4	18.5'-20'	Light brown LEAN CLAY	24.8										
B032	SPT-5	23.5'-25'	Light brown, mottled gray LEAN CLAY	24.8										
B032	SPT-6	28.5'-30'	Light brown, spotted reddish brown and gray LEAN CLAY	25.0										
B032	SPT-7	33.5'-35'	Gray and brown, spotted reddish brown LEAN CLAY with trace of shale	14.3										
B032	SPT-8	38.5'-40'	Gray and brown LEAN CLAY with trace of shale and gravel	17.3										

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, spotted grayish brown LEAN CLAY	40	21	19			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B017 SPT-1 **Depth:** 6.5'-7'

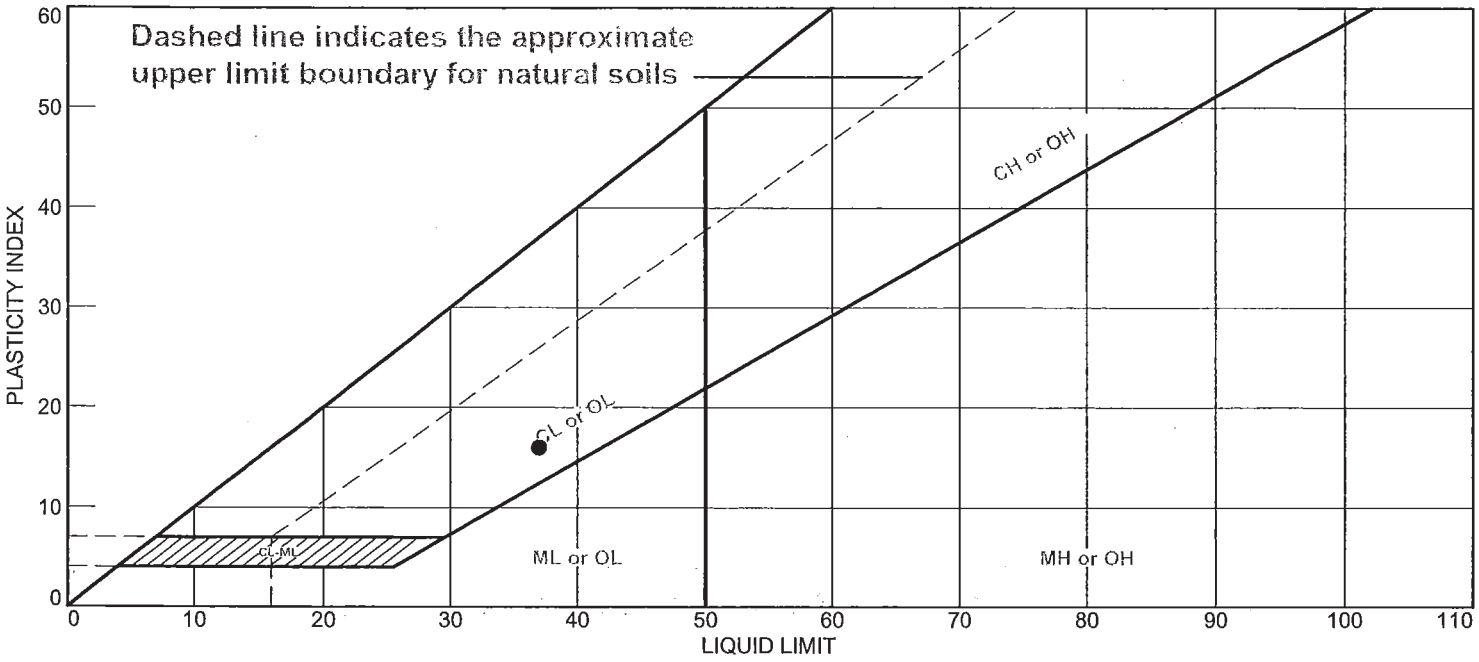
Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: T.B. **Checked By:** T.T.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, mottled light brown LEAN CLAY	37	21	16			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B017 SPT-3 **Depth:** 16'-17.5'

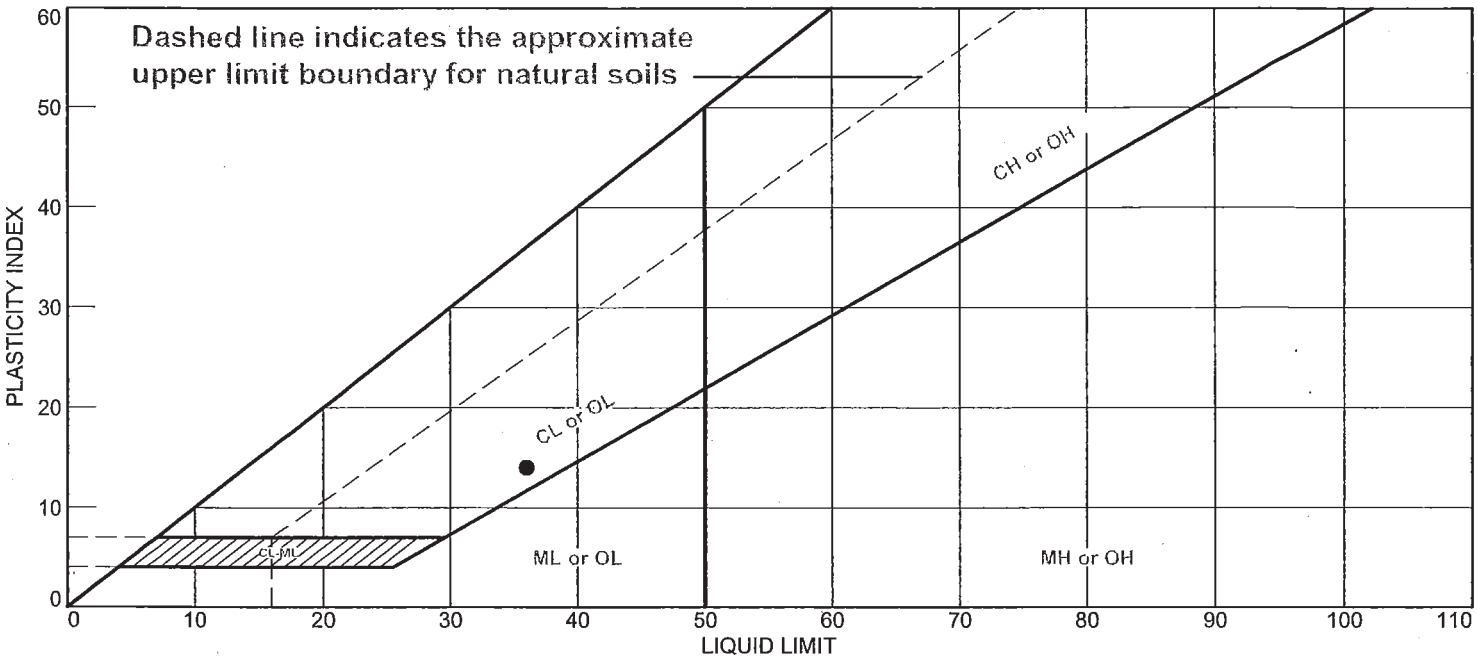
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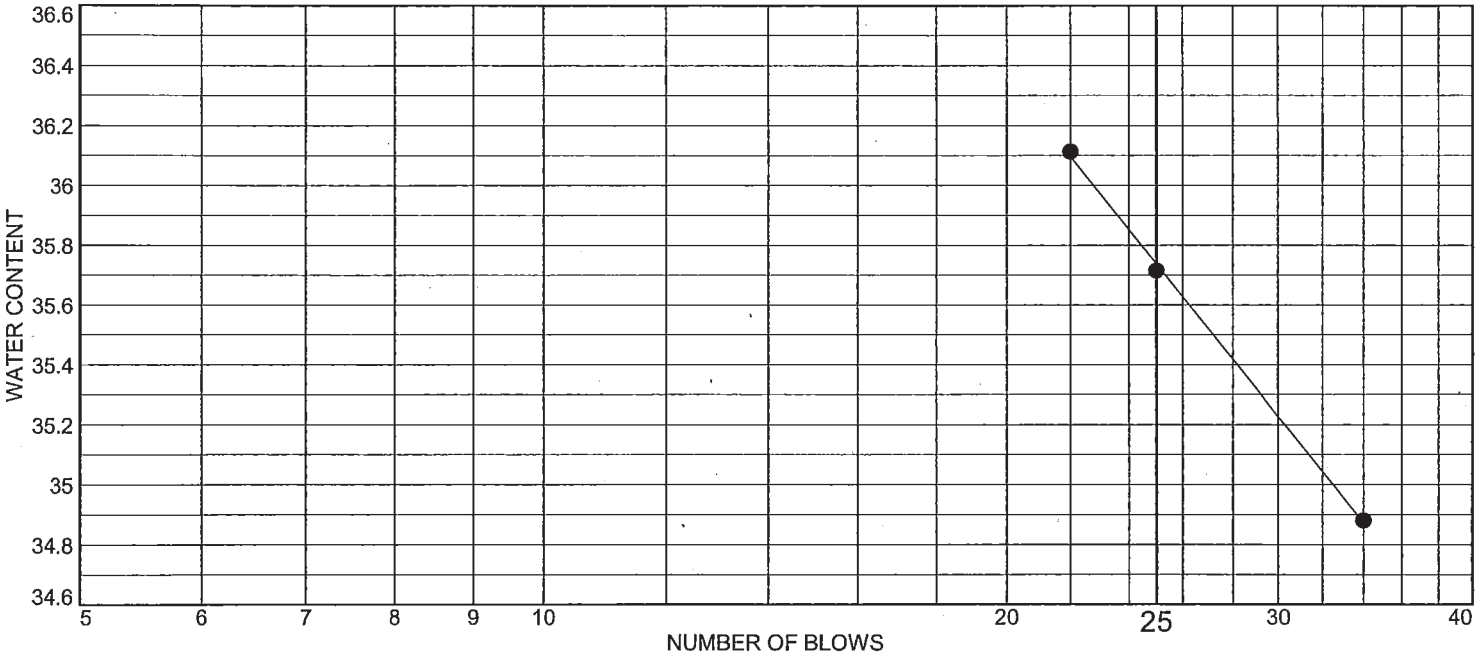
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.T.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light brown, mottled reddish brown, speckled gray LEAN CLAY	36	22	14			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B017 SPT-9 **Depth:** 46'-47.5'

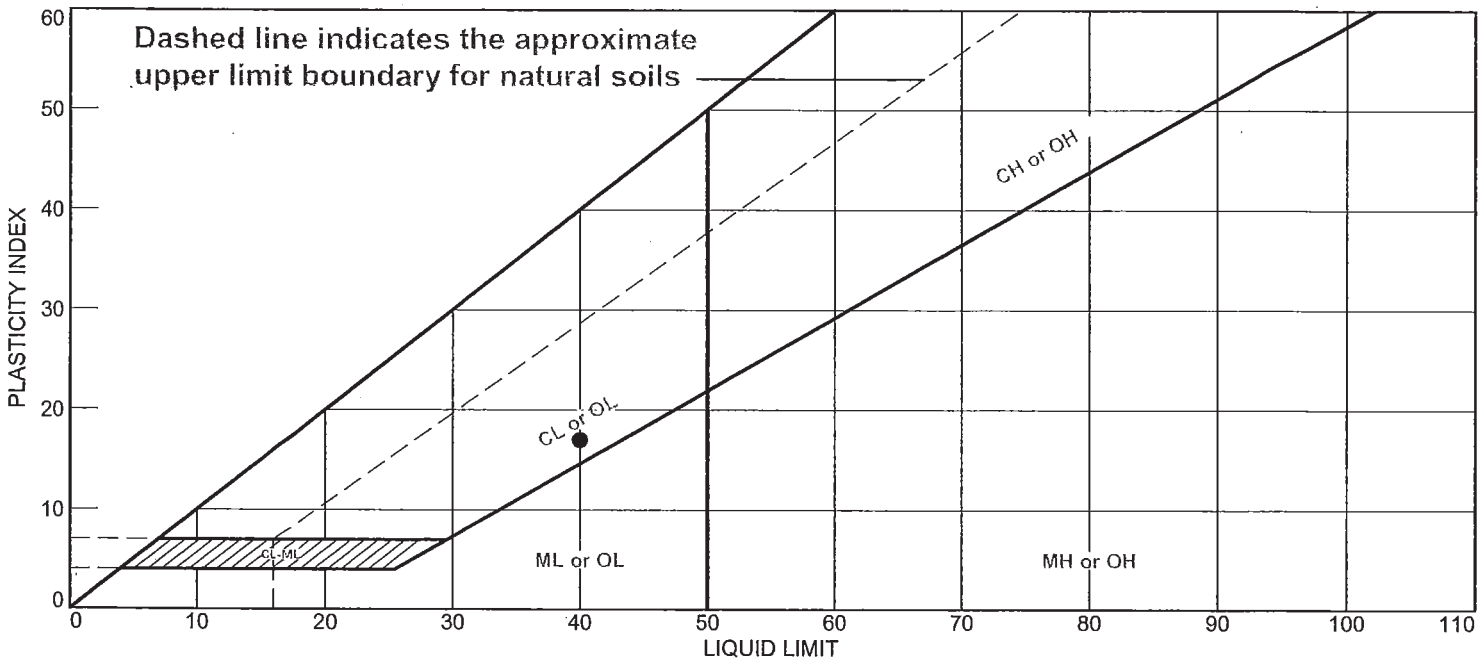
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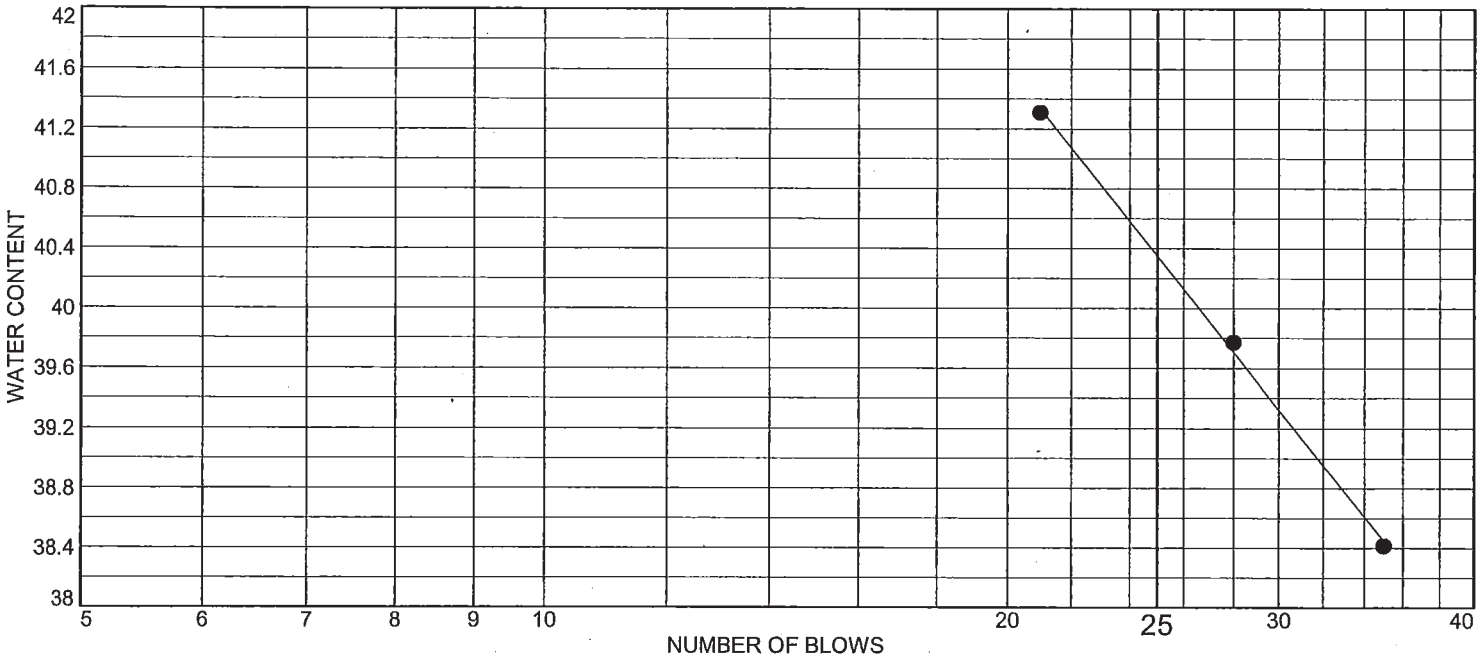
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, mottled dark brown, spotted black and gray LEAN CLAY with trace of organics	40	23	17			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B019 ST-1 **Depth:** 3.5'-5'

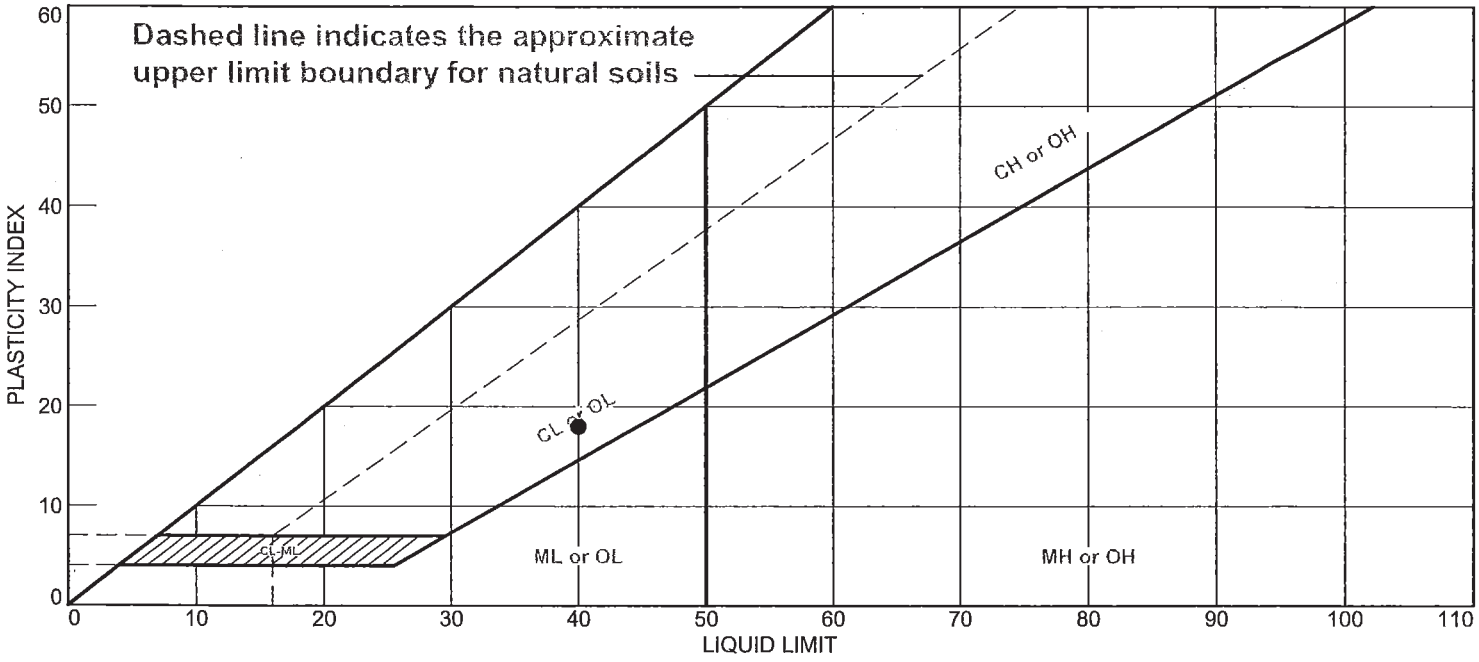
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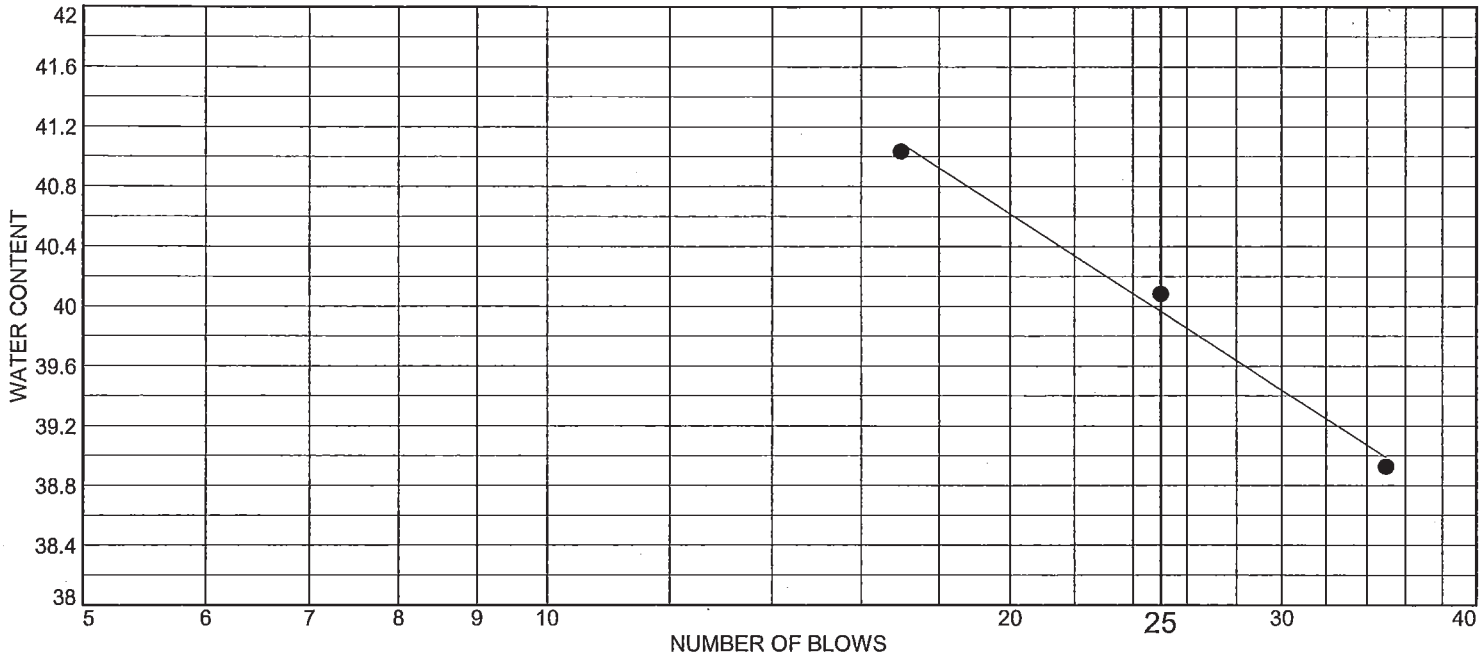
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown, spotted black, speckled reddish brown LEAN CLAY	40	22	18			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B019 ST-2 **Depth:** 14.25'-15'

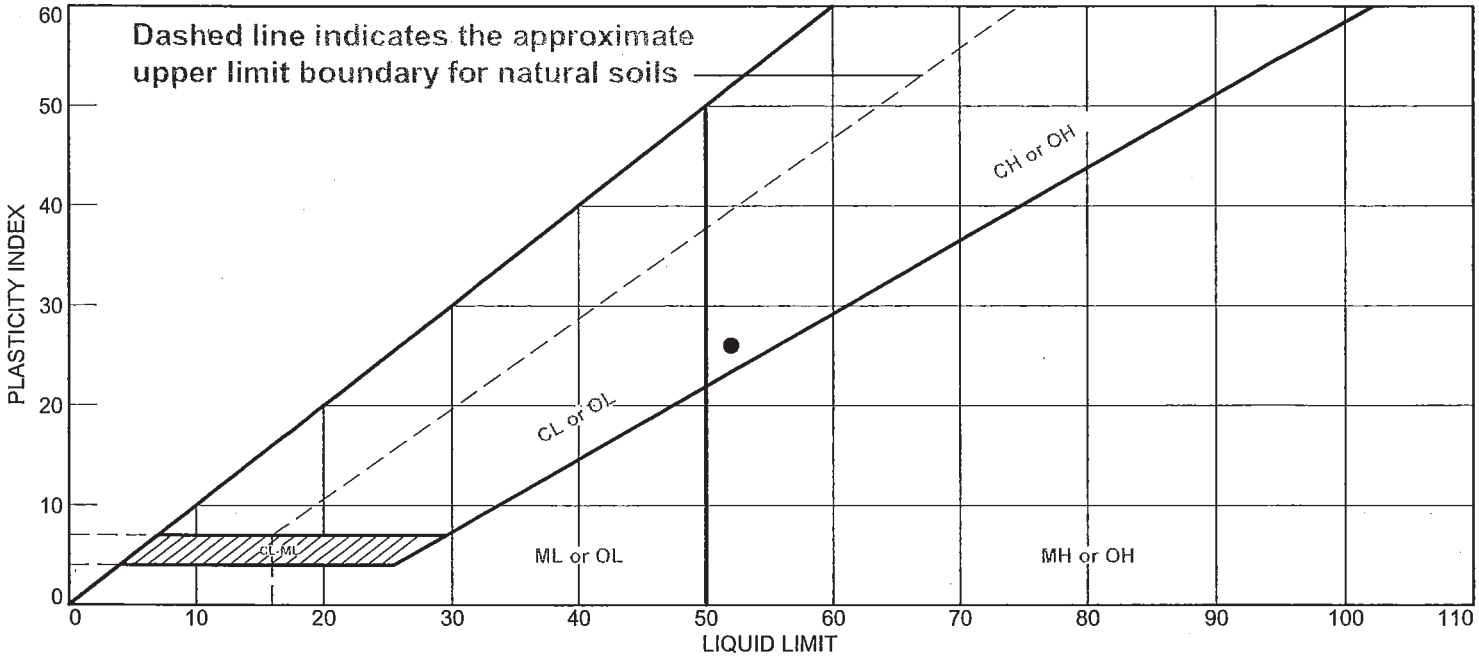
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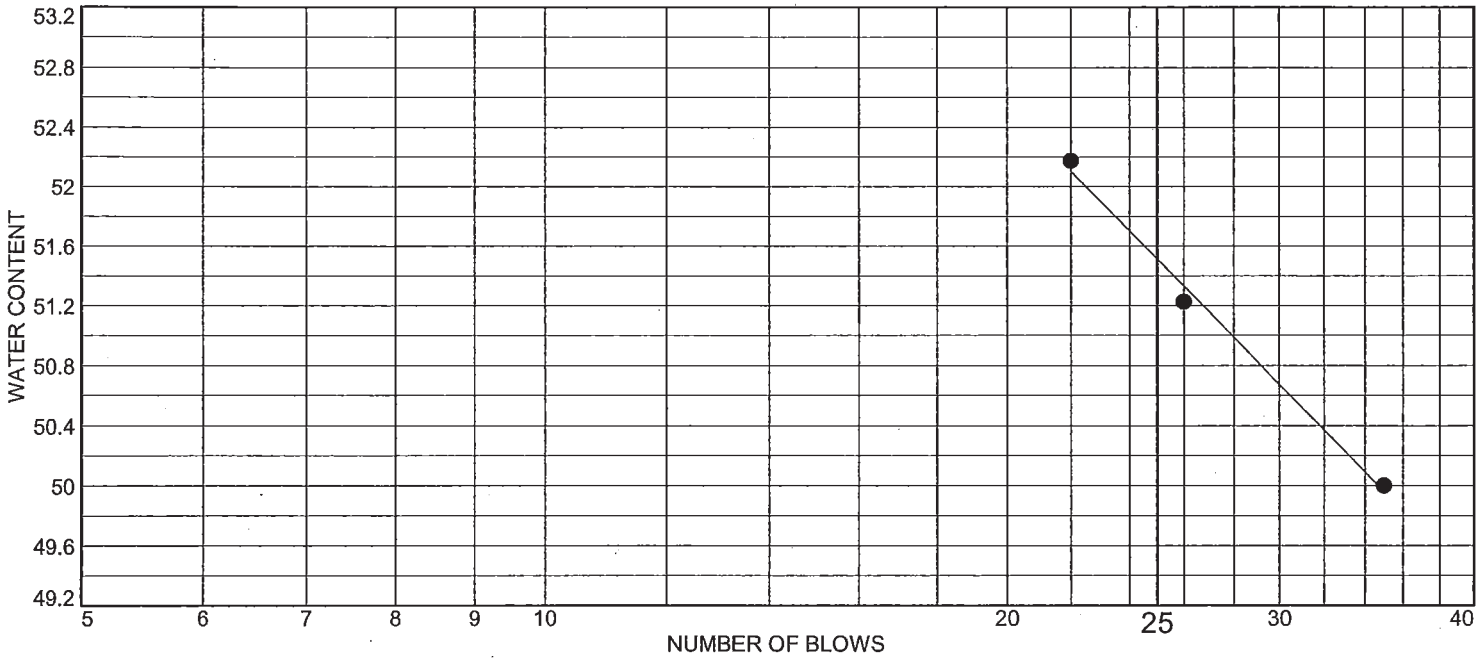
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, mottled black, speckled reddish brown FAT CLAY with weathered shale and coal fragments	52	26	26			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B019 ST-3 **Depth:** 33.5'-34'

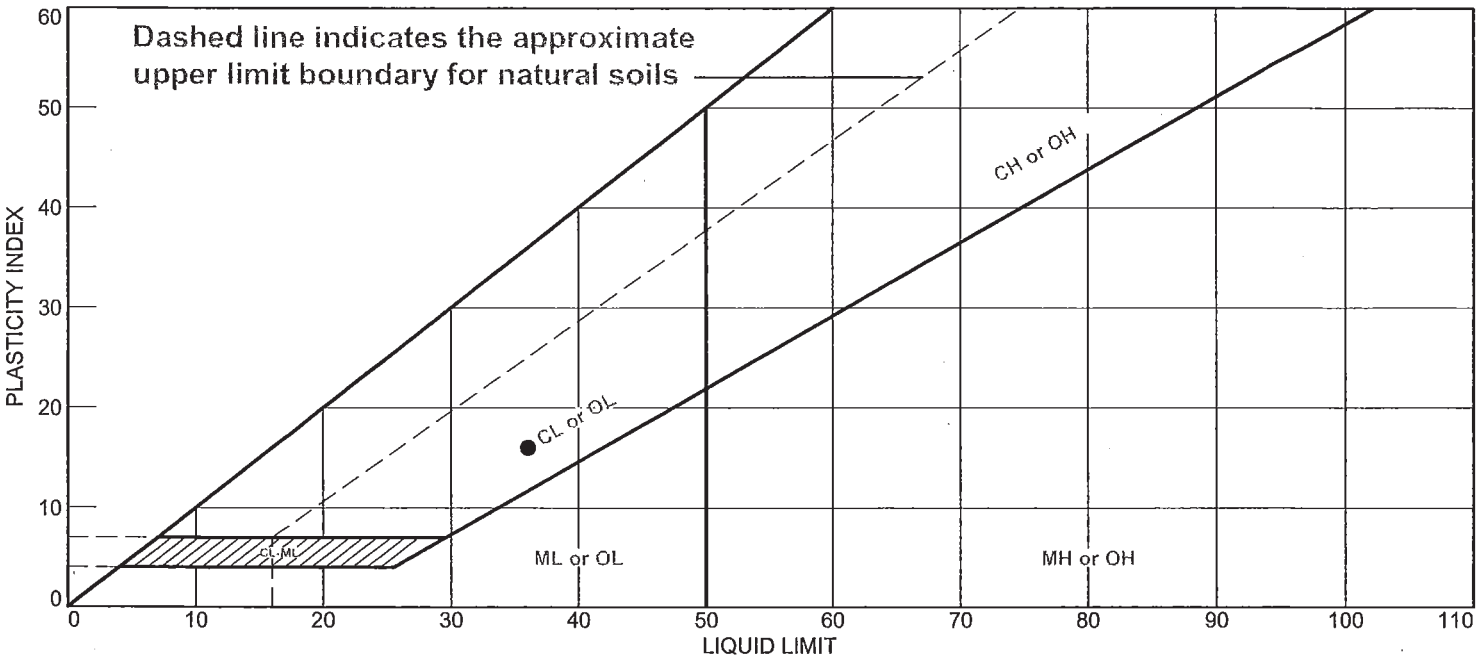
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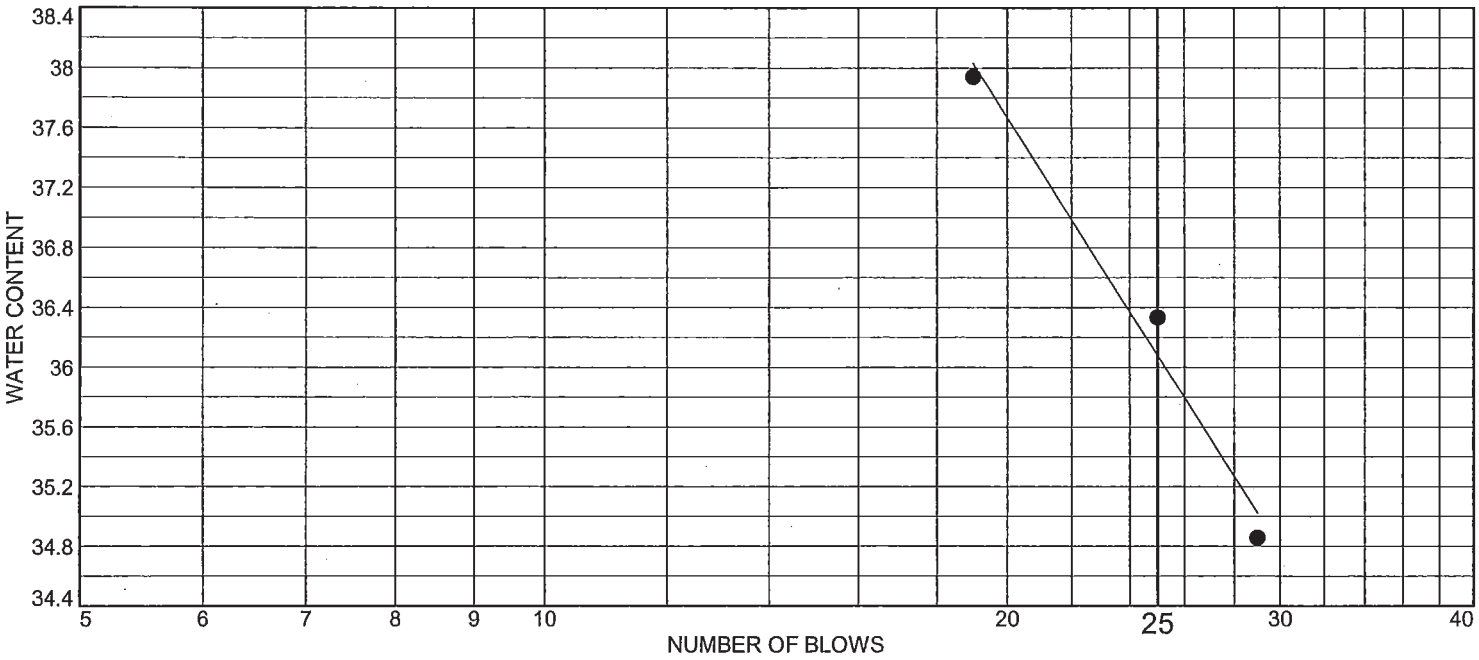
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, mottled dark brown LEAN CLAY with weathered shale	36	20	16			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B019 ST-4 **Depth:** 43.5'-45'

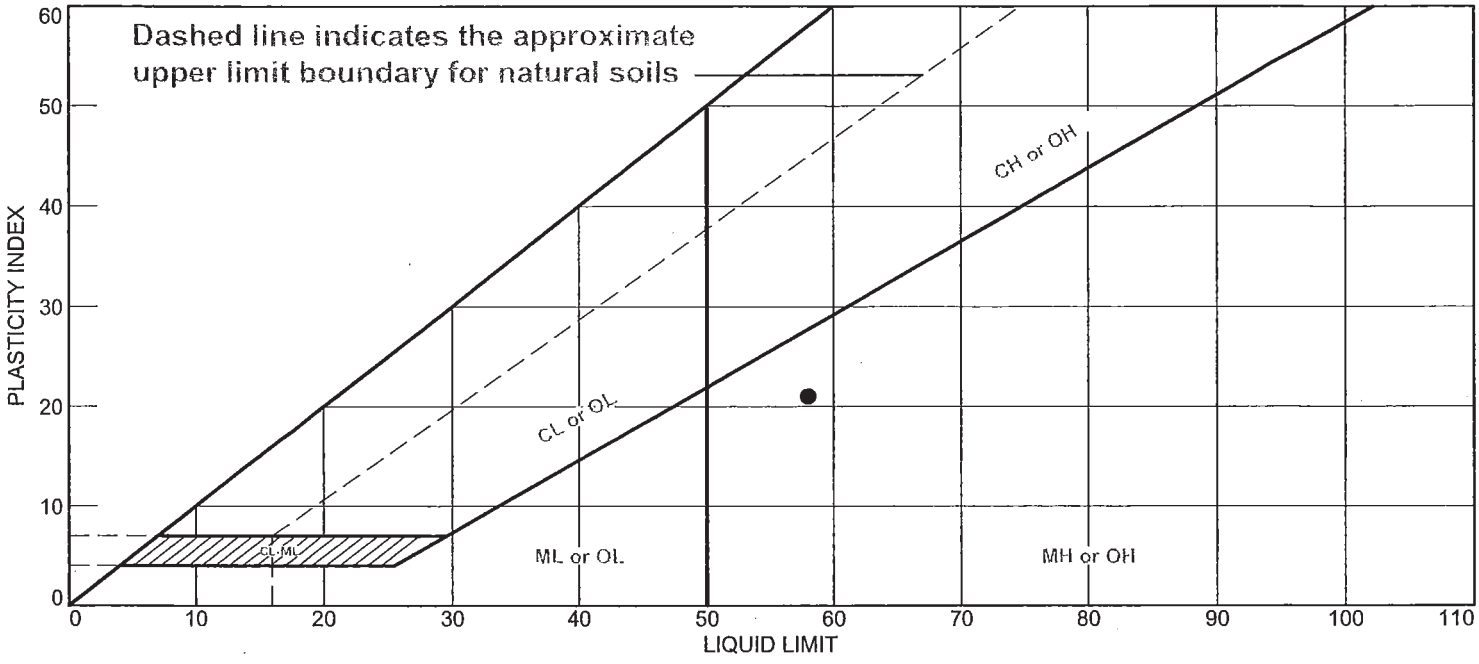
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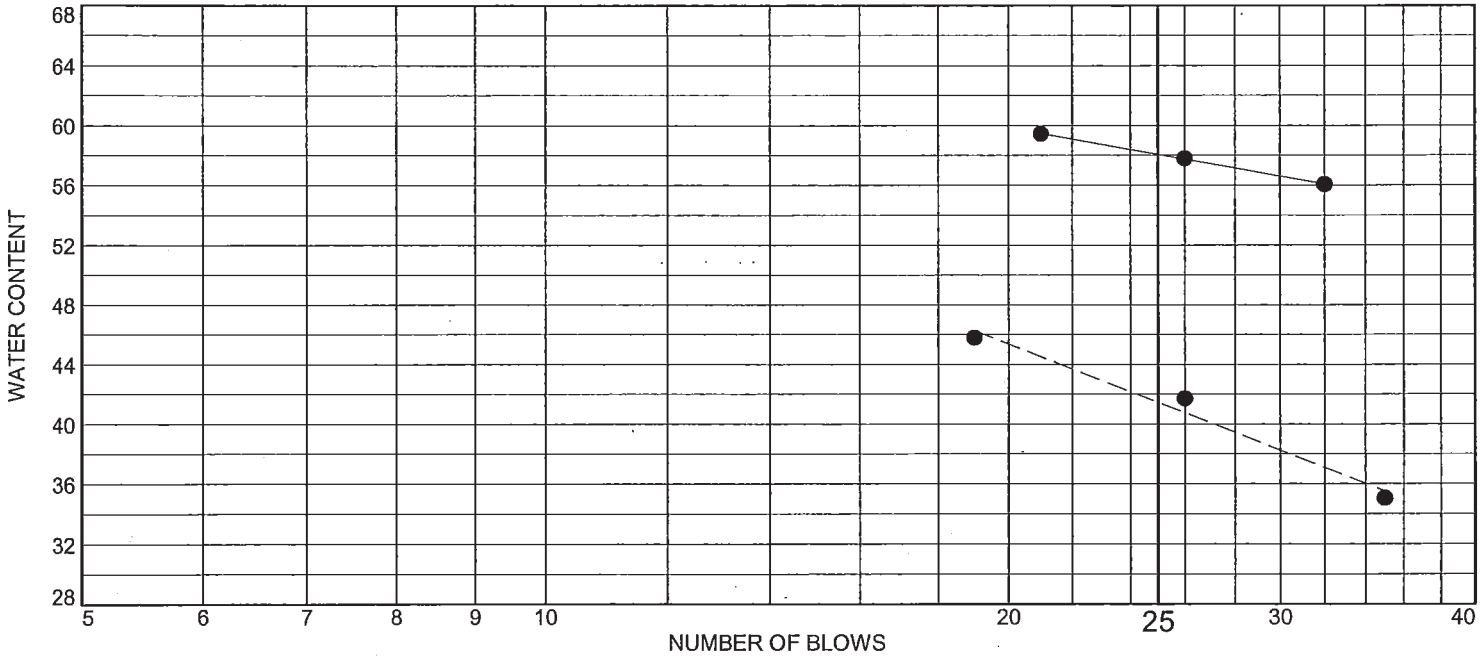
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown, mottled blue gray organic silt with some weathered shale	58	37	21			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B019 ST-5 **Depth:** 53'-55'

ALPHA-OMEGA GEOTECH

Remarks:

● Liquid limit after oven drying exhibited a value less than 75% of the original liquid limit before drying.

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMIT TEST DATA

11/23/2015

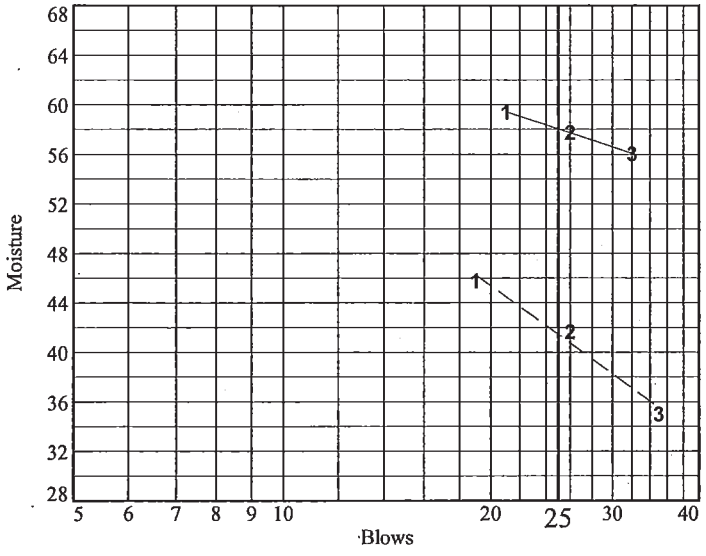
Client: AECOM
Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)
Project Number: 15-328T
Depth: 53'-55' **Sample Number:** B019 ST-5
Material Description: Dark brown, mottled blue gray organic silt with some weathered shale
Tested by: D.B. **Checked by:** T.B.
Testing Remarks: Liquid limit after oven drying exhibited a value less than 75% of the original liquid limit before drying.

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	57.41	62.72	64.80			
Dry+Tare	54.92	58.04	59.62			
Tare	50.73	49.94	50.38			
# Blows	21	26	32			
Moisture	59.4	57.8	56.1			

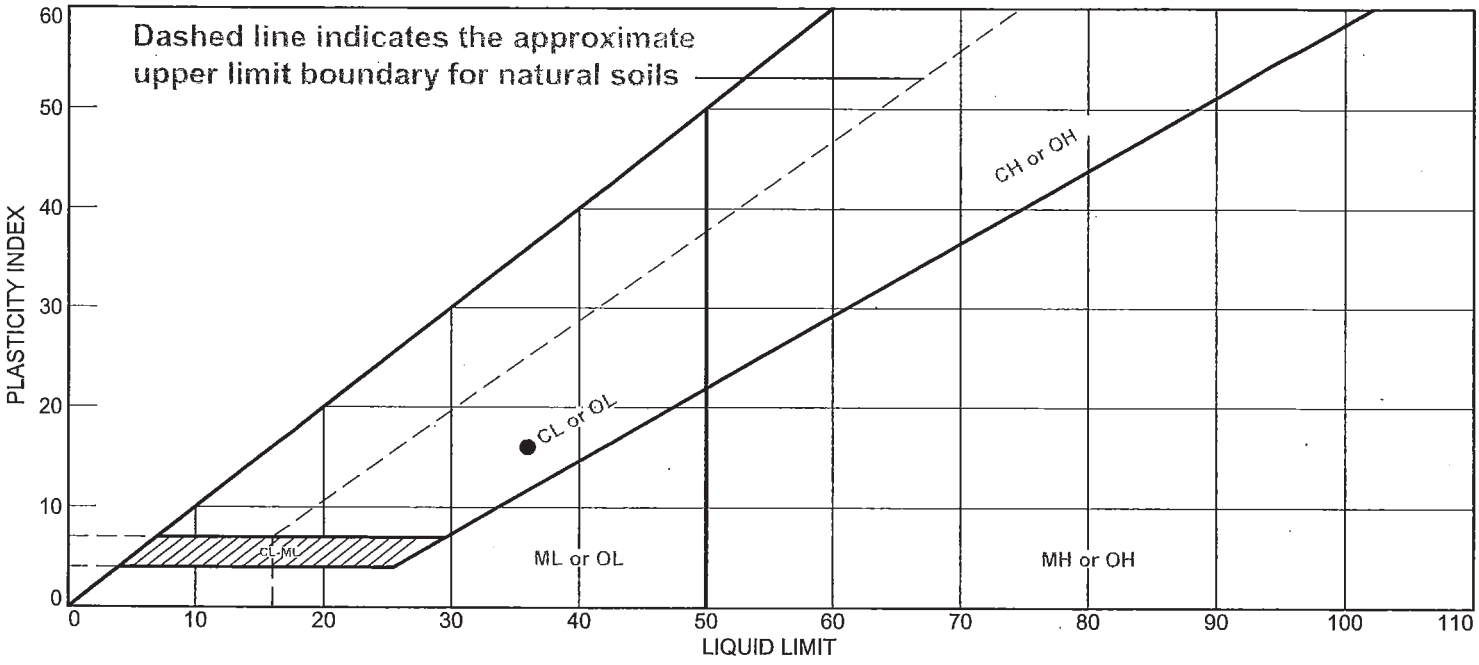
Organics Liquid Limit Data

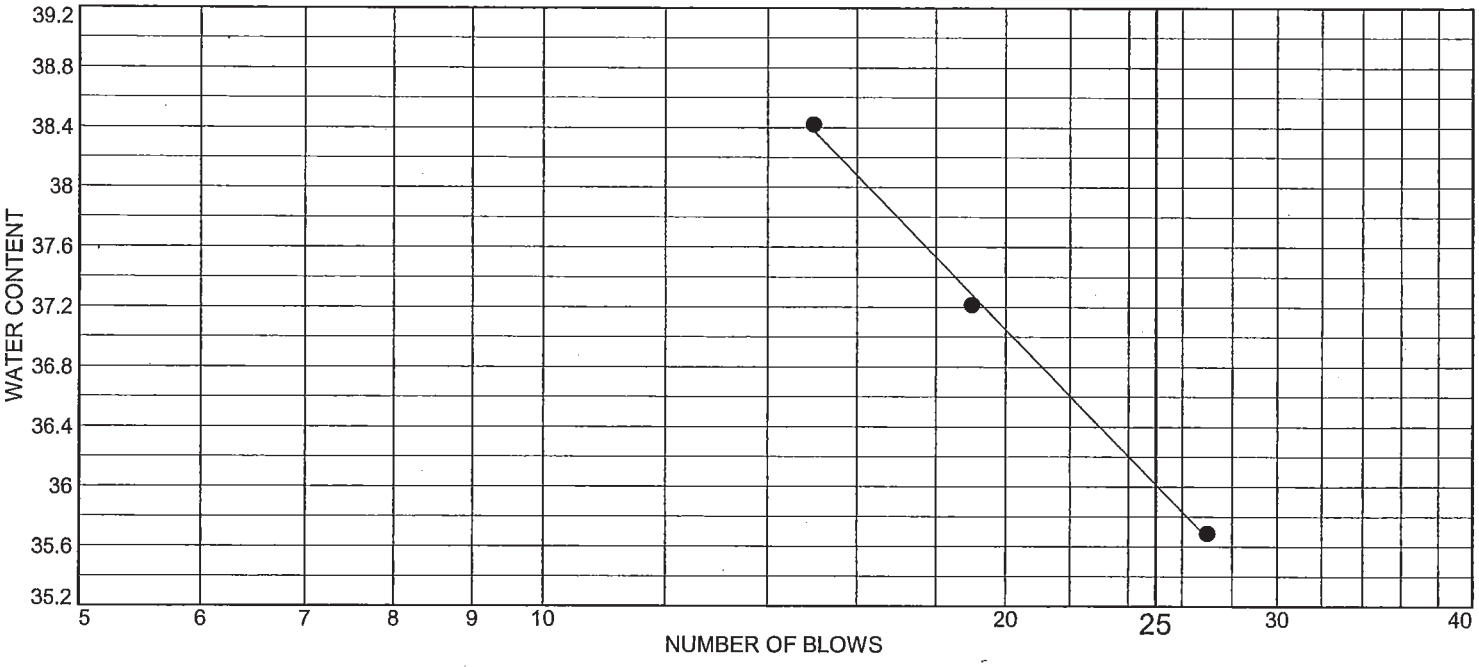
Run No.	1	2	3	4	5	6
Wet+Tare	18.18	23.52	18.32			
Dry+Tare	15.89	19.98	16.40			
Tare	10.89	11.49	10.92			
# Blows	19	26	35			
Moisture	45.8	41.7	35.0			



Liquid Limit= 58
Liquid Limit (organics)= 41
Plastic Limit= 37
Plasticity Index= 21

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, mottled gray, spotted reddish brown, speckled black LEAN CLAY with weathered shale fragments and trace of organics	36	20	16			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B020 ST-1 **Depth:** 3.5'-5'

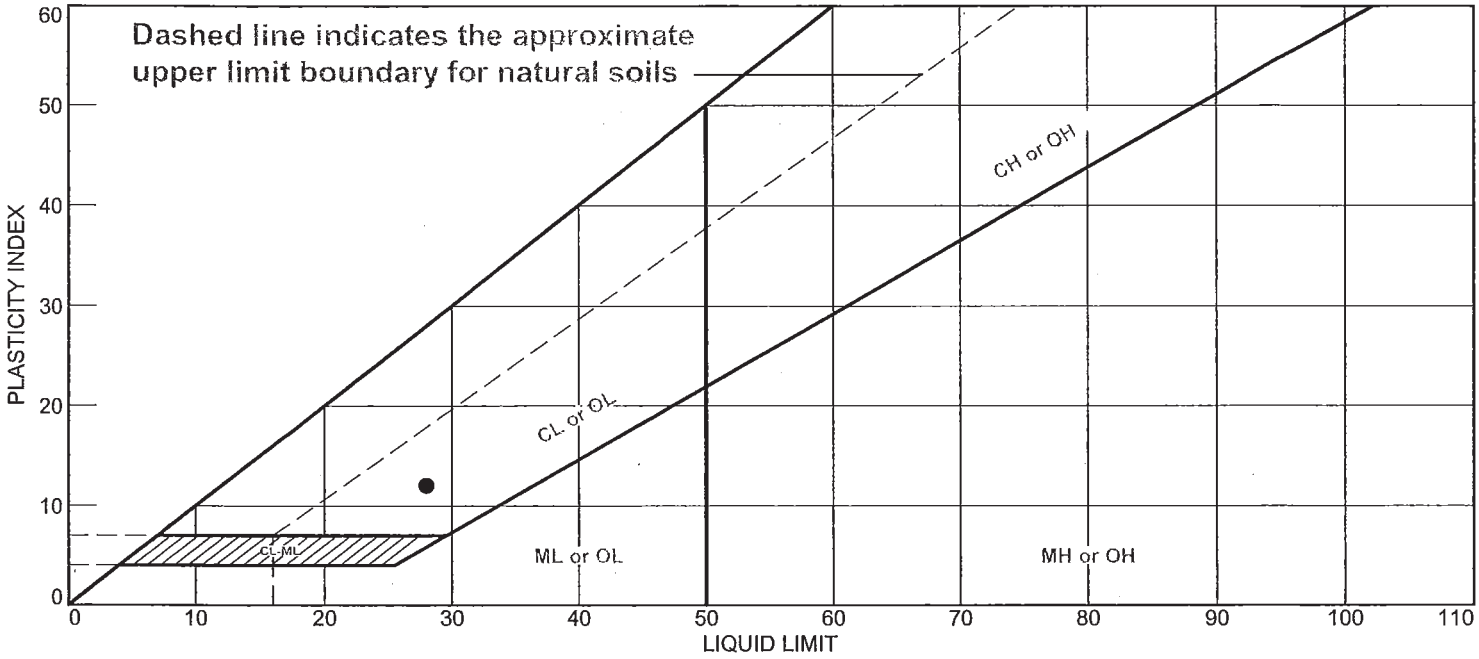
Remarks:

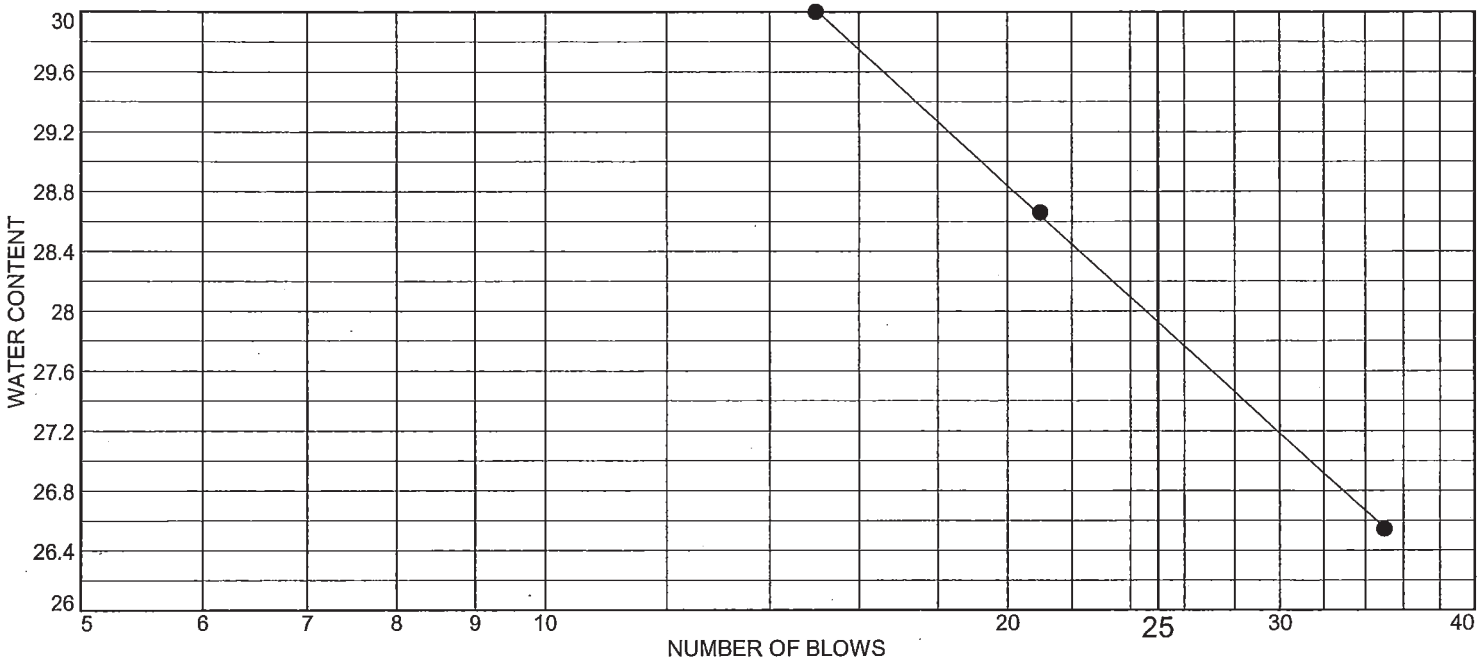
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light blue and gray, mottled light olive brown, speckled reddish brown and black LEAN CLAY with trace of weathered shale and coal fragments	28	16	12			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B020 ST-2 **Depth:** 13.5'-15'

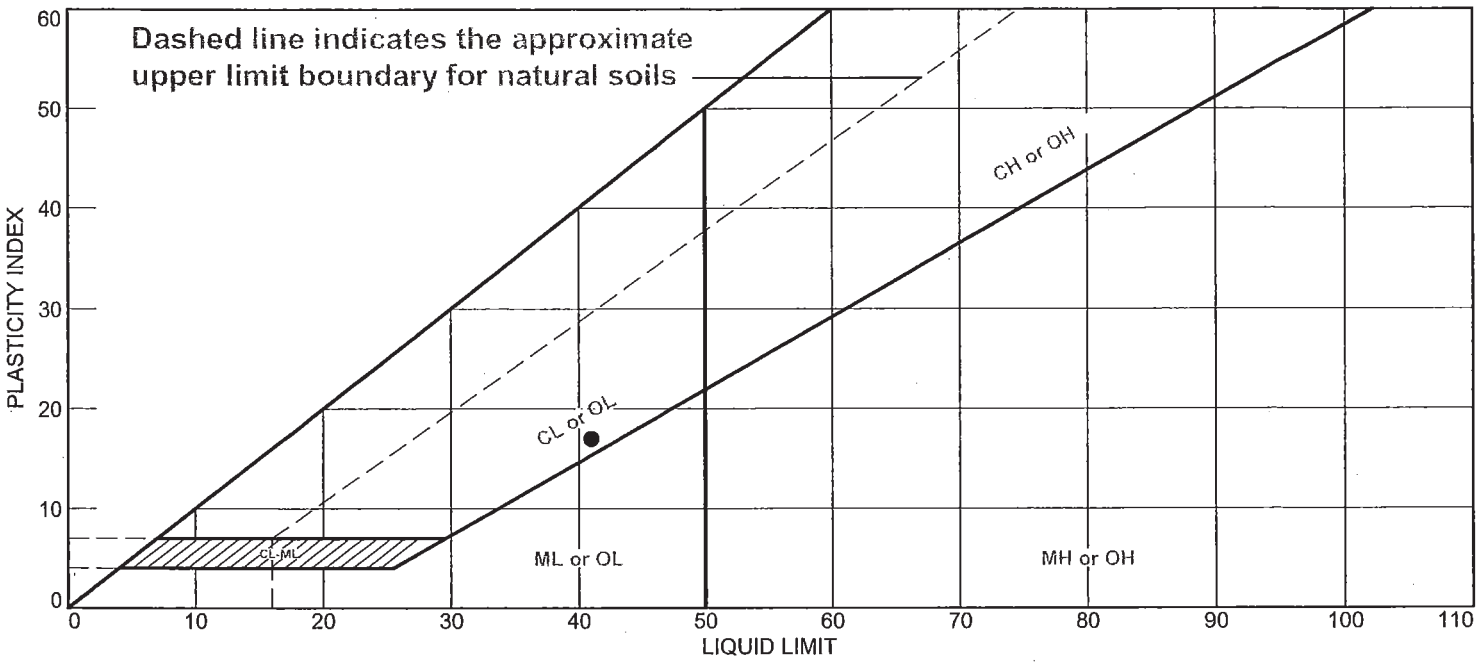
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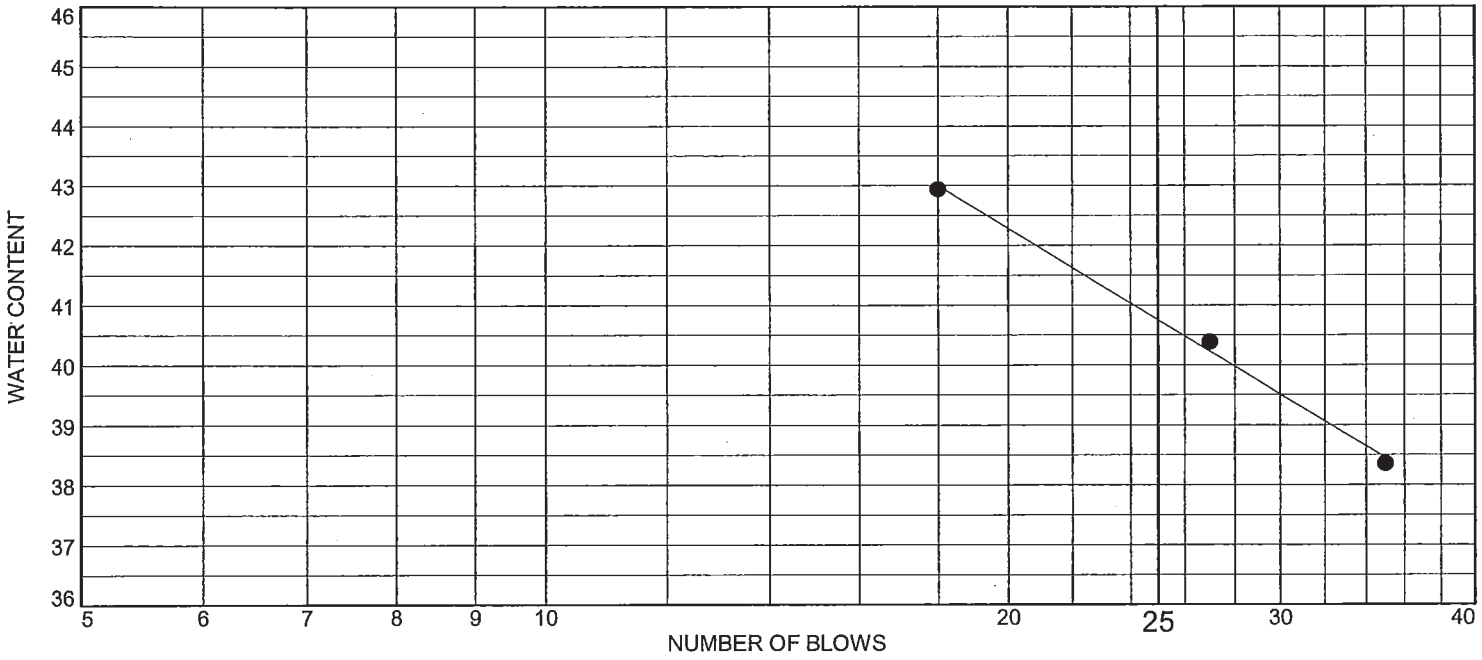
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray, spotted reddish brown LEAN CLAY (weathered shale)	41	24	17			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B020 ST-3 **Depth:** 23.5'-25'

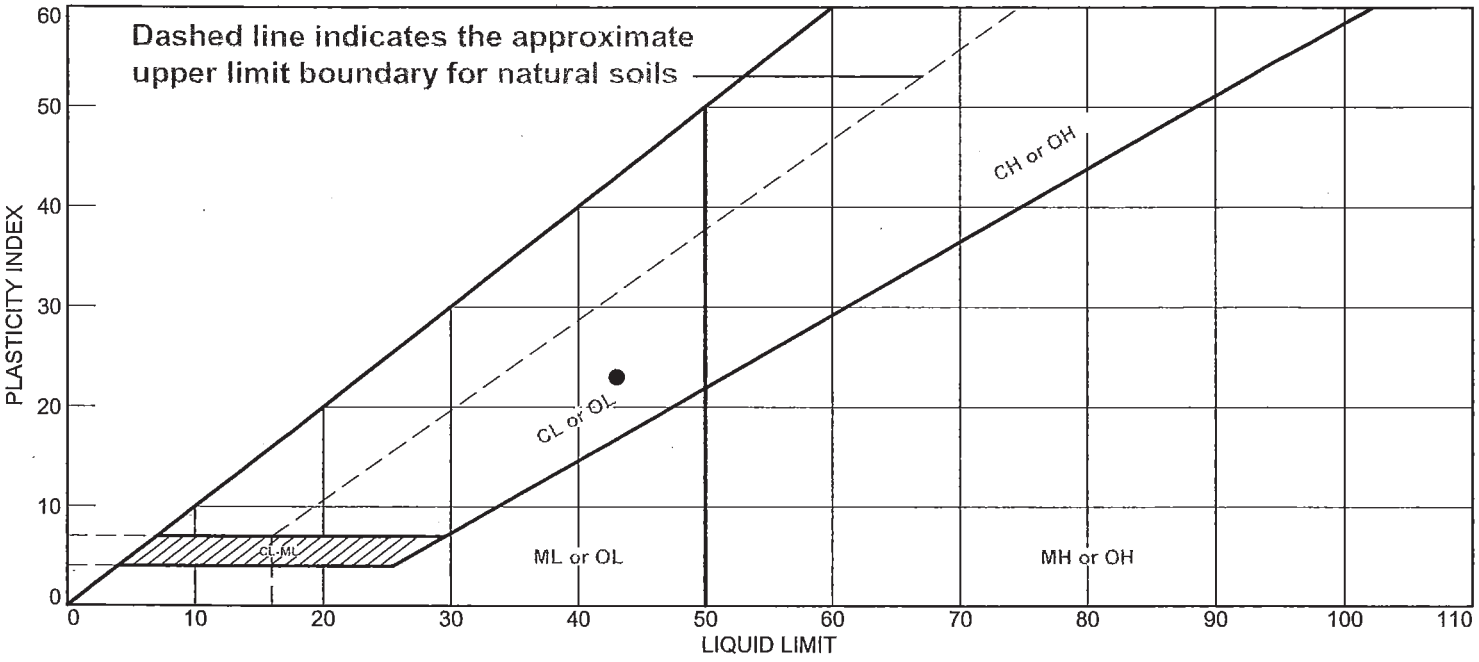
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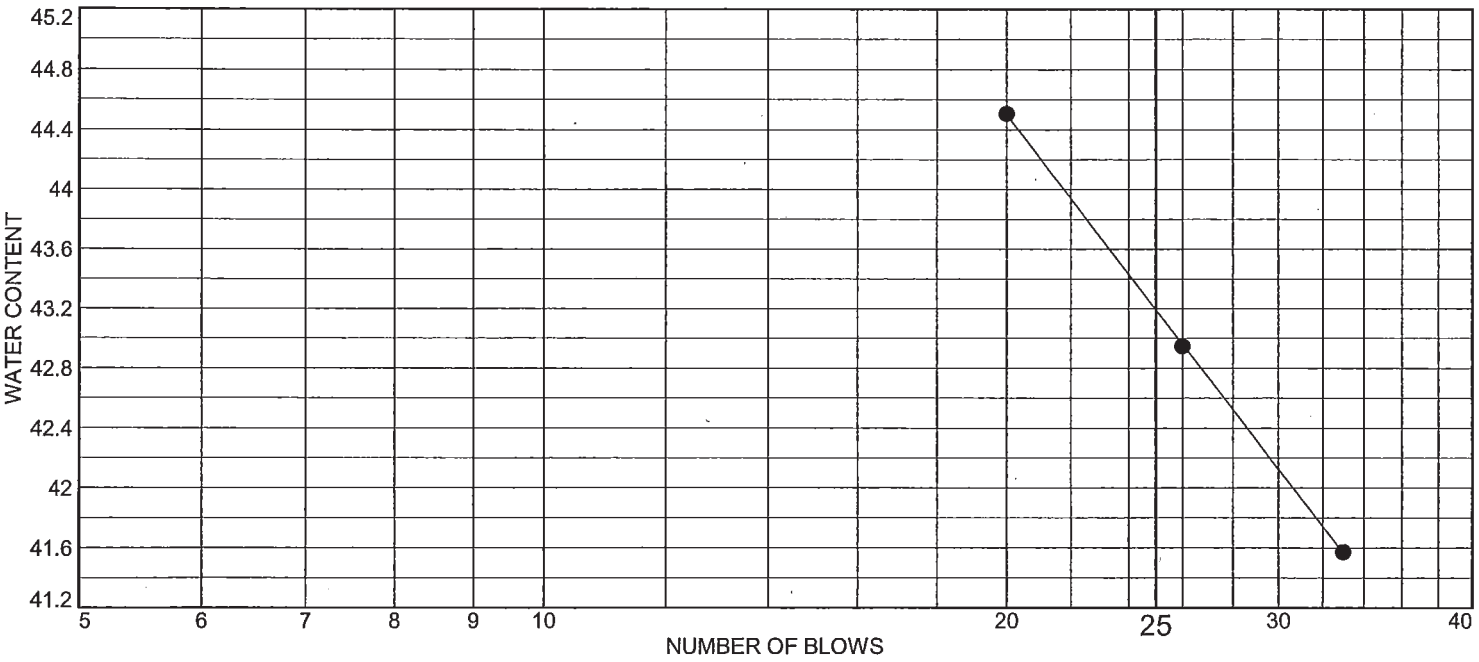
ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: D.B. **Checked By:** T.B.

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light blue gray, spotted brown and reddish brown LEAN CLAY with trace of fine sand	43	20	23			

Project No. 15-328T **Client:** AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B020 ST-4 **Depth:** 33.5'-35'

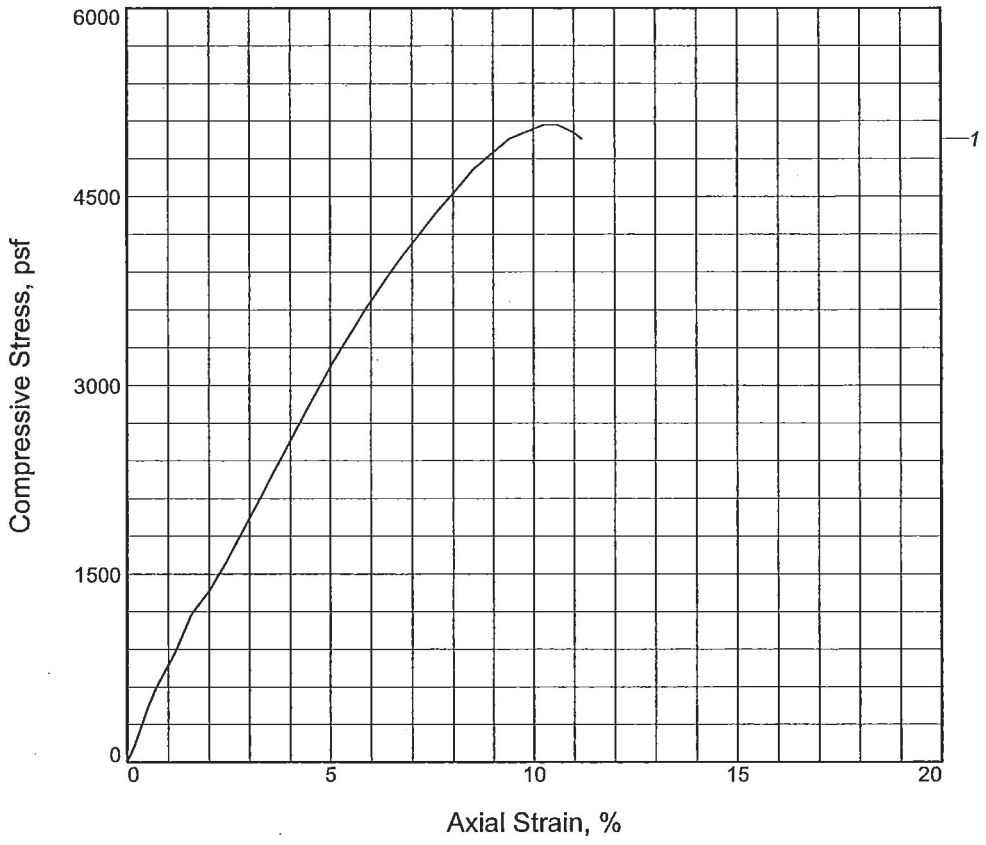
Remarks:

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: T.B. **Checked By:** T.T.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	5070			
Undrained shear strength, psf	2535			
Failure strain, %	10.6			
Strain rate, in./min.	0.08			
Water content, %	19.1			
Wet density, pcf	129.2			
Dry density, pcf	108.4			
Saturation, %	93.1			
Void ratio	0.5548			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Brown, mottled dark brown, spotted black and gray LEAN CLAY with trace of organics

LL = 40	**PL** = 23	**PI** = 17	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

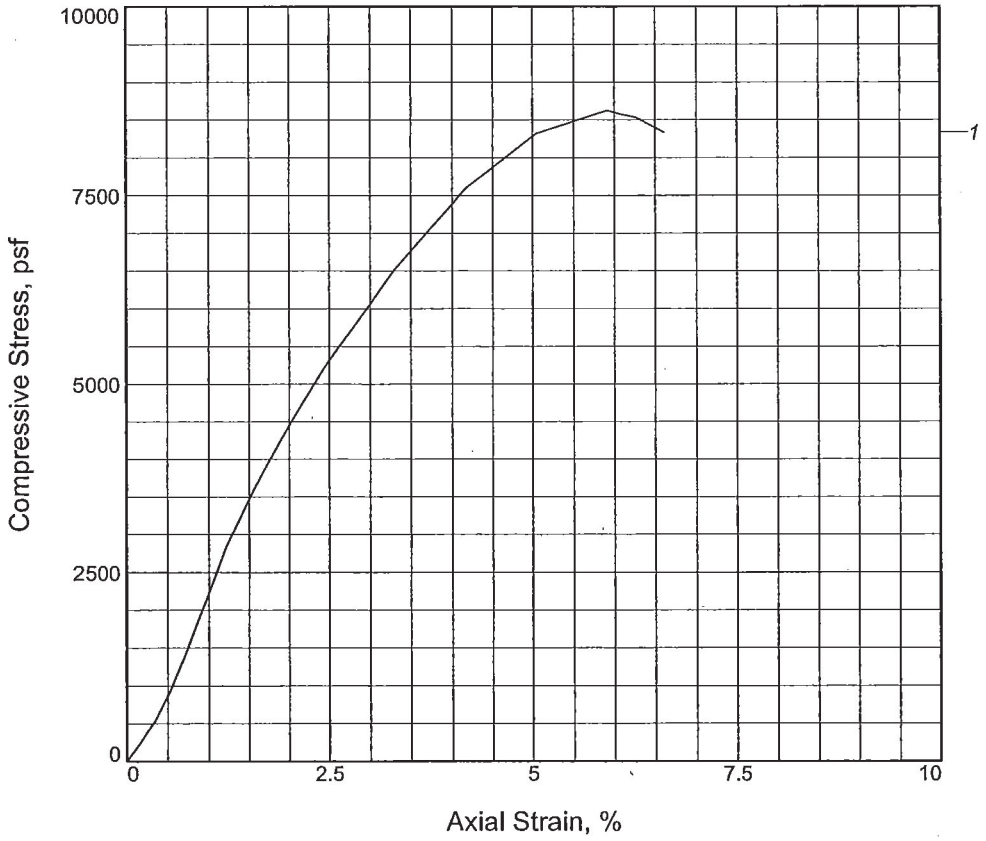
Sample Number: B019 ST-1 **Depth:** 3.5'-5'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	8624			
Undrained shear strength, psf	4312			
Failure strain, %	5.9			
Strain rate, in./min.	0.08			
Water content, %	17.7			
Wet density, pcf	126.7			
Dry density, pcf	107.6			
Saturation, %	84.4			
Void ratio	0.5658			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Dark brown, spotted black, speckled reddish brown LEAN CLAY

LL = 40	**PL** = 22	**PI** = 18	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B019 ST-2 **Depth:** 14.25'-15'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** GA

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME:	Dynegy CCR Ph 3/7 - Duck Creek (Ash Pond 2)	PROJECT NO.:	15-328T
LOCATION:			
BORING NO.:	B019	SAMPLE NO.: ST-4	DEPTH: 43.5' - 45'
SAMPLE TYPE:	Undisturbed	% COMPACTION:	

INITIAL DATA			FINAL DATA	
MOISTURE:	17.7 %		MOISTURE:	26.8 %
DRY UNIT WEIGHT:	104.3 pcf		DRY UNIT WEIGHT:	104.3 pcf
HEIGHT:	2.05 inches		HEIGHT:	2.05 inches
DIAMETER:	2.84 inches		DIAMETER:	2.84 inches
WEIGHT:	418.3 grams		WEIGHT:	450.6 grams
SATURATION:	77.6 %		SATURATION:	100.0 %

PERMEANT LIQUID:	Deaired tap water		
EFFECTIVE CONSOLIDATION STRESS:	Maximum 5.4 psi	Minimum	5.0 psi
BACK PRESSURE:	90 psi	RANGE OF HYDRAULIC GRADIENT:	4.2 to 3.8
SAMPLE DESCRIPTION:	Gray, mottled dark brown LEAN CLAY with weathered shale		

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
11/18/2015	1	12,720	22.0	19.8	26
11/18/2015	2	12,720	22.0	19.8	26
11/19/2015	3	12,720	22.0	19.8	26
11/19/2015	4	12,720	22.0	19.8	26
AVERAGE		12,720	22.0	19.8	26

k= 4.3E-07 cm/s

k20= 3.7E-07 cm/s

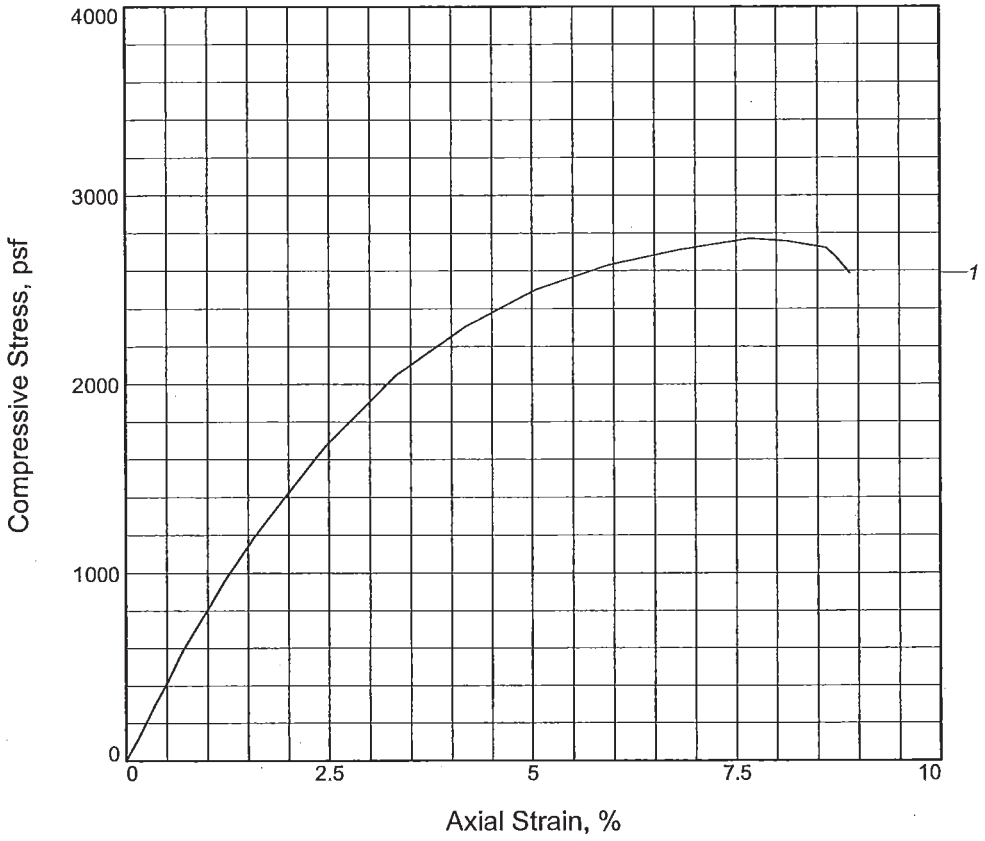
n/n20= 0.8694

k = Hydraulic Conductivity before n/n20 correction factor

k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2770			
Undrained shear strength, psf	1385			
Failure strain, %	7.7			
Strain rate, in./min.	0.08			
Water content, %	20.2			
Wet density, pcf	127.1			
Dry density, pcf	105.7			
Saturation, %	91.7			
Void ratio	0.5944			
Specimen diameter, in.	2.84			
Specimen height, in.	5.73			
Height/diameter ratio	2.02			

Description: Gray, mottled dark brown LEAN CLAY with weathered shale

LL = 36	**PL =** 20	**PI =** 16	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

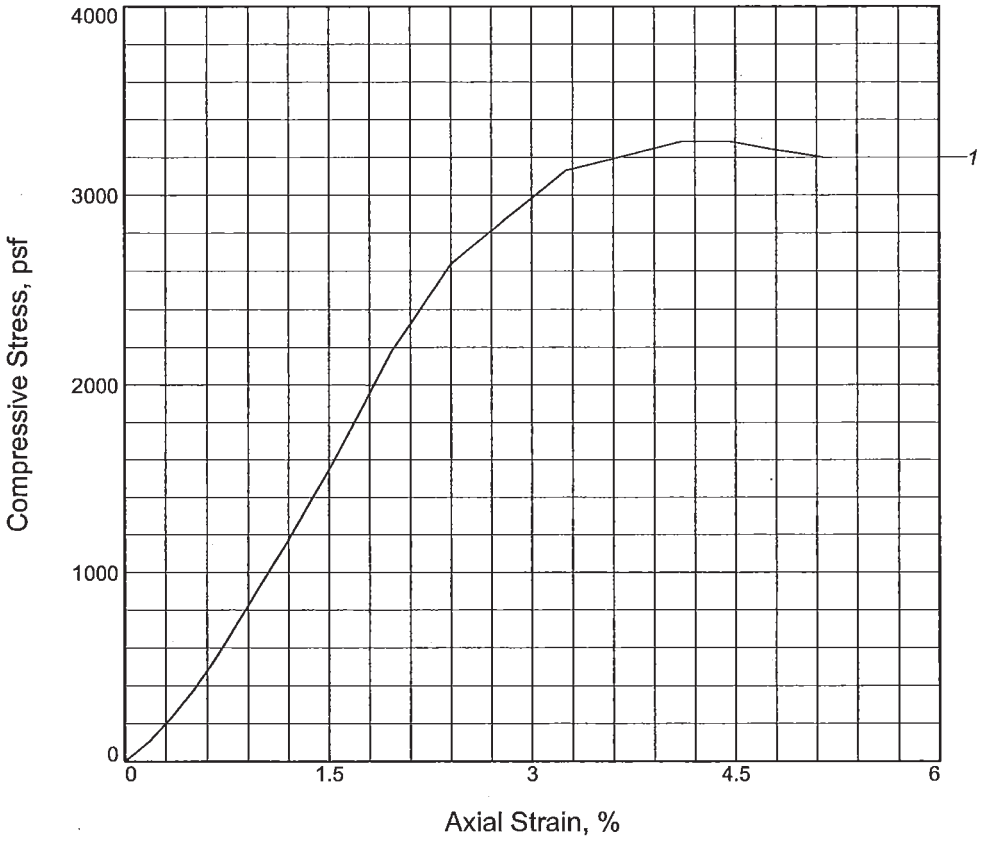
Sample Number: B019 ST-4 **Depth:** 43.5'-45'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	3285			
Undrained shear strength, psf	1642			
Failure strain, %	4.1			
Strain rate, in./min.	0.08			
Water content, %	39.7			
Wet density, pcf	105.9			
Dry density, pcf	75.8			
Saturation, %	87.7			
Void ratio	1.2240			
Specimen diameter, in.	2.87			
Specimen height, in.	5.84			
Height/diameter ratio	2.03			

Description: Dark brown, mottled blue gray organic silt with some weathered shale

LL = 58	**PL** = 37	**PI** = 21	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

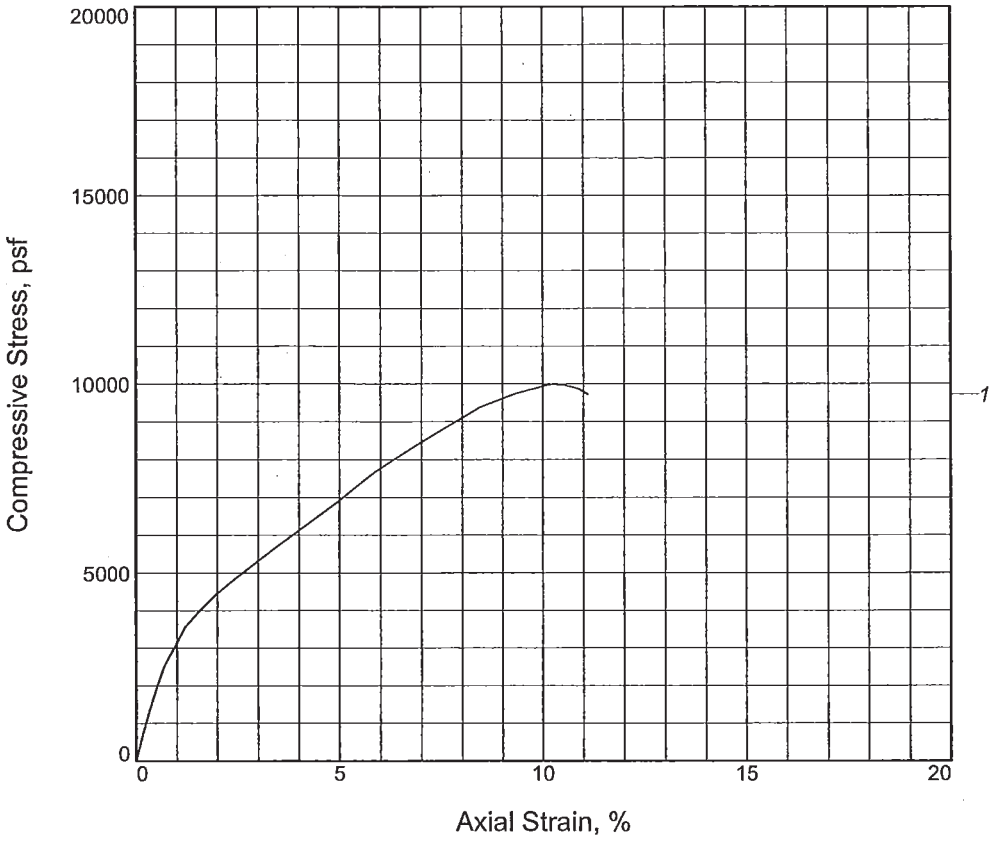
Sample Number: B019 ST-5 **Depth:** 53'-55'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	9985			
Undrained shear strength, psf	4992			
Failure strain, %	10.2			
Strain rate, in./min.	0.08			
Water content, %	17.7			
Wet density, pcf	128.5			
Dry density, pcf	109.2			
Saturation, %	87.8			
Void ratio	0.5430			
Specimen diameter, in.	2.86			
Specimen height, in.	5.79			
Height/diameter ratio	2.02			

Description: Brown, mottled dark brown, speckled black and reddish brown LEAN CLAY with trace of organics (finger roots)

LL =	PL =	PI =	Assumed GS= 2.70	Type: Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

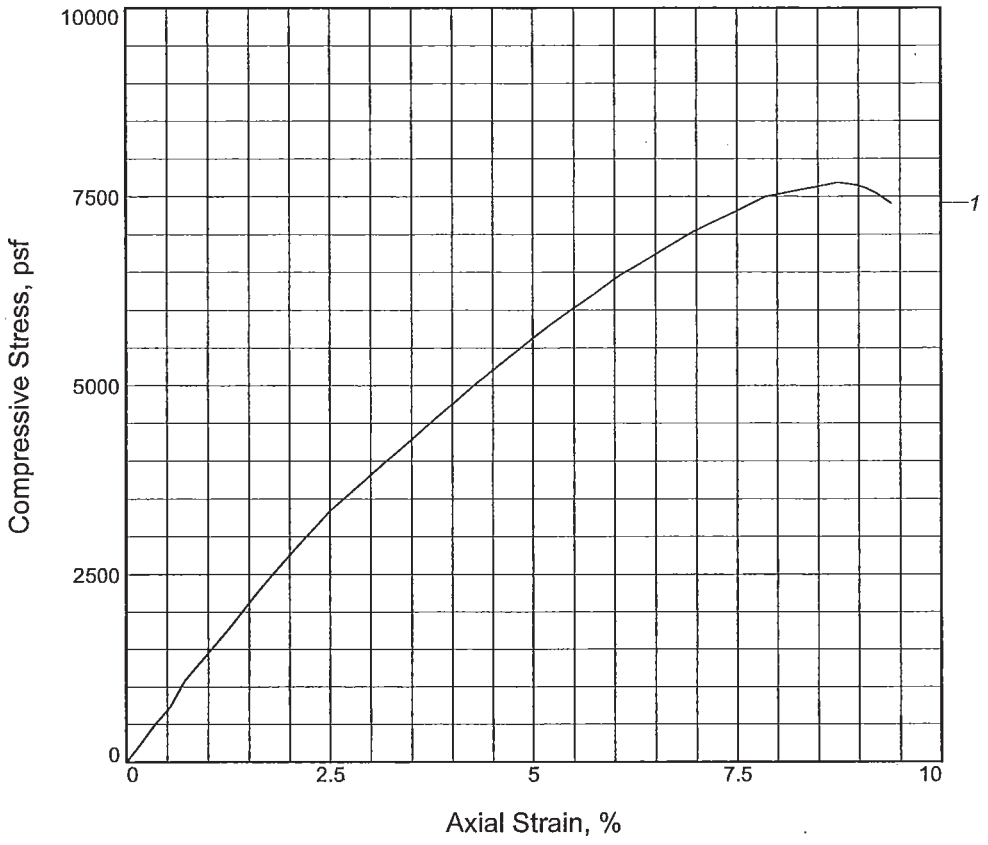
Sample Number: B025 ST-1 **Depth:** 3.5'-5'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	7685			
Undrained shear strength, psf	3843			
Failure strain, %	8.8			
Strain rate, in./min.	0.08			
Water content, %	15.4			
Wet density, pcf	134.8			
Dry density, pcf	116.8			
Saturation, %	93.9			
Void ratio	0.4437			
Specimen diameter, in.	2.88			
Specimen height, in.	5.60			
Height/diameter ratio	1.94			

Description: Brown, spotted gray, speckled reddish brown LEAN CLAY with trace of gravel

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

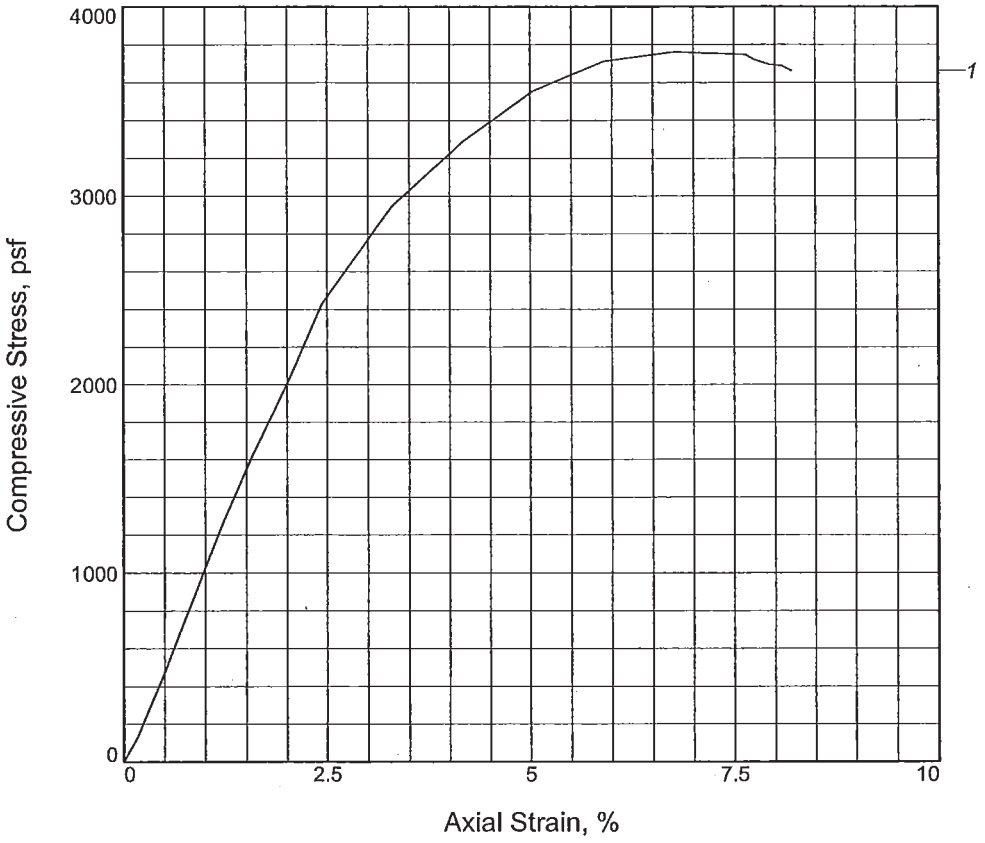
Sample Number: B025 ST-2 **Depth:** 13.5'-15'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	3762			
Undrained shear strength, psf	1881			
Failure strain, %	6.8			
Strain rate, in./min.	0.08			
Water content, %	15.9			
Wet density, pcf	137.1			
Dry density, pcf	118.3			
Saturation, %	99.4			
Void ratio	0.4353			
Specimen diameter, in.	2.86			
Specimen height, in.	5.76			
Height/diameter ratio	2.01			

Description: Brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand and gravel

LL =	PL =	PI =	Assumed GS= 2.72	Type: Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

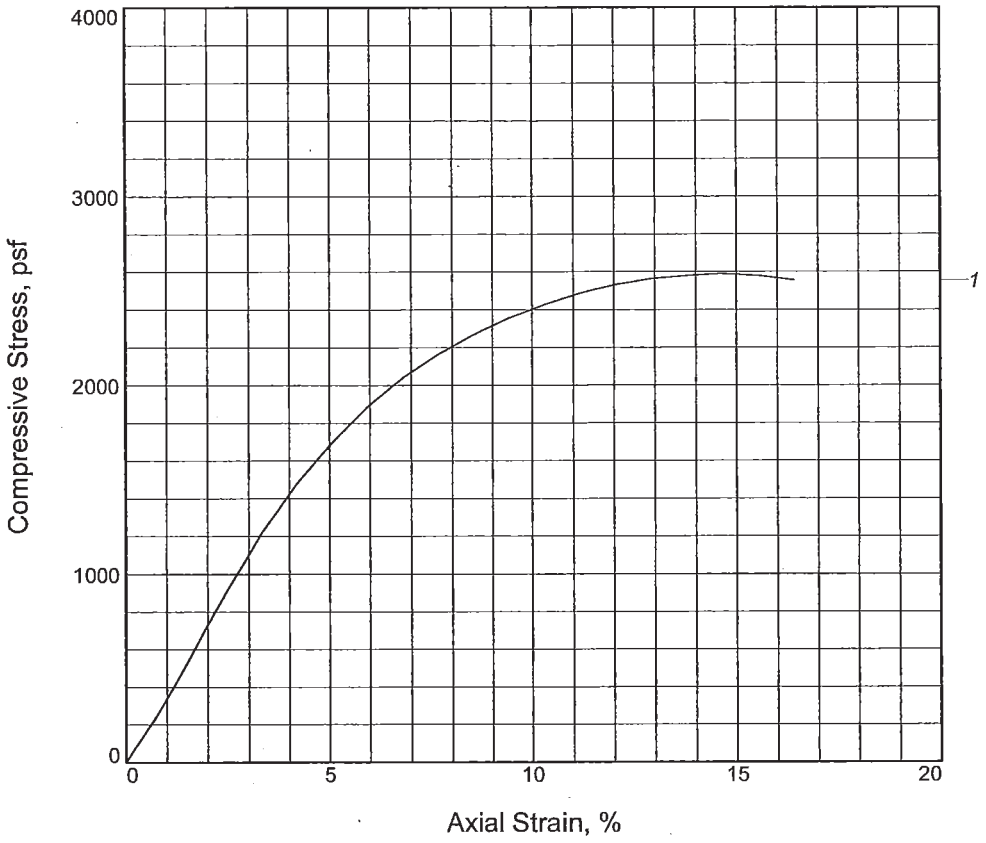
Sample Number: B025 ST-3 **Depth:** 23.5'-25'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2588			
Undrained shear strength, psf	1294			
Failure strain, %	14.7			
Strain rate, in./min.	0.08			
Water content, %	23.8			
Wet density, pcf	127.4			
Dry density, pcf	102.9			
Saturation, %	99.7			
Void ratio	0.6498			
Specimen diameter, in.	2.86			
Specimen height, in.	5.73			
Height/diameter ratio	2.00			

Description: Brown, mottled dark gray, speckled black and reddish brown LEAN CLAY with trace of organics

LL =	**PL =**	**PI =**	**Assumed GS=** 2.72	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

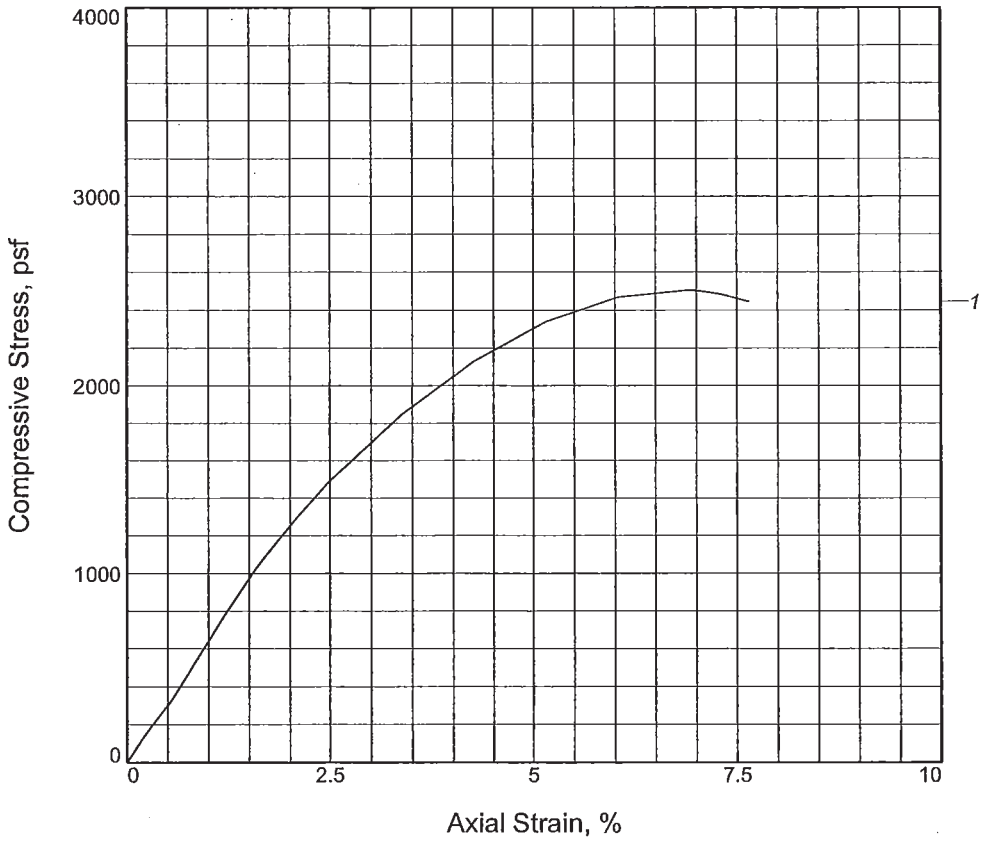
Sample Number: B025 ST-4 **Depth:** 33.5'-35'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2506			
Undrained shear strength, psf	1253			
Failure strain, %	6.9			
Strain rate, in./min.	0.08			
Water content, %	15.1			
Wet density, pcf	139.5			
Dry density, pcf	121.2			
Saturation, %	104.1			
Void ratio	0.3903			
Specimen diameter, in.	2.86			
Specimen height, in.	5.63			
Height/diameter ratio	1.97			

Description: Brown, spotted gray, speckled reddish brown LEAN CLAY with weathered shale fragments

LL =	PL =	PI =	Assumed GS= 2.70	Type: Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

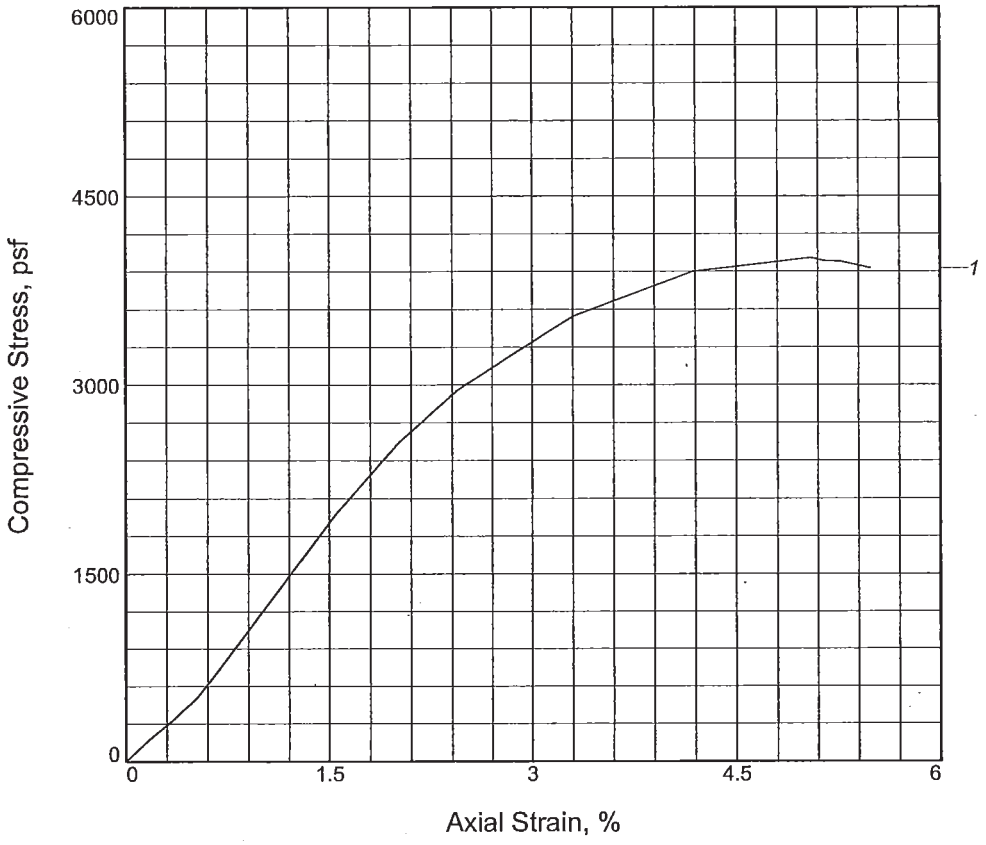
Sample Number: B025 ST-5 **Depth:** 43.5'-45'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	4009			
Undrained shear strength, psf	2004			
Failure strain, %	5.1			
Strain rate, in./min.	0.08			
Water content, %	14.3			
Wet density, pcf	135.2			
Dry density, pcf	118.3			
Saturation, %	91.0			
Void ratio	0.4251			
Specimen diameter, in.	2.88			
Specimen height, in.	5.74			
Height/diameter ratio	1.99			

Description: Brown, mottled dark brown, spotted gray, speckled black and reddish brown LEAN CLAY with trace of sand

LL =	PL =	PI =	Assumed GS= 2.70	Type: Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

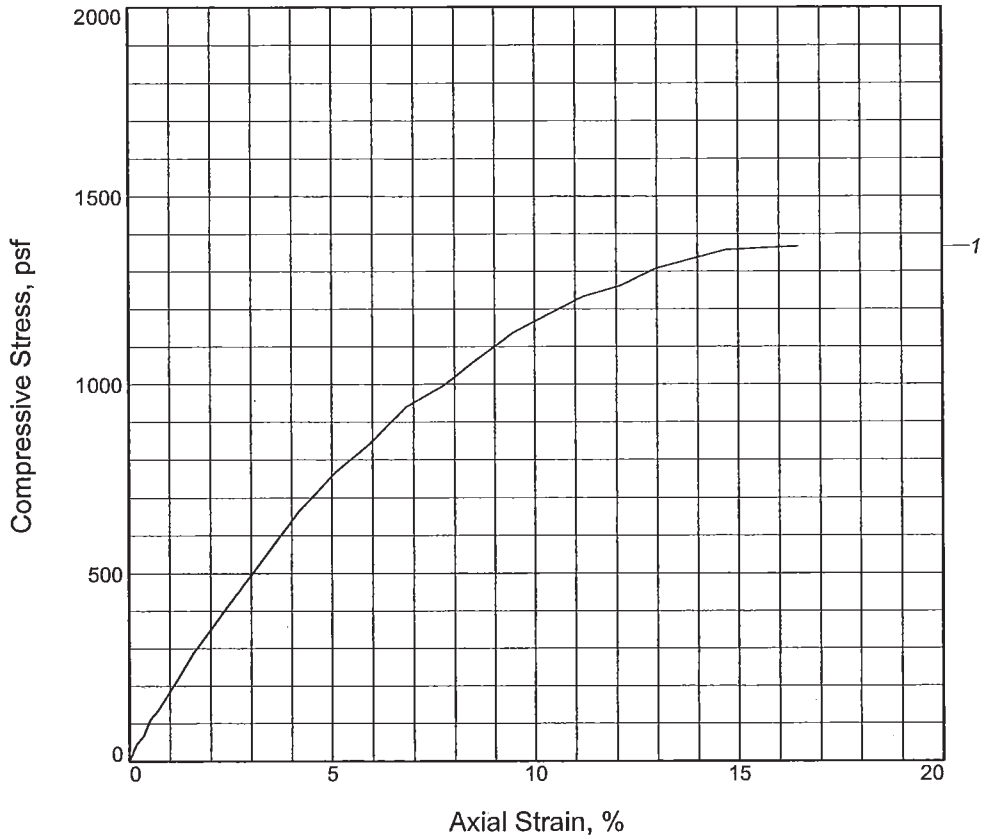
Sample Number: B026 ST-1 **Depth:** 3.5'-5'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1367			
Undrained shear strength, psf	683			
Failure strain, %	16.5			
Strain rate, in./min.	0.08			
Water content, %	20.5			
Wet density, pcf	131.8			
Dry density, pcf	109.4			
Saturation, %	102.3			
Void ratio	0.5410			
Specimen diameter, in.	2.86			
Specimen height, in.	5.71			
Height/diameter ratio	2.00			

Description: Brown, spotted gray, dark gray, black and reddish brown LEAN CLAY with some weathered shale particles

LL =	PL =	PI =	Assumed GS= 2.70	Type: Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

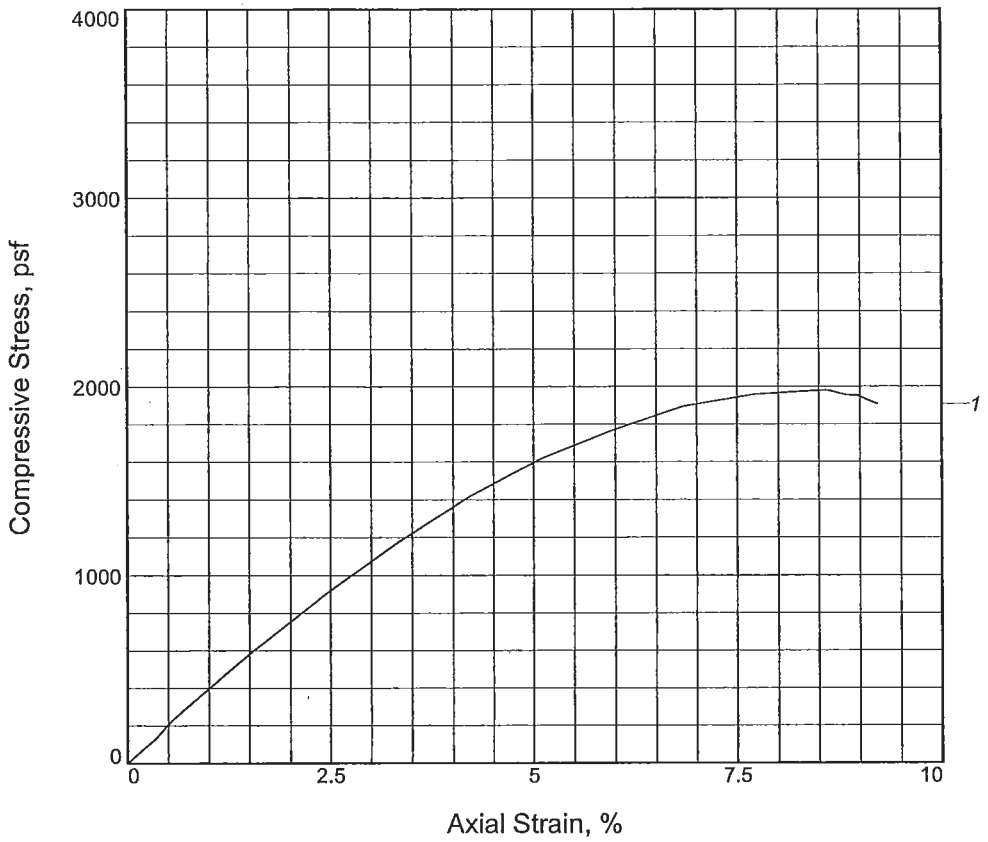
Sample Number: B026 ST-2 **Depth:** 13.5'-15'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1980			
Undrained shear strength, psf	990			
Failure strain, %	8.6			
Strain rate, in./min.	0.08			
Water content, %	15.1			
Wet density, pcf	135.0			
Dry density, pcf	117.3			
Saturation, %	93.2			
Void ratio	0.4369			
Specimen diameter, in.	2.88			
Specimen height, in.	5.70			
Height/diameter ratio	1.98			

Description: Brown, spotted gray, speckled reddish brown LEAN CLAY with some weathered shale

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

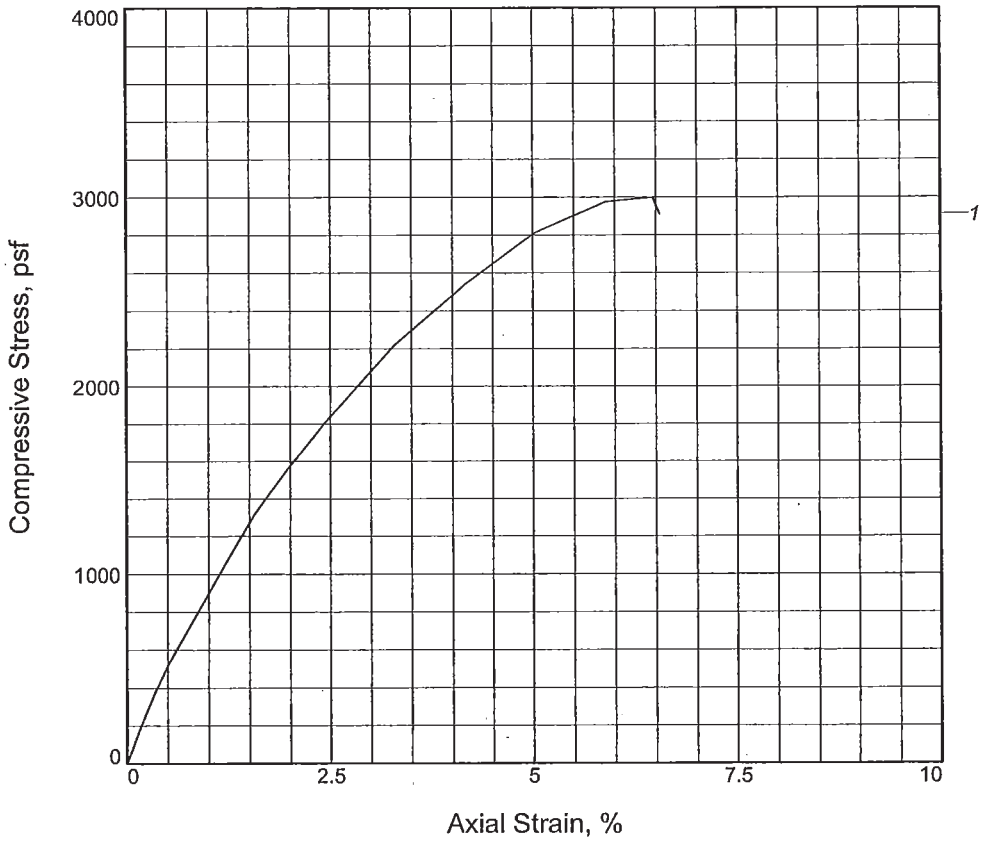
Sample Number: B026 ST-3 **Depth:** 23.5'-25'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2998			
Undrained shear strength, psf	1499			
Failure strain, %	6.5			
Strain rate, in./min.	0.08			
Water content, %	19.2			
Wet density, pcf	127.9			
Dry density, pcf	107.3			
Saturation, %	90.8			
Void ratio	0.5707			
Specimen diameter, in.	2.87			
Specimen height, in.	5.77			
Height/diameter ratio	2.01			

Description: Brown, spotted gray, speckled black and reddish brown LEAN CLAY with weathered shale

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 15-328T
Date Sampled: 11/16/2015
Remarks:

Client: AECOM

Project: Dynegy CCR Ph 3/7-Duck Creek (Ash Pond 2)

Sample Number: B026 ST-4 **Depth:** 33.5'-35'

ALPHA-OMEGA GEOTECH

Figure 1 of 1

Tested By: DB **Checked By:** TB

FALLING HEAD PERMEABILITY REPORT

(Method C: Rising Tail-Water)

ASTM D 5084

ALPHA-OMEGA GEOTECH

PROJECT NAME: Dynegy CCR Ph 3/7 - Duck Creek (Ash Pond 2) PROJECT NO.: 15-328T

LOCATION:

BORING NO.: B026 SAMPLE NO.: ST-4 DEPTH: 33.5' - 35'

SAMPLE TYPE: Undisturbed % COMPACTION:

	INITIAL DATA		FINAL DATA	
MOISTURE:	21.0	%	22.5	%
DRY UNIT WEIGHT:	106.4	pcf	106.4	pcf
HEIGHT:	2.73	inches	2.73	inches
DIAMETER:	2.85	inches	2.85	inches
WEIGHT:	588.3	grams	595.5	grams
SATURATION:	97.1	%	100.0	%

PERMEANT LIQUID: Deaired tap water

EFFECTIVE CONSOLIDATION STRESS: Maximum 5.4 psi Minimum 5.0 psi

BACK PRESSURE: 90 psi RANGE OF HYDRAULIC GRADIENT: 3.2 to 2.7

SAMPLE DESCRIPTION: Brown, spotted gray, speckled black and reddish brown LEAN CLAY with weathered shale

TEST DATA

DATE	TEST NO.	TIME (sec)	HEAD1 (cm)	HEAD 2 (cm)	TEMP °C
11/12 - 11/13	1	63,480	22.0	18.8	26
11/13 - 11/14	2	63,480	22.0	18.8	26
11/14 - 11/15	3	63,480	22.0	18.8	26
11/15 - 11/16	4	63,480	22.0	18.8	26
AVERAGE		63,480	22.0	18.8	26

k= 1.7E-07 cm/s n/n20= 0.8694

k20= 1.5E-07 cm/s

k = Hydraulic Conductivity before n/n20 correction factor

k20= Hydraulic Conductivity after correction to 20 ° Celsius

This is a laboratory testing result. Field values may vary.

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND2) PO 64671 ACM
02156344
12/8/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Unconfined Compression psf NOTE*	CU Triaxial NOTE*	USCS Symbol					
B021	ST-1	6.0	7.5	17.5	112	36	19	17			NOTE*						
	Color		olive gray trace yellowish brow							**Visual Classification**		Lean Clay with Sand					
	ST-2	16.0	16.5	x	x	X	X	X									
	Color		x							**Visual Classification**		X					
	ST-3	26.0	27.5	20.5	104.0	41	22	19			NOTE*						
	Color		olive gray with dark gray trace dark brown							**Visual Classification**		Lean Clay with Sand					
	ST-4	36.0	37.5	20.1	109						NOTE*						
	Color		dark grayish brown with dark brown trace gray							**Visual Classification**		Lean Clay wih Sand					
	ST-5	46.0	47.5	x	x					X							
	Color		x							**Visual Classification**		X					
	ST-6	56.0	57.5	x	x					X							
	Color		x							**Visual Classification**		X					
B022	ST-1	6.0	7.5	18.5	111						NOTE*						
	Color		gray with graysih brown trace brown							**Visual Classification**		Fat Clay with Sand					
	ST-2	16.0	17.5	30.1	91						NOTE*						
	Color		olive gray with yellowish brown							**Visual Classification**		Lean Clay with Sand					
	ST-3	26.0	27.5	20.3	111						NOTE*						
	Color		dark gray with very dark gray							**Visual Classification**		Lean Clay with Sand					
	ST-4	36.0	37.5	X	x					X							
	Color		X							**Visual Classification**		X					

NOTE*: SEE ATTACHED DATA SHEETS.
** Testing not Possible

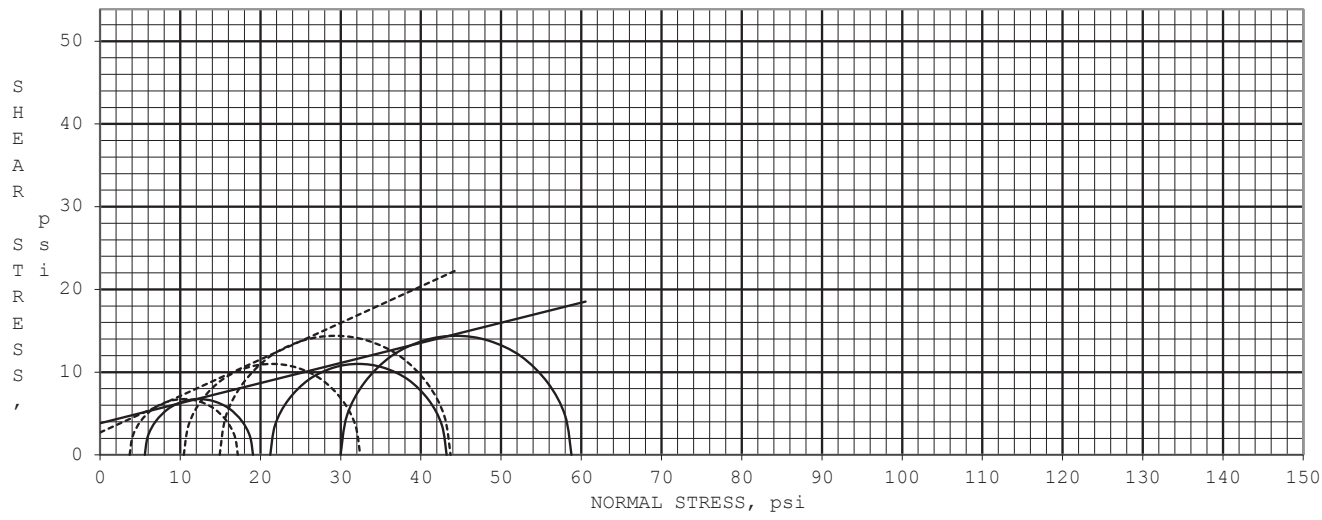
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND2) PO 64671 ACM
02156344
12/8/2015

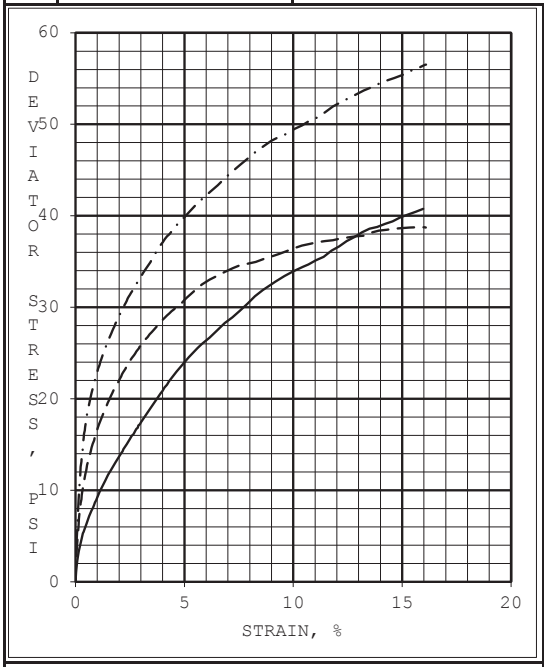
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Unconfined Compression psf NOTE*	CU Triaxial NOTE*	USCS Symbol					
B029	ST-1	6.0	7.5	14.2	118	35	18	17			**						
	Color		brown with grayish brown							**Visual Classification**		Lean Clay with Sand					
	ST-2	16.0	16.5	17.4	114	33	18	15			NOTE*						
	Color		yellowish brown wtih gray & olive gray							**Visual Classification**		Lean Clay with Sand					
	ST-3	26.0	27.5	17.3	113.8	37	17	20			NOTE*						
	Color		brown with yellowish brown trace gray							**Visual Classification**		Lean Clay with Sand					
	ST-4	36.0	37.5	x	x	x	x	x		x							
	Color		x							**Visual Classification**		X					
	ST-5	46.0	47.5	x	x					X							
	Color		x							**Visual Classification**		X					
	ST-6	56.0	57.5	x	x					X							
	Color		x							**Visual Classification**		X					
B030	ST-1	6.0	7.5	17.4	113	33	18	15			NOTE*						
	Color		brown with grayish brown							**Visual Classification**		Lean Clay with Sand					
	ST-2	16.0	17.5	18.6	111	37	20	17			NOTE*						
	Color		olive gray with dark brown							**Visual Classification**		Lean Clay with Sand					
	ST-3	26.0	27.5	22.6	102	42	20	22			NOTE*						
	Color		grayish brown with very dark gray							**Visual Classification**		Lean Clay with Sand					
	ST-4	36.0	37.5	X	x					X							
	Color		X							**Visual Classification**		X					

NOTE*: SEE ATTACHED DATA SHEETS.
** Testing not Possible

Terracon



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**23.8**	COHESION, psi	**2.7**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**13.7**	COHESION, psi	**3.8**



SPECIMEN ID:		ST-1	ST-2	ST-3
INITIAL	WATER CONTENT, %	17.5	20.5	20.1
	DRY DENSITY, pcf	112.1	103.9	109.4
	SATURATION, %	94	89	100
	VOID RATIO	0.50	0.62	0.54
BEFORE SHEAR	WATER CONTENT, %	18.4	21.3	18.5
	DRY DENSITY, pcf	112.6	106.9	112.4
	SATURATION (B PARAMETER)	1.00	0.97	0.97
	VOID RATIO	0.50	0.58	0.50
	FINAL BACK PRESSURE, psi	100.0	100.6	101.0
MINOR PRINCIPAL STRESS, psi		5.6	21.2	30.0
EFFECTIVE STRESS PEAK AT % STRAIN		2.0	2.0	2.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		13.5	22.0	28.8
TOTAL STRESS PEAK AT % STRAIN		2.0	2.0	2.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		13.5	22.0	28.8
ULTIMATE DEVIATOR STRESS (15% STR), psi		39.9	38.7	55.4
TIME TO 50% PRIMARY CONSOLIDATION, min		3.00	11.00	21.00
STRAIN RATE, % / hour		4.08	1.60	0.86
INITIAL DIAMETER, inch		2.882	2.862	2.856
INITIAL HEIGHT, inch		5.858	5.743	5.862
AREA AFTER CONSOLIDATION, inch2		6.510	6.310	6.298

CONTROLLED - STRAIN TEST

SAMPLE TYPE: 3" SHELBY TUBE

DESCRIPTION OF SPECIMENS:

LL	PL	PI	Gs 2.7 EST.

PROJECT NO. 02156344 Task 02

PROJECT: DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)
PO 64671ACM

BORING #: B021

LABORATORY: TERRACON - LENEXA

SAMPLE #: ST-1, ST-3 & ST-4

DATE: 12/7/2015

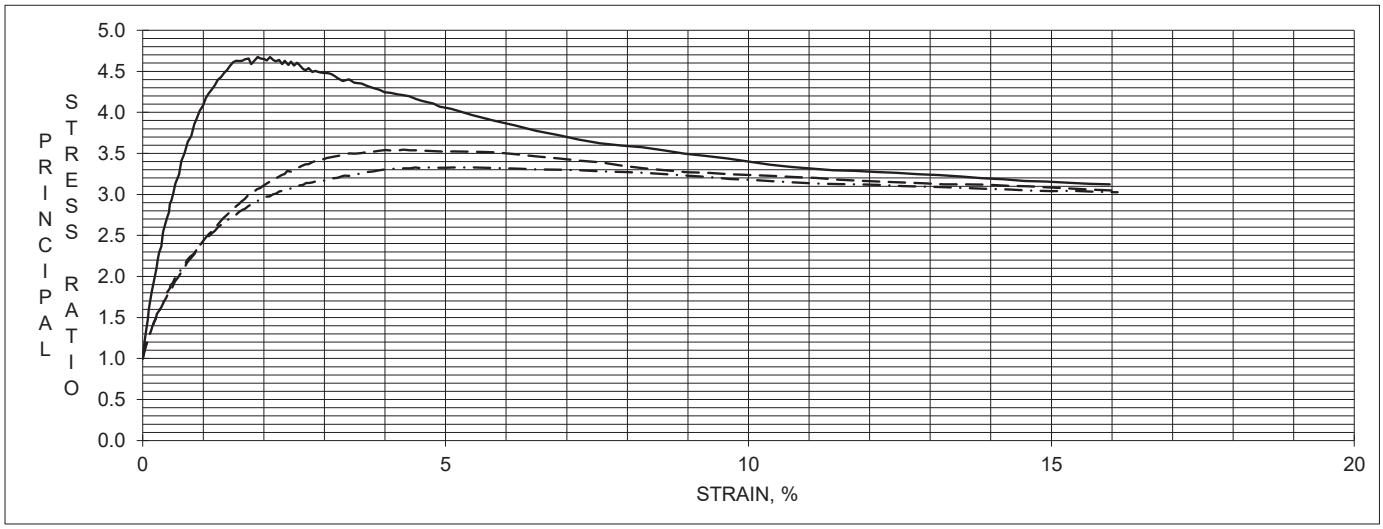
DEPTH, feet: 6.0 - 37.5

PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)

02156344 Task 02 B021 ST-1, ST-3 & ST-4 6.0 - 37.5

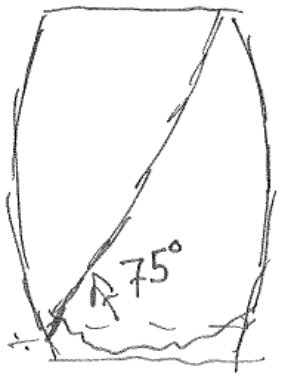


FAILURE SKETCH



SPECIMEN A

FAILURE SKETCH



SPECIMEN B

FAILURE SKETCH



SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 2 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 2 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

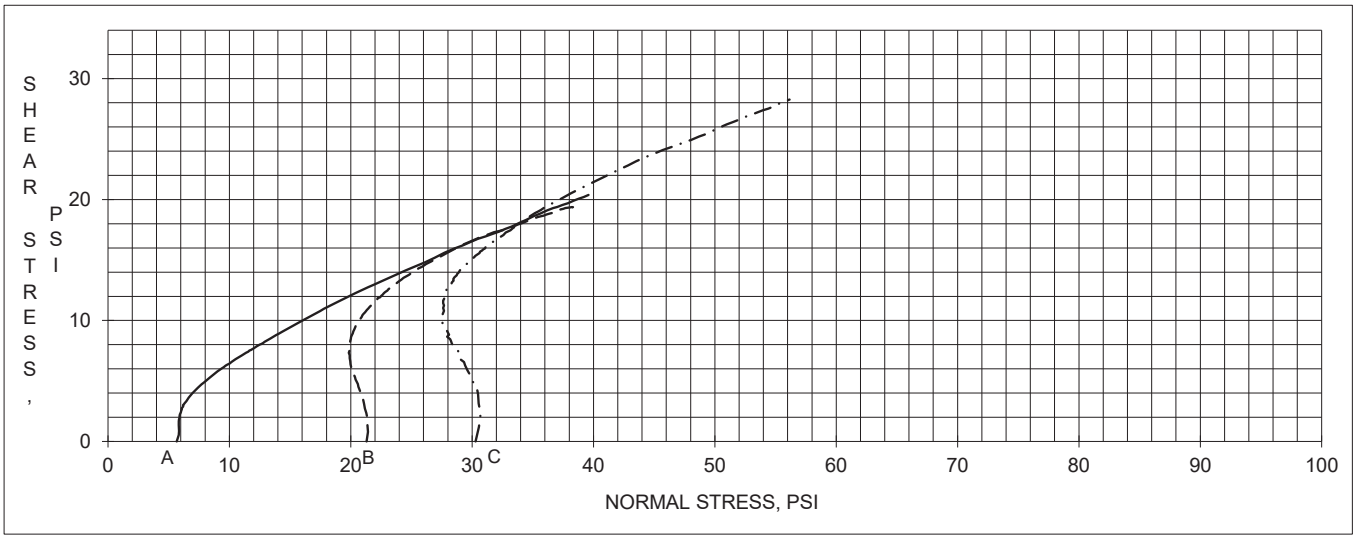
DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

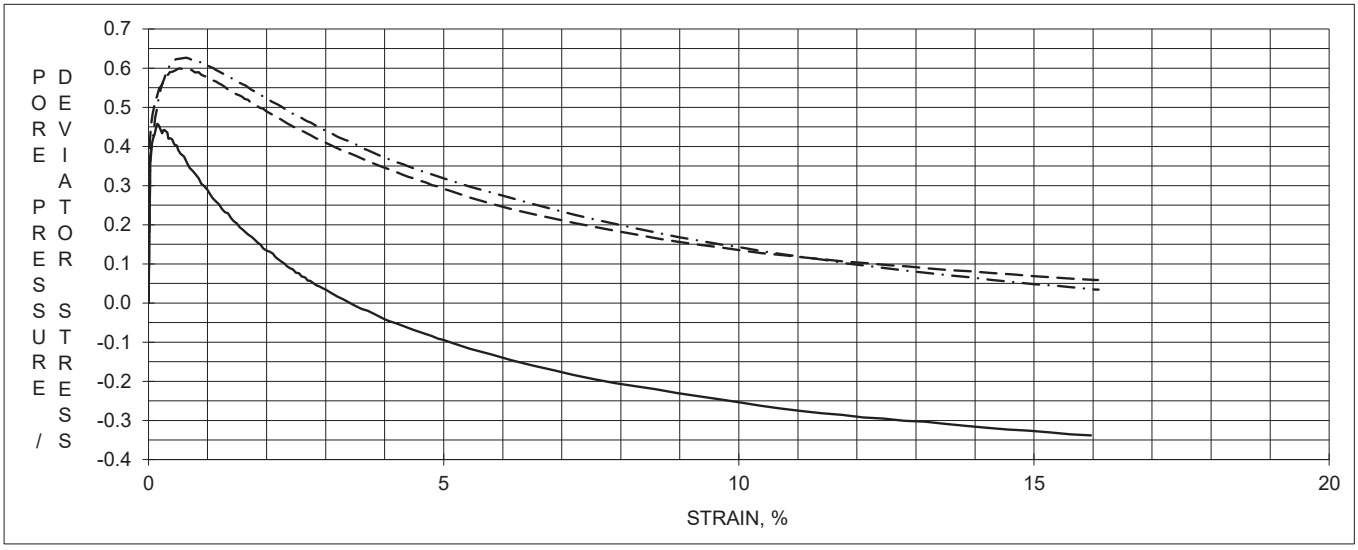
AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

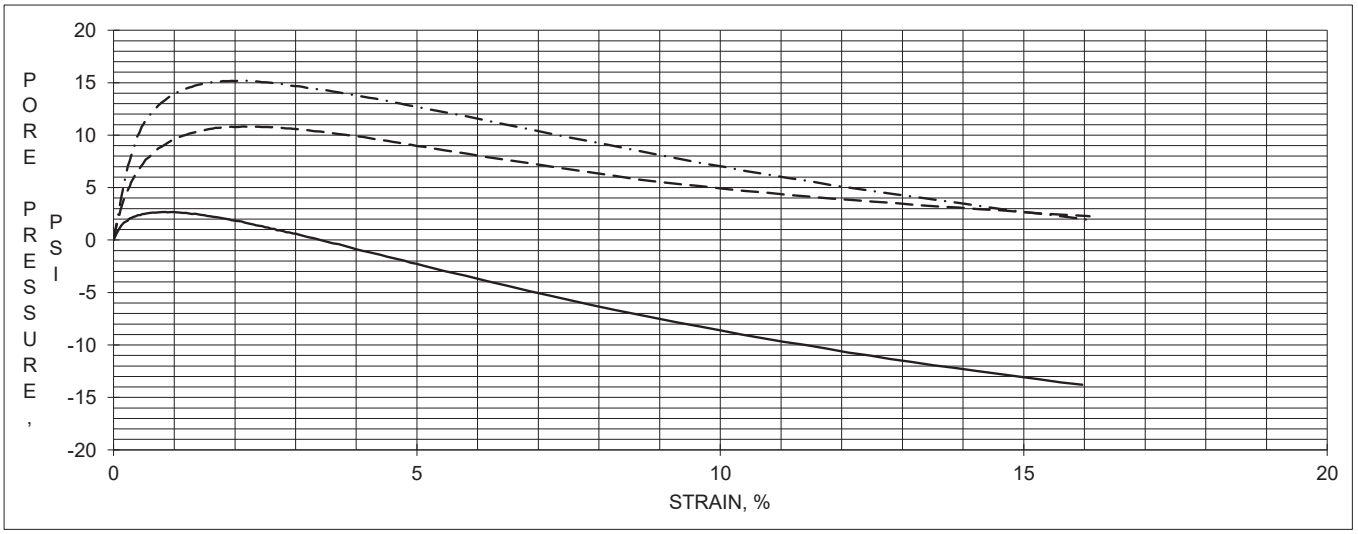
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)

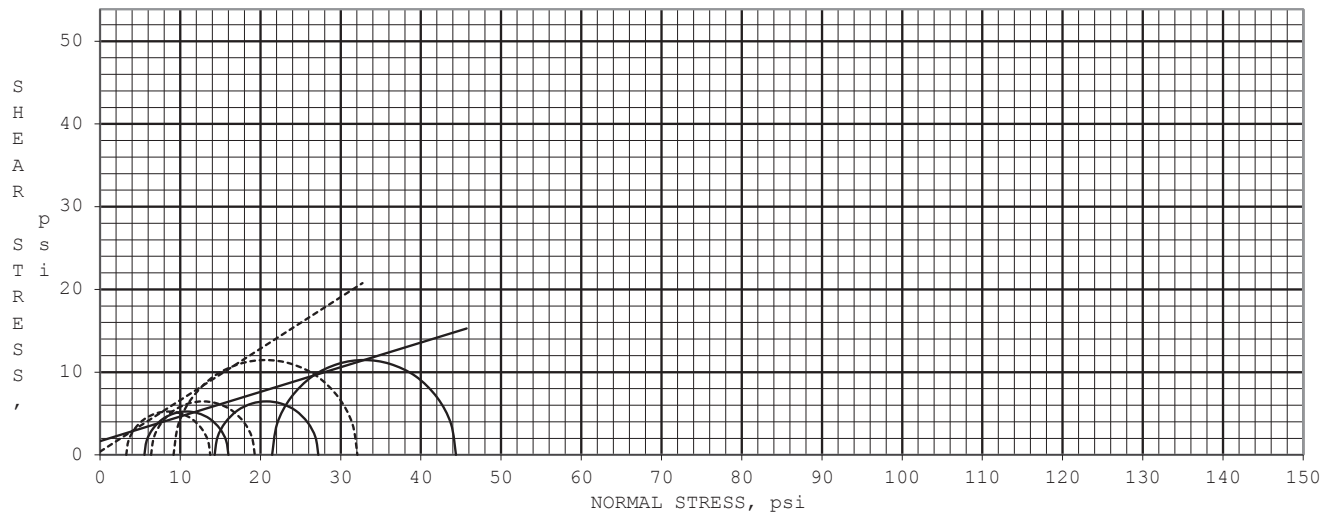
02156344 Task 02 B021 ST-1, ST-3 & ST-4 6.0 - 37.5



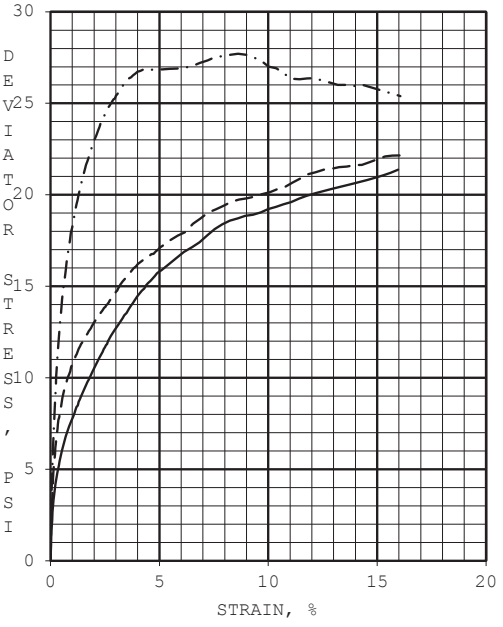




Terracon



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**31.9**	COHESION, psi	**0.4**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**16.6**	COHESION, psi	**1.7**



	SPECIMEN ID:	ST-1	ST-2	ST-3
INITIAL	WATER CONTENT, %	18.5	30.1	20.3
	DRY DENSITY, pcf	111.2	91.1	111.0
	SATURATION, %	97	96	106
	VOID RATIO	0.52	0.85	0.52
BEFORE SHEAR	WATER CONTENT, %	18.8	29.8	18.0
	DRY DENSITY, pcf	111.7	93.3	113.4
	SATURATION (B PARAMETER)	0.97	0.96	1.00
	VOID RATIO	0.51	0.81	0.49
	FINAL BACK PRESSURE, psi	99.7	100.0	100.5
	MINOR PRINCIPAL STRESS, psi	5.5	14.3	21.5
	EFFECTIVE STRESS PEAK AT % STRAIN	2.0	2.0	2.0
	EFF. DEVIATOR STRESS AT PEAK STRAIN, psi	10.5	12.9	22.9
	TOTAL STRESS PEAK AT % STRAIN	2.0	2.0	2.0
	TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi	10.5	12.9	22.9
	ULTIMATE DEVIATOR STRESS (15% STR), psi	21.0	21.9	25.8
	TIME TO 50% PRIMARY CONSOLIDATION, min	16.00	3.80	2.80
	STRAIN RATE, % / hour	1.07	1.10	3.98
	INITIAL DIAMETER, inch	2.874	2.851	2.898
	INITIAL HEIGHT, inch	5.848	5.859	5.897
	AREA AFTER CONSOLIDATION, inch2	6.472	6.286	6.511

CONTROLLED - STRAIN TEST

SAMPLE TYPE: 3" SHELBY TUBE

DESCRIPTION OF SPECIMENS:

LL	PL	PI	Gs 2.7 EST.

PROJECT NO. 02156344 Task 02

PROJECT: DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)
PO 64671ACM

BORING #: B022

LABORATORY: TERRACON - LENEXA

SAMPLE #: ST-1, ST-2 & ST-3

DATE: 12/7/2015

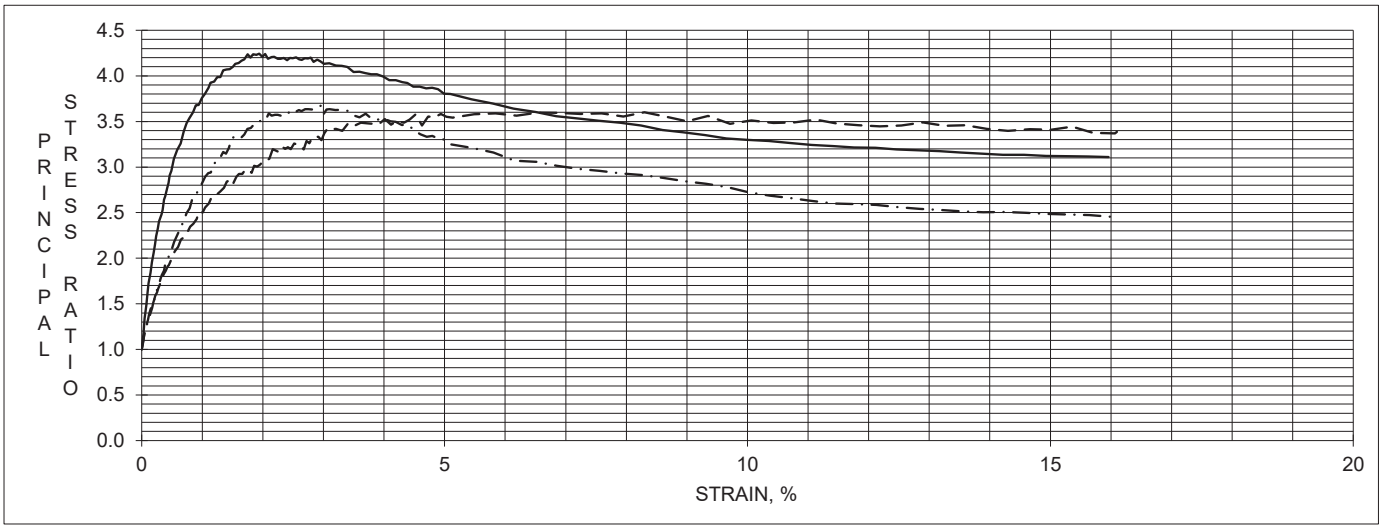
DEPTH, feet: 6.0 - 27.5

PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

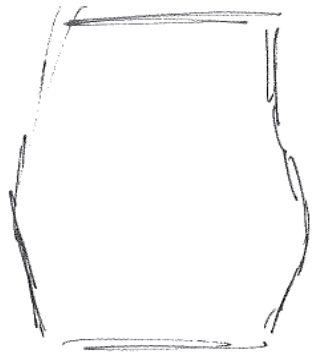
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)

02156344 Task 02 B022 ST-1, ST-2 & ST-3 6.0 - 27.5

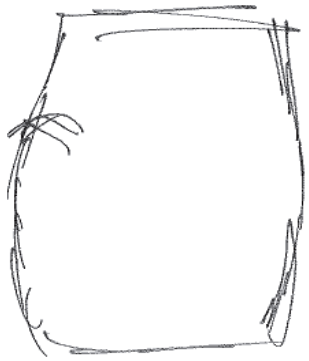


FAILURE SKETCH



SPECIMEN A

FAILURE SKETCH



SPECIMEN B

FAILURE SKETCH



SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 2 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 2 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

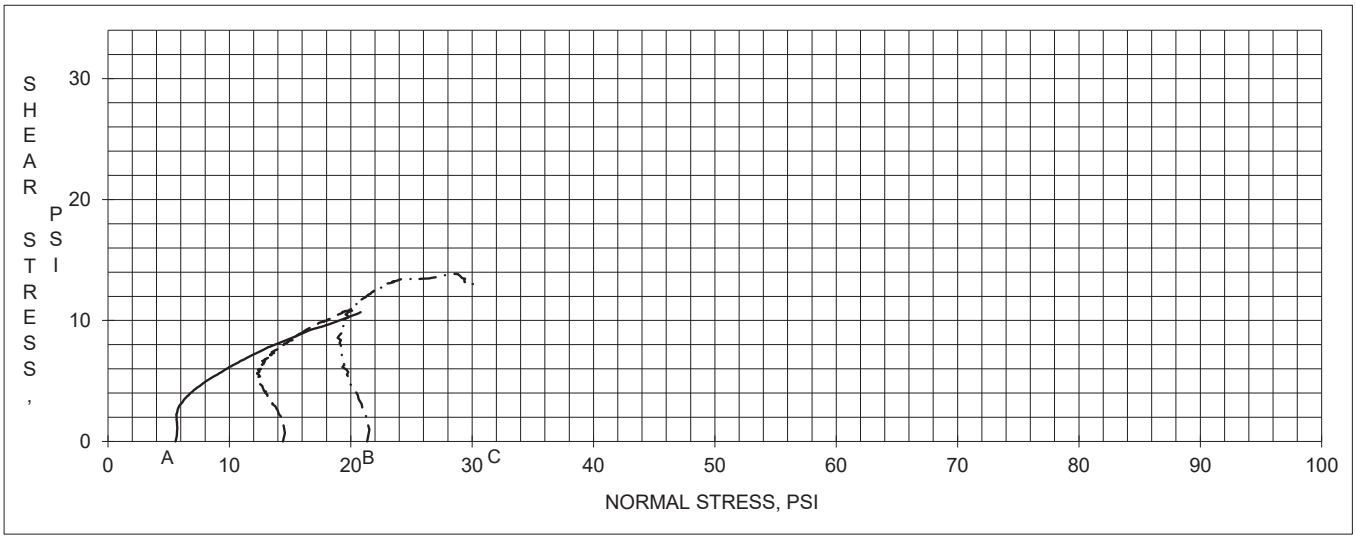
DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

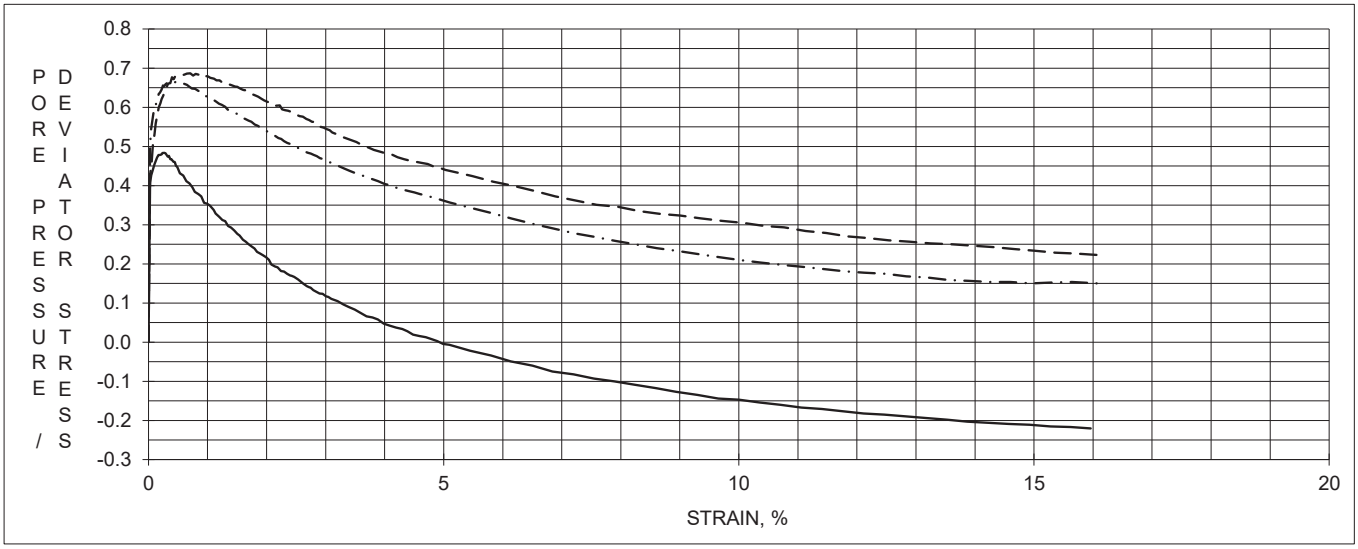
AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

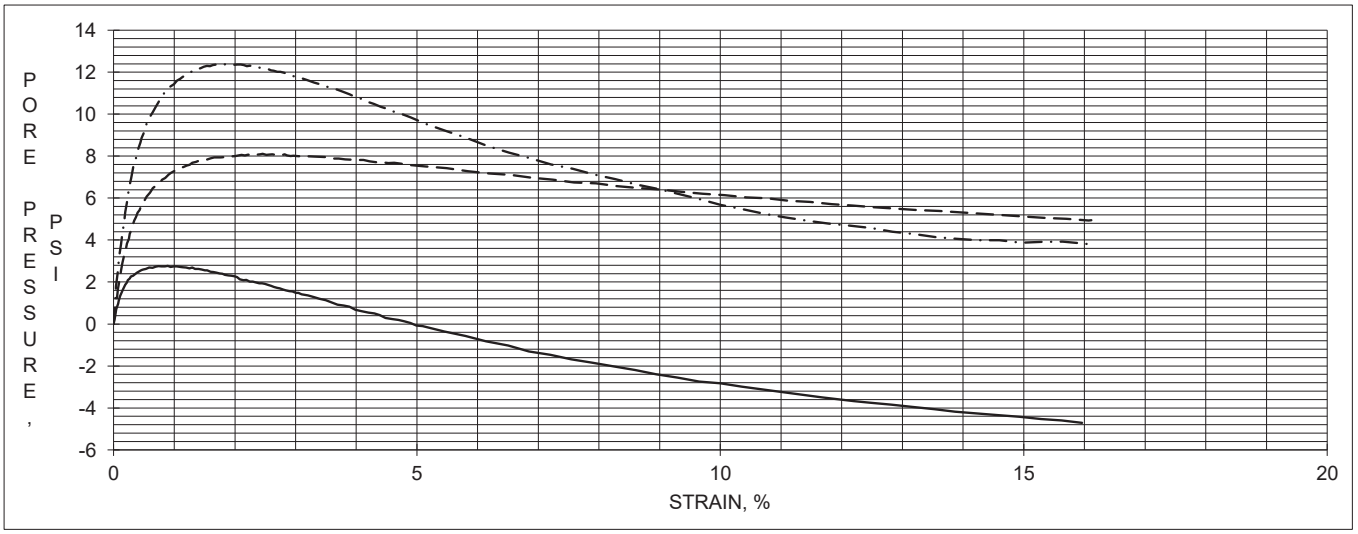
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DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)

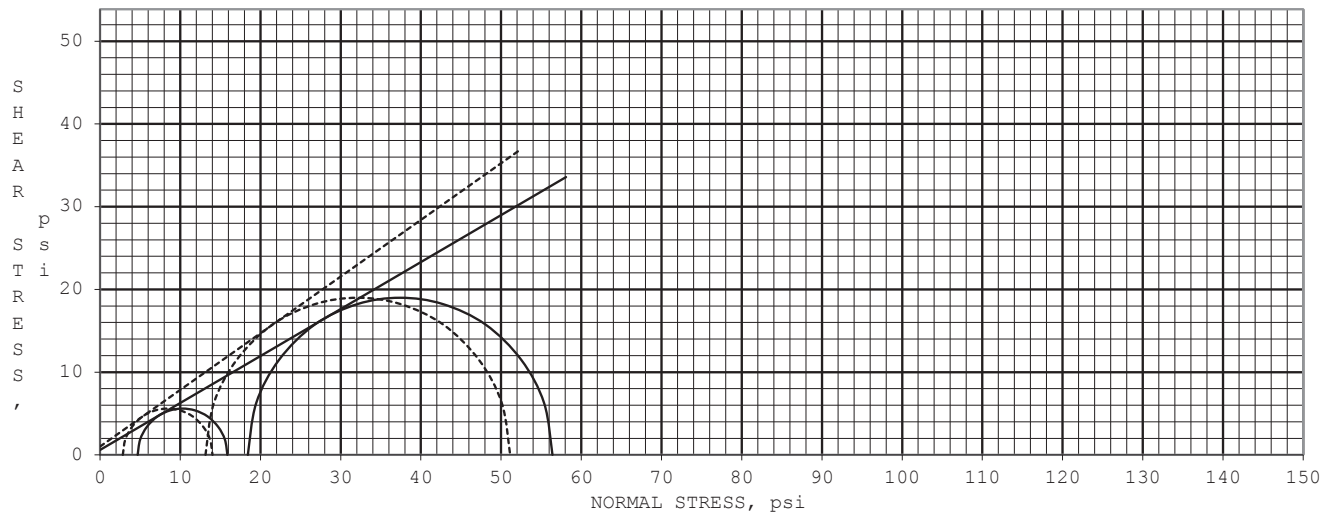
02156344 Task 02 B022 ST-1, ST-2 & ST-3 6.0 - 27.5



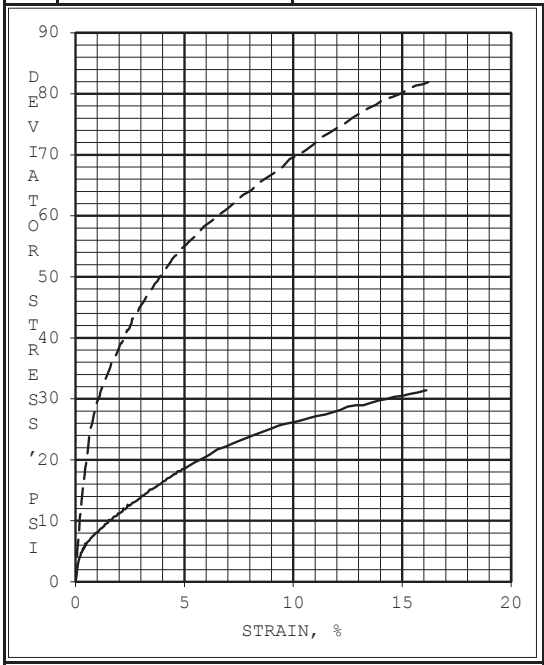




Terracon



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**34.4**	COHESION, psi	**1.0**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**29.6**	COHESION, psi	**0.6**



SPECIMEN ID:		A	B	
INITIAL	WATER CONTENT, %	17.4	17.3	
	DRY DENSITY, pcf	114.1	113.8	
	SATURATION, %	98	97	
	VOID RATIO	0.48	0.48	
BEFORE SHEAR	WATER CONTENT, %	17.4	16.0	
	DRY DENSITY, pcf	114.7	117.6	
	SATURATION (B PARAMETER)	1.00	1.00	
	VOID RATIO	0.47	0.43	
	FINAL BACK PRESSURE, psi	101.2	103.1	
MINOR PRINCIPAL STRESS, psi		4.7	18.4	
EFFECTIVE STRESS PEAK AT % STRAIN		2.0	2.0	
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		11.2	38.0	
TOTAL STRESS PEAK AT % STRAIN		2.0	2.0	
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		11.2	38.0	
ULTIMATE DEVIATOR STRESS (15% STR), psi		30.5	80.2	
TIME TO 50% PRIMARY CONSOLIDATION, min		9.20	21.00	
STRAIN RATE, % / hour		1.88	0.86	
INITIAL DIAMETER, inch		2.845	2.878	
INITIAL HEIGHT, inch		5.827	5.853	
AREA AFTER CONSOLIDATION, inch2		6.332	6.433	

CONTROLLED - STRAIN TEST

SAMPLE TYPE: 3" SHELBY TUBE

DESCRIPTION OF SPECIMENS:

LL	PL	PI	Gs 2.7 EST.

PROJECT NO. 02156344 Task 02

PROJECT: DYNEGY CCR Ph 3/7 - DUCK CREEK (ASH POND 2)
PO 64671ACM

BORING #: B029

LABORATORY: TERRACON - LENEXA

SAMPLE #: ST-2 & ST-3

DATE: 12/8/2015

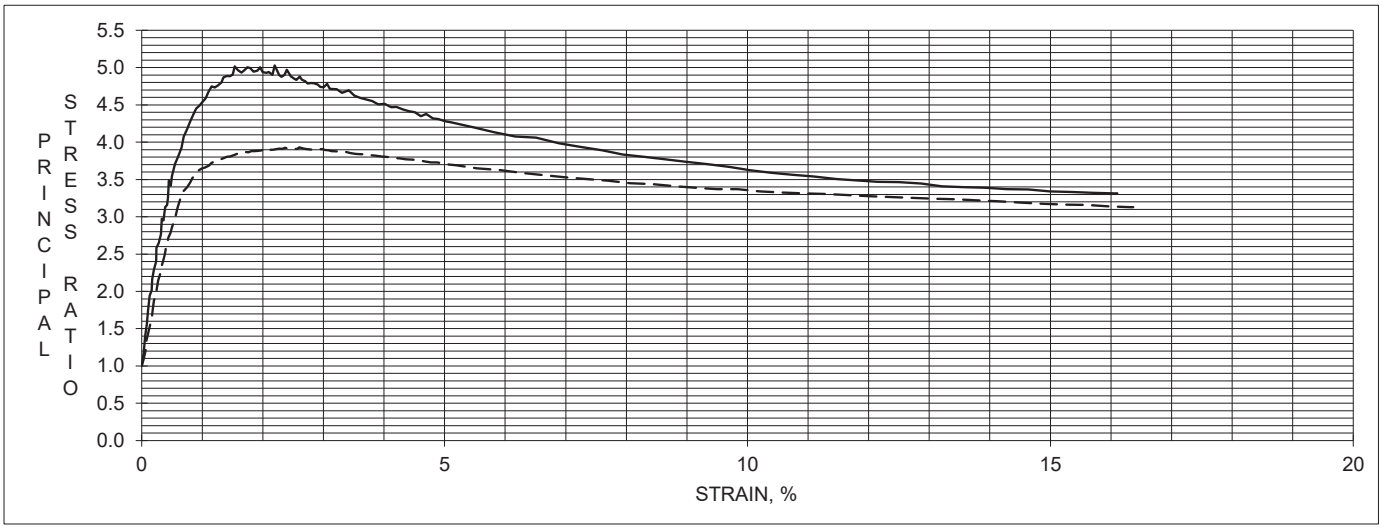
DEPTH, feet: 16.5 - 27.5

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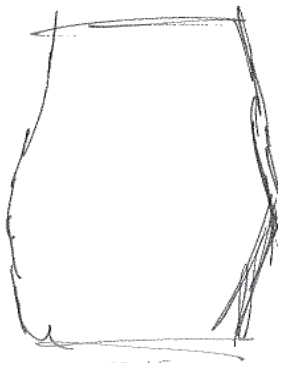
Terracon

DYNEGY CCR Ph 3/7 - DUCK CREEK (ASH POND 2)

02156344 Task 02 B029 ST-2 & ST-3 16.5 - 27.5

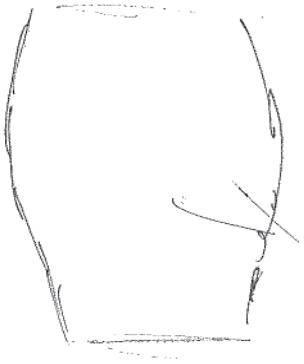


FAILURE SKETCH



SPECIMEN A

FAILURE SKETCH



SPECIMEN B

FAILURE SKETCH

SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 2 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 2 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

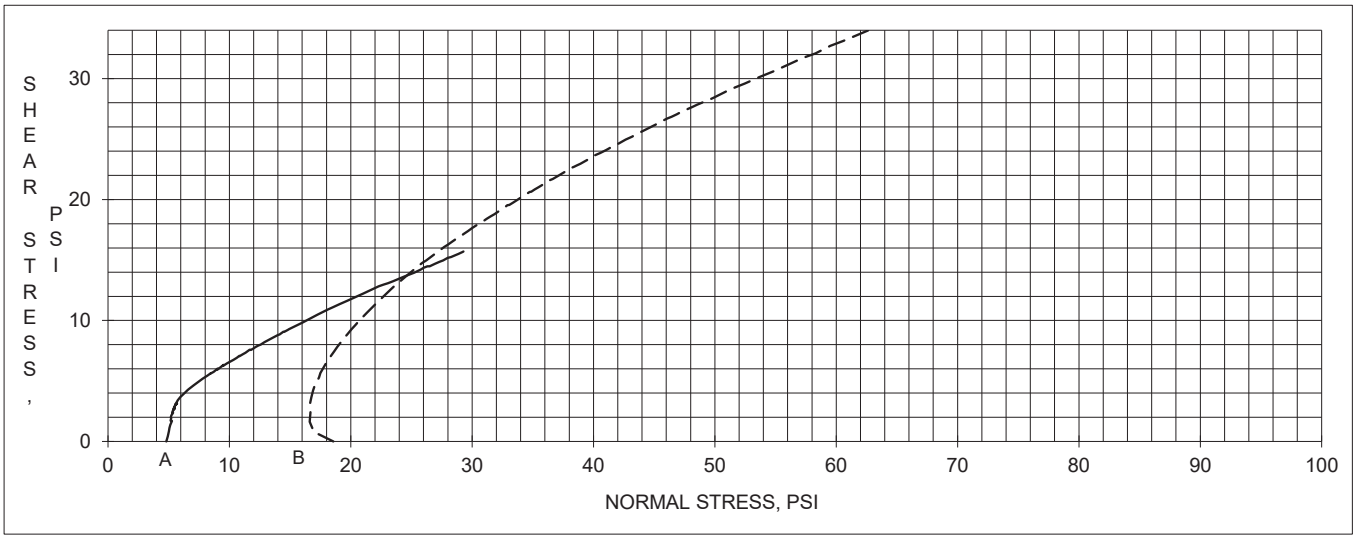
DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

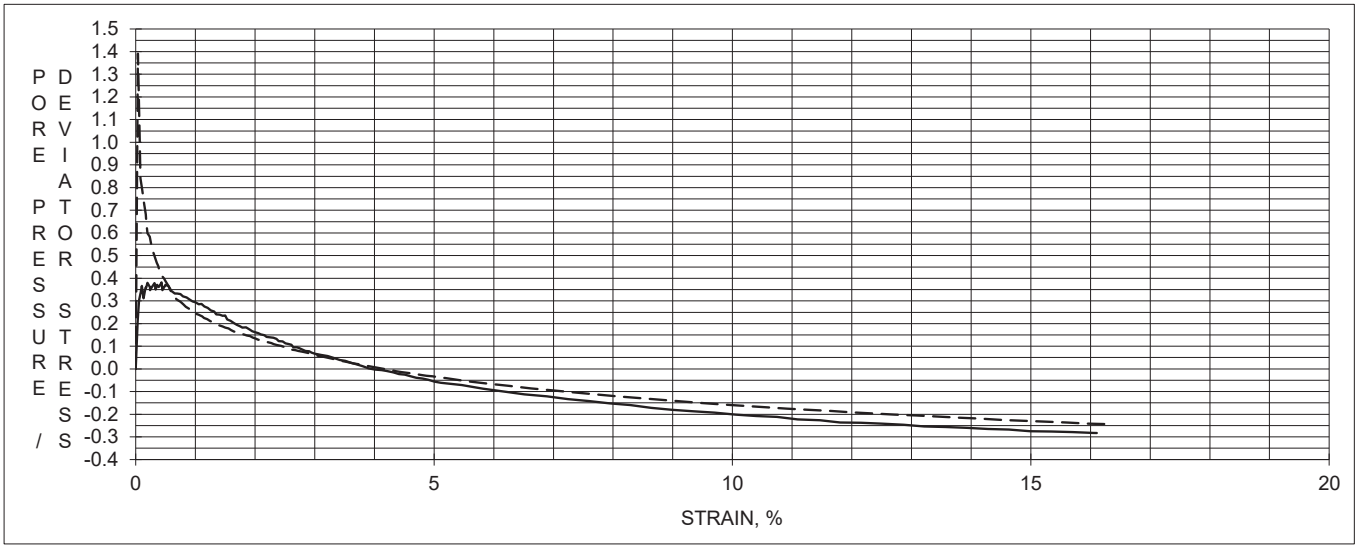
AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

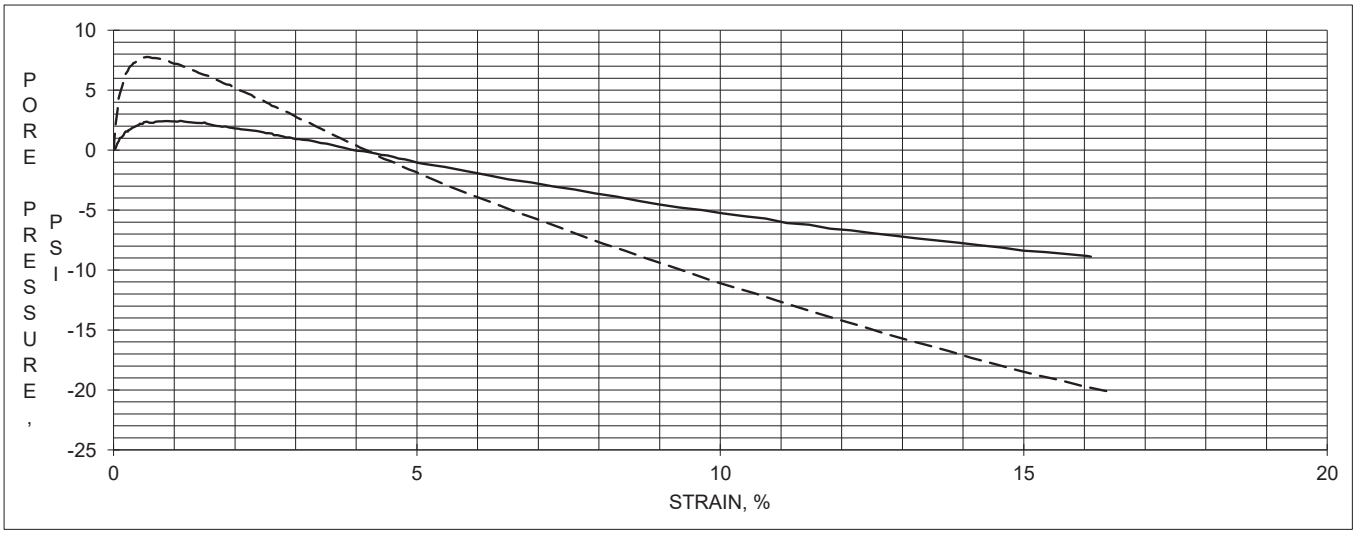
Terracon

DYNEGY CCR Ph 3/7 - DUCK CREEK (ASH POND 2)

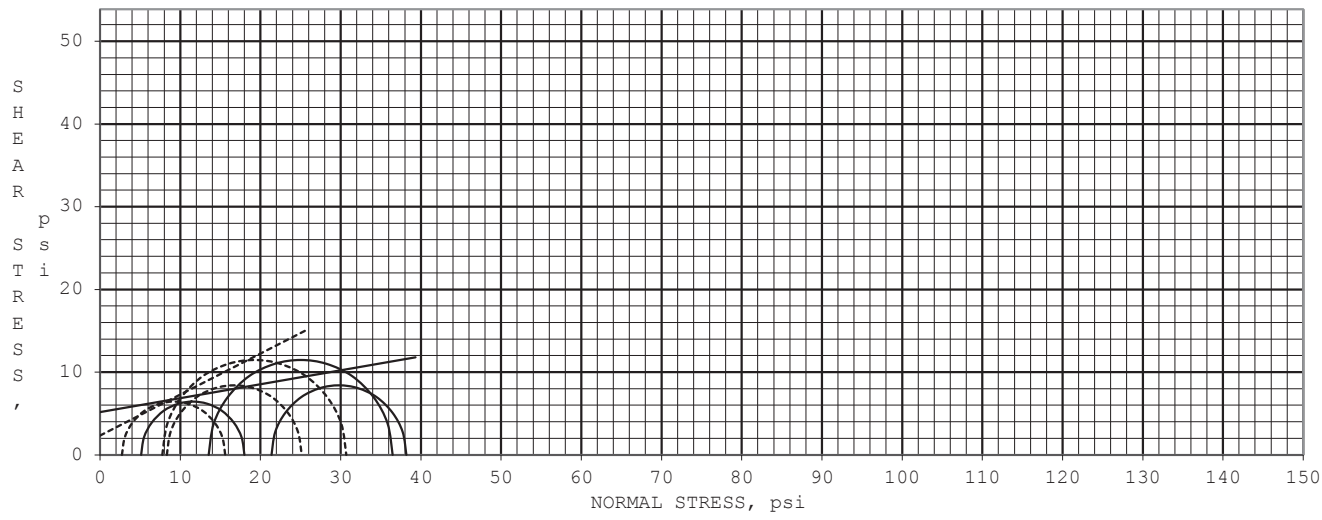
02156344 Task 02 B029 ST-2 & ST-3 16.5 - 27.5



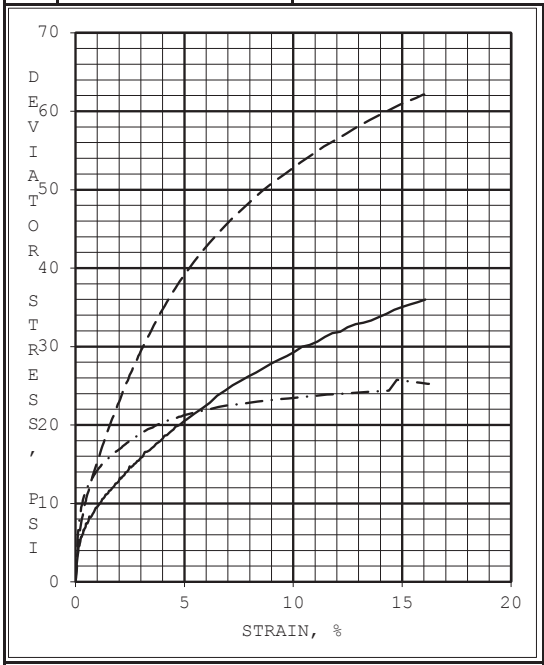




Terracon



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**26.4**	COHESION, psi	**2.3**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**9.6**	COHESION, psi	**5.2**



SPECIMEN ID:		ST-1	ST-2	ST-3
INITIAL	WATER CONTENT, %	17.4	18.6	22.6
	DRY DENSITY, pcf	112.9	111.1	101.8
	SATURATION, %	95	97	93
	VOID RATIO	0.49	0.52	0.66
BEFORE SHEAR	WATER CONTENT, %	18.0	18.3	22.2
	DRY DENSITY, pcf	113.3	112.7	105.3
	SATURATION (B PARAMETER)	0.95	1.00	0.96
	VOID RATIO	0.49	0.49	0.60
	FINAL BACK PRESSURE, psi	100.5	100.1	99.6
MINOR PRINCIPAL STRESS, psi		5.1	13.5	21.4
EFFECTIVE STRESS PEAK AT % STRAIN		2.0	2.0	2.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		12.9	22.9	16.8
TOTAL STRESS PEAK AT % STRAIN		2.0	2.0	2.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		12.9	22.9	16.8
ULTIMATE DEVIATOR STRESS (15% STR), psi		35.0	61.0	25.7
TIME TO 50% PRIMARY CONSOLIDATION, min		12.00	82.00	12.00
STRAIN RATE, % / hour		1.45	2.00	1.49
INITIAL DIAMETER, inch		2.878	2.869	2.912
INITIAL HEIGHT, inch		5.856	5.872	5.808
AREA AFTER CONSOLIDATION, inch2		6.504	6.400	6.536

CONTROLLED - STRAIN TEST

SAMPLE TYPE: 3" SHELBY TUBE

DESCRIPTION OF SPECIMENS:

LL	PL	PI	Gs 2.7 EST.

PROJECT NO. 02156344 Task 02

LABORATORY: TERRACON - LENEXA

DATE: 12/7/2015

PROJECT: DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)
PO 64671ACM

BORING #: B030

SAMPLE #: ST-1, ST-2 & ST-3

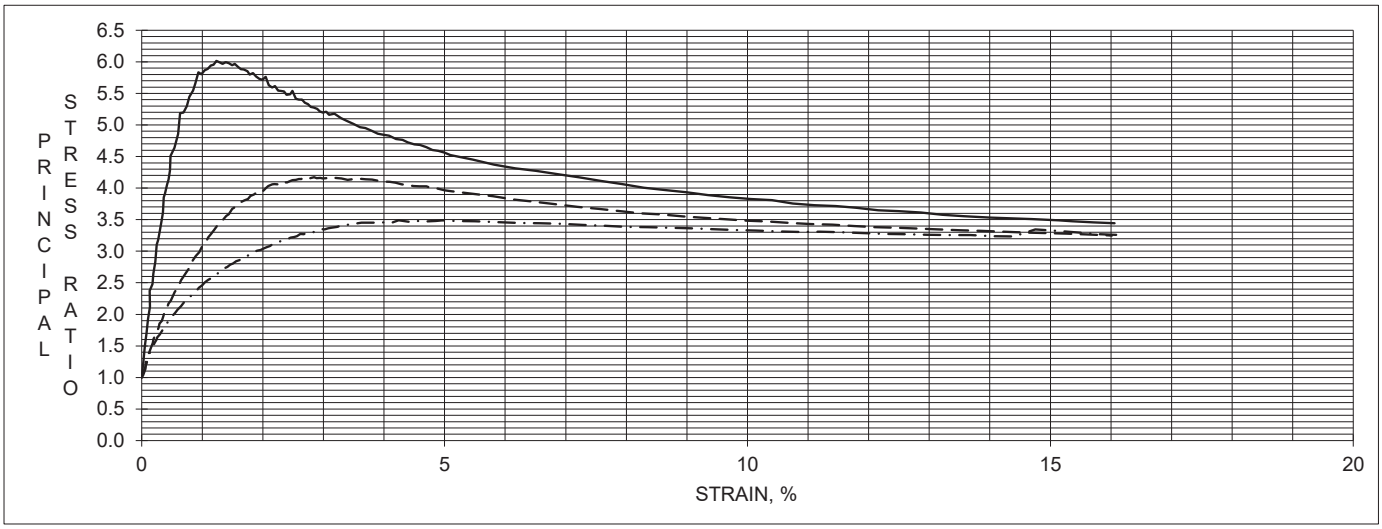
DEPTH, feet: 6.0 - 27.5

PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

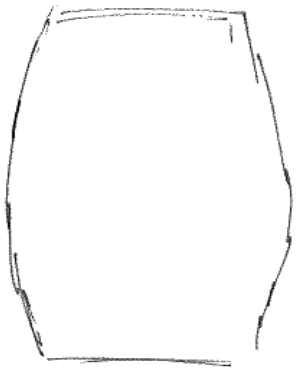
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)

02156344 Task 02 B030 ST-1, ST-2 & ST-3 6.0 - 27.5

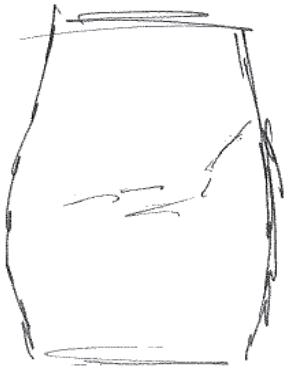


FAILURE SKETCH



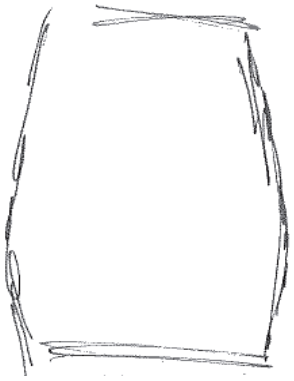
SPECIMEN A

FAILURE SKETCH



SPECIMEN B

FAILURE SKETCH



SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 2 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 2 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 2 % STRAIN.

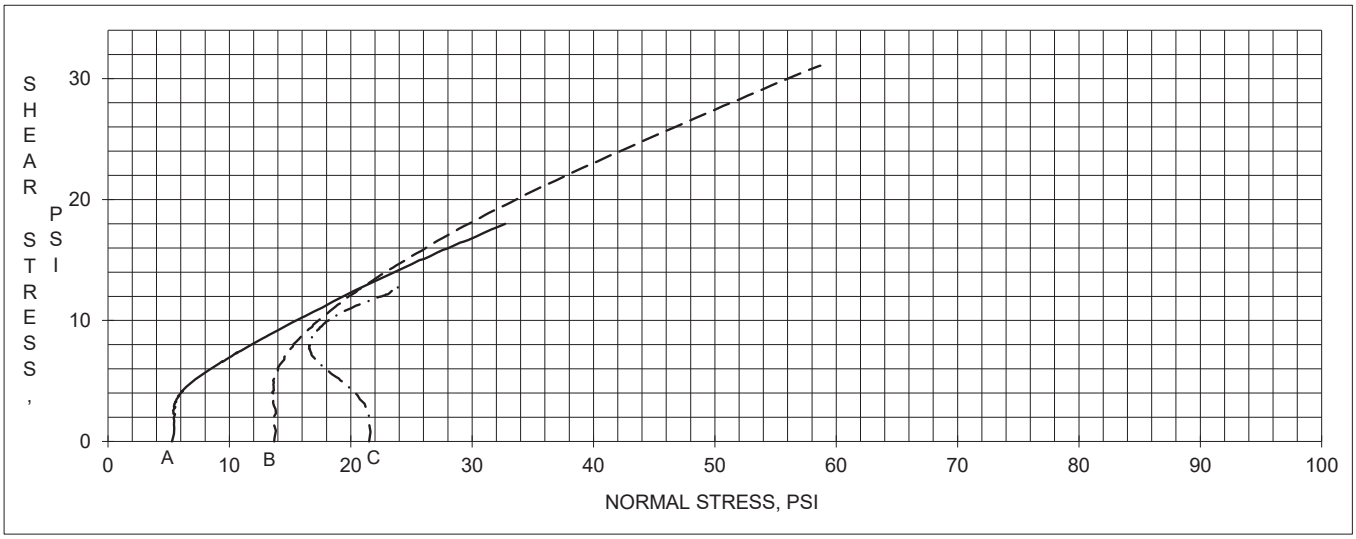
DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

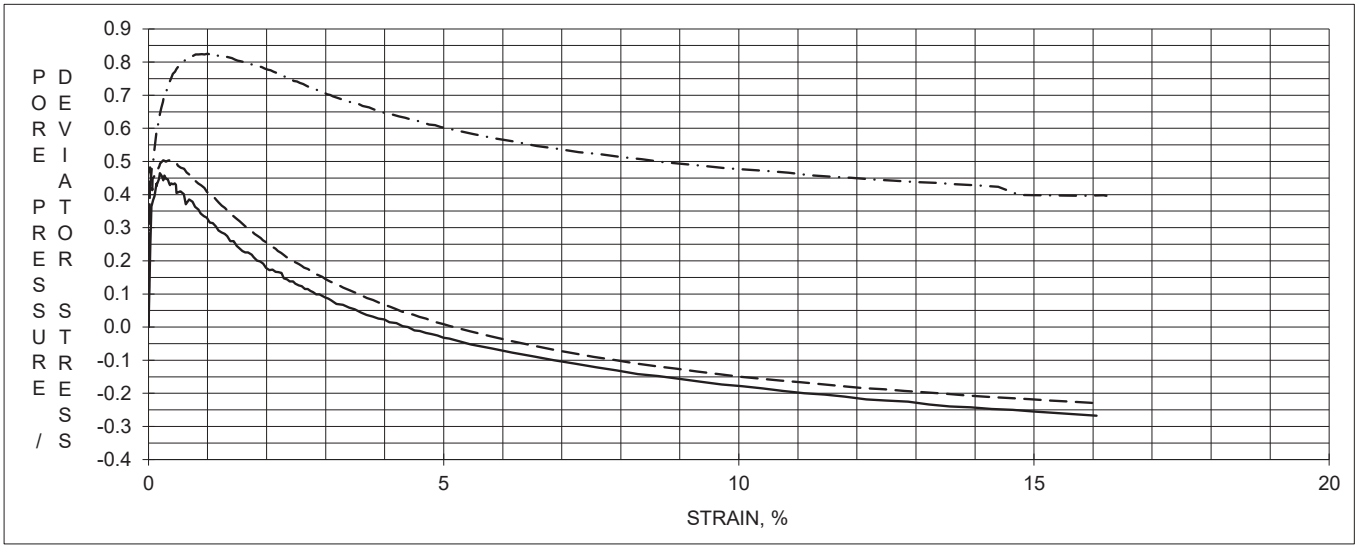
AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

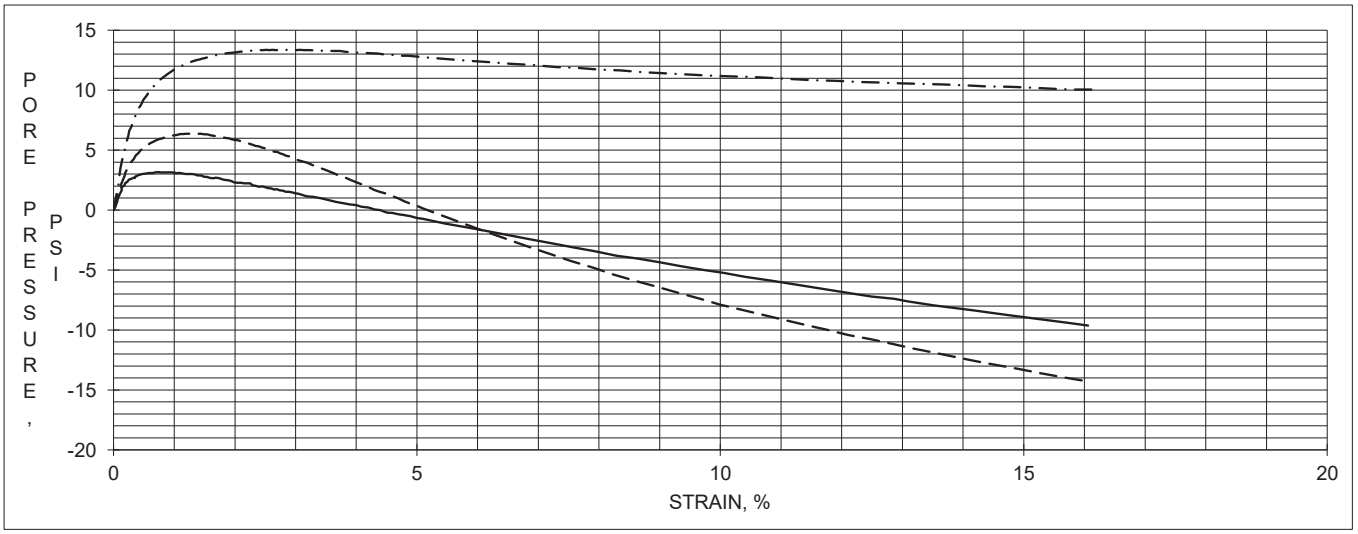
Terracon

DYNEGY CCR Ph 3/7-DUCK CREEK (ASH POND 2)

02156344 Task 02 B030 ST-1, ST-2 & ST-3 6.0 - 27.5







Terracon

Appendix B

Duck Creek Power Station: Ash Ponds 1 and 2 Supplemental Field Work, by Stantec, December 20, 2017

DUCK CREEK POWER STATION: ASH PONDS 1 AND 2 SUPPLEMENTAL FIELD WORK

February 28, 2018

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has completed the Supplemental Field Work and Borrow Study to support the closure design of Ash Pond 1 (AP1) and Ash Pond 2 (AP2) at the Illinois Power Resources Generating, LLC (IPRG) Duck Creek Power Station (DCPS). This work was performed under the purchase order issued by IPRG as discussed in the proposal entitled "Proposal – Ash Ponds 1 and 2 Supplemental Exploration at Duck Creek Power Station". Described in this document are the objectives, work performed, results, and conclusions regarding the ash pond portion of the Supplemental Field Work. The findings of Supplemental Field Work performed in the proposed borrow area are described in a separate document.

2.0 OBJECTIVE

Consistent with the programmatic framework for IPRG CCR facility closure projects, a Data Gap Analysis and Design Readiness Review has been performed to determine whether the project has adequate data/information to move forward with detailed closure design (Phase 2). As part of this effort, three primary data gaps were identified (below). The objective of this supplemental exploration is to address these gaps.

Limited characterization data exists for impounded CCR deposits and underlying foundation soil layers (mine spoil).

- Potential for dewatering to impact NPDES compliance at the permitted outfall. An anti-degradation study is being prepared by Hanson Professional Services Inc. (Hanson). Hanson requires support to identify representative locations to obtain pore and water column samples (based on Stantec's cut/fill plan that is being developed as part of an alternatives analysis).

- Discrete surveying of various ditches, pipes, utilities, etc.

Stantec developed a plan that includes a combination of drilling, test pit excavations, vane shear testing, and laboratory testing to address the limited characterization data gap and support the design. The interior pond foundation conditions (with appropriate consideration of the variability of mines spoils) were correlated to existing exterior sampling/testing locations. Results were used in required geotechnical characterization/analyses and in various constructability related items to support dewatering and subsequent grading efforts. Stantec also installed three piezometer sampling points for Hanson and obtained discrete surveying of various items.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

The work described below was performed to address the data gaps outlined above. Due to conditions encountered in field and preliminary findings, the fieldwork was varied from the proposed scope to fulfill the objectives of the supplemental fieldwork. A layout showing the performed work is attached as Attachment A.

All test pit and boring locations were checked for buried utilities by Blood Hound, a third-party locating service, using both ground penetrating radar and electromagnetic methods. All exploration locations were initially located using consumer-grade GPS devices and adjusted at the field engineer's discretion. Mauer-Stutz Inc. (Mauer-Stutz), a local, third-party surveyor contracted by IPRG measured the final excavation locations/elevations completion.

3.1 TEST PIT EXCAVATIONS

Test pit excavations were performed across the dry surface areas observed across AP 1 and AP2. A total of ten (10) test pits, designated TP-01 through TP-10, were conducted (three in each pond, and four at selected locations along the pond perimeter – described below) using Headwaters Plant Systems (Headwaters), a third-party excavator and operator contracted by IPRG.

Grab samples of excavated materials were obtained at selected intervals. Completed test pits were backfilled using excavated materials. Test pits were logged in the field by an engineer. Minimum logging efforts included a visual description of the materials encountered, including type, color, consistency, and moisture condition, depth(s) to any free water encountered, sampling intervals, and the tools, methods, and materials used for excavation and backfilling activities.

3.2 GEOTECHNICAL SUBSURFACE BORINGS

Subsurface exploratory borings were performed in dry surface areas observed across AP 1 and AP2. A total of four (4) sample borings were conducted (two in each pond) using a track-mounted drill rig (CME-55 track). Additionally, two (2) exploratory borings were conducted at offset locations to determine the location of the phreatic surface and acquire additional samples. The four (4) sample borings (S-1, S-2, S-3, and S-4) were advanced through the CCR deposits and upper portion of mine spoil using a mud-rotary drilling technique. Split-spoon testing (SPT) was conducted on approximate five-foot intervals and Shelby tube samples were performed at selected depths within the boring profile. After the completion of each boring, the borings were backfilled with a bentonite-cement grout.

Borings were logged in the field by an engineer. Logging efforts included a visual description of the materials encountered, including type, color, consistency, and moisture condition, sampling/testing intervals, and the tools, methods, and materials used for drilling and backfilling activities. Borings were located using consumer-grade GPS devices by Stantec field engineer(s).

3.3 VANE SHEAR TESTING

Vane shear testing was conducted at multiple locations across the ponds, including the test pit excavation locations described previously. Vane shear measurements provided a measurement of undrained shear strength. The intent was to establish a baseline condition for certain surface configurations that may be realized during construction.

3.4 PIEZOMETER INSTALLATIONS

Open standpipe piezometers were installed in selected (accessible) locations where dewatering is likely to facilitate collection of samples by Hanson. The locations of the three (3) sampling piezometers was determined in consultation with Hanson to obtain representative samples of pore fluid from AP1 and AP2. All three (3) sampling piezometers (PZ-1, PZ-2, and PZ-3) were installed at a depth below the local phreatic surface. Two (2) standpipes (PZ-1 and PZ-2) were installed using the CME-55 drill rig using 4.25-in. hollow stem augers under the supervision of a licensed well driller. Both PZ-1 standpipes consisted of a 2-in. PVC schedule 40 riser pipe and a 5-ft. screened section.

Each screened interval was backfilled with filter sand to a depth at least 1-ft. below and above the screened interval. A bentonite plug was installed to prevent ingress of surface water into the sampling piezometer. The remainder of the excavation was backfilled using a bentonite-cement grout. Due to access restrictions in the recently unwatered portion of AP2, PZ-3 was installed using a 2.5-in. stainless steel (305) drive point well. Well development was limited to bailing the casing after installation. Water level in each sampling piezometer were measured: 1) before bailing, 2) after bailing, and 3) after recharge.

3.5 LABORATORY TESTING

Samples obtained during the supplemental exploration were transported to our laboratory facilities for testing. Laboratory testing performed included moisture content and engineering classification, permeability, strength, consolidation. All testing was conducted in accordance with the relevant ASTM standards. Laboratory classification including the soil particle size distribution (ASTM D421 and D422) and index properties (e.g. Atterberg limits, ASTM D4318) were performed. Soil strength parameters were obtained using Consolidated-Undrained tri-axial compression testing. Consolidation was obtained using a 1-D incremental load test. Additional specialty hydraulic testing including the development of a soil water characteristic curve were conducted by Daniel B. Stevens and Associates, a third-party laboratory.

3.6 SURVEYING

As part of the supplemental fieldwork, Mauer-Stutz also collected additional survey data of infrastructure (ash pond and plant piping, sluice lines, etc.) and topography for the ash pond and perimeter dikes.

4.0 FIELD RESULTS

4.1 AP1/AP2 STRATIGRAPHY AND MATERIALS

Subsurface logs for both the exploratory borings and the test pits are attached to this document as Attachment B. Consistent site stratigraphy and conditions were encountered in the three evaluated areas (AP1, AP2 stacked area, AP1 unwatered areas). The CCR material in both AP1 and AP2 was characterized as being either stacked or sluiced into place. Stacked ash was encountered above elevation 625 and 639 in AP1 and AP2, respectively. Similarly, below elevation 625 (AP1) and 639 (AP2), soft saturated (sluiced) ash was encountered. A suspected bridging layer of bottom ash was encountered at elevation 630 in AP1 and 634 in AP2. The CCR material were observed to contain fly ash, FGD waste ("gypsum"), and bottom ash in varying proportions.

A review of the samples recovered during the subsurface exploratory program, indicated that there were six (6) representative materials encountered in AP1 and AP2. These six (6) materials include AP1 stacked ash, AP2 stacked ash, AP1 sluiced ash, AP2 sluiced ash, bottom ash, and mine spoil. In the stacked areas of AP1 and AP2 (AP1/AP2 stacked ash), the fly ash and gypsum CCR materials were observed to be comingled with some bottom ash especially near the surface. This material is described in the enclosed subsurface explorations as a commingled fly ash and gypsum, typically light gray, moist, and stiff to medium stiff. Conversely, in the sluiced CCR materials discrete thin layers of fly ash, gypsum, and bottom ash were observed. This material ranged from predominately fly ash with trace amounts of gypsum and bottom ash to interbedded fly ash and gypsum (at or around equal proportions) with trace bottom ash. The sluice ash was described in the boring logs as brown to dark gray, wet, and soft to vary soft.

Underlying the CCR material in both ash ponds was the reclaimed mine spoil at an elevation of approximately 590 feet. The mine spoil material is a disturbed material that was described as a lean clay, brown, wet, and very stiff. The bottom ash material was visually classified as a silty sand and was present throughout the CCR deposits in both trace quantities (stacked and sluiced ash) and in placed lifts ("bridging layers") that were between one and three feet thick. Due to the granular nature of the bottom ash material insufficient sample was recovered to perform laboratory classification testing. Representative laboratory classification data for the aforementioned soil types are presented in Table 1. In addition to the classification testing described in Table 1, strength and hydraulic properties for the CCR material were collected and is presented in Attachment C.

TABLE 1. TYPICAL MATERIAL PROPERTIES FOR REPRESENTATIVE MATERIALS IN AP1 AND AP2.

Description	Location	Boring	Percentage By Weight				USCS Symbol	Group Name
			G	S	M	C		
Stacked Ash	AP1	S-3	1.6	11.3	69.6	17.5	ML	Silt
Stacked Ash	AP2	S-1	1.4	19.3	67.3	11.8	ML	Silt with Sand
Sluiced Ash	AP1	S-4	0	15.4	74.1	10.5	ML	Silt with Sand
Sluiced Ash	AP2	S-2	0	7.1	82.6	10.3	ML	Silt
Mine Spoil	Site	BA	0.1	7.2	65	27.7	CL	Lean Clay
¤ Where G, S, M, and C represent the mass fraction of gravel, sand, silt, and clay, respectively.								

4.2 PHREATIC CONDITION

Determination of the elevation of the subsurface impounded water ("impounded water") was a primary goal of the supplemental field work with specific interest in how impounded water may affect any proposed dewatering activities during closure. The elevation of the impounded water was found to be between 622 ft and 625 feet in AP1 which roughly corresponds to the elevation of the rim ditch and the water impounded at the AP1/AP2 divider dike. Similarly, in the stacked area of AP2 subsurface impounded water was found at 635 feet. In the recently unwatered portion of AP2, near PZ-3 water was observed near the surface at an elevation of 626 feet which was visually related to the impounded surface water elevation at the north end of AP2.

In both AP1 and AP2 the impounded surface water elevation measured near surface (from borings, test pits, sampling wells, existing piezometers) was observed to be consistent with the elevation of impounded water subsurface water. A tabulation of the observed phreatic conditions in AP1 and AP2 during the period of the supplemental fieldwork (June 2017) is presented as Table 2.

TABLE 2. REPRESENTATIVE PHREATIC CONDITIONS IN AP1 AND AP2 AS OBSERVED DURING SUPPLEMENTARY FIELD EXPLORATION (JUNE 2017)

Location	Area	Ground	Depth to Water	Free Water Elevation
			D [ft]	z [ft]
TP-10	AP1	637.27	15.1	622.17
S-5	AP1	655.64	>30 (dry)	<625.6
S-6	AP2	653.78	18.1	635.68
PZ-1	AP1	635.65	14.4	621.25
PZ-2	Divider Dike	635.26	13.15	622.11
PZ-3	AP2	628.9	2.6	626.3
OM-26	AP2	655.1	18.9	636.2
OM-27	AP1	650.3	24.5	625.8
OM-28	AP1	659	33.9	625.1

4.3 VANE SHEAR

Vane shear testing was performed in both AP1 and AP2 as previously described in Section 3.3. Results from vane shear testing at all test pit and vane shear locations are attached as Attachment D.

In both AP1 and the stacked portion of AP2, the development of a hard surface "crust" was observed with the measured undrained shear strength decreasing below approximately 5 feet. For example, in AP1 shear strength measurements from depths of 0 to 5 feet averaged 3,300 psf and 2,000 psf for depths below five feet. Similarly, in AP2, shear strength in the top 5 feet measured 2,200 psf and 2,100 for depths below five feet. From the field measurements in the stacked ash materials, an undrained shear strength of 1,500 (low measurement) to 2,000 psf may be taken as a typical value.

In the recently unwatered section, the development of a stiff crust was observed in the top 1-2 feet depending on the depth to saturated CCR materials at that location. Shear strength in recently unwatered material ranged from 1,000 to 2,000 psf in unsaturated CCR materials to 0 to 500 psf in saturated materials.

5.0 CONCLUSIONS

Based on the results of the field and laboratory investigations, Stantec believes that the DCPS AP1 and AP2 have been characterized to facilitate closure design. The data obtained, and

documented herein, will be used to develop cut fill plans to 1) balance cut-fill operations, 2) minimize handling of saturated CCR materials, and 3) develop a site-specific dewatering plan.

6.0 CLOSURE

The observations, analyses, and results presented herein are based on information gathered from the observations, borings, and test pits using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. No warranties can be made regarding the continuity of subsurface conditions beyond or between the excavations.

The exploration data and related information depict approximate subsurface conditions only at the specific locations noted and at the time of excavation. Conditions at other locations may differ from those occurring at the excavation locations. Also, the passage of time may result in a change in the subsurface conditions at the excavation locations.

Attachment: Attachment A – AP1/AP2 Supplemental Exploration Layout
Attachment B – AP1/AP2 Supplemental Exploration Boring Logs
Attachment C – AP1/AP2 Supplemental Exploration Laboratory Testing Results
Attachment D – AP1/AP2 Supplemental Exploration Vane Shear Testing Results
Attachment E – Porewater Sampling Piezometer installation details

ATTACHMENT A
AP1/AP2 EXPLORATORY LAYOUT





Legend

- Boring
- Test Pit
- Vane Shear Test

0 300 600 1,200 1,800 Feet

1:7,200 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane Illinois West FIPS 1202 Feet
2. 2015 Orthophotography for Duck Creek provided by Dynegy

Stantec

Project Location
Latitude : 40.483552
Longitude: -89.986989
Fulton County, Illinois

175667029
Prepared by WSW on 2017-12-13
Technical Review by KL on 2017-12-13

Client/Project
Dynegy Inc
Duck Creek Ash Ponds 1 and 2 Closure Plan

Figure No.
1

Title
Supplemental Field Exploration Layout

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

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ATTACHMENT B
AP1/AP2 SUBSURFACE EXPLORATION LOGS

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-01** Total Depth 15.8 ft
County	Fulton County, IL	Surface Elevation	651.4 ft
Project Type	Geotechnical Exploration	Date Started	6/14/17 Completed 6/14/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry Date/Time 6/14/17
Logged By	C. Garner	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
651.4'	0.0'	Top of Hole							
		BOTTOM ASH WITH FLY ASH, black to dark gray, dry, loose to very dense		BAG-1	0.0' - 1.5'	'		22	
649.4'	2.0'								
		FLY ASH, black, dry, hard and cemented, with trace bottom ash		BAG-2	2.0' - 2.5'	'		14	
647.1'	4.3'								
		COMMINGLED FLY ASH AND GYPSUM, gray to light gray, moist, stiff to medium stiff		BAG-3	5.0' - 5.5'	'		37	
				Grab-1	9.0' - 10.0'	'		30	
				Grab-2	12.0' - 12.5'	'		25	
636.2'	15.2'								
				Grab-3	15.2' - 15.3'	'		31	
635.6'	15.8'	BOTTOM ASH, black, wet, loose, with fly ash		BAG-4	15.3' - 15.8'	'		29	

No Refusal /
Bottom of Hole

General Notes:

1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-02**	Total Depth	17.5 ft
County	Fulton County, IL	Surface Elevation	653.3 ft		
Project Type	Geotechnical Exploration	Date Started	6/14/17	Completed	6/14/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry	Date/Time	6/14/17
Logged By	C. Garner	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
653.3'	0.0'	Top of Hole							
		BOTTOM ASH, dark gray, dry, loose, with fly ash		BAG-1	0.0' - 3.2'	'		24	
650.0'	3.3'								
		FLY ASH, black, dry, hard and cemented, cemented between 3.3 feet and 3.9 feet		BAG-2	3.2' - 5.0'	'		8	
648.3'	5.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray to light gray, moist, hard to medium stiff		BAG-3	5.0' - 6.0'	'		20	
642.3'	11.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray to light gray, moist, soft		Grab-1	11.1' - 12.0'	'		30	
				Grab-2	15.0' - 16.0'	'		38	
635.8'	17.5'								
		No Refusal / Bottom of Hole							

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-03**	Total Depth	16.8 ft
County	Fulton County, IL	Surface Elevation	651.4 ft		
Project Type	Geotechnical Exploration	Date Started	6/14/17	Completed	6/14/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry	Date/Time	6/14/17
Logged By	C. Garner	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
651.4'	0.0'	Top of Hole							
650.9'	0.5'	BOTTOM ASH, dark gray, dry, loose, with fly ash							
		FLY ASH, dark gray, dry, hard and cemented, with trace bottom ash		BAG-1	0.5' - 4.5'	'		25	
646.9'	4.5'								
		COMMINGLED FLY ASH AND GYPSUM, gray, moist, very stiff to stiff, with bottom ash seam at 8'							
641.6'	9.8'								
		COMMINGLED FLY ASH AND GYPSUM, gray to light gray, moist to wet, stiff, with some bottom ash		BAG-2	9.8' - 10.5'	'		30	
				Grab-3	11.0' - 12.0'	'		30	
634.6'	16.8'			Grab-4	16.0' - 16.8'	'		46	
		No Refusal / Bottom of Hole							

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-04**
County	Fulton County, IL	Surface Elevation	635.5 ft
Project Type	Geotechnical Exploration	Date Started	6/13/17
Supervisor	C. Garner	Driller	Headwaters
Logged By	C. Garner		

Total Depth: 16.4 ft | Completed: 6/13/17 | Depth to Water: Dry | Date/Time: 6/13/17 | Depth to Water: N/A | Date/Time: N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
635.5'	0.0'	Top of Hole							
635.0'	0.5'	FLY ASH, black, dry, very soft to hard, with some bottom ash and trace coal fragments, hard and cemented between 0.5 ft and 3.1 ft		BAG-1	0.5' - 3.1'	'		20	
		COMMINGLED FLY ASH AND GYPSUM, gray to light gray, moist, hard to medium stiff		BAG-2	3.1' - 4.0'	'		23	
619.1'	16.4'	No Refusal / Bottom of Hole							

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-05**	Total Depth	16.8 ft
County	Fulton County, IL	Surface Elevation	653.0 ft		
Project Type	Geotechnical Exploration	Date Started	6/14/17	Completed	6/14/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry	Date/Time	6/14/17
Logged By	C. Garner	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
653.0'	0.0'	Top of Hole							
652.0'	1.0'	BOTTOM ASH, black, dry, loose, with some fly ash and gravel							
		FLY ASH, black, dry, hard, with trace bottom ash		BAG-1	1.0' - 3.0'	'		--	
648.0'	5.0'								
		FLY ASH, black, moist, hard and cemented		BAG-2	5.1' - 7.0'	'		12	
643.0'	10.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray to light gray, moist, stiff to firm		Grab-2	10.0' - 12.0'	'		21	
639.0'	14.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray to light gray, moist, stiff to firm		Grab-3	16.0' - 16.5'	'		37	
636.2'	16.8'								

No Refusal /
Bottom of Hole

General Notes:

1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-06**	Total Depth	15.5 ft
County	Fulton County, IL	Surface Elevation	640.4 ft		
Project Type	Geotechnical Exploration	Date Started	6/13/17	Completed	6/13/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry	Date/Time	6/13/17
Logged By	C. Garner	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
640.4'	0.0'	Top of Hole							
		COMMINGLED FLY ASH AND GYPSUM, dark gray, dry, very stiff, with some cementation		Grab-1	0.0' - 4.5'	'		11	
631.9'	8.5'								
		COMMINGLED FLY ASH AND GYPSUM, dark gray, moist, soft		Grab-2 BAG-2	8.5' - 9.0' 9.0' - 9.5'	' '		51 --	
629.0'	11.4'								
		LEAN CLAY, tan, moist, stiff, with occasional gravel, coal fragments, and roots		Grab-3	11.0' - 12.2'	'		13	
624.9'	15.5'								

No Refusal /
Bottom of Hole

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-07**	Total Depth	15.0 ft
County	Fulton County, IL	Surface Elevation	659.3 ft		
Project Type	Geotechnical Exploration	Date Started	6/14/17	Completed	6/14/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry	Date/Time	6/14/17
Logged By	C. Garner	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
659.3'	0.0'	Top of Hole							
659.0'	0.3'	BOTTOM ASH, black, dry, loose							
		FLY ASH, black, dry, hard and cemented, with bottom ash							
654.7'	4.6'								
653.5'	5.8'	FLY ASH, black, moist, hard to very stiff		Grab-1	4.6' - 5.8'	'		12	
		COMMINGLED FLY ASH AND GYPSUM, gray, moist, stiff to medium stiff		Grab-2	5.8' - 6.5'	'		21	
644.3'	15.0'								

No Refusal /
Bottom of Hole

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-08**	Total Depth	14.5 ft
County	Fulton County, IL	Surface Elevation	634.6 ft		
Project Type	Geotechnical Exploration	Date Started	6/13/17	Completed	6/13/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry	Date/Time	6/13/17
Logged By	C. Garner	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
634.6'	0.0'	Top of Hole							
		FLY ASH, black, dry, hard and cemented, with bottom ash		BAG-1	0.0' - 3.0'	'		14	
631.4'	3.2'								
		COMMINGLED FLY ASH AND GYPSUM, gray, mosit, stiff to firm		Grab-1	5.0' - 7.0'	'		32	
				Grab-2	10.0' - 12.0'	'		34	
620.1'	14.5'								

No Refusal /
Bottom of Hole

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-09** Total Depth 15.3 ft
County	Fulton County, IL	Surface Elevation	640.6 ft
Project Type	Geotechnical Exploration	Date Started	6/13/17 Completed 6/13/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	Dry Date/Time 6/13/17
Logged By	C. Garner	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
640.6'	0.0'	Top of Hole							
		FLY ASH, black, dry, soft to hard, and lightly cemented		Grab-1	0.0' - 3.2'	'		7	
637.4'	3.2'								
		COMMINGLED FLY ASH AND GYPSUM, light brown, dry, hard to cemented		Grab-2	3.2' - 5.0'	'		9	
635.6'	5.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray, moist, soft		Grab-3	5.0' - 5.5'	'		44	
631.1'	9.5'								
		COMMINGLED FLY ASH AND GYPSUM, dark gray, moist, hard		Grab-4	9.5' - 11.0'	'		22	
629.1'	11.5'								
		COMMINGLED FLY ASH AND GYPSUM, gray to dark gray, moist, very stiff to soft							
625.3'	15.3'								

No Refusal /
Bottom of Hole

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**TP-10**	Total Depth	15.5 ft
County	Fulton County, IL	Surface Elevation	635.3 ft		
Project Type	Geotechnical Exploration	Date Started	6/12/17	Completed	6/12/17
Supervisor	C. Garner Driller Headwaters	Depth to Water	15.1 ft	Date/Time	6/12/17
Logged By	C. Garner	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
635.3'	0.0'	Top of Hole							
		FLY ASH, black, dry, loose to lightly cemented, with bottom ash		Grab-1	0.0' - 2.5'	'		6	
631.8'	3.5'								
		FLY ASH, black, dry, hard and cemented, with bottom ash		Grab-2	4.0' - 6.0'	'		15	
628.3'	7.0'								
		COMMINGLED FLY ASH AND GYPSUM, dark gray, moist, soft		Grab-3	7.0' - 9.0'	'		49	
624.8'	10.5'								
		COMMINGLED FLY ASH AND GYPSUM, grey, moist, stiff, with trace gravel and clay		Grab-4	11.0' - 13.0'	'		20	
620.3'	15.0'								
619.8'	15.5'	COMMINGLED FLY ASH AND GYPSUM, grey, wet, firm		Grab-5	15.0' - 15.5'	'		65	

No Refusal /
Bottom of Hole

General Notes:
1. Excavation Conducted Using Komatsu PC170LC-11 Excavator with 24 in Bucket.
2. Hole Backfilled with Excavated Materials.
3. Laboratory Testing Specimens Formed From Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_TEST_PITS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**S-1**	Total Depth	70.0 ft
County	Fulton County, IL	Surface Elevation	653.8 ft		
Project Type	Geotechnical Exploration	Date Started	6/15/17	Completed	6/16/17
Supervisor	L. Eaves Driller G.Thompson	Depth to Water	Dry	Date/Time	6/16/17
Logged By	L. Eaves	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
653.8'	0.0'	Top of Hole							
		BOTTOM ASH, black, dry, medium dense, with fly ash		SPT-1	0.0' - 1.5'	1.5'	15-12-15	30	
648.8'	5.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray, moist, medium stiff to very soft, (stacked ash)		SPT-2	5.0' - 6.5'	1.5'	9-10-10	28	
				SPT-3	10.0' - 11.5'	1.1'	2-3-3	33	
638.8'	15.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray, wet, very soft, (stacked ash)		SPT-4	15.0' - 16.5'	1.5'	WOH-WOH-2	42	
633.8'	20.0'								
631.8'	22.0'	BOTTOM ASH, black, wet, medium dense, (layer observed from tube down pressure)		ST-1	20.0' - 22.0'	0.0'		--	
				SPT-5	22.5' - 24.0'	0.0'	4-4-4	--	
		INTERBEDDED FLY ASH AND GYPSUM, light gray to dark gray, wet, very soft, with trace bottom ash (sluiced ash)		ST-2	25.0' - 27.0'	1.4'		--	
				SPT-6	30.0' - 31.5'	1.5'	WOH-WOH-2	44	
				ST-3	35.0' - 37.0'	0.7'		--	

STANTEC/FMSM_LEGACY 175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number 175667029 Location (See Boring Layout)

Project Name Duck Creek Ash Pond 1 and 2 Closure Boring No. **S-1** Total Depth 70.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		INTERBEDDED FLY ASH AND GYPSUM, light gray to dark gray, wet, very soft, with trace bottom ash (sluiced ash) *(Continued)*		SPT-7	40.0' - 41.5'	0.9'	WOH-2-1	56	
				SPT-8	45.0' - 46.5'	1.3'	2-1-1	71	
				SPT-9	50.0' - 51.5'	1.5'	WOH-WOH-2	66	
598.8'	55.0'								
		FLY ASH, brown to dark gray, wet, very soft, with trace bottom ash (sluiced ash)		SPT-10	55.0' - 56.5'	1.5'	WOH-WOH-3	74	
593.8'	60.0'								
		LEAN CLAY, brown to gray, wet, very stiff to soft, (mine spoil)		SPT-11	60.0' - 61.5'	1.5'	8-10-11	27	
				ST-4	63.0' - 65.0'	0.0'		--	
				SPT-12	65.0' - 66.5'	1.5'	4-6-7	23	
				ST-5	68.0' - 70.0'	0.0'		--	
583.8'	70.0'								

No Refusal /
Bottom of Hole

General Notes:

1. Boring Advanced with 5 7/8 in. O.D. Mud Rotary Technqiue (Tri-Cone Bit) and CME-55 Tracked Drill Rig.
2. Hole Backfilled with Cement-Bentonite Grout.
3. Laboratory Testing Specimens Formed from Recovered Samples as Designated.

STANTEC/FMSM_LEGACY_175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**S-2**	Total Depth	60.0 ft
County	Fulton County, IL	Surface Elevation	654.0 ft		
Project Type	Geotechnical Exploration	Date Started	6/16/17	Completed	6/16/17
Supervisor	L. Eaves Driller G.Thompson	Depth to Water	Dry	Date/Time	6/16/17
Logged By	L. Eaves	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
654.0'	0.0'	Top of Hole							
		COMMINGLED FLY ASH AND GYPSUM, gray, dry to wet, very stiff to very soft, (stacked ash with sluiced ash at depth)		SPT-1	0.0' - 1.5'	1.2'	6-9-7	21	
				SPT-2	5.0' - 6.5'	1.5'	3-2-3	29	
				SPT-3	10.0' - 11.5'	1.2'	6-6-7	34	
				SPT-4	15.0' - 16.5'	1.0'	WOH-WOH-1	47	
				ST-1	20.0' - 22.0'	1.0'		--	
				SPT-5	25.0' - 26.5'	0.0'	WOH-WOH-WOH	--	
				SPT-6	30.0' - 31.5'	1.3'	WOH-WOH-2	59	
				ST-2	35.0' - 37.0'	1.5'		--	

STANTEC/FMSM_LEGACY 175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number 175667029 Location (See Boring Layout)

Project Name Duck Creek Ash Pond 1 and 2 Closure Boring No. **S-2** Total Depth 60.0 ft

Lithology		Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
Elevation	Depth								
613.0'	41.0'			SPT-7	40.0' - 41.5'	1.3'	WOR-3-4	63	
612.0'	42.0'	BOTTOM ASH, dark gray, wet, loose, (sluiced ash)							
		INTERBEDDED FLY ASH AND GYPSUM, gray, wet, very soft, gypsum content increased with depth (sluiced ash)		SPT-8	45.0' - 46.5'	0.0'	WOR-WOR-WOR	--	
				SPT-9	50.0' - 51.5'	1.5'	WOR-WOH-1	64	
599.0'	55.0'								
		LEAN CLAY, brown to dark gray, wet, very stiff, (mine spoil)		SPT-10	55.0' - 56.5'	1.0'	3-9-12	20	
				ST-3	58.0' - 60.0'	0.5'		--	
594.0'	60.0'								

No Refusal /
Bottom of Hole

General Notes:
1. Boring Advanced with 5 7/8 in. O.D. Mud Rotary Technqiue (Tri-Cone Bit) and CME-55 Tracked Drill Rig.
2. Hole Backfilled with Cement-Bentonite Grout.
3. Laboratory Testing Specimens Formed from Recovered Samples as Designated.

STANTEC/FMSM_LEGACY_175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**S-3**
County	Fulton County, IL	Surface Elevation	655.9 ft
Project Type	Geotechnical Exploration	Date Started	6/13/17
Supervisor	L. Eaves	Driller	G.Thompson
Logged By	L. Eaves		

Total Depth: 71.5 ft | Completed: 6/14/17 | Depth to Water: Dry | Date/Time: 6/14/17 | Depth to Water: N/A | Date/Time: N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
655.9'	0.0'	Top of Hole							
		BOTTOM ASH, gray, dry, medium dense, with fly ash		SPT-1	0.0' - 1.5'	0.8'	10-10-10	8	
650.9'	5.0'								
		COMMINGLED FLY ASH AND GYPSUM, dark gray, moist, stiff to medium stiff, gypsum content increases with depth (stacked ash)		SPT-2	5.0' - 6.5'	1.0'	11-8-6	24	
				SPT-3	10.0' - 11.5'	0.8'	3-6-5	28	
				SPT-4	15.0' - 16.5'	1.1'	3-2-4	40	
				SPT-5	20.0' - 21.5'	0.7'	3-3-3	46	
				ST-1	25.0' - 27.0'	0.0'		--	
627.9'	28.0'			SPT-6	27.0' - 28.5'	1.5'	3-3-13	40	
625.9'	30.0'	BOTTOM ASH, black, wet, medium dense							
		COMMINGLED FLY ASH AND GYPSUM, gray, wet, soft, (indeterminate stacked or sluiced ash)		SPT-7	30.0' - 31.5'	1.5'	2-2-1	50	
				ST-2	35.0' - 37.0'	1.3'		--	

STANTEC/FMSM_LEGACY 175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number 175667029 Location (See Boring Layout)

Project Name Duck Creek Ash Pond 1 and 2 Closure Boring No. **S-3** Total Depth 71.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
615.4'	40.5'	BOTTOM ASH, black, wet, medium dense, with interbedded gypsum and fly ash seams (sluiced ash)		SPT-8	40.0' - 41.5'	1.1'	1-5-6	43	
610.9'	45.0'	INTERBEDDED FLY ASH AND GYPSUM, gray, wet, soft to very soft, with trace bottom ash (sluiced ash)		SPT-9	45.0' - 46.5'	1.2'	1-1-2	70	
				ST-3	50.0' - 52.0'	1.0'		--	
				SPT-10	55.0' - 56.5'	0.3'	WH-2-2	78	
				SPT-11	60.0' - 61.5'	0.0'	WH-2-1	--	
				SPT-12	65.0' - 66.5'	0.0'	WR-1-1	--	
585.9'	70.0'								
584.4'	71.5'	LEAN CLAY, brown, wet, very stiff, (mine spoil)		SPT-13	70.0' - 71.5'	1.5'	7-12-16	19	

No Refusal /
Bottom of Hole

General Notes:
1. Boring Advanced with 5 7/8 in. O.D. Mud Rotary Technqiue (Tri-Cone Bit) and CME-55 Tracked Drill Rig.
2. Hole Backfilled with Cement-Bentonite Grout.
3. Laboratory Testing Specimens Formed from Recovered Samples as Designated.

STANTEC/FMSM_LEGACY_175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**S-4**	Total Depth	66.5 ft
County	Fulton County, IL	Surface Elevation	659.7 ft		
Project Type	Geotechnical Exploration	Date Started	6/14/17	Completed	6/15/17
Supervisor	L. Eaves Driller G.Thompson	Depth to Water	Dry	Date/Time	6/15/17
Logged By	L. Eaves	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
659.7'	0.0'	Top of Hole							
		COMMINGLED FLY ASH AND GYPSUM, black, dry to moist, very stiff, (stacked ash)		SPT-1	0.0' - 1.5'	1.0'	7-8-10	7	
				SPT-2	5.0' - 6.5'	0.9'	5-5-4	22	
				SPT-3	10.0' - 11.5'	0.8'	3-3-3	35	
644.2'	15.5'								
		BOTTOM ASH, black, moist to wet, medium dense		SPT-4	15.0' - 16.5'	1.3'	4-5-21	29	
639.7'	20.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray, wet, stiff, (stacked ash)		SPT-5	20.0' - 21.5'	1.5'	4-6-7	34	
				ST-1	25.0' - 27.0'	1.2'		--	
629.7'	30.0'								
		BOTTOM ASH, black, wet, medium dense		SPT-6	30.0' - 31.5'	1.5'	8-8-9	28	
624.7'	35.0'								
				SPT-7	35.0' - 36.5'	1.5'	20-24-21	24	

STANTEC/FMSM_LEGACY 175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

Stantec

SUBSURFACE LOG

Project Number 175667029 Location (See Boring Layout)

Project Name Duck Creek Ash Pond 1 and 2 Closure Boring No. **S-4** Total Depth 66.5 ft

Lithology		Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
Elevation	Depth								
		INTERBEDDED FLY ASH AND GYPSUM, gray, wet, very stiff to very soft, with trace bottom ash, gypsum content increases with depth (sluiced ash) *(Continued)*		SPT-8	40.0' - 41.5'	1.5'	WH-2-3	61	
				ST-2	45.0' - 47.0'	0.0'		--	
				SPT-9	47.0' - 48.5'	1.0'	WR-3-3	59	
				SPT-10	50.0' - 51.5'	0.9'	3-4-4	43	
				SPT-11	55.0' - 56.5'	1.0'	3-4-2	45	
				SPT-12	60.0' - 61.5'	1.1'	WR-WR-WR	54	
594.7'	65.0'								
593.2'	66.5'	LEAN CLAY, brown, wet, very stiff, (mine spoil)		SPT-13	65.0' - 66.5'	1.5'	8-11-15	18	

No Refusal /
Bottom of Hole

General Notes:
1. Boring Advanced with 5 7/8 in. O.D. Mud Rotary Technqiue (Tri-Cone Bit) and CME-55 Tracked Drill Rig.
2. Hole Backfilled with Cement-Bentonite Grout.
3. Laboratory Testing Specimens Formed from Recovered Samples as Designated.

STANTEC/FMSM_LEGACY_175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**S-5**	Total Depth	30.0 ft
County	Fulton County, IL	Surface Elevation	655.6 ft		
Project Type	Geotechnical Exploration	Date Started	6/15/17	Completed	6/15/17
Supervisor	L. Eaves	Driller	G.Thompson	Depth to Water	Dry	Date/Time	6/15/17
Logged By	L. Eaves	Depth to Water	N/A	Date/Time	N/A

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
655.6'	0.0'	Top of Hole							
652.6'	3.0'	BOTTOM ASH, black, medium dense to dense							
		COMMINGLED FLY ASH AND GYPSUM, gray, medium stiff to soft, (stacked ash)							
625.6'	30.0'								

STANTEC/FMSM_LEGACY 175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number 175667029 Location (See Boring Layout)

Project Name Duck Creek Ash Pond 1 and 2 Closure Boring No. **S-5** Total Depth 30.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		No Refusal / Bottom of Hole							

General Notes:

1. Boring Advanced with 4 1/4 in. O.D. Hollow Stem Auger and CME-55 Tracked Drill Rig.
2. Hole Backfilled with Cement-Bentonite Grout.
3. Laboratory Testing Specimens Formed from Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

SUBSURFACE LOG

Project Number	175667029	Location	(See Boring Layout)		
Project Name	Duck Creek Ash Pond 1 and 2 Closure	Boring No.	**S-6**	Total Depth	21.0 ft
County	Fulton County, IL	Surface Elevation	653.2 ft		
Project Type	Geotechnical Exploration	Date Started	6/17/17	Completed	6/17/17
Supervisor	L. Eaves Driller G.Thompson	Depth to Water	18.1 ft	Date/Time	6/17/17
Logged By	L. Eaves	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
653.2'	0.0'	Top of Hole							
		COMMINGLED FLY ASH AND GYPSUM, gray, dry, medium stiff, (stacked ash)							
646.2'	7.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray, moist, medium stiff to soft, (stacked ash)							
640.2'	13.0'								
		COMMINGLED FLY ASH AND GYPSUM, gray, wet, soft, (stacked ash)		ST-1	14.0' - 16.0'	0.0'		--	
				ST-2	19.0' - 21.0'	1.9'		--	
632.2'	21.0'								

No Refusal /
Bottom of Hole

General Notes:

1. Boring Advanced with 4 1/4 in. O.D. Hollow Stem Auger and CME-55 Tracked Drill Rig.
2. Hole Backfilled with Cement-Bentonite Grout.
3. Laboratory Testing Specimens Formed from Recovered Samples as Designated.

STANTEC/FMSM_LEGACY 175667029_GINT_LOGS.GPJ FMSM-GRAPHIC LOG.GDT 12/13/17

ATTACHMENT C
AP1/AP2 LABORATORY TEST RESULTS

ATTACHMENT C.1
MOSITURE CONTENT TESTING

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name: Dynegy Duck Creek Closure Supplemental Field Work

Project Number: 175667029

Tested By: CM

Test Method: ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous, Disturbed

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
S-1, 0.0'-1.5'	37	7/7/17	Hom	No. 10			Yes	31.82	150.95	123.20	30.4
S-1, 5.0'-6.5'	38	7/7/17	Hom	3/8"			No	31.74	153.05	126.90	27.5
S-1, 10.0'-11.5'	40	7/7/17	Hom	No. 10			Yes	31.78	123.15	100.40	33.2
S-1, 15.0'-16.5'	41	7/7/17	Hom	No. 4			No	30.33	107.16	84.37	42.2
S-1, 30.0'-34.5'	42	7/7/17	Hom	No. 10			Yes	30.12	146.76	110.94	44.3
S-1, 40.0'-41.5'	43	7/7/17	Hom	No. 10			Yes	29.72	123.03	89.74	55.5
S-1, 45.0'-46.5'	44	7/7/17	Hom	No. 10			Yes	31.46	135.12	92.01	71.2
S-1, 50.0'-51.5'	45	7/10/17	Hom	No. 10			Yes	30.60	114.77	81.37	65.8
S-1, 55.0'-56.5'	46	7/10/17	Hom	No. 10			Yes	31.48	94.62	67.73	74.2
S-1, 60.0'-61.5'	47	7/10/17	Hom	No. 4			No	31.81	156.54	129.81	27.3
S-1, 65.0'-66.5'	48	7/10/17	Hom	No. 10			Yes	31.64	148.24	126.79	22.5
S-2, 0.0'-1.5'	49	7/10/17	Hom	3/8"			No	30.07	116.27	101.42	20.8
S-2, 5.0'-6.5'	50	7/10/17	Hom	3/4"			No	31.39	154.86	126.81	29.4
S-2, 10.0'-11.5'	51	7/10/17	Hom	No. 10			Yes	31.56	153.43	122.76	33.6
S-2, 15.0'-16.5'	52	7/10/17	Hom	No. 10			Yes	30.14	141.96	106.14	47.1
S-2, 25.0'-26.5' No Recovery	53	7/10/17									
S-2, 30.0'-31.5'	54	7/10/17	Hom	No. 10			Yes	31.63	107.28	79.18	59.1
S-2, 35.0'-37.0' Shelby Tube	55	7/10/17									
S-2, 40.0'-41.5'	56	7/10/17	Hom	No. 10			Yes	30.43	130.50	91.72	63.3
S-2, 45.0'-46.5' No Recovery	58	7/10/17									
S-2, 50.0'-51.5'	59	7/10/17	Hom	No. 10			Yes	32.12	98.46	72.52	64.2
S-2, 55.0'-56.5'	60	7/10/17	Hom	No. 10			Yes	30.19	183.34	158.16	19.7
S-3, 0.0'-1.5'	61	7/10/17	Hom	No. 4			No	30.12	126.48	119.40	7.9
S-3, 5.0'-6.5'	62	7/10/17	Hom	No. 10			Yes	31.63	148.89	126.35	23.8
S-3, 10.0'-11.5'	63	7/10/17	Hom	No. 10			Yes	31.63	138.60	115.32	27.8
S-3, 15.0'-16.5'	64	7/10/17	Hom	No. 10			Yes	31.10	99.85	80.29	39.8
S-3, 20.0'-21.5'	66	7/10/17	Hom	No. 10			Yes	31.52	112.37	87.03	45.6
S-3, 27.0'-28.5'	67	7/10/17	Hom	3/8"			No	31.39	122.41	96.21	40.4

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name: Dynegy Duck Creek Closure Supplemental Field Work

Project Number: 175667029

Tested By: CM

Test Method: ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous, Disturbed

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
S-3, 30.0'-31.5'	68	7/10/17	Hom	3/8"			No	31.52	107.88	82.33	50.3
S-3, 40.0'-41.5'	69	7/10/17	Hom	No. 10			Yes	30.97	127.44	98.63	42.6
S-3, 45.0'-46.5'	70	7/10/17	Hom	No. 10			Yes	30.08	112.54	78.64	69.8
S-3, 55.0'-56.5'	71	7/10/17	Hom	No. 10			Yes	30.20	94.01	66.10	77.7
S-3, 60.0'-61.5' No Recovery	72	7/10/17									
S-3, 65.0'-66.5' No Recovery	73	7/10/17									
S-3, 70.0'-71.5'	74	7/10/17	Hom	No. 10			Yes	31.41	161.65	141.06	18.8
S-4, 0.0'-1.5'	75	7/10/17	Hom	No. 4			No	31.65	110.61	105.75	6.6
S-4, 5.0'-6.5'	76	7/10/17	Hom	No. 4			No	31.59	135.87	117.02	22.1
S-4, 10.0'-11.5'	77	7/10/17	Hom	No. 10			Yes	30.18	157.58	124.82	34.6
S-4, 15.0'-16.5'	78	7/10/17	Hom	No. 10			Yes	30.73	155.13	126.95	29.3
S-4, 20.0'-21.5'	79	7/10/17	Hom	No. 10			Yes	31.14	137.77	110.63	34.1
S-4, 30.0'-31.5'	80	7/10/17	Hom	3/8"			No	30.40	127.54	106.33	27.9
S-4, 35.0'-36.5'	81	7/10/17	Hom	No. 4			Yes	31.39	155.21	131.52	23.7
S-4, 40.0'-41.5'	83	7/10/17	Hom	No. 10			Yes	31.40	122.39	88.10	60.5
S-4, 47.0'-48.5'	84	7/10/17	Hom	No. 10			Yes	31.76	125.40	90.63	59.1
S-4, 50.0'-51.5'	85	7/10/17	Hom	3/8"			No	31.95	120.72	93.93	43.2
S-4, 55.0'-56.5'	86	7/10/17	Hom	No. 10			Yes	30.64	139.77	105.90	45.0
S-4, 60.0'-61.5'	87	7/10/17	Hom	No. 10			Yes	31.03	113.69	84.57	54.4
S-4, 65.0'-66.5'	88	7/10/17	Hom	No. 10			Yes	31.79	198.11	172.85	17.9
TP-1, 0.0'-1.5'	89	7/11/17	Hom	3/8"			No	22.41	72.35	63.50	21.5
TP-1, 2.0'-2.5'	90	7/11/17	Hom	3/8"			No	21.73	83.72	75.94	14.4
TP-1, 5.0'-5.5'	91	7/11/17	Hom	No. 4			No	21.26	90.65	71.98	36.8
TP-1, 9.0'-10.0'	92	7/11/17	Hom	No. 10			Yes	20.94	69.51	58.46	29.5
TP-1, 12.0'-12.5'	93	7/11/17	Hom	No. 10			Yes	26.26	103.07	87.58	25.3
TP-1, 15.2'-15.8'	94	7/11/17	Hom	3/8"			No	22.51	89.18	73.42	31.0
TP-1, 15.2'-15.9'	95	7/11/17	Hom	No. 4			No	21.33	110.29	90.53	28.6
TP-2, 0.0'-3.2'	96	7/11/17	Hom	3/8"			No	20.89	82.55	70.49	24.3

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name: Dynegy Duck Creek Closure Supplemental Field Work

Project Number: 175667029

Tested By: CM

Test Method: ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous, Disturbed

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
TP-2, 3.2'-5.0'	97	7/11/17	Hom	No. 4			No	21.31	63.15	60.20	7.6
TP-2, 5.0'-6.0'	98	7/11/17	Hom	No. 4			No	22.30	95.58	83.37	20.0
TP-2, 11.0'-12.0'	99	7/11/17	Hom	No. 10			Yes	21.38	77.09	64.22	30.0
TP-2, 15.0'-16.0'	100	7/11/17	Hom	No. 10			Yes	21.18	77.03	61.79	37.5
TP-3, 0.5'-4.5'	101	7/11/17	Hom	3/8"			No	20.97	79.56	67.93	24.8
TP-3, 9.8'-10.5'	102	7/11/17	Hom	No. 10			Yes	21.27	67.96	57.28	29.7
TP-3, 11.0'-12.0'	103	7/11/17	Hom	No. 4			No	22.90	94.02	77.82	29.5
TP-3, 16.0'-16.8'	104	7/11/17	Hom	No. 10			Yes	21.00	84.77	64.82	45.5
TP-4, 0.5'-3.1'	105	7/11/17	Hom	3/8"			No	21.00	96.96	84.27	20.1
TP-4, 3.1'-4.0'	106	7/11/17	Hom	No. 4			No	21.07	96.83	82.72	22.9
TP-5, 1.0'-3.0' Missing	107	7/11/17									
TP-5, 5.0'-7.0'	108	7/11/17	Hom	3/8"			No	20.94	71.88	66.25	12.4
TP-5, 10.0'-12.0'	109	7/11/17	Hom	3/8"			No	20.91	88.79	77.11	20.8
TP-5, 16.0'-16.5'	110	7/11/17	Hom	No. 10			Yes	20.71	74.37	59.81	37.2
TP-6, 0.0'-4.5'	111	7/11/17	Hom	No. 4			No	20.72	68.45	63.67	11.1
TP-6, 8.5'-9.5'	112	7/11/17	Hom	No. 10			Yes	21.29	101.12	74.06	51.3
TP-6, 11.0'-12.2'	113	7/11/17	Hom	No. 4			No	22.86	102.45	93.39	12.8
TP-7, 4.6'-5.8'	114	7/11/17	Hom	No. 4			No	20.90	73.69	67.97	12.2
TP-7, 5.8'-6.5'	115	7/11/17	Hom	No. 10			Yes	21.07	69.50	61.40	20.1
TP-8, 0.0'-3.0'	116	7/11/17	Hom	3/4"			No	21.03	98.34	89.12	13.5
TP-8, 5.0'-7.0'	117	7/11/17	Hom	No. 10			Yes	20.96	72.85	60.33	31.8
TP-8, 10.0'-12.0'	118	7/11/17	Hom	No. 10			Yes	20.76	89.61	72.15	34.0
TP-9, 0.0'-3.2'	119	7/11/17	Hom	No. 4			No	22.24	74.20	70.70	7.2
TP-9, 3.2'-5.0'	120	7/11/17	Hom	No. 10			Yes	21.05	69.76	65.94	8.5
TP-9, 5.5'	121	7/11/17	Hom	No. 10			Yes	21.85	89.75	69.15	43.6
TP-9, 9.5'-11.0'	122	7/11/17	Hom	3/8"			No	21.12	81.46	70.43	22.4
TP-10, 0.0'-2.5'	123	7/11/17	Hom	No. 10			Yes	21.02	75.49	72.20	6.4
TP-10, 4.0'-6.0'	124	7/11/17	Hom	3/4"			No	26.07	108.66	98.13	14.6

Stantec

Moisture Content of Soil

ASTM D 2216

Project Name: Dynegy Duck Creek Closure Supplemental Field Work

Project Number: 175667029

Tested By: CM

Test Method: ASTM

Maximum Particle Size in Sample	No. 10	No. 4	3/8"	3/4"	1 1/2"	3"
Recommended Minimum Mass (g)	20	100	500	2,500	10,000	50,000

Material Type: Stratified, Laminated, Lensed, Homogeneous, Disturbed

Source	Lab ID	Date Tested	Material Type	Maximum Particle Size	Material Excluded Amount	Material Excluded Size	Pass Min. Mass? (Y/N)	Can Weight (g)	Wet Soil & Can Weight (g)	Dry Soil & CanWeight (g)	Moisture Content (%)
TP-10, 7.0'-9.0'	125	7/11/17	Hom	No. 10			Yes	29.52	100.22	77.14	48.5
TP-10, 11.0'-13.0'	126	7/11/17	Hom	3/8"			No	21.08	86.51	75.68	19.8
TP-10, 15.0'-15.5'	127	7/11/17	Hom	No. 4			No	21.03	77.30	55.24	64.5

Comments: Oven dried at 60° C.

Reviewed By: RJ

ATTACHMENT C.2
CLASSIFICATION TESTING

Stantec

Summary of Soil Tests

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-1, 10.0'-11.5', 15.0'-16.5'	Lab ID	39
Sample Type	SPT Composite	Date Received	7-5-17
		Date Reported	7-19-17

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
3/8"	9.5	100.0
No. 4	4.75	98.6
No. 10	2	95.6
No. 40	0.425	90.4
No. 200	0.075	79.1
	0.02	45.9
	0.005	11.8
	0.002	3.9
estimated	0.001	0.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	1.4	4.4
Coarse Sand	3.0	5.2
Medium Sand	5.2	---
Fine Sand	11.3	11.3
Silt	67.3	75.2
Clay	11.8	3.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.44

Classification

Unified Group Symbol:	ML
Group Name:	Silt with sand
AASHTO Classification:	A-4 (0)

Comments: Oven dried at 60° C.

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-1, 10.0'-11.5', 15.0'-16.5'	Lab ID	39

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Hard and Durable
Tested By	KWS
Test Date	07-11-2017
Date Received	07-05-2017

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3/8"	100.0
No. 4	98.6
No. 10	95.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

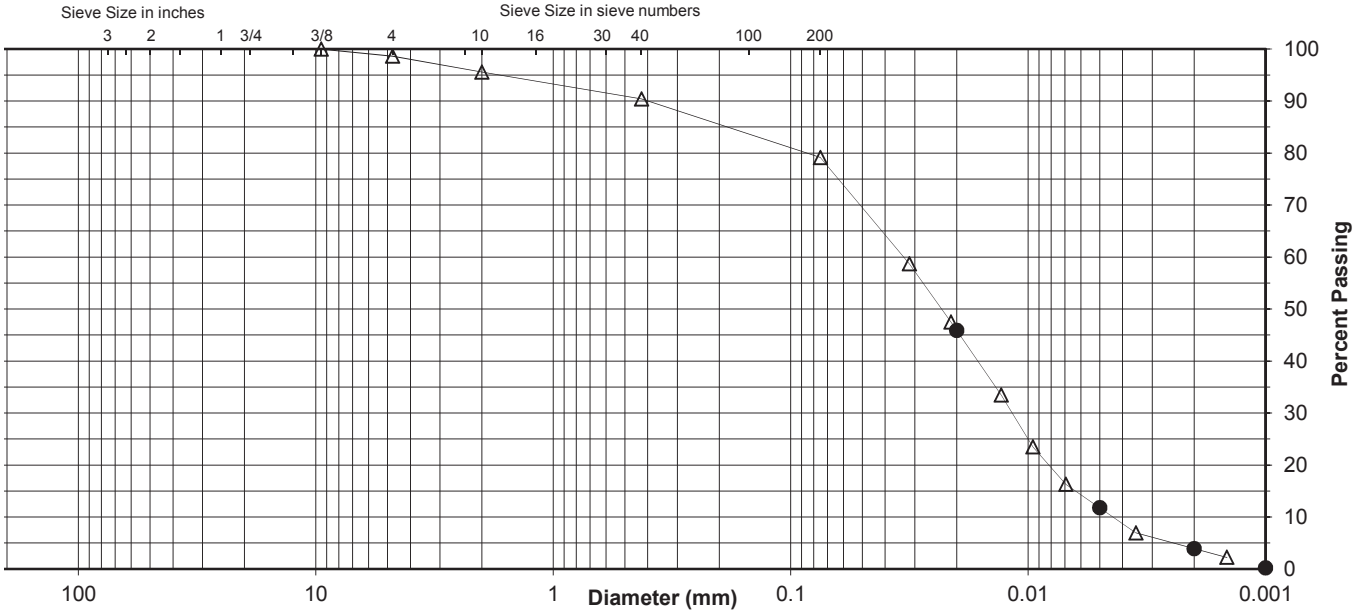
Specific Gravity 2.44

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	90.4
No. 200	79.1
0.02 mm	45.9
0.005 mm	11.8
0.002 mm	3.9
0.001 mm	0.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.4	3.0	5.2	11.3	67.3	11.8
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	4.4			5.2	11.3	75.2	3.9



Comments Oven dried at 60° C.

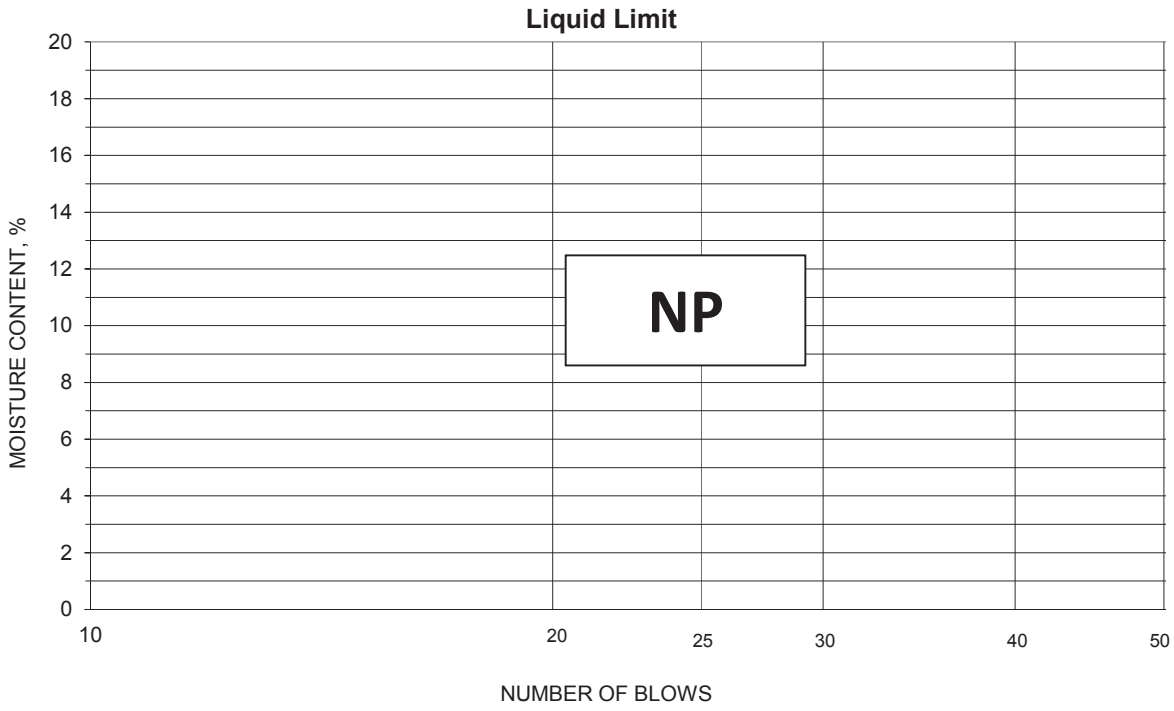
Reviewed By RJ

Stantec

ATTERBERG LIMITS

Project	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-1, 10.0'-11.5', 15.0'-16.5'	Lab ID	39
		% + No. 40	10
Tested By	DB	Test Method	ASTM D 4318 Method A
Test Date	07-11-2017	Prepared	Dry
		Date Received	07-05-2017

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: Oven dried at 60° C.

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-2, 40.0'-41.5', 50.0'-51.5'	Lab ID	57
Sample Type	SPT Composite	Date Received	7-5-17
		Date Reported	7-19-17

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
No. 4	4.75	100.0
No. 10	2	99.8
No. 40	0.425	98.2
No. 200	0.075	92.9
	0.02	53.3
	0.005	10.3
	0.002	4.2
estimated	0.001	2.4

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.2
Coarse Sand	0.2	1.6
Medium Sand	1.6	---
Fine Sand	5.3	5.3
Silt	82.6	88.7
Clay	10.3	4.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit:	NP
Plastic Limit:	NP
Plasticity Index:	NP
Activity Index:	N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3):	N/A
Maximum Dry Density (kg/m^3):	N/A
Optimum Moisture Content (%):	N/A
Over Size Correction %:	N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%):	N/A
Compacted Dry Density (lb/ft^3):	N/A
Compacted Moisture Content (%):	N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size:	No. 10
Specific Gravity at 20° Celsius:	2.59

Classification

Unified Group Symbol: ML

Group Name: Silt

AASHTO Classification: A-4 (0)

Comments: Oven dried at 60° C.

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-2, 40.0'-41.5', 50.0'-51.5'	Lab ID	57

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Weathered and Friable
Tested By	KWS
Test Date	07-11-2017
Date Received	07-05-2017

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
No. 4	100.0
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

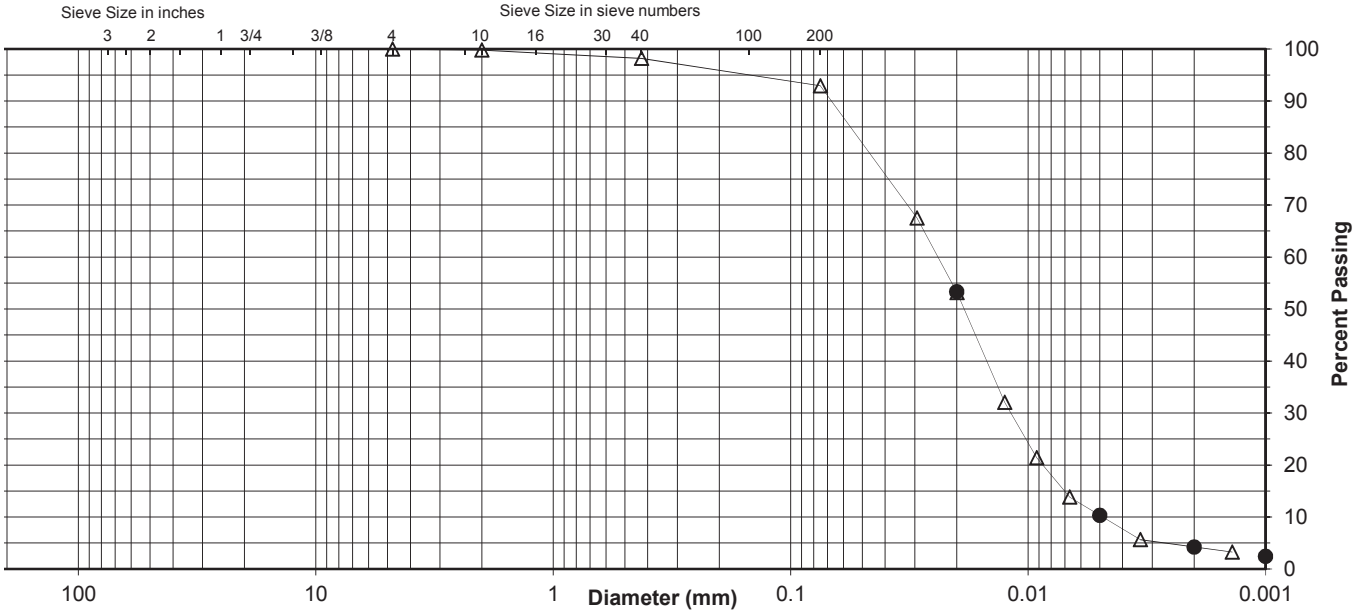
Specific Gravity 2.59

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	98.2
No. 200	92.9
0.02 mm	53.3
0.005 mm	10.3
0.002 mm	4.2
0.001 mm	2.4

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.2	1.6	5.3	82.6	10.3
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	0.2			1.6	5.3	88.7	4.2



Comments Oven dried at 60° C.

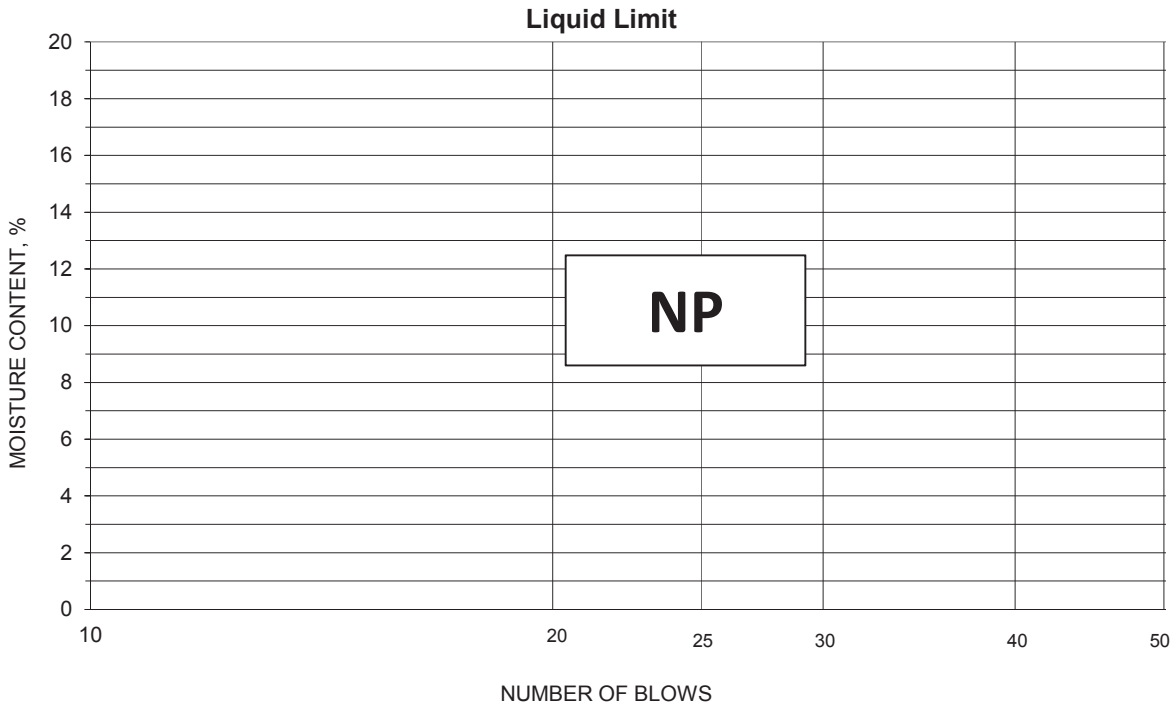
Reviewed By RJ

Stantec

ATTERBERG LIMITS

Project	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-2, 40.0'-41.5', 50.0'-51.5'	Lab ID	57
		% + No. 40	2
Tested By	DB	Test Method	ASTM D 4318 Method A
Test Date	07-11-2017	Prepared	Dry
		Date Received	07-05-2017

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: Oven dried at 60° C.

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-3, 20.0'-21.5', 27.0'-28.5'	Lab ID	65
Sample Type	SPT Composite	Date Received	7-5-17
		Date Reported	7-19-17

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
3/4"	19	100.0
3/8"	9.5	99.3
No. 4	4.75	98.4
No. 10	2	93.8
No. 40	0.425	90.3
No. 200	0.075	87.1
	0.02	66.6
	0.005	17.5
	0.002	6.2
estimated	0.001	3.6

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	1.6	6.2
Coarse Sand	4.6	3.5
Medium Sand	3.5	---
Fine Sand	3.2	3.2
Silt	69.6	80.9
Clay	17.5	6.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: NP
Plastic Limit: NP
Plasticity Index: NP
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.49

Classification

Unified Group Symbol: ML
Group Name: Silt

AASHTO Classification: A-4 (0)

Comments: Oven dried at 60° C.

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-3, 20.0'-21.5', 27.0'-28.5'	Lab ID	65

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Hard and Durable
Tested By	KWS
Test Date	07-11-2017
Date Received	07-05-2017

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	99.3
No. 4	98.4
No. 10	93.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.49

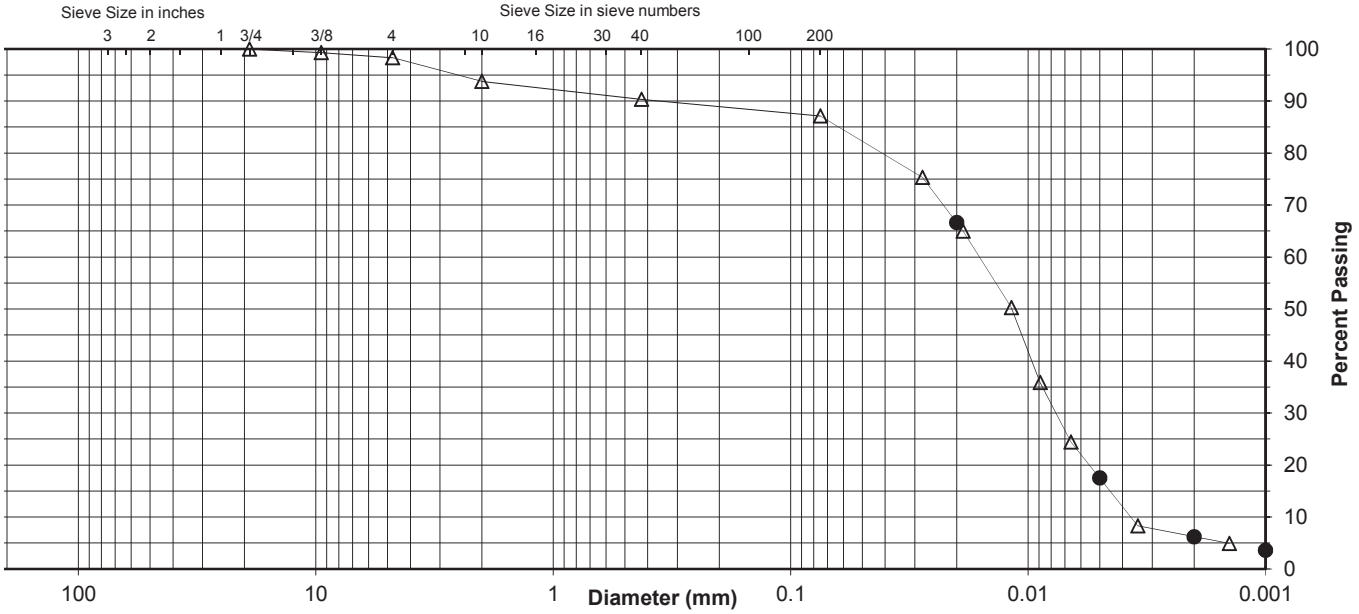
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	90.3
No. 200	87.1
0.02 mm	66.6
0.005 mm	17.5
0.002 mm	6.2
0.001 mm	3.6

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	1.6	4.6	3.5	3.2	69.6	17.5

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	6.2	3.5	3.2	80.9	6.2



Comments Oven dried at 60° C.

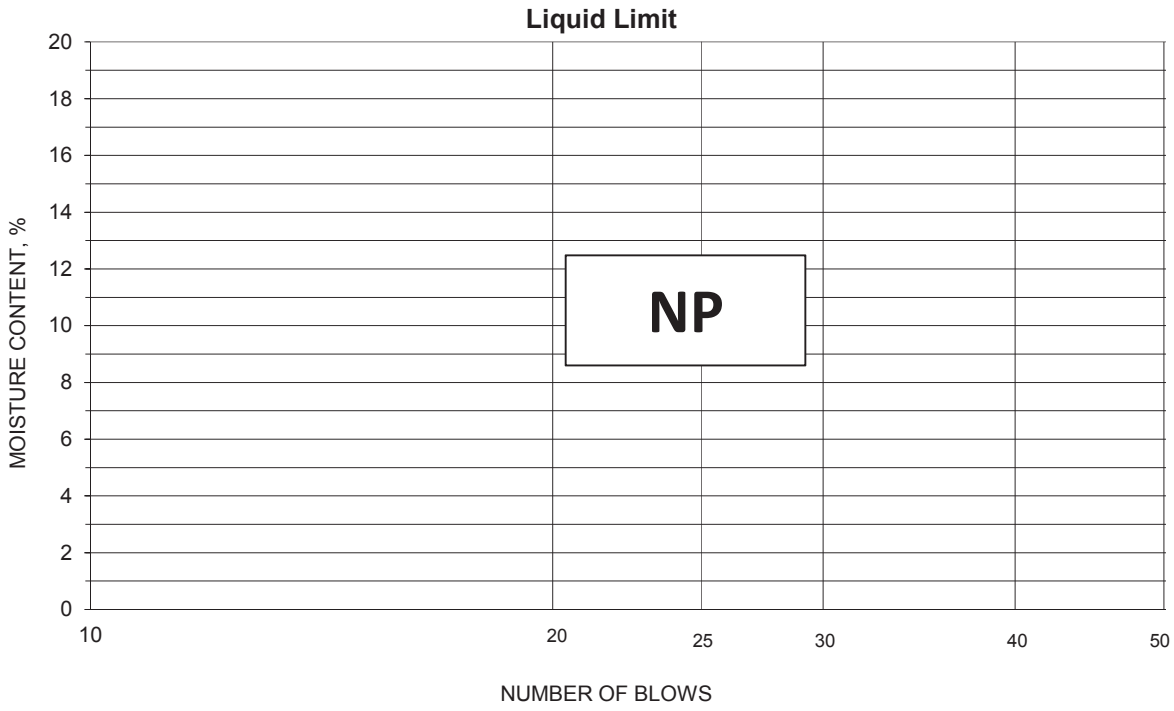
Reviewed By RJ

Stantec

ATTERBERG LIMITS

Project	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-3, 20.0'-21.5', 27.0'-28.5'	Lab ID	65
		% + No. 40	10
Tested By	DB	Test Method	ASTM D 4318 Method A
Test Date	07-11-2017	Prepared	Dry
		Date Received	07-05-2017

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: Oven dried at 60° C.

Reviewed By RJ

Stantec

Summary of Soil Tests

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-4, 40.0'-41.5', 47.0'-48.5'	Lab ID	82
Sample Type	SPT Composite	Date Received	7-5-17
		Date Reported	7-19-17

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
	N/A	
	N/A	
	N/A	
	N/A	
	N/A	
3/8"	9.5	100.0
No. 4	4.75	100.0
No. 10	2	98.7
No. 40	0.425	94.0
No. 200	0.075	84.6
	0.02	45.0
	0.005	10.5
	0.002	5.3
estimated	0.001	4.9

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	1.3
Coarse Sand	1.3	4.7
Medium Sand	4.7	---
Fine Sand	9.4	9.4
Silt	74.1	79.3
Clay	10.5	5.3

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: NP

Plastic Limit: NP

Plasticity Index: NP

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.40

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments: Oven dried at 60° C.

Reviewed By RJ

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project Number	175667029
Source	S-4, 40.0'-41.5', 47.0'-48.5'	Lab ID	82

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method	ASTM D 422
Prepared using	ASTM D 421
Particle Shape	Angular
Particle Hardness:	Hard and Durable
Tested By	KWS
Test Date	07-11-2017
Date Received	07-05-2017

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3/8"	100.0
No. 4	100.0
No. 10	98.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

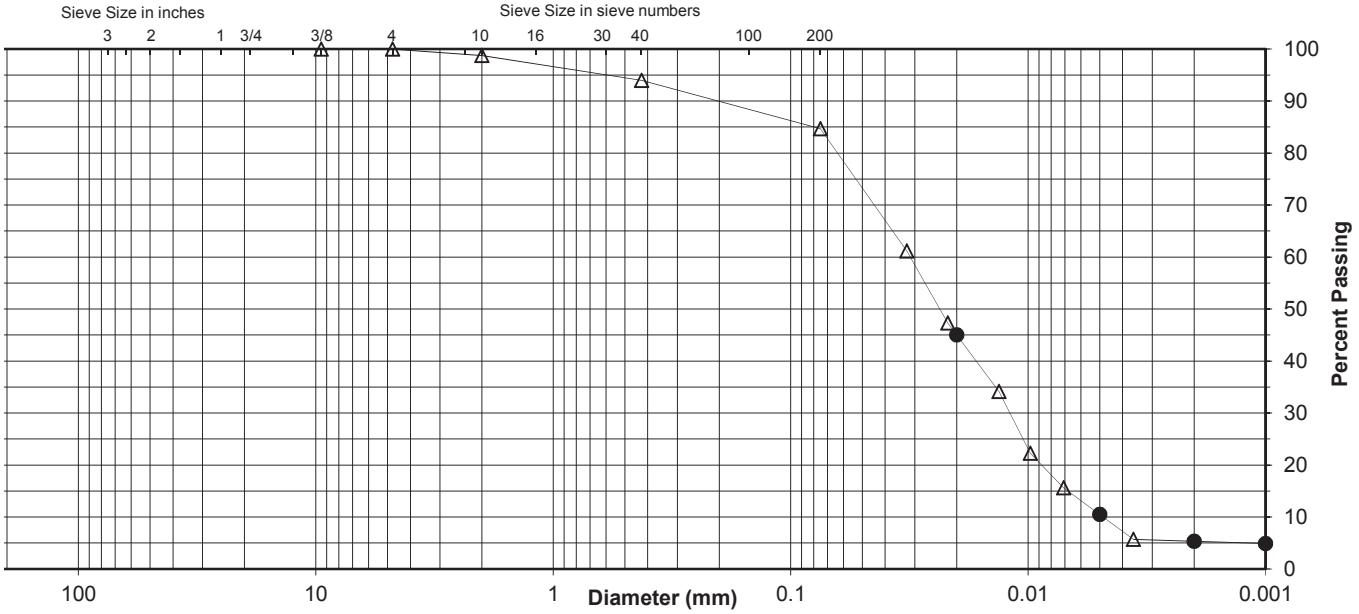
Specific Gravity 2.4

Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	94.0
No. 200	84.6
0.02 mm	45.0
0.005 mm	10.5
0.002 mm	5.3
0.001 mm	4.9

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	1.3	4.7	9.4	74.1	10.5
AASHTO	Gravel			Coarse Sand	Fine Sand	Silt	Clay
	1.3			4.7	9.4	79.3	5.3



Comments Oven dried at 60° C.

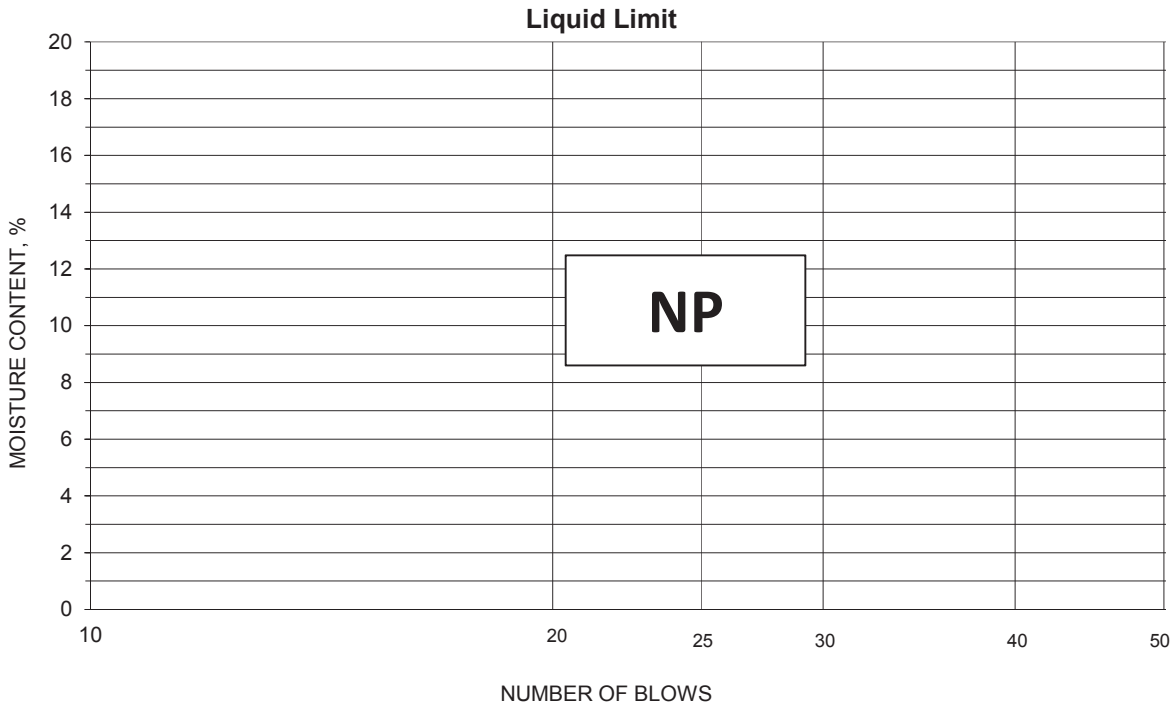
Reviewed By RJ

Stantec

ATTERBERG LIMITS

Project	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-4, 40.0'-41.5', 47.0'-48.5'	Lab ID	82
		% + No. 40	6
Tested By	DB	Test Method	ASTM D 4318 Method A
Test Date	07-11-2017	Prepared	Dry
		Date Received	07-05-2017

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: Oven dried at 60° C.

Reviewed By RJ

ATTACHMENT C.3
STRENGTH TESTING

Stantec

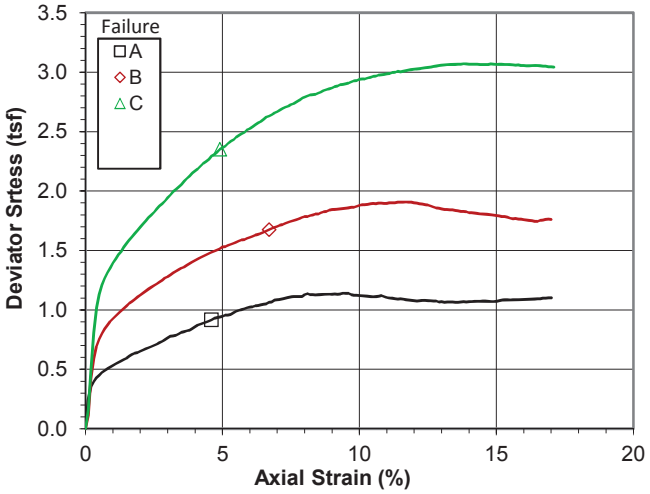
Consolidated Undrained Triaxial Compression

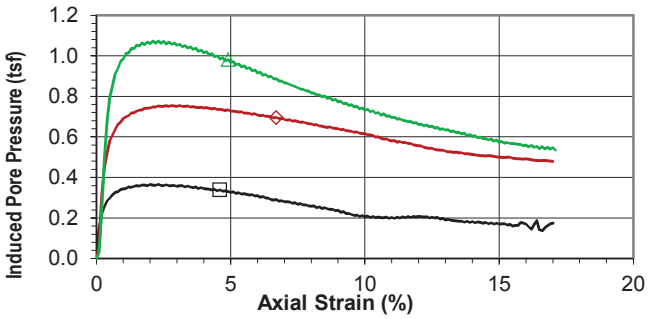
ASTM D 4767

Project Name Dynegy Duck Creek Closure Supplemental Field Work

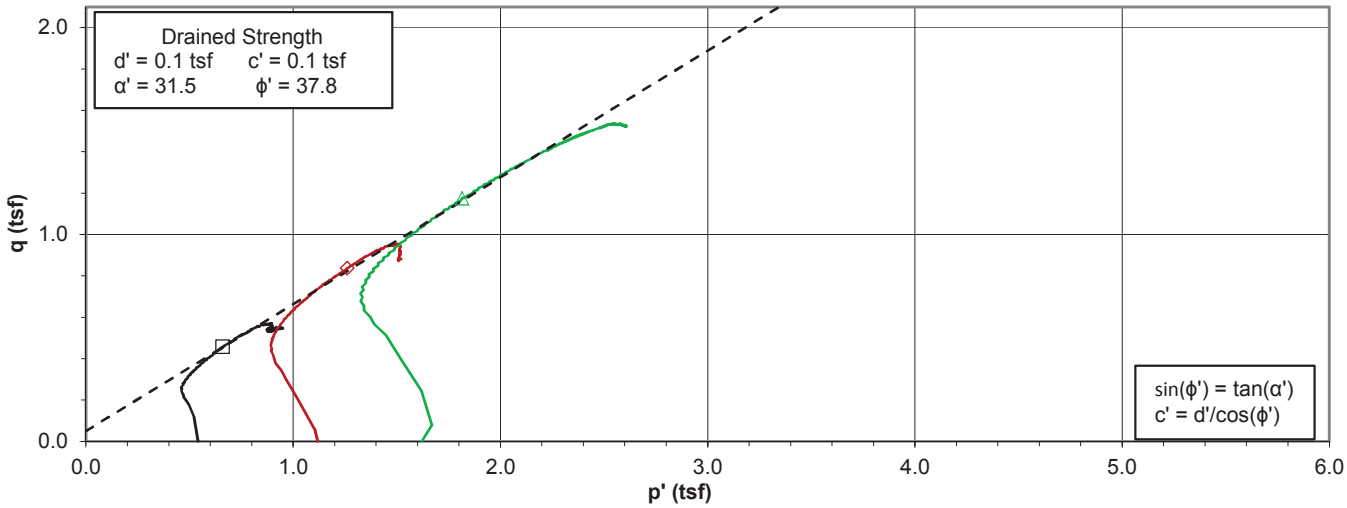
Project 175667029
Set ID 1

Test	Lab ID	Source	Description	Gs	LL	PL	PI
A	31A	S-2, 35.0'-35.5'	Silt with Sand (ML), gray, wet, soft	2.50			
B	31B	S-2, 35.5'-36.0'	Silt with Sand (ML), gray, wet, soft	2.50			
C	31C	S-2, 36.0'-36.5'	Silt with Sand (ML), gray, wet, soft	2.50			





Specimen	A	B	C		
	Initial Specimen Conditions				
Average Height (in)	5.812	5.701	5.833		
Average Diameter (in)	2.745	2.718	2.749		
Moist Unit Weight (pcf)	105.3	104.7	108.7		
Moisture Content (%)	63.2	65.2	50.9		
Dry Unit Weight (pcf)	64.5	63.4	72.0		
Void Ratio	1.415	1.458	1.163		
Degree of Saturation (%)	111.7	111.8	109.4		
	Consolidated Specimen Conditions				
Moist Unit Weight (pcf)	102.5	102.1	107.3		
Moisture Content (%)	53.1	54.0	43.1		
Dry Unit Weight (pcf)	67.0	66.3	75.0		
Void Ratio	1.327	1.349	1.078		
Degree of Saturation (%)	100.0	100.0	100.0		
Eff. Con. Stress, σ_3' (tsf)	0.541	1.118	1.621		
	At Drained Failure				
Failure Criterion	Max. Eff. Prin. Stress Ratio				
Axial Strain (%)	4.598	6.698	4.903		
Deviator Stress (tsf)	0.915	1.676	2.349		
Induced Pore Press. (tsf)	0.339	0.696	0.981		
Minor Eff. Stress, σ_3' (tsf)	0.202	0.422	0.640		
Major Eff. Stress, σ_1' (tsf)	1.117	2.099	2.989		
Eff. Stress Ratio, σ_1'/σ_3'	5.530	4.968	4.671		
p' (tsf)	0.660	1.260	1.815		
q (tsf)	0.458	0.838	1.175		



Comments Oven dried at 60° C.

Reviewed By KG

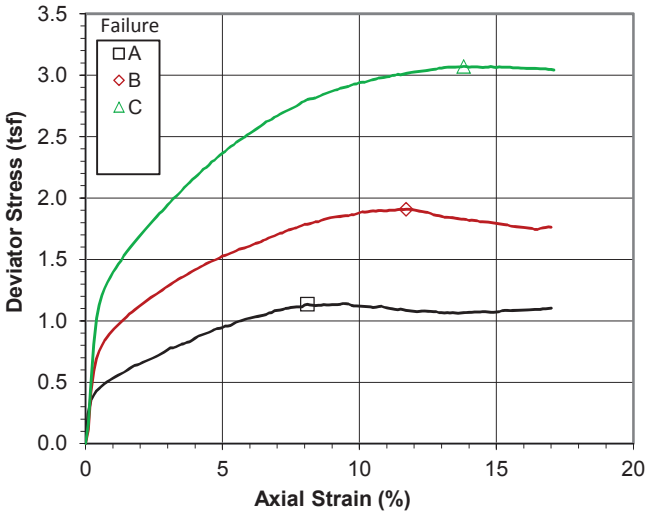
Consolidated Undrained Triaxial Compression

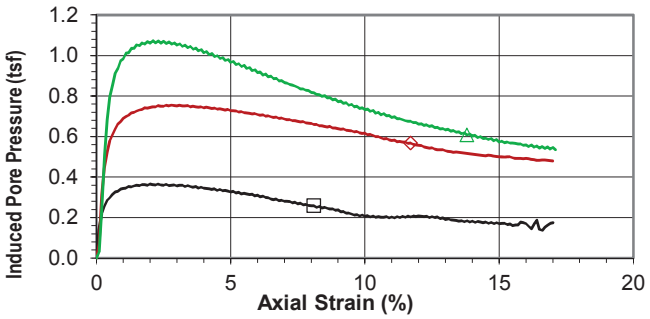
ASTM D 4767

Project Name Dynegy Duck Creek Closure Supplemental Field Work

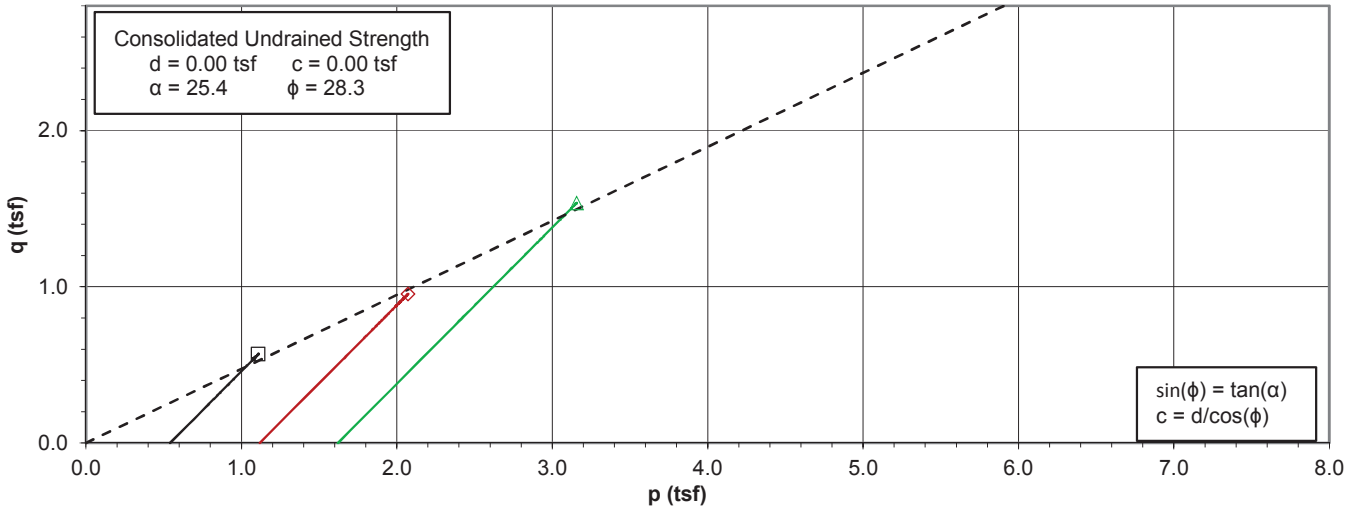
Project 175667029
Set ID 1

Test	Lab ID	Source	Description	Gs	LL	PL	PI
A	31A	S-2, 35.0'-35.5'	Silt with Sand (ML), gray, wet, soft	2.50			
B	31B	S-2, 35.5'-36.0'	Silt with Sand (ML), gray, wet, soft	2.50			
C	31C	S-2, 36.0'-36.5'	Silt with Sand (ML), gray, wet, soft	2.50			





Specimen	A	B	C		
	Initial Specimen Conditions				
Average Height (in)	5.812	5.701	5.833		
Average Diameter (in)	2.745	2.718	2.749		
Moist Unit Weight (pcf)	105.3	104.7	108.7		
Moisture Content (%)	63.2	65.2	50.9		
Dry Unit Weight (pcf)	64.5	63.4	72.0		
Void Ratio	1.415	1.458	1.163		
Degree of Saturation (%)	111.7	111.8	109.4		
	Consolidated Specimen Conditions				
Moist Unit Weight (pcf)	102.5	102.1	107.3		
Moisture Content (%)	53.1	54.0	43.1		
Dry Unit Weight (pcf)	67.0	66.3	75.0		
Void Ratio	1.327	1.349	1.078		
Degree of Saturation (%)	100.0	100.0	100.0		
Eff. Con. Stress, σ_3' (tsf)	0.541	1.118	1.621		
	At Consolidated Undrained Failure				
Failure Criterion	Max. σ_D or 15% Strain				
Axial Strain (%)	8.101	11.699	13.803		
Deviator Stress (tsf)	1.136	1.908	3.071		
Min. Prin. Stress, σ_3 (tsf)	0.541	1.118	1.621		
Maj. Prin. Stress, σ_1 (tsf)	1.677	3.026	4.692		
p (tsf)	1.109	2.072	3.156		
q (tsf)	0.568	0.954	1.536		



Comments Oven dried at 60° C.

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-2, 35.0'-35.5'	Lab ID	31A
Description	Silt with Sand (ML), gray, wet, soft	Test ID	1-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	07/05/2017
		Date Tested	07/13/2017

Specific Gravity 2.50
ASTM D 854, A

Liquid Limit
Plastic Limit
Plasticity Index

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	82.5
Nominal Consolidation Pressure (psi)	7.5

Saturation / Consolidation Results

Pore Pressure Parameter B	0.99
Measured Effective Consol. Stress (tsf)	0.541
Time to 50% Consolidation (min)	1.10
Actual Axial Strain Rate of Test (%/min)	0.081

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	102.5
Moisture Content (%)	53.1
Dry Unit Weight (pcf)	67.0
Void Ratio	1.327
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

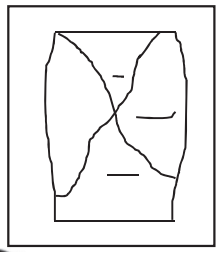
Axial Strain (%)	4.598
Deviator Stress (tsf)	0.915
Induced Pore Pressure (tsf)	0.339
Minor Effective Stress, σ_3' (tsf)	0.202
Major Effective Stress, σ_1' (tsf)	1.117
Eff. Principal Stress Ratio, σ_1'/σ_3'	5.530
p' (tsf)	0.660
q (tsf)	0.458

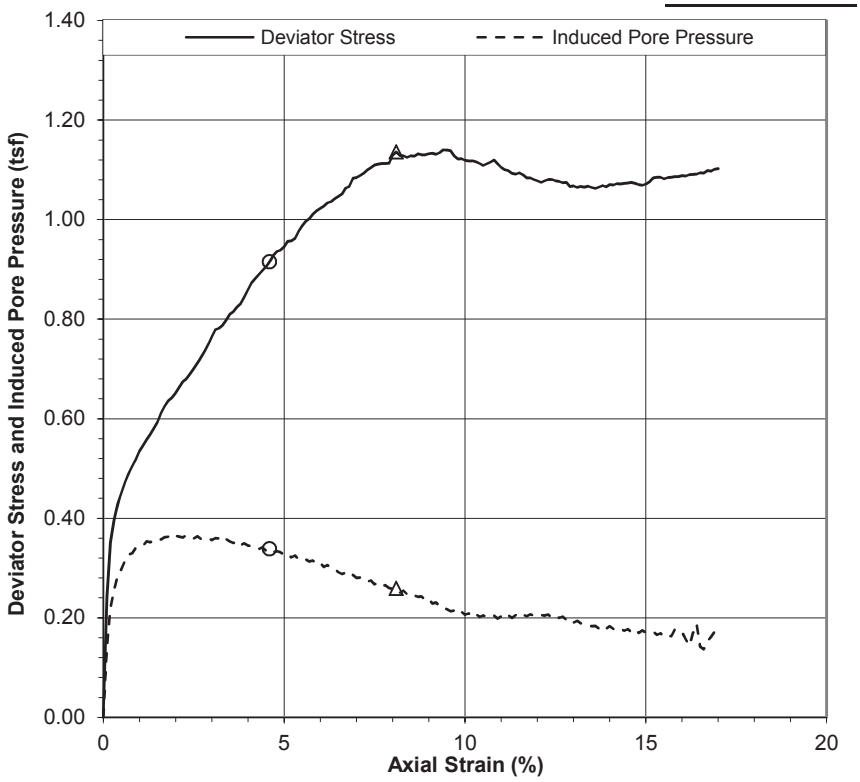
At Consolidated Undrained Failure

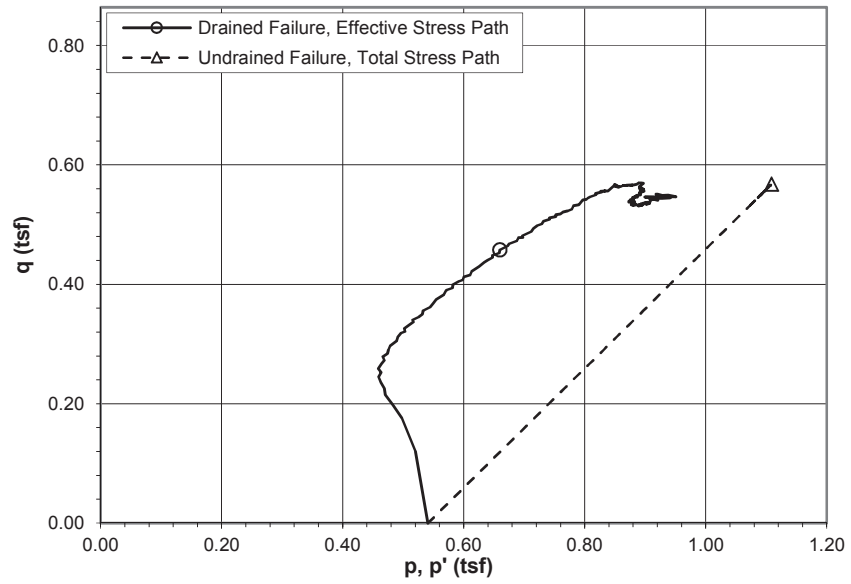
Failure Criterion: Peak Deviator Stress

Axial Strain (%)	8.101
Deviator Stress (tsf)	1.136
Minor Principal Stress, σ_3 (tsf)	0.541
Major Principal Stress, σ_1 (tsf)	1.677
p (tsf)	1.109
q (tsf)	0.568

Failure Sketch







Comments Oven dried at 60° C.

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-2, 35.0'-35.5'	Lab ID	31A
Description	Silt with Sand (ML), gray, wet, soft	Test ID	1-A

Initial Specimen Conditions		Consolidated Specimen Conditions			
Average Height (in)	5.812	Calculated Height (in)	5.746	Specific Gravity	2.50
Average Diameter (in)	2.745	Calculated Diameter (in)	2.710	ASTM D	854, A
Calculated Area (in^2)	5.919	Calculated Area (in^2)	5.769	Liquid Limit	
Moist Weight (lb)	2.096	Moist Weight (lb)	1.966	Plastic Limit	
Moist Unit Weight (pcf)	105.3	Moist Unit Weight (pcf)	102.5	Plasticity Index	
Moisture Content (%)	63.2	Moisture Content (%)	53.1		
Dry Weight (lb)	1.285	Dry Weight (lb)	1.285		
Dry Unit Weight (pcf)	64.5	Dry Unit Weight (pcf)	67.0	Confining Stress	
Void Ratio	1.415	Void Ratio	1.327	σ_3 (tsf)	0.541
Degree of Saturation (%)	111.7	Degree of Saturation (%)	100.0		
				Effective Consolidation Stress	
				σ_3' (tsf)	0.541

Moisture contents obtained using whole specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175667029			Source: S-2, 35.0'-35.5'								Lab ID: 31A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	5.769	0.000	0.000	5.939	0.000	0.541	0.541	0.541	0.541	0.541	0.000	1.000
2.2	19.4	0.006	0.10	5.775	0.241	0.241	6.080	0.141	0.782	0.641	0.400	0.662	0.520	0.121	1.603
4.1	28.2	0.011	0.20	5.781	0.352	0.351	6.158	0.219	0.892	0.674	0.322	0.717	0.498	0.176	2.090
5.5	31.8	0.017	0.29	5.786	0.396	0.395	6.194	0.256	0.936	0.681	0.286	0.739	0.483	0.198	2.385
6.9	34.6	0.023	0.40	5.792	0.430	0.429	6.224	0.285	0.970	0.685	0.256	0.756	0.471	0.215	2.678
8.2	36.4	0.029	0.50	5.798	0.452	0.451	6.236	0.297	0.992	0.694	0.244	0.766	0.469	0.225	2.850
9.5	38.1	0.034	0.60	5.804	0.473	0.471	6.252	0.313	1.012	0.699	0.228	0.777	0.463	0.236	3.070
10.8	39.6	0.040	0.70	5.810	0.491	0.489	6.265	0.326	1.030	0.704	0.215	0.786	0.460	0.245	3.278
12.1	40.9	0.046	0.80	5.816	0.507	0.505	6.269	0.330	1.046	0.716	0.211	0.793	0.464	0.252	3.387
13.4	42.0	0.051	0.90	5.822	0.520	0.517	6.280	0.341	1.058	0.718	0.200	0.800	0.459	0.259	3.582
14.7	43.4	0.057	1.00	5.828	0.537	0.534	6.283	0.344	1.075	0.731	0.197	0.808	0.464	0.267	3.711
16.0	44.5	0.063	1.10	5.833	0.549	0.546	6.284	0.345	1.087	0.742	0.196	0.814	0.469	0.273	3.788
17.3	45.5	0.069	1.20	5.839	0.561	0.558	6.292	0.353	1.099	0.745	0.188	0.820	0.466	0.279	3.973
18.6	46.4	0.075	1.30	5.845	0.572	0.568	6.290	0.351	1.109	0.758	0.190	0.825	0.474	0.284	3.995
19.9	47.5	0.080	1.40	5.851	0.584	0.581	6.295	0.356	1.122	0.766	0.185	0.831	0.476	0.290	4.133
21.2	48.6	0.086	1.50	5.857	0.597	0.593	6.298	0.359	1.134	0.775	0.182	0.838	0.478	0.297	4.265
22.6	50.1	0.092	1.60	5.863	0.615	0.611	6.296	0.357	1.152	0.795	0.184	0.847	0.489	0.306	4.323
23.9	51.3	0.097	1.70	5.869	0.629	0.625	6.301	0.362	1.166	0.804	0.179	0.853	0.491	0.312	4.487
25.2	52.3	0.103	1.80	5.875	0.641	0.636	6.302	0.363	1.177	0.815	0.178	0.859	0.496	0.318	4.571
26.5	52.9	0.109	1.90	5.881	0.647	0.642	6.298	0.359	1.183	0.824	0.182	0.862	0.503	0.321	4.530
27.9	53.7	0.115	2.00	5.887	0.656	0.651	6.304	0.365	1.192	0.827	0.176	0.867	0.502	0.326	4.700
29.2	54.7	0.121	2.10	5.893	0.669	0.663	6.302	0.363	1.204	0.841	0.178	0.873	0.510	0.332	4.728
30.6	55.7	0.126	2.20	5.899	0.680	0.674	6.300	0.361	1.215	0.854	0.180	0.878	0.517	0.337	4.751
31.9	56.3	0.132	2.30	5.905	0.686	0.680	6.305	0.366	1.221	0.856	0.175	0.881	0.515	0.340	4.878
33.3	57.2	0.138	2.40	5.911	0.697	0.690	6.300	0.361	1.231	0.871	0.180	0.886	0.525	0.345	4.831
34.6	58.1	0.144	2.50	5.917	0.707	0.700	6.298	0.360	1.241	0.882	0.182	0.891	0.532	0.350	4.858
36.0	59.1	0.149	2.60	5.923	0.718	0.711	6.303	0.364	1.252	0.889	0.177	0.897	0.533	0.356	5.017
37.3	60.2	0.155	2.70	5.929	0.731	0.724	6.297	0.359	1.265	0.906	0.183	0.903	0.544	0.362	4.967
38.6	61.2	0.161	2.80	5.935	0.742	0.735	6.298	0.359	1.276	0.917	0.182	0.908	0.549	0.367	5.042
40.0	62.4	0.166	2.90	5.942	0.756	0.749	6.300	0.361	1.290	0.929	0.180	0.916	0.555	0.374	5.156
41.3	63.8	0.172	3.00	5.948	0.773	0.765	6.295	0.356	1.306	0.950	0.185	0.924	0.567	0.383	5.136
42.7	65.1	0.178	3.10	5.954	0.787	0.779	6.299	0.360	1.320	0.961	0.181	0.931	0.571	0.390	5.294
44.0	65.4	0.184	3.20	5.960	0.790	0.782	6.298	0.359	1.323	0.964	0.182	0.932	0.573	0.391	5.297
45.4	65.9	0.189	3.30	5.966	0.796	0.787	6.292	0.353	1.328	0.975	0.188	0.935	0.582	0.394	5.190
46.7	66.9	0.195	3.40	5.972	0.807	0.798	6.297	0.358	1.339	0.981	0.183	0.940	0.582	0.399	5.356
48.0	68.0	0.201	3.50	5.979	0.819	0.810	6.293	0.354	1.351	0.998	0.187	0.946	0.593	0.405	5.323
49.2	68.5	0.207	3.60	5.985	0.824	0.815	6.289	0.350	1.356	1.006	0.191	0.948	0.599	0.407	5.264
50.5	69.4	0.213	3.70	5.991	0.834	0.825	6.292	0.353	1.366	1.013	0.188	0.953	0.600	0.412	5.394
51.7	70.0	0.218	3.80	5.997	0.841	0.831	6.285	0.346	1.372	1.026	0.195	0.956	0.611	0.415	5.256

Project: 175667029			Source: S-2, 35.0'-35.5'								Lab ID: 31A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
52.9	71.2	0.224	3.90	6.003	0.854	0.844	6.289	0.350	1.385	1.035	0.191	0.963	0.613	0.422	5.412
54.2	72.6	0.230	4.00	6.010	0.869	0.859	6.284	0.345	1.400	1.055	0.196	0.971	0.626	0.430	5.382
55.4	73.8	0.236	4.10	6.016	0.884	0.873	6.283	0.344	1.414	1.070	0.197	0.978	0.634	0.437	5.428
56.6	74.6	0.241	4.20	6.022	0.892	0.881	6.281	0.342	1.422	1.080	0.199	0.982	0.640	0.441	5.427
57.8	75.4	0.247	4.30	6.029	0.901	0.890	6.277	0.338	1.431	1.092	0.203	0.986	0.648	0.445	5.388
59.0	76.2	0.253	4.40	6.035	0.909	0.897	6.281	0.342	1.438	1.096	0.199	0.990	0.648	0.449	5.513
60.2	76.9	0.259	4.50	6.041	0.916	0.905	6.274	0.335	1.446	1.111	0.206	0.993	0.659	0.452	5.384
61.3	77.9	0.264	4.60	6.047	0.927	0.915	6.278	0.339	1.456	1.117	0.202	0.999	0.660	0.458	5.530
62.5	79.0	0.270	4.70	6.054	0.940	0.928	6.271	0.332	1.469	1.137	0.209	1.005	0.673	0.464	5.450
63.7	79.8	0.276	4.80	6.060	0.948	0.936	6.273	0.334	1.477	1.143	0.207	1.009	0.675	0.468	5.516
64.9	80.1	0.281	4.90	6.067	0.951	0.939	6.270	0.331	1.480	1.149	0.210	1.010	0.679	0.469	5.475
66.1	80.8	0.287	5.00	6.073	0.958	0.946	6.265	0.326	1.487	1.160	0.215	1.014	0.688	0.473	5.405
67.3	81.8	0.293	5.10	6.079	0.969	0.956	6.268	0.329	1.497	1.168	0.212	1.019	0.690	0.478	5.508
68.5	82.0	0.299	5.20	6.086	0.970	0.957	6.261	0.322	1.498	1.176	0.219	1.020	0.698	0.479	5.362
69.7	82.5	0.304	5.30	6.092	0.976	0.962	6.264	0.325	1.503	1.178	0.216	1.022	0.697	0.481	5.454
71.0	83.9	0.310	5.40	6.099	0.990	0.976	6.257	0.318	1.517	1.200	0.223	1.029	0.712	0.488	5.369
72.2	84.9	0.316	5.50	6.105	1.002	0.988	6.259	0.320	1.529	1.209	0.221	1.035	0.715	0.494	5.459
73.4	85.8	0.322	5.60	6.112	1.011	0.996	6.256	0.317	1.537	1.220	0.224	1.039	0.722	0.498	5.453
74.6	86.4	0.328	5.70	6.118	1.017	1.002	6.252	0.313	1.543	1.230	0.228	1.042	0.729	0.501	5.396
75.8	87.2	0.333	5.80	6.125	1.026	1.011	6.254	0.315	1.552	1.237	0.226	1.046	0.732	0.505	5.464
76.9	87.9	0.339	5.90	6.131	1.032	1.017	6.247	0.308	1.558	1.250	0.233	1.050	0.742	0.509	5.367
78.2	88.5	0.345	6.00	6.138	1.038	1.023	6.249	0.311	1.564	1.253	0.231	1.052	0.742	0.511	5.436
79.4	89.0	0.350	6.10	6.144	1.042	1.027	6.241	0.302	1.568	1.266	0.239	1.054	0.752	0.513	5.301
80.6	89.7	0.356	6.20	6.151	1.049	1.034	6.245	0.306	1.575	1.269	0.235	1.058	0.752	0.517	5.392
81.8	90.0	0.362	6.30	6.157	1.052	1.036	6.238	0.299	1.577	1.278	0.242	1.059	0.760	0.518	5.285
83.0	90.6	0.368	6.40	6.164	1.058	1.042	6.237	0.298	1.583	1.285	0.243	1.062	0.764	0.521	5.290
84.2	91.1	0.373	6.50	6.170	1.063	1.046	6.231	0.292	1.588	1.296	0.249	1.064	0.773	0.523	5.197
85.4	91.7	0.379	6.60	6.177	1.068	1.052	6.227	0.288	1.593	1.305	0.253	1.067	0.779	0.526	5.156
86.7	92.8	0.385	6.70	6.184	1.080	1.063	6.230	0.291	1.604	1.313	0.250	1.073	0.781	0.532	5.253
87.9	93.2	0.391	6.80	6.190	1.084	1.066	6.223	0.284	1.607	1.324	0.257	1.074	0.790	0.533	5.147
89.1	94.7	0.397	6.90	6.197	1.101	1.083	6.225	0.286	1.624	1.338	0.255	1.083	0.797	0.542	5.245
90.3	95.0	0.402	7.00	6.204	1.103	1.085	6.219	0.280	1.626	1.345	0.261	1.083	0.803	0.542	5.159
91.5	95.4	0.408	7.10	6.210	1.107	1.088	6.220	0.281	1.629	1.349	0.260	1.085	0.805	0.544	5.178
92.7	96.0	0.414	7.20	6.217	1.112	1.094	6.217	0.279	1.635	1.356	0.263	1.088	0.809	0.547	5.166
93.9	96.7	0.419	7.30	6.224	1.118	1.100	6.212	0.273	1.641	1.368	0.268	1.091	0.818	0.550	5.100
95.1	97.2	0.425	7.40	6.230	1.123	1.104	6.214	0.275	1.645	1.370	0.266	1.093	0.818	0.552	5.152
96.3	97.8	0.431	7.50	6.237	1.129	1.110	6.206	0.267	1.651	1.383	0.274	1.096	0.828	0.555	5.056
97.5	98.1	0.437	7.60	6.244	1.131	1.112	6.210	0.271	1.653	1.382	0.270	1.097	0.826	0.556	5.111
98.8	98.3	0.443	7.70	6.251	1.133	1.113	6.203	0.264	1.654	1.390	0.277	1.097	0.834	0.556	5.015
100.0	98.5	0.448	7.80	6.258	1.133	1.113	6.204	0.265	1.654	1.389	0.276	1.098	0.832	0.557	5.034
101.2	98.6	0.454	7.90	6.264	1.133	1.113	6.198	0.259	1.654	1.395	0.282	1.098	0.838	0.557	4.951
102.5	100.1	0.460	8.00	6.271	1.150	1.129	6.197	0.258	1.670	1.413	0.283	1.106	0.848	0.565	4.985
103.7	100.8	0.465	8.10	6.278	1.156	1.136	6.198	0.259	1.677	1.418	0.282	1.109	0.850	0.568	5.028
105.0	100.3	0.471	8.20	6.285	1.150	1.129	6.190	0.251	1.670	1.419	0.290	1.105	0.855	0.564	4.886
106.2	100.4	0.477	8.30	6.292	1.149	1.128	6.194	0.255	1.669	1.414	0.286	1.105	0.850	0.564	4.939
107.4	100.3	0.483	8.40	6.299	1.146	1.125	6.186	0.247	1.666	1.419	0.294	1.103	0.856	0.562	4.831
108.6	100.7	0.488	8.50	6.305	1.150	1.128	6.189	0.250	1.669	1.419	0.291	1.105	0.855	0.564	4.877
109.8	100.8	0.494	8.60	6.312	1.150	1.128	6.184	0.245	1.669	1.424	0.296	1.105	0.860	0.564	4.810
111.0	101.3	0.500	8.70	6.319	1.154	1.132	6.181	0.242	1.673	1.431	0.299	1.107	0.865	0.566	4.784
112.3	101.3	0.506	8.80	6.326	1.153	1.130	6.182	0.243	1.671	1.429	0.298	1.106	0.863	0.565	4.792
113.4	101.4	0.512	8.90	6.333	1.153	1.130	6.175	0.236	1.671	1.435	0.305	1.106	0.870	0.565	4.705
114.6	101.7	0.517	9.00	6.340	1.155	1.132	6.177	0.238	1.673	1.435	0.303	1.107	0.869	0.566	4.738
115.8	102.0	0.523	9.10	6.347	1.157	1.133	6.168	0.229	1.674	1.445	0.312	1.108	0.879	0.567	4.632
117.0	101.9	0.529	9.20	6.354	1.155	1.131	6.170	0.231	1.672	1.441	0.310	1.107	0.876	0.566	4.645
118.2	102.4	0.535	9.30	6.361	1.159	1.135	6.161	0.222	1.676	1.454	0.319	1.108	0.886	0.567	4.561
119.4	103.0	0.540	9.40	6.368	1.164	1.140	6.160	0.221	1.681	1.460	0.320	1.111	0.890	0.570	4.567
120.6	103.1	0.546	9.50	6.375	1.164	1.140	6.156	0.217	1.681	1.464	0.324	1.111	0.894	0.570	4.523
121.8	103.1	0.552	9.60	6.382	1.163	1.138	6.152	0.213	1.679	1.466	0.328	1.110	0.897	0.569	4.471
123.1	102.3	0.558	9.70	6.389	1.153	1.128	6.153	0.214	1.669	1.455	0.327	1.105	0.891	0.564	4.455
124.3	101.9	0.563	9.80	6.397	1.147	1.122	6.146	0.207	1.663	1.455	0.334	1.102	0.895	0.561	4.361
125.5	102.1	0.569	9.90	6.403	1.148	1.122	6.151	0.212	1.663	1.451	0.329	1.102	0.890	0.561	4.410
126.7	101.9	0.575	10.00	6.411	1.145	1.119	6.145	0.206	1.661	1.454	0.335	1.101	0.895	0.560	4.343
127.9	102.0	0.580	10.10	6.418	1.144	1.118	6.148	0.209	1.659	1.450	0.332	1.100	0.891	0.559	4.366
129.1	102.1	0.586	10.20	6.425	1.144	1.118	6.141	0.202	1.659	1.456	0.339	1.100	0.897	0.559	4.300
130.3	102.0	0.592	10.30	6.432	1.142	1.116	6.146	0.207	1.657	1.450	0.334	1.099	0.892	0.558	4.343
131.5	101.9	0.598	10.40	6.439	1.139	1.113	6.141	0.202	1.654	1.452	0.339	1.097	0.896	0.556	4.278
132.7	101.7	0.604	10.50	6.446	1.136	1.109	6.144	0.205	1.650	1.445	0.336	1.096	0.891	0.555	4.299
133.9	102.1	0.609	10.60	6.454	1.139	1.112	6.140	0.201	1.653	1.452	0.340	1.097	0.896	0.556	4.275
135.2	102.5	0.615	10.70	6.461	1.143	1.115	6.140	0.201	1.656	1.456	0.340	1.099	0.898	0.558	4.279

Project: 175667029			Source: S-2, 35.0'-35.5'								Lab ID: 31A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
136.4	103.1	0.621	10.80	6.468	1.147	1.120	6.143	0.204	1.661	1.457	0.337	1.101	0.897	0.560	4.323
137.6	102.5	0.626	10.90	6.475	1.140	1.112	6.138	0.199	1.653	1.454	0.342	1.097	0.898	0.556	4.247
138.7	102.0	0.632	11.00	6.483	1.133	1.105	6.142	0.203	1.646	1.443	0.338	1.093	0.890	0.552	4.269
140.0	101.7	0.638	11.10	6.490	1.128	1.100	6.137	0.198	1.641	1.442	0.343	1.091	0.892	0.550	4.211
141.2	101.7	0.644	11.20	6.497	1.126	1.098	6.144	0.205	1.639	1.434	0.336	1.090	0.885	0.549	4.267
142.4	101.3	0.649	11.30	6.505	1.121	1.093	6.139	0.200	1.634	1.434	0.341	1.087	0.887	0.546	4.204
143.6	101.3	0.655	11.40	6.512	1.120	1.091	6.145	0.206	1.632	1.427	0.335	1.087	0.881	0.546	4.256
144.7	101.7	0.661	11.50	6.519	1.124	1.094	6.140	0.201	1.635	1.434	0.340	1.088	0.887	0.547	4.223
146.0	101.5	0.667	11.60	6.527	1.120	1.090	6.146	0.207	1.631	1.424	0.334	1.086	0.879	0.545	4.264
147.1	101.1	0.673	11.71	6.534	1.114	1.084	6.142	0.203	1.625	1.422	0.338	1.083	0.880	0.542	4.206
148.3	101.2	0.678	11.80	6.541	1.114	1.084	6.146	0.207	1.625	1.418	0.334	1.083	0.876	0.542	4.245
149.5	101.1	0.684	11.90	6.549	1.111	1.081	6.143	0.204	1.622	1.417	0.337	1.081	0.877	0.540	4.211
150.7	101.0	0.690	12.00	6.556	1.109	1.078	6.146	0.207	1.619	1.412	0.334	1.080	0.873	0.539	4.229
152.0	100.8	0.695	12.10	6.564	1.106	1.075	6.144	0.205	1.616	1.411	0.336	1.079	0.873	0.538	4.204
153.2	101.2	0.701	12.20	6.571	1.109	1.078	6.143	0.204	1.619	1.415	0.337	1.080	0.876	0.539	4.199
154.4	101.6	0.707	12.30	6.579	1.112	1.081	6.145	0.206	1.622	1.415	0.335	1.081	0.875	0.540	4.229
155.7	101.7	0.713	12.40	6.586	1.112	1.081	6.139	0.200	1.622	1.421	0.341	1.081	0.881	0.540	4.170
156.9	101.7	0.718	12.50	6.594	1.110	1.078	6.143	0.204	1.619	1.415	0.337	1.080	0.876	0.539	4.204
158.1	101.7	0.724	12.60	6.601	1.109	1.077	6.139	0.200	1.618	1.418	0.341	1.079	0.880	0.538	4.154
159.3	101.6	0.730	12.70	6.609	1.107	1.074	6.142	0.203	1.615	1.413	0.338	1.078	0.876	0.537	4.174
160.6	101.8	0.736	12.80	6.617	1.107	1.075	6.135	0.196	1.616	1.420	0.345	1.078	0.883	0.537	4.113
161.8	101.1	0.741	12.90	6.624	1.099	1.066	6.137	0.198	1.607	1.410	0.343	1.074	0.876	0.533	4.105
163.0	101.4	0.747	13.00	6.632	1.101	1.068	6.129	0.190	1.609	1.418	0.351	1.075	0.885	0.534	4.046
164.2	101.2	0.753	13.10	6.639	1.098	1.064	6.133	0.194	1.605	1.411	0.347	1.073	0.879	0.532	4.068
165.4	101.6	0.759	13.20	6.647	1.100	1.067	6.128	0.189	1.608	1.419	0.352	1.074	0.886	0.533	4.028
166.5	101.6	0.765	13.31	6.655	1.099	1.065	6.126	0.187	1.607	1.420	0.354	1.074	0.887	0.533	4.009
167.7	101.9	0.770	13.41	6.663	1.101	1.067	6.124	0.185	1.608	1.423	0.356	1.075	0.890	0.534	3.999
168.9	101.8	0.776	13.51	6.670	1.099	1.065	6.122	0.183	1.606	1.422	0.358	1.073	0.890	0.532	3.977
170.1	101.8	0.782	13.60	6.678	1.097	1.063	6.123	0.184	1.604	1.420	0.357	1.072	0.889	0.531	3.974
171.2	102.2	0.787	13.70	6.686	1.100	1.065	6.118	0.179	1.606	1.428	0.362	1.074	0.895	0.533	3.941
172.4	102.6	0.793	13.80	6.693	1.103	1.068	6.122	0.184	1.609	1.426	0.358	1.075	0.892	0.534	3.988
173.6	102.5	0.799	13.90	6.701	1.101	1.066	6.117	0.178	1.607	1.429	0.363	1.074	0.896	0.533	3.938
174.9	103.0	0.805	14.00	6.709	1.106	1.070	6.122	0.183	1.611	1.428	0.358	1.076	0.893	0.535	3.991
176.1	103.1	0.811	14.11	6.717	1.106	1.070	6.116	0.177	1.611	1.434	0.364	1.076	0.899	0.535	3.938
177.3	103.5	0.816	14.21	6.725	1.109	1.072	6.120	0.181	1.613	1.433	0.360	1.077	0.896	0.536	3.976
178.5	103.6	0.822	14.31	6.733	1.108	1.072	6.116	0.177	1.613	1.435	0.364	1.077	0.899	0.536	3.947
179.7	103.9	0.828	14.41	6.741	1.110	1.073	6.113	0.174	1.614	1.440	0.367	1.078	0.903	0.537	3.924
180.9	104.1	0.833	14.51	6.748	1.111	1.074	6.116	0.177	1.615	1.437	0.364	1.078	0.901	0.537	3.952
182.0	104.4	0.839	14.61	6.756	1.112	1.075	6.110	0.171	1.616	1.445	0.370	1.078	0.908	0.537	3.905
183.3	104.3	0.845	14.71	6.764	1.110	1.073	6.115	0.176	1.614	1.438	0.365	1.077	0.902	0.536	3.938
184.5	104.2	0.851	14.81	6.772	1.108	1.070	6.108	0.169	1.611	1.442	0.372	1.076	0.907	0.535	3.881
185.7	104.2	0.857	14.91	6.780	1.107	1.069	6.114	0.175	1.610	1.435	0.366	1.075	0.901	0.534	3.917
186.9	104.6	0.862	15.01	6.788	1.110	1.071	6.109	0.170	1.612	1.442	0.371	1.077	0.907	0.536	3.887
188.1	105.2	0.868	15.11	6.796	1.114	1.076	6.111	0.172	1.617	1.445	0.369	1.079	0.907	0.538	3.912
189.3	106.1	0.874	15.21	6.804	1.122	1.084	6.111	0.172	1.625	1.453	0.369	1.083	0.911	0.542	3.935
190.5	106.4	0.880	15.31	6.812	1.124	1.085	6.105	0.166	1.626	1.461	0.375	1.084	0.918	0.543	3.890
191.7	106.5	0.885	15.41	6.820	1.124	1.085	6.108	0.169	1.626	1.457	0.372	1.083	0.915	0.542	3.915
192.9	106.4	0.891	15.51	6.828	1.121	1.082	6.100	0.161	1.623	1.462	0.380	1.082	0.921	0.541	3.846
194.1	106.7	0.897	15.61	6.836	1.124	1.084	6.103	0.164	1.625	1.462	0.377	1.083	0.919	0.542	3.876
195.3	107.0	0.902	15.71	6.844	1.125	1.085	6.102	0.163	1.626	1.463	0.378	1.084	0.920	0.543	3.873
196.5	107.2	0.908	15.81	6.853	1.126	1.086	6.116	0.177	1.627	1.450	0.364	1.084	0.907	0.543	3.984
197.7	107.4	0.914	15.91	6.861	1.127	1.087	6.114	0.175	1.628	1.453	0.366	1.084	0.910	0.543	3.966
198.9	107.7	0.920	16.01	6.869	1.129	1.088	6.109	0.170	1.629	1.459	0.371	1.085	0.915	0.544	3.934
200.1	107.8	0.926	16.11	6.877	1.129	1.088	6.095	0.156	1.629	1.472	0.385	1.085	0.928	0.544	3.828
201.2	108.2	0.931	16.21	6.885	1.131	1.090	6.083	0.144	1.631	1.487	0.397	1.086	0.942	0.545	3.749
202.5	108.4	0.937	16.31	6.894	1.133	1.091	6.109	0.170	1.632	1.462	0.371	1.087	0.916	0.545	3.944
203.7	108.7	0.943	16.41	6.902	1.134	1.092	6.127	0.188	1.633	1.445	0.353	1.087	0.899	0.546	4.091
204.8	109.0	0.948	16.51	6.910	1.136	1.094	6.081	0.142	1.635	1.493	0.399	1.088	0.946	0.547	3.742
205.9	109.1	0.954	16.61	6.918	1.136	1.094	6.076	0.137	1.635	1.498	0.404	1.088	0.951	0.547	3.706
207.0	109.8	0.960	16.71	6.927	1.141	1.099	6.092	0.153	1.640	1.487	0.388	1.090	0.938	0.549	3.829
208.0	109.8	0.966	16.81	6.935	1.140	1.098	6.101	0.162	1.639	1.477	0.379	1.090	0.928	0.549	3.895
209.1	110.4	0.971	16.91	6.943	1.145	1.101	6.111	0.172	1.642	1.470	0.369	1.092	0.920	0.551	3.984
210.2	110.6	0.977	17.01	6.952	1.146	1.102	6.113	0.175	1.643	1.469	0.367	1.092	0.918	0.551	4.007

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-2, 35.5'-36.0'	Lab ID	31B
Description	Silt with Sand (ML), gray, wet, soft	Test ID	1-B
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	07/05/2017
		Date Tested	07/14/2017

Specific Gravity	2.50
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	75
Nominal Consolidation Pressure (psi)	15

Saturation / Consolidation Results

Pore Pressure Parameter B	0.98
Measured Effective Consol. Stress (tsf)	1.118
Time to 50% Consolidation (min)	0.45
Actual Axial Strain Rate of Test (%/min)	0.095

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	102.1
Moisture Content (%)	54.0
Dry Unit Weight (pcf)	66.3
Void Ratio	1.349
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criteria: Max. Eff. Prin. Stress Ratio

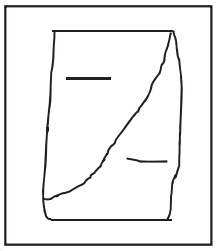
Axial Strain (%)	6.698
Deviator Stress (tsf)	1.676
Induced Pore Pressure (tsf)	0.696
Minor Effective Stress, σ_3' (tsf)	0.422
Major Effective Stress, σ_1' (tsf)	2.099
Eff. Principal Stress Ratio, σ_1'/σ_3'	4.968
p' (tsf)	1.260
q (tsf)	0.838

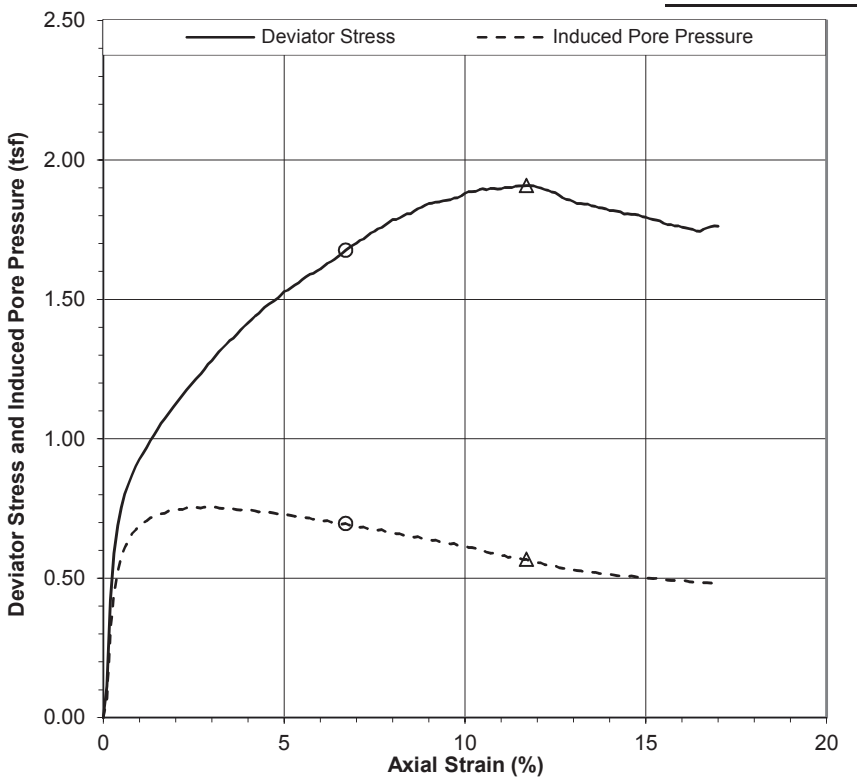
At Consolidated Undrained Failure

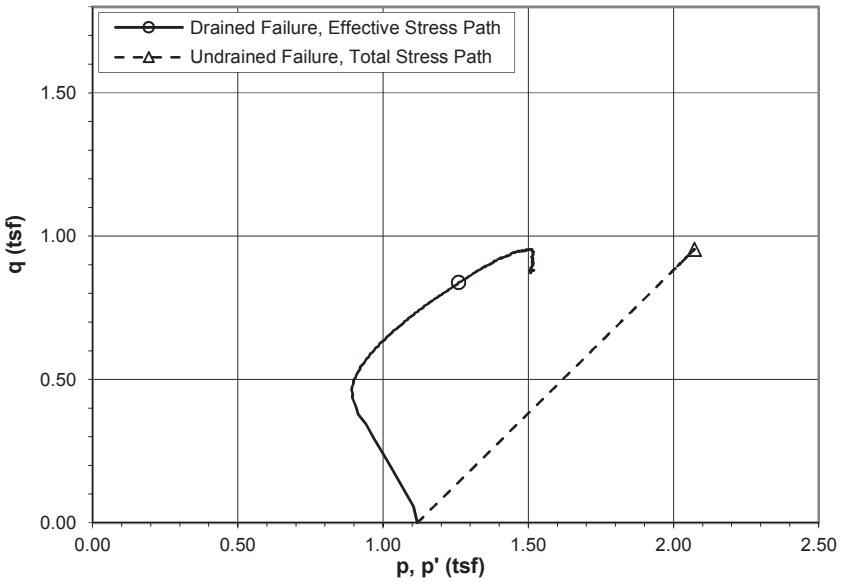
Failure Criterion: Peak Deviator Stress

Axial Strain (%)	11.699
Deviator Stress (tsf)	1.908
Minor Principal Stress, σ_3 (tsf)	1.118
Major Principal Stress, σ_1 (tsf)	3.026
p (tsf)	2.072
q (tsf)	0.954

Failure Sketch







Comments Oven dried at 60° C.

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-2, 35.5'-36.0'	Lab ID	31B
Description	Silt with Sand (ML), gray, wet, soft	Test ID	1-B

Initial Specimen Conditions		Consolidated Specimen Conditions			
Height (in)	5.701	Height (in)	5.599	Specific Gravity	2.50
Diameter (in)	2.718	Calculated Diameter (in)	2.681	ASTM D	854, A
Area (in^2)	5.801	Calculated Area (in^2)	5.645	Liquid Limit	
Moist Weight (lb)	2.004	Moist Weight (lb)	1.867	Plastic Limit	
Moist Unit Weight (pcf)	104.7	Moist Unit Weight (pcf)	102.1	Plasticity Index	
Moisture Content (%)	65.2	Moisture Content (%)	54.0		
Dry Weight (lb)	1.213	Dry Weight (lb)	1.213		
Dry Unit Weight (pcf)	63.4	Dry Unit Weight (pcf)	66.3	Confining Stress	
Void Ratio	1.458	Void Ratio	1.349	σ_3 (tsf)	1.118
Degree of Saturation (%)	111.8	Degree of Saturation (%)	100.0		
				Effective Consolidation Stress	
				σ_3' (tsf)	1.118

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175667029			Source: S-2, 35.5'-36.0'								Lab ID: 31B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	5.645	0.000	0.000	5.362	0.000	1.118	1.118	1.118	1.118	1.118	0.000	1.000
1.1	8.9	0.006	0.10	5.651	0.113	0.113	5.432	0.070	1.231	1.161	1.048	1.175	1.105	0.057	1.108
2.2	33.2	0.011	0.20	5.656	0.422	0.422	5.673	0.312	1.540	1.228	0.807	1.329	1.017	0.211	1.523
3.3	46.4	0.017	0.30	5.662	0.591	0.590	5.807	0.445	1.708	1.263	0.673	1.413	0.968	0.295	1.876
4.3	54.4	0.022	0.40	5.668	0.691	0.690	5.885	0.523	1.808	1.285	0.595	1.463	0.940	0.345	2.159
5.3	59.5	0.028	0.50	5.673	0.755	0.754	5.941	0.580	1.872	1.293	0.539	1.495	0.916	0.377	2.400
6.4	63.3	0.034	0.60	5.679	0.803	0.802	5.972	0.611	1.920	1.309	0.508	1.519	0.908	0.401	2.579
7.4	66.5	0.039	0.70	5.685	0.842	0.840	5.999	0.637	1.958	1.321	0.481	1.538	0.901	0.420	2.745
8.4	69.1	0.045	0.80	5.691	0.874	0.872	6.022	0.660	1.990	1.330	0.458	1.554	0.894	0.436	2.904
9.4	71.5	0.050	0.90	5.696	0.904	0.901	6.035	0.673	2.020	1.346	0.445	1.569	0.896	0.451	3.026
10.5	73.5	0.056	1.00	5.702	0.928	0.926	6.052	0.690	2.044	1.354	0.428	1.581	0.891	0.463	3.161
11.5	75.4	0.061	1.10	5.708	0.951	0.948	6.060	0.698	2.066	1.368	0.420	1.592	0.894	0.474	3.258
12.6	77.1	0.067	1.20	5.713	0.972	0.969	6.067	0.705	2.087	1.382	0.413	1.603	0.897	0.484	3.345
13.6	79.2	0.073	1.30	5.719	0.997	0.994	6.079	0.717	2.112	1.395	0.401	1.615	0.898	0.497	3.475
14.7	80.9	0.078	1.40	5.725	1.017	1.013	6.081	0.720	2.132	1.412	0.399	1.625	0.905	0.507	3.543
15.7	82.6	0.084	1.50	5.731	1.038	1.034	6.088	0.727	2.152	1.425	0.392	1.635	0.909	0.517	3.639
16.7	84.4	0.089	1.60	5.737	1.060	1.056	6.093	0.731	2.174	1.443	0.387	1.646	0.915	0.528	3.727
17.7	85.9	0.095	1.70	5.743	1.077	1.072	6.095	0.733	2.190	1.457	0.385	1.654	0.921	0.536	3.784
18.8	87.3	0.101	1.80	5.748	1.094	1.089	6.103	0.741	2.208	1.466	0.377	1.663	0.922	0.545	3.888
19.8	89.0	0.106	1.90	5.754	1.113	1.109	6.102	0.741	2.227	1.486	0.378	1.673	0.932	0.554	3.935
20.8	90.4	0.112	2.00	5.760	1.129	1.124	6.105	0.743	2.243	1.500	0.375	1.680	0.938	0.562	3.995
21.9	91.8	0.117	2.10	5.766	1.146	1.141	6.109	0.747	2.259	1.512	0.371	1.689	0.942	0.571	4.074
22.9	93.4	0.123	2.20	5.772	1.164	1.159	6.108	0.747	2.277	1.530	0.372	1.698	0.951	0.579	4.118
24.0	94.9	0.129	2.30	5.778	1.182	1.176	6.114	0.752	2.295	1.543	0.366	1.706	0.954	0.588	4.212
25.0	96.2	0.134	2.40	5.784	1.197	1.191	6.112	0.750	2.309	1.559	0.368	1.714	0.964	0.595	4.236
26.0	97.4	0.140	2.50	5.790	1.211	1.205	6.112	0.750	2.323	1.573	0.368	1.721	0.971	0.602	4.272
27.1	98.6	0.146	2.60	5.796	1.225	1.218	6.116	0.754	2.336	1.582	0.364	1.727	0.973	0.609	4.344
28.1	100.0	0.151	2.70	5.802	1.241	1.234	6.113	0.751	2.352	1.601	0.367	1.735	0.984	0.617	4.358
29.2	101.4	0.157	2.80	5.808	1.257	1.250	6.117	0.755	2.368	1.613	0.363	1.743	0.988	0.625	4.439
30.2	103.0	0.162	2.90	5.814	1.275	1.268	6.114	0.752	2.386	1.634	0.366	1.752	1.000	0.634	4.465
31.2	104.1	0.168	3.00	5.820	1.288	1.280	6.113	0.751	2.399	1.648	0.367	1.758	1.008	0.640	4.485
32.2	105.5	0.174	3.10	5.826	1.304	1.296	6.116	0.755	2.415	1.660	0.364	1.766	1.012	0.648	4.565
33.2	107.0	0.179	3.20	5.832	1.321	1.312	6.113	0.751	2.431	1.680	0.367	1.775	1.023	0.656	4.574
34.2	108.2	0.185	3.30	5.838	1.334	1.326	6.112	0.751	2.444	1.693	0.368	1.781	1.030	0.663	4.605
35.2	109.4	0.190	3.40	5.844	1.348	1.339	6.114	0.752	2.458	1.705	0.366	1.788	1.035	0.670	4.661
36.3	110.6	0.196	3.50	5.850	1.362	1.353	6.109	0.747	2.471	1.724	0.371	1.795	1.048	0.676	4.642
37.3	111.4	0.201	3.60	5.856	1.370	1.361	6.111	0.749	2.479	1.730	0.369	1.799	1.049	0.680	4.689
38.3	112.7	0.207	3.70	5.862	1.385	1.375	6.108	0.746	2.493	1.748	0.372	1.806	1.060	0.688	4.692
39.4	114.1	0.213	3.80	5.868	1.400	1.391	6.106	0.744	2.509	1.765	0.374	1.814	1.069	0.695	4.718

Project: 175667029			Source: S-2, 35.5'-36.0'								Lab ID: 31B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
40.4	115.3	0.218	3.90	5.874	1.414	1.404	6.108	0.746	2.522	1.775	0.372	1.820	1.074	0.702	4.775
41.5	116.5	0.224	4.00	5.880	1.426	1.416	6.104	0.742	2.534	1.792	0.376	1.826	1.084	0.708	4.764
42.5	117.5	0.229	4.10	5.886	1.438	1.427	6.106	0.745	2.545	1.801	0.374	1.832	1.087	0.714	4.819
43.6	118.7	0.235	4.20	5.892	1.451	1.440	6.103	0.741	2.558	1.817	0.377	1.838	1.097	0.720	4.818
44.7	119.7	0.241	4.30	5.899	1.462	1.451	6.100	0.738	2.569	1.831	0.380	1.844	1.106	0.725	4.814
45.7	121.0	0.246	4.40	5.905	1.476	1.464	6.102	0.741	2.583	1.842	0.378	1.850	1.110	0.732	4.878
46.8	122.0	0.252	4.50	5.911	1.486	1.475	6.097	0.735	2.593	1.858	0.383	1.856	1.120	0.737	4.852
47.8	123.0	0.257	4.60	5.917	1.497	1.485	6.099	0.737	2.603	1.866	0.381	1.861	1.124	0.742	4.892
48.9	123.8	0.263	4.70	5.923	1.504	1.492	6.095	0.734	2.611	1.877	0.385	1.864	1.131	0.746	4.880
49.9	124.7	0.269	4.80	5.930	1.514	1.502	6.092	0.731	2.620	1.890	0.388	1.869	1.139	0.751	4.875
51.0	125.8	0.274	4.90	5.936	1.526	1.513	6.095	0.733	2.631	1.898	0.385	1.875	1.142	0.756	4.927
52.0	127.2	0.280	5.00	5.942	1.541	1.528	6.089	0.727	2.647	1.920	0.391	1.883	1.155	0.764	4.907
53.1	127.7	0.285	5.10	5.948	1.545	1.532	6.089	0.728	2.651	1.923	0.391	1.884	1.157	0.766	4.922
54.2	128.6	0.291	5.20	5.955	1.555	1.542	6.087	0.725	2.660	1.935	0.393	1.889	1.164	0.771	4.924
55.2	129.6	0.297	5.30	5.961	1.565	1.551	6.083	0.722	2.670	1.948	0.397	1.894	1.172	0.776	4.912
56.3	130.4	0.302	5.40	5.967	1.573	1.559	6.085	0.723	2.677	1.954	0.395	1.898	1.175	0.780	4.946
57.3	131.5	0.308	5.50	5.974	1.585	1.571	6.080	0.718	2.689	1.971	0.400	1.904	1.185	0.785	4.926
58.3	132.6	0.313	5.60	5.980	1.596	1.582	6.079	0.717	2.700	1.983	0.401	1.909	1.192	0.791	4.940
59.4	133.3	0.319	5.70	5.986	1.603	1.588	6.077	0.716	2.707	1.991	0.403	1.913	1.197	0.794	4.944
60.5	133.8	0.325	5.80	5.993	1.607	1.593	6.073	0.711	2.711	1.999	0.407	1.915	1.203	0.796	4.914
61.5	134.8	0.330	5.90	5.999	1.617	1.602	6.076	0.714	2.720	2.007	0.404	1.919	1.206	0.801	4.961
62.5	135.5	0.336	6.00	6.005	1.625	1.609	6.070	0.708	2.727	2.019	0.410	1.923	1.215	0.805	4.921
63.6	136.5	0.342	6.10	6.012	1.634	1.619	6.067	0.705	2.737	2.032	0.413	1.928	1.223	0.809	4.914
64.6	137.5	0.347	6.20	6.018	1.645	1.629	6.068	0.707	2.747	2.041	0.412	1.933	1.226	0.814	4.957
65.7	138.2	0.353	6.30	6.025	1.652	1.636	6.063	0.701	2.754	2.053	0.417	1.936	1.235	0.818	4.922
66.7	139.1	0.358	6.40	6.031	1.660	1.644	6.064	0.702	2.762	2.060	0.416	1.940	1.238	0.822	4.951
67.7	140.1	0.364	6.50	6.037	1.671	1.655	6.059	0.698	2.773	2.075	0.421	1.946	1.248	0.827	4.935
68.8	141.1	0.369	6.60	6.044	1.681	1.664	6.056	0.694	2.782	2.088	0.424	1.950	1.256	0.832	4.923
69.8	142.3	0.375	6.70	6.050	1.693	1.676	6.058	0.696	2.794	2.099	0.422	1.956	1.260	0.838	4.968
70.9	143.3	0.381	6.80	6.057	1.703	1.686	6.052	0.690	2.804	2.114	0.428	1.961	1.271	0.843	4.935
72.0	144.1	0.386	6.90	6.063	1.711	1.693	6.052	0.691	2.811	2.121	0.428	1.965	1.274	0.847	4.960
73.0	145.0	0.392	7.00	6.070	1.719	1.701	6.048	0.686	2.820	2.133	0.432	1.969	1.283	0.851	4.938
74.1	146.1	0.397	7.10	6.076	1.731	1.712	6.045	0.683	2.831	2.148	0.435	1.974	1.291	0.856	4.933
75.2	146.6	0.403	7.20	6.083	1.735	1.717	6.046	0.684	2.835	2.151	0.434	1.977	1.293	0.858	4.953
76.2	147.7	0.409	7.30	6.090	1.746	1.727	6.040	0.678	2.846	2.168	0.440	1.982	1.304	0.864	4.925
77.3	148.8	0.414	7.40	6.096	1.757	1.738	6.041	0.679	2.856	2.177	0.439	1.987	1.308	0.869	4.955
78.3	149.4	0.420	7.50	6.103	1.763	1.744	6.038	0.676	2.862	2.186	0.442	1.990	1.314	0.872	4.943
79.4	150.4	0.425	7.60	6.109	1.773	1.753	6.034	0.672	2.871	2.199	0.446	1.995	1.323	0.876	4.929
80.4	151.0	0.431	7.70	6.116	1.778	1.758	6.036	0.674	2.876	2.202	0.444	1.997	1.323	0.879	4.957
81.5	152.0	0.437	7.80	6.123	1.787	1.767	6.030	0.668	2.886	2.218	0.450	2.002	1.334	0.884	4.923
82.5	152.9	0.442	7.90	6.129	1.797	1.776	6.028	0.666	2.895	2.229	0.452	2.006	1.341	0.888	4.926
83.6	154.0	0.448	8.00	6.136	1.807	1.786	6.026	0.664	2.905	2.240	0.454	2.012	1.347	0.893	4.935
84.7	154.2	0.454	8.10	6.143	1.807	1.786	6.021	0.659	2.905	2.245	0.459	2.011	1.352	0.893	4.893
85.7	154.9	0.459	8.20	6.149	1.814	1.792	6.022	0.660	2.911	2.251	0.458	2.015	1.355	0.896	4.911
86.8	155.7	0.465	8.30	6.156	1.821	1.800	6.016	0.654	2.918	2.264	0.464	2.018	1.364	0.900	4.876
87.9	156.6	0.470	8.40	6.163	1.829	1.807	6.015	0.653	2.926	2.272	0.465	2.022	1.369	0.904	4.888
88.9	156.7	0.476	8.50	6.169	1.829	1.807	6.012	0.650	2.925	2.275	0.468	2.022	1.371	0.903	4.861
90.1	157.8	0.481	8.60	6.176	1.839	1.817	6.009	0.647	2.936	2.288	0.471	2.027	1.380	0.909	4.858
91.2	158.6	0.487	8.70	6.183	1.847	1.825	6.011	0.649	2.943	2.294	0.469	2.031	1.381	0.912	4.892
92.2	159.2	0.493	8.80	6.190	1.852	1.830	6.005	0.643	2.948	2.305	0.475	2.033	1.390	0.915	4.849
93.3	160.2	0.498	8.90	6.197	1.861	1.838	6.004	0.642	2.956	2.314	0.476	2.037	1.395	0.919	4.862
94.4	160.8	0.504	9.00	6.203	1.867	1.844	6.001	0.640	2.962	2.322	0.479	2.040	1.401	0.922	4.852
95.4	161.2	0.509	9.10	6.210	1.868	1.845	5.997	0.636	2.963	2.328	0.483	2.041	1.405	0.923	4.823
96.5	161.6	0.515	9.20	6.217	1.872	1.848	5.999	0.637	2.966	2.329	0.481	2.042	1.405	0.924	4.839
97.5	161.9	0.521	9.30	6.224	1.873	1.849	5.993	0.631	2.968	2.337	0.487	2.043	1.412	0.925	4.794
98.6	162.4	0.526	9.40	6.231	1.877	1.853	5.991	0.629	2.971	2.342	0.489	2.045	1.416	0.926	4.786
99.6	162.9	0.532	9.50	6.238	1.880	1.856	5.989	0.628	2.974	2.346	0.491	2.046	1.418	0.928	4.782
100.7	163.3	0.538	9.60	6.245	1.882	1.858	5.985	0.623	2.976	2.353	0.495	2.047	1.424	0.929	4.750
101.8	163.9	0.543	9.70	6.251	1.888	1.863	5.987	0.625	2.981	2.356	0.493	2.050	1.425	0.931	4.777
102.8	164.3	0.549	9.80	6.258	1.890	1.865	5.980	0.618	2.983	2.365	0.500	2.051	1.433	0.932	4.728
103.9	165.0	0.554	9.90	6.265	1.897	1.871	5.977	0.616	2.989	2.374	0.503	2.054	1.438	0.936	4.723
104.9	166.0	0.560	10.00	6.272	1.906	1.880	5.978	0.617	2.998	2.382	0.502	2.058	1.442	0.940	4.749
106.0	166.8	0.565	10.10	6.279	1.912	1.886	5.971	0.610	3.005	2.395	0.509	2.061	1.452	0.943	4.709
107.0	167.0	0.571	10.20	6.286	1.912	1.886	5.972	0.610	3.004	2.394	0.508	2.061	1.451	0.943	4.712
108.1	167.3	0.577	10.30	6.293	1.914	1.887	5.968	0.607	3.006	2.399	0.512	2.062	1.455	0.944	4.687
109.1	168.0	0.582	10.40	6.300	1.920	1.893	5.961	0.599	3.012	2.413	0.519	2.065	1.466	0.947	4.646
110.2	168.5	0.588	10.50	6.307	1.923	1.896	5.962	0.600	3.014	2.414	0.518	2.066	1.466	0.948	4.659
111.3	168.4	0.593	10.60	6.314	1.920	1.893	5.954	0.593	3.011	2.419	0.526	2.065	1.472	0.946	4.600
112.3	169.0	0.599	10.70	6.321	1.925	1.898	5.951	0.589	3.016	2.427	0.529	2.067	1.478	0.949	4.587

Project: 175667029			Source: S-2, 35.5'-36.0'								Lab ID: 31B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
113.4	169.2	0.605	10.80	6.329	1.925	1.898	5.952	0.590	3.016	2.426	0.528	2.067	1.477	0.949	4.594
114.4	169.2	0.610	10.90	6.336	1.923	1.895	5.946	0.584	3.013	2.429	0.534	2.066	1.482	0.947	4.547
115.5	169.5	0.616	11.00	6.343	1.925	1.896	5.942	0.580	3.015	2.434	0.538	2.066	1.486	0.948	4.524
116.6	170.2	0.622	11.10	6.350	1.930	1.901	5.943	0.582	3.020	2.438	0.537	2.069	1.487	0.951	4.543
117.7	170.4	0.627	11.20	6.357	1.931	1.902	5.936	0.574	3.020	2.445	0.544	2.069	1.495	0.951	4.497
118.7	170.7	0.633	11.30	6.364	1.931	1.902	5.938	0.577	3.020	2.443	0.542	2.069	1.493	0.951	4.511
119.8	171.3	0.638	11.40	6.372	1.935	1.906	5.934	0.572	3.024	2.452	0.546	2.071	1.499	0.953	4.490
120.9	171.6	0.644	11.50	6.379	1.937	1.907	5.934	0.572	3.025	2.453	0.546	2.072	1.500	0.954	4.491
122.0	171.7	0.650	11.60	6.386	1.936	1.906	5.928	0.567	3.025	2.458	0.552	2.072	1.505	0.953	4.457
123.0	172.1	0.655	11.70	6.393	1.938	1.908	5.929	0.567	3.026	2.459	0.551	2.072	1.505	0.954	4.464
124.1	172.3	0.661	11.80	6.400	1.938	1.908	5.923	0.562	3.026	2.464	0.557	2.072	1.510	0.954	4.427
125.1	172.4	0.666	11.90	6.408	1.937	1.907	5.920	0.559	3.025	2.466	0.560	2.072	1.513	0.953	4.406
126.2	172.2	0.672	12.00	6.415	1.933	1.902	5.918	0.557	3.020	2.464	0.562	2.069	1.513	0.951	4.387
127.2	172.2	0.678	12.10	6.422	1.930	1.899	5.917	0.555	3.017	2.462	0.563	2.068	1.513	0.949	4.371
128.2	171.9	0.683	12.20	6.429	1.925	1.894	5.910	0.549	3.012	2.463	0.570	2.065	1.517	0.947	4.325
129.3	171.9	0.689	12.30	6.437	1.922	1.891	5.908	0.546	3.009	2.463	0.572	2.064	1.517	0.945	4.305
130.4	171.6	0.694	12.40	6.444	1.918	1.886	5.905	0.543	3.004	2.461	0.575	2.061	1.518	0.943	4.280
131.4	171.6	0.700	12.50	6.451	1.915	1.882	5.906	0.545	3.001	2.456	0.574	2.060	1.515	0.941	4.282
132.5	171.0	0.705	12.60	6.459	1.907	1.874	5.900	0.538	2.992	2.454	0.580	2.055	1.517	0.937	4.231
133.6	170.4	0.711	12.70	6.466	1.898	1.865	5.897	0.535	2.983	2.448	0.583	2.051	1.515	0.932	4.199
134.6	170.1	0.717	12.80	6.474	1.892	1.859	5.896	0.534	2.977	2.443	0.584	2.048	1.514	0.930	4.182
135.7	170.1	0.722	12.90	6.481	1.890	1.857	5.897	0.535	2.975	2.440	0.583	2.047	1.511	0.928	4.184
136.7	169.8	0.728	13.00	6.489	1.885	1.851	5.892	0.530	2.969	2.439	0.588	2.044	1.514	0.926	4.147
137.8	169.4	0.733	13.10	6.496	1.878	1.844	5.889	0.527	2.962	2.435	0.591	2.040	1.513	0.922	4.120
138.9	169.6	0.739	13.20	6.504	1.877	1.843	5.887	0.526	2.962	2.436	0.593	2.040	1.514	0.922	4.111
139.9	169.7	0.745	13.30	6.511	1.876	1.842	5.884	0.523	2.960	2.437	0.596	2.039	1.516	0.921	4.093
141.0	169.9	0.750	13.40	6.519	1.876	1.842	5.886	0.524	2.960	2.436	0.594	2.039	1.515	0.921	4.100
142.0	169.6	0.756	13.50	6.526	1.871	1.836	5.884	0.522	2.954	2.432	0.596	2.036	1.514	0.918	4.079
143.1	169.6	0.761	13.60	6.534	1.868	1.833	5.883	0.521	2.952	2.431	0.597	2.035	1.514	0.917	4.070
144.2	169.3	0.767	13.70	6.541	1.864	1.829	5.879	0.518	2.947	2.429	0.601	2.033	1.515	0.914	4.044
145.3	169.5	0.773	13.80	6.549	1.863	1.828	5.878	0.516	2.946	2.430	0.602	2.032	1.516	0.914	4.036
146.3	169.4	0.778	13.90	6.556	1.860	1.825	5.877	0.516	2.943	2.427	0.603	2.031	1.515	0.912	4.028
147.3	169.1	0.784	14.00	6.564	1.854	1.818	5.876	0.515	2.937	2.422	0.604	2.027	1.513	0.909	4.012
148.4	169.3	0.789	14.10	6.572	1.855	1.819	5.873	0.511	2.937	2.426	0.607	2.028	1.516	0.909	3.997
149.5	169.3	0.795	14.20	6.579	1.853	1.816	5.871	0.510	2.935	2.425	0.609	2.026	1.517	0.908	3.984
150.5	169.3	0.801	14.30	6.587	1.850	1.814	5.870	0.508	2.932	2.423	0.610	2.025	1.517	0.907	3.973
151.5	168.8	0.806	14.40	6.595	1.843	1.806	5.869	0.507	2.924	2.417	0.611	2.021	1.514	0.903	3.954
152.6	169.1	0.812	14.50	6.602	1.845	1.807	5.867	0.506	2.925	2.420	0.613	2.022	1.516	0.904	3.949
153.7	169.1	0.817	14.60	6.610	1.842	1.805	5.869	0.508	2.923	2.415	0.611	2.021	1.513	0.902	3.956
154.7	169.4	0.823	14.70	6.618	1.843	1.805	5.868	0.506	2.923	2.417	0.612	2.021	1.515	0.902	3.947
155.8	169.4	0.829	14.80	6.626	1.841	1.803	5.866	0.504	2.921	2.417	0.614	2.020	1.516	0.901	3.934
156.9	169.1	0.834	14.90	6.634	1.836	1.797	5.863	0.501	2.915	2.414	0.617	2.017	1.516	0.899	3.911
158.0	169.1	0.840	15.00	6.641	1.833	1.795	5.862	0.500	2.913	2.413	0.618	2.016	1.515	0.897	3.904
159.0	168.9	0.845	15.10	6.649	1.829	1.790	5.861	0.499	2.908	2.409	0.619	2.013	1.514	0.895	3.893
160.1	168.7	0.851	15.20	6.657	1.825	1.786	5.860	0.499	2.904	2.406	0.620	2.011	1.513	0.893	3.882
161.1	168.8	0.857	15.30	6.665	1.824	1.784	5.862	0.500	2.902	2.402	0.618	2.010	1.510	0.892	3.887
162.2	168.7	0.862	15.40	6.673	1.821	1.781	5.861	0.499	2.899	2.400	0.619	2.009	1.509	0.890	3.877
163.3	168.1	0.868	15.50	6.681	1.812	1.772	5.857	0.496	2.891	2.395	0.623	2.004	1.509	0.886	3.847
164.4	168.0	0.874	15.60	6.689	1.808	1.768	5.855	0.493	2.886	2.393	0.625	2.002	1.509	0.884	3.827
165.5	168.2	0.879	15.70	6.696	1.809	1.768	5.854	0.492	2.887	2.395	0.626	2.002	1.510	0.884	3.823
166.6	168.0	0.885	15.80	6.704	1.805	1.764	5.853	0.491	2.882	2.391	0.627	2.000	1.509	0.882	3.814
167.6	168.2	0.890	15.90	6.712	1.805	1.764	5.853	0.491	2.882	2.391	0.627	2.000	1.509	0.882	3.811
168.7	168.0	0.896	16.00	6.720	1.800	1.759	5.854	0.492	2.877	2.385	0.626	1.998	1.505	0.879	3.810
169.8	168.0	0.902	16.10	6.728	1.798	1.757	5.852	0.490	2.875	2.384	0.628	1.997	1.506	0.878	3.798
170.8	168.0	0.907	16.20	6.736	1.795	1.754	5.849	0.488	2.872	2.384	0.631	1.995	1.508	0.877	3.780
171.8	167.9	0.913	16.30	6.744	1.793	1.751	5.847	0.486	2.869	2.383	0.633	1.994	1.508	0.875	3.768
172.8	167.6	0.918	16.40	6.752	1.787	1.745	5.845	0.483	2.863	2.379	0.635	1.991	1.507	0.872	3.748
173.9	167.8	0.924	16.50	6.761	1.787	1.745	5.844	0.483	2.863	2.380	0.636	1.991	1.508	0.872	3.745
174.9	168.7	0.929	16.60	6.769	1.795	1.752	5.845	0.484	2.870	2.387	0.635	1.994	1.511	0.876	3.760
176.0	169.4	0.935	16.70	6.777	1.800	1.757	5.846	0.484	2.875	2.391	0.634	1.997	1.512	0.878	3.771
177.0	170.0	0.941	16.80	6.785	1.804	1.760	5.845	0.483	2.879	2.396	0.635	1.998	1.515	0.880	3.771
178.1	170.5	0.946	16.90	6.793	1.807	1.764	5.843	0.481	2.882	2.401	0.637	2.000	1.519	0.882	3.768
179.1	170.6	0.952	17.00	6.801	1.806	1.762	5.841	0.479	2.880	2.401	0.639	1.999	1.520	0.881	3.758

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-2, 36.0'-36.5'	Lab ID	31C
Description	Silt with Sand (ML), gray, wet, soft	Test ID	1-C
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	07/05/2017
		Date Tested	07/14/2017

Specific Gravity	2.50
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	67.5
Nominal Consolidation Pressure (psi)	22.5

Saturation / Consolidation Results

Pore Pressure Parameter B	0.97
Measured Effective Consol. Stress (tsf)	1.621
Time to 50% Consolidation (min)	0.42
Actual Axial Strain Rate of Test (%/min)	0.092

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	107.3
Moisture Content (%)	43.1
Dry Unit Weight (pcf)	75.0
Void Ratio	1.078
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criteria: Max. Eff. Prin. Stress Ratio

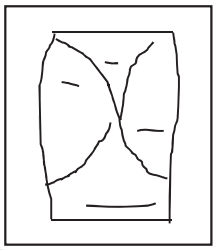
Axial Strain (%)	4.903
Deviator Stress (tsf)	2.349
Induced Pore Pressure (tsf)	0.981
Minor Effective Stress, σ_3' (tsf)	0.640
Major Effective Stress, σ_1' (tsf)	2.989
Eff. Principal Stress Ratio, σ_1'/σ_3'	4.671
p' (tsf)	1.815
q (tsf)	1.175

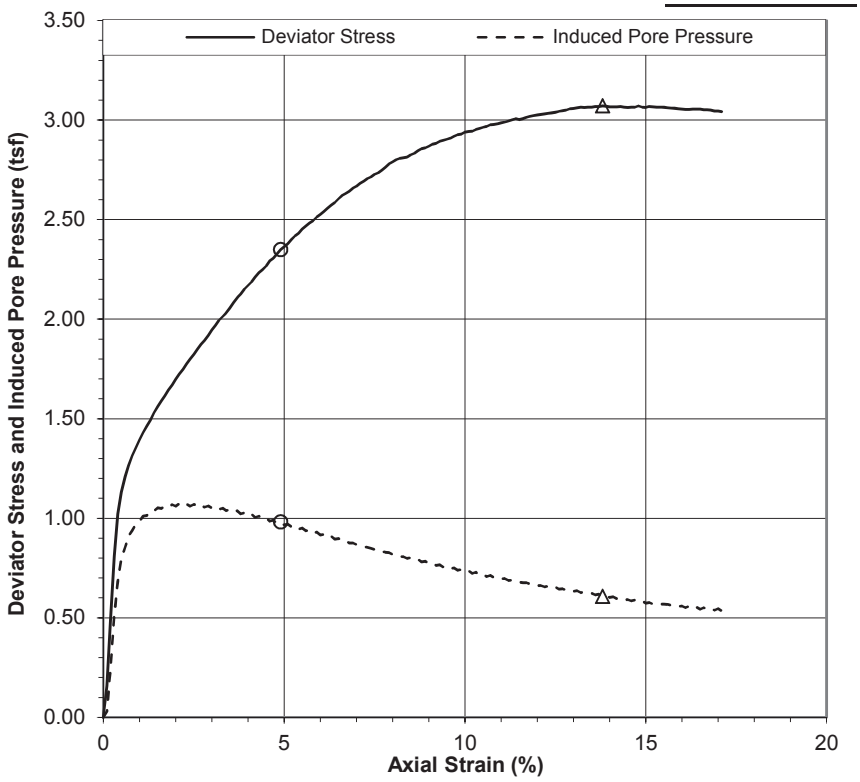
At Consolidated Undrained Failure

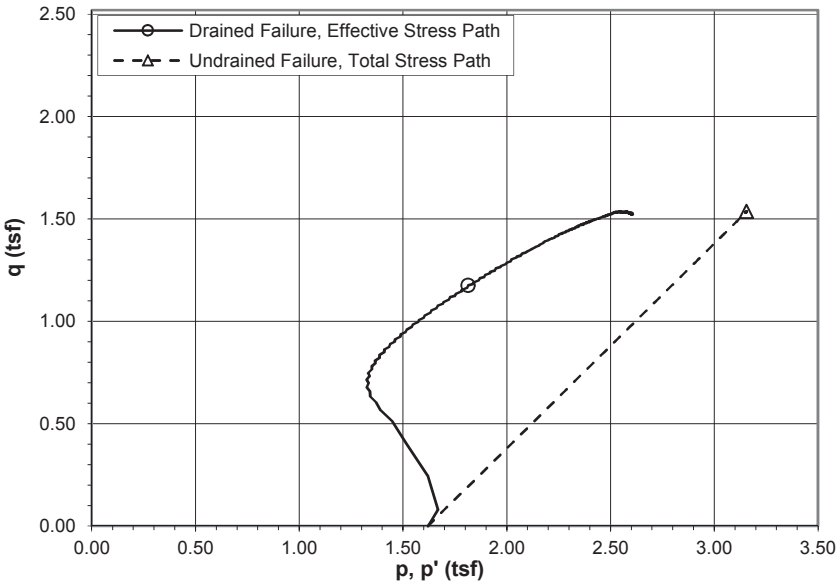
Failure Criterion: Peak Deviator Stress

Axial Strain (%)	13.803
Deviator Stress (tsf)	3.071
Minor Principal Stress, σ_3 (tsf)	1.621
Major Principal Stress, σ_1 (tsf)	4.692
p (tsf)	3.156
q (tsf)	1.536

Failure Sketch







Comments Oven dried at 60° C.

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-2, 36.0'-36.5'	Lab ID	31C
Description	Silt with Sand (ML), gray, wet, soft	Test ID	1-C

Initial Specimen Conditions		Consolidated Specimen Conditions			
Height (in)	5.833	Height (in)	5.730	Specific Gravity	2.50
Diameter (in)	2.749	Calculated Diameter (in)	2.718	ASTM D	854, A
Area (in^2)	5.934	Calculated Area (in^2)	5.802	Liquid Limit	
Moist Weight (lb)	2.177	Moist Weight (lb)	2.064	Plastic Limit	
Moist Unit Weight (pcf)	108.7	Moist Unit Weight (pcf)	107.3	Plasticity Index	
Moisture Content (%)	50.9	Moisture Content (%)	43.1		
Dry Weight (lb)	1.442	Dry Weight (lb)	1.442		
Dry Unit Weight (pcf)	72.0	Dry Unit Weight (pcf)	75.0	Confining Stress	
Void Ratio	1.163	Void Ratio	1.078	σ_3 (tsf)	1.621
Degree of Saturation (%)	109.4	Degree of Saturation (%)	100.0		
				Effective Consolidation Stress	
				σ_3' (tsf)	1.621

Moisture contents obtained using whole specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175667029			Source: S-2, 36.0'-36.5'								Lab ID: 31C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	5.802	0.000	0.000	4.859	0.000	1.621	1.621	1.621	1.621	1.621	0.000	1.000
2.2	12.9	0.006	0.10	5.808	0.160	0.159	4.890	0.031	1.780	1.750	1.590	1.701	1.670	0.080	1.100
3.4	39.1	0.012	0.20	5.814	0.485	0.484	5.101	0.242	2.105	1.863	1.379	1.863	1.621	0.242	1.351
4.5	65.4	0.017	0.30	5.820	0.810	0.809	5.369	0.510	2.430	1.919	1.111	2.025	1.515	0.404	1.728
5.7	82.7	0.023	0.40	5.826	1.023	1.022	5.542	0.683	2.642	1.959	0.938	2.132	1.448	0.511	2.090
6.8	91.7	0.029	0.50	5.832	1.132	1.131	5.654	0.795	2.752	1.957	0.826	2.186	1.391	0.565	2.369
7.9	98.1	0.034	0.60	5.837	1.210	1.209	5.715	0.855	2.830	1.974	0.765	2.225	1.370	0.604	2.579
9.0	102.8	0.040	0.70	5.843	1.267	1.265	5.771	0.912	2.886	1.975	0.709	2.254	1.342	0.633	2.784
10.0	106.9	0.046	0.80	5.849	1.316	1.314	5.797	0.938	2.935	1.997	0.683	2.278	1.340	0.657	2.925
11.1	110.4	0.052	0.90	5.855	1.358	1.356	5.833	0.974	2.977	2.003	0.647	2.299	1.325	0.678	3.094
12.2	113.7	0.057	1.00	5.861	1.397	1.395	5.843	0.984	3.016	2.031	0.637	2.318	1.334	0.697	3.190
13.3	116.7	0.063	1.10	5.867	1.432	1.430	5.870	1.011	3.050	2.039	0.610	2.336	1.325	0.715	3.344
14.3	119.6	0.069	1.20	5.873	1.467	1.464	5.873	1.014	3.085	2.071	0.607	2.353	1.339	0.732	3.411
15.4	122.1	0.075	1.30	5.879	1.496	1.493	5.895	1.036	3.113	2.077	0.585	2.367	1.331	0.746	3.552
16.6	125.3	0.080	1.40	5.885	1.533	1.530	5.895	1.036	3.151	2.115	0.585	2.386	1.350	0.765	3.614
17.6	128.1	0.086	1.50	5.891	1.565	1.561	5.911	1.052	3.182	2.130	0.569	2.402	1.349	0.781	3.746
18.7	130.5	0.092	1.60	5.897	1.593	1.589	5.908	1.049	3.210	2.161	0.572	2.415	1.366	0.794	3.778
19.7	132.8	0.098	1.70	5.903	1.619	1.615	5.922	1.063	3.236	2.173	0.558	2.428	1.366	0.807	3.893
20.8	135.2	0.103	1.80	5.909	1.648	1.643	5.915	1.055	3.264	2.209	0.565	2.443	1.387	0.822	3.906
21.8	137.6	0.109	1.90	5.915	1.675	1.670	5.928	1.068	3.291	2.223	0.552	2.456	1.388	0.835	4.023
22.9	140.2	0.115	2.00	5.921	1.704	1.699	5.919	1.060	3.320	2.260	0.561	2.470	1.410	0.850	4.030
23.9	142.4	0.120	2.10	5.927	1.730	1.724	5.932	1.073	3.345	2.272	0.548	2.483	1.410	0.862	4.148
25.0	144.6	0.126	2.20	5.933	1.755	1.749	5.921	1.062	3.370	2.308	0.559	2.495	1.434	0.875	4.128
26.0	147.0	0.132	2.30	5.939	1.782	1.776	5.931	1.072	3.397	2.325	0.549	2.509	1.437	0.888	4.234
27.0	149.1	0.138	2.40	5.945	1.806	1.800	5.920	1.061	3.420	2.359	0.560	2.521	1.459	0.900	4.215
28.1	151.3	0.143	2.50	5.951	1.830	1.824	5.930	1.071	3.445	2.374	0.550	2.533	1.462	0.912	4.315
29.1	153.5	0.149	2.60	5.957	1.856	1.849	5.918	1.059	3.470	2.411	0.562	2.545	1.487	0.925	4.290
30.2	155.7	0.155	2.70	5.963	1.880	1.873	5.927	1.067	3.494	2.427	0.553	2.558	1.490	0.937	4.385
31.3	157.6	0.161	2.80	5.970	1.901	1.894	5.915	1.056	3.514	2.458	0.565	2.568	1.511	0.947	4.353
32.3	159.8	0.166	2.90	5.976	1.926	1.918	5.922	1.063	3.539	2.477	0.558	2.580	1.517	0.959	4.436
33.4	162.3	0.172	3.00	5.982	1.953	1.945	5.911	1.051	3.566	2.515	0.569	2.594	1.542	0.973	4.416
34.4	164.3	0.178	3.10	5.988	1.976	1.968	5.916	1.057	3.589	2.532	0.564	2.605	1.548	0.984	4.490
35.5	166.7	0.183	3.20	5.994	2.003	1.995	5.904	1.045	3.615	2.571	0.576	2.618	1.574	0.997	4.461
36.5	168.5	0.189	3.30	6.000	2.021	2.013	5.910	1.051	3.634	2.583	0.570	2.627	1.577	1.007	4.530
37.6	170.3	0.195	3.40	6.007	2.042	2.033	5.898	1.038	3.654	2.616	0.582	2.638	1.599	1.017	4.491
38.7	172.4	0.201	3.50	6.013	2.065	2.056	5.904	1.045	3.677	2.632	0.576	2.649	1.604	1.028	4.569
39.9	175.0	0.206	3.60	6.019	2.094	2.084	5.890	1.031	3.705	2.674	0.590	2.663	1.632	1.042	4.533
40.9	177.1	0.212	3.70	6.025	2.116	2.107	5.896	1.037	3.728	2.690	0.584	2.674	1.637	1.053	4.609
42.0	178.9	0.218	3.80	6.032	2.136	2.126	5.881	1.022	3.747	2.725	0.599	2.684	1.662	1.063	4.552

Project: 175667029			Source: S-2, 36.0'-36.5'								Lab ID: 31C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
43.1	181.2	0.223	3.90	6.038	2.161	2.151	5.888	1.029	3.772	2.744	0.592	2.697	1.668	1.076	4.632
44.2	183.0	0.229	4.00	6.044	2.180	2.170	5.873	1.014	3.791	2.777	0.607	2.706	1.692	1.085	4.573
45.3	184.7	0.235	4.10	6.050	2.198	2.187	5.879	1.020	3.808	2.789	0.601	2.715	1.695	1.094	4.639
46.4	186.9	0.241	4.20	6.057	2.222	2.211	5.864	1.005	3.832	2.827	0.616	2.726	1.722	1.106	4.588
47.4	189.0	0.246	4.30	6.063	2.245	2.234	5.870	1.011	3.854	2.844	0.610	2.738	1.727	1.117	4.661
48.5	190.4	0.252	4.40	6.069	2.259	2.248	5.854	0.995	3.869	2.874	0.626	2.745	1.750	1.124	4.592
49.6	192.3	0.258	4.50	6.076	2.279	2.268	5.859	1.000	3.889	2.889	0.621	2.755	1.755	1.134	4.651
50.7	194.7	0.264	4.60	6.082	2.305	2.293	5.843	0.984	3.914	2.930	0.637	2.768	1.783	1.147	4.602
51.8	196.0	0.269	4.70	6.089	2.318	2.306	5.849	0.990	3.927	2.937	0.631	2.774	1.784	1.153	4.658
52.9	198.0	0.275	4.80	6.095	2.339	2.327	5.834	0.975	3.948	2.973	0.646	2.784	1.809	1.164	4.604
54.0	200.2	0.281	4.90	6.102	2.362	2.349	5.840	0.981	3.970	2.989	0.640	2.796	1.815	1.175	4.671
55.0	201.6	0.287	5.00	6.108	2.376	2.363	5.825	0.966	3.984	3.018	0.655	2.803	1.837	1.182	4.609
56.1	203.1	0.292	5.10	6.114	2.392	2.379	5.830	0.971	4.000	3.028	0.650	2.810	1.839	1.189	4.661
57.2	205.2	0.298	5.20	6.121	2.414	2.400	5.815	0.956	4.021	3.066	0.665	2.821	1.866	1.200	4.608
58.2	206.9	0.304	5.30	6.127	2.431	2.418	5.819	0.960	4.039	3.079	0.661	2.830	1.870	1.209	4.659
59.3	208.3	0.309	5.40	6.134	2.445	2.431	5.804	0.945	4.052	3.107	0.676	2.837	1.891	1.216	4.598
60.4	210.3	0.315	5.50	6.140	2.466	2.452	5.810	0.951	4.073	3.121	0.670	2.847	1.895	1.226	4.662
61.5	212.0	0.321	5.60	6.147	2.483	2.469	5.796	0.936	4.090	3.154	0.684	2.855	1.919	1.235	4.608
62.6	213.4	0.327	5.70	6.153	2.497	2.482	5.800	0.941	4.103	3.162	0.680	2.862	1.921	1.241	4.651
63.7	214.7	0.332	5.80	6.160	2.509	2.494	5.784	0.925	4.115	3.190	0.696	2.868	1.943	1.247	4.586
64.7	216.6	0.338	5.90	6.166	2.529	2.514	5.790	0.930	4.135	3.204	0.690	2.878	1.947	1.257	4.640
65.8	217.9	0.344	6.00	6.173	2.541	2.526	5.775	0.915	4.147	3.232	0.705	2.884	1.969	1.263	4.581
66.9	219.4	0.350	6.10	6.179	2.557	2.541	5.778	0.919	4.162	3.243	0.702	2.891	1.973	1.271	4.619
68.0	221.1	0.355	6.20	6.186	2.573	2.557	5.763	0.903	4.178	3.275	0.717	2.900	1.996	1.279	4.565
69.0	222.7	0.361	6.30	6.192	2.589	2.573	5.768	0.909	4.194	3.285	0.712	2.907	1.999	1.286	4.613
70.0	224.0	0.367	6.40	6.199	2.602	2.585	5.755	0.895	4.206	3.311	0.725	2.914	2.018	1.293	4.564
71.1	225.9	0.373	6.50	6.206	2.621	2.604	5.758	0.899	4.225	3.326	0.722	2.923	2.024	1.302	4.607
72.2	227.7	0.378	6.60	6.213	2.639	2.622	5.745	0.886	4.243	3.357	0.735	2.932	2.046	1.311	4.566
73.2	228.6	0.384	6.70	6.219	2.647	2.630	5.746	0.887	4.251	3.364	0.734	2.936	2.049	1.315	4.584
74.2	229.9	0.390	6.80	6.226	2.659	2.642	5.734	0.875	4.263	3.387	0.746	2.942	2.067	1.321	4.542
75.4	231.6	0.395	6.90	6.232	2.675	2.657	5.735	0.876	4.278	3.402	0.745	2.950	2.074	1.329	4.567
76.4	232.7	0.401	7.00	6.239	2.686	2.668	5.726	0.867	4.289	3.422	0.754	2.955	2.088	1.334	4.538
77.5	234.3	0.407	7.10	6.246	2.700	2.682	5.723	0.864	4.303	3.439	0.757	2.962	2.098	1.341	4.544
78.6	235.6	0.413	7.20	6.253	2.713	2.694	5.717	0.857	4.315	3.458	0.763	2.968	2.111	1.347	4.529
79.6	236.8	0.418	7.30	6.259	2.724	2.706	5.712	0.853	4.327	3.473	0.768	2.974	2.121	1.353	4.525
80.7	237.9	0.424	7.40	6.266	2.734	2.715	5.708	0.848	4.336	3.487	0.772	2.978	2.130	1.357	4.514
81.8	239.2	0.430	7.50	6.273	2.746	2.727	5.702	0.843	4.348	3.505	0.778	2.984	2.141	1.363	4.505
82.9	240.3	0.436	7.60	6.280	2.755	2.736	5.695	0.835	4.357	3.521	0.785	2.989	2.153	1.368	4.483
84.0	241.7	0.441	7.70	6.286	2.768	2.748	5.693	0.834	4.369	3.535	0.787	2.995	2.161	1.374	4.494
85.1	243.2	0.447	7.80	6.293	2.782	2.762	5.687	0.828	4.383	3.555	0.793	3.002	2.174	1.381	4.485
86.2	245.1	0.453	7.90	6.300	2.801	2.781	5.686	0.827	4.402	3.575	0.794	3.011	2.184	1.390	4.501
87.2	246.1	0.458	8.00	6.307	2.810	2.790	5.677	0.818	4.410	3.593	0.803	3.016	2.198	1.395	4.473
88.3	247.4	0.464	8.10	6.314	2.821	2.801	5.675	0.816	4.421	3.605	0.805	3.021	2.205	1.400	4.480
89.4	248.3	0.470	8.20	6.321	2.829	2.808	5.667	0.808	4.429	3.621	0.813	3.025	2.217	1.404	4.454
90.5	248.8	0.476	8.30	6.328	2.831	2.810	5.666	0.807	4.431	3.624	0.814	3.026	2.219	1.405	4.452
91.6	249.5	0.481	8.40	6.334	2.836	2.814	5.658	0.799	4.435	3.637	0.822	3.028	2.229	1.407	4.423
92.7	250.7	0.487	8.50	6.341	2.846	2.825	5.660	0.801	4.446	3.645	0.820	3.033	2.232	1.412	4.445
93.8	251.7	0.493	8.60	6.348	2.855	2.833	5.649	0.790	4.454	3.664	0.831	3.038	2.247	1.417	4.411
94.9	253.2	0.499	8.70	6.355	2.869	2.847	5.652	0.793	4.467	3.674	0.828	3.044	2.251	1.423	4.438
96.0	254.3	0.504	8.80	6.362	2.878	2.855	5.640	0.781	4.476	3.695	0.840	3.048	2.267	1.428	4.401
97.1	255.1	0.510	8.90	6.369	2.883	2.861	5.644	0.785	4.481	3.697	0.836	3.051	2.267	1.430	4.421
98.1	256.1	0.516	9.00	6.376	2.892	2.869	5.631	0.772	4.490	3.718	0.849	3.055	2.283	1.434	4.380
99.2	257.3	0.521	9.10	6.383	2.902	2.879	5.635	0.776	4.500	3.724	0.845	3.060	2.285	1.439	4.405
100.3	258.0	0.527	9.20	6.390	2.907	2.883	5.623	0.763	4.504	3.741	0.857	3.063	2.299	1.442	4.363
101.4	259.2	0.533	9.30	6.397	2.917	2.894	5.626	0.767	4.514	3.747	0.854	3.068	2.301	1.447	4.388
102.5	259.8	0.539	9.40	6.405	2.921	2.897	5.614	0.755	4.518	3.763	0.866	3.069	2.314	1.449	4.346
103.6	260.7	0.544	9.50	6.412	2.928	2.904	5.618	0.759	4.525	3.765	0.862	3.073	2.314	1.452	4.369
104.6	261.5	0.550	9.60	6.419	2.934	2.909	5.606	0.747	4.530	3.783	0.874	3.076	2.329	1.455	4.329
105.7	262.6	0.556	9.70	6.426	2.943	2.918	5.609	0.750	4.539	3.789	0.871	3.080	2.330	1.459	4.351
106.8	263.7	0.562	9.80	6.433	2.951	2.926	5.598	0.738	4.547	3.809	0.882	3.084	2.345	1.463	4.316
107.9	264.4	0.567	9.90	6.440	2.956	2.930	5.601	0.742	4.551	3.809	0.879	3.086	2.344	1.465	4.335
109.0	265.5	0.573	10.00	6.447	2.965	2.940	5.591	0.732	4.561	3.829	0.889	3.091	2.359	1.470	4.305
110.1	266.1	0.579	10.10	6.454	2.969	2.943	5.595	0.736	4.564	3.828	0.885	3.093	2.356	1.472	4.327
111.2	266.5	0.585	10.20	6.461	2.970	2.944	5.583	0.724	4.564	3.841	0.897	3.093	2.369	1.472	4.281
112.3	267.5	0.590	10.30	6.469	2.978	2.952	5.588	0.729	4.572	3.844	0.892	3.097	2.368	1.476	4.308
113.4	268.4	0.596	10.40	6.476	2.984	2.958	5.574	0.715	4.578	3.863	0.906	3.100	2.384	1.479	4.266
114.5	269.3	0.602	10.50	6.483	2.991	2.964	5.579	0.720	4.585	3.865	0.901	3.103	2.383	1.482	4.291
115.5	270.0	0.607	10.60	6.490	2.995	2.968	5.566	0.707	4.589	3.882	0.914	3.105	2.398	1.484	4.247
116.6	271.0	0.613	10.70	6.498	3.003	2.976	5.573	0.714	4.597	3.883	0.907	3.109	2.395	1.488	4.281

Project: 175667029			Source: S-2, 36.0'-36.5'								Lab ID: 31C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
117.7	271.5	0.619	10.80	6.505	3.006	2.978	5.561	0.702	4.599	3.897	0.919	3.110	2.408	1.489	4.241
118.7	272.1	0.625	10.90	6.512	3.008	2.980	5.563	0.703	4.601	3.898	0.917	3.111	2.408	1.490	4.248
119.8	272.9	0.630	11.00	6.520	3.014	2.986	5.554	0.695	4.607	3.912	0.926	3.114	2.419	1.493	4.225
120.8	273.5	0.636	11.10	6.527	3.017	2.989	5.556	0.697	4.610	3.913	0.924	3.116	2.418	1.495	4.236
121.9	274.5	0.642	11.20	6.534	3.025	2.996	5.547	0.688	4.617	3.929	0.933	3.119	2.431	1.498	4.211
123.0	275.2	0.647	11.30	6.542	3.029	3.000	5.548	0.689	4.621	3.932	0.932	3.121	2.432	1.500	4.219
124.1	276.1	0.653	11.40	6.549	3.036	3.007	5.542	0.683	4.628	3.944	0.938	3.124	2.441	1.503	4.206
125.2	276.0	0.659	11.50	6.556	3.031	3.002	5.538	0.679	4.623	3.943	0.942	3.122	2.443	1.501	4.188
126.3	276.8	0.665	11.60	6.564	3.037	3.007	5.535	0.675	4.628	3.952	0.945	3.124	2.449	1.504	4.181
127.4	277.7	0.670	11.70	6.571	3.043	3.013	5.535	0.676	4.634	3.958	0.945	3.127	2.452	1.506	4.188
128.5	278.5	0.676	11.80	6.579	3.048	3.018	5.528	0.669	4.638	3.969	0.952	3.130	2.461	1.509	4.170
129.6	279.2	0.682	11.90	6.586	3.052	3.022	5.529	0.669	4.643	3.974	0.951	3.132	2.463	1.511	4.176
130.7	279.9	0.688	12.00	6.594	3.057	3.026	5.520	0.661	4.647	3.986	0.960	3.134	2.473	1.513	4.153
131.8	280.4	0.693	12.10	6.601	3.058	3.027	5.522	0.662	4.648	3.986	0.958	3.135	2.472	1.514	4.159
132.9	281.0	0.699	12.20	6.609	3.062	3.031	5.514	0.655	4.651	3.996	0.966	3.136	2.481	1.515	4.137
134.0	281.7	0.705	12.30	6.616	3.066	3.035	5.517	0.658	4.656	3.997	0.963	3.138	2.480	1.517	4.153
135.1	282.2	0.711	12.40	6.624	3.068	3.036	5.509	0.649	4.657	4.008	0.971	3.139	2.490	1.518	4.125
136.2	282.9	0.716	12.50	6.631	3.071	3.039	5.512	0.653	4.660	4.007	0.968	3.141	2.488	1.520	4.140
137.3	283.6	0.722	12.60	6.639	3.076	3.044	5.503	0.644	4.664	4.021	0.977	3.143	2.499	1.522	4.115
138.4	284.3	0.728	12.70	6.646	3.080	3.047	5.505	0.646	4.668	4.022	0.975	3.145	2.498	1.524	4.126
139.4	284.9	0.734	12.80	6.654	3.082	3.050	5.496	0.637	4.671	4.034	0.984	3.146	2.509	1.525	4.100
140.5	285.9	0.739	12.90	6.662	3.090	3.057	5.499	0.640	4.678	4.038	0.981	3.149	2.510	1.529	4.116
141.7	286.3	0.745	13.00	6.670	3.091	3.058	5.492	0.633	4.679	4.046	0.988	3.150	2.517	1.529	4.096
142.7	287.1	0.751	13.10	6.677	3.095	3.062	5.495	0.636	4.683	4.047	0.985	3.152	2.516	1.531	4.109
143.8	287.7	0.756	13.20	6.685	3.099	3.065	5.486	0.627	4.686	4.059	0.994	3.153	2.527	1.533	4.082
144.9	287.9	0.762	13.30	6.693	3.098	3.064	5.489	0.630	4.685	4.055	0.991	3.153	2.523	1.532	4.092
146.0	288.3	0.768	13.40	6.700	3.098	3.064	5.480	0.621	4.685	4.064	1.000	3.153	2.532	1.532	4.065
147.1	288.7	0.774	13.50	6.708	3.099	3.064	5.482	0.623	4.685	4.062	0.998	3.153	2.530	1.532	4.071
148.1	289.4	0.779	13.60	6.716	3.102	3.068	5.474	0.615	4.689	4.074	1.006	3.155	2.540	1.534	4.048
149.3	289.7	0.785	13.70	6.724	3.103	3.068	5.477	0.618	4.689	4.071	1.003	3.155	2.537	1.534	4.058
150.3	290.4	0.791	13.80	6.732	3.106	3.071	5.467	0.607	4.692	4.085	1.013	3.156	2.549	1.536	4.031
151.4	290.7	0.797	13.90	6.739	3.105	3.070	5.471	0.612	4.691	4.079	1.009	3.156	2.544	1.535	4.043
152.5	290.6	0.802	14.00	6.747	3.102	3.066	5.461	0.602	4.687	4.085	1.019	3.154	2.552	1.533	4.010
153.5	291.0	0.808	14.10	6.755	3.102	3.066	5.465	0.605	4.687	4.082	1.015	3.154	2.549	1.533	4.020
154.6	291.4	0.814	14.20	6.763	3.103	3.067	5.454	0.595	4.688	4.092	1.026	3.154	2.559	1.533	3.990
155.8	291.9	0.819	14.30	6.771	3.104	3.068	5.458	0.599	4.689	4.090	1.022	3.155	2.556	1.534	4.002
156.9	291.9	0.825	14.40	6.779	3.101	3.064	5.450	0.591	4.685	4.094	1.030	3.153	2.562	1.532	3.974
158.0	292.2	0.831	14.50	6.786	3.100	3.063	5.451	0.592	4.684	4.093	1.029	3.153	2.561	1.532	3.976
159.1	292.6	0.837	14.60	6.795	3.101	3.064	5.445	0.585	4.685	4.099	1.035	3.153	2.567	1.532	3.959
160.2	293.1	0.842	14.70	6.802	3.102	3.065	5.449	0.590	4.686	4.096	1.031	3.153	2.563	1.532	3.972
161.3	294.0	0.848	14.80	6.810	3.108	3.071	5.438	0.579	4.692	4.112	1.042	3.156	2.577	1.535	3.948
162.4	293.9	0.854	14.90	6.818	3.103	3.066	5.444	0.585	4.686	4.102	1.036	3.154	2.569	1.533	3.958
163.5	294.0	0.860	15.00	6.826	3.101	3.063	5.432	0.573	4.684	4.111	1.048	3.152	2.579	1.531	3.923
164.5	294.8	0.865	15.10	6.835	3.106	3.067	5.436	0.577	4.688	4.111	1.044	3.155	2.578	1.534	3.938
165.6	295.0	0.871	15.20	6.842	3.104	3.066	5.428	0.569	4.686	4.117	1.052	3.154	2.584	1.533	3.915
166.7	295.3	0.877	15.30	6.851	3.103	3.064	5.432	0.573	4.685	4.113	1.048	3.153	2.580	1.532	3.923
167.7	295.7	0.883	15.40	6.859	3.105	3.065	5.427	0.568	4.686	4.118	1.053	3.154	2.586	1.533	3.911
168.8	296.1	0.888	15.50	6.867	3.104	3.065	5.427	0.568	4.686	4.118	1.053	3.153	2.585	1.533	3.911
169.8	296.1	0.894	15.60	6.875	3.101	3.061	5.426	0.567	4.682	4.115	1.054	3.151	2.585	1.530	3.904
170.9	296.3	0.900	15.70	6.883	3.100	3.060	5.422	0.563	4.681	4.118	1.058	3.151	2.588	1.530	3.891
171.9	296.8	0.905	15.80	6.891	3.101	3.061	5.423	0.564	4.682	4.118	1.057	3.151	2.588	1.530	3.895
173.0	296.8	0.911	15.90	6.899	3.097	3.057	5.416	0.557	4.677	4.121	1.064	3.149	2.592	1.528	3.873
174.1	297.1	0.917	16.00	6.908	3.097	3.056	5.418	0.559	4.677	4.118	1.062	3.149	2.590	1.528	3.878
175.1	297.3	0.923	16.10	6.916	3.095	3.054	5.410	0.551	4.675	4.124	1.070	3.148	2.597	1.527	3.854
176.2	297.7	0.928	16.20	6.924	3.095	3.054	5.418	0.559	4.675	4.116	1.062	3.148	2.589	1.527	3.876
177.3	298.2	0.934	16.30	6.933	3.097	3.055	5.407	0.548	4.676	4.128	1.073	3.148	2.600	1.528	3.848
178.4	298.5	0.940	16.40	6.941	3.097	3.055	5.413	0.554	4.676	4.122	1.067	3.149	2.595	1.528	3.863
179.5	298.9	0.946	16.50	6.949	3.097	3.055	5.402	0.543	4.676	4.133	1.078	3.149	2.606	1.528	3.834
180.5	299.0	0.951	16.60	6.957	3.095	3.052	5.410	0.551	4.673	4.122	1.070	3.147	2.596	1.526	3.854
181.6	299.3	0.957	16.70	6.966	3.094	3.051	5.400	0.541	4.672	4.131	1.080	3.146	2.606	1.526	3.825
182.7	299.7	0.963	16.80	6.974	3.094	3.051	5.407	0.548	4.672	4.123	1.073	3.146	2.598	1.525	3.844
183.8	299.6	0.969	16.90	6.983	3.089	3.046	5.398	0.539	4.667	4.128	1.082	3.144	2.605	1.523	3.814
184.9	299.9	0.974	17.00	6.991	3.089	3.046	5.406	0.546	4.667	4.120	1.074	3.144	2.597	1.523	3.835
186.0	300.0	0.980	17.10	6.999	3.086	3.042	5.394	0.535	4.663	4.128	1.086	3.142	2.607	1.521	3.801

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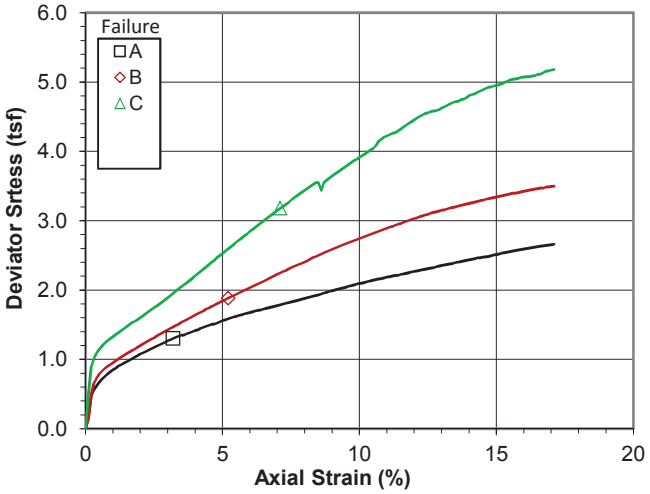
Consolidated Undrained Triaxial Compression

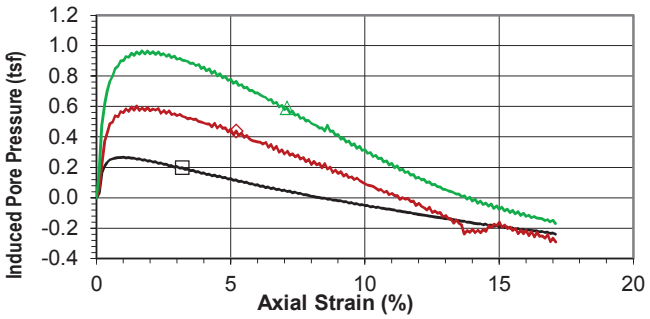
ASTM D 4767

Project Name Dynegy Duck Creek Closure Supplemental Field Work

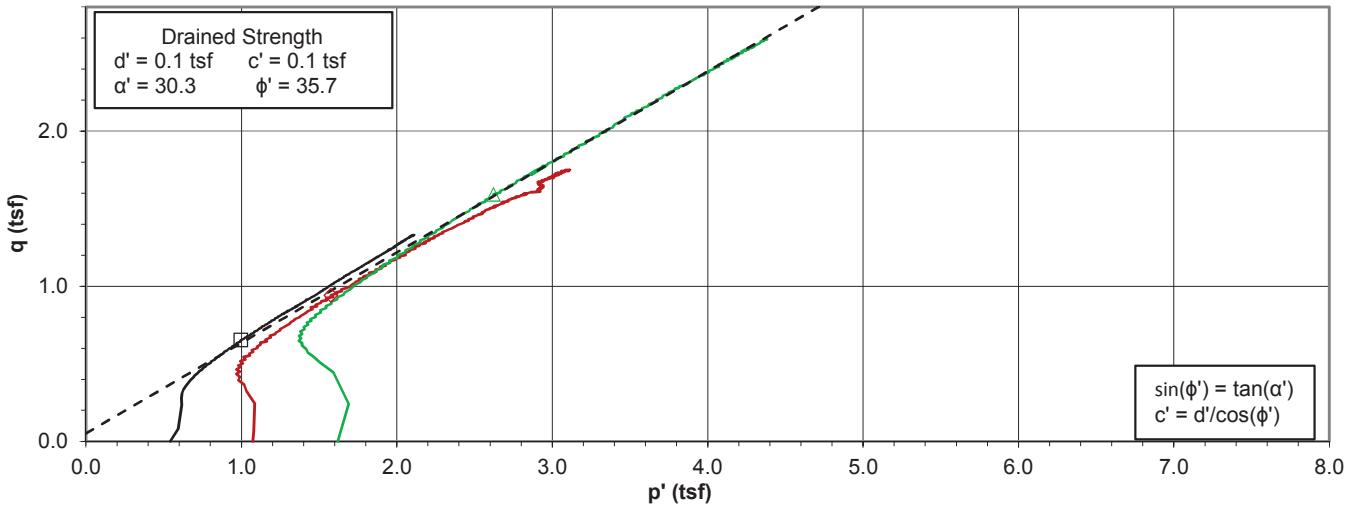
Project 175667029
Set ID 2

Test	Lab ID	Source	Description	Gs	LL	PL	PI
A	36A	S-6, 19.0'-19.5'	Silt with Sand (ML), dark gray, wet, soft	2.46			
B	36B	S-6, 19.5'-20.0'	Silt with Sand (ML), dark gray, wet, soft	2.46			
C	36C	S-6, 20.0'-20.5'	Silt with Sand (ML), dark gray, wet, soft	2.46			





Specimen	A	B	C		
	Initial Specimen Conditions				
Average Height (in)	5.773	5.695	5.677		
Average Diameter (in)	2.815	2.814	2.801		
Moist Unit Weight (pcf)	110.1	111.6	106.5		
Moisture Content (%)	35.3	42.4	41.7		
Dry Unit Weight (pcf)	81.4	78.4	75.2		
Void Ratio	0.884	0.956	1.040		
Degree of Saturation (%)	98.1	109.1	98.7		
	Consolidated Specimen Conditions				
Moist Unit Weight (pcf)	112.0	109.7	110.9		
Moisture Content (%)	33.8	37.3	35.4		
Dry Unit Weight (pcf)	83.7	79.9	81.9		
Void Ratio	0.831	0.918	0.871		
Degree of Saturation (%)	100.0	100.0	100.0		
Eff. Con. Stress, σ_3' (tsf)	0.541	1.073	1.621		
	At Drained Failure				
Failure Criterion	Max. Eff. Prin. Stress Ratio				
Axial Strain (%)	3.200	5.203	7.102		
Deviator Stress (tsf)	1.303	1.882	3.181		
Induced Pore Press. (tsf)	0.196	0.439	0.591		
Minor Eff. Stress, σ_3' (tsf)	0.345	0.634	1.030		
Major Eff. Stress, σ_1' (tsf)	1.649	2.516	4.211		
Eff. Stress Ratio, σ_1'/σ_3'	4.778	3.966	4.087		
p' (tsf)	0.997	1.575	2.621		
q (tsf)	0.652	0.941	1.590		



Comments Oven dried at 60° C.

Reviewed By KG

Stantec

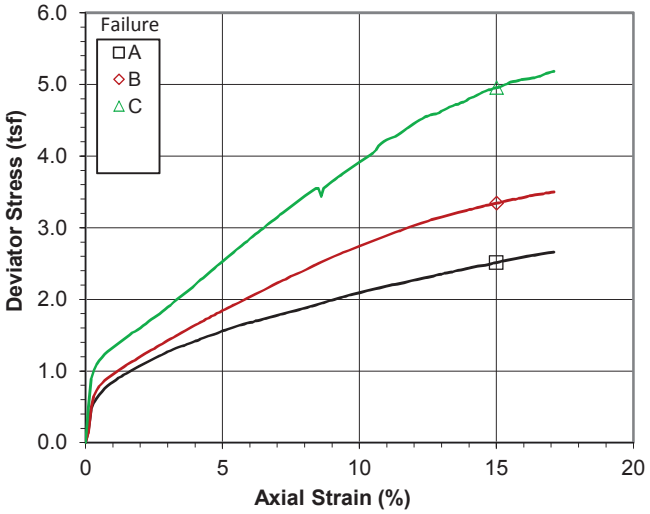
Consolidated Undrained Triaxial Compression

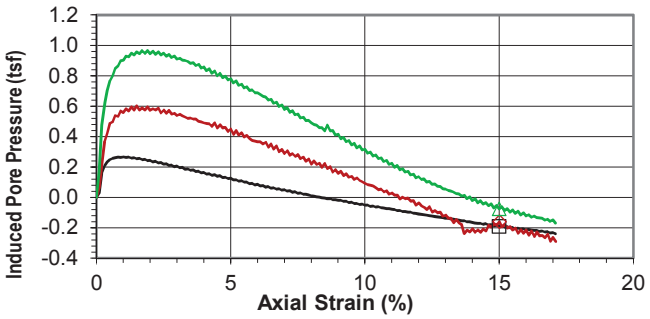
ASTM D 4767

Project Name Dynegy Duck Creek Closure Supplemental Field Work

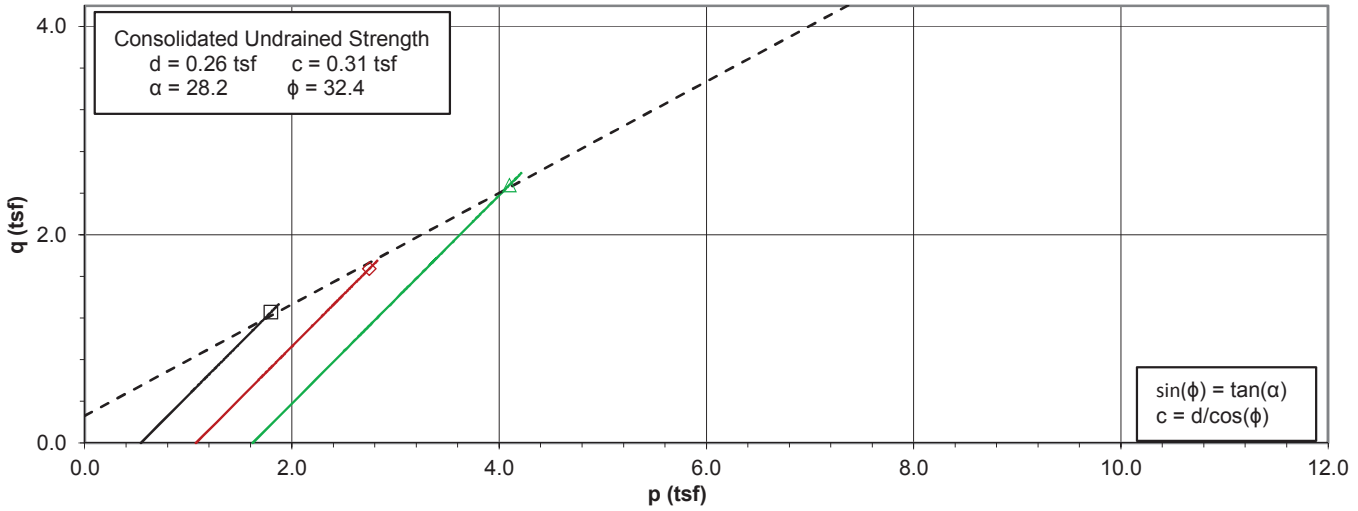
Project 175667029
Set ID 2

Test	Lab ID	Source	Description	Gs	LL	PL	PI
A	36A	S-6, 19.0'-19.5'	Silt with Sand (ML), dark gray, wet, soft	2.46			
B	36B	S-6, 19.5'-20.0'	Silt with Sand (ML), dark gray, wet, soft	2.46			
C	36C	S-6, 20.0'-20.5'	Silt with Sand (ML), dark gray, wet, soft	2.46			





Specimen	A	B	C		
	Initial Specimen Conditions				
Average Height (in)	5.773	5.695	5.677		
Average Diameter (in)	2.815	2.814	2.801		
Moist Unit Weight (pcf)	110.1	111.6	106.5		
Moisture Content (%)	35.3	42.4	41.7		
Dry Unit Weight (pcf)	81.4	78.4	75.2		
Void Ratio	0.884	0.956	1.040		
Degree of Saturation (%)	98.1	109.1	98.7		
	Consolidated Specimen Conditions				
Moist Unit Weight (pcf)	112.0	109.7	110.9		
Moisture Content (%)	33.8	37.3	35.4		
Dry Unit Weight (pcf)	83.7	79.9	81.9		
Void Ratio	0.831	0.918	0.871		
Degree of Saturation (%)	100.0	100.0	100.0		
Eff. Con. Stress, σ_3' (tsf)	0.541	1.073	1.621		
	At Consolidated Undrained Failure				
Failure Criterion	Max. σ_D or 15% Strain				
Axial Strain (%)	15.002	15.010	15.005		
Deviator Stress (tsf)	2.512	3.344	4.954		
Min. Prin. Stress, σ_3 (tsf)	0.541	1.073	1.621		
Maj. Prin. Stress, σ_1 (tsf)	3.053	4.417	6.575		
p (tsf)	1.797	2.745	4.098		
q (tsf)	1.256	1.672	2.477		



Comments Oven dried at 60° C.

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-6, 19.0'-19.5'	Lab ID	36A
Description	Silt with Sand (ML), dark gray, wet, soft	Test ID	2-A
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	07/05/2017
		Date Tested	07/13/2017

Specific Gravity	2.46
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	82.5
Nominal Consolidation Pressure (psi)	7.5

Saturation / Consolidation Results

Pore Pressure Parameter B	0.96
Measured Effective Consol. Stress (tsf)	0.541
Time to 50% Consolidation (min)	0.37
Actual Axial Strain Rate of Test (%/min)	0.095

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	112.0
Moisture Content (%)	33.8
Dry Unit Weight (pcf)	83.7
Void Ratio	0.831
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criterion: Max. Eff. Prin. Stress Ratio

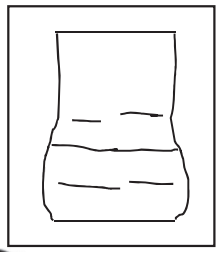
Axial Strain (%)	3.200
Deviator Stress (tsf)	1.303
Induced Pore Pressure (tsf)	0.196
Minor Effective Stress, σ_3' (tsf)	0.345
Major Effective Stress, σ_1' (tsf)	1.649
Eff. Principal Stress Ratio, σ_1'/σ_3'	4.778
p' (tsf)	0.997
q (tsf)	0.652

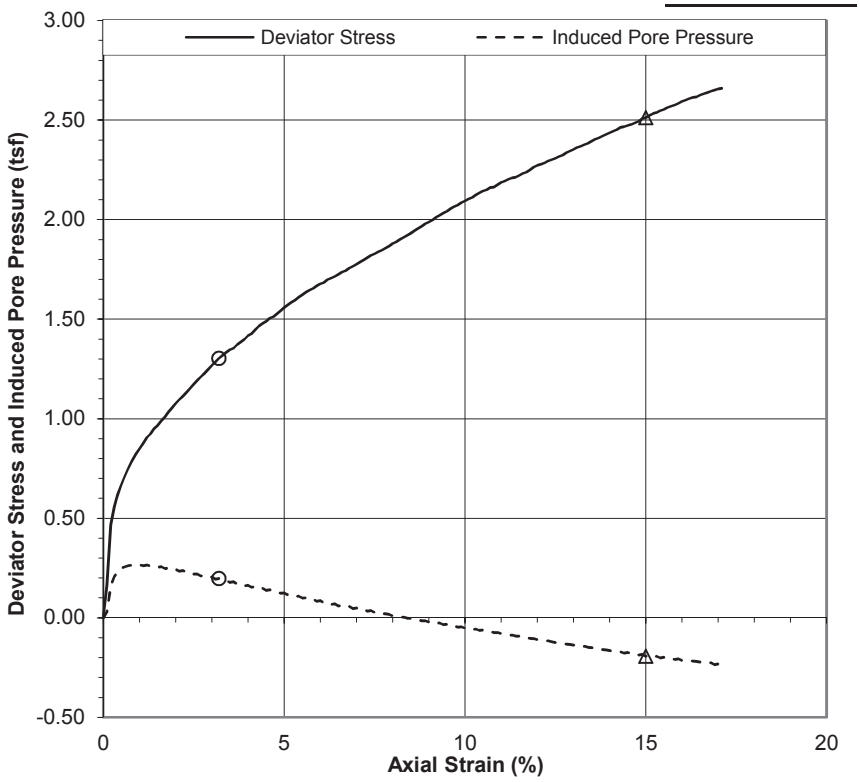
At Consolidated Undrained Failure

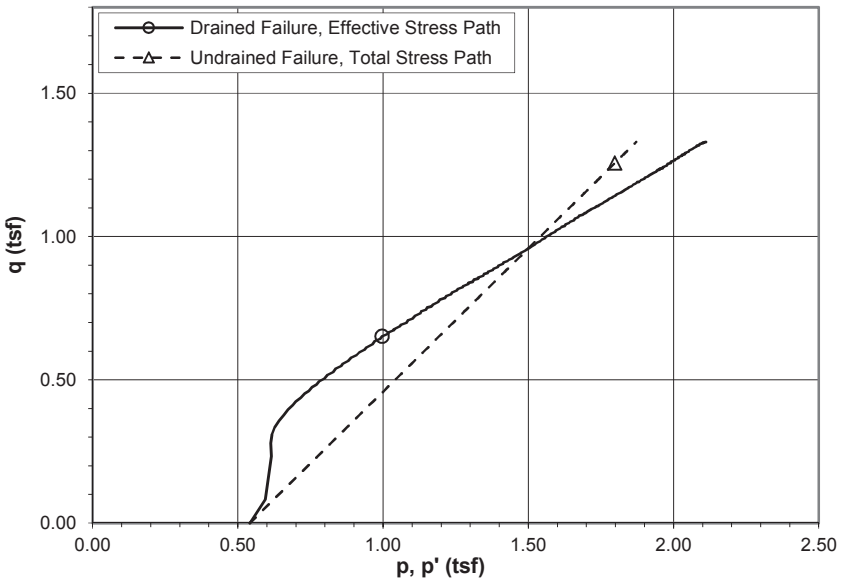
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.002
Deviator Stress (tsf)	2.512
Minor Principal Stress, σ_3 (tsf)	0.541
Major Principal Stress, σ_1 (tsf)	3.053
p (tsf)	1.797
q (tsf)	1.256

Failure Sketch







Comments Oven dried at 60° C.

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-6, 19.0'-19.5'	Lab ID	36A
Description	Silt with Sand (ML), dark gray, wet, soft	Test ID	2-A

Initial Specimen Conditions		Consolidated Specimen Conditions			
Average Height (in)	5.773	Calculated Height (in)	5.760	Specific Gravity	2.46
Average Diameter (in)	2.815	Calculated Diameter (in)	2.778	ASTM D	854, A
Calculated Area (in^2)	6.225	Calculated Area (in^2)	6.063	Liquid Limit	
Moist Weight (lb)	2.289	Moist Weight (lb)	2.264	Plastic Limit	
Moist Unit Weight (pcf)	110.1	Moist Unit Weight (pcf)	112.0	Plasticity Index	
Moisture Content (%)	35.3	Moisture Content (%)	33.8		
Dry Weight (lb)	1.692	Dry Weight (lb)	1.692		
Dry Unit Weight (pcf)	81.4	Dry Unit Weight (pcf)	83.7	Confining Stress	
Void Ratio	0.884	Void Ratio	0.831	σ_3 (tsf)	0.541
Degree of Saturation (%)	98.1	Degree of Saturation (%)	100.0		
				Effective Consolidation Stress	
				σ_3' (tsf)	0.541

Moisture contents obtained using whole specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175667029			Source: S-6, 19.0'-19.5'								Lab ID: 36A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.063	0.000	0.000	5.939	0.000	0.541	0.541	0.541	0.541	0.541	0.000	1.000
1.1	13.9	0.006	0.10	6.069	0.165	0.165	5.968	0.030	0.706	0.676	0.512	0.624	0.594	0.082	1.321
2.2	39.5	0.012	0.20	6.075	0.468	0.468	6.098	0.159	1.009	0.850	0.382	0.775	0.616	0.234	2.223
3.1	47.2	0.017	0.30	6.082	0.559	0.558	6.146	0.207	1.099	0.892	0.334	0.820	0.613	0.279	2.669
4.2	52.5	0.023	0.40	6.087	0.621	0.620	6.172	0.234	1.162	0.928	0.308	0.852	0.618	0.310	3.014
5.2	56.6	0.029	0.50	6.094	0.669	0.668	6.187	0.249	1.209	0.961	0.293	0.875	0.627	0.334	3.281
6.3	60.6	0.035	0.60	6.100	0.716	0.714	6.195	0.256	1.256	0.999	0.285	0.898	0.642	0.357	3.504
7.4	64.2	0.040	0.70	6.106	0.757	0.755	6.199	0.261	1.296	1.036	0.281	0.919	0.658	0.378	3.689
8.4	67.4	0.046	0.80	6.112	0.794	0.792	6.203	0.265	1.333	1.069	0.277	0.937	0.673	0.396	3.859
9.5	70.2	0.052	0.90	6.118	0.826	0.823	6.202	0.263	1.365	1.102	0.278	0.953	0.690	0.412	3.959
10.6	72.4	0.058	1.00	6.125	0.851	0.848	6.205	0.266	1.390	1.123	0.275	0.966	0.699	0.424	4.083
11.6	74.7	0.063	1.10	6.131	0.878	0.875	6.201	0.262	1.416	1.154	0.279	0.979	0.717	0.438	4.133
12.7	77.4	0.069	1.20	6.137	0.908	0.905	6.203	0.264	1.447	1.183	0.277	0.994	0.730	0.453	4.267
13.7	79.0	0.075	1.30	6.143	0.926	0.923	6.198	0.259	1.465	1.205	0.282	1.003	0.744	0.462	4.269
14.8	81.3	0.081	1.40	6.149	0.952	0.949	6.199	0.261	1.490	1.229	0.281	1.016	0.755	0.474	4.382
15.8	82.9	0.086	1.50	6.156	0.970	0.966	6.192	0.254	1.508	1.254	0.288	1.025	0.771	0.483	4.357
16.9	85.0	0.092	1.60	6.162	0.993	0.989	6.195	0.256	1.530	1.274	0.285	1.036	0.780	0.494	4.466
18.0	86.9	0.098	1.71	6.168	1.014	1.010	6.186	0.248	1.552	1.304	0.294	1.047	0.799	0.505	4.437
19.0	89.0	0.104	1.80	6.174	1.038	1.033	6.189	0.250	1.575	1.325	0.291	1.058	0.808	0.517	4.544
20.1	91.0	0.110	1.90	6.181	1.060	1.055	6.179	0.241	1.597	1.356	0.301	1.069	0.828	0.528	4.510
21.1	93.1	0.115	2.00	6.187	1.083	1.079	6.182	0.243	1.620	1.377	0.298	1.081	0.838	0.539	4.616
22.2	94.8	0.121	2.10	6.193	1.102	1.096	6.172	0.234	1.638	1.404	0.308	1.090	0.856	0.548	4.563
23.3	96.3	0.127	2.20	6.200	1.118	1.113	6.176	0.237	1.654	1.417	0.304	1.098	0.861	0.557	4.655
24.3	98.1	0.133	2.30	6.206	1.138	1.132	6.166	0.227	1.674	1.447	0.314	1.108	0.880	0.566	4.601
25.4	100.0	0.138	2.40	6.212	1.159	1.153	6.167	0.229	1.695	1.466	0.313	1.118	0.890	0.577	4.686
26.4	101.9	0.144	2.50	6.219	1.180	1.173	6.158	0.219	1.715	1.496	0.322	1.128	0.909	0.587	4.641
27.5	103.7	0.150	2.60	6.225	1.200	1.193	6.158	0.220	1.735	1.515	0.322	1.138	0.918	0.597	4.709
28.5	105.4	0.156	2.70	6.231	1.218	1.211	6.149	0.210	1.753	1.542	0.331	1.147	0.937	0.606	4.658
29.6	106.9	0.161	2.80	6.238	1.234	1.227	6.151	0.212	1.768	1.556	0.329	1.155	0.943	0.613	4.727
30.7	108.8	0.167	2.90	6.244	1.255	1.248	6.140	0.201	1.789	1.588	0.340	1.165	0.964	0.624	4.667
31.7	110.9	0.173	3.00	6.251	1.277	1.270	6.143	0.205	1.811	1.606	0.337	1.176	0.971	0.635	4.773
32.8	112.4	0.179	3.10	6.257	1.293	1.286	6.133	0.194	1.827	1.633	0.347	1.184	0.990	0.643	4.702
33.8	114.1	0.184	3.20	6.264	1.311	1.303	6.135	0.196	1.845	1.649	0.345	1.193	0.997	0.652	4.778
34.9	115.7	0.190	3.30	6.270	1.328	1.320	6.124	0.185	1.861	1.676	0.356	1.201	1.016	0.660	4.708
35.9	117.0	0.196	3.40	6.277	1.342	1.334	6.126	0.187	1.875	1.688	0.354	1.208	1.021	0.667	4.768
37.0	118.2	0.202	3.50	6.283	1.355	1.346	6.116	0.177	1.888	1.710	0.364	1.215	1.037	0.673	4.696
38.1	119.1	0.208	3.60	6.290	1.363	1.354	6.119	0.181	1.895	1.714	0.361	1.218	1.037	0.677	4.755
39.1	120.8	0.213	3.70	6.296	1.382	1.373	6.109	0.170	1.914	1.744	0.371	1.228	1.058	0.686	4.698
40.2	122.1	0.219	3.80	6.303	1.394	1.385	6.111	0.172	1.926	1.754	0.369	1.234	1.062	0.692	4.752

Project: 175667029			Source: S-6, 19.0'-19.5'								Lab ID: 36A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
41.2	123.4	0.225	3.90	6.309	1.409	1.399	6.099	0.161	1.940	1.780	0.381	1.241	1.080	0.699	4.676
42.3	125.1	0.231	4.00	6.316	1.426	1.417	6.102	0.163	1.958	1.795	0.378	1.250	1.086	0.708	4.747
43.3	126.3	0.236	4.10	6.323	1.438	1.428	6.092	0.153	1.969	1.816	0.388	1.255	1.102	0.714	4.679
44.4	128.2	0.242	4.20	6.329	1.458	1.448	6.094	0.155	1.989	1.834	0.386	1.265	1.110	0.724	4.748
45.4	129.8	0.248	4.30	6.336	1.476	1.465	6.083	0.145	2.006	1.862	0.397	1.274	1.129	0.732	4.691
46.4	131.1	0.254	4.40	6.342	1.489	1.478	6.087	0.149	2.019	1.870	0.393	1.280	1.132	0.739	4.763
47.5	132.3	0.259	4.50	6.349	1.501	1.490	6.077	0.138	2.031	1.893	0.403	1.286	1.148	0.745	4.694
48.5	133.9	0.265	4.60	6.356	1.516	1.505	6.080	0.142	2.046	1.905	0.400	1.294	1.152	0.752	4.763
49.6	134.6	0.271	4.70	6.362	1.524	1.512	6.069	0.131	2.053	1.923	0.411	1.297	1.167	0.756	4.681
50.6	136.0	0.277	4.80	6.369	1.538	1.526	6.071	0.133	2.067	1.935	0.409	1.304	1.172	0.763	4.733
51.7	137.7	0.282	4.90	6.376	1.555	1.543	6.061	0.123	2.084	1.961	0.419	1.313	1.190	0.771	4.686
52.7	139.3	0.288	5.00	6.382	1.571	1.559	6.064	0.126	2.100	1.975	0.416	1.321	1.195	0.779	4.748
53.8	140.5	0.294	5.10	6.389	1.584	1.571	6.053	0.114	2.112	1.998	0.427	1.327	1.213	0.785	4.679
54.8	141.9	0.300	5.20	6.396	1.598	1.585	6.055	0.116	2.126	2.010	0.425	1.334	1.218	0.792	4.725
55.9	143.1	0.305	5.30	6.402	1.609	1.596	6.045	0.106	2.138	2.031	0.435	1.340	1.233	0.798	4.669
56.9	144.6	0.311	5.40	6.409	1.624	1.611	6.047	0.108	2.152	2.044	0.433	1.347	1.238	0.805	4.719
58.0	145.8	0.317	5.50	6.416	1.636	1.623	6.038	0.100	2.164	2.064	0.442	1.353	1.253	0.811	4.674
59.0	147.1	0.323	5.60	6.423	1.649	1.635	6.040	0.101	2.177	2.076	0.440	1.359	1.258	0.818	4.715
60.1	148.2	0.328	5.70	6.430	1.660	1.646	6.029	0.091	2.187	2.096	0.451	1.364	1.273	0.823	4.652
61.1	149.3	0.334	5.80	6.437	1.670	1.655	6.031	0.092	2.197	2.104	0.449	1.369	1.277	0.828	4.685
62.1	150.5	0.340	5.90	6.443	1.682	1.667	6.021	0.082	2.209	2.126	0.459	1.375	1.293	0.834	4.632
63.1	151.6	0.346	6.00	6.450	1.692	1.677	6.024	0.086	2.218	2.133	0.456	1.380	1.294	0.838	4.680
64.1	152.4	0.351	6.10	6.457	1.699	1.684	6.014	0.075	2.225	2.150	0.466	1.383	1.308	0.842	4.610
65.2	153.9	0.357	6.20	6.464	1.714	1.698	6.016	0.077	2.240	2.162	0.464	1.391	1.313	0.849	4.660
66.2	154.7	0.363	6.30	6.471	1.722	1.706	6.006	0.067	2.248	2.180	0.474	1.395	1.327	0.853	4.598
67.2	155.7	0.369	6.40	6.478	1.731	1.715	6.009	0.071	2.256	2.186	0.471	1.399	1.328	0.858	4.644
68.3	157.0	0.375	6.50	6.485	1.743	1.726	5.998	0.060	2.268	2.208	0.482	1.405	1.345	0.863	4.583
69.3	158.1	0.380	6.60	6.492	1.754	1.737	6.002	0.063	2.279	2.215	0.478	1.410	1.347	0.869	4.634
70.3	158.9	0.386	6.70	6.499	1.760	1.743	5.993	0.055	2.285	2.230	0.487	1.413	1.359	0.872	4.581
71.2	160.2	0.392	6.80	6.506	1.773	1.756	5.995	0.057	2.297	2.240	0.485	1.419	1.362	0.878	4.623
72.3	161.2	0.398	6.90	6.513	1.783	1.765	5.985	0.047	2.307	2.260	0.495	1.424	1.377	0.883	4.568
73.3	162.3	0.403	7.00	6.520	1.793	1.775	5.988	0.049	2.317	2.267	0.492	1.429	1.380	0.888	4.608
74.3	163.6	0.409	7.10	6.527	1.805	1.787	5.979	0.040	2.329	2.288	0.501	1.435	1.395	0.894	4.566
75.3	164.7	0.415	7.20	6.534	1.815	1.797	5.981	0.043	2.339	2.296	0.499	1.440	1.398	0.899	4.603
76.3	165.9	0.421	7.30	6.541	1.827	1.809	5.972	0.033	2.350	2.317	0.508	1.446	1.412	0.904	4.559
77.3	167.2	0.426	7.40	6.548	1.838	1.820	5.975	0.036	2.361	2.325	0.505	1.451	1.415	0.910	4.602
78.3	168.2	0.432	7.50	6.555	1.848	1.829	5.966	0.028	2.371	2.343	0.514	1.456	1.428	0.915	4.559
79.3	169.3	0.438	7.60	6.562	1.858	1.839	5.966	0.028	2.380	2.353	0.514	1.461	1.433	0.919	4.580
80.3	170.2	0.444	7.70	6.569	1.865	1.846	5.959	0.020	2.387	2.367	0.521	1.464	1.444	0.923	4.543
81.3	171.3	0.449	7.80	6.576	1.876	1.856	5.959	0.021	2.398	2.377	0.521	1.470	1.449	0.928	4.564
82.3	172.6	0.455	7.90	6.583	1.887	1.868	5.955	0.016	2.409	2.393	0.525	1.475	1.459	0.934	4.557
83.3	173.8	0.461	8.00	6.591	1.899	1.879	5.948	0.009	2.421	2.411	0.532	1.481	1.472	0.940	4.532
84.3	174.9	0.467	8.10	6.598	1.908	1.888	5.947	0.008	2.430	2.422	0.533	1.486	1.477	0.944	4.541
85.3	176.2	0.472	8.20	6.605	1.921	1.900	5.942	0.004	2.442	2.438	0.538	1.492	1.488	0.950	4.533
86.4	177.3	0.478	8.30	6.612	1.931	1.910	5.941	0.002	2.452	2.450	0.539	1.497	1.494	0.955	4.543
87.4	178.5	0.484	8.40	6.619	1.941	1.920	5.936	-0.002	2.462	2.464	0.544	1.502	1.504	0.960	4.533
88.5	179.7	0.490	8.50	6.626	1.953	1.931	5.934	-0.004	2.473	2.477	0.546	1.507	1.511	0.966	4.541
89.5	181.1	0.495	8.60	6.634	1.965	1.944	5.929	-0.010	2.485	2.495	0.551	1.513	1.523	0.972	4.525
90.6	182.4	0.501	8.70	6.641	1.977	1.956	5.929	-0.010	2.497	2.507	0.551	1.519	1.529	0.978	4.549
91.6	183.7	0.507	8.80	6.648	1.989	1.967	5.923	-0.015	2.509	2.524	0.557	1.525	1.541	0.984	4.532
92.7	185.0	0.513	8.90	6.655	2.002	1.979	5.924	-0.015	2.521	2.536	0.556	1.531	1.546	0.990	4.559
93.8	186.1	0.518	9.00	6.663	2.011	1.988	5.918	-0.021	2.530	2.550	0.562	1.536	1.556	0.994	4.537
94.8	187.2	0.524	9.10	6.670	2.021	1.998	5.918	-0.020	2.539	2.560	0.562	1.540	1.561	0.999	4.556
95.9	188.6	0.530	9.20	6.678	2.034	2.011	5.912	-0.027	2.553	2.580	0.568	1.547	1.574	1.006	4.538
96.9	189.9	0.536	9.30	6.685	2.045	2.022	5.912	-0.027	2.563	2.590	0.568	1.552	1.579	1.011	4.559
98.0	191.1	0.542	9.40	6.692	2.056	2.032	5.904	-0.034	2.574	2.608	0.576	1.558	1.592	1.016	4.531
99.1	192.2	0.547	9.50	6.700	2.066	2.042	5.905	-0.033	2.584	2.617	0.575	1.563	1.596	1.021	4.554
100.1	193.7	0.553	9.60	6.707	2.079	2.056	5.898	-0.040	2.597	2.637	0.582	1.569	1.609	1.028	4.535
101.2	194.8	0.559	9.70	6.714	2.089	2.065	5.899	-0.040	2.606	2.646	0.581	1.574	1.613	1.032	4.552
102.2	195.8	0.565	9.80	6.722	2.097	2.073	5.891	-0.047	2.615	2.662	0.589	1.578	1.625	1.037	4.522
103.3	197.2	0.570	9.90	6.729	2.110	2.085	5.893	-0.045	2.627	2.672	0.587	1.584	1.629	1.043	4.554
104.4	198.2	0.576	10.00	6.737	2.119	2.094	5.886	-0.052	2.635	2.687	0.594	1.588	1.641	1.047	4.527
105.5	199.3	0.582	10.10	6.744	2.128	2.103	5.887	-0.052	2.644	2.696	0.593	1.593	1.645	1.051	4.545
106.5	200.4	0.588	10.20	6.752	2.137	2.112	5.880	-0.059	2.653	2.712	0.600	1.597	1.656	1.056	4.517
107.6	201.9	0.593	10.30	6.759	2.151	2.125	5.882	-0.057	2.666	2.723	0.598	1.604	1.661	1.063	4.552
108.7	203.0	0.599	10.40	6.767	2.160	2.134	5.875	-0.064	2.676	2.740	0.605	1.609	1.672	1.067	4.527
109.8	204.1	0.605	10.50	6.774	2.169	2.143	5.877	-0.061	2.684	2.746	0.603	1.613	1.674	1.071	4.555
110.8	205.1	0.611	10.60	6.782	2.177	2.151	5.869	-0.069	2.692	2.761	0.611	1.617	1.686	1.075	4.522
111.9	206.3	0.616	10.70	6.790	2.188	2.161	5.868	-0.070	2.703	2.773	0.612	1.622	1.692	1.081	4.533

Project: 175667029			Source: S-6, 19.0'-19.5'								Lab ID: 36A		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
113.0	206.8	0.622	10.80	6.797	2.190	2.163	5.864	-0.075	2.705	2.779	0.616	1.623	1.698	1.082	4.511
114.1	208.1	0.628	10.90	6.805	2.202	2.175	5.864	-0.074	2.716	2.791	0.616	1.629	1.703	1.088	4.531
115.2	209.6	0.634	11.00	6.813	2.215	2.187	5.859	-0.080	2.729	2.809	0.621	1.635	1.715	1.094	4.522
116.2	210.4	0.639	11.10	6.820	2.221	2.193	5.858	-0.081	2.734	2.815	0.622	1.638	1.719	1.096	4.525
117.3	211.5	0.645	11.20	6.828	2.230	2.203	5.852	-0.087	2.744	2.831	0.628	1.643	1.729	1.101	4.506
118.4	212.5	0.651	11.30	6.836	2.238	2.210	5.851	-0.088	2.751	2.839	0.629	1.646	1.734	1.105	4.511
119.5	213.0	0.657	11.40	6.843	2.241	2.212	5.846	-0.092	2.754	2.846	0.634	1.648	1.740	1.106	4.490
120.5	214.3	0.663	11.50	6.851	2.252	2.223	5.846	-0.093	2.764	2.857	0.634	1.653	1.746	1.111	4.506
121.6	215.4	0.668	11.60	6.859	2.261	2.232	5.840	-0.099	2.774	2.872	0.640	1.658	1.756	1.116	4.487
122.6	216.2	0.674	11.70	6.867	2.267	2.238	5.840	-0.099	2.780	2.878	0.640	1.661	1.759	1.119	4.497
123.7	217.7	0.680	11.80	6.874	2.280	2.250	5.834	-0.104	2.792	2.896	0.646	1.667	1.771	1.125	4.486
124.8	219.2	0.686	11.90	6.882	2.294	2.264	5.833	-0.106	2.805	2.911	0.647	1.673	1.779	1.132	4.499
125.9	220.2	0.691	12.00	6.890	2.301	2.272	5.828	-0.110	2.813	2.923	0.652	1.677	1.787	1.136	4.486
127.0	221.0	0.697	12.10	6.898	2.307	2.277	5.827	-0.112	2.818	2.930	0.653	1.680	1.792	1.138	4.485
128.1	222.1	0.703	12.20	6.906	2.316	2.285	5.824	-0.115	2.827	2.942	0.656	1.684	1.799	1.143	4.482
129.2	223.3	0.709	12.30	6.914	2.326	2.295	5.822	-0.117	2.837	2.953	0.658	1.689	1.806	1.148	4.488
130.3	224.2	0.714	12.40	6.921	2.332	2.301	5.818	-0.121	2.843	2.964	0.662	1.692	1.813	1.151	4.475
131.3	225.0	0.720	12.50	6.929	2.338	2.307	5.815	-0.124	2.849	2.972	0.665	1.695	1.819	1.154	4.469
132.4	226.3	0.726	12.60	6.937	2.349	2.317	5.811	-0.127	2.859	2.986	0.669	1.700	1.827	1.159	4.465
133.5	227.2	0.732	12.70	6.945	2.356	2.324	5.810	-0.128	2.865	2.994	0.670	1.703	1.832	1.162	4.469
134.6	228.7	0.737	12.80	6.953	2.368	2.336	5.807	-0.132	2.878	3.010	0.673	1.710	1.841	1.168	4.470
135.6	229.9	0.743	12.90	6.961	2.377	2.345	5.805	-0.133	2.887	3.020	0.675	1.714	1.848	1.173	4.475
136.7	230.8	0.749	13.00	6.969	2.385	2.352	5.801	-0.138	2.894	3.032	0.679	1.718	1.856	1.176	4.462
137.8	232.1	0.755	13.10	6.977	2.395	2.363	5.800	-0.138	2.904	3.042	0.680	1.723	1.861	1.181	4.477
138.9	233.0	0.760	13.20	6.985	2.402	2.369	5.796	-0.143	2.910	3.053	0.684	1.726	1.869	1.184	4.461
139.9	234.1	0.766	13.30	6.993	2.411	2.377	5.795	-0.143	2.919	3.062	0.685	1.730	1.874	1.189	4.472
141.0	235.0	0.772	13.40	7.001	2.417	2.383	5.790	-0.149	2.925	3.074	0.690	1.733	1.882	1.192	4.453
142.1	236.3	0.778	13.50	7.010	2.428	2.394	5.789	-0.150	2.936	3.085	0.691	1.739	1.888	1.197	4.463
143.2	237.6	0.783	13.60	7.018	2.438	2.404	5.783	-0.155	2.945	3.100	0.697	1.743	1.899	1.202	4.450
144.3	238.6	0.789	13.70	7.026	2.445	2.411	5.784	-0.155	2.952	3.107	0.696	1.747	1.902	1.205	4.462
145.3	239.7	0.795	13.80	7.034	2.454	2.419	5.778	-0.160	2.961	3.121	0.702	1.751	1.911	1.210	4.449
146.4	240.8	0.801	13.90	7.042	2.462	2.427	5.777	-0.162	2.969	3.131	0.703	1.755	1.917	1.214	4.452
147.5	241.9	0.806	14.00	7.050	2.471	2.436	5.773	-0.165	2.977	3.143	0.707	1.759	1.925	1.218	4.447
148.6	243.1	0.812	14.10	7.058	2.479	2.444	5.770	-0.169	2.986	3.154	0.710	1.764	1.932	1.222	4.442
149.6	244.2	0.818	14.20	7.067	2.488	2.453	5.767	-0.171	2.994	3.166	0.713	1.768	1.939	1.226	4.441
150.7	245.5	0.824	14.30	7.075	2.499	2.463	5.767	-0.171	3.005	3.176	0.713	1.773	1.945	1.232	4.455
151.8	246.2	0.830	14.40	7.083	2.503	2.467	5.761	-0.178	3.008	3.186	0.719	1.775	1.953	1.233	4.430
152.9	247.1	0.835	14.50	7.092	2.509	2.473	5.764	-0.174	3.015	3.189	0.716	1.778	1.953	1.237	4.455
153.9	247.9	0.841	14.60	7.100	2.514	2.477	5.756	-0.183	3.019	3.202	0.724	1.780	1.963	1.239	4.420
155.0	249.0	0.847	14.70	7.108	2.522	2.486	5.759	-0.179	3.027	3.206	0.721	1.784	1.964	1.243	4.448
156.0	250.2	0.853	14.80	7.117	2.531	2.494	5.751	-0.187	3.036	3.223	0.729	1.789	1.976	1.247	4.422
157.1	251.7	0.858	14.90	7.125	2.543	2.506	5.754	-0.184	3.048	3.232	0.726	1.795	1.979	1.253	4.453
158.2	252.5	0.864	15.00	7.133	2.549	2.512	5.746	-0.193	3.053	3.246	0.734	1.797	1.990	1.256	4.421
159.2	254.0	0.870	15.10	7.142	2.560	2.523	5.750	-0.188	3.064	3.252	0.730	1.803	1.991	1.261	4.458
160.3	255.3	0.876	15.20	7.150	2.570	2.533	5.742	-0.197	3.074	3.271	0.738	1.808	2.005	1.266	4.430
161.4	256.1	0.881	15.30	7.158	2.576	2.538	5.745	-0.193	3.079	3.272	0.735	1.810	2.004	1.269	4.453
162.5	257.4	0.887	15.40	7.167	2.586	2.547	5.737	-0.202	3.089	3.291	0.743	1.815	2.017	1.274	4.428
163.6	258.4	0.893	15.50	7.175	2.593	2.554	5.740	-0.198	3.095	3.294	0.740	1.818	2.017	1.277	4.453
164.6	259.6	0.899	15.60	7.184	2.601	2.563	5.732	-0.206	3.104	3.311	0.748	1.823	2.029	1.281	4.426
165.7	260.6	0.904	15.70	7.193	2.609	2.570	5.736	-0.203	3.111	3.314	0.744	1.826	2.029	1.285	4.454
166.8	261.5	0.910	15.80	7.201	2.615	2.576	5.729	-0.210	3.117	3.327	0.751	1.829	2.039	1.288	4.427
167.8	262.6	0.916	15.90	7.209	2.623	2.583	5.732	-0.207	3.125	3.332	0.748	1.833	2.040	1.292	4.452
168.9	264.0	0.922	16.00	7.218	2.633	2.593	5.725	-0.214	3.135	3.349	0.755	1.838	2.052	1.297	4.433
170.0	265.1	0.927	16.10	7.227	2.641	2.601	5.726	-0.212	3.142	3.354	0.754	1.842	2.054	1.300	4.451
171.0	266.1	0.933	16.20	7.235	2.648	2.607	5.722	-0.216	3.149	3.365	0.758	1.845	2.062	1.304	4.440
172.1	267.0	0.939	16.30	7.244	2.654	2.614	5.721	-0.218	3.155	3.373	0.759	1.848	2.066	1.307	4.442
173.2	267.7	0.945	16.40	7.253	2.657	2.616	5.720	-0.219	3.158	3.376	0.760	1.850	2.068	1.308	4.443
174.2	268.9	0.950	16.50	7.261	2.666	2.625	5.716	-0.223	3.167	3.390	0.764	1.854	2.077	1.313	4.434
175.3	270.0	0.956	16.60	7.270	2.674	2.633	5.716	-0.222	3.174	3.396	0.764	1.858	2.080	1.316	4.447
176.3	270.8	0.962	16.70	7.279	2.678	2.637	5.710	-0.229	3.178	3.407	0.770	1.860	2.089	1.318	4.423
177.4	271.9	0.968	16.80	7.288	2.687	2.645	5.713	-0.226	3.186	3.412	0.767	1.864	2.090	1.322	4.448
178.5	272.8	0.973	16.90	7.296	2.692	2.650	5.704	-0.235	3.192	3.426	0.776	1.867	2.101	1.325	4.413
179.5	273.7	0.979	17.00	7.305	2.698	2.656	5.707	-0.232	3.197	3.429	0.773	1.869	2.101	1.328	4.435
180.6	274.5	0.985	17.10	7.314	2.702	2.660	5.698	-0.240	3.201	3.441	0.782	1.871	2.112	1.330	4.402

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-6, 19.5'-20.0'	Lab ID	36B
Description	Silt with Sand (ML), dark gray, wet, soft	Test ID	2-B
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	07/05/2017
		Date Tested	07/14/2017

Specific Gravity	2.46
ASTM D 854, A	
Liquid Limit	
Plastic Limit	
Plasticity Index	

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	75
Nominal Consolidation Pressure (psi)	15

Saturation / Consolidation Results

Pore Pressure Parameter B	0.96
Measured Effective Consol. Stress (tsf)	1.073
Time to 50% Consolidation (min)	0.42
Actual Axial Strain Rate of Test (%/min)	0.094

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	109.7
Moisture Content (%)	37.3
Dry Unit Weight (pcf)	79.9
Void Ratio	0.918
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criteria: Max. Eff. Prin. Stress Ratio

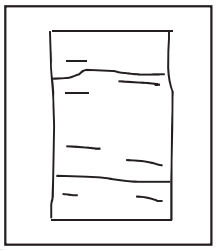
Axial Strain (%)	5.203
Deviator Stress (tsf)	1.882
Induced Pore Pressure (tsf)	0.439
Minor Effective Stress, σ_3' (tsf)	0.634
Major Effective Stress, σ_1' (tsf)	2.516
Eff. Principal Stress Ratio, σ_1'/σ_3'	3.966
p' (tsf)	1.575
q (tsf)	0.941

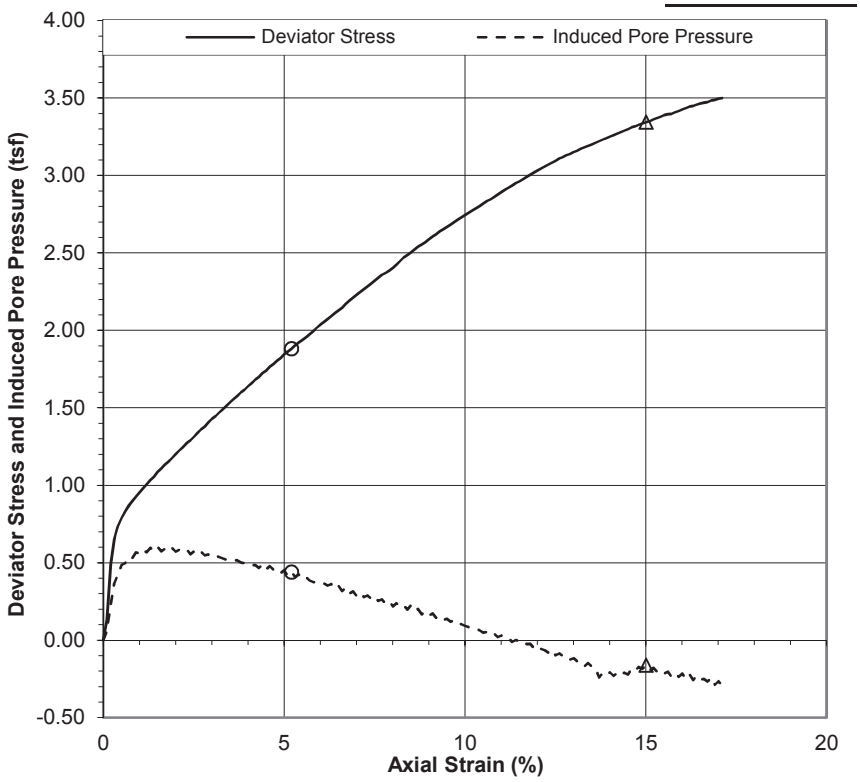
At Consolidated Undrained Failure

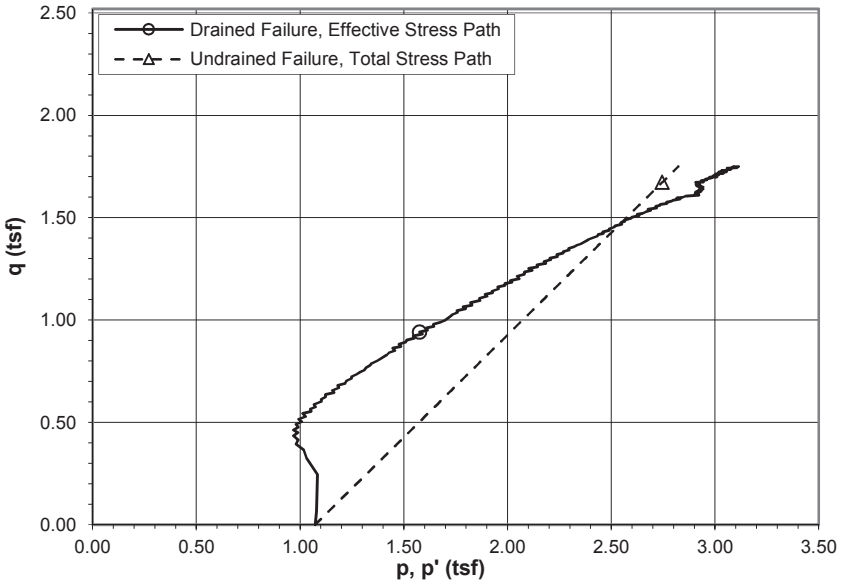
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.010
Deviator Stress (tsf)	3.344
Minor Principal Stress, σ_3 (tsf)	1.073
Major Principal Stress, σ_1 (tsf)	4.417
p (tsf)	2.745
q (tsf)	1.672

Failure Sketch







Comments Oven dried at 60° C.

Reviewed KG

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-6, 19.5'-20.0'	Lab ID	36B
Description	Silt with Sand (ML), dark gray, wet, soft	Test ID	2-B

Initial Specimen Conditions		Consolidated Specimen Conditions			
Height (in)	5.695	Height (in)	5.667	Specific Gravity	2.46
Diameter (in)	2.814	Calculated Diameter (in)	2.793	ASTM D	854, A
Area (in^2)	6.219	Calculated Area (in^2)	6.129	Liquid Limit	
Moist Weight (lb)	2.287	Moist Weight (lb)	2.206	Plastic Limit	
Moist Unit Weight (pcf)	111.6	Moist Unit Weight (pcf)	109.7	Plasticity Index	
Moisture Content (%)	42.4	Moisture Content (%)	37.3		
Dry Weight (lb)	1.606	Dry Weight (lb)	1.606		
Dry Unit Weight (pcf)	78.4	Dry Unit Weight (pcf)	79.9	Confining Stress	
Void Ratio	0.956	Void Ratio	0.918	σ_3 (tsf)	1.073
Degree of Saturation (%)	109.1	Degree of Saturation (%)	100.0		
				Effective Consolidation Stress	
				σ_3' (tsf)	1.073

Moisture contents obtained using partial specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175667029			Source: S-6, 19.5'-20.0'								Lab ID: 36B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	6.129	0.000	0.000	5.407	0.000	1.073	1.073	1.073	1.073	1.073	0.000	1.000
1.0	11.2	0.006	0.10	6.135	0.131	0.131	5.467	0.060	1.204	1.144	1.013	1.138	1.079	0.065	1.129
2.1	41.8	0.012	0.21	6.141	0.490	0.490	5.640	0.233	1.563	1.329	0.840	1.318	1.085	0.245	1.583
3.2	55.6	0.017	0.30	6.147	0.651	0.650	5.774	0.367	1.723	1.356	0.706	1.398	1.031	0.325	1.921
4.3	62.5	0.023	0.40	6.153	0.731	0.730	5.828	0.421	1.803	1.382	0.652	1.438	1.017	0.365	2.120
5.4	67.6	0.028	0.50	6.160	0.790	0.789	5.894	0.487	1.862	1.375	0.586	1.468	0.980	0.395	2.347
6.4	71.1	0.034	0.60	6.166	0.831	0.829	5.904	0.497	1.902	1.405	0.576	1.488	0.991	0.415	2.439
7.5	74.6	0.040	0.70	6.172	0.870	0.869	5.946	0.539	1.942	1.403	0.534	1.507	0.968	0.434	2.627
8.5	77.3	0.046	0.80	6.178	0.901	0.899	5.939	0.532	1.972	1.440	0.541	1.523	0.991	0.450	2.663
9.6	79.7	0.051	0.90	6.185	0.928	0.926	5.974	0.567	1.999	1.431	0.506	1.536	0.968	0.463	2.831
10.6	82.2	0.057	1.00	6.191	0.956	0.954	5.965	0.558	2.027	1.468	0.515	1.550	0.992	0.477	2.853
11.7	84.6	0.062	1.10	6.197	0.983	0.980	5.990	0.583	2.053	1.470	0.490	1.563	0.980	0.490	3.001
12.7	86.9	0.068	1.20	6.203	1.008	1.005	5.974	0.567	2.078	1.511	0.506	1.576	1.009	0.503	2.987
13.8	89.4	0.074	1.30	6.210	1.036	1.033	6.003	0.596	2.106	1.510	0.477	1.590	0.993	0.517	3.167
14.8	91.4	0.079	1.40	6.216	1.059	1.056	5.982	0.575	2.129	1.554	0.498	1.601	1.026	0.528	3.119
15.9	94.2	0.085	1.50	6.222	1.090	1.087	6.010	0.603	2.160	1.557	0.470	1.616	1.013	0.543	3.311
17.0	96.2	0.091	1.60	6.229	1.112	1.108	5.980	0.573	2.181	1.607	0.500	1.627	1.054	0.554	3.217
18.0	98.5	0.096	1.70	6.235	1.137	1.133	5.997	0.590	2.206	1.616	0.483	1.639	1.050	0.566	3.345
19.1	100.2	0.102	1.80	6.241	1.156	1.151	5.981	0.574	2.224	1.651	0.499	1.649	1.075	0.576	3.306
20.1	102.5	0.108	1.90	6.248	1.182	1.177	6.002	0.594	2.250	1.655	0.478	1.661	1.067	0.588	3.460
21.2	104.9	0.113	2.00	6.254	1.207	1.202	5.979	0.572	2.275	1.703	0.501	1.674	1.102	0.601	3.402
22.2	106.9	0.119	2.10	6.260	1.229	1.224	5.990	0.583	2.297	1.714	0.490	1.685	1.102	0.612	3.499
23.3	109.1	0.125	2.20	6.267	1.253	1.248	5.982	0.575	2.321	1.746	0.498	1.697	1.122	0.624	3.506
24.4	111.3	0.130	2.30	6.273	1.277	1.272	5.993	0.586	2.345	1.758	0.487	1.709	1.122	0.636	3.613
25.4	113.1	0.136	2.41	6.280	1.297	1.291	5.961	0.554	2.364	1.809	0.519	1.718	1.164	0.645	3.490
26.5	115.2	0.142	2.50	6.286	1.319	1.313	5.981	0.574	2.386	1.812	0.499	1.730	1.156	0.657	3.631
27.5	117.4	0.148	2.60	6.293	1.344	1.337	5.961	0.554	2.410	1.856	0.519	1.742	1.187	0.669	3.577
28.6	119.6	0.153	2.70	6.299	1.367	1.360	5.978	0.571	2.433	1.862	0.502	1.753	1.182	0.680	3.711
29.6	121.4	0.159	2.80	6.305	1.387	1.380	5.954	0.547	2.453	1.906	0.526	1.763	1.216	0.690	3.622
30.7	123.9	0.165	2.90	6.312	1.413	1.406	5.959	0.552	2.479	1.927	0.521	1.776	1.224	0.703	3.700
31.8	126.0	0.170	3.00	6.318	1.435	1.428	5.946	0.539	2.501	1.962	0.534	1.787	1.248	0.714	3.675
32.8	127.9	0.176	3.10	6.325	1.455	1.448	5.954	0.547	2.521	1.973	0.526	1.797	1.250	0.724	3.754
33.9	129.9	0.182	3.20	6.332	1.477	1.469	5.943	0.536	2.542	2.006	0.537	1.808	1.271	0.735	3.738
34.9	131.9	0.187	3.30	6.338	1.499	1.491	5.936	0.529	2.564	2.035	0.544	1.818	1.289	0.745	3.739
36.0	133.8	0.193	3.40	6.345	1.519	1.511	5.927	0.520	2.583	2.064	0.553	1.828	1.308	0.755	3.730
37.0	136.2	0.198	3.50	6.351	1.544	1.535	5.930	0.523	2.608	2.086	0.550	1.841	1.318	0.768	3.790
38.1	138.3	0.204	3.61	6.358	1.566	1.557	5.922	0.515	2.630	2.116	0.558	1.852	1.337	0.779	3.789
39.1	140.1	0.210	3.70	6.364	1.585	1.576	5.923	0.516	2.649	2.133	0.557	1.861	1.345	0.788	3.831
40.2	142.4	0.216	3.80	6.371	1.609	1.599	5.909	0.502	2.672	2.171	0.571	1.873	1.371	0.800	3.799

Project: 175667029			Source: S-6, 19.5'-20.0'								Lab ID: 36B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
41.2	144.1	0.221	3.90	6.378	1.627	1.618	5.904	0.497	2.691	2.194	0.576	1.882	1.385	0.809	3.808
42.3	146.3	0.227	4.00	6.384	1.650	1.640	5.897	0.490	2.713	2.222	0.583	1.893	1.402	0.820	3.815
43.3	148.3	0.233	4.10	6.391	1.670	1.660	5.892	0.485	2.733	2.248	0.588	1.903	1.418	0.830	3.825
44.3	150.4	0.238	4.20	6.398	1.692	1.682	5.892	0.485	2.755	2.270	0.588	1.914	1.429	0.841	3.859
45.4	152.2	0.244	4.30	6.404	1.711	1.700	5.873	0.466	2.773	2.307	0.607	1.923	1.457	0.850	3.802
46.4	154.5	0.250	4.40	6.411	1.735	1.724	5.896	0.489	2.797	2.308	0.584	1.935	1.446	0.862	3.953
47.4	156.1	0.255	4.50	6.418	1.752	1.741	5.864	0.457	2.814	2.357	0.616	1.943	1.486	0.870	3.826
48.5	158.5	0.261	4.60	6.424	1.776	1.765	5.885	0.478	2.838	2.360	0.595	1.955	1.478	0.882	3.964
49.5	160.2	0.267	4.70	6.431	1.794	1.782	5.862	0.455	2.855	2.400	0.618	1.964	1.509	0.891	3.885
50.5	162.4	0.272	4.80	6.438	1.817	1.805	5.868	0.461	2.878	2.417	0.612	1.975	1.515	0.902	3.948
51.5	164.2	0.278	4.90	6.445	1.834	1.822	5.840	0.433	2.895	2.462	0.640	1.984	1.551	0.911	3.846
52.6	166.5	0.284	5.00	6.452	1.858	1.846	5.858	0.451	2.919	2.468	0.622	1.996	1.545	0.923	3.966
53.6	168.1	0.289	5.10	6.458	1.874	1.862	5.821	0.414	2.935	2.521	0.659	2.004	1.590	0.931	3.826
54.6	170.1	0.295	5.20	6.465	1.895	1.882	5.846	0.439	2.955	2.516	0.634	2.014	1.575	0.941	3.966
55.7	172.1	0.301	5.30	6.472	1.915	1.902	5.816	0.409	2.975	2.566	0.664	2.024	1.615	0.951	3.864
56.7	174.1	0.306	5.40	6.479	1.935	1.921	5.832	0.425	2.994	2.569	0.648	2.034	1.609	0.961	3.965
57.8	175.8	0.312	5.50	6.486	1.951	1.937	5.804	0.397	3.010	2.614	0.676	2.042	1.645	0.969	3.866
58.8	177.6	0.318	5.60	6.492	1.970	1.956	5.815	0.408	3.029	2.621	0.665	2.051	1.643	0.978	3.943
59.8	179.5	0.323	5.70	6.499	1.988	1.974	5.793	0.386	3.047	2.661	0.687	2.060	1.674	0.987	3.874
60.9	181.6	0.329	5.80	6.506	2.010	1.996	5.782	0.375	3.069	2.694	0.698	2.071	1.696	0.998	3.859
61.9	183.8	0.335	5.90	6.513	2.032	2.017	5.777	0.370	3.090	2.720	0.703	2.081	1.711	1.009	3.871
63.0	185.7	0.340	6.00	6.520	2.051	2.036	5.773	0.366	3.109	2.743	0.707	2.091	1.725	1.018	3.882
64.0	187.6	0.346	6.10	6.527	2.070	2.055	5.773	0.366	3.128	2.762	0.707	2.100	1.734	1.027	3.906
65.1	189.5	0.352	6.21	6.534	2.088	2.073	5.759	0.352	3.146	2.794	0.721	2.109	1.757	1.036	3.874
66.1	191.5	0.357	6.31	6.541	2.108	2.092	5.770	0.363	3.165	2.802	0.710	2.119	1.756	1.046	3.945
67.1	193.5	0.363	6.40	6.548	2.127	2.111	5.738	0.331	3.184	2.854	0.742	2.129	1.798	1.056	3.845
68.2	195.2	0.369	6.50	6.555	2.144	2.128	5.758	0.351	3.201	2.850	0.722	2.137	1.786	1.064	3.947
69.2	197.0	0.374	6.60	6.562	2.162	2.146	5.724	0.317	3.219	2.902	0.756	2.146	1.829	1.073	3.836
70.3	199.5	0.380	6.70	6.569	2.187	2.170	5.745	0.338	3.243	2.906	0.735	2.158	1.820	1.085	3.952
71.4	201.6	0.386	6.81	6.576	2.207	2.190	5.708	0.301	3.263	2.962	0.772	2.168	1.867	1.095	3.836
72.4	203.7	0.391	6.90	6.583	2.228	2.211	5.722	0.315	3.284	2.969	0.758	2.179	1.864	1.106	3.916
73.5	205.8	0.397	7.00	6.590	2.248	2.231	5.694	0.287	3.304	3.017	0.786	2.189	1.902	1.116	3.838
74.5	207.7	0.403	7.11	6.597	2.267	2.250	5.713	0.306	3.323	3.017	0.767	2.198	1.892	1.125	3.933
75.6	209.4	0.408	7.20	6.604	2.283	2.265	5.685	0.278	3.338	3.060	0.795	2.206	1.928	1.133	3.850
76.6	211.2	0.414	7.30	6.612	2.300	2.282	5.696	0.289	3.355	3.067	0.784	2.214	1.925	1.141	3.909
77.7	213.4	0.420	7.40	6.619	2.322	2.303	5.675	0.268	3.376	3.109	0.805	2.225	1.957	1.152	3.861
78.7	215.5	0.425	7.50	6.626	2.341	2.323	5.689	0.282	3.396	3.114	0.791	2.234	1.953	1.161	3.935
79.8	217.2	0.431	7.60	6.633	2.358	2.339	5.661	0.254	3.412	3.158	0.819	2.242	1.988	1.169	3.857
80.9	219.2	0.437	7.70	6.640	2.377	2.357	5.671	0.264	3.430	3.167	0.809	2.252	1.988	1.179	3.913
81.9	220.7	0.442	7.80	6.647	2.390	2.371	5.645	0.238	3.444	3.207	0.835	2.259	2.021	1.186	3.838
83.0	222.3	0.448	7.91	6.655	2.405	2.386	5.659	0.252	3.459	3.207	0.821	2.266	2.014	1.193	3.906
84.0	224.3	0.454	8.01	6.662	2.424	2.405	5.626	0.219	3.478	3.259	0.854	2.275	2.057	1.202	3.815
85.1	226.5	0.459	8.10	6.669	2.445	2.425	5.646	0.239	3.498	3.259	0.834	2.286	2.046	1.213	3.908
86.2	228.7	0.465	8.20	6.676	2.467	2.446	5.623	0.216	3.519	3.303	0.857	2.296	2.080	1.223	3.854
87.2	231.1	0.471	8.31	6.684	2.490	2.469	5.633	0.226	3.542	3.317	0.847	2.308	2.082	1.235	3.914
88.2	232.9	0.476	8.40	6.691	2.506	2.485	5.604	0.197	3.558	3.361	0.876	2.316	2.119	1.243	3.837
89.3	234.9	0.482	8.51	6.698	2.525	2.504	5.630	0.223	3.577	3.353	0.850	2.325	2.102	1.252	3.947
90.4	236.8	0.488	8.61	6.706	2.542	2.521	5.596	0.189	3.594	3.405	0.884	2.334	2.145	1.261	3.851
91.4	238.8	0.493	8.70	6.713	2.561	2.539	5.608	0.201	3.612	3.411	0.872	2.343	2.141	1.270	3.913
92.5	240.4	0.499	8.81	6.720	2.576	2.554	5.573	0.166	3.627	3.462	0.907	2.350	2.185	1.277	3.815
93.5	242.1	0.505	8.90	6.728	2.591	2.569	5.589	0.182	3.642	3.460	0.891	2.358	2.176	1.285	3.884
94.6	244.2	0.510	9.01	6.735	2.610	2.588	5.565	0.158	3.661	3.503	0.915	2.367	2.209	1.294	3.829
95.6	246.1	0.516	9.11	6.743	2.628	2.606	5.580	0.173	3.679	3.506	0.900	2.376	2.203	1.303	3.894
96.7	247.8	0.522	9.21	6.750	2.643	2.621	5.550	0.143	3.694	3.550	0.930	2.383	2.240	1.310	3.819
97.7	249.8	0.527	9.31	6.758	2.662	2.639	5.561	0.154	3.711	3.557	0.919	2.392	2.238	1.319	3.872
98.8	251.6	0.533	9.41	6.765	2.678	2.654	5.539	0.132	3.727	3.595	0.941	2.400	2.268	1.327	3.821
99.9	253.1	0.539	9.51	6.772	2.691	2.668	5.545	0.138	3.741	3.603	0.935	2.407	2.269	1.334	3.853
101.0	254.9	0.544	9.61	6.780	2.707	2.683	5.525	0.118	3.756	3.638	0.955	2.415	2.297	1.342	3.810
102.0	256.8	0.550	9.71	6.787	2.724	2.700	5.536	0.129	3.773	3.644	0.944	2.423	2.294	1.350	3.859
103.1	258.5	0.556	9.81	6.795	2.739	2.715	5.519	0.112	3.788	3.676	0.961	2.431	2.319	1.358	3.825
104.1	260.3	0.561	9.91	6.802	2.755	2.731	5.510	0.103	3.804	3.701	0.970	2.438	2.336	1.365	3.814
105.2	262.1	0.567	10.01	6.810	2.771	2.746	5.499	0.092	3.819	3.728	0.981	2.446	2.355	1.373	3.799
106.3	263.7	0.573	10.11	6.818	2.785	2.760	5.491	0.084	3.833	3.749	0.989	2.453	2.369	1.380	3.790
107.3	265.3	0.578	10.21	6.825	2.799	2.773	5.487	0.080	3.846	3.766	0.993	2.460	2.380	1.387	3.793
108.4	267.0	0.584	10.31	6.833	2.814	2.788	5.482	0.075	3.861	3.786	0.998	2.467	2.392	1.394	3.794
109.5	268.8	0.590	10.41	6.841	2.829	2.803	5.470	0.063	3.876	3.814	1.010	2.475	2.412	1.402	3.775
110.5	270.6	0.595	10.51	6.848	2.845	2.819	5.457	0.050	3.892	3.842	1.023	2.482	2.433	1.409	3.754
111.6	272.4	0.601	10.61	6.856	2.861	2.834	5.461	0.054	3.907	3.854	1.019	2.490	2.437	1.417	3.780
112.7	273.8	0.607	10.71	6.864	2.873	2.846	5.442	0.035	3.919	3.884	1.038	2.496	2.461	1.423	3.741

Project: 175667029			Source: S-6, 19.5'-20.0'								Lab ID: 36B		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
113.8	275.6	0.612	10.81	6.871	2.888	2.861	5.451	0.044	3.934	3.891	1.029	2.504	2.460	1.431	3.779
114.9	277.4	0.618	10.91	6.879	2.904	2.877	5.428	0.021	3.950	3.929	1.052	2.511	2.491	1.438	3.734
115.9	279.3	0.624	11.01	6.887	2.920	2.892	5.437	0.030	3.965	3.936	1.043	2.519	2.490	1.446	3.772
117.1	281.0	0.630	11.11	6.895	2.934	2.907	5.420	0.013	3.980	3.966	1.060	2.526	2.513	1.453	3.743
118.1	282.5	0.635	11.21	6.902	2.947	2.920	5.421	0.014	3.993	3.978	1.059	2.533	2.519	1.460	3.758
119.2	284.3	0.641	11.31	6.910	2.963	2.935	5.396	-0.011	4.008	4.018	1.084	2.540	2.551	1.467	3.708
120.3	286.2	0.646	11.41	6.918	2.979	2.950	5.408	0.001	4.023	4.023	1.072	2.548	2.547	1.475	3.752
121.4	287.5	0.652	11.51	6.926	2.989	2.961	5.397	-0.010	4.034	4.044	1.083	2.553	2.563	1.480	3.734
122.5	289.4	0.658	11.61	6.934	3.006	2.977	5.401	-0.006	4.050	4.056	1.079	2.561	2.567	1.488	3.759
123.6	291.1	0.664	11.71	6.941	3.020	2.991	5.381	-0.026	4.064	4.090	1.099	2.568	2.594	1.495	3.721
124.7	292.9	0.669	11.81	6.949	3.034	3.005	5.384	-0.023	4.078	4.101	1.096	2.575	2.598	1.503	3.743
125.8	294.7	0.675	11.91	6.957	3.050	3.020	5.356	-0.051	4.093	4.144	1.124	2.583	2.634	1.510	3.688
126.9	296.3	0.680	12.01	6.965	3.062	3.033	5.371	-0.036	4.106	4.142	1.109	2.589	2.625	1.516	3.735
128.0	297.6	0.686	12.11	6.973	3.073	3.043	5.351	-0.056	4.116	4.172	1.129	2.595	2.651	1.522	3.696
129.1	299.5	0.692	12.21	6.981	3.089	3.058	5.341	-0.066	4.131	4.197	1.139	2.602	2.668	1.529	3.686
130.2	301.0	0.697	12.31	6.989	3.101	3.070	5.326	-0.081	4.143	4.225	1.154	2.608	2.690	1.535	3.660
131.3	302.4	0.703	12.41	6.997	3.112	3.082	5.344	-0.063	4.155	4.217	1.136	2.614	2.677	1.541	3.713
132.4	304.0	0.709	12.51	7.005	3.125	3.094	5.309	-0.098	4.167	4.265	1.171	2.620	2.718	1.547	3.641
133.5	305.9	0.715	12.61	7.013	3.140	3.109	5.321	-0.086	4.182	4.269	1.159	2.628	2.714	1.555	3.682
134.6	307.2	0.720	12.71	7.021	3.151	3.119	5.305	-0.102	4.192	4.294	1.175	2.633	2.735	1.560	3.655
135.7	308.6	0.726	12.81	7.029	3.162	3.130	5.309	-0.098	4.203	4.301	1.171	2.638	2.736	1.565	3.673
136.7	309.9	0.732	12.91	7.037	3.171	3.139	5.282	-0.125	4.212	4.337	1.198	2.643	2.767	1.570	3.621
137.8	311.6	0.737	13.01	7.045	3.184	3.152	5.290	-0.117	4.225	4.342	1.190	2.649	2.766	1.576	3.648
138.9	312.7	0.743	13.11	7.053	3.192	3.159	5.270	-0.137	4.232	4.369	1.210	2.653	2.790	1.580	3.611
140.0	314.2	0.748	13.21	7.061	3.204	3.171	5.269	-0.138	4.244	4.382	1.211	2.659	2.797	1.586	3.619
141.1	315.8	0.754	13.31	7.070	3.216	3.183	5.240	-0.167	4.256	4.423	1.240	2.665	2.832	1.592	3.567
142.1	317.0	0.760	13.41	7.078	3.224	3.191	5.260	-0.147	4.264	4.411	1.220	2.669	2.815	1.596	3.616
143.2	318.1	0.765	13.51	7.086	3.232	3.199	5.237	-0.170	4.272	4.441	1.243	2.672	2.842	1.599	3.574
144.3	319.8	0.771	13.61	7.094	3.245	3.212	5.226	-0.181	4.285	4.465	1.254	2.679	2.860	1.606	3.562
145.3	321.1	0.777	13.71	7.102	3.255	3.221	5.168	-0.240	4.294	4.533	1.312	2.683	2.923	1.610	3.454
146.4	322.6	0.783	13.81	7.111	3.267	3.233	5.192	-0.215	4.306	4.520	1.288	2.689	2.904	1.616	3.511
147.5	323.9	0.788	13.91	7.119	3.276	3.241	5.178	-0.229	4.314	4.543	1.302	2.694	2.923	1.621	3.490
148.6	325.3	0.794	14.01	7.127	3.286	3.252	5.199	-0.208	4.325	4.533	1.281	2.699	2.907	1.626	3.538
149.6	326.4	0.800	14.11	7.135	3.294	3.259	5.176	-0.231	4.332	4.562	1.304	2.702	2.933	1.629	3.500
150.7	327.9	0.805	14.21	7.144	3.305	3.270	5.194	-0.213	4.343	4.556	1.286	2.708	2.921	1.635	3.542
151.8	329.2	0.811	14.31	7.152	3.314	3.279	5.177	-0.230	4.352	4.581	1.303	2.712	2.942	1.639	3.517
152.8	330.6	0.817	14.41	7.160	3.325	3.289	5.198	-0.209	4.362	4.571	1.282	2.718	2.927	1.645	3.566
153.9	331.9	0.822	14.51	7.169	3.334	3.298	5.186	-0.221	4.371	4.592	1.294	2.722	2.943	1.649	3.549
155.0	333.5	0.828	14.61	7.177	3.346	3.310	5.223	-0.184	4.383	4.567	1.257	2.728	2.912	1.655	3.633
156.0	334.7	0.833	14.71	7.185	3.354	3.317	5.210	-0.197	4.390	4.588	1.270	2.732	2.929	1.659	3.612
157.1	336.0	0.839	14.81	7.194	3.363	3.326	5.235	-0.172	4.399	4.571	1.245	2.736	2.908	1.663	3.671
158.2	337.3	0.845	14.91	7.202	3.372	3.335	5.223	-0.184	4.408	4.592	1.257	2.740	2.924	1.667	3.654
159.2	338.6	0.851	15.01	7.211	3.381	3.344	5.245	-0.162	4.417	4.579	1.235	2.745	2.907	1.672	3.708
160.3	339.6	0.856	15.11	7.219	3.387	3.349	5.212	-0.195	4.422	4.618	1.268	2.748	2.943	1.675	3.640
161.4	341.3	0.862	15.21	7.228	3.400	3.362	5.228	-0.179	4.435	4.614	1.252	2.754	2.933	1.681	3.685
162.5	342.5	0.868	15.31	7.237	3.408	3.370	5.204	-0.203	4.443	4.646	1.276	2.758	2.961	1.685	3.641
163.5	343.7	0.873	15.41	7.245	3.416	3.378	5.215	-0.192	4.451	4.643	1.265	2.762	2.954	1.689	3.669
164.6	345.3	0.879	15.51	7.254	3.427	3.389	5.192	-0.215	4.462	4.677	1.288	2.767	2.982	1.694	3.632
165.7	346.4	0.885	15.61	7.262	3.434	3.396	5.204	-0.203	4.469	4.671	1.276	2.771	2.974	1.698	3.662
166.8	347.1	0.890	15.71	7.271	3.437	3.398	5.171	-0.236	4.471	4.707	1.309	2.772	3.008	1.699	3.595
167.8	348.5	0.896	15.81	7.279	3.447	3.408	5.194	-0.213	4.481	4.694	1.286	2.777	2.990	1.704	3.651
168.9	349.8	0.902	15.91	7.288	3.456	3.416	5.171	-0.236	4.489	4.725	1.309	2.781	3.017	1.708	3.610
170.0	351.2	0.907	16.01	7.297	3.465	3.426	5.191	-0.216	4.499	4.715	1.289	2.786	3.002	1.713	3.657
171.1	352.5	0.913	16.11	7.306	3.474	3.434	5.157	-0.250	4.507	4.757	1.323	2.790	3.040	1.717	3.596
172.2	354.0	0.919	16.21	7.314	3.485	3.444	5.184	-0.223	4.517	4.740	1.296	2.795	3.018	1.722	3.659
173.3	354.8	0.924	16.31	7.323	3.489	3.449	5.149	-0.258	4.521	4.779	1.331	2.797	3.055	1.724	3.592
174.3	356.1	0.930	16.41	7.332	3.497	3.457	5.178	-0.229	4.530	4.759	1.302	2.801	3.030	1.728	3.655
175.4	357.3	0.936	16.51	7.341	3.505	3.464	5.153	-0.254	4.537	4.791	1.327	2.805	3.059	1.732	3.610
176.5	358.3	0.941	16.61	7.349	3.511	3.470	5.155	-0.252	4.543	4.794	1.325	2.808	3.059	1.735	3.619
177.6	359.1	0.947	16.71	7.358	3.514	3.473	5.140	-0.267	4.546	4.813	1.340	2.809	3.076	1.736	3.592
178.7	360.7	0.953	16.81	7.367	3.525	3.484	5.164	-0.243	4.557	4.800	1.316	2.815	3.058	1.742	3.647
179.7	361.6	0.958	16.91	7.376	3.530	3.488	5.118	-0.289	4.561	4.850	1.362	2.817	3.106	1.744	3.561
180.8	362.8	0.964	17.01	7.385	3.537	3.495	5.142	-0.265	4.568	4.833	1.338	2.820	3.085	1.747	3.612
181.9	363.7	0.970	17.11	7.394	3.542	3.499	5.116	-0.291	4.572	4.863	1.364	2.823	3.114	1.750	3.566

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-6, 20.0'-20.5'	Lab ID	36C
Description	Silt with Sand (ML), dark gray, wet, soft	Test ID	2-C
Specimen Type	Intact		
Preparation	Wet Mounting	Date Received	07/05/2017
		Date Tested	07/13/2017

Specific Gravity 2.46
ASTM D 854, A

Liquid Limit
Plastic Limit
Plasticity Index

Target Test Parameters

Nominal Chamber Pressure (psi)	90
Nominal Back Pressure (psi)	67.5
Nominal Consolidation Pressure (psi)	22.5

Saturation / Consolidation Results

Pore Pressure Parameter B	0.95
Measured Effective Consol. Stress (tsf)	1.621
Time to 50% Consolidation (min)	0.45
Actual Axial Strain Rate of Test (%/min)	0.094

Consolidated Specimen Conditions

Moist Unit Weight (pcf)	110.9
Moisture Content (%)	35.4
Dry Unit Weight (pcf)	81.9
Void Ratio	0.871
Degree of Saturation (%)	100.0

At Drained Failure

Failure Criteria: Max. Eff. Prin. Stress Ratio

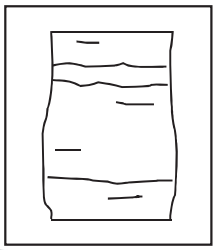
Axial Strain (%)	7.102
Deviator Stress (tsf)	3.181
Induced Pore Pressure (tsf)	0.591
Minor Effective Stress, σ_3' (tsf)	1.030
Major Effective Stress, σ_1' (tsf)	4.211
Eff. Principal Stress Ratio, σ_1'/σ_3'	4.087
p' (tsf)	2.621
q (tsf)	1.590

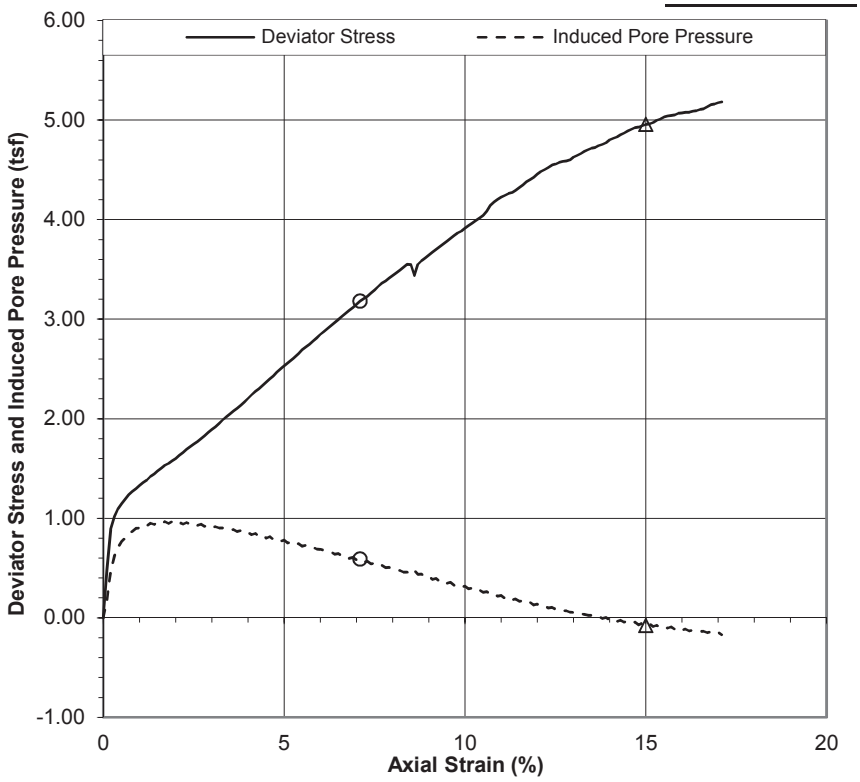
At Consolidated Undrained Failure

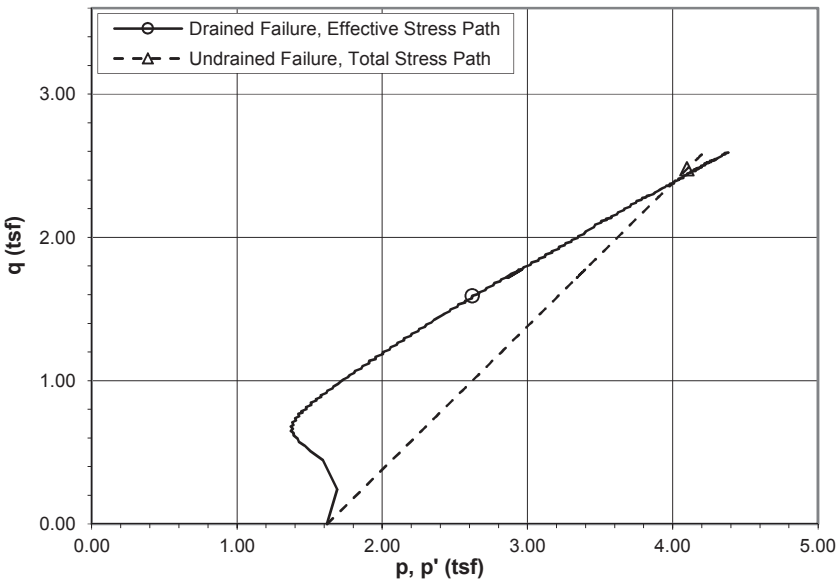
Failure Criterion: 15% Axial Strain

Axial Strain (%)	15.005
Deviator Stress (tsf)	4.954
Minor Principal Stress, σ_3 (tsf)	1.621
Major Principal Stress, σ_1 (tsf)	6.575
p (tsf)	4.098
q (tsf)	2.477

Failure Sketch







Comments Oven dried at 60° C.

Reviewed KG

Template: tmp_cu_input.xlsm
Version: 20170216
Approved By: RJ

Stantec Consulting Services Inc.
Lexington, Kentucky

Reported By: KG
Report Date: 07/19/2017

Stantec

Consolidated Undrained Triaxial Compression

ASTM D 4767

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-6, 20.0'-20.5'	Lab ID	36C
Description	Silt with Sand (ML), dark gray, wet, soft	Test ID	2-C

Initial Specimen Conditions		Consolidated Specimen Conditions			
Height (in)	5.677	Height (in)	5.639	Specific Gravity	2.46
Diameter (in)	2.801	Calculated Diameter (in)	2.692	ASTM D	854, A
Area (in^2)	6.160	Calculated Area (in^2)	5.690	Liquid Limit	
Moist Weight (lb)	2.156	Moist Weight (lb)	2.060	Plastic Limit	
Moist Unit Weight (pcf)	106.5	Moist Unit Weight (pcf)	110.9	Plasticity Index	
Moisture Content (%)	41.7	Moisture Content (%)	35.4		
Dry Weight (lb)	1.521	Dry Weight (lb)	1.521		
Dry Unit Weight (pcf)	75.2	Dry Unit Weight (pcf)	81.9	Confining Stress	
Void Ratio	1.040	Void Ratio	0.871	σ_3 (tsf)	1.621
Degree of Saturation (%)	98.7	Degree of Saturation (%)	100.0		
				Effective Consolidation Stress	
				σ_3' (tsf)	1.621

Moisture contents obtained using whole specimen.
Specimen consolidated cross-sectional area determined using method B.
Membrane corrections have been applied,where Em = 200 lbf/in and t = 0.012 in.
All other tests performed in association with this specimen are reported separately.

Project: 175667029			Source: S-6, 20.0'-20.5'								Lab ID: 36C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
0.0	0.0	0.000	0.00	5.690	0.000	0.000	4.859	0.000	1.621	1.621	1.621	1.621	1.621	0.000	1.000
1.5	38.1	0.006	0.10	5.696	0.482	0.482	5.030	0.171	2.103	1.931	1.450	1.862	1.690	0.241	1.332
3.3	70.5	0.011	0.20	5.702	0.891	0.890	5.334	0.475	2.511	2.036	1.146	2.066	1.591	0.445	1.777
4.5	80.8	0.018	0.31	5.708	1.019	1.018	5.485	0.626	2.639	2.013	0.995	2.130	1.504	0.509	2.023
5.6	86.7	0.023	0.40	5.713	1.092	1.091	5.561	0.702	2.712	2.011	0.919	2.167	1.465	0.546	2.187
6.7	91.2	0.028	0.50	5.719	1.148	1.146	5.626	0.767	2.767	2.000	0.854	2.194	1.427	0.573	2.343
7.7	94.8	0.034	0.60	5.724	1.193	1.191	5.659	0.800	2.812	2.012	0.821	2.217	1.416	0.596	2.451
8.8	98.4	0.040	0.70	5.730	1.237	1.235	5.707	0.848	2.856	2.008	0.773	2.239	1.390	0.618	2.598
9.9	101.2	0.045	0.80	5.736	1.271	1.269	5.725	0.866	2.890	2.024	0.755	2.255	1.390	0.634	2.680
10.9	103.6	0.051	0.90	5.742	1.299	1.297	5.758	0.899	2.918	2.019	0.722	2.269	1.370	0.648	2.796
12.0	106.4	0.057	1.00	5.748	1.333	1.330	5.761	0.902	2.951	2.049	0.719	2.286	1.384	0.665	2.850
13.0	108.8	0.062	1.10	5.753	1.361	1.359	5.789	0.930	2.980	2.050	0.691	2.300	1.370	0.679	2.966
14.1	110.9	0.068	1.20	5.759	1.387	1.384	5.782	0.923	3.005	2.082	0.698	2.313	1.390	0.692	2.983
15.1	113.8	0.074	1.30	5.765	1.422	1.418	5.809	0.950	3.039	2.089	0.671	2.330	1.380	0.709	3.114
16.1	116.1	0.079	1.41	5.771	1.448	1.444	5.795	0.936	3.065	2.129	0.685	2.343	1.407	0.722	3.110
17.2	118.6	0.085	1.50	5.777	1.478	1.474	5.817	0.958	3.095	2.137	0.663	2.358	1.400	0.737	3.224
18.2	121.1	0.090	1.60	5.783	1.508	1.503	5.803	0.944	3.125	2.180	0.677	2.373	1.428	0.752	3.222
19.2	123.5	0.096	1.70	5.789	1.537	1.532	5.825	0.966	3.153	2.187	0.655	2.387	1.421	0.766	3.338
20.3	125.2	0.102	1.81	5.795	1.556	1.552	5.806	0.947	3.173	2.226	0.674	2.397	1.450	0.776	3.301
21.3	127.4	0.107	1.90	5.800	1.581	1.576	5.824	0.965	3.197	2.232	0.656	2.409	1.444	0.788	3.403
22.4	129.5	0.113	2.00	5.806	1.605	1.600	5.804	0.945	3.221	2.276	0.676	2.421	1.476	0.800	3.368
23.4	132.1	0.118	2.10	5.812	1.637	1.631	5.820	0.961	3.252	2.291	0.660	2.437	1.476	0.816	3.471
24.4	134.6	0.124	2.20	5.818	1.666	1.660	5.800	0.941	3.281	2.340	0.680	2.451	1.510	0.830	3.443
25.5	137.5	0.130	2.31	5.824	1.699	1.693	5.816	0.958	3.314	2.357	0.664	2.468	1.510	0.847	3.552
26.5	139.8	0.136	2.40	5.830	1.726	1.720	5.796	0.937	3.341	2.404	0.684	2.481	1.544	0.860	3.514
27.5	141.9	0.141	2.50	5.836	1.751	1.745	5.808	0.949	3.366	2.417	0.672	2.493	1.545	0.872	3.594
28.5	144.2	0.147	2.60	5.842	1.777	1.770	5.787	0.928	3.391	2.463	0.693	2.506	1.578	0.885	3.554
29.6	146.7	0.152	2.70	5.848	1.806	1.799	5.800	0.941	3.420	2.479	0.680	2.521	1.579	0.900	3.647
30.6	149.2	0.158	2.80	5.854	1.836	1.828	5.779	0.920	3.449	2.530	0.701	2.535	1.615	0.914	3.608
31.7	152.2	0.164	2.90	5.860	1.869	1.862	5.789	0.930	3.483	2.553	0.691	2.552	1.622	0.931	3.696
32.7	154.8	0.169	3.00	5.866	1.900	1.892	5.768	0.909	3.513	2.604	0.712	2.567	1.658	0.946	3.658
33.7	157.2	0.175	3.10	5.872	1.927	1.919	5.775	0.916	3.541	2.624	0.705	2.581	1.665	0.960	3.723
34.7	160.3	0.181	3.20	5.878	1.963	1.955	5.762	0.903	3.576	2.673	0.718	2.598	1.696	0.977	3.722
35.8	163.2	0.186	3.30	5.884	1.997	1.989	5.760	0.901	3.610	2.709	0.720	2.615	1.715	0.994	3.761
36.9	166.1	0.192	3.41	5.891	2.030	2.022	5.754	0.895	3.643	2.748	0.726	2.632	1.737	1.011	3.785
37.9	168.5	0.197	3.50	5.896	2.057	2.048	5.741	0.882	3.669	2.787	0.739	2.645	1.763	1.024	3.771
38.9	171.3	0.203	3.60	5.903	2.090	2.080	5.744	0.885	3.701	2.816	0.736	2.661	1.776	1.040	3.826
39.9	173.5	0.209	3.70	5.909	2.114	2.104	5.727	0.868	3.725	2.858	0.753	2.673	1.805	1.052	3.793
41.0	176.4	0.215	3.80	5.915	2.147	2.137	5.735	0.876	3.759	2.883	0.745	2.690	1.814	1.069	3.867

Project: 175667029			Source: S-6, 20.0'-20.5'								Lab ID: 36C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
42.0	179.3	0.220	3.90	5.921	2.180	2.170	5.709	0.850	3.791	2.942	0.771	2.706	1.857	1.085	3.814
43.1	182.4	0.226	4.00	5.927	2.215	2.205	5.718	0.859	3.826	2.967	0.762	2.724	1.865	1.103	3.893
44.1	185.5	0.231	4.10	5.933	2.251	2.240	5.692	0.833	3.861	3.028	0.788	2.741	1.908	1.120	3.844
45.2	188.4	0.237	4.20	5.940	2.284	2.273	5.705	0.847	3.894	3.048	0.775	2.758	1.911	1.137	3.935
46.2	190.8	0.243	4.30	5.946	2.311	2.300	5.676	0.817	3.921	3.103	0.804	2.771	1.954	1.150	3.861
47.2	193.7	0.248	4.40	5.952	2.343	2.332	5.691	0.832	3.953	3.121	0.789	2.787	1.955	1.166	3.954
48.3	196.9	0.254	4.50	5.958	2.379	2.368	5.659	0.800	3.989	3.188	0.821	2.805	2.004	1.184	3.885
49.3	199.9	0.259	4.60	5.964	2.413	2.402	5.675	0.816	4.023	3.206	0.805	2.822	2.006	1.201	3.984
50.3	202.5	0.265	4.70	5.971	2.442	2.430	5.646	0.787	4.051	3.264	0.834	2.836	2.049	1.215	3.915
51.4	206.0	0.271	4.80	5.977	2.481	2.469	5.656	0.797	4.090	3.293	0.824	2.855	2.058	1.234	3.996
52.4	208.7	0.276	4.90	5.983	2.511	2.499	5.631	0.772	4.120	3.348	0.849	2.870	2.098	1.249	3.943
53.5	211.6	0.282	5.00	5.990	2.544	2.531	5.639	0.780	4.152	3.372	0.841	2.887	2.106	1.265	4.011
54.5	214.3	0.288	5.10	5.996	2.573	2.560	5.612	0.753	4.181	3.428	0.868	2.901	2.148	1.280	3.948
55.6	217.1	0.293	5.20	6.002	2.604	2.591	5.624	0.765	4.212	3.447	0.856	2.916	2.151	1.295	4.027
56.6	220.1	0.299	5.30	6.009	2.637	2.624	5.596	0.737	4.245	3.507	0.884	2.933	2.196	1.312	3.969
57.7	223.0	0.305	5.40	6.015	2.669	2.655	5.604	0.745	4.276	3.531	0.876	2.949	2.204	1.328	4.031
58.7	226.3	0.310	5.50	6.021	2.706	2.692	5.579	0.720	4.313	3.593	0.901	2.967	2.247	1.346	3.987
59.8	229.0	0.316	5.60	6.028	2.736	2.721	5.586	0.727	4.342	3.615	0.894	2.982	2.255	1.361	4.044
60.8	231.6	0.322	5.70	6.034	2.763	2.749	5.562	0.703	4.370	3.666	0.918	2.995	2.292	1.374	3.995
61.9	234.7	0.327	5.80	6.041	2.798	2.783	5.566	0.707	4.404	3.697	0.914	3.013	2.306	1.391	4.044
62.9	237.4	0.333	5.90	6.047	2.827	2.811	5.548	0.689	4.432	3.744	0.932	3.027	2.338	1.406	4.015
63.9	240.6	0.338	6.00	6.053	2.862	2.846	5.547	0.688	4.467	3.779	0.933	3.044	2.356	1.423	4.052
64.9	243.4	0.344	6.10	6.060	2.892	2.877	5.535	0.676	4.498	3.821	0.945	3.059	2.383	1.438	4.045
66.0	246.4	0.350	6.20	6.066	2.924	2.908	5.524	0.665	4.529	3.864	0.956	3.075	2.410	1.454	4.042
67.0	249.2	0.355	6.30	6.073	2.955	2.938	5.519	0.660	4.559	3.899	0.961	3.090	2.430	1.469	4.059
68.0	251.9	0.361	6.40	6.079	2.983	2.967	5.499	0.640	4.588	3.948	0.981	3.104	2.464	1.483	4.024
69.0	254.5	0.367	6.50	6.086	3.011	2.994	5.506	0.647	4.615	3.968	0.974	3.118	2.471	1.497	4.073
70.1	257.7	0.372	6.60	6.092	3.046	3.029	5.478	0.620	4.650	4.031	1.002	3.136	2.516	1.515	4.024
71.1	260.6	0.378	6.70	6.099	3.077	3.059	5.486	0.627	4.681	4.053	0.994	3.151	2.523	1.530	4.079
72.1	263.4	0.384	6.80	6.105	3.107	3.089	5.456	0.597	4.710	4.113	1.024	3.166	2.569	1.545	4.016
73.2	266.0	0.389	6.90	6.112	3.134	3.116	5.467	0.608	4.737	4.129	1.013	3.179	2.571	1.558	4.075
74.2	269.1	0.395	7.00	6.118	3.166	3.148	5.438	0.579	4.769	4.190	1.042	3.195	2.616	1.574	4.022
75.2	272.2	0.401	7.10	6.125	3.199	3.181	5.450	0.591	4.802	4.211	1.030	3.212	2.621	1.590	4.087
76.2	274.7	0.406	7.20	6.132	3.225	3.207	5.419	0.560	4.828	4.268	1.061	3.225	2.665	1.603	4.021
77.3	277.1	0.412	7.30	6.138	3.250	3.231	5.428	0.569	4.852	4.283	1.052	3.237	2.668	1.616	4.071
78.3	279.9	0.417	7.40	6.145	3.279	3.260	5.401	0.542	4.881	4.339	1.079	3.251	2.709	1.630	4.022
79.3	283.2	0.423	7.50	6.152	3.314	3.295	5.408	0.549	4.916	4.367	1.072	3.269	2.720	1.648	4.074
80.4	286.3	0.429	7.60	6.158	3.348	3.328	5.380	0.521	4.949	4.428	1.100	3.285	2.764	1.664	4.027
81.4	289.4	0.434	7.70	6.165	3.380	3.360	5.387	0.528	4.981	4.453	1.093	3.301	2.773	1.680	4.074
82.5	291.8	0.440	7.80	6.172	3.404	3.384	5.363	0.504	5.005	4.501	1.117	3.313	2.809	1.692	4.030
83.5	294.7	0.446	7.90	6.178	3.434	3.414	5.367	0.508	5.035	4.527	1.113	3.328	2.820	1.707	4.066
84.5	297.0	0.451	8.00	6.185	3.458	3.437	5.349	0.490	5.058	4.569	1.131	3.340	2.850	1.719	4.038
85.6	299.8	0.457	8.10	6.192	3.487	3.466	5.339	0.480	5.087	4.607	1.141	3.354	2.874	1.733	4.038
86.6	302.5	0.463	8.20	6.198	3.514	3.493	5.334	0.475	5.114	4.639	1.146	3.368	2.892	1.747	4.049
87.7	305.5	0.468	8.30	6.205	3.544	3.523	5.317	0.458	5.144	4.686	1.163	3.383	2.925	1.761	4.028
88.7	308.1	0.474	8.40	6.212	3.571	3.550	5.318	0.459	5.171	4.712	1.162	3.396	2.937	1.775	4.055
89.8	308.3	0.479	8.50	6.219	3.570	3.548	5.297	0.438	5.169	4.730	1.183	3.395	2.957	1.774	4.000
90.8	299.2	0.485	8.60	6.226	3.460	3.438	5.335	0.476	5.059	4.583	1.145	3.340	2.864	1.719	4.002
91.9	309.4	0.491	8.70	6.232	3.574	3.552	5.295	0.436	5.173	4.737	1.185	3.397	2.961	1.776	3.998
92.9	312.7	0.496	8.80	6.239	3.609	3.586	5.298	0.439	5.207	4.768	1.182	3.414	2.975	1.793	4.035
94.0	315.7	0.502	8.90	6.246	3.639	3.616	5.270	0.411	5.237	4.827	1.210	3.429	3.018	1.808	3.988
95.1	318.5	0.508	9.00	6.253	3.668	3.645	5.275	0.416	5.266	4.849	1.205	3.443	3.027	1.822	4.026
96.1	321.5	0.513	9.10	6.260	3.698	3.675	5.244	0.385	5.296	4.911	1.236	3.458	3.074	1.837	3.972
97.2	324.3	0.519	9.20	6.267	3.726	3.702	5.253	0.394	5.323	4.929	1.227	3.472	3.078	1.851	4.018
98.3	326.9	0.525	9.30	6.274	3.752	3.728	5.224	0.365	5.349	4.984	1.256	3.485	3.120	1.864	3.969
99.3	329.9	0.530	9.40	6.281	3.782	3.758	5.233	0.374	5.379	5.004	1.247	3.500	3.126	1.879	4.014
100.4	332.6	0.536	9.50	6.288	3.809	3.784	5.204	0.345	5.406	5.061	1.276	3.513	3.168	1.892	3.966
101.4	335.0	0.541	9.60	6.294	3.832	3.808	5.214	0.355	5.429	5.074	1.266	3.525	3.170	1.904	4.008
102.5	338.3	0.547	9.70	6.302	3.865	3.840	5.185	0.326	5.461	5.135	1.295	3.541	3.215	1.920	3.966
103.5	340.9	0.553	9.80	6.308	3.891	3.866	5.197	0.338	5.487	5.149	1.283	3.554	3.216	1.933	4.013
104.6	343.1	0.558	9.90	6.315	3.912	3.887	5.169	0.310	5.508	5.198	1.311	3.564	3.254	1.943	3.964
105.6	345.8	0.564	10.00	6.322	3.939	3.913	5.175	0.316	5.534	5.218	1.305	3.577	3.261	1.956	3.999
106.7	348.6	0.570	10.10	6.329	3.965	3.939	5.149	0.291	5.560	5.270	1.331	3.591	3.300	1.970	3.961
107.8	351.3	0.575	10.20	6.337	3.992	3.966	5.157	0.298	5.587	5.289	1.323	3.604	3.306	1.983	3.998
108.9	354.0	0.581	10.30	6.344	4.018	3.992	5.130	0.271	5.613	5.342	1.350	3.617	3.346	1.996	3.957
109.9	356.8	0.587	10.40	6.351	4.045	4.019	5.139	0.280	5.640	5.360	1.341	3.630	3.350	2.009	3.996
111.0	359.4	0.592	10.50	6.358	4.070	4.043	5.114	0.255	5.664	5.410	1.366	3.643	3.388	2.022	3.959
112.1	363.5	0.598	10.60	6.365	4.112	4.085	5.120	0.261	5.706	5.445	1.360	3.663	3.402	2.042	4.004
113.2	369.2	0.604	10.70	6.372	4.172	4.144	5.095	0.236	5.765	5.529	1.385	3.693	3.457	2.072	3.991

Project: 175667029			Source: S-6, 20.0'-20.5'								Lab ID: 36C		Test ID		
Test Time (min)	Corr. Axial Load (lbf)	Axial Deform. (in)	Axial Strain (%)	Corr. Area (in^2)	Deviator Stress (tsf)	Corr. Deviator Stress (tsf)	Pore Pressure (tsf)	Induced Pore Pressure (tsf)	σ_1 (tsf)	σ_1' (tsf)	σ_3' (tsf)	p (tsf)	p' (tsf)	q (tsf)	Eff. Princ. Stress Ratio σ_1'/σ_3'
114.3	372.5	0.609	10.80	6.379	4.205	4.177	5.103	0.244	5.798	5.554	1.377	3.709	3.466	2.088	4.032
115.3	375.3	0.615	10.90	6.386	4.231	4.203	5.075	0.216	5.824	5.608	1.405	3.723	3.507	2.102	3.992
116.4	377.8	0.620	11.00	6.394	4.254	4.226	5.084	0.225	5.847	5.621	1.396	3.734	3.509	2.113	4.028
117.5	379.7	0.626	11.10	6.401	4.271	4.243	5.057	0.198	5.864	5.666	1.423	3.742	3.545	2.121	3.981
118.6	381.7	0.632	11.20	6.408	4.289	4.260	5.068	0.209	5.881	5.672	1.412	3.751	3.542	2.130	4.018
119.6	383.1	0.637	11.30	6.415	4.300	4.271	5.039	0.180	5.892	5.712	1.441	3.756	3.576	2.135	3.964
120.7	385.7	0.643	11.40	6.422	4.324	4.294	5.048	0.189	5.915	5.727	1.432	3.768	3.580	2.147	3.998
121.8	388.6	0.649	11.50	6.430	4.351	4.322	5.024	0.165	5.943	5.778	1.456	3.782	3.617	2.161	3.968
122.9	391.4	0.654	11.60	6.437	4.378	4.348	5.031	0.172	5.969	5.797	1.449	3.795	3.623	2.174	4.000
123.9	394.6	0.660	11.70	6.444	4.409	4.379	5.006	0.148	6.000	5.853	1.474	3.811	3.663	2.190	3.972
125.0	397.1	0.666	11.80	6.451	4.432	4.402	5.012	0.153	6.023	5.870	1.468	3.822	3.669	2.201	3.997
126.1	399.8	0.671	11.90	6.459	4.457	4.426	4.986	0.127	6.047	5.920	1.494	3.834	3.707	2.213	3.963
127.2	403.2	0.677	12.00	6.466	4.490	4.459	4.996	0.137	6.080	5.943	1.484	3.850	3.714	2.229	4.004
128.2	405.9	0.682	12.10	6.473	4.514	4.483	4.976	0.117	6.104	5.987	1.504	3.863	3.746	2.242	3.981
129.3	408.2	0.688	12.20	6.481	4.535	4.503	4.980	0.121	6.124	6.003	1.500	3.873	3.751	2.252	4.003
130.4	410.4	0.694	12.30	6.488	4.555	4.523	4.959	0.100	6.144	6.044	1.521	3.883	3.783	2.261	3.973
131.5	413.2	0.700	12.40	6.496	4.579	4.548	4.963	0.104	6.169	6.065	1.517	3.895	3.791	2.274	3.997
132.6	414.4	0.705	12.50	6.503	4.588	4.556	4.944	0.085	6.177	6.092	1.536	3.899	3.814	2.278	3.967
133.6	416.6	0.711	12.60	6.511	4.607	4.574	4.947	0.088	6.196	6.107	1.533	3.908	3.820	2.287	3.984
134.7	417.8	0.716	12.70	6.518	4.615	4.583	4.933	0.074	6.204	6.130	1.547	3.912	3.839	2.291	3.961
135.8	418.8	0.722	12.80	6.526	4.621	4.589	4.929	0.070	6.210	6.139	1.551	3.915	3.845	2.294	3.959
136.9	420.4	0.728	12.90	6.533	4.634	4.600	4.915	0.056	6.221	6.165	1.565	3.921	3.865	2.300	3.940
138.0	423.4	0.733	13.00	6.541	4.661	4.627	4.914	0.055	6.248	6.194	1.566	3.935	3.880	2.314	3.954
139.0	425.5	0.739	13.10	6.548	4.679	4.645	4.905	0.046	6.266	6.220	1.575	3.944	3.897	2.323	3.950
140.1	427.8	0.745	13.20	6.556	4.698	4.664	4.901	0.042	6.285	6.243	1.579	3.953	3.911	2.332	3.954
141.2	430.4	0.750	13.30	6.563	4.721	4.687	4.893	0.034	6.308	6.274	1.587	3.965	3.930	2.344	3.954
142.3	432.2	0.756	13.40	6.571	4.736	4.702	4.884	0.025	6.323	6.298	1.596	3.972	3.947	2.351	3.946
143.4	434.2	0.761	13.50	6.578	4.752	4.717	4.882	0.023	6.338	6.315	1.598	3.980	3.956	2.359	3.953
144.4	435.3	0.767	13.60	6.586	4.759	4.724	4.866	0.007	6.345	6.338	1.614	3.983	3.976	2.362	3.928
145.5	437.7	0.773	13.70	6.594	4.779	4.744	4.873	0.014	6.365	6.351	1.607	3.993	3.979	2.372	3.952
146.6	439.3	0.778	13.80	6.601	4.792	4.756	4.851	-0.008	6.377	6.386	1.629	3.999	4.007	2.378	3.919
147.6	441.4	0.784	13.90	6.609	4.809	4.774	4.862	0.003	6.395	6.392	1.618	4.008	4.005	2.387	3.950
148.7	444.7	0.790	14.00	6.617	4.839	4.803	4.838	-0.021	6.424	6.446	1.642	4.023	4.044	2.402	3.925
149.8	446.7	0.795	14.10	6.624	4.855	4.819	4.850	-0.009	6.440	6.449	1.630	4.030	4.040	2.409	3.956
150.9	448.3	0.801	14.20	6.632	4.866	4.830	4.823	-0.036	6.451	6.487	1.657	4.036	4.072	2.415	3.914
151.9	450.8	0.807	14.30	6.640	4.888	4.852	4.837	-0.022	6.473	6.495	1.643	4.047	4.069	2.426	3.953
153.0	452.9	0.812	14.40	6.647	4.905	4.868	4.815	-0.044	6.489	6.534	1.665	4.055	4.099	2.434	3.923
154.1	455.5	0.818	14.50	6.655	4.928	4.890	4.824	-0.035	6.511	6.546	1.656	4.066	4.101	2.445	3.953
155.1	457.6	0.824	14.60	6.663	4.945	4.907	4.803	-0.056	6.528	6.584	1.677	4.075	4.131	2.454	3.926
156.2	459.6	0.829	14.70	6.671	4.961	4.923	4.817	-0.042	6.544	6.586	1.663	4.083	4.124	2.462	3.960
157.2	460.9	0.835	14.80	6.679	4.968	4.930	4.788	-0.071	6.551	6.622	1.692	4.086	4.157	2.465	3.914
158.3	462.8	0.840	14.90	6.686	4.983	4.945	4.806	-0.053	6.566	6.619	1.674	4.093	4.146	2.472	3.954
159.4	464.2	0.846	15.01	6.695	4.993	4.954	4.782	-0.077	6.575	6.653	1.698	4.098	4.175	2.477	3.917
160.4	465.4	0.852	15.10	6.702	5.000	4.961	4.797	-0.062	6.582	6.644	1.683	4.102	4.163	2.481	3.948
161.5	467.4	0.857	15.20	6.710	5.016	4.977	4.771	-0.088	6.598	6.686	1.709	4.109	4.197	2.488	3.912
162.5	469.9	0.863	15.30	6.718	5.037	4.997	4.784	-0.075	6.618	6.693	1.696	4.120	4.195	2.499	3.946
163.6	471.8	0.869	15.40	6.726	5.050	5.010	4.762	-0.097	6.631	6.728	1.718	4.126	4.223	2.505	3.917
164.7	474.1	0.874	15.50	6.734	5.069	5.029	4.775	-0.084	6.650	6.734	1.705	4.136	4.219	2.515	3.950
165.7	475.7	0.880	15.60	6.742	5.080	5.040	4.754	-0.105	6.661	6.767	1.726	4.141	4.246	2.520	3.920
166.8	476.8	0.886	15.70	6.750	5.086	5.045	4.767	-0.092	6.666	6.758	1.713	4.144	4.236	2.523	3.945
167.8	478.1	0.891	15.80	6.758	5.093	5.053	4.743	-0.116	6.674	6.790	1.737	4.147	4.263	2.526	3.909
168.9	480.2	0.897	15.90	6.766	5.110	5.069	4.757	-0.102	6.690	6.791	1.723	4.155	4.257	2.534	3.942
169.9	481.2	0.902	16.00	6.774	5.114	5.073	4.736	-0.122	6.694	6.817	1.744	4.158	4.280	2.537	3.910
171.0	482.1	0.908	16.10	6.782	5.118	5.077	4.744	-0.115	6.698	6.813	1.736	4.159	4.274	2.538	3.924
172.0	483.0	0.914	16.20	6.790	5.121	5.080	4.727	-0.132	6.701	6.832	1.753	4.161	4.292	2.540	3.898
173.1	484.3	0.919	16.30	6.798	5.129	5.087	4.736	-0.123	6.708	6.832	1.744	4.165	4.288	2.544	3.917
174.1	485.4	0.925	16.40	6.806	5.135	5.093	4.725	-0.134	6.714	6.848	1.755	4.167	4.302	2.546	3.902
175.2	487.4	0.931	16.50	6.815	5.150	5.108	4.723	-0.136	6.729	6.865	1.757	4.175	4.311	2.554	3.907
176.2	488.6	0.936	16.60	6.823	5.156	5.114	4.721	-0.138	6.735	6.872	1.759	4.178	4.315	2.557	3.908
177.3	491.1	0.942	16.70	6.831	5.176	5.133	4.709	-0.150	6.754	6.904	1.771	4.188	4.337	2.567	3.899
178.3	493.6	0.948	16.80	6.839	5.197	5.154	4.715	-0.144	6.775	6.919	1.765	4.198	4.342	2.577	3.920
179.4	495.0	0.953	16.90	6.847	5.205	5.162	4.700	-0.159	6.783	6.941	1.780	4.202	4.360	2.581	3.900
180.4	496.8	0.959	17.00	6.856	5.218	5.174	4.712	-0.147	6.795	6.942	1.768	4.208	4.355	2.587	3.926
181.5	498.3	0.964	17.10	6.864	5.227	5.183	4.689	-0.170	6.804	6.974	1.791	4.212	4.383	2.591	3.893

ATTACHMENT C.4
CONSOLIDATION TESTING

Stantec

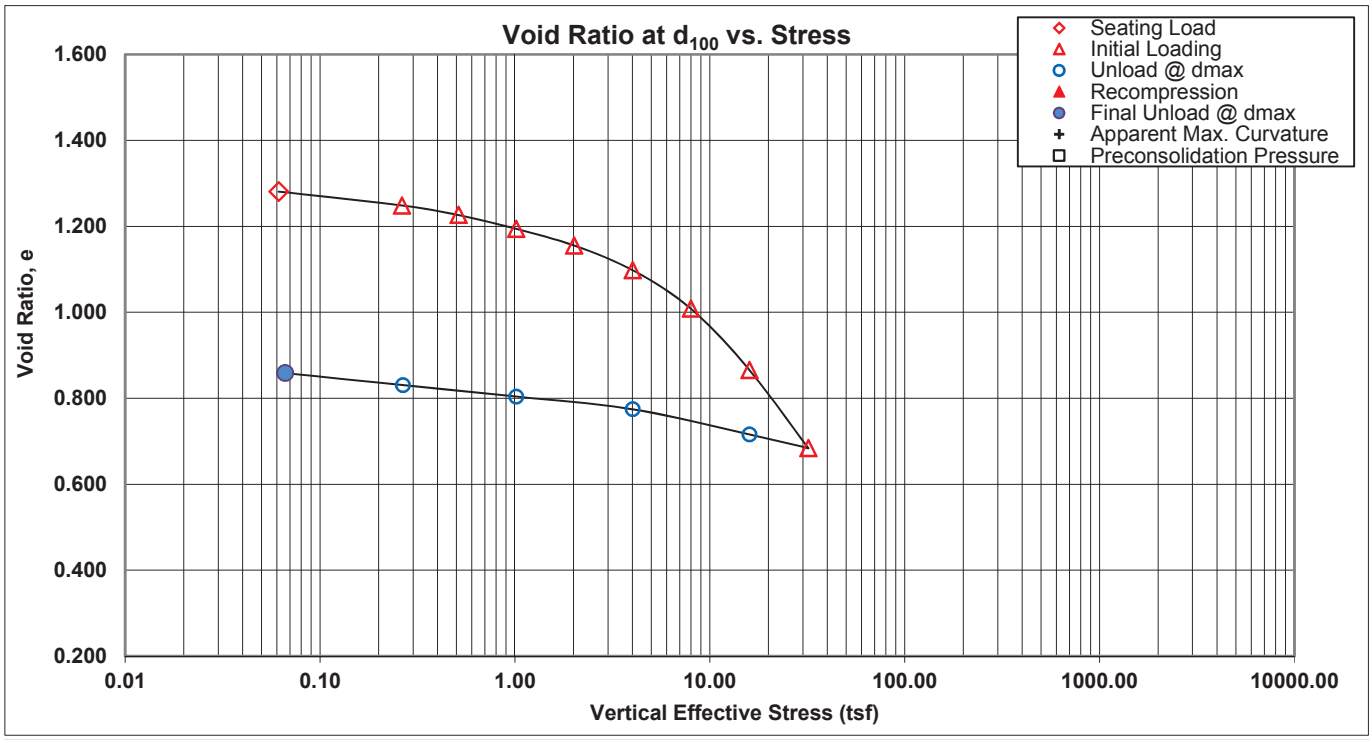
One Dimensional Consolidation of Soils Using Incremental Loading

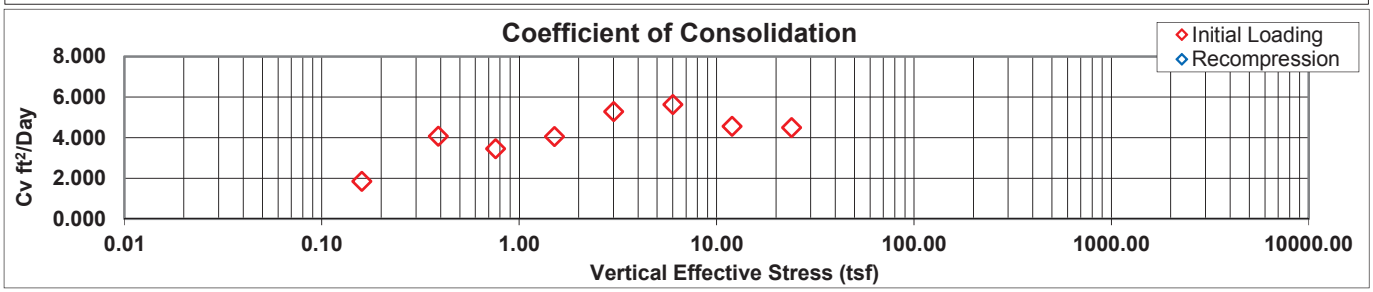
ASTM D 2435

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-1, 35.45'-35.7'	Lab ID	29
Description	Silt with Sand (ML), dark gray, wet, very soft	Date Received	07/05/2017
Specimen Type	Undisturbed		

LL	N/A	Specific Gravity	2.53	ASTM D 854, A	Prepared: Using Cutting Ring
PL	N/A				Test Method: B - for 60 min.
PI	N/A				Test Condition: Inundated at 0.05 tsf

Initial Specimen Conditions		Final Specimen Conditions	
Moisture Content (%)	49.8	Moisture Content (%)	35.9
Dry Unit Weight (pcf)	69.1	Dry Unit Weight (pcf)	84.8
Void Ratio	1.281	Void Ratio	0.859
Degree of Saturation (%)	98.4	Degree of Saturation (%)	105.7
Initial Specimen Height (in)	0.9919	Final Specimen Height (in)	0.8083
Equivalent Height of Solids (in)	0.435	Preconsolidation Pressure* (tsf)	
		Void Ratio @ Preconsolidation Pressure	





Comments: Oven dried at 60° C

Reviewed By: KG

Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Project No.: 175667029
Source: S-1, 35.45'-35.7'
Lab ID: 29
Description: Silt with Sand (ML), dark gray, wet, very soft
Date Received: 07/05/2017
Specimen Type: Undisturbed

Load Increment tsf σ_v	Specimen Height (in) @ d_0	Specimen Height (in) @ d_{100}	Void Ratio e @ d_{100}	Specimen Height (in) @ d_{max}	Void Ratio e @ d_{max}	Load At Cv tsf	Specimen Height (in) @ d_{50}	Fitting Time** (min) @ t_{50}	Fitting Time** (min) @ t_{90}	Cv ft^2/day
0.06	0.9919	----	----	----	----	----	----	----	----	----
0.26	0.9810	0.9778	1.249	0.9765	1.246	0.16	0.9794		1.1	1.845
0.51	0.9702	0.9682	1.226	0.9655	1.220	0.39	0.9692		0.5	4.064
1.01	0.9570	0.9542	1.194	0.9516	1.188	0.76	0.9556		0.6	3.442
2.02	0.9406	0.9373	1.155	0.9342	1.148	1.51	0.9389		0.5	4.042
4.01	0.9195	0.9124	1.098	0.9087	1.089	3.02	0.9160		0.3	5.287
8.01	0.8850	0.8733	1.008	0.8662	0.992	6.01	0.8792		0.3	5.619
16.00	0.8300	0.8112	0.865	0.8035	0.848	12.01	0.8206		0.3	4.552
32.01	0.7520	0.7323	0.684	0.7225	0.661	24.01	0.7421		0.3	4.489
16.01	0.7333			0.7462	0.716					
4.01	0.7565			0.7718	0.775					
1.02	0.7761			0.7845	0.804					
0.27	0.7879			0.7961	0.831					
0.07	0.7990			0.8083	0.859					

Testing Details:

Consolidation Press ID: CON-5
Trimming Ring ID: GS-91
Initial MC from Trimmings (%): 52.1
Final Differential Height (in): -0.034
Test Start Date: 07/24/2017
Technician: KG
Test End Date: 07/25/2017
Technician: KG

When available, all other tests performed in association with this specimen are reported separately.
* When presented, The preconsolidation pressure evaluated using the Cassagrande Method, as per ASTM D 2435.
** Cv Computation Methods:

@ t_{50}, Cv calculated using Log Time Method.

@ t_{90}, Cv calculated using Square Root of Time Method.

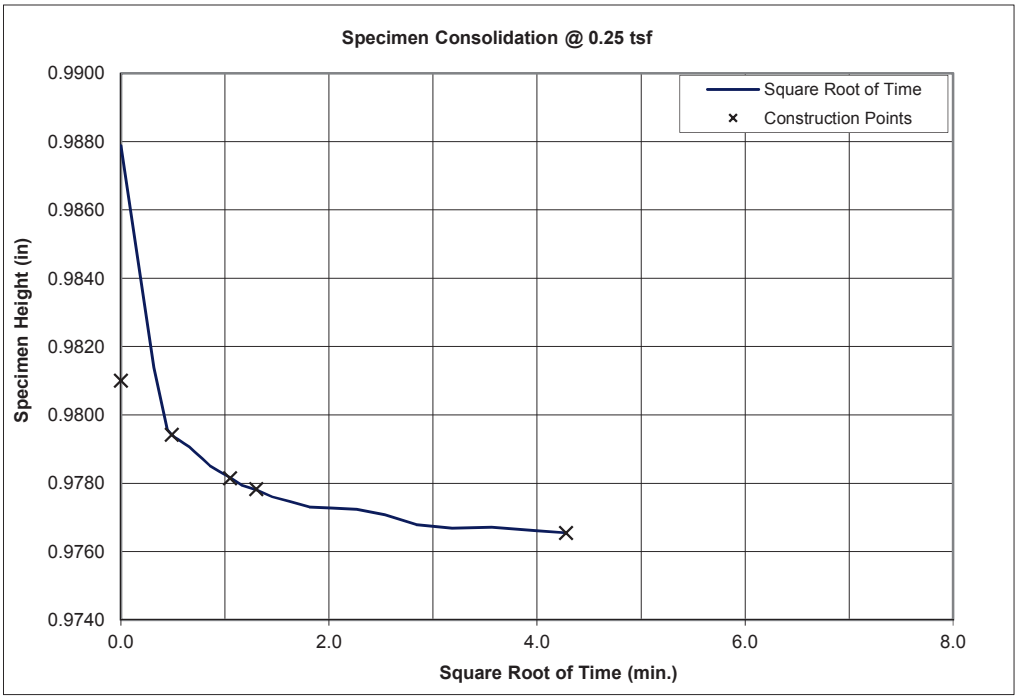
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	0.25
Actual Load (tsf)	0.26
Cycle	Load
Start Date	07/24/2017
Start Time	8:49
End Date	07/24/2017
End Time	9:07



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.9810
@ t_{50}	0.2	0.9794
@ t_{90}	1.1	0.9781
@ t_{100}	1.7	0.9778
@ t_{max}	18.3	0.9765

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.9879						
0.32	0.9814						
0.45	0.9796						
0.48	0.9794						
0.52	0.9793						
0.55	0.9793						
0.61	0.9792						
0.66	0.9791						
0.71	0.9789						
0.79	0.9787						
0.86	0.9785						
0.95	0.9783						
1.06	0.9782						
1.17	0.9779						
1.30	0.9778						
1.45	0.9776						
1.62	0.9775						
1.81	0.9773						
2.02	0.9773						
2.27	0.9772						
2.54	0.9771						
2.84	0.9768						
3.18	0.9767						
3.57	0.9767						
4.00	0.9766						
4.3	0.9765						

Comments

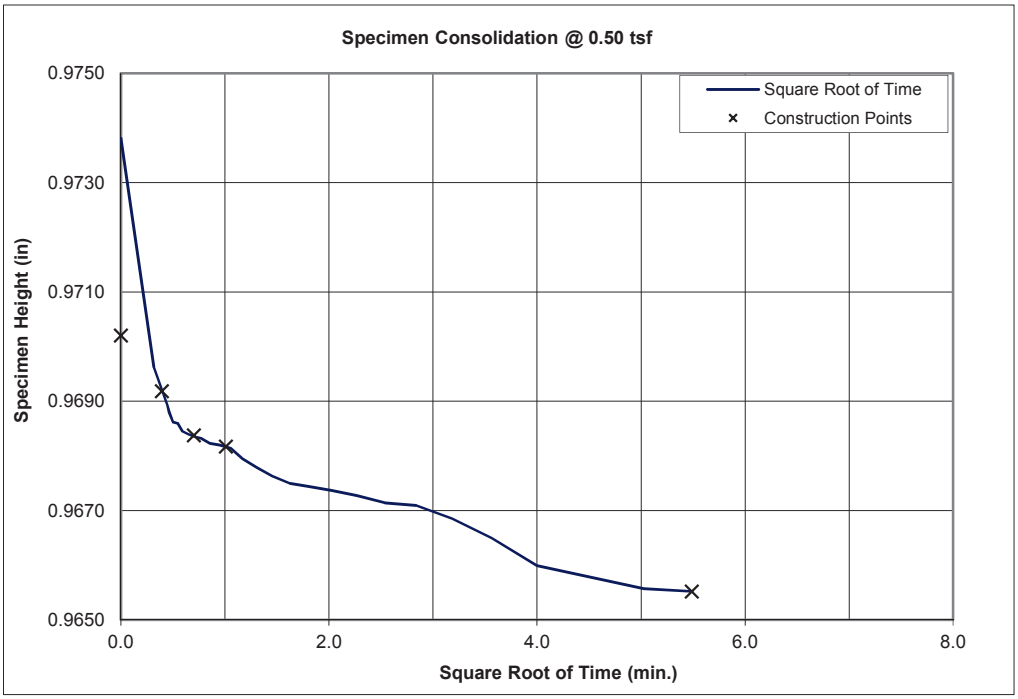
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	0.5
Actual Load (tsf)	0.51
Cycle	Load
Start Date	07/24/2017
Start Time	9:07
End Date	07/24/2017
End Time	9:37



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.9702
@ t_{50}	0.2	0.9692
@ t_{90}	0.5	0.9684
@ t_{100}	1.0	0.9682
@ t_{max}	30.1	0.9655

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.9738	5.02	0.9656				
0.32	0.9696	5.49	0.9655				
0.45	0.9689						
0.47	0.9688						
0.50	0.9686						
0.55	0.9686						
0.59	0.9685						
0.65	0.9684						
0.71	0.9684						
0.77	0.9683						
0.86	0.9682						
0.95	0.9682						
1.06	0.9681						
1.17	0.9680						
1.30	0.9678						
1.45	0.9676						
1.62	0.9675						
1.81	0.9674						
2.02	0.9674						
2.27	0.9673						
2.54	0.9671						
2.84	0.9671						
3.18	0.9669						
3.57	0.9665						
4.00	0.9660						
4.5	0.9657						

Comments

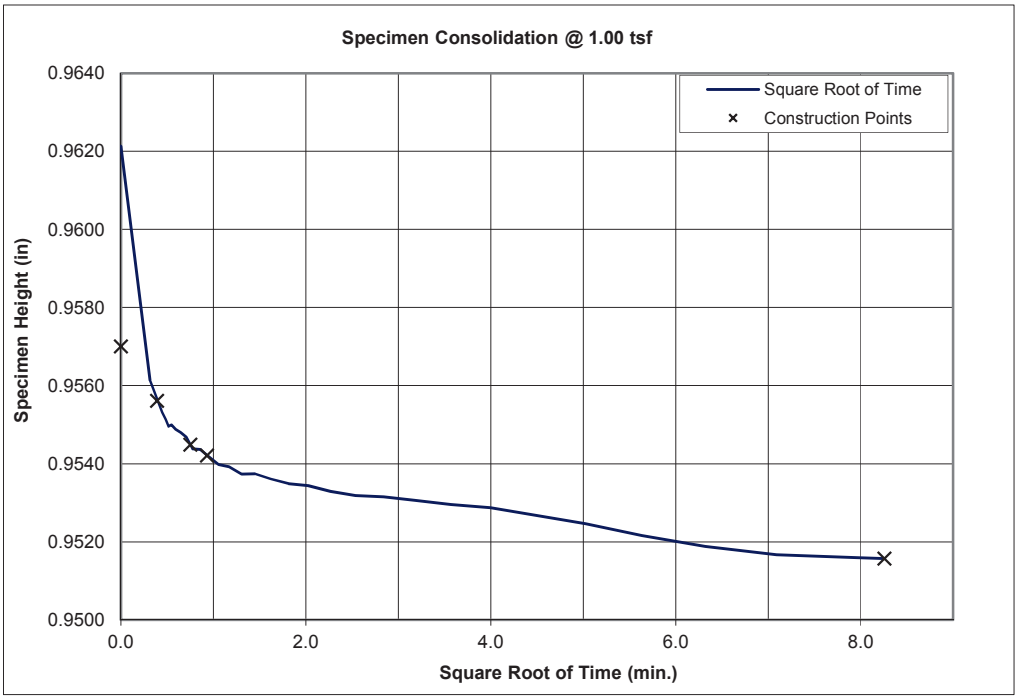
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	1
Actual Load (tsf)	1.01
Cycle	Load
Start Date	07/24/2017
Start Time	9:37
End Date	07/24/2017
End Time	10:45



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.9570
@ t_{50}	0.2	0.9556
@ t_{90}	0.6	0.9545
@ t_{100}	0.9	0.9542
@ t_{max}	68.2	0.9516

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.9621	5.02	0.9525				
0.32	0.9561	5.63	0.9522				
0.45	0.9553	6.32	0.9519				
0.48	0.9551	7.09	0.9517				
0.52	0.9550	7.95	0.9516				
0.55	0.9550	8.26	0.9516				
0.59	0.9549						
0.65	0.9548						
0.71	0.9547						
0.77	0.9544						
0.86	0.9544						
0.95	0.9542						
1.06	0.9540						
1.17	0.9539						
1.30	0.9537						
1.45	0.9537						
1.62	0.9536						
1.81	0.9535						
2.02	0.9534						
2.27	0.9533						
2.54	0.9532						
2.84	0.9531						
3.18	0.9531						
3.57	0.9530						
4.00	0.9529						
4.5	0.9527						

Comments

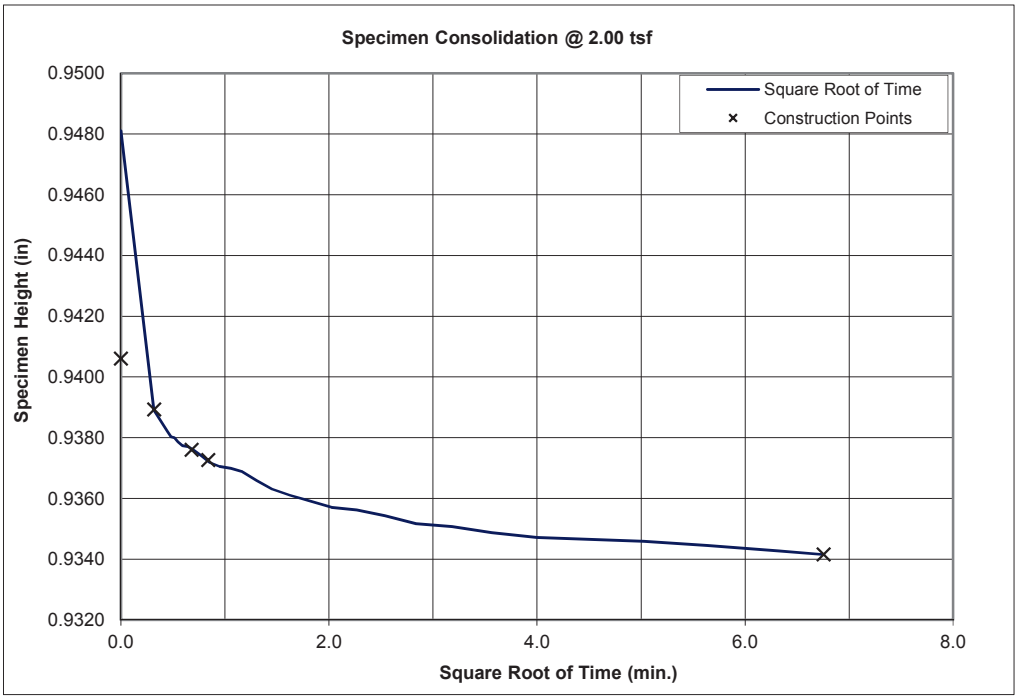
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	2
Actual Load (tsf)	2.02
Cycle	Load
Start Date	07/24/2017
Start Time	10:45
End Date	07/24/2017
End Time	11:31



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.9406
@ t_{50}	0.1	0.9389
@ t_{90}	0.5	0.9376
@ t_{100}	0.7	0.9373
@ t_{max}	45.6	0.9342

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.9481	5.02	0.9346				
0.32	0.9389	5.63	0.9345				
0.45	0.9382	6.32	0.9343				
0.48	0.9380	6.76	0.9342				
0.52	0.9380						
0.55	0.9379						
0.59	0.9377						
0.65	0.9377						
0.71	0.9376						
0.77	0.9374						
0.86	0.9372						
0.95	0.9370						
1.06	0.9370						
1.17	0.9369						
1.30	0.9366						
1.45	0.9363						
1.62	0.9361						
1.81	0.9359						
2.02	0.9357						
2.27	0.9356						
2.54	0.9354						
2.84	0.9352						
3.18	0.9351						
3.57	0.9349						
4.00	0.9347						
4.5	0.9347						

Comments

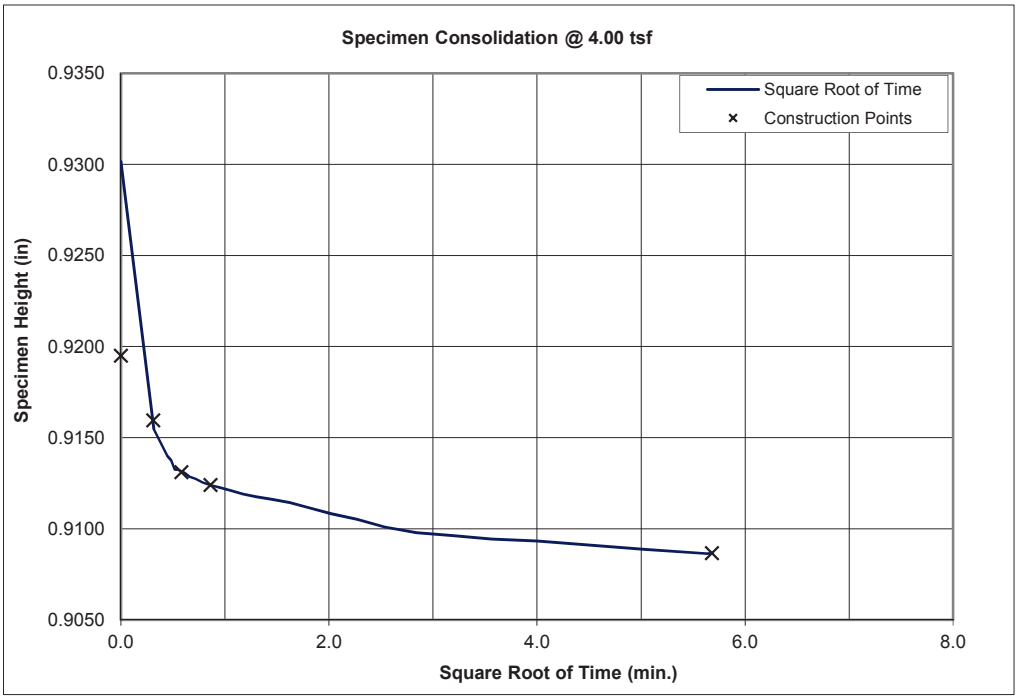
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	4
Actual Load (tsf)	4.01
Cycle	Load
Start Date	07/24/2017
Start Time	11:31
End Date	07/24/2017
End Time	12:03



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.9195
@ t_{50}	0.1	0.9160
@ t_{90}	0.3	0.9131
@ t_{100}	0.7	0.9124
@ t_{max}	32.3	0.9087

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.9302	5.02	0.9089				
0.32	0.9155	5.64	0.9086				
0.45	0.9140	5.68	0.9087				
0.48	0.9138						
0.52	0.9133						
0.55	0.9132						
0.61	0.9131						
0.66	0.9129						
0.72	0.9127						
0.79	0.9126						
0.87	0.9124						
0.96	0.9122						
1.06	0.9121						
1.18	0.9119						
1.30	0.9118						
1.45	0.9116						
1.62	0.9114						
1.81	0.9111						
2.02	0.9108						
2.27	0.9105						
2.54	0.9101						
2.84	0.9098						
3.18	0.9096						
3.57	0.9094						
4.00	0.9093						
4.5	0.9092						

Comments

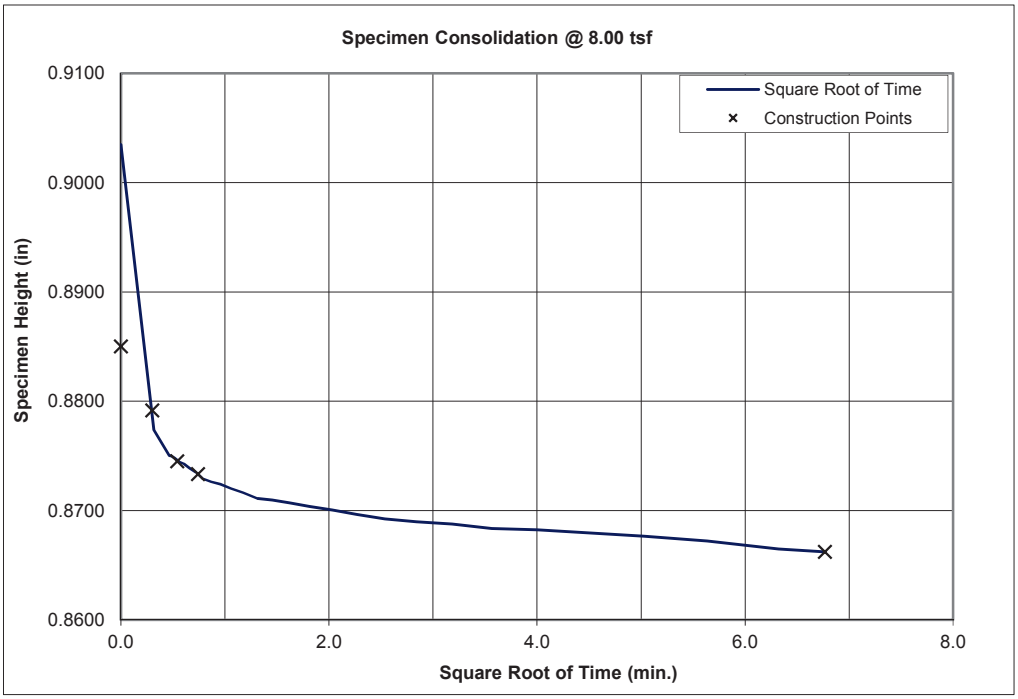
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	8
Actual Load (tsf)	8.01
Cycle	Load
Start Date	07/24/2017
Start Time	12:03
End Date	07/24/2017
End Time	12:49



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.8850
@ t_{50}	0.1	0.8792
@ t_{90}	0.3	0.8745
@ t_{100}	0.5	0.8733
@ t_{max}	45.8	0.8662

Square Root of Time (min)	Spec. Height (in)
0.00	0.9035
0.32	0.8774
0.47	0.8750
0.48	0.8750
0.52	0.8748
0.56	0.8745
0.61	0.8743
0.66	0.8739
0.72	0.8735
0.79	0.8729
0.87	0.8726
0.96	0.8724
1.06	0.8720
1.18	0.8716
1.31	0.8711
1.45	0.8710
1.62	0.8707
1.81	0.8704
2.03	0.8701
2.27	0.8696
2.54	0.8692
2.84	0.8690
3.18	0.8688
3.57	0.8684
4.00	0.8683
4.5	0.8680
5.03	0.8677
5.64	0.8672
6.32	0.8665
6.77	0.8662

Comments

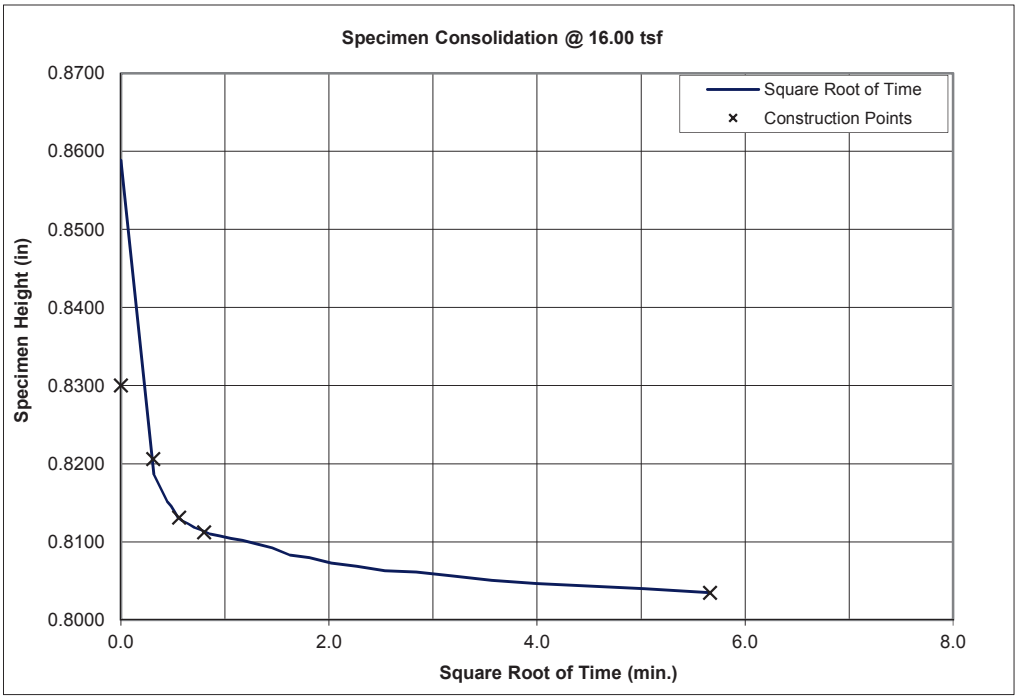
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	16
Actual Load (tsf)	16.00
Cycle	Load
Start Date	07/24/2017
Start Time	12:49
End Date	07/24/2017
End Time	13:21



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.8300
@ t_{50}	0.1	0.8206
@ t_{90}	0.3	0.8131
@ t_{100}	0.6	0.8112
@ t_{max}	32.1	0.8035

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.8589	5.02	0.8040				
0.32	0.8186	5.63	0.8035				
0.45	0.8151	5.66	0.8035				
0.48	0.8146						
0.52	0.8138						
0.55	0.8132						
0.59	0.8127						
0.65	0.8123						
0.71	0.8118						
0.77	0.8115						
0.86	0.8110						
0.95	0.8108						
1.06	0.8104						
1.17	0.8102						
1.30	0.8097						
1.45	0.8092						
1.62	0.8083						
1.81	0.8080						
2.02	0.8073						
2.27	0.8069						
2.54	0.8063						
2.84	0.8061						
3.18	0.8056						
3.57	0.8050						
4.00	0.8046						
4.5	0.8045						

Comments

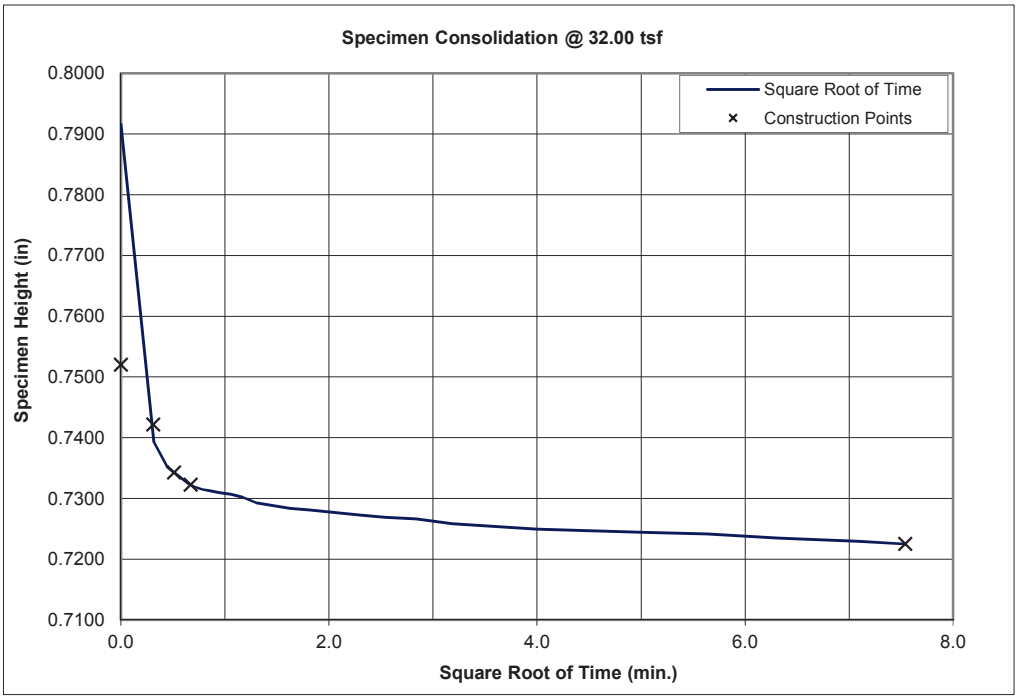
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	32
Actual Load (tsf)	32.01
Cycle	Load
Start Date	07/24/2017
Start Time	13:21
End Date	07/24/2017
End Time	14:18



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.7520
@ t_{50}	0.1	0.7421
@ t_{90}	0.3	0.7343
@ t_{100}	0.4	0.7323
@ t_{max}	56.8	0.7225

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.7916	5.02	0.7244				
0.32	0.7393	5.63	0.7241				
0.45	0.7352	6.32	0.7235				
0.48	0.7346	7.09	0.7230				
0.52	0.7342	7.54	0.7225				
0.55	0.7338						
0.59	0.7332						
0.65	0.7325						
0.71	0.7319						
0.79	0.7315						
0.86	0.7312						
0.95	0.7309						
1.06	0.7307						
1.17	0.7302						
1.30	0.7293						
1.45	0.7288						
1.62	0.7284						
1.81	0.7281						
2.02	0.7278						
2.27	0.7273						
2.54	0.7269						
2.84	0.7266						
3.18	0.7258						
3.57	0.7254						
4.00	0.7249						
4.5	0.7246						

Comments

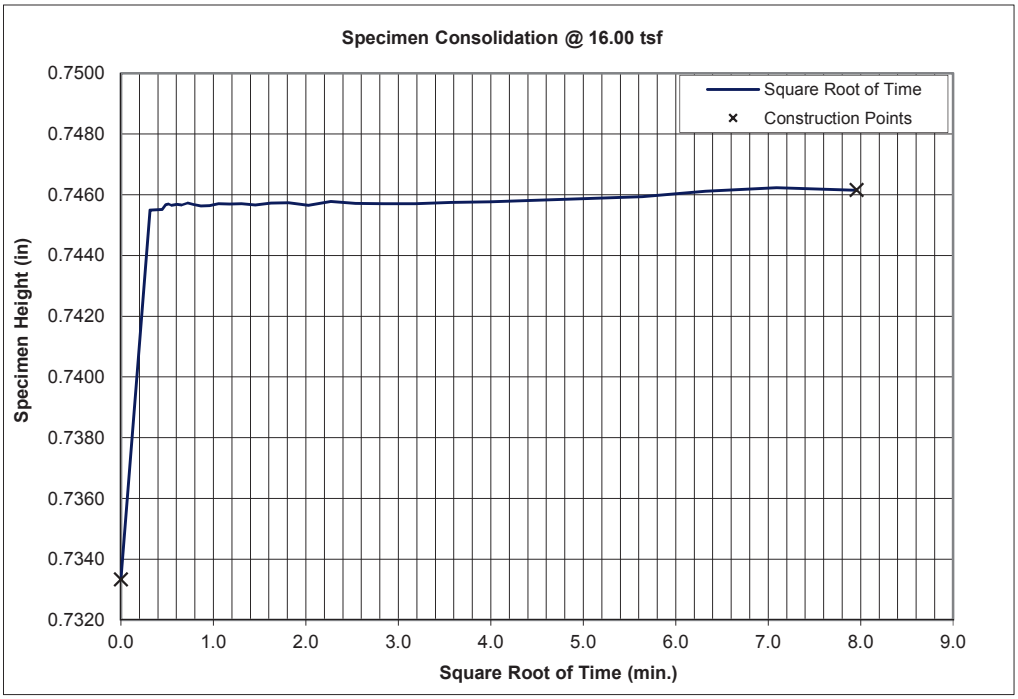
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	16
Actual Load (tsf)	16.01
Cycle	Unload
Start Date	07/24/2017
Start Time	14:18
End Date	07/24/2017
End Time	15:21



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.7333
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	63.3	0.7462

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.7333	5.03	0.7459				
0.32	0.7455	5.64	0.7459				
0.45	0.7455	6.32	0.7461				
0.48	0.7457	7.09	0.7462				
0.52	0.7457	7.95	0.7461				
0.55	0.7457	7.96	0.7462				
0.61	0.7457						
0.66	0.7457						
0.72	0.7457						
0.79	0.7457						
0.87	0.7456						
0.96	0.7456						
1.06	0.7457						
1.18	0.7457						
1.30	0.7457						
1.45	0.7457						
1.62	0.7457						
1.81	0.7457						
2.03	0.7457						
2.27	0.7458						
2.54	0.7457						
2.84	0.7457						
3.18	0.7457						
3.57	0.7457						
4.00	0.7458						
4.5	0.7458						

Comments

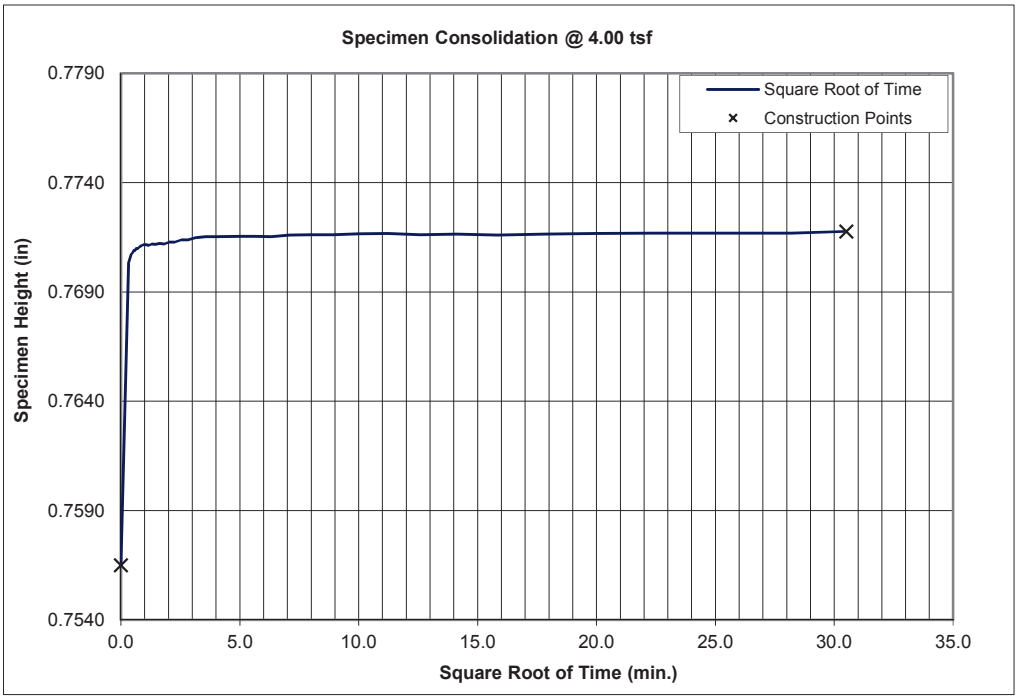
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	4
Actual Load (tsf)	4.01
Cycle	Unload
Start Date	07/24/2017
Start Time	15:21
End Date	07/25/2017
End Time	6:52



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.7565
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	931.1	0.7718

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.7565	5.02	0.7715				
0.32	0.7703	5.63	0.7715				
0.45	0.7707	6.32	0.7715				
0.48	0.7708	7.09	0.7716				
0.52	0.7708	7.95	0.7716				
0.55	0.7709	8.92	0.7716				
0.59	0.7709	10.01	0.7717				
0.65	0.7710	11.23	0.7717				
0.71	0.7710	12.59	0.7716				
0.79	0.7711	14.13	0.7716				
0.86	0.7711	15.85	0.7716				
0.95	0.7712	17.79	0.7716				
1.06	0.7712	19.96	0.7717				
1.17	0.7711	22.39	0.7717				
1.30	0.7712	25.12	0.7717				
1.45	0.7712	28.19	0.7717				
1.62	0.7712	30.51	0.7718				
1.81	0.7712						
2.02	0.7713						
2.27	0.7713						
2.54	0.7714						
2.84	0.7714						
3.18	0.7715						
3.57	0.7715						
4.00	0.7715						
4.5	0.7716						

Comments

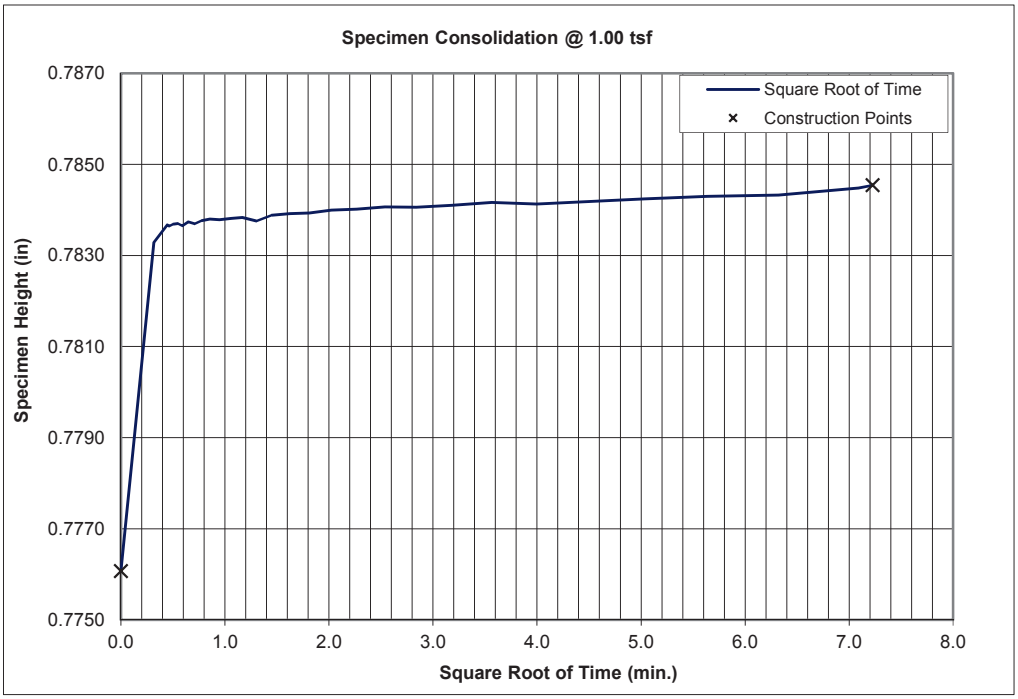
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	1
Actual Load (tsf)	1.02
Cycle	Unload
Start Date	07/25/2017
Start Time	6:52
End Date	07/25/2017
End Time	7:44



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.7761
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	52.2	0.7845

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.7761	5.02	0.7842				
0.32	0.7833	5.63	0.7843				
0.45	0.7837	6.32	0.7843				
0.47	0.7836	7.09	0.7845				
0.50	0.7837	7.22	0.7845				
0.55	0.7837						
0.59	0.7837						
0.65	0.7837						
0.71	0.7837						
0.77	0.7838						
0.86	0.7838						
0.95	0.7838						
1.06	0.7838						
1.17	0.7838						
1.30	0.7838						
1.45	0.7839						
1.62	0.7839						
1.81	0.7839						
2.02	0.7840						
2.27	0.7840						
2.54	0.7841						
2.84	0.7841						
3.18	0.7841						
3.57	0.7842						
4.00	0.7841						
4.5	0.7842						

Comments

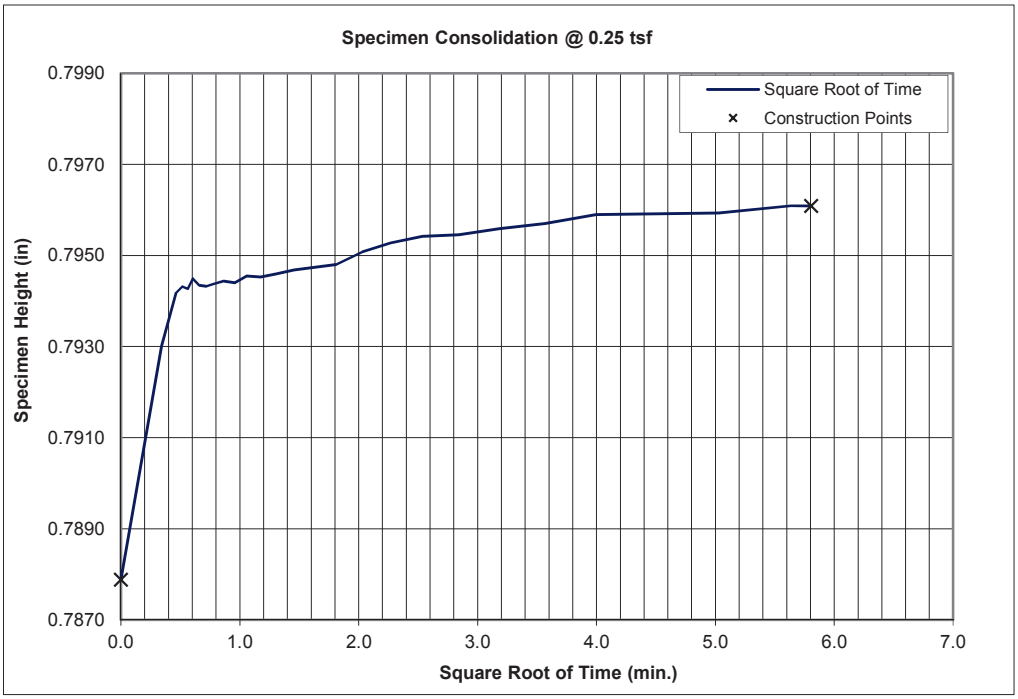
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	0.25
Actual Load (tsf)	0.27
Cycle	Unload
Start Date	07/25/2017
Start Time	7:44
End Date	07/25/2017
End Time	8:18



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.7879
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	33.7	0.7961

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.7879	5.03	0.7959				
0.34	0.7930	5.64	0.7961				
0.47	0.7942	5.81	0.7961				
0.48	0.7942						
0.52	0.7943						
0.56	0.7943						
0.61	0.7945						
0.66	0.7943						
0.72	0.7943						
0.79	0.7944						
0.87	0.7944						
0.96	0.7944						
1.06	0.7945						
1.18	0.7945						
1.31	0.7946						
1.45	0.7947						
1.62	0.7947						
1.81	0.7948						
2.03	0.7951						
2.27	0.7953						
2.54	0.7954						
2.84	0.7955						
3.18	0.7956						
3.57	0.7957						
4.00	0.7959						
4.5	0.7959						

Comments

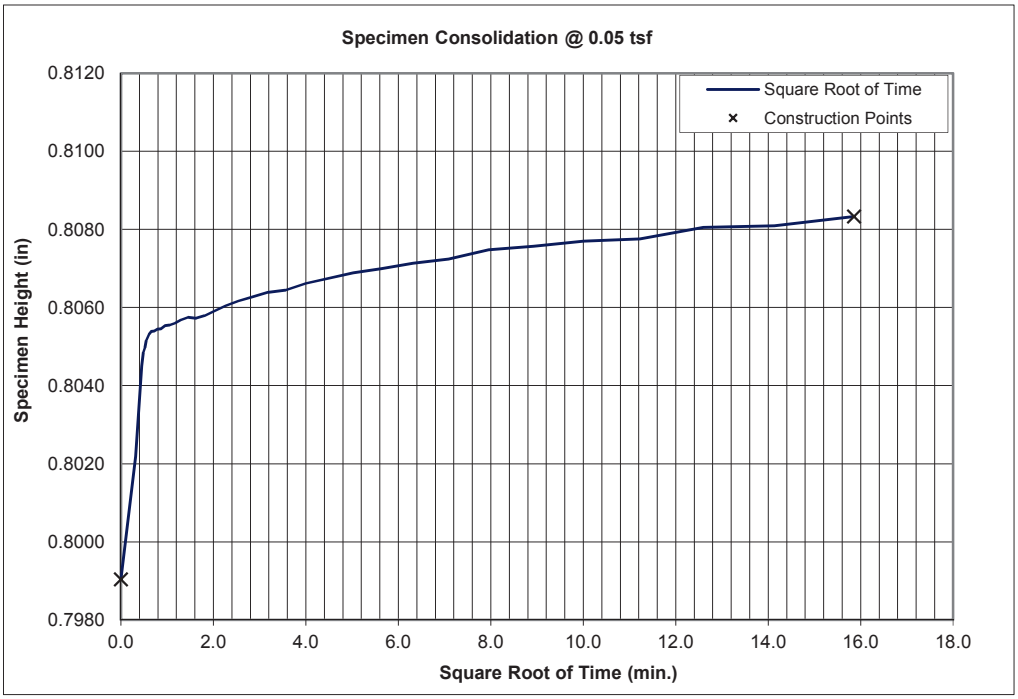
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-1, 35.45'-35.7'
Description: Silt with Sand (ML), dark gray, wet, very soft

Project No.	175667029
Lab ID	29
Nominal Load (tsf)	0.05
Actual Load (tsf)	0.07
Cycle	Final
Start Date	07/25/2017
Start Time	8:18
End Date	07/25/2017
End Time	12:30



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.7990
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	251.3	0.8083

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.7990	5.02	0.8069				
0.32	0.8022	5.63	0.8070				
0.45	0.8045	6.32	0.8071				
0.48	0.8048	7.09	0.8072				
0.52	0.8050	7.95	0.8075				
0.55	0.8051	8.92	0.8076				
0.61	0.8053	10.01	0.8077				
0.66	0.8054	11.23	0.8078				
0.72	0.8054	12.59	0.8081				
0.79	0.8054	14.13	0.8081				
0.87	0.8055	15.85	0.8083				
0.96	0.8055						
1.06	0.8056						
1.18	0.8056						
1.30	0.8057						
1.45	0.8058						
1.62	0.8057						
1.81	0.8058						
2.02	0.8059						
2.27	0.8060						
2.54	0.8062						
2.84	0.8063						
3.18	0.8064						
3.57	0.8064						
4.00	0.8066						
4.5	0.8067						

Comments

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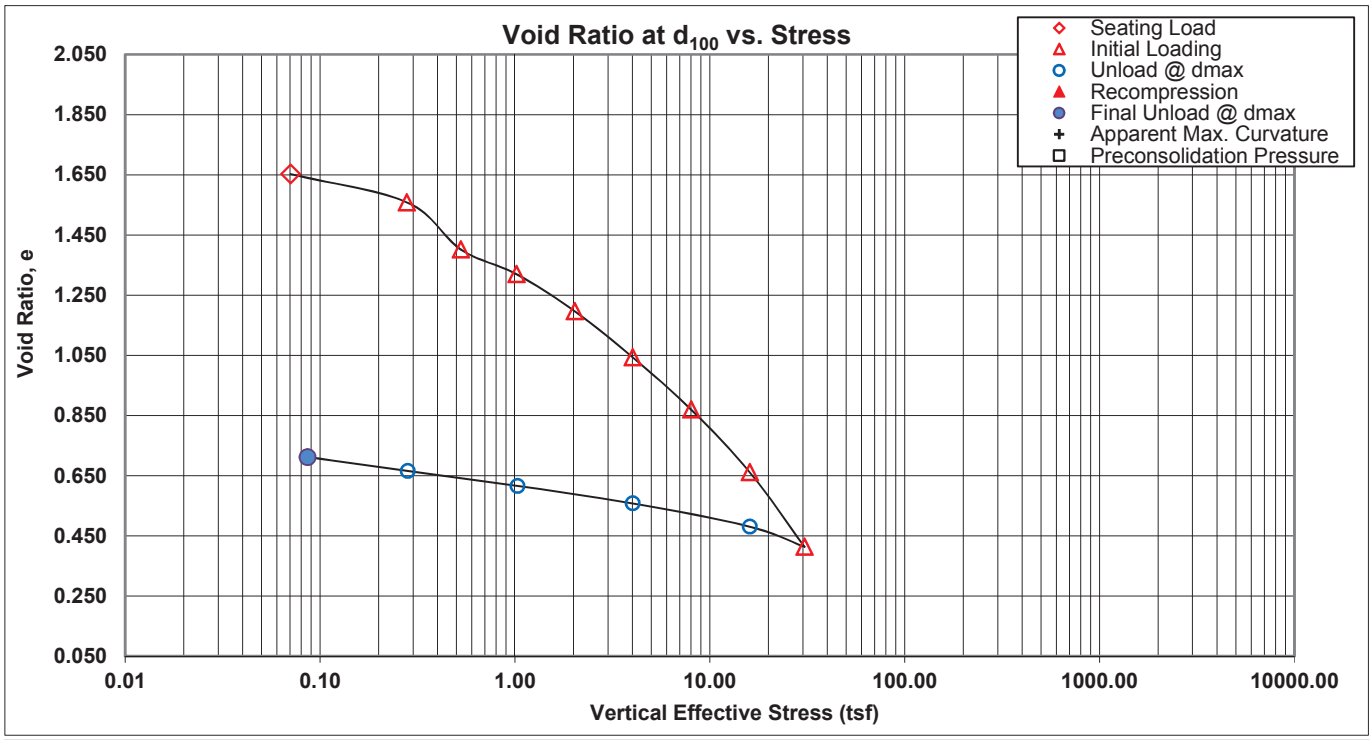
One Dimensional Consolidation of Soils Using Incremental Loading

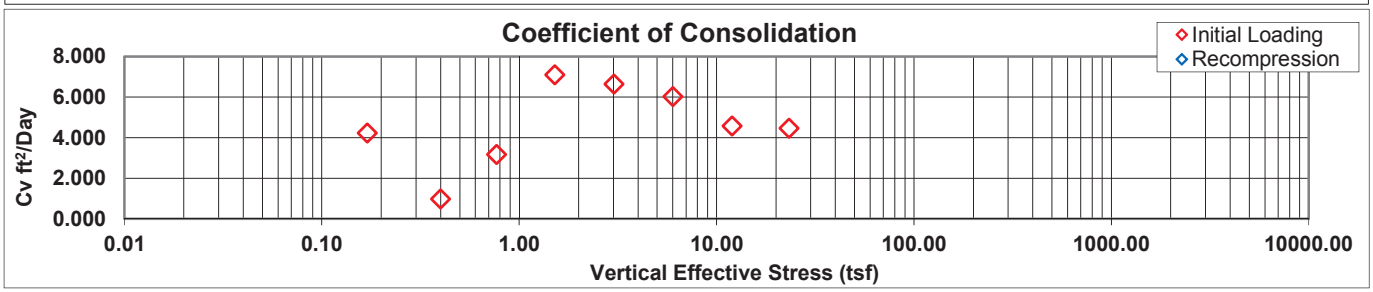
ASTM D 2435

Project Name	Dynegy Duck Creek Closure Supplemental Field Work	Project No.	175667029
Source	S-3, 50.5'-50.75'	Lab ID	34
Description	Silt (ML), gray and dark gray, wet, very soft	Date Received	07/05/2017
Specimen Type	Undisturbed		

LL	N/A	Specific Gravity	2.54	Prepared	Using Cutting Ring
PL	N/A	ASTM D 854, A		Test Method	B - for 60 min.
PI	N/A			Test Condition	Inundated at 0.05 tsf

Initial Specimen Conditions		Final Specimen Conditions	
Moisture Content (%)	68.7	Moisture Content (%)	35.6
Dry Unit Weight (pcf)	59.7	Dry Unit Weight (pcf)	92.4
Void Ratio	1.652	Void Ratio	0.712
Degree of Saturation (%)	105.5	Degree of Saturation (%)	127.2
Initial Specimen Height (in)	1.0002	Final Specimen Height (in)	0.6455
Equivalent Height of Solids (in)	0.377	Preconsolidation Pressure* (tsf)	
		Void Ratio @ Preconsolidation Pressure	





Comments Oven dried at 60° C

Reviewed By KG

Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Project No.: 175667029
Source: S-3, 50.5'-50.75'
Lab ID: 34
Description: Silt (ML), gray and dark gray, wet, very soft
Date Received: 07/05/2017
Specimen Type: Undisturbed

Load Increment tsf σ_v	Specimen Height (in) @ d_0	Specimen Height (in) @ d_{100}	Void Ratio e @ d_{100}	Specimen Height (in) @ d_{max}	Void Ratio e @ d_{max}	Load At Cv tsf	Specimen Height (in) @ d_{50}	Fitting Time** (min) @ t_{50}	Fitting Time** (min) @ t_{90}	Cv ft^2/day
0.07	1.0002	----	----	----	----	----	----	----	----	----
0.28	0.9825	0.9649	1.559	0.9618	1.551	0.17	0.9737		0.5	4.222
0.53	0.9200	0.9055	1.401	0.9005	1.388	0.40	0.9128		1.8	0.969
1.02	0.8825	0.8747	1.320	0.8691	1.305	0.77	0.8786		0.5	3.157
2.03	0.8550	0.8283	1.197	0.8223	1.181	1.52	0.8417		0.2	7.097
4.03	0.8035	0.7704	1.043	0.7646	1.028	3.03	0.7869		0.2	6.630
8.02	0.7450	0.7051	0.870	0.6955	0.844	6.02	0.7250		0.2	6.027
16.01	0.6650	0.6267	0.662	0.6178	0.638	12.02	0.6459		0.2	4.568
30.57	0.5400	0.5331	0.414	0.5325	0.412	23.29	0.5366		0.1	4.458
16.02	0.5461			0.5583	0.481					
4.03	0.5699			0.5876	0.558					
1.03	0.5938			0.6092	0.616					
0.28	0.6126			0.6282	0.666					
0.09	0.6304			0.6455	0.712					

Testing Details:

Consolidation Press ID: CON-6
Trimming Ring ID: GS-89
Initial MC from Trimmings (%): 68.8
Final Differential Height (in): -0.070
Test Start Date: 07/24/2017
Technician: KG
Test End Date: 07/25/2017
Technician: KG

When available, all other tests performed in association with this specimen are reported separately.
* When presented, The preconsolidation pressure evaluated using the Cassagrande Method, as per ASTM D 2435.
** Cv Computation Methods:

@ t_{50}, Cv calculated using Log Time Method.

@ t_{90}, Cv calculated using Square Root of Time Method.

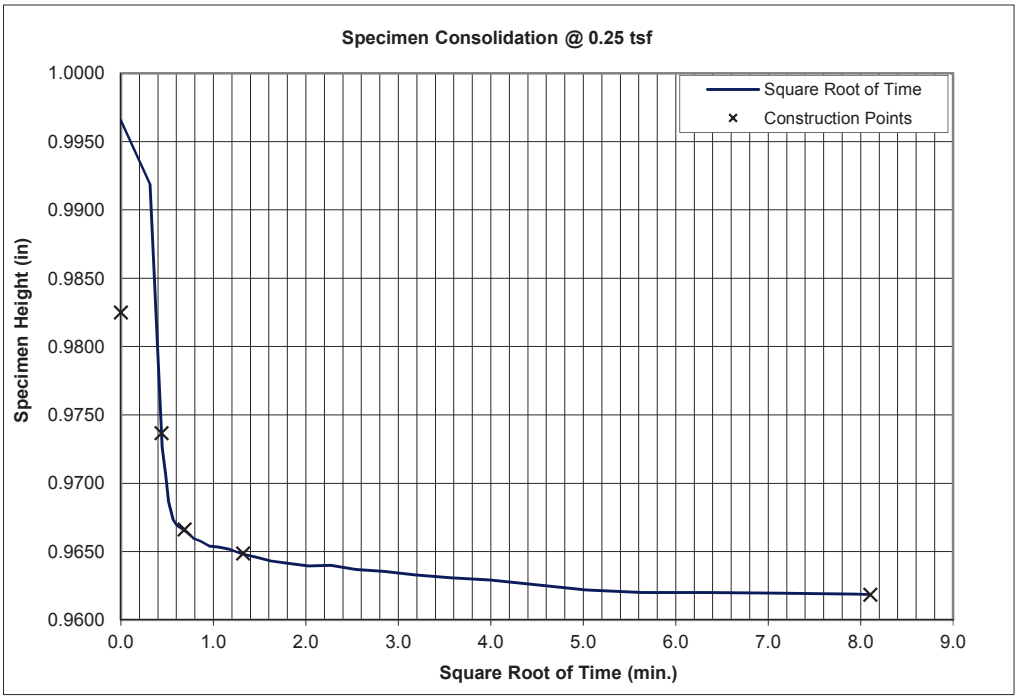
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	0.25
Actual Load (tsf)	0.28
Cycle	Load
Start Date	07/24/2017
Start Time	9:40
End Date	07/24/2017
End Time	10:45



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.9825
@ t_{50}	0.2	0.9737
@ t_{90}	0.5	0.9666
@ t_{100}	1.7	0.9649
@ t_{max}	65.7	0.9618

Square Root of Time (min)	Spec. Height (in)
0.00	0.9965
0.32	0.9919
0.45	0.9726
0.48	0.9706
0.52	0.9686
0.56	0.9673
0.61	0.9669
0.66	0.9667
0.72	0.9664
0.79	0.9660
0.87	0.9658
0.96	0.9654
1.06	0.9653
1.18	0.9652
1.30	0.9648
1.45	0.9646
1.62	0.9643
1.81	0.9641
2.03	0.9639
2.27	0.9640
2.54	0.9637
2.84	0.9635
3.18	0.9633
3.57	0.9631
4.00	0.9629
4.5	0.9624

Square Root of Time (min)	Spec. Height (in)
5.03	0.9622
5.64	0.9620
6.32	0.9620
7.09	0.9619
7.95	0.9619
8.11	0.9618

Square Root of Time (min)	Spec. Height (in)

Square Root of Time (min)	Spec. Height (in)

Comments

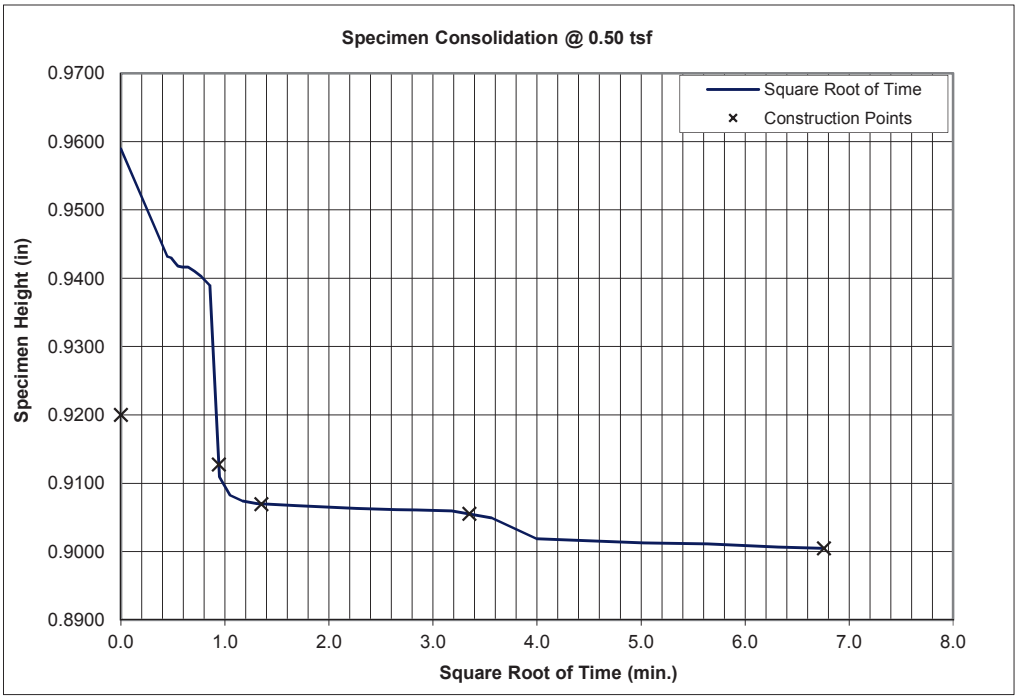
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	0.5
Actual Load (tsf)	0.53
Cycle	Load
Start Date	07/24/2017
Start Time	10:45
End Date	07/24/2017
End Time	11:31



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.9200
@ t_{50}	0.9	0.9128
@ t_{90}	1.8	0.9070
@ t_{100}	11.2	0.9055
@ t_{max}	45.7	0.9005

Square Root of Time (min)	Spec. Height (in)
0.00	0.9589
0.32	0.9478
0.45	0.9432
0.48	0.9430
0.52	0.9423
0.55	0.9418
0.59	0.9416
0.65	0.9416
0.71	0.9410
0.77	0.9402
0.86	0.9390
0.95	0.9109
1.05	0.9083
1.17	0.9074
1.30	0.9070
1.45	0.9069
1.62	0.9068
1.81	0.9066
2.02	0.9064
2.27	0.9063
2.54	0.9062
2.84	0.9061
3.18	0.9059
3.57	0.9049
4.00	0.9019
4.5	0.9015

Square Root of Time (min)	Spec. Height (in)
5.02	0.9013
5.63	0.9011
6.32	0.9007
6.76	0.9005

Square Root of Time (min)	Spec. Height (in)

Square Root of Time (min)	Spec. Height (in)

Comments

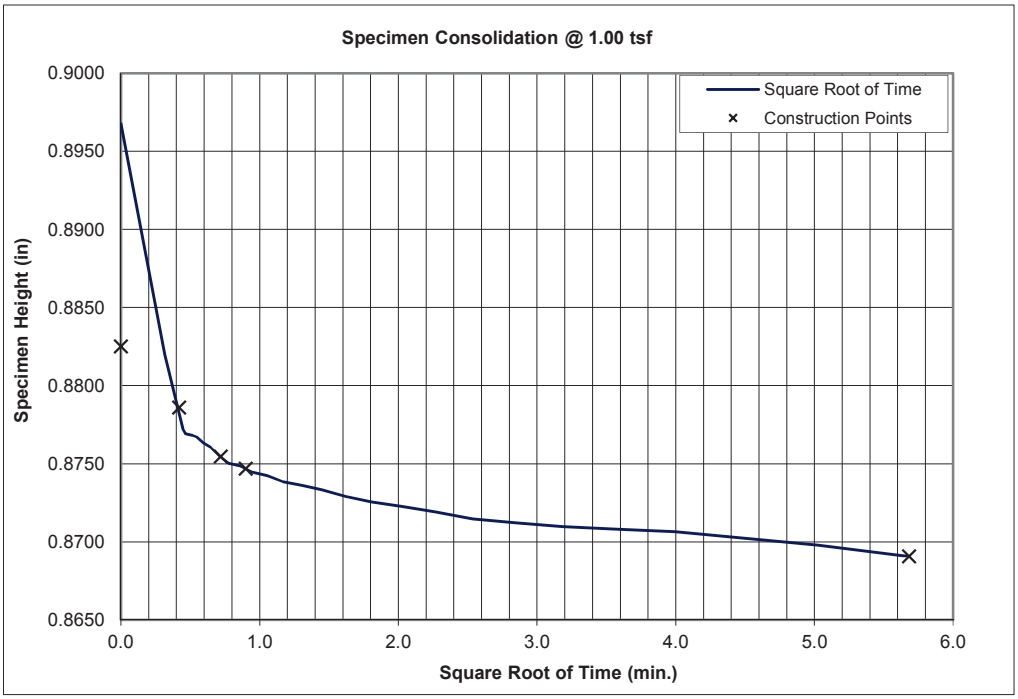
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	1
Actual Load (tsf)	1.02
Cycle	Load
Start Date	07/24/2017
Start Time	11:31
End Date	07/24/2017
End Time	12:03



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.8825
@ t_{50}	0.2	0.8786
@ t_{90}	0.5	0.8755
@ t_{100}	0.8	0.8747
@ t_{max}	32.3	0.8691

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.8968	5.02	0.8698				
0.32	0.8820	5.63	0.8691				
0.45	0.8772	5.68	0.8691				
0.47	0.8769						
0.52	0.8768						
0.55	0.8767						
0.59	0.8763						
0.65	0.8761						
0.71	0.8755						
0.77	0.8750						
0.86	0.8749						
0.95	0.8745						
1.06	0.8742						
1.17	0.8739						
1.30	0.8736						
1.45	0.8733						
1.62	0.8729						
1.81	0.8726						
2.02	0.8723						
2.27	0.8719						
2.54	0.8715						
2.84	0.8712						
3.18	0.8710						
3.57	0.8708						
4.00	0.8707						
4.5	0.8703						

Comments

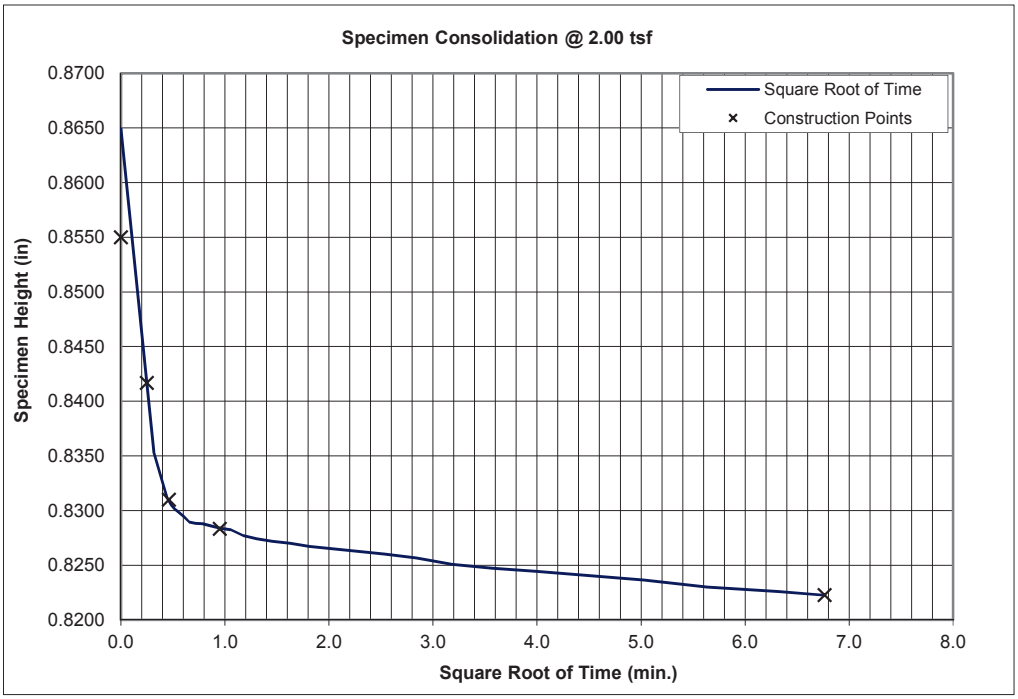
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	2
Actual Load (tsf)	2.03
Cycle	Load
Start Date	07/24/2017
Start Time	12:03
End Date	07/24/2017
End Time	12:49



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.8550
@ t_{50}	0.1	0.8417
@ t_{90}	0.2	0.8310
@ t_{100}	0.9	0.8283
@ t_{max}	45.8	0.8223

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.8650	5.02	0.8236				
0.32	0.8353	5.63	0.8230				
0.45	0.8311	6.32	0.8226				
0.48	0.8305	6.77	0.8223				
0.52	0.8301						
0.55	0.8299						
0.61	0.8294						
0.66	0.8289						
0.72	0.8288						
0.79	0.8288						
0.87	0.8286						
0.96	0.8284						
1.06	0.8282						
1.18	0.8277						
1.30	0.8274						
1.45	0.8272						
1.62	0.8270						
1.81	0.8267						
2.02	0.8265						
2.27	0.8263						
2.54	0.8260						
2.84	0.8257						
3.18	0.8251						
3.57	0.8247						
4.00	0.8244						
4.5	0.8241						

Comments

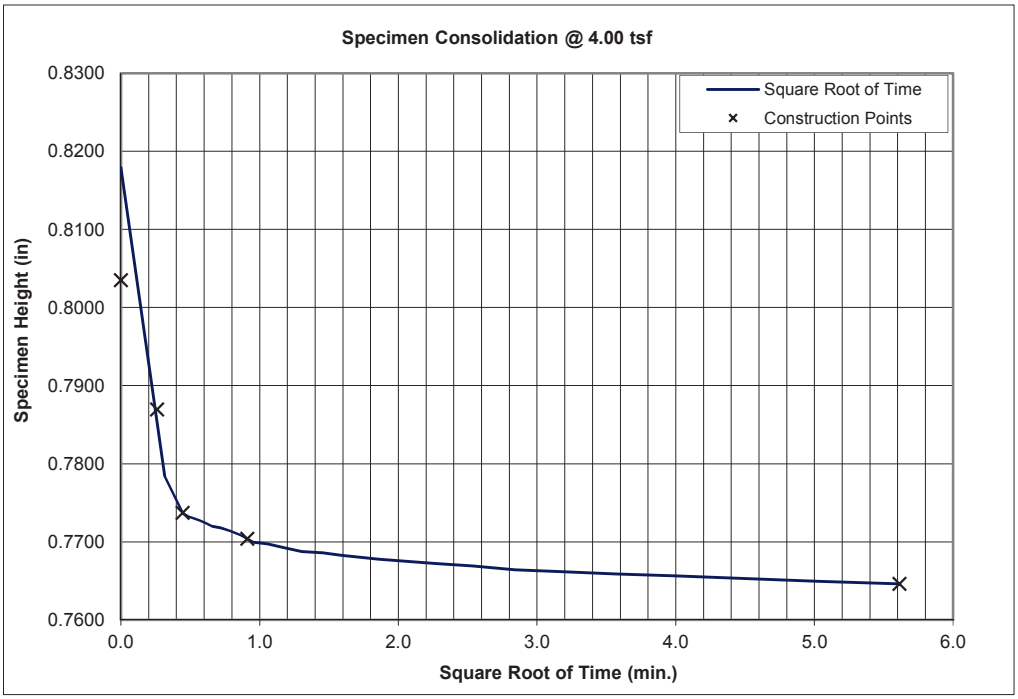
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One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	4
Actual Load (tsf)	4.03
Cycle	Load
Start Date	07/24/2017
Start Time	12:49
End Date	07/24/2017
End Time	13:21



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.8035
@ t_{50}	0.1	0.7869
@ t_{90}	0.2	0.7737
@ t_{100}	0.8	0.7704
@ t_{max}	31.5	0.7646

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.8179	5.02	0.7650				
0.32	0.7784	5.61	0.7646				
0.45	0.7736						
0.48	0.7732						
0.52	0.7731						
0.56	0.7728						
0.61	0.7725						
0.66	0.7720						
0.72	0.7718						
0.79	0.7714						
0.87	0.7708						
0.96	0.7700						
1.06	0.7697						
1.18	0.7693						
1.30	0.7688						
1.45	0.7686						
1.62	0.7682						
1.81	0.7679						
2.02	0.7675						
2.27	0.7672						
2.54	0.7669						
2.84	0.7664						
3.18	0.7662						
3.57	0.7659						
4.00	0.7656						
4.5	0.7654						

Comments

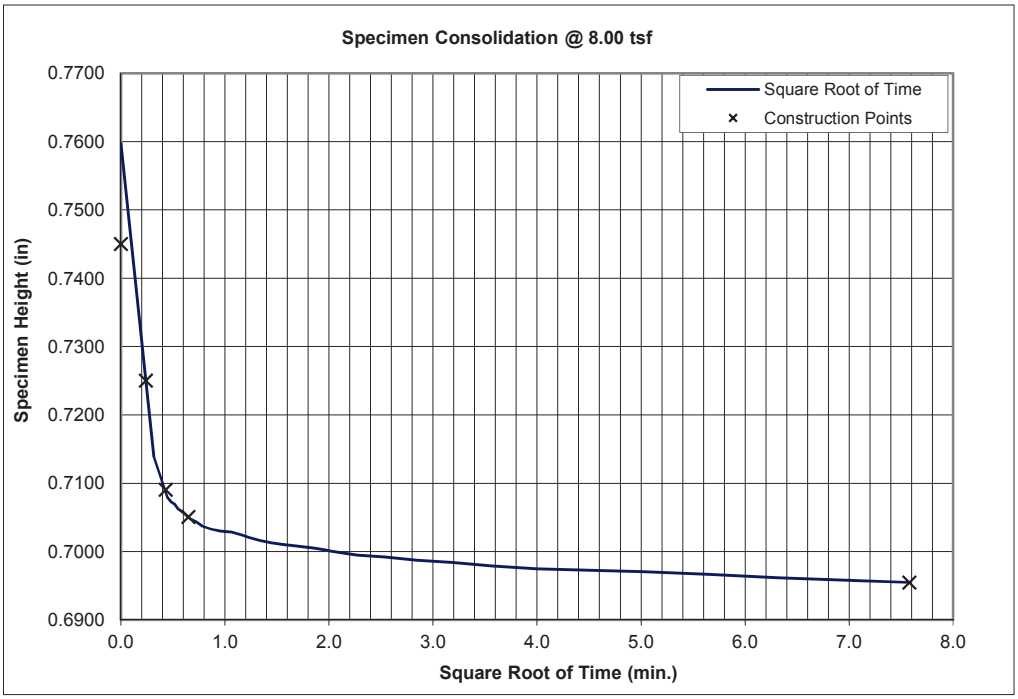
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	8
Actual Load (tsf)	8.02
Cycle	Load
Start Date	07/24/2017
Start Time	13:21
End Date	07/24/2017
End Time	14:18



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.7450
@ t_{50}	0.1	0.7250
@ t_{90}	0.2	0.7090
@ t_{100}	0.4	0.7051
@ t_{max}	57.5	0.6955

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.7597	5.02	0.6970				
0.32	0.7139	5.64	0.6967				
0.45	0.7080	6.32	0.6962				
0.48	0.7073	7.09	0.6958				
0.52	0.7069	7.58	0.6955				
0.55	0.7063						
0.61	0.7056						
0.66	0.7049						
0.72	0.7044						
0.79	0.7037						
0.87	0.7033						
0.96	0.7030						
1.06	0.7029						
1.18	0.7023						
1.30	0.7017						
1.45	0.7013						
1.62	0.7009						
1.81	0.7006						
2.02	0.7000						
2.27	0.6995						
2.54	0.6992						
2.84	0.6988						
3.18	0.6984						
3.57	0.6979						
4.00	0.6975						
4.5	0.6972						

Comments

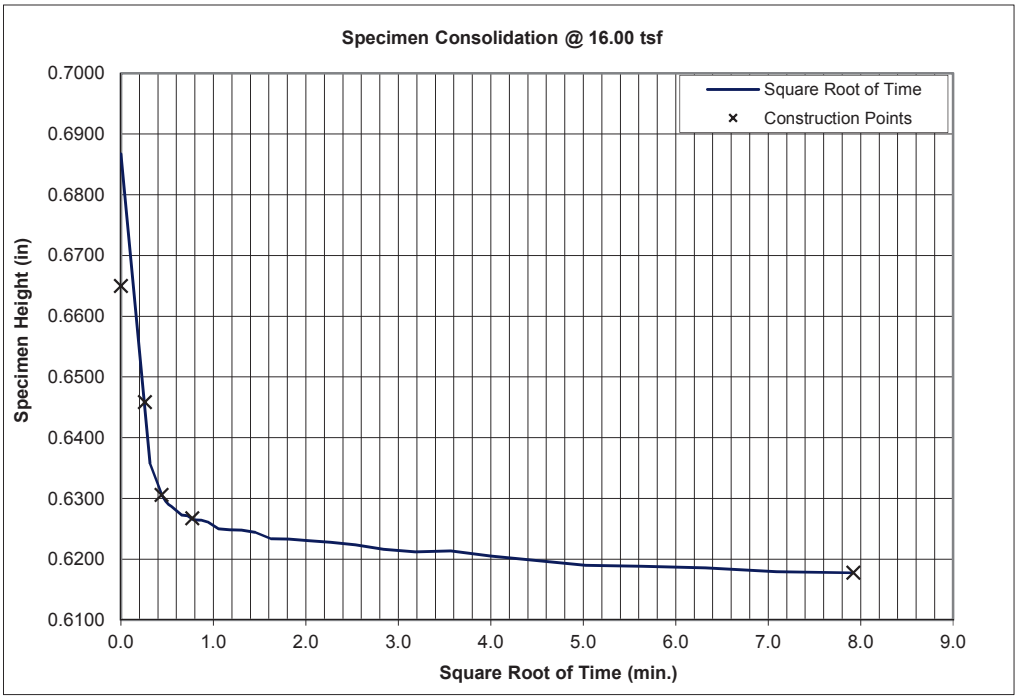
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	16
Actual Load (tsf)	16.01
Cycle	Load
Start Date	07/24/2017
Start Time	14:18
End Date	07/24/2017
End Time	15:21



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.6650
@ t_{50}	0.1	0.6459
@ t_{90}	0.2	0.6306
@ t_{100}	0.6	0.6267
@ t_{max}	62.7	0.6178

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.6867	5.02	0.6190				
0.32	0.6357	5.63	0.6188				
0.45	0.6305	6.32	0.6185				
0.48	0.6295	7.09	0.6179				
0.52	0.6290	7.92	0.6178				
0.55	0.6287						
0.59	0.6281						
0.66	0.6273						
0.72	0.6271						
0.79	0.6265						
0.87	0.6264						
0.95	0.6261						
1.06	0.6250						
1.18	0.6248						
1.30	0.6248						
1.45	0.6244						
1.62	0.6233						
1.81	0.6233						
2.03	0.6230						
2.27	0.6228						
2.54	0.6224						
2.84	0.6216						
3.18	0.6212						
3.57	0.6214						
4.00	0.6205						
4.5	0.6198						

Comments

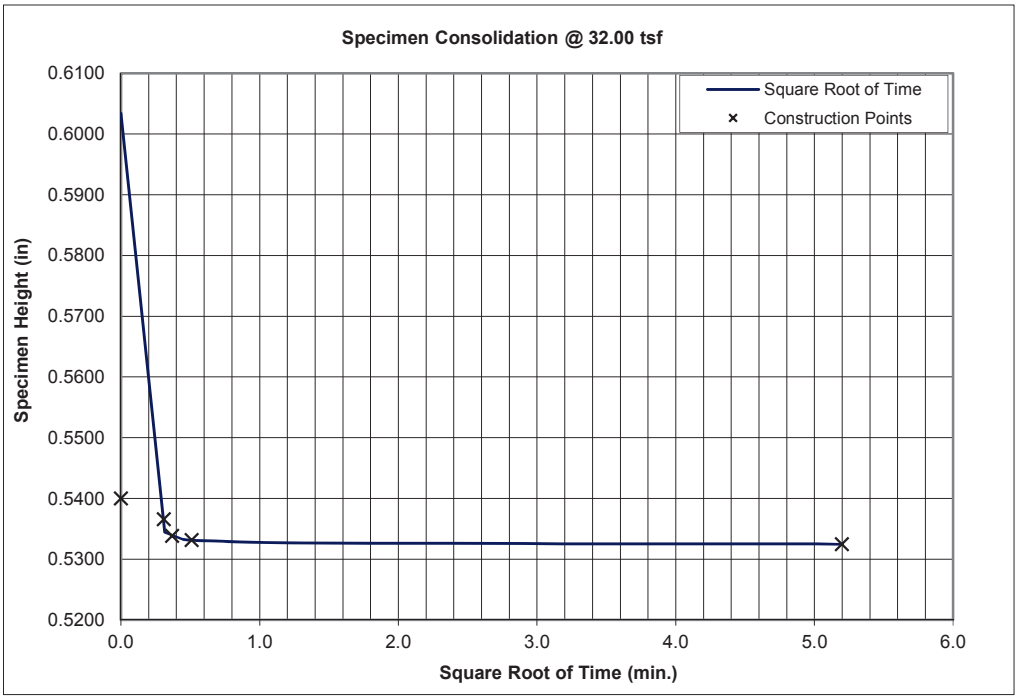
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name Dynegy Duck Creek Closure Supplemental Field Work
Source S-3, 50.5'-50.75'
Description Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	32
Actual Load (tsf)	30.57
Cycle	Load
Start Date	07/24/2017
Start Time	15:21
End Date	07/24/2017
End Time	15:48



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.5400
@ t_{50}	0.1	0.5366
@ t_{90}	0.1	0.5338
@ t_{100}	0.3	0.5331
@ t_{max}	27.0	0.5325

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.6034	5.02	0.5325				
0.32	0.5344	5.20	0.5325				
0.45	0.5332						
0.48	0.5332						
0.50	0.5331						
0.55	0.5331						
0.59	0.5330						
0.65	0.5330						
0.71	0.5330						
0.77	0.5329						
0.86	0.5328						
0.95	0.5328						
1.05	0.5327						
1.17	0.5327						
1.30	0.5327						
1.45	0.5326						
1.62	0.5326						
1.81	0.5326						
2.02	0.5326						
2.27	0.5326						
2.53	0.5326						
2.84	0.5326						
3.18	0.5325						
3.57	0.5325						
4.00	0.5325						
4.5	0.5325						

Comments

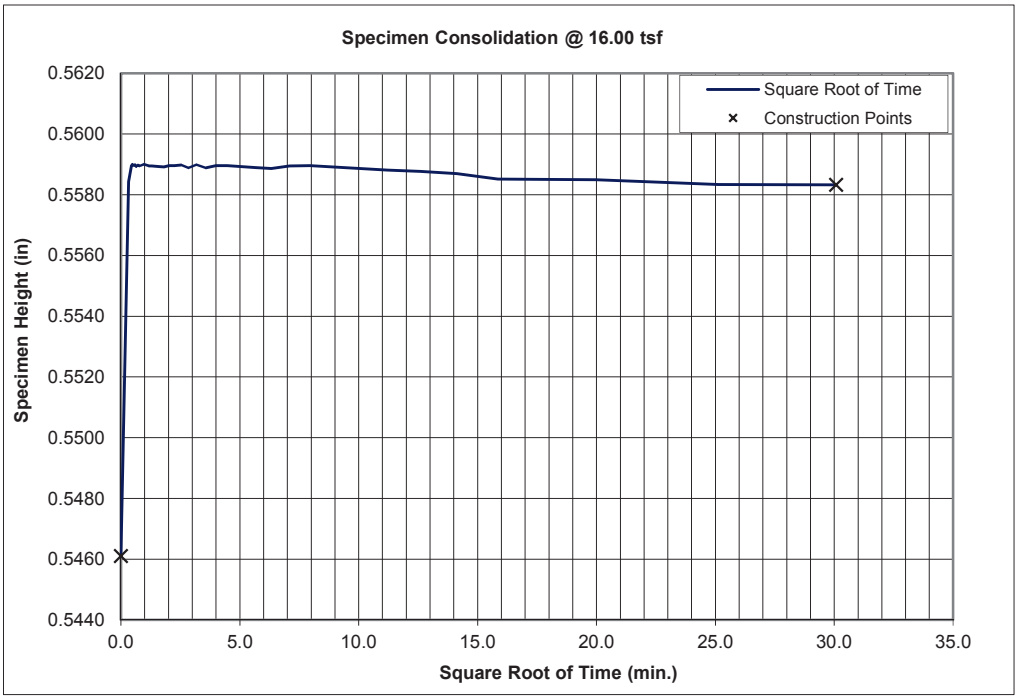
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	16
Actual Load (tsf)	16.02
Cycle	Unload
Start Date	07/24/2017
Start Time	15:48
End Date	07/25/2017
End Time	6:52



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.5461
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	904.6	0.5583

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.5461	5.63	0.5589				
0.32	0.5584	6.32	0.5589				
0.45	0.5590	7.09	0.5589				
0.48	0.5590	7.95	0.5590				
0.52	0.5590	11.23	0.5588				
0.55	0.5590	12.59	0.5588				
0.59	0.5590	14.13	0.5587				
0.65	0.5589	15.85	0.5585				
0.71	0.5590	17.79	0.5585				
0.77	0.5590	19.96	0.5585				
0.86	0.5590	25.12	0.5583				
0.95	0.5590	30.08	0.5583				
1.17	0.5589						
1.30	0.5589						
1.45	0.5589						
1.62	0.5589						
1.81	0.5589						
2.02	0.5590						
2.27	0.5590						
2.54	0.5590						
2.84	0.5589						
3.18	0.5590						
3.57	0.5589						
4.00	0.5590						
4.48	0.5590						
5.0	0.5588						

Comments

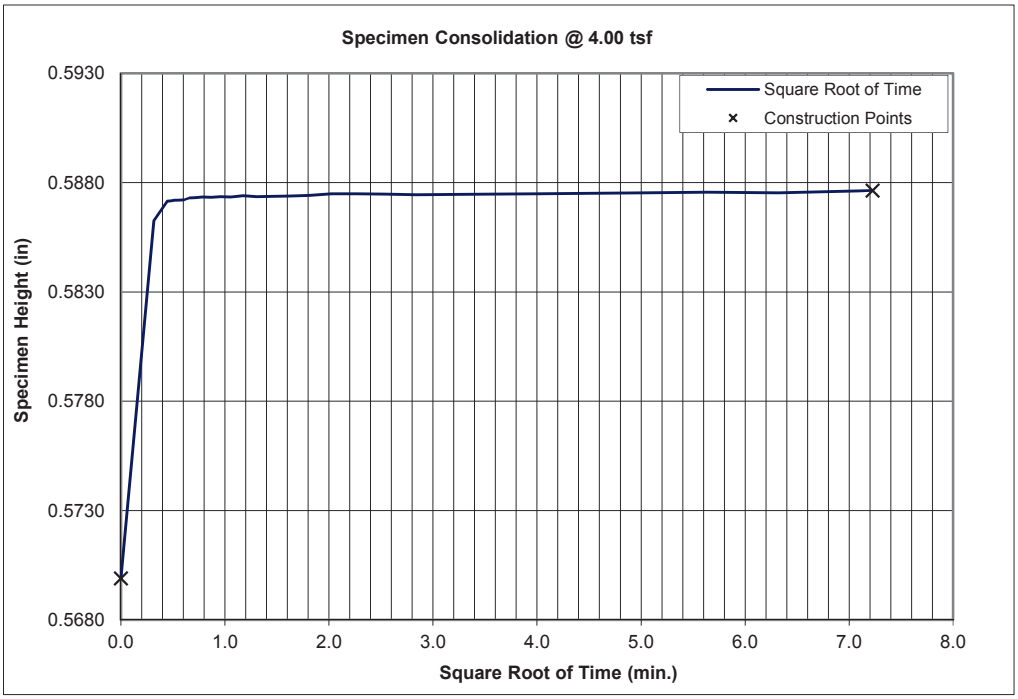
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	4
Actual Load (tsf)	4.03
Cycle	Unload
Start Date	07/25/2017
Start Time	6:52
End Date	07/25/2017
End Time	7:45



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.5699
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	52.2	0.5876

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.5699	5.02	0.5875				
0.32	0.5863	5.64	0.5876				
0.45	0.5872	6.32	0.5875				
0.48	0.5872	7.09	0.5876				
0.52	0.5872	7.23	0.5876				
0.55	0.5872						
0.61	0.5872						
0.66	0.5873						
0.72	0.5873						
0.79	0.5873						
0.87	0.5873						
0.96	0.5874						
1.06	0.5873						
1.18	0.5874						
1.30	0.5874						
1.45	0.5874						
1.62	0.5874						
1.81	0.5874						
2.02	0.5875						
2.27	0.5875						
2.54	0.5875						
2.84	0.5874						
3.18	0.5875						
3.57	0.5875						
4.00	0.5875						
4.5	0.5875						

Comments

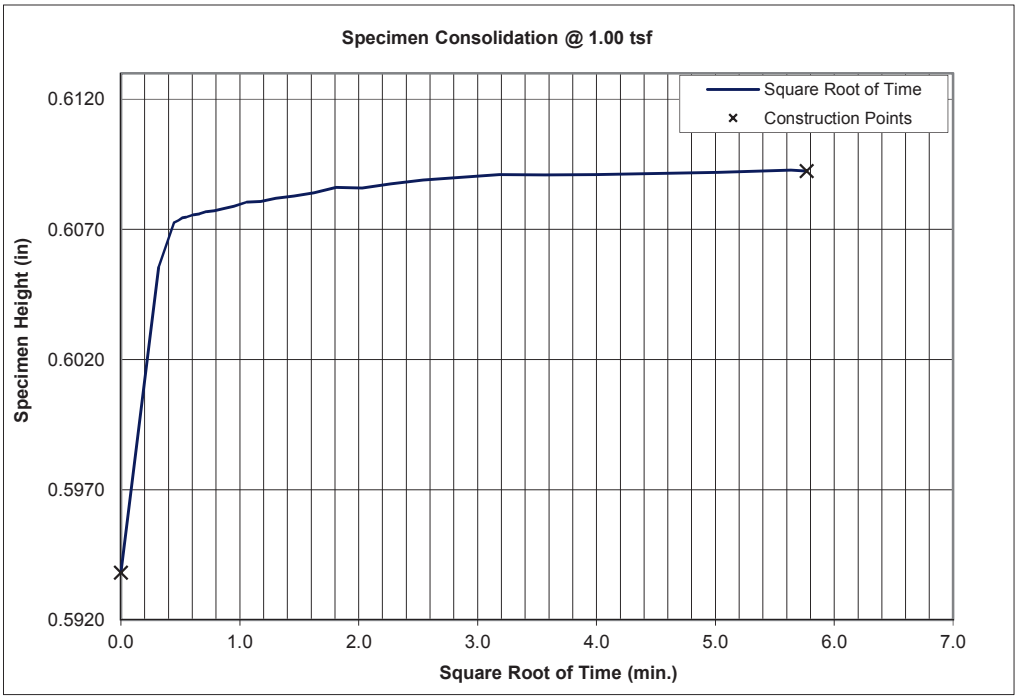
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	1
Actual Load (tsf)	1.03
Cycle	Unload
Start Date	07/25/2017
Start Time	7:45
End Date	07/25/2017
End Time	8:18



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.5938
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	33.3	0.6092

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.5938	5.02	0.6092				
0.32	0.6056	5.64	0.6093				
0.45	0.6073	5.77	0.6092				
0.48	0.6074						
0.52	0.6075						
0.55	0.6075						
0.61	0.6076						
0.66	0.6076						
0.72	0.6077						
0.79	0.6077						
0.87	0.6078						
0.95	0.6079						
1.06	0.6080						
1.18	0.6081						
1.30	0.6082						
1.45	0.6083						
1.62	0.6084						
1.81	0.6086						
2.03	0.6086						
2.27	0.6088						
2.54	0.6089						
2.84	0.6090						
3.18	0.6091						
3.57	0.6091						
4.00	0.6091						
4.5	0.6092						

Comments

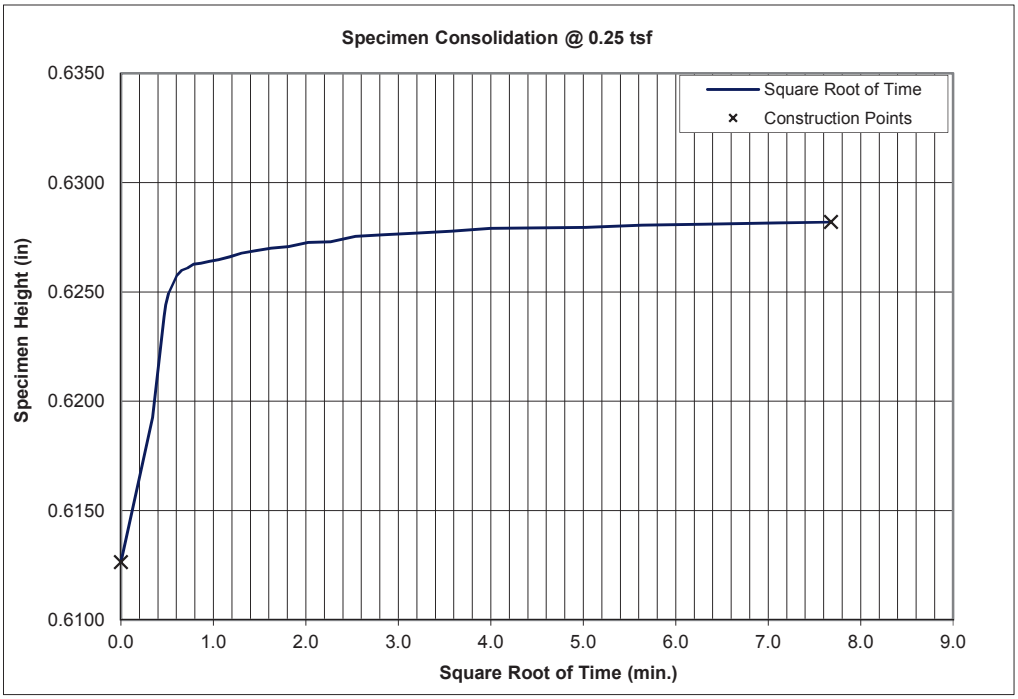
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	0.25
Actual Load (tsf)	0.28
Cycle	Unload
Start Date	07/25/2017
Start Time	8:18
End Date	07/25/2017
End Time	9:17



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.6126
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	59.0	0.6282

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.6126	5.02	0.6279				
0.34	0.6193	5.64	0.6281				
0.47	0.6239	6.32	0.6281				
0.48	0.6244	7.09	0.6282				
0.52	0.6249	7.68	0.6282				
0.56	0.6254						
0.61	0.6258						
0.66	0.6260						
0.72	0.6261						
0.79	0.6263						
0.87	0.6263						
0.96	0.6264						
1.06	0.6265						
1.18	0.6266						
1.30	0.6268						
1.45	0.6269						
1.62	0.6270						
1.81	0.6271						
2.02	0.6273						
2.27	0.6273						
2.54	0.6275						
2.84	0.6276						
3.18	0.6277						
3.57	0.6278						
4.00	0.6279						
4.5	0.6279						

Comments

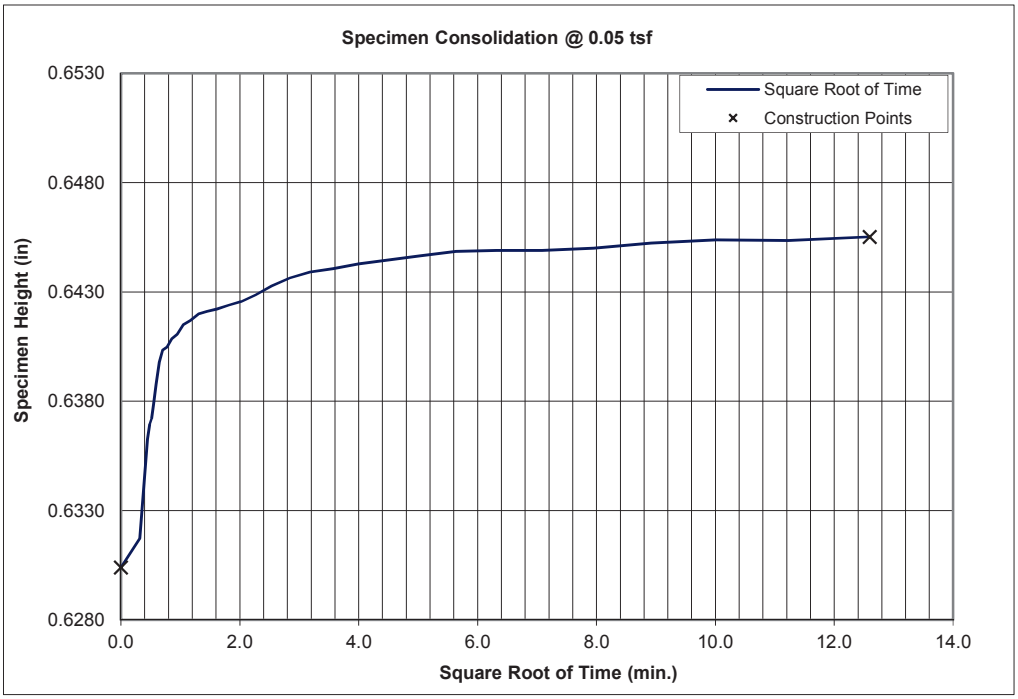
Stantec

One Dimensional Consolidation of Soils Using Incremental Loading

ASTM D 2435

Project Name: Dynegy Duck Creek Closure Supplemental Field Work
Source: S-3, 50.5'-50.75'
Description: Silt (ML), gray and dark gray, wet, very soft

Project No.	175667029
Lab ID	34
Nominal Load (tsf)	0.05
Actual Load (tsf)	0.09
Cycle	Final
Start Date	07/25/2017
Start Time	9:17
End Date	07/25/2017
End Time	11:56



Time VS Deformation Results

	Elapsed Time (min)	Spec. Height (in)
@ t_0	0.0	0.6304
@ t_{50}		
@ t_{90}		
@ t_{100}		
@ t_{max}	158.6	0.6455

Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)	Square Root of Time (min)	Spec. Height (in)
0.00	0.6304	5.02	0.6447				
0.32	0.6317	5.63	0.6449				
0.45	0.6363	6.32	0.6449				
0.48	0.6370	7.09	0.6449				
0.52	0.6372	7.95	0.6450				
0.55	0.6379	8.92	0.6452				
0.59	0.6388	10.01	0.6454				
0.65	0.6398	11.23	0.6453				
0.71	0.6403	12.59	0.6455				
0.77	0.6405						
0.86	0.6409						
0.95	0.6411						
1.05	0.6415						
1.17	0.6417						
1.30	0.6420						
1.45	0.6421						
1.62	0.6422						
1.81	0.6424						
2.02	0.6426						
2.27	0.6429						
2.54	0.6433						
2.84	0.6436						
3.18	0.6439						
3.57	0.6441						
4.00	0.6443						
4.5	0.6444						

Comments

ATTACHMENT C.5
SOIL-WATER CHARACTERISTIC CURVE TESTING

Laboratory Report for

Stantec

Duck Creek, 175667029

August 31, 2017

Daniel B. Stephens & Associates, Inc.

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113

August 31, 2017

Cyrus Garner
Stantec
3052 Beaumont Centre Circle
Lexington, KY 40513
(859) 422 - 3083

Re: DBS&A Laboratory Report for the Stantec Duck Creek, 175667029 Project

Dear Mr. Garner:

Enclosed is the report for the Stantec Duck Creek, 175667029 project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Stantec and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Laboratory Manager

Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
4400 Alameda Blvd. NE, Suite C
Albuquerque, NM 87113
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
S-2 (21-22)	X	X				X	X	X		X	X			X								
S-4 (25-27)	X	X				X	X	X		X	X			X								

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample Receipt:
Two samples, each in ~3"x 12" shelby tube sealed with end caps and electrical tape, were received on July 12, 2017. Both samples were wrapped in bubble wrap and delivered in a 5-gallon bucket sealed with a lid and duct tape. Both samples arrived in good order.

Sample Preparation and Testing Notes:
An intact sub-sample was obtained from the middle of each sleeve by using a pipe cutter to remove an intact section from the original sample. The sub-samples were subjected to initial properties analysis, saturation, and the hanging column and pressure chamber portions of the moisture retention testing. Another intact sub-sample was obtained in the same manner from adjacent material in each sleeve. These sub-samples were extruded from the original sleeve and were subjected to saturated hydraulic conductivity testing via the flexible wall method.

Adjacent sample material was used for the for the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing.

As requested, a confining pressure of 12.5 psi was used during the flexible wall saturated hydraulic conductivity test.

Porosity calculations are based on the use of an assumed specific gravity value of 2.48.

Photos

Project: Duck Creek, 175667029
Sample: S-2: (21'-22') Top



Notes:
Photo of sample upon receipt.

Photos

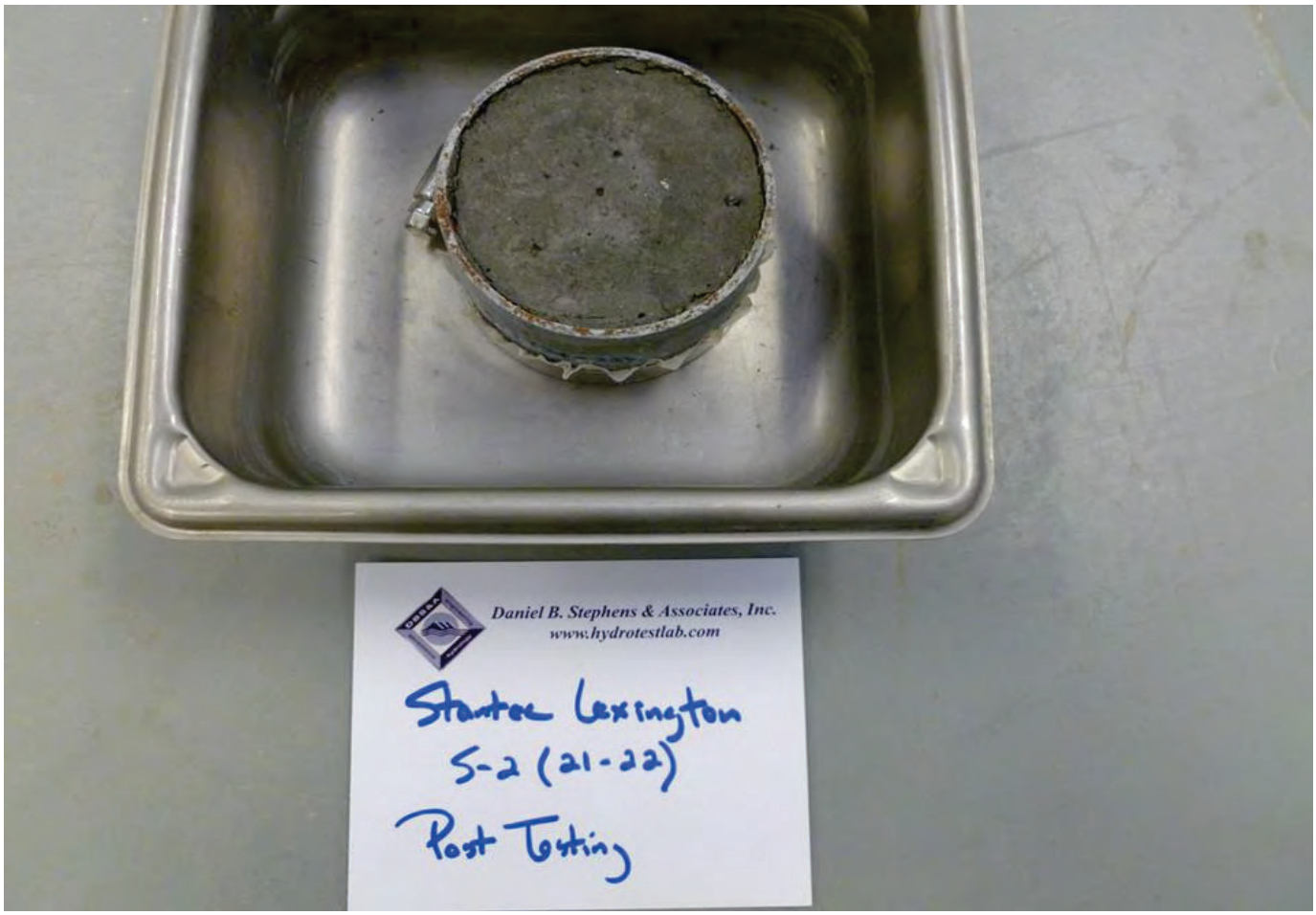
Project: Duck Creek, 175667029
Sample: S-2: (21'-22') Bottom



Notes:
Photo of sample upon receipt.

Photos

Project: Duck Creek, 175667029
Sample: S-2: (21'-22')



Notes:
Photo post-testing.

Photos

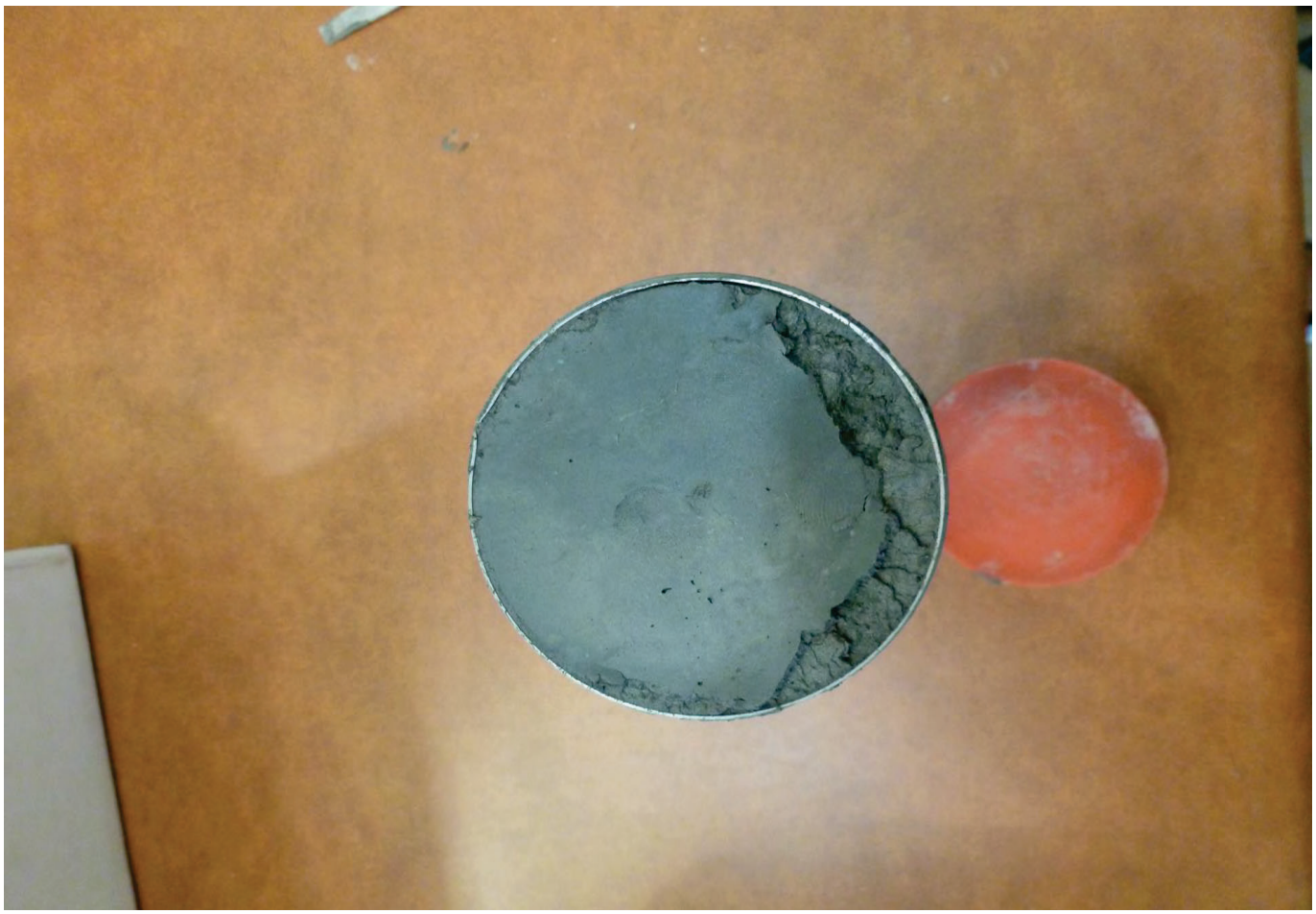
Project: Duck Creek, 175667029
Sample: S-4: (25'-27') Top



Notes:
Photo of sample upon receipt.

Photos

Project: Duck Creek, 175667029
Sample: S-4: (25'-27') Bottom



Notes:
Photo of sample upon receipt.

Photos

Project: Duck Creek, 175667029
Sample: S-4: (25'-27')



Notes:
Photo post-testing.

Summary of Sample Preparation/Volume Changes

	Initial Sample Data[1]			Volume Change Post Saturation[2]				Volume Change Post Drying Curve[3]			
Sample Number	Moisture Content (%, g/g)	Dry Bulk Density (g/cm^3)	Dry Bulk Density (pcf)	Dry Bulk Density (g/cm^3)	Dry Bulk Density (pcf)	% Volume Change (%)	% of Initial Density (%)	Dry Bulk Density (g/cm^3)	Dry Bulk Density (pcf)	% Volume Change (%)	% of Initial Density (%)
S-2 (21-22)	48.4	1.06	65.9	1.10	68.8	-4.2%	104%	1.13	70.7	-6.7%	107%
S-4 (25-27)	37.8	1.26	78.8	1.32	82.1	-4.1%	104%	1.35	84.0	-6.3%	107%

[1]Initial Sample Data: The 'as received' dry bulk density and moisture content.

[2]Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

[3]Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content				Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)			
S-2 (21-22)	48.4	51.1	---	---	1.06	1.57	57.4
S-4 (25-27)	37.8	47.7	---	---	1.26	1.74	49.1

NA = Not analyzed

--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head Flexible Wall	Method of Analysis: Falling Head Flexible Wall
S-2: (21-22)	4.7E-05	NA		X
S-4: (25-27)	1.0E-05	NA		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
S-2 (21-22)	0	52.8 ⌗
	20	52.6 ⌗
	53	53.5 ⌗
	130	51.6 ⌗
	337	49.7 ⌗
	14889	5.6 ⌗
	48339	2.9 ⌗
	150013	2.2 ⌗
	519486	1.7 ⌗
	851293	1.3 ⌗
S-4 (25-27)	0	46.9 ⌗
	18	46.3 ⌗
	28	45.4 ⌗
	130	44.8 ⌗
	337	43.7 ⌗
	25597	4.5 ⌗
	61800	3.0 ⌗
	151950	2.2 ⌗
	450038	1.9 ⌗
	851293	1.3 ⌗

⌗ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
S-2 (21-22)	0.0011	1.8978	1.46	52.86	NA	NA
S-4 (25-27)	0.0010	1.8069	1.35	46.00	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content				Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)			
S-2 (21-22)	48.4	51.1	---	---	1.06	1.57	57.4
S-4 (25-27)	37.8	47.7	---	---	1.26	1.74	49.1

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-2 (21-22)
Project Name: Duck Creek
Project Number: 175667029

	As Received	Remolded
Test Date:	14-Jul-17	---
Field weight of sample* (g)*:*	393.59	
Tare weight, ring (g)*:*	122.81	
Tare weight, pan/plate (g)*:*	0.00	
Tare weight, other (g)*:*	0.00	
Dry weight of sample (g)*:*	182.46	
Sample volume (cm^3)*:*	172.86	
Assumed particle density (g/cm^3)*:*	2.48	
Gravimetric Moisture Content (% g/g)*:*	48.4	
Volumetric Moisture Content (% vol)*:*	51.1	
Dry bulk density (g/cm^3)*:*	1.06	
Wet bulk density (g/cm^3)*:*	1.57	
Calculated Porosity (% vol)*:*	57.4	
Percent Saturation:	89.0	

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-4 (25-27)
Project Name: Duck Creek
Project Number: 175667029

	As Received	Remolded
Test Date:	14-Jul-17	---
Field weight of sample* (g)*:*	434.08	
Tare weight, ring (g)*:*	127.29	
Tare weight, pan/plate (g)*:*	0.00	
Tare weight, other (g)*:*	0.00	
Dry weight of sample (g)*:*	222.61	
Sample volume (cm^3)*:*	176.46	
Assumed particle density (g/cm^3)*:*	2.48	
Gravimetric Moisture Content (% g/g)*:*	37.8	
Volumetric Moisture Content (% vol)*:*	47.7	
Dry bulk density (g/cm^3)*:*	1.26	
Wet bulk density (g/cm^3)*:*	1.74	
Calculated Porosity (% vol)*:*	49.1	
Percent Saturation:	97.1	

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head Flexible Wall	Method of Analysis: Falling Head Flexible Wall
S-2: (21-22)	4.7E-05	NA		X
S-4: (25-27)	1.0E-05	NA		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

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Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-2 (21'-22')
Project Name: Duck Creek
Project Number: 175667029

Remolded or Initial Sample Properties		Post Permeation Sample Properties		Test and Sample Conditions	
Initial Mass (g):	340.41	*Saturated Mass (g):*	336.54	*Permeant liquid used:*	Tap Water
Diameter (cm):	7.283	*Dry Mass (g):*	234.59	*Sample Preparation:*	☑ In situ sample, extruded
Length (cm):	5.166	*Diameter (cm):*	6.961		☐ Remolded Sample
Area (cm^2):	41.66	*Length (cm):*	5.086	*Number of Lifts:*	NA
Volume (cm^3):	215.21	*Deformation (%)**:*	1.56	*Split:*	NA
Dry Density (g/cm^3):	1.09	*Area (cm^2):*	38.06	*Percent Coarse Material (%):*	NA
Dry Density (pcf):	68.0	*Volume (cm^3):*	193.57	*Particle Density(g/cm^3):*	2.48 ☑ Assumed ☐ Measured
Water Content (%, g/g):	45.1	*Dry Density (g/cm^3):*	1.21	*Cell pressure (PSI):*	82.5
Water Content (%, vol):	49.2	*Dry Density (pcf):*	75.7	*Influent pressure (PSI):*	70.0
Void Ratio (e):	1.28	*Water Content (%, g/g):*	43.5	*Effluent pressure (PSI):*	70.0
Porosity (%, vol):	56.0	*Water Content (%, vol):*	52.7	*Panel Used:*	☐ A ☑ B ☐ C
Saturation (%):	87.7	*Void Ratio(e):*	1.05	*Reading:*	☐ Annulus ☑ Pipette
		Porosity (%, vol):	51.1		Date/Time
		Saturation (%):*	103.0	B-Value (% saturation) prior to test*:	0.95 7/17/17 830
				B-Value (% saturation) post to test:	0.95 7/17/17 1006

* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

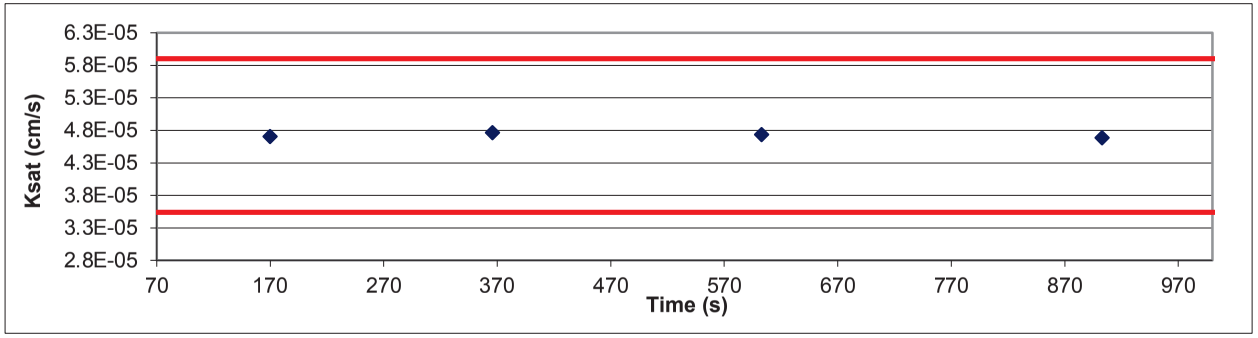
Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-2 (21'-22')
Project Name: Duck Creek
Project Number: 175667029

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm^3)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k_{sat} T°C (cm/s)	k_{sat} Corrected (cm/s)
Test # 1:											
17-Jul-17	08:32:10	21.5	5.00	20.00	3.41	0.87	170	1.00	13%	4.87E-05	4.71E-05
17-Jul-17	08:35:00	21.5	6.00	19.00	2.95						
Test # 2:											
17-Jul-17	08:35:00	21.5	6.00	19.00	2.95	0.87	196	1.00	15%	4.93E-05	4.76E-05
17-Jul-17	08:38:16	21.5	7.00	18.00	2.50						
Test # 3:											
17-Jul-17	08:38:16	21.5	7.00	18.00	2.50	0.87	237	1.00	18%	4.90E-05	4.73E-05
17-Jul-17	08:42:13	21.5	8.00	17.00	2.04						
Test # 4:											
17-Jul-17	08:42:13	21.5	8.00	17.00	2.04	0.87	300	1.00	22%	4.85E-05	4.68E-05
17-Jul-17	08:47:13	21.5	9.00	16.00	1.59						

***Average Ksat* (cm/sec):** **4.72E-05**
Calculated Gravel Corrected Average Ksat (cm/sec): NA



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 3.54E-05

Ksat (+25%) (cm/s): 5.90E-05

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Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-4 (25'-27')
Project Name: Duck Creek
Project Number: 175667029

Remolded or Initial Sample Properties		Post Permeation Sample Properties		Test and Sample Conditions	
Initial Mass (g):	420.05	*Saturated Mass (g):*	414.06	*Permeant liquid used:*	Tap Water
Diameter (cm):	7.265	*Dry Mass (g):*	313.9	*Sample Preparation:*	☑ In situ sample, extruded
Length (cm):	5.796	*Diameter (cm):*	7.053		☐ Remolded Sample
Area (cm^2):	41.45	*Length (cm):*	5.723	*Number of Lifts:*	NA
Volume (cm^3):	240.26	*Deformation (%)**:*	1.28	*Split:*	NA
Dry Density (g/cm^3):	1.31	*Area (cm^2):*	39.07	*Percent Coarse Material (%):*	NA
Dry Density (pcf):	81.6	*Volume (cm^3):*	223.59	*Particle Density(g/cm^3):*	2.48 ☑ Assumed ☐ Measured
Water Content (%, g/g):	33.8	*Dry Density (g/cm^3):*	1.40	*Cell pressure (PSI):*	82.5
Water Content (%, vol):	44.2	*Dry Density (pcf):*	87.6	*Influent pressure (PSI):*	70.0
Void Ratio (e):	0.90	*Water Content (%, g/g):*	31.9	*Effluent pressure (PSI):*	70.0
Porosity (%, vol):	47.3	*Water Content (%, vol):*	44.8	*Panel Used:*	☑ A ☐ B ☐ C
Saturation (%):	93.4	*Void Ratio(e):*	0.77	*Reading:*	☐ Annulus ☑ Pipette
		Porosity (%, vol):	43.4		Date/Time
		Saturation (%):*	103.2	B-Value (% saturation) prior to test*:	0.95 7/17/17 820
				B-Value (% saturation) post to test:	0.95 7/17/17 1004

* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.

**Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

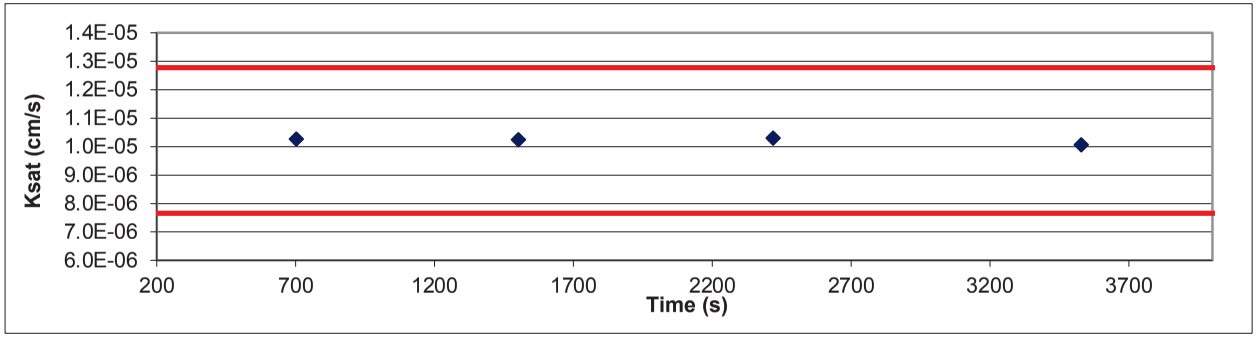
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Saturated Hydraulic Conductivity
Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-4 (25'-27')
Project Name: Duck Creek
Project Number: 175667029

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm^3)	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k_{sat} T°C (cm/s)	k_{sat} Corrected (cm/s)
Test # 1:											
17-Jul-17	08:43:58	21.5	6.00	24.00	3.63	0.87	703	1.00	11%	1.06E-05	1.03E-05
17-Jul-17	08:55:41	21.5	7.00	23.00	3.23						
Test # 2:											
17-Jul-17	08:55:41	21.5	7.00	23.00	3.23	0.87	799	1.00	13%	1.06E-05	1.02E-05
17-Jul-17	09:09:00	21.5	8.00	22.00	2.82						
Test # 3:											
17-Jul-17	09:09:00	21.5	8.00	22.00	2.82	0.87	917	1.00	14%	1.07E-05	1.03E-05
17-Jul-17	09:24:17	21.5	9.00	21.00	2.42						
Test # 4:											
17-Jul-17	09:24:17	21.5	9.00	21.00	2.42	0.87	1110	1.00	17%	1.04E-05	1.01E-05
17-Jul-17	09:42:47	21.5	10.00	20.00	2.02						

***Average Ksat* (cm/sec):** **1.02E-05**
Calculated Gravel Corrected Average Ksat (cm/sec): NA



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 7.66E-06

Ksat (+25%) (cm/s): 1.28E-05

Moisture Retention Characteristics

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
S-2 (21-22)	0	52.8 ⌗
	20	52.6 ⌗
	53	53.5 ⌗
	130	51.6 ⌗
	337	49.7 ⌗
	14889	5.6 ⌗
	48339	2.9 ⌗
	150013	2.2 ⌗
	519486	1.7 ⌗
	851293	1.3 ⌗
S-4 (25-27)	0	46.9 ⌗
	18	46.3 ⌗
	28	45.4 ⌗
	130	44.8 ⌗
	337	43.7 ⌗
	25597	4.5 ⌗
	61800	3.0 ⌗
	151950	2.2 ⌗
	450038	1.9 ⌗
	851293	1.3 ⌗

⌗ Volume adjustments are applicable at this matric potential (see data sheet for this sample).

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm^{-1})	N (dimensionless)	θ_r (% vol)	θ_s (% vol)	Oversize Corrected θ_r (% vol)	Oversize Corrected θ_s (% vol)
S-2 (21-22)	0.0011	1.8978	1.46	52.86	NA	NA
S-4 (25-27)	0.0010	1.8069	1.35	46.00	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-2 (21-22)
Project Name: Duck Creek
Project Number: 175667029

Dry wt. of sample (g): 182.46
Tare wt., ring (g): 122.81
Tare wt., screen & clamp (g): 26.60
Initial sample volume (cm^3): 172.86
Initial dry bulk density (g/cm^3): 1.06
Assumed particle density (g/cm^3): 2.48
Initial calculated total porosity (%): 57.44

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	17-Jul-17	12:00	419.31	0	52.81	‡‡
	24-Jul-17	14:00	419.02	20.0	52.63	‡‡
	31-Jul-17	14:10	418.35	53.0	53.52	‡‡
	7-Aug-17	15:00	415.13	130.0	51.65	‡‡
Pressure plate:	17-Aug-17	12:12	411.98	337	49.69	‡‡

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	165.58	-4.21%	1.10	55.57
	20.0	165.58	-4.21%	1.10	55.57
	53.0	161.58	-6.52%	1.13	54.47
	130.0	161.21	-6.74%	1.13	54.36
Pressure plate:	337	161.21	-6.74%	1.13	54.36

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: J. Hines
Checked by: C. Krous

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: S-2 (21-22)

Initial sample bulk density (g/cm^3)*:* 1.06

Fraction of bulk sample used (<2.00mm fraction) (%): 98.53

Dry weight of dew point potentiometer sample* (g)*:* 139.84

Tare weight, jar (g)*:* 112.91

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	27-Jul-17	11:05	141.19	14889	5.58	‡‡
	25-Jul-17	10:45	140.55	48339	2.94	‡‡
	20-Jul-17	11:30	140.38	150013	2.24	‡‡
	18-Jul-17	10:40	140.26	519486	1.74	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14889	161.21	-6.74%	1.13	54.36
	48339	161.21	-6.74%	1.13	54.36
	150013	161.21	-6.74%	1.13	54.36
	519486	161.21	-6.74%	1.13	54.36

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

Laboratory analysis by: J. Falance
Data entered by: J. Hines
Checked by: C. Krous

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: S-2 (21-22)

Initial sample bulk density (g/cm^3)*:* 1.06

Fraction of bulk sample used (<2.00mm fraction) (%): 98.53

Dry weight of relative humidity box sample* (g)*:* 72.42

Tare weight (g)*:* 41.90

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	25-Jul-17	11:40	72.76	851293	1.26	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	851293	161.21	-6.74%	1.13	54.36

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

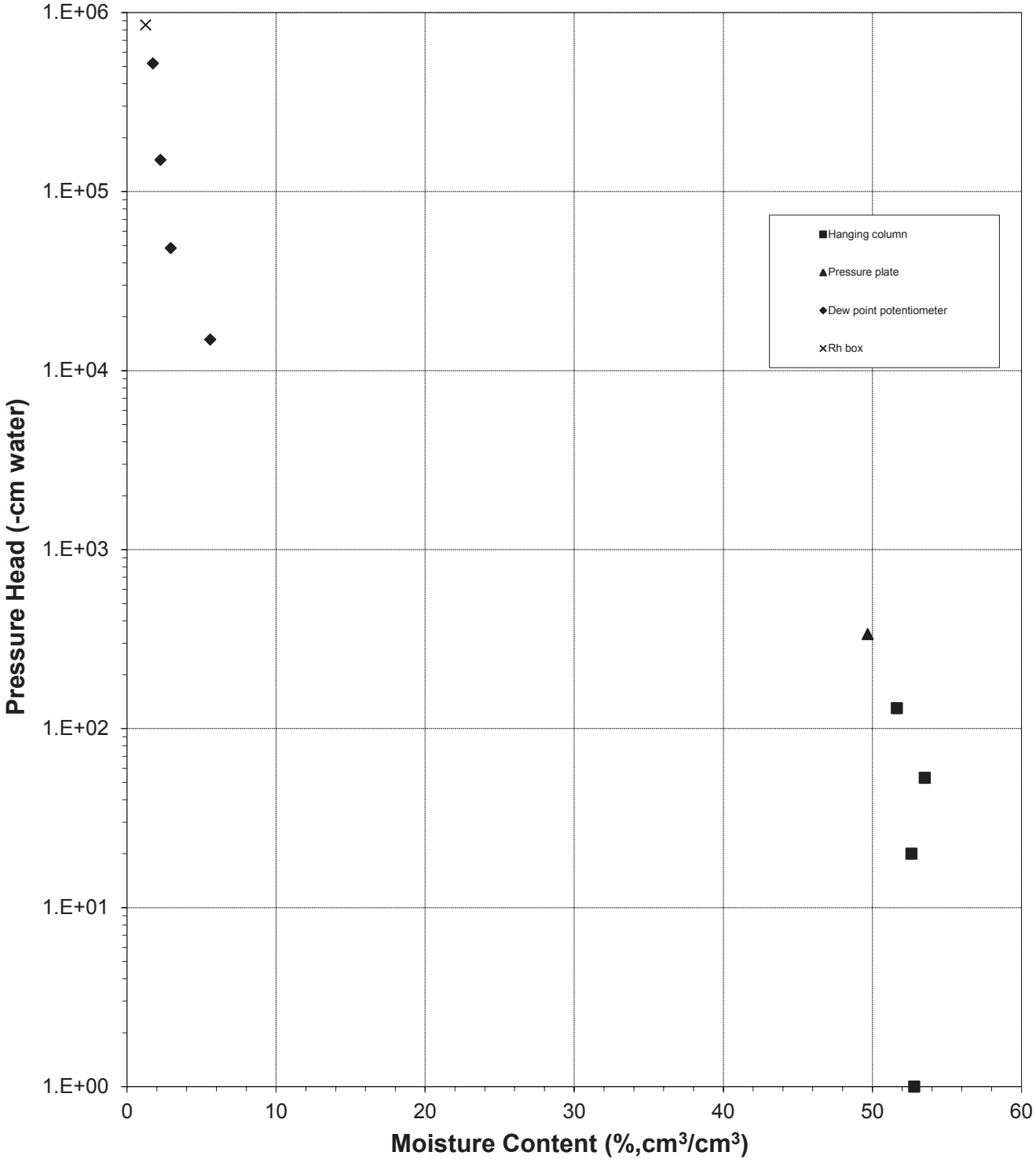
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: J. Falance
Data entered by: J. Hines
Checked by: C. Krous

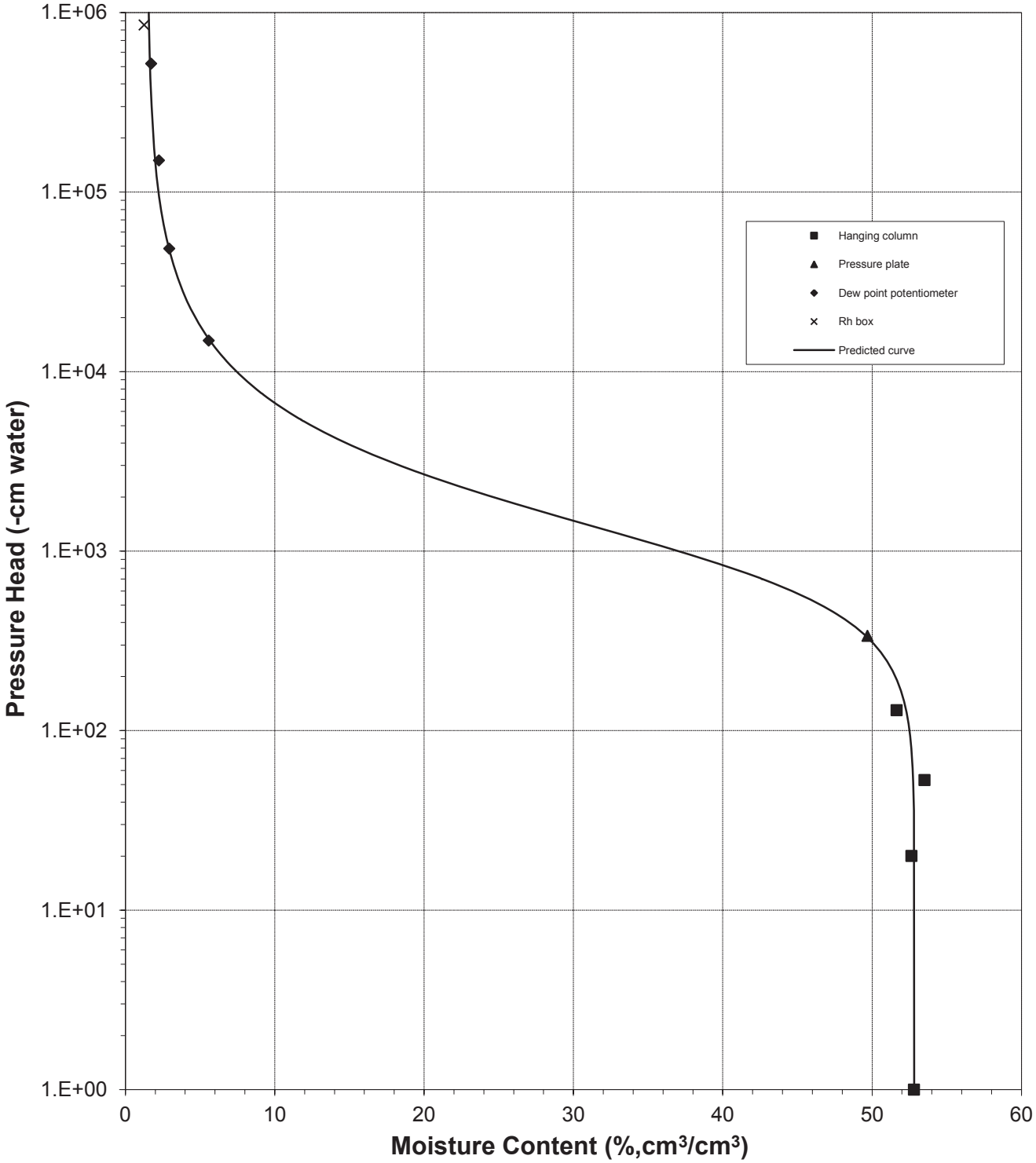
Water Retention Data Points

Sample Number: S-2 (21-22)



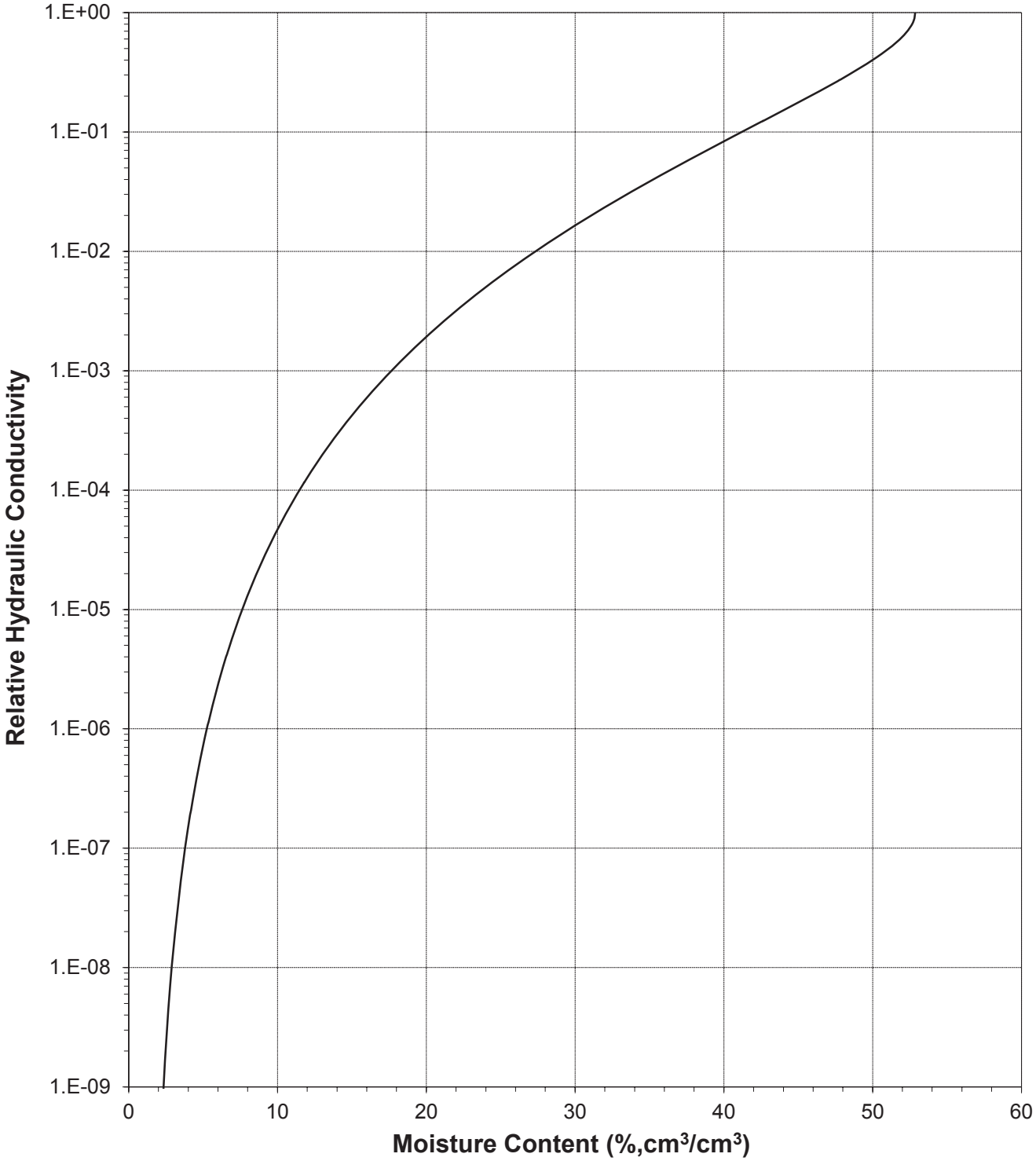
Predicted Water Retention Curve and Data Points

Sample Number: S-2 (21-22)



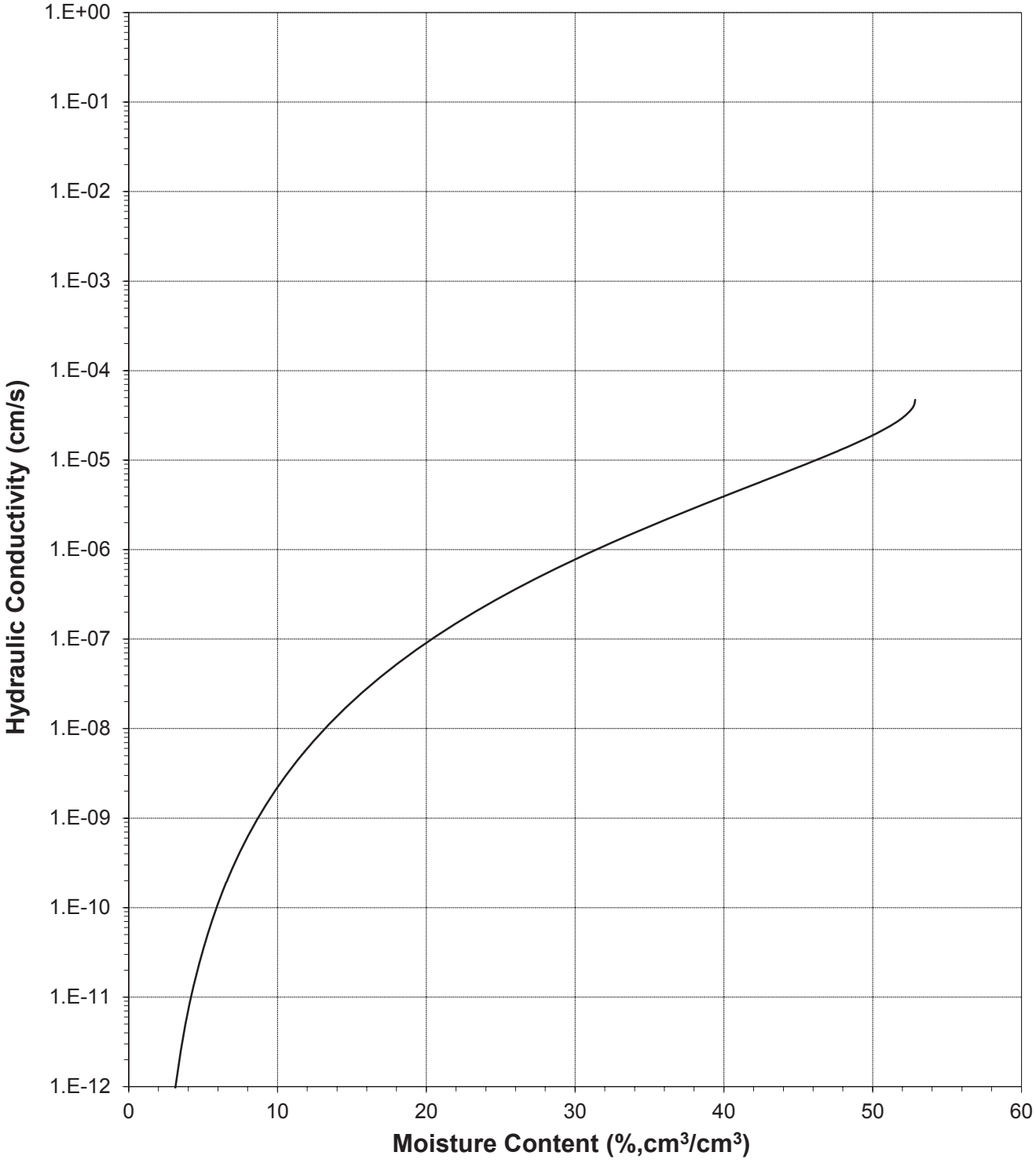
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: S-2 (21-22)



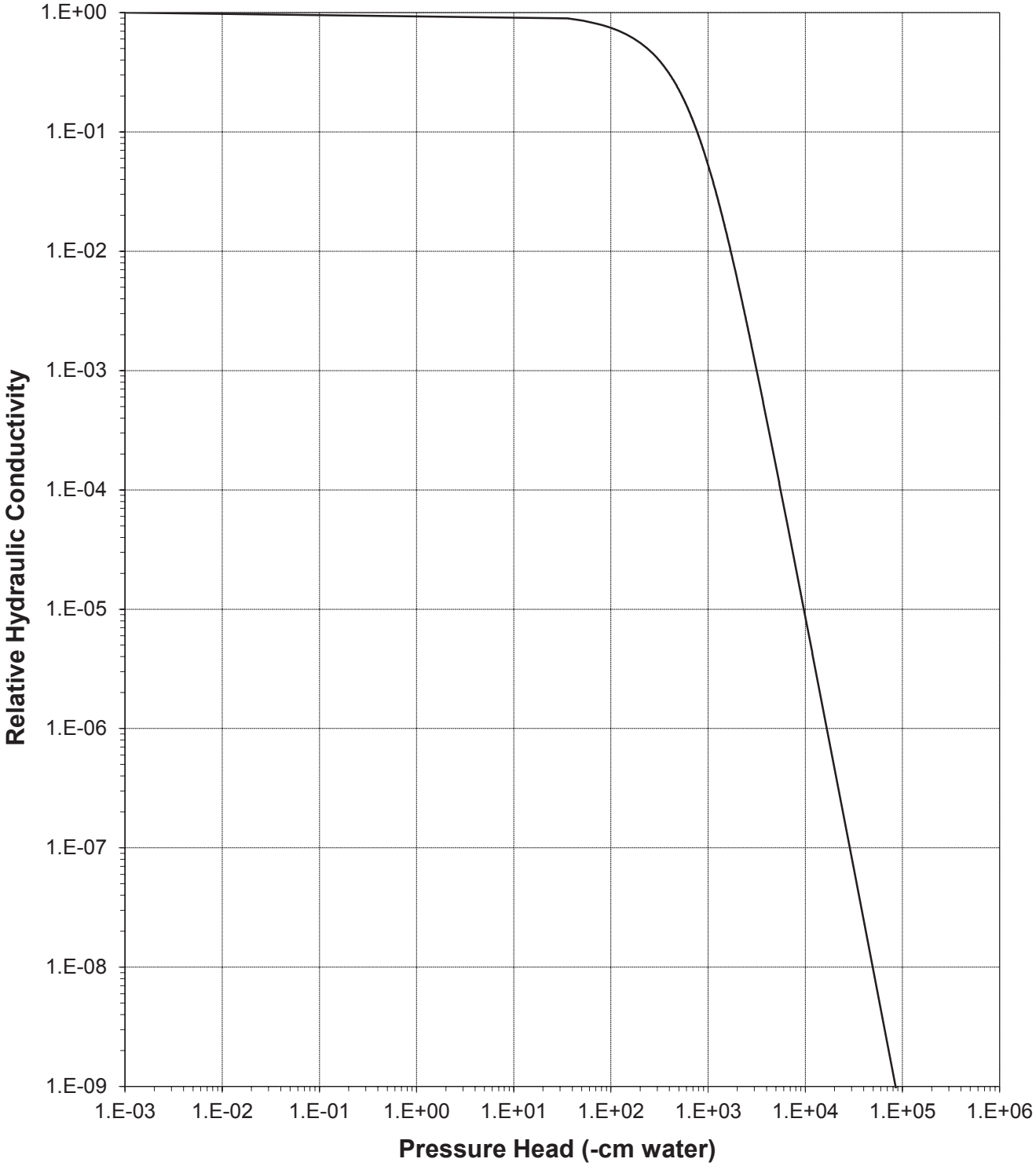
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: S-2 (21-22)



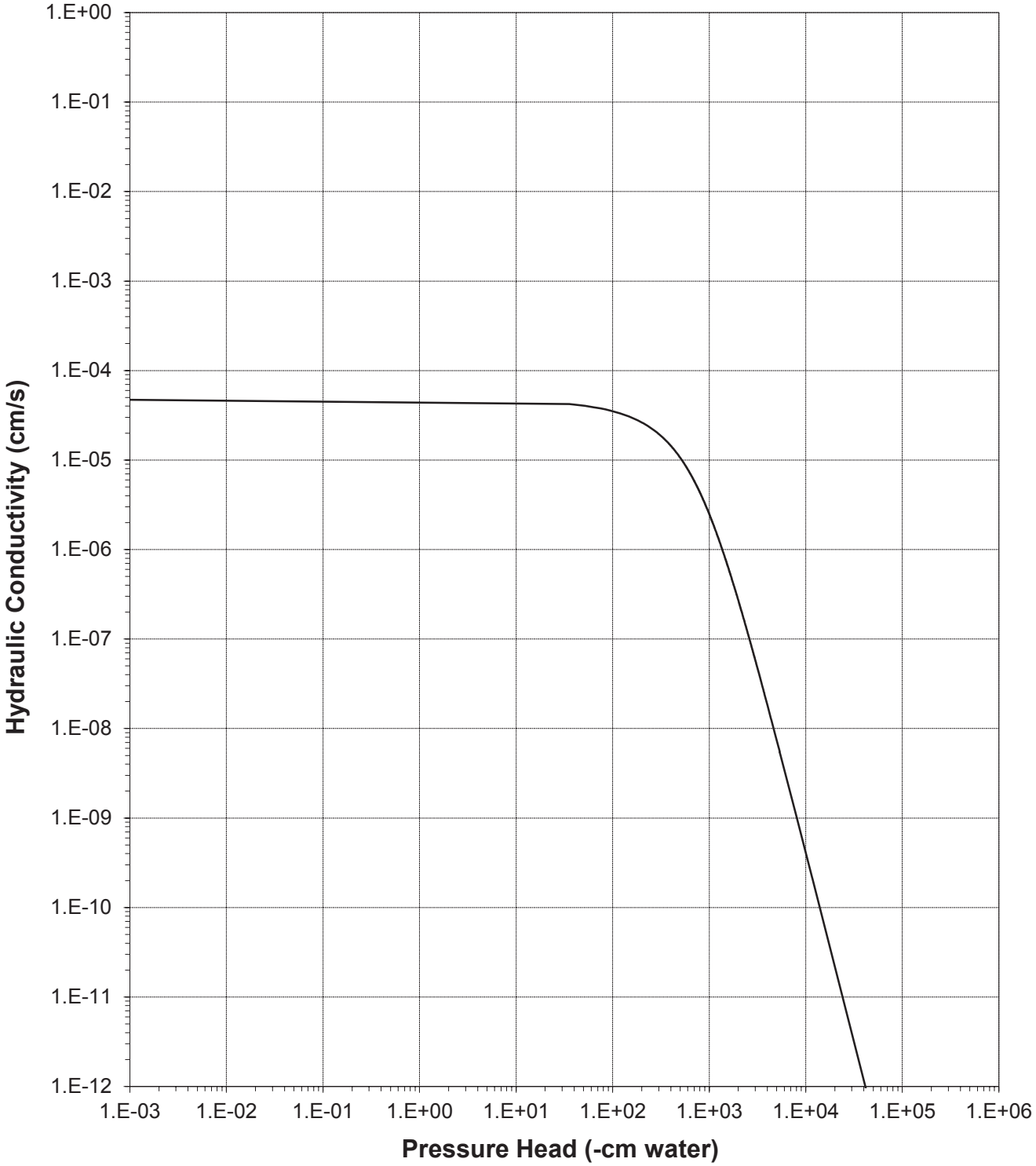
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: S-2 (21-22)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: S-2 (21-22)



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column / Pressure Plate

(Soil-Water Characteristic Curve)

Job Name: Stantec
Job Number: DB17.1176.00
Sample Number: S-4 (25-27)
Project Name: Duck Creek
Project Number: 175667029

Dry wt. of sample (g): 222.61
Tare wt., ring (g): 127.29
Tare wt., screen & clamp (g): 27.99
Initial sample volume (cm^3): 176.46
Initial dry bulk density (g/cm^3): 1.26
Assumed particle density (g/cm^3): 2.48
Initial calculated total porosity (%): 49.13

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	17-Jul-17	12:00	457.16	0	46.85	‡‡
	24-Jul-17	14:05	455.18	17.5	46.25	‡‡
	31-Jul-17	14:15	453.02	28.0	45.43	‡‡
	7-Aug-17	15:00	451.93	130.0	44.77	‡‡
Pressure plate:	17-Aug-17	12:05	450.14	337	43.69	‡‡

Volume Adjusted Data [1]

	Matric Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calculated Porosity (%)
Hanging column:	0.0	169.19	-4.12%	1.32	46.94
	17.5	167.11	-5.30%	1.33	46.28
	28.0	165.36	-6.29%	1.35	45.72
	130.0	165.36	-6.29%	1.35	45.72
Pressure plate:	337	165.36	-6.29%	1.35	45.72

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Assumed density of water is 1.0 g/cm^3

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Technician Notes:

Laboratory analysis by: D. O'Dowd
Data entered by: J. Hines
Checked by: C. Krous

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: S-4 (25-27)

Initial sample bulk density (g/cm^3)*:* 1.26

Fraction of bulk sample used (<2.00mm fraction) (%): 93.22

Dry weight of dew point potentiometer sample* (g)*:* 149.81

Tare weight, jar (g)*:* 115.13

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Dew point potentiometer:	27-Jul-17	11:10	151.07	25597	4.55	‡‡
	25-Jul-17	10:55	150.63	61800	2.95	‡‡
	20-Jul-17	12:50	150.42	151950	2.22	‡‡
	18-Jul-17	10:50	150.33	450038	1.87	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	25597	165.36	-6.29%	1.35	45.72
	61800	165.36	-6.29%	1.35	45.72
	151950	165.36	-6.29%	1.35	45.72
	450038	165.36	-6.29%	1.35	45.72

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

Laboratory analysis by: J. Falance
Data entered by: J. Hines
Checked by: C. Krous

Moisture Retention Data

Dew Point Potentiometer / Relative Humidity Box

(Soil-Water Characteristic Curve)

Sample Number: S-4 (25-27)

Initial sample bulk density (g/cm^3)*:* 1.26

Fraction of bulk sample used (<2.00mm fraction) (%): 93.22

Dry weight of relative humidity box sample* (g)*:* 65.25

Tare weight (g)*:* 42.91

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)	
Relative humidity box:	25-Jul-17	11:40	65.49	851293	1.32	‡‡

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Relative humidity box:	851293	165.36	-6.29%	1.35	45.72

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

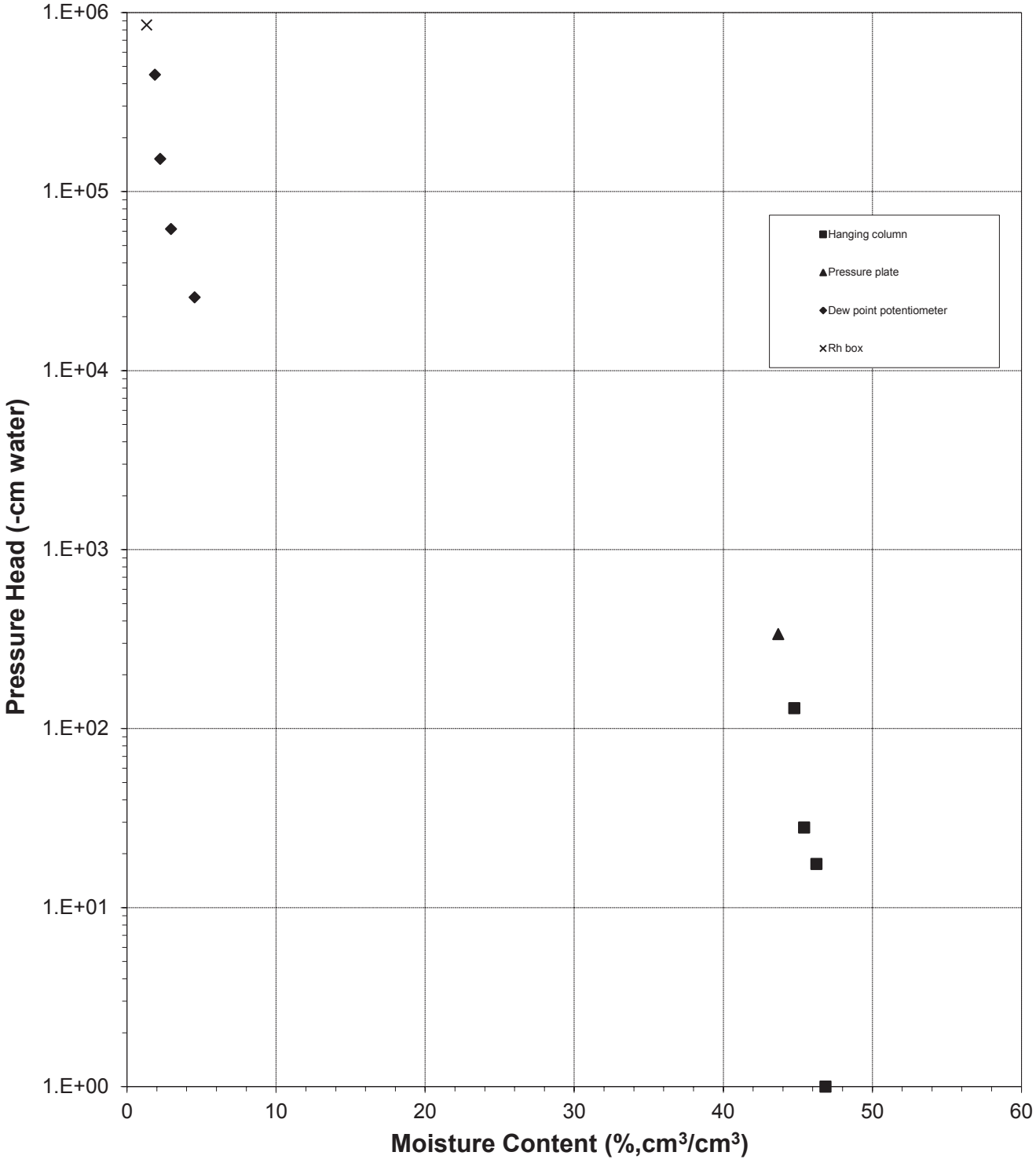
† Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: J. Falance
Data entered by: J. Hines
Checked by: C. Krous

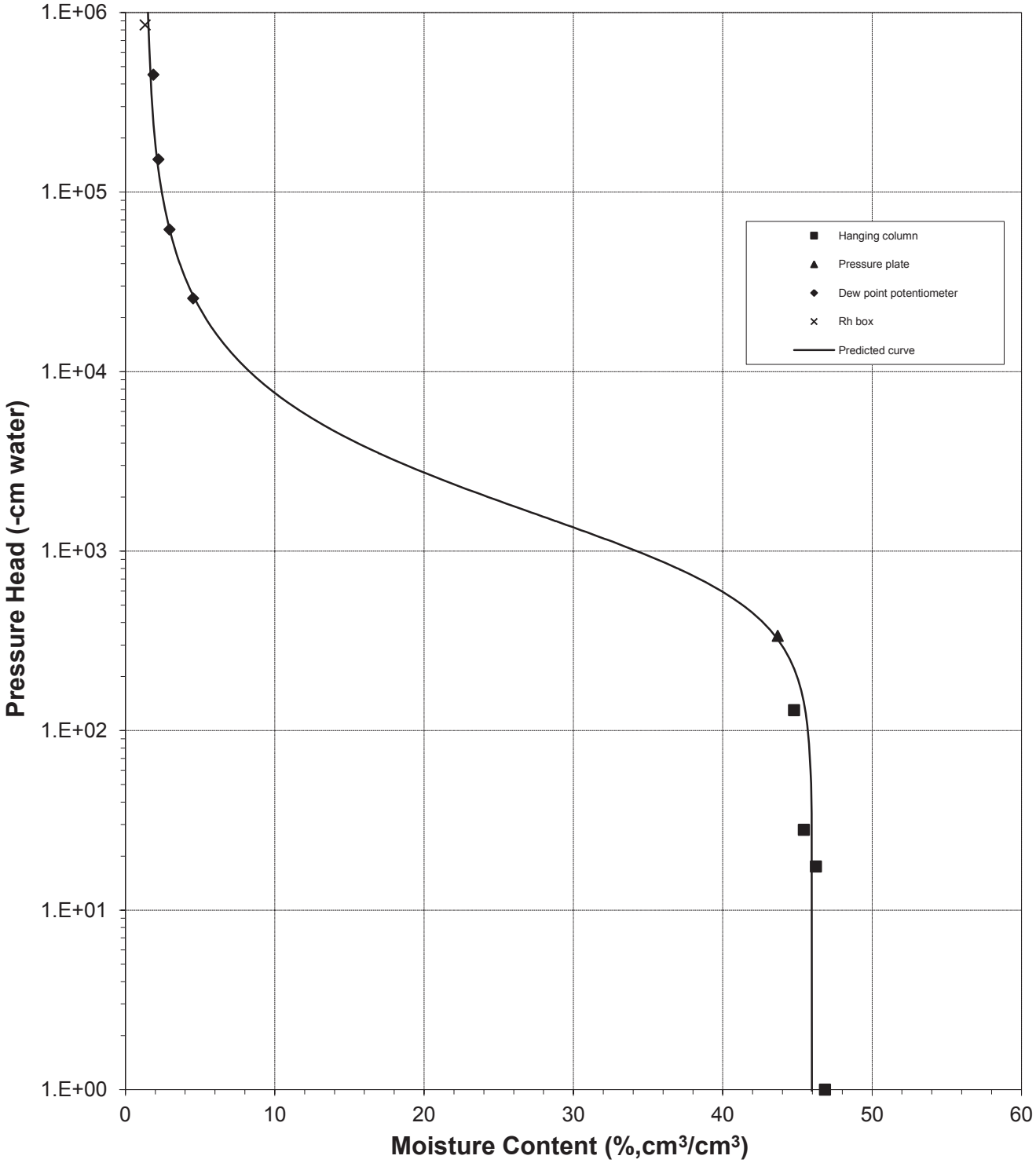
Water Retention Data Points

Sample Number: S-4 (25-27)



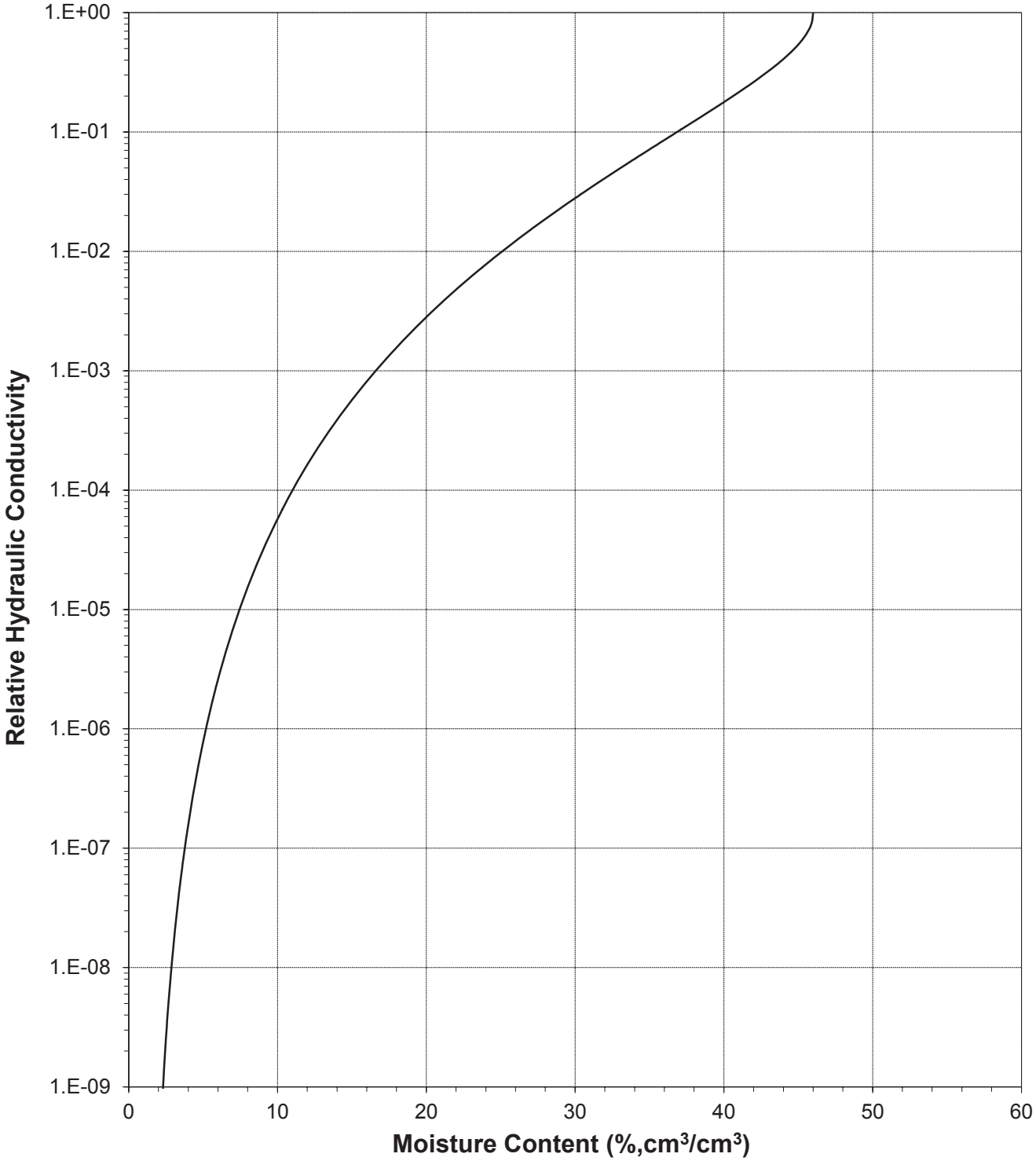
Predicted Water Retention Curve and Data Points

Sample Number: S-4 (25-27)



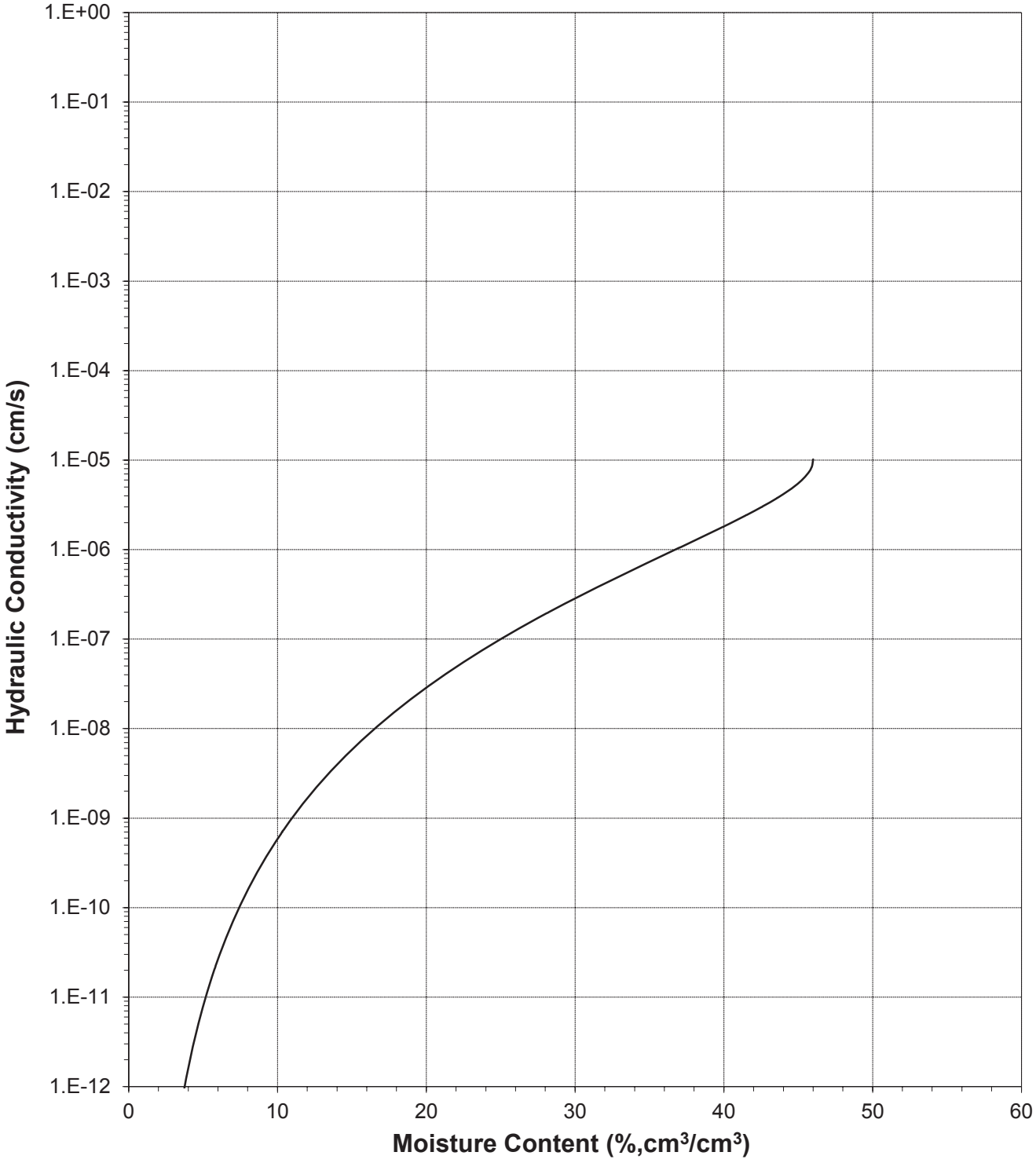
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: S-4 (25-27)



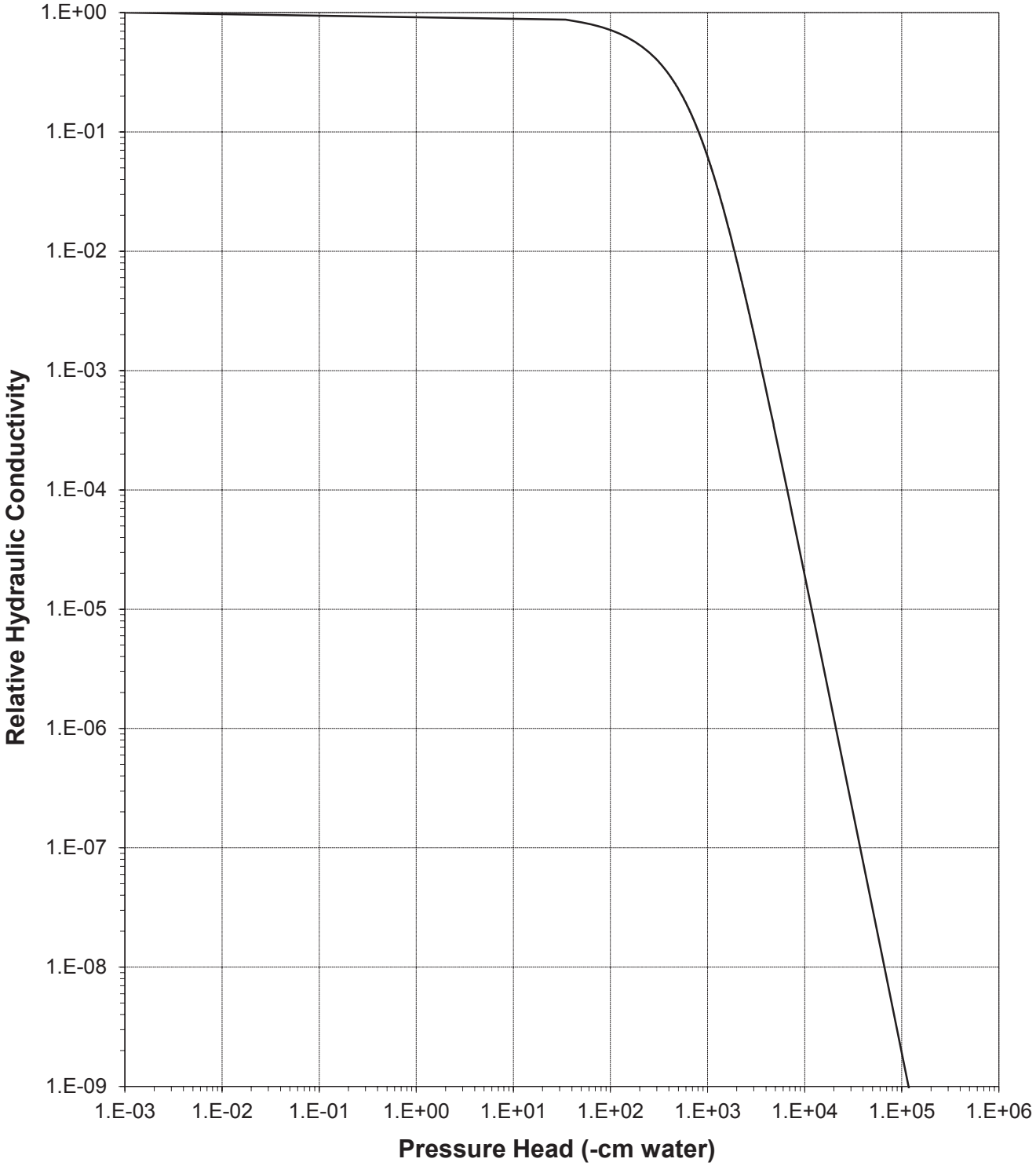
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: S-4 (25-27)



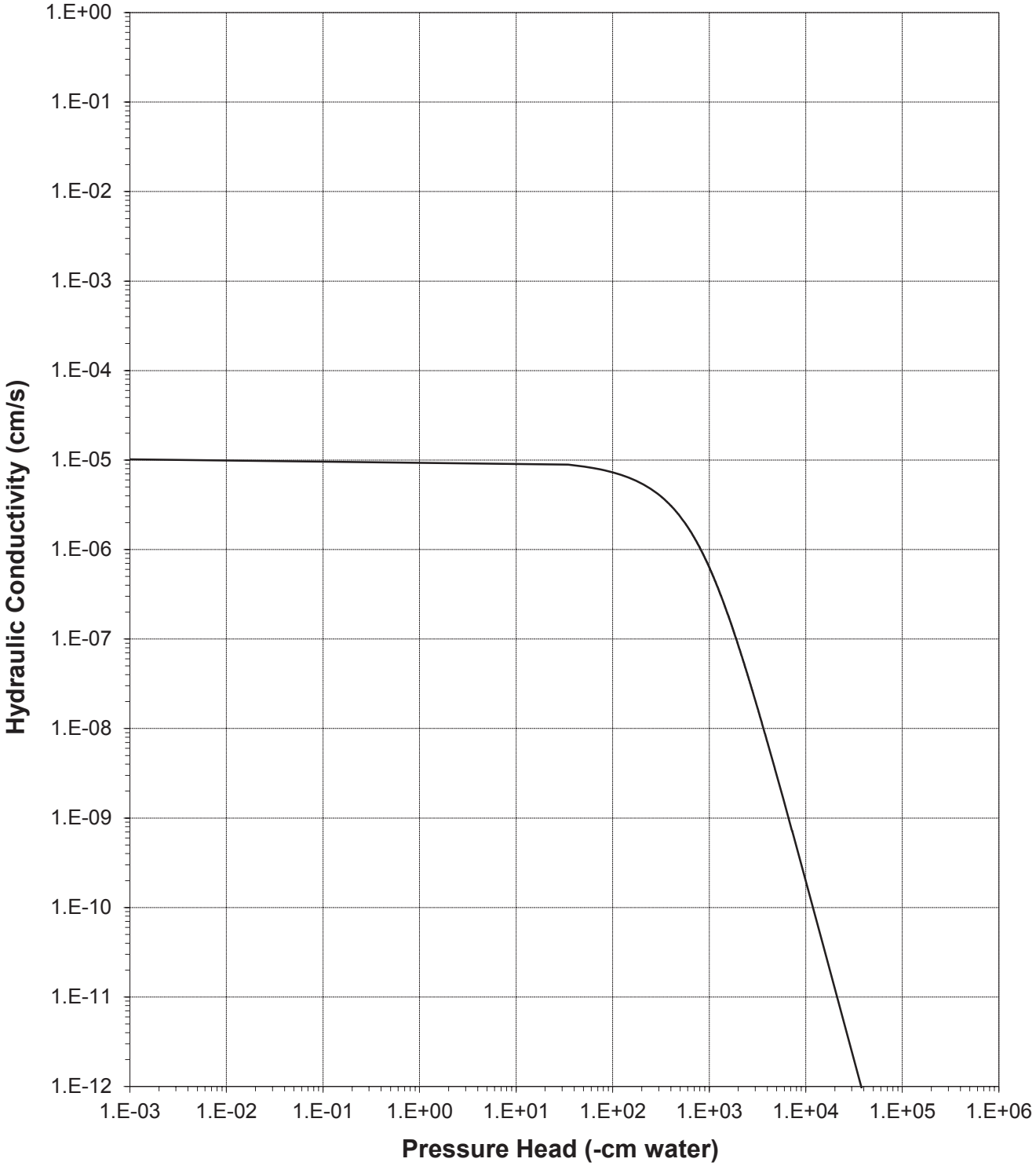
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: S-4 (25-27)



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: S-4 (25-27)



Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Falling Head Rising Tail: (Flexible Wall)	ASTM D5084
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991

ATTACHMENT D
AP1/AP2 VANE SHEAR TEST RESULTS

D.1 VANE SHEAR TESTING RESULTS

Contained in this attachment is a summary of all vane shear data collected at the Duck Creek Power Station as part of the supplemental exploration. Vane shear data was collected with a Geonor H60 vane shear apparatus using the manufacturer's written proceedure . The results of this testing are presented in Table D1.

TABLE D1. VANE SHEAR TESTING RESULTS AT DUCK CREEK AP1 AND AP2.

Location	Test No.	Depth [ft]	Embedment [ft]	Shear Strength [psf]			
TP-1	VS-1	5	0.5	3301	2674	2507	
TP-1	VS-2	10	0.3	2507	2507	2089	
TP-1	VS-3	15.2	0.1	R[1]	R[1]	R[1]	
TP-2	VS-1	6	0.1	R[1]	R[1]	R[1]	
TP-2	VS-2	11	0.5	1421	1838	NR[2]	
TP-3	VS-1	4.5	0.5	>5431[3]	>5431[3]	>5431[3]	
TP-3	VS-2	9.8	0.1	R[1]	R[1]	R[1]	
TP-3	VS-3	11	0.2	836	1045	NR[2]	
TP-3	VS-4	15.5	0.1	R[1]	R[1]	R[1]	
TP-4	VS-1	5	0.8	1922	1755	2089	
TP-4	VS-2	8	1	1588	1588	1421	
TP-4	VS-3	11.5	1	2298	1755	1922	
TP-5	VS-1	5	0.1	R[1]	R[1]	R[1]	
TP-5	VS-2	10	0.1	R[1]	R[1]	R[1]	
TP-5	VS-3	14	N/A	R[4]	R[4]	R[4]	
TP-6	VS-1	5	0.1	R[1]	R[1]	R[1]	
TP-6	VS-2	10	1	1170	3175	1588	1253
TP-6	VS-3	15	0.1	R[1]	R[1]	R[1]	
TP-7	VS-1	5.8	0.1	R[1]	R[1]	R[1]	
TP-7	VS-2	10.8	0.4	2089	1421	1671	
TP-8	VS-1	5.2	0.1	R[1]	R[1]	R[1]	
TP-8	VS-2	10	0.4	2507	2507	2423	
TP-8	VS-3	14	0.1	R[1]	R[1]	R[1]	
TP-9	VS-1	5.5	1	2089	2089	2423	
TP-9	VS-2	10	0.1	R[1]	R[1]	R[1]	
TP-9	VS-3	14	0.1	R[4]	R[4]	R[4]	
TP-10	VS-1	9	1	1880	2507	NR[2]	
TP-10	VS-2	10.5	0.1	R[1]	R[1]	R[1]	

TABLE D1. VANE SHEAR TESTING RESULTS AT DUCK CREEK AP1 AND AP2.

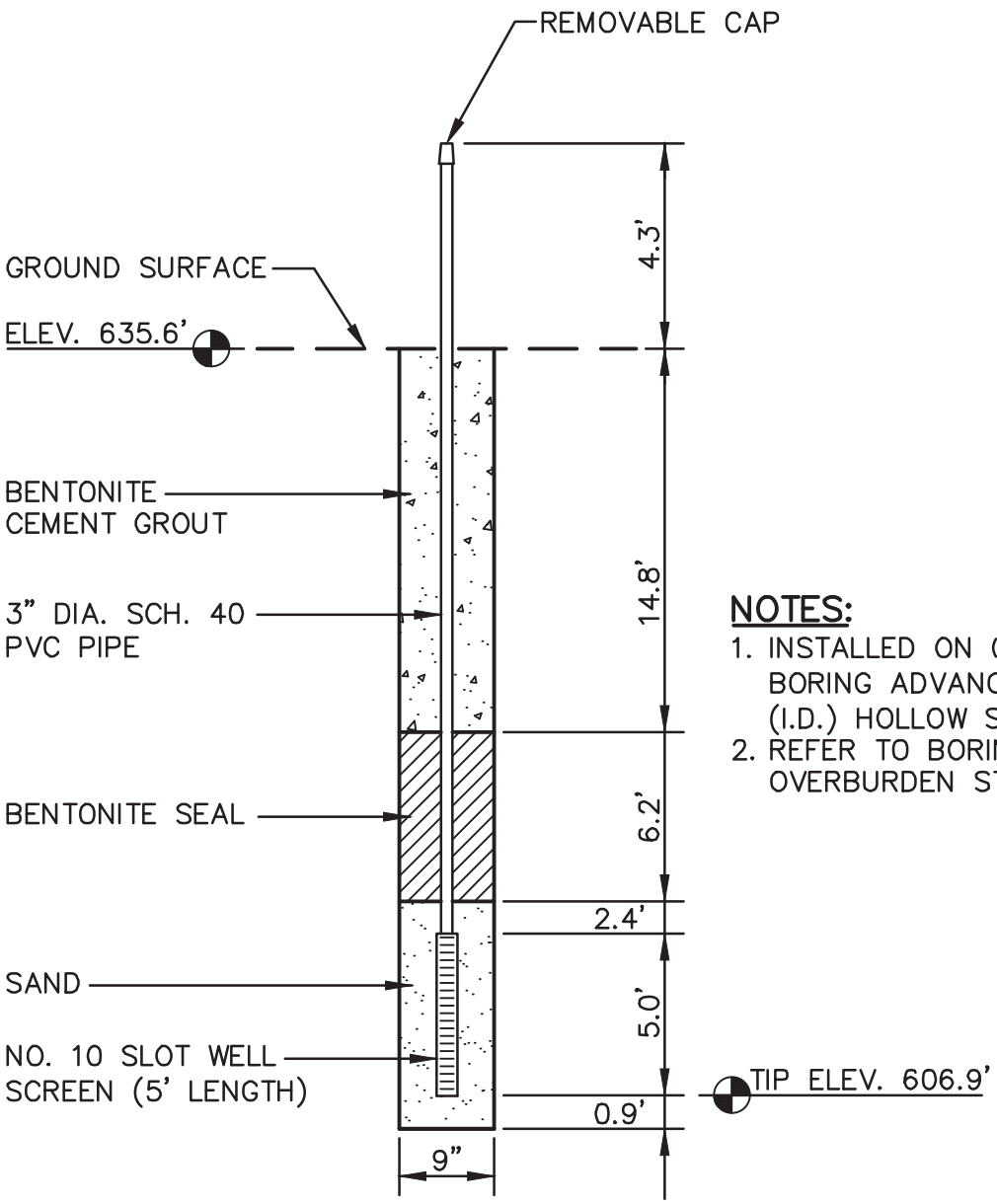
Location	Test No.	Depth [ft]	Embedment [ft]	Shear Strength [psf]			
VS-1	VS-1	0.5	0.5	125			
VS-1	VS-2	2.1	2.1	627	0[6]		
VS-1	VS-3	3.8	3.8	0	0[6]	502	
VS-1	VS-4	5.4	5.4	1003	0[6]		
VS-1	VS-5	5.8	5.8	>2423[3,5]			
VS-2	VS-1	0.5	0.5	1588	*418*[6]		
VS-2	VS-2	2.1	2.1	710	0[6]		
VS-2	VS-3	3.8	3.8	668	0[6]		
VS-2	VS-4	5.4	5.4	0	0[6]		
VS-2	VS-5	7.1	7.1	501	0[6]		
VS-2	VS-6	7.5	7.5	>5013[3,5]			
VS-3	VS-1	0.5	0.5	1086	460[6]		
VS-3	VS-2	2.1	2.1	42	0[6]	501	
VS-3	VS-3	3.8	3.8	0	0[6]	292	
VS-3	VS-4	5.4	5.4	2590	167[6]	3092	
VS-3	VS-5	5.8	5.8	>3593[3,5]			
VS-4	VS-1	0.5	0.5	84	0[6]		
VS-4	VS-2	2.1	2.1	2256	501[6]	2131	
VS-4	VS-3	3	3	>2549[3,5]	0[6]		
VS-5	VS-1	0.5	0.5	188	167		
VS-5	VS-2	2.1	2.1	209	10		
VS-5	VS-3	3.8	3.8	125	0[6]		
VS-5	VS-4	5.4	5.4	>971[3]	658	188	
VS-5	VS-5	5.8	5.8	>627[3,5]			
VS-6	VS-1	0.5	0.5	>1358[5]			
VS-6	VS-2	2.1	2.1	460[6]	1253	0[6]	
VS-6	VS-3	3.8	3.8	856	606	0[6]	
VS-6	VS-4	5.4	5.4	585	42[6]		
VS-6	VS-5	7.1	7.1	626.7	0[6]		
VS-6	VS-6	8.7	8.7	397	0[6]		
VS-6	VS-7	10.3	10.3	0	0[6]		
VS-7	VS-1	0.5	0.5	731	230[6]		

TABLE D1. VANE SHEAR TESTING RESULTS AT DUCK CREEK AP1 AND AP2.

Location	Test No.	Depth [ft]	Embedment [ft]	Shear Strength [psf]			
VS-7	VS-2	2.1	2.1	522	0[6]		
VS-7	VS-3	3.8	3.8	0	0[6]		
VS-7	VS-4	5.4	5.4	0	0[6]		
VS-7	VS-5	7.1	7.1	209	0[6]		
VS-7	VS-6	8.7	8.7	710	0[6]		
VS-7	VS-7	10.3	10.3	146	0[6]		
VS-8	VS-1	0.5	0.5	230	104[6]		
VS-8	VS-2	2.1	2.1	1149	21[6]		
VS-8	VS-3	3.8	3.8	272	0[6]		
VS-8	VS-4	5.4	5.4	146	0[6]		
VS-8	VS-5	7.1	7.1	397	188[6]		
VS-8	VS-6	8.7	8.7	272	0[6]		
VS-8	VS-7	10.3	10.3	292	0[6]		
VS-9	VS-1	0.5	0.5	125	42[6]	115	0[6]
VS-9	VS-2	2.1	2.1	84	0[6]	104	52[6]
VS-9	VS-3	3.8	3.8	0	0[6]	366	0[6]
VS-9	VS-4	5.4	5.4	63	0[6]	366	0[6]
VS-9	VS-5	7.1	7.1	0	0[6]	0	0[6]
VS-9	VS-6	8.7	8.7	125	0[6]	251	0[6]
VS-9	VS-7	10.3	10.3	0	0[6]	94	0[6]

[1]Refusal of Probe to Penetrate, [2]No Reading Due to Failure of Soil Plug, [3]Reading Exceeded Gauge Limit, [4]Refusal by Inspection Due to Soil Stiffness or Bottom Conditions, [5]Test Conducted at Limit of Penetration, [6]Indicates Residual Strength Result

ATTACHMENT E
PORE WATER SAMPLING PIEZOMETER DETAILS



NOTES:

1. INSTALLED ON 06/20/2017. BORING ADVANCED WITH 4.25" (I.D.) HOLLOW STEM AUGERS.
2. REFER TO BORING LOG FOR OVERBURDEN STRATIGRAPHY.

LOCATION:

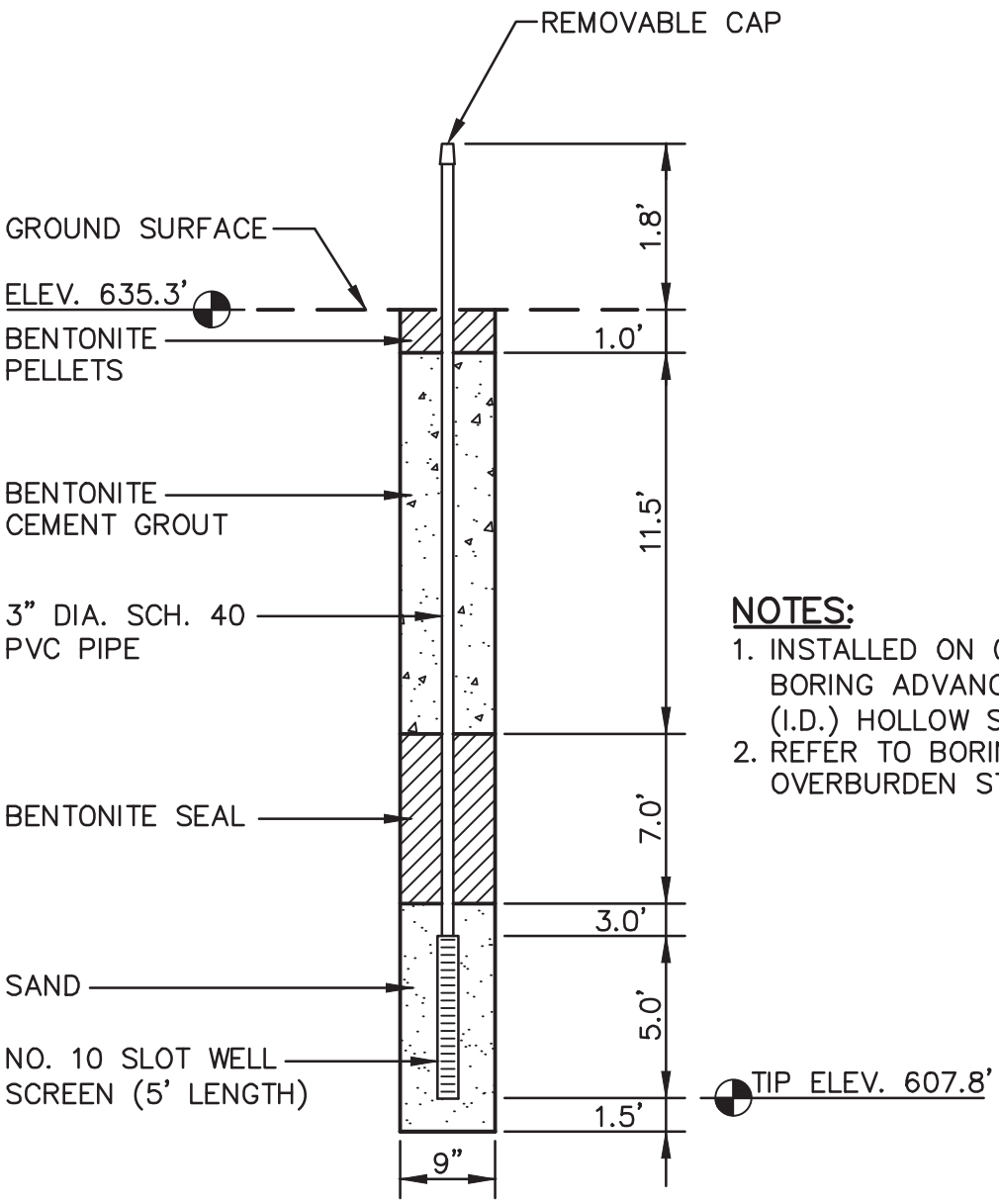
NORTHING: 1387132.6
EASTING: 2346039.1
GROUND ELEVATION: 635.6 FEET
LOCATIONS PROVIDED BY MAUER–STUTZ SURVEYORS.
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NGVD29

PIEZOMETER PZ-1
DUCK CREEK
FULTON COUNTY, ILLINOIS

Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, Kentucky 40513
859-422-3000
www.stantec.com

DRAWN BY	BMS	DATE	07/25/2017	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	175667029	1.	3.	1 OF 1
CHECKED BY	–	SCALE	NTS	2.	4.	

PLOT DATE: 10/30/2017 USER: SHELTON, BEN
V:\1756\ACTIVE\175667029\TECHNICAL_PRODUCTION\DRAWING\SHEET_FILES\INSTRUMENTATION\PZ-1.DWG



NOTES:

1. INSTALLED ON 06/18/2017. BORING ADVANCED WITH 4.25" (I.D.) HOLLOW STEM AUGERS.
2. REFER TO BORING LOG FOR OVERBURDEN STRATIGRAPHY.

LOCATION:

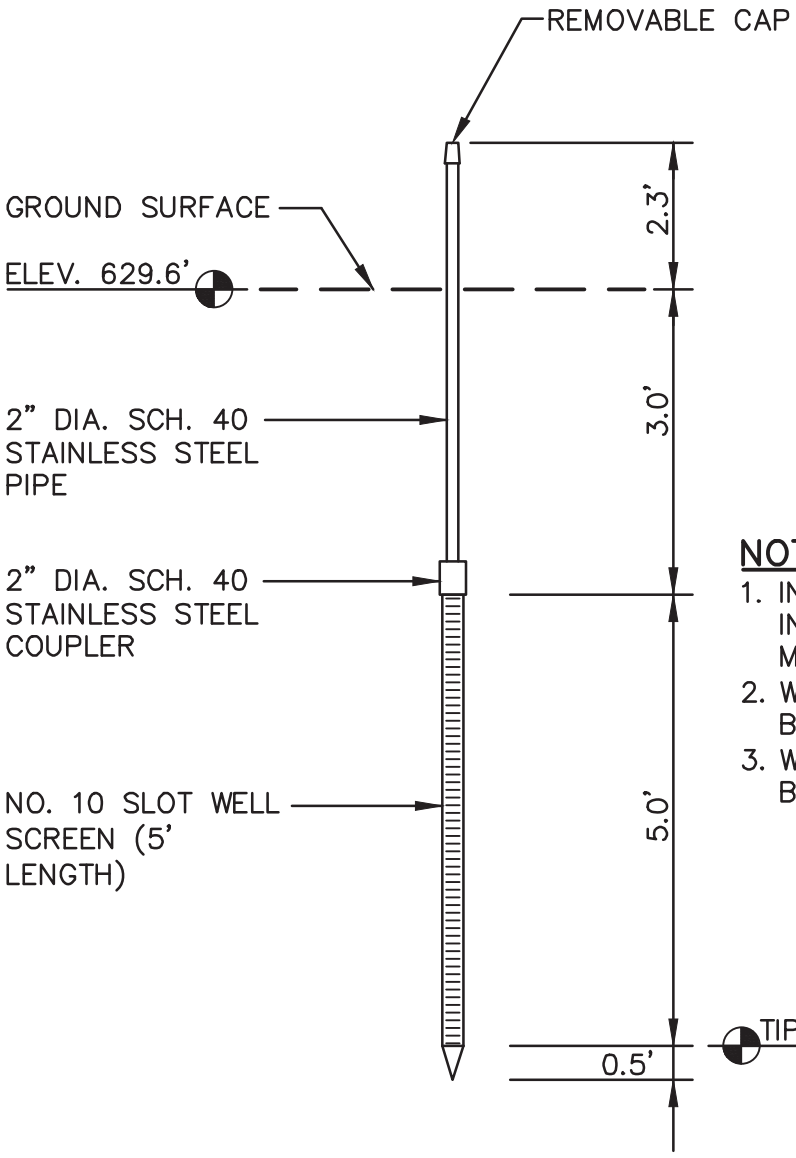
NORTHING: 1389397.8
EASTING: 2346523.7
GROUND ELEVATION: 635.3 FEET
LOCATIONS PROVIDED BY MAUER-STUTZ SURVEYORS.
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NGVD29

PIEZOMETER PZ-2
DUCK CREEK
FULTON COUNTY, ILLINOIS

Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, Kentucky 40513
859-422-3000
www.stantec.com

DRAWN BY	BMS	DATE	07/25/2017	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	175667029	1.	3.	1 OF 1
CHECKED BY	—	SCALE	NTS	2.	4.	

PLOT DATE: 10/30/2017 USER: SHELTON, BEN
V:\1756\ACTIVE\175667029\TECHNICAL_PRODUCTION\DRAWING\SHEET_FILES\INSTRUMENTATION\PZ-2.DWG



NOTES:

1. INSTALLED ON 06/21/2017. INSTRUMENT DRIVEN MANUALLY.
2. WELL WAS BAILED TO 5.0' BELOW GROUND SURFACE.
3. WELL RECOVERED TO 2.6' BELOW GROUND SURFACE.

LOCATION:

NORTHING: 1391632.9
EASTING: 2346645.9
GROUND ELEVATION: 629.6 FEET

LOCATIONS PROVIDED BY MAUER–STUTZ SURVEYORS.
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NGVD29

PIEZOMETER PZ-3
DUCK CREEK
FULTON COUNTY, ILLINOIS

Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, Kentucky 40513
859-422-3000
www.stantec.com

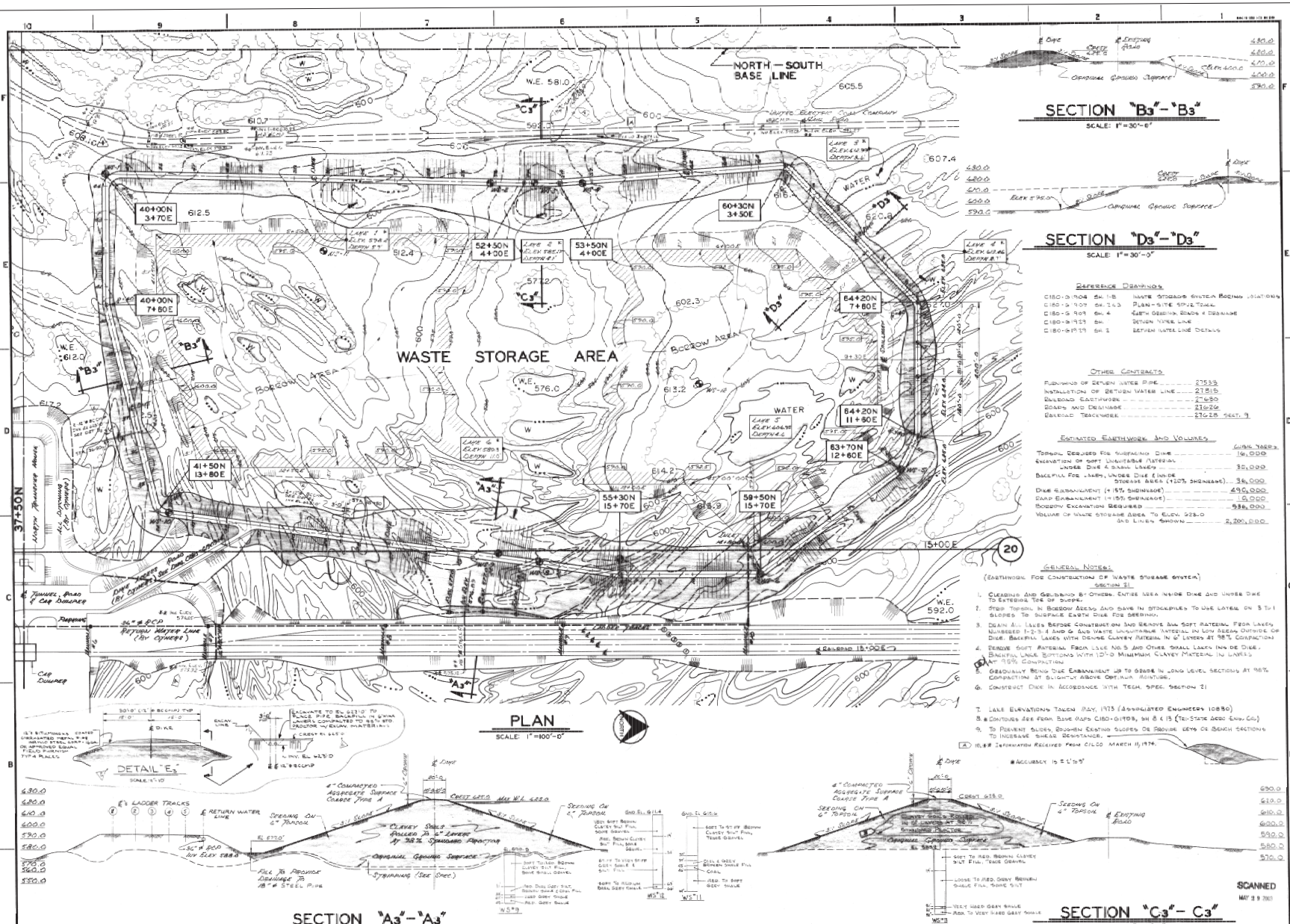
DRAWN BY	BMS	DATE	07/25/2017	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	175667029	1.	3.	1 OF 1
CHECKED BY	–	SCALE	NTS	2.	4.	

PLOT DATE: 10/30/2017 USER: SHELTON, BEN
V:\1756\ACTIVE\175667029\TECHNICAL_PRODUCTION\DRAWING\SHEET_FILES\INSTRUMENTATION\PZ-3.DWG

February 28, 2018

Appendix C

RECORD DRAWINGS


NORTH — SOUTH BASE LINE
WASTE STORAGE AREA
BORROW AREA
WATER
PLAN
SCALE: 1"=100'-0"
SECTION "B3"–"B3"
SCALE: 1"=30'-0"
SECTION "D3"–"D3"
SCALE: 1"=30'-0"
SECTION "A3"–"A3"
SCALE: 1"=30'-0"
SECTION "C3"–"C3"
SCALE: 1"=30'-0"
DETAIL "E3"
SCALE: 1"=10'
40+00N 3+70E
40+00N 7+60E
41+50N 13+80E
37+50N
52+50N 4+00E
53+50N 4+00E
60+30N 3+50E
64+20N 7+80E
64+20N 11+60E
63+70N 12+60E
55+30N 15+70E
58+50N 15+70E
15+00E
RAILROAD 15+00E
W.E. 581.0
W.E. 612.0
W.E. 576.0
W.E. 592.0
612.5
612.4
617.2
613.2
614.2
613.9
602.3
607.4
610.7
605.5
616.
620.8
LAKE 1 ELEV. 594.8 DEPTH 5'
LAKE 2 ELEV. 592.0 DEPTH 8'
LAKE 3 ELEV. 610.0 DEPTH 3.5'
LAKE 4 ELEV. 614.4 DEPTH 8'
LAKE 5 ELEV. 604.5 DEPTH 4.5'
LAKE 6 ELEV. 580.5 DEPTH 11.0'
36" ø RCCP RETURN WATER LINE (BY OTHERS)
DIKE (BY OTHERS)
TUNNEL ROAD & CAR DUMPER
CAR DUMPER
NORTH TRANSFER HOUSE
SOUTH TRANSFER HOUSE
ALL DITCHING (BY OTHERS)
RETURN WATER LINE
ROAD
DIKE
EXISTING GRADE
ORIGINAL GROUND SURFACE
CREST 620.0
CREST 628.0
MAX W.L. 620.0
SEEDING ON 6" TOPSOIL
4" COMPACTED AGGREGATE SURFACE COURSE TYPE A
CLAYEY SOILS ROLLED TO 6" LAYERS AT 95% STANDARD PROCTOR
STRIPPING (SEE SPEC.)
FILL TO PROVIDE DRAINAGE TO 18" ø STEEL PIPE
LADDER TRACKS
EL. RETURN WATER LINE
INV. ELEV. 588.5
EL. 577.0'
EL. 628.0
EL. 618.0
EL. 614.4
EL. 608.5
EL. 613.0
EL. 603.0
EL. 598.5
EL. 593.0
EL. 588.0
EL. 583.0
SOFT TO STIFF BROWN CLAYEY SILT FILL, TRACE GRAVEL
SOFT TO VERY STIFF GRAY SHALE & SILT FILL
SOFT TO MEDIUM BROWN SHALE FILL
SOFT TO MEDIUM GRAY SHALE
MED. BROWN CLAYEY SILT FILL, SOME SMALL GRAVEL
MED. GRAY SHALE
SOFT TO MED. BROWN CLAYEY SILT FILL, SOME GRAVEL
LOOSE TO MED. GRAY BROWN SHALE FILL, SOME SILT
VERY HARD GRAY SHALE
HARD TO VERY HARD GRAY SHALE
WS#12
WS#11
WS#13
WS#5
WS#10
WS#9
WS#8
WS#7
WS#6
WS#4
WS#3
WS#2
WS#1
WS#14
WS#15
WS#16
WS#17
WS#18
WS#19
WS#20
WS#21
WS#22
WS#23
WS#24
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WS#30
WS#31
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WS#40
WS#41
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WS#52
WS#53

GENERAL NOTES

1) SITE SURVEY FROM ABRAMS AERIAL SURVEY MAPPING OF OCTOBER 1981 (18049AA.SUR 17759).

2) THE AREA WITHIN WASTE DISPOSAL AREA II, RECYCLE POND, ALL DIKE FOUNDATIONS, FILL AREAS, BORROW AREAS, AND DRAIN EXCAVATIONS SHALL BE CLEARED PRIOR TO ANY SUBSEQUENT WORK.

3) ALL SUBGRADES SHALL BE APPROVED BY THE OWNER'S REPRESENTATIVE PRIOR TO THE PLACEMENT OF ANY FILL

4) ALL DIKE EMBANKMENTS SHALL BE COMPACTED TO 98% OF MAXIMUM DENSITY AS OBTAINED BY ASTM D 698.

5) ALL RANDOM FILL AREAS SHALL BE COMPACTED TO 85% OF MAXIMUM DENSITY AS OBTAINED BY ASTM D 698. RANDOM FILL SHALL BE SLOPED AWAY FROM DISPOSAL AREA AND RECYCLE POND & TOWARDS DRAINAGE DITCHES ADJACENT TO RAILROAD TRACKS. RANDOM FILL SHALL BE AS FOLLOWS.

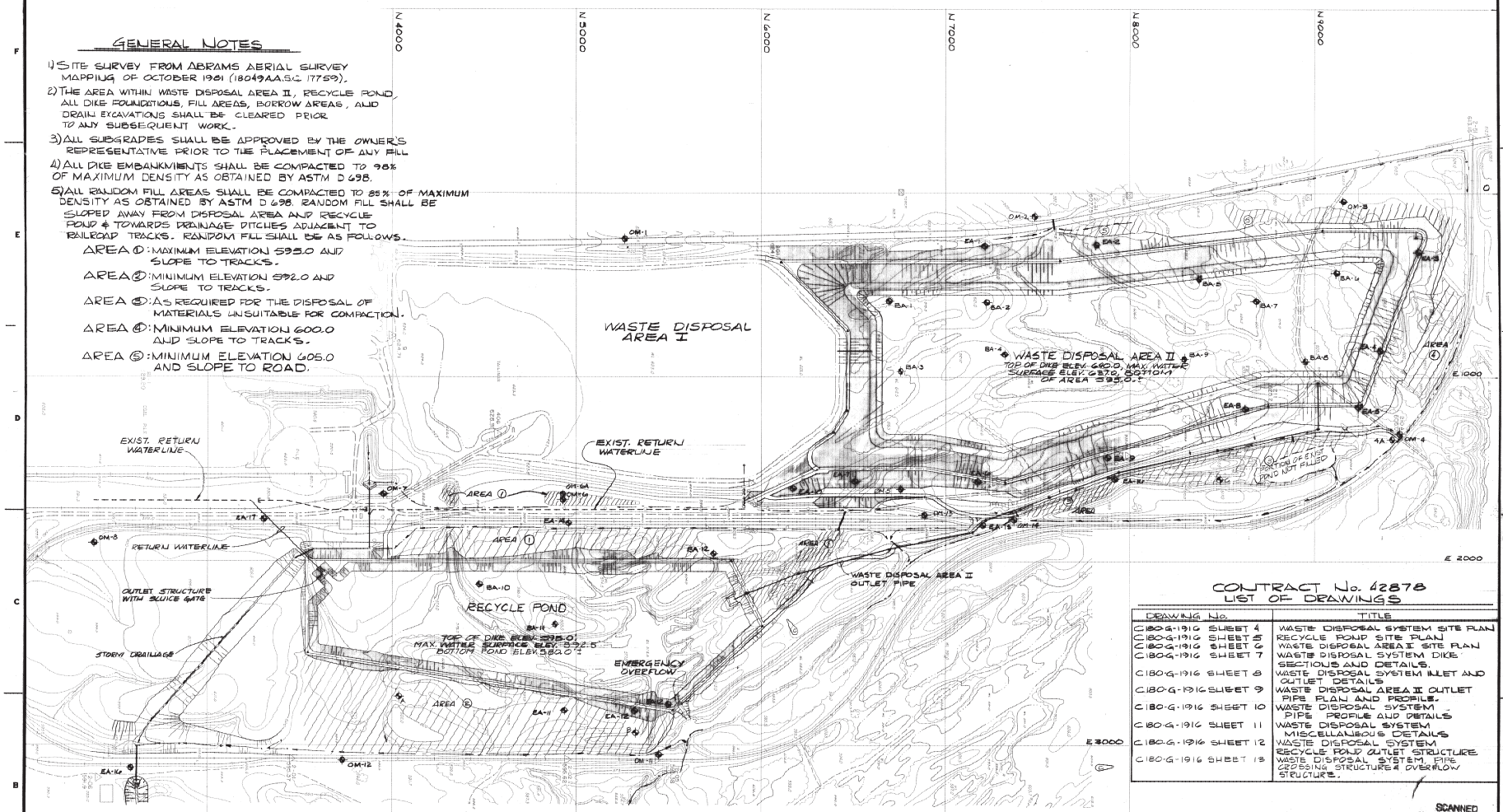
AREA ①: MAXIMUM ELEVATION 595.0 AND SLOPE TO TRACKS.

AREA ②: MINIMUM ELEVATION 592.0 AND SLOPE TO TRACKS.

AREA ③: AS REQUIRED FOR THE DISPOSAL OF MATERIALS UNSUITABLE FOR COMPACTION.

AREA ④: MINIMUM ELEVATION 600.0 AND SLOPE TO TRACKS.

AREA ⑤: MINIMUM ELEVATION 605.0 AND SLOPE TO ROAD.



CONTRACT No. 42878
LIST OF DRAWINGS

DRAWING No.	TITLE
C180-G-1916 SHEET 4	WASTE DISPOSAL SYSTEM SITE PLAN
C180-G-1916 SHEET 5	RECYCLE POND SITE PLAN
C180-G-1916 SHEET 6	WASTE DISPOSAL AREA I SITE PLAN
C180-G-1916 SHEET 7	WASTE DISPOSAL SYSTEM DIKE SECTIONS AND DETAILS.
C180-G-1916 SHEET 8	WASTE DISPOSAL SYSTEM INLET AND OUTLET DETAILS
C180-G-1916 SHEET 9	WASTE DISPOSAL AREA II OUTLET PIPE PLAN AND PROFILE.
C180-G-1916 SHEET 10	WASTE DISPOSAL SYSTEM PIPE PROFILE AND DETAILS
C180-G-1916 SHEET 11	WASTE DISPOSAL SYSTEM MISCELLANEOUS DETAILS
C180-G-1916 SHEET 12	WASTE DISPOSAL SYSTEM RECYCLE POND OUTLET STRUCTURE
C180-G-1916 SHEET 13	WASTE DISPOSAL SYSTEM PIPE CROSSING STRUCTURE & OVERFLOW STRUCTURE.

SCANNED
MAY 3 0 2001

LEGEND

- INDICATES FINAL DISPOSAL AREA AND RECYCLE POND SLOPES.
- INDICATES RANDOM FILL AREAS.
- INDICATES DITCHES/DRAINAGE
- OM-1 MONITORING WELL
- EA-14 EMBANKMENT AREA OR DIKE BORING
- BA-10 BORROW AREA BORING

PLAN

SCALE: 1"=200'
CONTOURS @ 5' INTERVALS

ISSUED FOR CONSTRUCTION BEVA 5-3-82

BRCH.	ELEC.	PROJECT	PE	CIVIL
N.A.	N.A.	82417	N.A.	607

DRAWN BY R.S.B. 11-27-81 | CHECKED BY R.S.B. 12-14-81 | ENGINEER R.S.B. 12/16/81 | SUPERVISING ENGINEER J.K. Meiseheimer

PREPARED UNDER THE RESPONSIBLE SUPERVISION OF J.K. MEISEHEIMER PE
ILLINOIS PROFESSIONAL REGISTRATION NO. ____
M.I. ____ PROFESSIONAL REGISTRATION NO. 62-53028
AT THE OFFICES OF COMMONWEALTH ASSOCIATES INC.
209 E. WASHINGTON AVE. JACKSON, MICH.

OWNER
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA, ILLINOIS
DUCK CREEK SITE - UNIT NO. 1

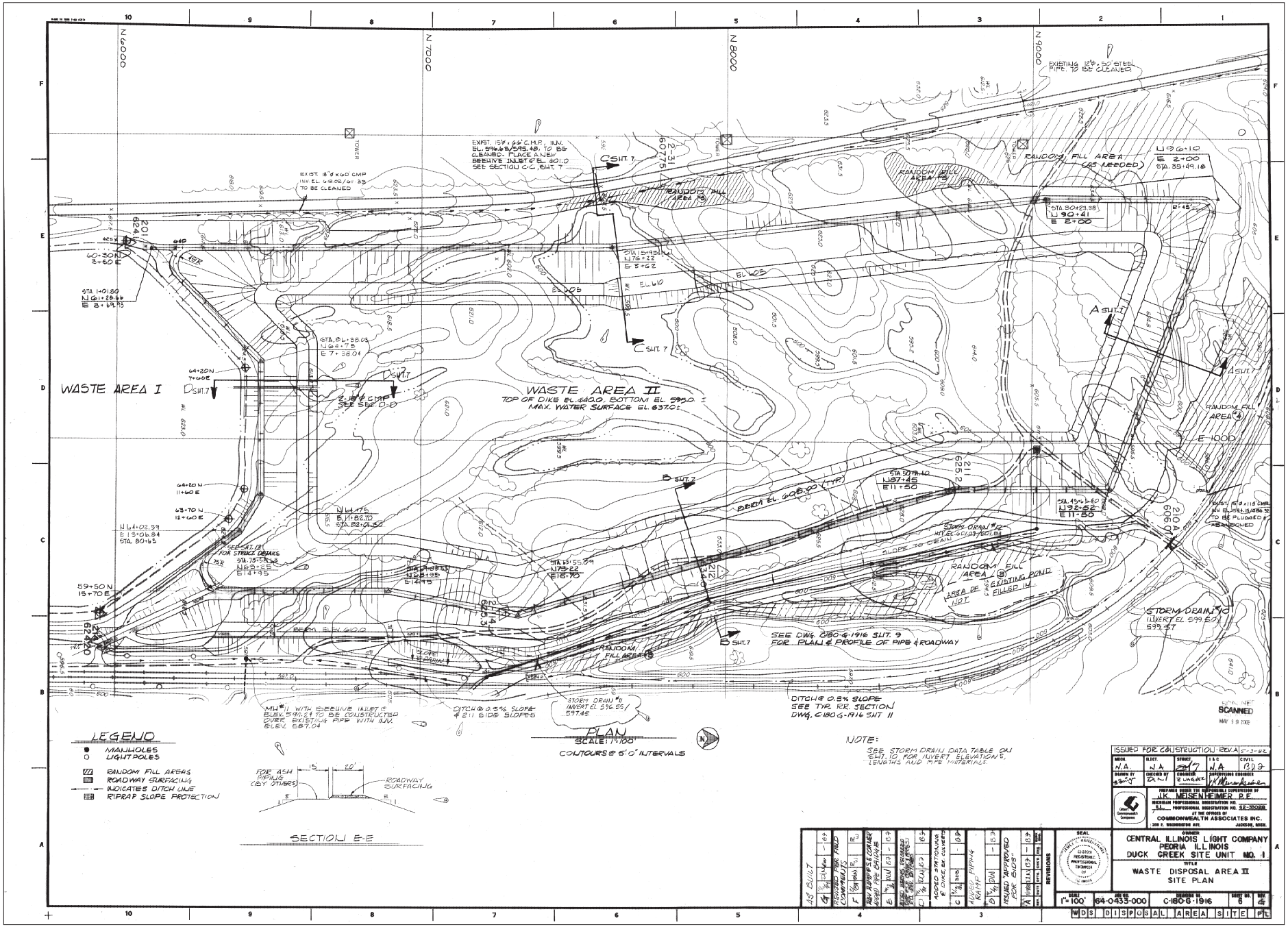
TITLE
WASTE DISPOSAL SYSTEM SITE PLAN

SCALE	JOB NO.	DRAWING NO.	SHEET NO.	REV.
1"= 200'	64-0433-000	C180-G-1916	4	F

W/S SITE PLAN

REVISIONS

AS BUILT 10/84 JW 13
REVISED PER FIELD COMMENTS 12/84 JW 12
REVISED PER WASTE DISPOSAL AREA II DIKE ALIGNMENT 9/84 JW 11
REVISED PER FIELD COMMENTS 10/83 JW 10
ISSUED APPROVED FOR BIDS 5/82 BEVA 9



NOTE:

SEE STORM DRAIN DATA TABLE ON SHT. 10 FOR INVERT ELEVATIONS, LENGTHS AND PIPE MATERIALS

SCANNED
MAY 19 2005

ISSUED FOR CONSTRUCTION - REV. A 6-3-82

BRCH.	ELECT.	STRUCT.	I & C	CIVIL
NA	NA	5917	NA	1817

DRAWN BY: [illegible] CHECKED BY: DAN CONSTRUCTION ENGINEER: R. UNGARE SUPERVISING ENGINEER: [illegible]

PREPARED UNDER THE RESPONSIBLE SUPERVISION OF J.K. MEISENHEIMER, P.E.
MICHIGAN PROFESSIONAL REGISTRATION NO. [illegible]
ILL. PROFESSIONAL REGISTRATION NO. 62-30286
AT THE OFFICES OF COMMONWEALTH ASSOCIATES INC.
209 E. WASHINGTON AVE. JACKSON, MICH.

OWNER: CENTRAL ILLINOIS LIGHT COMPANY PEORIA ILLINOIS
DUCK CREEK SITE UNIT NO. 1

TITLE: WASTE DISPOSAL AREA II SITE PLAN

SCALE	JOB NO.	DRAWING NO.	SHEET NO.	REV.
1"=100'	64-0433-000	C-180-G-1916	6	4

WDS DISPOSAL AREA SITE PL

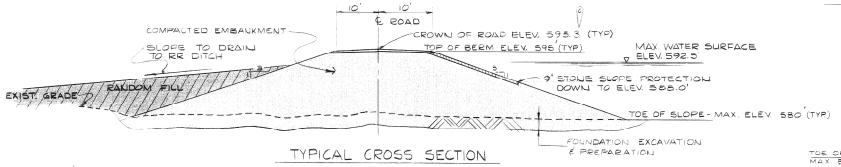
REVISIONS

NO.	DATE	APPD.	CHKD.	BY
A	4/82	[illegible]	[illegible]	[illegible]
B	5/82	[illegible]	[illegible]	[illegible]
C	5/82	[illegible]	[illegible]	[illegible]
D	6/82	[illegible]	[illegible]	[illegible]
E	7/82	[illegible]	[illegible]	[illegible]
F	7/82	[illegible]	[illegible]	[illegible]
G	8/82	[illegible]	[illegible]	[illegible]
H	8/82	[illegible]	[illegible]	[illegible]
I	8/82	[illegible]	[illegible]	[illegible]
J	8/82	[illegible]	[illegible]	[illegible]
K	8/82	[illegible]	[illegible]	[illegible]

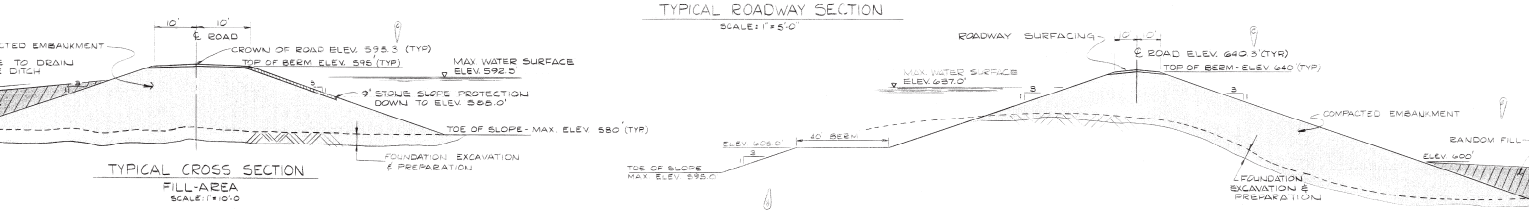
AS BUILT
REVISED PER FIELD COMMENTS
NEW PURPOSE COVER AREA PER SHEET
ADDED STATIONING & DIKE EL. CULVERTS
ADDED PIPING RAMP
ISSUED APPROVED FOR BIDS



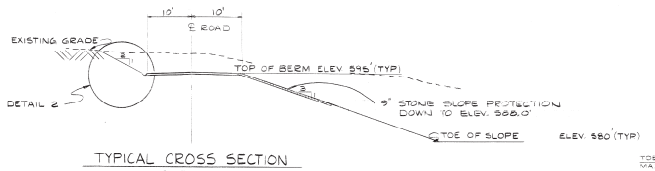
TYPICAL ROADWAY SECTION
SCALE: 1" = 5'-0"



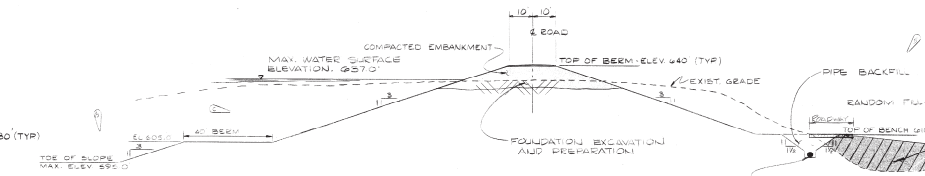
TYPICAL CROSS SECTION
FILL-AREA
SCALE: 1" = 10'-0



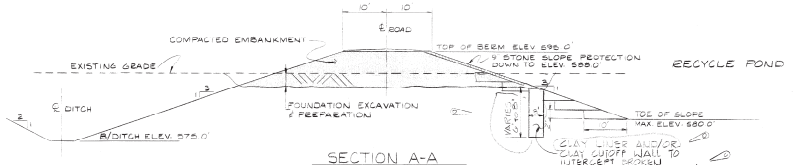
SECTION A-A
SCALE: 1" = 20'
SHEET 6



TYPICAL CROSS SECTION
CUT-AREA
SCALE: 1" = 10'-0

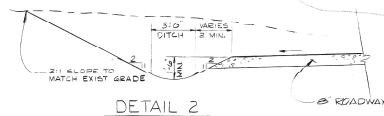


SECTION B-B
SCALE: 1" = 20'
SHEET 6

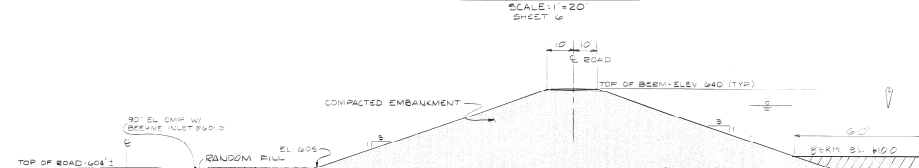


SECTION A-A
SCALE: 1" = 10'-0
SHEET 5

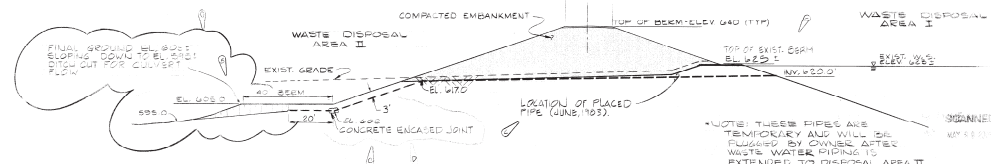
NOTE: CLAY LINER INSTALLED SUMMER 1984. DISCUSSIONS WITH CONSTRUCTION PERSONNEL INDICATE MATERIAL PLACED AND COMPACTED PARALLEL TO SLOPE; STEP METHOD WAS NOT USED.



DETAIL 2
2:1 SLOPE - CUT SLOPE



SECTION C-C
SCALE: 1" = 20'
SHEET 6



*NOTE: THESE PIPES ARE TEMPORARY AND WILL BE PLUGGED BY OWNER AFTER WASTE WATER PIPING IS EXTENDED TO DISPOSAL AREA II

SECTION D-D
SCALE: 1" = 20'
SHEET 6

RECYCLE POND
SEE DWG C-180-G-1916-SHT. 5

WASTE DISPOSAL AREA II
SEE DWG C-180-G-1916-SHT. 6

NOTES
1. COMPACTED CLAY LINER TO BE INSTALLED AS DIRECTED BY OWNER'S REPRESENTATIVE (SUPERINTENDENT) WHEN LOOSE OR HIGHER PERMEABILITY MATERIALS ARE ENCOUNTERED IN CUT SECTIONS OF THE INSIDE SLOPE.
2. THE CLAY LINER MATERIAL WILL BE OBTAINED FROM BORROW SOURCES APPROVED FOR EMBANKMENT FILL.
3. THE CLAY LINER SHALL BE PLACED AND COMPACTED TO 95% OF THE MAXIMUM DENSITY AS OBTAINED BY ASTM D-698.
4. DIKE ROADWAY SUBGRADE STABILIZED WITH APPROXIMATELY 3% LIME PRIOR TO PLACEMENT OF ROAD SURFACING.

REVISIONS					
NO.	DATE	APP'D	CHK'D	DES.	DWN.
A	10/1/84				

ISSUED APPROVED FOR BIDS 10/1/84

SUPERSEDED AS RECORDED 12/1/84

AS BUILT 12/1/84

REVISED AS FIELD 12/1/84

MECH. N.A.	ELECT. N.A.	STRUCT. [illegible]	I & C N.A.	CIVIL [illegible]
DRAWN BY [illegible]	CHECKED BY [illegible]	ENGINEER [illegible]	SUPERVISING ENGINEER [illegible]

PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
J.K. MEISENHEIMER P.E.
MISSOURI PROFESSIONAL REGISTRATION NO. [illegible]
ILL. PROFESSIONAL REGISTRATION NO. 62-33028
AT THE OFFICES OF
COMMONWEALTH ASSOCIATES INC.
209 E. WASHINGTON AVE. JACKSON, MICH.

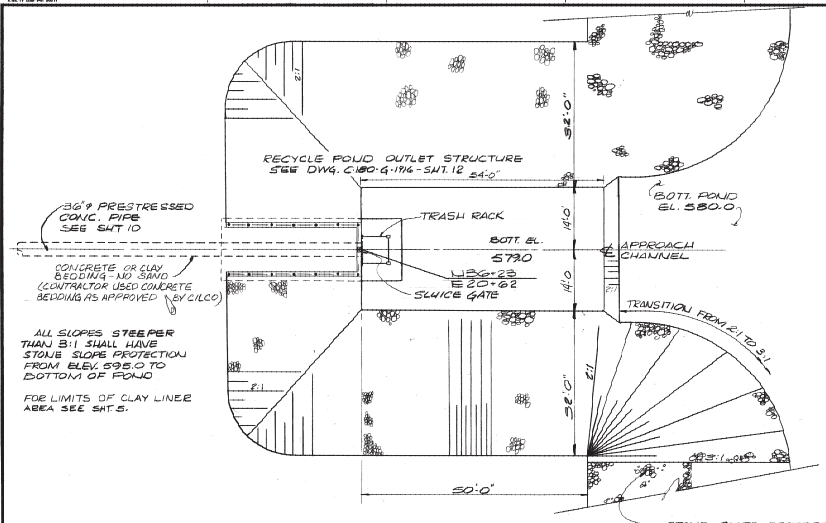
SEAL

OWNER
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA ILLINOIS
DUCK CREEK SITE UNIT NO. 1

TITLE
WASTE DISPOSAL SYSTEM
DIKE SECTIONS AND DETAILS

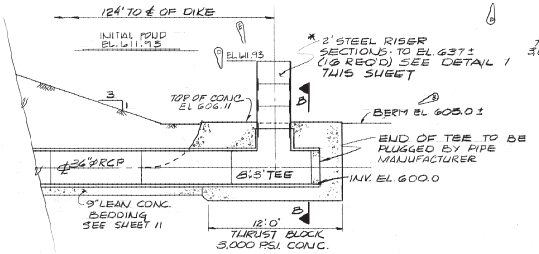
SCALE	JOB NO.	DRAWING NO.	SHEET NO.	REV.
AS NOTED	64-0433-000	C-180-G-1916	7	

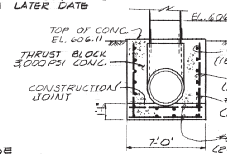
WDS DIKE SECTION & DET



PLAN - OUTLET
RECYCLE POND
N.T.S

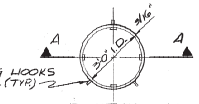
*NOTE:
16 STEEL RISER SECTIONS ARE TO BE SUPPLIED BY CONTRACTOR, ONE SECTION INSTALLED INITIALLY & THE REMAINDER TO BE INSTALLED BY OWNER AT A LATER DATE



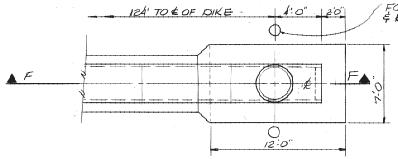


SECTION BB

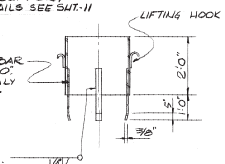
SECTION F-F
WASTE AREA II OUTLET PIPE
SCALE: 1/4"=1'-0"



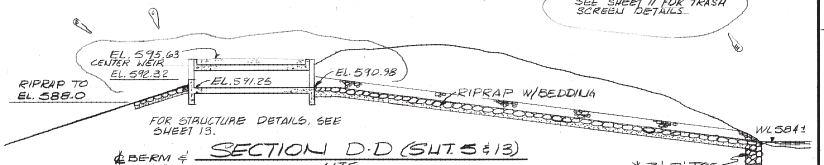
DETAIL 1
N.T.S



PLAN
WASTE AREA II OUTLET PIPE
SCALE: 1/4"=1'-0"

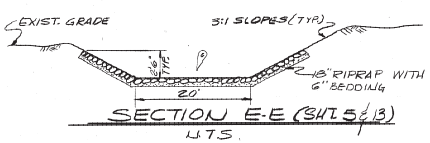


SECTION A-A
N.T.S
SEE SHEET 11 FOR TRASH SCREEN DETAILS.

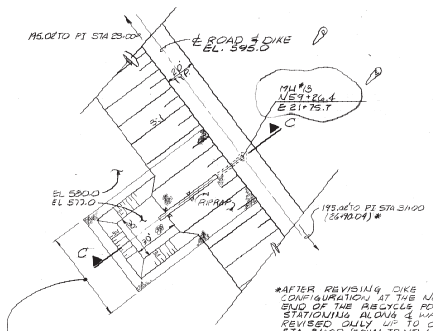


SECTION D-D (SHT. 5 & 13)
N.T.S.

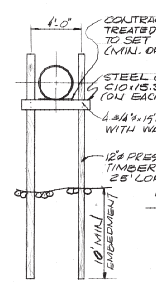
*INCIDENTAL TO PAY ITEM FOR RIPRAP.



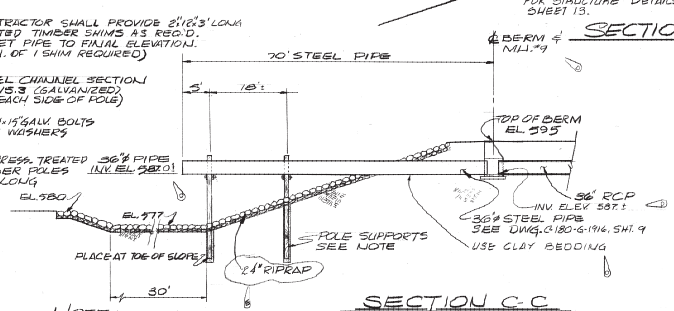
SECTION E-E (SHT. 5 & 13)
N.T.S.



*AFTER REVISING ℄ DIKE CONFIGURATION AT THE NORTH END OF THE RECYCLE POND, STATIONING ALONG ℄ WAS REVISED ONLY UP TO OLD STA 3+00 (EQUAL TO NEW STA 2+70.04).



POLE SUPPORT DETAIL
N.T.S.



SECTION C-C
SCALE: 1"=10'

NOTE:
SLOPES WITHOUT RIPRAP ARE TO HAVE STONE SURFACE FROM EL 588 TO EL. 595. SEE SHT 5
POLE SUPPORTS ARE TO BE INSTALLED IN AUGERED HOLES, 18" DIAMETER OR GREATER, AND HOLES ARE TO BE BACKFILLED WITH LEAN CONCRETE.

PLAN
INLET FOR RECYCLE POND
SCALE: 1"=30'

SCANNED
MAY 2 8 2003

ISSUED FOR CONSTRUCTION - REV A 5-3-82

DESIGN	ELECT.	STRUCT.	M & E	CIVIL
N.A.	N.A.	[illegible]	N.A.	[illegible]

DRAWN BY [illegible] 11-28-81 | CHECKED BY [illegible] 11-30-81 | ENGINEER A. JOHNSON | SUPERVISING ENGINEER J.K. MEISENHEIMER

PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
J.K. MEISENHEIMER, P.E.
MICHIGAN PROFESSIONAL REGISTRATION NO. [illegible]
ILL. PROFESSIONAL REGISTRATION NO. 62-32028
AT THE OFFICES OF
COMMONWEALTH ASSOCIATES INC.
200 E. WASHINGTON AVE. JACKSON, MICH.

REVISIONS	DESIGN	ELECT.	STRUCT.	M & E	CIVIL	DATE
AS BUILT	-	-	-	-	-	10-83
E REVISED PER FIELD CHANGES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7-83
D REVISED SECTIONS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10-82
C REVISED SECTIONS D-D & E-E	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10-82
B ISSUED BERM & OUTLET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6-82
A ISSUED APPROVED FOR BIDS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5-82

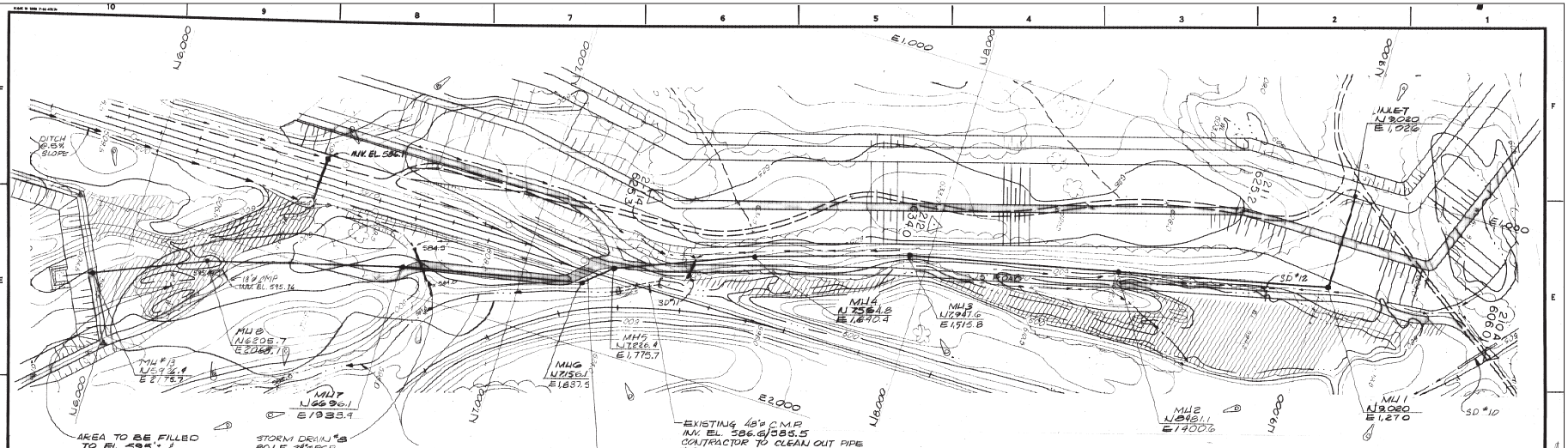
REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

OWNER
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA ILLINOIS
DUCK CREEK SITE UNIT NO. 1

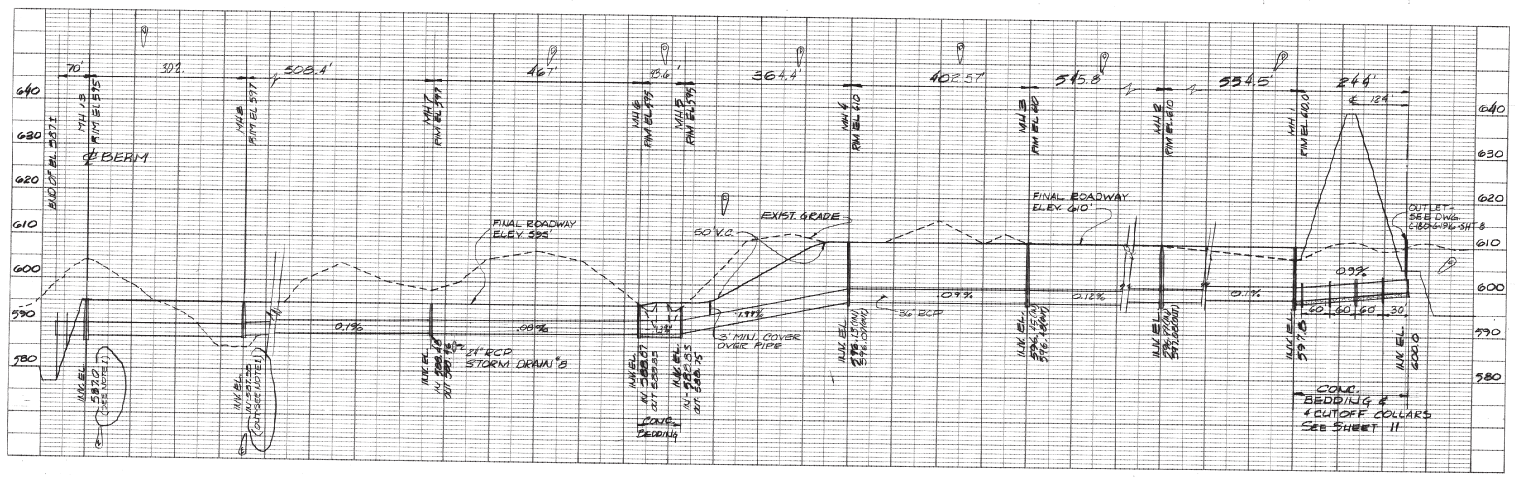
TITLE
WASTE DISPOSAL SYSTEM
INLET AND OUTLET DETAILS

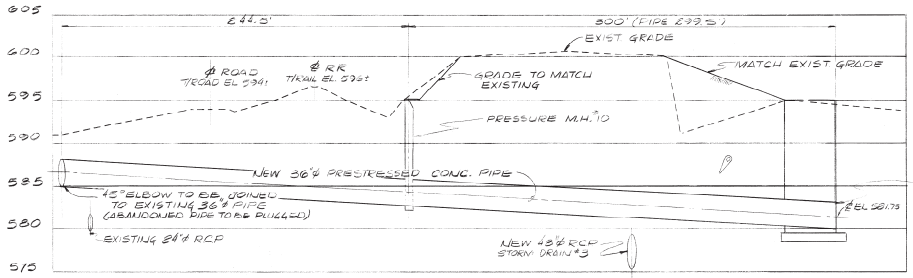
SCALE	JOB NO.	DRAWING NO.	SHEET NO.	REV.
AS NOTED	64-0433-000	C-180-G-1916	8	E

WDS INLET OUTLET DETAILS



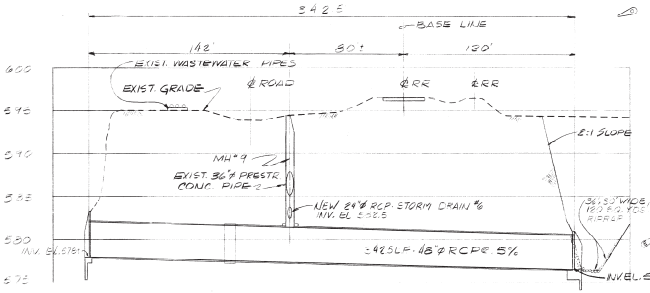
PLAN
SCALE: 1" = 100'
CONTOURS @ 5'-0" INTERVALS


70'
302.
308.4'
46'
36.6'
364.4'
402.57'
545.8'
534.5'
244'
640
630
620
610
600
590
580
MH 13 RIM EL 595.1
MH 8 RIM EL 597.1
MH 7 RIM EL 597.1
MH 6 RIM EL 597.1
MH 4 RIM EL 597.10
MH 3 RIM EL 600
MH 2 RIM EL 600.0
MH 1 RIM EL 600.0
INVT EL. 583.0 (SEE NOTE 2)
INV. EL. 583.20 (SEE NOTE 2)
INV. EL. 583.20 (SEE NOTE 2)
INV. EL. 583.20 (SEE NOTE 2)
INV. EL. 583.35 (SEE NOTE 2)
INV. EL. 583.35 (SEE NOTE 2)
INV. EL. 583.35



RECYCLE POND - RETURN WATERLINE PROFILE

SCALE: 1"=5' VERT. 1"=30' HORIZ.



STORM DRAIN #2

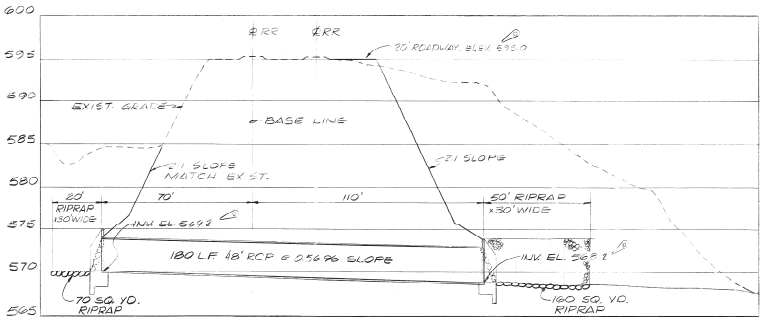
SCALE: 1"=5' VERT. 1"=30' HORIZ.

STORM DRAIN DATA

No.	SIZE	LENGTH	MAT.	INV. EL. INLET	INV. EL. OUTLET	END CONDITION INLET	END CONDITION OUTLET	METHOD
*2	48"	342	RCP	578.0	576.0	HDWL.	HDWL.	JACKED
3	48"	136	RCP	576.10	574.30	HDWL.	HDWL.	OPEN CUT
1	48"	180	RCP	669.2	668.2	HDWL.	HDWL.	JACKED
6	24"	132	RCP	BEL ?	576.10	END SEC	BUSHED	OPEN CUT
9	24"	116	RPE	588.68	587.50	END SEC	M.H.	OPEN CUT
DELETED								
8	24"	80	RCP	584.50	584.00	END SEC	END SEC	OPEN CUT
DELETED								
10	24"	54	RCP	579.67	579.50	OPEN	OPEN	OPEN CUT
11	18"	24	CMP	592.45	592.25	OPEN	OPEN	OPEN CUT
12	8	25	CMP	601.53	601.09	OPEN	OPEN	OPEN CUT
13	24	43	RCP	570.93	570.90	OPEN	OPEN	OPEN CUT

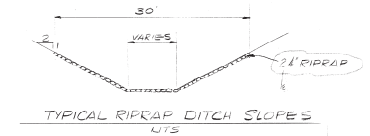
* COMBINED S.D. #14 & #2, JACKED FULL DISTANCE.

NOTE: MH #9 TO BE BUILT OVER EXISTING 36" PRESSURE PIPE, FLOW TO BE DIRECTED INTO NEW MH #9 & ABANDONED PRESSURE PIPE TO BE PLUGGED. (I.E. NO PIPE ONLY THE ENDS NEED TO BE PLUGGED-NOT THE ENTIRE PIPE)

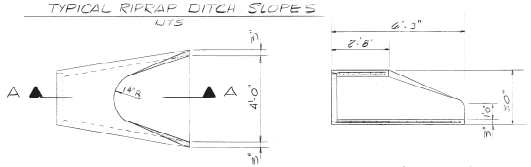


STORM DRAIN #4

SCALE: 1"=5' VERT. 1"=20' HORIZ.



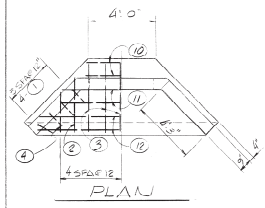
TYPICAL RIPRAP DITCH SLOPES



PLAN SECTION A-A

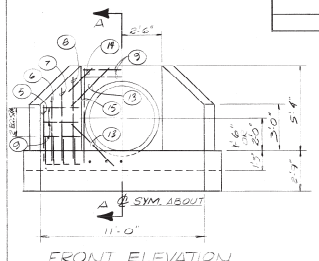
24"ø RCP END SECTION

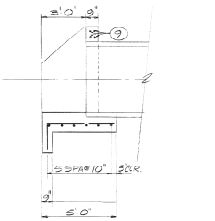
SCALE 1/2"=1'-0"



BAR SCHEDULE

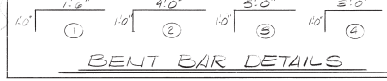
MARK NO.	QUANT.	SIZE	SHAPE	LENGTH	WEIGHT
C180-6-1916	8	#4	BENT	2'-6"	13
2	2		BENT	5'-0"	7
3	5		BENT	4'-0"	20
4	2		BENT	4'-0"	5
5	2		STRAIGHT	3'-0"	4
6	2			3'-9"	5
7	2			4'-6"	6
8	4			5'-3"	14
9	10			4'-3"	28
10	2			4'-0"	5
11	2			7'-0"	9
12	2			10'-0"	13
13	4			5'-6"	7
14	2	#4	STRAIGHT	2'-0"	3
			TOTAL		141





TYPICAL HEADWALL DETAILS

SCALE: 1/2"=1'-0"



BENT BAR DETAILS

NOTES:
ALL LAPS AND BENDS SHALL BE IN ACCORDANCE WITH ACI 315

SCANNED

ISSUED FOR CONSTRUCTION REV 8

MECH.	ELECT.	STRUCT.	I & C	CIVIL
N.A.	N.A.	[illegible]	N.A.	[illegible]

DRAWN BY [illegible] CHECKED BY [illegible] ENGINEER [illegible] SUPERVISING ENGINEER [illegible]

PREPARED UNDER THE RESPONSIBLE SUPERVISION OF J.R. MEISENHEIMER P.E.
MISSOURI PROFESSIONAL REGISTRATION NO. [illegible]
ILL. PROFESSIONAL REGISTRATION NO. 62-33028
AT THE OFFICES OF COMMONWEALTH ASSOCIATES INC.
209 E. WASHINGTON AVE. JACKSON, MICH.

OWNER
CENTRAL ILLINOIS LIGHT COMPANY
PEORIA ILLINOIS
DUCK CREEK SITE UNIT NO. 1

TITLE
WASTE DISPOSAL SYSTEM
PIPE PROFILE AND DETAILS

SCALE	JOB NO.	DRAWING NO.	SHEET NO.	REV.
AS NOTED	64-0433-000	C-180-6-1916	10	E

WDS PIPE PROFILES & DET

REVISIONS

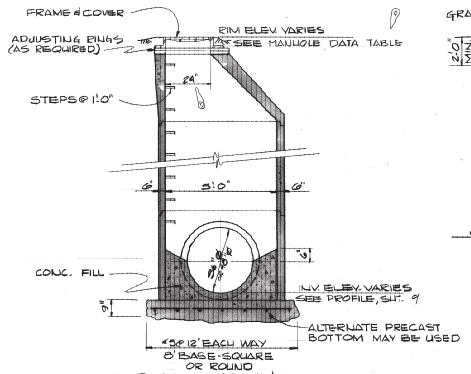
REV.	DATE	DRAWN	CHECK.	ENG. APPR.
A	[illegible]	[illegible]	[illegible]	[illegible]
B	[illegible]	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]	[illegible]
D	[illegible]	[illegible]	[illegible]	[illegible]
E	[illegible]	[illegible]	[illegible]	[illegible]

ISSUED APPROVED FOR CONST.

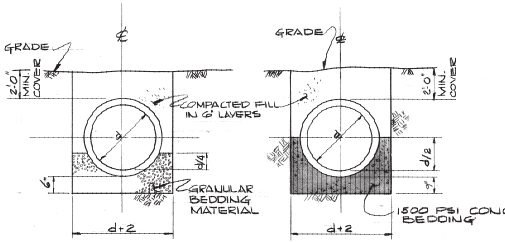
ADD NOTE TO BOLT BAR DETAILS

REVISED PER CONSTRUCTION

AS BUILT

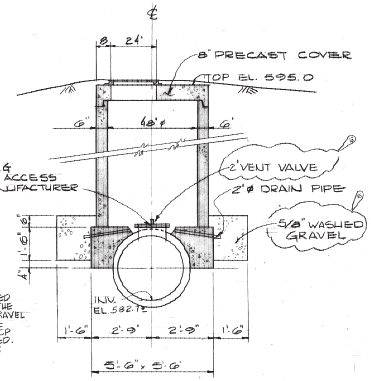


TYPICAL MANHOLE
SCALE: 1/2"=1'-0"



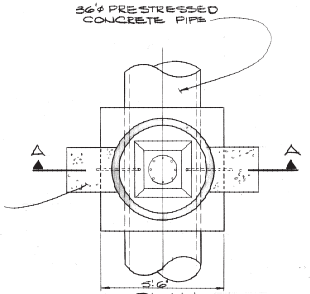
GRANULAR SOIL LEAN CONCRETE

TYPICAL PIPE TRENCH BEDDING DETAILS
SCALE: 1/2"=1'-0"

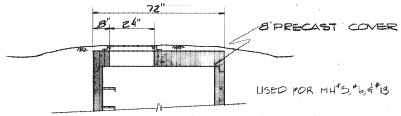


SECTION AA

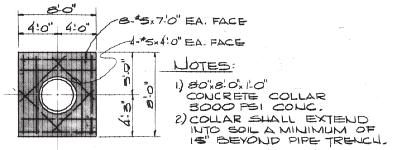
NOTE:
MH #9 SHALL BE CONSTRUCTED SIMILAR TO MH #10 EXCEPT THE 2" ø DRAIN PIPES & THE 3/8" GRAVEL SHALL BE OMITTED. BRAKE LINE FROM THE TOP OF THE 48" ø RCP AFTER MH # 9 IS CONSTRUCTED. (AS BUILT NOTE: CONTRACTOR USED 3/8" GRAVEL.)



PLAN MANHOLE #10 (PRESSURE PIPE)

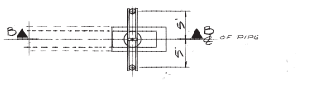


ALTERNATE M.H. COVER
SCALE: 1/2"=1'-0"

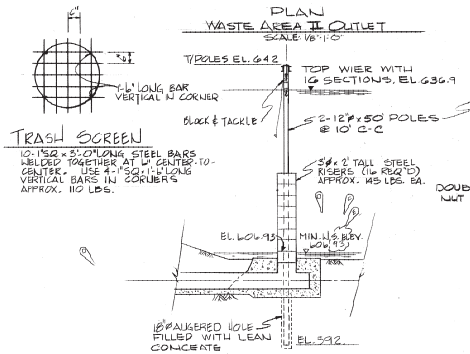


NOTES:
1) 80"x8'-0"x1'-0" CONCRETE COLLAR 3000 PSI CONC.
2) COLLAR SHALL EXTEND INTO SOIL A MINIMUM OF 15" BEYOND PIPE TRENCH.

DETAIL CUT-OFF COLLAR FOR 36" PRESTRESSED CONCRETE PIPE
SCALE: 1/4"=1'-0"

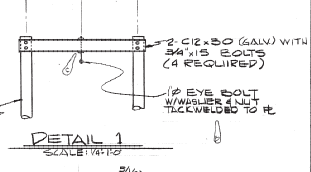


PLAN WASTE AREA II OUTLET
SCALE: 1/8"=1'-0"

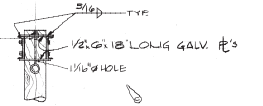


TRASH SCREEN
10-1"SQ x 5'-0" LONG STEEL BARS WELDED TOGETHER AT 1'-0" CENTER-TO-CENTER. USE 4-1"SQ x 1'-1" LONG VERTICAL BARS IN CORNERS APPROX. 110 LBS.

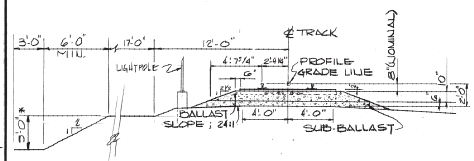
SECTION B-B
SCALE: 1/8"=1'-0"



DETAIL 1
SCALE: 1/4"=1'-0"

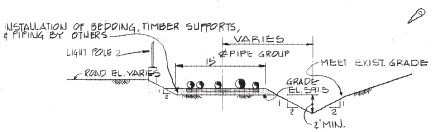


DETAIL 2
SCALE: 1/2"=1'-0"



TYPICAL RAILROAD SECTION
SCALE: 1/4"=1'-0"

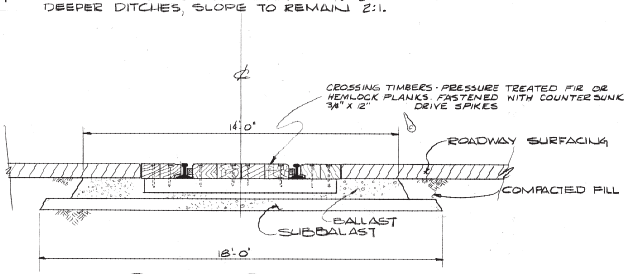
* NOTE: MIN. DITCH TO BE THREE (3') FOOT. FOR DEEPER DITCHES, SLOPE TO REMAIN 2:1.



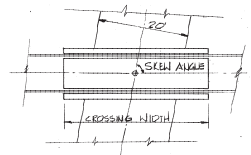
PIPING TRESTLE DETAIL
NO SCALE

MANHOLE DATA					
MH No.	SIZE & TYPE PIPE	RIM ELEV.	INVERT ELEV. IN	INVERT ELEV. OUT	
1	36" RCP	610.0	597.80	597.80	
2	36" RCP	610.0	596.99	596.08	
3	36" RCP	610.0	596.15	595.48	
4	36" RCP	610.0	595.16	594.07	
5	36" RCP	598.0	588.88	588.75	
6	36" RCP	598.0	588.87	588.85	
7	36" RCP	597.0	588.48	588.46	
8	36" RCP	597.0	587.33	587.55	
9	48" RCP	596.95	577.55	577.55	REVISED
10	24" RCP	595.5	582.11	581.11	
11	24" RCP	589.01	———	588.11	
12	24" RCP	594.55	~~587.85~~	~~577.35~~	DELETE
	24" RCP		584.51	———	
9	48" RCP	596.95	577 ±	577 ±	
	36" RCP		592.51	———	
	24" RCP		585.01	———	
15	36" RCP	595.0	587.0	587.0	

RCP - REINFORCED CONCRETE PIPE
PCP - PLASTIC PIPE



RAILROAD CROSSING (TYPICAL)
SCALE: 1/2"=1'-0"



TYPICAL CROSSING PLAN
NO SCALE

CROSSING DATA		
CROSSING NO	SKEW ANGLE	CROSSING WIDTH
1	45°	32'
2	82.5°	32'
3	95°	32'

SCANNED
MAY 10 '99

ISSUED FOR CONSTRUCTION REV 8

BRCH.	ELECT.	STRUCT.	I & I	CIVIL
W.A.	W.A.	32	N.A.	6

DRAWN BY: D.L.L. 11-5-98
CHECKED BY: R.S.B. 11-5-98
ENGINEER: A. JANSEN
SUPERVISING ENGINEER: J.K. MEISENHEIMER

PREPARED UNDER THE RESPONSIBLE SUPERVISION OF J.K. MEISENHEIMER P.E.
MICHIGAN PROFESSIONAL REGISTRATION NO. ____
ILL. PROFESSIONAL REGISTRATION NO. 62-19082
AT THE OFFICES OF COMMONWEALTH ASSOCIATES INC. 209 E. WASHINGTON AVE. JACKSON, MICH.

REVISIONS			
AS BUILT	E	11-13-98	
REVISED PER FIELD COMMENTS	D	5/14/98	K.C.
ADD BRAKE W.A.II OUTLET DELETE PART 9	C	3/24/98	K.C.
REVISE CROSSING SIZES ADDED SPRING SIZES ADDED CROSSING NOTE & LEGEND	B	3/4/98	K.C.
ISSUED AS APPROVED FOR BIDS	A	12/22/97	K.C.

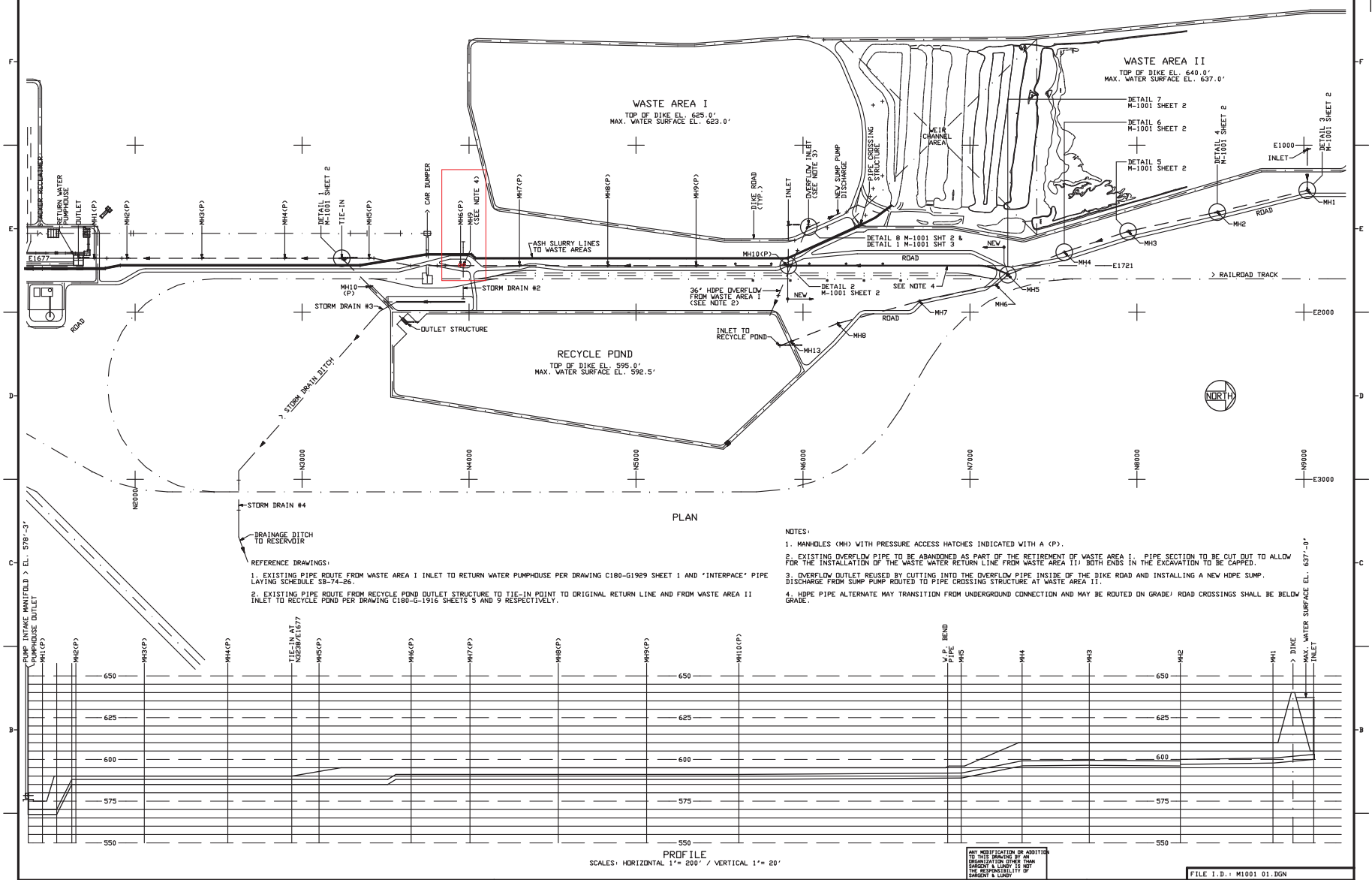
SEAL: ILLINOIS REGISTERED PROFESSIONAL ENGINEER

OWNER: CENTRAL ILLINOIS LIGHT COMPANY PEORIA ILLINOIS DUCK CREEK SITE UNIT NO. 1

TITLE: WASTE DISPOSAL SYSTEM MISCELLANEOUS DETAILS

SCALE	JOB NO.	DRAWING NO.	SHEET NO.	REV.
AS NOTED	64-0433-000	C-180-G-1916	11	E

WDS MISC DETAILS



NOTES:

1. MANHOLES (MH) WITH PRESSURE ACCESS HATCHES INDICATED WITH A (P).

2. EXISTING OVERFLOW PIPE TO BE ABANDONED AS PART OF THE RETIREMENT OF WASTE AREA I. PIPE SECTION TO BE CUT OUT TO ALLOW FOR THE INSTALLATION OF THE WASTE WATER RETURN LINE FROM WASTE AREA II; BOTH ENDS IN THE EXCAVATION TO BE CAPPED.

3. OVERFLOW OUTLET REUSED BY CUTTING INTO THE OVERFLOW PIPE INSIDE OF THE DIKE ROAD AND INSTALLING A NEW HDPE SUMP. DISCHARGE FROM SUMP PUMP ROUTED TO PIPE CROSSING STRUCTURE AT WASTE AREA II.

4. HDPE PIPE ALTERNATE MAY TRANSITION FROM UNDERGROUND CONNECTION AND MAY BE ROUTED ON GRADE; ROAD CROSSINGS SHALL BE BELOW GRADE.

REFERENCE DRAWINGS:

1. EXISTING PIPE ROUTE FROM WASTE AREA I INLET TO RETURN WATER PUMPHOUSE PER DRAWING C180-G1929 SHEET 1 AND 'INTERPACE' PIPE LAYING SCHEDULE SB-74-26.

2. EXISTING PIPE ROUTE FROM RECYCLE POND OUTLET STRUCTURE TO TIE-IN POINT TO ORIGINAL RETURN LINE AND FROM WASTE AREA II INLET TO RECYCLE POND PER DRAWING C180-G-1916 SHEETS 5 AND 9 RESPECTIVELY.

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY

FILE I.D.: M1001 01.DGN

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	07/30/04	J.ALCANTARA	M.MAZZAFERRO		FOR RECORD/SENT TO CLIENT	

SCALE: 1"=200'

PROJECT NUMBER: 11478-006

PIPE PLAN & PROFILE RECYCLE POND BYPASS

DUCK CREEK SITE UNIT 1 CANTON, ILLINOIS AMEREN CILCO

Sargent & Lundy LLC

DRAWING NO. M-1001

REV. 0

SHEET 1 OF

ATTACHMENT D

EMERGENCY ACTION PLAN

Illinois Power Resources Generating, LLC

DUCK CREEK POWER PLANT

FULTON COUNTY, ILLINOIS

Emergency Action Plan (EAP)

40 C.F.R. § 257.73(a)(3), Ill. Adm. Code 845.520
Coal Combustion Residual (CCR) Impoundment
& Related Facilities

- Ash Pond No. 1 (NID # IL50715) (IEPA # W0578010001-01)
- Ash Pond No. 2 (NID # IL50014) (IEPA # W0578010001-02)
- Bottom Ash Pond (NID # IL50716) (IEPA # W0578010001-03)
- Gypsum Management Facility (GMF) Pond (NID # IL50573) (IEPA # W0578010001-04)

Revision Date: September 16, 2021

Qualified Professional Engineer Certification; Emergency Action Plan for the Duck Creek Power Plant Ash Pond 1, Ash Pond 2, Bottom Ash Pond, and GMF Pond

In accordance with 40 C.F.R. § 257.73(a)(3)(iv) and 35 Ill. Adm. Code 845.520(e), the owner or operator of a CCR unit that is required to prepare a written Emergency Action Plan under 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520(a) must obtain a certification from a qualified professional engineer stating that the written Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

I, Phil Morris, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that:

1. the information contained in this Emergency Action Plan was prepared in accordance with the accepted practice of engineering; and

2. this Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

Phil Morris
Senior Director, Corporate Environmental

9/27/21
Date



DUCK CREEK POWER PLANT
EMERGENCY ACTION PLAN
CCR IMPOUNDMENTS & RELATED FACILITIES

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2	COMMUNICATION	6
3	EAP ROLES AND RESPONSIBILITIES	10
4	EAP RESPONSE	11
5	PREPAREDNESS	16
6	FACILITY/IMPOUNDMENT DESCRIPTION	18
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DUCK CREEK POWER PLANT
EMERGENCY ACTION PLAN
CCR IMPOUNDMENTS & RELATED FACILITIES

1 STATEMENT OF PURPOSE

The Duck Creek Power Plant (Power Plant) is a retired facility located near Canton in Fulton County, Illinois. The location is shown in Figure 1-1. The Power Plant is a coal-fired electricity producing power plant owned and operated by Illinois Power Resources Generating, LLC, a subsidiary of Dynegy Midwest Generation, LLC (DMG). This Emergency Action Plan (EAP) was prepared in accordance with 40 CFR § 257.73(a)(3) and Title 35, Section 845.520 of IEPA Administrative Code and covers the following Coal Combustion Residual (CCR) surface impoundments located at the site:

- Ash Pond No. 1 (Capped/Closed) (NID # IL50715) (IEPA # W0578010001-01)
- Ash Pond No. 2 (Capped/Closed) (NID # IL50014) (IEPA # W0578010001-02)
- Bottom Ash Pond (NID # IL50716) (IEPA # W0578010001-03)
- Gypsum Management Facility (GMF) Pond (NID # IL50573) (IEPA # W0578010001-04)

The locations of these impoundments are shown in Figure 1-2. Section 6 of this EAP includes a description of each impoundment.

The purpose of this Emergency Action Plan (EAP) is to:

1. Safeguard the lives, as well as to reduce property damage, of citizens living within potential downstream flood inundation areas of CCR impoundments and related facilities at the Duck Creek Power Plant.
2. Define the events or circumstances involving the CCR impoundments and related facilities at the Duck Creek Power Plant that represent atypical operating conditions that pose a safety hazard or emergency and how to identify those conditions.
3. Define responsible persons, their responsibilities, and notification procedures in the event of a safety emergency.
4. Provide contact information of emergency responders.
5. Identify emergency actions in the event of a potential or imminent failure of the impoundments.
6. Identify the downstream area that would be affected by failure of the impoundments.
7. Provide for effective facility surveillance, prompt notification to local Emergency Management Agencies, citizen warning and notification responses, and preparation should an emergency occur.

Information provided by Illinois Power Resources Generating, LLC was utilized and relied upon in preparation of this report.





Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO,
3. USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

0 6,000 Feet

1:36,000 (At original document size of 11x17)

Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-23
Technical Review by PV on 2017-03-23
Independent Review by NS on 2017-03-23

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
1-1

Title
Location Map

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\\ut1269-f01\shared_projects\175605019-Matt.Hoy\gis\mxd\007_duckcrk\DuckCreekLocationMap.mxd Revised: 2017-03-24 By: cajohnson





Legend

CCR Surface Impoundment Boundary

0 3,000 Feet

1:18,000 (At original document size of 11x17)

Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-16
Technical Review by PV on 2017-03-16
Independent Review by NS on 2017-03-16

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
1-2

Title
CCR Impoundments

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community2015 NAIP Imagery

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2 COMMUNICATION

To facilitate understanding among everyone involved in implementing this EAP, four response levels are used to identify the condition of an impoundment. These are:

Response Levels:

- **Level 0:** Normal conditions and routine operations, including surveillance and initial investigation of unusual conditions and effects of storm events.
- **Level 1:** Potentially hazardous condition exists, requiring investigation and possible corrective action.
- **Level 2:** Potential failure situation is developing; possible mode of failure is being assessed; corrective measures are underway.
- **Level 3:** Failure is occurring or is imminent, public protective actions are required.

The 4-Step Incident Response Process is outlined in Figure 2-1. This should be used in conjunction with the Notification Flowchart (Figure 2-2) and EAP Decision Tree (Figure 2-3). Section 4 provides guidance tables for determining Response Levels and a table providing emergency actions to be taken given various situations. Table 2-1 lists contact information for the emergency responders.

Figure 2-1. Summary/Sequence of Tasks 4-Step Incident Response Process

Step 1: Detection, Evaluation, and Response Level Determination

Sequence of Tasks:

- Notify EAP Coordinator, Power Plant Management (Director and Engineering), and DMG Dam Safety Manager of unusual condition detected and confer on next steps needed.
- Conduct technical evaluation of conditions as needed.
- Determine Response Level based on evaluation. **(Table 4-1)**
- Reset Response Level as revised evaluations warrant.

Step 2: Notification

Sequence of Tasks:

- Notify authorities, designated personnel, and external response partners of change in Response Level, using the Notification Flowchart. **(Figure 2-2)**
- *Re-notify authorities, designated personnel, and external response partners as Response Level is changed*.

Step 3: Emergency Actions

Sequence of Tasks:

- Perform emergency actions with goal of saving the impoundment and minimizing impacts to life, property, and environment. **(Table 4-3)**
- Take continuous actions to include situation assessment, information sharing, remediation, and public safety advisories or warnings, as warranted.
- *Revise action plan as changes in conditions warrant*.

Step 4: Follow-up

Sequence of Tasks:

- Document conditions and decisions in the Emergency Incident Log.
- Notify authorities, designated personnel, and external response partners that condition is stabilized; limit incident termination declarations to conditions at the site.
- Conduct and document after-action review of incident and response.

Figure 2-2. Notification Flowchart

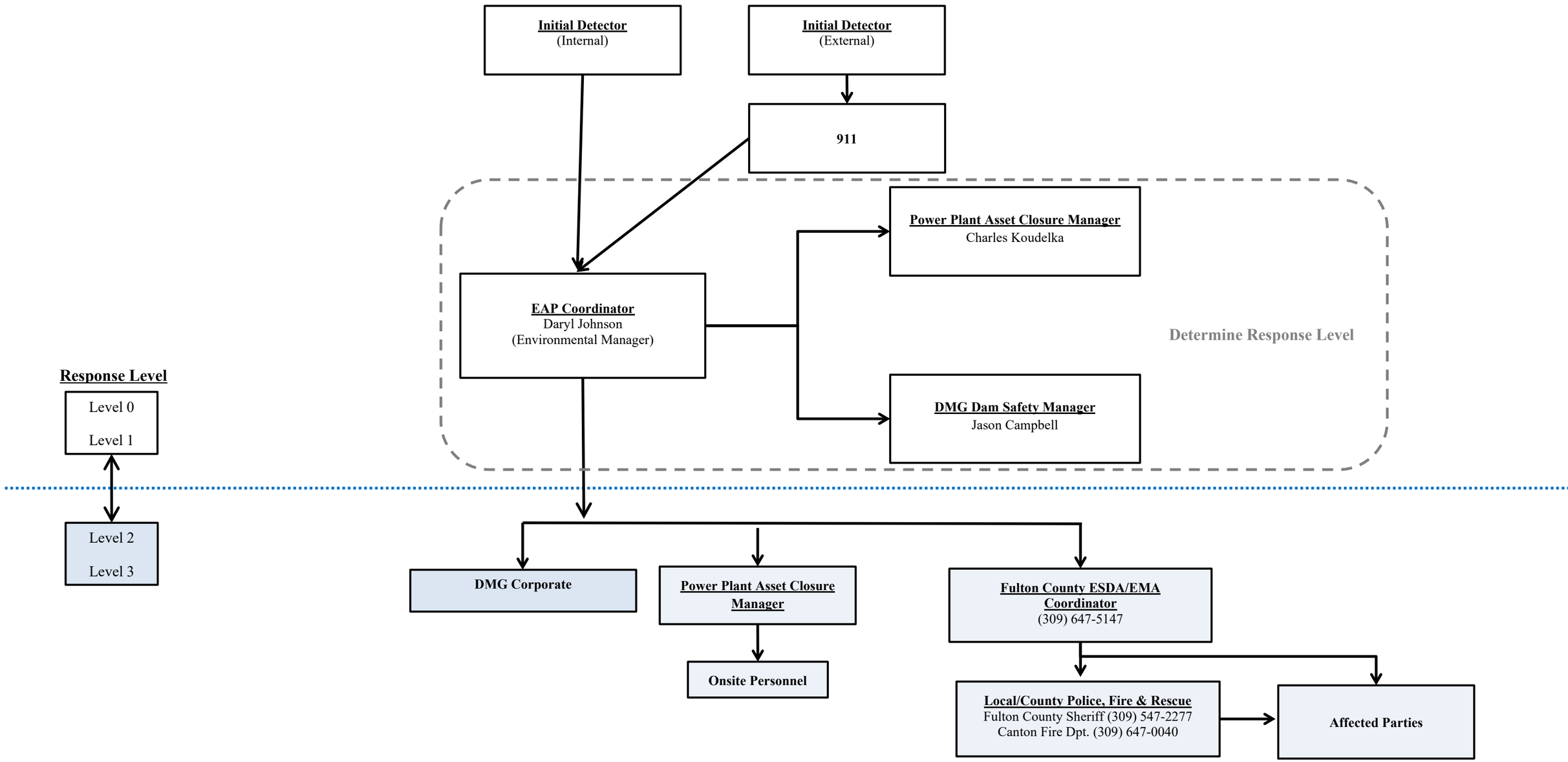


Figure 2-3. EAP Response Process Decision Tree

Note: At any given below, if failure is imminent or actively occurring **CALL 911 IMMEDIATELY** to notify emergency responders and then continue with process afterwards.

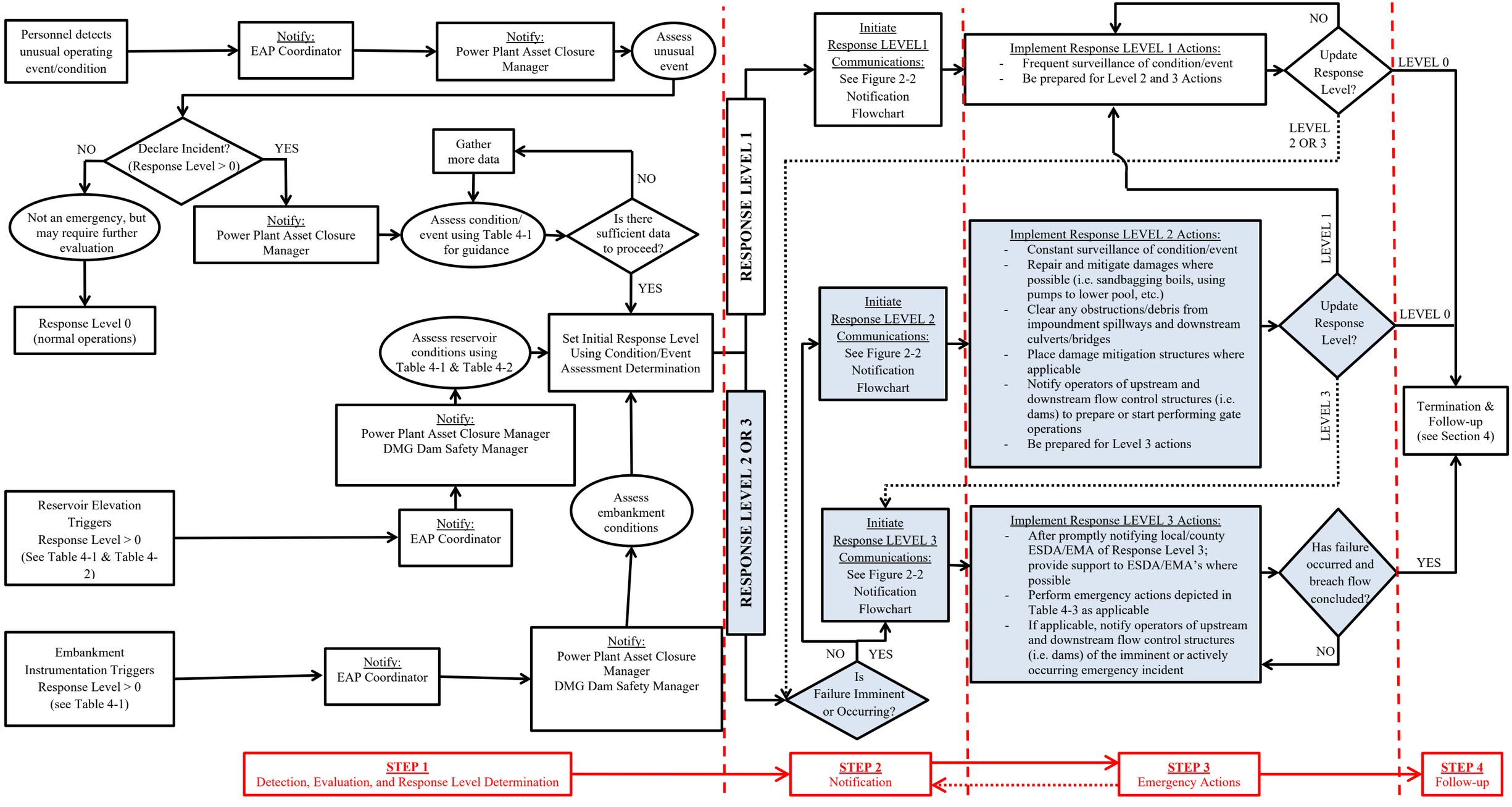


Table 2-1. EAP Emergency Responders

Position / Entity	Contact Information	
Internal Contacts		
Duck Creek Power Plant	**Contact**	
Asset Closure Manager	(903) 577-5207	
EAP Coordinator (Environmental Manager)	(309) 668-3816	
DMG Corporate Operations		
Dam Safety Manager	(618) 792-8488	
External Contacts		
Local/County ESDA/EMA, Police, & Fire	**Phone #**	**Alternate Phone #**
Fulton County Sheriff	(309) 547-2277	911
Fulton County ESDA/EMA	(309) 224-7701	
City of Canton Police Department	(309) 647-5131	
City of Canton Fire Department	(309) 647-0040	
Fulton County Ambulance	(309) 647-5147	
State Emergency Management Agencies & Organizations	**Phone #**	**Alternate Phone #**
IDNR-OWR Dam Safety Section Manager	(217) 782-4427	
Rice Lake State Fish & Wildlife Area	(309) 647-9184	(309) 338-0496
Illinois Conservation Police	(309) 338-1017	
Illinois State Police	(309) 833-4046	

3 EAP ROLES AND RESPONSIBILITIES

Table 3-1 provides a summary of the EAP roles during an emergency event.

Table 3-1. Summary of EAP Roles

Entity	Role Description
DMG Emergency Response Team (ERT)	**ERT:** DMG personnel responsible for EAP implementation, distribution, updates/maintenance, and training activities. The *ERT* is comprised of the following roles; 1. **DMG Corporate:** DMG corporate entity, committee, team, or position with relevant responsibility for a given generating power plant. 2. **Power Plant Management:** Personnel responsible for day-to-day operation and management of the Power Plant. 3. **Dam Safety Manager:** Personnel that is most knowledgeable about the design and technical operation of facilities at a given power plant. 4. **EAP Coordinator:** Personnel responsible for implementing the EAP and associated activities. **Emergency Event – EAP Responsibilities** 1. Respond to emergencies at the Power Plant. 2. Verify and assess emergency conditions. 3. Notify and coordinate as appropriate with participating emergency services disaster agencies or emergency management agencies (ESDA/EMA's), emergency responders, regulatory agencies, and all other entities involved or affected by this EAP. 4. Take corrective action at the Power Plant. 5. Declare termination of emergencies at the Power Plant.
Fulton County ESDA/EMA	1. Receive Response Level reports from *DMG Corporate* through *EAP Coordinator*. 2. Coordinate emergency response activities with local authorities: police, fire and rescue, etc. 3. Coordinate notification of public as necessary through established channels, which may include door-to-door contact. 4. Coordinate notification activities to affected parties within inundation areas. 5. Evaluate risk to areas beyond the inundation areas, communicate needs to the *DMG Corporate* and/or *EAP Coordinator*, and coordinate aid as appropriate. 6. Responsible for declaring termination of an emergency condition off-site upon receiving notification of an emergency status termination from the *DMG Corporate*. 7. If necessary, coordinate with *State ESDA/EMA*.
Canton Police, Fire, and Rescue	1. Receive alert status reports from the *ERT* or the Fulton County *ESDA/EMA*. 2. If necessary, notify affected parties and general public within inundation areas (see Section 7). 3. Render assistance to Fulton County *ESDA/EMA*, as necessary. 4. Render assistance to *DMG Corporate* and *Power Plant Management*, as necessary.
Fulton County Police, Fire and Rescue, and Emergency Services	1. Receive alert status reports from the *ERT* or the Fulton County *ESDA/EMA*. 2. If necessary, notify affected parties within the inundation area. 3. Provide mutual aid to other affected areas, if requested and able.

4 EAP RESPONSE

The 4-Step Incident Response Process is shown in Figure 2-1. The Decision Tree shown in Figure 2-3 provides a flowchart for the various elements of the response process. Upon reaching Step 4 of the response process (termination and follow-up), the EAP Coordinator is responsible for notifying the ESDA/EMA's that the condition of the dam/impoundment has been stabilized. The purpose of this section is to provide specific information that can be used during a response. This information is provided in the following tables:

- Table 4-1 provides guidance for determining the response level.
- Table 4-2 provides impoundment pool level trigger elevations.
- Table 4-3 lists emergency actions to be taken depending on the situation.

Table 4-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Spillway flow (See Table 4-2 for relevant elevations)	Primary spillway flow is not causing active erosion and impoundment water surface elevation is below auxiliary spillway crest elevation (if equipped).	Level 0
	Impoundment water surface elevation is at or above auxiliary spillway crest elevation (if equipped). No active erosion caused by spillway flow.	Level 1
	Spillway flow actively causing minor erosion that is not threatening the control section or dam/impoundment stability.	Level 2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise.	Level 2
	Abnormal operation of the spillway system due to blockage or damage that could lead to flooding.	Level 2
	Spillway flow actively eroding the soil around the spillway that is threatening the control section (e.g. undermining) or dam/impoundment stability.	Level 3
	Spillway flow that is flooding people downstream.	Level 3
Embankment Overtopping (See Table 4-2 for relevant elevations)	Impoundment water surface elevation at or below typical normal pool fluctuation elevation.	Level 0
	Impoundment water surface elevation above typical high pool fluctuation elevation.	Level 1
	Impoundment water surface elevation within 2 feet of the embankment crest elevation	Level 2
	Impoundment water surface elevation at or above embankment crest elevation.	Level 3
Seepage	New seepage areas in or near the dam/impoundment with clear flow.	Level 1
	New seepage areas with cloudy discharge or increasing flow rate.	Level 2
	Heavy seepage with active erosion, muddy flow, and/or sand boils.	Level 3
Sinkholes	Observation of new sinkhole in impoundment area or on embankment.	Level 2
	Rapidly enlarging sinkhole and/or whirlpool in the impoundment.	Level 3
Embankment cracking	New cracks in the embankment greater than ¼ inch wide without seepage.	Level 1
	Any crack in the embankment with seepage.	Level 2
	Enlarging cracks with muddy seepage.	Level 3

Table 4-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Embankment movement	Visual signs of movement/slippage of the embankment slope.	Level 1
	Detectable active movement/slippage of the embankment slope or other related effects (tension cracking, bulges/heaves, etc.) that could threaten the integrity of the embankment.	Level 2
	Sudden or rapidly proceeding slides of the embankment slopes.	Level 3
Embankment Monitoring Equipment (piezometers, inclinometers, surface displacement mounts, etc.)	Instrumentation readings beyond historic normal.	Level 1
	Instrumentation readings indicate the embankment is susceptible to failure.	Level 2
	Instrumentation readings indicate embankment is at threshold of failure or is currently failing.	Level 3
Earthquake or other event	Measurable earthquake felt or reported on or within 100 miles of the impoundment.	Level 1
	Earthquake or other event resulting in visible damage to the impoundment or appurtenances.	Level 2
	Earthquake or other event resulting in uncontrolled release of water or materials from the impoundment.	Level 3
Security threat	Verified bomb threat or other physical threat that, if carried out, could result in damage to the impoundment.	Level 2
	Detonated bomb or other physical damage that has resulted in damage to the impoundment or appurtenances.	Level 3
Sabotage/ vandalism	Damage to impoundment or appurtenance with no impact to the functioning of the impoundment.	Level 1
	Modification to the impoundment or appurtenances that could adversely impact the functioning of the impoundment. This would include unauthorized operation of spillway facilities.	Level 2
	Damage to impoundment or appurtenances that has resulted in seepage flow.	Level 2
	Damage to impoundment or appurtenances that has resulted in uncontrolled water release.	Level 3

Table 4-2. Impoundment Trigger Elevations

Impoundment	Embankment Crest Elevation	Auxiliary Spillway Crest Elevation	Normal Pool Fluctuation	
			Typical	High
Ash Pond No. 1	625 ft.	N/A	N/A	N/A
Ash Pond No. 2	640 ft.	N/A	N/A	N/A
Bottom Ash Pond				
GMF Pond	620 ft.	Not Applicable	616 ft.	618 ft.

Notes:
*Elevation estimated from Digital Elevation Model (DEM) developed by the Illinois State Geological Survey.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
High Water Level/ Large Spillway Release	Not applicable to capped impoundments. See Table 4-1 and Table 4-2 for elevations and triggering water levels associated with the impoundments and spillways covered by this EAP.	1. Assess cause of increased reservoir stage, especially during fair weather conditions. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Perform additional tasks as determined through consultation with the ERT. 5. Make notifications if condition worsens such that downstream flooding is imminent. **Response Level 0**: require enhanced surveillance 3 times per day **Response Level 1**: contact internal chain of command and external response partners as necessary; inspect impoundment minimum 1 time per hour **Response Level 2**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties. **Response Level 3**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties of emergency incident.
Seepage	Localized new seepage or boil(s) observed along downstream face / toe of earthen embankment with muddy discharge and increasing but controllable discharge of water.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart. 4. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a) Place a ring of sand bags with a weir at the top towards the natural drainage path to monitor flow rate. If boil becomes too large to sand bag, place a blanket filter over the area using non-woven filter fabric and pea gravel. Attempt to contain flow in such a manner (without performing any excavations) that flow rates can be measured. Stockpile gravel and sand fill for later use, if necessary.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
		b) Inspect the embankment and collect piezometer, water level and seepage flow data daily unless otherwise instructed by the Dam Safety Manager. Record any changes of conditions. Carefully observe embankment for signs of depressions, seepage, sinkholes, cracking or movement. c) Maintain continuous monitoring of feature. Record measured flow rate and any changes of condition, including presence or absence of muddy discharge. 5. Make notifications as outlined in the lower portion of the Notification Flowchart (Figure 2-2) if condition worsens such that failure is imminent.
Sabotage and Miscellaneous Other Issues	Criminal action with significant damage to embankment or structures where significant repairs are required and the integrity of the facility is compromised—condition appears stable with time.	1. Contact law enforcement authorities and restrict all access (except emergency responders) to impoundment. Restrict traffic on embankment crest to essential emergency operations only. 2. Determine Response Level. 3. Make internal notifications as outlined in the upper portion of the Notification Flowchart (Figure 2-2). 4. In conjunction with the Dam Safety Manager, assess extent of damage and visually inspect entire embankment and ancillary structures for additional less obvious damage. Based on inspection results, confirm if extent of damage to various components of the impoundment warrants a revised Response Level and additional notifications. 5. Perform additional tasks as directed by the ERT. 6. Make notifications if conditions worsen.
Embankment Deformation	**Cracks:** New longitudinal (along the embankment) or transverse (across the embankment) cracks more than 6 inches deep or more than 3 inches wide or increasing with time. New concave cracks on or near the embankment crest associated with slope movement.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine Response Level. 4. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a) Place buttress fill against base of slope immediately below surface feature. Stockpile additional fill. b) Place sandbags as necessary around crack area to divert any storm water runoff from flowing into crack(s). 6. As directed by the Dam Safety Manager, additional inspection and monitoring of the dam may be required. Items may include; inspect the dam on a schedule determined by the Dam Safety Manager; collect piezometer and water level data; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
	Slides / Erosion: Deep slide / erosion (greater than 2 feet deep) on the embankment that may also extend beyond the	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection report. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine the Response Level.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
	embankment toe but does not encroach onto the embankment crest and appears stable with time.	4. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items. a) Place sandbags as necessary around slide area to divert any storm water runoff from flowing into slide(s). b) Increase inspections of the dam; collect piezometer and water level data; and record any changes of condition. During inspections, carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 6. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
	Sinkholes: Small depression observed on the embankment or within 50 feet of the embankment toe that is less than 5 feet deep and 30 feet wide or which is increasing with time.	1. Slowly open drain gates to lower pool elevation. 2. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 3. Restrict traffic on embankment crest to essential emergency operations only. 4. Determine Response Level. 5. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 6. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items: a) Backfill the depression with relatively clean earth fill (free of organic materials) generally even with surrounding grade and slightly mounded (6 to 12 inches higher) in the center to shed storm water away from the depression. Stockpile additional fill. b) Increase inspections of the dam; collect piezometer and water level data daily unless otherwise instructed by Dam Safety Manager; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
Gate Malfunction or Failure	Sluice gate damaged structurally (sabotage, debris, etc.) with uncontrolled release of water at a constant volume. Condition appears stable.	1. Close any other gates, if open. 2. Determine Response Level. 3. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Obtain instructions from the Dam Safety Manager to determine if there are other methods to stop or slow down the flow of water. 5. If conditions worsen such that failure is imminent, make notifications as outlined in the lower portion of the Figure 2-2 Notification Flowchart.

5 PREPAREDNESS

The intent of this section is to provide information that will be utilized during a response. Established emergency supplies and locations, suppliers, and equipment are provided in Table 5-1. Supplier contact information is listed in Table 5-2.

A coordination meeting shall be conducted annually between representatives of the Illinois Power Resources Generating, LLC and local emergency responders. This meeting may be in the form of a face-to-face meeting, tabletop exercise, or additional training regarding the EAP.

Table 5-1. Emergency Supplies and Equipment

Item	On-site (Yes/No/Occasionally)	Remarks
Flashlights	Yes	Typically, at Duck Creek Power Plant Maintenance Facility: contact Asset Closure Manager for location(s).
Generator		
Extension Cords		
Fire extinguishers		
Floodlights		
Backhoe	Yes	John Deere 301 Backhoe/Loader and Caterpillar 426C Backhoe/Loader; contact Asset Closure Manager for location(s).
Dozer	Yes	Caterpillar D9R Dozer and Caterpillar D10R Dozer; contact Asset Closure Manager for location(s).
Large Equipment (Rental – including excavating equipment, pumps, lighting)	Yes	Two Caterpillar 834 Rubber Tired Bucket Loader, Fiatt Road Grader, two farm tractors with end loaders, and a Caterpillar Skid Steer with end loaders are also available; contact Asset Closure Manager for location(s). Contact Altorfer, Inc., Bolon's Repair, MH Equipment, or Sunbelt Rentals for additional large equipment (see Table 5-2).
Dump Truck	No	Contact Captain Hook Roll-Off Boxes or Done Rite Construction Co. Inc. for additional dump trucks (see Table 5-2).
Pump and Hoses	No	Contact Bolon's Repair or Pratt Lumber Do It Center for additional pumps and hoses (see Table 5-2).
Sandbags and Sand	No	Contact Duck Creek Sand and Gravel, Davis Sand and Gravel, or Pratt Lumber Do It Center for additional sandbags and sand (see Table 5-2).
Fill (Stone, aggregate, sand)	No	Contact Duck Creek Sand and Gravel, Davis Sand and Gravel, or Pratt Lumber Do It Center for additional fill (see Table 5-2).
Concrete/grout	No	Contact Canton Redi-Mix for additional batch plant concrete or Pratt Lumber Do It Center for additional bagged concrete (see Table 5-2).
Geotextile Filter Fabric	Yes	Two rolls of 10-ounce, non-woven filter fabric are available on site; contact Asset Closure Manager for location(s).
Plastic Sheeting	No	Contact Pratt Lumber Do It Center for additional plastic sheeting (see Table 5-2).
Rope	No	Contact Alexander Lumber, Bolon's Repair, and Pratt Lumber Do It Center for additional rope (see Table 5-2).
Personal Flotation Devices	Yes	Typically, at Duck Creek Power Plant Maintenance Facility, contact Asset Closure Manager for location(s).

Table 5-2. Supplier Addresses

Supply/Rental Item(s)	Supplier Contact Information	Distance from Site (miles)	Address
Rope	**Alexander Lumber Co**. (309) 647-0396	8.4	406 South 5th Ave Canton, IL 61520
Large Equipment	**Altorfer, Inc.** (309) 697-1234	33.5	6315 West Fauber Road Bartonville, IL 61607
Large Equipment, Pump and Hoses, Rope	**Bolon's Repair** (309) 647-2203	10.5	999 West Locust Canton, IL 61520
Concrete/grout	**Canton Redi-Mix** (309) 668-2261	13.1	22381 IL-78 Canton, IL 61520
Dump Truck	**Captain Hook Roll-Off Boxes** (309) 565-7676	18.2	309 South Glasford Road Glasford, IL 61533
Sandbags and Sand	**Davis Sand and Gravel** (309) 647-0019	10.7	1130 West Locust Street Canton, IL 61520
Dump Truck	**Done Rite Construction Co Inc**. (309) 331-4983	55.6	10277 IL RT 101 Littleton, IL 61452
Fill (Stone, aggregate, sand)	**Duck Creek Sand and Gravel** (309) 668-2278	5.5	17505 North Duck Island Road Canton, IL 61520
Large Equipment	**MH Equipment** (309) 699-4024	38.4	111 Carver Lane East Peoria, IL 61611
Concrete/grout, Pump and Hoses, Sandbags and Sand, Fill (Stone, aggregate, sand), Plastic Sheeting, Rope	**Pratt Lumber Do It Center** (309) 547-3587	13.4	311 East Avenue E Lewistown, IL 61542
Large Equipment	**Sunbelt Rentals** (309) 694-6201	39.7	1601 North Main Street East Peoria, IL 61611

6 FACILITY/IMPOUNDMENT DESCRIPTION

The impoundments included in this EAP are described as follows and illustrated in Figure 1-2. Table 6-1 contains additional geometric details for each impoundment.

The Duck Creek Power Plant is a retired plant located in Canton, Illinois, roughly 50 miles west of Bloomington, Illinois east of IL-78 and west of US-24.

Ash Pond No. 1 is a diked impoundment that was commissioned in 1976. The main inflow into Ash Pond No. 1 was precipitation, which accumulated and transported through channels around the inside perimeter of the pond, reaching two small internal impoundments. It has a maximum embankment height of 28 feet, a crest elevation of 625 feet above Mean Sea Level (MSL), and a crest width of 20 feet. The total length of the embankment is approximately 6,500 feet. The storage capacity of the pond is approximately 1,300 acre-feet at normal pool elevation. Approximately three-fourths of Ash Pond No. 1 is stacked ash, located on the southern side. Free water volume accounts for approximately one-fourth of the pond and is located on the northern end.

Ash Pond No. 2 is a diked impoundment that was commissioned in 1986. The main inflows into Ash Pond No. 2 are precipitation and stormwater pumped from Ash Pond No. 1. The diked fly ash is constructed in a serpentine channel to direct process water and allow for additional time to filter suspended solids before entering the main pond. The outlet structure is in the northeast corner of the pond and transports water into the Recycle Pond, along with a seepage blanket and pump. It has a maximum embankment height of 30 feet, a crest elevation of 640 feet above MSL, and a crest width of 20 feet. The total length of the embankment is approximately 9,000 feet. The storage capacity of the pond is approximately 1,000 acre-feet at normal pool elevation.

The Bottom Ash Pond…….

The GMF Pond is located directly north of the GMF Recycle Pond, east of North Bethel Cemetery Road. The pond encompasses approximately 30 acres and is graded to the south, where water discharges into a channel to flow into the GMF Recycle Pond. From the GMF Recycle Pond, water exits through piping into the Duck Creek Cooling Pond.

Table 6-1. Power Plant Impoundment Characteristics

Feature/Parameter	Ash Pond No. 1	Ash Pond No. 2	Bottom Ash Pond	GMF Pond
Maximum Embankment Height	28 feet*	30 feet*		11 feet
Length of Dam	6,500 feet*	9,000 feet*		4,560 feet
Crest Width	N/A	N/A		30 feet
Crest Elevation	±625 feet	±640 feet*		±620 feet
Reservoir Area at Top of Dam	N/A	N/A		31.6 acres
Storage Capacity at Top of Dam	N/A	N/A		Unknown
Primary Spillway Type	Stormwater let-down structures are now the spillways	Stormwater let-down structures are now the spillways		Lined open channel
Primary Spillway Crest Elevation	None	None		615 feet
Storage Capacity at Primary Spillway Elevation	None	None		None
Reservoir Area at Normal Water Surface Elevation	N/A	N/A		31 acres
Auxiliary Spillway Type	None	None		None
Auxiliary Spillway Crest Elevation	None	None		None

Notes:
*Source: "COAL ASH IMPOUNDMENT SITE ASSESSMENT FINAL REPORT", May 10, 2011. Elevations are in reference to original construction drawings by Commonwealth Associates, Inc.
All remaining values are GIS estimated.

7 BREACH INUNDATION MAPS AND POTENTIAL IMPACTS

Inundation maps for Ash Pond No. 1, Ash Pond No. 2, Bottom Ash Pond, and the GMF Pond potential breach scenarios are provided in this section. It is the Fulton County ESDA/EMA's responsibility to keep a current list of affected parties/properties to contact in the case of emergencies that result in Response Level 2 or 3. This list should encompass all properties within and adjacent to the probable inundation extents shown in the provided maps.

The methodology used to identify probable inundation extents for potential breach scenarios varied as a function of the impoundment size, location, surrounding topography, and surrounding structures/facilities/waterbodies.

Ash Pond No. 1, Ash Pond No. 2, Bottom Ash Pond, and the GMF Pond inundation maps were developed from visual assessments. Topographic data and basemap imagery were used to identify the mapped inundation areas.

Three failure scenarios were identified at Ash Pond No. 1 and Ash Pond No. 2. At both impoundments, the breach would be contained in either the Duck Creek Cooling Pond or the unnamed body of water west of N. Cilco Road. The Bottom Ash Pond is incised and no failure scenarios were identified. Four failure scenarios were identified at the GMF Pond. Only Duck Creek Power Plant owned structures were identified in the potential breach paths, with a breach contained in the Duck Creek Cooling Pond. The land between the impoundments and the Duck Creek Cooling Pond and unnamed body of water west of N. Cilco Road would also be inundated during a breach.

Approximate inundation areas are illustrated on Figure 7-1, Figure 7-2, Figure 7-3, and Figure 7-4.





Legend

- Disposal Area Approximate Limits
- Approximate Anticipated Inundation Extents

0 1,500 3,000 Feet

1:18,000 (At original document size of 11x17)

Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-06
Technical Review by MAT on 2017-03-10

Client/Project
Duck Creek Power Station
Emergency Action Plan

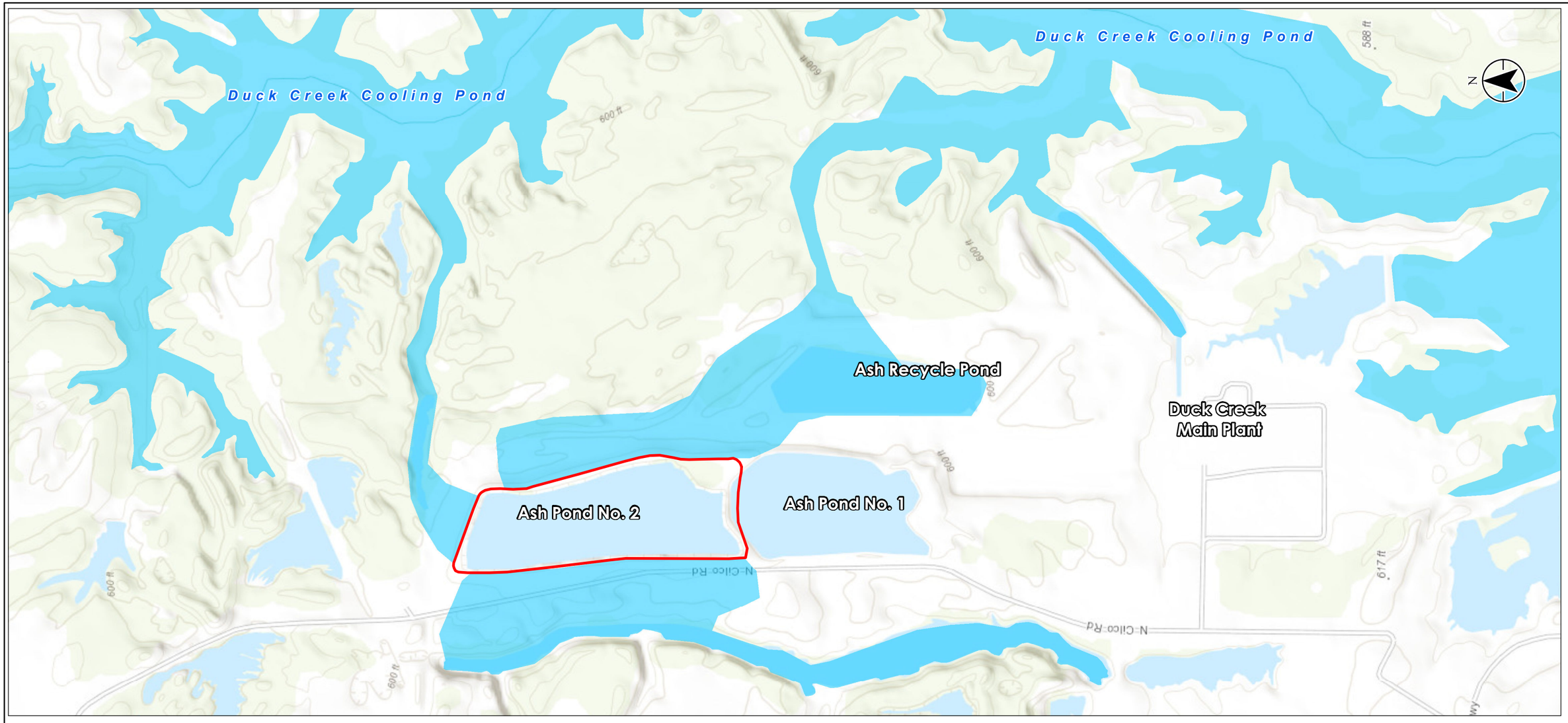
Figure No.
7-1

Title
Inundation Map
Ash Pond No. 1

Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

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Legend

- Disposal Area Approximate Limits
- Approximate Anticipated Inundation Extents

0 1,500 3,000 Feet

1:18,000 (At original document size of 11x17)

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

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Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

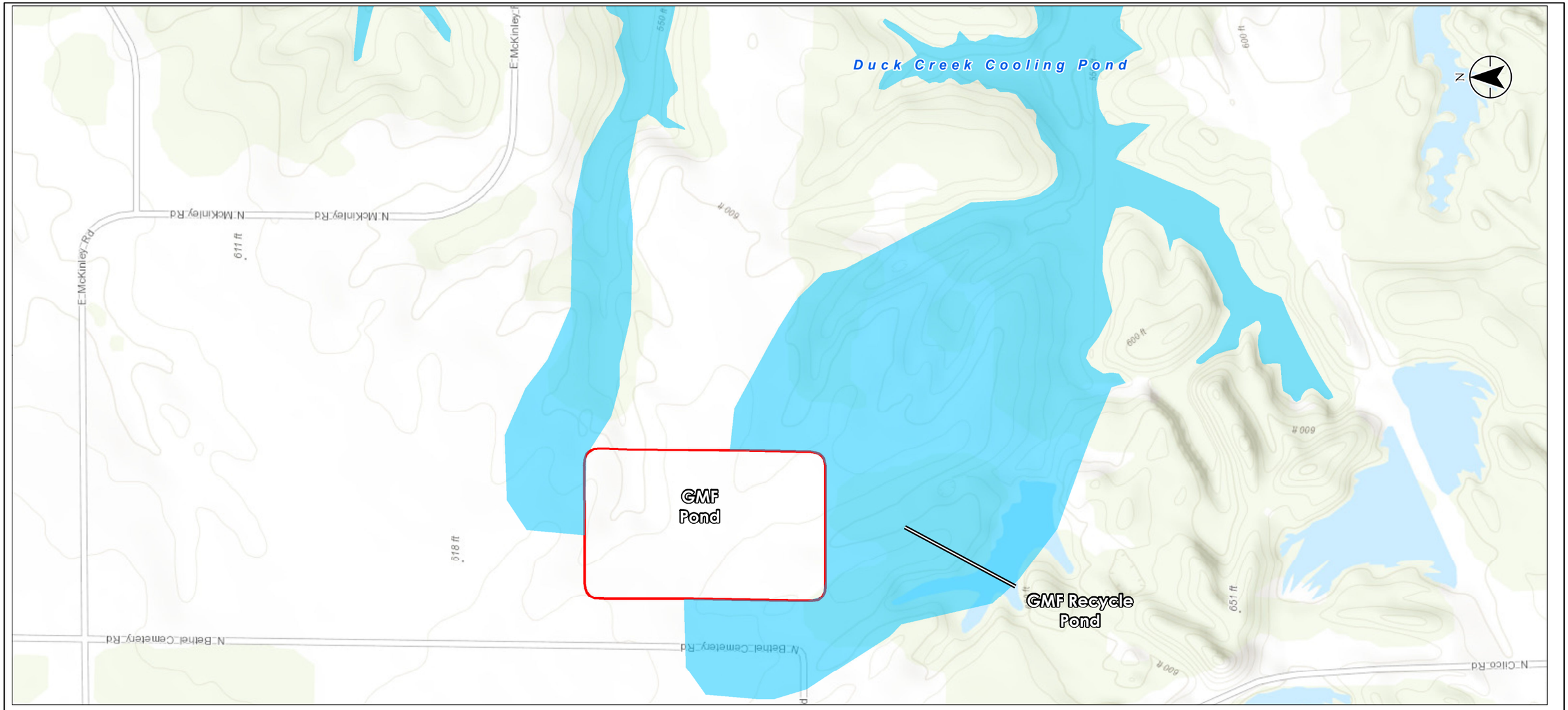
175605019
Prepared by CAJ on 2017-03-06
Technical Review by MAT on 2017-03-10

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
7-2

Title
Inundation Map
Ash Pond No. 2

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Legend

- Disposal Area Approximate Limits
- Approximate Anticipated Inundation Extents

0 800 1,600 Feet

1:9,600 (At original document size of 11x17)

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, 3. USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

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Stantec DYNEGY

Project Location
Latitude: 40.466181
Longitude: -89.984236
Fulton County, Illinois

175605019
Prepared by CAJ on 2017-03-06
Technical Review by MAT on 2017-03-10
Independent Review by MC on 2017-03-14

Client/Project
Duck Creek Power Station
Emergency Action Plan

Figure No.
7-3

Title
Inundation Map
GMF Pond

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