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GZA GeoEnvironmental of NY  
535 Washington Street  
11th Floor  
Buffalo, NY 14203  
T: 716.685.2300  
F: 716.685.3629  
www.gza.com



October 14, 2016  
File: 21.0056797.00

Mr. Kevin Schroeder  
Kevin.schroeder@nrgenergy.com  
Huntley Power LLC  
Tonawanda, NY 14150

Re: CCR Surface Impoundment Design Criteria  
Huntley Generating Station  
Tonawanda, New York

Dear Mr. Schroeder:

GZA GeoEnvironmental of New York (GZA) presents this letter to Huntley Power LLC (Huntley) with respect to the existing coal combustion residuals (CCR) surface impoundment (identified as the South Settling Pond) located at the Huntley Generating Station in Tonawanda, New York (Site). This Design Criteria information is required by the United States Environmental Protection Agencies (USEPA) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, as presented in the Federal Register Volume 80 No 74 dated April 17, 2015. In accordance with the CCR Rule (40 CFR §257.73), owners/operators of existing CCR surface impoundments are required to document the following initial structural integrity criteria:

§257.73 (a)(2): an initial hazard potential classification assessment  
§257.73 (d): an initial structural stability assessment, and  
§257.73 (e): an initial safety factor assessment

The requested structural integrity criteria for the Huntley plants South Settling Pond was recently evaluated in a report titled "Pond Embankment Evaluation" prepared by GZA GeoEnvironmental of New York, dated February 20, 2015 for NRG-Huntley Power. This report was prepared prior to the EPA CCR Rule and included embankment assessments on multiple surface impoundments (ponds) located at the Site. The ponds evaluated included three ponds in the northern portion of the Site, two asphalt lined equalization ponds (for non-CCR process water) and the South Settling Pond. Since the CCR rule went into effect, the three northern ponds were closed and removed from service prior to the effective date of the CCR Rule and therefore are not addressed in this document. Additionally, as the two asphalt lined ponds adjacent to the South Settling Pond never contained or stored CCR associated wastes, these ponds are also not required to be addressed in accordance with the Design Criteria requirements of the CCR Rule.



In accordance with §257.73(f)(2), the use of a previously completed assessment(s) can be used as the initial assessments required by §257.73 as the previously completed embankment evaluation report is dated February 20, 2015 which meets the criteria of less than 42 months prior to October 17, 2016. Therefore, the following is a summary of the findings for the South Settling Pond that is supported by the February 2015 Pond Embankment Evaluation report. A copy of this report is attached to this document.

**§257.73(a)(2): Determination of an initial hazard potential classification for the CCR Surface Impoundment.**

**Hazard Potential: LOW**

Per the requirements of §257.73(a)(2) an initial hazard potential classification assessment is required for the Site specific CCR surface impoundment and is to be classified as either high potential, significant potential or low potential hazard.

Based on the conclusions presented in the previously completed Pond Embankment Evaluation report, the South Settling Pond was recommended to have a classification of “**low hazard potential**” since an improbable failure or mis-operation of the impoundment would result in no probable loss of human life and low economic and/or environmental losses.

Additionally, since the time of the report, the discharge of CCR sluice water has been eliminated due to the Huntley Plant boilers being removed from service on February 29, 2016, resulting in a reduction of discharge flow rates from about 6,800 gallons per minute (gpm) down to about 1,500 gpm (for non-CCR water only). This flow reduction has resulted in a lowering of pond elevation from about elevation (el.) 570.0 to about el. 569.4 feet (as measured from the measurement gauge located near the outfall 008 pipe invert). This reduction in water elevation within the pond further supports the low hazard potential determination.

**§257.73(d): Completion of an initial structural stability analysis for the CCR Surface Impoundment**

Per the requirements of §257.73(d), the existing CCR surface impoundment must have an initial structural stability assessment completed to document, at a minimum, whether the CCR unit has been designed, constructed, operated and maintenance with the following requirements.

- (i) Stability of Foundations and Abutments- Based on the previously completed Pond Embankment Evaluation report, the South Settling Pond embankment is identified as situated between the pond and the Niagara River and includes an asphalt pavement access road over its top portion. Rip rap armor (consisting of about 18-inch thick cut stone) was observed on the side slopes between the asphalt and the shorelines on both sides of the embankment. The rip rap located on the settling pond side has some grassy vegetation cover and the rip rap on the Niagara River side was observed and documented as interlocked with cement



grout. This armor was reportedly installed over an approximate 12-inch layer of structural gravel and a woven fabric material over gradual fill soil and native silt and sand. A corrugated metal discharge pipe (CMP) is located through the embankment to allow drainage from the settling pond into the Niagara River. This CMP is oval shaped, with approximate dimensions of 65-inches tall by 92 inches wide and identified as Outfall #008. A plan view and cross section of the embankment and its associated materials are presented in Figure 3 and 4 of the attached Pond Embankment Evaluation. Weep drains consisting of approximate 4-inch diameter clay tile pipes were observed near the toe of the slope at 5-foot spacing and were installed to facilitate drainage of the River facing embankment side slope. The stability monitoring of the South Settling Pond embankment is generally limited to routine visual inspections for the side slopes, discharge pipe and grouted riprap side slopes. To date, there has been no evidence or indication of significant shifting, settling or general instability associated with the embankment.

- (ii) Slope Protection- A review of the previous Pond Embankment Evaluation report indicates the structure was constructed with an approximate 18-inch thick grouted rip rap armor (18-inch thick boulder sized rock) over 12-inches of structural gravel and a woven fabric. This slope protection is located on both the pond and river side of the embankment with the large CMP discharge pipe located in the central portion to drain the pond water into the river. The findings of the report, coupled with routine Site observations has not identified evidence of erosion or failures associated with the side slopes are indicative that the embankment rip-rap slopes area performing as designed. Based on this review and our observations, the embankment slope protection is providing sufficient protection from surface erosion, wave action and ice flows from the river, and from potential adverse effects of a rapid draw down
  
- (iii) Dike Compaction – Minimal historical documentation/information/drawings were available pertaining to construction methodology (e.g., fill lift thickness, compactive effort, proctor values, type of equipment, etc.). However, test borings completed as part of the pond embankment assessment were used to assess subsurface soil conditions and identified the various soil units with the following soil properties/parameters (based on laboratory testing and test boring density values).

Soil Type	Total Unit Weight (pcf)	Saturated Unit Weight (pcf)	Friction Angle
Riprap/Stone Layer (GW)	140	140	40
Fill Material (SM, SW, ML, GL)	128	130	30
Silt and Fine Sand Soil (ML, SM)	120.5	124.5	25
Sand (SW)	126	130	19



- (iv) Vegetated Slopes – The south settling pond embankment side slopes, both on the pond side and the river side, were constructed with a large rip-rap armor generally at a slope of 3 foot horizontal to 1 foot vertical (3H:1V). The river side slope was observed with grouted joints no vegetation and the pond side was observed with some grassy vegetation between armor block joints. Based on this design, the slope is considered to be an alternative form of slope protection and therefore is excluded from the vegetated slope requirements.
- (v) Spill Way Configuration – The South Settling Pond was not designed with a spillway, rather it is equipped with a CMP discharge pipe located through the embankment that is sloped to allow drainage from the settling pond into the Niagara River. This CMP is oval shaped, with approximate dimensions of 65-inches tall by 92-inches wide which has been sized to allow drainage during design flood levels (assumed ½ probable maximum flood (PMF) or el. 571.4 ft for the South Settling Pond) while maintaining a sufficient freeboard of about 4 feet within the pond area. Assuming the outfall pipe remains unobstructed, the pond would not be able to overtop its banks. Since the embankment has no spillway and its sidewalls are constructed of a rip-rap armor, the embankment is excluded from the spillway requirements.
- (vi) Hydraulic Structures – No hydraulic structures are present that underlie the base of the South Settling Pond, however the CMP outfall #008 that discharges water from the pond to the Niagara River is routinely inspected by visual means for evidence of changes to its structural integrity, and has been historically identified as free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation and debris which may affect the operation of the hydraulic structure. As a result of the plant boilers being shut down on February 29, 2016, the residual CCR sluice water was effectively eliminated from being discharged into the pond by late March 2016. As a result, the remaining non-CCR water flow at the outfall pipe invert has been reduced from el. 570± to el. 569.25± resulting with a reduced wetted perimeter/flow within the pipe. Based on the findings of the routine visual inspections, coupled with the reduced flow within the outfall pipe, the structural integrity of the pipe, has been maintained and the structure is considered to be free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation and debris which may negatively affect the operation of the outfall structure.
- (vii) Impacts from Downstream Waterbodies – The Niagara River is located downstream of the Huntley South Settling Pond at el. 566± during normal conditions as compared to the current pond elevations of slightly more than el. 569±. As stated in the Embankment Evaluation Report, a PMF has not been established for the Niagara River by a State, Federal or Canadian agency so the report used the 500-year elevation value of el. 570.65 as an example extreme flood condition for the Niagara River. This elevation is still below the berm height of el. 575.4 and would not overtop the berm to inundate the pond. Additionally, the design of the embankment slopes (grouted rip-rap armor and gravel) that comprise the slope face is



designed, constructed and maintained to maintain structural stability of the embankment from impacts associated with the Niagara River.

Based on the reviewed information provided by the Huntley Plant, and on our understanding and observations made at the Site, significant structural deficiencies were not identified at the South Settling Pond Embankment of the Huntley Plant. Therefore, the design, construction, operation and maintenance of the of the Huntley South Settling Pond are consistent with recognized and generally accepted good engineering practice for the volume of CCR that remains at the Site (previously estimated at 23,000 cy±). We note that the surface impoundment no longer receives CCR wastes as the plants boilers have been removed from service and no longer generates CCR wastes.

**§257.73(e): Periodic Safety Factor Assessments for the CCR Surface Impoundment**

Per the requirements of §257.73(e), the existing CCR surface impoundment must have an initial safety factor assessment completed for the CCR unit and document whether the calculated factors of safety achieve the minimum safety factors specified in paragraphs (e)(i) through (iv) for the critical cross section of the embankment.

As part of the previously completed Pond Embankment Evaluation report, a stability analysis was completed for the embankment in an effort to determine factors of safety for comparison to minimum EPA values for specific loading conditions (including normal pool, seismic conditions, rapid draw down and maximum pool (determined to be ½ PMF)) using the slope stability analysis program PCSTABL, Version 6 to provide an assessment of existing conditions at the Site. Additionally, soil parameters used in in the program were based on assumed soil index parameters that were based on soil test results and published values for similar soil types.

A water level during normal conditions was assumed to range in elevation from about el. 566± (river elevation) to el. 570± (pond elevation) feet. The Pond elevation for ½ PMF was determined to be about el. 571.4± feet and the Niagara River elevation for the 500-year storm was determined to be el. 570.65 ft. The following factors of safety were calculated for specified loading conditions and compared to the EPA minimum required factors of safety.

<b>Loading Condition</b>	<b>Calculated F.S.</b>	<b>EPA Minimum Required F.S.</b>
Circular Normal Pool (No Seismic)	1.5	1.5
Circular Normal Pool (W/ Seismic)	1.1	1.0
Block Normal Pool (No Seismic)	1.6	1.5
Block Normal Pool (W/ Seismic)	1.3	1.0
½ PMF	1.6	1.4
Rapid Draw Down	1.3	1.3



The safety factor calculated for the specific loading requirements were determined to meet or exceed the specific EPA minimum requirements. Based on these calculations and associated observations, GZA considers the South Settling Pond embankment along the Niagara River to be stable.

PROFESSIONAL ENGINEER CERTIFICATION


The undersigned registered professional engineer is familiar with the CCR Surface Impoundment requirements of §257.73, specifically:

- §257.73(a)(2) - Initial Hazard Potential Classification,
- §257.73 (d) – Initial Structural Stability Assessment, and
- §257.73 (e) – Initial Safety Factor Assessment

and has reviewed available documentation specific to the Huntley Power CCR Surface Impoundment (referred to as the South Settling Pond). Based on the document review and Site observations made, the undersigned registered professional engineer attests that the Pond Embankment Evaluation report dated February 20, 2015 that was prepared for various impoundment structures at the Huntley Plant was conducted in accordance with and meets the specific requirements of §257.73(a)(2), (d) and (e).

Name of Professional Engineer: Daniel J. Troy, P.E.

Company: GZA GEOENVIRONMENTAL OF NEW YORK

Signature: 

Date: October 14, 2016

PE Registration State: New York

PE Registration Number: 081139-1


Professional Engineer Seal:



We trust this information satisfies your needs for this project.

Sincerely,

GZA GEOENVIRONMENTAL OF NEW YORK

  
Daniel J. Troy, P.E.  
Senior Project Manager

  
Bart A. Klettke, P.E.  
Principal

Attachments: Pond Embankment Evaluation, prepared for the Huntley Generation Plant, Tonawanda, New York, prepared by GZA GeoEnvironmental of New York, dated February 20, 2015

**ATTACHMENT A**

February 20, 2015  
File No. 21.0056705.00

Mr. Joe Pietro  
[Joseph.pietro@nrgenergy.com](mailto:Joseph.pietro@nrgenergy.com)  
Huntley Power LLC  
3500 River Road  
Tonawanda, New York 14150



Re: Pond Embankment Evaluation  
Huntley Generation Plant  
Tonawanda, New York

Dear Mr. Pietro:

535 Washington Street  
11<sup>th</sup> Floor  
Buffalo, New York  
14203  
716-685-2300  
Fax: 716-685-3629  
[www.gza.com](http://www.gza.com)

GZA GeoEnvironmental of New York (GZA) is pleased to submit this Pond Embankment Evaluation Report to NRG / Huntley Power LLC (NRG) for three specific pond embankments located within the Huntley Generation Plant property at 3500 River Road in Tonawanda, New York (Site). The three embankments assessed as part of this work include:

- The embankment located between the South Settling Pond and the Niagara River in the southern portion of the Site (See Figure 1); and
- Two embankments along the northern portion of the Site property associated with ponds identified as Pond 2 and Pond 3 (see Figure 2).

This report summarizes:

- The subsurface conditions encountered at each of the three specified pond embankments at the site based on the recently completed test boring program.
- Topographic survey completed for the two northern embankments and the one southern embankment.
- Analytical testing results for various soil samples collected during the soil boring work.
- Our geotechnical evaluation of each of the three embankments.
- An engineering evaluation and stability analysis for each of the three embankments.
- GZAs responses to AMECs comments pertaining to GZAs hydrologic and hydraulic assessment of the Site as presented in our September 13, 2012 report.

## **BACKGROUND**

The EPA has conducted nation-wide assessments of Coal Combustion Waste (CCW) impoundments at coal combustion energy producers. AMEC was hired by EPA to perform assessments of six (6) ponds at NRG's Huntley Site. AMEC's June 2011 assessment included a site visit to perform visual observations, inventory the CCW surface impoundments, assess the containment dikes, and to collect relevant historical

impoundment documentation. Condition assessments, as accepted by the National Dam Safety Review Board (NDSRB), were ascribed by AMEC to each of the 6 impoundments, ranging from: “Satisfactory” – “Fair” – “Poor” – “Unsatisfactory” – “Not Rated”. AMEC completed EPA’s Coal Combustion Dam Assessment Checklists and CCW Impoundment Assessment Forms. The Impoundment Inspection Forms include a section that assigned a “Hazard Potential” rating ranging from “Less than Low” – “Low” – “Significant” – “High”. Based on the AMEC reporting, the Ponds were given a draft rating of “Poor” mainly due to insufficient data.



NRG requested that GZA review the EPA/AMEC report to assist NRG in preparing a response letter to provide additional support for reclassifying the respective pond embankments. Based on this request, GZA prepared a letter response to AMEC dated September 13, 2012 that provide additional rationale, analysis and general engineering judgments given the current site conditions. From this additional work, we provided our opinion as to what the appropriate classification should be for the various impoundments, raising from Poor to Satisfactory, based on accepted EPA qualifiers or rankings.

EPA/AMEC responded to GZA’s response letter in a letter report dated March 2013 that commented on several aspects of our report. Overall, the Ponds 2 and 3 and the South Settlement pond were reclassified as Fair from the draft classification of Poor. AMEC indicated that the classification of Fair and not Satisfactory was mainly due to the lack of geotechnical data available for the pond embankments. The letter stated that in an effort for the respective ponds to be considered for a Satisfactory rating, geotechnical investigations would be required to confirm strength parameters used in the stability analysis. Additionally, as part of the geotechnical study, it was recommended that one piezometer be installed at each embankment to monitor phreatic levels in the respective embankments.

AMECs comments also addressed several concerns regarding hydrologic and hydraulic recommendations that required clarification of analyses prepared by GZA and also for annual observations of specific pond embankments to be made. We note that annual observations have been completed by GZA for the years 2013 and 2014 with our findings and recommendations report submitted to NRG under separate cover.

Subsequent to EPA/AMECs comment letter, NRG made the decision to drain and close the three northern ponds at the Site prior to the end of 2014. Because these ponds only receive storm water and some limited process water from the power plant facility, it was determined that the generated water could be rerouted to another on-Site outfall for discharge into the Niagara River and thereby eliminating the need for these northern ponds. These ponds are scheduled to be drained and filled with soil material (as approved by the New York State Department of Environmental Conservation) prior to the end of 2014. Based on this information, much of the findings and clarifications recommended for the northern Pond 2 and Pond 3 may be considered moot due to their scheduled closure.

## GEOTECHNICAL ASSESSMENT

In an effort to obtain additional strength parameters from the soil units within the three ponds, GZA was engaged by NRG to drill three (3) test borings at each of the three identified pond embankments to observe subsurface conditions and provide a geotechnical and stability assessment of the respective embankments. Specific information obtained at each pond embankment included fill type and thickness, overburden soil type, physical properties and thickness, and depth to groundwater. Existing discharge pipes are present within each embankment, including one for Pond 3, one for the South Settling Pond and five (of differing size and elevations) from Pond 2, which allows surface water to drain from the respective ponds to the Niagara River.



GZA completed the following scope of services for this work.

- Retained the services of Earth Dimensions Inc. (EDI) of Elma, New York to complete nine (9) test borings at the Site (see Figure 3 for South Settling Pond, Figure 5 for North Pond 2, and Figure 7 for North Pond 3 plan views). Three borings were done at each pond embankment of which two were located on either side of the respective outfall pipes including one closer to the pond, one closer to the outfall slope and one in the middle of the embankment. The soil boring located closer to the respective outfall slope (discharge side) at each embankment was converted into a 2-inch diameter piezometer to allow for groundwater measurements to be made within each respective embankment. Overburden soil samples were collected by EDI and GZA characterized and logged the recovered soil samples. Ground water measurements were made from within the completed piezometers, and when allowable, from drilling augers at the completion of the each boring.
- Select overburden soil samples were collected for testing by GZA's geotechnical laboratory for various analyses including grain size (i.e., sieve tests), moisture content, total unit weight, direct shear and triaxial compression testing. To facilitate some of the testing, Shelby tube sample collection was attempted from distinct layers of apparent fine grained soils and were submitted to our soils laboratory for consolidated undrained triaxial testing and unit weight determination.
- Ground surface elevations in the areas of the respective embankment areas were measured by GZA's subcontractor, Clear Creek Land Surveying, LLC (Clear Creek) of Springville, New York. The ground surface elevation and location of Pond 2 and Pond 3 embankments, at the critical embankment cross-sections, and the respective test borings and piezometers were recorded, as well as, existing embankment features including rip-rap location, respective pond water levels, concrete headwall (Pond 2 only) and discharge pipe inverts, among others. These locations were tied into an existing Site benchmark that was provided by NRG for our use. Measurements from the South Settling Pond were made by GZA using typical rod and level methods to calculate elevations and tape measurements for horizontal measurements. These measurements were tied into the existing topographic survey completed by Clear Creek during our 2009 embankment assessment.
- Evaluated the stability of the three embankments for varying conditions (including normal pool, seismic conditions, rapid draw down and maximum pool (determined to



be ½ PMF) via the slope stability analysis program PCSTABL, Version 6 to provide an assessment of existing conditions at the Site.

- Prepared this evaluation report that summarizes the findings of the subsurface explorations, laboratory testing program, and embankment evaluation. As recommended by the AMEC response, this report also presents our recommendations of whether or not a more detailed slope stability analysis of the embankment is required and/or what types of remedial efforts can be made to respective embankments to prevent slope failures under specified conditions.

## SITE CONDITIONS

### South Settling Pond Embankment

The South Settling Pond currently is designed to receive stormwater runoff and process water associated with NRG's bottom ash removal system. Specifically, this pond receives flow from sluice waters and suspended solids from Unit 67 and Unit 68 bottom ash and economizer ash systems (only for a short duration in 2009) and discharge from the Low Level Waste Water Pit. Since 2009, economizer ash has been removed from the facility dry and taken directly to the Huntley Landfill for disposal, and is no longer being sluiced to the South Settling Pond. The Low Level Pit discharge includes rain water from roadway drains, sub-basement sump drains, boiler water releases, Huntley 1 roof and floor drains, auxiliary cooling systems drains and discharge from the Wastewater Treatment facility from treating the North and South Equalization basin water.

This ash is pumped to the settling pond, where the larger solids (e.g., bottom ash) being discharged settle out closer to the pipe discharge into the pond and the smaller particles (e.g., fly ash) settle out at distances further from the discharge pipes. Although the discharge volume into the settling pond reportedly varies from time to time, the surface elevation of the water within the pond typically remains consistent at an approximate elevation (el.) 570, which is slightly above the invert of the discharge pipe inlet that drains to the Niagara River. The settling pond is reportedly about 6 feet deep and is periodically (about once every five years) dredged to remove accumulated sediments (e.g., ash). It should be noted that accumulated ash proximate to the discharge pipes in the northern portion of the pond are dredged on a weekly basis to the extent practical. This weekly dredging of accumulated coarse grained ash reduces the accumulation of sediment within the central and southern portions of the settling pond.

This assessment area consists of the embankment located between the south end of the settling pond and the Niagara River and includes an asphalt pavement access road over its top portion. Rip rap armor was observed on the side slopes between the asphalt and the shorelines on both sides of the embankment. The rip rap located on the settling pond side has a grassy vegetation cover and the rip rap on the Niagara River side is interlocked with a cement grout with a small amount of vegetation present.

A corrugated metal discharge pipe (CMP) is present through the embankment that allows drainage from the settling pond to the Niagara River. This CMP is oval shaped, with

approximate dimensions of 65-inches tall by 95 inches wide. At the time of our visit, water was flowing through the pipe at an approximate depth of about 2 to 3 inches.

As shown on the attached Figure 4, the ground surface elevations of the existing embankment range from elevation (el.) 566 at the Niagara River shoreline (outside toe-of-slope) to el. 575.4 across the paved access road on top of the embankment to el. 570.0 at the pond shoreline (inside toe-of-slope).



#### North Pond 2 Embankment

The general area around the existing Pond 2 area was originally designed to receive Coal Combustion Waste (CCW), and remaining areas surrounding the pond may contain residual ash from former plant activities. The pond currently receives flow from the adjacent Pond 1 which itself receives facility drainage including sub-basement sump pumps, roof and floor drains, auxiliary cooling system drains and de-mineralized water production wastes.

Based on available pond design drawings (NRG No. 311.10-4578-01-0000), Pond 2 appears to have been constructed within an area of former fly ash with the bottom of the pond consisting of a 12-inch thick layer of bank run gravel beneath a 6-inch thick layer of reinforced concrete. The drawings imply the elevation of the bottom of Pond 2 is el. 570.0 (top of reinforced concrete) and the eastern pond embankment as being constructed with an approximate 6 foot wide clay soil wall that appears to extend below the finished pond floor. The clay material was likely placed for its low permeability characteristics around the pond sidewalls. The surface elevation of the water within Pond 2 can be controlled by a series of corrugated metal discharge pipes of varying elevations and sizes located within a concrete headwall structure on the northern side of the pond. Of the five outlet pipes observed, only one pipe remains open at all times (overflow pipe) and the other four are equipped with slide gates to allow for moderation of pond levels. The open overflow pipe has the highest invert elevation at el. 577.1 ft. The elevation of Pond 2 water was designed for and is typically maintained at el. 575. These five outlet pipes, which range in size from 12-inch to 24-inch diameter, were observed to discharge into a stone lined open drainage channel located about 45 feet north of the concrete headwall structure with invert elevations at the discharge points ranging from 568.9 to 573.0 ft. Discharge from these pipes eventually flows westerly within the open drainage channel, into the Niagara River.

This assessment area consists of the embankment located between the north end of Pond 2 and the stone lined open drainage channel. This embankment was generally observed to have a soil/gravel access road over its top portion to allow for passage of service vehicles. A bank stabilization material consisting of a formed concrete-like blanket material (estimated 6-inches thick) was observed on both the pond side and the drainage channel side of the embankment. Additionally, loose rip-rap (boulders) was also observed placed along portions of the embankment's northern slope.

As shown on the attached Figure 6, the ground surface elevations of the existing Pond 2 embankment range from el. 568 at the open channel drainage ditch (outside toe-of-slope)

to el. 579 across the access road on top of the embankment to el. 575 at the pond shoreline (inside toe-of-slope).

#### North Pond 3 Embankment



The general area of the existing Pond 3 area was originally designed to receive CCW, and remaining areas surrounding the pond may contain residual ash from former plant activities similar to Pond 2. The pond is designed to receive flows from the adjacent Pond 1. It should be noted that during recent visits, the drainage water was no longer flowing into Pond 3 as the facility closed off the outfall pipe from Pond 1 to Pond 3 with a metal slide gate. As such, accumulated water in Pond 3 was too shallow to drain out through the northern outfall. This closure is likely associated with NRGs plan to drain and close the northern ponds.

Based on available pond design drawings (NRG No. 311.10-4578-01-0000), Pond 3 appears to have been constructed within an area of former fly ash and does not appear to have been constructed similar to Pond 2 (which included a reinforced concrete and stone bottom). The drawings imply the elevation of the bottom of Pond 3 is el. 566.0 ft. The surface elevation of the water within Pond 3 does not include control gates at its outfall like Pond 2 (other than the ability to close off flow completely from Pond 1 slide gate) as the northern end of the pond consists of an open 24-inch diameter CMP overflow pipe. The open drainage pipe has invert elevation at el. 574.2 on the pond side and el. 573.5 at the outfall (open channel drainage ditch side). The elevation of surface water in Pond 3 apparently varies, but appears to be designed for el. 575.0. Discharge from Pond 3 eventually flows westerly within the open drainage channel into the Niagara River, within the same drainage channel as Pond 2.

This assessment area consists of the embankment located between the north end of Pond 3 and the stone lined open drainage channel (about 80 feet in length). This embankment was generally observed to have a soil/gravel access road over its top portion to allow for passage of service vehicles. A bank stabilization material between the pond and the southern side of the Pond 3 embankment consisted of a formed concrete-like material (estimated 6 inches thick) was observed on the pond side of the embankment.

As shown on the attached Figure 8, the ground surface elevations of the existing embankment range from el. 571 at the open channel drainage ditch (outside toe-of-slope) to el. 578 across the access road on top of the embankment to el. 575 at the pond shoreline (design inside toe-of-slope).

## SUBSURFACE EXPLORATIONS

The subsurface exploration program consisted of three test borings at each of the three ponds. The borings completed for the south settling pond were designated B-4 to B-6 as a continuation from borings B-1 through B-3 that were previously done as part of our 2009 embankment assessment. Borings for Pond 2 were designated as B-10 through B-12 and those for Pond 3 were designated as B-7 through B-9. The test boring locations are shown on Figures 3, 5 and 7. General test boring procedures include the following.



- Overburden drilling was done using 4-1/4 inch inside diameter hollow stem augers (HSA). In an effort to obtain accurate “N” values at locations below the groundwater table, the drillers attempted to use a mud slurry in an effort to minimize potential hydrostatic in-balance between water levels inside and outside the augers. It should be noted that only borings B-4 through B-7 were drilled with this slurry and the drillers had difficulty maintaining sufficient head within the augers. As a result, the remaining test borings (B-8 through B-12) were drilled without the use of mud slurry.
- Standard Penetration Tests (SPT) were completed in each boring in general accordance with ASTM D1586. SPT “N” values were determined by driving a 2-inch diameter split spoon sampler with a 140-pound automated hammer falling 30-inches. Soils were sampled over a 24-inch interval. The number of blows required to drive the split spoon sampler each 6-inch interval was recorded. The “N” value is the number of blows required to drive the sampler between the 6-inch to 18-inch interval.
- Split-spoon samples were recovered continuously to the bottom of each boring, at a depth of about 26 feet. The only exception was at boring B-12, which was done to a depth of 28 ft bgs.
- Shelby tube samples were attempted from several test borings from potentially cohesive soils, where encountered. With the exception of two locations, tube samples recovered typically had poor recovery/usability due to coarse grained soil (sand and silt) sample sliding out on retrieval, sample interference from gravel or drillers wax or insufficient recovery volume.
- Recovered soil samples (including Shelby tube samples) that were collected during this work were shipped to our geotechnical laboratory for index and strength testing.
- One test boring at each of the three embankments was equipped with a piezometer to measure water levels within the respective embankments. The piezometers were constructed of 2-inch diameter Schedule 40 PVC riser pipe and included a 10-foot slotted screen. Steel protective casings were fitted and secured with concrete over the riser pipes.
- Water level measurements were made inside the completed piezometers at different times during the field work. Additionally, at completion of the borings, HSAs were left open overnight to allow water level measurements to be made inside the augers the next morning.

GZA prepared test boring logs based on visual observations of the recovered soil samples, using apparent grain size distribution and plasticity. Characteristics such as relative density and consistency (based on the SPT), color, grain size, moisture, etc. were recorded on the boring logs. Test boring logs are included as Attachment 1.

## TOPOGRAPHIC SURVEY

The location and ground surface elevation at each test boring completed from Pond 2 and Pond 3 was measured in the field using GPS methods referencing the site datum established by NRG by GZAs subcontracted land surveyor, Clear Creek Land Surveying, LLC of Springville, New York. In an effort to properly tie into NRG's site grid system, NRG was able to provide survey control points tied into NRG's horizontal and vertical site datums. Additionally, Clear Creek was able to locate previous points used during their 2009 survey measurements of the South Settlement Pond embankment. Locations and ground surface elevation measurements for B-4 through B-6 at the South Settlement Pond embankment were made by GZA field staff using typical rod and level equipment and fiberglass tape based on known locations as identified on the 2009 topographic survey. Topographic surveys made for each pond embankment are incorporated into the respective Figures 5 and 7 for Ponds 2 and 3 respectively.



## LABORATORY TESTING

After review of the boring logs, and collected soil samples and in consultation with NRG, GZA selected representative soil samples for laboratory testing to confirm field descriptions and to assist in estimating engineering properties of the silt and fine sand layer encountered within and beneath the embankment. The laboratory testing program consisted of:

- Seven (7) soil samples for grain size analyses (not including hydrometer testing) (ASTM D422);
- Seven (7) soil samples for natural moisture content;

Additionally, a total of six (6) Shelby tube samples were collected from locations of fine grained soils and submitted for testing. Analyses of these samples included water content, total unit weight, torvane testing (shear strength), and where allowable, consolidated undrained triaxial compression (CIU) tests (ASTM D4767).

It should be noted that only two Shelby tube samples (identified as ST-6 and ST-7 from B-8 and B-11, respectively) were identified as suitable for the CIU testing. The remaining tube samples generally had poor or insufficient recovery for this testing. A composite sample from tube samples ST-3 and ST-4 (from borings B-5 and B-6, respectfully) was prepared by the laboratory to determine shear angle by a direct shear test (ASTM D3080). The tube sample ST-2 (from boring B-4) was observed with driller's wax down the entire length of the sample and therefore the calculated average total unit weight value reported is not considered to be representative of the soil conditions and is not used in our stability analysis.

The laboratory soil test results are included as Attachment 2.

## SUBSURFACE CONDITIONS

The soil stratigraphy conditions observed are described in this section. A generalized profile between the test borings is depicted on embankment cross-sections Figures 4, 6 and 8. The general thickness and elevations of the various soil layers encountered at the boring locations are summarized below.



### South Settlement Pond (Cross-Section on Figure 4)

In general, the soil borings B-4 through B-6 identified subsurface conditions generally similar to borings B-1 through B-3 that were done in the vicinity during our 2009 investigation. Test boring B-4 was located proximate to the southern side of the discharge pipe in the western central portion of the embankment (closer to the Niagara River). This boring was equipped with a 2-inch diameter PVC piezometer. Boring B-5 was located south of the drainage pipe and adjacent to the pond and boring B-6 was located north of the drainage pipe in the central portion of the access road. The ground surface elevation at B-4 is approximately 575.2 feet above sea level (MSL), B-5 is approximately 575.4 feet MSL and B-6 is approximately 574.5 ft MSL. In general, the overburden conditions encountered at the three locations explored are summarized as follows.

- **Overburden Fill:** The fill thickness varied between test borings including 12.0 feet at B-4 and B-5 and 10.0 feet at B-6. The soils sampled were visually described as varying between sand, gravel and slag in the upper portions of the fill soil to silt and fine sand material in the lower portions. Smaller amounts of brick, metal and wood fragments were observed throughout the fill material. The fill soil samples were predominantly coarse grained and non-plastic and generally observed with relative densities ranging from very loose to very dense.
- **Silt and Fine Sand:** The depth of the silt and fine sand soil encountered varied from about 12 feet bgs in B-4 and B-5 and to a depth of 10 ft bgs in B-6 and ranged from about 5.5 to 7.0 feet thick. The recovered samples were visually described as generally a grey to dark grey silt and fine sand soil (ML) with relative densities ranging from very loose to loose.
- **Sand –** A sand layer including very fine sand to coarse sand was observed at depths ranging from about 17.5 to 19 feet bgs and its presence continued to the end of each boring (26 feet bgs). These sands were observed with trace amounts of silt and rounded gravel with relative densities ranging between very loose and dense.

### Pond 2 (Cross-Section on Figure 6)

The three soil borings completed adjacent to Pond 2 designated as B-10 through B-12 are shown on Figure 5. Test boring B-10 was located proximate to the Pond, east of the embankment discharge pipes and concrete headwall (closer to pond). Test boring B-11 was located on the northern central portion of the embankment (east of the discharge pipes) and

was equipped with a of 2-inch diameter PVC piezometer. Boring B-12 was located west of the drainage pipes and headwall in the central portion of the embankment access road. The ground surface elevation at B-10 is approximately 579.6 feet MSL, B-11 is approximately 579.0 feet MSL and B-12 is approximately 578.7 ft MSL. In general, the overburden conditions encountered at the three locations explored within the embankment of Pond 2 are summarized as follows.



- **Overburden Fill:** The fill thickness varied between test borings including 16.0 ft at B-10, 16.5 ft at B-11 and an apparent 28.0 feet at B-12. The soils sampled were visually described as varying layers and lenses of silty clay and fine sand and gravel (presumably coal ash) in the fill soil. The silty clay soils fill was typically observed at shallow locations is likely material used for construction of Pond 2 that was placed over previously deposited coal ash materials. Apparent coal ash waste and slag lenses were observed at the bottom of B-12 and may be due to historic activities prior to the construction of Pond 2.
- **Silt and Fine Sand:** The depth of the silt and fine sand soil encountered varied from about 16.5 feet bgs in B-10, 16.0 ft bgs in B-11 and ranged from about 3 to 10.5 feet thick. The recovered samples were visually described generally as gray to black silt and fine sand soil with lesser amounts of clay and gravel.
- **Sand –** A sand layer including fine sand to medium sand was observed at depths ranging from about 19.5 to 25 feet bgs and its presence continued to the end of each boring. These sands were observed with trace amounts of silt and rounded gravel, with relative densities ranging from very loose to loose.

#### Pond 3 (Cross-Section on Figure 8)

The three soil borings completed at this location, designated as B-7 through B-9, are shown on Figure 7. It should be noted that due to clearance issues, overhead electric lines prohibited the drillers from installing B-7 any further to the North. Based on NRG-provided site plans, these locations appear to be within the limits of the former Erie Canal right-of-way. Test boring B-7 was located proximate to the northern side of the Pond 3 embankment, east of the pond discharge pipe (closer to the drainage ditch) and was equipped with a 2-inch diameter PVC piezometer. Test boring B-8 was located along the eastern side of the discharge pipe within the central portion of the embankment access road and B-9 was located on the western side of the Pond 3 discharge pipe at a location closer to the pond. The ground surface elevation at B-7 is approximately 577.6 ft MSL, B-8 is approximately 578.1 ft MSL and B-9 is approximately 578.0 ft MSL. In general, the overburden conditions encountered at the three locations explored within the embankment of Pond 3 are summarized as follows.

- **Overburden Fill:** The fill thickness varied between test borings including 6.0 feet at B-7, 9.5 feet at B-8, and 11.0 feet at B-9. The soils sampled were visually described as sand and gravel materials likely consisting predominantly of a coal ash waste material. Smaller amounts of silty clay, slag and rubber fragments were observed sporadically in

the fill material. The fill soil samples were predominantly coarse-grained and non-plastic with relative densities ranging from very loose to medium dense.



- Silty Clay (Fill): This silty clay soil is assumed to have been used to fill the historic Erie Canal as a thin seam of gray to black f/c sand and gravel soil with traces of slag was typically observed at depths of 17 to 18.5 feet bgs. The thin lens of coarse grained material is believed to be the bottom of the former Erie Canal. The depth of the reddish brown silty clay (CL) ranged from 6.0 feet bgs in B-7, 9.5 feet bgs in B-8 and 11.0 feet bgs in B-9 and ranged from 8 to 12 feet thick. This historic fill soil had consistency ranging from soft to medium stiff.
- Silty Clay (Native) – A reddish brown silty clay (CL) layer was observed at depths ranging from about 17 to 18.5 feet bgs (directly beneath the assumed bottom of historic Erie Canal) and its presence continued to the end of each boring (26 feet bgs). This material is assumed to be a glacially deposited native soil (unlike the lacustrine silt and sand deposits generally observed closer to the Niagara River) as it was observed as massive in structure and did not appear to have been placed as fill material. These soils had consistencies ranging from soft to very stiff.

#### GROUNDWATER CONDITIONS

Groundwater was measured inside the three installed piezometers at various times and the observed measurements are presented below.

Embankment	Test Boring	Date of Measurement	Water Measurement (ft bgs)	Groundwater Elevation (ft above MSL)
South Settlement Pond	B-4	6/30/14 and 8/5/14	11.3 / 11.3	566.5 / 566.5
Pond 3	B-7	6/30/14 and 8/5/14	6.7 / 7.3	573.9 / 573.3
Pond 2	B-11	6/30/14 and 8/5/14	13.2 / 14.6	568.7 / 567.3

The water elevation observed in the Niagara River adjacent to the South Settlement Pond outfall pipe appeared similar to the elevation observed during our 2009 assessment (based on location of shoreline to clay tiles, outfall pipe, rip rap stone, etc.). Based on these observations, GZA has assumed an elevation of the Niagara River to remain at 566.0 ft MSL (which corresponds to the water elevation measured in the piezometer of B-4).

As part of our September 13, 2012 response letter to AMEC, hydrologic analysis for specific ponds located at the Site were made. At AMECs recommendations, design flood levels for the three ponds was assumed to be ½ Probable Maximum Flood (½ PMF). The calculations and design programs used by GZA to calculate the respective ½ PMF for the three ponds is presented in our previously submitted response letter. Flood elevations utilized in this report's slope stability assessment include the following.

Location	Normal Pool El. (ft. MSL)	½ PMF El. (ft. MSL)
Pond 2	575.3	577.2
Pond 3	574.4	577.4
South Settling Pond	569.9	571.4
Niagara River	566.0	570.7*

\*Represents tailwater water elevation during 500-year peak flood level for the Niagara River as no PMF elevation was available for the Niagara River.



## **SLOPE STABILITY ANALYSES**

### South Settlement Pond Conditions

The soils encountered in B-4 through B-6 generally consists of a fine to coarse grained fill material over a silt and fine sand layer over a well graded sandy soil. At the boring locations, the composition of the fill material was variable with a greater amount of coarse soil (sand, gravel and slag and lesser amounts of concrete, brick, metal and wood debris) noted closer to the ground surface. Finer grained, sandy silt soil was observed generally in the lower portions of the fill layer. The soil encountered below the fill and below the water line was predominately a loose silt and fine sand (apparent lacustrine deposited soil) about 5.5 to 7 feet thick over a well graded medium dense sandy soil. The findings from these borings are generally similar to those of B-1 through B-3 from our 2009 investigation.

SPT “N” values from the silt and fine sand layer underlying the fill soils (about 10 to 12 feet bgs) were measured with values ranging from about 3 to 8 indicating a loose relative density for the silt layer and from 9 to 31 indicating a loose to dense relative density for the fine sand layer). The average relative densities per boring ranged from 12 to 33 indicating a medium dense fill material (generally similar to the previous borings B-1 through B-3).

The rip rap side slopes extending upward from the edge of the river and pond to the top of the embankment are generally observed to be sloped at 3-feet horizontal (H) to 1-foot vertical (V).

### Pond 2 Conditions

The soil encountered in B-10 through B-12 generally consists of a fine to coarse grained fill material over a sandy silt layer over a fine sand layer. At the boring locations, the composition of the fill material was generally observed as a variable consistency with a greater amount of fine grained soil (i.e., silty clay) noted closer to the ground surface (presumed placed during pond construction) and fine sand and gravel (presumably coal ash/waste) in the lower portions of the fill soil. The soil encountered below the fill and below the water line was predominately a very loose to loose silt and fine sand (apparent lacustrine deposited soil) about 2 to 7 feet thick over well-graded medium dense fine sand.



SPT “N” values from the silt and fine sand layer underlying the fill soils were measured with values ranging from about 2 to 8 indicating a loose relative density in locations B-10 and B-11. The soil Boring B-12 (western most boring in the Pond 2 embankment) had very loose conditions with low SPT “N” values (including weight of rod measurements) at deeper depths and may be historic fill material placed in this area prior to construction of the pond.

The embankment side slopes were observed consisting of a concrete bank stabilizer material on both sides. Large rip rap stone was also observed on the northern slope facing the drainage channel. An approximate 12 foot deep reinforced concrete headwall with side wingwalls was also observed as part of this embankment. The foundation footers for this structure were reportedly about 18 feet long and 16 feet wide. This headwall included five separate discharge pipe openings at varying elevations designed to control pond water elevations. It should be noted that stability modeling did not take into account this structure or the associated CMP drainage pipes with varying elevations. These existing features are likely to increase the calculated stabilities of the Pond 2 embankment.

#### Pond 3 Conditions

The soils encountered in soil borings B-7 through B-9 completed within the embankment for Pond 3, identified a similar coarse-grained soil as the other two embankments. However, these soil borings appear to be located within the former Erie Canal. The fill soil within this embankment was observed to be similar coarse grained material intermixed with coal ash waste. The soil encountered below the granular fill and below the water line was predominately an apparent fill material likely used to fill the former canal consisting of soft to very stiff silty clay (about 8 to 12 feet thick) over an assumed native, soft to stiff, silty clay.

SPT “N” values from the silty clay layers (both above and below the presumed bottom of the former Erie Canal) underlying the shallow granular fill soils were measured with values ranging from about 2 to 26 indicating a soft to stiff consistency in the three borings. The relative densities of the granular fill soil ranged from 3 to 28 indicating loose to medium dense consistency.

The embankment side slope proximate to the Pond was observed with a concrete slope stabilization material similar to Pond 2. This material was not readily observed on the northern slope adjacent to the drainage channel, mostly due to dense vegetation (grass and weeds) obstructing its observation. Large loose rip rap stone was observed, however, on portions of the northern slope.

### GZA EVALUATION OF TRIAXIAL COMPRESSION TEST RESULTS



GZA attempted to collect Shelby Tube samples of the fine grained soil layers encountered at each embankment in an effort to determine an internal friction angles ( $\phi$ ) and total unit weight for each location. Specifically, tube samples were attempted within the silty soil lacustrine deposit layers of the South Settlement Pond and from Pond 2. The silty clay fill and native glacial deposit layers were attempted from Pond 3. However, due to poor sampler recovery or insufficient sample volume at select locations, only two Shelby tube samples (from B-8 and B-11) were able to be tested for tri-axial compression testing. Our interpretation of the completed test indicates the following.

South Settlement Pond B-5 and B-6: A composite sample from B-5 and B-6 (ST-3 and ST-4, respectfully) was prepared by the laboratory due to insufficient sample volume and/or suitability of recovered sample. Based on this composite sample, an internal friction angle of 19 degrees was calculated.

Pond 2, B-6 (ST-6): A stress path aligned tangential to the stress circles plotted for failure at low minor principal inter-granular stress ( $\sigma_3$ ) and high  $\sigma_3$  produces a  $\phi$  angle of 29 degrees with a shear strength intercept (cohesion (c)) of about 500 psf.

Pond 3, B-11 (ST-7): A stress path beginning at the plot origin (shear strength = 0 psf) and extending tangentially to the stress circle for failure at high  $\sigma_3$  produces a  $\phi$  angle of 38 degrees.

GZA analyzed the respective embankment's stability considering these calculated friction angles results.

### SLOPE STABILITY EVALUATION

Using the computer program PCSTABL (version 6) to analyze the stability of the slope embankment at the study area and our assumed soil index parameters (which are based on soil test results, published values for similar soils and based on our experience with previously tested Site soils) presented in the tables below provides an analysis that indicates that the three embankment slopes are stable.

For previous seismic analyses, GZA applied a maximum horizontal acceleration (MHA) of 0.2g (90 percent probability of not being exceeded in 250 years), based on "Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico", U.S. Geologic Survey, Map MF-2120. This is a conservative value based on published information. More recent published data, which has catalogued earthquake activity, indicates lower MHA values. Additionally, based on the findings of the document "Geotechnical Engineering Circular No. 3 – Design Guidance: Geotechnical Earthquake Engineering for Highways, Volume 1 – Design Principals" dated May 1997 and published by the U.S. Department of Transportation, seismic acceleration values for slopes and embankments can be estimated to be one half the value of the maximum horizontal

acceleration. Based on this information, therefore, GZA applied a horizontal acceleration value of 0.1 g (half of 0.2g) for the slope stability calculations, for each pond embankment seismic evaluation.

Our stability analyses considered circular and block failures. The circular failures were calculated with and without seismic conditions, with assumed ½ PMF conditions and with rapid draw down conditions for the respective embankment. The sliding block failure was calculated with and without seismic conditions. Slopes are generally considered to be stable with factors of safety greater than 1.5 for normal conditions (without seismic effects), and greater than 1.0 for normal conditions with seismic considerations. A minimum factor of safety for conditions of maximum surcharge pool (½ PMF for this study) are 1.4 and the minimum value for rapid draw down from a maximum storage pool is 1.3.

Our analysis for each specific pond embankment is further discussed below.

### **SOUTH SETTLEMENT POND**

#### SOIL PARAMETERS USED FOR PCSTABL INPUT

Soil Type	Total Unit Weight (pcf)	Saturated Unit Weight (pcf)	Friction Angle
Riprap/Stone Layer (GW)	140	140	40
Fill Material (SM, SW, ML, GL)	128	130	30
Silt and Fine Sand Soil (ML, SM)	120.5*	124.5	25
Sand (SW) **	126	130	19

\*A laboratory test for total unit weight for the silt and fine sand layer was attempted from sample identified as ST-2 from B-4, however the sample result was deemed unusable as drillers wax extended down the entire length of the Shelby tube sample. Based on this, the unit weights previously determined from the 2009 laboratory sampling of similar soil layer were used.

\*\* Due to poor sample recovery, the friction angle for the sand layer was calculated by compositing soil samples from Shelby Tubes ST-3 and ST-4 (from borings B-5 and B-6, respectfully). The average total unit weight was based on an average from both samples.



GZA ascribed the same unit weight (128 pcf) and friction angle (30°) for the Fill material as previously estimated for the following reasons.



1. The relative densities were observed to be similar to those of previous borings B-1 through B-3, generally observed as medium dense.
2. The 30° friction angle value assigned is roughly based upon internal friction angle values published for silty-sand fill by Joseph E. Bowles, “Physical and Geotechnical Properties of Soils”, 1979, as follows: Loose Silty Sand: 25-35 degrees; Dense Silty Sand: 30 – 36 degrees. Based on these published values, an ascribed 30° friction angle is appropriate.
3. Due to the presence of gravel, slag, concrete, brick, cobbles and wood debris in the fill soils, plus the presence of the 65” x 92” steel arch pipe providing reinforcement, it is GZA’s opinion that the debris and pipe gives greater interlocking and a higher shear strength that warranted assigning a mid-range friction angle of 30 degrees to the fill layer.

A piezometric (water) level during normal conditions was assumed to range in elevation from about 566 (river elevation) to 570 (pond elevation) feet. The Pond elevation for ½ PMF was previously calculated to be about 577 feet and the Niagara River elevation for the 500 year storm was determined to be 570.65 ft. The following factors of safety were calculated for specified loading conditions. Copies of the different run models are included in Attachment 3.

<b>Loading Condition</b>	<b>Calculated F.S</b>	<b>EPA Minimum Required F.S.</b>
Circular Normal Pool (No Seismic)	1.5	1.5
Circular Normal Pool (W/ Seismic)	1.1	1.0
Block Normal Pool (No Seismic)	1.6	1.5
Block Normal Pool (W/ Seismic)	1.3	1.0
½ PMF	1.6	1.4
Rapid Draw Down	1.3	1.3

Based on these calculations and associated observations, GZA considers the South Ash Settling Basin embankment along the Niagara River to be stable.

**NORTH PONDS**

**POND 2**

**SOIL PARAMETERS USED FOR PCSTABL INPUT**



Soil Type	Total Unit Weight (pcf)	Saturated Unit Weight (pcf)	Friction Angle
Riprap/Stone Layer (GW)	140	140	40
Fill Material (SM, SW, ML, SP)	122	126	28
Silt, Clayey Silt and Fine Sand Soil (ML, SM)*	113	117	38
Sand (SW)**	128	132	19

\*Values for this layer based on lab results collected from Shelby Tube sample ST-7 (from B-11).

\*\*Values for this layer are based on sample results obtained from the sand layer associated with South Settling Pond due to similar conditions observed at similar depths.

A piezometric (water) level during normal conditions was assumed to range in elevation from about el. 566 (river elevation) to el. 575 (Pond 2 elevation) feet. The Pond Elevation for ½ PMF was previously calculated to be about el. 577.2 feet and the Niagara River elevation for the 500 year storm was determined to be el. 570.65 ft, which is slightly higher than the ground surface of the adjacent drainage channel (el. 568 ft MSL). The following factors of safety were calculated for specified loading conditions. Copies of the different run models are included in Attachment 3.

Loading Condition	Calculated F.S	EPA Minimum Required F.S
Circular Normal Pool (No Seismic)	1.6	1.5
Circular Normal Pool (W/ Seismic)	1.2	1.0
Block Normal Pool (No Seismic)	2.9	1.5
Block Normal Pool (W/ Seismic)	2.0	1.0
½ PMF	<b>1.1</b>	1.4
Rapid Draw Down	1.4	1.3

With the exception of the ½ PMF loading condition, the factors of safety calculated using updated laboratory and strength parameters exceed the EPA minimum required safety factors. GZA acknowledges that the value of 1.1 for ½ PMF is less than the required value of 1.4, however the failure plane for this condition appears to be limited to a shallow veneer failure of the rip rap and bank stabilization material. Potential failure along this

plane would not be catastrophic to the embankment and associated Pond 2. Additionally, the calculated FS values are likely lower than actual as our slope stability model does not take into account for the added stability and strength of the reinforced concrete headwall, associated wing walls and broad-width footer, and numerous CMP drainage pipes which vary in elevation throughout the embankment. Furthermore, due to NRGs plan to drain and fill Pond 2 prior to the end of 2014, the issue of embankment stability for Pond 2 becomes moot.



Based on these calculations and associated observations, GZA considers the Pond 2 embankment to be stable. However, as this pond is scheduled to be drained and filled, the issue of stability will not be applicable.

### **POND 3**

#### SOIL PARAMETERS USED FOR PCSTABL INPUT

Soil Type	Total Unit Weight (pcf)	Saturated Unit Weight (pcf)	Friction Angle
Fill Material (SM, SW, ML, GL)	122	126	28
Silty Clay Fill (CL)*	125.4	128	29
Silty Clay Native (CL)**	133.5	135	29

\*Total Unit Weight values for this layer are based on laboratory results collected from Shelby Tube sample ST-5 (from B-7). Friction angle was not tested although appears to be similar soil to the apparent native soils below it. Hence, a friction angle value of 29 was used.

\*\* Values for this layer based on lab results (including friction angle) collected from Shelby Tube sample ST-6 (from B-8).

A piezometric (water) level during normal conditions was assumed to range in elevation from about 569 (bottom of adjacent drainage channel) to 574 (Pond 3 elevation) feet. The Pond Elevation for ½ PMF was previously calculated to be about 577.4 feet and the Niagara River elevation for the 500-year storm was determined to be 570.65 ft, which is slightly higher than the ground surface of the adjacent drainage channel (569 ft MSL). The following factors of safety were calculated for specified loading conditions. Copies of the different run models are included in Attachment 3.



Loading Condition	Calculated F.S	EPA Minimum Required F.S
Circular Normal Pool (No Seismic)	1.5	1.5
Circular Normal Pool (W/ Seismic)	1.1	1.0
Block Normal Pool (No Seismic)	2.2	1.5
Block Normal Pool (W/ Seismic)	1.6	1.0
½ PMF	<b>1.3</b>	1.4
Rapid Draw Down	1.4	1.3

With the exception of the ½ PMF loading condition, the factors of safety calculated using updated laboratory and strength parameters exceed the EPA minimum required safety factors. GZA acknowledges that the value of 1.3 for ½ PMF is less than the required value of 1.4, however the failure plane for this condition appears to be limited to a shallow veneer failure of the rip rap and bank stabilization equipment. Potential failure along this plane would not be catastrophic to the embankment and associated Pond 2 as the top of this embankment is about 70 feet wide. Furthermore, due to NRGs plan to drain and fill Pond 3 prior to the end of 2014, the issue of embankment stability for this pond becomes moot.

Based on these calculations and associated observations, GZA considers the Pond 3 embankment to be stable. However, as this pond is scheduled to be drained and filled, the issue of stability will not be applicable.

#### **HYDROLOGIC AND HYDRAULIC STUDY CLARIFICATION**

GZAs responses to AMECs comments (shown in italics) pertaining to GZAs hydrologic and hydraulic assessment of the Site as presented in our September 13, 2012 report are addressed below.

*AMEC comment: “The 72-hour All-Season Probable Maximum Precipitation (PMP) generated by BOSS HMR52 specifically for this site is 33.0 inches and reasonable. The material submitted does not indicate the drawdown time of the impoundments to determine if a longer design storm duration is necessary due to long storage time in the ponds.”*

GZA Response: As Pond 2 and Pond 3 are scheduled to be closed and filled in, there is no need to evaluate whether a longer design storm duration is necessary. Additionally, due to the size of the South Settling Pond outfall pipe (96-inches) and its ability to maintain more than 3-feet freeboard during ½ PMF conditions, it is our opinion that there will be no need to evaluate for longer storm design durations.

*AMEC comment: “The report states that the ½ PMF was generated by taking 50% of the calculated discharge from application of the PMP to each watershed. The full model or output was not provided, so it is not known how this reduction was done in HEC-HMS.*

*The 500-year flood elevation on the Niagara River was used as the tailwater condition for the pond H&H analysis. It is incorrectly labeled on the drawings accompanying the report*



*as the ½ PMF water surface elevation for the river. The 500-year flood event is not directly related to the PMF, and the ½ PMF flow in the Niagara River could be larger or smaller than the 500-year flow. There may be a determination of the PMF for the Niagara River performed by a State, Federal, or Canadian agency. If it is possible to obtain a PMF flowrate for the river it could be compared to the flow rates given in the effective FIS to determine if the ½ PMF flow is similar to the 500-year flow. If no estimate of the PMF exists for the Niagara River, using the 500-year elevation as an example extreme flood condition is defensible, especially as it falls approximately 2.7 feet lower than the lowest outlet of the North Basins, 1.1 feet lower than the bottom of the equalization basins and 8.6 feet lower than the overflow outlet, and South Ash Settling Pond has over 3 feet of freeboard even with the tailwater condition.”*

GZAs Response: It is GZA’s current understanding that a PMF has not been established for the Niagara River by a State, Federal or Canadian agency. After an additional review for such information, we have opted to use the 500-year elevation value of 570.65 ft MSL as an example extreme flood condition for the Niagara River.

*AMEC comment: “The HEC-HMS models were not provided for review, and no output was included with the report. This review is based only on the given input and output tables in the report and the attached routing diagram. No drainage area maps were provided. The elevations of the various pipe inlets and outlets and tops of the berms are given in the report and the attached drawings. These have been assumed to be correct and entered into HEC-HMS model accurately, but this can’t be verified.”*

GZA Response:

The HEC-HMS models are included on a compact disc that has been provided to NRG, separate from this report.

Drainage area maps for the south ponds and the north ponds are attached as Figures 9 and 10, respectively. Elevations of the pipe inlets and outlets and top of berm elevations at the outlet structures have been measured by our surveyor (Clear Creek) as shown on attached drawings.

*AMEC comment: “The Equalization Basins drainage area is equal to its total pond footprint of 132,400 (sq. ft.), which matches up with the aerial photo, and indicates that no rainfall runoff from adjacent areas will surface drain into it. The drainage area of the South Ash Settling Pond is 343,700 (sq. ft.), which is larger than the pond footprint and indicates some adjacent area flowing to the pond. Page 6 of the report states that some roadway and building areas flow to this pond. The drainage area for this pond should be delineated on a map for review.*

*Case B, considering the tailwater impacts of Ponds 2 and 3 on Pond 1 is the most appropriate scenario to consider for the North Basins. It shows freeboard of at least 2.1 feet in each pond. The Conclusion section of the report (Pages 17-19), however, shows different ponding elevations for each pond that does not match the values in the results*

*table (Table 8, Page 12). The freeboard values from the conclusion are less than 2 feet for Ponds 2 and 3. No model or detailed output was submitted to verify the results presented in the report and to determine which freeboard values are correct”.*

GZA Response: GZA has delineated the pond drainage areas as shown on attached Figures 9 and 10.



The text presented in the Conclusions section of our September 2012 report was incorrectly stated. The text, specific to the North Basins is corrected as follows to match the values presented in the tables and figures.

Correction to Page 17 of September 2012 GZA Report, under “North Basins” discussion in Conclusions (corrected items in *italics*): “**Pond 1** – This pond is small, covering an area less than ½-acre, with partial embankments (Top El. 579.0’ ±) between itself and Ponds 2 and 3. The hydrologic analysis indicates that the ½ PMF event would result in a peak storm water elevation of 576.9’ providing about 2.1 feet of freeboard height.”

Correction to Page 17 of September 2012 GZA Report, under “North Basins” discussion in Conclusions (corrected items in *italics*): “**Pond 2** – This pond has a full surrounding embankment (Top El. 579.0’ ±). The hydrologic analysis indicates that the ½ PMF event would result in a peak storm water elevation of 576.40’ providing about 2.6 feet of freeboard height.”

Correction to Page 18 of September 2012 GZA Report, under “North Basins” discussion in Conclusions (corrected items in *italics*): “**Pond 3** - This pond has partial embankments (Top El. 579.0’ ±) along the west and north edges, with the east and south sides incised. The hydrologic analysis indicates that the ½ PMF would result in a peak storm water elevation of 576.5’ providing about 2.5 feet of freeboard height.”

The HEC-HMS models are presented on a compact disc that has been provided to NRG separate from this report.

*AMEC comment pertaining to Freeboard Guidelines for the south-side Equalization Basins: “The Equalization Basins have zero or less freeboard throughout many operating scenarios, even with the suggested plan to lower the overflow outlet pipe.”*

GZA Response:

Section 4.2 of the March 2013 AMEC letter acknowledges that the North and South Equalization Basins were determined to not be CCW impoundments (and were therefore not rated by AMEC). As such, we believe that these equalization basins should not be subject to the freeboard guidelines as stated in Chapter 8, Section 9 of the MSHA Coal Mine Impoundment Inspection and Plan Review Handbook. However, if these equalization basins are required to comply with the stated freeboard guidelines, an additional freeboard (minimum 3 feet high) may be attained atop designated lengths of the existing perimeter berms of the Equalization Basins, as shown on attached Figure 9. Adding freeboard atop

these berm intervals would prevent overflow to the Niagara River and direct the flow to the South Settling Pond. A cross-section view of this potential addition is shown on attached Figure 9.

## CONCLUSIONS

### SOUTH PONDS



#### *South Settling Pond*

Our current geotechnical investigations and laboratory testing results generally confirm our previous estimates of soil strength parameters. It is our opinion, therefore, that the South Settling Pond should have a National Dam Safety Review Board (NDSRB) condition assessment of “Satisfactory”<sup>1</sup> in that no existing or potential embankment safety deficiencies are recognized for all loading conditions.

In the highly unlikely event of a rare or extreme hydrologic and/or seismic event resulting in an embankment deficiency, the resultant risk of uncontrolled flow to the Niagara River could be quickly mitigated by the following procedures.

1. Shutting off the process water influent to the South Settling Pond.
2. Temporarily damming off the narrow section (about 60 feet wide) of the South Settling Pond immediately upstream of the outlet pipe using clay soils readily available in the area.
3. Establishing a temporary process water bypass system to decant the water to the Niagara River downstream of the temporary dam.
4. Repairing the embankment and restoring normal South Settling Pond operations.

We also believe that the South Settling Pond should have a “Low Hazard Potential” since an improbable failure or mis-operation of the impoundment results in no probable loss of human life and low economic and/or environmental losses. NRG would experience the economic loss of repairing the embankment deficiency; low environmental loss may be experienced for the short duration in shutting off the process water feeding the South Settling Pond and establishing a temporary dam and bypass system described above. Low environmental loss would also be attributed to the fact that NRG dredges the majority of coal combustion waste (CCW) sediment at the north-side inlet end of the South Settling Pond about 1,200 feet upstream of the pond outlet to the Niagara River. Transport of significant amounts of CCW sediment over that distance is unlikely to take place when NRG would immediately implement process inflow shut-off, temporary damming and bypass operations described above. The amount of CCW sediment formerly transported from NRG’s Unit 67 and Unit 68 bottom ash and economizer ash systems discharged from the Low Level Waste Water Pit to the South Settling Pond has been greatly reduced since economizer ash is currently removed dry and taken directly to the Huntley Landfill, and is

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<sup>1</sup> NDSRB Condition Assessment “Satisfactory” definition: No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines.

no longer being sluiced to the South Settlement Pond. Economizer Ash was only sent to the South Settlement pond for a short duration in 2009. This reduction in sediment transport into the South Settling Pond reduces the potential for sediment release to the Niagara River.



GZA recommends that periodic inspection and maintenance of the grouted rip rap and clay pipe drains be made on an annual basis. Areas of damaged grout between the rip rap should be filled and the clay pipes should periodically be cleared of accumulated river debris. Additionally, the existing corrugated metal drainage pipe located between the settling pond and the Niagara River should periodically be inspected and maintained free of accumulating debris to allow for proper pond drainage.

Another option for NRG to consider, if they determine it economically feasible, would be to implement a redundant outlet berm or containment system. An additional permanent containment structure (e.g., earthen berm, steel sheet pile coffer dam, etc.) with outlet flow structure could be constructed immediately upstream of the outlet pipe, across the narrow 60-foot wide section of the basin. The new outlet pipe could be equipped with a gate structure for immediate shut-off capability, if needed in the unlikely event of failure of the existing berm. Location of this new berm would not significantly impact the storage capacity of the South Settling Pond.

### *Equalization Basins*

AMEC stated in their March 2013 comment letter that the North and South Equalization Basins were determined to not be CCW impoundments and are, therefore, not rated. AMEC did state, however, that our estimated freeboard height of less than 1 foot for the ½-PMF flood condition is less than the minimum 3 feet minimum freeboard guideline as stated in Chapter 8, Section 9 of the MSHA Coal Mine Impoundment Inspection and Plan Review Handbook.

It is our opinion that since the Equalization Basins are not considered to be CCW impoundments, their minimum freeboard height should not be governed by the above-stated MSHA guidelines. However, if determined economically feasible by NRG, NRG may consider constructing additional berm height to the designated sections of the perimeter berms as shown and detailed on attached Figure 9, to attain a minimum freeboard height of 3 feet.

### **NORTH PONDS**

Based on NRG's planned closure of the North Ponds 1, 2 and 3 to be completed prior to the end of 2014, the consideration for a satisfactory rating will not be required once they are drained and backfilled. However, the current slope and subsurface conditions measured and evaluated for the existing embankments generally indicates that the embankments are stable. Surficial erosion, due to the potential undercutting of the slope by various methods (e.g., Niagara River Ice or wave action, animal burrows, construction activities, etc.) did not appear to be an issue based on our field investigations and observations. The rip rap /

stone veneers on the various embankments appear to be suitably drained and secured. It is our opinion, therefore, that the Northern Pond 2 and Pond 3 have a Satisfactory rating for the remaining time the Ponds are utilized by NRG for retaining water.

We appreciate the opportunity to have completed this work for NRG / Huntley Power LLC, We will contact you in a few days to discuss this report and address any questions or comments you may have.



Sincerely,

GZA GEOENVIRONMENTAL OF NEW YORK

A handwritten signature in blue ink that reads 'Daniel Troy'.

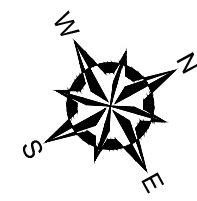
Daniel Troy, P.E.  
Senior Project Manager

A handwritten signature in blue ink that reads 'Bart A. Klettke'.

Bart Klettke, P.E.  
Principal

Attachments:      Figures 1 through 10  
                         Attachment 1 – Subsurface Boring Logs  
                         Attachment 2 – Laboratory Test Results  
                         Attachment 3 – Slope Stability Model Analyses  
                         HEC-HMS Models on CD (Provided to NRG under separate  
                         transmittal)


## **FIGURES**



NO.	ISSUE/DESCRIPTION	BY	DATE

**NRG OCTOBER 2014 RESPONSE TO EPA REPORT  
NRG HUNTLEY PLANT  
TONAWANDA, NEW YORK**

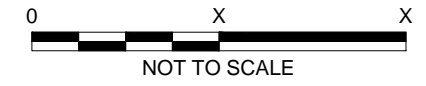
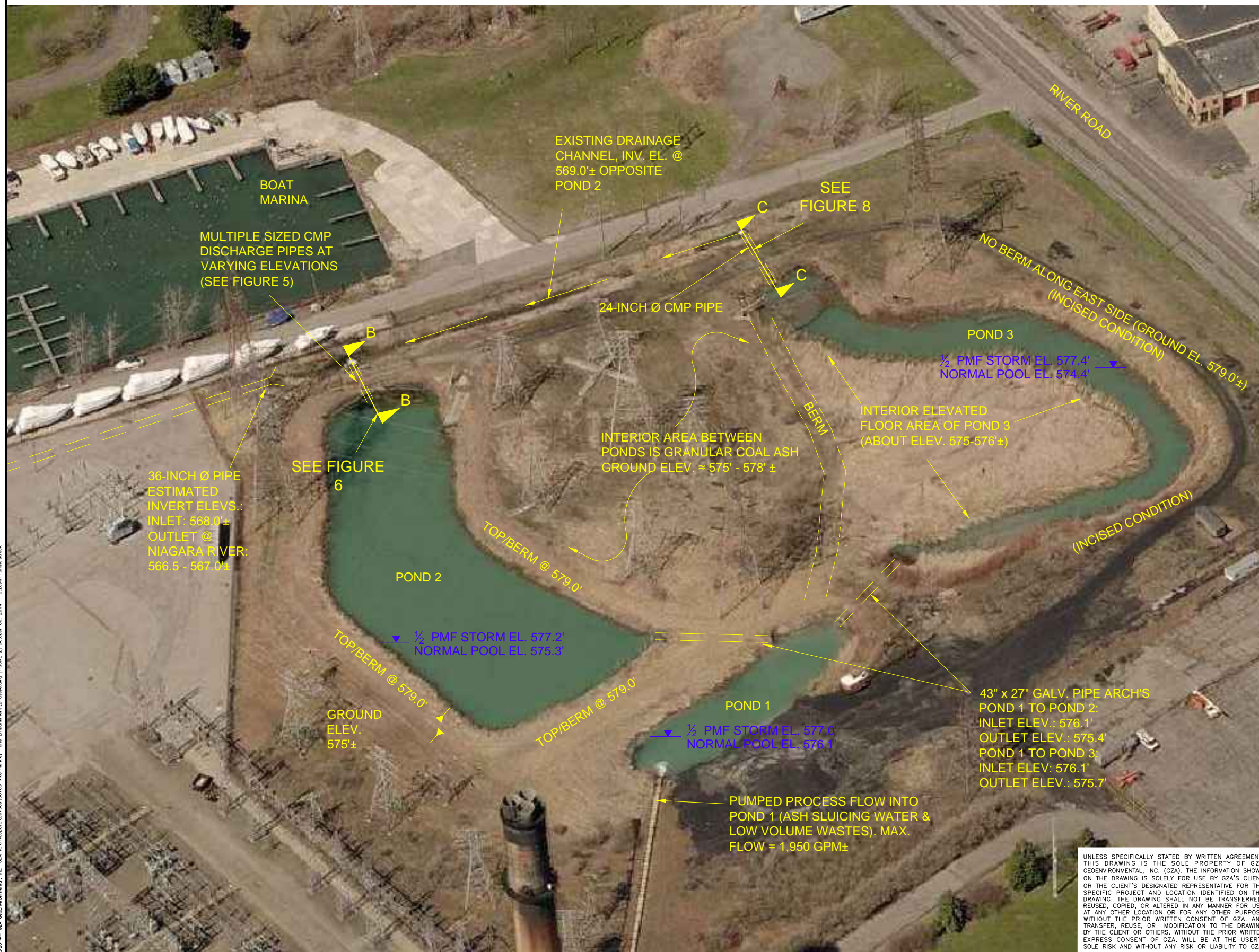
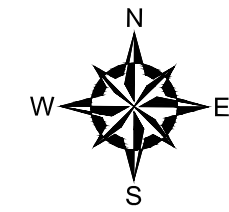
**SOUTH PONDS  
SITE PLAN**


PREPARED BY:  <b>GZA GeoEnvironmental Inc.</b> Engineers and Scientists 535 WASHINGTON STREET 11th FLOOR BUFFALO, NEW YORK 14203 (716) 685-2300	PREPARED FOR: <b>NRG HUNTLEY POWER, LLC</b> 3500 RIVER ROAD TONAWANDA, NEW YORK
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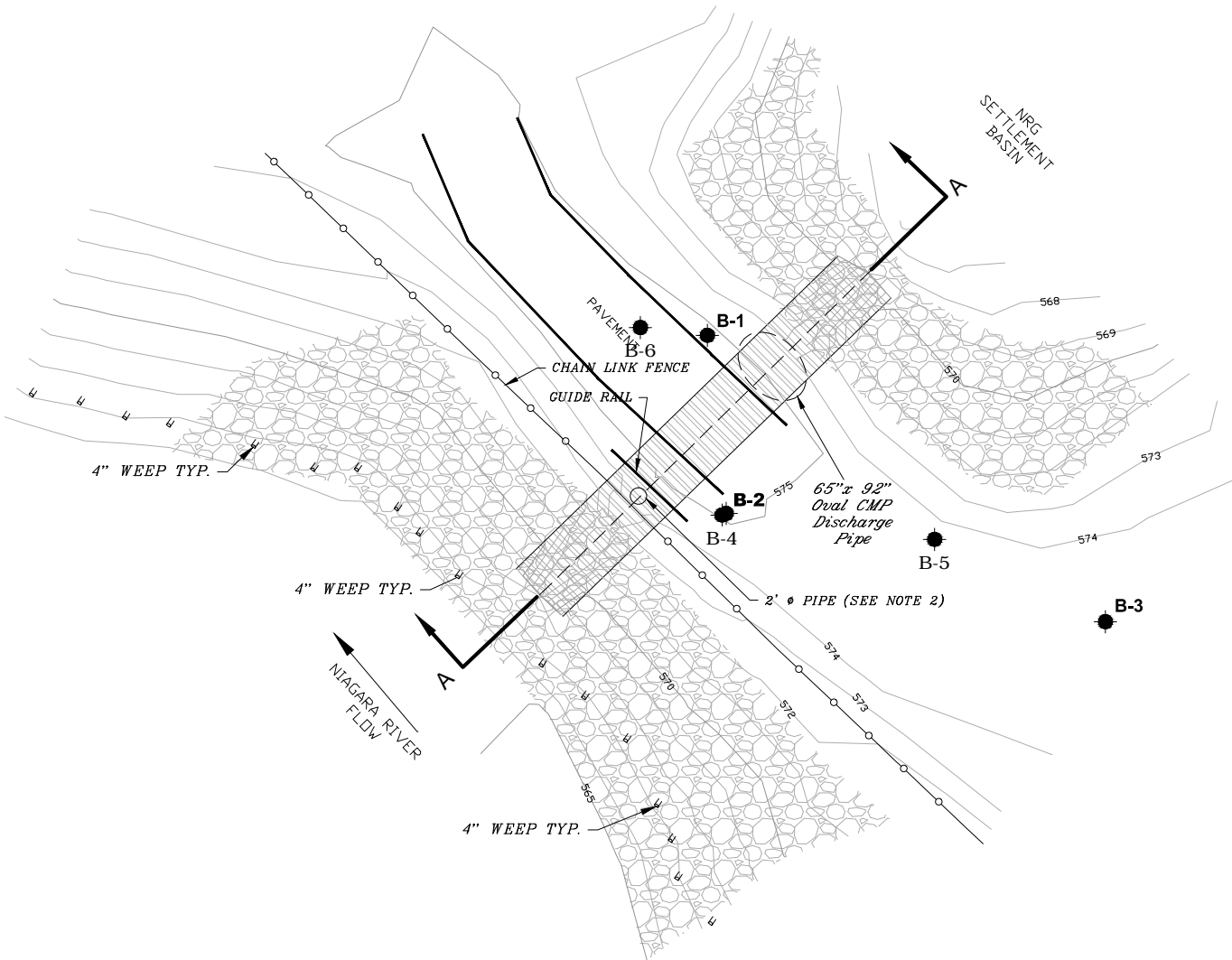
PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE <b>1</b>
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	
DATE OCTOBER 2014	PROJECT NO. 21.0056705.00	REVISION NO.	1 OF 10

© 2014 - GZA GeoEnvironmental, Inc. GZA-\\G:\PROJECTS\2014\2014-10-06-3113pm\_monistat.mxd [FIGURE 1] October 06, 2014 - 3:13pm monistat.mxd



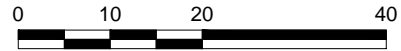
NO.	ISSUE/DESCRIPTION	BY	DATE
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<b>NORTH PONDS 1-3 SITE PLAN</b>			
PREPARED BY:  <b>GZA GeoEnvironmental Inc.</b> Engineers and Scientists 535 WASHINGTON STREET 11th FLOOR BUFFALO, NEW YORK 14203 (716) 685-2300		PREPARED FOR: <b>NRG HUNTLEY POWER, LLC</b> 3500 RIVER ROAD TONAWANDA, NEW YORK	
PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	<b>2</b>
DATE: OCTOBER 2014	PROJECT NO.: 21.0056705.00	REVISION NO.:	

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**NOTES:**

1. BASE TOPOGRAPHY MAP PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, MAY 2009.
2. LOCATIONS OF B-4, B-5, AND B-6 MADE USING 100' MEASURING TAPE FROM 6 OF 2' Ø PIPE IN CENTER OF DISCHARGE PIPE



SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

PREPARED BY:  
 **GZA GeoEnvironmental of N.Y.**  
 Engineers and Scientists  
 535 WASHINGTON STREET 11th FLOOR  
 BUFFALO, NEW YORK 14203  
 (716) 685-2300

**SOUTH SETTLING POND BORING LOCATION PLAN**

PROJ MGR: DJT    REVIEWED BY: BAK  
 DESIGNED BY: DJT    DRAWN BY: RJS

**NRG OCTOBER 2014 RESPONSE TO EPA REPORT**  
**NRG HUNTLEY PLANT**  
**TONAWANDA, NEW YORK**

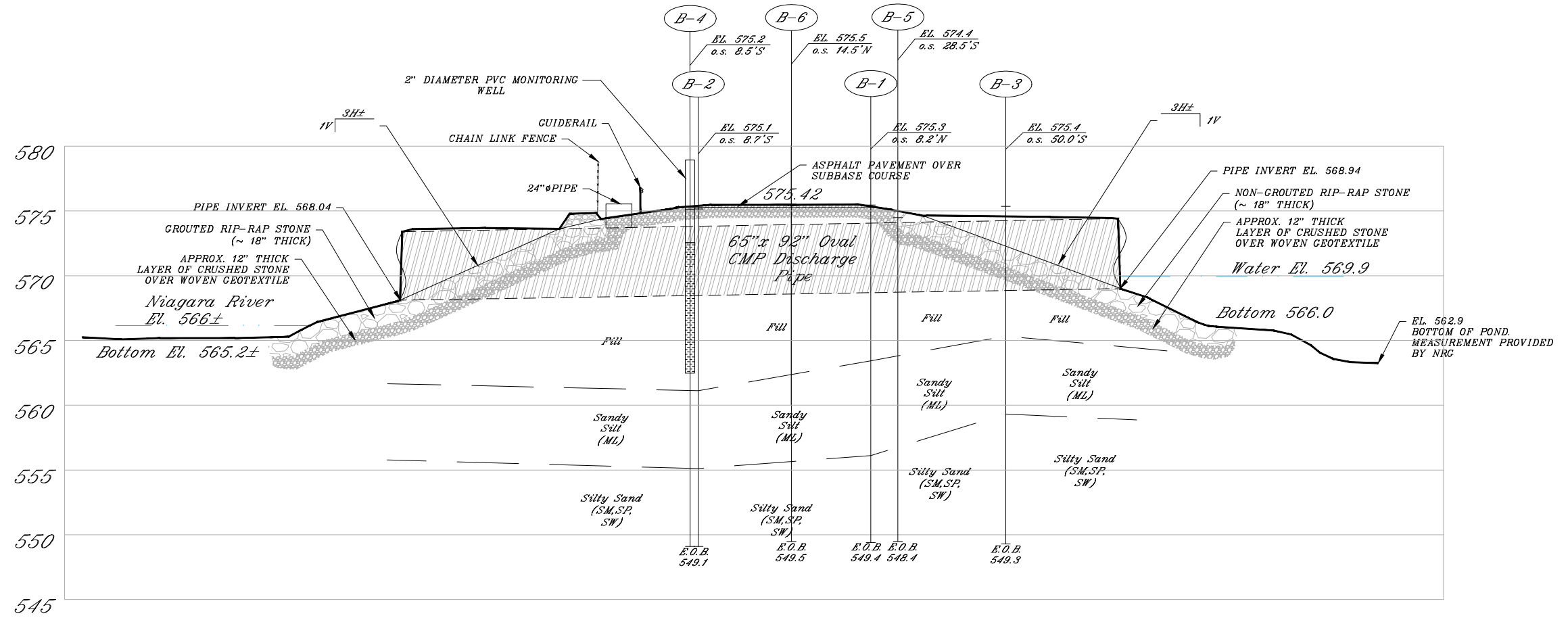
PREPARED FOR:  
**NRG HUNTLEY POWER, LLC**  
 3500 RIVER ROAD  
 TONAWANDA, NEW YORK

CHECKED BY: DJT    DATE: OCTOBER 2014  
 SCALE: 1" = 20'

PROJECT NO. 21.0056705.00    REVISION NO.

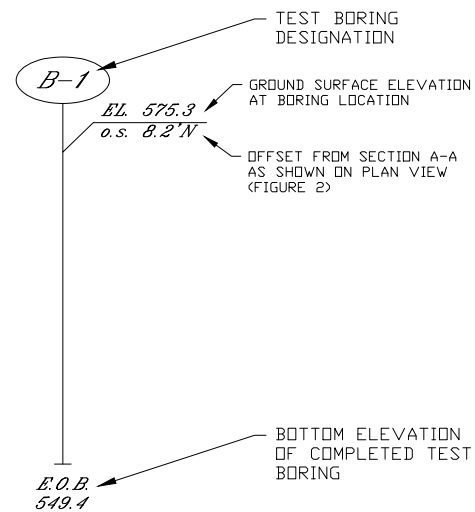
FIGURE  
**3**  
 3 OF 10

©2014 - GZA GeoEnvironmental, Inc. GZA-K:\PROJECTS\56700s\56705 NRG Huntley Pond Embankment\Cross Section 2&3.dwg [FIGURE 4] October 06, 2014 - 3:31pm ronald.strack



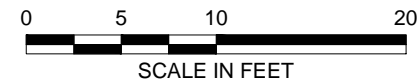
Cross Section A-A  
through Access Road

LEGEND:



NOTES:

1. BASE TOPOGRAPHY MAP AND ELEVATIONS SHOWN PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, UNLESS OTHERWISE SPECIFIED.
2. WATER LEVEL MEASUREMENTS MADE INSIDE AUGERS AT BORING COMPLETION.
3. SEE BORING LOGS FOR ADDITIONAL SUBSURFACE SOIL DESCRIPTIONS.
4. BORINGS B-1 THROUGH B-3 COMPLETED IN APRIL 2009. BORINGS B-4 THROUGH B-6 COMPLETED IN AUGUST 2014.
5. LOCATIONS AND ELEVATIONS OF B-4 THROUGH B-6 WERE MADE USING 100' TAPE MEASUREMENTS AND TYPICAL ROD AND LEVEL MEASUREMENTS FROM SPECIFIC LOCATIONS PREVIOUSLY MEASURED DURING 2009 TOPOGRAPHIC SURVEY



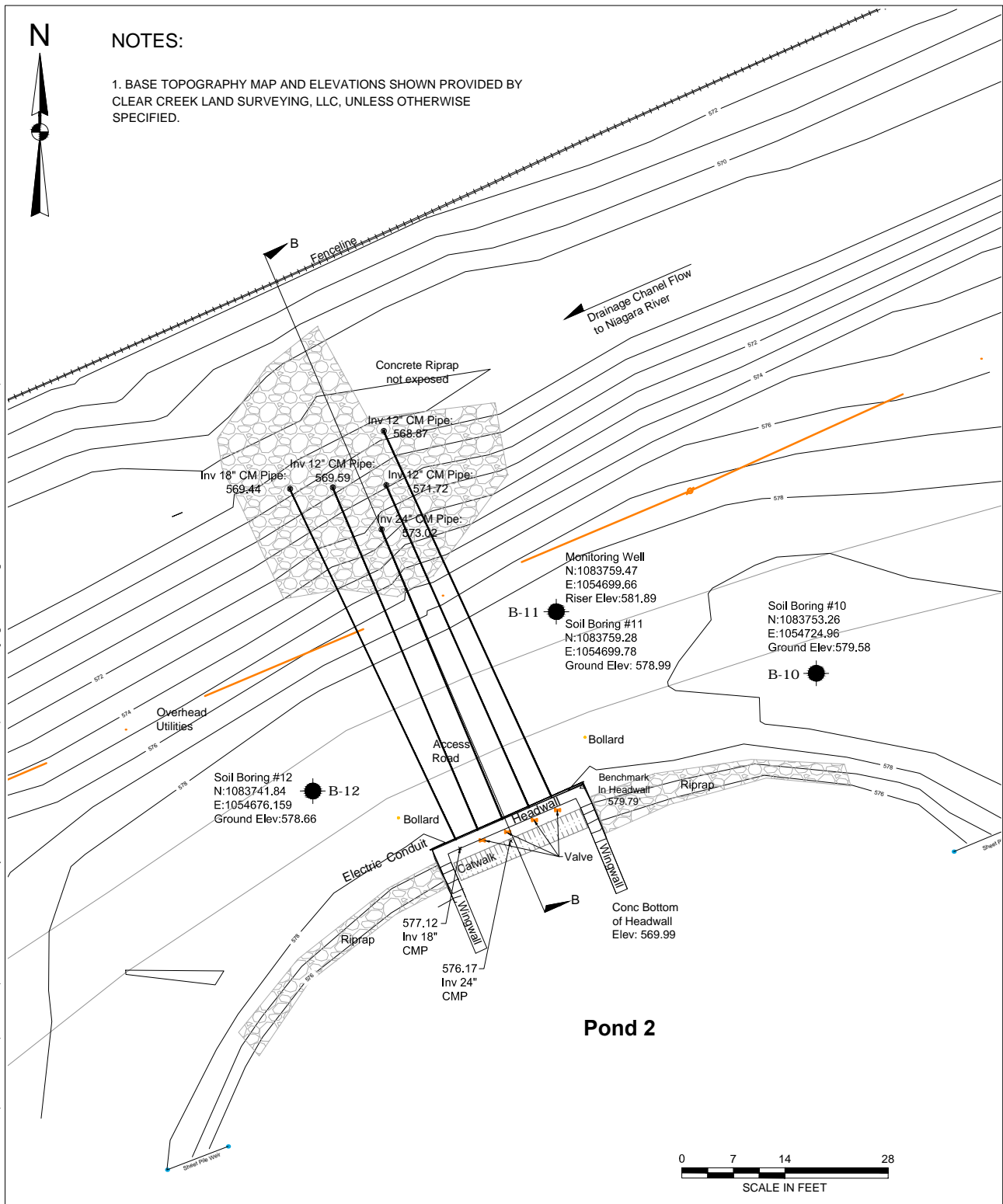
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<b>NRG OCTOBER 2014 RESPONSE TO EPA REPORT NRG HUNTLEY PLANT TONAWANDA, NEW YORK</b>			
<b>SOUTH SETTLING POND CROSS SECTION</b>			
PREPARED BY: <b>GZA</b> GeoEnvironmental of N.Y. Engineers and Scientists www.gza.com		PREPARED FOR: NRG HUNTLEY POWER, LLC 3500 RIVER ROAD TONAWANDA, NEW YORK	
PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	<b>FIGURE 4</b>
DESIGNED BY: RJS	DRAWN BY: RJS	SCALE: 1" = 10'	
DATE: OCTOBER 2014	PROJECT NO: 21.0056705.00	REVISION NO.	
			SHEET NO. 4 OF 10



**NOTES:**

1. BASE TOPOGRAPHY MAP AND ELEVATIONS SHOWN PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, UNLESS OTHERWISE SPECIFIED.

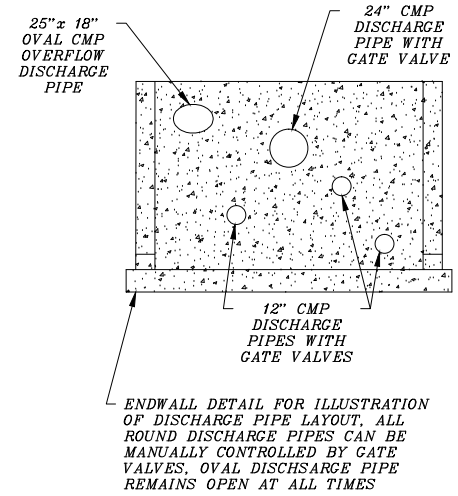
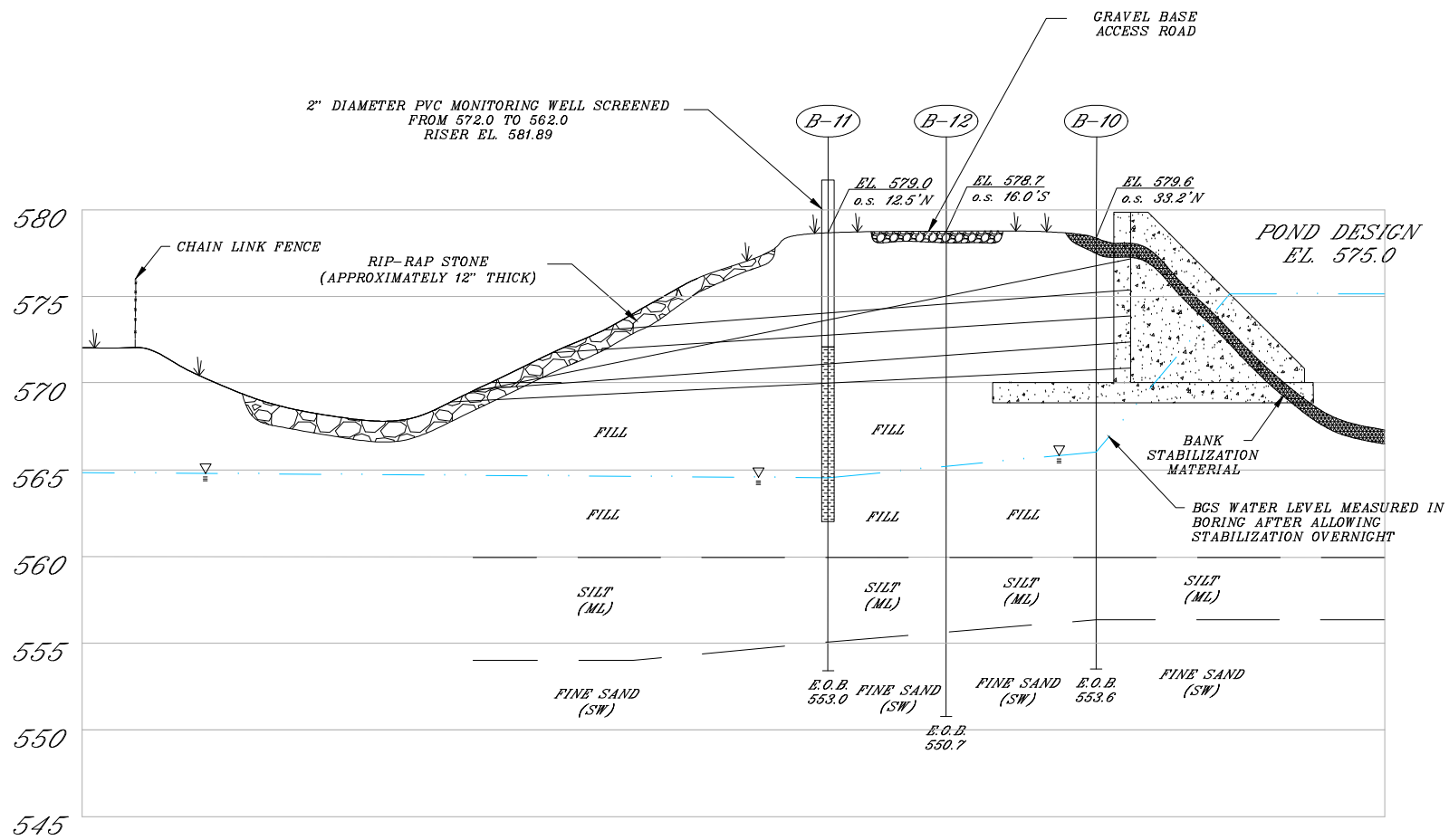
© 2014 - GZA GeoEnvironmental, Inc. GZA-K:\PROJECTS\56700s\56705 NRG Huntley Pond Embankment\FIG 5&7.dwg [FIGURE 5] October 06, 2014 - 3:29pm ronald.strack



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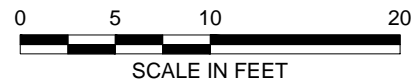
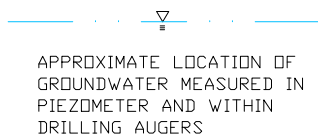
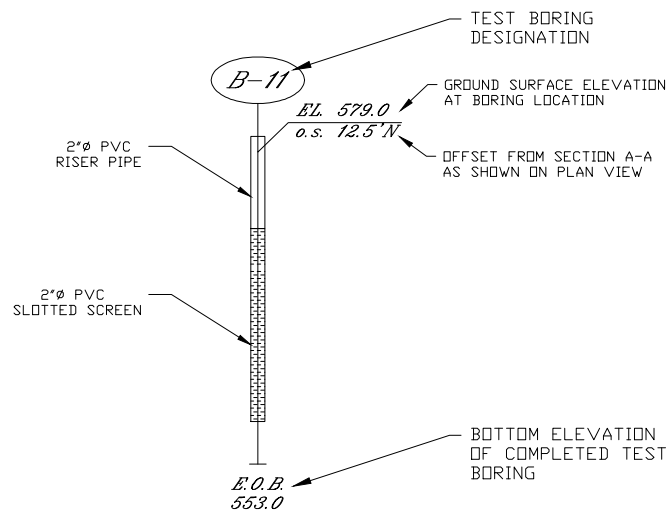
<p align="center"><b>NRG OCTOBER 2014 RESPONSE TO EPA REPORT NRG HUNTLEY PLANT TONAWANDA, NEW YORK</b></p>		<p>PREPARED BY: <b>GZA</b> GeoEnvironmental of N.Y. Engineers and Scientists www.gza.com</p>		<p>PREPARED FOR: NRG HUNTLEY POWER, LLC 3500 RIVER ROAD TONAWANDA, NEW YORK</p>	
		<p>PROJ MGR: DJT DESIGNED BY: DJT DATE: OCTOBER 2014</p>	<p>REVIEWED BY: BAK DRAWN BY: RJS PROJECT NO. 21.0056705.00</p>	<p>CHECKED BY: DJT SCALE: 1" = 14' REVISION NO.</p>	<p align="center"><b>FIGURE 5</b></p> <p align="right">SHEET NO. 5 OF 10</p>

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Cross Section B-B through Access Road

LEGEND:



NOTES:

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2. WATER LEVEL MEASUREMENTS MADE INSIDE AUGERS AT BORING COMPLETION WITH EXCEPTION OF B-11 WHICH WAS EQUIPPED WITH A PVC PIEZOMETER
3. SEE BORING LOGS FOR ADDITIONAL SUBSURFACE SOIL DESCRIPTIONS.

NO.	ISSUE/DESCRIPTION	BY	DATE

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NRG OCTOBER 2014 RESPONSE TO EPA REPORT  
NRG HUNTLEY PLANT  
TONAWANDA, NEW YORK

NORTH POND 2  
CROSS SECTION B-B

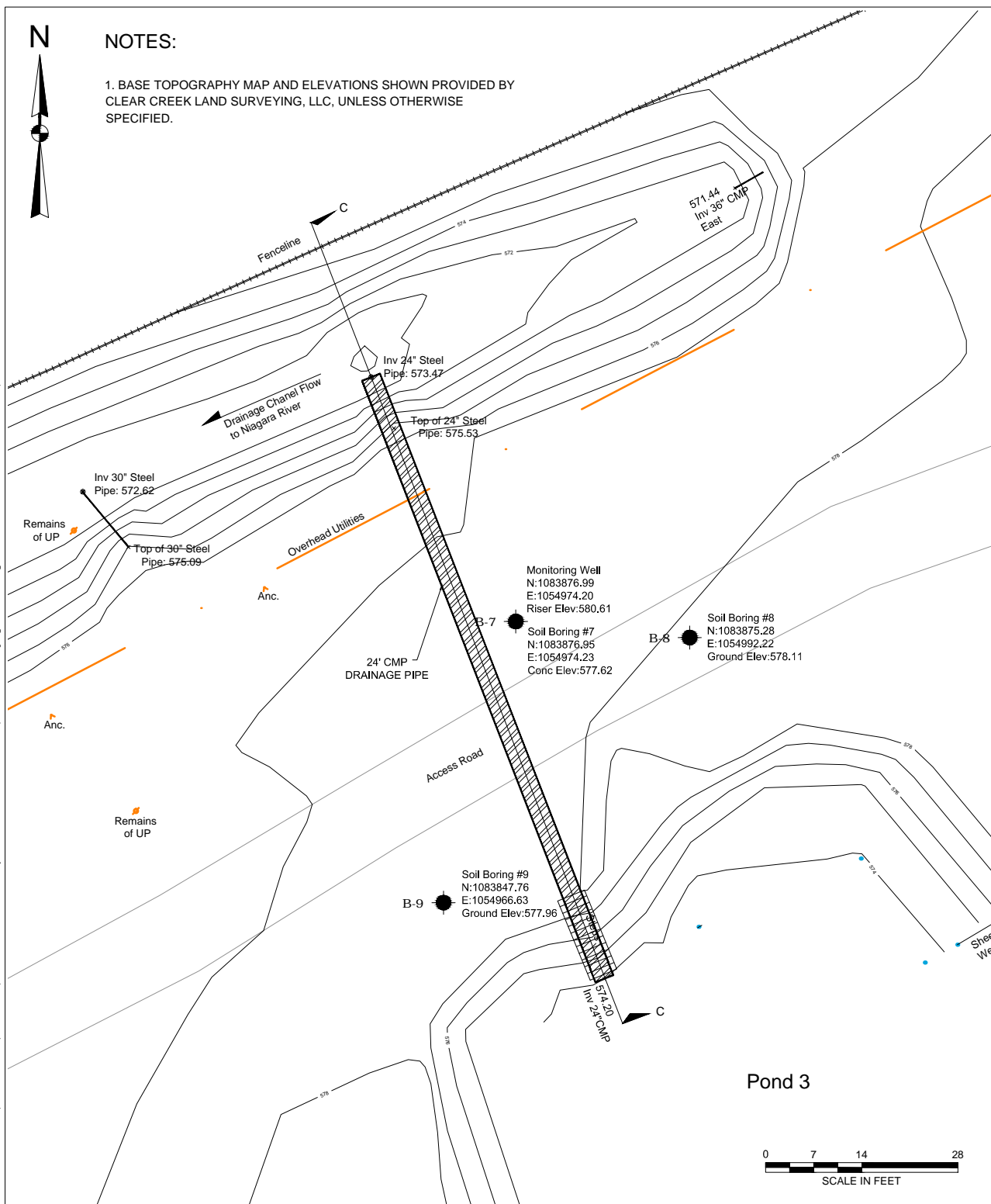
DESIGNED BY: RJS	DRAWN BY: RJS	DATE: OCTOBER 2014	PROJECT NO. 21.0056705.00	REVISION NO.	PREPARED BY: GZA GeoEnvironmental of N.Y. Engineers and Scientists www.gza.com	PREPARED FOR: NRG HUNTLEY POWER, LLC 3500 RIVER ROAD TONAWANDA, NEW YORK	FIGURE 6
PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	SCALE: 1" = 10'				SHEET NO. 6 OF 10



**NOTES:**

1. BASE TOPOGRAPHY MAP AND ELEVATIONS SHOWN PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, UNLESS OTHERWISE SPECIFIED.

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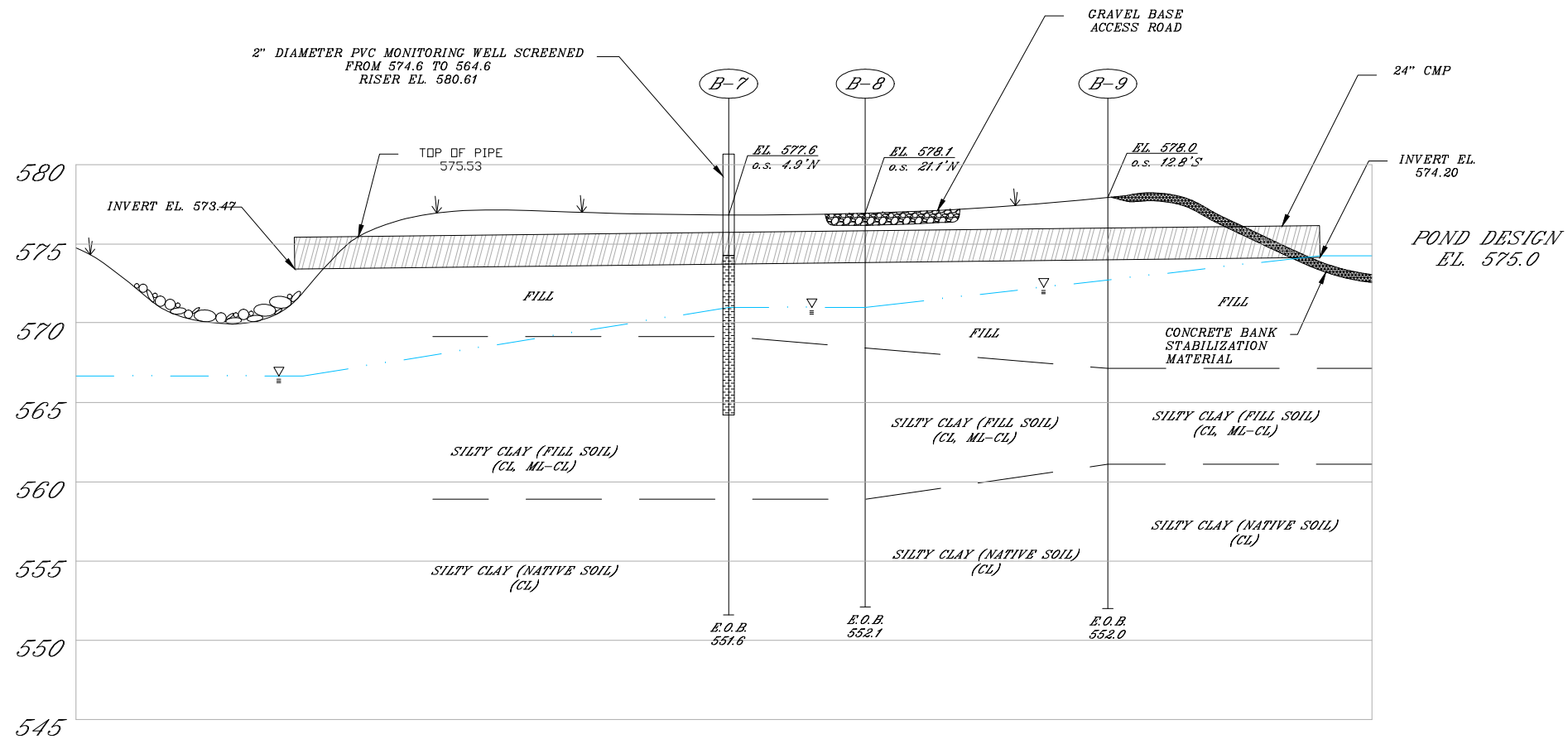
**NRG OCTOBER 2014 RESPONSE TO EPA REPORT  
NRG HUNTLEY PLANT  
TONAWANDA, NEW YORK**

**NORTH POND 3  
BORING LOCATION PLAN**

NO.	ISSUE/DESCRIPTION	BY	DATE

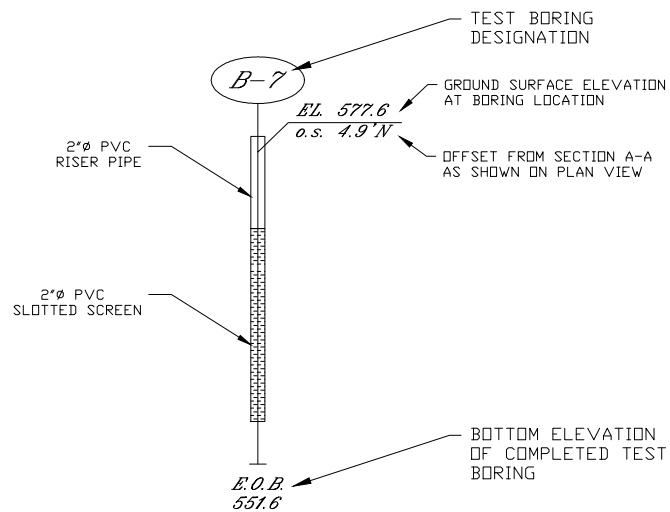
PREPARED BY: GZA GeoEnvironmental of N.Y. Engineers and Scientists www.gza.com	PREPARED FOR: NRG HUNTLEY POWER, LLC 3500 RIVER ROAD TONAWANDA, NEW YORK
PROJ MGR: DJT DESIGNED BY: DJT DATE: OCTOBER 2014	REVIEWED BY: BAK DRAWN BY: RJS PROJECT NO. 21.0056705.00
CHECKED BY: DJT SCALE: 1" = 14' REVISION NO.	<b>FIGURE</b> <b>7</b> SHEET NO. 7 OF 10

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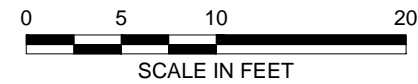


Cross Section C-C through Access Road

LEGEND:



APPROXIMATE LOCATION OF GROUNDWATER MEASURED IN PIEZOMETER AND WITHIN DRILLING AUGERS



NOTES:

1. BASE TOPOGRAPHY MAP AND ELEVATIONS SHOWN PROVIDED BY CLEAR CREEK LAND SURVEYING, LLC, UNLESS OTHERWISE SPECIFIED.
2. WATER LEVEL MEASUREMENTS MADE INSIDE AUGERS AT BORING COMPLETION WITH EXCEPTION OF B-7 WHICH WAS EQUIPPED WITH A PVC PIEZOMETER.
3. SEE BORING LOGS FOR ADDITIONAL SUBSURFACE SOIL DESCRIPTIONS.

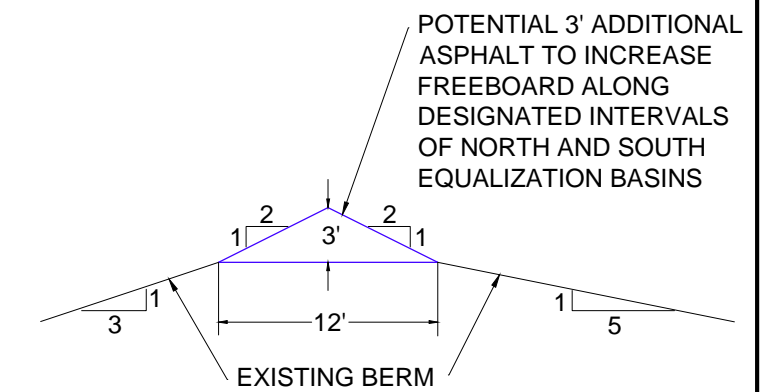
NO.	ISSUE/DESCRIPTION	BY	DATE
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<b>NRG OCTOBER 2014 RESPONSE TO EPA REPORT NRG HUNTLET PLANT TONAWANDA, NEW YORK</b>			
<b>NORTH POND 3 CROSS SECTION</b>			
PREPARED BY: <b>GZA</b> GeoEnvironmental of N.Y. Engineers and Scientists www.gza.com		PREPARED FOR: NRG HUNTLEY POWER, LLC 3500 RIVER ROAD TONAWANDA, NEW YORK	
PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	<b>FIGURE 8</b> SHEET NO. 8 OF 10
DESIGNED BY: RJS	DRAWN BY: RJS	SCALE: 1" = 10'	
DATE: OCTOBER 2014	PROJECT NO. 21.0056705.00	REVISION NO.	



PROCESS INFLOW PIPES  
MAXIMUM INFLOW: 6,800 GPM

EQUALIZATION BASINS  
CONTROL STRUCTURE WITH  
12-INCH Ø STEEL PIPE  
OVERFLOW OUTLET TO SOUTH  
ASH SETTLING BASIN, INV. ELEV.  
@ 579.3'. MAXIMUM PUMPED  
FLOW INTO BASINS = 500 GPM +  
STORM CONTRIBUTION WITHIN  
CENTERLINES OF BERMS

SECTION A-A



NORTH EQUALIZATION  
BASIN (#1):  
BOTTOM AREA: 30,320 SQ. FT.  
BOTTOM ELEV.: 571.8'  
TOP AREA (STORMWATER  
CONTRIBUTORY AREA): 65,000  
SQ. FT.  
TOP OF BERM ELEV.: 580.3'

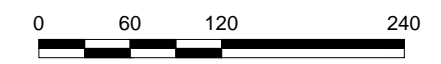
SOUTH ASH SETTLING BASIN  
ESTIMATED BOTTOM ELEV.: 563'±  
ESTIMATED BOTTOM AREA: 114,000 SQ. FT.  
ESTIMATED TOP ELEV.: 575'  
ESTIMATED TOP AREA: 200,000 SQ. FT.  
ESTIMATED CONTRIBUTORY WATERSHED  
AREA (RED BOUNDARY) = 343,700 SQ. FT.

SOUTH EQUALIZATION  
BASIN (#2):  
BOTTOM AREA: 36,800 SQ. FT.  
BOTTOM ELEV. 572.3'  
TOP AREA (STORMWATER  
CONTRIBUTORY AREA):  
67,400 SQ. FT.  
TOP OF BERM ELEV. 580.3

EXISTING BERM INTERVAL  
TO POTENTIALLY INCREASE  
BERM HEIGHT BY 3 FEET  
(SEE DETAIL THIS SHEET)

NIAGARA RIVER  
FLOW

92" x 65" STEEL PIPE ARCH  
LENGTH: 55±  
INVERT ELEV.:  
INLET: 568.94'  
OUTLET @ NIAGARA RIVER: 568.04'  
RIVER ELEV. @ 566'± (MEASURED  
APRIL 2009)  
TOP OF BERM ELEV. OVER PIPE: 575.4'



NO.	ISSUE/DESCRIPTION	BY	DATE

NRG OCTOBER 2014 RESPONSE TO EPA REPORT  
NRG HUNTLEY PLANT  
TONAWANDA, NEW YORK

SOUTH PONDS DRAINAGE AREA AND BASINS  
PROPOSED EQUALIZATION BASIN BERM HEIGHT INCREASE

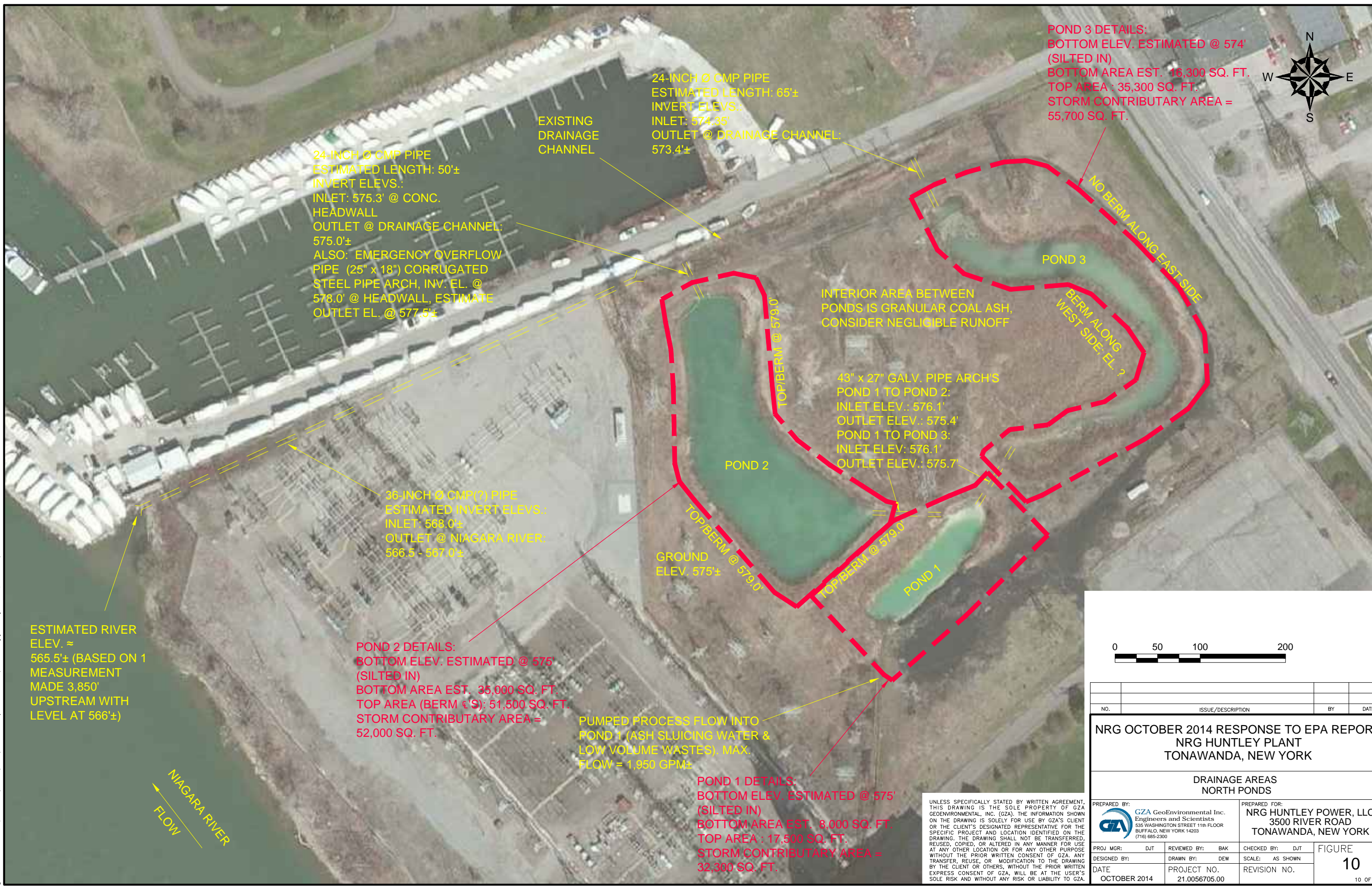
PREPARED BY:  
**GZA** GeoEnvironmental Inc.  
Engineers and Scientists  
635 WASHINGTON STREET 11th FLOOR  
BUFFALO, NEW YORK 14203  
(716) 685-2300

PREPARED FOR:  
**NRG HUNTLEY POWER, LLC**  
3500 RIVER ROAD  
TONAWANDA, NEW YORK

PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE <b>9</b>
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	
DATE OCTOBER 2014	PROJECT NO. 21.0056705.00	REVISION NO.	9 OF 10

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©2014 - GZA GeoEnvironmental, Inc. GZA-45\PROJECTS\36700\36700\_NRG\_Huntley\_Pond\_Embankment\Fig 8 at 10.dwg [PLOT] October 06, 2014 - 4:05pm modelatwork



24-INCH Ø CMP PIPE  
ESTIMATED LENGTH: 50'±  
INVERT ELEV.:  
INLET: 575.3' @ CONC.  
HEADWALL  
OUTLET @ DRAINAGE CHANNEL:  
575.0'±  
ALSO: EMERGENCY OVERFLOW  
PIPE (25" x 18") CORRUGATED  
STEEL PIPE ARCH, INV. EL. @  
578.0' @ HEADWALL, ESTIMATE  
OUTLET EL. @ 577.5'±

24-INCH Ø CMP PIPE  
ESTIMATED LENGTH: 65'±  
INVERT ELEV.:  
INLET: 574.35'  
OUTLET @ DRAINAGE CHANNEL:  
573.4'±

POND 3 DETAILS:  
BOTTOM ELEV. ESTIMATED @ 574'  
(SILTED IN)  
BOTTOM AREA EST. 16,300 SQ. FT.  
TOP AREA : 35,300 SQ. FT.  
STORM CONTRIBUTORY AREA =  
55,700 SQ. FT.

INTERIOR AREA BETWEEN  
PONDS IS GRANULAR COAL ASH,  
CONSIDER NEGLIGIBLE RUNOFF

43" x 27" GALV. PIPE ARCH'S  
POND 1 TO POND 2:  
INLET ELEV.: 576.1'  
OUTLET ELEV.: 575.4'  
POND 1 TO POND 3:  
INLET ELEV.: 576.1'  
OUTLET ELEV.: 575.7'

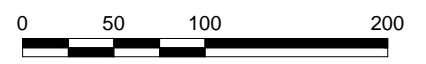
36-INCH Ø CMP(?) PIPE  
ESTIMATED INVERT ELEV.:  
INLET: 568.0'±  
OUTLET @ NIAGARA RIVER:  
566.5 - 567.0'±

ESTIMATED RIVER  
ELEV. ≈  
565.5'± (BASED ON 1  
MEASUREMENT  
MADE 3,850'  
UPSTREAM WITH  
LEVEL AT 566'±)

POND 2 DETAILS:  
BOTTOM ELEV. ESTIMATED @ 575'  
(SILTED IN)  
BOTTOM AREA EST. 35,000 SQ. FT.  
TOP AREA (BERM @ 579'): 51,500 SQ. FT.  
STORM CONTRIBUTORY AREA =  
52,000 SQ. FT.

PUMPED PROCESS FLOW INTO  
POND 1 (ASH SLUICING WATER &  
LOW VOLUME WASTES). MAX.  
FLOW = 1,950 GPM±

POND 1 DETAILS:  
BOTTOM ELEV. ESTIMATED @ 575'  
(SILTED IN)  
BOTTOM AREA EST. 8,000 SQ. FT.  
TOP AREA : 17,500 SQ. FT.  
STORM CONTRIBUTORY AREA =  
32,300 SQ. FT.



NO.	ISSUE/DESCRIPTION	BY	DATE

NRG OCTOBER 2014 RESPONSE TO EPA REPORT  
NRG HUNTLEY PLANT  
TONAWANDA, NEW YORK

DRAINAGE AREAS  
NORTH PONDS

PREPARED BY:  
**GZA** GeoEnvironmental Inc.  
Engineers and Scientists  
535 WASHINGTON STREET 11th FLOOR  
BUFFALO, NEW YORK 14203  
(716) 685-2300

PREPARED FOR:  
NRG HUNTLEY POWER, LLC  
3500 RIVER ROAD  
TONAWANDA, NEW YORK

PROJ MGR: DJT	REVIEWED BY: BAK	CHECKED BY: DJT	FIGURE <b>10</b>
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	
DATE OCTOBER 2014	PROJECT NO. 21.0056705.00	REVISION NO.	10 OF 10

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**ATTACHMENT 1**  
**SUBSURFACE SOIL BORINGS**



DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES	
	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)			
21	5	S-10	20-22	9	15	Grades to:...loose, trace roots		
	4							
	5							
22	5							
23	8	S-11	22-24	11	15	Medium dense, grey f/c SAND and rounded Gravel, trace Silt, wet		
	5							
	6							
24	8							
25	9	S-12	24-26	10	20	Grades to:...f/m SAND		
	6							
	4							
26	4					End of boring at 26' bgs		
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
S - Split Spoon Sample ST - Shelby Tube				NOTES:				
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.								



CONTRACTOR	Earth Dimensions Inc.	BORING LOCATION	NRG Huntley Plant South Settling Pond Outlet	
DRILLER	Phil Bence / Harold (Helper)	GROUND SURFACE ELEVATION	574.4	DATUM NA
START DATE	6/24/2014	END DATE	06/24/14	GZA GEOENVIRONMENTAL REPRESENTATIVE Daniel Troy

WATER LEVEL DATA					TYPE OF DRILL RIG	CME 550 ATV Rig
DATE	TIME	WATER	CASING	NOTES	CASING SIZE AND DIAMETER	4-1/4 casing (using drilling mud)
					OVERBURDEN SAMPLING METHOD	ASTM 1586
					ROCK DRILLING METHOD	N/A

DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES
	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)		
1	5	S-1	0-2	11	50	Dk brown Silt and f/c Sand, little Gravel, little organics, moist	Driller indicating losing water / mud slurry into open borehole. Additional casing placed to 9 ft bgs.
	4						
2	7					Grades to:... black SILT, some f/c Sand, little Gravel, trace brick, wood, glass, slag frags, moist (FILL)	
	10						
3	15	S-2	2-4	15	60	Grades to:...loose	
	9						
4	6					Grades to:...dark grey f SAND, little Silt, trace wood frags, wet (FILL)	
	6						
5	6	S-3	4-6	8	25	Grades to:...medium dense, f/m SAND, trace Gravel, trace Silt, trace metal frag, slag, wet	
	5						
6	3					(no sample recovery due to 1-1/2" size Gravel stuck in spoon shoe)	
	6						
7	8	S-4	6-8	29	50	Medium dense, dark grey f/c SAND, some Gravel, little Silt, trace slag, wood frag, wet (FILL)	
	15						
8	14					Grades to:... black f SAND, little Silt, wet	
	11						
9	2	S-5	8-10	6	1	Loose, grey SILT, some f. Sand, trace Gravel, trace Organics, wet	
	2						
10	4					Grey fine SAND, trace Silt, wet	
	3						
11	9	S-6	10-12	20	35	Grades to:...and Gravel, wet	
	15						
12	5					Grey SILT and fine Sand, trace Gravel, wet	
	2						
13	2	S-7	12-14	5	30	Loose, grey SILT and fine SAND, trace Clay, trace Gravel, wet.	
	2						
14	3					Thin lenses of fine Sand observed	
	4						
15		ST-3	14-16	-		Loose, grey f. SAND, little Silt, trace rounded Gravel, wet	
16							
17	2	S-8	16-18	3	25		
	1						
18	2						
	4						
19	1	S-9	18-20	8	45		
	3						
20	5						
	7						

S - Split Spoon Sample	NOTES:
ST - Shelby Tube	

General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.  
Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES	
	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)			
21	6	S-10	20-22	29	55	Medium dense, grey, f/c SAND, little rounded Gravel, trace Silt, trace wood frags		
	13							
	16							
22	19					End of Boring at 22 ft bgs		
23						Could not advance spilt spoon samplers past 22 ft bgs due to continuous collapsing borehole. Mud slurry not able to keep borehole open.		
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
S - Split Spoon Sample ST - Shelby Tube				NOTES:				
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.								



CONTRACTOR		Earth Dimensions Inc.		BORING LOCATION		NRG Huntley Plant South Settling Pond Outlet	
DRILLER		Phil Bence / Harold (Helper)		GROUND SURFACE ELEVATION		575.0 DATUM NA	
START DATE		6/24/2014		END DATE		06/24/14 GZA GEOENVIRONMENTAL REPRESENTATIVE Daniel Troy	
WATER LEVEL DATA					TYPE OF DRILL RIG		
					CME 550 ATV Rig		
DATE					CASING SIZE AND DIAMETER		
06/24/14					4-1/4 casing (using drilling mud)		
TIME					OVERBURDEN SAMPLING METHOD		
PM					ASTM 1586		
WATER					ROCK DRILLING METHOD		
567.1					N/A		
CASING							
Augers							
NOTES							
D E P T H	SAMPLE					SAMPLE DESCRIPTION	NOTES
	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)		
1	-	S-1	0-2	25	35	2" asphalt pavement over approx 4" Gravel Subbase	Drilling water/mud slurry being lost in borehole formation  Attempted to collect Shelby tube although no recovery. Driller collected split spoon sample.  Soil sample collected from Shelby Tube
	6					Medium dense, light brown f/c SAND, some Gravel trace Silt, trace brick, slag, moist (FILL)	
2	19						
	20						
3	25	S-2	2-4	55	75	Grades to:...very dense GRAVEL, some f/c Sand	
	32						
4	23						
	15					Grades to:...dark brown SILT and f/m Sand, trace Gravel, trace brick, slag, metal, moist (FILL)	
5	13	S-3	4-6	108	30	Grades to:... f/c SAND and Gravel, little Silt, trace brick, slag, wet (FILL)	
	47						
6	61						
	15						
7	9	S-4	6-8	10	10	Grades to:...medium dense, black f SAND, trace Gravel, trace slag, wet (FILL)	
	6						
8	4						
	9					Grades to:... f/c SAND and Gravel, wet (FILL)	
9	9	S-5	8-10	24	30	Grades to:... Intermixed reddish brown Silty Clay chunks	
	12						
10	12						
	5						
11	3	S-6	10-12	6	25	Loose, grey f SAND, some Silt, trace Organics, trace rounded Gravel, wet	
	2						
12	4					Grades to:...fine SAND and Silt	
	4						
13	2	S-7	12-14	5	25		
	3						
14	2						
	3						
15	2	S-8	14-16	4	10	Grades to:...some Silt, trace Gravel, trace organics	
	2						
16	2						
	1						
17	2	S-9	16-18	3	20	Grades to:...very loose, grey f SAND and SILT	
	1						
18	2						
	4						
19		ST-4	18-20			Grades to:...trace Silt	
20						Grades to:...fine SAND and Silt	
S - Split Spoon Sample		NOTES:					
ST - Shelby Tube							
General		1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.					
Notes:		2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.					

DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES
	BLOWS (6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)		
21	3	S-10	20-22	18	25	Medium dense, grey f SAND, trace Gravel, trace wood roots, wet Grades to:...little Gravel Grades to:...some Gravel Grades to:...f/c SAND, little rounded Gravel, trace Silt, wet  Grades to:...dense	
	6						
	12						
22	12						
	8	S-11	22-24	19	20		
23	9						
	10						
24	13						
	8	S-12	24-26	31	25		
25	15						
	16						
26	18						
27						End of boring 26' bgs	
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
S - Split Spoon Sample ST - Shelby Tube				NOTES:			
General							1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.
Notes:							2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.



CONTRACTOR		Earth Dimensions, Inc.		BORING LOCATION		NRG Huntley Plant North Pond #3			
DRILLER		Phil Bence / Harold (Helper)		GROUND SURFACE ELEVATION		577.6 DATUM NA			
START DATE		6/25/2014		END DATE		06/26/14 GZA GEOENVIRONMENTAL REPRESENTATIVE Daniel Troy			
WATER LEVEL DATA					TYPE OF DRILL RIG				
					CME 550 ATV Rig				
DATE					CASING SIZE AND DIAMETER				
TIME					4-1/4 casing (using drilling mud)				
WATER					OVERBURDEN SAMPLING METHOD				
Ei. 574.2					ASTM 1586				
6/25/14 PM					ROCK DRILLING METHOD				
6/27/14 AM					N/A				
Ei. 571.0									
6/30/14 AM									
Ei. 570.9									
DEPTH	SAMPLE					SAMPLE DESCRIPTION		NOTES	
	BLOWS	NO.	DEPTH	N-VALUE	RECOVERY				
(/6")			(FT)	/RQD %	(%)				
1	2	S-1	0-2	12	65	Brown f/c SAND, some Silt, little Organics, trace Gravel, moist		(3" Topsoil)	
	4					Medium dense, black, f/m SAND, trace Gravel, coal frags, moist (FILL)		(apparent coal ash waste)	
2	8								
	10								
3	6	S-2	2-4	28	50	Grades to:...coal, brick and concrete fragments (FILL)			
	13								
4	15					Grades to:... intermixed pieces of reddish brown Silty CLAY			
	16					Grades to:...f/m SAND, trace Silt Coal ash waste (FILL)			
5	9	S-3	4-6	18	60				
	12								
6	6								
	6								
7	2	S-4	6-8	4	50	Medium stiff, reddish brown Silty CLAY, trace f/c Sand, moist (FILL)			
	2							Apparent fill soil from historic Erie Canal	
8	4								
9	1	S-5	8-10	3	50	Grades to:...soft			
	1								
10	2							Installed 2" diameter PVC monitoring well with 10 foot slotted screen to a depth of 13 ft bgs.	
	3								
11	1	S-6	10-12	3	75	Grades to:...trace Gravel			
	1								
12	2								
	3								
13		ST-5	12-14			Grades to:...little Gravel		Shelby Tube Sample Collected	
14									
15	2	S-7	14-16	5	30	Grades to:...medium stiff			
	2								
16	3								
	3								
17	2	S-8	16-18	8	50	Grades to:...stiff			
	4								
	4								
18	9					Greenish Grey to black f SAND and Silt, little Gravel, wet with Coal frags (FILL)		Assumed bottom of historic Erie Canal	
19	4	S-9	18-20	16	50	Brown very stiff Silty CLAY, trace Gravel (Native)			
	5								
	11								
20	16								
S - Split Spoon Sample		NOTES: Groundwater Monitoring well installed to a depth of 13 feet bgs with 10 slot screen interval from 3.0 to 13.0 ft bgs. Drillers utilized drilling mud for this borehole							
ST - Shelby Tube									
General		1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.							
Notes:		2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.							

DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES	
	BLOWS (6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)			
21	4	S-10	20-22	14	35	Grades to:...stiff, trace Sand		
	6							
	8							
22	13							
	3	S-11	22-24	9	35			
23	4							
	5							
24	5							
	WOH/6	S-12	24-26	3	75			Grades to:...soft
25	1							
26	2							
27						End of Boring at 26 ft bgs		
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
S - Split Spoon Sample ST - Shelby Tube			NOTES: WOH = Weight of Hammer					
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.								



DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES
	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)		
21		ST-6	20-22	-		Stiff, reddish brown SILT and CLAY, trace f/m Sand, moist  Grades to:...soft  End of Boring at 26 ft bgs	Shelby tube sample collected Sampler sidewall slightly crimped
22							
23	5	S-11	22-24	12	75		
24	5						
24	7						
24	9						
25	1	S-12	24-26	2	75		
25	1						
26	1						
26	2						
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
S - Split Spoon Sample ST - Shelby Tube			NOTES:				
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.							



CONTRACTOR		Earth Dimensions Inc.		BORING LOCATION		NRG Huntley Plant North Pond #3		
DRILLER		Phil Bence / Harold (Helper)		GROUND SURFACE ELEVATION		578.0 DATUM NA		
START DATE		6/26/2014		END DATE		06/26/14 GZA GEOENVIRONMENTAL REPRESENTATIVE Daniel Troy		
WATER LEVEL DATA					TYPE OF DRILL RIG			
DATE					CME 550 ATV Rig			
TIME					CASING SIZE AND DIAMETER			
6/27/14					4-1/4 casing (no drilling mud)			
WATER					OVERBURDEN SAMPLING METHOD			
AM					ASTM 1586			
Ei. 565.5					ROCK DRILLING METHOD			
CASING					N/A			
NOTES								
D E P T H	SAMPLE					SAMPLE DESCRIPTION		NOTES
	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)			
1	5	S-1	0-2	13	75	Brown medium dense, f/c Sand, some Silt, little Organics, trace Gravel, moist (Topsoil)	(apparent coal ash waste)	
	5							
2	8					Medium dense, black, f/m SAND, trace Gravel, coal fragments, moist (FILL)		
	9							
3	5	S-2	2-4	17	80	Grades to:...trace slag		
	6							
4	11					Grades to:...wet (FILL)		
	13							
5	5	S-3	4-6	12	75	Grades to:...loose (FILL)		
	6							
6	6					Grades to:...loose (FILL)		
	4							
7	1	S-4	6-8	7	50	Grades to:...loose (FILL)		
	4							
8	3					Grades to:...trace Silty CLAY (FILL)		
	3							
9	2	S-5	8-10	6	50	Grades to:...trace Silty CLAY (FILL)		
	3							
10	3					Grades to:...medium stiff		
	2							
11	1	S-6	10-12	6	25	Grades to:...medium stiff		
	3							
12	3					Medium dense, reddish brown, SILT and Clay, trace f/c Sand, moist (FILL)		
	5							
13	1	S-7	12-14	11	35	Grades to:...stiff		
	4							
14	7					Grades to:...medium stiff		
	7							
15	1	S-8	14-16	5	40	Grades to:...medium stiff		
	4							
16	4					Grades to:...f SAND and SILT (FILL)		
	4							
17	1	S-9	16-18	6	50	Greenish grey, loose, f SAND, some Silt, trace Gravel, wet Grades to:...f SAND and SILT (FILL)		
	4							
18	2					Medium dense, brown Silty CLAY, trace f/c Sand, grey varving, moist (Native)		
	6							
19	9	S-10	18-20	26	85	Grades to:...very stiff		
	10							
20	16					Grades to:...very stiff		
	17							
S - Split Spoon Sample		NOTES:						
ST - Shelby Tube								
General		1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.						
Notes:		2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.						

DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES	
	BLOWS (6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)			
21	5	S-11	20-22	17	80	Very stiff, brown, Silty CLAYm trace f/c Sand, moist  Grades to: ...medium stiff		
	7							
	10							
22	11							
	5	S-12	22-24	7	95			
23	4							
	3							
24	4							
	1	S-13	24-26	4	90			
25	2							
	2							
26	2							
27						End of Boring at 26 ft bgs		
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
S - Split Spoon Sample				NOTES:				
ST - Shelby Tube								
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.								



CONTRACTOR		Earth Dimensions Inc.		BORING LOCATION		NRG Huntley Plant North Pond #2	
DRILLER		Phil Bence / Harold (Helper)		GROUND SURFACE ELEVATION		579.6 DATUM NA	
START DATE		6/26/2014		END DATE		06/27/14 GZA GEOENVIRONMENTAL REPRESENTATIVE Daniel Troy	
WATER LEVEL DATA					TYPE OF DRILL RIG		
DATE					CME 550 ATV Rig		
TIME					CASING SIZE AND DIAMETER		
6/27/14					4-1/4 casing (no drilling mud)		
WATER					OVERBURDEN SAMPLING METHOD		
AM					ASTM 1586		
Ei. 567.0					ROCK DRILLING METHOD		
CASING					N/A		
NOTES							
DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES
	BLOWS	NO.	DEPTH	N-VALUE	RECOVERY		
(/6")			(FT)	/RQD %	(%)		
1	2	S-1	0-2	7	50	Loose, brown, SILT, some f/c Sand, little organics, trace Gravel, moist (Topsoil)	(apparent coal ash waste)
	3					Loose, grey to black, SILT and f/c Sand, trace Gravel, trace coal, slag, moist (FILL)	
	4					Grades to:...medium dense	
2	4						
	5	S-2	2-4	12	90		
3	5						
	7						
4	9						
	5	S-3	4-6	7	80	Grades to:...loose	
5	4					Intermixed lenses of 1" thick reddish brown SILT and CLAY	
	3					Grades to:...wet	
6	4						
	3	S-4	6-8	5	75	(Intermixed layers of Black f/m SAND, SILT and Silty Clay	
7	2					lenses of fill material)	
	3						
8	5						
	4	S-5	8-10	9	75		
9	4						
	5						
10	6						
	3	S-6	10-12	7	75		
11	4						
	3						
12	2						
	2	S-7	12-14	3	50	Grades to:...very loose	
13	2						
	1						
14	2						
	1	S-8	14-16	3	30		
15	1						
	2						
16	2						
	1	S-9	16-18	3	50	Very loose, black, SILT, trace f Sand, wet	
17	1						
	2						
18	1						
	1	S-10	18-20	3	60		
19	1						
	2						
20	3					Loose, grey, f SAND, trace Silt, wet	
S - Split Spoon Sample		NOTES: WOR = weight of rods					
ST - Shelby Tube		Drilling mud not used in this borehole					
General		1) Stratification lines represent approximate boundary between soil types, transitions may be gradual.					
Notes:		2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.					

DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES	
	BLOWS (6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)			
21	1	S-11	20-22	8	60	Loose, grey, f SAND, trace Silt, wet		
	3							
	5							
22	7							
	wor	S-12	22-24	wor	75			Very loose, light grey, fine SAND, trace Silt, wet
23	wor							
	wor							
24	3					Grades to:...medium dense, trace Gravel		
	2	S-13	24-26	14	80			
25	9							
	5							
26	12					End of Boring at 26 ft bgs		
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
S - Split Spoon Sample ST - Shelby Tube				NOTES: WOR = weight of rods				
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.								



CONTRACTOR		Earth Dimensions Inc.		BORING LOCATION		NRG Huntley Plant North Pond #2	
DRILLER		Phil Bence / Harold (Helper)		GROUND SURFACE ELEVATION		579.0 DATUM NA	
START DATE		6/27/2014		END DATE		06/28/14 GZA GEOENVIRONMENTAL REPRESENTATIVE Daniel Troy	
WATER LEVEL DATA					TYPE OF DRILL RIG		
					CME 550 ATV Rig		
DATE					CASING SIZE AND DIAMETER		
6/27/14 AM					4-1/4 casing (no drilling mud)		
WATER					OVERBURDEN SAMPLING METHOD		
EI. 568.0					ASTM 1586		
CASING					ROCK DRILLING METHOD		
Augers					N/A		
6/30/14 AM							
EI. 565.8					2" PVC well		
D E P T H	SAMPLE					SAMPLE DESCRIPTION	NOTES
	BLOWS (/6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)		
1	5	S-1	0-2	22	40	Brown, SILT, some f/c Sand, little organics, trace Gravel, moist (Topsoil)	(coal waste seam)
	9						
2	13					Medium dense, grey, GRAVEL, some f/c Sand, moist (FILL)	
	10						
3	10	S-2	2-4	15	50	Grades to:...Stiff, reddish brown, Silty CLAY, trace f/c Sand, moist (FILL)	
	7						
4	8						
	9						
5	4	S-3	4-6	12	75	Grades to:...little Gravel	
	5						
6	7						
	9						
7	4	S-4	6-8	12	75		
	5						
8	7					Medium dense, black, f/m SAND, little Silt, trace Gravel intermixed with reddish brown Silty CLAY (FILL)	
	5						
9	2	S-5	8-10	11	75		
	4						
10	7						
	5						
11	5	S-6	10-12	4	60	Grades to:...loose	
	2						
12	2					Grades to:...wet	
	2						
13	1	S-7	12-14	6	50		
	3						
14	3						
	3						
15	2	S-8	14-16	3	5	Grades to:...very loose	
	2						
16	1						
	1						
17	1	S-9	16-18	2	75	Very loose, dark grey SILT, trace Organics, wet Grades to:...Clayey SILT	
	1						
18	1						
	1						
19		ST-7	18-20	-		(Layers of black fine Sand observed at top and bottom of tube sample)	
20							
S - Split Spoon Sample		NOTES: Groundwater Monitoring well installed to a depth of 17 feet bgs with 10 slot screen interval from about 7.0 to 17.0 ft bgs. Drilling mud not used in this borehole					
ST - Shelby Tube							
General Notes:		1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.					

DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES	
	BLOWS (6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)			
21	1	S-10	20-22	3	25	Very loose, dark grey, SILT, little f Sand, trace Clay trace Organics (roots), wet	End of Boring at 26 ft bgs	
22	2							
22	3							
23	1	S-11	22-24	8	75	Grades to:...loose SILT and fine Sand		
24	4					Grey, loose f SAND, little Silt, wet Grades to:... trace Silt		
24	3							
25	4	S-12	24-26	11	75	Grades to:...medium dense, f SAND, wet		
26	5							
26	6							
26	8							
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
S - Split Spoon Sample ST - Shelby Tube				NOTES: Drilling Mud not used in this borehole				
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.								



DEPTH	SAMPLE					SAMPLE DESCRIPTION	NOTES
	BLOWS (6")	NO.	DEPTH (FT)	N-VALUE /RQD %	RECOVERY (%)		
21	WOR	S-11	20-22	1	85	Grades to...f SAND and SILT (FILL)	Thin coal ash seams  Petroleum like odor noted
	WOR						
	1						
22	2						
	WOR	S-12	22-24	2	80	Loose, black, SILT, wet (FILL)	
23	1						
	1						
24	1						
	1	S-13	24-26	3	80	Grades to...trace wood fragment (FILL)	
25	1						
	2						
26	3					Very loose, greenish grey f/m SAND, trace Silt, wet (FILL)	
	3	S-14	26-28	9	75		
27	4					Grades to...loose, trace Gravel, trace Slag (FILL)	
	5						
28	8					End of Boring at 28 ft bgs	
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
S - Split Spoon Sample ST - Shelby Tube				NOTES:			
General 1) Stratification lines represent approximate boundary between soil types, transitions may be gradual. Notes: 2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.							

**ATTACHMENT 2**  
**LABORATORY TEST RESULTS**

## LABORATORY TESTING DATA SHEET

*Matthew P. Kelly*

Project Name NRG Huntley Embankment Evaluation  
 Project No. 21.0056705.00  
 Project Manager Dan Troy

Location Tonawanda, NY  
 Assigned By Dan Troy  
 Report Date 8/13/2014

Reviewed By \_\_\_\_\_  
 Date Reviewed 8/13/2014

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests							Strength Tests					Internal Friction Angle	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	OD LL %	Sieve -200 %	Hyd -2 $\mu$ %	ORG %	Dry unit wt. pcf	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or $\tau$ psf		
B-4	ST-2	16- 18	4	Average Total Unit Weight (16-17.4') = 107.9 pcf													Gray-brown SILT and fine SAND 0.5" to 1.25" diameter wax was observed down the entire length of the tube sample
		16.2															



## LABORATORY TESTING DATA SHEET

Project Name NRG Huntley Embankment Evaluation

Project Location Tonawanda, NY

Reviewed By *Matthew P. Kelly*

Project No. 21.0056705.00

Assigned By D. Troy / B. Klettke

Project Manager Dan Troy

Date 7/17/2014

Date Reviewed 7/17/2014

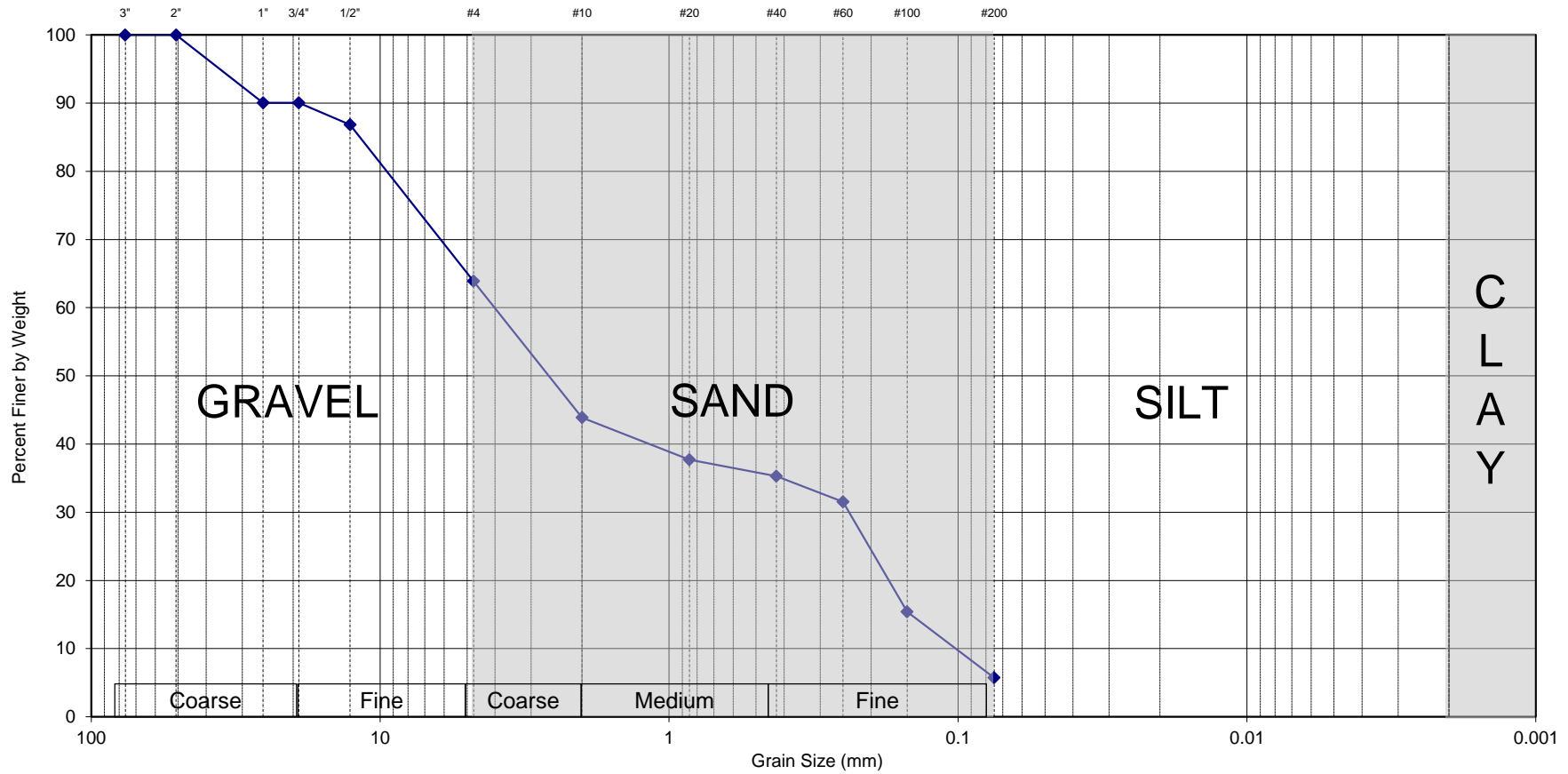
Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests						Density	Strength Tests						Laboratory Log and Soil Description
				Natural Water Content %	LL %	PL %	Sieve -200 %	Hyd -2 $\mu$ %	Org. %	$\gamma_d$ MAX (pcf) W <sub>opt</sub> (%)	CBR Setup as % of Proctor	CBR Dry unit wt. pcf	CBR Water Content %	CBR @ 0.1" @ 0.2"	$\sigma_1 - \sigma_3$ or $\tau$ psf	Strain %	
B-4	S-11	22-24	5	10.4			5.7										Gray f-c SAND and f-c GRAVEL, trace Silt
B-5	S-8	16-18	6	34.0			36.5										Gray fine SAND and SILT, trace Gravel
B-7	S-6	10-12	7	21.4			89.9										Brown SILT, trace Sand, trace Gravel
B-8	S-11	22-24	8	29.9			97.6										Brown SILT & CLAY, trace Sand
B-10	S-12	22-24	9	32.0			81.1										Black Organic SILT, little f-m Sand
B-11	S-6	10-12	10	29.3			15.8										Black f-m SAND, little Silt, trace Gravel
B-12	S-12	20-22	11	26.0			2.8										Gray fine SAND, trace Silt



195 Frances Avenue  
Cranston, RI 02910

401-467-6454

U.S. STANDARD SIEVE AND HYDROMETER



Gravel  
36.1%

Sand  
58.2%

Fines  
5.7%

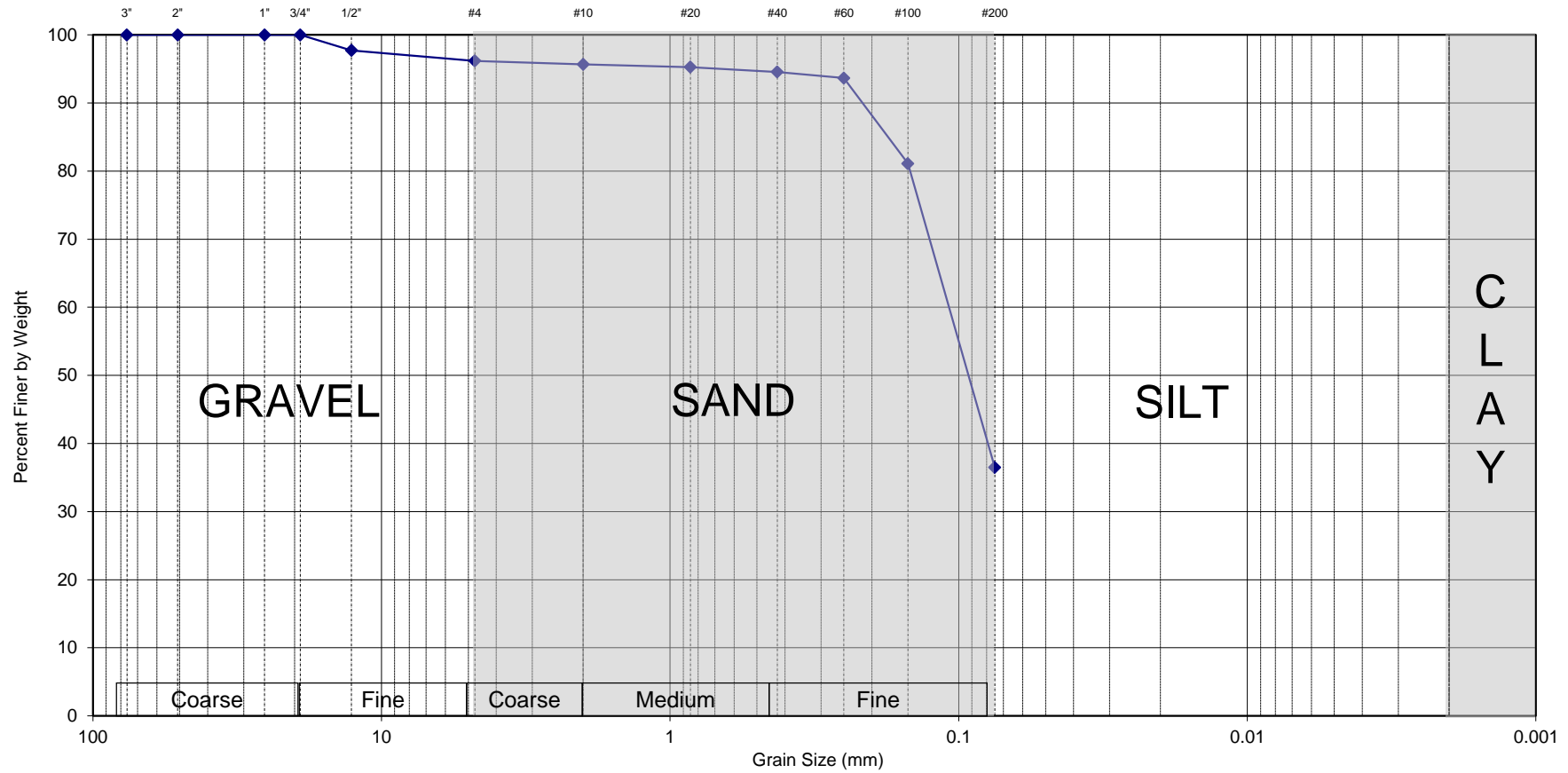
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
5	B-4	S-11	22-24'	Gray f-c SAND and f-c GRAVEL, trace Silt	10.4			

Sieve Size	% Passing
3/4"	90.0
1/2"	86.8
#4	63.9
#10	43.9
#20	37.7
#40	35.3
#60	31.5
#100	15.4
#200	5.7

74-14-0003  
 NRG Huntley Embankment Evaluation  
 Tonawanda, NY  
 GZA Project # 21.0056705.00  
 Tested by: LM Date: 7/17/14  
 Reviewed by: MBP Date: 7/17/14

**THIELSCH**  
**ENGINEERING**  
 195 Frances Ave., Cranston, RI 02910  
 401-467-6454

U.S. STANDARD SIEVE AND HYDROMETER



Gravel  
3.8%

Sand  
59.7%

Fines  
36.5%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
6	B-5	S-8	16-18'	Gray fine SAND and SILT, trace Gravel	34.0			

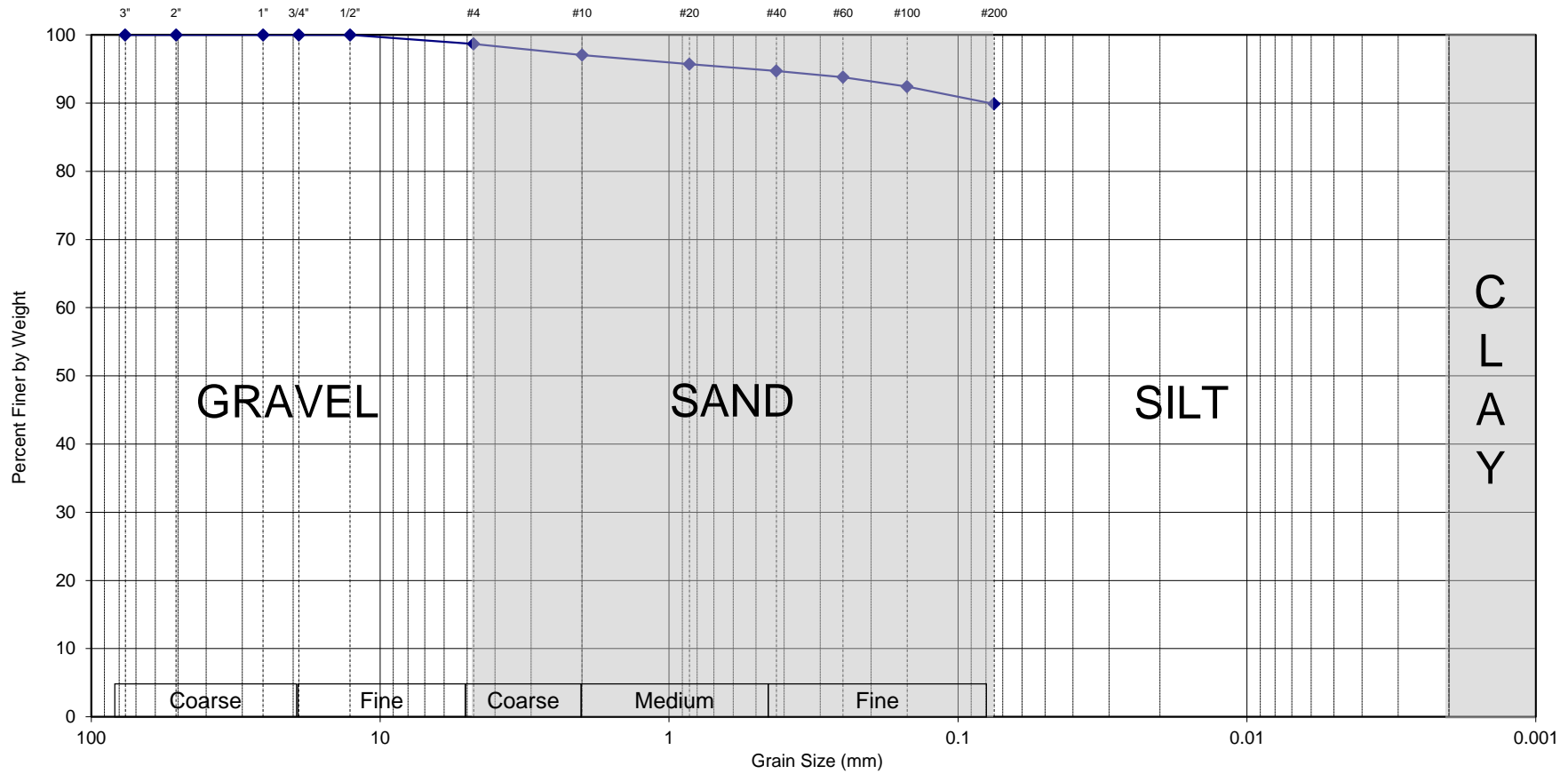
Sieve Size	% Passing
3/4"	100.0
1/2"	97.7
#4	96.2
#10	95.7
#20	95.3
#40	94.6
#60	93.7
#100	81.1
#200	36.5



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74-14-0003  
NRG Huntley Embankment Evaluation  
Tonawanda, NY  
GZA Project # 21.0056705.00  
Tested by: LM Date: 7/17/14  
Reviewed by: MBP Date: 7/17/14

U.S. STANDARD SIEVE AND HYDROMETER



Gravel  
1.3%

Sand  
8.8%

Fines  
89.9%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
7	B-6	S-6	10-12'	Brown SILT, trace Sand, trace Gravel	21.4			

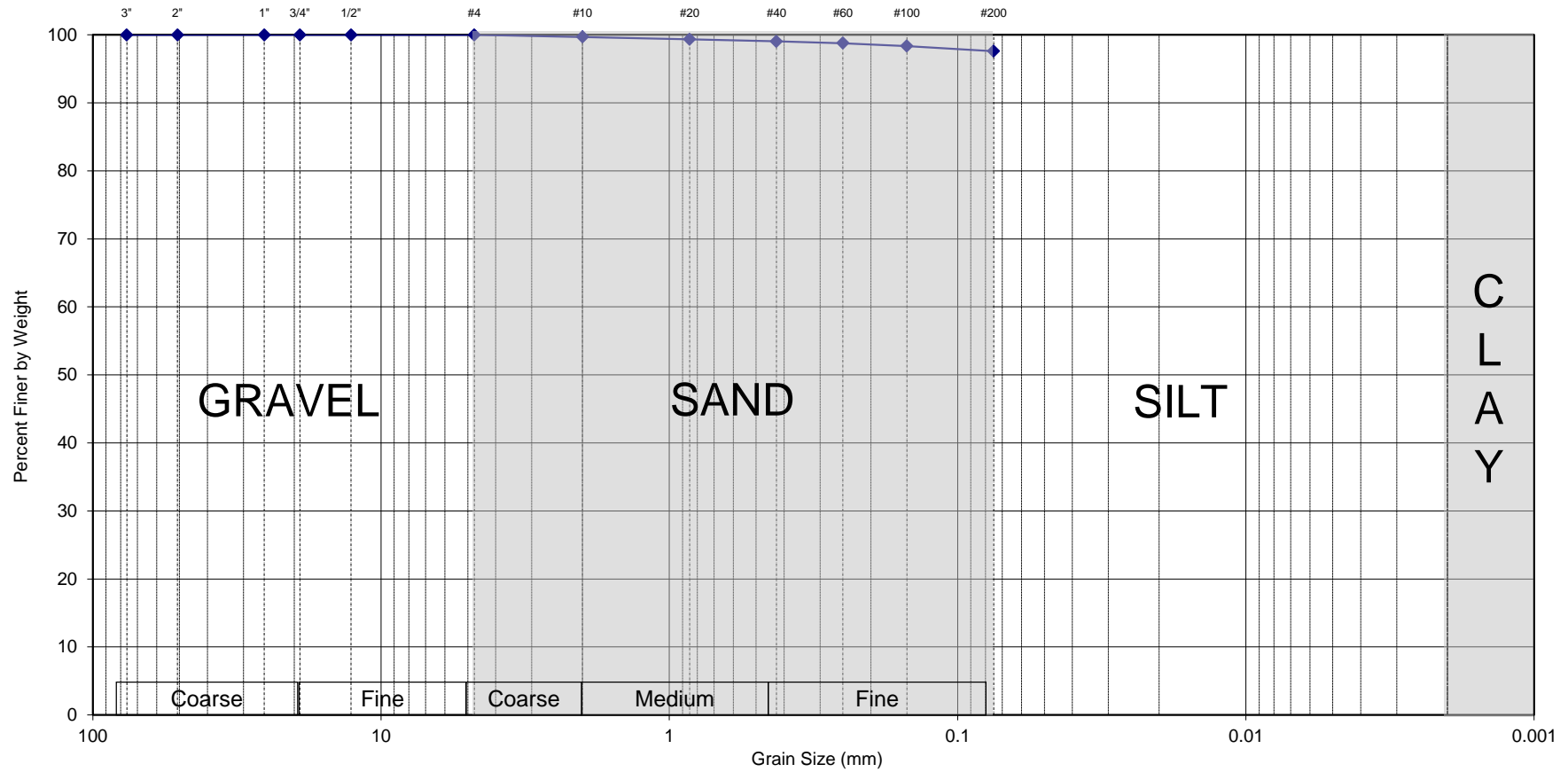
Sieve Size	% Passing
3/4"	100.0
1/2"	100.0
#4	98.7
#10	97.0
#20	95.7
#40	94.7
#60	93.8
#100	92.4
#200	89.9



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74-14-0003  
NRG Huntley Embankment Evaluation  
Tonawanda, NY  
GZA Project # 21.0056705.00  
Tested by: LM Date: 7/17/14  
Reviewed by: MBP Date: 7/17/14

U.S. STANDARD SIEVE AND HYDROMETER



Gravel  
0.0%

Sand  
2.4%

Fines  
97.6%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
8	B-8	S-11	22-24'	Brown SILT & CLAY, trace Sand	29.9			

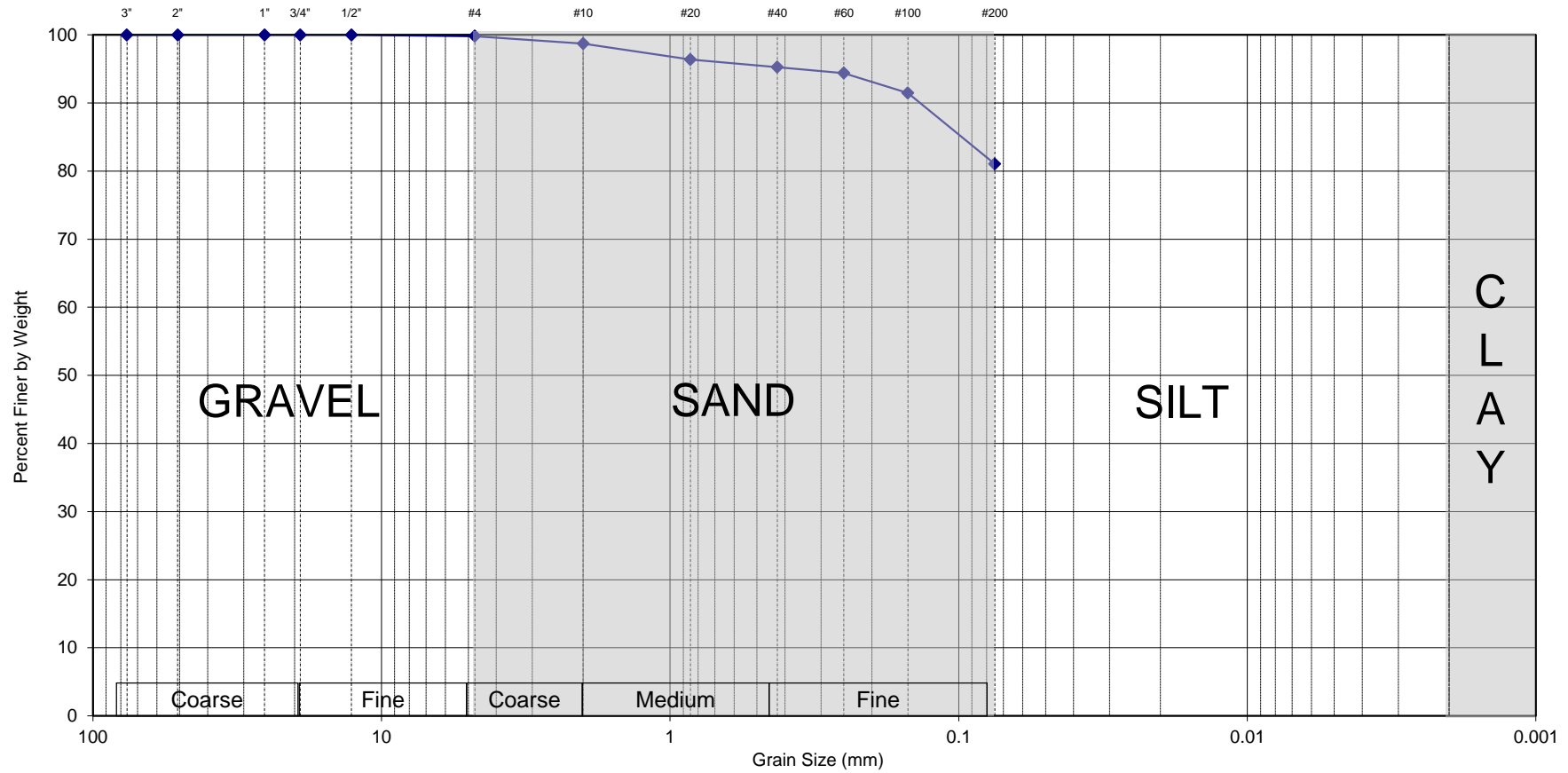
Sieve Size	% Passing
3/4"	100.0
1/2"	100.0
#4	100.0
#10	99.7
#20	99.4
#40	99.0
#60	98.8
#100	98.4
#200	97.6



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74-14-0003  
NRG Huntley Embankment Evaluation  
Tonawanda, NY  
GZA Project # 21.0056705.00  
Tested by: LM Date: 7/17/14  
Reviewed by: MBP Date: 7/17/14

U.S. STANDARD SIEVE AND HYDROMETER



Gravel  
0.2%

Sand  
18.8%

Fines  
81.0%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
9	B-10	S-12	22-24'	Black Organic SILT, little f-m Sand	32.0			

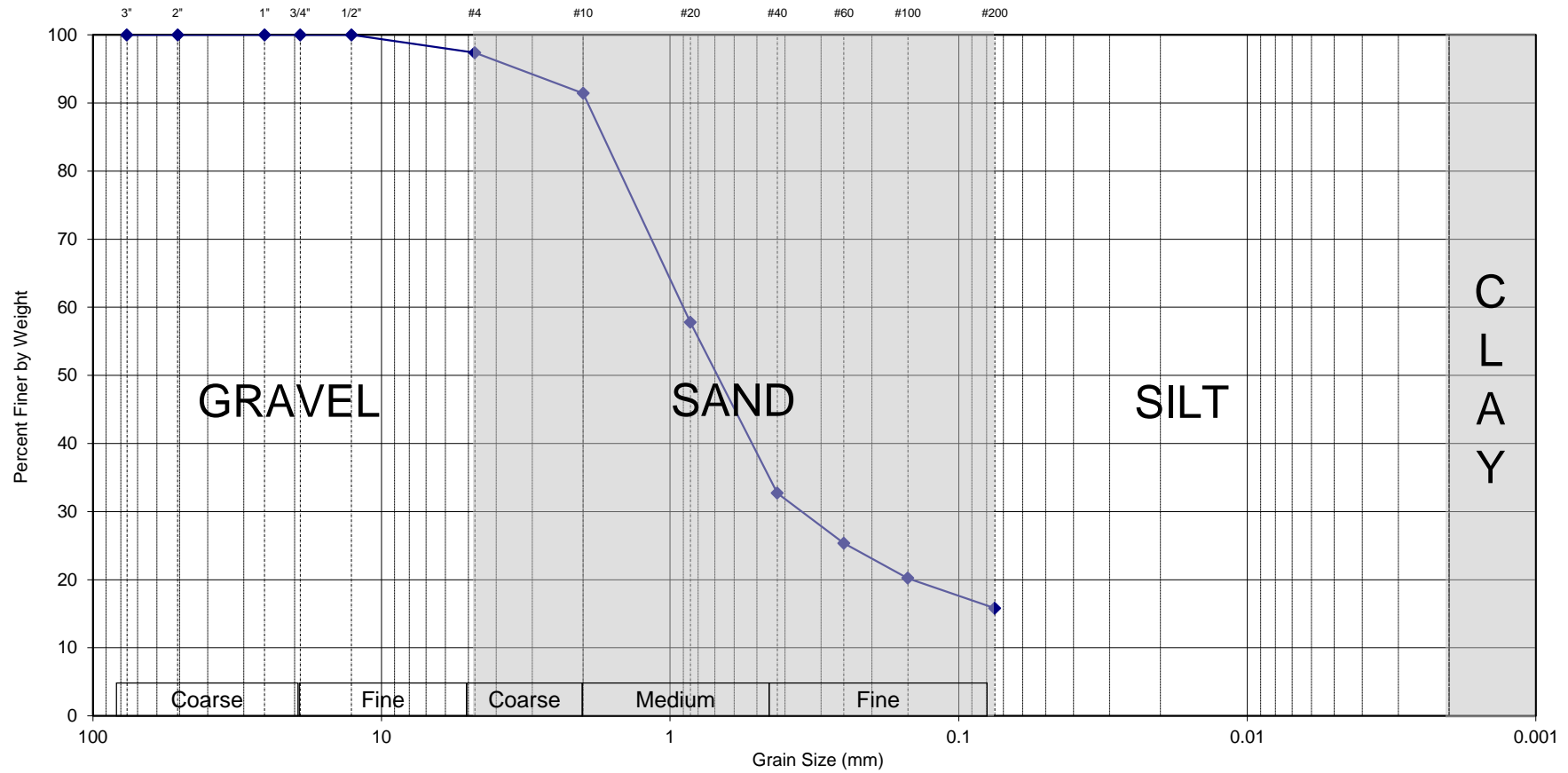
Sieve Size	% Passing
3/4"	100.0
1/2"	100.0
#4	99.8
#10	98.7
#20	96.4
#40	95.3
#60	94.4
#100	91.5
#200	81.0



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401-467-6454

74-14-0003  
NRG Huntley Embankment Evaluation  
Tonawanda, NY  
GZA Project # 21.0056705.00  
Tested by: LM Date: 7/17/14  
Reviewed by: MBP Date: 7/17/14

U.S. STANDARD SIEVE AND HYDROMETER



Gravel 2.6%      Sand 81.6%      Fines 15.8%

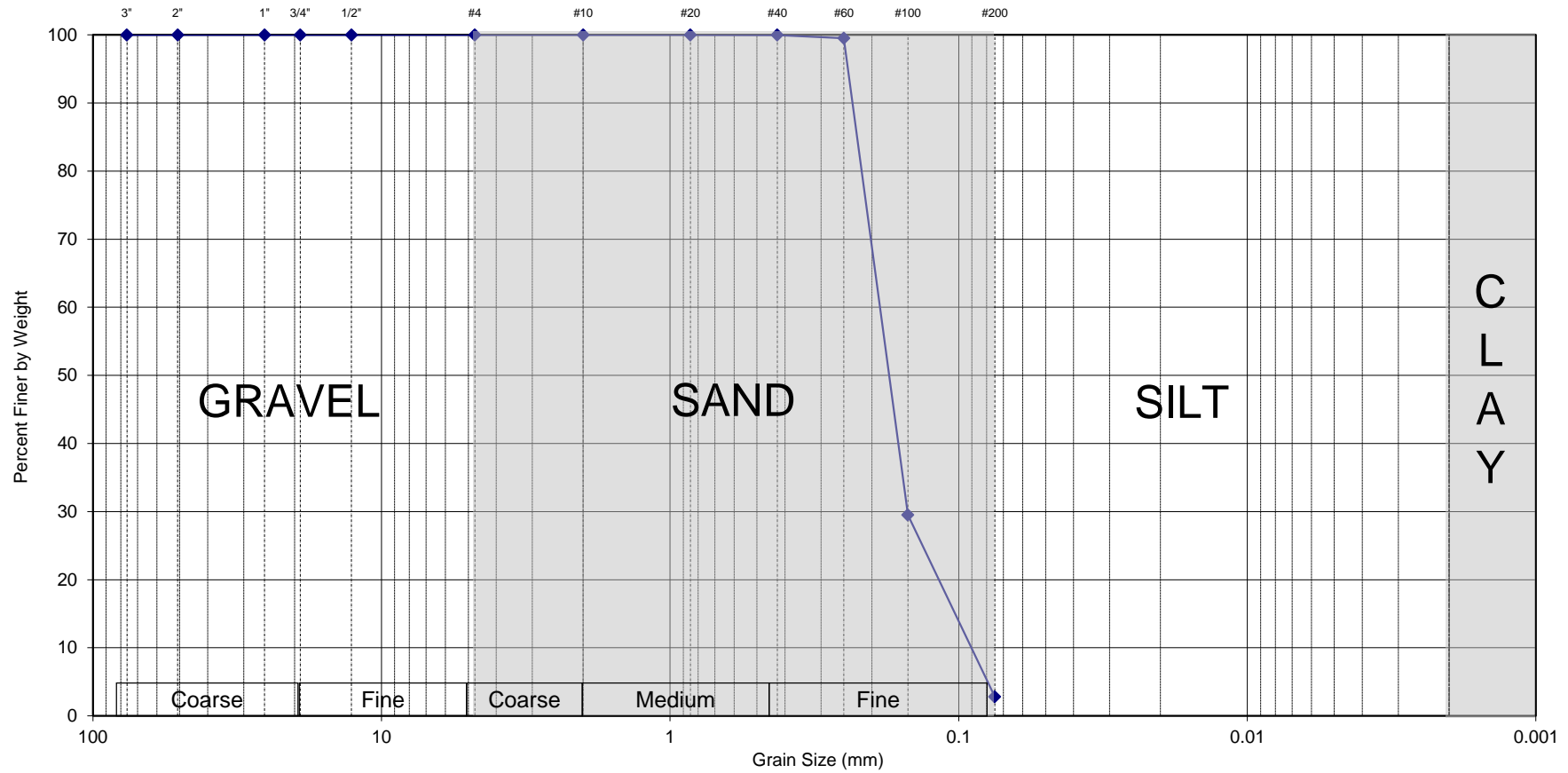
Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
10	B-11	S-6	10-12'	Black f-m SAND, little Silt, trace Gravel	29.3			

Sieve Size	% Passing
3/4"	100.0
1/2"	100.0
#4	97.4
#10	91.4
#20	57.8
#40	32.7
#60	25.3
#100	20.2
#200	15.8

74-14-0003  
 NRG Huntley Embankment Evaluation  
 Tonawanda, NY  
 GZA Project # 21.0056705.00  
 Tested by: LM      Date: 7/17/14  
 Reviewed by: MBP      Date: 7/17/14

**THIELSCH**  
**ENGINEERING**  
 195 Frances Ave., Cranston, RI 02910  
 401-467-6454

U.S. STANDARD SIEVE AND HYDROMETER



Gravel  
0.0%

Sand  
97.2%

Fines  
2.8%

Lab #	Exploration	Sample	Depth	Description	WC	LL	PL	PI
11	B-12	S-12	20-22'	Gray fine SAND, trace Silt	26.0			

Sieve Size	% Passing
3/4"	100.0
1/2"	100.0
#4	100.0
#10	100.0
#20	100.0
#40	100.0
#60	99.5
#100	29.5
#200	2.8



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74-14-0003  
NRG Huntley Embankment Evaluation  
Tonawanda, NY  
GZA Project # 21.0056705.00  
Tested by: LM Date: 7/17/14  
Reviewed by: MBP Date: 7/17/14

## LABORATORY TESTING DATA SHEET

*Matthew P. Kelly*

Project Name NRG Huntley Embankment Evaluation  
 Project No. 21.0056705.00  
 Project Manager Dan Troy

Location Tonawanda, NY  
 Assigned By Dan Troy  
 Report Date 8/12/2014

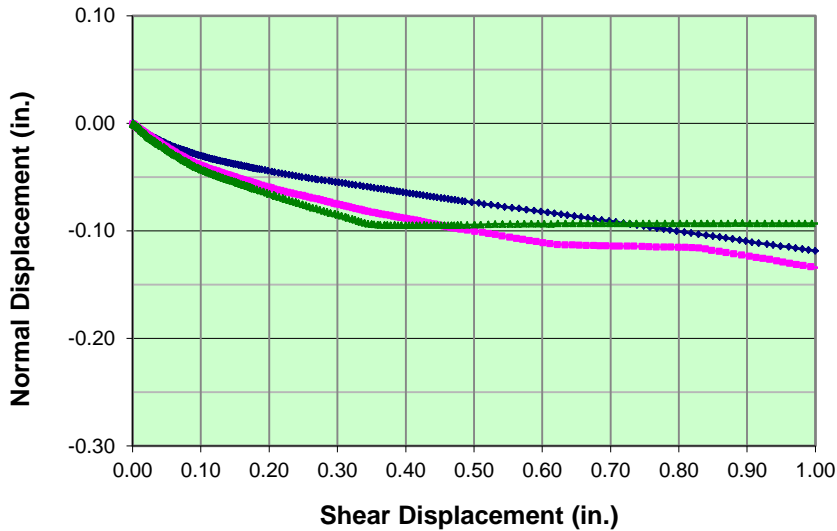
Reviewed By \_\_\_\_\_  
 Date Reviewed 8/12/2014

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests							Strength Tests							Laboratory Log and Soil Description	
				Water Content %	LL %	PL %	OD LL %	Sieve -200 %	Hyd -2 $\mu$ %	ORG %	Dry unit wt. pcf	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or $\tau$ psf	Strain %	Internal Friction Angle		
B-6	ST-4	18- 20	12	Average Total Unit Weight (18.0-19.5') = 125.5 pcf															
		18.0- 19.5		23.6	(Composite)													From 18.0' to 19.0': Gray-brown fine SAND trace Silt  From 19.0' to 19.5': Gray-brown fine SAND and SILT, some fine Gravel	
				(Composite of B-6 & B-5 Tube Samples)					91.3							18.8°			
B-5	ST-3	14- 16	13	Average Total Unit Weight (14.0-15.2') = 126.9 pcf															From 14.0' to 14.2': Gray-brown fine SAND trace Silt, trace Gravel From 14.2' to 14.6': Gray-brown fine SAND and fine GRAVEL From 14.6' to 15.2': Gray-brown SILT and fine SAND
		14.6		28.2	(Composite)														

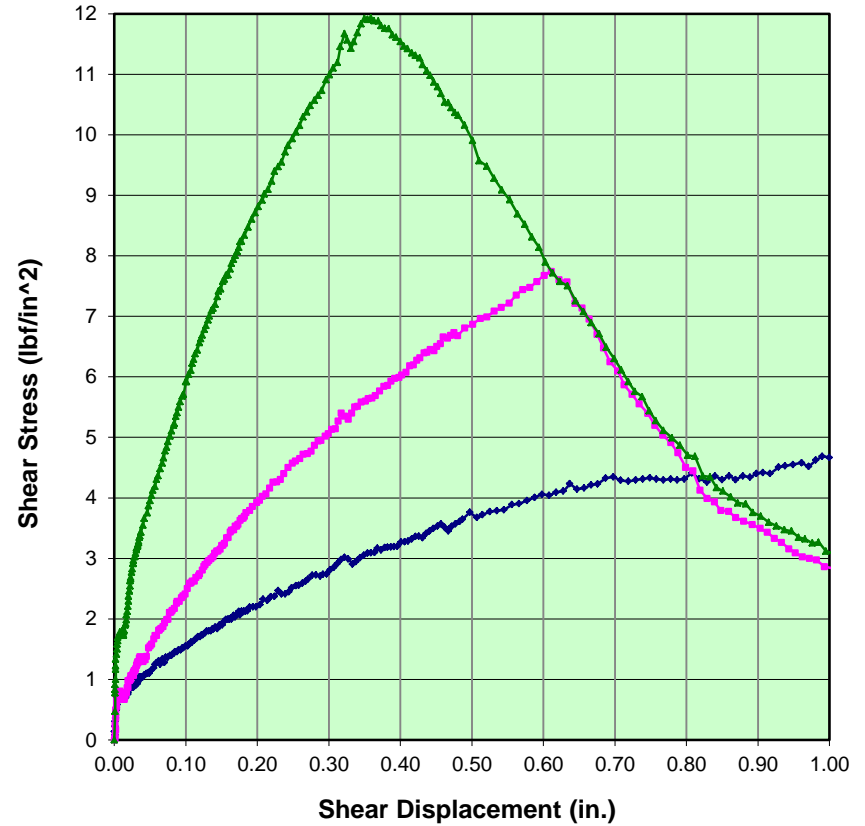


Direct Shear Test ASTM D3080

Normal Displacement vs. Shear Displacement



Shear Stress vs. Shear Displacement

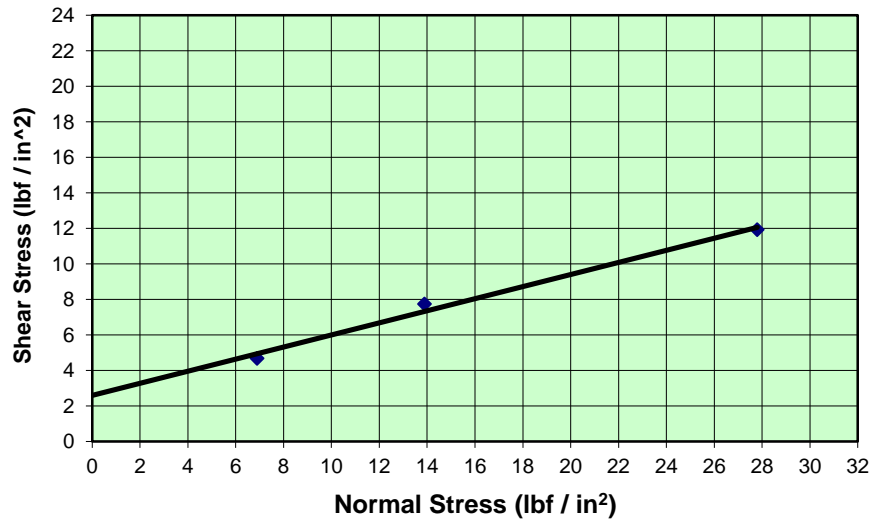


Normal Loads (psi)      —●— 6.9      —●— 13.9      —●— 27.8

Shear Stress vs. Normal Stress

$$y = 0.3401x + 2.6092$$

$$R^2 = 0.9902$$



Project	<u>NRG Huntley Embankment Evaluation</u>	Project Manager	<u>D. Troy</u>
Location	<u>Tonawanda, NY</u>	Assigned By	<u>D. Troy</u>
File No.	<u>21.0056705.00</u>	Tested By	<u>AS</u>
Test No.	<u>DS 21</u>	Reviewed By	<u>MBP</u>
Date	<u>8/7/2014</u>	<b>Shear Angle ( ° )</b>	<b>18.8°</b>
Condition	<u>Saturated</u>	Intercept (lbf/in <sup>2</sup> )	<u>2.6</u>
Source	<u>B-6 &amp; B-5 Composite</u>	Density (pcf)	<u>91.3</u>
Sample No.	<u>ST-4 &amp; ST-5 composite</u>	Area (in <sup>2</sup> )	<u>36.0</u>

## LABORATORY TESTING DATA SHEET

*Matthew P. Kelly*

Project Name NRG Huntley Embankment Evaluation  
 Project No. 21.0056705.00  
 Project Manager Dan Troy

Location Tonawanda, NY  
 Assigned By Dan Troy  
 Report Date 8/13/2014

Reviewed By \_\_\_\_\_  
 Date Reviewed 8/13/2014

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests							Strength Tests							Laboratory Log and Soil Description		
				Water Content %	LL %	PL %	OD LL %	Sieve -200 %	Hyd -2 $\mu$ %	ORG %	Dry unit wt. pcf	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or $\tau$ psf	Strain %	Internal Friction Angle			
B-7	ST-5	12-14	2																	
				Average Total Unit Weight (12.0-13.1') = 125.4 pcf																
		12.1-12.4																		
				(Sample Saved)																
		12.4-12.8																		
				(Sample Saved)																
		12.8-12.9		18.8									Tv= 1.5 tsf							

Red-brown Silty CLAY  
 little f-c Gravel,  
 (1.5" Stone at 12.4')  
 little coarse Sand  
 Very Stiff Consistency



## LABORATORY TESTING DATA SHEET

*Matthew P. Kelly*

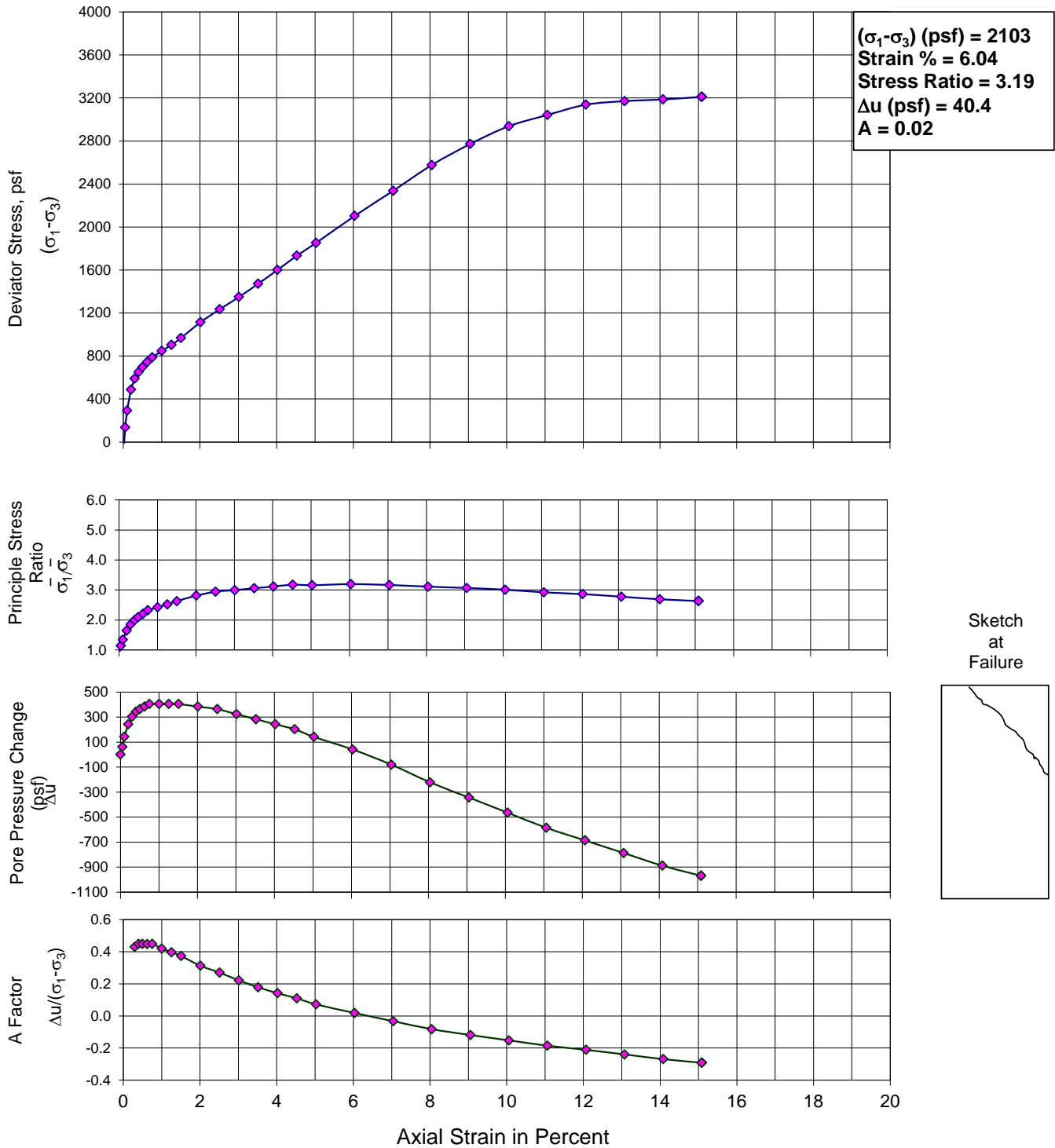
Project Name NRG Huntley Embankment Evaluation  
 Project No. 21.0056705.00  
 Project Manager Dan Troy

Location Tonawanda, NY  
 Assigned By Dan Troy  
 Report Date 8/12/2014

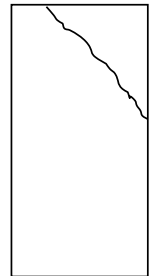
Reviewed By \_\_\_\_\_  
 Date Reviewed 8/12/2014

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests							Strength Tests							Laboratory Log and Soil Description
				Water Content %	LL %	PL %	OD LL %	Sieve -200 %	Hyd -2 $\mu$ %	ORG %	Dry unit wt. pcf	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or $\tau$ psf	Strain %	Internal Friction Angle	
B-8	ST-6	20- 22	3	Average Total Unit Weight (20.0-21.3') = 133.5 pcf														
		20.0- 20.4		23.0						104.8	CIU	1000	$\sigma_1 - \sigma_3$ Max	2103	6.0		Red-brown Silty CLAY trace fine Gravel Very Stiff Consistency	
		20.4- 20.8		21.0						110.3	CIU	2000	$\sigma_1 - \sigma_3$ Max	3962	4.5			
		20.8- 21.2		21.7						109.5	CIU	4000	$\sigma_1 - \sigma_3$ Max	5582	4.5	28.6°		
		21.3		22.9							Tv= 2.0 tsf							





Sketch at Failure

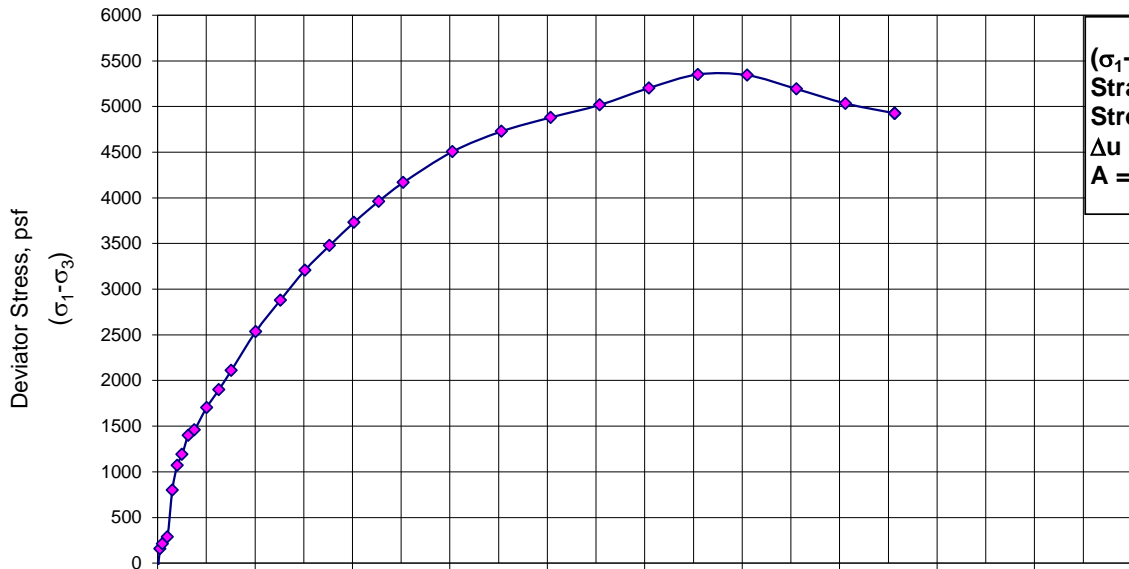


195 Frances Ave.  
 Cranston, RI 02910

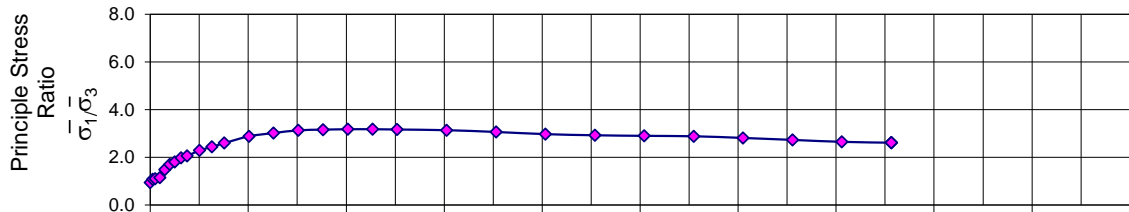
SOIL DESCRIPTION:	Red-brown Silty CLAY
LIQUID LIMIT:	PLASTIC LIMIT: NT
SPECIFIC GRAVITY:	NT

TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS		RATE OF STRAIN, PERCENT PER MINUTE
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	INITIAL STRESS, ksf $\sigma_1 = \sigma_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %	
T 3.1	23.0	104.8	4.000	2.000	1.00	8.64	1.75	96.8	23.5	106.7	0.030

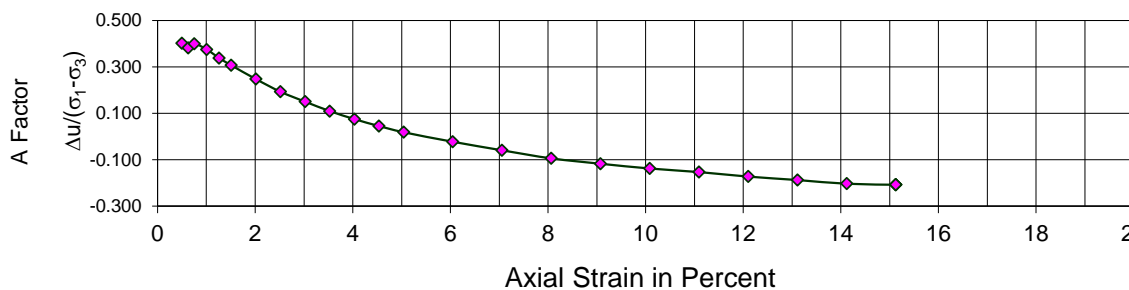
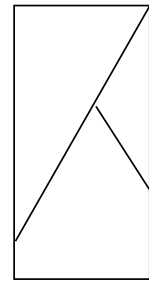
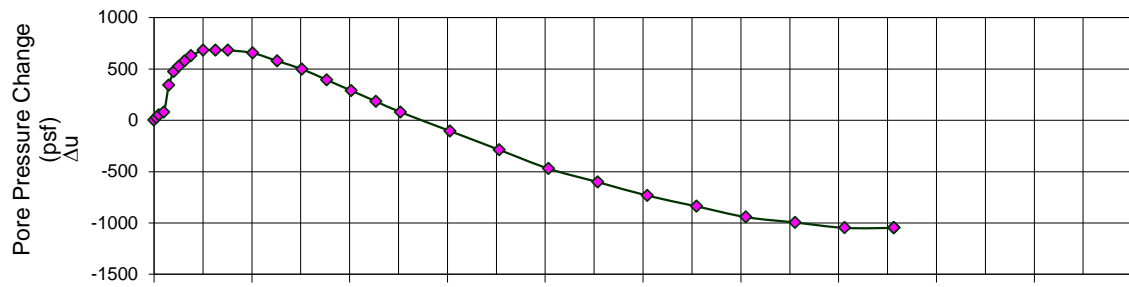
NRG Huntley Embankment Evaluation Tonawanda, NY TRIAXIAL COMPRESSION TESTS (CIU)	
BORING: B-8	FILE NO: 21.0056705.00
SAMPLE: ST-6	Date: 7/18/2014
DEPTH: 20.0-20.4'	Tech.: AS
TEST NO: T 3.1	Reviewer: MBP



( $\sigma_1 - \sigma_3$ ) (psf) = 3962  
 Strain % = 4.54  
 Stress Ratio = 3.18  
 $\Delta u = 183.4$   
 A = 0.05



Sketch at Failure



Axial Strain in Percent



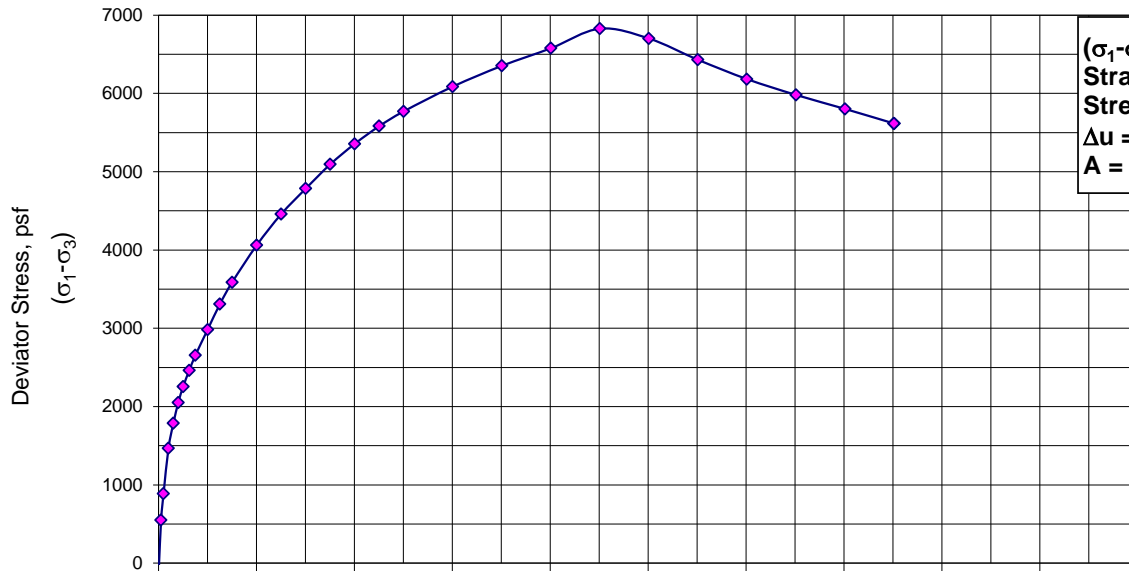
195 Frances Ave.  
 Cranston, RI 02910

SOIL DESCRIPTION:	Red-brown Silty CLAY
LIQUID LIMIT: NT	SPECIFIC GRAVITY: NT
PLASTIC LIMIT: NT	

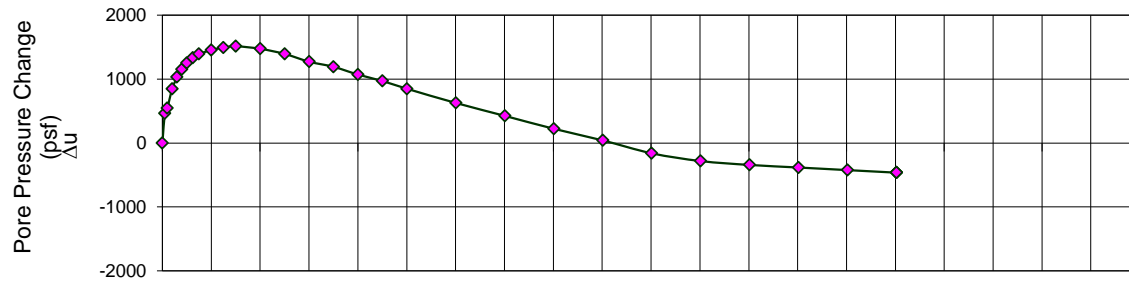
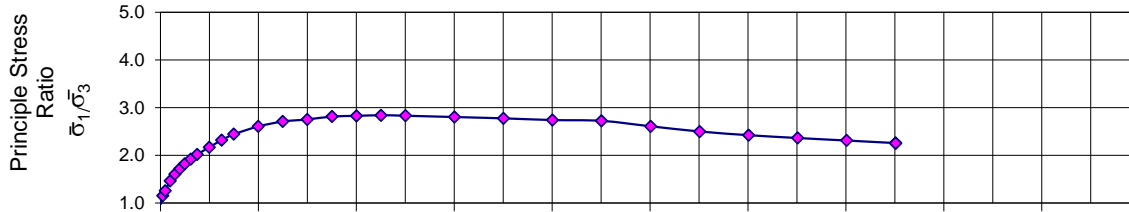
TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS	
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	INITIAL STRESS, ksf $\sigma_1 = \sigma_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %
T 3.2	21.0	110.3	4.002	2.002	2.00	8.64	2.76	96.8	22.0	113.4

RATE OF STRAIN, PERCENT PER MINUTE	0.030
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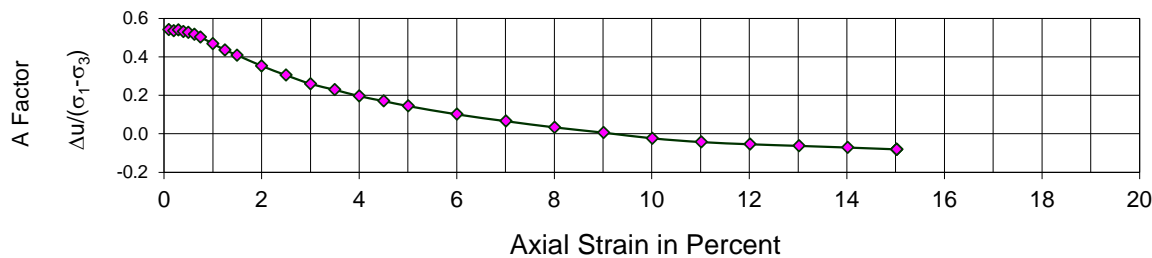
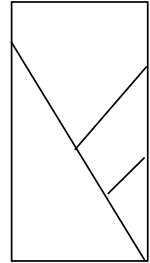
<b>NRG Huntley Embankment Evaluation</b> <b>Tonawanda, NY</b> <b>TRIAXIAL COMPRESSION TESTS (CIU)</b>	
BORING: B-8	FILE NO: 21.0056705.00
SAMPLE: ST-6	Date: 7/18/14
DEPTH: 20.4-20.8'	Tech.: AS
TEST NO: T 3.2	Reviewer: MBP



( $\sigma_1 - \sigma_3$ ) (psf) = 5582  
 Strain % = 4.51  
 Stress Ratio = 2.84  
 $\Delta u = 969.7$   
 A = 0.17



Sketch at Failure



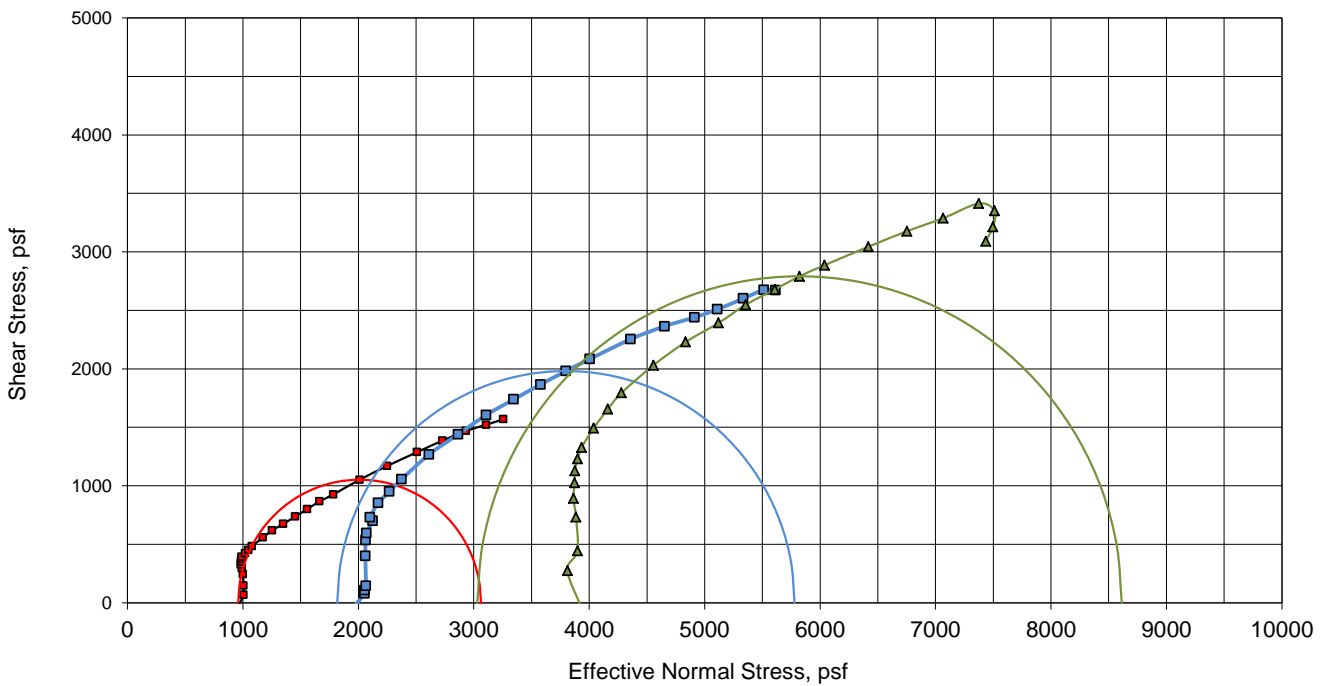
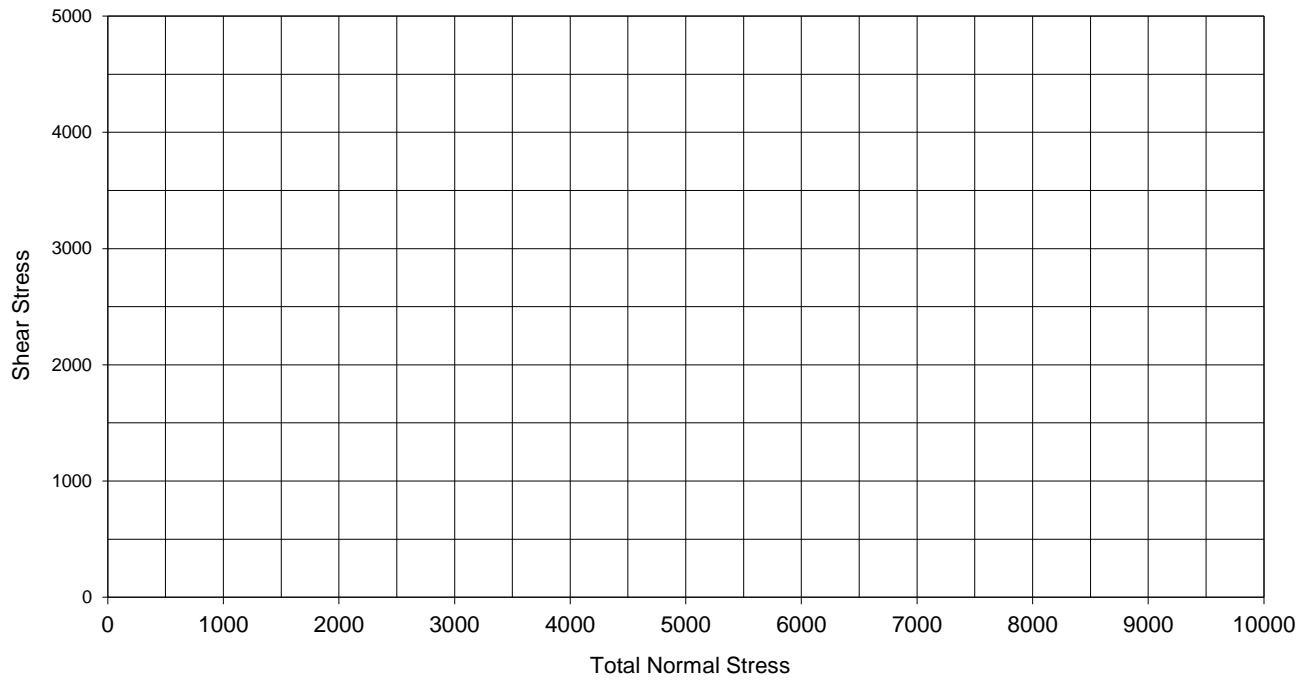
195 Frances Ave.  
 Cranston, RI 02910

SOIL DESCRIPTION:	Red-brown Silty CLAY
LIQUID LIMIT: NT	SPECIFIC GRAVITY: NT
PLASTIC LIMIT: NT	

TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS	
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	INITIAL STRESS, ksf $\sigma_1 = \sigma_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %
T 3.3	21.7	109.5	4.060	2.002	4.00	8.64	4.88	95.4	22.7	115.1

RATE OF STRAIN, PERCENT PER MINUTE	0.030
------------------------------------	-------

<b>NRG Huntley Embankment Evaluation</b>	
<b>Tonawanda, NY</b>	
<b>TRIAXIAL COMPRESSION TESTS (CIU)</b>	
BORING: B-8	FILE NO: 21.0056705.00
SAMPLE: ST-6	Date: 7/21/2014
DEPTH: 20.8-21.2'	Tech.: AS
TEST NO: T 3.3	Reviewer: MBP



FAILURE CRITERIA:  $\sigma_1 - \sigma_3$  MAX  
 REMARKS:

SOIL DESCRIPTION: Red-brown Silty CLAY  
 LIQUID PLASTIC SPECIFIC  
 LIMIT: NT LIMIT: NT GRAVITY: NT



195 Frances Ave.  
 Cranston, RI 02910 401-467-6454

**NRG Huntley Embankment Evaluation**  
**Tonawanda, NY**  
**TRIAxIAL COMPRESSION TESTS (CIU)**  
 BORING: B-8 FILE NO: 21.0056705.00  
 SAMPLE: ST-6 Date: 7/18/2014  
 DEPTH: 20-22' Tech.: AS  
 TEST SERIES: 3 Reviewer: MBP

## LABORATORY TESTING DATA SHEET

*Matthew P. Kelly*

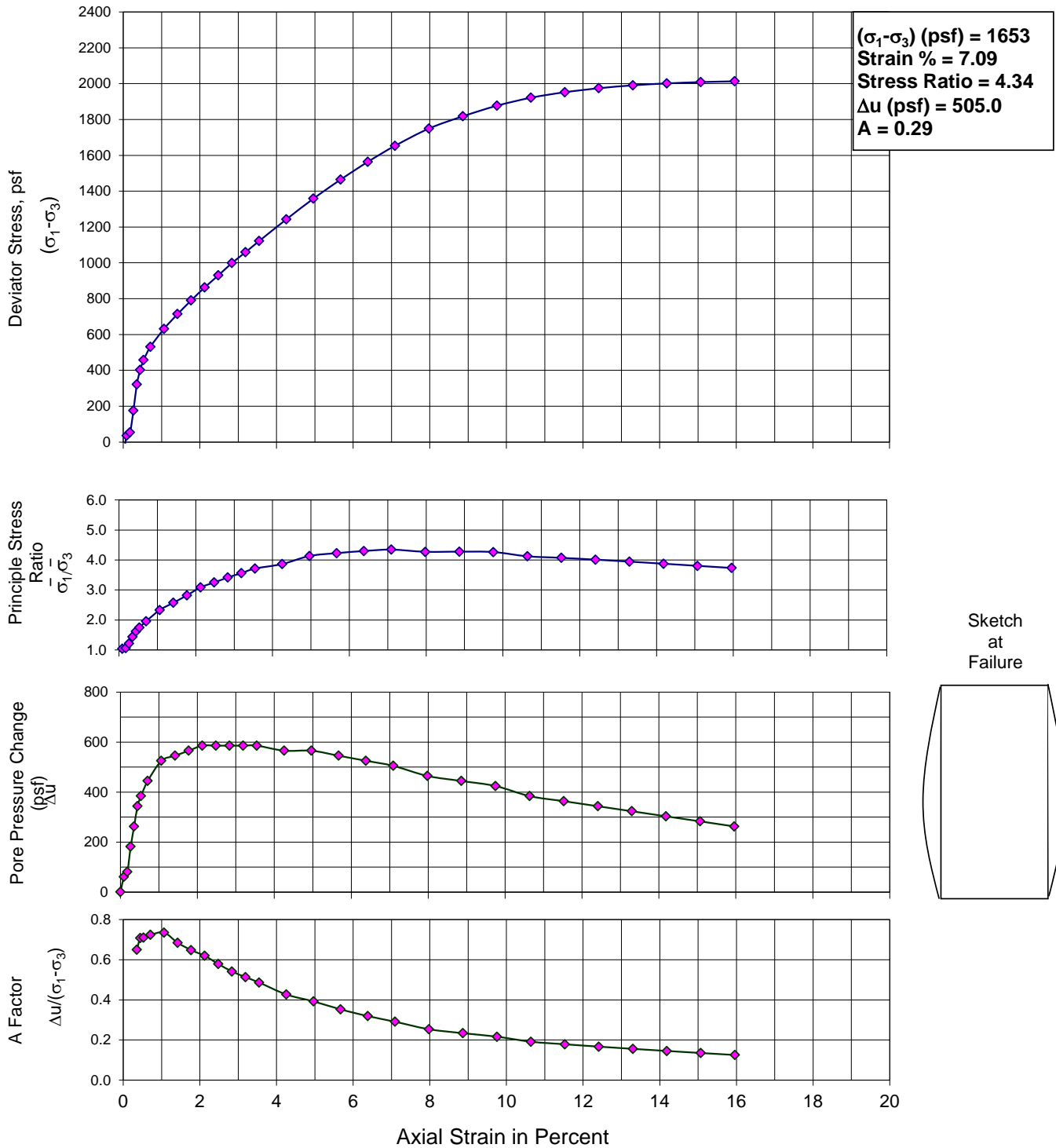
Project Name NRG Huntley Embankment Evaluation  
 Project No. 21.0056705.00  
 Project Manager Dan Troy

Location Tonawanda, NY  
 Assigned By Dan Troy  
 Report Date 8/12/2014

Reviewed By \_\_\_\_\_  
 Date Reviewed 8/12/2014

Boring/ Test Pit No.	Sample No.	Depth ft.	Lab No.	Identification Tests							Strength Tests							Laboratory Log and Soil Description
				Water Content %	LL %	PL %	OD LL %	Sieve -200 %	Hyd -2 $\mu$ %	ORG %	Dry unit wt. pcf	Torvane or Type Test	$\bar{\sigma}_c$ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or $\tau$ psf	Strain %	Internal Friction Angle	
B-11	ST-7	18- 20	1	Average Total Unit Weight (18.0-20.0') = 112.9 pcf														
		18.2		43.4							Tv= 0.14 tsf						Gray Clayey SILT Soft to Medium Consistency  Layers of Black Sand were observed at the top and bottom of the tube sample	
		18.25- 18.75		38.8					81.9	CIU	1000	$\sigma_1 - \sigma_3$ Max	1653	7.1				
		18.8		37.0						Tv= 0.34 tsf								
		18.85- 19.35		36.7					83.7	CIU	2000	$\sigma_1 - \sigma_3$ Max	2536	8.1				
		19.4		35.3						Tv= 0.29 tsf								
		19.4- 19.9		34.7					86.1	CIU	4000	$\sigma_1 - \sigma_3$ Max	4863	10.7	37.9°			





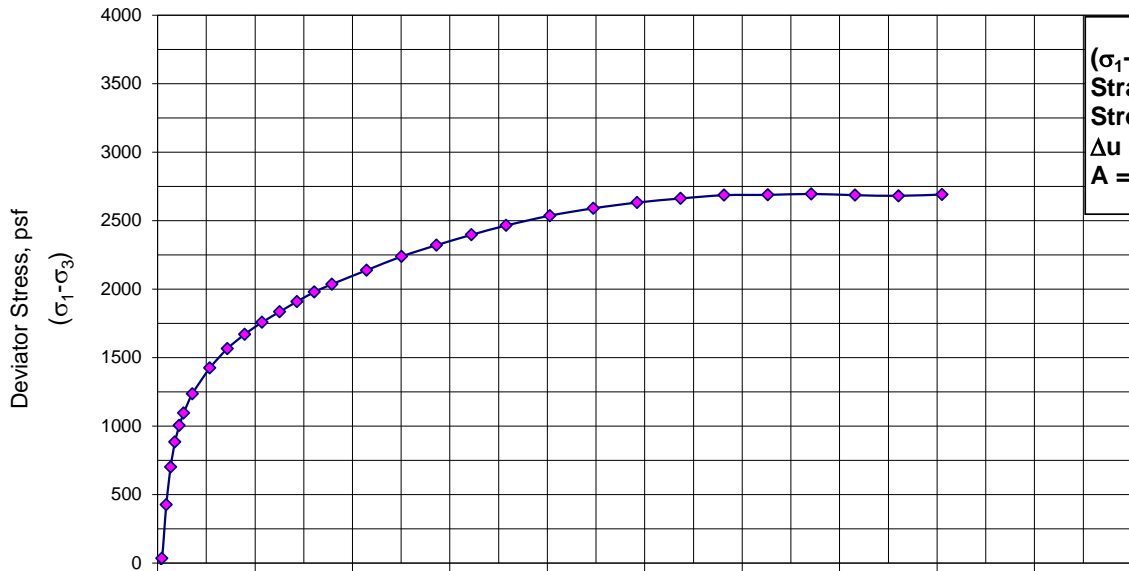
195 Frances Ave.  
 Cranston, RI 02910

SOIL DESCRIPTION:	Gray Clayey SILT
LIQUID LIMIT: NT	PLASTIC LIMIT: NT
SPECIFIC GRAVITY: NT	

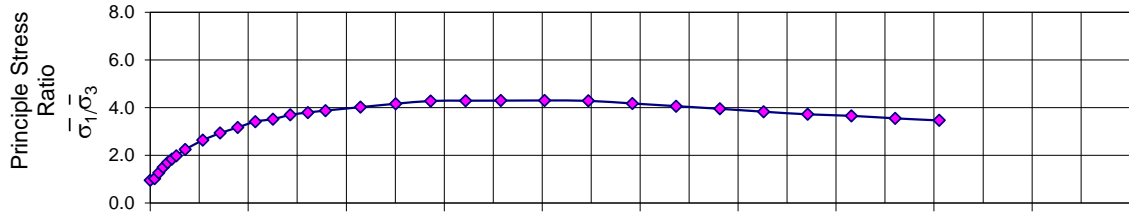
TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS	
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	INITIAL STRESS, $\sigma_1 = \sigma_3$ , ksf	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %
T 1.1	38.8	81.9	5.700	2.860	1.00	8.64	3.20	99.6	35.7	84.6

RATE OF STRAIN, PERCENT PER MINUTE	0.158
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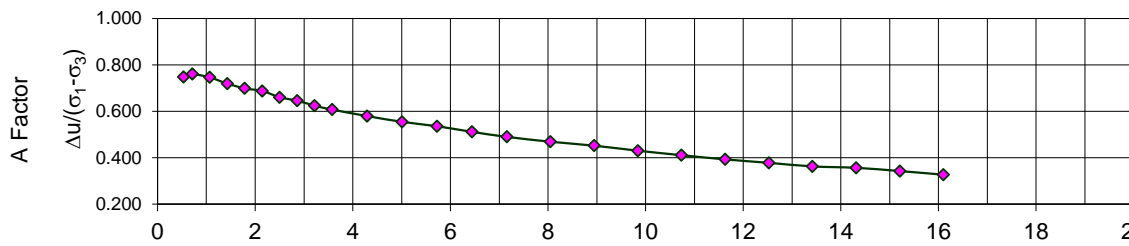
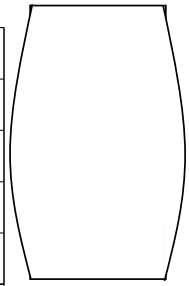
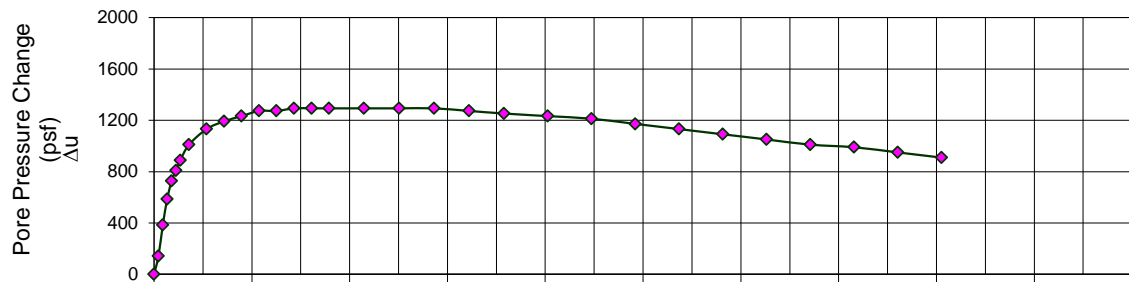
NRG Huntley Embankment Evaluation Tonawanda, NY TRIAXIAL COMPRESSION TESTS (CIU)	
BORING: B-11	FILE NO: 21.0056705.00
SAMPLE: ST-7	Date: 7/15/2014
DEPTH: 18.25-18.75	Tech.: AS
TEST NO: T 1.1	Reviewer: MBP



$(\sigma_1 - \sigma_3)$  (psf) = 2536  
 Strain % = 8.05  
 Stress Ratio = 4.30  
 $\Delta u = 1232.3$   
 $A = 0.47$



Sketch at Failure



Axial Strain in Percent



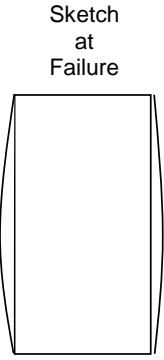
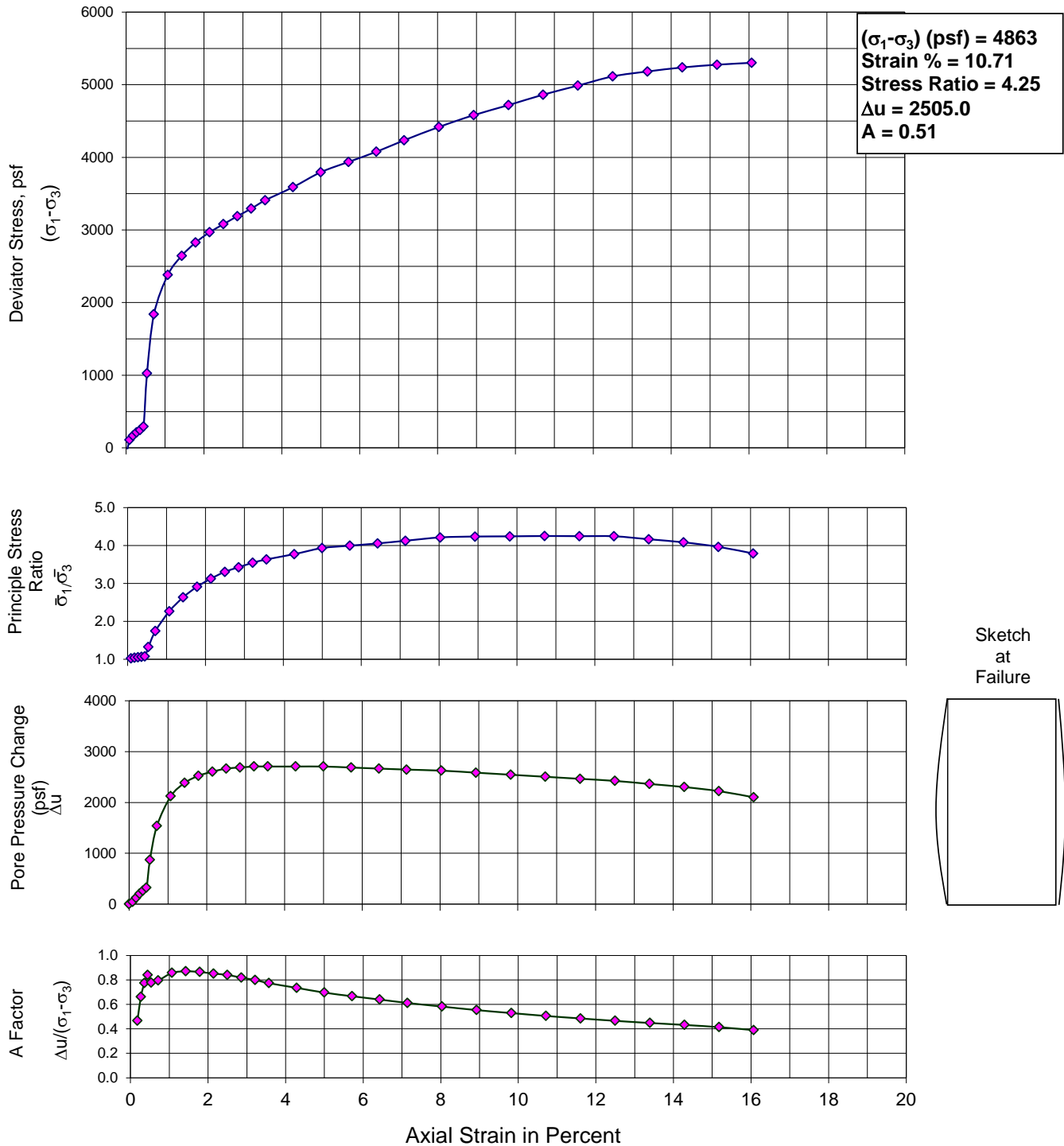
195 Frances Ave.  
Cranston, RI 02910

SOIL DESCRIPTION:	Gray Clayey SILT
LIQUID LIMIT: NT	PLASTIC LIMIT: NT
SPECIFIC GRAVITY: NT	

TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS	
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	INITIAL STRESS, ksf $\sigma_1 = \sigma_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %
T 1.2	36.7	83.7	5.700	2.862	2.00	8.64	5.91	99.6	33.1	89.0

RATE OF STRAIN, PERCENT PER MINUTE	0.158
------------------------------------	-------

<b>NRG Huntley Embankment Evaluation</b> <b>Tonawanda, NY</b> <b>TRIAXIAL COMPRESSION TESTS (CIU)</b>	
BORING: B-11	FILE NO: 21.0056705.00
SAMPLE: ST-7	Date: 7/15/14
DEPTH: 18.85-19.35'	Tech.: AS
TEST NO: T 1.2	Reviewer: MBP



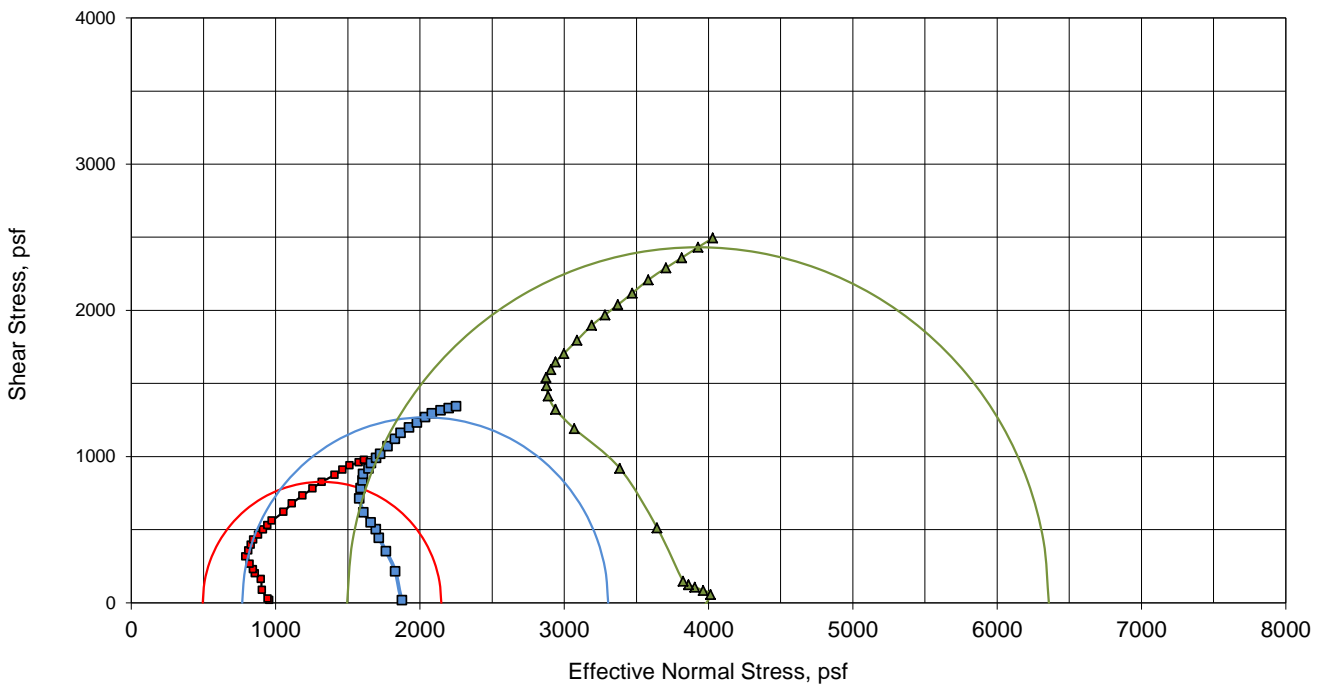
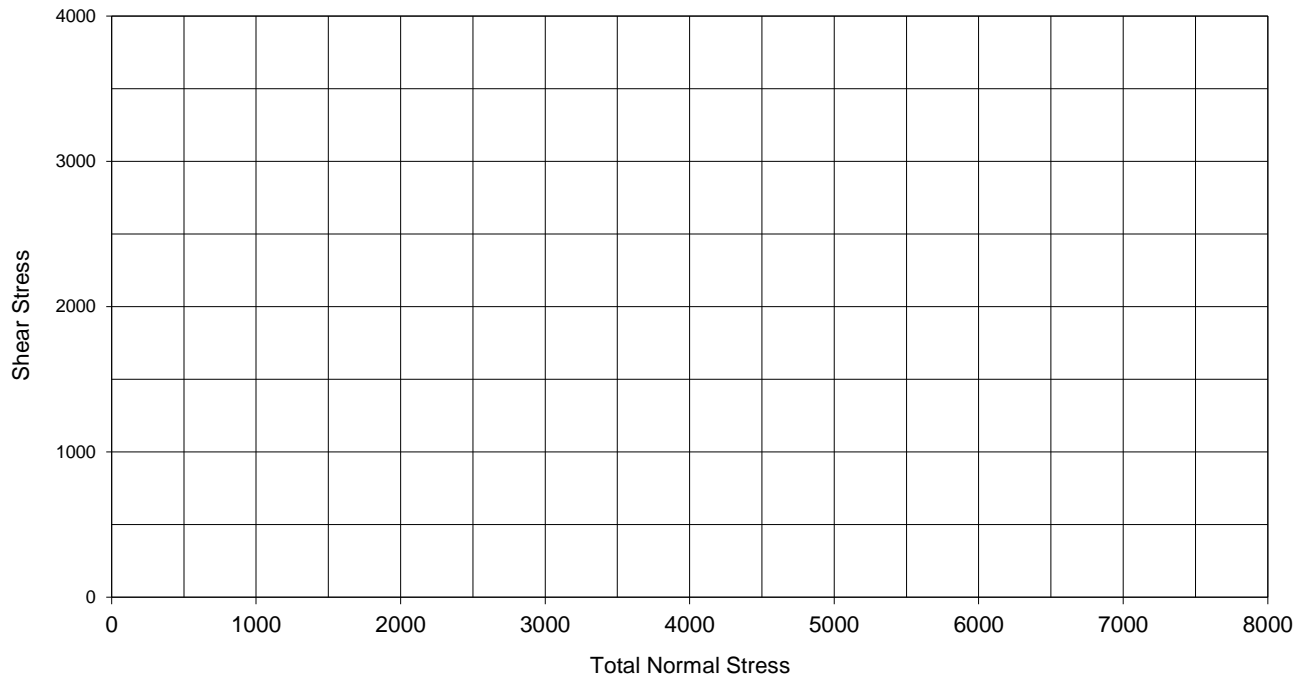
195 Frances Ave.  
 Cranston, RI 02910

SOIL DESCRIPTION:	Gray Clayey SILT
LIQUID LIMIT: NT	PLASTIC LIMIT: NT
	SPECIFIC GRAVITY: NT

TEST NO. / SYMBOL	INITIAL CONDITIONS				CONDITIONS BEFORE SHEAR				FINAL CONDITIONS	
	INITIAL WATER CONTENT, %	INITIAL DRY UNIT WEIGHT, pcf	SAMPLE HEIGHT, IN.	SAMPLE DIAMETER, IN.	INITIAL STRESS, ksf $\bar{\sigma}_1 = \bar{\sigma}_3$	FINAL BACK PRESSURE, ksf	VOLUMETRIC STRAIN, %	PORE PRESSURE RESPONSE, %	FINAL WATER CONTENT, %	FINAL DRY UNIT WEIGHT, %
T 1.3	34.7	86.1	5.714	2.858	4.00	8.64	5.97	99.6	29.8	91.6

RATE OF STRAIN, PERCENT PER MINUTE	0.158
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<b>NRG Huntley Embankment Evaluation</b>	
<b>Tonawanda, NY</b>	
<b>TRIAXIAL COMPRESSION TESTS (CIU)</b>	
BORING: B-11	FILE NO: 21.0056705.00
SAMPLE: ST-7	Date: 7/15/2014
DEPTH: 19.4-19.9'	Tech.: AS
TEST NO: T 1.3	Reviewer: MBP



FAILURE CRITERIA:  $\sigma_1 - \sigma_3$  MAX  
 REMARKS:

SOIL DESCRIPTION: Gray Clayey SILT  
 LIQUID PLASTIC SPECIFIC  
 LIMIT: NT LIMIT: NT GRAVITY: NT



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401-467-6454

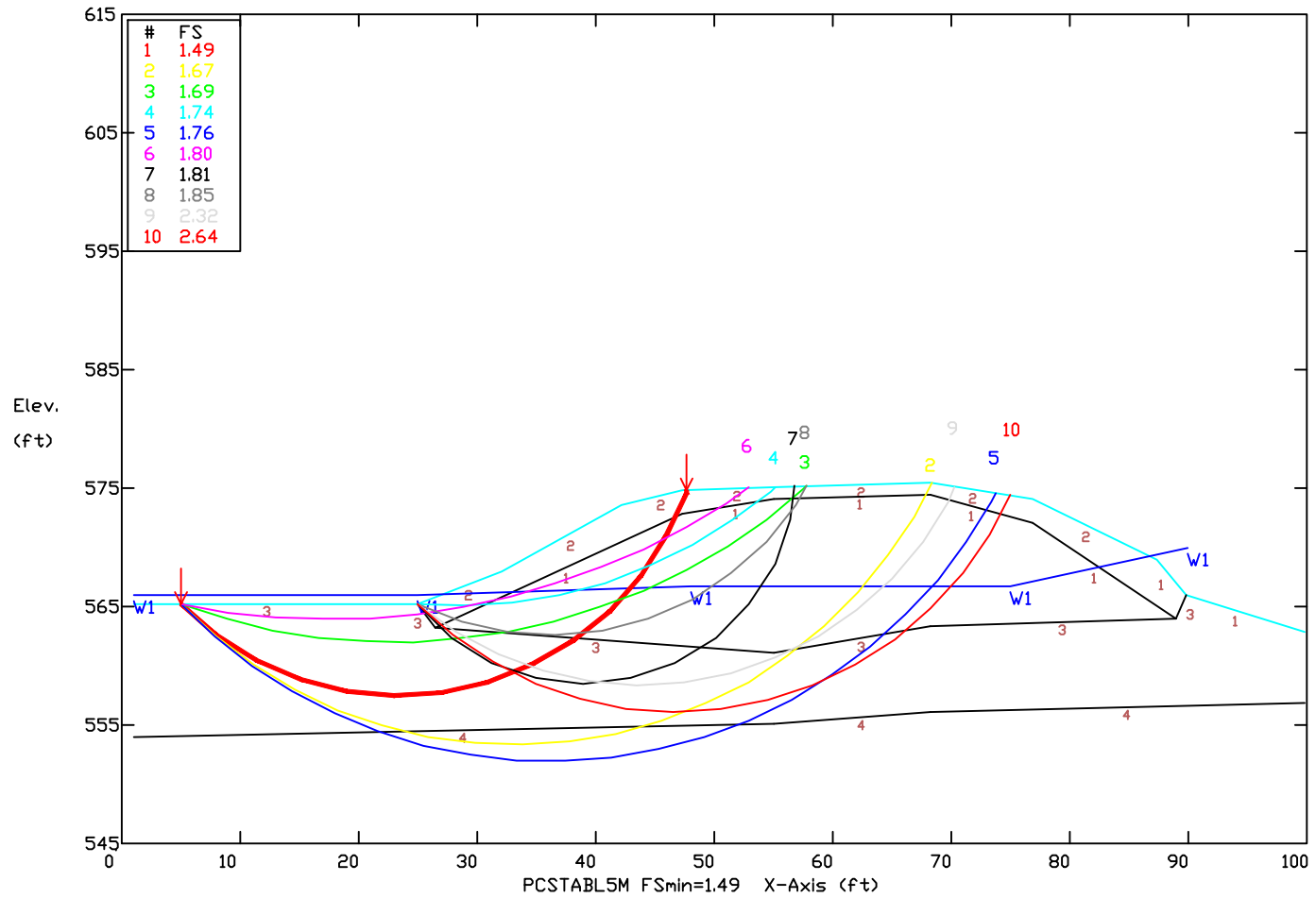
**NRG Huntley Embankment Evaluation**  
**Tonawanda, NY**  
**TRIAxIAL COMPRESSION TESTS (CIU)**

BORING: B-11	FILE NO: 21.0056705.00
SAMPLE: ST-7	Date: 7/15/2014
DEPTH: 18-20'	Tech.: AS
TEST SERIES: 1	Reviewer: MBP

**ATTACHMENT 3**  
**SLOPE STABILITY MODEL ANALYSES**

South Settling Pond NRG No Seismic

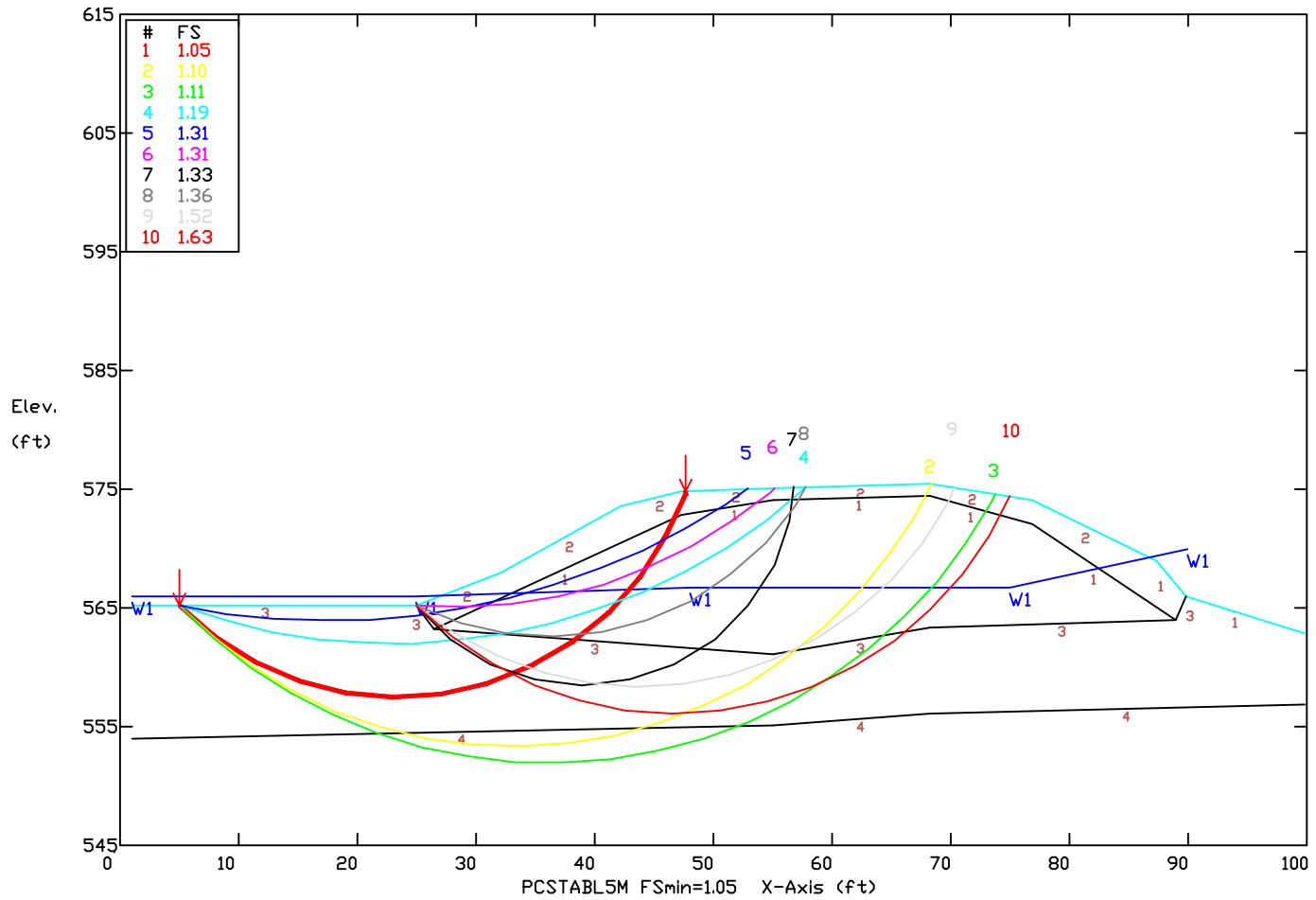
Ten Most Critical. C:\SPOND\DC.PL T By: GZA dtroy 10-03-14 2:59pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	1
2	140	140	0	40	0	0	0
3	120.5	124.5	0	25	0	0	1
4	126	130	0	19	0	0	1

South Settling Pond NRG Seismic 0.10g

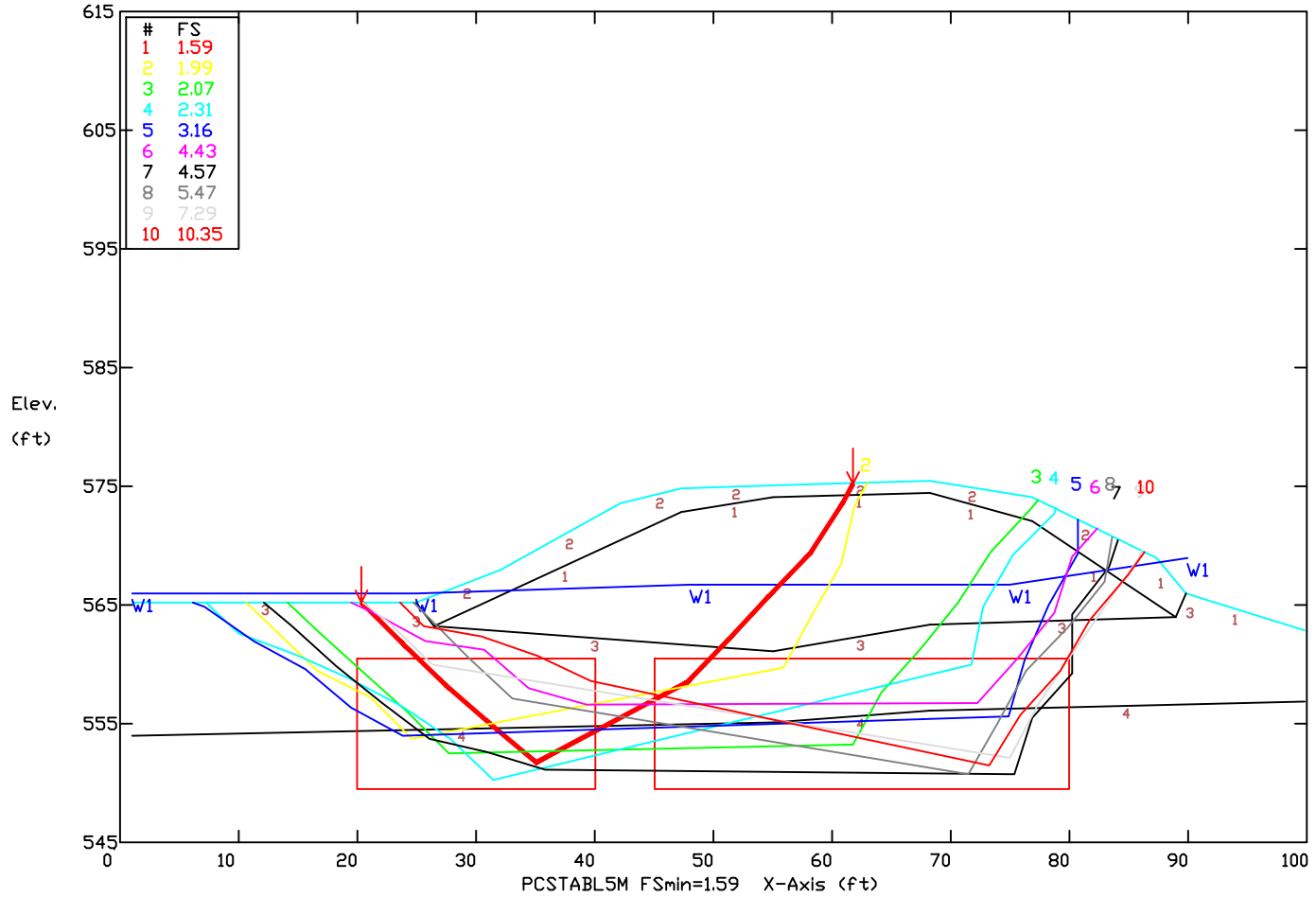
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Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	1
2	140	140	0	40	0	0	0
3	120.5	124.5	0	25	0	0	1
4	126	130	0	19	0	0	1

South Settling Pond NRG No Seismic

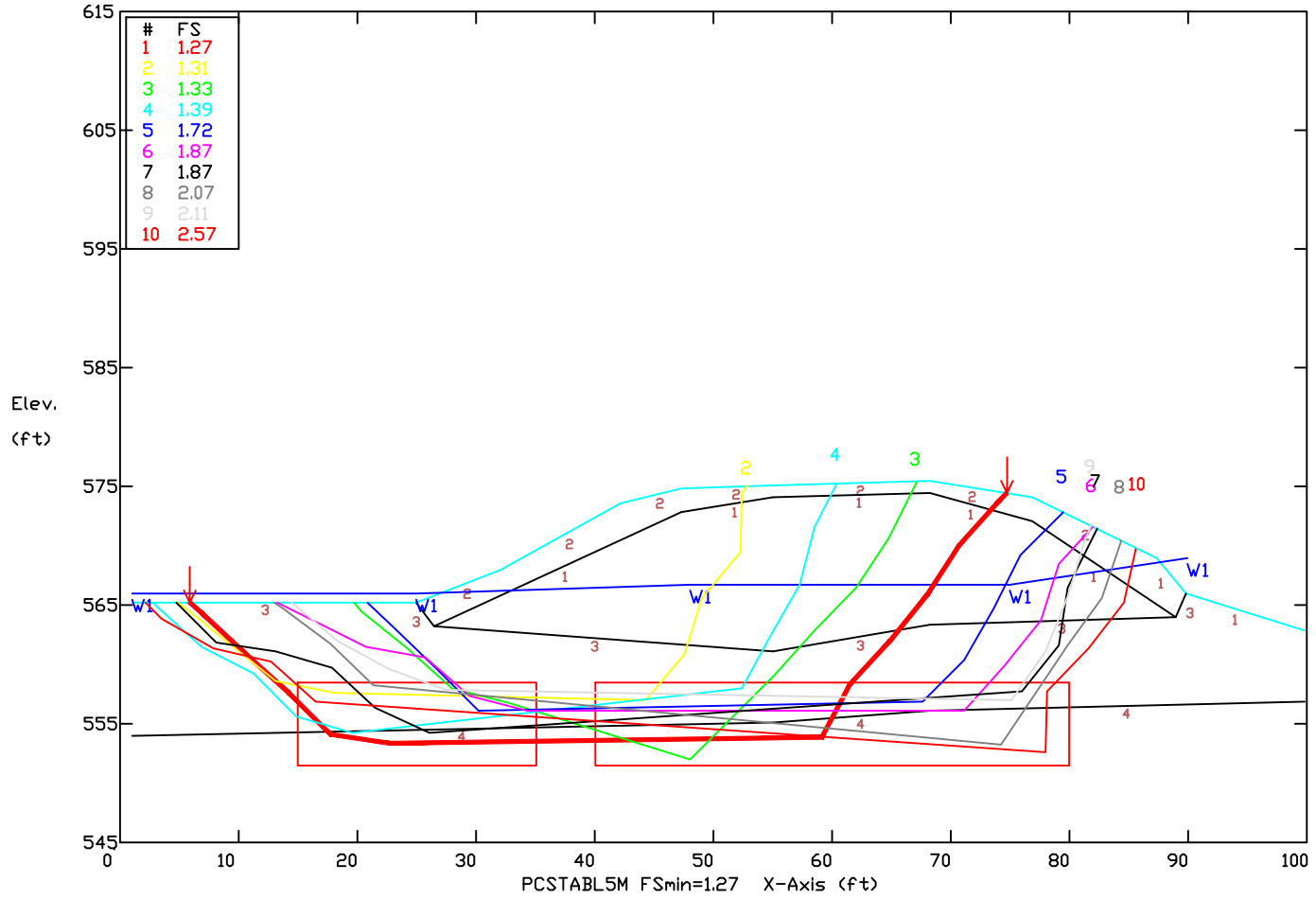
Ten Most Critical. C:\SPOND\B.PL T By: GZA dtroy 10-03-14 2:58pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	1
2	140	140	0	40	0	0	0
3	120.5	124.5	0	25	0	0	1
4	126	130	0	19	0	0	1

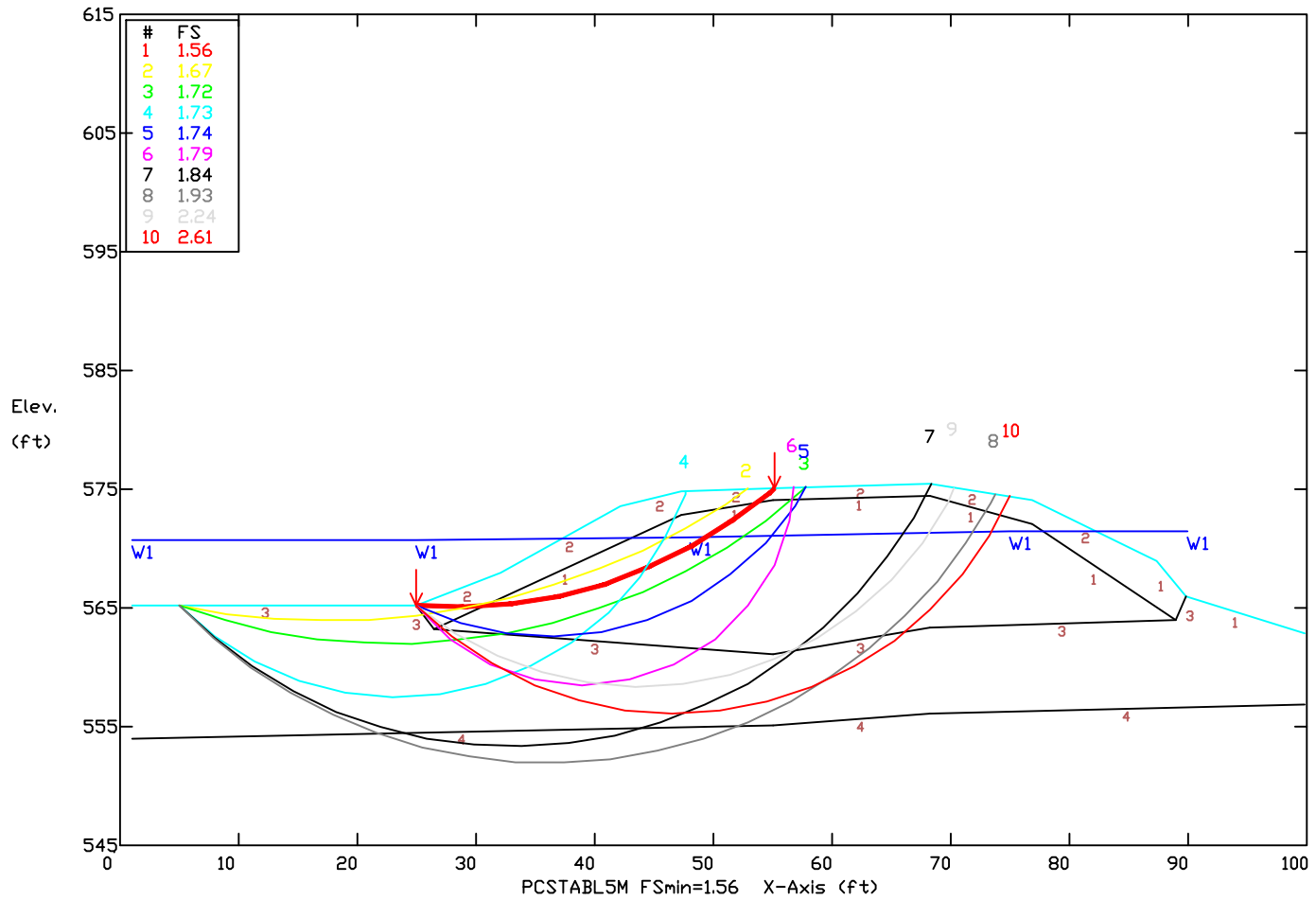
South Settling Pond NRG Seismic 0.10g

Ten Most Critical. C:SPOND\BG2.PLT By: GZA dtroy 10-03-14 2:59pm



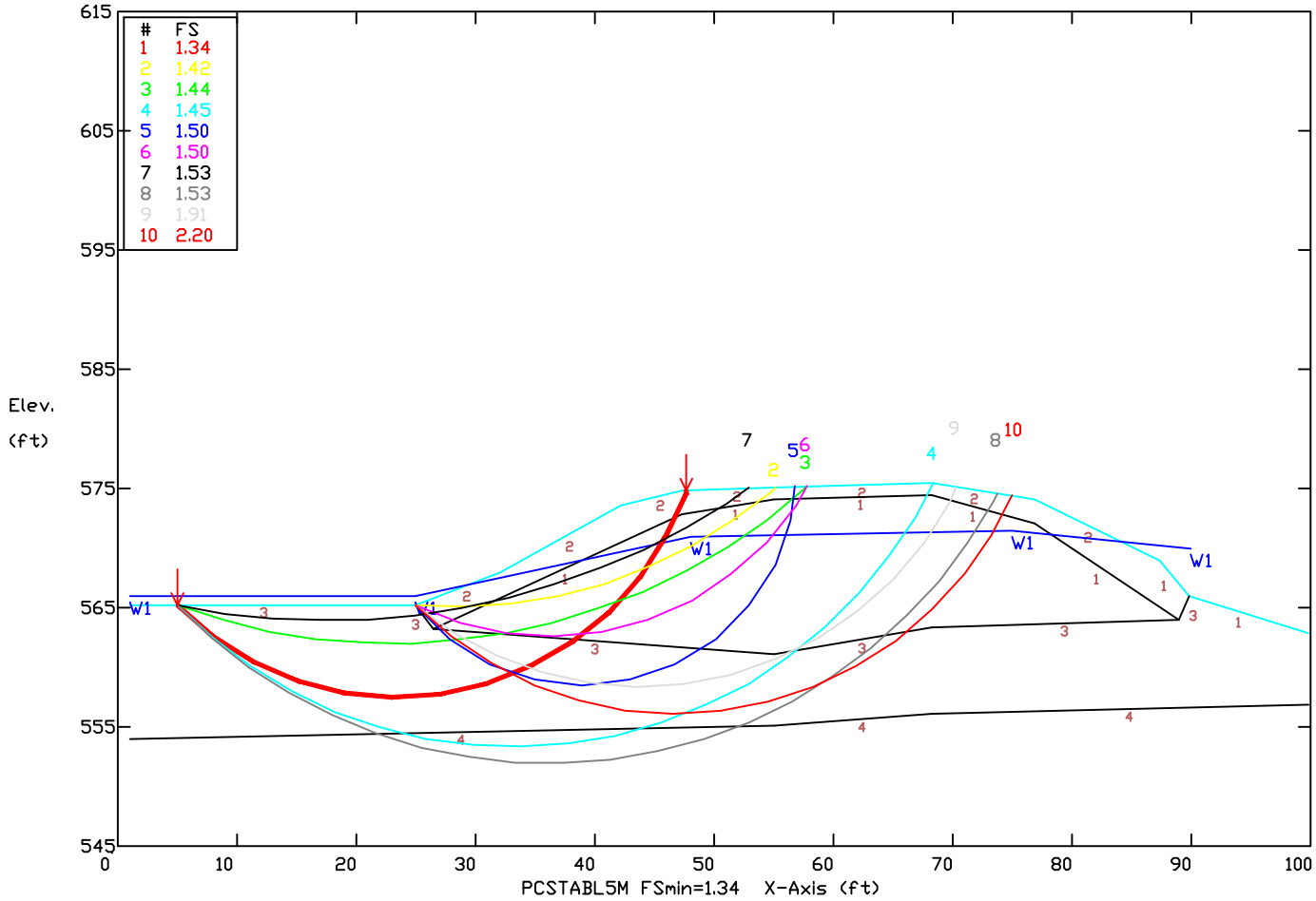
Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	1
2	140	140	0	40	0	0	0
3	120.5	124.5	0	25	0	0	1
4	126	130	0	19	0	0	1

South Settling Pond 1/2 PMF NRG No Seismic  
 Ten Most Critical. C:SPCPMF.PLT By: GZA dtroy 10-03-14 2:57pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	1
2	140	140	0	40	0	0	1
3	120.5	124.5	0	25	0	0	1
4	126	130	0	19	0	0	1

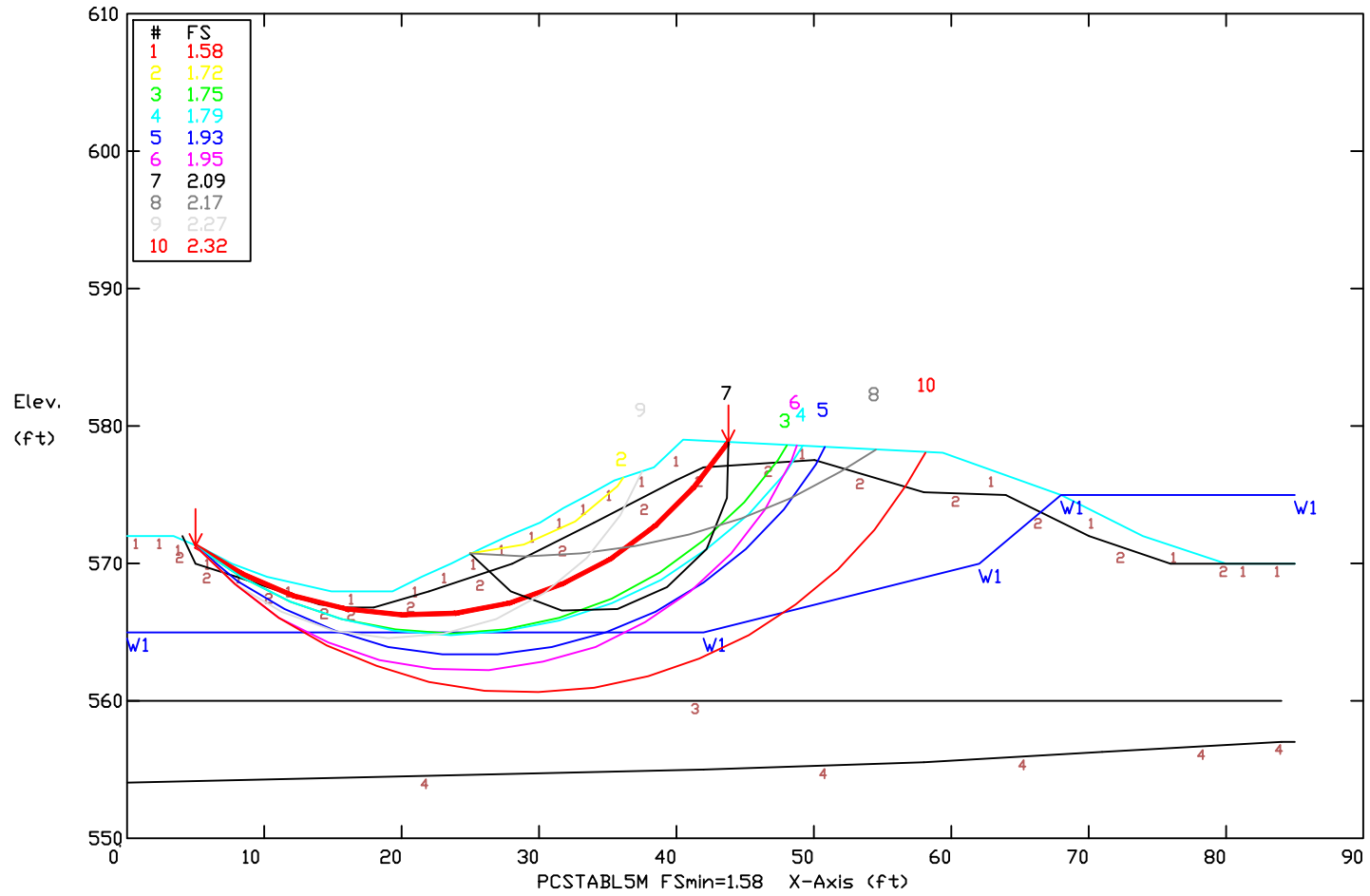
South Settling Pond RAPID DRAWDOWN NRG No Seismic  
 Ten Most Critical. C:SPCRDD.PLT By: GZA dtroy 10-03-14 2:58pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	128	130	0	30	0	0	1
2	140	140	0	40	0	0	1
3	120.5	124.5	0	25	0	0	1
4	126	130	0	19	0	0	1

Pond 2 No Seismic

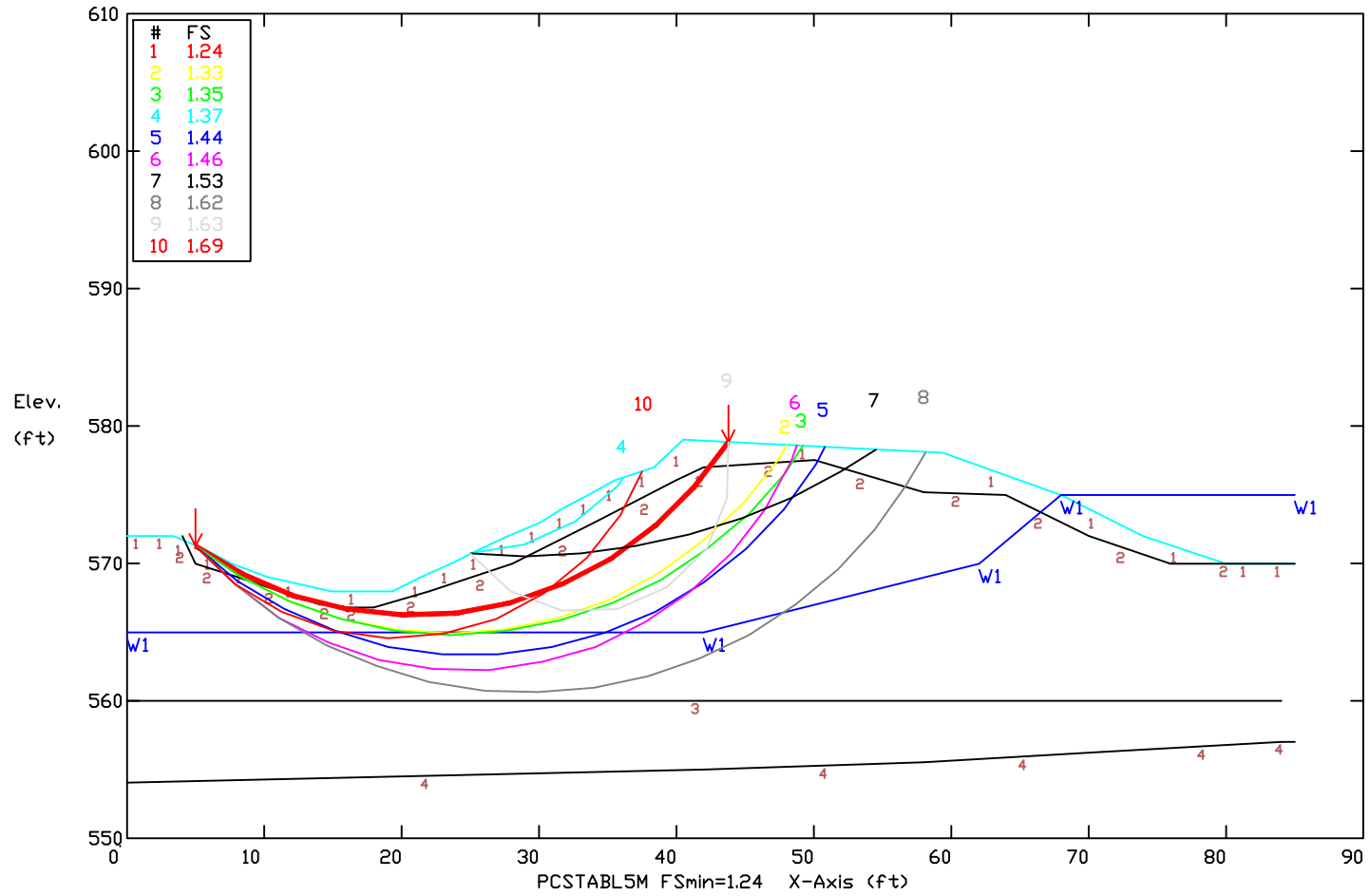
Ten Most Critical. C:POND2C.PLT By: GZA dtroy 10-03-14 1:54pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	140	140	0	40	0	0	1
2	122	126	0	28	0	0	1
3	113	117	0	38	0	0	1
4	126	132	0	19	0	0	1

Pond 2 NRG Seismic 0.1g

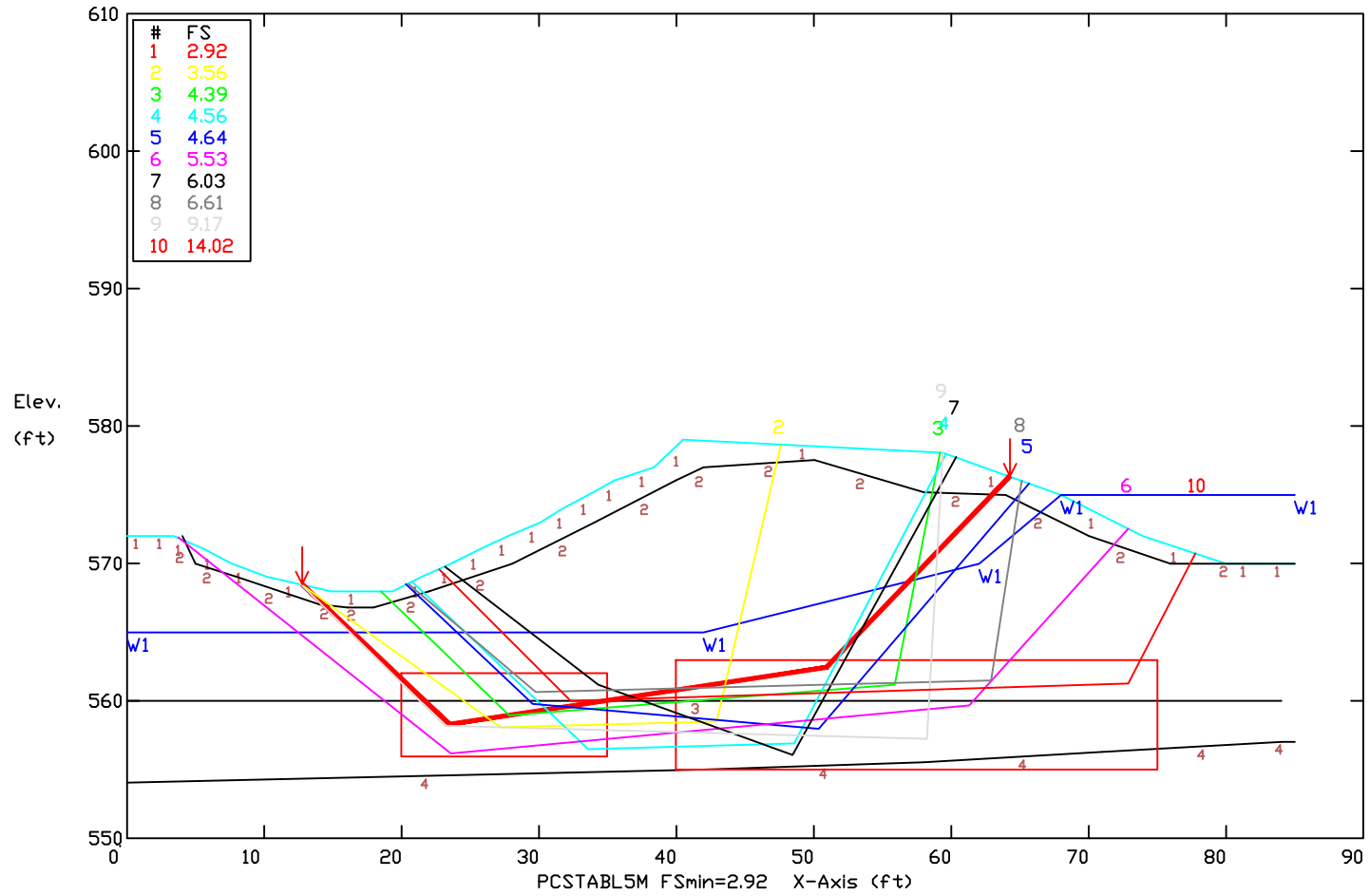
Ten Most Critical. C:\POND2CG2.PLT By: GZA dtroy 10-03-14 1:54pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	140	140	0	40	0	0	1
2	122	126	0	28	0	0	1
3	113	117	0	38	0	0	1
4	126	130	0	19	0	0	1

Pond 2 NRG No Seismic

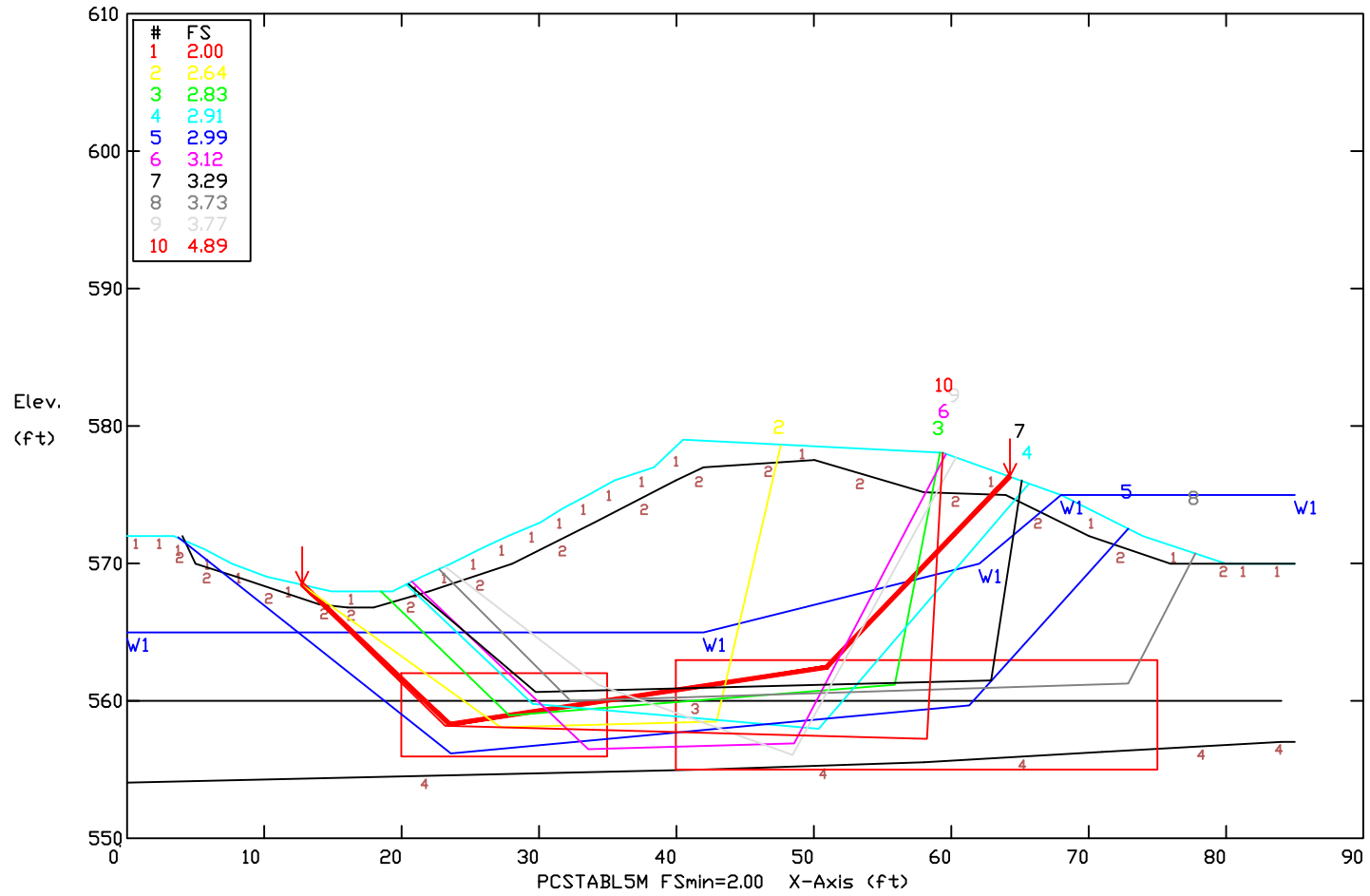
Ten Most Critical. C:\POND2B.PLT By: GZA dtroy 10-03-14 2:02pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	140	140	0	40	0	0	1
2	122	126	0	28	0	0	1
3	113	117	0	38	0	0	1
4	126	130	0	19	0	0	1

Pond 2 NRG Seismic 0.10g

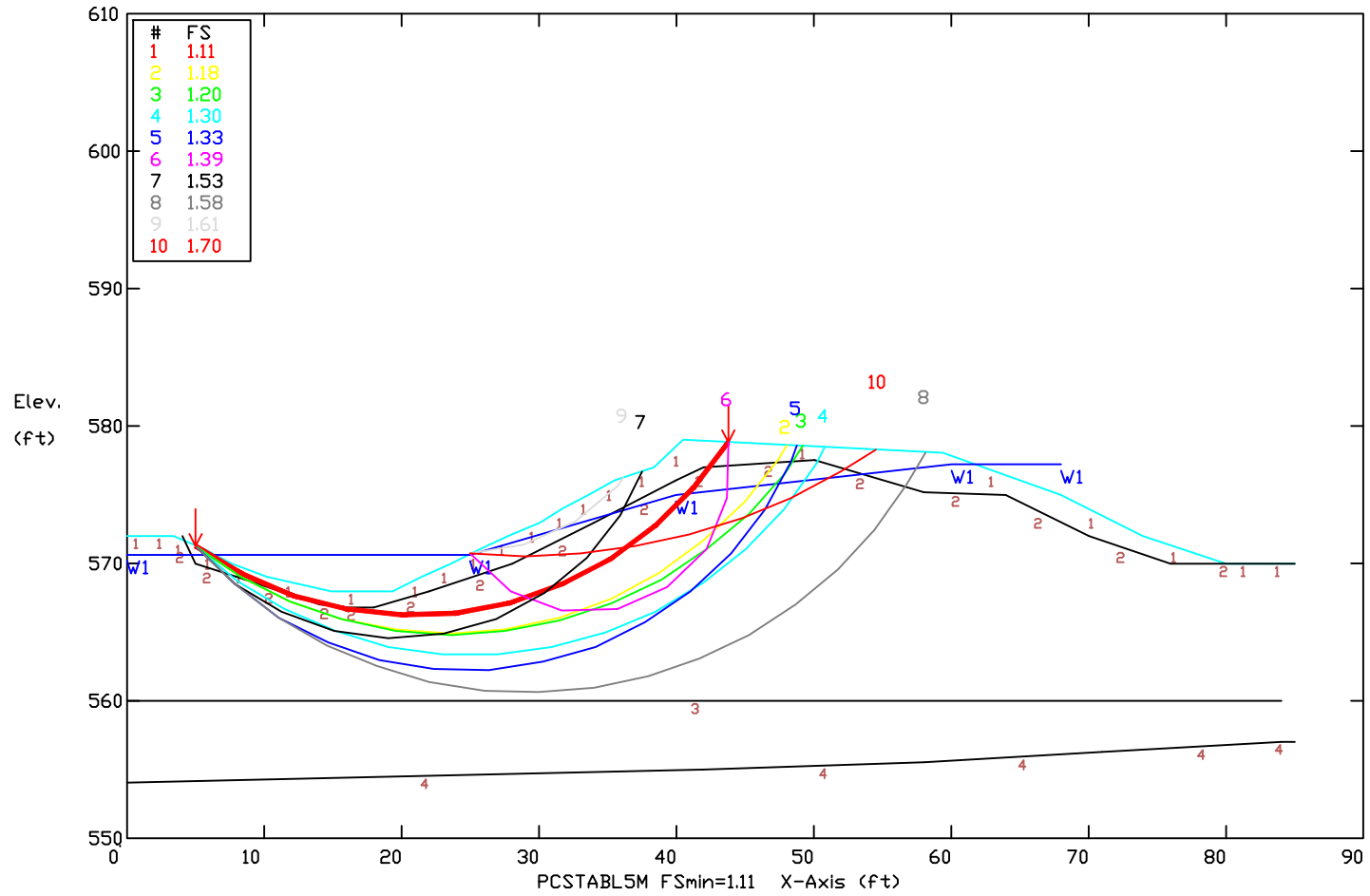
Ten Most Critical. C:\POND2BG2.PLT By: GZA dtroy 10-03-14 2:03pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	140	140	0	40	0	0	1
2	122	126	0	28	0	0	1
3	113	117	0	38	0	0	1
4	126	130	0	19	0	0	1

Pond 2 1/2PMC No Seismic

Ten Most Critical. C:\P2\CPMC.PLT By: GZA dtroy 10-03-14 2:03pm

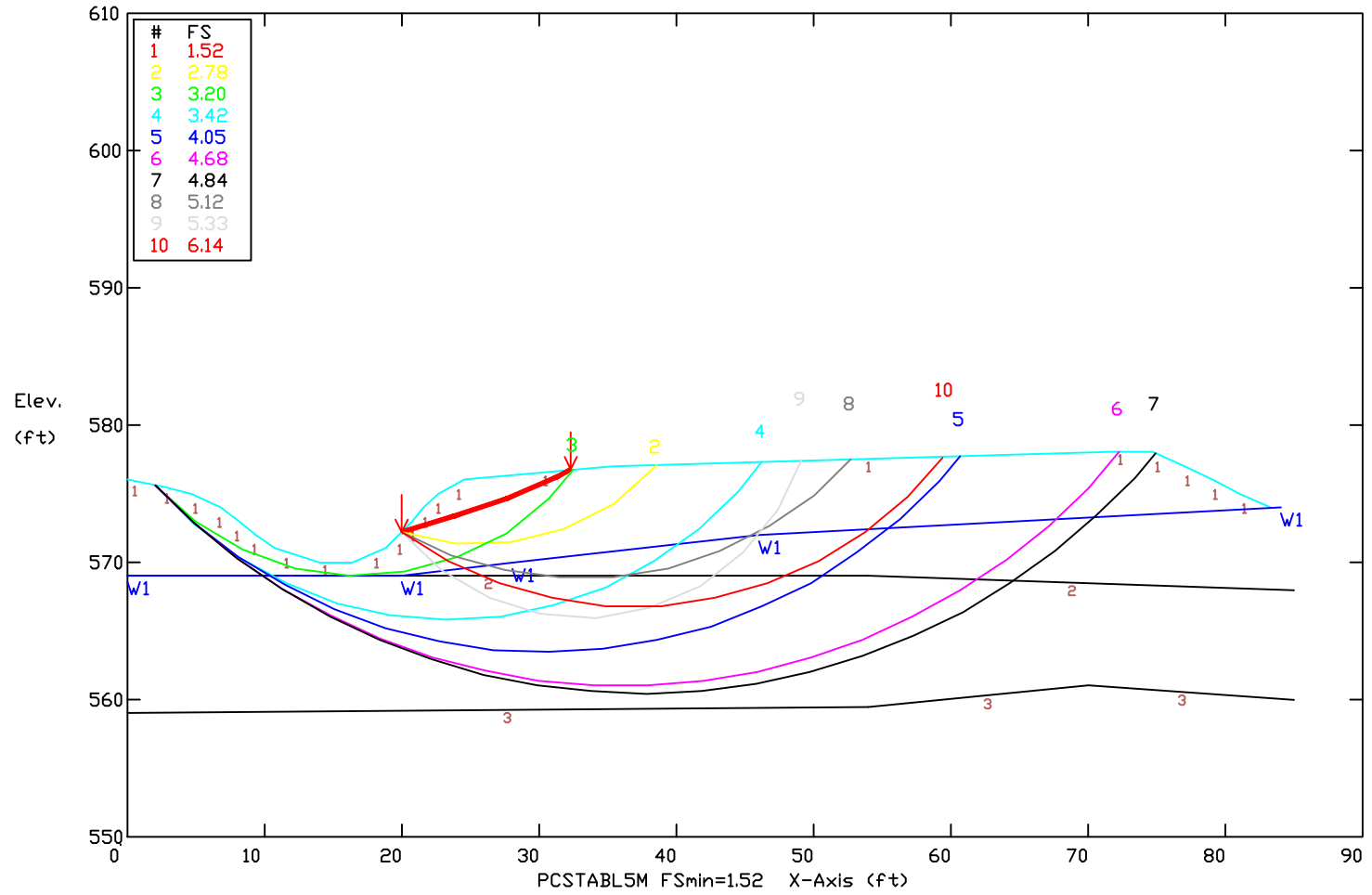


Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	140	140	0	40	0	0	1
2	122	126	0	28	0	0	1
3	113	117	0	38	0	0	1
4	126	130	0	19	0	0	1



Pond 3 NRG no seismic

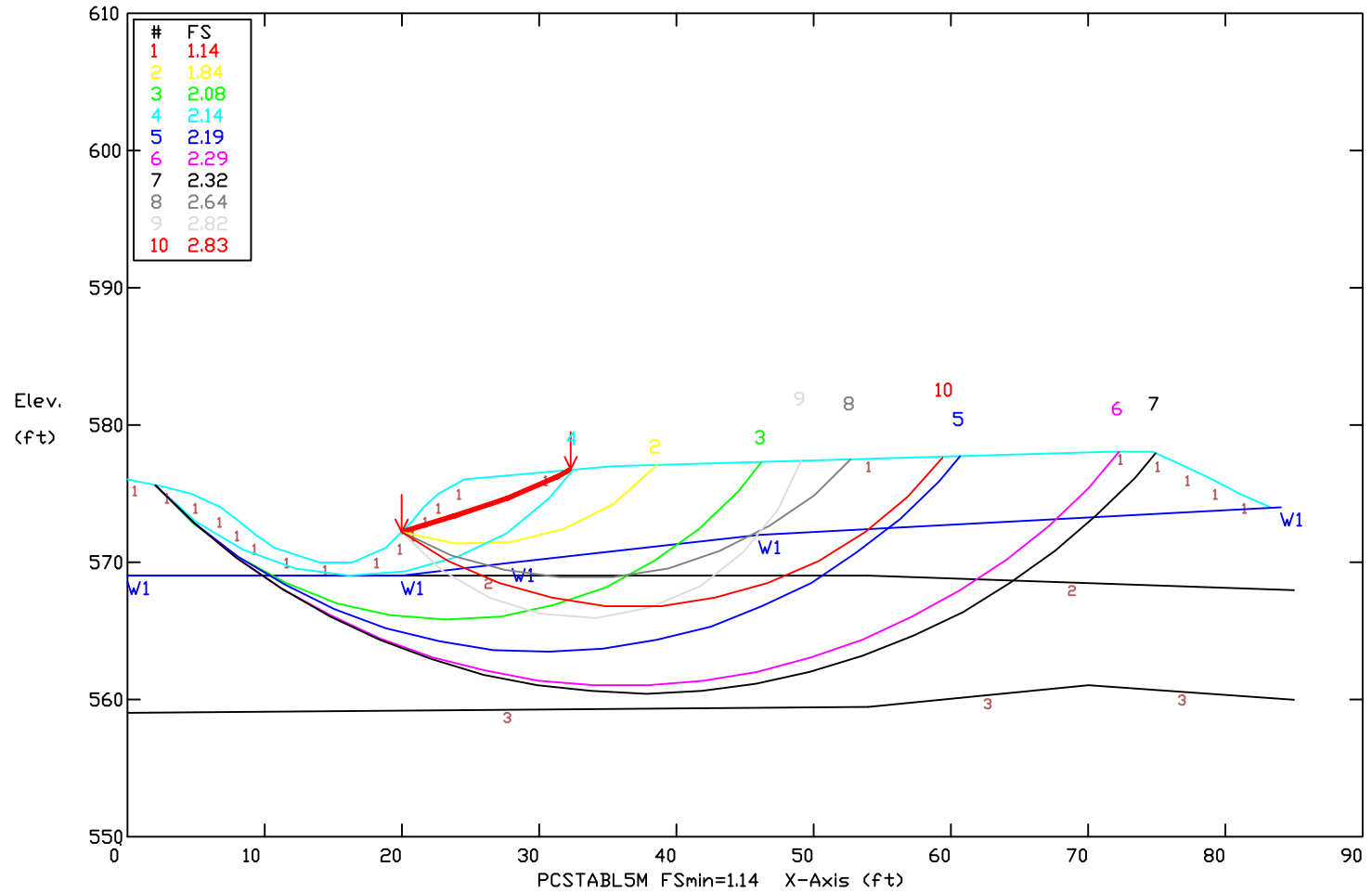
Ten Most Critical. C:\POND3C.PLT By: GZA dtroy 10-03-14 2:04pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	122	126	0	28	0	0	1
2	125.4	128	0	29	0	0	1
3	133.5	135	0	29	0	0	1

Pond 3 NRG seismic 0.10g

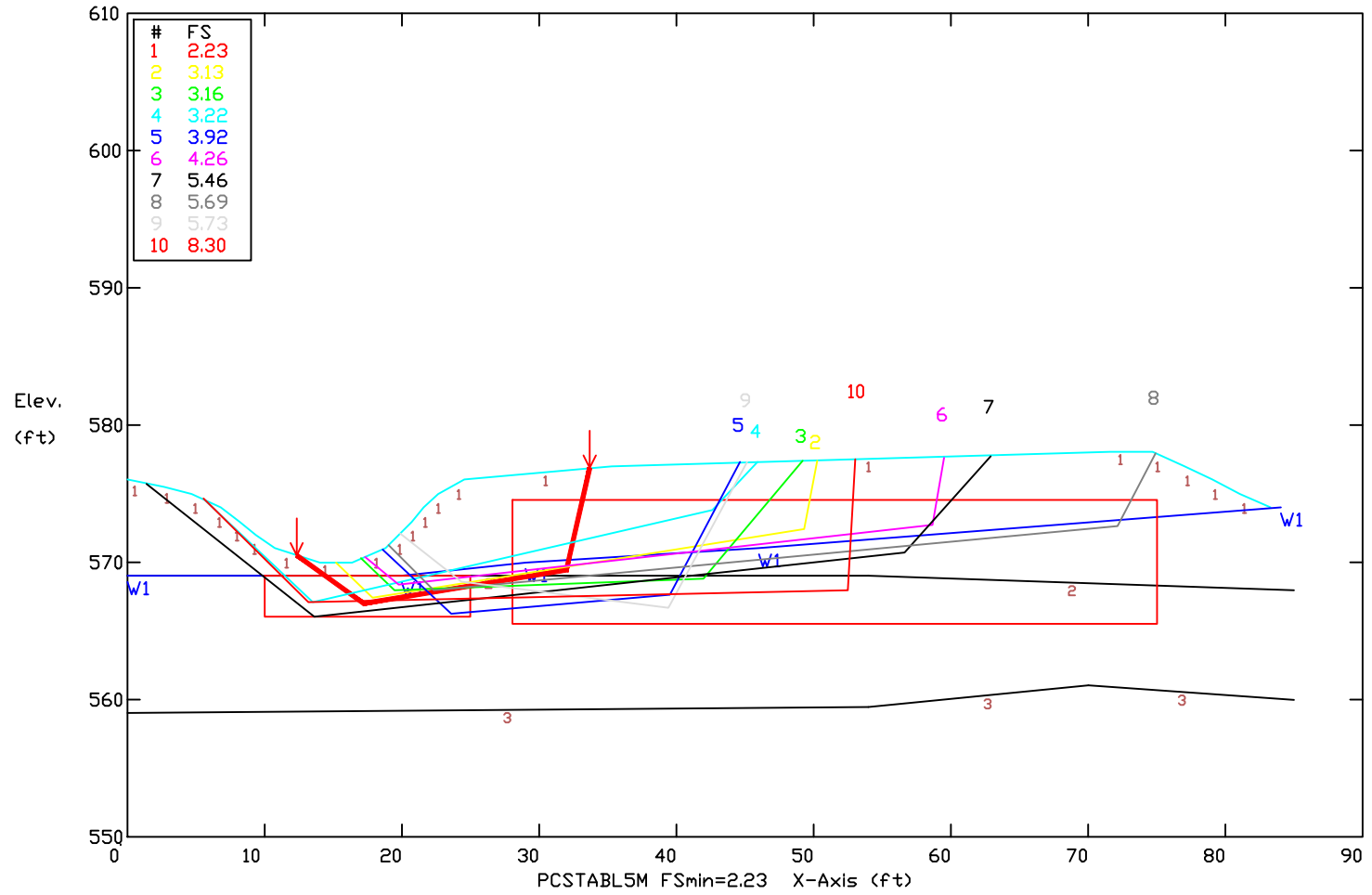
Ten Most Critical. C:\POND3CG2.PLT By: GZA dtroy 10-03-14 2:05pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	122	126	0	28	0	0	1
2	125.4	128	0	29	0	0	1
3	133.5	135	0	29	0	0	1

Pond 3 Block NRG No Seismic

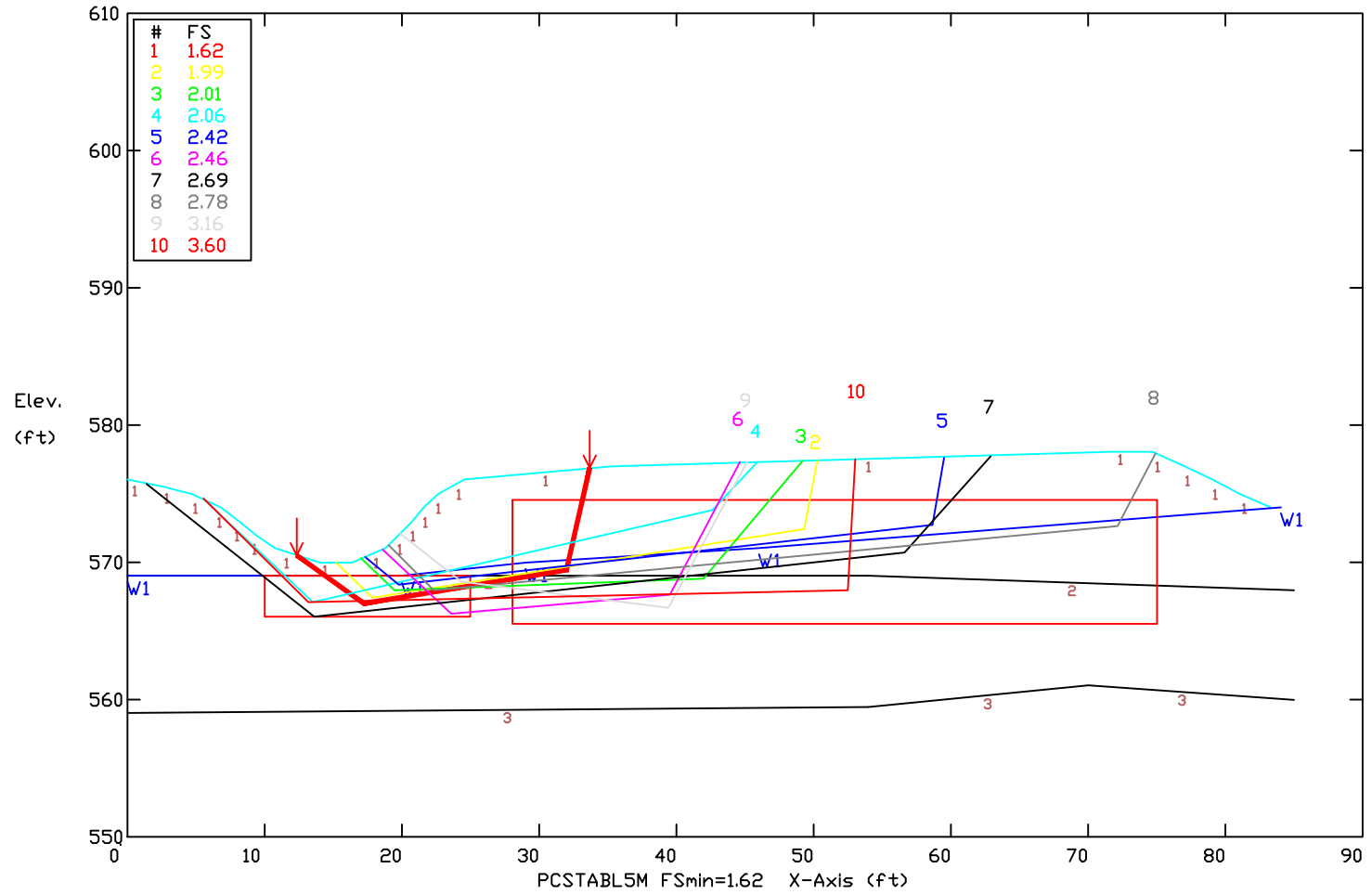
Ten Most Critical. C:\POND3B.PLT By: GZA dtroy 10-03-14 2:06pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	122	126	0	28	0	0	1
2	125.4	128	0	29	0	0	1
3	133.5	135	0	29	0	0	1

Pond 3 Block NRG Seismic 0.10g

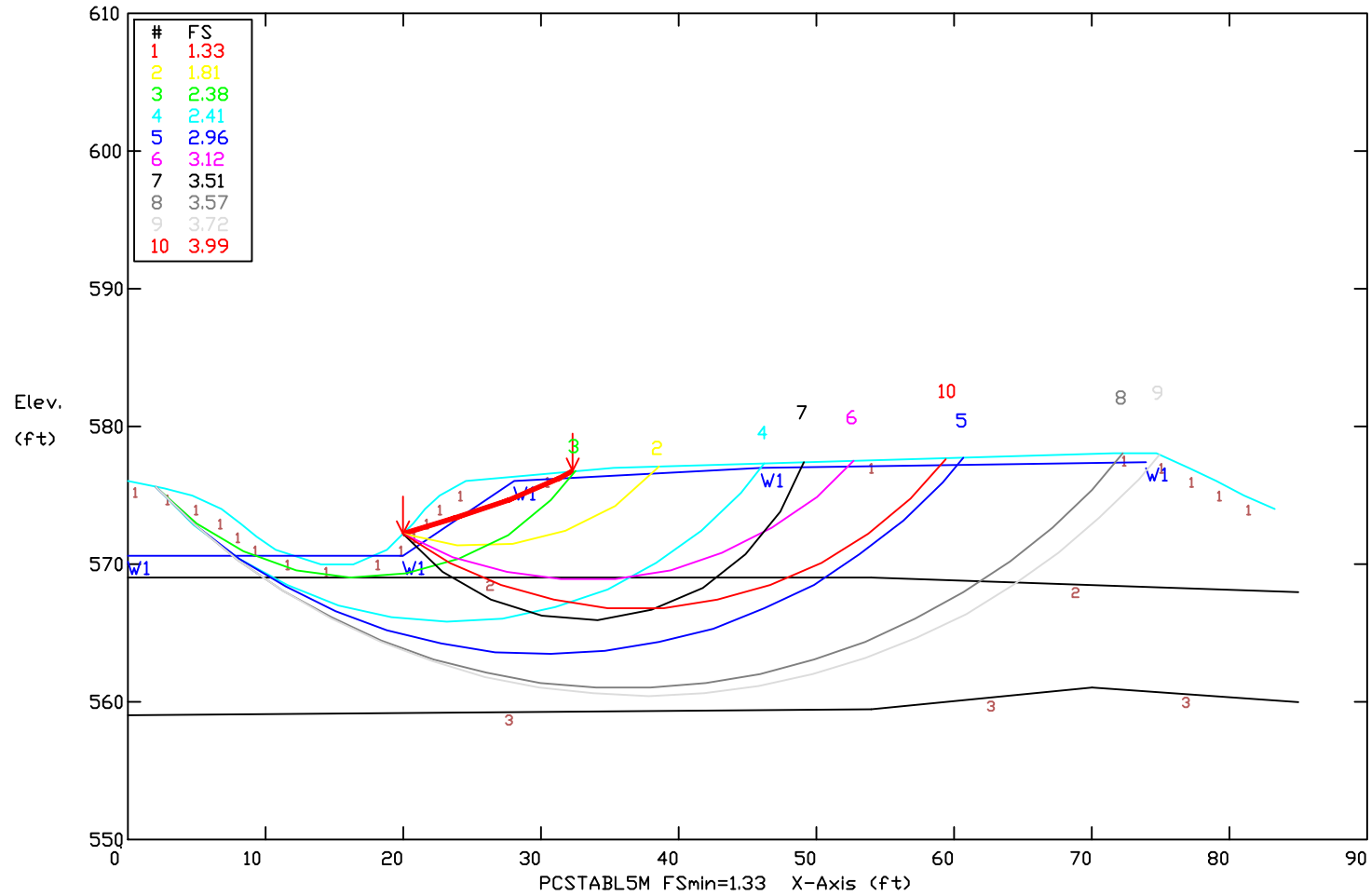
Ten Most Critical. C:\POND3BG2.PLT By: GZA dtroy 10-03-14 2:06pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	122	126	0	28	0	0	1
2	125.4	128	0	29	0	0	1
3	133.5	135	0	29	0	0	1

Pond 3 1/2 PMF NRG no seismic

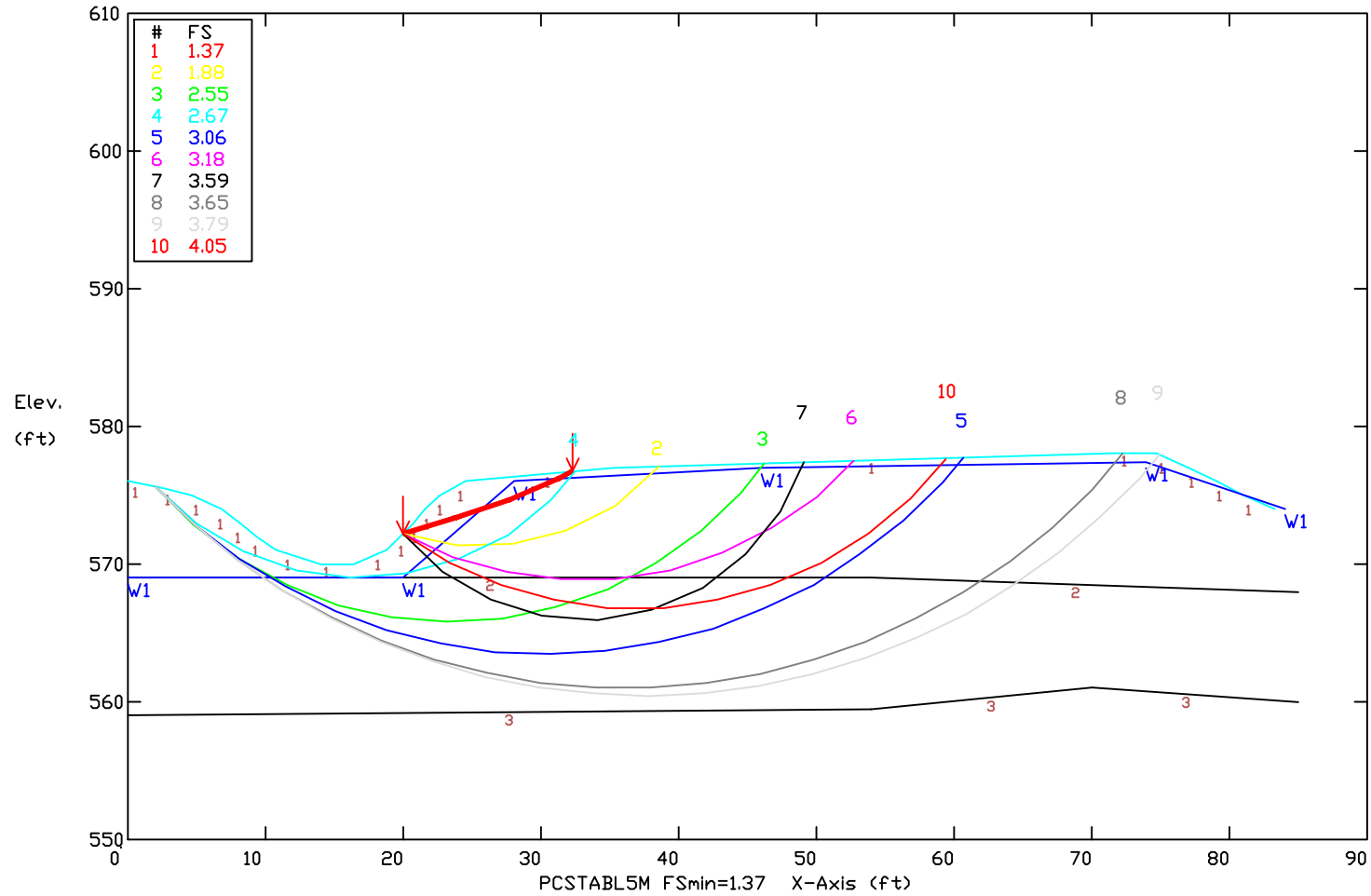
Ten Most Critical. C:\P3CPMF.PLT By: GZA dtroy 10-03-14 2:07pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	122	126	0	28	0	0	1
2	125.4	128	0	29	0	0	1
3	133.5	135	0	29	0	0	1

Pond 3 RAPID DRAWDOWN NRG no seismic

Ten Most Critical. C:\P3CRDD.PLT By: GZA dtroy 10-03-14 2:07pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	122	126	0	28	0	0	1
2	125.4	128	0	29	0	0	1
3	133.5	135	0	29	0	0	1