Dam 1 Stability Evaluation

Dam Crest Elevation 1,245 feet

Prepared for
Northshore Mining Company
Silver Bay, Minnesota

September 2013

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BARR

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CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

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1.0 Introduction

1.1 Introduction

This report presents the seepage and slope stability analyses performed by Barr Engineering Company (Barr) for the proposed 2014 raise of the Dam 1 embankment at the Northshore Mining Company (NSM) Milepost 7 Tailing Basin (Milepost 7) facility in Silver Bay, Minnesota. Barr previously performed a detailed slope stability and seepage analysis for the raise of Dam 1 to elevation 1,215 feet in 2009. As part of the engineering effort in 2009, preliminary analyses were also performed on dam raises to elevations 1,230, 1,245, and 1,315 feet. Barr has recently completed detailed analyses for the 2014 raise of Dam 1 to elevation 1,245 feet to determine the seepage and slope stability characteristics. A plan view showing the location of Dam 1 is included in the Dam 1 construction plans, attached in Appendix A.

1.2 Background

The following sections provide a brief summary of the dam construction background and previous subsurface investigations and laboratory testing.

1.2.1 Dam Construction

Dam 1 is located at the southern end of the Milepost 7 tailings basin. Prior to 2004, Dam 1 and Dam 1E were two separate dams, with Dam 1E located east of Dam 1. Dam 1E was constructed on the east side of a natural high point, the previous eastern abutment on Dam 1. Dam 1E was located east of the highpoint and west of another natural high ground area. Because the crest is wide in this area, the dams share the same alignment, although it changes direction at the location of the high ground location between the two dams. The dams are typically collectively denoted as Dam 1.

Dam 1 was initially constructed of a starter dam comprised of sand and gravel overlying a layer of lacustrine clay approximately 15 to 25 feet thick, which overlies a layer of glacial till. Glacial till cutoff material was placed upon the upstream slope of the starter dam to the approximate elevation of 1,195 feet. Plant aggregate composes the dam slope downstream of the starter dam and clay core. The original intent was to raise the dam using downstream construction methods; however, upstream construction methods were alternatively employed during the early years of operation. Fine tailings were deposited by pipeline above the lacustrine clay, upstream of the starter dam, to elevations of approximately 1,132 to 1,186 feet.

In about 2003, dam construction was changed to an offset upstream method, in which a filter berm is constructed approximately 800 feet upstream of the starter dam, and tailings are discharged upstream to create a beach. Plant aggregate has been placed downstream of the filter berm, over the tailings originally placed by pipeline, to the current dam elevation of approximately 1,227 feet. A seepage collection trench was also constructed immediately upstream of the glacial till seepage cutoff in 2003 and 2004 to collect and route seepage to the ends of the dam.

1.2.2 Previous Investigations

Extensive subsurface investigation and laboratory testing has been performed since the 1970s at Milepost 7. Klohn-Leonoff (Klohn) of Calgary, Alberta, performed numerous test borings and laboratory testing, and presented the data in several reports from 1974 through 1987. Sitka Corp. (Sitka) performed a field investigation, including test borings with instrumentation installations, cone penetration test (CPT) soundings, field vane shear testing (FVST), and laboratory testing in 1996, presenting this information in reports submitted in 1997. Sitka also submitted a report in 1998 discussing the instrumentation installed in 1997. Barr performed a geotechnical investigation and laboratory testing to further augment subsurface information in 2005, 2006, and 2007, as well. These efforts included CPT soundings, testing borings with instrumentation installations, FVST, and laboratory testing.

2.0 Methods

2.1 Analysis Software

GeoStudio, a limit equilibrium slope stability and seepage modeling software, was used to analyze the 2014 raise configuration for Dam 1. The 2012 version of the software, produced by GEO-SLOPE International, Ltd. of Calgary, Alberta, was utilized to determine the factors of safety for the downstream slopes. Spencer's Method was used to calculate the factor of safety of the dam for the slope stability analyses. This method is considered adequate because it satisfies conditions of static equilibrium and provides a factor of safety based on both force and moment equilibrium.

2.2 Model Geometry

The stratigraphy configuration of the models for the 2014 raise is similar to models for previous analyses by Barr, incorporating the results of previous test borings performed within the dam and CPT soundings performed in the fine tailings adjacent to the dam, as well as records of construction.

The crest elevation for the 2014 Dam 1 raise has been set by NSM at 1,245 feet with a downstream slope for the raise of 6 horizontal to 1 vertical (6H:1V). Two cross sections (identified as 28+40 and 35+00) have historically been identified as critical areas of study during the initial phases of design at Dam 1. These cross sections are near the middle of the western portion of the dam in the area of the highest potential dam raise, also identified as the lowest natural ground foundation area where soft lacustrine clay deposits are present. As part of the 2009 analysis, Barr developed a hybrid cross section to incorporate the features from the dam stratigraphy at stations 28+40 and 35+00, using cross sections for each station developed by Klohn and Sitka as a basis.

As part of the 2014 analysis, the test borings performed at and near stations 28+40 and 35+00 by Klohn, Sitka, and Barr were again reviewed to further refine the lacustrine clay thicknesses and general model geometry. CPT soundings were also reviewed again for additional model refinement. **Figure 1** depicts the location of test borings along the model cross section that were recently reviewed for geometry adjustments. A layer of select sand and gravel was also included in the model geometry beneath the starter dam based on additional review of original dam design drawings by Klohn.

The geometry for the 2014 model was also extended upstream further than previous models as part of additional refinement. Part of the extension includes the addition of a layer of plant aggregate placed north of Dam 1 in the early 2000s, which is visible on aerial photographs and an aerometric survey from 2003. These "hoosier" piles, as they are called by NSM staff, were placed on the beach. The piles were about eight to ten feet high and represented one truckload of plant aggregate. The piles were placed next to each other within one continuous zone upstream of the current filter tailings. As was custom in the past, the tops of the hoosier piles were typically flattened with the dozer and the lift compacted prior to placing other fill; however, this did not occur on the hoosier piles inside the basin. Over the years since placement of the hoosier piles, fine tailings had been discharged off the dam in the new construction configuration. The fine tailings flowed around and over the piles, subsequently covering this layer of plant aggregate which now forms a relatively thin (possibly about 8 to 15 feet) high permeability zone upstream of the dam.

2.3 Loading Conditions

The 2014 Dam 1 raise was modeled for three main scenarios including two types of undrained strength stability analyses (USSA) and the drained or effective stress stability analysis (ESSA), which will be discussed in the following sections. Since it can be common for failure surfaces to occur along the interface between lacustrine and glacial till soils, scenarios where the till layer is considered impenetrable to force a block failure were evaluated, as well.

2.3.1 Drained Conditions (ESSA)

If shear stress is applied to a soil at such a rate and/or the drainage conditions are such that excess pore water pressure is zero when failure occurs, failure is said to occur under drained conditions, or the drained shear strength of the soil has been mobilized. This case is typically applied to long-term, steady-state seepage conditions, when any excess pore water pressures generated due to loading have dissipated. The drained condition also applies to granular materials for short-term conditions. When such materials have a high enough permeability, any excess pore water pressure is nearly immediately dissipated. The drained strength is most often described in terms of a strength envelope. The failure envelope may be linear, using the Mohr-Coulomb model to provide a drained friction angle (ϕ'), or it may be represented as a non-linear failure envelope.

2.3.2 Undrained Conditions (USSA)

If shear stress is applied to a soil quickly and/or if the drainage conditions are such that no shear-induced pore water pressure can dissipate when failure occurs, failure is said to occur in an undrained condition, or the undrained shear strength of the sample has been mobilized. The undrained shear strength is typically applied to short-term conditions for saturated soils, for example during or immediately after construction when construction proceeds at a fast enough rate that excess pore water pressure develops. Failure in undrained conditions may also occur for permeable, granular soils during seismic events or other events where shearing occurs so quickly that shear-induced excess pore water pressures cannot dissipate.

2.3.2.1 Undrained Conditions – Yield Strength

It has been observed in soft soils that the undrained yield strength is often a function of consolidation stress. When the undrained yield strength increases linearly with pressure, the Undrained Shear Strength Ratio ($USSR_{yield}$) is generally preferred to model the material strength. The $USSR_{yield}$ is defined as the ratio of the undrained shear strength, $s_{u(yield)}$, divided by the effective overburden stress, σ'_{vo}.

2.3.2.2 Undrained Conditions – Liquefied Strength

It is anticipated that most of the time, loading or change in loading within the fine tailings at MP 7 will be slow enough for the fine tailings to be sheared under drained conditions. However, there are circumstances in the field during which rapid changes in load and/or local stress may occur that can lead to undrained loading. As a result, liquefaction potential needs to be evaluated.

The state of a soil dictates how a soil will respond to undrained loading. If the soil is in a compacted or dense state, it will exhibit dilative behavior and the particles will have to roll over each other, thereby increasing the volume of the soil mass when sheared. If drainage is not permitted, negative porewater pressures will develop. A contractive soil is in a loose state, and when loaded and sheared, the particles will compress and become more compacted, decreasing the volume of the soil mass. If drainage is not permitted, positive porewater pressures will develop. Flow liquefaction can only be triggered in contractive soils.

Liquefaction has been observed in saturated mine tailings, which are hydraulically deposited and often exhibit contractive response (Castro, Walberg, and Perlea, 2003); therefore, the state of the fine tailings and their potential to liquefy should be analyzed. Dilative materials at MP 7, including glacial till, clay core, lacustrine clay, plant aggregate, the sand and gravel for the starter dam, and filter material are not considered subject to liquefaction, so they were not evaluated for liquefied shear strength.

The liquefied condition is a special case within the undrained condition where a contractive soil is sheared beyond the yield strength to a minimum shear stress, the liquefied strength. The liquefied shear strength is the shear strength mobilized at large deformation by a saturated contractive soil following the triggering of a strain-softening response. The terms "steady state" (SS) or "residual" are also used to describe this case. This strength reduction can be induced in the laboratory with either cyclic triaxial (followed by monotonic loading) or undrained monotonic triaxial testing. However, preparing a contractive specimen is challenging for some soils. Many triaxial tests must be conducted to obtain one that is contractive. The liquefied strength has also been correlated to various field data. The liquefied shear strength is presented herein either in terms of undrained shear strength or when appropriate as a function of overburden ($USSR_{liq}$). The $USSR_{liq}$ is defined as the ratio of the liquefied undrained shear strength, $s_{u(liq)}$, divided by the effective overburden stress, σ'_{vo}.

The potential for seismic triggering of liquefaction should also be evaluated, and is assessed in two steps. The first step is to determine whether the potential for seismic triggering exists. This evaluation is performed using site-specific data including the anticipated seismic events (the potential driver for liquefaction) and in-situ soil data (the soils' resistance to liquefaction). The screening analysis is based on procedures laid out by Boulanger and Idriss (2004) and a summary report from the 1996 NCEER and 1998 NCEER/NSF Workshop (Youd et al, 2001) that discusses the evaluation of liquefaction resistance of soils using data from in-situ testing, such as SPT and CPT.

If this screening procedure indicates that the design seismic event at the site could trigger liquefaction, then an analysis using a geomechanical model would be used as part of further evaluations of stability.

3.0 Groundwater

Groundwater and seepage conditions at Dam 1 were evaluated using SEEP/W. The SEEP/W module of the GeoStudio software has the ability to perform finite element groundwater flow calculations. Prior to performing seepage and stability analyses for the new raise, a seepage calibration of the model was performed. The calibration is important because it attempts to match the current heads from monitoring locations (piezometers) to predicted heads from the models. Hydraulic conductivities are then adjusted until relative agreement occurs between observations and predictions. This is important because hydraulic conductivities and stratigraphy can vary significantly on a dam cross section from the assumed configurations based on limited geotechnical information. The permeability values derived in 2009 and initially incorporated into the model are shown in Table 1.

Table 1 Initial Permeability Values (Barr, 2009)

Material	Vertical Permeability (ft/sec)	Permeability Anisotropy (k_H/k_V)
Foundation Till	4.43×10^{-7}	9.00
Lacustrine Clay (Normally Consolidated)	3.61×10^{-11} – 1.58×10^{-7}	0.9 ± (Varies)
Lacustrine Clay (Overconsolidated)	1.84×10^{-10} – 2.20×10^{-9}	65 ± (Varies)
Glacial Till Cutoff	3.28×10^{-9} – 2.20×10^{-8}	1.00
Filter Material	6.56×10^{-5}	1.00
Sand and Gravel	8.20×10^{-6} – 1.64×10^{-3}	1.00
Plant Aggregate	2.63×10^{-3}	1.00
Fine Tailings/Slimes	1.31×10^{-6}	1.00

Analyses were conducted for future conditions including the upstream tailings pond elevation increased to 1,235 feet, which is the maximum tailings pond level when the dam crest is raised to elevation 1,245 feet because it allows for the minimum required 10 feet of freeboard at the maximum normal operating pond condition. Seepage and stability models were reviewed for the occurrence of a tailing basin flood (maximum surcharge pool) condition, as well. This situation is considered to transpire when the tailing pond water rises, reducing the freeboard to 3 feet (approximate wave run up). For the 2014 dam raise, this corresponds to an upstream tailing pond elevation of 1,242 feet. The results of these seepage analyses are discussed in subsequent sections.

4.0 Strength Parameters

Barr previously evaluated data from test borings, cone penetration test (CPT) soundings, field vane shear testing (FVST), and laboratory testing performed for Milepost 7 to derive parameters for the previous dam raise. For the 2014 Dam raise, undrained and drained shear strength data for the lacustrine clays as well as undrained shear strength data for the fine tailings were again reviewed for further refinement. Table 2 presents the updated strength parameters used in the slope stability models, and the following sections discuss derivation of these updated parameters for the lacustrine clays and fine tailings.

Table 2 Strength Parameters

Soil Type	Moist Unit Weight (pcf)	Drained (ESSA) (Φ degrees)	Undrained (USSA)		
			USSR (1)	Mohr-Coulomb	
			Su/σ'v	Cohesion (psf)	Friction Angle (deg)
Foundation Till	145	28	0.29	--	--
Plant Aggregate	144	40	--	0	40
Filter Material	130	38	--	0	38
Select Sand and Gravel	125	33	--	0	33
Lacustrine Clay (NC)	113	Non-Linear(2)	0.205	--	--
Lacustrine Clay (OC)	113	Non-Linear(2)	--	680	0
Fine Tailings - Yield Strength	130	24	0.28	--	--
Fine Tailings - Liquefied Strength	130	--	0.1	--	--

1 Undrained Shear Strength Ratio
2 Figure 8

As has been incorporated for previous analyses, the method of representing the undrained shear strength for foundation till, lacustrine clay, and fine tailings with USSR was continued for the 2014 Dam 1 raise, though the methods of deriving USSRs for the normally consolidated lacustrine clays and fine tailings were updated.

4.1 Lacustrine Clay

4.1.1 Undrained Shear Strength

Extensive field and laboratory testing of lacustrine clays has been performed by Klohn, Sitka, and Barr to evaluate undrained strength parameters for the lacustrine clays at the site. The testing considered most applicable for undrained shear strength of the normally consolidated lacustrine clays, and thus incorporated into the design undrained shear strength for the 2014 Dam 1 raise, includes FVST, consolidated-undrained (CIU) triaxial testing, and direct simple shear (DSS) testing.

Lacustrine clay data previously processed in accordance with the methods discussed in the Barr (2009) report were assembled for CIU triaxial, DSS, and FVST tests. These data were initially plotted separately per test type as confining pressure, normal stress, or preconsolidation stress, as applicable per each test type, vs. shear stress, as shown in **Figures 2, 3, and 4**. A strength envelope consisting of the 33rd percentile of the DSS and CIU triaxial data was initially reviewed, but an envelope was not reviewed for the FVST data alone due to the wide scatter of data. The DSS, CIU triaxial, and FVST data were then plotted on the same graph for comparison, as shown in **Figure 5**. Since the DSS test is the closest to representing the anticipated failure mode of undrained clays, yet also falls within the overall range of CIU triaxial and FVST data, the corresponding $USSR_{(yield)}$ for the 33rd percentile envelope of 0.205 was incorporated into the model for the undrained shear strength of normally consolidated clays.

Consistent with previous analyses, the undrained strength envelope presented by Klohn was considered where the lacustrine clay is highly overconsolidated (OCR of approximately 2 to greater than 7), near the toe of the dam. This envelope includes a cohesion of 680 psf and friction angle of 0 degrees.

4.1.2 Drained Shear Strength

For evaluating the drained shear strength of the lacustrine clays, CIU triaxial and direct shear (DS) testing are considered the most applicable. The 33rd percentile for data for these tests previously processed as described in the Barr (2009) report were incorporated into the drained design strength for the 2014 Dam 1 raise. The data were plotted as confining pressure/normal stress vs. shear stress, initially separately per test type as shown in **Figures 6 and 7**, then combined into one graph as shown in **Figure 8**. Since the direct shear test is the closest to mimicking the anticipated failure mode of drained clays, yet also falls within the data range for the CIU triaxial data, the 33rd percentile non-linear envelope for the DS test data was incorporated into the model.

4.2 Fine Tailings

4.2.1 Yield Undrained Shear Strength

4.2.1.1 Cone Penetration Resistance

The undrained shear strength of the fine tailings from CPT data collected in 2005 and 2006, recorded with pore water pressure measurements, was re-processed using methods updated since the original data analysis was performed in 2005 through 2008 and are based on Olson and Stark (2003). The field cone penetration resistance measured at the cone tip is q_c for fine grained soils, which may also be converted to the total cone resistance by the following equation:

$$q_t = q_c + (1 - a)u$$

Where:

a = unequal end area ratio of the cone

u = pore water pressure measured between the tip and the friction sleeve

The total cone resistance is corrected to a standard effective overburden pressure of one atmosphere (p_a, typically 1 tsf) by:

$$q_{t1} = q_t \left(\frac{p_a}{\sigma'_{vo}}\right)^{0.5}$$

Calculation of the undrained yield (peak) shear strength of the fine tailings from the CPT data was performed using the equation below from the method by Olson (2009). This method uses the corrected cone penetration tip resistance (q_{c1}) for q_{c1} values less than 6.5 MPa. The method also includes the replacement of q_{c1} by q_{t1} where pore pressure develops within the materials during penetration.

$$s_u = 0.205 + 0.0143(q_{t1}) * \sigma'_{vo}$$

By dividing the resulting undrained shear strength by the corresponding effective overburden stress, σ'_{vo}, the $USSR_{yield}$ for each relevant data point (where q_{c1} was less than 6.5 MPa) was calculated. Statistical information was subsequently calculated for the $USSR_{yield}$ values, including the 33rd percentile $USSR_{yield}$ incorporated into the overall design $USSR_{yield}$.

The calculated undrained shear strengths versus the corresponding effective overburden stress for all of the CPT soundings performed in 2005 and 2006, as well as the 33rd percentile $USSR_{yield}$ for the CPT data, are summarized graphically in **Figure 9**.

4.2.1.2 Yield Undrained Shear Strength – Field Vane Shear and CIU Testing

In addition to the CPT soundings, yield undrained shear strength from FVST and CIU triaxial data for fine tailings were also reviewed for the 2014 Dam 1 raise. FVST and CIU triaxial data processed per the methods discussed in the Barr (2009) report were assembled for comparison with the updated CPT results.

The effective vertical stress was plotted versus the undrained shear strength data from FVST and CIU triaxial tests as separate plots per the test type, as shown in **Figures 10 and 11**. Some of the FVST data appeared high indicating potentially dilative behavior at the test depth location, although the tests were validated based on rotational speed of the vane and the material characteristics at the test depth location. A realistic upper bound was identified for the FVST and used in calculating the 33 percentile USSRs for peak (yield) conditions used in the design value calculation.

4.2.1.3 Yield Undrained Shear Strength – Design Value

Selection of the design value combines the evidence from all testing methods with engineering judgment. A summary of the yield USSRs from field and laboratory testing are shown in Table 3. The 33rd percentile yield USSRs from the field data were averaged, then the average of the field and laboratory USSRs was calculated to result in the design $USSR_{yield}$ of 0.28. The resulting design value is higher than both the triaxial tests and the CPT correlation which tested the finest portion of the fine tailings material. However, when reviewing the CPT logs, it is apparent that there are many layers of stronger tailings interspersed within the fine tailings deposit. These layers contribute to the strength of the tailings mass but are generally neglected in the CPT correlation because the tip resistance exceeds 6.5 MPa, which is the upper bound tip resistance for calculation of the yield undrained strength. The FVST results are higher but are represented by a realistic upper bound undrained strength ratio.

Table 3 Yield Undrained Shear Strength for Fine Tailings

Tests	Field		Lab
	CPT	FVST	CU Triaxial
Number of Tests	13 Soundings	18	18
33rd Percentile USSR	0.24	0.40	0.23
Combined 33rd Percentile $USSR_{yield}$ per Test Type	0.32		0.23
Design $USSR_{yield}$ Value(1)	**0.28**		

(1) Design value is reported to nearest 0.01

4.2.2 Liquefied Undrained Shear Strength

The CPT behavior plots are one way to determine which materials are susceptible to liquefaction; another way is to plot CPT tip resistance relative to the medium compressibility boundary as developed by Fear and Robertson (1995) and updated by Olson (2009) for medium compressibility materials. CPT tip resistance plots show corrected tip resistance (q_{c1}) versus calculated pre-failure effective stress. Points that plot to the left of the medium compressibility boundary are potentially contractive, and points that plot to the right are potentially dilative. **Figure 12** shows the CPT tip resistance plot for CPT D1-2840R100 from 2005. The CPT tip resistance plots for each CPT sounding along Dam 1 are provided in Appendix C.

4.2.2.1 Strength Characterization

As discussed in the previous section the fine tailings can behave in a contractive manner, although the behavior is variable (sometimes dilative) through the depths of the soundings. Therefore it is necessary to evaluate the liquefied strength of the fine tailings. The following sections present an updated analysis of the liquefied strength of the fine tailings using techniques developed since the previous analysis in 2009.

4.2.2.1.1 Cone Penetration Resistance

Evaluation of the undrained liquefied shear strength of the fine tailings for each data point of the CPT data was performed using the method by Olson (2009). The relationship was developed based on back analysis of data from case histories of failed slopes comprised of sands, silty sands, and tailings. Olson has updated the correlation such that it utilizes the corrected tip resistance, q_{t1}, rather than q_{c1} as was originally proposed by Olson and Stark (2002). The Olson method filters out data from materials that should not be characterized with a liquefied undrained shear strength (i.e. dilative), specifying that the calculation should include only data from soils that are classified as contractive using the Olson contractive/dilative screening criteria (2009), as discussed in Section 2.3, which corresponds to a tip resistance of about 6.5 MPa for many sites.

$$S_{u(liq)} = 0.03 + 0.0143\ (q_{t1}) \pm 0.03 * \sigma'_{vo}$$

Similar to the calculation of the USSR for the yield strength in the previous section, the $USSR_{liq}$ for each relevant data point is calculated by dividing the resulting liquefied undrained shear strength by the corresponding effective overburden stress. Statistical information was subsequently calculated for the $USSR_{liq}$ values, including the average $USSR_{liq}$ used as part of the calculation for the overall design $USSR_{liq}$.

Figures related to the development of the liquefied shear strength from CPT data are also provided in Appendix C. **Figure 12** presents the results of one such analysis. The dynamic pore pressure shown on **Figure 12** represents the pore pressure as the cone is advanced through the tailings. Dissipation tests, where available, are presented as purple dots. They indicate an "equilibrium" water level reading at the probe depth.

The normalized excess pore pressure difference, also shown on **Figure 12** (and the other CPT behavior plots), aids identification of contractive and dilative layers. The normalized excess pore pressure difference is the difference between the dynamic pore pressure developed during cone advancement and the estimated hydrostatic conditions interpreted from the dissipation tests normalized by dividing by the effective overburden stress (σ'_{vo}). Where the normalized pore pressure difference is positive, which is the result of dynamic pore pressure response above hydrostatic conditions, that material has a potential for contractive behavior and is susceptible to liquefaction. Where the normalized pore pressure difference is negative, the dynamic pore water pressure is less than the existing groundwater conditions, and that soil is considered potentially dilative and will not liquefy. Analysis of the CPT behavior plots for all 13 CPT soundings reviewed indicates the percentage (per sounding) of potentially contractive fine tailings ranges mainly between approximately 76 and 98 percent, although one sounding indicated 46.5 percent of the fine tailings were potentially contractive.

Although the CPT plots indicate some zones of the fine tailings may be dilative, all of the fine tailings were considered contractive for the purposes of modeling the scenario including the liquefied undrained shear strength of the fine tailings. This approach is used because it is conservative to assume all of the fine tailings will be reduced to the liquefied strength with the understanding that there is data showing that some materials are dilative. Therefore a single liquefied strength value for fine tailings was calculated, using only the data from the contractive fine tailings.

The CPT behavior plots are one way to determine which materials are susceptible to liquefaction; another way is to plot CPT tip resistance relative to the medium compressibility boundary as developed by Fear and Robertson (1995) and updated by Olson (2009) for medium compressibility materials. **Figure 13** shows the corrected tip resistance (q_{c1}) versus calculated pre-failure effective stress. Points that plot to the left of the medium compressibility boundary are potentially contractive, and points that plot to the right are potentially dilative. **Figure 13** shows that this method of analysis indicates the majority of fine tailings from the CPT tests are potentially contractive.

The material behavior evaluation used the CPT behavior plots (Appendix C) to: (1) establish which material types are contractive and susceptible to liquefaction; and (2) identify tests that may have evaluated more dilative layers within generally contractive zones so that those results could be excluded from liquefied shear strength calculations. It can be seen from these plots that the fine tailings behave in both a contractive and dilative manner. Using the established criteria presented, **Figure 14** shows the liquefied strength of the fine tailings. The average strength ratio using the strength determination methodology in Olson and Stark (2003) is 0.08.

4.2.2.1.2 Liquefied Undrained Shear Strength – Field Vane Shear and CIU Triaxial Testing

FVST and CIU triaxial data for fine tailings were also reviewed in addition to the CPT data as part of the 2014 Dam 1 raise for the liquefied undrained shear strength. FVST and CIU triaxial data processed per the methods discussed in Barr (2009) were assembled for comparison with the corresponding updated CPT results.

The effective vertical stress was plotted versus the undrained shear strength data from FVST and CIU triaxial tests as separate plots per the test type, as shown in **Figures 15 and 16**. As some of the CIU data appeared high, a realistic upper bound was identified for the CIU testing and used in calculating the average USSR for liquefied conditions, which was included in the design value calculation. The average USSR for the FVST data was incorporated into the design value calculation.

4.2.2.1.3 Seismic Considerations

4.2.2.1.3.1 Site Specific Seismic Hazard

As discussed briefly in Section 2, the potential for seismic triggering is considered when assessing the liquefied undrained shear strength. A site-specific probabilistic seismic hazard analysis (PSHA) was prepared for the Milepost 7 site (Appendix E). A PSHA is a quantitative estimate of the hazards for ground-shaking at the site analyzed probabilistically to consider uncertainties in earthquake location, size, and frequency of occurrence. The PSHA was used to develop acceleration-time histories for dynamic stability analyses for the Milepost 7 tailings basin. This site-specific analysis assesses the potential local and regional seismic sources that could affect the site, models their attenuation to the site, and provides an estimate of seismic impact at the site.

Seismicity at the site is likely to be governed by one of two conditions: (1) nearfield events, which are low magnitude earthquakes with epicenters in the Midwest, and (2) farfield events, which are higher magnitude earthquakes caused by the New Madrid Seismic Zone. The New Madrid Seismic Zone contains the nearest active fault and is approximately 750 miles south of the site. The zone is named after New Madrid, Missouri, which is close to the northern boundary of the seismic zone.

U.S. Geological Survey (USGS) data was used to evaluate potential earthquake frequency and ground acceleration at the Project site (USGS, 2011). Table 4 summarizes the ground motions for earthquakes with 50 year probability of exceedance of 10%, 5%, and 2%. There is a 2% probability that the Peak Ground Acceleration (PGA) at the site will exceed 0.028g in 50 years. This corresponds to a 0.0004 probability of exceedance per year, or a return period of 2,475 years.

Table 4 Summary of USGS Seismic Risk Calculation

Probability of Exceedance			
Per Annum	0.0021	0.0010	0.0004
In 50 years	10%	5%	2%
Return Period [years]	475	975	2,475
Peak Ground Acceleration [g]	0.008	0.015	0.028

The results of the PSHA include three earthquake records, based on a 2% probability of exceedance in 50 years, related to nearfield sources, farfield sources, and a record that aggregates these two sources.

4.2.2.1.3.2 Seismic Liquefaction Screening Evaluation

Evaluation of the potential for seismic liquefaction requires estimation of the cyclic shear stresses and the soil's ability to resist liquefaction. The analysis used the estimation method determined in workshops jointly held by the National Center for Earthquake Engineering Research (NCEER) and National Science Foundation (NSF) (Youd et al, 2001). This evaluation used the 2,475-year return period event from the PSHA and CPT data to determine a factor of safety against liquefaction triggering. Several parameters were computed.

The *CSR* is the cyclic stress ratio, which represents the seismic demand on a soil layer. The *CSR* is computed as:

$$CSR = 0.65 * \frac{a_{max}}{g} * \frac{\sigma_{vo}}{\sigma'_{vo}} * r_d$$

Where:

a_{max} = peak horizontal ground acceleration at the ground surface due to the design earthquake (2,475-year return period)

g = acceleration due to gravity

r_d = stress reduction coefficient, which accounts for flexibility of the soil profile

0.65 = reduction factor from Youd et al (2001) to produce a *CSR* representative of the most significant cycles over the full loading duration

In Youd et al, 2001, the depth reduction factor (r_d) is a shear stress reduction coefficient (or shear mass participation factor), computed as a function of depth (z) in meters by:

$$r_d = \frac{1.000 - 0.4113z^{0.5} + 0.04052\, z + 0.001753\, z^{1.5}}{1.000 - 0.4177z^{0.5} + 0.05792z - 0.006205z^{1.5} + 0.001210z^2}$$

The *CRR* is the cyclic resistance ratio, indicating the capacity of the soil to resist liquefaction. The *CRR* is computed using the normalized clean-sand cone penetration resistance, $(q_{c1N})_{CS}$, from CPT data as:

$$If\ (q_{c1N})_{cs} < 50,\ \ CRR = 0.833 * \frac{(q_{c1N})_{cs}}{1000} + 0.05$$

$$If\ 50 < (q_{c1N})_{cs} < 160,\ \ CRR = 93 * (\frac{(q_{c1N})_{cs}}{1000})^3 + 0.08$$

Seed and Idriss (1982) analyzed multiple level-ground sites where seismically induced liquefaction did or did not occur. From these analyses, relationships were proposed to identify when materials would or would not liquefy. However, because all of the earthquakes involved different magnitudes (i.e., differences in duration of shaking and frequency content), it is necessary to adjust the earthquake demand (i.e., $\tau_{seismic}$) for earthquake magnitudes higher or lower than 7.5. This adjustment is accomplished using a Magnitude Scaling Factor (*MSF*). Since then, multiple scaling factors have been proposed. Based on the results of the NCEER/NSF workshops, Youd et al (2001) recommends the following MSF relationship:

$$MSF = \left(\frac{M_w}{7.5}\right)^{-2.56}$$

Boulanger and Idriss (2004) and Youd et al (2001) suggest that when the factor of safety against liquefaction triggering is less than 1.0, triggering will occur. The factor of safety against triggering is determined as:

$$FOS_{triggering} = \frac{CRR_{7.5}}{CSR_{7.5}} * MSF * K_\sigma$$

Where:

K_σ = a correction factor to extrapolate the simplified procedure to larger overburden pressure conditions.

4.2.2.1.3.3 Screening Results

The factor of safety values obtained at each CPT point for the test locations were plotted versus depth to determine if any points are susceptible to triggering based on the design earthquake presented in the

PSHA. The design event corresponds to a 2,475-year return period with a probability of exceedance of 2% in 50 years (M_w = 5.92, a_{max} = 0.028g). The lowest factor of safety against triggering computed for all CPT locations was 4.8. The applied seismic event was then scaled up to determine what event would trigger liquefaction. It was determined that an earthquake with M_w = 5.0 and a_{max} = 0.3g would be required to trigger liquefaction. This event corresponds to a 170,000-year return period.

Results indicate that the seismic design event would not trigger liquefaction of the fine tailings at Milepost 7. This analysis does not preclude the fact that an unknown or combination of triggers could occur causing liquefaction at the site. Therefore it is appropriate to evaluate the liquefied strength of the fine tailings for use in a static liquefaction analysis.

4.2.2.2 Liquefied Undrained Shear Strength – Design Value

A summary of the average USSRs from laboratory and field testing are shown in Table 5. To calculate the design $USSR_{liq}$ value of 0.1, the average of the average USSRs from each set of field and laboratory test data was computed.

Table 5 Liquefied Undrained Shear Strength for Fine Tailings

	Field		Lab
Tests	**CPT**	**FVST**	**CU Triaxial**
Number of Tests	13 Soundings	17	14
Average USSR	0.08	0.09	0.12
Design $USSR_{liq}$ Value(1)	**0.1**		

(1) Design value is reported to nearest 0.01

4.2.3 Drained Shear Strength

The drained shear strength for fine tailings was evaluated for the Barr (2009) report by reviewing triaxial data from tests conducted by Barr as well as historical data. The values presented in the Barr (2009) report are considered suitable for representing the fine tailings in the models for the 2014 dam raise.

5.0 Dam Stability Analyses

This section of the memo presents the results of the analyses performed, beginning with seepage the model calibration. The stability of the dam will be discussed in subsequent sections.

5.1 Seepage Calibration

The main objective of the seepage analysis is to develop a good understanding of the groundwater flow and the relationship to dam stability. Groundwater plays a major role in the stability and construction sequence of the dam. The seepage simulations presented in this report model groundwater flow for steady-state conditions.

Hydraulic conductivity (permeability) values were assigned to each material type, based on previous testing performed on the materials (Barr 2009), and the total head was fixed for the upstream pond for the existing dam configuration. The upstream pond head was set at elevation 1,210.2 feet, or the reading from late October 2012, for model calibration since the fall piezometer readings were also recorded during the same timeframe. A region representing a relief well was also included in the model at the toe of the dam. Since a reading is only available from one of the relief wells within close proximity of stations 28+40 and 35+00, due to submergence of other relief well outlets within the seepage collection pond, the head assigned to the relief well in the model matches the water level of 1,136 feet recorded in relief well R-7 in October 2012.

The hydraulic conductivities initially assigned to each soil type in the final models are presented in Table 1. The values for each of these materials, except the select sand and gravel, were presented in the Barr (2009) report and were originally incorporated into the model, then adjusted over several model iterations to minimize the difference between the resulting modeled head and measured head of piezometers within Dam 1. After initial model iterations, the normally consolidated (NC) lacustrine clay was divided into upstream and downstream for the seepage model since the upstream NC lacustrine clay appears to generally contain more sand and silt lenses, and hence a higher permeability, than the downstream NC lacustrine clay. Permeability of the select sand and gravel was not reviewed as part of the Barr (2009) report, so the permeability reported by Klohn for the select sand and gravel material beneath the starter dam was incorporated into the model.

Table 6 shows the difference for the majority of measured head values versus resulting modeled head values is within approximately 2 to 5 feet of head. Piezometers with a larger head difference between modeled and measured values, such as 3K-P2, 2H-P1, and D1-2840R650 bottom may be malfunctioning. For instance 3K-P2 and 2H-P1 are older pneumatic-style piezometers. In the past few years the pneumatic piezometers at the basin have been failing and these two may be failing as well. D1-2840R650 is a newer vibrating wire piezometer installed in 2005 and should still be operating properly; however, limited instrumentation is present in this area to confirm the reading.

Table 6 Measured and Predicted Head from Seepage Calibration

Instrumentation Designation and Type	Dam Cross Section Location	Approximate Cross Section Station	Piezometer Elevation (ft)	Material	Measured Head from 10/2012 (ft)	Modeled Head (ft)	Difference*
3K-P2 - Pneumatic	28+40	3+50	1149.6	Fine Tailings	1183.1	1196.5	13.4
D1-2840R650 (Top) - VW	28+40	6+50	1168	Fine Tailings	1197.5	1193.2	-4.3
D1-2840R650 (Bottom) - VW	28+40	6+50	1110	Foundation Till	1165.3	1156.8	-8.5
2K-P1 - Pneumatic	35+00	3+50	1141.4	Fine Tailings	1200.9	1196.4	-4.5
2H-P1 - Pneumatic	35+00	7+67	1113.2	NC Lacustrine Clay	1136.5	1145.4	8.9
2B-P2 - Casagrande	35+00	9+98	1103	Foundation Till	1146.7	1141.5	-5.2
P97-4 - Pneumatic	35+00	12+77	1106.3	Foundation Till	1132.9	1135.3	2.4
P97-10A - Pneumatic	28+40	0+78	1177.2	Fine Tailings	1196.8	1199.8	3.0
P97-10B - Pneumatic	28+40	0+78	1162.2	Fine Tailings	1194.5	1199.7	5.2
P97-10C - Pneumatic	28+40	0+78	1146.7	Fine Tailings	1196.3	1199.6	3.3
P97-1 - Pneumatic	28+40	12+10	1102.5	Foundation Till	1131.3	1134.6	3.3

*Positive difference indicates a model value higher than measured

Additional instrumentation has been recommended and will be installed along the toe of Dam 1. The installation of new vibrating wire piezometers, planned for late summer 2013, will be helpful in comparing field groundwater conditions to model results and may aid in determining whether some of the existing piezometers are no longer serving their intended purpose. Also, the relief well level in the model corresponds only to R-7 since other adjacent relief well outlets are below the level of the adjacent pool, which may affect the resulting model heads. For purposes of this phase of modeling for the 2014 dam raise, the model head values are considered acceptable. The resulting permeability values estimated from the seepage calibration are presented in Table 7.

Table 7 Permeability Values from Seepage Calibration

Material	Resulting Permeability from Calibration (ft/sec)	Permeability Anisotropy (k_h/k_v)
Foundation Till	$6.0x10^{-6}$	5.0
Downstream Lacustrine Clay (Normally Consolidated)	$2.45x10^{-8}$	0.70
Upstream Lacustrine Clay (Normally Consolidated)	$7.5x10^{-7}$	0.40
Lacustrine Clay (Overconsolidated)	$1.41x10^{-8}$	55.3
Glacial Till Cutoff	$3.28x10^{-9}$	1
Filter Material	$3.4x10^{-4}$	1
Sand and Gravel	$3.3x10^{-3}$	1
Select Sand and Gravel	$1.67x10^{-3}$	1
Plant Aggregate	$1.62x10^{-3}$	1
Fine Tailings/Slimes	$1.8x10^{-6}$	1

Comparing Table 7 to Table 1, the foundation till and plant aggregate permeabilities are less than estimated in the Barr (2009) report. The calibrated permeability values of the upstream NC clay and filter material are greater than the value/range in the 2009 report, while the permeability values of the sand and gravel, plant aggregate, and fine tailings are slightly greater than the value/range in the 2009 report. The calibrated anisotropy values are less than the value in the 2009 report for the foundation till as well as the NC and OC lacustrine clays, but remain the same for the other materials. The additional instrumentation proposed for installation in 2013 will be used to further refine the seepage models in the future.

5.2 Slope Stability

Slope stability analyses were performed for the proposed 2014 Dam 1 raise geometry by integrating the results of seepage analyses with the slope stability modeling module SLOPE/W within the GeoStudio 2012 software. Analyses were performed for the downstream slope of Dam 1 for six failure mode configurations including: ESSA, ESSA with a block failure, USSA for yield fine tailings strength with and without block failure, and USSA for liquefied fine tailings strength with and without a block failure. A minimum factor of safety of 1.3 is considered acceptable for USSA conditions at the MP 7 site. For the ESSA condition, a minimum factor of safety of 1.5 is considered acceptable. The liquefied strength analyses represent an unknown triggering condition which could cause a failure in the dam that could include significant seismic events or a combination of other events which are often difficult to quantify. In this region, seismic triggering is not considered to be a significant contributor to slope instability, and for this site, CPT data indicate the fine tailings are not considered susceptible to liquefaction as shown in Appendix D. Therefore the analyses were carried out assuming an unknown triggering event leads to full liquefaction of the fine tailings. A factor of safety of 1.05 is considered acceptable for the liquefied strength case.

The adjacent upstream pond level was adjusted for each of these material configurations for three scenarios. These pond elevations include the existing pond level of 1,212.8 feet, future maximum operating pool of 1,235 feet (allowing 10 feet of freeboard) with the existing fine tailings beach elevation, future maximum operating pond with the future anticipated tailings beach elevation, probable maximum pond flood level of 1,242 feet (allowing 3 feet of freeboard) with the existing tailings beach elevation, and probable maximum pond flood level with the future anticipated beach elevation. The results of the scenarios for stability modeling performed for the hybrid cross section model of stations 28+40 and 35+00 are shown in Table 8 and depicted graphically in Appendix B. The resulting model factors of safety exceed the corresponding minimum factor of safety for all of the ESSA, USSA-yield and USSA-liquefied scenarios and the dam is considered stable under the conditions that were analyzed.

Table 8 Computed Factors of Safety for Various Scenarios

Slope Location and Material Configuration	Factor of Safety for Pond Scenarios				Minimum Acceptable FOS
	Tailings Pond at 1,212.8 ft (Existing)	Tailings Pond at 1,235 ft, Existing Beach	Tailings Pond at 1,235 ft, Future Beach	Tailings Pond at 1,242 ft, Future Beach	
Downstream Slope, ESSA	2.45	2.42	2.43	2.42	**1.5**
Downstream Slope, ESSA Block Failure	2.26	2.21	2.22	2.19	**1.5**
Downstream Slope, USSA, Fine Tailings Yield Strength	1.60	1.58	1.58	1.58	**1.3**
Downstream Slope, USSA, Fine Tailings Yield Strength, Block Failure	1.52	1.47	1.47	1.45	**1.3**
Downstream Slope, USSA, Fine Tailings Liquefied Strength	1.57	1.53	1.53	1.51	**1.05**
Downstream Slope, USSA, Fine Tailings Liquefied Strength, Block Failure	1.41	1.36	1.37	1.35	**1.05**

6.0 Summary and Recommendations

Seepage analyses were performed for Dam 1 for the following conditions. All seepage analyses are for steady state conditions.

- The existing dam configuration for model calibration based on piezometer readings and the upstream pond level from October 2012 (1,210.2 feet).
- The existing pond elevation (1212.8 feet) with the proposed 2014 raised dam arrangement including the existing beach configuration to review pore pressures and to incorporate into slope stability analyses.
- Maximum normal pond operating conditions (elevation 1,235 feet) for the proposed 2014 raised dam arrangement including the existing beach configuration to review pore pressures and to incorporate into slope stability analyses.
- Maximum normal operating pond conditions (elevation 1,235 feet) for the proposed 2014 raised dam arrangement including the future anticipated beach configuration to review pore pressures and for incorporation into stability analyses.
- Flood conditions (pond elevation of 1,242 feet) for the proposed 2014 raised dam arrangement including the future anticipated beach configuration to review pore pressures and for incorporation into slope stability analyses.

Analyses were performed to review the stability of Dam 1 including expanded and refined model geometry as well as updated strength parameters for the lacustrine clays and fine tailings. Analysis scenarios for which the model results indicate acceptable factors of safety include the following:

- ESSA for the downstream slope for normal operating pond conditions with the existing and future anticipated beach, as well as the flood conditions with the future anticipated beach.
- ESSA model simulating a block failure along the interface between the lacustrine clay and till soils for the downstream slope for normal operating pond conditions with the existing and future anticipated beach, as well as the flood conditions with the future anticipated beach.
- USSA incorporating the yield strength of fine tailings for the downstream slope for normal operating conditions with the existing and future anticipated beach, as well as the flood conditions with the future anticipated beach.
- USSA incorporating the yield strength of fine tailings as well as simulating a block failure along the interface between the lacustrine clay and till for the downstream slope for normal operating pond conditions with the existing and future anticipated beach, as well as the flood conditions with the future anticipated beach.

- USSA incorporating the liquefied strength of fine tailings for the downstream slope for normal operating pond conditions with the existing and future anticipated beach, as well as the flood conditions with the future anticipated beach.
- USSA incorporating the liquefied strength of fine tailings as well as simulating a block failure along the interface between the lacustrine clay and underlying till for the downstream slope for normal operating pond conditions with the existing and future anticipated beach, as well as the flood conditions with the future anticipated beach

The following are recommendations based on the seepage and stability analyses performed and summarized previously for the project:

- The dam should continually be raised including a finished downstream slope face of 6 horizontal to 1 vertical in accordance with previous plans.
- Non-functioning instrumentation at Dam 1 should be replaced to evaluate the behavior of the lacustrine clays and glacial till materials found in the foundation of the dam under various pond level and operating conditions. A geotechnical investigation and instrumentation installation is planned for late summer 2013, which includes replacement of some non-functional instrumentation.
- Piezometers should be connected to data loggers to provide a more continuous record of pore pressure conditions in the lacustrine clays, fine tailings, and glacial till soils. The pore pressure response during dam construction is an important part of the analysis to evaluate dam stability. A plan to install data loggers should be implemented over the next Five Year Operating Plan.
- Due to the discrepancies noticed between the modeled and measured heads while calibrating the present analyses, the seepage analysis should be revisited after readings are available from the new instrumentation, and the stability analyses subsequently updated.

7.0 References

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Figures

Figures

Figure 1

Northshore Mining Company, Dam 1
Station 28+40 and 35+00 Existing Conditions
Boring and CPT Locations

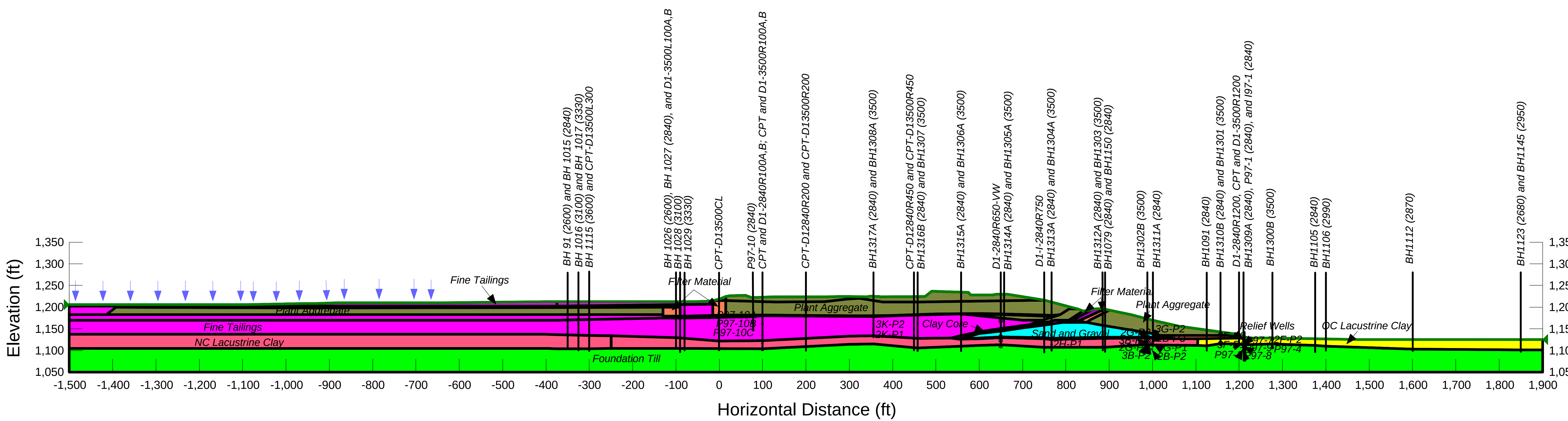


FIGURE 2

Lacustrine Clay Undrained Shear Strength Envelopes from CIU Triaxial Data

Northshore Mining Milepost 7 Tailings Basin, Dam 1

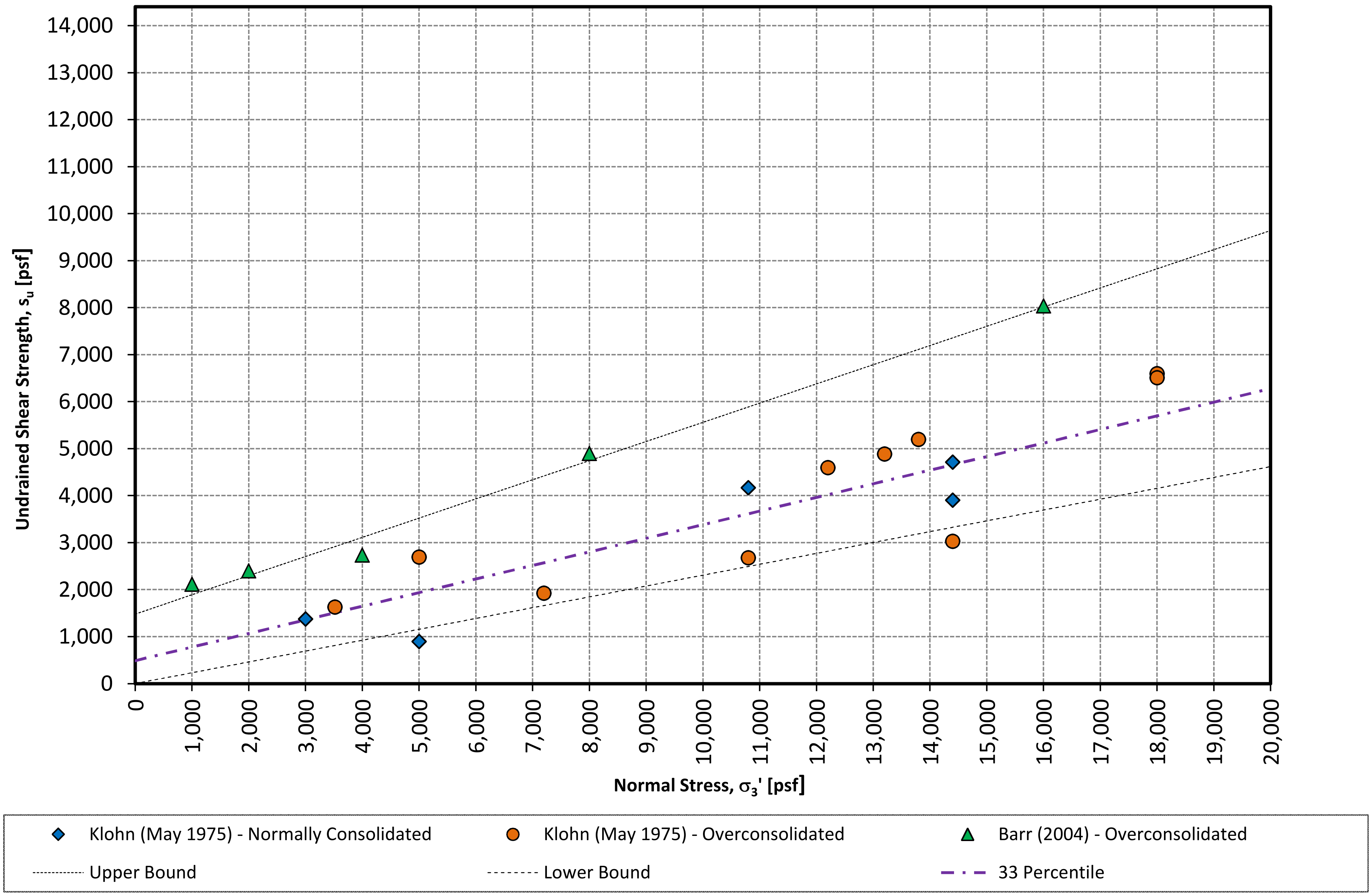
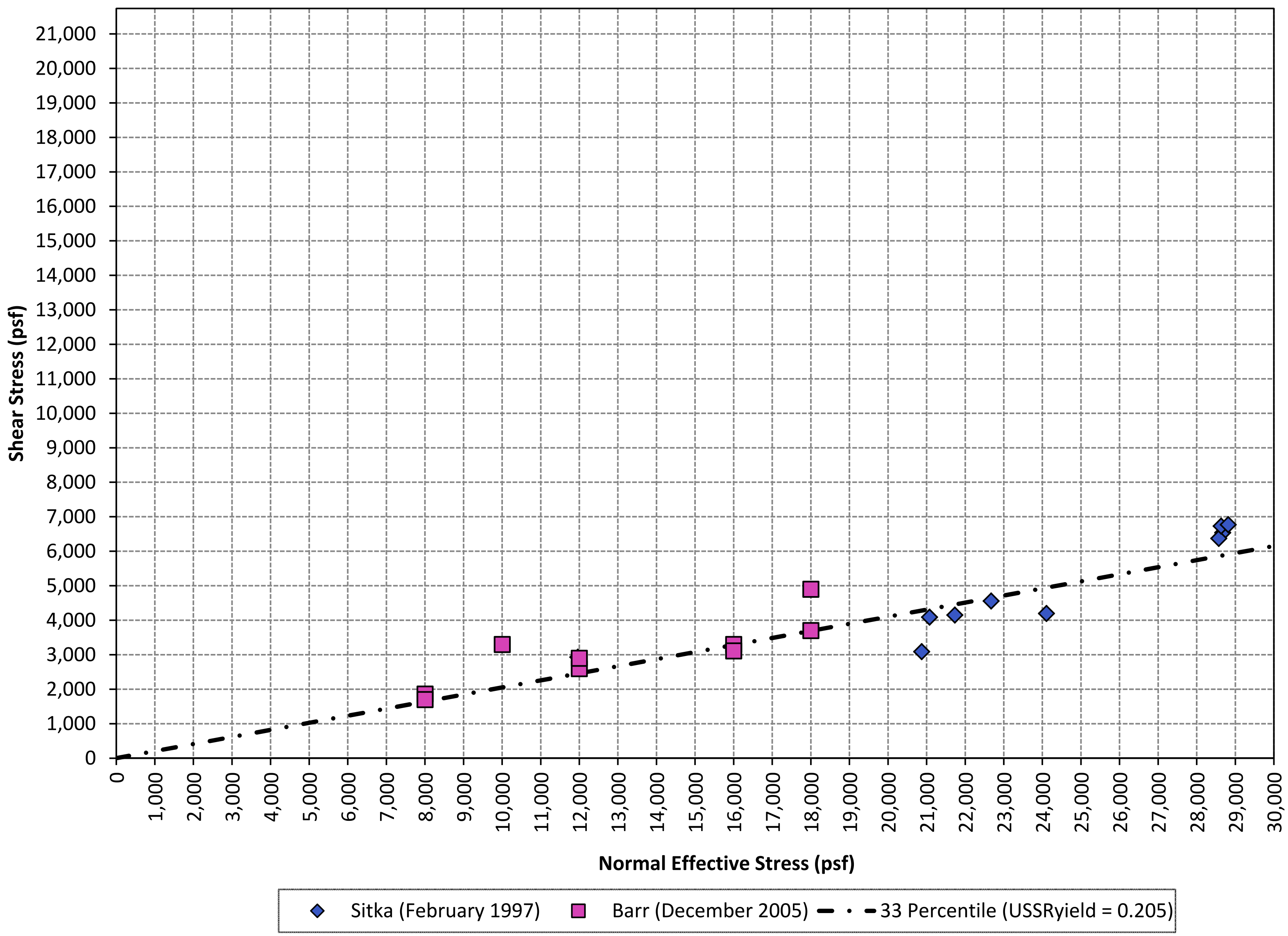


FIGURE 3

Lacustrine Clay Undrained Shear Strength Envelope, Direct Simple Shear Data

Northshore Mining Milepost 7 Tailings Basin, Dam 1



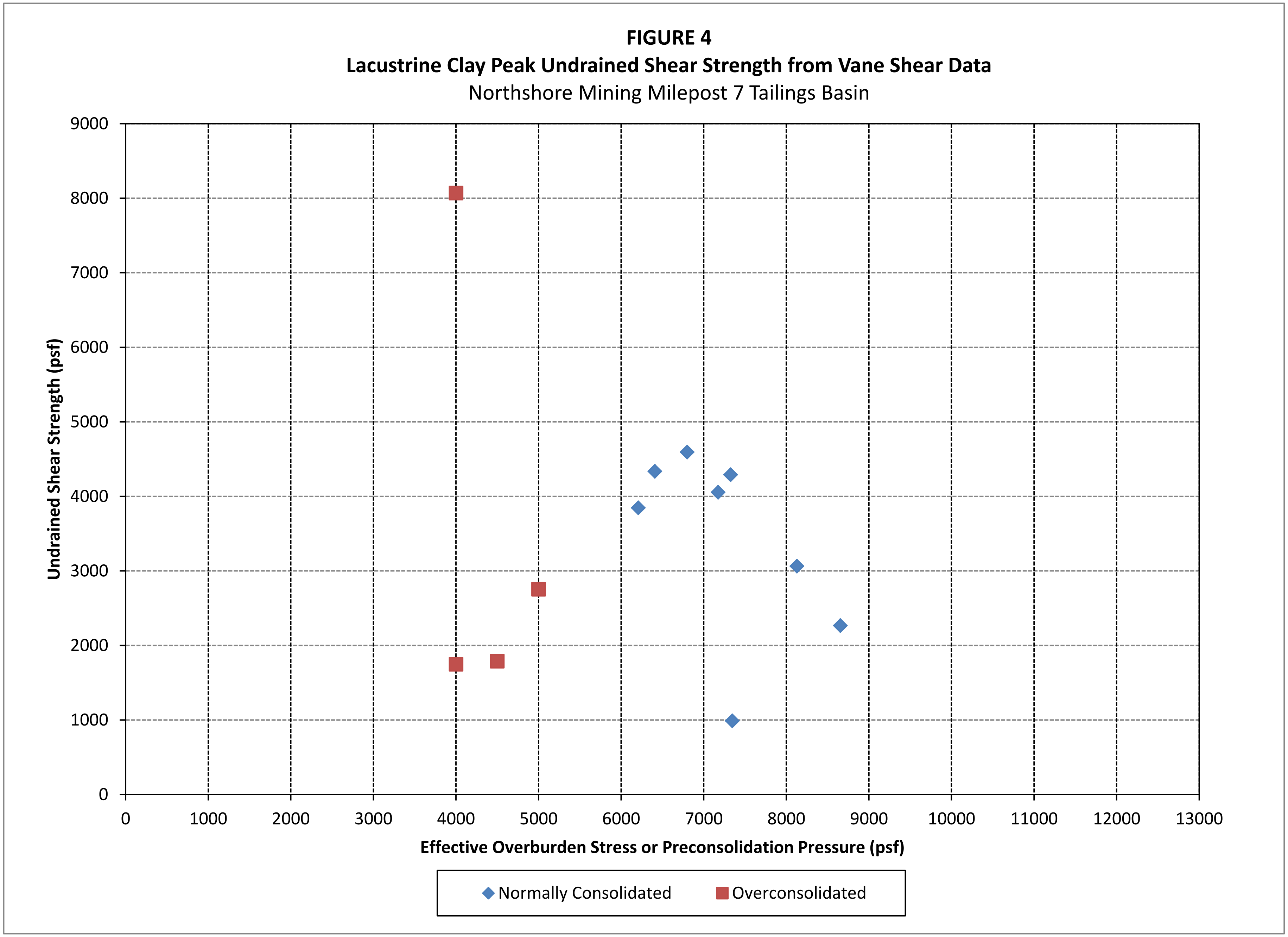


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FIGURE 5

Lacustrine Clay Undrained Shear Strength from CIU Triaxial, Direct Simple Shear, and Vane Shear Test Data

Northshore Mining Milepost 7 Tailings Basin

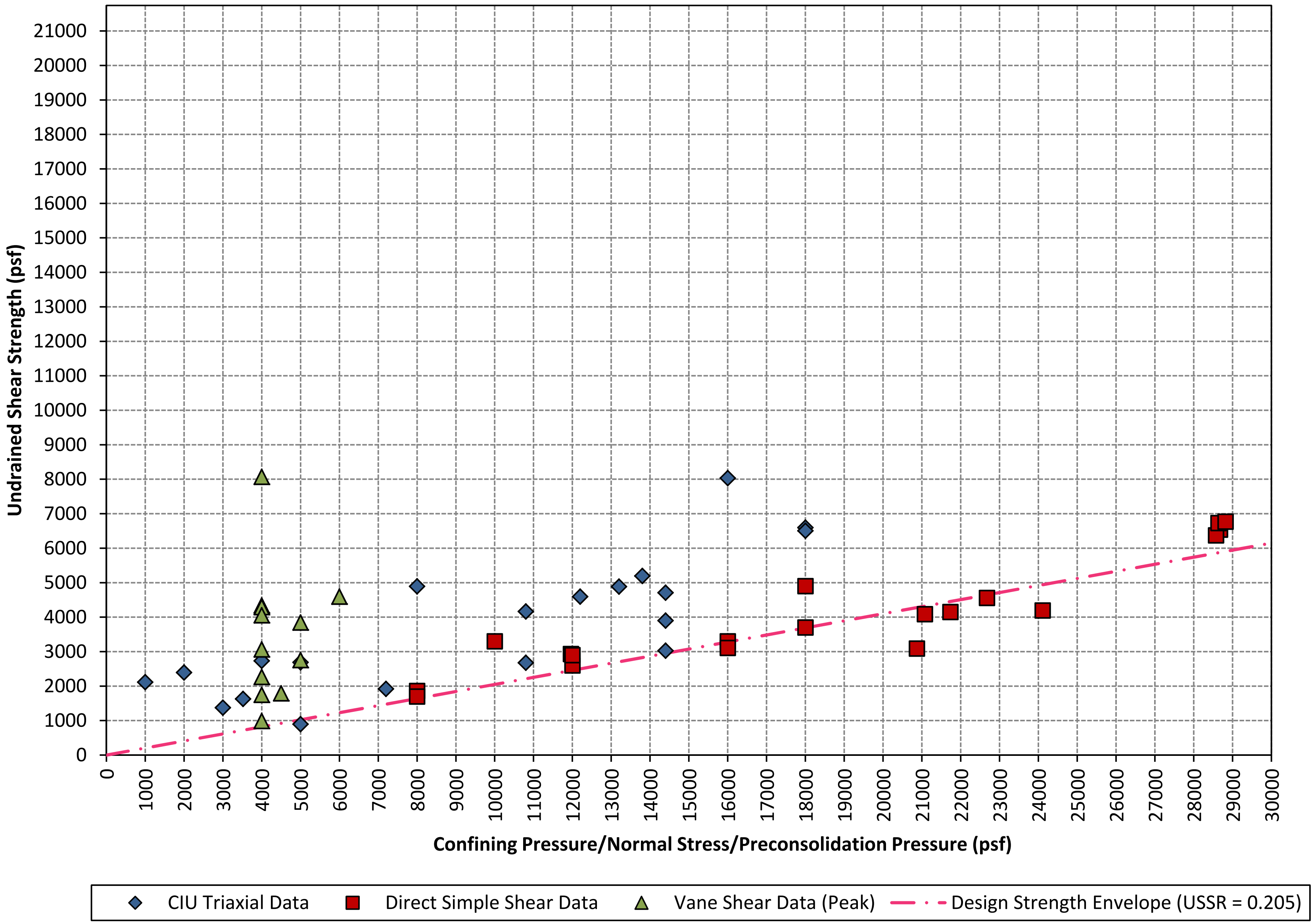

FIGURE 6

Lacustrine Clay Drained Shear Strength Envelope from CIU Triaxial Data

Northshore Mining Milepost 7 Tailings Basin

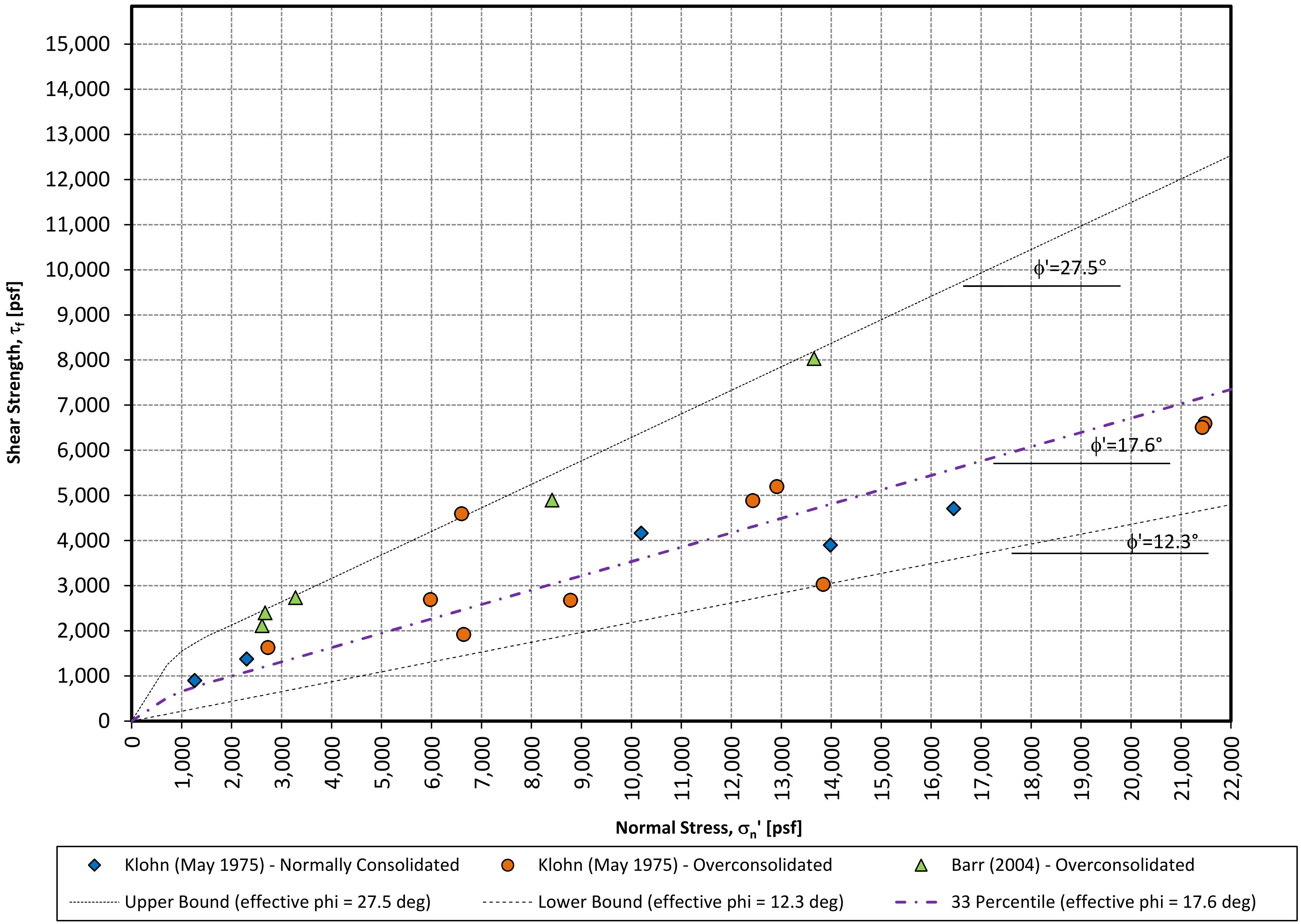

FIGURE 7
Lacustrine Clay Drained Shear Strength Envelope from Direct Shear Tests

Northshore Mining Milepost 7 Tailings Basin

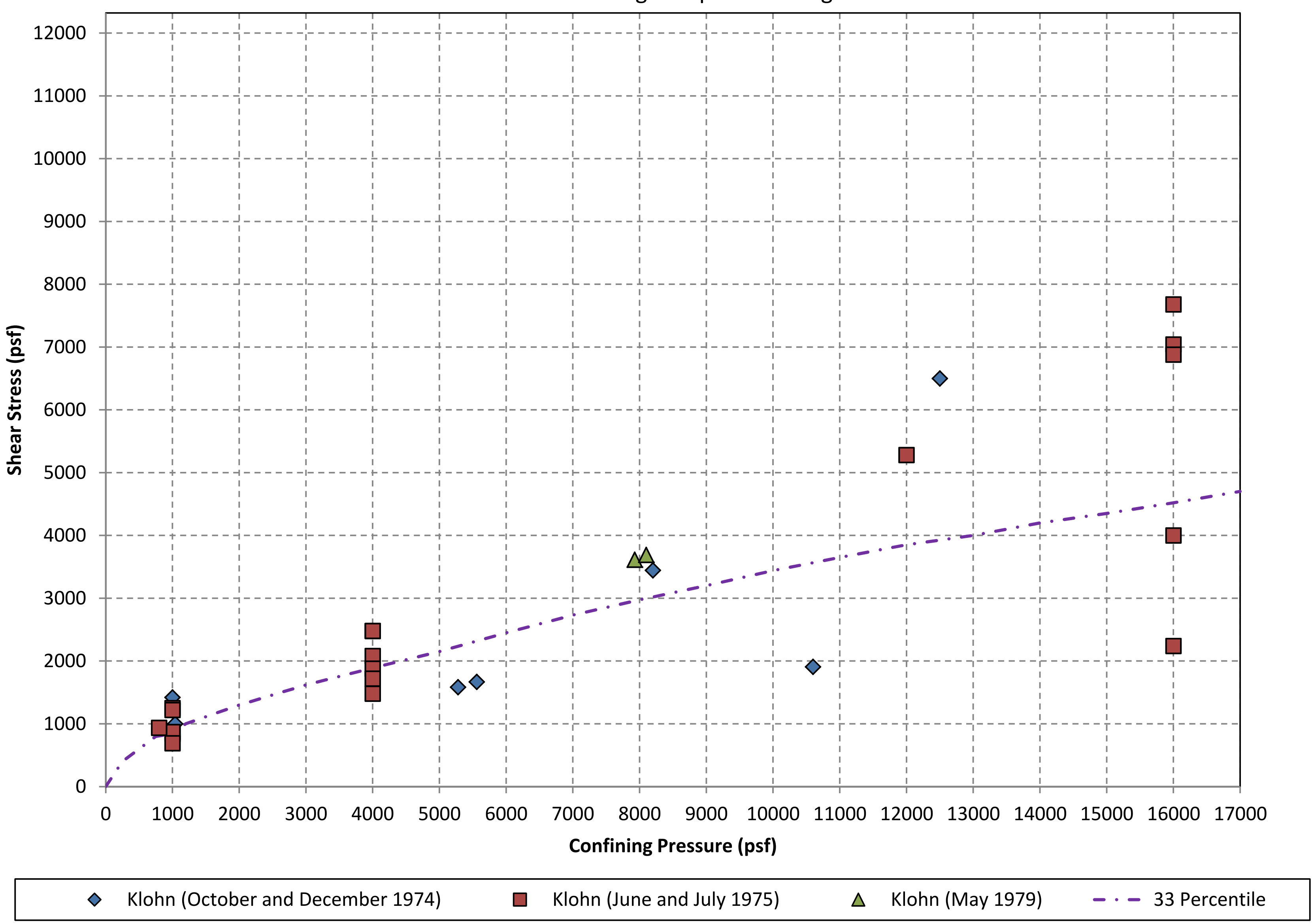

FIGURE 8

Lacustrine Clay Drained Shear Strength from CIU Triaxial and Direct Shear Data

Northshore Mining Milepost 7 Tailings Basin

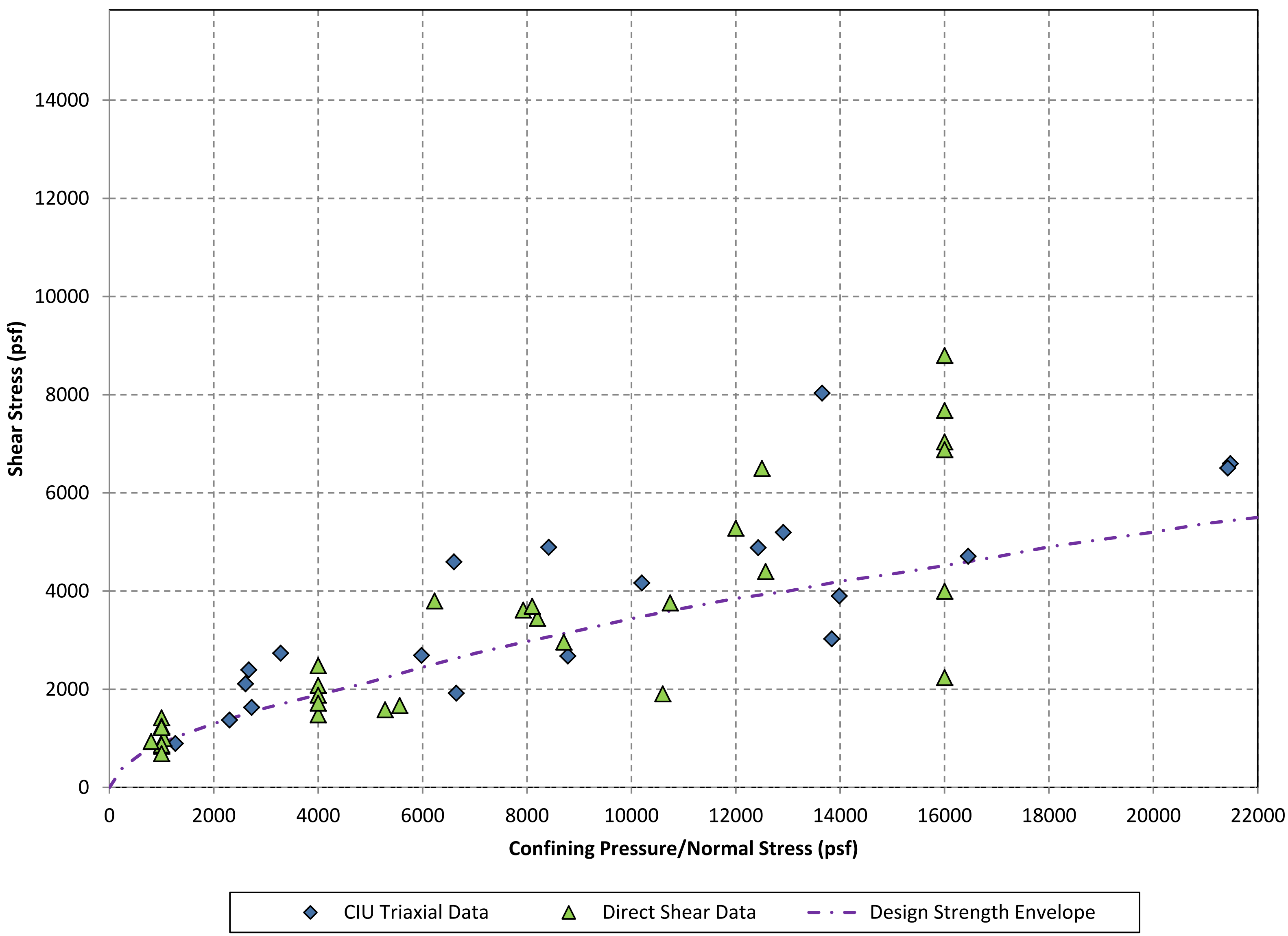

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FIGURE 9
CPT Correlated Undrained Yield Shear Strength Envelope - Fine Tailings (Olson and Stark, 2003)
Northshore Mine Milepost 7 Tailings Basin

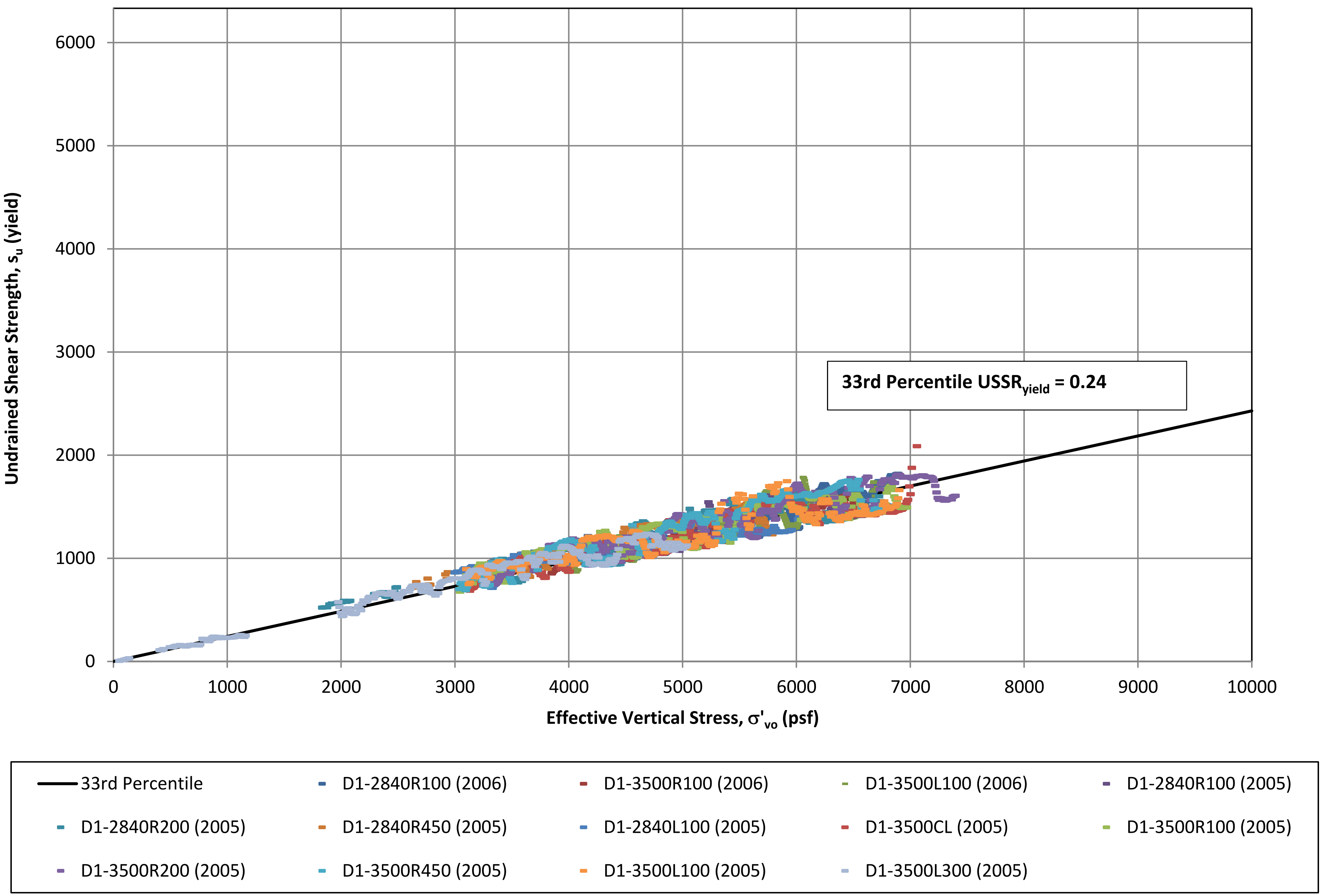


FIGURE 10
Field Vane Shear Test Peak Undrained Shear Strength Envelopes - Fine Tailings
Northsore Mine Milepost 7 Tailings Basin

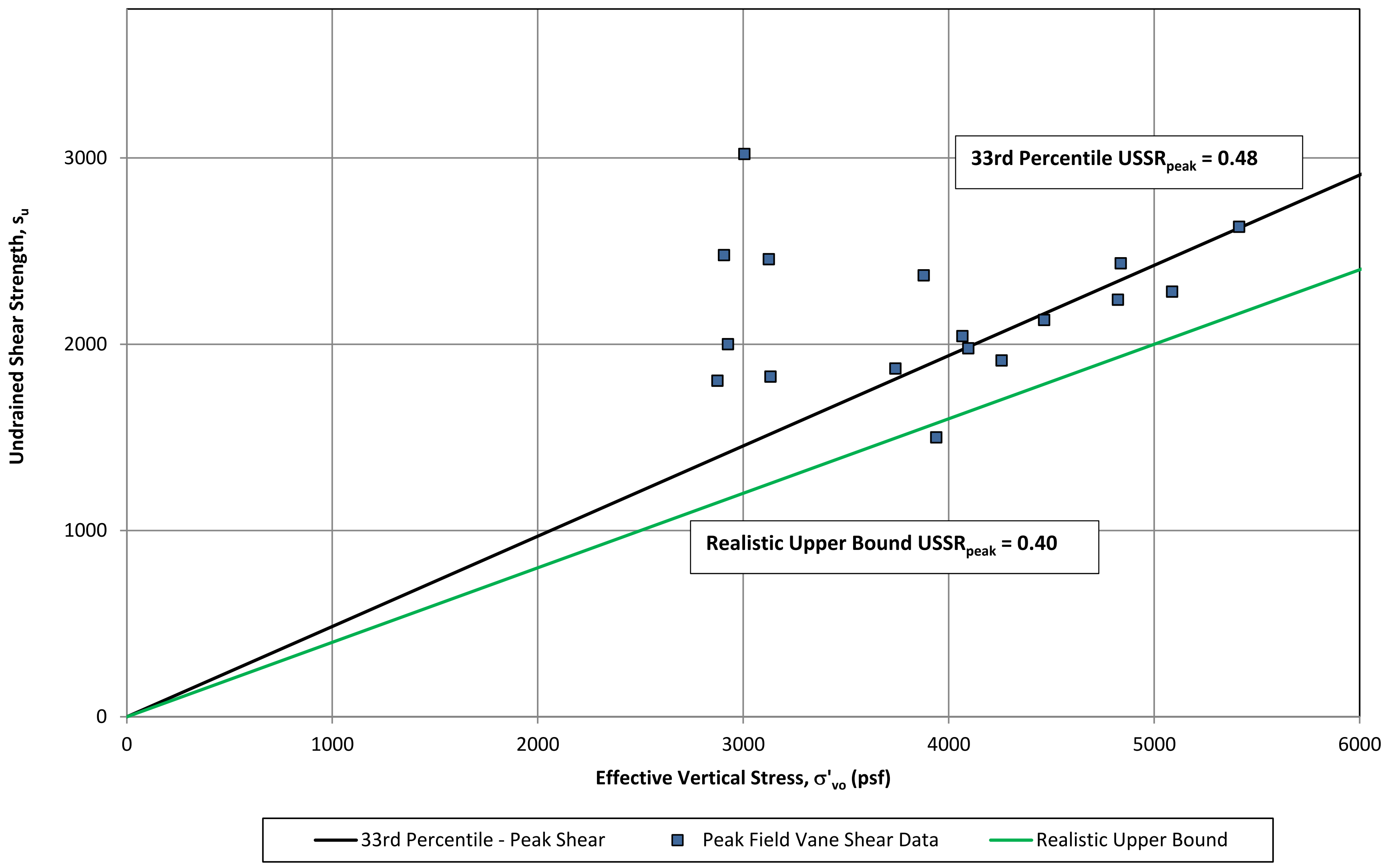
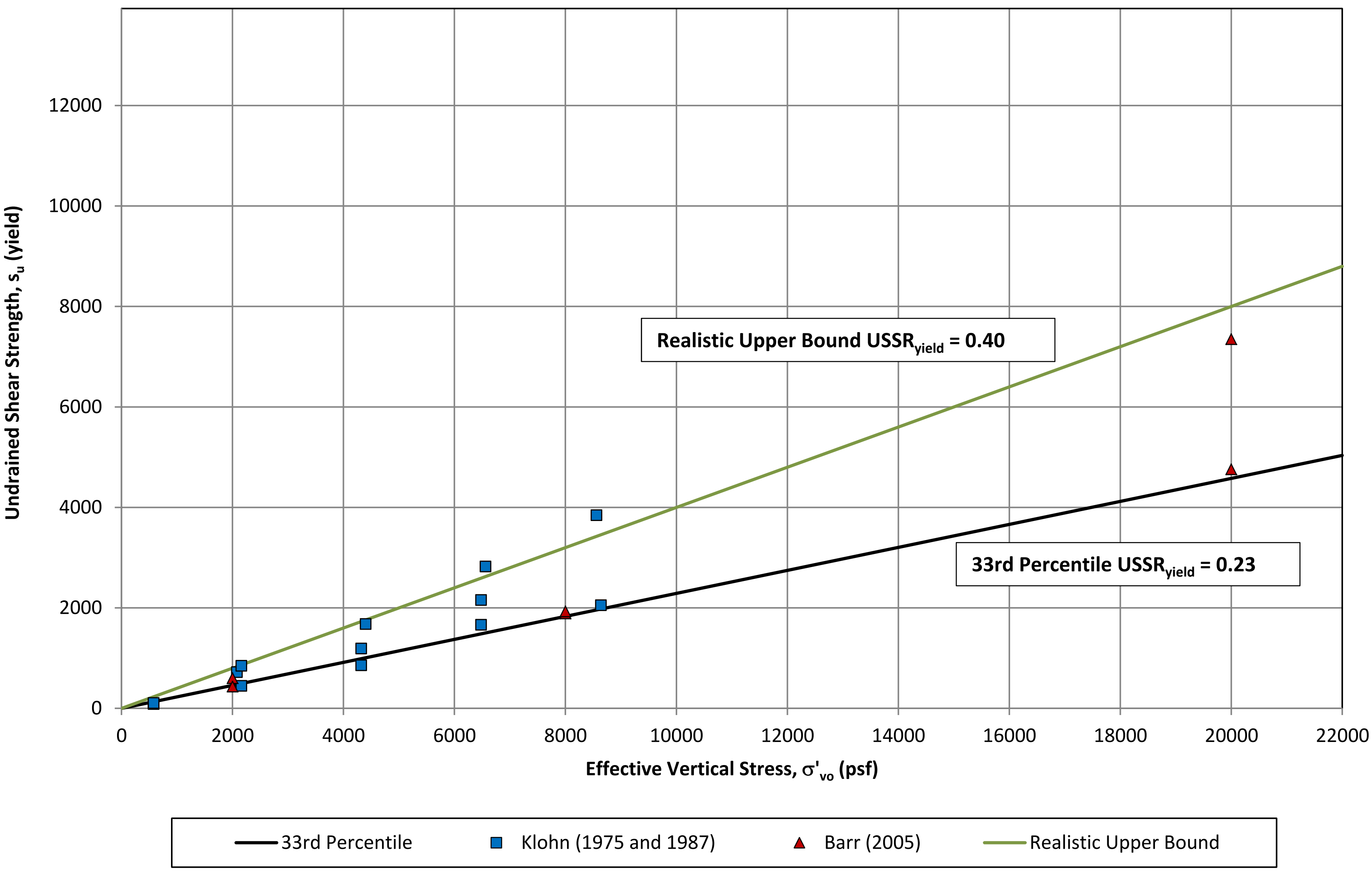


FIGURE 11
CIU Test Undrained Shear Strength Envelope - Fine Tailings, Yield
Northshore Mine Milepost 7 Tailings Basin



Note: Some Klohn 1982 and Barr 2005 data not presented due to possible cavitation during testing

6/26/2013
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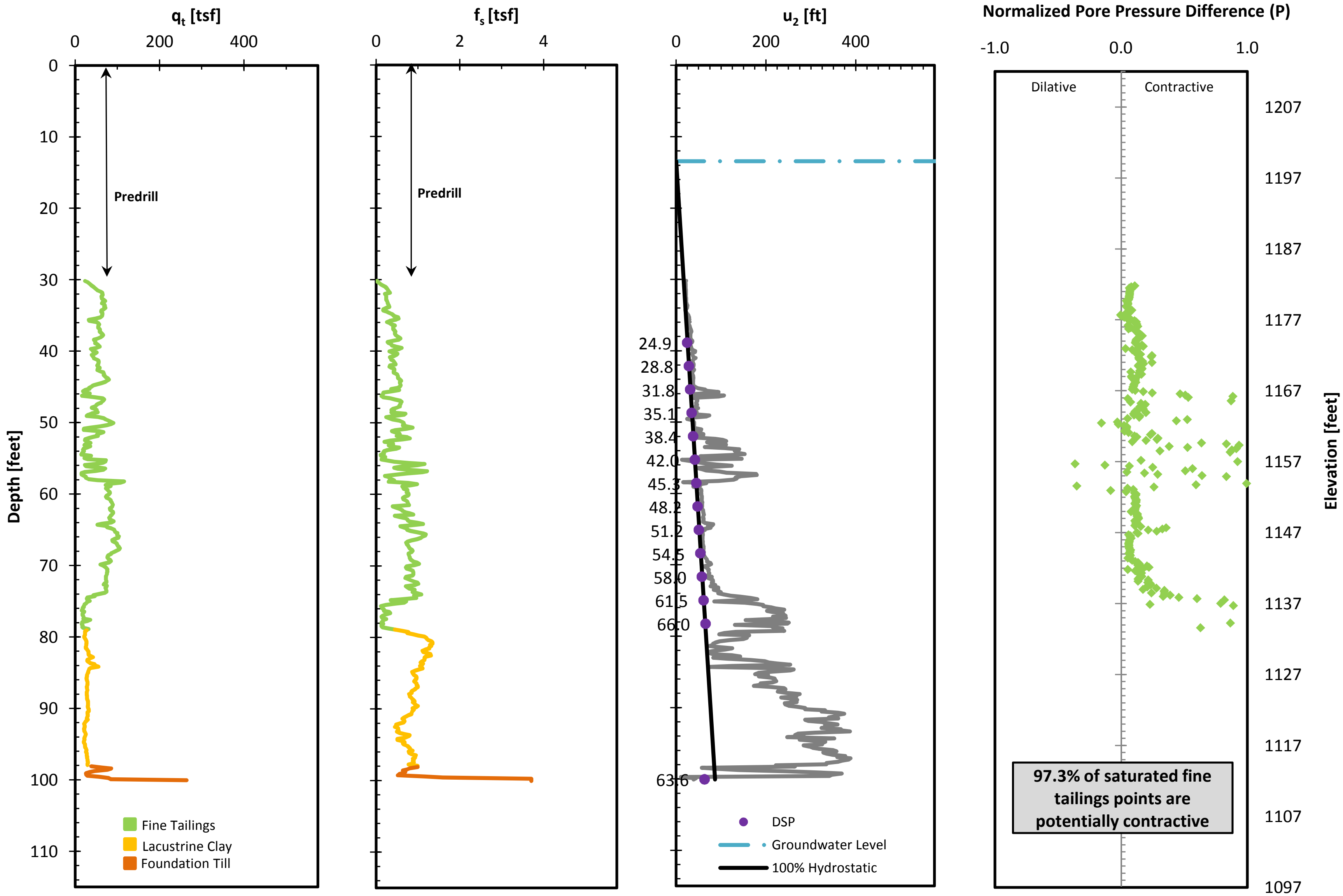
FIGURE 12
Tip Resistance, Side Friction, Groundwater, and Compressibility from CPT Data
D1-2840R100 (2005)
Northshore Mine Milepost 7 Tailings Basin



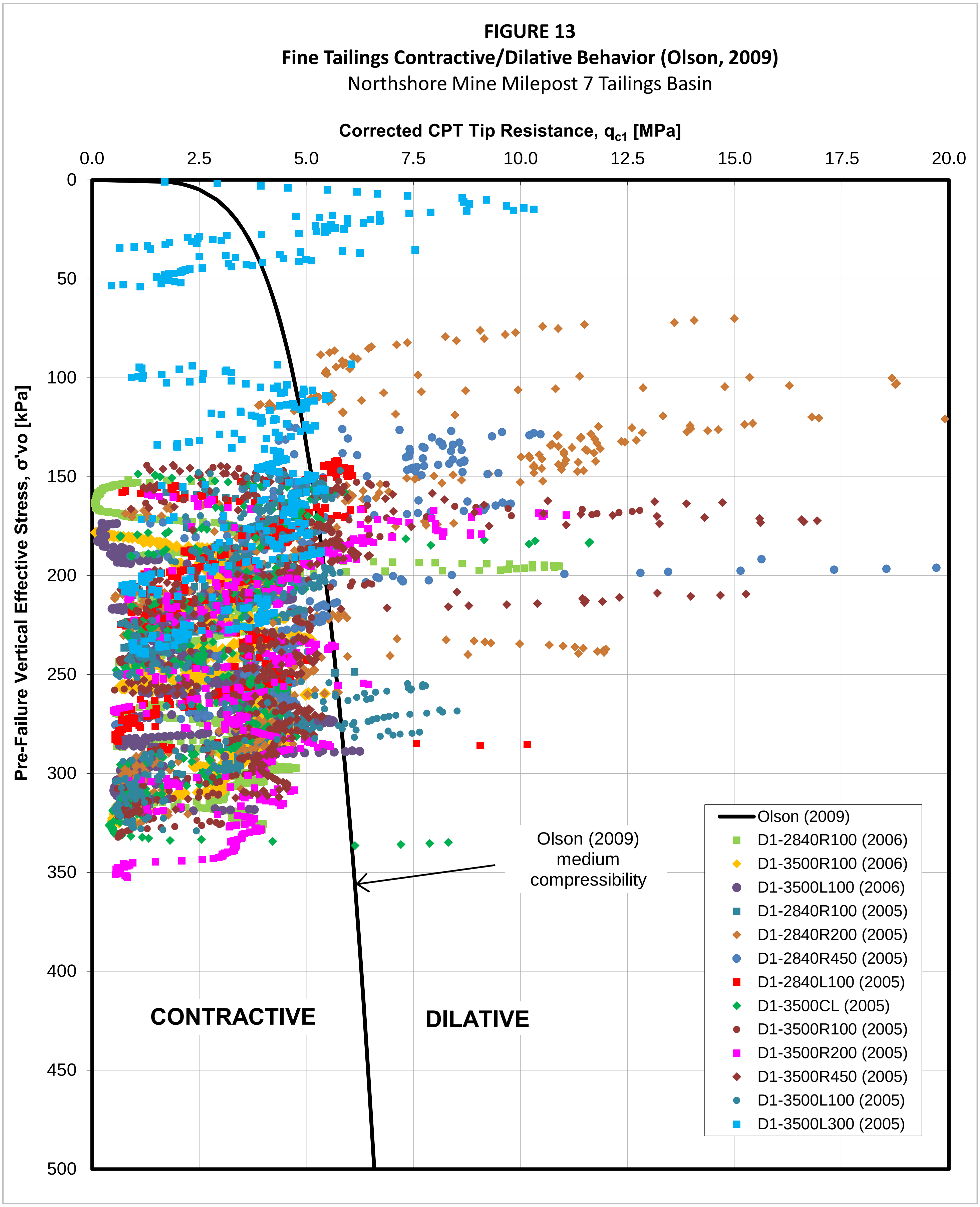
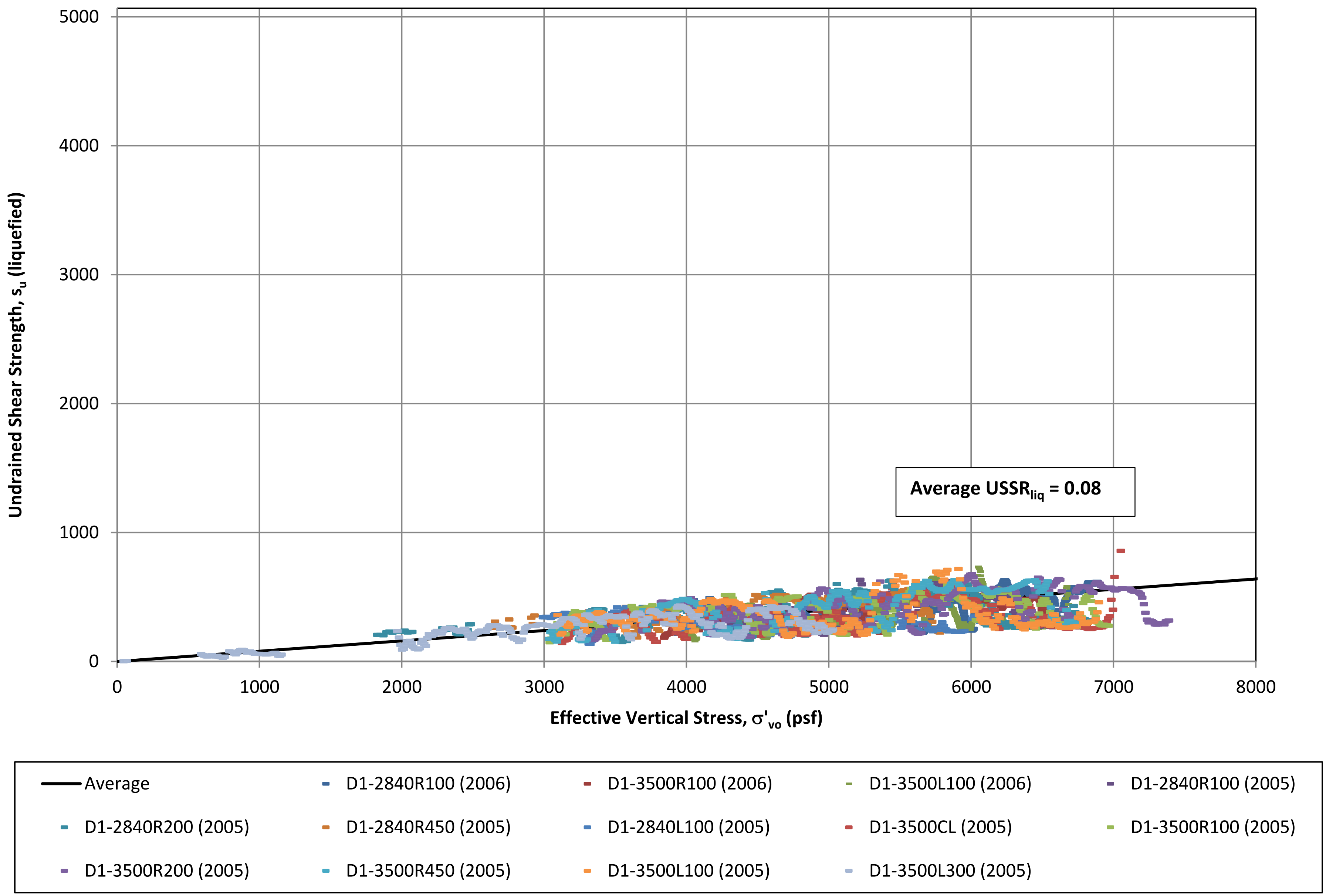


FIGURE 13
Fine Tailings Contractive/Dilative Behavior (Olson, 2009)
Northshore Mine Milepost 7 Tailings Basin
Corrected CPT Tip Resistance, q_{c1} [MPa]
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
Pre-Failure Vertical Effective Stress, σ'vo [kPa]
0
50
100
150
200
250
300
350
400
450
500
Olson (2009) medium compressibility
CONTRACTIVE
DILATIVE
Olson (2009)
D1-2840R100 (2006)
D1-3500R100 (2006)
D1-3500L100 (2006)
D1-2840R100 (2005)
D1-2840R200 (2005)
D1-2840R450 (2005)
D1-2840L100 (2005)
D1-3500CL (2005)
D1-3500R100 (2005)
D1-3500R200 (2005)
D1-3500R450 (2005)
D1-3500L100 (2005)
D1-3500L300 (2005)

FIGURE 14
CPT Correlated Liquefied Undrained Shear Strength Envelope - Fine Tailings (Olson and Stark, 2003)
Northshore Mine Milepost 7 Tailings Basin



6/26/2013
P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

FIGURE 15

Field Vane Shear Test Remolded Undrained Shear Strength Envelope - Fine Tailings

Northsore Mine Milepost 7 Tailings Basin

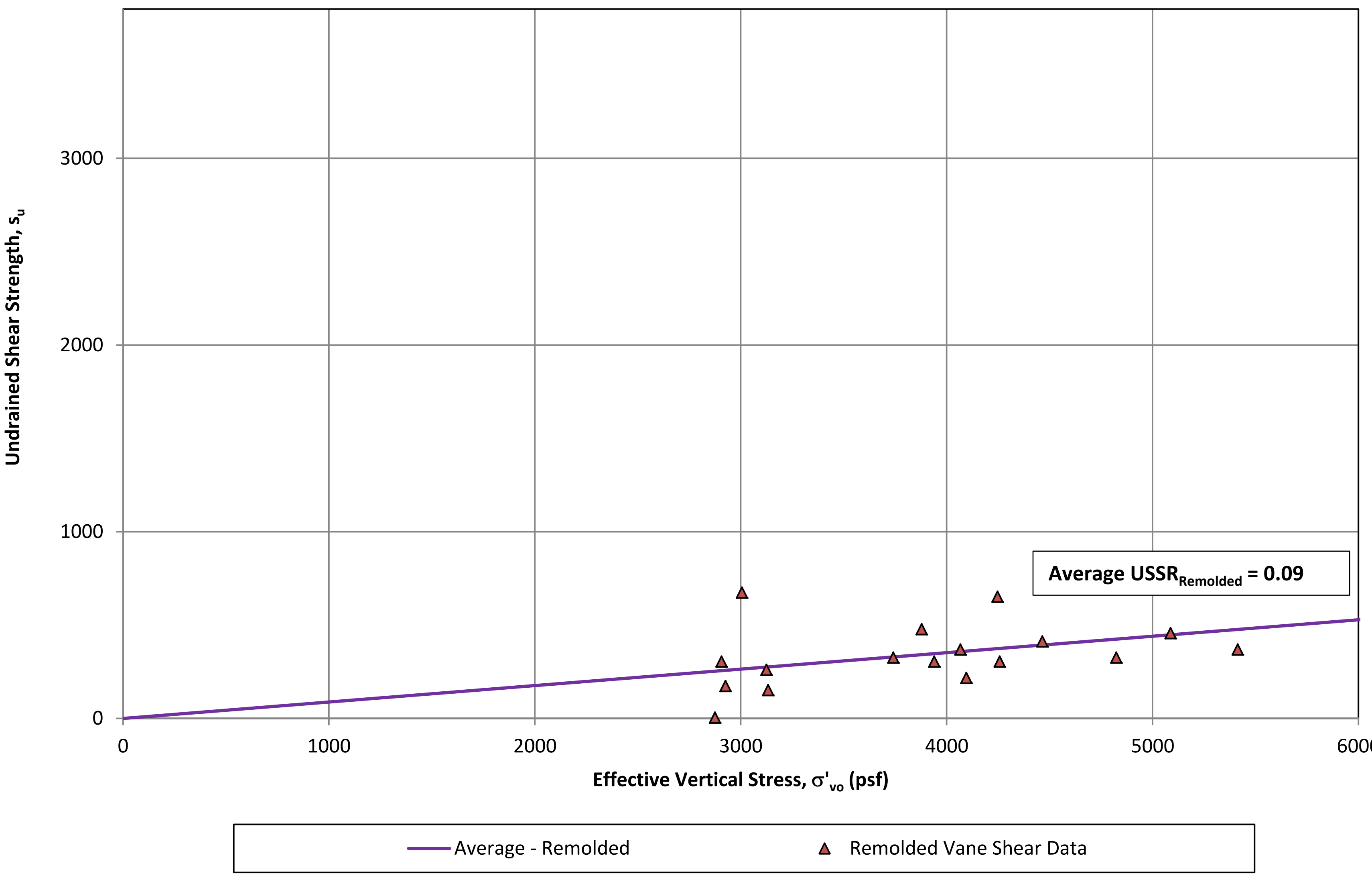
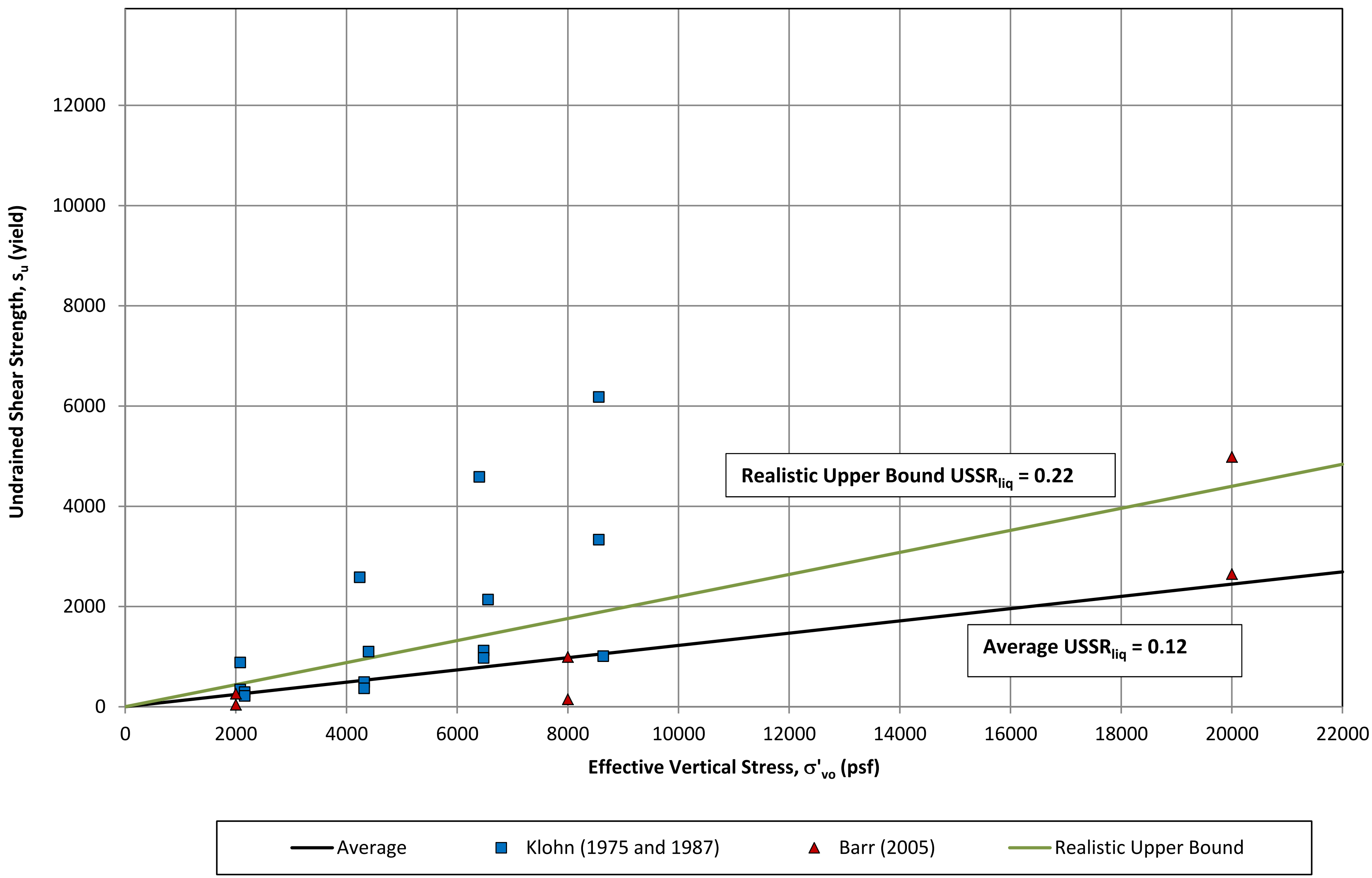


FIGURE 16

CIU Test Undrained Shear Strength Envelope - Fine Tailings, Liquefied

Northshore Mine Milepost 7 Tailings Basin



Note: Some Klohn 1982 and Barr 2005 data not presented due to possible cavitation during testing

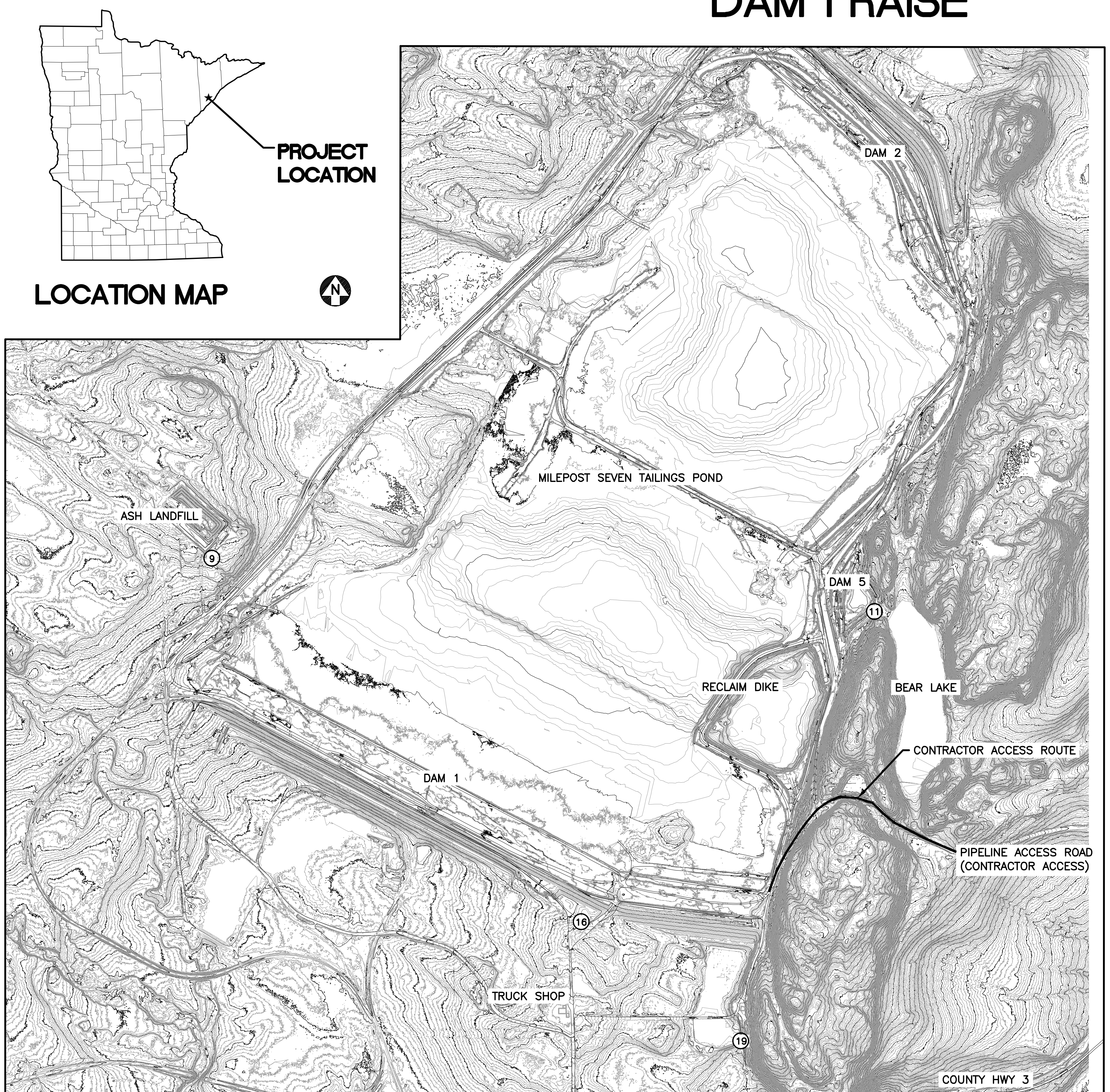
Appendix A

Dam Construction Plans

Appendix A

Dam Construction Plans

NORTHSHORE MINING COMPANY
DAM 1 RAISE



TAILING BASIN CONTROL DATA

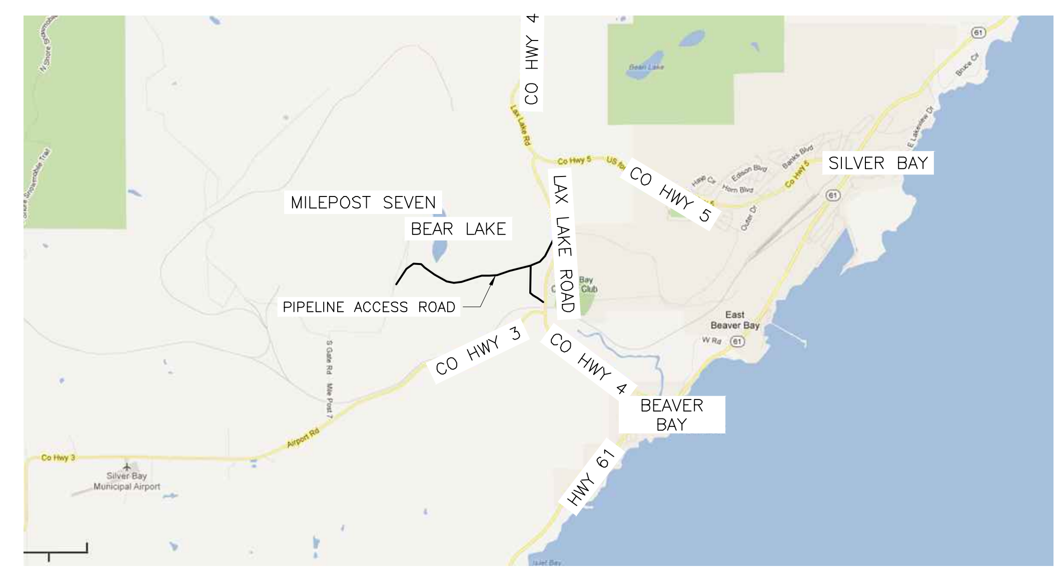
BASIN CONTROL

NUMBER	NAME	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	HV-1	633317.4670	3058535.4610	1260.50	ELEVATION SHOT (NOT SHOWN)
2	~~HV-2~~	~~630988.2460~~	~~3062756.9580~~		LOST
3	HV-3	629237.6030	3055025.7570	1279.45	
4	HV-4	628860.3920	3065021.5920	1074.08	RESET
5	HV-5	627118.3550	3053032.4500	1282.36	
6	HV-6	626869.8220	3056117.4250	~~1203.54~~	1203.45
7	HV-7	626556.9590	3063987.7860		
8	~~HV-8~~	~~624210.9990~~	~~3060731.2050~~		LOST
9	HV-9	621587.4510	3048856.4250	1308.69	
10	HV-10	622144.3200	3052628.5600	1203.48	
11	HV-11	620725.2580	3059623.2150	1201.82	
12	HV-12	623264.1010	3066683.2400		
13	HV-13	621973.5000	3064939.1690		
14	HV-14	618769.1630	3047140.9460	1236.61	
15	HV-15	617984.6850	3051180.5900	1217.50	
16	HV-16	615676.6820	3054865.0750	1214.85	
17	HV-17	616947.0370	3061729.9260		
18	HV-18	613041.6280	3048880.1880		
19	HV-19	613756.3770	3057456.3040	1180.18	REVISED COORDS
20	HV-20	607757.4790	3039041.8880		
21	HV-21	607307.4110	3042001.3040		
22	HV-22	611828.6780	3051567.0600		
23	HV-23	611930.4590	3051899.1130		
24	HV-24	609360.0970	3054733.1200		
25	HV-25	616650.4460	3055689.9480	1214.00	
26	HV-26	619946.4520	3049228.7120	1215.50	
27	~~HV-27~~	~~628900.5960~~	~~3058511.1370~~	~~1206.44~~	LOST
28	~~HV-28~~	~~625548.7060~~	~~3061033.2610~~	~~1209.95~~	LOST
29	~~HV-29~~	~~621441.3880~~	~~3058790.1490~~		LOST
30	MON #1	615561.7414	3049384.3056	1137.13	MON #1=BM 109
31	M1A	615029.2024	3049048.4111	1134.05	
32	M1B	615035.1445	3049035.4817	1134.20	
33	M13A	615183.2566	3048762.1013	1119.42	
34	M13	615178.2094	3048749.5361	1119.37	
35	M2	617991.2396	3048112.8961	1194.44	
36	MON #2	619103.5816	3047292.2067	1246.02	MON #2=BM 113
37	M10	619447.1477	3047003.5273	1268.41	
38	M10A	619438.8907	3046983.8117	1268.50	
39	HV-39	624916.4170	3061133.3300	1221.53	
40	HV-40	631187.5960	3062978.2150	1156.20	PIN MARKED 302
41	HV-41	630131.8310	3061017.3930	1157.87	
42	HV-42	630093.3420	3058663.2790	1215.48	
43	HV-43	632342.8920	3045529.2660	1436.99	WEST ACCESS ROAD (NOT SHOWN)

NOTE:
NOT ALL CONTROL POINTS ARE SHOWN ON SITE PLAN

INDEX OF SHEETS

CC-001 . . . . TITLE SHEET, SITE PLAN, AND SHEET INDEX
CC-002 . . . . CONSTRUCTION LOCATION MAP
CC-003 . . . . EXISTING CONDITIONS, PLAN AND PROFILE
CC-004 . . . . CONSTRUCTION PLAN
CC-005 . . . . TYPICAL SECTIONS



0 1000 2000
SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

CADD USER: Randy Wilson FILE: D-SIZE-BARR_2011_TEMPLATE.DWG PLOT SCALE: 1:1 PLOT DATE: 6/12/2008 3:47 PM

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

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Date	04/01/2013
Drawn	GSJ
Checked	ATG
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Approved	

NORTHSHORE MINING COMPANY
SILVER BAY, MINNESOTA

MILEPOST SEVEN TAILINGS BASIN
SILVER BAY, MINNESOTA

DAM 1 RAISE – ELEVATION 1245
TITLE SHEET, SITE PLAN, AND SHEET INDEX

BARR PROJECT No. 23/38-086
CLIENT PROJECT No.
DWG. No. CC-001
REV. No. 0

LAYOUT NOTES:

1. LAYOUT BASED ON CONTOURS DEVELOPED FROM AERIAL SURVEY BY AERO-METRIC OF SHEYBOYGAN, WISCONSIN. DATE OF PHOTOGRAPHY APRIL 12, 2012. AERO-METRIC MAPPING BASED ON THE FOLLOWING DATUM:

- VERTICAL DATUM: TWO FOOT CONTOUR INTERVAL BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.
- HORIZONTAL DATUM: MINNESOTA STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NAD 83/96.

1 PLAN: VICINITY MAP

PRELIMINARY
NOT FOR CONSTRUCTION

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NORTHSHORE MINING COMPANY
SILVER BAY, MINNESOTA

2013 PROPOSED DAM CONSTRUCTION
MILEPOST SEVEN TAILINGS POND, DAM 1

CONSTRUCTION LOCATION MAP

BARR PROJECT No. 23/38-086
CLIENT PROJECT No.
DWG. No. CC-002
REV. No. A

CADD USER: Greg Johnson FILE: K:\DESIGN\23380086.00\23380086 DAM 1_CC-002.DWG PLOT SCALE: 1:2 PLOT DATE: 6/26/2013 8:03 AM
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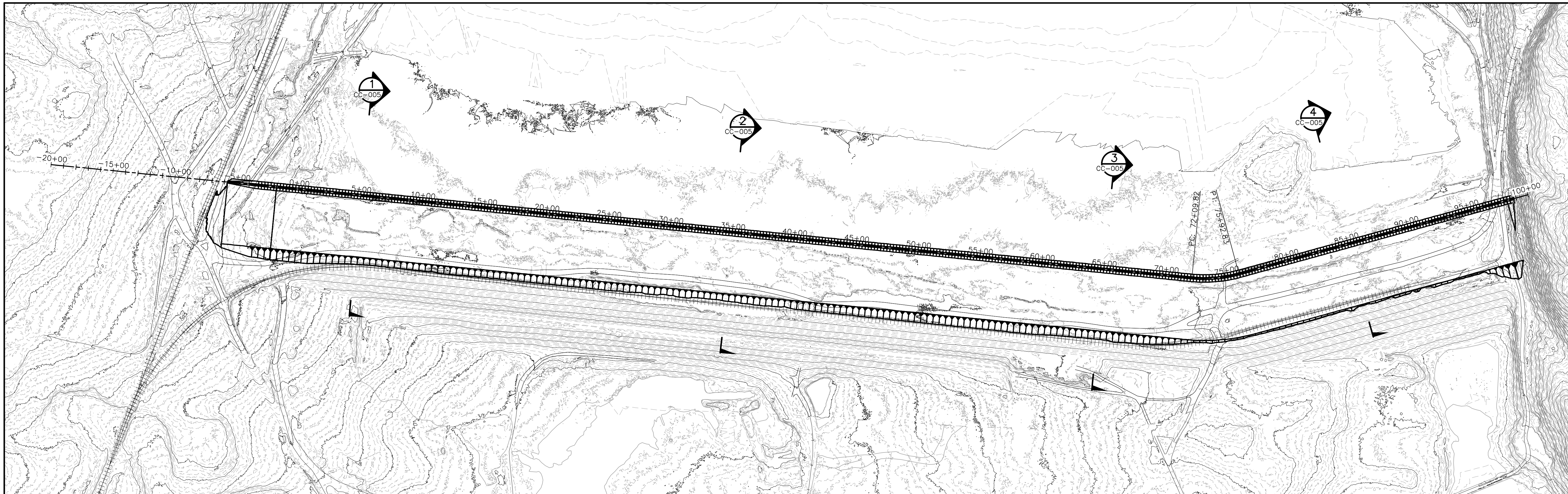


LAYOUT NOTES:

1. LAYOUT BASED ON CONTOURS DEVELOPED FROM AERIAL LIDAR SURVEY BY AERO-METRIC OF SHEYBOYGAN, WISCONSIN. DATE OF AERIAL LIDAR SURVEY APRIL 12, 2012. MAPPING BASED ON THE FOLLOWING DATUM:

-VERTICAL DATUM: TWO FOOT CONTOUR INTERVAL BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

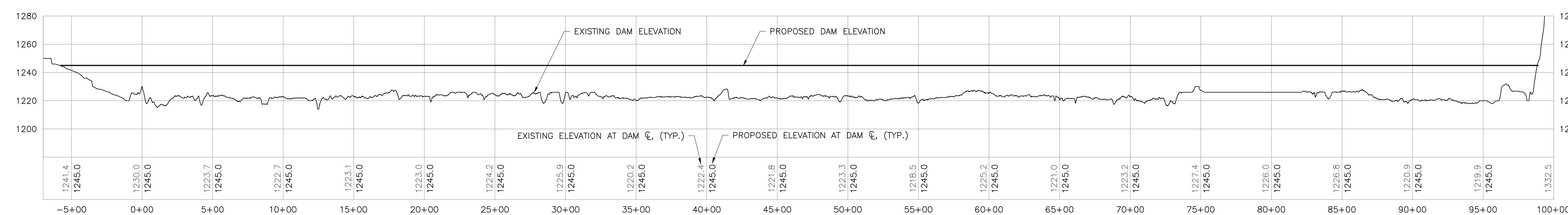
-HORIZONTAL DATUM: MINNESOTA STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NAD 83/96

1 PLAN: DAM 1

0 400 800
SCALE IN FEET

GENERAL NOTES:

1. ALL INSTRUMENTATION SHALL BE PROTECTED.
2. CONSTRUCTION OF THE DAM HAS BEEN ONGOING BY NSM. CONDITIONS HAVE CHANGED FROM THE TIME OF THE SURVEY.
3. PROTECT TAILINGS PIPE DURING CONSTRUCTION ACTIVITIES.



1 PROFILE: DAM 1

HORIZONTAL SCALE: 0 400 800 SCALE IN FEET

VERTICAL SCALE: 0 40 80 SCALE IN FEET

PRELIMINARY DRAFT

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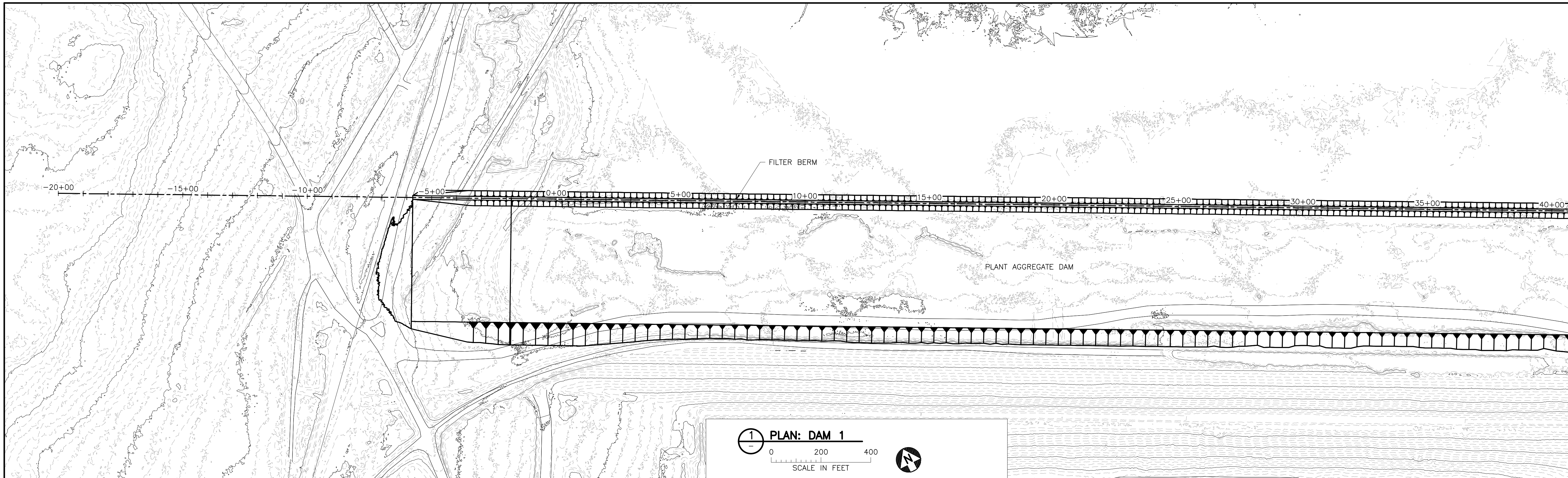
SILVER BAY, MINNESOTA

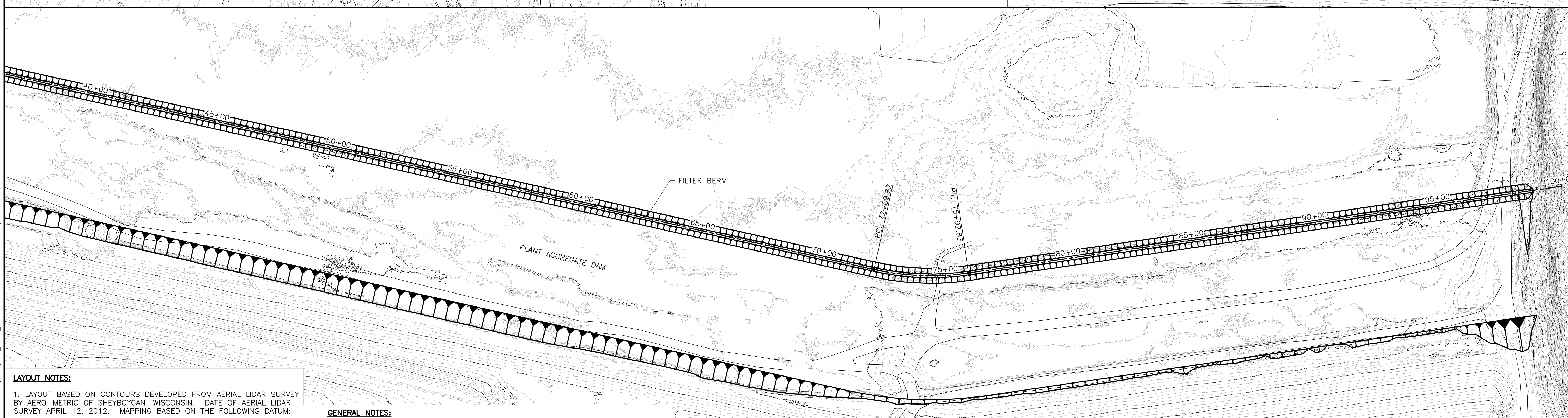
2013 PROPOSED DAM CONTRUCTION
MILEPOST SEVEN TAILINGS POND, DAM 1

EXISTING CONDITIONS PLAN AND PROFILE

BARR PROJECT No. 23/38-086
CLIENT PROJECT No.
DWG. No. CC-003
REV. No. A



① PLAN: DAM 1
0 200 400
SCALE IN FEET



LAYOUT NOTES:

1. LAYOUT BASED ON CONTOURS DEVELOPED FROM AERIAL LIDAR SURVEY BY AERO-METRIC OF SHEYBOYGAN, WISCONSIN. DATE OF AERIAL LIDAR SURVEY APRIL 12, 2012. MAPPING BASED ON THE FOLLOWING DATUM:

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-HORIZONTAL DATUM: MINNESOTA STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NAD 83/96

GENERAL NOTES:

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2. CONSTRUCTION OF THE DAM HAS BEEN ONGOING BY NSM. CONDITIONS HAVE CHANGED FROM THE TIME OF THE SURVEY.
3. PROTECT TAILINGS PIPE DURING CONSTRUCTION ACTIVITIES.

② PLAN: DAM 1
0 200 400
SCALE IN FEET

PRELIMINARY DRAFT

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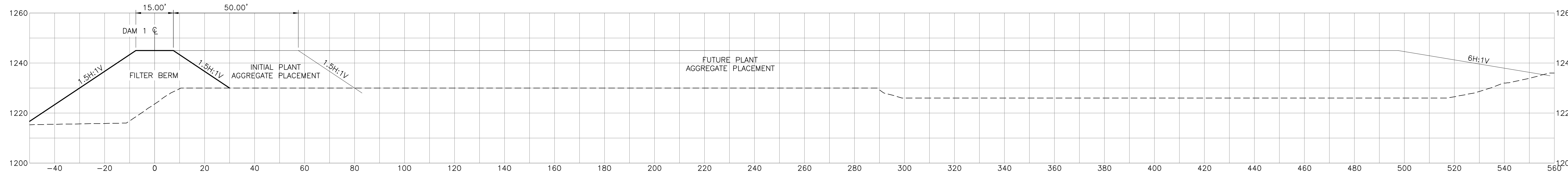
NORTHSHORE MINING COMPANY
SILVER BAY, MINNESOTA

2013 PROPOSED DAM CONTRUCTION
MILEPOST SEVEN TAILINGS POND, DAM 1

CONSTRUCTION PLAN

BARR PROJECT No. 23/38-086
CLIENT PROJECT No.
DWG. No. CC-004
REV. No. A



1 CC-003 **SECTION: STA 5+00**

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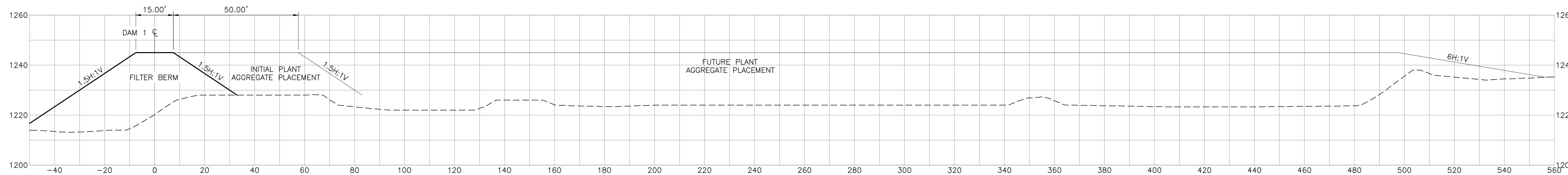
SCALE IN FEET



2 CC-003 **SECTION: STA 35+00**

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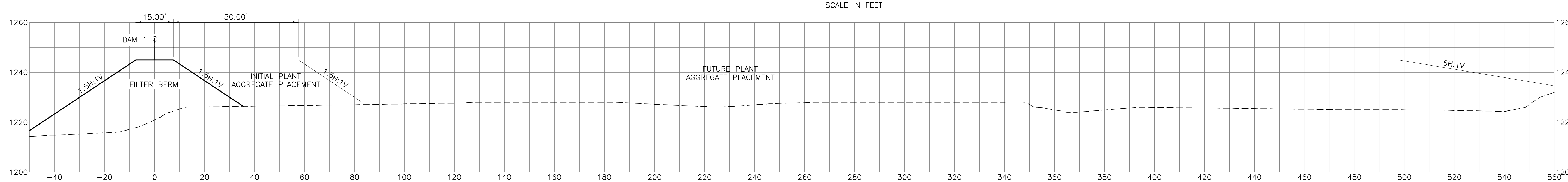
SCALE IN FEET



3 CC-003 **SECTION: STA 65+00**

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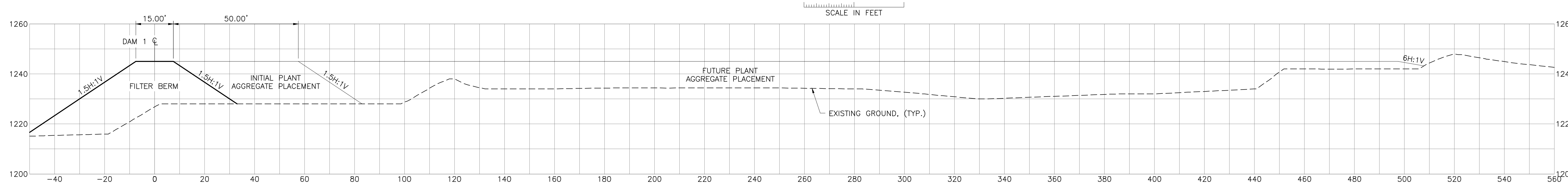
SCALE IN FEET



GENERAL NOTES:

1. ALL INSTRUMENTATION SHALL BE PROTECTED.
2. CONSTRUCTION OF THE DAM HAS BEEN ONGOING BY NSM. CONDITIONS HAVE CHANGED FROM THE TIME OF THE SURVEY.
3. PROTECT TAILINGS PIPE DURING CONSTRUCTION ACTIVITIES.

4 CC-003 **SECTION: STA 85+00**

0 20 40
SCALE IN FEET

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NORTHSHORE MINING COMPANY
SILVER BAY, MINNESOTA

2013 PROPOSED DAM CONTRUCTION
MILEPOST SEVEN TAILINGS POND, DAM 1

SECTIONS

BARR PROJECT No. 23/38-086
CLIENT PROJECT No.
DWG. No. CC-005
REV. No. A

Appendix B

Seepage and Stability Model Output

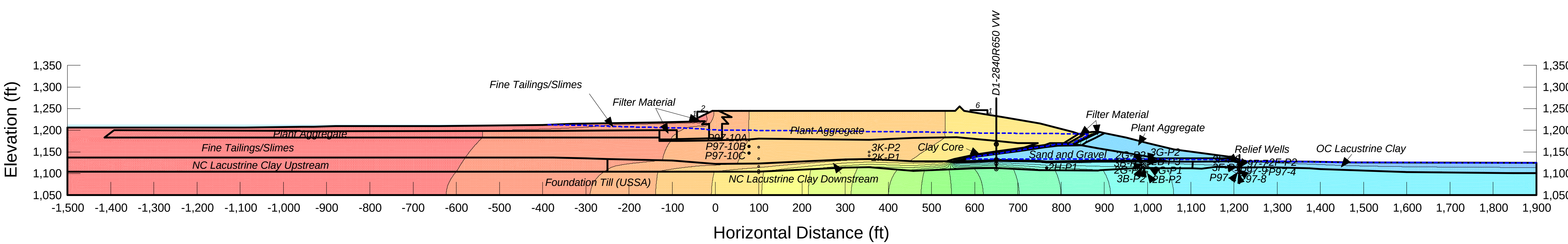
Appendix B

Seepage and Stability Model Output

Dam 1 Raised to 1,245 ft, South Pond at 1,212.8 ft, Existing Beach

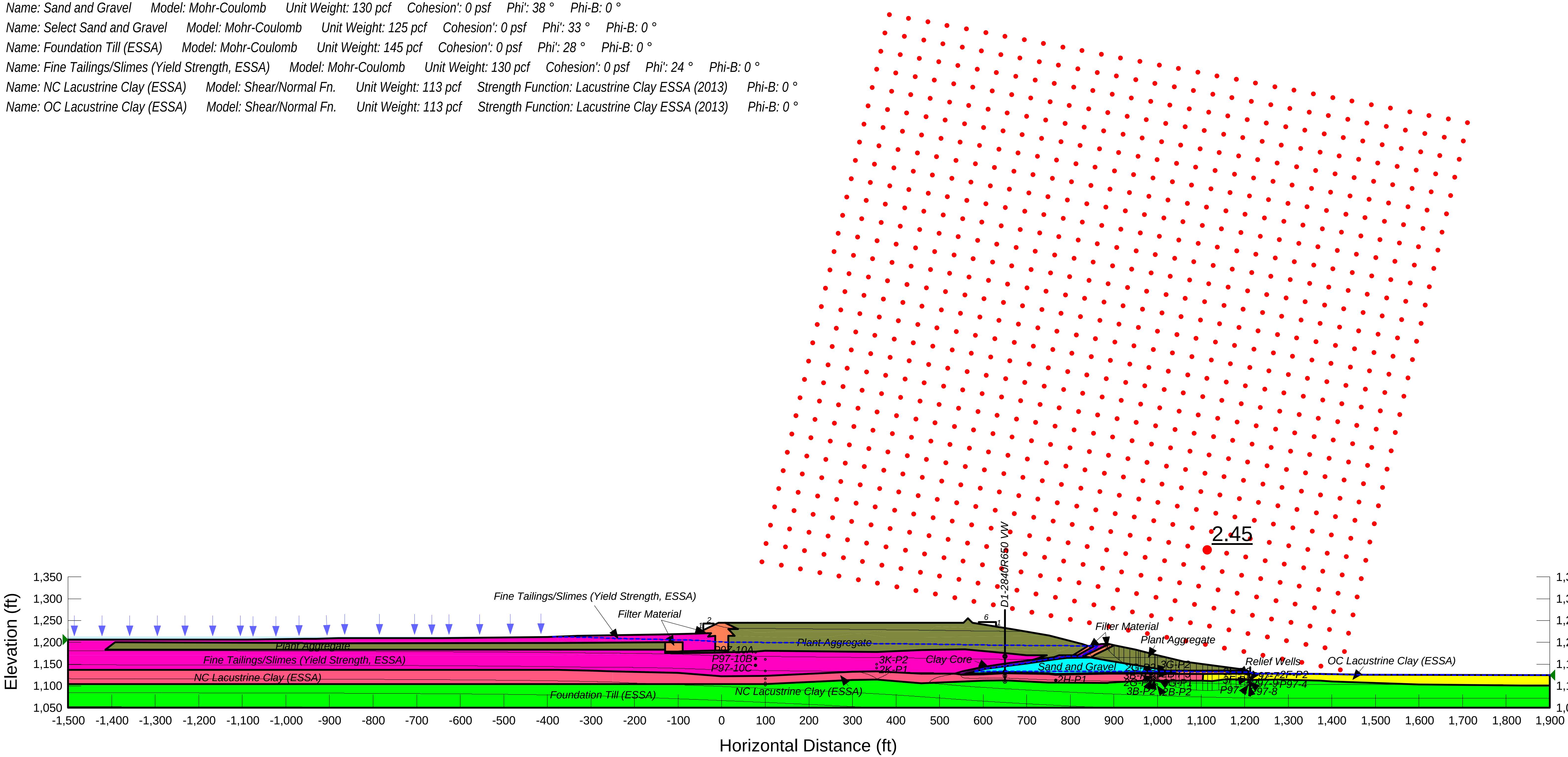
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,212.8 ft
File Name: D1-2840 and 3500 EL1245.gsz
Analysis Name: Steady-State Seepage
Date: 5/8/2013

Name: Foundation Till (USSA) Model: Saturated / Unsaturated K-Function: FOUNDATION TILL Higher Perm Kxsat = 6e-6 Ky'/Kx' Ratio: 0.2
Name: NC Lacustrine Clay Downstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC, Kxsat = 2.45e-8 ft/s Ky'/Kx' Ratio: 1.43
Name: OC Lacustrine Clay Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY OC HORIZ, Ksat = 1.41E-8 Ky'/Kx' Ratio: 0.0181
Name: Plant Aggregate Model: Saturated / Unsaturated K-Function: COARSE TAILINGS, Ksat = 1.624E-3 Ky'/Kx' Ratio: 1
Name: Clay Core Model: Saturated / Unsaturated K-Function: CLAY CORE TILL (Low End), Ksat =3.28E-9 Ky'/Kx' Ratio: 1
Name: Fine Tailings/Slimes Model: Saturated / Unsaturated K-Function: FINE TAILINGS (1/2 order mag higher), Ksat =1.8e-6 ft/s Ky'/Kx' Ratio: 1
Name: Filter Material Model: Saturated / Unsaturated K-Function: FILTER BERM, Ksat = 3.4E-4 ft/s Ky'/Kx' Ratio: 1
Name: Sand and Gravel Model: Saturated / Unsaturated K-Function: SAND AND GRAVEL, Ksat = 3.3e-03 ft/s Ky'/Kx' Ratio: 1
Name: Select Sand and Gravel Model: Saturated / Unsaturated K-Function: SELECT SAND AND GRAVEL, Ksat = 1.67E-3 Ky'/Kx' Ratio: 1
Name: Relief Well Model: Saturated / Unsaturated K-Function: Relief Well, Ksat = 1 Ky'/Kx' Ratio: 1
Name: NC Lacustrine Clay Upstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC (1.5 order mag higher), Kxsat =7.5e-7 ft/s (2) Ky'/Kx' Ratio: 2.5



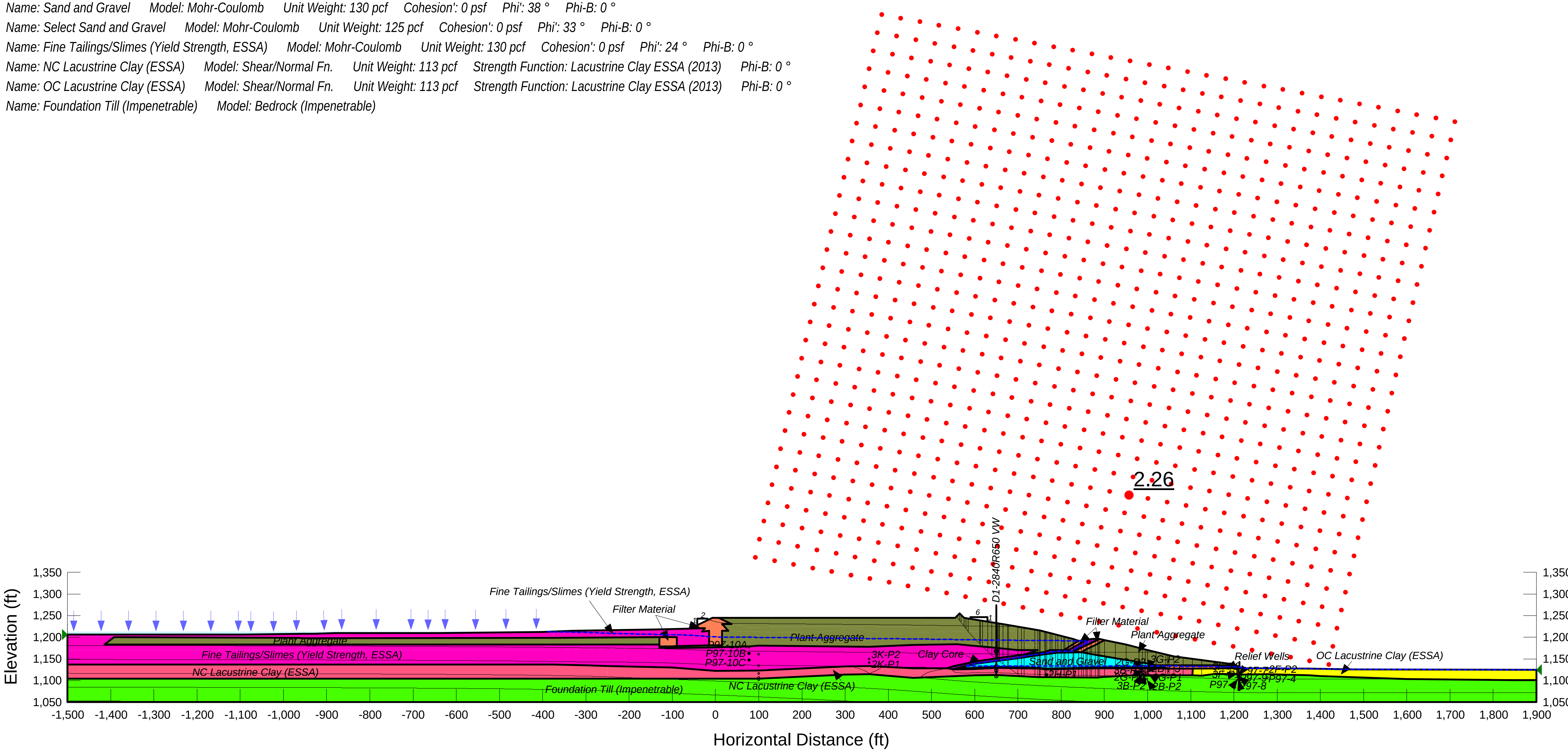
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,212.8 ft
File Name: D1-2840 and 3500 EL1245.gsz
Analysis Name: Downstream Slope Stability - ESSA
Date: 5/8/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Foundation Till (ESSA) Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 24 ° Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °



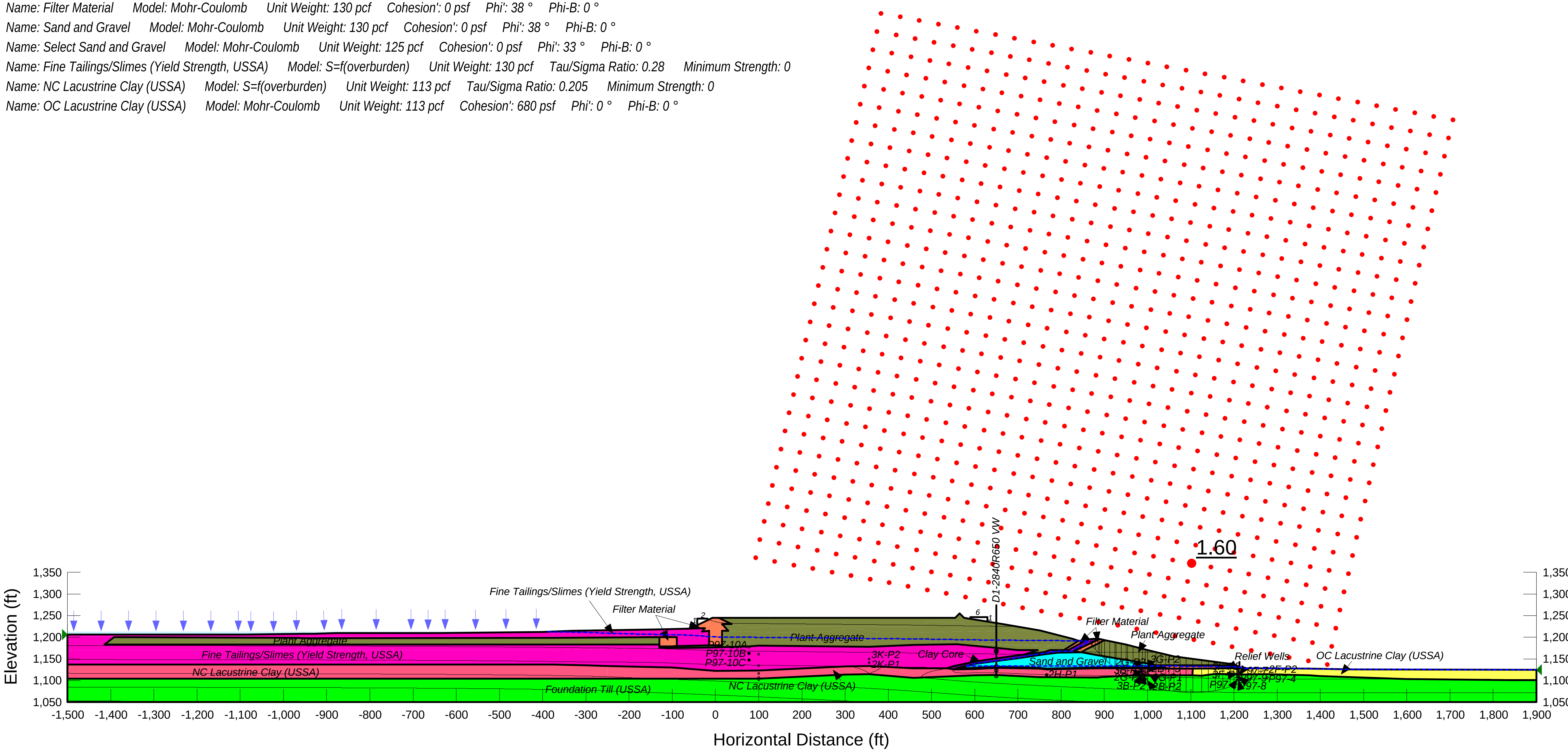
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,212.8 ft
File Name: D1-2840 and 3500 EL1245.gsz
Analysis Name: Downstream Slope Stability - ESSA, Impenetrable Till
Date: 5/8/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 24 ° Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



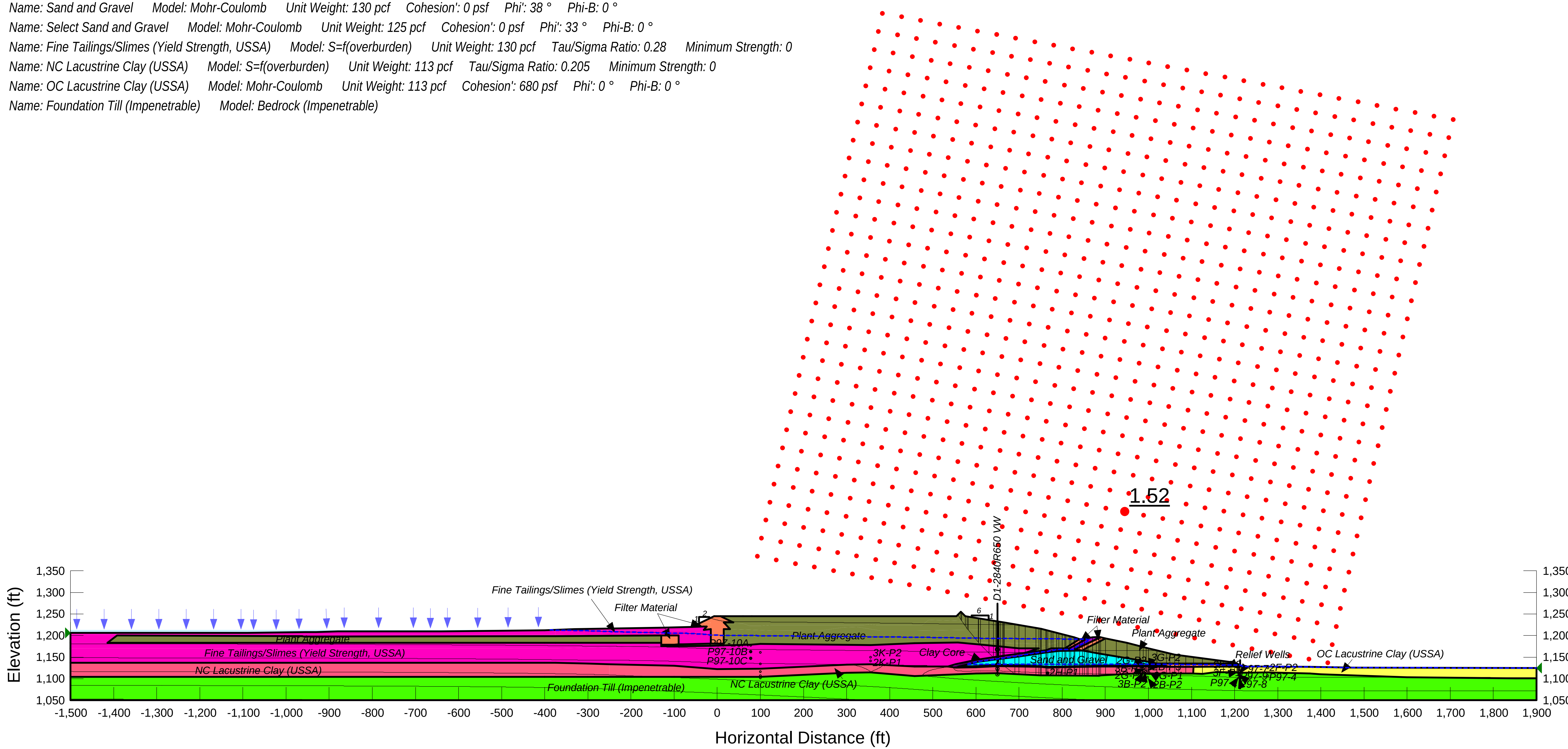
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,212.8 ft
File Name: D1-2840 and 3500 EL1245.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength
Date: 5/13/2013

Name: Foundation Till (USSA)   Model: S=f(overburden)   Unit Weight: 145 pcf   Tau/Sigma Ratio: 0.29   Minimum Strength: 0
Name: Plant Aggregate   Model: Mohr-Coulomb   Unit Weight: 144 pcf   Cohesion': 0 psf   Phi': 40 °   Phi-B: 0 °
Name: Clay Core   Model: Mohr-Coulomb   Unit Weight: 145 pcf   Cohesion': 0 psf   Phi': 31 °   Phi-B: 0 °
Name: Filter Material   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 38 °   Phi-B: 0 °
Name: Sand and Gravel   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 38 °   Phi-B: 0 °
Name: Select Sand and Gravel   Model: Mohr-Coulomb   Unit Weight: 125 pcf   Cohesion': 0 psf   Phi': 33 °   Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, USSA)   Model: S=f(overburden)   Unit Weight: 130 pcf   Tau/Sigma Ratio: 0.28   Minimum Strength: 0
Name: NC Lacustrine Clay (USSA)   Model: S=f(overburden)   Unit Weight: 113 pcf   Tau/Sigma Ratio: 0.205   Minimum Strength: 0
Name: OC Lacustrine Clay (USSA)   Model: Mohr-Coulomb   Unit Weight: 113 pcf   Cohesion': 680 psf   Phi': 0 °   Phi-B: 0 °



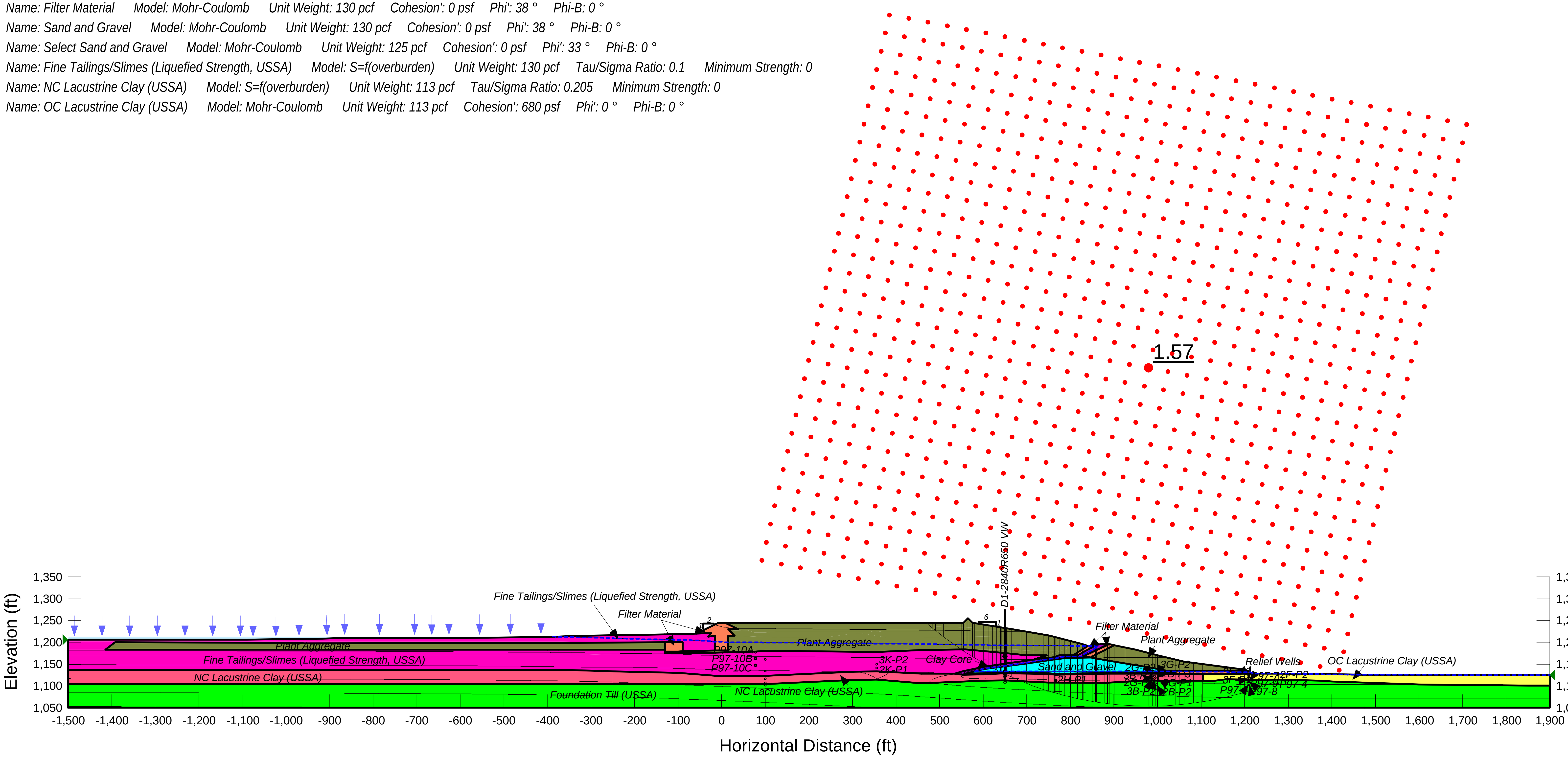
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,212.8 ft
File Name: D1-2840 and 3500 EL1245.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength, Impenetrable Till
Date: 5/13/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.28 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



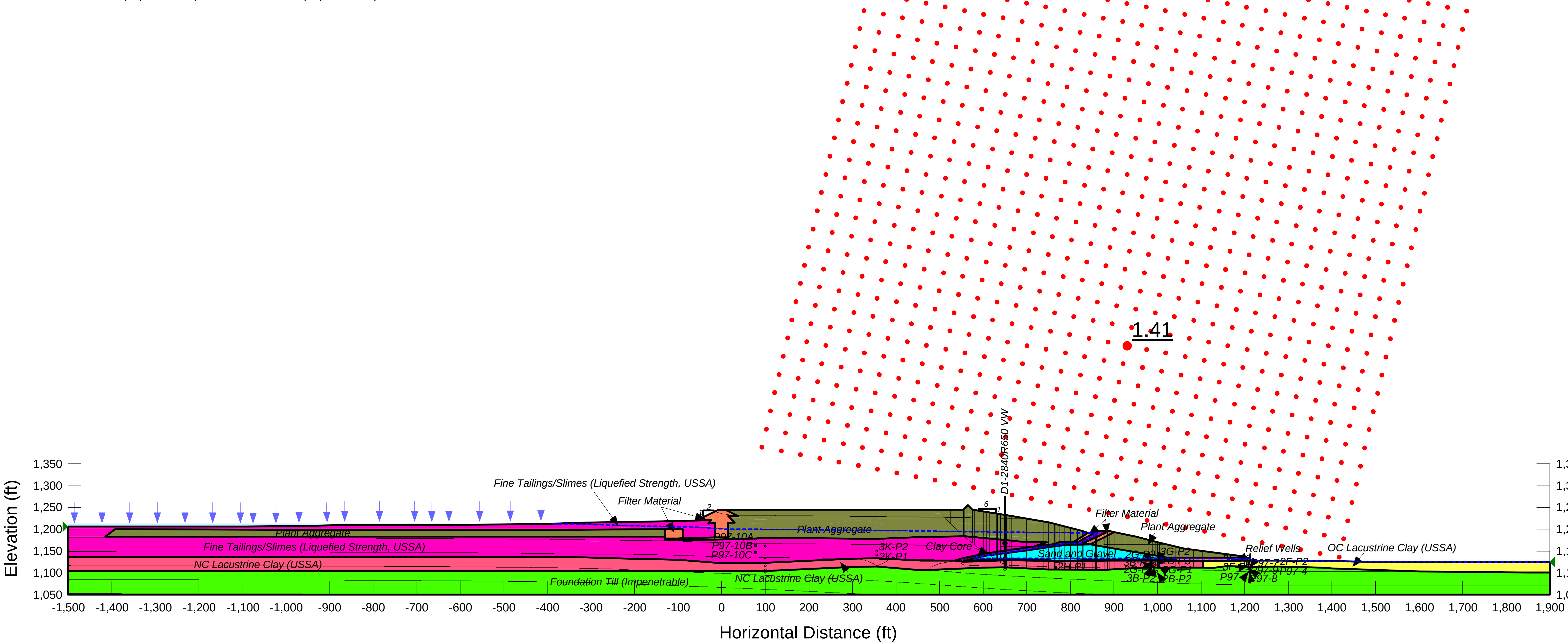
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,212.8 ft
File Name: D1-2840 and 3500 EL1245.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength
Date: 5/8/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Liquefied Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.1 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °



Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,212.8 ft
File Name: D1-2840 and 3500 EL1245.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength, Impenetrable Till
Date: 5/8/2013

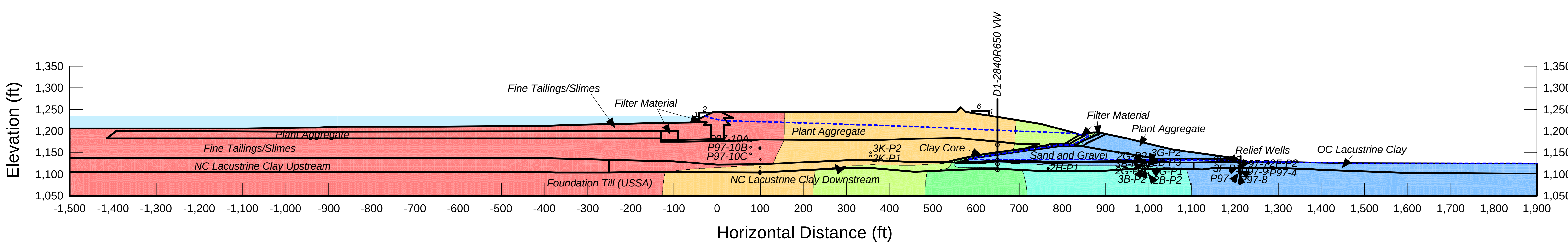
Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Liquefied Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.1 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



Dam 1 Raised to 1,245 ft, South Pond at 1,235 ft, Existing Beach

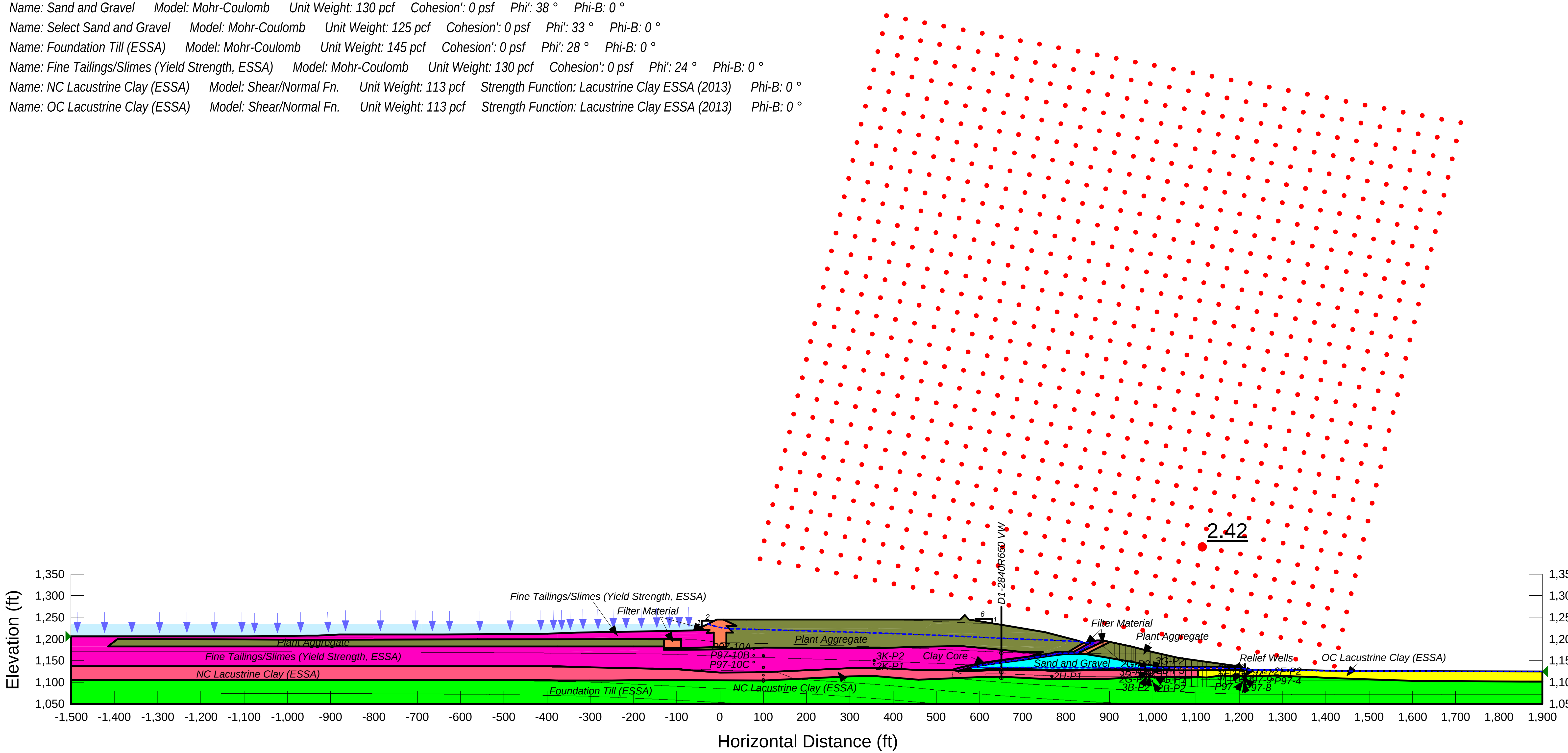
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft
File Name: D1-2840 and 3500 EL1245 Pond 1235.gsz
Analysis Name: Steady-State Seepage
Date: 5/9/2013

Name: Foundation Till (USSA) Model: Saturated / Unsaturated K-Function: FOUNDATION TILL Higher Perm Kxsat = 6e-6 Ky'/Kx' Ratio: 0.2
Name: NC Lacustrine Clay Downstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC, Kxsat = 2.45e-8 ft/s Ky'/Kx' Ratio: 1.43
Name: OC Lacustrine Clay Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY OC HORIZ, Ksat = 1.41E-8 Ky'/Kx' Ratio: 0.0181
Name: Plant Aggregate Model: Saturated / Unsaturated K-Function: COARSE TAILINGS, Ksat = 1.624E-3 Ky'/Kx' Ratio: 1
Name: Clay Core Model: Saturated / Unsaturated K-Function: CLAY CORE TILL (Low End), Ksat =3.28E-9 Ky'/Kx' Ratio: 1
Name: Fine Tailings/Slimes Model: Saturated / Unsaturated K-Function: FINE TAILINGS (1/2 order mag higher), Ksat =1.8e-6 ft/s Ky'/Kx' Ratio: 1
Name: Filter Material Model: Saturated / Unsaturated K-Function: FILTER BERM, Ksat = 3.4E-4 ft/s Ky'/Kx' Ratio: 1
Name: Sand and Gravel Model: Saturated / Unsaturated K-Function: SAND AND GRAVEL, Ksat = 3.3e-03 ft/s Ky'/Kx' Ratio: 1
Name: Select Sand and Gravel Model: Saturated / Unsaturated K-Function: SELECT SAND AND GRAVEL, Ksat = 1.67E-3 Ky'/Kx' Ratio: 1
Name: Relief Well Model: Saturated / Unsaturated K-Function: Relief Well, Ksat = 1 Ky'/Kx' Ratio: 1
Name: NC Lacustrine Clay Upstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC (1.5 order mag higher), Kxsat =7.5e-7 ft/s (2) Ky'/Kx' Ratio: 2.5



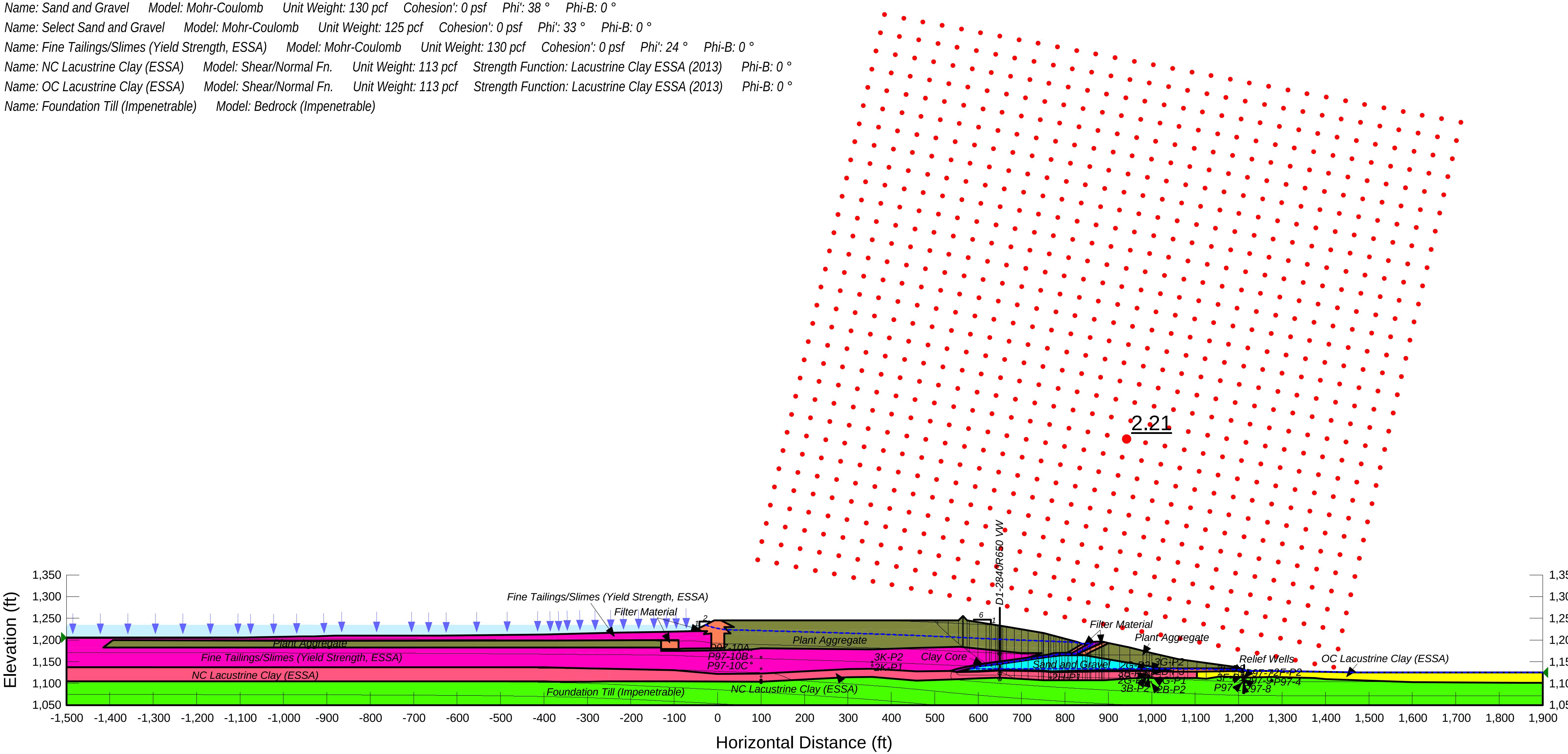
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft
File Name: D1-2840 and 3500 EL1245 Pond 1235.gsz
Analysis Name: Downstream Slope Stability - ESSA
Date: 5/9/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Foundation Till (ESSA) Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 24 ° Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °



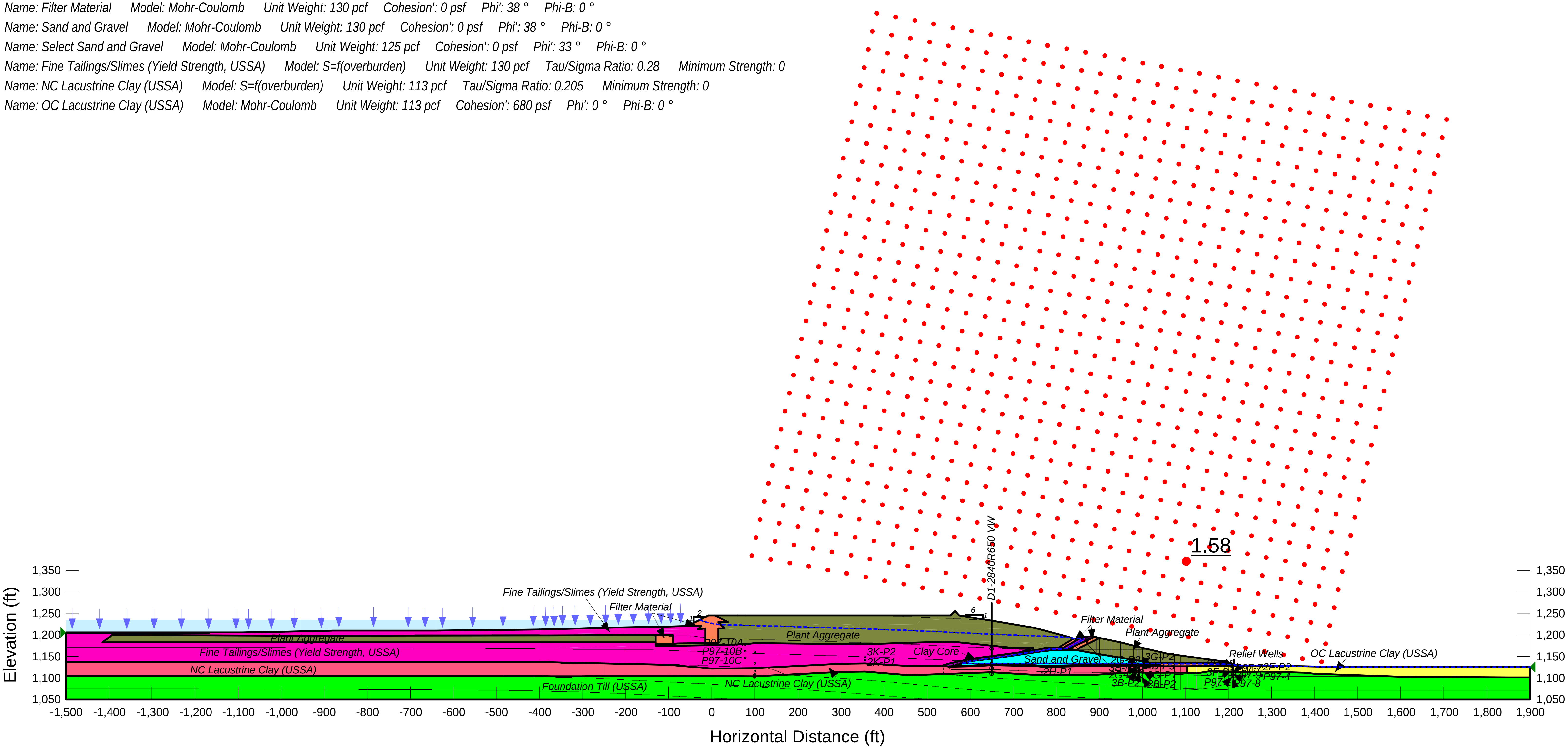
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft
File Name: D1-2840 and 3500 EL1245 Pond 1235.gsz
Analysis Name: Downstream Slope Stability - ESSA, Impenetrable Till
Date: 5/9/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 24 ° Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



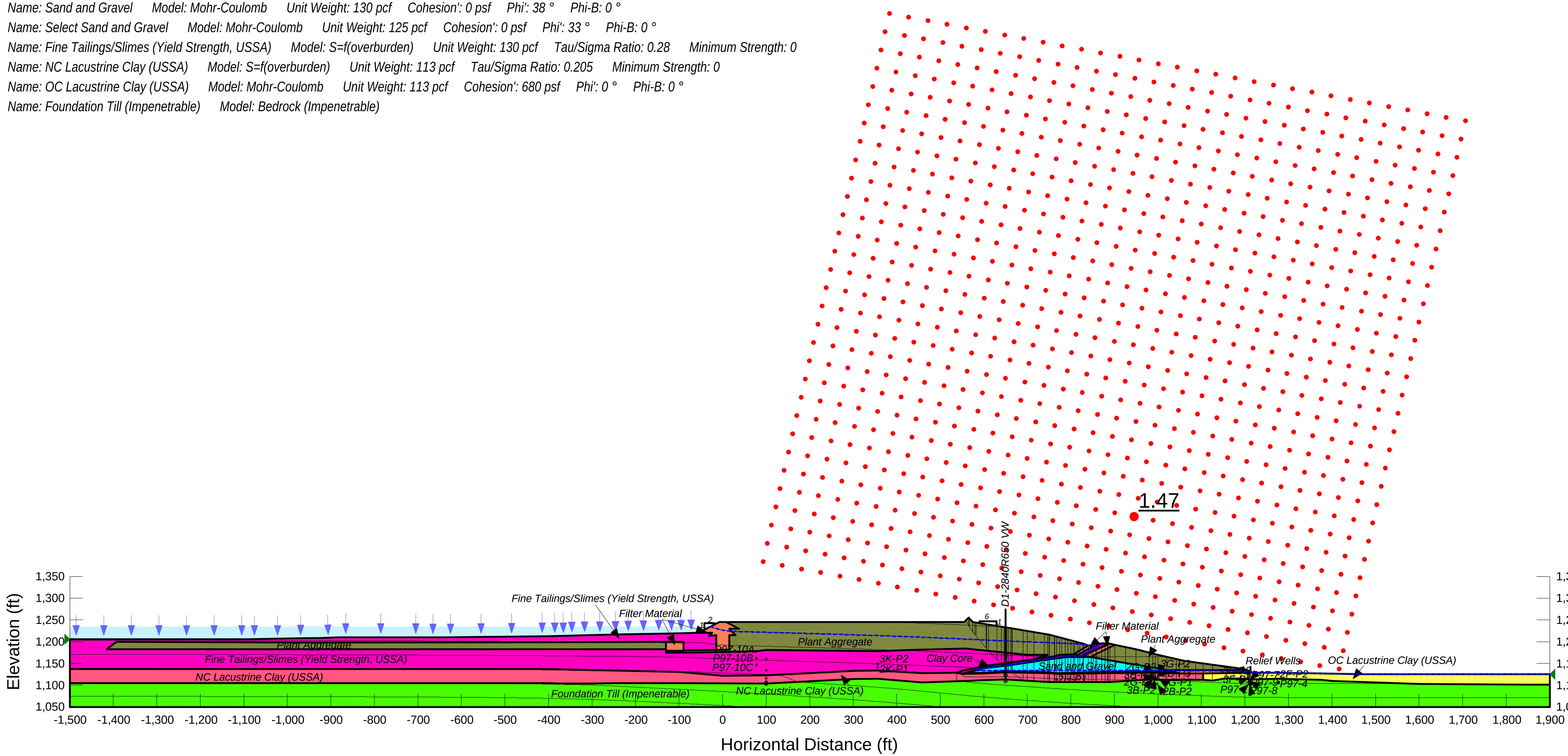
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft
File Name: D1-2840 and 3500 EL1245 Pond 1235.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength
Date: 5/13/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.28 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °



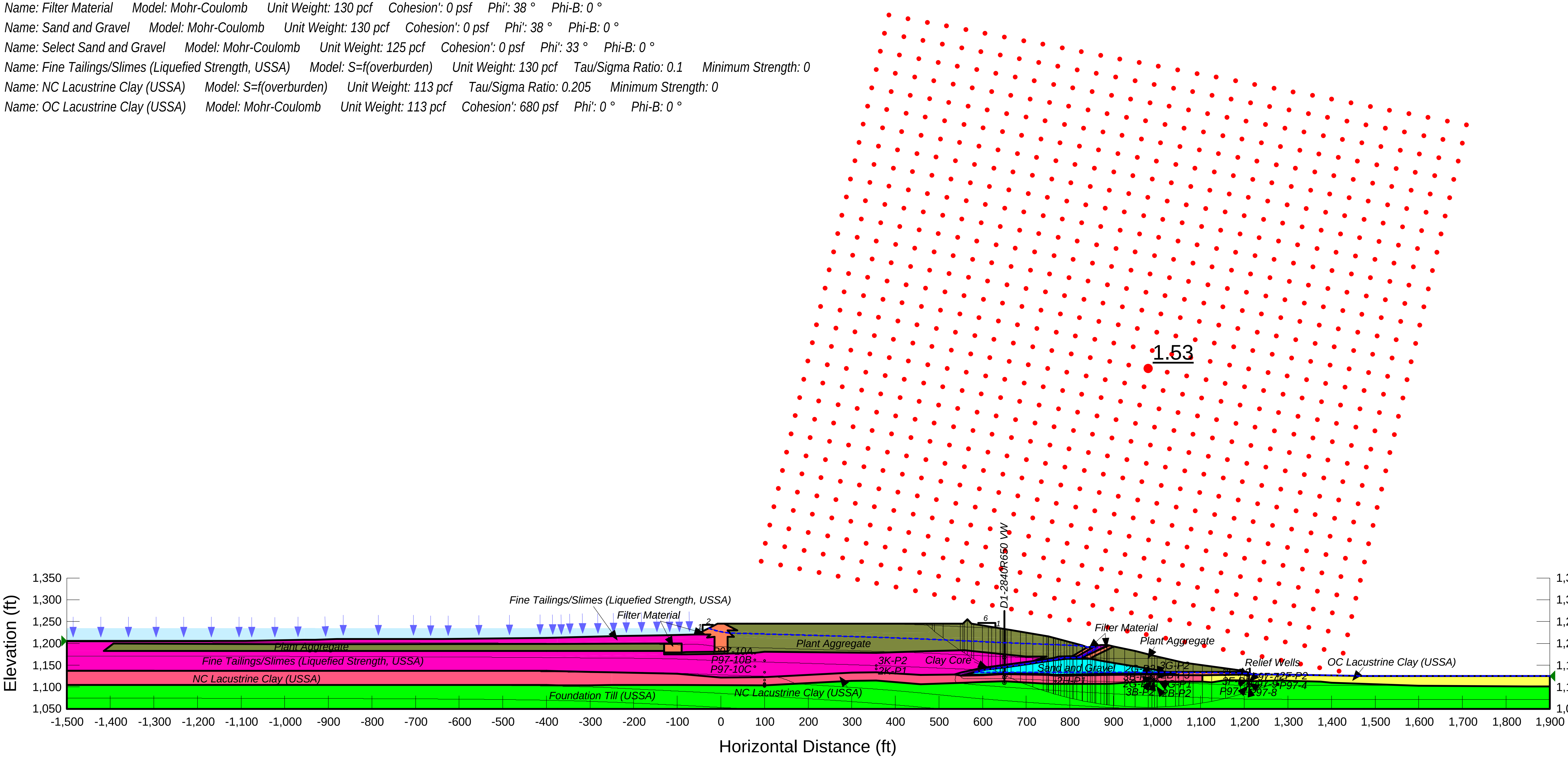
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft
File Name: D1-2840 and 3500 EL1245 Pond 1235.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength, Impenetrable Till
Date: 5/13/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.28 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



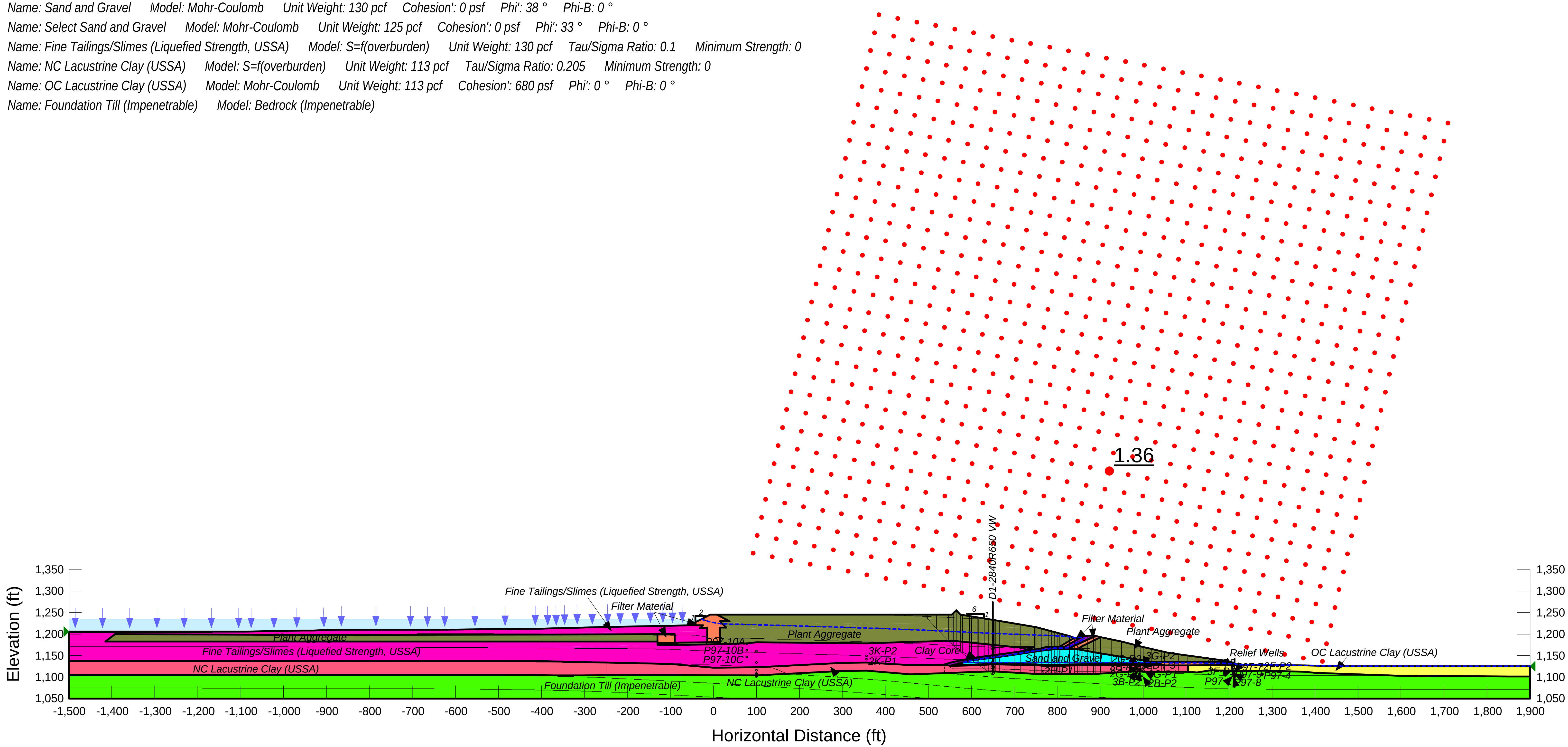
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft
File Name: D1-2840 and 3500 EL1245 Pond 1235.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength
Date: 5/9/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Liquefied Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.1 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °



Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft
File Name: D1-2840 and 3500 EL1245 Pond 1235.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength, Impenetrable Till
Date: 5/9/2013

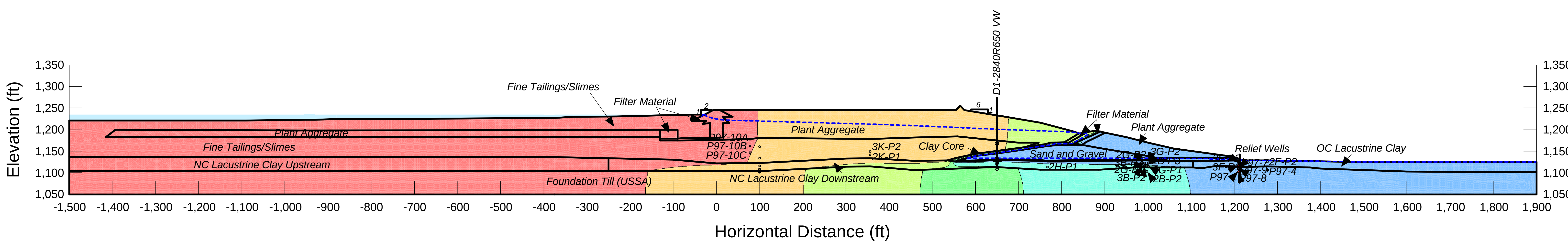
Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Liquefied Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.1 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



Dam 1 Raised to 1,245 ft, South Pond at 1,235 ft, Future Beach

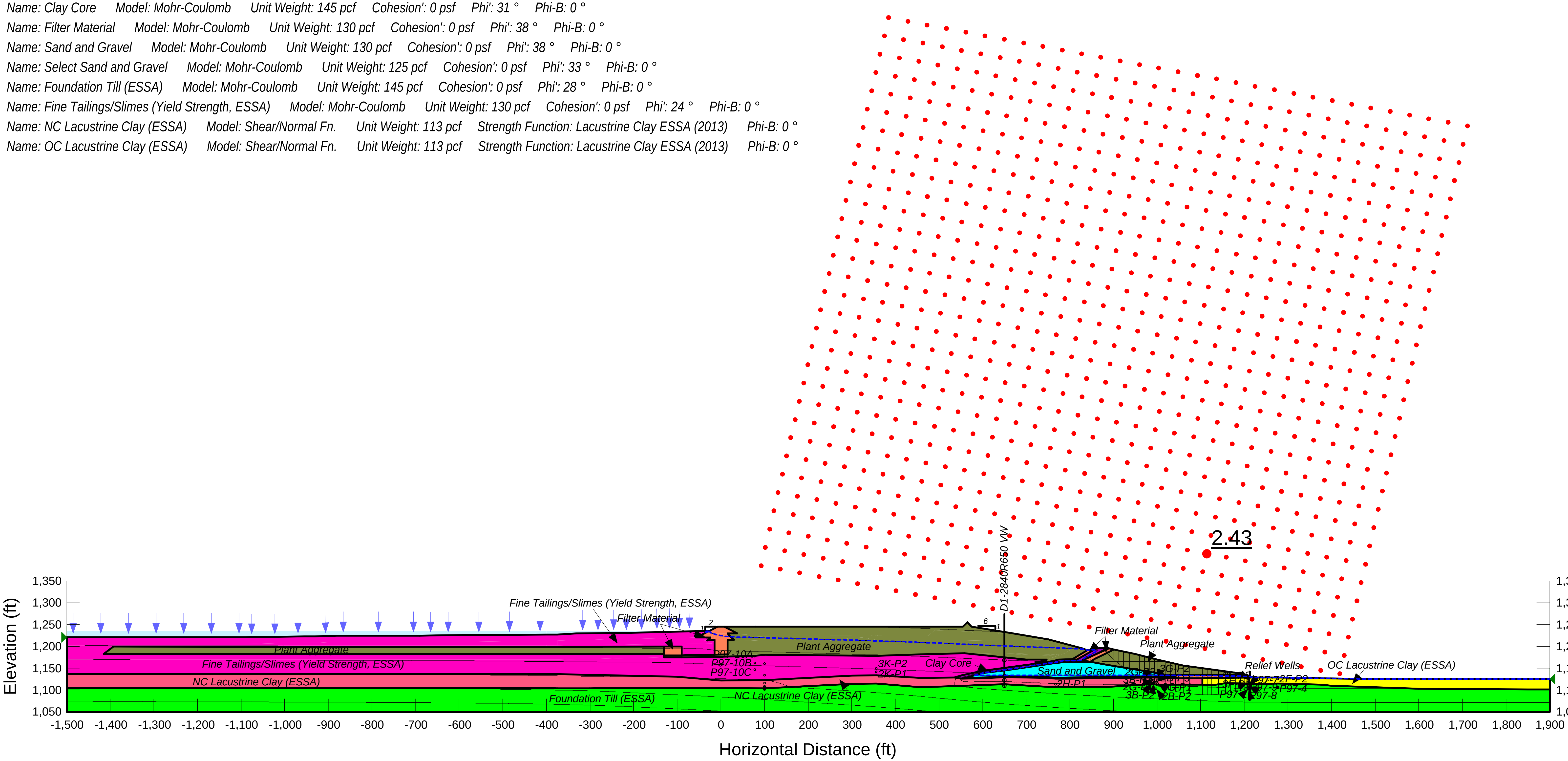
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1235 with Beach.gsz
Analysis Name: Steady-State Seepage
Date: 5/13/2013

Name: Foundation Till (USSA) Model: Saturated / Unsaturated K-Function: FOUNDATION TILL Higher Perm Kxsat = 6e-6 Ky'/Kx' Ratio: 0.2
Name: NC Lacustrine Clay Downstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC, Kxsat = 2.45e-8 ft/s Ky'/Kx' Ratio: 1.43
Name: OC Lacustrine Clay Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY OC HORIZ, Ksat = 1.41E-8 Ky'/Kx' Ratio: 0.0181
Name: Plant Aggregate Model: Saturated / Unsaturated K-Function: COARSE TAILINGS, Ksat = 1.624E-3 Ky'/Kx' Ratio: 1
Name: Clay Core Model: Saturated / Unsaturated K-Function: CLAY CORE TILL (Low End), Ksat =3.28E-9 Ky'/Kx' Ratio: 1
Name: Fine Tailings/Slimes Model: Saturated / Unsaturated K-Function: FINE TAILINGS (1/2 order mag higher), Ksat =1.8e-6 ft/s Ky'/Kx' Ratio: 1
Name: Filter Material Model: Saturated / Unsaturated K-Function: FILTER BERM, Ksat = 3.4E-4 ft/s Ky'/Kx' Ratio: 1
Name: Sand and Gravel Model: Saturated / Unsaturated K-Function: SAND AND GRAVEL, Ksat = 3.3e-03 ft/s Ky'/Kx' Ratio: 1
Name: Select Sand and Gravel Model: Saturated / Unsaturated K-Function: SELECT SAND AND GRAVEL, Ksat = 1.67E-3 Ky'/Kx' Ratio: 1
Name: Relief Well Model: Saturated / Unsaturated K-Function: Relief Well, Ksat = 1 Ky'/Kx' Ratio: 1
Name: NC Lacustrine Clay Upstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC (1.5 order mag higher), Kxsat =7.5e-7 ft/s (2) Ky'/Kx' Ratio: 2.5



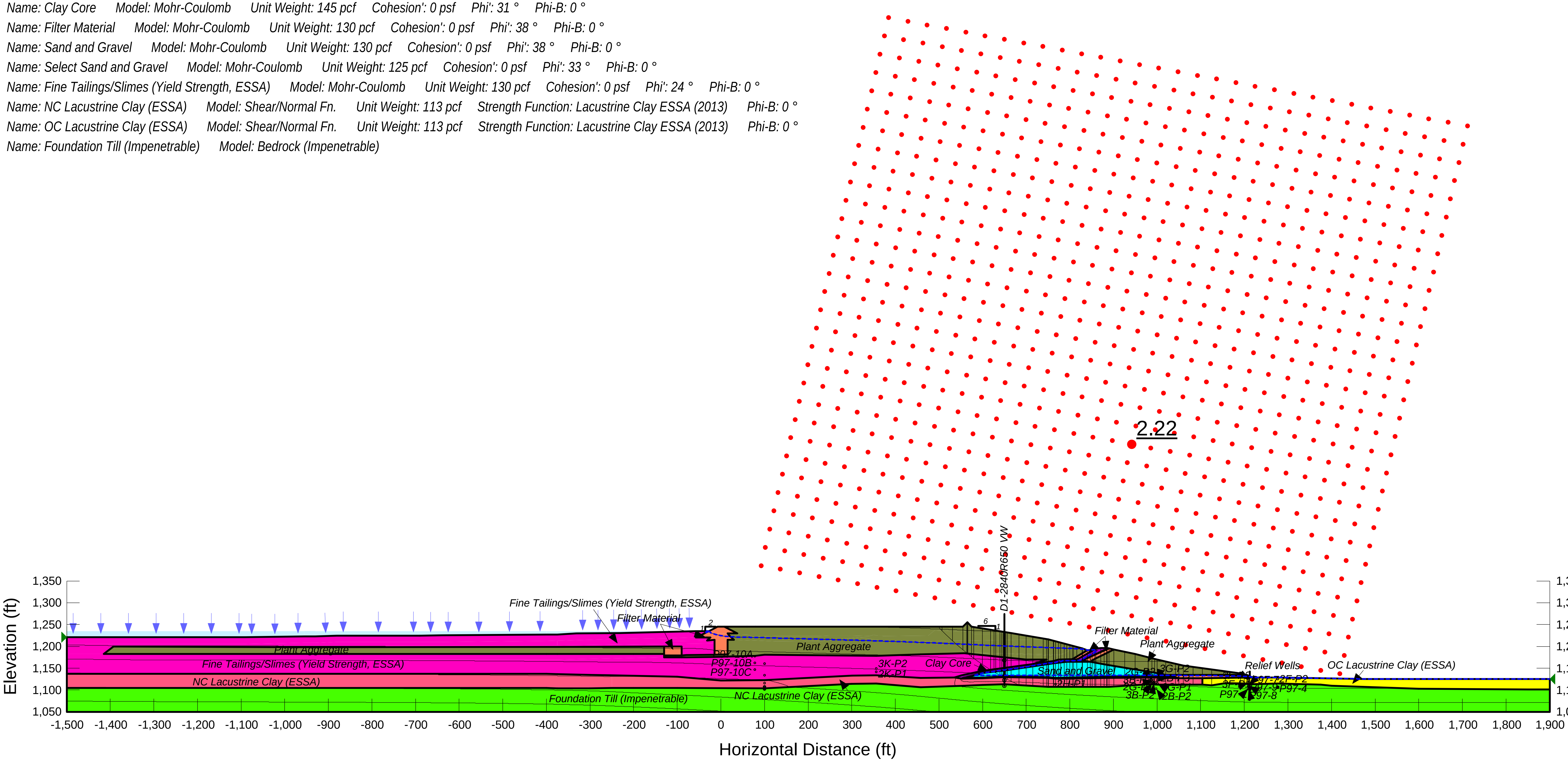
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1235 with Beach.gsz
Analysis Name: Downstream Slope Stability - ESSA
Date: 5/13/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Foundation Till (ESSA) Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 24 ° Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °

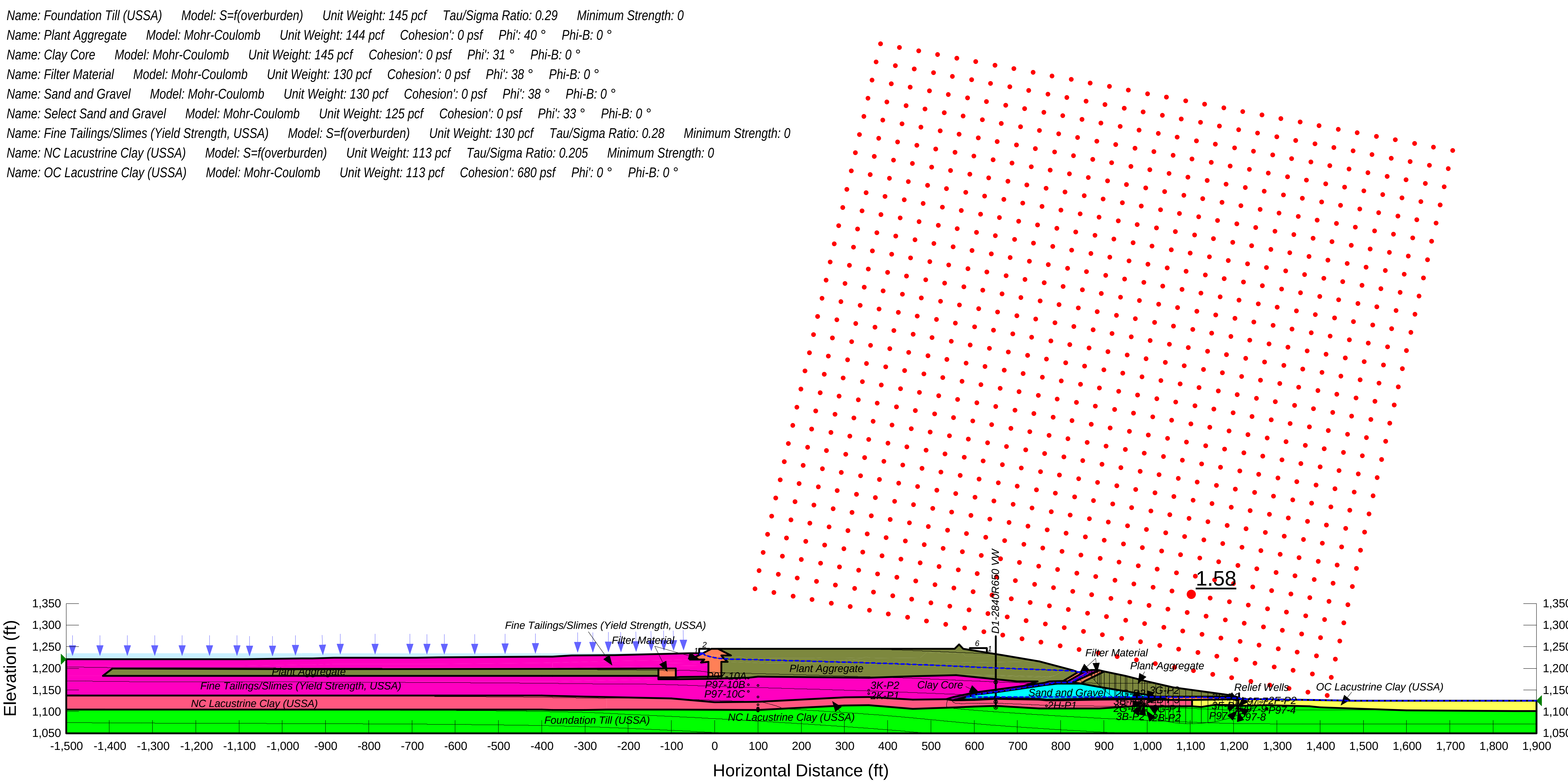


Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1235 with Beach.gsz
Analysis Name: Downstream Slope Stability - ESSA, Impenetrable Till
Date: 5/13/2013

Name: Foundation Till (USSA)   Model: S=f(overburden)   Unit Weight: 145 pcf   Tau/Sigma Ratio: 0.29   Minimum Strength: 0
Name: Plant Aggregate   Model: Mohr-Coulomb   Unit Weight: 144 pcf   Cohesion': 0 psf   Phi': 40 °   Phi-B: 0 °
Name: Clay Core   Model: Mohr-Coulomb   Unit Weight: 145 pcf   Cohesion': 0 psf   Phi': 31 °   Phi-B: 0 °
Name: Filter Material   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 38 °   Phi-B: 0 °
Name: Sand and Gravel   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 38 °   Phi-B: 0 °
Name: Select Sand and Gravel   Model: Mohr-Coulomb   Unit Weight: 125 pcf   Cohesion': 0 psf   Phi': 33 °   Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA)   Model: Mohr-Coulomb   Unit Weight: 130 pcf   Cohesion': 0 psf   Phi': 24 °   Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA)   Model: Shear/Normal Fn.   Unit Weight: 113 pcf   Strength Function: Lacustrine Clay ESSA (2013)   Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA)   Model: Shear/Normal Fn.   Unit Weight: 113 pcf   Strength Function: Lacustrine Clay ESSA (2013)   Phi-B: 0 °
Name: Foundation Till (Impenetrable)   Model: Bedrock (Impenetrable)

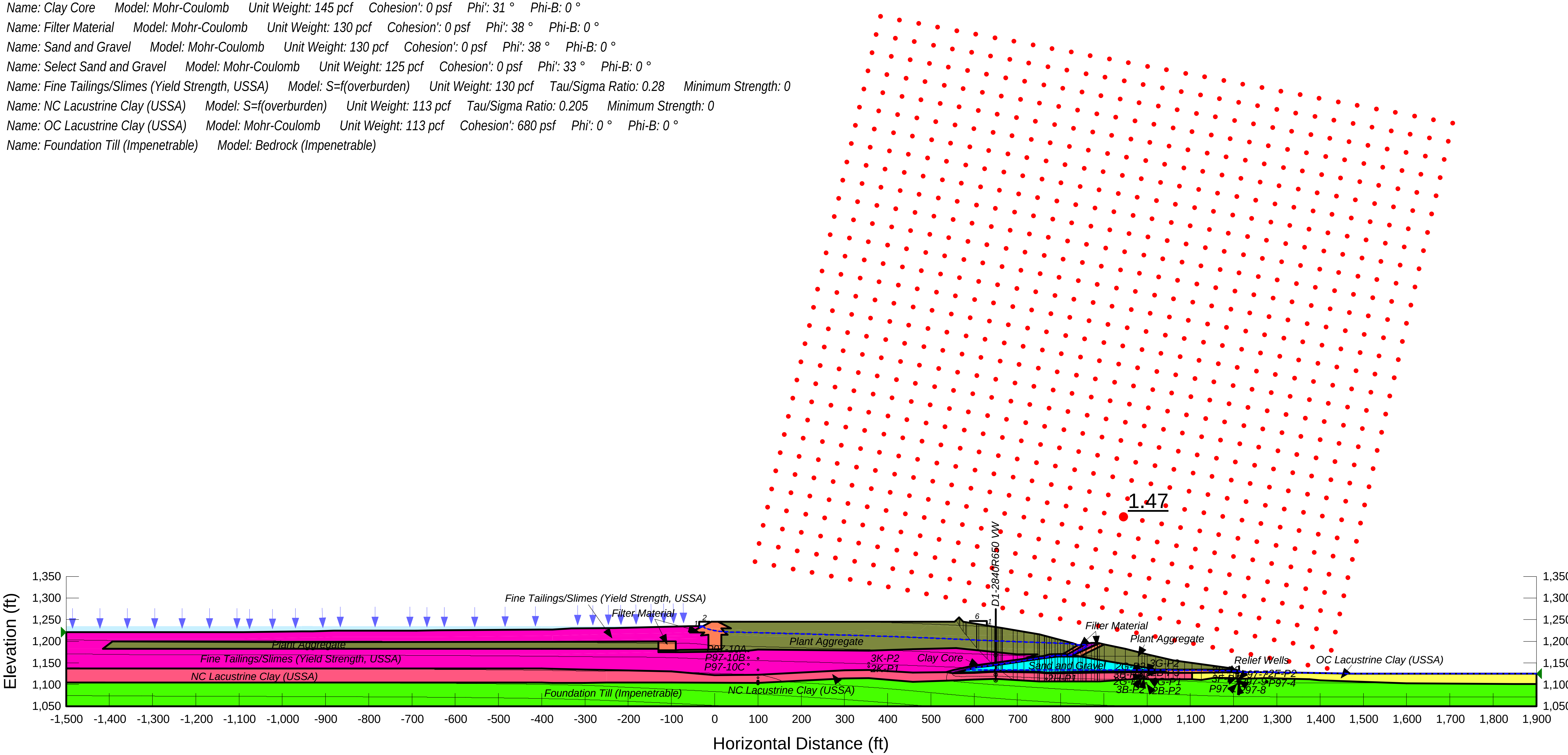


Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1235 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength
Date: 5/13/2013



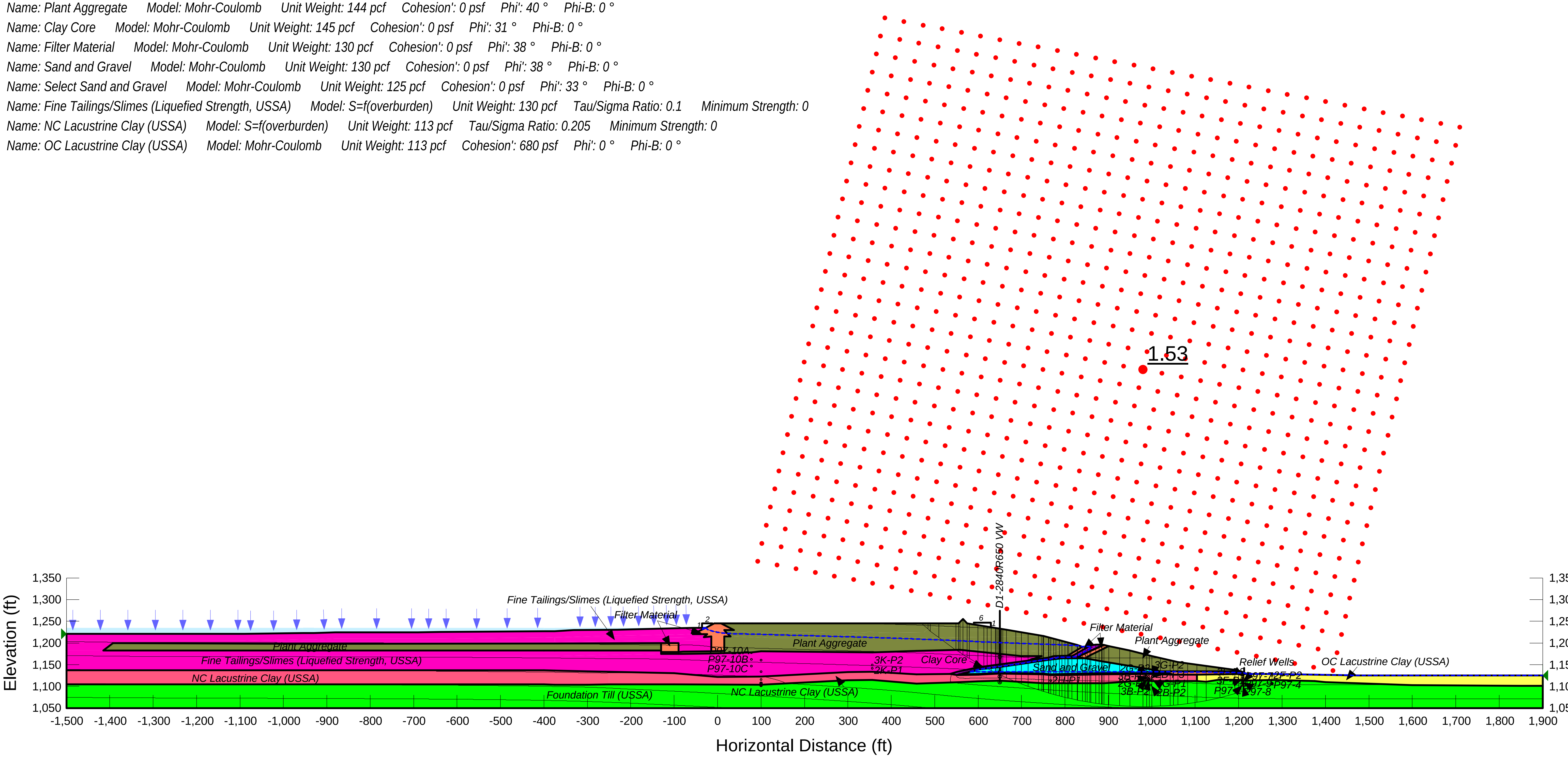
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1235 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength, Impenetrable Till
Date: 5/13/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.28 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



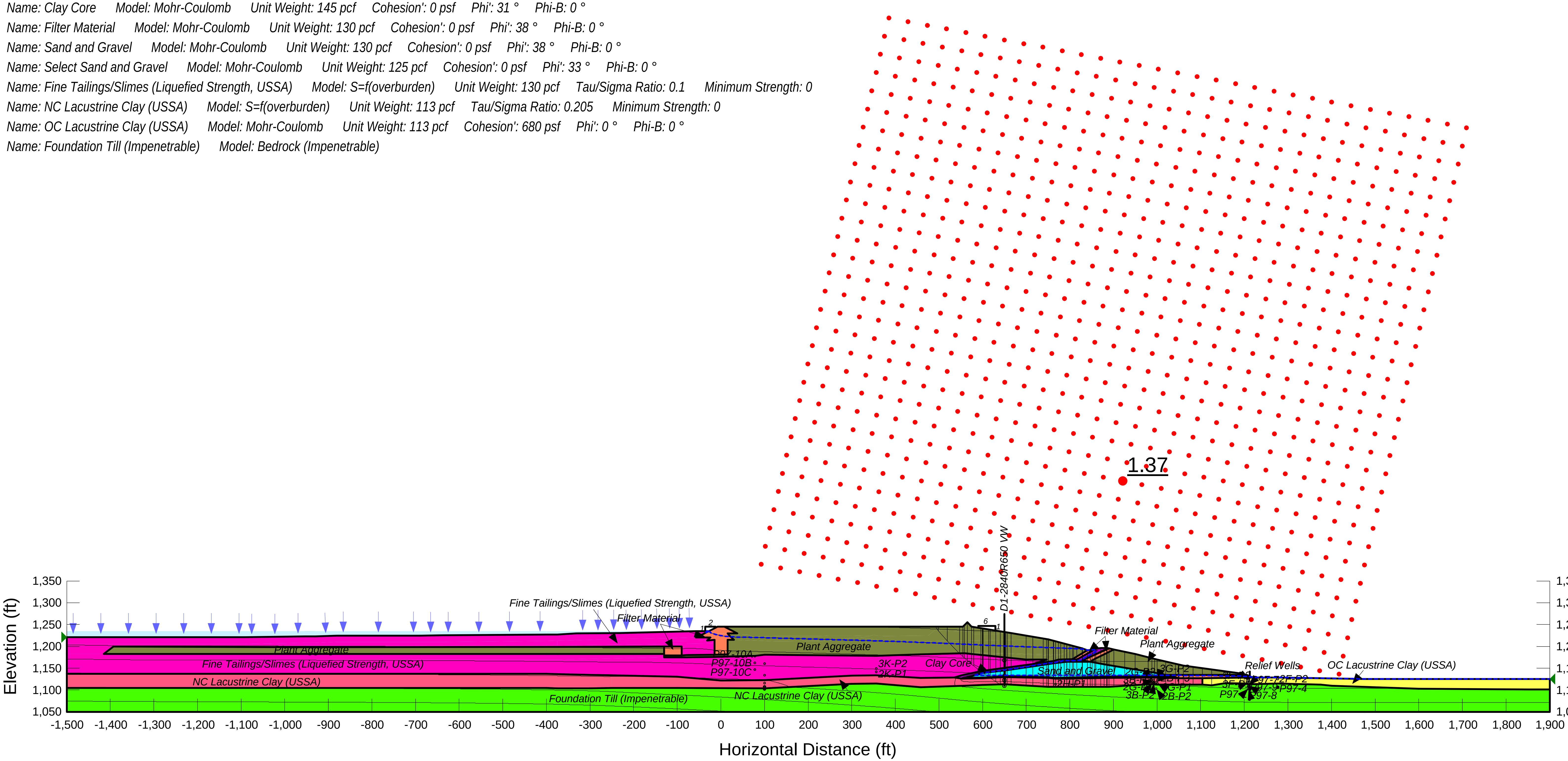
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1235 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength
Date: 5/13/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Liquefied Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.1 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °



Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,235 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1235 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength, Impenetrable Till
Date: 5/13/2013

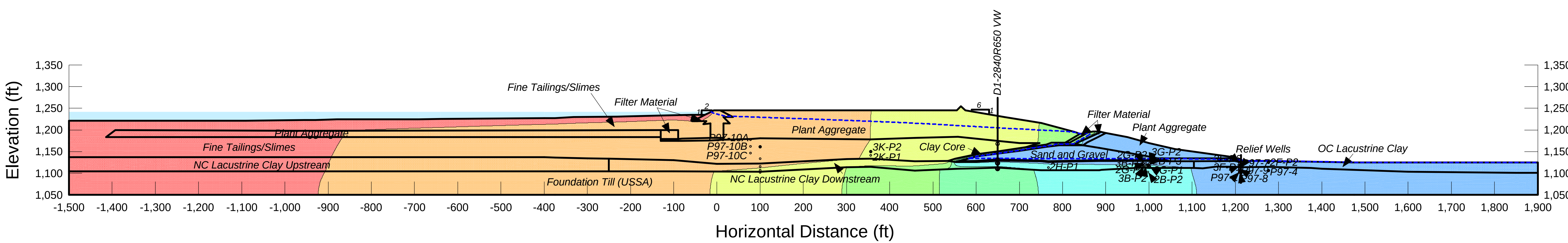
Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Liquefied Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.1 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



Dam 1 Raised to 1,245 ft, South Pond at 1,242 ft, Future Beach

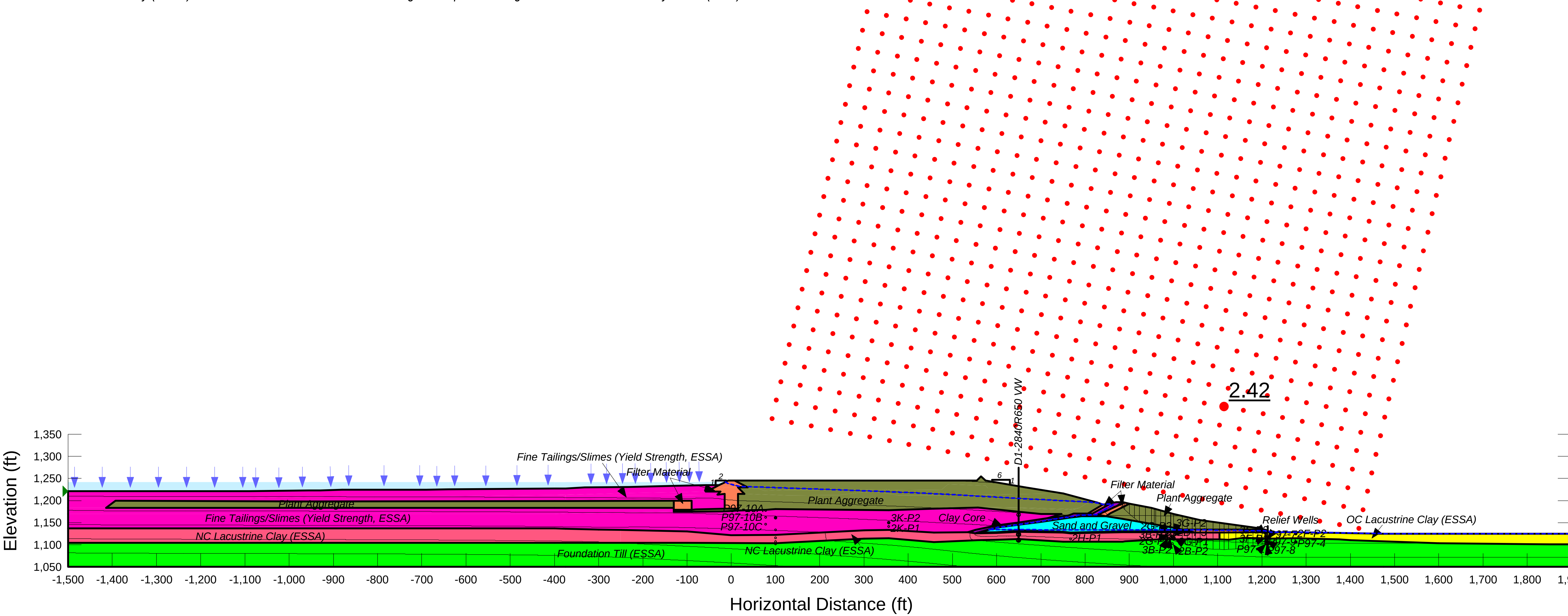
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,242 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1242 with Beach.gsz
Analysis Name: Steady-State Seepage
Date: 5/14/2013

Name: Foundation Till (USSA) Model: Saturated / Unsaturated K-Function: FOUNDATION TILL Higher Perm Kxsat = 6e-6 Ky'/Kx' Ratio: 0.2
Name: NC Lacustrine Clay Downstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC, Kxsat = 2.45e-8 ft/s Ky'/Kx' Ratio: 1.43
Name: OC Lacustrine Clay Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY OC HORIZ, Ksat = 1.41E-8 Ky'/Kx' Ratio: 0.0181
Name: Plant Aggregate Model: Saturated / Unsaturated K-Function: COARSE TAILINGS, Ksat = 1.624E-3 Ky'/Kx' Ratio: 1
Name: Clay Core Model: Saturated / Unsaturated K-Function: CLAY CORE TILL (Low End), Ksat =3.28E-9 Ky'/Kx' Ratio: 1
Name: Fine Tailings/Slimes Model: Saturated / Unsaturated K-Function: FINE TAILINGS (1/2 order mag higher), Ksat =1.8e-6 ft/s Ky'/Kx' Ratio: 1
Name: Filter Material Model: Saturated / Unsaturated K-Function: FILTER BERM, Ksat = 3.4E-4 ft/s Ky'/Kx' Ratio: 1
Name: Sand and Gravel Model: Saturated / Unsaturated K-Function: SAND AND GRAVEL, Ksat = 3.3e-03 ft/s Ky'/Kx' Ratio: 1
Name: Select Sand and Gravel Model: Saturated / Unsaturated K-Function: SELECT SAND AND GRAVEL, Ksat = 1.67E-3 Ky'/Kx' Ratio: 1
Name: Relief Well Model: Saturated / Unsaturated K-Function: Relief Well, Ksat = 1 Ky'/Kx' Ratio: 1
Name: NC Lacustrine Clay Upstream Model: Saturated / Unsaturated K-Function: LACUSTRINE CLAY NC (1.5 order mag higher), Kxsat =7.5e-7 ft/s (2) Ky'/Kx' Ratio: 2.5



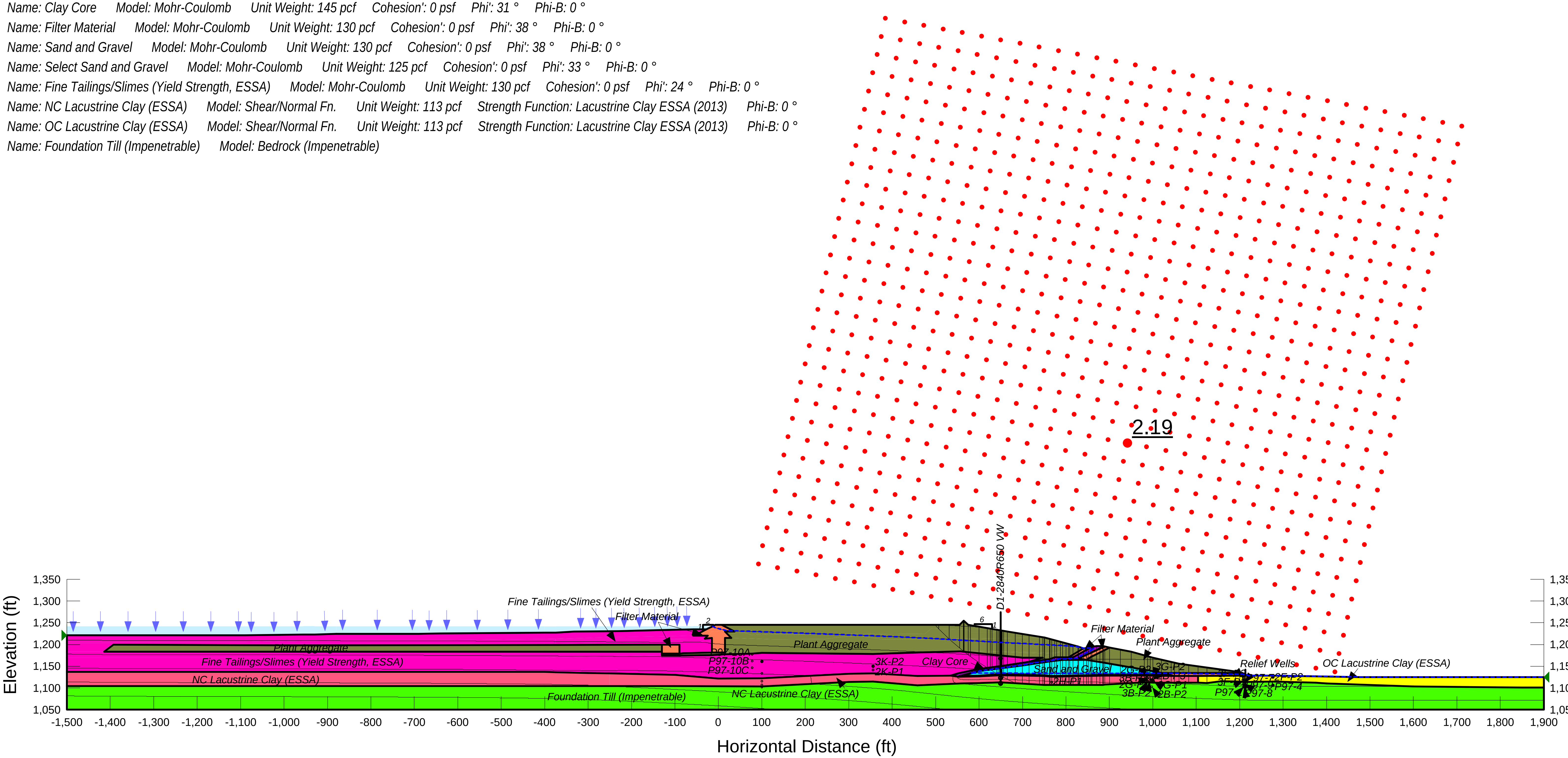
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,242 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1242 with Beach.gsz
Analysis Name: Downstream Slope Stability - ESSA
Date: 5/14/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Foundation Till (ESSA) Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 28 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 24 ° Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °



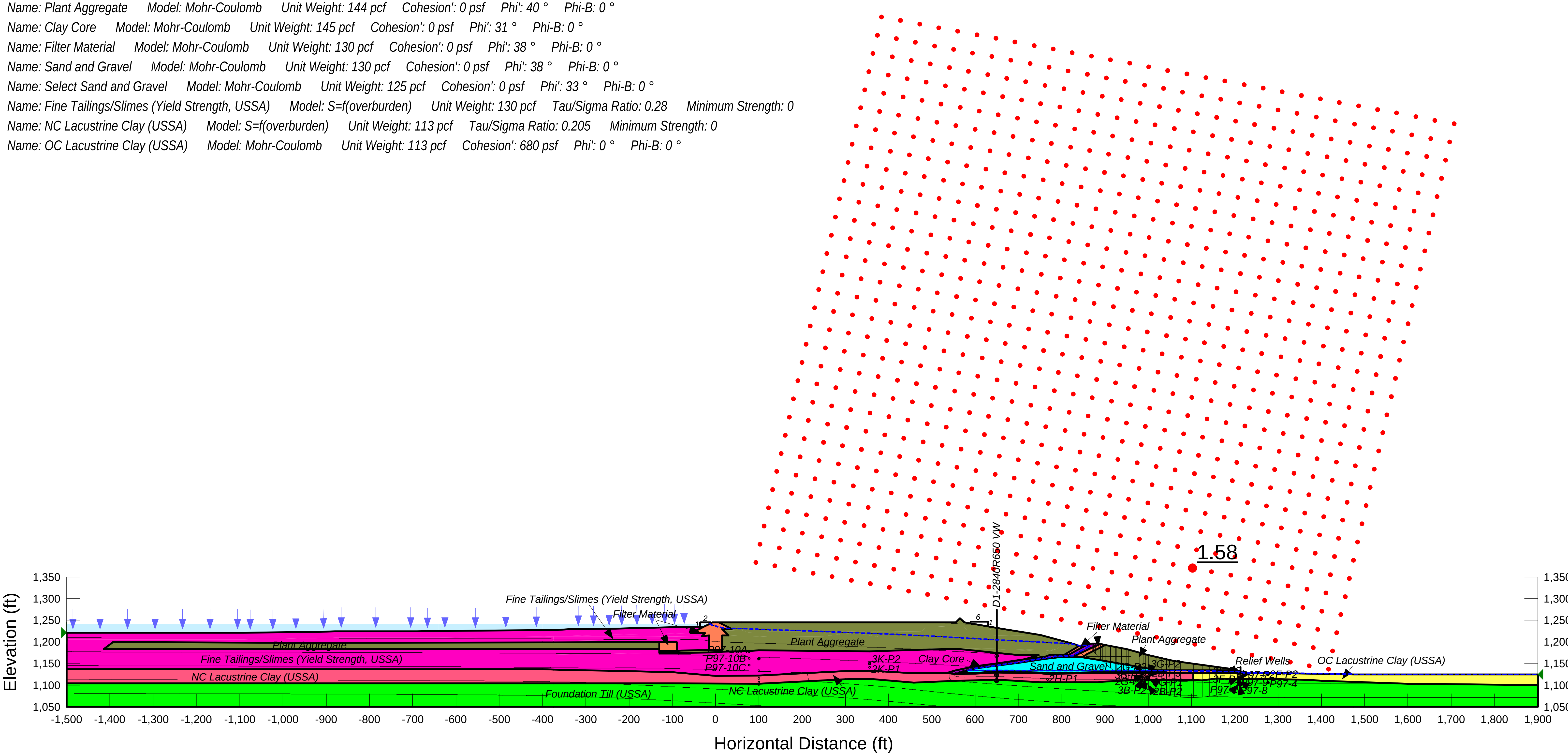
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,242 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1242 with Beach.gsz
Analysis Name: Downstream Slope Stability - ESSA, Impenetrable Till
Date: 5/14/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, ESSA) Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 24 ° Phi-B: 0 °
Name: NC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: OC Lacustrine Clay (ESSA) Model: Shear/Normal Fn. Unit Weight: 113 pcf Strength Function: Lacustrine Clay ESSA (2013) Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



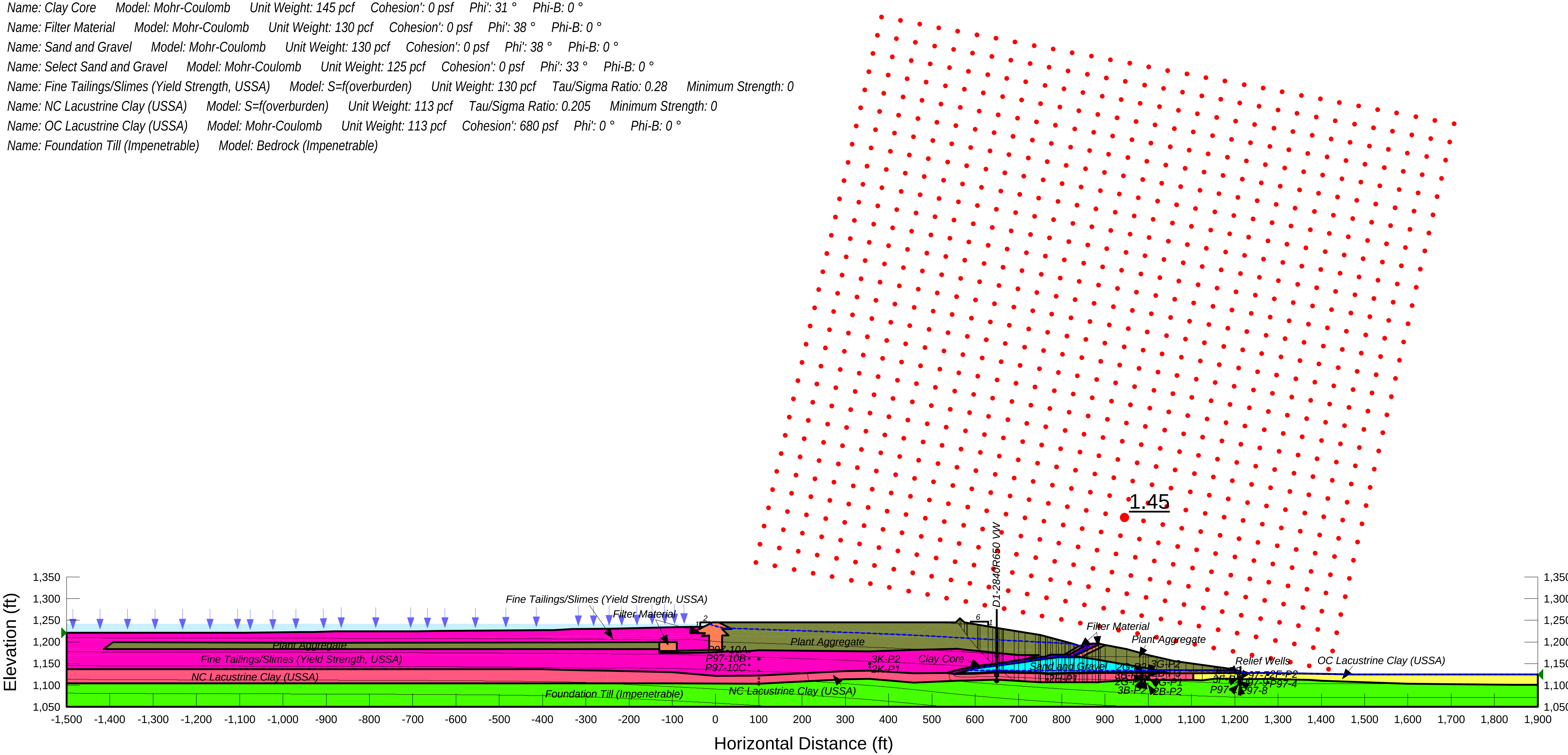
Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,242 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1242 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength
Date: 5/14/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.28 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °

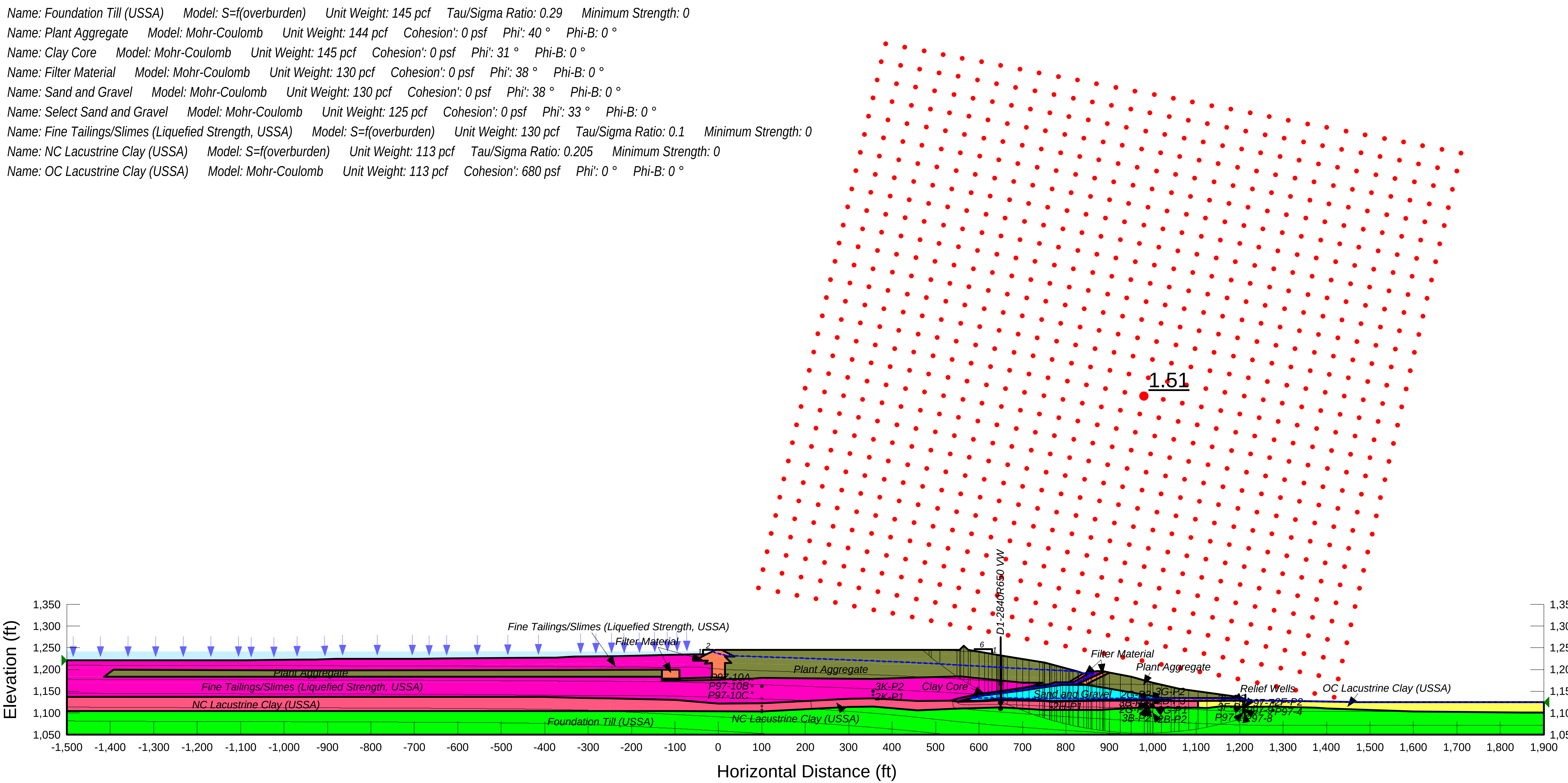


Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,242 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1242 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Yield Strength, Impenetrable Till
Date: 5/14/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Yield Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.28 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)

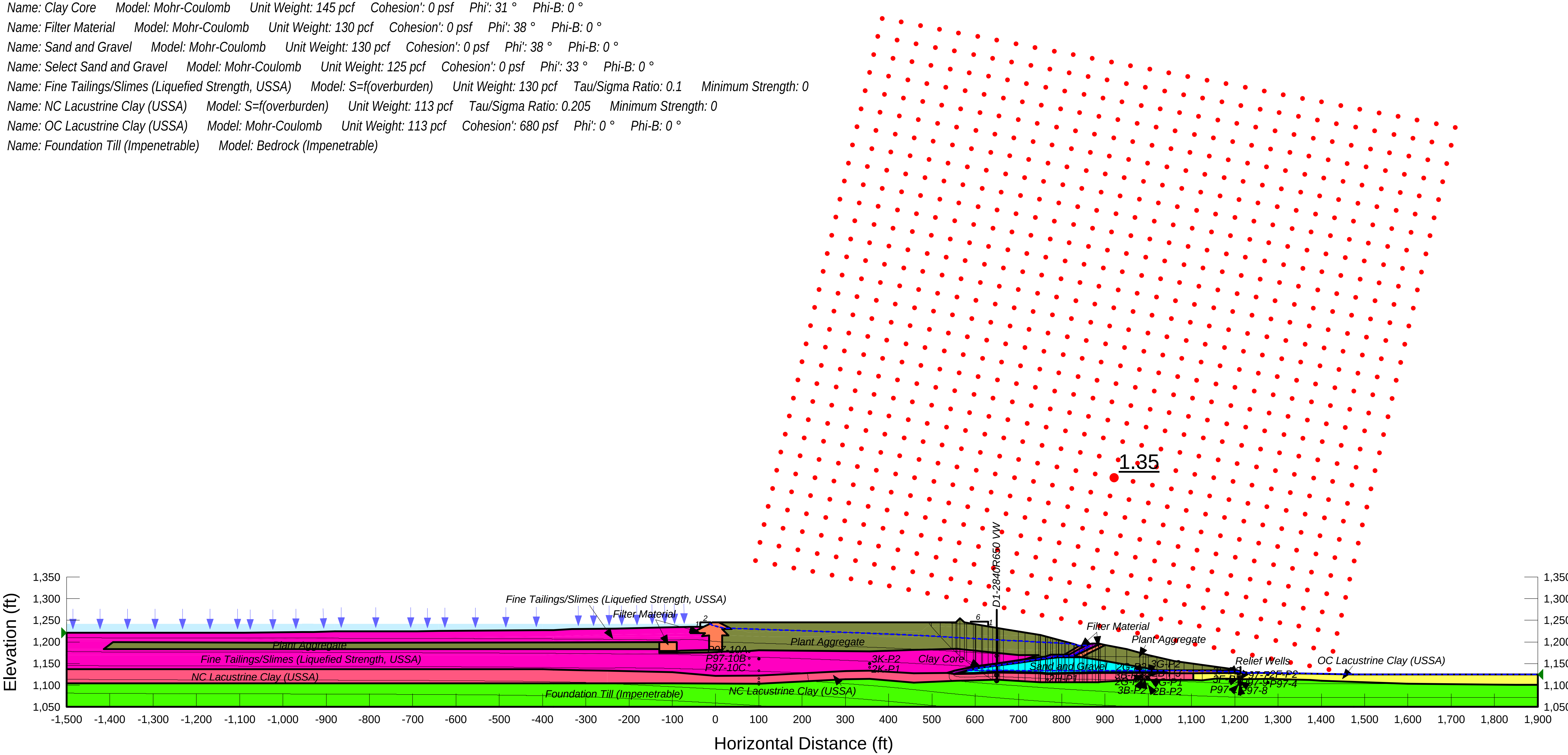


Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,242 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1242 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength
Date: 5/14/2013



Northshore Mining Company, Dam 1
Station 28+40 and 35+00, Dam Raise to Elevation 1,245 ft
South Pond at Elevation 1,242 ft with Future Beach
File Name: D1-2840 and 3500 EL1245 Pond 1242 with Beach.gsz
Analysis Name: Downstream Slope Stability - USSA, Fine Tailings Liquified Strength, Impenetrable Till
Date: 5/14/2013

Name: Foundation Till (USSA) Model: S=f(overburden) Unit Weight: 145 pcf Tau/Sigma Ratio: 0.29 Minimum Strength: 0
Name: Plant Aggregate Model: Mohr-Coulomb Unit Weight: 144 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 °
Name: Clay Core Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion': 0 psf Phi': 31 ° Phi-B: 0 °
Name: Filter Material Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 130 pcf Cohesion': 0 psf Phi': 38 ° Phi-B: 0 °
Name: Select Sand and Gravel Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 33 ° Phi-B: 0 °
Name: Fine Tailings/Slimes (Liquefied Strength, USSA) Model: S=f(overburden) Unit Weight: 130 pcf Tau/Sigma Ratio: 0.1 Minimum Strength: 0
Name: NC Lacustrine Clay (USSA) Model: S=f(overburden) Unit Weight: 113 pcf Tau/Sigma Ratio: 0.205 Minimum Strength: 0
Name: OC Lacustrine Clay (USSA) Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 680 psf Phi': 0 ° Phi-B: 0 °
Name: Foundation Till (Impenetrable) Model: Bedrock (Impenetrable)



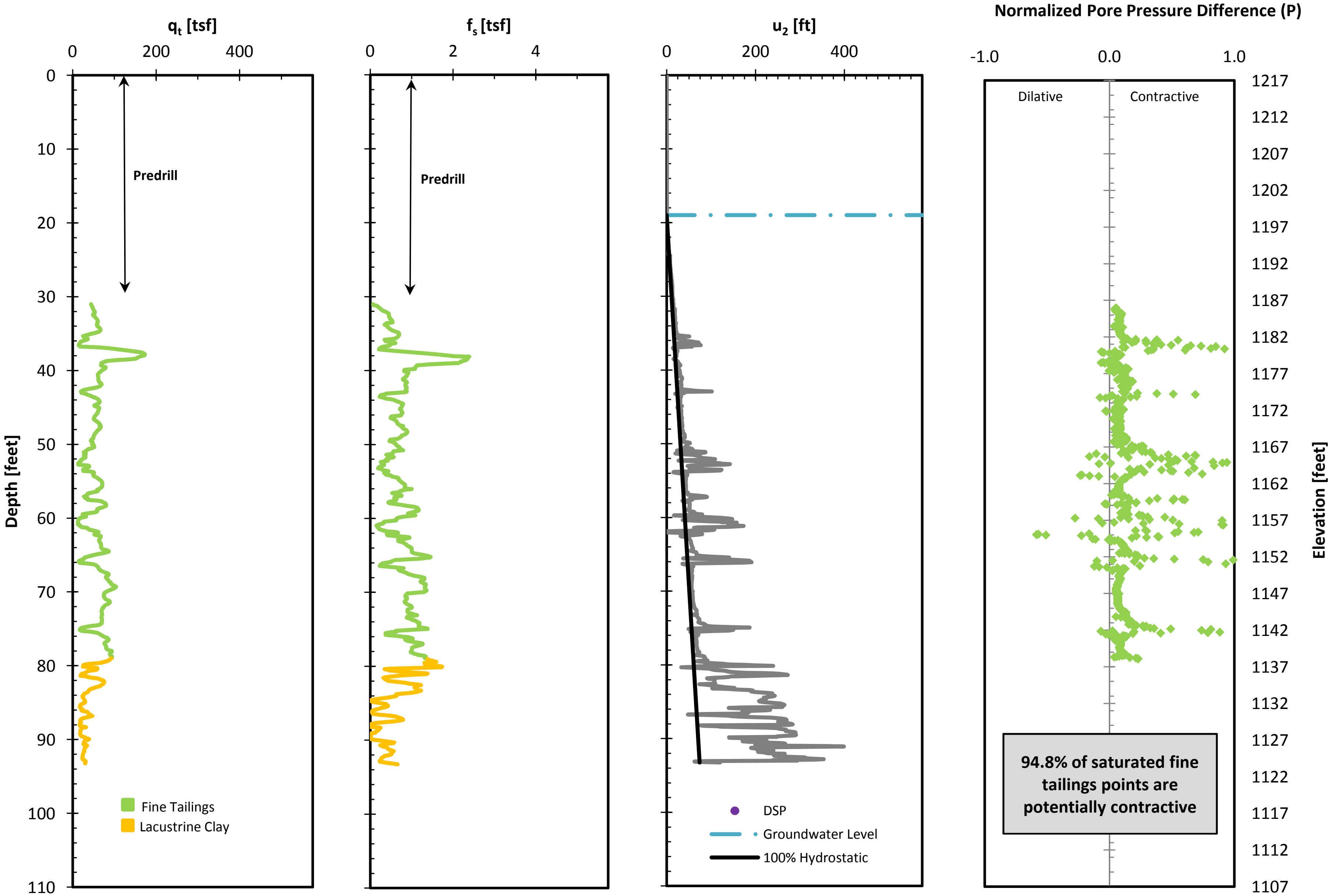
Appendix C

Plots of Tip Resistance, Side Friction, Groundwater, and Compressibility from CPT

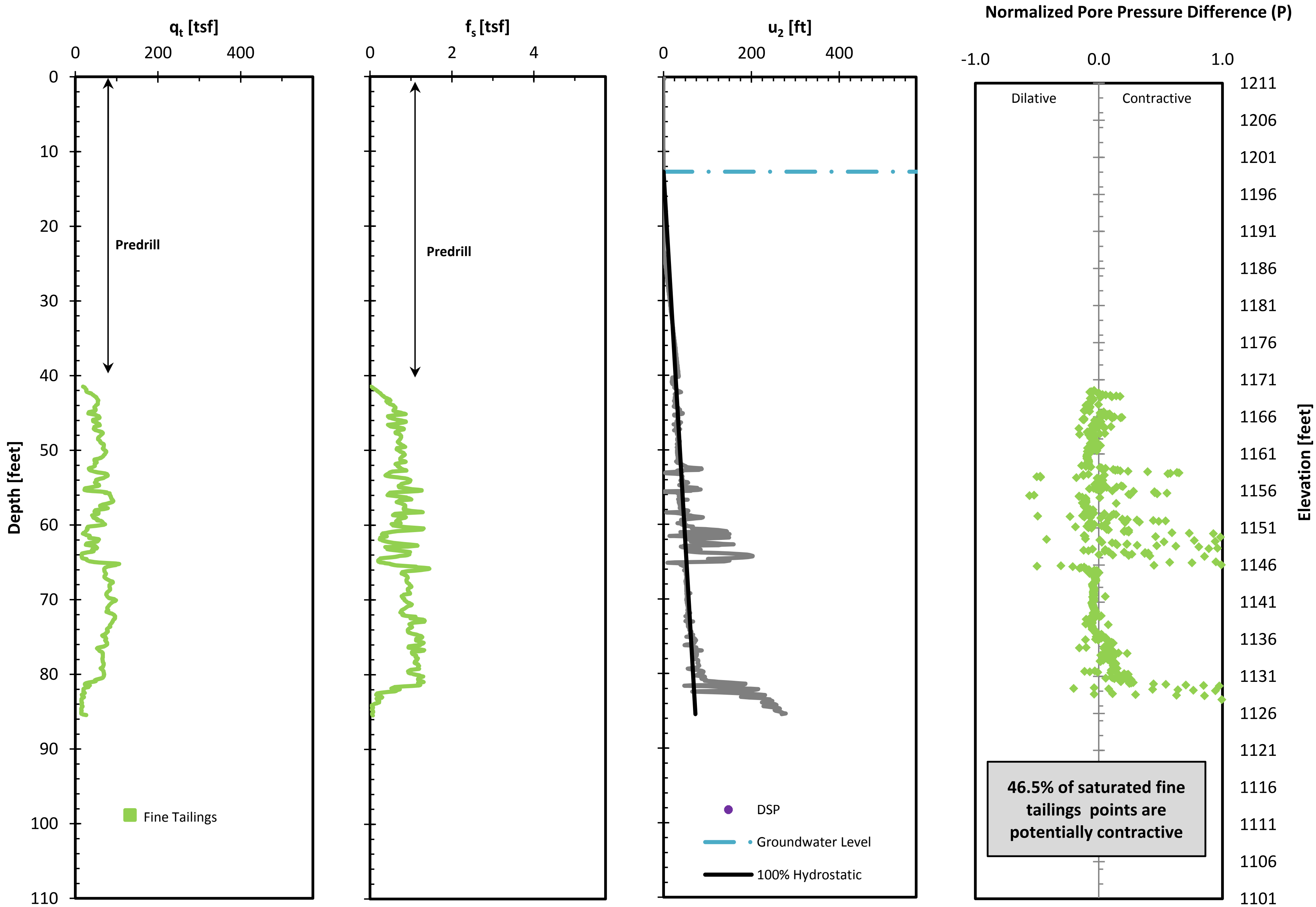
Appendix C

Plots of Tip Resistance, Side Friction, Groundwater, and Compressibility from CPT

D1-2840R100 (2006)
Northshore Mine Milepost 7 Tailings Basin



D1-3500R100 (2006)
Northshore Mine Milepost 7 Tailings Basin



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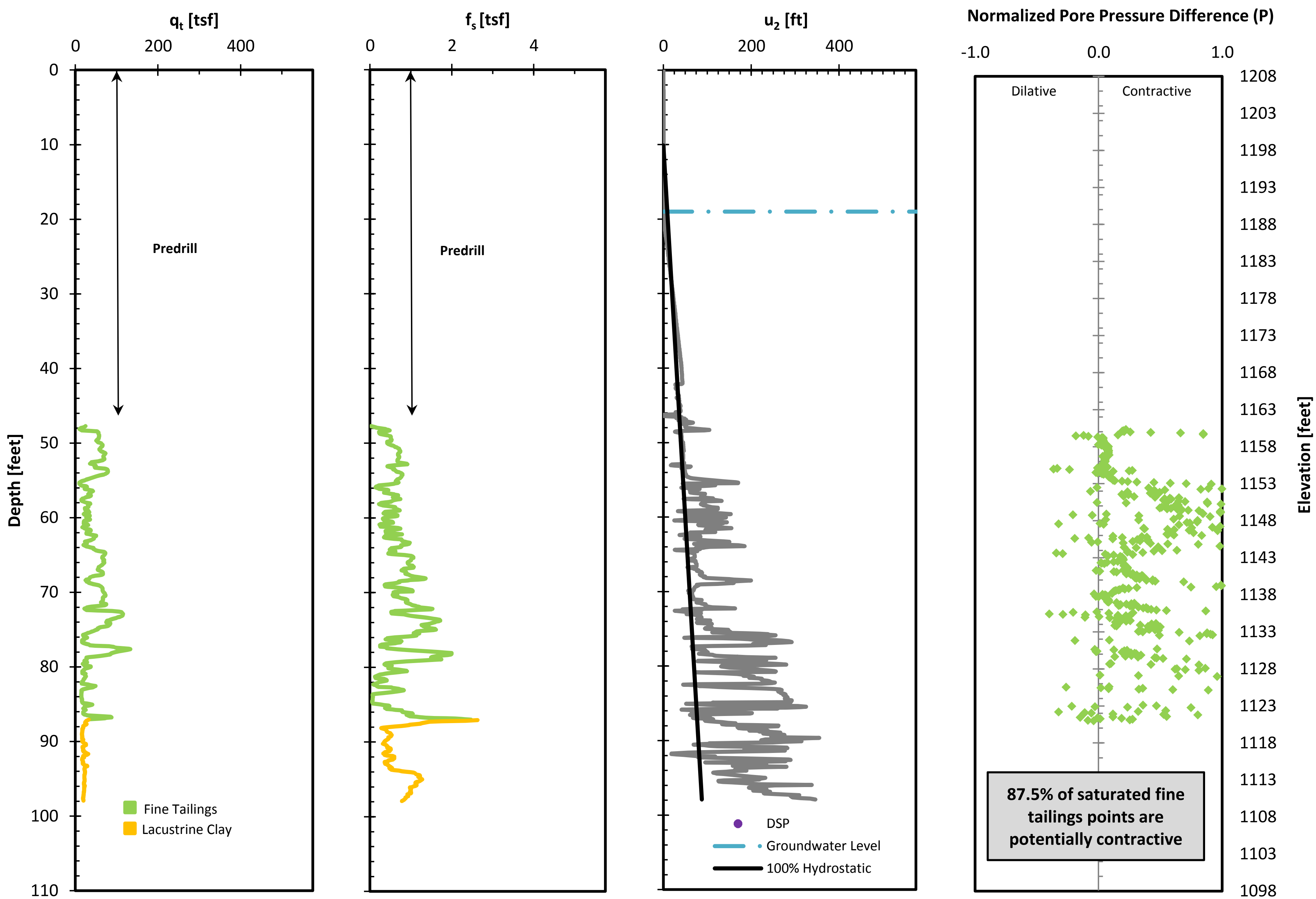
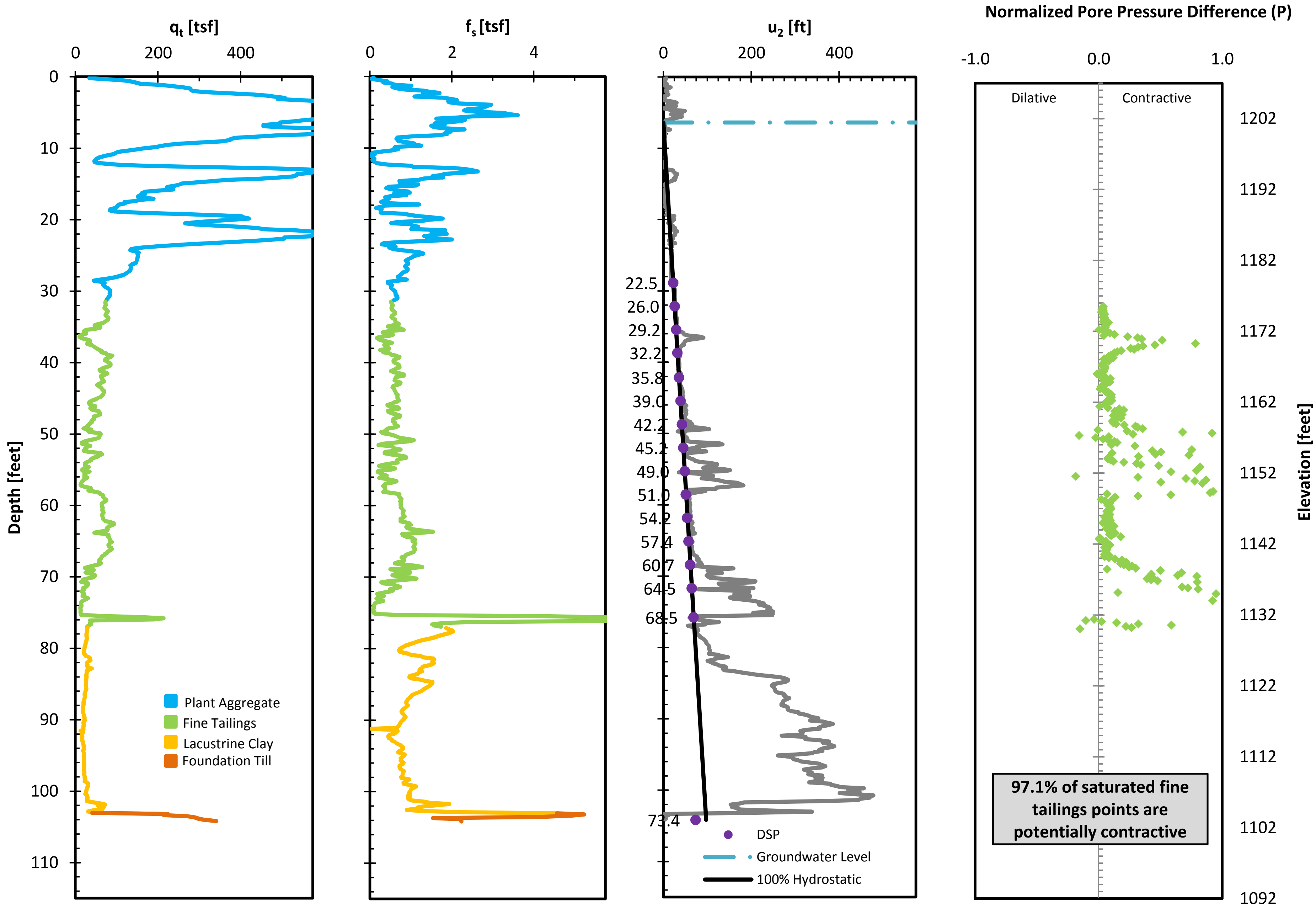
D1-3500L100 (2006)
Northshore Mine Milepost 7 Tailings Basin



P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

D1-2840L100 (2005)
Northshore Mine Milepost 7 Tailings Basin



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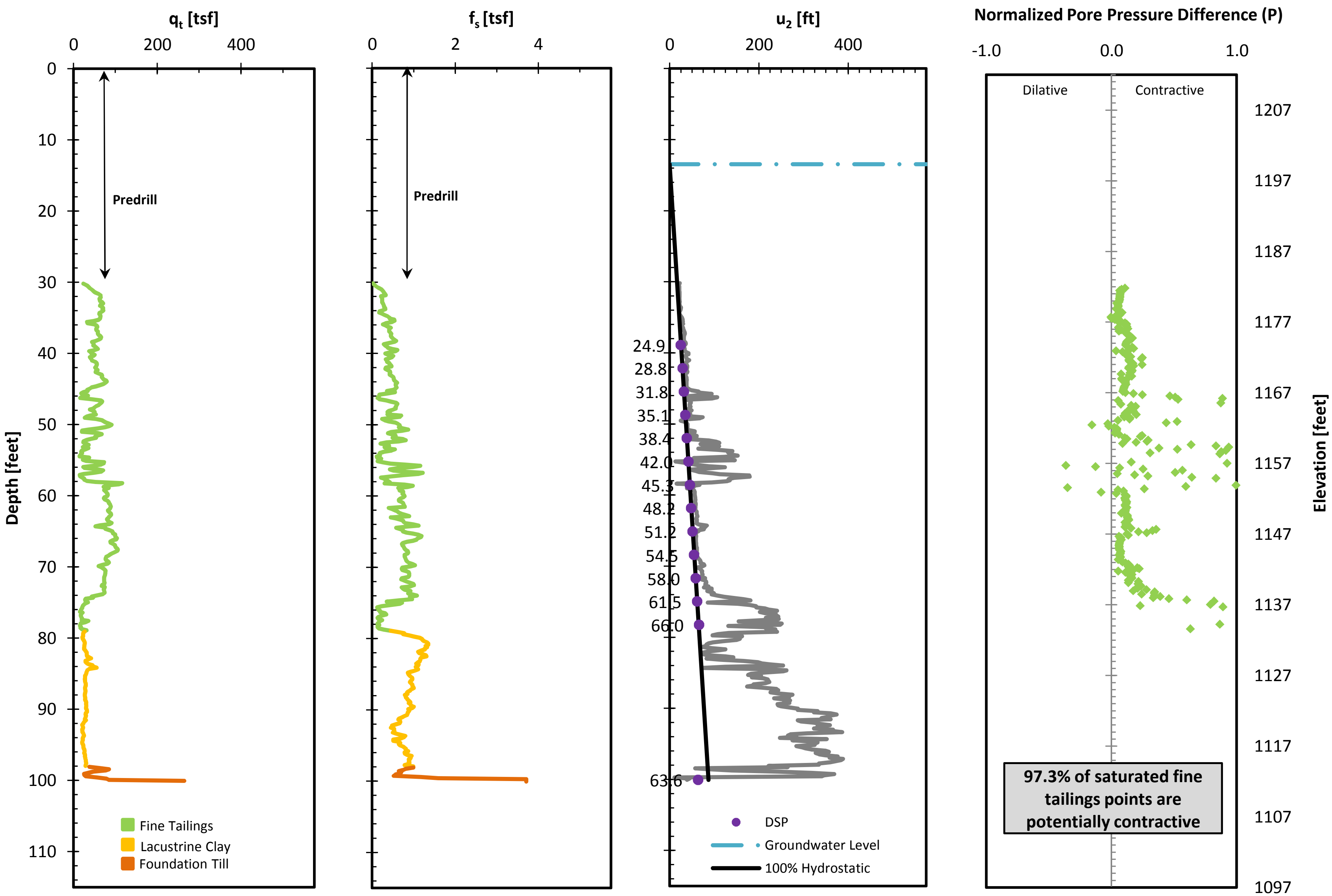
Tip Resistance, Side Friction, Groundwater, and Compressibility from CPT Data
D1-2840R100 (2005)
Northshore Mine Milepost 7 Tailings Basin



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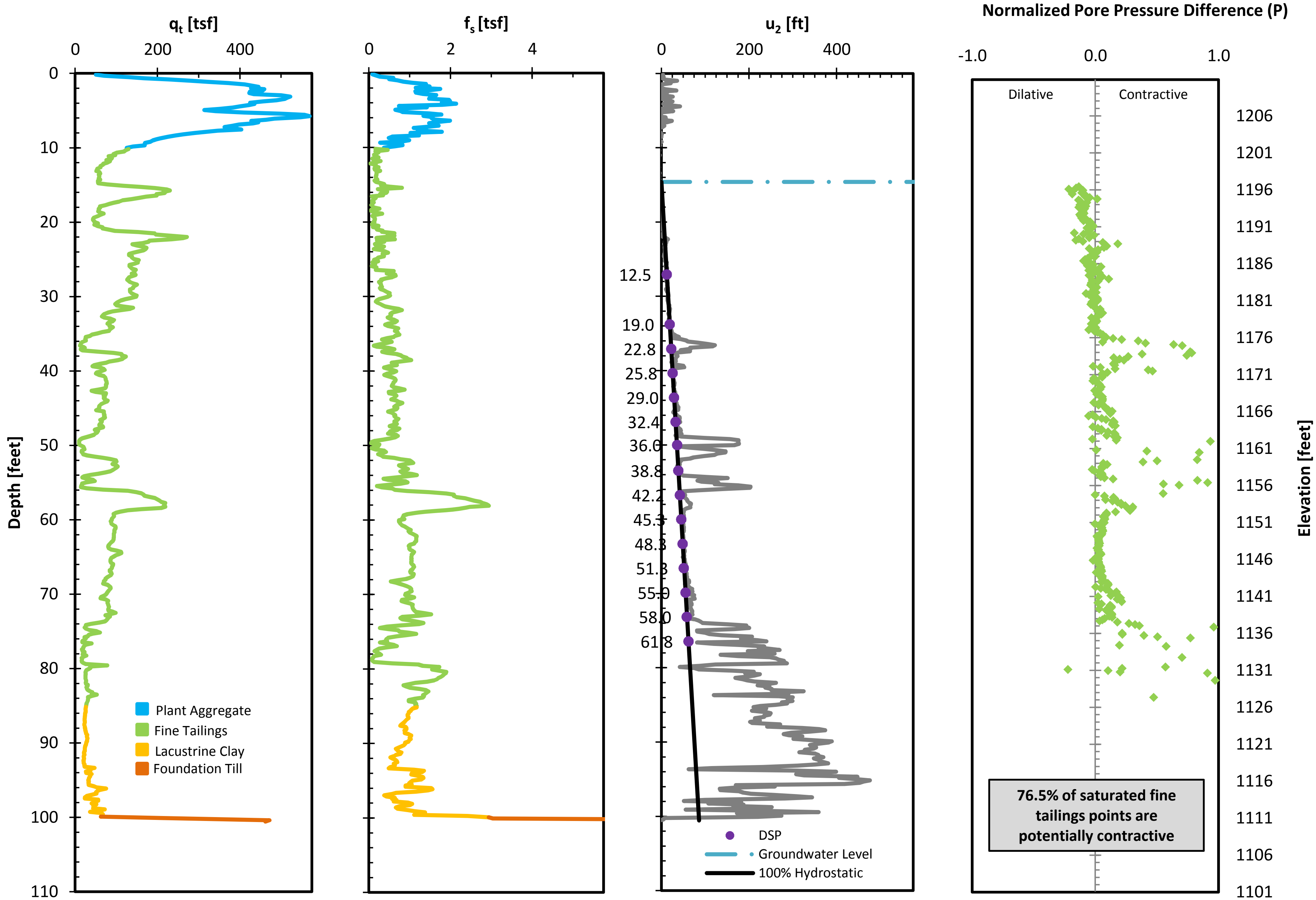
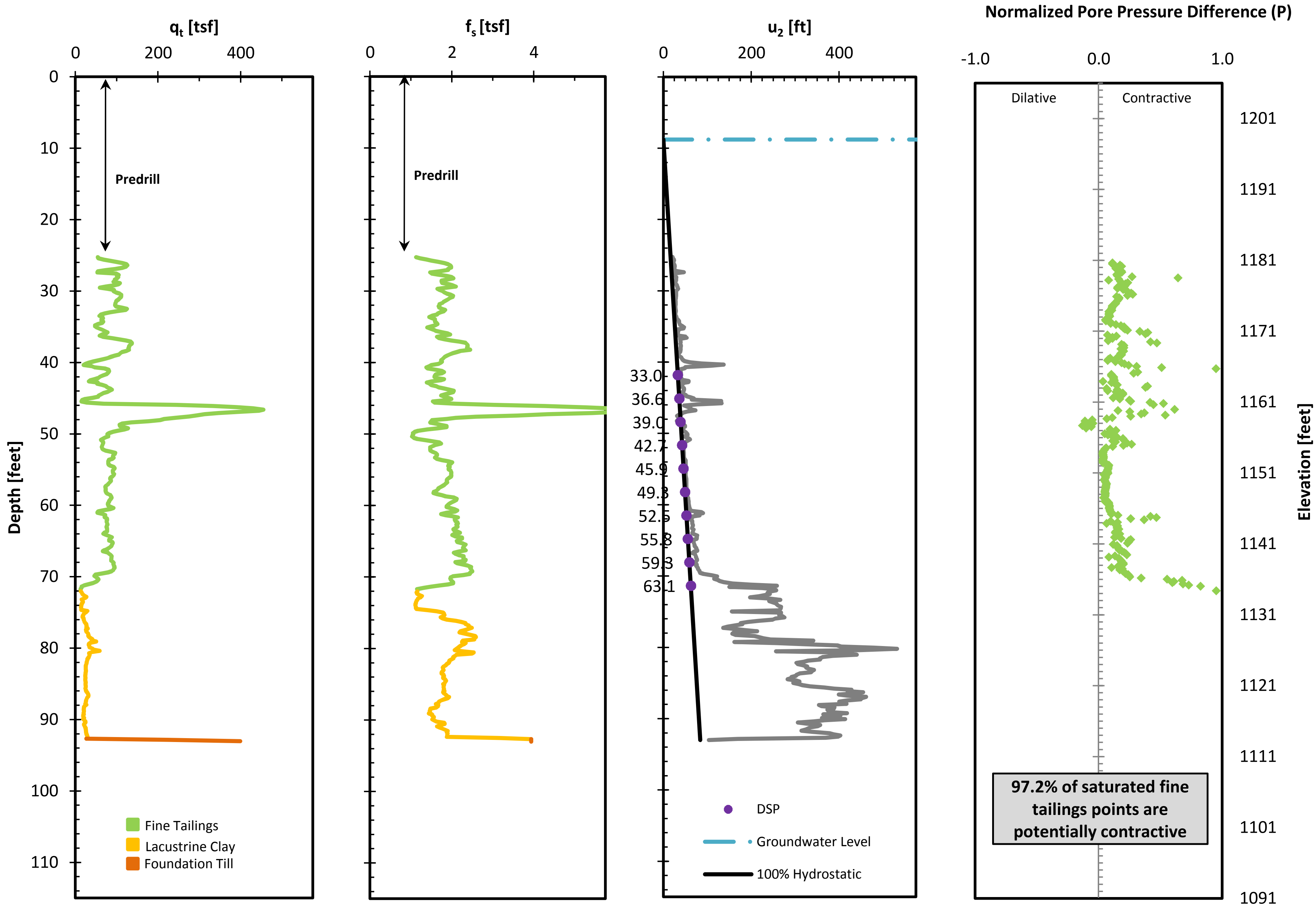
D1-2840R200 (2005)
Northshore Mine Milepost 7 Tailings Basin



P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

D1-2840R450 (2005)
Northshore Mine Milepost 7 Tailings Basin



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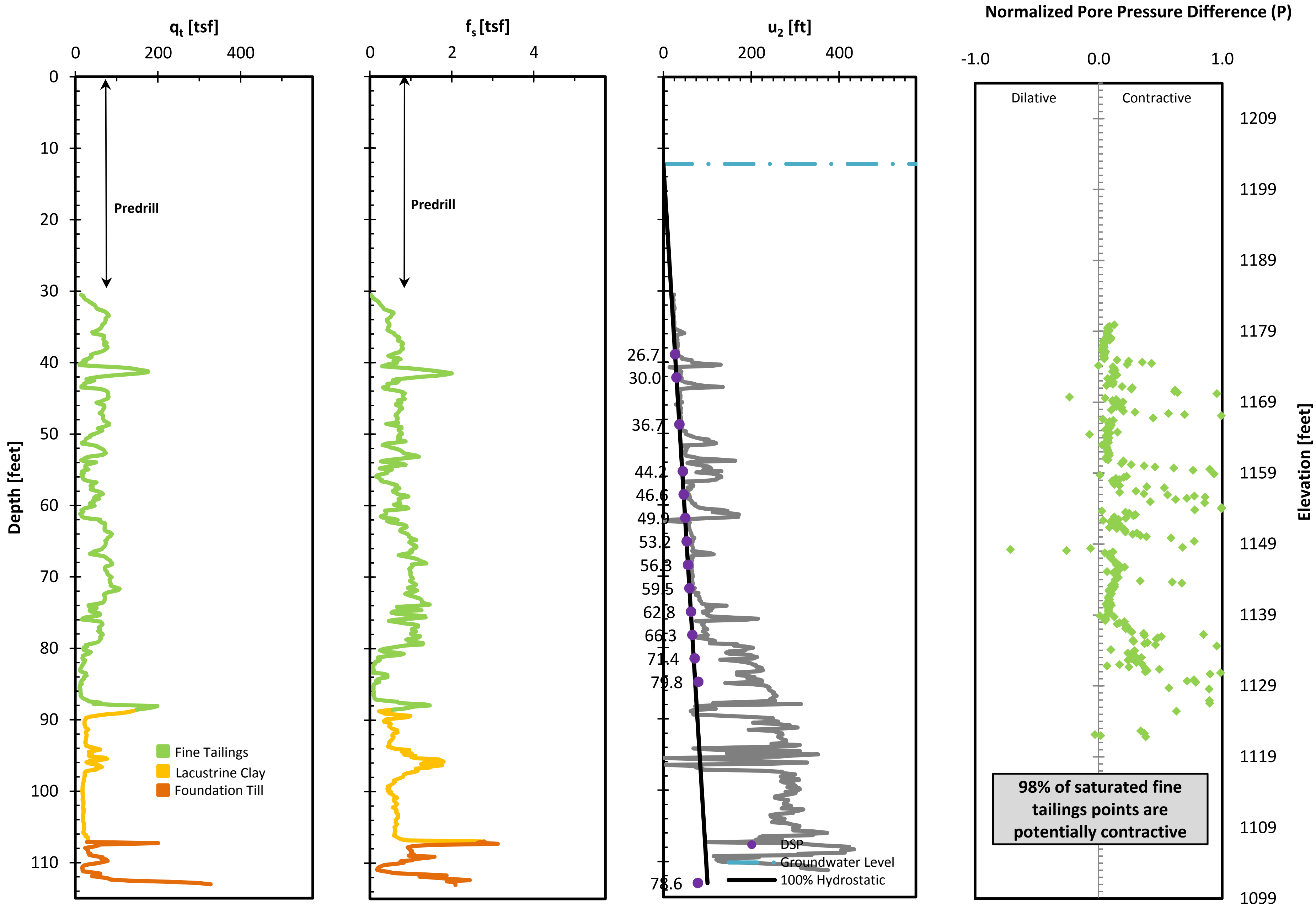
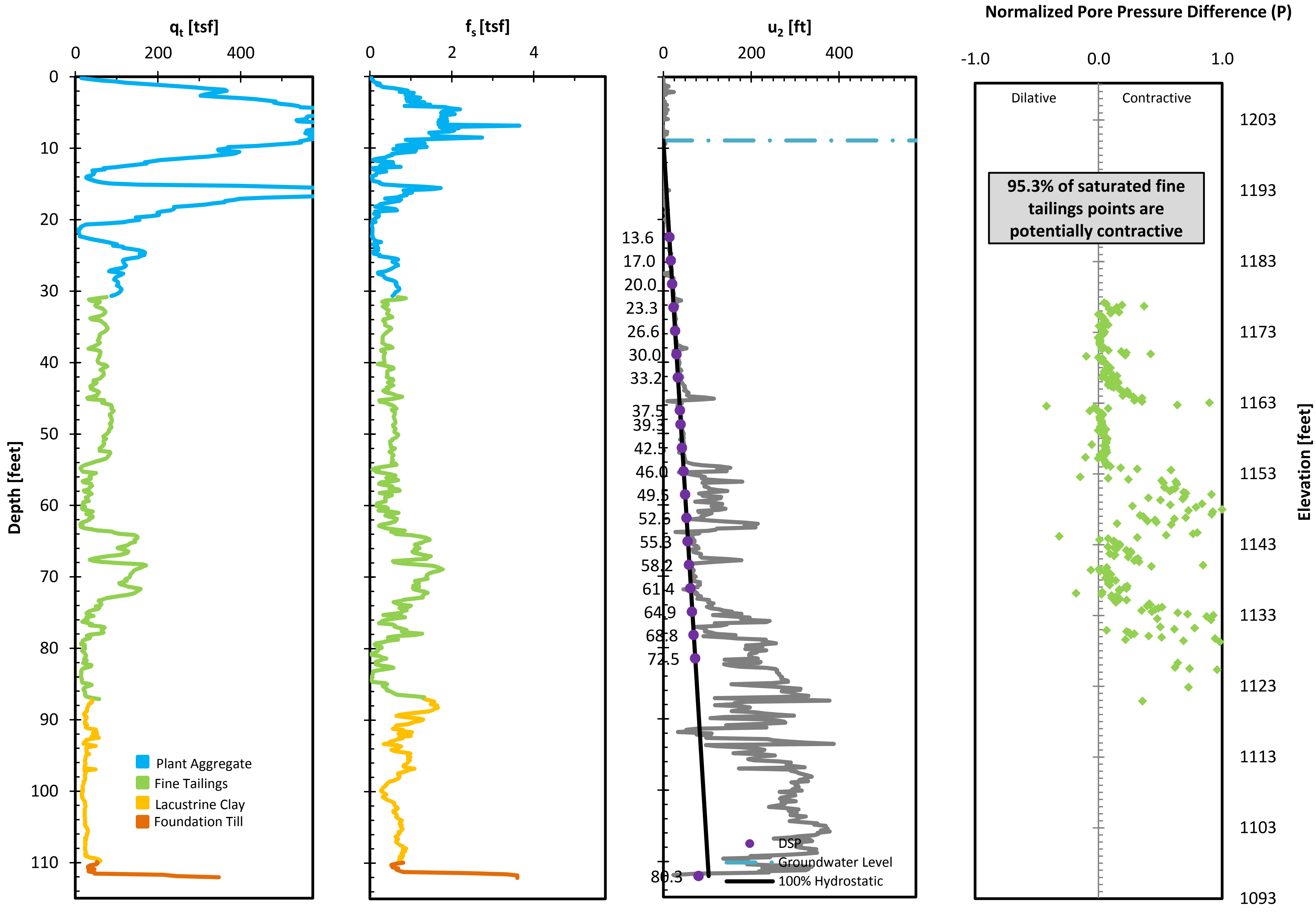
D1-3500CL (2005)
Northshore Mine Milepost 7 Tailings Basin



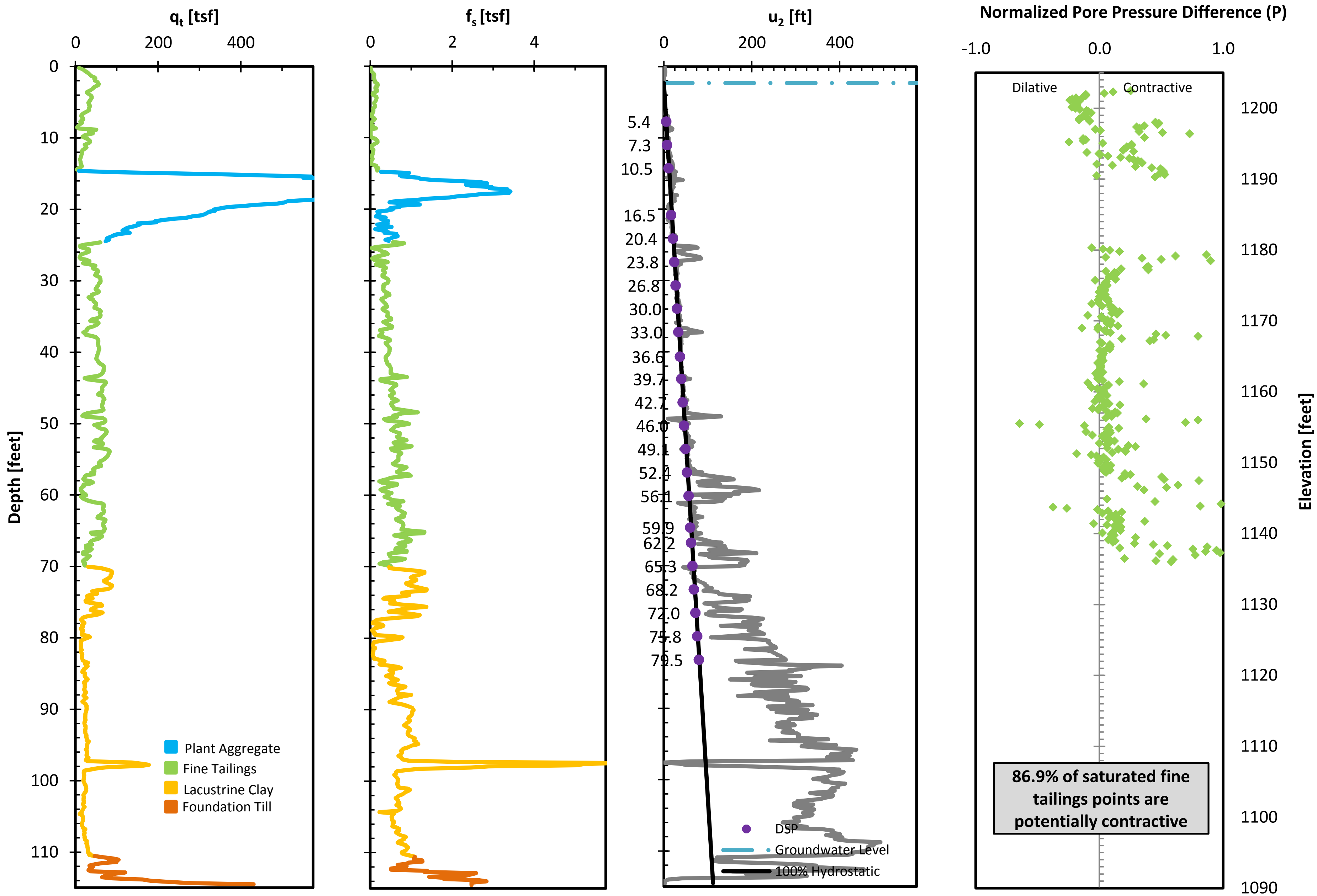
P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

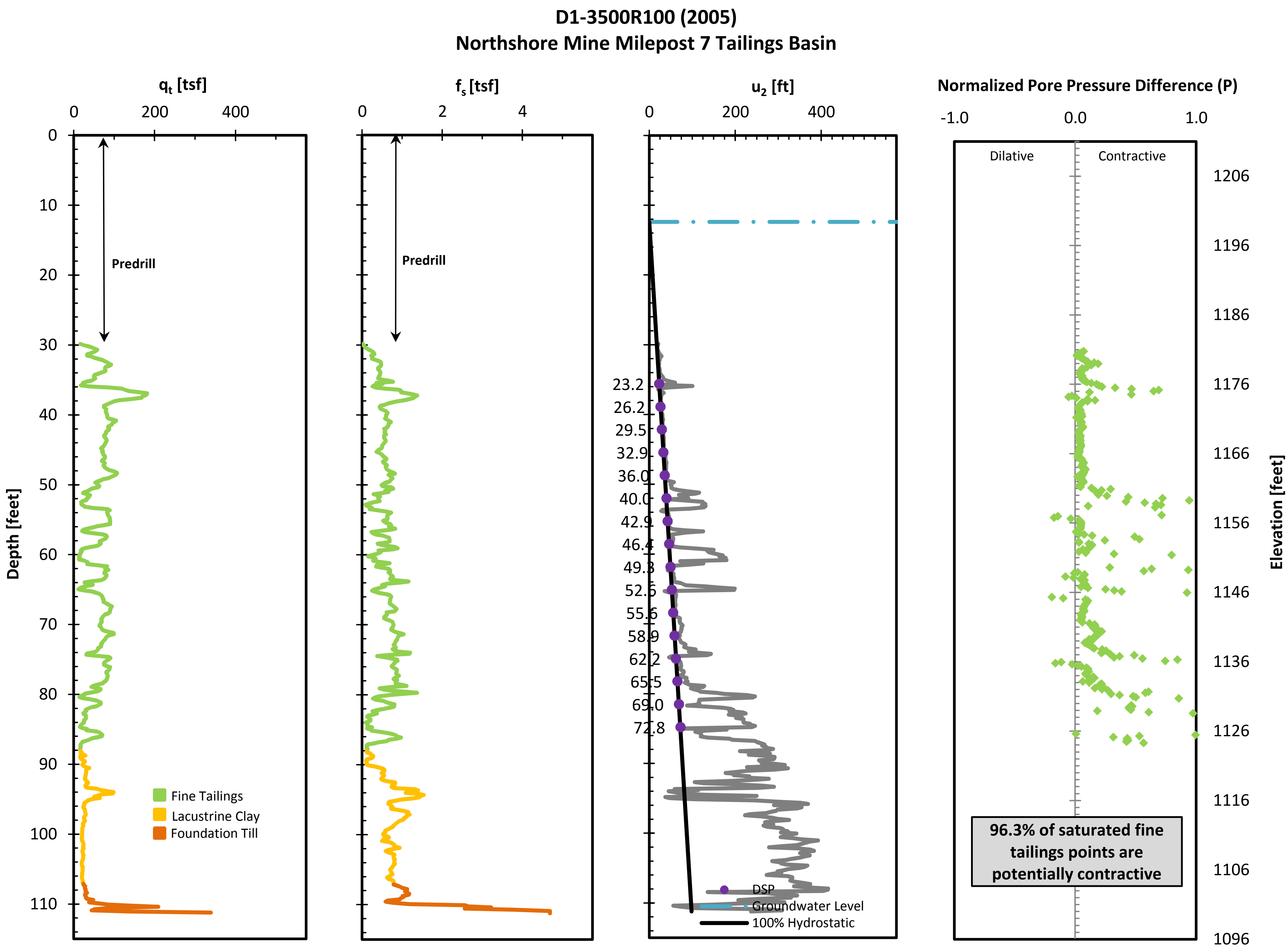
D1-3500L100 (2005)
Northshore Mine Milepost 7 Tailings Basin



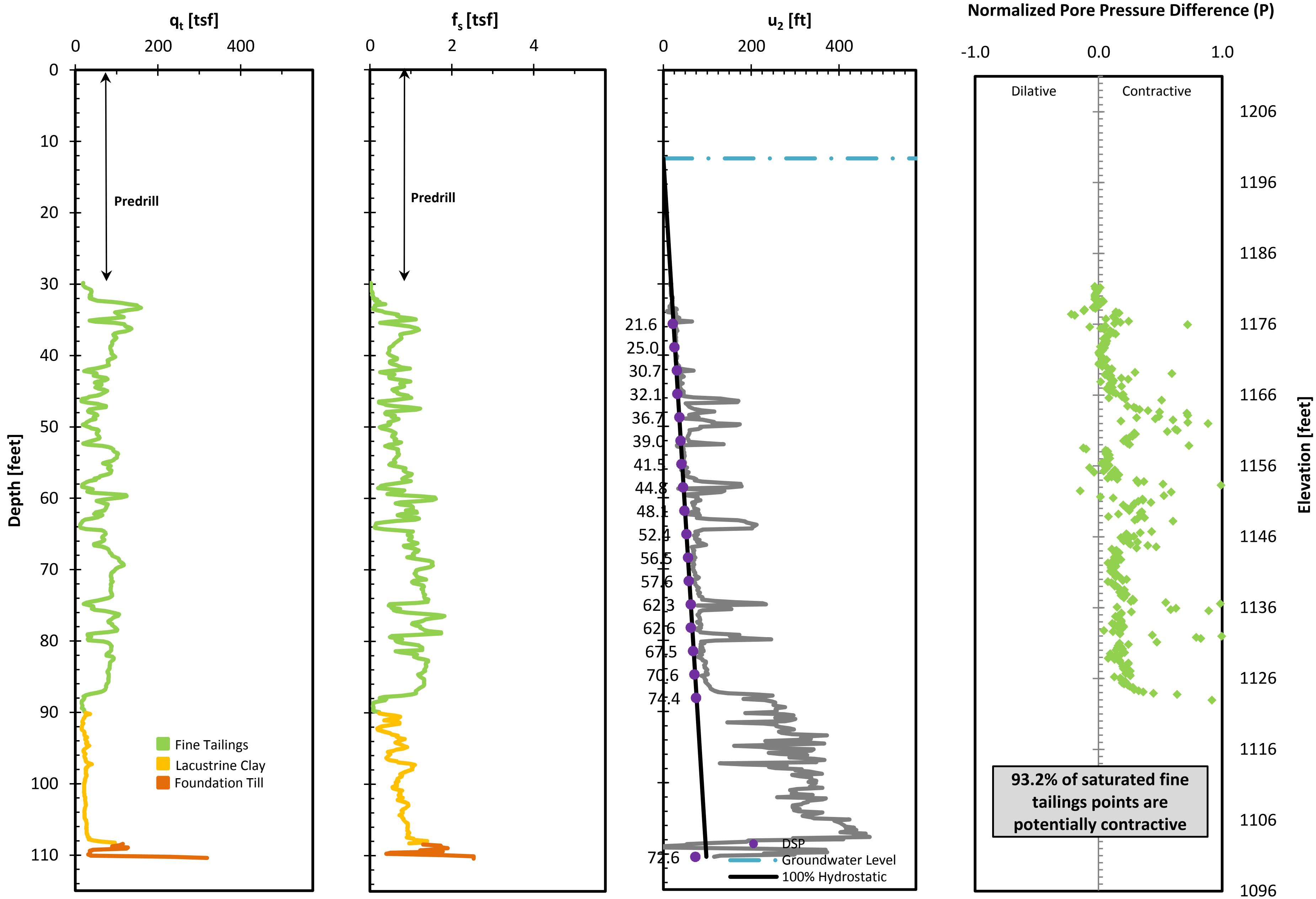
P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

D1-3500L300 (2005)
Northshore Mine Milepost 7 Tailings Basin



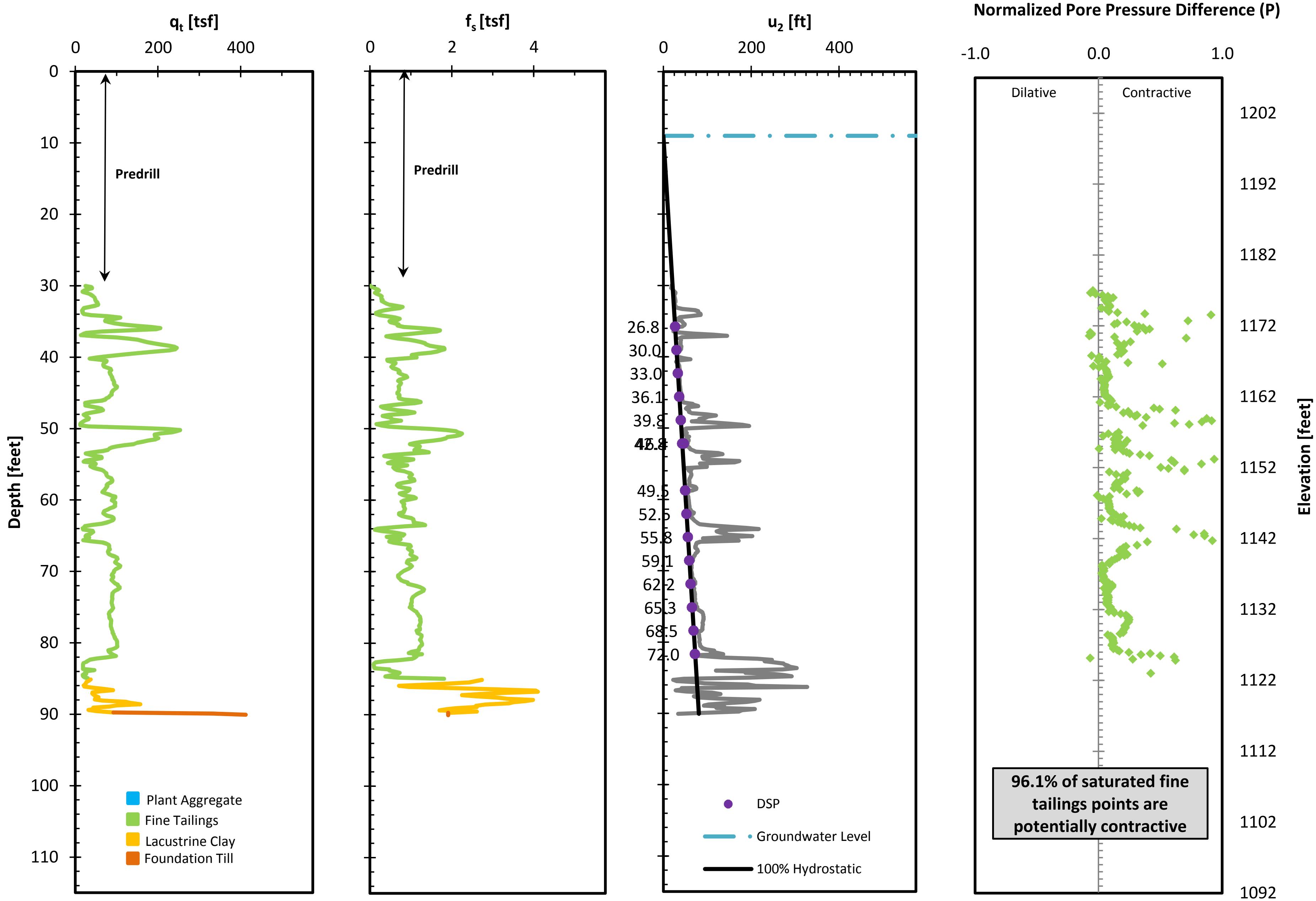

D1-3500R100 (2005)
Northshore Mine Milepost 7 Tailings Basin
q_t [tsf]
f_s [tsf]
u_2 [ft]
Normalized Pore Pressure Difference (P)
Depth [feet]
Elevation [feet]
Predrill
Predrill
Fine Tailings
Lacustrine Clay
Foundation Till
23.2
26.2
29.5
32.9
36.0
40.0
42.9
46.4
49.3
52.6
55.6
58.9
62.2
65.5
69.0
72.8
DSP
Groundwater Level
100% Hydrostatic
Dilative
Contractive
96.3% of saturated fine tailings points are potentially contractive

D1-3500R200 (2005)
Northshore Mine Milepost 7 Tailings Basin



P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

D1-3500R450 (2005)
Northshore Mine Milepost 7 Tailings Basin



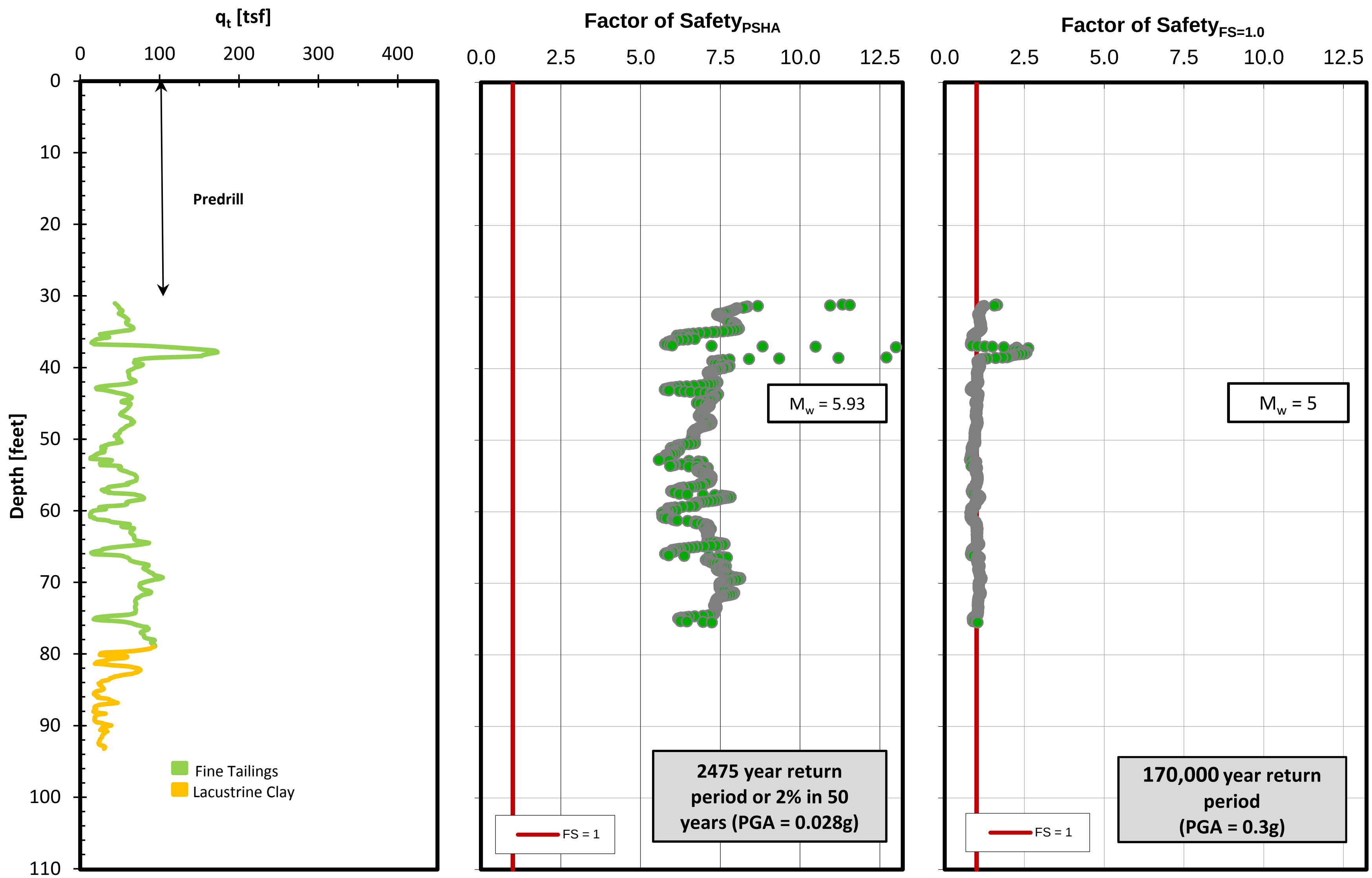
Appendix D

Liquefaction Susceptibility Plots

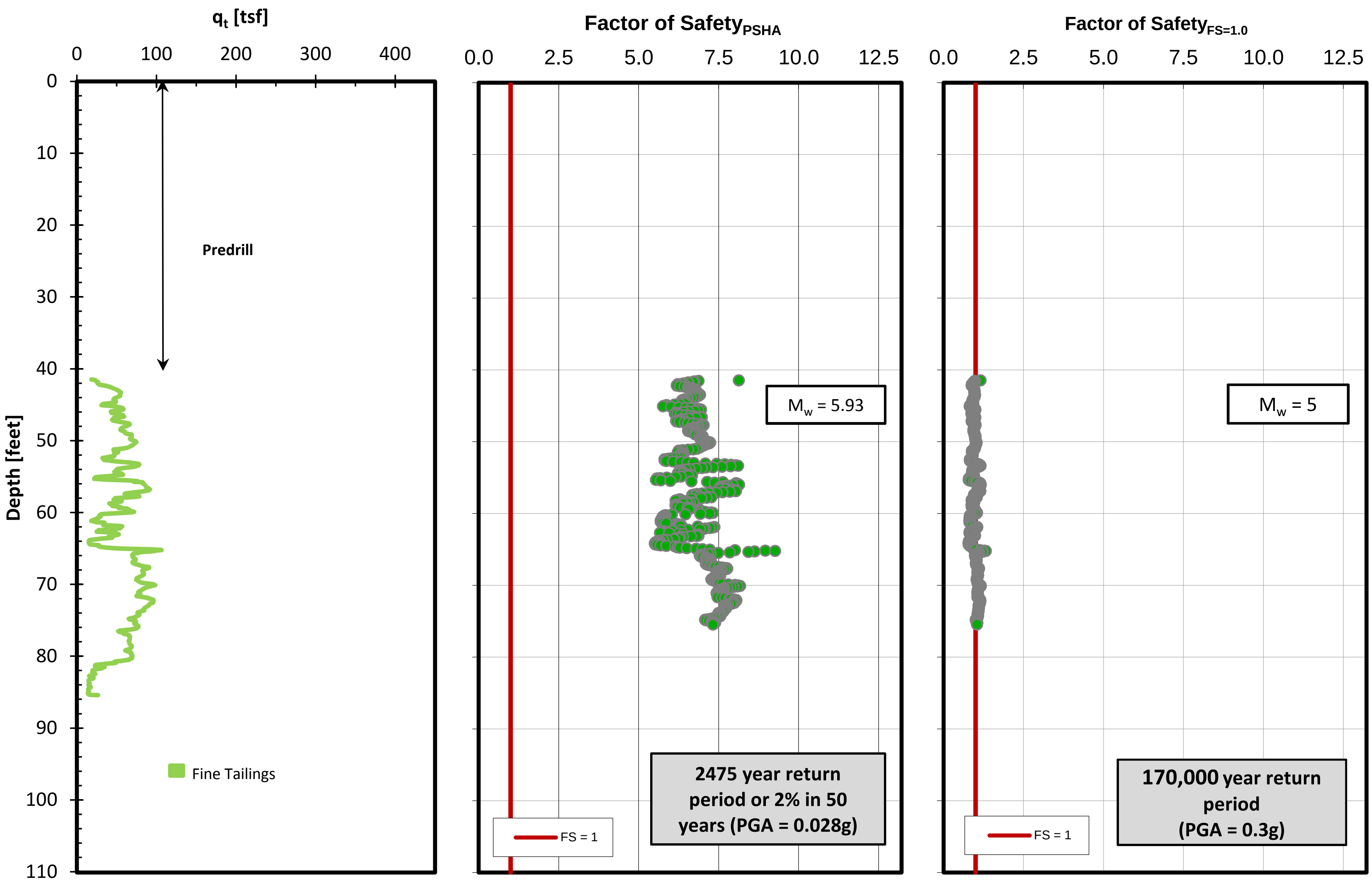
Appendix D

Liquefaction Susceptibility Plots

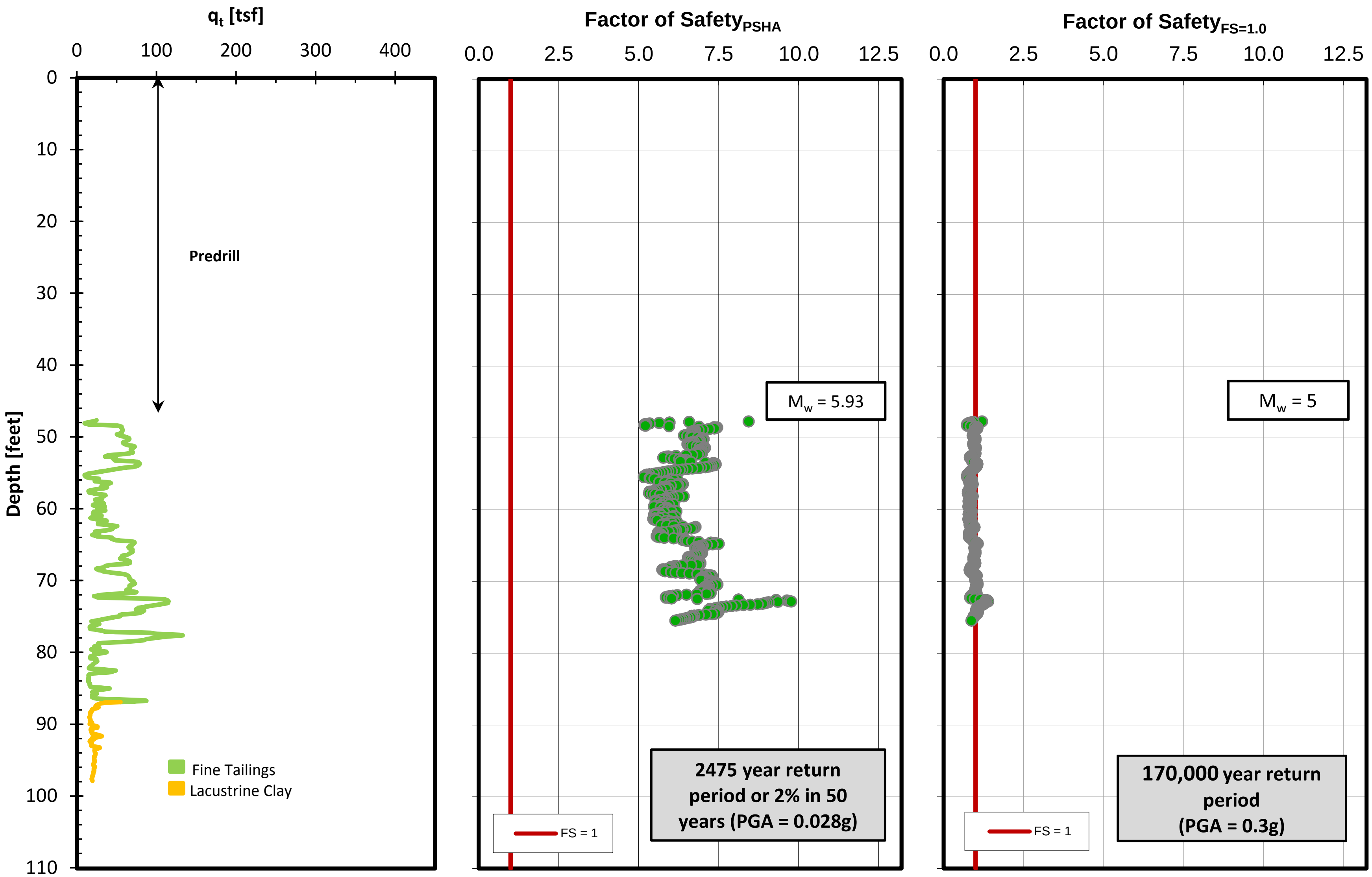
Sounding D1-2480R100 (2006) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin



Sounding D1-3500R100 (2006) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin

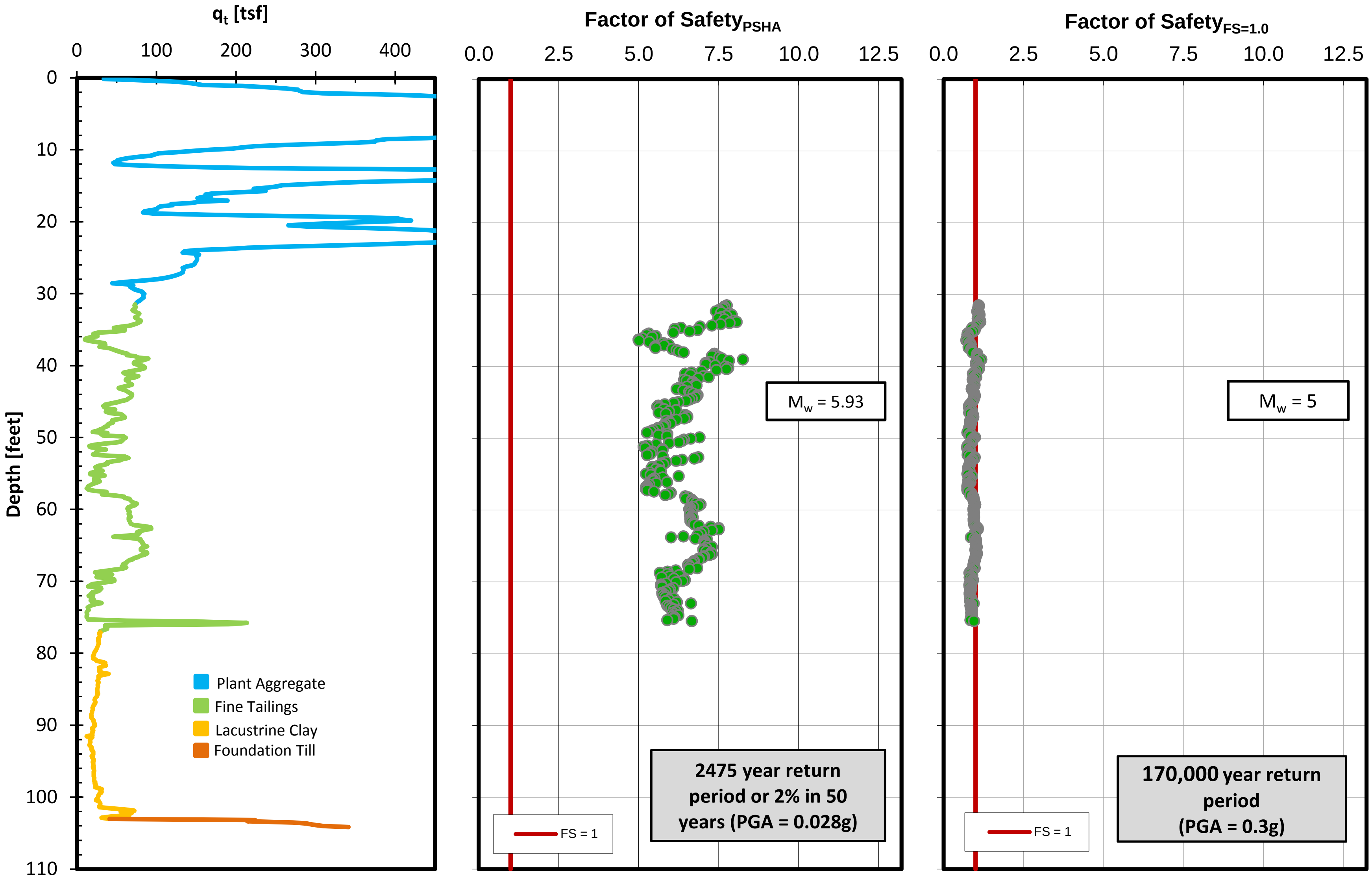


Sounding D1-3500L100 (2006) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin

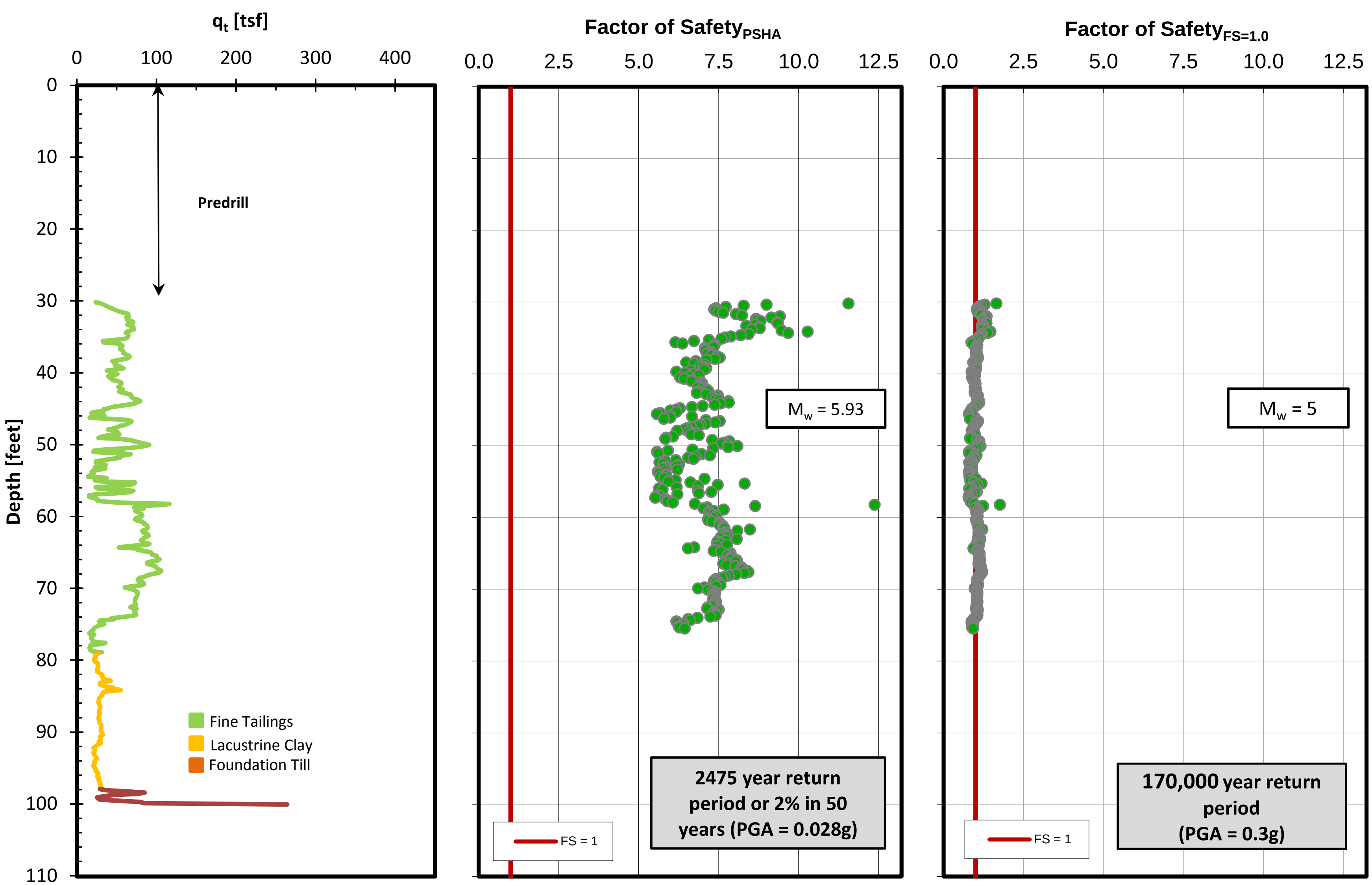


P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

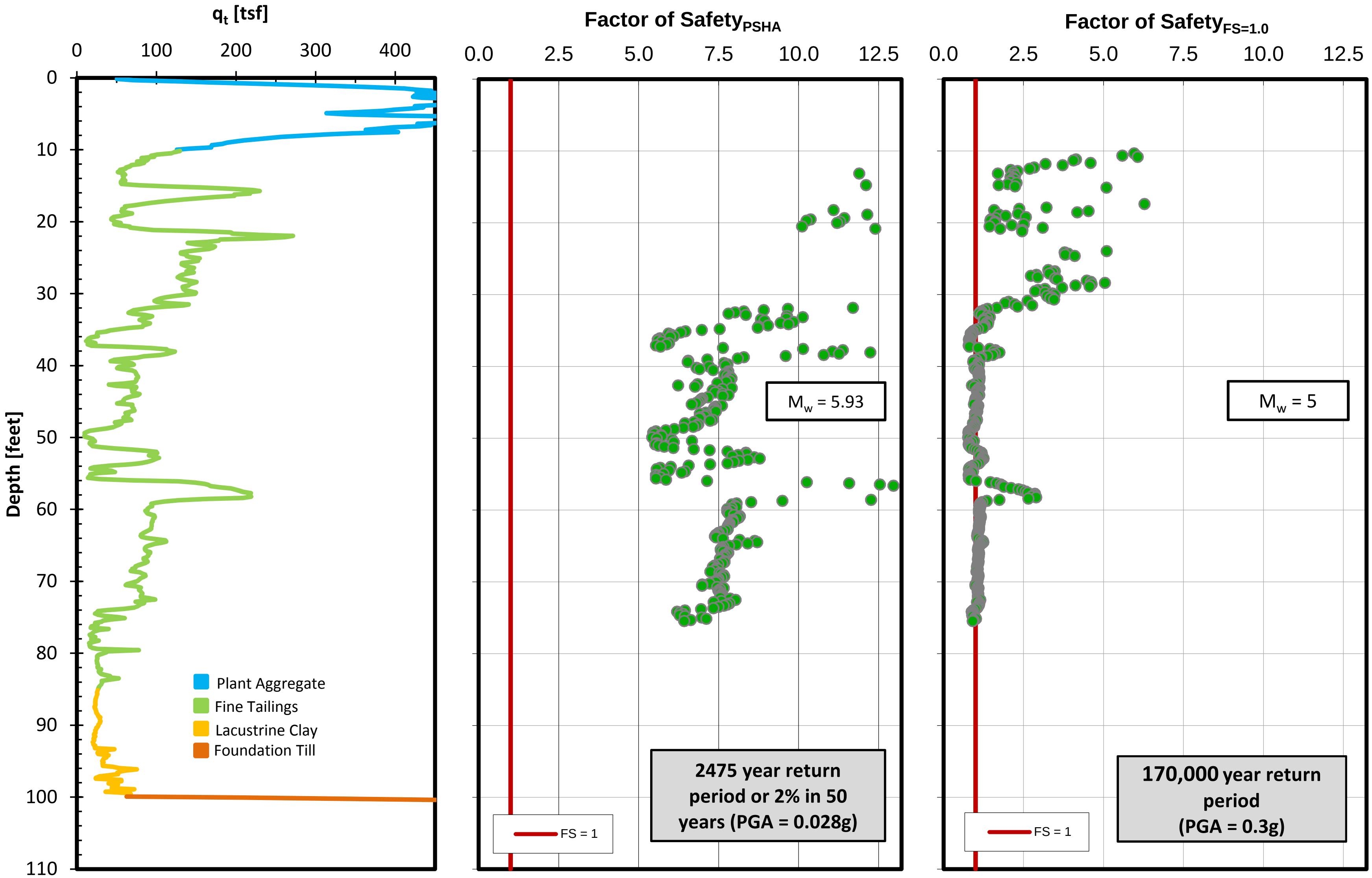
Sounding D1-2840L100 (2005) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin



Sounding D1-2840R100 (2005) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin

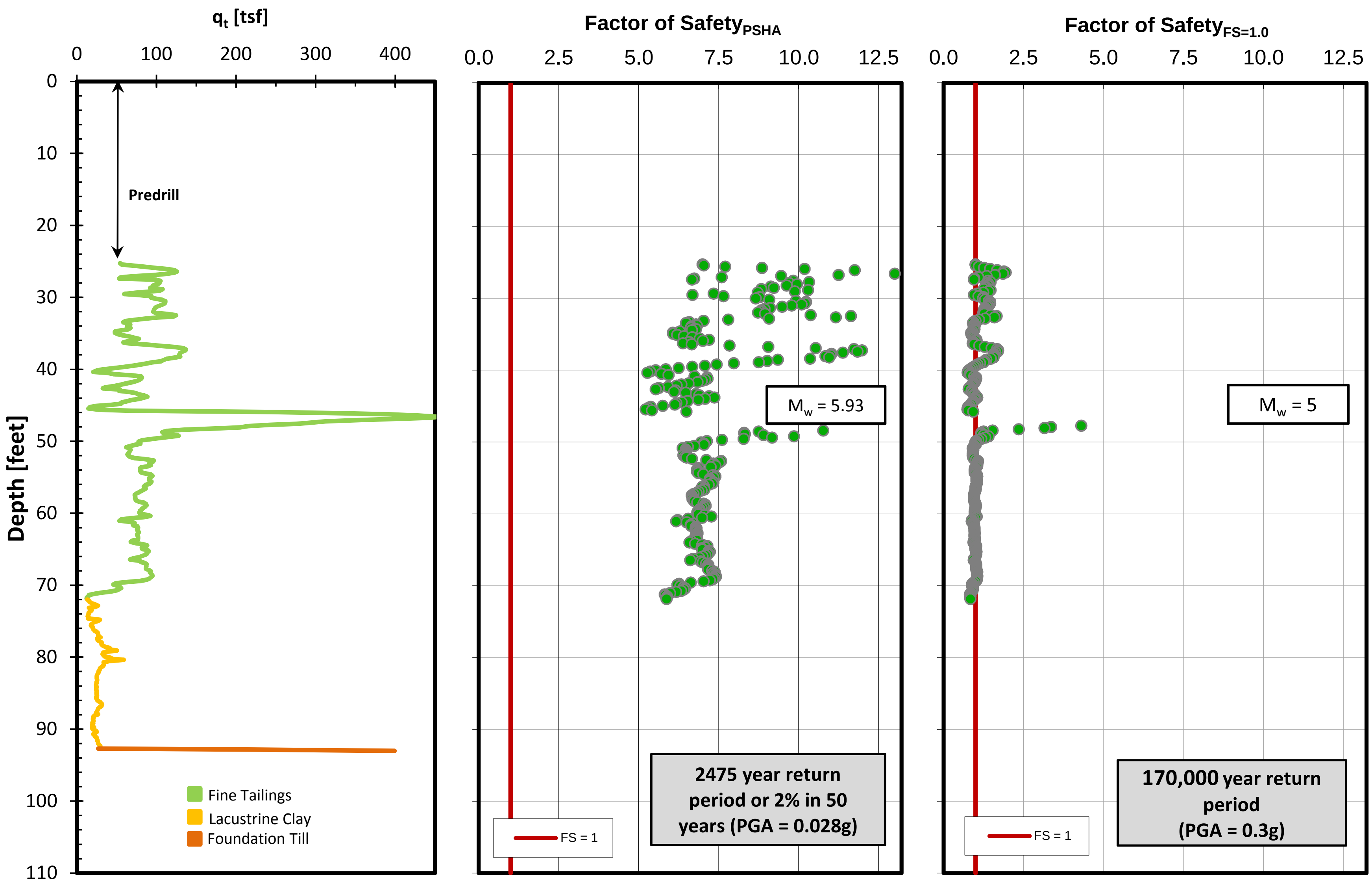


Sounding D1-2840R200 (2005) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin



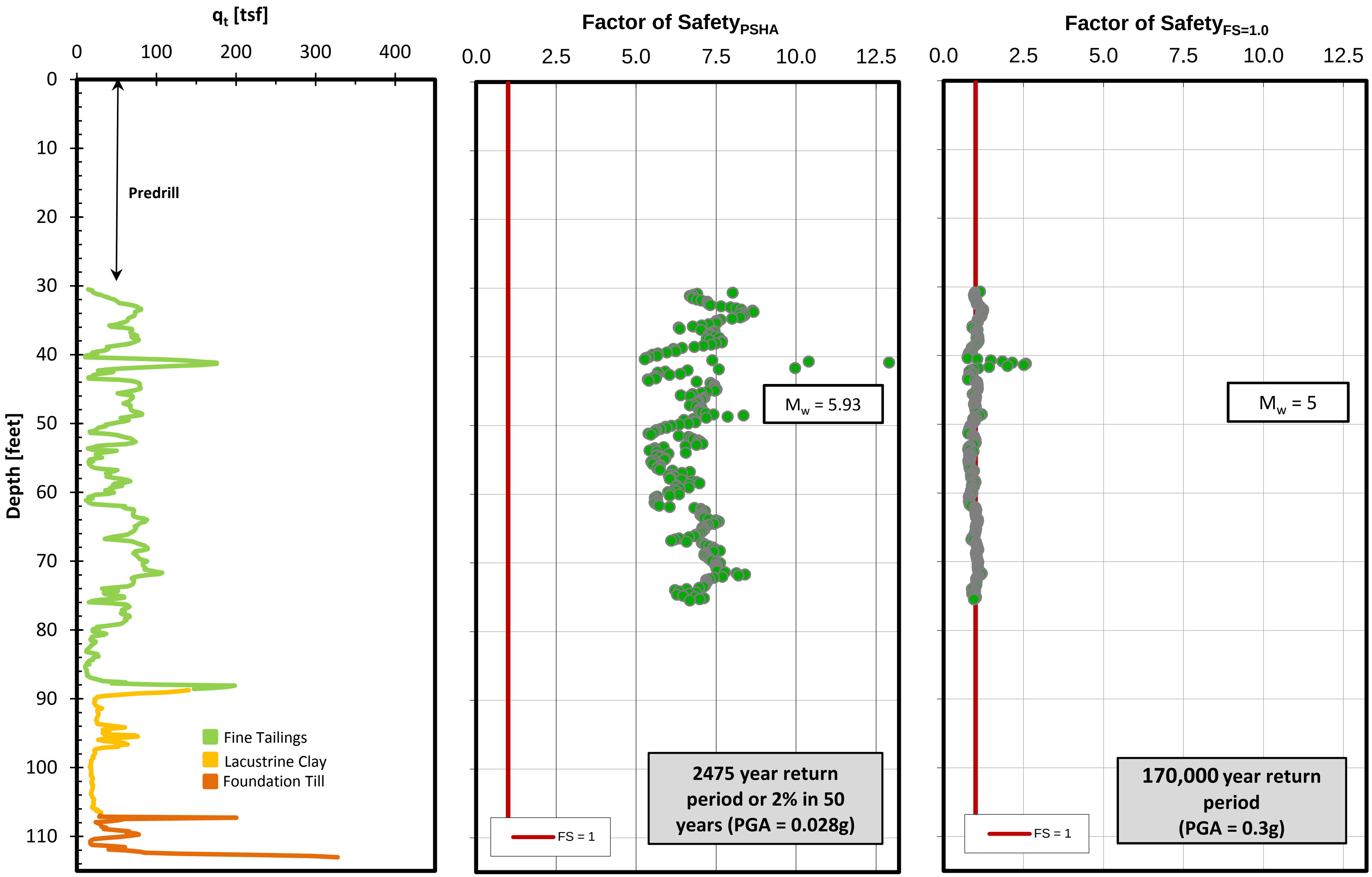
P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

Sounding D1-2840R450 (2005) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin



P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

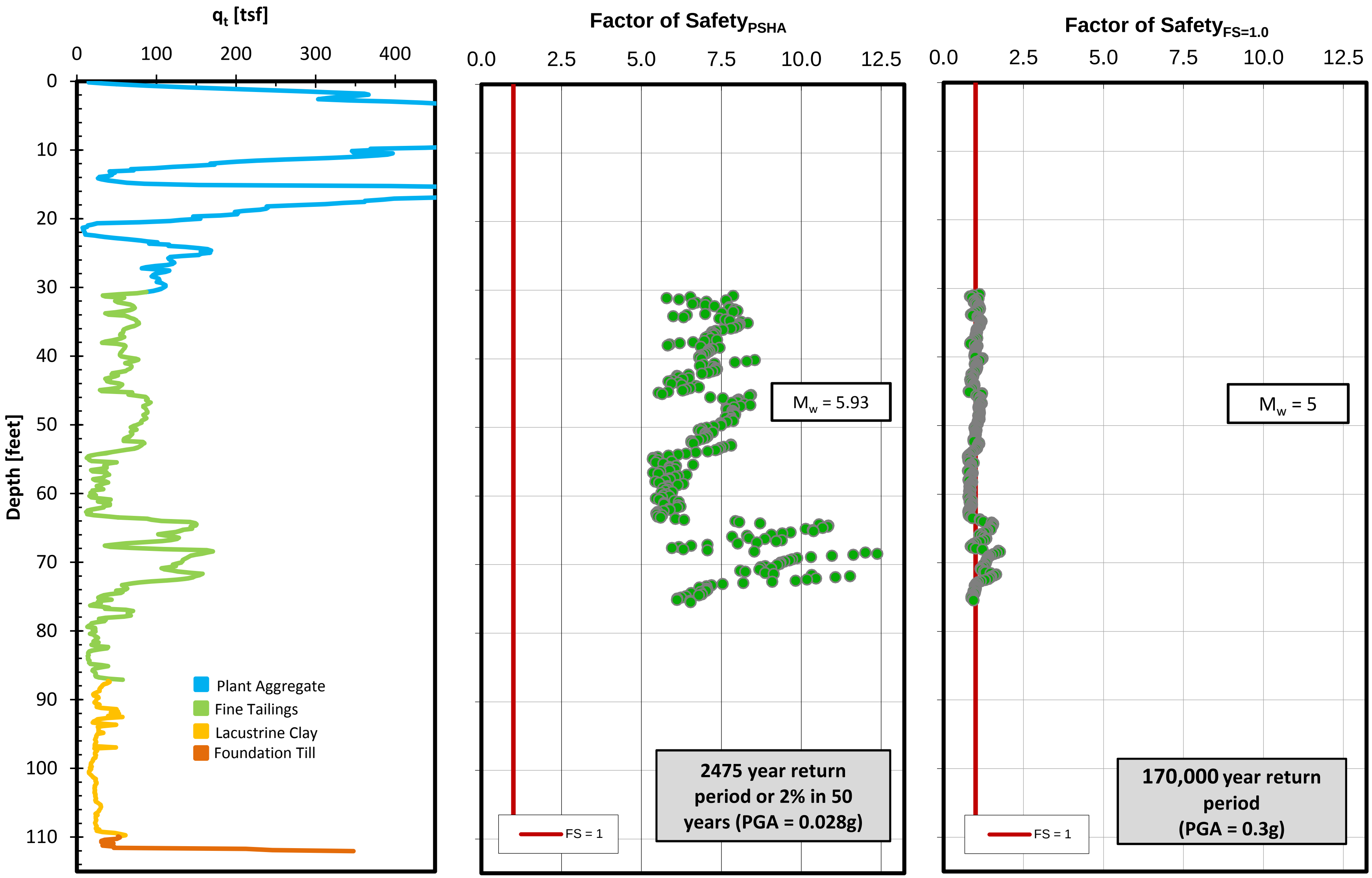
Sounding D1-3500CL (2005) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin



Sounding D1-3500L100 (2005) Triggering Potential

Based on CPT Data (Boulanger and Idriss, 2004)

Northshore Mine Milepost 7 Tailings Basin

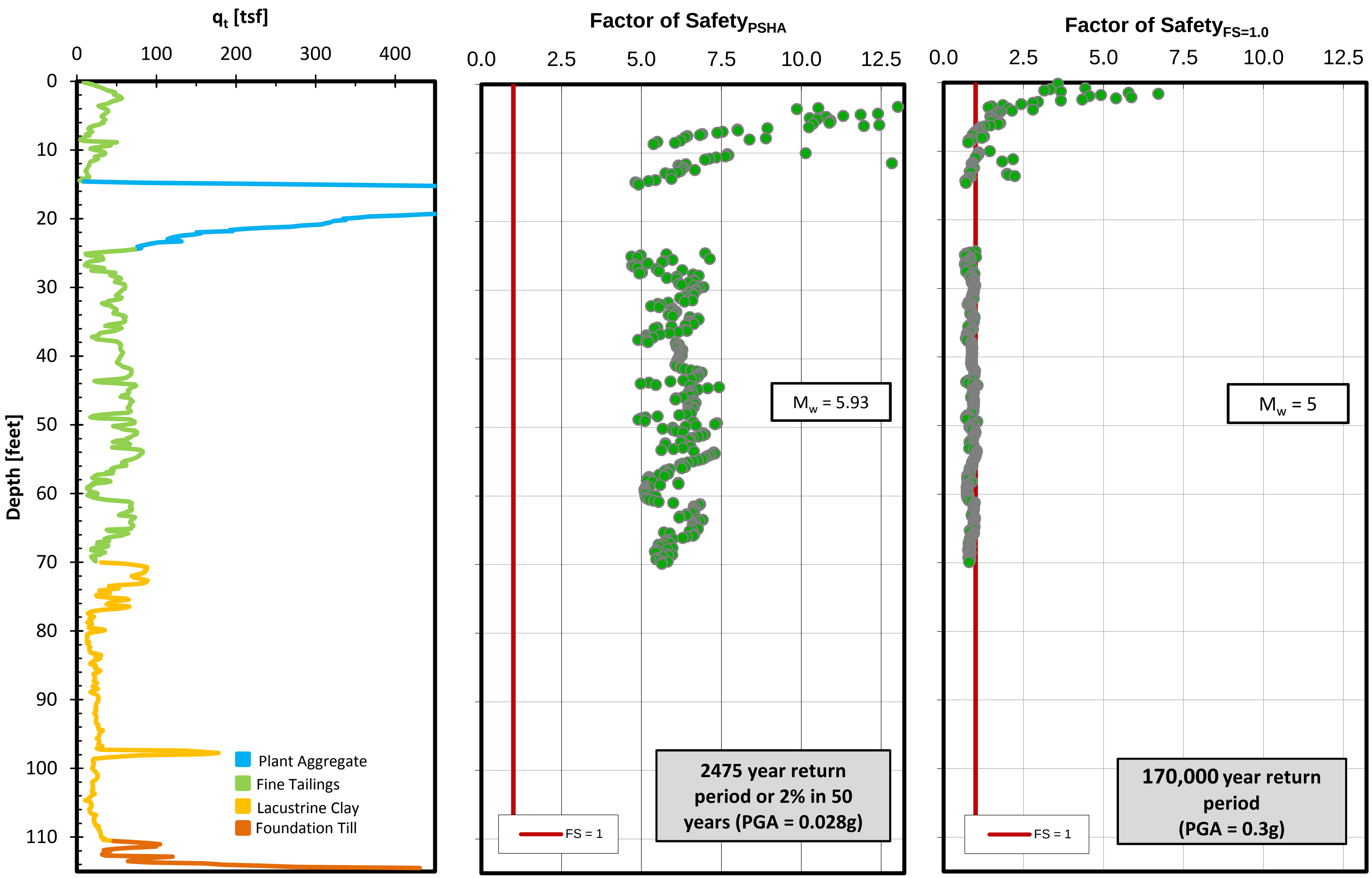


P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

Sounding D1-3500L300 (2005) Triggering Potential

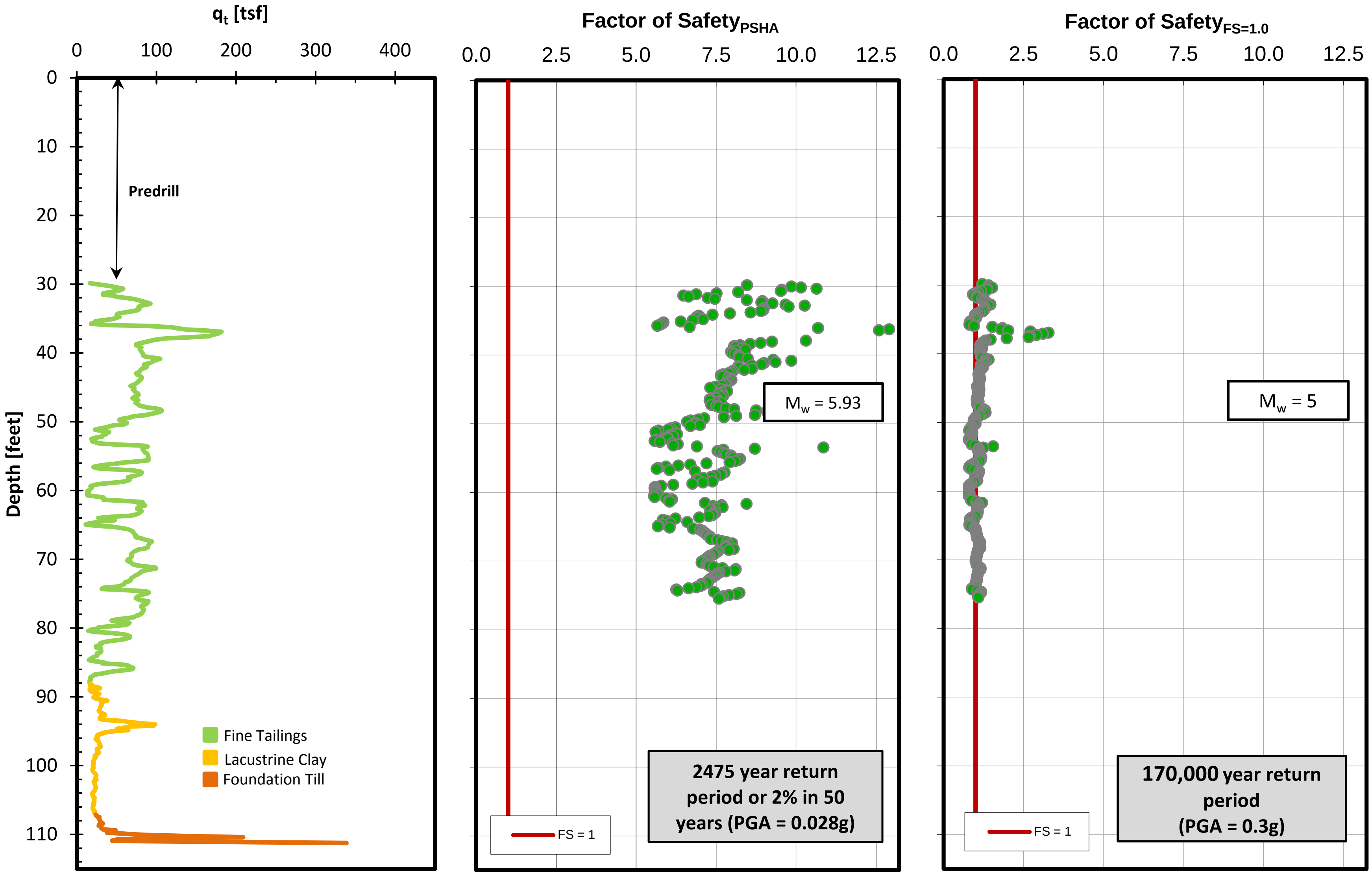
Based on CPT Data (Boulanger and Idriss, 2004)

Northshore Mine Milepost 7 Tailings Basin



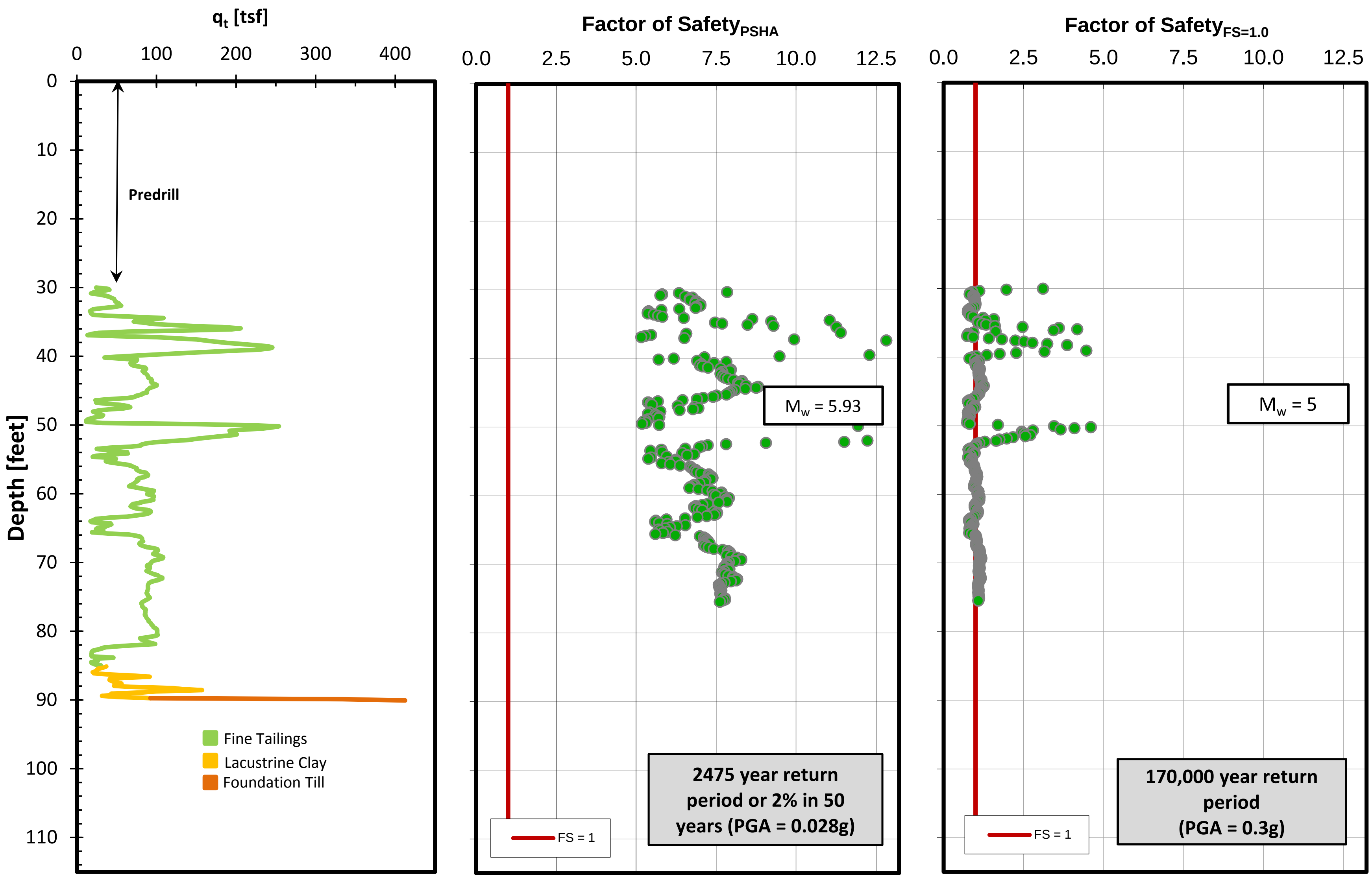
P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

Sounding D1-3500R100 (2005) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin



P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

Sounding D1-3500R450 (2005) Triggering Potential
Based on CPT Data (Boulanger and Idriss, 2004)
Northshore Mine Milepost 7 Tailings Basin



P:\Mpls\23 MN\38\2338086\WorkFiles\2013_Work\DS13\Dam 1 Raise\Updated Material Characterization\NSM Dam 1 FT USSR 2013 Review.xlsm

Appendix E

Probabilistic Seismic Hazard Assessment

Appendix E

Probabilistic Seismic Hazard Assessment

```
*********************************************
*****                EZ-FRISK          *****
***** SEISMIC HAZARD ANALYSIS DEFINITION  *****
*****        RISK ENGINEERING, INC.        *****
*****           BOULDER, CO  USA           *****
*********************************************
```

PROGRAM VERSION
  EZ-FRISK 7.62 Build 000

ANALYSIS TITLE:
  Northshore - Combined

ANALYSIS TYPE:
  Single Site Analysis

SITE COORDINATES
  Latitude 47.2942
  Longitude -91.3598

INTENSITY TYPE: Maximum Rotated Component of Spectral Response @ 5% Damping

```
HAZARD DEAGGREGATION
  Status: ON
  Period: PGA
  Amplitude: 0.02
  Bin Configuration
    Magnitude
      Scale:         Moment Magnitude
      Lowest Value:  4 Mw
      Highest Value: 9 Mw
      Bin Size:      0.1
    Distance
      Lowest Value:  0 km
      Highest Value: 2025 km
      Bin Size:      25 km
    Epsilon
      Lowest Value:  -2.2
      Highest Value: 4.2
      Bin Size:      0.2
```

SOIL AMPLIFICATION
  Method: Do not use soil amplification

ATTENUATION EQUATION SITE PARAMETERS

```
  Vs30 (m/s): 450

AMPLITUDES - Acceleration (g)
  0.0001
  0.001
  0.01
  0.02
  0.05
  0.07
  0.1
  0.2
  0.3
  0.4
  0.5
  0.7
  1
  2
  3

PERIODS (s)
  PGA
  0.05
  0.1
  0.2
  0.3
  0.4
  0.5
  0.75
  1
  2
  3
  4

DETERMINISTIC FRACTILES

PLOTTING PARAMETERS
  Period at which to plot PGA: 0.030303

CALCULATIONAL PARAMETERS
  Fault Seismic Sources -
    Maximum inclusion distance           :   2000 km
    Down dip integration increment       :   1 km
    Horizontal integration increment     :   1 km
    Number rupture length per earthquake :   4
  Subduction Interface Seismic Sources -
```

```
    Maximum inclusion distance           :   2000 km
    Down dip integration increment       :   5 km
    Horizontal integration increment     :   20 km
    Number rupture length per earthquake :   1
  Subduction Slab Seismic Sources -
    Maximum inclusion distance           :   2000 km
    Down dip integration increment       :   5 km
    Horizontal integration increment     :   20 km
    Number rupture length per earthquake :   1
  Area Seismic Sources -
    Maximum inclusion distance           :   2000 km
    Vertical integration increment       :   3 km
    Number of rupture azimuths           :   3
    Minimum epicentral distance step     :   0.5 km
    Maximum epicentral distance step     :   10 km
  Gridded Seismic Sources -
    Maximum inclusion distance            :   2000 km
    Default number of rupture azimuths    :   20
    Maximum distance for default azimuths :   40 km
    Minimum distance for one azimuth      :   150
    Use binned calcuations if possible    :   true
    Bins per decade in distance (km)      :   20
  All Seismic Sources -
    Magnitude integration step           :   0.1 M
    Apply magnitude scaling              :   NO
    Include near-source directivity      :   NO
```

ATTENUATION EQUATIONS

```
  Name: Campbell (2003) USGS 2008 MbLg - AB MRC
  Database: C:\Program Files (x86)\EZ-FRISK 7.62\Files\standard.bin-attendb
  Base: FEMA P-750 Table C21.2-1
  Truncation Type: No Truncation
  Truncation Value: 0
  Magnitude Scale: MbLg
  Distance Type: Distance To Rupture

  Name: Silva et al (2002) USGS 2008 MbLg - AB MRC
  Database: C:\Program Files (x86)\EZ-FRISK 7.62\Files\standard.bin-attendb
  Base: FEMA P-750 Table C21.2-1
  Truncation Type: No Truncation
  Truncation Value: 0
  Magnitude Scale: MbLg
  Distance Type: Distance To Rupture
```

Name: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Database: C:\Program Files (x86)\EZ-FRISK 7.62\Files\standard.bin-attendb
Base: FEMA P-750 Table C21.2-1
Truncation Type: No Truncation
Truncation Value: 0
Magnitude Scale: MbLg
Distance Type: Distance To Rupture

SEISMIC SOURCE SUMMARY TABLE

Closest Source Distance	Deterministic Magnitude	Fault Mechanism	Dip Angle	Dips To	Region	Site Lies
CEUS Gridded - AB					USGS 2008 Central and Eastern US	
0.00	7.0000	Strike Slip	90.0000	--		Above
CEUS Gridded - J					USGS 2008 Central and Eastern US	
0.00	7.0000	Strike Slip	90.0000	--		Above
New Madrid - Composite					USGS 2008 New Madrid	
1127.27	7.7000	Reverse	38-89	W,NW		N

SEISMIC SOURCES

Name: CEUS Gridded - AB
Region: USGS 2008 Central and Eastern US
Category:Composite Seismic Source
Database: C:\Users\kna\AppData\Local\Risk Engineering\EZ-FRISK\Regions\USGS2008 Lower 48 v2.00\Files\USGS 2008 Lower 48.bin-ssdb
Magnitude Scale: MbLg
Probability of Activity: 1
------ Start Nested Sources forCEUS Gridded - AB -------
Name: CEUS Gridded - AB.1.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
FileType: USGS2008

General Parameters
Magnitude Scale: MbLg
Probability of Activity: 0.0333
Latitude Increment, degrees: 0.1
Longitude Increment, degrees: 0.1
Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters (Varies point to point?)
Cell Weight: 1

```
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                                Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                        Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - AB.1.Y
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0166
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                                Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                        Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - AB.2.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0666
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5
```

```
Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                             Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                     Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - AB.2.Y
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0333
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                             Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                     Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - AB.3.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.1666
```

```
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                                Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                        Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - AB.3.Y
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0833
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                                Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                        Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - AB.4.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008
```

```
General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0666
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                             Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                     Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - AB.4.Y
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0333
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                             Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                     Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

 ------ End Nested Sources for CEUS Gridded - AB -------
```

```
Attenuation Equations for Source:
  Raw Weight  Normalized Weight  Name
         1      0.333333          Toro (1999) Midcontinent - USGS 2008 MbLg MRC
         1      0.333333          Campbell (2003) USGS 2008 MbLg - AB MRC
         1      0.333333          Silva et al (2002) USGS 2008 MbLg - AB MRC

*******************************************

Name: CEUS Gridded - J
Region: USGS 2008 Central and Eastern US
Category:Composite Seismic Source
Database: C:\Users\kna\AppData\Local\Risk Engineering\EZ-FRISK\Regions\USGS2008
Lower 48 v2.00\Files\USGS 2008 Lower 48.bin-ssdb
Magnitude Scale: MbLg
Probability of Activity: 1
 ------ Start Nested Sources forCEUS Gridded - J -------
Name: CEUS Gridded - J.1.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0333
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                               Yes
  Rate at Minimum Magnitude, events per year: 0     Yes
  Beta: 2.1875                                       Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - J.1.Y
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008
```

```
General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0166
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                            Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                    Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - J.2.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0666
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                            Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                    Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - J.2.Y
Region: USGS 2008 Central and Eastern US
```

```
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0333
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                              Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                      Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - J.3.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.1666
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                              Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                      Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike
```

```
Name: CEUS Gridded - J.3.Y
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0833
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                            Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                    Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - J.4.N
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0666
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                            Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                    Yes
```

```
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

Name: CEUS Gridded - J.4.Y
Region: USGS 2008 Central and Eastern US
Category:Gridded
  FileType: USGS2008

General Parameters
  Magnitude Scale: MbLg
  Probability of Activity: 0.0333
  Latitude Increment, degrees:   0.1
  Longitude Increment, degrees:  0.1
  Magnitude Threshold for Weighting: 6.5

Earthquake Model Parameters               (Varies point to point?)
  Cell Weight: 1
  Fault Mechanism: Strike Slip
  Depth to Top of Rupture, km: 5
  Minimum Magnitude: 5
  Maximum Magnitude: 7                             Yes
  Rate at Minimum Magnitude, events per year: 0   Yes
  Beta: 2.1875                                     Yes
  Horizontal Rupture Length, A parameter: -3.22
  Horizontal Rupture Length, B parameter: 0.69
  Rupture Strike Azimuth Model: Random Strike

 ------ End Nested Sources for CEUS Gridded - J -------

Attenuation Equations for Source:
  Raw Weight  Normalized Weight  Name
       1      0.333333          Toro (1999) Midcontinent - USGS 2008 MbLg MRC
       1      0.333333          Campbell (2003) USGS 2008 MbLg - AB MRC
       1      0.333333          Silva et al (2002) USGS 2008 MbLg - AB MRC

*******************************************

Name: New Madrid - Composite
Region: USGS 2008 New Madrid
Category:Composite Seismic Source
Database: C:\Users\kna\AppData\Local\Risk Engineering\EZ-FRISK\Regions\USGS2008
Lower 48 v2.00\Files\USGS 2008 Lower 48.bin-ssdb
Magnitude Scale: Moment Magnitude
Probability of Activity: 1
```

```
 ------ Start Nested Sources forNew Madrid - Composite -------
Name: New Madrid - Central location - Unclustered
Region: USGS 2008 New Madrid
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.34990000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic      0.45    Activity  2.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.180000    Activity  2.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.050000    Activity  1.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.020000    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
```

```
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.1500   -89.0530
    36.6860   -89.5870
    36.2050   -89.5100
    35.4490   -90.6330

Name: New Madrid - Eastern location - Unclustered
Region: USGS 2008 New Madrid
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.02500000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic      0.45    Activity  2.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.180000    Activity  2.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.050000    Activity  1.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.020000    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.290000  7.300000
```

```
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl       Sigl        Aw        Bw
Sigw        Aa        Ba       Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.9600   -88.9290
    36.6390   -89.2790
    36.1350   -89.1780
    35.2600   -90.4150

Name: New Madrid - Mideastern location - Unclustered
Region: USGS 2008 New Madrid
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.05000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic      0.45    Activity  2.000e-003  7.690000  7.700000
```

```
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.180000    Activity  2.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.050000    Activity  1.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.020000    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa         Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --         --

Trace Coordinates:
  Latitude   Longitude
    37.0700   -89.0010
    36.6670   -89.4625
    36.1700   -89.3440
    35.3500   -90.5100

Name: New Madrid - Midwestern location - Unclustered
Region: USGS 2008 New Madrid
```

```
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.05000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic      0.45    Activity  2.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.180000    Activity  2.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.050000    Activity  1.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.020000    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl         Aw         Bw
Sigw        Aa         Ba       Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --         --        --
```

```
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.2050   -89.1814
    36.7040   -89.6991
    36.2700   -89.6575
    35.5400   -90.6725

Name: New Madrid - Western location - Unclustered
Region: USGS 2008 New Madrid
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.02500000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic      0.45    Activity  2.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.180000    Activity  2.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.135000    Activity  2.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.050000    Activity  1.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.020000    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000
   Characteristic  0.015000    Activity  1.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
```

```
  Rupture Dimensioning        Al        Bl       Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.2630   -89.3230
    36.7340   -89.8860
    36.3460   -89.8300
    35.6470   -90.7190

Name: NMSZ - Clustered - Central - 1000yr - M7.3
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.00525
Time Independent Cluster Rate (events/year): 0.001
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1000yr - M7.3
-------
Name: NMSZ - Clustered - Central - 1000yr - M7.3 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.3

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23
```

```
Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning       Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1000yr - M7.1 - Northern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.1

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.090000  7.100000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning       Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.1500   -89.0530
```

```
    36.6860   -89.5870

Name: NMSZ - Clustered - Central - 1000yr - M7.3 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.3

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1000yr - M7.3
-------

Name: NMSZ - Clustered - Central - 1000yr - M7.5
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.007
Time Independent Cluster Rate (events/year): 0.001
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1000yr - M7.5
-------
Name: NMSZ - Clustered - Central - 1000yr - M7.5 - Central
Region: New Madrid USGS2008
Category:Fault
```

```
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.5

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1000yr - M7.3 - Northern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.3

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
```

```
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.1500   -89.0530
    36.6860   -89.5870

Name: NMSZ - Clustered - Central - 1000yr - M7.5 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.5

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1000yr - M7.5
-------

Name: NMSZ - Clustered - Central - 1000yr - M7.7
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
```

```
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.0175
Time Independent Cluster Rate (events/year): 0.001
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1000yr - M7.7
-------
Name: NMSZ - Clustered - Central - 1000yr - M7.7 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1000yr - M7.5 - Northern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.5

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25
```

```
Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning       Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.1500   -89.0530
    36.6860   -89.5870

Name: NMSZ - Clustered - Central - 1000yr - M7.7 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.3

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning       Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
```

```
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1000yr - M7.7
-------

Name: NMSZ - Clustered - Central - 1000yr - M8.0
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.00525
Time Independent Cluster Rate (events/year): 0.001
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1000yr - M8.0
-------
Name: NMSZ - Clustered - Central - 1000yr - M8.0 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1000yr - M7.8 - Northern
Region: New Madrid USGS2008
Category:Fault
```

```
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.5

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.790000  7.800000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.1500   -89.0530
    36.6860   -89.5870

Name: NMSZ - Clustered - Central - 1000yr - M8.0 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  1.000e-003  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
```

```
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1000yr - M8.0
-------

Name: NMSZ - Clustered - Central - 1500yr - M7.3
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.023625
Time Independent Cluster Rate (events/year): 0.000666667
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1500yr - M7.3
-------
Name: NMSZ - Clustered - Central - 1500yr - M7.3 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.3

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --
```

```
Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1500yr - M7.3 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.3

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1500yr - M7.3
-------

Name: NMSZ - Clustered - Central - 1500yr - M7.5
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.0315
Time Independent Cluster Rate (events/year): 0.000666667
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1500yr - M7.5
-------
```

```
Name: NMSZ - Clustered - Central - 1500yr - M7.5 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.5

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.490000  7.500000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1500yr - M7.5 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.5

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.490000  7.500000
```

```
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1500yr - M7.5
-------

Name: NMSZ - Clustered - Central - 1500yr - M7.7
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.07875
Time Independent Cluster Rate (events/year): 0.000666667
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1500yr - M7.7
-------
Name: NMSZ - Clustered - Central - 1500yr - M7.7 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
```

```
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1500yr - M7.7 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.690000  7.700000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning       Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1500yr - M7.7
-------

Name: NMSZ - Clustered - Central - 1500yr - M8.0
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.023625
```

```
Time Independent Cluster Rate (events/year): 0.000666667
 ------ Start Nested Sources forNMSZ - Clustered - Central - 1500yr - M8.0
-------
Name: NMSZ - Clustered - Central - 1500yr - M8.0 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl         Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 1500yr - M8.0 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.7

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
```

```
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  6.667e-004  7.990000  8.000000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.2050   -89.5100
    35.4490   -90.6330

 ------ End Nested Sources for NMSZ - Clustered - Central - 1500yr - M8.0
-------

Name: NMSZ - Clustered - Central - 500yr - M7.3
Region: USGS 2008 New Madrid
Category:Clustered Seismic Source
Magnitude Scale: Moment Magnitude
Probability of Activity: 0.023625
Time Independent Cluster Rate (events/year): 0.002
 ------ Start Nested Sources forNMSZ - Clustered - Central - 500yr - M7.3
-------
Name: NMSZ - Clustered - Central - 500yr - M7.3 - Central
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.3

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        38        10     10.01     19.23

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  2.000e-003  7.290000  7.300000
2.300000  0.000000  0.120000  0.000100 10.000000
```

```
Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.010000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    36.6860   -89.5870
    36.2050   -89.5100

Name: NMSZ - Clustered - Central - 500yr - M7.1 - Northern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
Probability of Activity: 1.00000000
Deterministic Magnitude: 7.1

Fault Profile Parameters:
        Dip1      Dip2    Depth1    Depth2    Depth3
          90        89        10     10.01        25

Magnitude Recurrence Distributions:
        ModelType    Weight    RateType        Rate    MinMag    MaxMag
Beta      Mean     Sigma    Delta1    Delta2
   Characteristic         1    Activity  2.000e-003  7.090000  7.100000
2.300000  0.000000  0.120000  0.000100 10.000000

Rupture Length Parameters
  Rupture Dimensioning        Al        Bl      Sigl        Aw        Bw
Sigw        Aa        Ba      Sigw
      Length and Width  4.000000  0.000000  0.010000  4.000000  0.000000
0.100000        --        --        --

Trace Coordinates:
  Latitude   Longitude
    37.1500   -89.0530
    36.6860   -89.5870

Name: NMSZ - Clustered - Central - 500yr - M7.3 - Southern
Region: New Madrid USGS2008
Category:Fault
Fault Mechanism: Reverse
Magnitude Scale: Moment Magnitude
```

```
Start:  16:47:19 Tuesday, August 02, 2011
******************************************
Start processing input file: G:\KNA\EZ-FRISK_New\Northshore\Combined\Northshore
(Combined) - Northshore - Combined.ezf-shad
Application version: EZ-FRISK 7.62 Build 000
Vs30 (m/s) used in hazard calculations:  450
Analyzing site  Latitude: 47.2942 Longitude: -91.3598
Validating setup.
Input data validated.
Preparing to calculate PSHA and DSHA.
Calculating hazard for each source.
Information: Using parallel processing of sources.
Start loop on sources:  16:47:24 Tuesday, August 02, 2011
Calculating hazard for: CEUS Gridded - J : USGS 2008 Central and Eastern US
Calculating hazard for: CEUS Gridded - AB : USGS 2008 Central and Eastern US
Calculating hazard for nested source: CEUS Gridded - J.1.N of CEUS Gridded - J.
Calculating hazard for nested source: CEUS Gridded - AB.1.N of CEUS Gridded -
AB.
Calculating hazard for: New Madrid - Composite : USGS 2008 New Madrid
Calculating hazard for nested source: CEUS Gridded - J.1.Y of CEUS Gridded - J.
Calculating hazard for nested source: CEUS Gridded - J.2.N of CEUS Gridded - J.
Calculating hazard for nested source: New Madrid - Central location -
Unclustered of New Madrid - Composite.
Done calculating hazard for nested source: New Madrid - Central location -
Unclustered of New Madrid - Composite.
Calculating hazard for nested source: New Madrid - Eastern location -
Unclustered of New Madrid - Composite.
Done calculating hazard for nested source: New Madrid - Eastern location -
Unclustered of New Madrid - Composite.
Calculating hazard for nested source: New Madrid - Mideastern location -
Unclustered of New Madrid - Composite.
Done calculating hazard for nested source: New Madrid - Mideastern location -
Unclustered of New Madrid - Composite.
Calculating hazard for nested source: New Madrid - Midwestern location -
Unclustered of New Madrid - Composite.
Calculating hazard for nested source: CEUS Gridded - J.2.Y of CEUS Gridded - J.
Done calculating hazard for nested source: New Madrid - Midwestern location -
Unclustered of New Madrid - Composite.
Calculating hazard for nested source: New Madrid - Western location -
Unclustered of New Madrid - Composite.
Done calculating hazard for nested source: New Madrid - Western location -
Unclustered of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr -
M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr -
```

M7.3 - Central of NMSZ - Clustered - Central - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.3 - Central of NMSZ - Clustered - Central - 1000yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.1 - Northern of NMSZ - Clustered - Central - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.1 - Northern of NMSZ - Clustered - Central - 1000yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.3 - Southern of NMSZ - Clustered - Central - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.3 - Southern of NMSZ - Clustered - Central - 1000yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 - Central of NMSZ - Clustered - Central - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 - Central of NMSZ - Clustered - Central - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.3 - Northern of NMSZ - Clustered - Central - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.3 - Northern of NMSZ - Clustered - Central - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 - Southern of NMSZ - Clustered - Central - 1000yr - M7.5
Calculating hazard for nested source: CEUS Gridded - AB.1.Y of CEUS Gridded - AB.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 - Southern of NMSZ - Clustered - Central - 1000yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.7 - Central of NMSZ - Clustered - Central - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.7 - Central of NMSZ - Clustered - Central - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 - Northern of NMSZ - Clustered - Central - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.5 - Northern of NMSZ - Clustered - Central - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.7 - Southern of NMSZ - Clustered - Central - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr - M7.7 - Southern of NMSZ - Clustered - Central - 1000yr - M7.7.

```
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr
- M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr -
M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr -
M8.0 - Central of NMSZ - Clustered - Central - 1000yr - M8.0
Calculating hazard for nested source: CEUS Gridded - AB.2.N of CEUS Gridded -
AB.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr
- M8.0 - Central of NMSZ - Clustered - Central - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr -
M7.8 - Northern of NMSZ - Clustered - Central - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr
- M7.8 - Northern of NMSZ - Clustered - Central - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr -
M8.0 - Southern of NMSZ - Clustered - Central - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr
- M8.0 - Southern of NMSZ - Clustered - Central - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.5 - Central of NMSZ - Clustered - Central - 1500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.7 - Central of NMSZ - Clustered - Central - 1500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.5 - Central of NMSZ - Clustered - Central - 1500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.5 - Southern of NMSZ - Clustered - Central - 1500yr - M7.5
Calculating hazard for nested source: CEUS Gridded - AB.2.Y of CEUS Gridded -
AB.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.3 - Central of NMSZ - Clustered - Central - 1500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.7 - Central of NMSZ - Clustered - Central - 1500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.7 - Southern of NMSZ - Clustered - Central - 1500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.3 - Central of NMSZ - Clustered - Central - 1500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M7.3 - Southern of NMSZ - Clustered - Central - 1500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
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- M7.5 - Southern of NMSZ - Clustered - Central - 1500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.3 - Southern of NMSZ - Clustered - Central - 1500yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1000yr
- M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.7 - Southern of NMSZ - Clustered - Central - 1500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M8.0 - Central of NMSZ - Clustered - Central - 1500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M8.0 - Central of NMSZ - Clustered - Central - 1500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr -
M8.0 - Southern of NMSZ - Clustered - Central - 1500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.3
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.3
- Central of NMSZ - Clustered - Central - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.5
of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M8.0 - Southern of NMSZ - Clustered - Central - 1500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M7.5 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr -
M7.3 - Central of NMSZ - Clustered - Central - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.1
- Northern of NMSZ - Clustered - Central - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr -
M7.1 - Northern of NMSZ - Clustered - Central - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.7
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.7
- Central of NMSZ - Clustered - Central - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 1500yr
- M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.3
- Southern of NMSZ - Clustered - Central - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr -
M7.3 - Southern of NMSZ - Clustered - Central - 500yr - M7.3.
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Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.5 - Central of NMSZ - Clustered - Central - 500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.7 - Central of NMSZ - Clustered - Central - 500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.5 - Northern of NMSZ - Clustered - Central - 500yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M8.0 - Central of NMSZ - Clustered - Central - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.5 - Northern of NMSZ - Clustered - Central - 500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.7 - Southern of NMSZ - Clustered - Central - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M8.0 - Central of NMSZ - Clustered - Central - 500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.8 - Northern of NMSZ - Clustered - Central - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.8 - Northern of NMSZ - Clustered - Central - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M8.0 - Southern of NMSZ - Clustered - Central - 500yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.3 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.5 - Central of NMSZ - Clustered - Central - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.3 - Northern of NMSZ - Clustered - Central - 500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.3 - Central of NMSZ - Clustered - Central - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.3 - Northern of NMSZ - Clustered - Central - 500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.7 - Southern of NMSZ - Clustered - Central - 500yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.3 - Central of NMSZ - Clustered - Central - 750yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M8.0 - Southern of NMSZ - Clustered - Central - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.1 - Northern of NMSZ - Clustered - Central - 750yr - M7.3
Calculating hazard for nested source: NMSZ - Clustered - Central - 500yr - M7.5 - Southern of NMSZ - Clustered - Central - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr -

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M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.5
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.5
- Central of NMSZ - Clustered - Central - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.1 - Northern of NMSZ - Clustered - Central - 750yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.3
- Southern of NMSZ - Clustered - Central - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr -
M7.5 - Southern of NMSZ - Clustered - Central - 500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.5 - Central of NMSZ - Clustered - Central - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.3
- Northern of NMSZ - Clustered - Central - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr -
M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.3 - Southern of NMSZ - Clustered - Central - 750yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.7
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.7
- Central of NMSZ - Clustered - Central - 750yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Central - 500yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M8.0
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M8.0
- Central of NMSZ - Clustered - Central - 750yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.3 - Northern of NMSZ - Clustered - Central - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.5
- Southern of NMSZ - Clustered - Central - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.3 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.5 - Southern of NMSZ - Clustered - Central - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.3 - Central of NMSZ - Clustered - Eastern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.7 - Central of NMSZ - Clustered - Central - 750yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.5
- Northern of NMSZ - Clustered - Central - 750yr - M7.7
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Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.5 - Northern of NMSZ - Clustered - Central - 750yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.7
- Southern of NMSZ - Clustered - Central - 750yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.3 - Central of NMSZ - Clustered - Eastern - 1000yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.1 - North of NMSZ - Clustered - Eastern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.7 - Southern of NMSZ - Clustered - Central - 750yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.1 - North of NMSZ - Clustered - Eastern - 1000yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M8.0 - Central of NMSZ - Clustered - Central - 750yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M7.8
- Northern of NMSZ - Clustered - Central - 750yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.3 - Southern of NMSZ - Clustered - Eastern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.5 - Central of NMSZ - Clustered - Eastern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.5 - Central of NMSZ - Clustered - Eastern - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.3 - North of NMSZ - Clustered - Eastern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.3 - Southern of NMSZ - Clustered - Eastern - 1000yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.8 - Northern of NMSZ - Clustered - Central - 750yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.3 - North of NMSZ - Clustered - Eastern - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Central - 750yr - M8.0
- Southern of NMSZ - Clustered - Central - 750yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.7 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M8.0 - Southern of NMSZ - Clustered - Central - 750yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.5 - Southern of NMSZ - Clustered - Eastern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
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- M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.7 - Central of NMSZ - Clustered - Eastern - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.5 - Southern of NMSZ - Clustered - Eastern - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M8.0 - Central of NMSZ - Clustered - Eastern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M8.0 - Central of NMSZ - Clustered - Eastern - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.8 - North of NMSZ - Clustered - Eastern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.8 - North of NMSZ - Clustered - Eastern - 1000yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.7 - Central of NMSZ - Clustered - Eastern - 1000yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.5 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Central - 750yr -
M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.5 - North of NMSZ - Clustered - Eastern - 1000yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr -
M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr -
M7.3 - Central of NMSZ - Clustered - Eastern - 1500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.5 - North of NMSZ - Clustered - Eastern - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M7.7 - Southern of NMSZ - Clustered - Eastern - 1000yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr -
M8.0 - Southern of NMSZ - Clustered - Eastern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr
- M7.3 - Central of NMSZ - Clustered - Eastern - 1500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr -
M7.5 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr
- M7.7 - Southern of NMSZ - Clustered - Eastern - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr -
M7.3 - Southern of NMSZ - Clustered - Eastern - 1500yr - M7.3
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr -
M7.5 - Central of NMSZ - Clustered - Eastern - 1500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr
- M7.3 - Southern of NMSZ - Clustered - Eastern - 1500yr - M7.3.
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Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.5 - Central of NMSZ - Clustered - Eastern - 1500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr - M8.0 - Southern of NMSZ - Clustered - Eastern - 1000yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.3 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr - M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1000yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.5 - Southern of NMSZ - Clustered - Eastern - 1500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.7 - Central of NMSZ - Clustered - Eastern - 1500yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M8.0 - Central of NMSZ - Clustered - Eastern - 1500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.7 - Central of NMSZ - Clustered - Eastern - 1500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.3 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M8.0 - Central of NMSZ - Clustered - Eastern - 1500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M8.0 - Southern of NMSZ - Clustered - Eastern - 1500yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.7 - Southern of NMSZ - Clustered - Eastern - 1500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M8.0 - Southern of NMSZ - Clustered - Eastern - 1500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.5 - Southern of NMSZ - Clustered - Eastern - 1500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr - M7.7 - Southern of NMSZ - Clustered - Eastern - 1500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.3 - Central of NMSZ - Clustered - Eastern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.3 - Central of NMSZ - Clustered - Eastern - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.1 - North of NMSZ - Clustered - Eastern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.1 - North of NMSZ - Clustered - Eastern - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.3

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- Southern of NMSZ - Clustered - Eastern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr
- M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr
- M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.5
of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 1500yr
- M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.7
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.5
- Central of NMSZ - Clustered - Eastern - 500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.7
- Central of NMSZ - Clustered - Eastern - 500yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M8.0
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M8.0
- Central of NMSZ - Clustered - Eastern - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.5 - Central of NMSZ - Clustered - Eastern - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.3
- North of NMSZ - Clustered - Eastern - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M8.0 - Central of NMSZ - Clustered - Eastern - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.8
- North of NMSZ - Clustered - Eastern - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.3 - North of NMSZ - Clustered - Eastern - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.5
- Southern of NMSZ - Clustered - Eastern - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.8 - North of NMSZ - Clustered - Eastern - 500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.7 - Central of NMSZ - Clustered - Eastern - 500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M8.0
- Southern of NMSZ - Clustered - Eastern - 500yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.5
- North of NMSZ - Clustered - Eastern - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.5 - Southern of NMSZ - Clustered - Eastern - 500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.3 - Southern of NMSZ - Clustered - Eastern - 500yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M8.0 - Southern of NMSZ - Clustered - Eastern - 500yr - M8.0.
```

```
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.5 - North of NMSZ - Clustered - Eastern - 500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr - M7.7
- Southern of NMSZ - Clustered - Eastern - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.7 - Southern of NMSZ - Clustered - Eastern - 500yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.5 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.3
of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 500yr -
M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.3
- Central of NMSZ - Clustered - Eastern - 750yr - M7.3
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.5
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.7
of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.7
- Central of NMSZ - Clustered - Eastern - 750yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.5
- Central of NMSZ - Clustered - Eastern - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr -
M7.7 - Central of NMSZ - Clustered - Eastern - 750yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr -
M7.3 - Central of NMSZ - Clustered - Eastern - 750yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr -
M7.5 - Central of NMSZ - Clustered - Eastern - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.5
- North of NMSZ - Clustered - Eastern - 750yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.3
- North of NMSZ - Clustered - Eastern - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr -
M7.5 - North of NMSZ - Clustered - Eastern - 750yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr -
M7.3 - North of NMSZ - Clustered - Eastern - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.7
- Southern of NMSZ - Clustered - Eastern - 750yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.5
- Southern of NMSZ - Clustered - Eastern - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr -
```

**M7.7 - Southern of NMSZ - Clustered - Eastern - 750yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.5 - Southern of NMSZ - Clustered - Eastern - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.1 - North of NMSZ - Clustered - Eastern - 750yr - M7.3
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M8.0 - Central of NMSZ - Clustered - Eastern - 750yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 - Central of NMSZ - Clustered - Mideastern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 - Central of NMSZ - Clustered - Mideastern - 1000yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.1 - North of NMSZ - Clustered - Mideastern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M8.0 - Central of NMSZ - Clustered - Eastern - 750yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.8 - North of NMSZ - Clustered - Eastern - 750yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.8 - North of NMSZ - Clustered - Eastern - 750yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.1 - North of NMSZ - Clustered - Eastern - 750yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M8.0 - Southern of NMSZ - Clustered - Eastern - 750yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.3 - Southern of NMSZ - Clustered - Eastern - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.1 - North of NMSZ - Clustered - Mideastern - 1000yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M8.0 - Southern of NMSZ - Clustered - Eastern - 750yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.3 - Southern of NMSZ - Clustered - Eastern - 750yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.7 of New Madrid - Composite.**

**Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.5 - Central of NMSZ - Clustered - Mideastern - 1000yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.7 - Central of NMSZ - Clustered - Mideastern - 1000yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M8.0 - Central of NMSZ - Clustered - Mideastern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.5 - Central of NMSZ - Clustered - Mideastern - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 - North of NMSZ - Clustered - Mideastern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.7 - Central of NMSZ - Clustered - Mideastern - 1000yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.3 - North of NMSZ - Clustered - Mideastern - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.5 - North of NMSZ - Clustered - Mideastern - 1000yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.5 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.5 - North of NMSZ - Clustered - Mideastern - 1000yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Eastern - 750yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.7 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M8.0 - Central of NMSZ - Clustered - Mideastern - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M7.3 - Central of NMSZ - Clustered - Mideastern - 1500yr - M7.3
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.8 - North of NMSZ - Clustered - Mideastern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.5 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr - M7.8 - North of NMSZ - Clustered - Mideastern - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1000yr -**

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M8.0 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1000yr - M7.7 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1500yr - M7.3 - Central of NMSZ - Clustered - Mideastern - 1500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M7.3 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1000yr - M8.0 - Southern of NMSZ - Clustered - Mideastern - 1000yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1500yr - M7.3 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1000yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M7.5 - Central of NMSZ - Clustered - Mideastern - 1500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1500yr - M7.5 - Central of NMSZ - Clustered - Mideastern - 1500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1000yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M7.5 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M7.7 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1500yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M7.7 - Central of NMSZ - Clustered - Mideastern - 1500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1000yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M8.0 - Central of NMSZ - Clustered - Mideastern - 1500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1500yr - M7.7 - Central of NMSZ - Clustered - Mideastern - 1500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr -
M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr -
M7.3 - Central of NMSZ - Clustered - Mideastern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
1500yr - M7.5 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr -
M7.7 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M7.7
```

**Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M8.0 - Central of NMSZ - Clustered - Mideastern - 1500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M8.0 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M7.7 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.3 - Central of NMSZ - Clustered - Mideastern - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.1 - North of NMSZ - Clustered - Mideastern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.1 - North of NMSZ - Clustered - Mideastern - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.3 - Southern of NMSZ - Clustered - Mideastern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.3 - Southern of NMSZ - Clustered - Mideastern - 500yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M8.0 - Southern of NMSZ - Clustered - Mideastern - 1500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.5 - Central of NMSZ - Clustered - Mideastern - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.7 - Central of NMSZ - Clustered - Mideastern - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.7 - Central of NMSZ - Clustered - Mideastern - 500yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.5 - Central of NMSZ - Clustered - Mideastern - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.5 - North of NMSZ - Clustered - Mideastern - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M8.0 - Central of NMSZ - Clustered - Mideastern - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 1500yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -**

```
M7.3 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M7.5 - North of NMSZ - Clustered - Mideastern - 500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr -
M7.7 - Southern of NMSZ - Clustered - Mideastern - 500yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -
M7.3 - Central of NMSZ - Clustered - Mideastern - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M8.0 - Central of NMSZ - Clustered - Mideastern - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr -
M7.8 - North of NMSZ - Clustered - Mideastern - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M7.7 - Southern of NMSZ - Clustered - Mideastern - 500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr -
M7.3 - North of NMSZ - Clustered - Mideastern - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M7.3 - Central of NMSZ - Clustered - Mideastern - 750yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M7.8 - North of NMSZ - Clustered - Mideastern - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr -
M8.0 - Southern of NMSZ - Clustered - Mideastern - 500yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -
M7.1 - North of NMSZ - Clustered - Mideastern - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M7.1 - North of NMSZ - Clustered - Mideastern - 750yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -
M7.3 - Southern of NMSZ - Clustered - Mideastern - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M8.0 - Southern of NMSZ - Clustered - Mideastern - 500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M7.3 - North of NMSZ - Clustered - Mideastern - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr -
M7.5 - Southern of NMSZ - Clustered - Mideastern - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M7.7 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M7.3 - Southern of NMSZ - Clustered - Mideastern - 750yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M7.5 - Southern of NMSZ - Clustered - Mideastern - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -
M7.5 - Central of NMSZ - Clustered - Mideastern - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
500yr - M7.5 of New Madrid - Composite.
```

Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.7 - Central of NMSZ - Clustered - Mideastern - 750yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 500yr - M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.5 - Central of NMSZ - Clustered - Mideastern - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.3 - North of NMSZ - Clustered - Mideastern - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.7 - Central of NMSZ - Clustered - Mideastern - 750yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.5 - North of NMSZ - Clustered - Mideastern - 750yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.3 - North of NMSZ - Clustered - Mideastern - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.5 - Southern of NMSZ - Clustered - Mideastern - 750yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M8.0 - Central of NMSZ - Clustered - Mideastern - 750yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M7.3 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.5 - North of NMSZ - Clustered - Mideastern - 750yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.5 - Southern of NMSZ - Clustered - Mideastern - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M7.3 - Central of NMSZ - Clustered - Midwestern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M7.3 - Central of NMSZ - Clustered - Midwestern - 1000yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M7.1 - North of NMSZ - Clustered - Midwestern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M8.0 - Central of NMSZ - Clustered - Mideastern - 750yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M7.1 - North of NMSZ - Clustered - Midwestern - 1000yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.7 - Southern of NMSZ - Clustered - Mideastern - 750yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr - M7.7 - Southern of NMSZ - Clustered - Mideastern - 750yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -

```
M7.8 - North of NMSZ - Clustered - Mideastern - 750yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M7.8 - North of NMSZ - Clustered - Mideastern - 750yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Mideastern - 750yr -
M8.0 - Southern of NMSZ - Clustered - Mideastern - 750yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.3 -  Southern of NMSZ - Clustered - Midwestern - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.5 - Central of NMSZ - Clustered - Midwestern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.5 - Central of NMSZ - Clustered - Midwestern - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.3 - North of NMSZ - Clustered - Midwestern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M8.0 - Southern of NMSZ - Clustered - Mideastern - 750yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.3 - North of NMSZ - Clustered - Midwestern - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.5 -  Southern of NMSZ - Clustered - Midwestern - 1000yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.3 -  Southern of NMSZ - Clustered - Midwestern - 1000yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.7 - Central of NMSZ - Clustered - Midwestern - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.5 -  Southern of NMSZ - Clustered - Midwestern - 1000yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.7 - Central of NMSZ - Clustered - Midwestern - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.5 - North of NMSZ - Clustered - Midwestern - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.5 - North of NMSZ - Clustered - Midwestern - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M7.7 -  Southern of NMSZ - Clustered - Midwestern - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Mideastern -
750yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M8.0 of New Madrid - Composite.
```

```
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr -
M8.0 - Central of NMSZ - Clustered - Midwestern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.5 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.7 -  Southern of NMSZ - Clustered - Midwestern - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.3 - Central of NMSZ - Clustered - Midwestern - 1500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.5 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1500yr - M7.3 - Central of NMSZ - Clustered - Midwestern - 1500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.5 - Central of NMSZ - Clustered - Midwestern - 1500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.3 -  Southern of NMSZ - Clustered - Midwestern - 1500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1500yr - M7.3 -  Southern of NMSZ - Clustered - Midwestern - 1500yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M8.0 - Central of NMSZ - Clustered - Midwestern - 1000yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1000yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.7 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1500yr - M7.5 - Central of NMSZ - Clustered - Midwestern - 1500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.5 -  Southern of NMSZ - Clustered - Midwestern - 1500yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.7 - Central of NMSZ - Clustered - Midwestern - 1500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1500yr - M7.7 - Central of NMSZ - Clustered - Midwestern - 1500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M7.7 -  Southern of NMSZ - Clustered - Midwestern - 1500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1500yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
1500yr - M7.7 -  Southern of NMSZ - Clustered - Midwestern - 1500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr -
```

M8.0 - Central of NMSZ - Clustered - Midwestern - 1500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr - M7.5 - Southern of NMSZ - Clustered - Midwestern - 1500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M7.8 - North of NMSZ - Clustered - Midwestern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr - M8.0 - Central of NMSZ - Clustered - Midwestern - 1500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr - M8.0 - Southern of NMSZ - Clustered - Midwestern - 1500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M7.8 - North of NMSZ - Clustered - Midwestern - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M8.0 - Southern of NMSZ - Clustered - Midwestern - 1000yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr - M8.0 - Southern of NMSZ - Clustered - Midwestern - 1500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 - Central of NMSZ - Clustered - Midwestern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M8.0 - Southern of NMSZ - Clustered - Midwestern - 1000yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.5 - Central of NMSZ - Clustered - Midwestern - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 - Central of NMSZ - Clustered - Midwestern - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.1 - North of NMSZ - Clustered - Midwestern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.5 - Central of NMSZ - Clustered - Midwestern - 500yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.1 - North of NMSZ - Clustered - Midwestern - 500yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 - Southern of NMSZ - Clustered - Midwestern - 500yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1500yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 - North of NMSZ - Clustered - Midwestern - 500yr - M7.5

Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.7 - Central of NMSZ - Clustered - Midwestern - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 - Southern of NMSZ - Clustered - Midwestern - 500yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 1000yr - M8.0 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.7 - Central of NMSZ - Clustered - Midwestern - 500yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.5 - North of NMSZ - Clustered - Midwestern - 500yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 - North of NMSZ - Clustered - Midwestern - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.5 - Southern of NMSZ - Clustered - Midwestern - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.5 - Southern of NMSZ - Clustered - Midwestern - 500yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M8.0 - Central of NMSZ - Clustered - Midwestern - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M8.0 - Central of NMSZ - Clustered - Midwestern - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.8 - North of NMSZ - Clustered - Midwestern - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.5 - North of NMSZ - Clustered - Midwestern - 500yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.8 - North of NMSZ - Clustered - Midwestern - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.7 - Southern of NMSZ - Clustered - Midwestern - 500yr - M7.7
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M8.0 - Southern of NMSZ - Clustered - Midwestern - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.7 - Southern of NMSZ - Clustered - Midwestern - 500yr - M7.7.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M8.0 - Southern of NMSZ - Clustered - Midwestern - 500yr - M8.0.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 500yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr - M7.3 - Central of NMSZ - Clustered - Midwestern - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr - M7.3 - Central of NMSZ - Clustered - Midwestern - 750yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -

```
M7.1 - North of NMSZ - Clustered - Midwestern - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
500yr - M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M7.5 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M7.5 - Central of NMSZ - Clustered - Midwestern - 750yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
750yr - M7.5 - Central of NMSZ - Clustered - Midwestern - 750yr - M7.5.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
500yr - M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
500yr - M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M8.0 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
750yr - M7.1 - North of NMSZ - Clustered - Midwestern - 750yr - M7.3.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M7.3 -  Southern of NMSZ - Clustered - Midwestern - 750yr - M7.3
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M8.0 - Central of NMSZ - Clustered - Midwestern - 750yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M7.3 - North of NMSZ - Clustered - Midwestern - 750yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M7.7 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M7.7 - Central of NMSZ - Clustered - Midwestern - 750yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
750yr - M7.3 -  Southern of NMSZ - Clustered - Midwestern - 750yr - M7.3.
Done calculating hazard for nested source: NMSZ - Clustered - Midwestern -
750yr - M7.7 - Central of NMSZ - Clustered - Midwestern - 750yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Midwestern - 750yr -
M7.8 - North of NMSZ - Clustered - Midwestern - 750yr - M8.0
Calculating hazard for nested source: NMSZ - Clustered - Western - 1000yr -
M7.1 - North of NMSZ - Clustered - Western - 1000yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Western - 1000yr
- M7.5 - North of NMSZ - Clustered - Western - 1000yr - M7.7.
Calculating hazard for nested source: NMSZ - Clustered - Western - 1000yr -
M7.7 - Southern of NMSZ - Clustered - Western - 1000yr - M7.7
Done calculating hazard for nested source: NMSZ - Clustered - Western - 1000yr
- M7.5 - Southern of NMSZ - Clustered - Western - 1000yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Western - 1500yr -
M7.5 of New Madrid - Composite.
Done calculating hazard for nested source: NMSZ - Clustered - Western - 1500yr
- M8.0 - Southern of NMSZ - Clustered - Western - 1500yr - M8.0.
```

Calculating hazard for nested source: NMSZ - Clustered - Western - 500yr - M7.3 - North of NMSZ - Clustered - Western - 500yr - M7.5
Done calculating hazard for nested source: NMSZ - Clustered - Western - 500yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Western - 750yr - M7.3 of New Madrid - Composite.
Calculating hazard for nested source: NMSZ - Clustered - Western - 750yr - M7.3 - Central of NMSZ - Clustered - Western - 750yr - M7.3
Done calculating hazard for nested source: NMSZ - Clustered - Western - 500yr - M7.8 - North of NMSZ - Clustered - Western - 500yr - M8.0.
Calculating hazard for nested source: NMSZ - Clustered - Western - 500yr - M8.0 - Southern of NMSZ - Clustered - Western - 500yr - M8.0
Done calculating hazard for nested source: NMSZ - Clustered - Western - 750yr - M7.3 - North of NMSZ - Clustered - Western - 750yr - M7.5.
Calculating hazard for nested source: NMSZ - Clustered - Western - 750yr - M7.5 - Southern of NMSZ - Clustered - Western - 750yr - M7.5
Calculating hazard for nested source: NMSZ - Clustered - Western - 750yr - M7.7 - Southern of NMSZ - Clustered - Western - 750yr - M7.7
Done calculating hazard for nested source: CEUS Gridded - J.2.Y of CEUS Gridded - J.
Calculating hazard for nested source: CEUS Gridded - J.3.N of CEUS Gridded - J.
Done calculating hazard for nested source: CEUS Gridded - AB.1.N of CEUS Gridded - AB.
Calculating hazard for nested source: CEUS Gridded - AB.3.N of CEUS Gridded - AB.
Done calculating hazard for nested source: CEUS Gridded - J.1.Y of CEUS Gridded - J.
Calculating hazard for nested source: CEUS Gridded - J.3.Y of CEUS Gridded - J.
Done calculating hazard for nested source: CEUS Gridded - J.2.N of CEUS Gridded - J.
Calculating hazard for nested source: CEUS Gridded - J.4.N of CEUS Gridded - J.
Done calculating hazard for nested source: CEUS Gridded - J.3.N of CEUS Gridded - J.
Calculating hazard for nested source: CEUS Gridded - J.4.Y of CEUS Gridded - J.
Done calculating hazard for nested source: CEUS Gridded - J.1.N of CEUS Gridded - J.
Done calculating hazard for nested source: CEUS Gridded - AB.2.Y of CEUS Gridded - AB.
Calculating hazard for nested source: CEUS Gridded - AB.4.Y of CEUS Gridded - AB.
Done calculating hazard for nested source: CEUS Gridded - AB.3.Y of CEUS Gridded - AB.
Done calculating hazard for nested source: CEUS Gridded - AB.4.N of CEUS Gridded - AB.
Done calculating hazard for nested source: CEUS Gridded - J.4.Y of CEUS Gridded

```
- J.
Done calculating hazard for nested source: CEUS Gridded - J.4.N of CEUS Gridded
- J.
Done calculating hazard for: CEUS Gridded - J : USGS 2008 Central and Eastern
US.
Done calculating hazard for nested source: CEUS Gridded - AB.4.Y of CEUS
Gridded - AB.
Done calculating hazard for: CEUS Gridded - AB : USGS 2008 Central and Eastern
US.
End loop on sources:  16:53:53 Tuesday, August 02, 2011
Combining hazard from sources.
G:\KNA\EZ-FRISK_New\Northshore\Combined\Northshore (Combined) - Northshore -
Combined.ezf-shad calculated successfully
Writing hazard results
Writing TSV Export Report
Writing probabilistic spectra results
Writing source contribution results
Writing activity rate results
Writing deaggregation results
Finish: 16:53:57 Tuesday, August 02, 2011
Total number of ground motion evaluations: 420156
```

Probabilistic Hazard Results for EZ-FRISK 7.62 Build 000

SPECTRAL PERIOD: PGA
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	1.937e-001	1.947e-001	2.116e-001	1.750e-001
1.0e-003	2.240e-002	1.861e-002	2.707e-002	2.153e-002
0.010	1.733e-003	1.327e-003	2.132e-003	1.740e-003
0.020	6.611e-004	5.611e-004	7.883e-004	6.339e-004
0.050	1.642e-004	1.620e-004	1.898e-004	1.408e-004
0.070	9.734e-005	9.989e-005	1.094e-004	8.274e-005
0.100	5.605e-005	5.892e-005	6.116e-005	4.808e-005
0.200	1.910e-005	1.997e-005	2.058e-005	1.674e-005
0.300	9.924e-006	1.007e-005	1.103e-005	8.663e-006
0.400	6.085e-006	5.993e-006	7.004e-006	5.257e-006
0.500	4.082e-006	3.911e-006	4.844e-006	3.490e-006
0.700	2.145e-006	1.962e-006	2.667e-006	1.806e-006
1.000	1.014e-006	8.803e-007	1.315e-006	8.460e-007
2.000	1.815e-007	1.451e-007	2.401e-007	1.593e-007
3.000	5.383e-008	4.228e-008	6.670e-008	5.250e-008

SPECTRAL PERIOD: 0.05
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.013e-001	8.604e-002	2.361e-001	2.818e-001
1.0e-003	2.915e-002	1.317e-002	3.149e-002	4.279e-002
0.010	3.044e-003	2.041e-003	3.275e-003	3.815e-003
0.020	1.413e-003	1.021e-003	1.583e-003	1.634e-003
0.050	4.451e-004	3.522e-004	5.828e-004	4.005e-004
0.070	2.787e-004	2.291e-004	3.803e-004	2.265e-004
0.100	1.661e-004	1.421e-004	2.314e-004	1.246e-004
0.200	5.813e-005	5.283e-005	8.017e-005	4.139e-005
0.300	3.079e-005	2.837e-005	4.197e-005	2.202e-005
0.400	1.936e-005	1.781e-005	2.638e-005	1.390e-005
0.500	1.338e-005	1.221e-005	1.833e-005	9.595e-006

0.700	7.491e-006	6.679e-006	1.047e-005	5.328e-006
1.000	3.902e-006	3.345e-006	5.636e-006	2.725e-006
2.000	9.402e-007	7.234e-007	1.471e-006	6.268e-007
3.000	3.569e-007	2.578e-007	5.765e-007	2.365e-007

SPECTRAL PERIOD: 0.1
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.005e-001	6.631e-002	2.044e-001	3.306e-001
1.0e-003	3.331e-002	1.222e-002	3.045e-002	5.724e-002
0.010	3.753e-003	2.381e-003	3.644e-003	5.233e-003
0.020	1.819e-003	1.267e-003	1.846e-003	2.344e-003
0.050	5.862e-004	4.727e-004	6.559e-004	6.300e-004
0.070	3.631e-004	3.155e-004	4.141e-004	3.597e-004
0.100	2.124e-004	2.008e-004	2.408e-004	1.954e-004
0.200	7.154e-005	7.805e-005	7.450e-005	6.208e-005
0.300	3.741e-005	4.300e-005	3.647e-005	3.274e-005
0.400	2.345e-005	2.755e-005	2.202e-005	2.078e-005
0.500	1.620e-005	1.921e-005	1.491e-005	1.449e-005
0.700	9.096e-006	1.083e-005	8.231e-006	8.225e-006
1.000	4.743e-006	5.635e-006	4.256e-006	4.337e-006
2.000	1.126e-006	1.338e-006	9.641e-007	1.075e-006
3.000	4.226e-007	5.106e-007	3.299e-007	4.272e-007

SPECTRAL PERIOD: 0.2
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.296e-001	1.430e-001	2.292e-001	3.167e-001
1.0e-003	3.818e-002	2.382e-002	3.868e-002	5.204e-002
0.010	4.045e-003	3.336e-003	4.245e-003	4.554e-003
0.020	1.856e-003	1.672e-003	1.931e-003	1.965e-003
0.050	5.330e-004	5.550e-004	5.716e-004	4.725e-004
0.070	3.139e-004	3.505e-004	3.366e-004	2.547e-004
0.100	1.740e-004	2.092e-004	1.831e-004	1.298e-004
0.200	5.294e-005	7.086e-005	5.121e-005	3.676e-005

0.300	2.604e-005	3.591e-005	2.393e-005	1.829e-005
0.400	1.561e-005	2.167e-005	1.402e-005	1.115e-005
0.500	1.042e-005	1.443e-005	9.284e-006	7.535e-006
0.700	5.541e-006	7.599e-006	4.949e-006	4.074e-006
1.000	2.724e-006	3.681e-006	2.454e-006	2.036e-006
2.000	5.703e-007	7.617e-007	4.969e-007	4.523e-007
3.000	1.968e-007	2.672e-007	1.557e-007	1.674e-007

SPECTRAL PERIOD: 0.3
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.304e-001	1.673e-001	2.588e-001	2.652e-001
1.0e-003	3.670e-002	2.609e-002	4.387e-002	4.015e-002
0.010	3.392e-003	2.697e-003	4.036e-003	3.441e-003
0.020	1.402e-003	1.215e-003	1.582e-003	1.410e-003
0.050	3.500e-004	3.636e-004	3.873e-004	2.991e-004
0.070	1.976e-004	2.225e-004	2.158e-004	1.546e-004
0.100	1.054e-004	1.284e-004	1.118e-004	7.608e-005
0.200	3.012e-005	4.077e-005	2.909e-005	2.050e-005
0.300	1.431e-005	1.988e-005	1.316e-005	9.879e-006
0.400	8.367e-006	1.169e-005	7.548e-006	5.867e-006
0.500	5.475e-006	7.638e-006	4.910e-006	3.879e-006
0.700	2.827e-006	3.921e-006	2.533e-006	2.028e-006
1.000	1.345e-006	1.858e-006	1.197e-006	9.781e-007
2.000	2.616e-007	3.716e-007	2.110e-007	2.024e-007
3.000	8.586e-008	1.272e-007	5.897e-008	7.140e-008

SPECTRAL PERIOD: 0.4
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.303e-001	1.927e-001	2.658e-001	2.325e-001
1.0e-003	3.609e-002	2.938e-002	4.401e-002	3.486e-002
0.010	2.981e-003	2.466e-003	3.466e-003	3.011e-003
0.020	1.131e-003	1.021e-003	1.171e-003	1.202e-003
0.050	2.570e-004	2.853e-004	2.487e-004	2.371e-004

0.070	1.414e-004	1.709e-004	1.347e-004	1.185e-004
0.100	7.349e-005	9.640e-005	6.784e-005	5.623e-005
0.200	1.998e-005	2.915e-005	1.658e-005	1.421e-005
0.300	9.232e-006	1.382e-005	7.229e-006	6.652e-006
0.400	5.303e-006	7.975e-006	4.051e-006	3.882e-006
0.500	3.424e-006	5.145e-006	2.590e-006	2.536e-006
0.700	1.734e-006	2.597e-006	1.300e-006	1.305e-006
1.000	8.084e-007	1.212e-006	5.927e-007	6.203e-007
2.000	1.506e-007	2.342e-007	9.285e-008	1.249e-007
3.000	4.799e-008	7.767e-008	2.311e-008	4.319e-008

SPECTRAL PERIOD: 0.5

Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.317e-001	2.149e-001	2.711e-001	2.090e-001
1.0e-003	3.631e-002	3.306e-002	4.446e-002	3.140e-002
0.010	2.767e-003	2.422e-003	3.158e-003	2.722e-003
0.020	9.823e-004	9.246e-004	9.592e-004	1.063e-003
0.050	2.069e-004	2.419e-004	1.808e-004	1.981e-004
0.070	1.114e-004	1.423e-004	9.530e-005	9.654e-005
0.100	5.661e-005	7.869e-005	4.658e-005	4.455e-005
0.200	1.477e-005	2.286e-005	1.070e-005	1.075e-005
0.300	6.696e-006	1.060e-005	4.552e-006	4.937e-006
0.400	3.805e-006	6.034e-006	2.529e-006	2.851e-006
0.500	2.439e-006	3.857e-006	1.609e-006	1.850e-006
0.700	1.222e-006	1.923e-006	7.990e-007	9.433e-007
1.000	5.619e-007	8.860e-007	3.554e-007	4.443e-007
2.000	1.008e-007	1.654e-007	4.953e-008	8.748e-008
3.000	3.123e-008	5.310e-008	1.090e-008	2.970e-008

SPECTRAL PERIOD: 0.75

Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.288e-001	2.529e-001	2.778e-001	1.557e-001
1.0e-003	3.677e-002	4.077e-002	4.523e-002	2.433e-002

0.010	2.597e-003	2.663e-003	2.953e-003	2.174e-003
0.020	8.401e-004	8.855e-004	8.192e-004	8.154e-004
0.050	1.466e-004	1.904e-004	1.127e-004	1.369e-004
0.070	7.512e-005	1.067e-004	5.536e-005	6.334e-005
0.100	3.653e-005	5.657e-005	2.554e-005	2.750e-005
0.200	8.871e-006	1.530e-005	5.375e-006	5.934e-006
0.300	3.878e-006	6.815e-006	2.216e-006	2.602e-006
0.400	2.147e-006	3.769e-006	1.205e-006	1.465e-006
0.500	1.346e-006	2.354e-006	7.502e-007	9.339e-007
0.700	6.496e-007	1.131e-006	3.547e-007	4.633e-007
1.000	2.854e-007	4.992e-007	1.460e-007	2.110e-007
2.000	4.646e-008	8.502e-008	1.623e-008	3.814e-008
3.000	1.369e-008	2.586e-008	3.018e-009	1.218e-008

SPECTRAL PERIOD: 1
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	2.243e-001	2.817e-001	2.639e-001	1.272e-001
1.0e-003	3.687e-002	4.855e-002	4.145e-002	2.062e-002
0.010	2.542e-003	3.143e-003	2.611e-003	1.873e-003
0.020	7.963e-004	1.012e-003	6.951e-004	6.821e-004
0.050	1.201e-004	1.796e-004	7.357e-005	1.071e-004
0.070	5.836e-005	9.382e-005	3.322e-005	4.803e-005
0.100	2.716e-005	4.697e-005	1.442e-005	2.009e-005
0.200	6.223e-006	1.177e-005	2.869e-006	4.031e-006
0.300	2.646e-006	5.059e-006	1.169e-006	1.709e-006
0.400	1.433e-006	2.729e-006	6.252e-007	9.429e-007
0.500	8.809e-007	1.672e-006	3.794e-007	5.916e-007
0.700	4.113e-007	7.794e-007	1.683e-007	2.862e-007
1.000	1.740e-007	3.329e-007	6.274e-008	1.264e-007
2.000	2.660e-008	5.317e-008	5.319e-009	2.133e-008
3.000	7.649e-009	1.562e-008	8.157e-010	6.514e-009

SPECTRAL PERIOD: 2
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	1.604e-001	2.093e-001	1.927e-001	7.921e-002
1.0e-003	2.503e-002	3.418e-002	2.639e-002	1.452e-002
0.010	1.742e-003	2.077e-003	1.611e-003	1.540e-003
0.020	5.271e-004	5.918e-004	3.957e-004	5.939e-004
0.050	6.590e-005	6.634e-005	2.483e-005	1.065e-004
0.070	2.844e-005	2.772e-005	8.240e-006	4.937e-005
0.100	1.147e-005	1.122e-005	2.810e-006	2.038e-005
0.200	1.947e-006	2.156e-006	4.786e-007	3.206e-006
0.300	7.003e-007	8.455e-007	1.793e-007	1.076e-006
0.400	3.410e-007	4.298e-007	8.543e-008	5.077e-007
0.500	1.947e-007	2.502e-007	4.588e-008	2.881e-007
0.700	8.245e-008	1.063e-007	1.623e-008	1.249e-007
1.000	3.205e-008	3.998e-008	4.593e-009	5.158e-008
2.000	4.411e-009	4.547e-009	2.246e-010	8.460e-009
3.000	1.243e-009	1.039e-009	2.604e-011	2.664e-009

SPECTRAL PERIOD: 3
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	1.241e-001	1.661e-001	1.515e-001	5.475e-002
1.0e-003	1.765e-002	2.367e-002	1.904e-002	1.023e-002
0.010	1.084e-003	1.129e-003	9.780e-004	1.146e-003
0.020	2.975e-004	2.644e-004	1.844e-004	4.436e-004
0.050	3.897e-005	2.594e-005	7.605e-006	8.335e-005
0.070	1.769e-005	1.107e-005	2.266e-006	3.974e-005
0.100	7.429e-006	4.667e-006	7.466e-007	1.687e-005
0.200	1.239e-006	9.350e-007	1.233e-007	2.660e-006
0.300	4.112e-007	3.595e-007	4.077e-008	8.332e-007
0.400	1.846e-007	1.768e-007	1.686e-008	3.602e-007
0.500	9.840e-008	9.931e-008	7.914e-009	1.880e-007
0.700	3.763e-008	3.936e-008	2.212e-009	7.131e-008
1.000	1.333e-008	1.351e-008	4.707e-010	2.602e-008
2.000	1.652e-009	1.226e-009	1.227e-011	3.719e-009
3.000	4.616e-010	2.398e-010	9.520e-013	1.144e-009

SPECTRAL PERIOD: 4
Column 1: Acceleration (g)
Column 2: Mean
Column 3: Toro (1999) Midcontinent - USGS 2008 MbLg MRC

Column 4: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
1.0e-004	9.967e-002	1.392e-001	1.170e-001	4.282e-002
1.0e-003	1.330e-002	1.794e-002	1.380e-002	8.152e-003
0.010	7.314e-004	6.892e-004	5.576e-004	9.474e-004
0.020	1.965e-004	1.416e-004	7.868e-005	3.693e-004
0.050	2.939e-005	1.349e-005	2.374e-006	7.229e-005
0.070	1.398e-005	5.918e-006	7.122e-007	3.532e-005
0.100	6.084e-006	2.559e-006	2.476e-007	1.545e-005
0.200	1.037e-006	5.126e-007	3.765e-008	2.559e-006
0.300	3.363e-007	1.911e-007	1.054e-008	8.072e-007
0.400	1.460e-007	9.079e-008	3.752e-009	3.435e-007
0.500	7.512e-008	4.932e-008	1.546e-009	1.745e-007
0.700	2.691e-008	1.840e-008	3.485e-010	6.198e-008
1.000	8.842e-009	5.853e-009	5.794e-011	2.061e-008
2.000	9.756e-010	4.452e-010	8.969e-013	2.481e-009
3.000	2.655e-010	7.743e-011	5.043e-014	7.190e-010

Probabilistic Spectra results for EZ-FRISK 7.62 Build 000

ANNUAL FREQUENCY OF EXCEEDANCE: 4.041e-004
RETURN PERIOD: 2474.9
PROBABILITY OF EXCEEDENCE: 2.0% IN 50.0 YEARS
Column 1: Spectral Period
Column 2: Acceleration (g) for: Mean
Column 3: Acceleration (g) for: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Acceleration (g) for: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Acceleration (g) for: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
PGA	2.765e-002	2.548e-002	3.075e-002	2.631e-002
0.05	5.360e-002	4.442e-002	6.674e-002	4.971e-002
0.1	6.494e-002	5.698e-002	7.114e-002	6.528e-002
0.2	5.963e-002	6.308e-002	6.233e-002	5.445e-002
0.3	4.548e-002	4.615e-002	4.864e-002	4.186e-002
0.4	3.780e-002	3.893e-002	3.753e-002	3.700e-002
0.5	3.373e-002	3.522e-002	3.215e-002	3.390e-002
0.75	2.937e-002	3.193e-002	2.772e-002	2.868e-002
1	2.778e-002	3.253e-002	2.495e-002	2.592e-002
2	2.249e-002	2.347e-002	1.980e-002	2.456e-002
3	1.697e-002	1.633e-002	1.444e-002	2.105e-002
4	1.367e-002	1.263e-002	1.121e-002	1.872e-002

ANNUAL FREQUENCY OF EXCEEDANCE: 1.026e-003
RETURN PERIOD: 974.8
PROBABILITY OF EXCEEDENCE: 5.0% IN 50.0 YEARS
Column 1: Spectral Period
Column 2: Acceleration (g) for: Mean
Column 3: Acceleration (g) for: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Acceleration (g) for: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Acceleration (g) for: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
PGA	1.458e-002	1.230e-002	1.665e-002	1.437e-002
0.05	2.578e-002	1.990e-002	2.977e-002	2.708e-002
0.1	3.179e-002	2.434e-002	3.365e-002	3.559e-002
0.2	3.091e-002	3.001e-002	3.219e-002	3.037e-002
0.3	2.458e-002	2.274e-002	2.652e-002	2.414e-002
0.4	2.125e-002	1.992e-002	2.163e-002	2.187e-002
0.5	1.943e-002	1.856e-002	1.923e-002	2.039e-002
0.75	1.769e-002	1.823e-002	1.771e-002	1.700e-002
1	1.719e-002	1.983e-002	1.631e-002	1.512e-002

2	1.360e-002	1.476e-002	1.250e-002	1.344e-002
3	1.030e-002	1.047e-002	9.636e-003	1.084e-002
4	7.644e-003	7.550e-003	6.457e-003	9.183e-003

ANNUAL FREQUENCY OF EXCEEDANCE: 2.107e-003
RETURN PERIOD: 474.6
PROBABILITY OF EXCEEDENCE: 10.0% IN 50.0 YEARS
Column 1: Spectral Period
Column 2: Acceleration (g) for: Mean
Column 3: Acceleration (g) for: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Column 4: Acceleration (g) for: Campbell (2003) USGS 2008 MbLg - AB MRC
Column 5: Acceleration (g) for: Silva et al (2002) USGS 2008 MbLg - AB MRC

1	2	3	4	5
PGA	8.388e-003	6.683e-003	1.008e-002	8.394e-003
0.05	1.394e-002	9.616e-003	1.523e-002	1.624e-002
0.1	1.737e-002	1.144e-002	1.747e-002	2.154e-002
0.2	1.786e-002	1.585e-002	1.852e-002	1.888e-002
0.3	1.453e-002	1.239e-002	1.618e-002	1.464e-002
0.4	1.282e-002	1.132e-002	1.374e-002	1.309e-002
0.5	1.200e-002	1.105e-002	1.265e-002	1.208e-002
0.75	1.137e-002	1.159e-002	1.200e-002	1.022e-002
1	1.119e-002	1.277e-002	1.119e-002	8.933e-003
2	8.485e-003	9.881e-003	8.015e-003	7.248e-003
3	5.778e-003	6.235e-003	5.514e-003	5.269e-003
4	4.317e-003	4.541e-003	3.852e-003	4.252e-003

```
Source Contribution results for EZ-FRISK 7.62 Build 000

Source: CEUS Gridded - AB
Region: USGS 2008 Central and Eastern US
  Equation: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  9.732e-002  8.887e-003  6.808e-004  2.907e-004  8.481e-005  5.249e-
005  3.109e-005  1.064e-005  5.409e-006  3.242e-006  2.132e-006  1.085e-006
4.965e-007  8.644e-008  2.621e-008
      0.05  4.268e-002  6.484e-003  1.043e-003  5.237e-004  1.824e-004  1.191e-
004  7.424e-005  2.786e-005  1.506e-005  9.510e-006  6.551e-006  3.618e-006
1.837e-006  4.132e-007  1.522e-007
       0.1  3.271e-002  6.121e-003  1.213e-003  6.482e-004  2.438e-004  1.634e-
004  1.044e-004  4.097e-005  2.272e-005  1.463e-005  1.025e-005  5.828e-006
3.067e-006  7.530e-007  2.959e-007
       0.2  7.132e-002  1.152e-002  1.703e-003  8.573e-004  2.878e-004  1.828e-
004  1.098e-004  3.773e-005  1.929e-005  1.172e-005  7.852e-006  4.177e-006
2.052e-006  4.423e-007  1.604e-007
       0.3  8.360e-002  1.257e-002  1.380e-003  6.313e-004  1.926e-004  1.189e-
004  6.938e-005  2.249e-005  1.110e-005  6.591e-006  4.343e-006  2.261e-006
1.092e-006  2.291e-007  8.127e-008
       0.4  9.637e-002  1.426e-002  1.244e-003  5.342e-004  1.536e-004  9.305e-
005  5.316e-005  1.647e-005  7.918e-006  4.619e-006  3.006e-006  1.541e-006
7.334e-007  1.488e-007  5.108e-008
       0.5  1.075e-001  1.617e-002  1.186e-003  4.828e-004  1.321e-004  7.872e-
005  4.416e-005  1.317e-005  6.198e-006  3.567e-006  2.300e-006  1.165e-006
5.473e-007  1.072e-007  3.560e-008
      0.75  1.265e-001  2.017e-002  1.176e-003  4.303e-004  1.049e-004  6.036e-
005  3.270e-005  9.129e-006  4.130e-006  2.309e-006  1.455e-006  7.104e-007
3.201e-007  5.733e-008  1.805e-008
         1  1.409e-001  2.417e-002  1.299e-003  4.350e-004  9.420e-005  5.225e-
005  2.734e-005  7.192e-006  3.146e-006  1.717e-006  1.061e-006  5.027e-007
2.192e-007  3.684e-008  1.120e-008
         2  1.047e-001  1.704e-002  7.204e-004  1.888e-004  2.803e-005  1.371e-
005  6.385e-006  1.412e-006  5.714e-007  2.954e-007  1.742e-007  7.571e-008
2.927e-008  3.526e-009  8.320e-010
         3  8.312e-002  1.170e-002  3.642e-004  8.977e-005  1.298e-005  6.311e-
006  2.916e-006  6.302e-007  2.482e-007  1.243e-007  7.089e-008  2.883e-008
1.019e-008  9.788e-010  1.973e-010
         4  6.967e-002  8.760e-003  2.192e-004  5.246e-005  7.489e-006  3.622e-
006  1.662e-006  3.508e-007  1.340e-007  6.497e-008  3.590e-008  1.377e-008
4.510e-009  3.625e-010  6.486e-011
  Equation: Campbell (2003) USGS 2008 MbLg - AB MRC
```

```
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  1.059e-001  1.330e-002  9.695e-004  3.978e-004  1.003e-004  5.826e-
005  3.273e-005  1.097e-005  5.854e-006  3.713e-006  2.572e-006  1.426e-006
7.120e-007  1.349e-007  3.850e-008
      0.05  1.181e-001  1.556e-002  1.525e-003  7.958e-004  2.998e-004  1.964e-
004  1.201e-004  4.213e-005  2.217e-005  1.395e-005  9.695e-006  5.537e-006
2.989e-006  7.935e-007  3.167e-007
       0.1  1.023e-001  1.489e-002  1.786e-003  9.401e-004  3.380e-004  2.144e-
004  1.255e-004  3.949e-005  1.946e-005  1.177e-005  7.962e-006  4.388e-006
2.272e-006  5.244e-007  1.832e-007
       0.2  1.147e-001  1.903e-002  2.055e-003  9.856e-004  2.986e-004  1.775e-
004  9.770e-005  2.796e-005  1.314e-005  7.688e-006  5.077e-006  2.699e-006
1.343e-006  2.804e-007  9.057e-008
       0.3  1.295e-001  2.170e-002  1.888e-003  8.028e-004  2.063e-004  1.166e-
004  6.142e-005  1.637e-005  7.412e-006  4.233e-006  2.745e-006  1.417e-006
6.771e-007  1.252e-007  3.646e-008
       0.4  1.330e-001  2.184e-002  1.537e-003  5.851e-004  1.361e-004  7.513e-
005  3.860e-005  9.642e-006  4.187e-006  2.335e-006  1.491e-006  7.540e-007
3.507e-007  5.841e-008  1.515e-008
       0.5  1.356e-001  2.212e-002  1.323e-003  4.649e-004  1.012e-004  5.469e-
005  2.731e-005  6.380e-006  2.695e-006  1.491e-006  9.505e-007  4.782e-007
2.181e-007  3.243e-008  7.419e-009
      0.75  1.390e-001  2.258e-002  1.093e-003  3.363e-004  6.415e-005  3.319e-
005  1.577e-005  3.354e-006  1.369e-006  7.443e-007  4.665e-007  2.252e-007
9.564e-008  1.140e-008  2.203e-009
         1  1.320e-001  2.071e-002  8.886e-004  2.474e-004  4.136e-005  2.041e-
005  9.229e-006  1.842e-006  7.456e-007  4.008e-007  2.461e-007  1.121e-007
4.326e-008  3.923e-009  6.223e-010
         2  9.641e-002  1.316e-002  4.291e-004  9.233e-005  1.005e-005  4.335e-
006  1.776e-006  3.335e-007  1.277e-007  6.224e-008  3.413e-008  1.249e-008
3.663e-009  1.903e-010  2.270e-011
         3  7.581e-002  9.445e-003  2.080e-004  3.549e-005  2.893e-006  1.183e-
006  4.805e-007  8.986e-008  3.090e-008  1.315e-008  6.309e-009  1.819e-009
3.988e-010  1.088e-011  8.622e-013
         4  5.856e-002  6.756e-003  9.678e-005  1.359e-005  9.680e-007  4.043e-
007  1.692e-007  2.885e-008  8.420e-009  3.078e-009  1.293e-009  2.993e-010
5.097e-011  8.182e-013  4.674e-014
  Equation: Silva et al (2002) USGS 2008 MbLg - AB MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  8.755e-002  1.061e-002  5.773e-004  2.172e-004  6.330e-005  4.035e-
005  2.475e-005  8.990e-006  4.701e-006  2.872e-006  1.918e-006  1.004e-006
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4.774e-007  9.369e-008  3.187e-008
      0.05  1.410e-001  2.138e-002  1.458e-003  5.401e-004  1.456e-004  9.161e-
005  5.628e-005  2.139e-005  1.174e-005  7.501e-006  5.214e-006  2.922e-006
1.510e-006  3.581e-007  1.385e-007
       0.1  1.654e-001  2.864e-002  2.153e-003  8.119e-004  2.134e-004  1.325e-
004  8.071e-005  3.079e-005  1.713e-005  1.110e-005  7.817e-006  4.486e-006
2.390e-006  6.083e-007  2.470e-007
       0.2  1.584e-001  2.604e-002  1.812e-003  6.381e-004  1.500e-004  8.942e-
005  5.227e-005  1.841e-005  9.753e-006  6.090e-006  4.165e-006  2.285e-006
1.159e-006  2.669e-007  1.016e-007
       0.3  1.327e-001  2.007e-002  1.271e-003  4.249e-004  9.458e-005  5.540e-
005  3.171e-005  1.060e-005  5.421e-006  3.296e-006  2.209e-006  1.175e-006
5.772e-007  1.247e-007  4.532e-008
       0.4  1.163e-001  1.741e-002  1.065e-003  3.436e-004  7.223e-005  4.143e-
005  2.321e-005  7.462e-006  3.734e-006  2.240e-006  1.487e-006  7.807e-007
3.791e-007  7.994e-008  2.850e-008
       0.5  1.046e-001  1.567e-002  9.305e-004  2.918e-004  5.869e-005  3.314e-
005  1.828e-005  5.720e-006  2.825e-006  1.681e-006  1.110e-006  5.787e-007
2.788e-007  5.757e-008  2.014e-008
      0.75  7.792e-002  1.211e-002  6.820e-004  2.024e-004  3.700e-005  2.019e-
005  1.078e-005  3.212e-006  1.550e-006  9.076e-007  5.910e-007  3.008e-007
1.404e-007  2.665e-008  8.772e-009
         1  6.369e-002  1.023e-002  5.530e-004  1.583e-004  2.726e-005  1.456e-
005  7.623e-006  2.202e-006  1.044e-006  6.026e-007  3.874e-007  1.928e-007
8.738e-008  1.549e-008  4.872e-009
         2  3.967e-002  7.100e-003  4.232e-004  1.238e-004  1.940e-005  9.558e-
006  4.540e-006  1.110e-006  4.915e-007  2.733e-007  1.716e-007  8.298e-008
3.686e-008  6.520e-009  2.112e-009
         3  2.743e-002  4.855e-003  2.785e-004  8.168e-005  1.257e-005  6.028e-
006  2.737e-006  5.949e-007  2.464e-007  1.316e-007  8.046e-008  3.768e-008
1.633e-008  2.824e-009  9.173e-010
         4  2.145e-002  3.758e-003  2.126e-004  6.294e-005  9.734e-006  4.624e-
006  2.056e-006  4.157e-007  1.635e-007  8.441e-008  5.042e-008  2.295e-008
9.741e-009  1.657e-009  5.404e-010
  Weighted Average
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  9.692e-002  1.093e-002  7.425e-004  3.019e-004  8.282e-005  5.037e-
005  2.952e-005  1.020e-005  5.321e-006  3.276e-006  2.207e-006  1.171e-006
5.620e-007  1.050e-007  3.219e-008
      0.05  1.006e-001  1.447e-002  1.342e-003  6.199e-004  2.093e-004  1.357e-
004  8.355e-005  3.046e-005  1.632e-005  1.032e-005  7.153e-006  4.026e-006
2.112e-006  5.216e-007  2.025e-007
       0.1  1.001e-001  1.655e-002  1.718e-003  8.001e-004  2.651e-004  1.701e-
```

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004  1.036e-004  3.708e-005  1.977e-005  1.250e-005  8.677e-006  4.901e-006
2.576e-006  6.286e-007  2.420e-007
       0.2  1.148e-001  1.887e-002  1.857e-003  8.270e-004  2.455e-004  1.499e-
004  8.660e-005  2.803e-005  1.406e-005  8.499e-006  5.698e-006  3.054e-006
1.518e-006  3.299e-007  1.175e-007
       0.3  1.153e-001  1.811e-002  1.513e-003  6.197e-004  1.645e-004  9.698e-
005  5.417e-005  1.649e-005  7.979e-006  4.707e-006  3.099e-006  1.618e-006
7.819e-007  1.597e-007  5.435e-008
       0.4  1.152e-001  1.784e-002  1.282e-003  4.876e-004  1.206e-004  6.987e-
005  3.832e-005  1.119e-005  5.280e-006  3.064e-006  1.995e-006  1.025e-006
4.877e-007  9.572e-008  3.158e-008
       0.5  1.159e-001  1.799e-002  1.146e-003  4.132e-004  9.733e-005  5.552e-
005  2.992e-005  8.425e-006  3.906e-006  2.246e-006  1.454e-006  7.405e-007
3.481e-007  6.574e-008  2.105e-008
      0.75  1.145e-001  1.829e-002  9.838e-004  3.230e-004  6.869e-005  3.791e-
005  1.975e-005  5.231e-006  2.350e-006  1.320e-006  8.376e-007  4.121e-007
1.854e-007  3.179e-008  9.674e-009
         1  1.122e-001  1.837e-002  9.136e-004  2.803e-004  5.427e-005  2.907e-
005  1.473e-005  3.745e-006  1.645e-006  9.067e-007  5.649e-007  2.692e-007
1.166e-007  1.875e-008  5.565e-009
         2  8.027e-002  1.243e-002  5.242e-004  1.350e-004  1.916e-005  9.201e-
006  4.234e-006  9.517e-007  3.969e-007  2.103e-007  1.267e-007  5.706e-008
2.327e-008  3.412e-009  9.888e-010
         3  6.212e-002  8.666e-003  2.836e-004  6.898e-005  9.482e-006  4.507e-
006  2.044e-006  4.383e-007  1.751e-007  8.967e-008  5.255e-008  2.278e-008
8.973e-009  1.271e-009  3.718e-010
         4  4.989e-002  6.425e-003  1.762e-004  4.300e-005  6.063e-006  2.883e-
006  1.296e-006  2.651e-007  1.020e-007  5.082e-008  2.920e-008  1.234e-008
4.768e-009  6.735e-010  2.018e-010


Source: CEUS Gridded - J
Region: USGS 2008 Central and Eastern US
  Equation: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  9.543e-002  8.326e-003  6.392e-004  2.701e-004  7.720e-005  4.740e-
005  2.783e-005  9.332e-006  4.665e-006  2.751e-006  1.780e-006  8.775e-007
3.839e-007  5.864e-008  1.606e-008
      0.05  4.147e-002  6.209e-003  9.987e-004  4.970e-004  1.698e-004  1.100e-
004  6.790e-005  2.497e-005  1.331e-005  8.304e-006  5.657e-006  3.061e-006
1.508e-006  3.101e-007  1.056e-007
       0.1  3.176e-002  5.894e-003  1.168e-003  6.191e-004  2.289e-004  1.522e-
004  9.641e-005  3.708e-005  2.029e-005  1.292e-005  8.961e-006  5.004e-006
```

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2.568e-006  5.848e-007  2.148e-007
       0.2  6.977e-002  1.103e-002  1.629e-003  8.141e-004  2.672e-004  1.677e-
004  9.934e-005  3.313e-005  1.662e-005  9.950e-006  6.581e-006  3.422e-006
1.629e-006  3.195e-007  1.068e-007
       0.3  8.177e-002  1.186e-002  1.285e-003  5.813e-004  1.710e-004  1.036e-
004  5.907e-005  1.828e-005  8.774e-006  5.096e-006  3.295e-006  1.660e-006
7.667e-007  1.425e-007  4.593e-008
       0.4  9.442e-002  1.333e-002  1.129e-003  4.782e-004  1.316e-004  7.782e-
005  4.325e-005  1.268e-005  5.898e-006  3.356e-006  2.139e-006  1.056e-006
4.788e-007  8.539e-008  2.658e-008
       0.5  1.055e-001  1.504e-002  1.048e-003  4.200e-004  1.094e-004  6.349e-
005  3.453e-005  9.688e-006  4.401e-006  2.467e-006  1.556e-006  7.581e-007
3.387e-007  5.813e-008  1.750e-008
      0.75  1.245e-001  1.871e-002  9.793e-004  3.504e-004  8.113e-005  4.533e-
005  2.371e-005  6.172e-006  2.686e-006  1.460e-006  8.983e-007  4.204e-007
1.792e-007  2.769e-008  7.817e-009
         1  1.389e-001  2.249e-002  1.028e-003  3.324e-004  6.825e-005  3.678e-
005  1.858e-005  4.547e-006  1.910e-006  1.012e-006  6.104e-007  2.767e-007
1.137e-007  1.633e-008  4.419e-009
         2  1.027e-001  1.525e-002  4.627e-004  1.110e-004  1.525e-005  7.275e-
006  3.299e-006  6.923e-007  2.690e-007  1.336e-007  7.572e-008  3.053e-008
1.070e-008  1.021e-009  2.066e-010
         3  8.108e-002  1.010e-002  2.224e-004  5.101e-005  6.874e-006  3.259e-
006  1.467e-006  2.982e-007  1.108e-007  5.247e-008  2.840e-008  1.053e-008
3.318e-009  2.471e-010  4.244e-011
         4  6.763e-002  7.333e-003  1.299e-004  2.921e-005  3.890e-006  1.835e-
006  8.200e-007  1.604e-007  5.696e-008  2.581e-008  1.342e-008  4.635e-009
1.342e-009  8.273e-011  1.257e-011
  Equation: Campbell (2003) USGS 2008 MbLg - AB MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  1.038e-001  1.188e-002  8.829e-004  3.647e-004  8.923e-005  5.109e-
005  2.843e-005  9.611e-006  5.180e-006  3.291e-006  2.272e-006  1.241e-006
6.034e-007  1.052e-007  2.820e-008
      0.05  1.161e-001  1.404e-002  1.424e-003  7.547e-004  2.826e-004  1.839e-
004  1.113e-004  3.804e-005  1.980e-005  1.243e-005  8.632e-006  4.929e-006
2.647e-006  6.771e-007  2.597e-007
       0.1  1.003e-001  1.368e-002  1.686e-003  8.938e-004  3.178e-004  1.997e-
004  1.153e-004  3.501e-005  1.701e-005  1.026e-005  6.952e-006  3.844e-006
1.984e-006  4.397e-007  1.467e-007
       0.2  1.126e-001  1.776e-002  1.911e-003  9.205e-004  2.728e-004  1.591e-
004  8.544e-005  2.325e-005  1.079e-005  6.334e-006  4.208e-006  2.250e-006
1.111e-006  2.165e-007  6.510e-008
       0.3  1.274e-001  2.028e-002  1.716e-003  7.300e-004  1.805e-004  9.911e-
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005  5.036e-005  1.271e-005  5.747e-006  3.315e-006  2.165e-006  1.116e-006
5.204e-007  8.571e-008  2.251e-008
       0.4  1.309e-001  2.028e-002  1.345e-003  5.096e-004  1.118e-004  5.944e-
005  2.923e-005  6.942e-006  3.042e-006  1.717e-006  1.099e-006  5.460e-007
2.420e-007  3.445e-008  7.958e-009
       0.5  1.336e-001  2.045e-002  1.111e-003  3.865e-004  7.836e-005  4.048e-
005  1.926e-005  4.315e-006  1.857e-006  1.038e-006  6.589e-007  3.208e-007
1.373e-007  1.710e-008  3.479e-009
      0.75  1.370e-001  2.075e-002  8.250e-004  2.484e-004  4.373e-005  2.149e-
005  9.705e-006  2.021e-006  8.463e-007  4.607e-007  2.838e-007  1.295e-007
5.034e-008  4.829e-009  8.153e-010
         1  1.300e-001  1.884e-002  6.104e-004  1.640e-004  2.509e-005  1.175e-
005  5.085e-006  1.026e-006  4.239e-007  2.244e-007  1.333e-007  5.619e-008
1.948e-008  1.396e-009  1.934e-010
         2  9.436e-002  1.133e-002  2.203e-004  4.198e-005  4.094e-006  1.740e-
006  7.245e-007  1.418e-007  5.148e-008  2.318e-008  1.174e-008  3.739e-009
9.302e-010  3.434e-011  3.343e-012
         3  7.377e-002  7.700e-003  8.833e-005  1.297e-005  1.026e-006  4.406e-
007  1.876e-007  3.281e-008  9.845e-009  3.708e-009  1.605e-009  3.927e-010
7.196e-011  1.385e-012  8.980e-014
         4  5.652e-002  5.159e-003  3.482e-005  4.251e-006  3.368e-007  1.489e-
007  6.208e-008  8.707e-009  2.122e-009  6.739e-010  2.528e-010  4.919e-011
6.968e-012  7.878e-014  3.691e-015
  Equation: Silva et al (2002) USGS 2008 MbLg - AB MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  8.551e-002  9.049e-003  4.277e-004  1.729e-004  5.378e-005  3.454e-
005  2.123e-005  7.645e-006  3.949e-006  2.382e-006  1.571e-006  8.021e-007
3.685e-007  6.556e-008  2.063e-008
      0.05  1.389e-001  1.951e-002  1.058e-003  3.995e-004  1.180e-004  7.614e-
005  4.754e-005  1.820e-005  9.945e-006  6.308e-006  4.352e-006  2.402e-006
1.214e-006  2.687e-007  9.798e-008
       0.1  1.634e-001  2.670e-002  1.588e-003  5.897e-004  1.677e-004  1.075e-
004  6.715e-005  2.611e-005  1.452e-005  9.358e-006  6.554e-006  3.716e-006
1.944e-006  4.671e-007  1.802e-007
       0.2  1.564e-001  2.410e-002  1.279e-003  4.402e-004  1.127e-004  6.970e-
005  4.186e-005  1.500e-005  7.900e-006  4.888e-006  3.310e-006  1.779e-006
8.761e-007  1.854e-007  6.587e-008
       0.3  1.306e-001  1.818e-002  8.590e-004  2.841e-004  6.955e-005  4.211e-
005  2.463e-005  8.278e-006  4.172e-006  2.496e-006  1.646e-006  8.492e-007
4.004e-007  7.768e-008  2.609e-008
       0.4  1.143e-001  1.555e-002  6.925e-004  2.200e-004  5.086e-005  3.015e-
005  1.723e-005  5.525e-006  2.707e-006  1.588e-006  1.032e-006  5.215e-007
2.409e-007  4.491e-008  1.469e-008
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       0.5  1.025e-001  1.383e-002  5.861e-004  1.803e-004  3.983e-005  2.323e-
005  1.305e-005  4.045e-006  1.946e-006  1.128e-006  7.266e-007  3.626e-007
1.653e-007  2.991e-008  9.560e-009
      0.75  7.588e-002  1.033e-002  3.956e-004  1.133e-004  2.246e-005  1.263e-
005  6.850e-006  2.000e-006  9.315e-007  5.275e-007  3.333e-007  1.610e-007
7.040e-008  1.149e-008  3.413e-009
         1  6.165e-002  8.504e-003  3.026e-004  8.248e-005  1.521e-005  8.357e-
006  4.436e-006  1.248e-006  5.683e-007  3.159e-007  1.964e-007  9.217e-008
3.890e-008  5.839e-009  1.642e-009
         2  3.764e-002  5.561e-003  2.087e-004  5.388e-005  7.915e-006  3.930e-
006  1.895e-006  4.659e-007  2.010e-007  1.083e-007  6.589e-008  3.012e-008
1.247e-008  1.876e-009  5.457e-010
         3  2.542e-002  3.556e-003  1.258e-004  3.193e-005  4.325e-006  2.034e-
006  9.172e-007  1.986e-007  8.072e-008  4.201e-008  2.499e-008  1.111e-008
4.503e-009  6.668e-010  1.957e-010
         4  1.947e-002  2.625e-003  9.093e-005  2.306e-005  3.023e-006  1.380e-
006  5.962e-007  1.172e-007  4.526e-008  2.288e-008  1.336e-008  5.818e-009
2.327e-009  3.431e-010  1.017e-010
  Weighted Average
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  9.493e-002  9.752e-003  6.499e-004  2.692e-004  7.340e-005  4.434e-
005  2.583e-005  8.863e-006  4.598e-006  2.808e-006  1.874e-006  9.735e-007
4.519e-007  7.646e-008  2.163e-008
      0.05  9.884e-002  1.325e-002  1.160e-003  5.504e-004  1.902e-004  1.233e-
004  7.558e-005  2.707e-005  1.435e-005  9.013e-006  6.214e-006  3.464e-006
1.790e-006  4.186e-007  1.544e-007
       0.1  9.845e-002  1.543e-002  1.481e-003  7.009e-004  2.381e-004  1.531e-
004  9.295e-005  3.274e-005  1.727e-005  1.084e-005  7.489e-006  4.188e-006
2.165e-006  4.972e-007  1.806e-007
       0.2  1.129e-001  1.763e-002  1.606e-003  7.250e-004  2.176e-004  1.322e-
004  7.555e-005  2.379e-005  1.177e-005  7.057e-006  4.700e-006  2.484e-006
1.205e-006  2.405e-007  7.926e-008
       0.3  1.133e-001  1.677e-002  1.287e-003  5.318e-004  1.403e-004  8.159e-
005  4.469e-005  1.309e-005  6.231e-006  3.636e-006  2.369e-006  1.208e-006
5.625e-007  1.020e-007  3.151e-008
       0.4  1.132e-001  1.639e-002  1.056e-003  4.026e-004  9.808e-005  5.580e-
005  2.990e-005  8.381e-006  3.882e-006  2.220e-006  1.423e-006  7.079e-007
3.206e-007  5.492e-008  1.641e-008
       0.5  1.139e-001  1.644e-002  9.147e-004  3.289e-004  7.587e-005  4.240e-
005  2.228e-005  6.016e-006  2.735e-006  1.545e-006  9.806e-007  4.805e-007
2.137e-007  3.505e-008  1.018e-008
      0.75  1.124e-001  1.660e-002  7.333e-004  2.374e-004  4.911e-005  2.648e-
005  1.342e-005  3.398e-006  1.488e-006  8.160e-007  5.051e-007  2.370e-007
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9.996e-008  1.467e-008  4.015e-009
         1  1.102e-001  1.661e-002  6.471e-004  1.929e-004  3.618e-005  1.896e-
005  9.367e-006  2.274e-006  9.674e-007  5.175e-007  3.134e-007  1.417e-007
5.737e-008  7.854e-009  2.085e-009
         2  7.823e-002  1.071e-002  2.972e-004  6.894e-005  9.088e-006  4.315e-
006  1.973e-006  4.333e-007  1.738e-007  8.834e-008  5.112e-008  2.146e-008
8.035e-009  9.771e-010  2.519e-010
         3  6.009e-002  7.118e-003  1.455e-004  3.197e-005  4.075e-006  1.911e-
006  8.572e-007  1.765e-007  6.713e-008  3.273e-008  1.833e-008  7.343e-009
2.631e-009  3.051e-010  7.940e-011
         4  4.788e-002  5.039e-003  8.520e-005  1.884e-005  2.417e-006  1.121e-
006  4.927e-007  9.544e-008  3.478e-008  1.645e-008  9.010e-009  3.501e-009
1.225e-009  1.420e-010  3.811e-011


Source: New Madrid - Composite
Region: USGS 2008 New Madrid
  Equation: Toro (1999) Midcontinent - USGS 2008 MbLg MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  1.899e-003  1.396e-003  7.238e-006  2.873e-007  1.234e-009  1.183e-
010  8.027e-012  2.352e-014  5.339e-016  3.074e-017  3.005e-018  8.154e-020
9.671e-022  1.995e-025  9.477e-028
      0.05  1.885e-003  4.783e-004  1.041e-007  1.602e-009  1.939e-012  1.162e-
013  4.790e-015  5.283e-018  5.528e-020  2.079e-021  1.523e-022  2.514e-024
2.620e-026  1.963e-030  5.146e-033
       0.1  1.853e-003  2.079e-004  1.197e-008  1.228e-010  8.621e-014  4.224e-
015  1.404e-016  9.434e-020  8.416e-022  2.744e-023  1.748e-024  2.337e-026
1.947e-028  9.432e-033  1.915e-035
       0.2  1.899e-003  1.266e-003  4.134e-006  1.471e-007  5.530e-010  5.057e-
011  3.269e-012  8.738e-015  1.883e-016  1.042e-017  9.887e-019  2.013e-020
3.352e-022  6.260e-026  2.806e-028
       0.3  1.900e-003  1.665e-003  3.232e-005  2.021e-006  1.623e-008  1.968e-
009  1.719e-010  8.286e-013  2.526e-014  1.798e-015  2.103e-016  7.072e-018
1.497e-019  4.110e-023  2.641e-025
       0.4  1.900e-003  1.790e-003  9.294e-005  8.181e-006  1.029e-007  1.473e-
008  1.535e-009  1.041e-011  3.880e-013  3.183e-014  4.158e-015  1.650e-016
4.381e-018  1.520e-021  1.200e-023
       0.5  1.900e-003  1.843e-003  1.887e-004  2.182e-005  3.907e-007  6.366e-
008  7.612e-009  6.755e-011  2.945e-012  2.701e-013  3.847e-014  1.738e-015
5.292e-017  2.275e-020  2.107e-022
      0.75  1.900e-003  1.880e-003  5.076e-004  1.048e-004  4.306e-006  9.762e-
007  1.684e-007  3.196e-009  2.238e-010  2.910e-011  5.476e-012  3.811e-013
1.864e-014  2.989e-017  4.582e-019
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         1  1.900e-003  1.891e-003  8.155e-004  2.442e-004  1.711e-005  4.783e-
006  1.040e-006  3.197e-008  3.025e-009  4.910e-010  1.103e-010  1.010e-011
6.675e-013  1.982e-015  4.727e-017
         2  1.900e-003  1.892e-003  8.935e-004  2.920e-004  2.306e-005  6.731e-
006  1.533e-006  5.163e-008  5.159e-009  8.708e-010  2.016e-010  1.933e-011
1.342e-012  4.388e-015  1.107e-016
         3  1.900e-003  1.876e-003  5.421e-004  1.237e-004  6.088e-006  1.497e-
006  2.841e-007  6.675e-009  5.389e-010  7.811e-011  1.606e-011  1.287e-012
7.381e-014  1.660e-016  3.372e-018
         4  1.900e-003  1.852e-003  3.401e-004  5.993e-005  2.116e-006  4.605e-
007  7.667e-008  1.393e-009  9.659e-011  1.256e-011  2.373e-012  1.673e-013
8.373e-015  1.438e-017  2.172e-019
  Equation: Campbell (2003) USGS 2008 MbLg - AB MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  1.900e-003  1.890e-003  2.799e-004  2.582e-005  2.023e-007  2.067e-
008  1.356e-009  2.697e-012  3.967e-014  1.526e-015  1.047e-016  1.419e-018
7.368e-021  2.179e-025  2.645e-028
      0.05  1.900e-003  1.892e-003  3.261e-004  3.288e-005  2.893e-007  3.086e-
008  2.123e-009  4.636e-012  7.210e-014  2.886e-015  2.041e-016  2.892e-018
1.532e-020  5.002e-025  6.435e-028
       0.1  1.900e-003  1.883e-003  1.718e-004  1.184e-005  6.266e-008  5.517e-
009  3.086e-010  4.492e-013  5.503e-015  1.859e-016  1.150e-017  1.322e-019
6.826e-022  1.470e-026  1.482e-029
       0.2  1.900e-003  1.892e-003  2.790e-004  2.446e-005  1.776e-007  1.766e-
008  1.128e-009  2.148e-012  3.101e-014  1.180e-015  8.037e-017  1.074e-018
6.724e-021  1.955e-025  2.353e-028
       0.3  1.900e-003  1.897e-003  4.316e-004  4.914e-005  4.970e-007  5.588e-
008  4.075e-009  1.011e-011  1.709e-013  7.291e-015  5.431e-016  8.395e-018
7.369e-020  2.281e-024  3.259e-027
       0.4  1.900e-003  1.899e-003  5.842e-004  7.650e-005  8.186e-007  9.066e-
008  6.368e-009  1.374e-011  2.051e-013  7.848e-015  5.313e-016  6.980e-018
4.053e-020  9.760e-025  1.017e-027
       0.5  1.900e-003  1.899e-003  7.250e-004  1.077e-004  1.222e-006  1.342e-
007  9.164e-009  1.768e-011  2.384e-013  8.346e-015  5.221e-016  5.998e-018
2.873e-020  4.801e-025  3.835e-028
      0.75  1.900e-003  1.900e-003  1.035e-003  2.346e-004  4.840e-006  6.687e-
007  5.888e-008  1.920e-010  3.584e-012  1.593e-013  1.205e-014  1.860e-016
1.522e-018  3.665e-023  4.380e-026
         1  1.900e-003  1.900e-003  1.112e-003  2.837e-004  7.111e-006  1.064e-
006  1.026e-007  4.074e-010  8.641e-012  4.231e-013  3.460e-014  6.041e-016
5.725e-018  1.735e-022  2.494e-025
         2  1.900e-003  1.899e-003  9.614e-004  2.614e-004  1.069e-005  2.164e-
006  3.100e-007  3.352e-009  1.484e-010  1.311e-011  1.764e-012  6.978e-014
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1.731e-015  5.672e-019  2.050e-021
         3  1.900e-003  1.896e-003  6.817e-004  1.360e-004  3.686e-006  6.429e-
007  7.855e-008  6.208e-010  2.281e-011  1.765e-012  2.142e-013  7.242e-015
1.520e-016  3.726e-020  1.034e-022
         4  1.900e-003  1.889e-003  4.260e-004  6.084e-005  1.069e-006  1.590e-
007  1.638e-008  9.242e-011  2.781e-012  1.866e-013  2.026e-014  5.790e-016
1.017e-017  9.935e-022  3.899e-024
  Equation: Silva et al (2002) USGS 2008 MbLg - AB MRC
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  1.900e-003  1.876e-003  7.354e-004  2.438e-004  2.372e-005  7.854e-
006  2.103e-006  1.051e-007  1.387e-008  2.911e-009  8.074e-010  1.035e-010
1.001e-011  6.645e-014  2.636e-015
      0.05  1.900e-003  1.896e-003  1.299e-003  6.940e-004  1.368e-004  5.879e-
005  2.077e-005  1.795e-006  3.296e-007  8.786e-008  2.940e-008  5.026e-009
6.626e-010  8.160e-012  4.685e-013
       0.1  1.900e-003  1.898e-003  1.492e-003  9.427e-004  2.488e-004  1.196e-
004  4.757e-005  5.180e-006  1.091e-006  3.213e-007  1.163e-007  2.240e-008
3.362e-009  5.359e-011  3.592e-012
       0.2  1.900e-003  1.898e-003  1.463e-003  8.863e-004  2.098e-004  9.558e-
005  3.565e-005  3.357e-006  6.407e-007  1.747e-007  5.935e-008  1.033e-008
1.379e-009  1.709e-011  9.727e-013
       0.3  1.900e-003  1.897e-003  1.312e-003  7.009e-004  1.350e-004  5.709e-
005  1.974e-005  1.618e-006  2.858e-007  7.387e-008  2.409e-008  3.949e-009
4.961e-010  5.496e-012  2.946e-013
       0.4  1.900e-003  1.896e-003  1.253e-003  6.381e-004  1.140e-004  4.693e-
005  1.578e-005  1.228e-006  2.105e-007  5.331e-008  1.711e-008  2.740e-009
3.360e-010  3.562e-012  1.863e-013
       0.5  1.900e-003  1.895e-003  1.206e-003  5.911e-004  9.962e-005  4.017e-
005  1.323e-005  9.884e-007  1.657e-007  4.129e-008  1.309e-008  2.060e-009
2.480e-010  2.540e-012  1.305e-013
      0.75  1.900e-003  1.891e-003  1.096e-003  4.998e-004  7.740e-005  3.052e-
005  9.868e-006  7.228e-007  1.209e-007  3.019e-008  9.617e-009  1.529e-009
1.873e-010  2.021e-012  1.082e-013
         1  1.900e-003  1.888e-003  1.018e-003  4.413e-004  6.462e-005  2.512e-
005  8.028e-006  5.809e-007  9.704e-008  2.430e-008  7.766e-009  1.245e-009
1.544e-010  1.728e-012  9.520e-014
         2  1.900e-003  1.862e-003  9.079e-004  4.162e-004  7.922e-005  3.589e-
005  1.395e-005  1.630e-006  3.837e-007  1.261e-007  5.062e-008  1.177e-008
2.247e-009  6.497e-011  6.687e-012
         3  1.899e-003  1.816e-003  7.417e-004  3.299e-004  6.645e-005  3.168e-
005  1.322e-005  1.866e-006  5.061e-007  1.866e-007  8.254e-008  2.252e-008
5.189e-009  2.281e-010  3.102e-011
         4  1.899e-003  1.769e-003  6.438e-004  2.833e-004  5.954e-005  2.932e-
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005  1.279e-005  2.026e-006  5.984e-007  2.362e-007  1.107e-007  3.321e-008
8.546e-009  4.803e-010  7.684e-011
  Weighted Average
    Period  Amp=0.0001  Amp=0.001   Amp=0.01    Amp=0.02    Amp=0.05    Amp=
0.07    Amp=0.1     Amp=0.2     Amp=0.3     Amp=0.4     Amp=0.5     Amp=0.7
Amp=1       Amp=2       Amp=3
       PGA  1.900e-003  1.721e-003  3.408e-004  8.998e-005  7.974e-006  2.625e-
006  7.014e-007  3.502e-008  4.623e-009  9.705e-010  2.691e-010  3.451e-011
3.336e-012  2.215e-014  8.786e-016
      0.05  1.895e-003  1.422e-003  5.416e-004  2.423e-004  4.569e-005  1.961e-
005  6.923e-006  5.984e-007  1.099e-007  2.929e-008  9.800e-009  1.675e-009
2.209e-010  2.720e-012  1.562e-013
       0.1  1.884e-003  1.330e-003  5.546e-004  3.182e-004  8.297e-005  3.988e-
005  1.586e-005  1.727e-006  3.638e-007  1.071e-007  3.875e-008  7.468e-009
1.121e-009  1.786e-011  1.197e-012
       0.2  1.900e-003  1.686e-003  5.820e-004  3.036e-004  6.999e-005  3.187e-
005  1.188e-005  1.119e-006  2.136e-007  5.824e-008  1.978e-008  3.443e-009
4.598e-010  5.696e-012  3.242e-013
       0.3  1.900e-003  1.819e-003  5.919e-004  2.507e-004  4.516e-005  1.905e-
005  6.583e-006  5.393e-007  9.527e-008  2.462e-008  8.030e-009  1.316e-009
1.654e-010  1.832e-012  9.820e-014
       0.4  1.900e-003  1.861e-003  6.433e-004  2.409e-004  3.830e-005  1.568e-
005  5.264e-006  4.093e-007  7.018e-008  1.777e-008  5.704e-009  9.134e-010
1.120e-010  1.187e-012  6.210e-014
       0.5  1.900e-003  1.879e-003  7.064e-004  2.402e-004  3.374e-005  1.345e-
005  4.414e-006  3.295e-007  5.523e-008  1.376e-008  4.365e-009  6.866e-010
8.265e-011  8.468e-013  4.349e-014
      0.75  1.900e-003  1.890e-003  8.796e-004  2.797e-004  2.885e-005  1.072e-
005  3.365e-006  2.421e-007  4.036e-008  1.007e-008  3.207e-009  5.099e-010
6.245e-011  6.737e-013  3.606e-014
         1  1.900e-003  1.893e-003  9.818e-004  3.231e-004  2.961e-005  1.032e-
005  3.057e-006  2.044e-007  3.336e-008  8.263e-009  2.625e-009  4.184e-010
5.170e-011  5.766e-013  3.175e-014
         2  1.900e-003  1.884e-003  9.209e-004  3.232e-004  3.766e-005  1.493e-
005  5.263e-006  5.616e-007  1.297e-007  4.233e-008  1.694e-008  3.929e-009
7.494e-010  2.166e-011  2.229e-012
         3  1.900e-003  1.863e-003  6.552e-004  1.965e-004  2.541e-005  1.127e-
005  4.527e-006  6.245e-007  1.689e-007  6.222e-008  2.752e-008  7.508e-009
1.730e-009  7.604e-011  1.034e-011
         4  1.899e-003  1.836e-003  4.700e-004  1.347e-004  2.091e-005  9.980e-
006  4.295e-006  6.759e-007  1.995e-007  7.874e-008  3.690e-008  1.107e-008
2.849e-009  1.601e-010  2.561e-011
```

Deaggregation results for EZ-FRISK 7.62 Build 000

DEAGGREGATION: Magnitude
All magnitudes in Moment Magnitude scale.

Spectral Period:	**PGA**
Amplitude:	**0.02**
Annual Frequency of Exceedance:	**6.641e-004**
Mode Magnitude:	**4.75**
Mode Rate (by magnitude):	**4.670e-005**
Mean Magnitude:	**5.93**

Magnitude	Probability Density
4.05	8.942e-292
4.15	8.942e-292
4.25	8.942e-292
4.35	8.942e-292
4.45	8.942e-292
4.55	8.942e-292
4.65	8.942e-292
4.75	7.033e-001
4.85	6.648e-001
4.95	6.287e-001
5.05	5.946e-001
5.15	5.622e-001
5.25	5.327e-001
5.35	8.942e-292
5.45	5.052e-001
5.55	4.786e-001
5.65	4.530e-001
5.75	4.285e-001
5.85	4.051e-001
5.95	8.942e-292
6.05	3.921e-001
6.15	3.720e-001
6.25	3.537e-001
6.35	8.942e-292
6.45	3.374e-001
6.55	3.081e-001
6.65	8.942e-292
6.75	2.682e-001
6.85	1.737e-001
6.95	8.942e-292
7.05	1.825e-001
7.15	1.257e-001
7.25	5.247e-002

7.35	6.083e-002
7.45	2.375e-001
7.55	2.041e-010
7.65	6.344e-001
7.75	7.737e-002
7.85	1.628e-002
7.95	4.512e-001
8.05	8.942e-292
8.15	8.942e-292
8.25	8.942e-292
8.35	8.942e-292
8.45	8.942e-292
8.55	8.942e-292
8.65	8.942e-292
8.75	8.942e-292
8.85	8.942e-292
8.95	8.942e-292

Integral : 1.000e+000

DEAGGREGATION: Distance

Spectral Period:	PGA
Amplitude:	0.02
Annual Frequency of Exceedance:	6.641e-004
Mode Distance:	137.50
Mode Rate (by distance):	7.491e-005
Mean Distance:	317.31

Distance	Probability Density
12.5	1.012e-003
37.5	3.002e-003
62.5	4.488e-003
87.5	3.413e-003
112.5	4.152e-003
137.5	4.512e-003
162.5	2.170e-003
187.5	2.153e-003
212.5	1.997e-003
237.5	1.720e-003
262.5	1.424e-003
287.5	1.110e-003
312.5	2.208e-294
337.5	7.932e-004
362.5	5.755e-004

387.5	2.208e-294
412.5	3.856e-004
437.5	2.208e-294
462.5	2.407e-004
487.5	2.208e-294
512.5	2.208e-294
537.5	1.637e-004
562.5	2.208e-294
587.5	1.438e-004
612.5	2.208e-294
637.5	2.208e-294
662.5	1.281e-004
687.5	2.208e-294
712.5	2.208e-294
737.5	8.844e-005
762.5	2.208e-294
787.5	2.208e-294
812.5	2.208e-294
837.5	6.724e-005
862.5	2.208e-294
887.5	2.208e-294
912.5	2.208e-294
937.5	1.306e-004
962.5	2.208e-294
987.5	2.208e-294
1012.5	2.208e-294
1037.5	2.208e-294
1062.5	1.201e-004
1087.5	2.208e-294
1112.5	2.208e-294
1137.5	2.259e-003
1162.5	3.795e-004
1187.5	1.725e-003
1212.5	7.157e-005
1237.5	1.225e-003
1262.5	7.532e-005
1287.5	2.208e-294
1312.5	2.208e-294
1337.5	1.127e-004
1362.5	2.208e-294
1387.5	2.208e-294
1412.5	2.208e-294
1437.5	2.208e-294
1462.5	2.208e-294
1487.5	1.055e-004

1512.5	2.208e-294
1537.5	2.208e-294
1562.5	2.208e-294
1587.5	2.208e-294
1612.5	2.208e-294
1637.5	2.208e-294
1662.5	4.099e-005
1687.5	2.208e-294
1712.5	2.208e-294
1737.5	2.208e-294
1762.5	2.208e-294
1787.5	2.208e-294
1812.5	2.208e-294
1837.5	2.208e-294
1862.5	2.208e-294
1887.5	1.609e-005
1912.5	2.208e-294
1937.5	2.208e-294
1962.5	2.208e-294
1987.5	2.208e-294
2012.5	1.413e-008

Integral : 1.000e+000

DEAGGREGATION: Epsilon

Spectral Period:	PGA
Amplitude:	0.02
Annual Frequency of Exceedance:	6.641e-004
Mode Epsilon:	0.90
Mode Rate (by epsilon):	5.232e-005
Mean Epsilon:	0.15

Epsilon	Probability Density
-2.1	3.220e-001
-1.9	7.731e-002
-1.7	8.877e-002
-1.5	1.134e-001
-1.3	1.361e-001
-1.1	1.561e-001
-0.9	1.950e-001
-0.7	2.056e-001
-0.5	2.420e-001
-0.3	2.569e-001
-0.1	3.052e-001

0.1	2.882e-001
0.3	3.025e-001
0.5	2.525e-001
0.7	2.782e-001
0.9	3.939e-001
1.1	2.298e-001
1.3	2.708e-001
1.5	2.988e-001
1.7	2.065e-001
1.9	1.138e-001
2.1	9.419e-002
2.3	6.362e-002
2.5	4.245e-002
2.7	2.826e-002
2.9	1.674e-002
3.1	8.837e-003
3.3	5.769e-003
3.5	3.011e-003
3.7	1.654e-003
3.9	1.017e-003
4.1	8.773e-004

Integral : 1.000e+000

DEAGGREGATION: Magnitude - Distance
All magnitudes in Moment Magnitude scale.

Spectral Period:	PGA
Amplitude:	0.02
Annual Frequency of Exceedance:	6.641e-004
Mode Magnitude:	7.65
Mode Distance:	1187.50
Mode Rate (by distance and magnitude):	1.365e-005
Mean Magnitude:	5.93
Mean Distance:	317.31

Magnitude	Distance	Probability Density
4.05	12.5	4.416e-295
4.05	37.5	4.416e-295
4.05	62.5	4.416e-295
4.05	87.5	4.416e-295
4.05	112.5	4.416e-295
4.05	137.5	4.416e-295
4.05	162.5	4.416e-295
4.05	187.5	4.416e-295

4.05	212.5	4.416e-295
4.05	237.5	4.416e-295
4.05	262.5	4.416e-295
4.05	287.5	4.416e-295
4.05	312.5	4.416e-295
4.05	337.5	4.416e-295
4.05	362.5	4.416e-295
4.05	387.5	4.416e-295
4.05	412.5	4.416e-295
4.05	437.5	4.416e-295
4.05	462.5	4.416e-295
4.05	487.5	4.416e-295
4.05	512.5	4.416e-295
4.05	537.5	4.416e-295
4.05	562.5	4.416e-295
4.05	587.5	4.416e-295
4.05	612.5	4.416e-295
4.05	637.5	4.416e-295
4.05	662.5	4.416e-295
4.05	687.5	4.416e-295
4.05	712.5	4.416e-295
4.05	737.5	4.416e-295
4.05	762.5	4.416e-295
4.05	787.5	4.416e-295
4.05	812.5	4.416e-295
4.05	837.5	4.416e-295
4.05	862.5	4.416e-295
4.05	887.5	4.416e-295
4.05	912.5	4.416e-295
4.05	937.5	4.416e-295
4.05	962.5	4.416e-295
4.05	987.5	4.416e-295
4.05	1012.5	4.416e-295
4.05	1037.5	4.416e-295
4.05	1062.5	4.416e-295
4.05	1087.5	4.416e-295
4.05	1112.5	4.416e-295
4.05	1137.5	4.416e-295
4.05	1162.5	4.416e-295
4.05	1187.5	4.416e-295
4.05	1212.5	4.416e-295
4.05	1237.5	4.416e-295
4.05	1262.5	4.416e-295
4.05	1287.5	4.416e-295
4.05	1312.5	4.416e-295

4.05	1337.5	4.416e-295
4.05	1362.5	4.416e-295
4.05	1387.5	4.416e-295
4.05	1412.5	4.416e-295
4.05	1437.5	4.416e-295
4.05	1462.5	4.416e-295
4.05	1487.5	4.416e-295
4.05	1512.5	4.416e-295
4.05	1537.5	4.416e-295
4.05	1562.5	4.416e-295
4.05	1587.5	4.416e-295
4.05	1612.5	4.416e-295
4.05	1637.5	4.416e-295
4.05	1662.5	4.416e-295
4.05	1687.5	4.416e-295
4.05	1712.5	4.416e-295
4.05	1737.5	4.416e-295
4.05	1762.5	4.416e-295
4.05	1787.5	4.416e-295
4.05	1812.5	4.416e-295
4.05	1837.5	4.416e-295
4.05	1862.5	4.416e-295
4.05	1887.5	4.416e-295
4.05	1912.5	4.416e-295
4.05	1937.5	4.416e-295
4.05	1962.5	4.416e-295
4.05	1987.5	4.416e-295
4.05	2012.5	4.416e-295
4.15	12.5	4.416e-295
4.15	37.5	4.416e-295
4.15	62.5	4.416e-295
4.15	87.5	4.416e-295
4.15	112.5	4.416e-295
4.15	137.5	4.416e-295
4.15	162.5	4.416e-295
4.15	187.5	4.416e-295
4.15	212.5	4.416e-295
4.15	237.5	4.416e-295
4.15	262.5	4.416e-295
4.15	287.5	4.416e-295
4.15	312.5	4.416e-295
4.15	337.5	4.416e-295
4.15	362.5	4.416e-295
4.15	387.5	4.416e-295
4.15	412.5	4.416e-295

4.15	437.5	4.416e-295
4.15	462.5	4.416e-295
4.15	487.5	4.416e-295
4.15	512.5	4.416e-295
4.15	537.5	4.416e-295
4.15	562.5	4.416e-295
4.15	587.5	4.416e-295
4.15	612.5	4.416e-295
4.15	637.5	4.416e-295
4.15	662.5	4.416e-295
4.15	687.5	4.416e-295
4.15	712.5	4.416e-295
4.15	737.5	4.416e-295
4.15	762.5	4.416e-295
4.15	787.5	4.416e-295
4.15	812.5	4.416e-295
4.15	837.5	4.416e-295
4.15	862.5	4.416e-295
4.15	887.5	4.416e-295
4.15	912.5	4.416e-295
4.15	937.5	4.416e-295
4.15	962.5	4.416e-295
4.15	987.5	4.416e-295
4.15	1012.5	4.416e-295
4.15	1037.5	4.416e-295
4.15	1062.5	4.416e-295
4.15	1087.5	4.416e-295
4.15	1112.5	4.416e-295
4.15	1137.5	4.416e-295
4.15	1162.5	4.416e-295
4.15	1187.5	4.416e-295
4.15	1212.5	4.416e-295
4.15	1237.5	4.416e-295
4.15	1262.5	4.416e-295
4.15	1287.5	4.416e-295
4.15	1312.5	4.416e-295
4.15	1337.5	4.416e-295
4.15	1362.5	4.416e-295
4.15	1387.5	4.416e-295
4.15	1412.5	4.416e-295
4.15	1437.5	4.416e-295
4.15	1462.5	4.416e-295
4.15	1487.5	4.416e-295
4.15	1512.5	4.416e-295
4.15	1537.5	4.416e-295

4.15	1562.5	4.416e-295
4.15	1587.5	4.416e-295
4.15	1612.5	4.416e-295
4.15	1637.5	4.416e-295
4.15	1662.5	4.416e-295
4.15	1687.5	4.416e-295
4.15	1712.5	4.416e-295
4.15	1737.5	4.416e-295
4.15	1762.5	4.416e-295
4.15	1787.5	4.416e-295
4.15	1812.5	4.416e-295
4.15	1837.5	4.416e-295
4.15	1862.5	4.416e-295
4.15	1887.5	4.416e-295
4.15	1912.5	4.416e-295
4.15	1937.5	4.416e-295
4.15	1962.5	4.416e-295
4.15	1987.5	4.416e-295
4.15	2012.5	4.416e-295
4.25	12.5	4.416e-295
4.25	37.5	4.416e-295
4.25	62.5	4.416e-295
4.25	87.5	4.416e-295
4.25	112.5	4.416e-295
4.25	137.5	4.416e-295
4.25	162.5	4.416e-295
4.25	187.5	4.416e-295
4.25	212.5	4.416e-295
4.25	237.5	4.416e-295
4.25	262.5	4.416e-295
4.25	287.5	4.416e-295
4.25	312.5	4.416e-295
4.25	337.5	4.416e-295
4.25	362.5	4.416e-295
4.25	387.5	4.416e-295
4.25	412.5	4.416e-295
4.25	437.5	4.416e-295
4.25	462.5	4.416e-295
4.25	487.5	4.416e-295
4.25	512.5	4.416e-295
4.25	537.5	4.416e-295
4.25	562.5	4.416e-295
4.25	587.5	4.416e-295
4.25	612.5	4.416e-295
4.25	637.5	4.416e-295

4.25	662.5	4.416e-295
4.25	687.5	4.416e-295
4.25	712.5	4.416e-295
4.25	737.5	4.416e-295
4.25	762.5	4.416e-295
4.25	787.5	4.416e-295
4.25	812.5	4.416e-295
4.25	837.5	4.416e-295
4.25	862.5	4.416e-295
4.25	887.5	4.416e-295
4.25	912.5	4.416e-295
4.25	937.5	4.416e-295
4.25	962.5	4.416e-295
4.25	987.5	4.416e-295
4.25	1012.5	4.416e-295
4.25	1037.5	4.416e-295
4.25	1062.5	4.416e-295
4.25	1087.5	4.416e-295
4.25	1112.5	4.416e-295
4.25	1137.5	4.416e-295
4.25	1162.5	4.416e-295
4.25	1187.5	4.416e-295
4.25	1212.5	4.416e-295
4.25	1237.5	4.416e-295
4.25	1262.5	4.416e-295
4.25	1287.5	4.416e-295
4.25	1312.5	4.416e-295
4.25	1337.5	4.416e-295
4.25	1362.5	4.416e-295
4.25	1387.5	4.416e-295
4.25	1412.5	4.416e-295
4.25	1437.5	4.416e-295
4.25	1462.5	4.416e-295
4.25	1487.5	4.416e-295
4.25	1512.5	4.416e-295
4.25	1537.5	4.416e-295
4.25	1562.5	4.416e-295
4.25	1587.5	4.416e-295
4.25	1612.5	4.416e-295
4.25	1637.5	4.416e-295
4.25	1662.5	4.416e-295
4.25	1687.5	4.416e-295
4.25	1712.5	4.416e-295
4.25	1737.5	4.416e-295
4.25	1762.5	4.416e-295

4.25	1787.5	4.416e-295
4.25	1812.5	4.416e-295
4.25	1837.5	4.416e-295
4.25	1862.5	4.416e-295
4.25	1887.5	4.416e-295
4.25	1912.5	4.416e-295
4.25	1937.5	4.416e-295
4.25	1962.5	4.416e-295
4.25	1987.5	4.416e-295
4.25	2012.5	4.416e-295
4.35	12.5	4.416e-295
4.35	37.5	4.416e-295
4.35	62.5	4.416e-295
4.35	87.5	4.416e-295
4.35	112.5	4.416e-295
4.35	137.5	4.416e-295
4.35	162.5	4.416e-295
4.35	187.5	4.416e-295
4.35	212.5	4.416e-295
4.35	237.5	4.416e-295
4.35	262.5	4.416e-295
4.35	287.5	4.416e-295
4.35	312.5	4.416e-295
4.35	337.5	4.416e-295
4.35	362.5	4.416e-295
4.35	387.5	4.416e-295
4.35	412.5	4.416e-295
4.35	437.5	4.416e-295
4.35	462.5	4.416e-295
4.35	487.5	4.416e-295
4.35	512.5	4.416e-295
4.35	537.5	4.416e-295
4.35	562.5	4.416e-295
4.35	587.5	4.416e-295
4.35	612.5	4.416e-295
4.35	637.5	4.416e-295
4.35	662.5	4.416e-295
4.35	687.5	4.416e-295
4.35	712.5	4.416e-295
4.35	737.5	4.416e-295
4.35	762.5	4.416e-295
4.35	787.5	4.416e-295
4.35	812.5	4.416e-295
4.35	837.5	4.416e-295
4.35	862.5	4.416e-295

4.35	887.5	4.416e-295
4.35	912.5	4.416e-295
4.35	937.5	4.416e-295
4.35	962.5	4.416e-295
4.35	987.5	4.416e-295
4.35	1012.5	4.416e-295
4.35	1037.5	4.416e-295
4.35	1062.5	4.416e-295
4.35	1087.5	4.416e-295
4.35	1112.5	4.416e-295
4.35	1137.5	4.416e-295
4.35	1162.5	4.416e-295
4.35	1187.5	4.416e-295
4.35	1212.5	4.416e-295
4.35	1237.5	4.416e-295
4.35	1262.5	4.416e-295
4.35	1287.5	4.416e-295
4.35	1312.5	4.416e-295
4.35	1337.5	4.416e-295
4.35	1362.5	4.416e-295
4.35	1387.5	4.416e-295
4.35	1412.5	4.416e-295
4.35	1437.5	4.416e-295
4.35	1462.5	4.416e-295
4.35	1487.5	4.416e-295
4.35	1512.5	4.416e-295
4.35	1537.5	4.416e-295
4.35	1562.5	4.416e-295
4.35	1587.5	4.416e-295
4.35	1612.5	4.416e-295
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4.75	112.5	3.938e-003
4.75	137.5	3.325e-003
4.75	162.5	1.141e-003
4.75	187.5	8.732e-004
4.75	212.5	5.861e-004
4.75	237.5	3.440e-004
4.75	262.5	1.810e-004
4.75	287.5	8.386e-005
4.75	312.5	4.416e-295
4.75	337.5	3.268e-005
4.75	362.5	1.214e-005
4.75	387.5	4.416e-295
4.75	412.5	3.857e-006
4.75	437.5	4.416e-295
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4.75	637.5	4.416e-295

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4.75	687.5	4.416e-295
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4.85	162.5	1.232e-003
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4.85	237.5	4.129e-004
4.85	262.5	2.260e-004
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4.85	362.5	1.734e-005
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4.85	587.5	1.405e-007
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4.95	1787.5	4.416e-295
4.95	1812.5	4.416e-295
4.95	1837.5	4.416e-295
4.95	1862.5	4.416e-295
4.95	1887.5	5.734e-016
4.95	1912.5	4.416e-295
4.95	1937.5	4.416e-295
4.95	1962.5	4.416e-295
4.95	1987.5	4.416e-295
4.95	2012.5	2.546e-018
5.05	12.5	1.023e-003
5.05	37.5	3.120e-003
5.05	62.5	4.523e-003
5.05	87.5	3.254e-003
5.05	112.5	3.674e-003
5.05	137.5	3.507e-003
5.05	162.5	1.391e-003
5.05	187.5	1.179e-003

5.05	212.5	8.805e-004
5.05	237.5	5.781e-004
5.05	262.5	3.424e-004
5.05	287.5	1.796e-004
5.05	312.5	4.416e-295
5.05	337.5	7.980e-005
5.05	362.5	3.408e-005
5.05	387.5	4.416e-295
5.05	412.5	1.254e-005
5.05	437.5	4.416e-295
5.05	462.5	3.985e-006
5.05	487.5	4.416e-295
5.05	512.5	4.416e-295
5.05	537.5	1.229e-006
5.05	562.5	4.416e-295
5.05	587.5	4.207e-007
5.05	612.5	4.416e-295
5.05	637.5	4.416e-295
5.05	662.5	1.447e-007
5.05	687.5	4.416e-295
5.05	712.5	4.416e-295
5.05	737.5	3.036e-008
5.05	762.5	4.416e-295
5.05	787.5	4.416e-295
5.05	812.5	4.416e-295
5.05	837.5	4.106e-009
5.05	862.5	4.416e-295
5.05	887.5	4.416e-295
5.05	912.5	4.416e-295
5.05	937.5	8.252e-010
5.05	962.5	4.416e-295
5.05	987.5	4.416e-295
5.05	1012.5	4.416e-295
5.05	1037.5	4.416e-295
5.05	1062.5	1.314e-010
5.05	1087.5	4.416e-295
5.05	1112.5	4.416e-295
5.05	1137.5	4.416e-295
5.05	1162.5	4.416e-295
5.05	1187.5	1.864e-011
5.05	1212.5	4.416e-295
5.05	1237.5	4.416e-295
5.05	1262.5	4.416e-295
5.05	1287.5	4.416e-295
5.05	1312.5	4.416e-295

5.05	1337.5	2.893e-012
5.05	1362.5	4.416e-295
5.05	1387.5	4.416e-295
5.05	1412.5	4.416e-295
5.05	1437.5	4.416e-295
5.05	1462.5	4.416e-295
5.05	1487.5	4.502e-013
5.05	1512.5	4.416e-295
5.05	1537.5	4.416e-295
5.05	1562.5	4.416e-295
5.05	1587.5	4.416e-295
5.05	1612.5	4.416e-295
5.05	1637.5	4.416e-295
5.05	1662.5	5.562e-014
5.05	1687.5	4.416e-295
5.05	1712.5	4.416e-295
5.05	1737.5	4.416e-295
5.05	1762.5	4.416e-295
5.05	1787.5	4.416e-295
5.05	1812.5	4.416e-295
5.05	1837.5	4.416e-295
5.05	1862.5	4.416e-295
5.05	1887.5	3.666e-015
5.05	1912.5	4.416e-295
5.05	1937.5	4.416e-295
5.05	1962.5	4.416e-295
5.05	1987.5	4.416e-295
5.05	2012.5	1.726e-017
5.15	12.5	8.234e-004
5.15	37.5	2.565e-003
5.15	62.5	3.944e-003
5.15	87.5	2.984e-003
5.15	112.5	3.492e-003
5.15	137.5	3.479e-003
5.15	162.5	1.450e-003
5.15	187.5	1.272e-003
5.15	212.5	9.860e-004
5.15	237.5	6.727e-004
5.15	262.5	4.146e-004
5.15	287.5	2.265e-004
5.15	312.5	4.416e-295
5.15	337.5	1.050e-004
5.15	362.5	4.689e-005
5.15	387.5	4.416e-295
5.15	412.5	1.806e-005

5.15	437.5	4.416e-295
5.15	462.5	6.024e-006
5.15	487.5	4.416e-295
5.15	512.5	4.416e-295
5.15	537.5	1.958e-006
5.15	562.5	4.416e-295
5.15	587.5	7.103e-007
5.15	612.5	4.416e-295
5.15	637.5	4.416e-295
5.15	662.5	2.600e-007
5.15	687.5	4.416e-295
5.15	712.5	4.416e-295
5.15	737.5	5.878e-008
5.15	762.5	4.416e-295
5.15	787.5	4.416e-295
5.15	812.5	4.416e-295
5.15	837.5	8.779e-009
5.15	862.5	4.416e-295
5.15	887.5	4.416e-295
5.15	912.5	4.416e-295
5.15	937.5	2.063e-009
5.15	962.5	4.416e-295
5.15	987.5	4.416e-295
5.15	1012.5	4.416e-295
5.15	1037.5	4.416e-295
5.15	1062.5	4.056e-010
5.15	1087.5	4.416e-295
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5.15	1137.5	4.416e-295
5.15	1162.5	4.416e-295
5.15	1187.5	7.275e-011
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5.15	1237.5	4.416e-295
5.15	1262.5	4.416e-295
5.15	1287.5	4.416e-295
5.15	1312.5	4.416e-295
5.15	1337.5	1.317e-011
5.15	1362.5	4.416e-295
5.15	1387.5	4.416e-295
5.15	1412.5	4.416e-295
5.15	1437.5	4.416e-295
5.15	1462.5	4.416e-295
5.15	1487.5	2.290e-012
5.15	1512.5	4.416e-295
5.15	1537.5	4.416e-295

5.15	1562.5	4.416e-295
5.15	1587.5	4.416e-295
5.15	1612.5	4.416e-295
5.15	1637.5	4.416e-295
5.15	1662.5	3.120e-013
5.15	1687.5	4.416e-295
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5.15	1762.5	4.416e-295
5.15	1787.5	4.416e-295
5.15	1812.5	4.416e-295
5.15	1837.5	4.416e-295
5.15	1862.5	4.416e-295
5.15	1887.5	2.267e-014
5.15	1912.5	4.416e-295
5.15	1937.5	4.416e-295
5.15	1962.5	4.416e-295
5.15	1987.5	4.416e-295
5.15	2012.5	1.132e-016
5.25	12.5	6.626e-004
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5.25	62.5	3.397e-003
5.25	87.5	2.696e-003
5.25	112.5	3.267e-003
5.25	137.5	3.404e-003
5.25	162.5	1.494e-003
5.25	187.5	1.363e-003
5.25	212.5	1.101e-003
5.25	237.5	7.843e-004
5.25	262.5	5.057e-004
5.25	287.5	2.892e-004
5.25	312.5	4.416e-295
5.25	337.5	1.404e-004
5.25	362.5	6.555e-005
5.25	387.5	4.416e-295
5.25	412.5	2.636e-005
5.25	437.5	4.416e-295
5.25	462.5	9.183e-006
5.25	487.5	4.416e-295
5.25	512.5	4.416e-295
5.25	537.5	3.127e-006
5.25	562.5	4.416e-295
5.25	587.5	1.197e-006
5.25	612.5	4.416e-295
5.25	637.5	4.416e-295

5.25	662.5	4.653e-007
5.25	687.5	4.416e-295
5.25	712.5	4.416e-295
5.25	737.5	1.137e-007
5.25	762.5	4.416e-295
5.25	787.5	4.416e-295
5.25	812.5	4.416e-295
5.25	837.5	1.899e-008
5.25	862.5	4.416e-295
5.25	887.5	4.416e-295
5.25	912.5	4.416e-295
5.25	937.5	5.315e-009
5.25	962.5	4.416e-295
5.25	987.5	4.416e-295
5.25	1012.5	4.416e-295
5.25	1037.5	4.416e-295
5.25	1062.5	1.288e-009
5.25	1087.5	4.416e-295
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5.25	1137.5	4.416e-295
5.25	1162.5	4.416e-295
5.25	1187.5	2.817e-010
5.25	1212.5	4.416e-295
5.25	1237.5	4.416e-295
5.25	1262.5	4.416e-295
5.25	1287.5	4.416e-295
5.25	1312.5	4.416e-295
5.25	1337.5	5.809e-011
5.25	1362.5	4.416e-295
5.25	1387.5	4.416e-295
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5.25	1437.5	4.416e-295
5.25	1462.5	4.416e-295
5.25	1487.5	1.123e-011
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5.25	1537.5	4.416e-295
5.25	1562.5	4.416e-295
5.25	1587.5	4.416e-295
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5.25	1637.5	4.416e-295
5.25	1662.5	1.686e-012
5.25	1687.5	4.416e-295
5.25	1712.5	4.416e-295
5.25	1737.5	4.416e-295
5.25	1762.5	4.416e-295

5.25	1787.5	4.416e-295
5.25	1812.5	4.416e-295
5.25	1837.5	4.416e-295
5.25	1862.5	4.416e-295
5.25	1887.5	1.351e-013
5.25	1912.5	4.416e-295
5.25	1937.5	4.416e-295
5.25	1962.5	4.416e-295
5.25	1987.5	4.416e-295
5.25	2012.5	7.153e-016
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5.35	87.5	4.416e-295
5.35	112.5	4.416e-295
5.35	137.5	4.416e-295
5.35	162.5	4.416e-295
5.35	187.5	4.416e-295
5.35	212.5	4.416e-295
5.35	237.5	4.416e-295
5.35	262.5	4.416e-295
5.35	287.5	4.416e-295
5.35	312.5	4.416e-295
5.35	337.5	4.416e-295
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5.35	437.5	4.416e-295
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5.35	562.5	4.416e-295
5.35	587.5	4.416e-295
5.35	612.5	4.416e-295
5.35	637.5	4.416e-295
5.35	662.5	4.416e-295
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5.35	712.5	4.416e-295
5.35	737.5	4.416e-295
5.35	762.5	4.416e-295
5.35	787.5	4.416e-295
5.35	812.5	4.416e-295
5.35	837.5	4.416e-295
5.35	862.5	4.416e-295

5.35	887.5	4.416e-295
5.35	912.5	4.416e-295
5.35	937.5	4.416e-295
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5.35	1387.5	4.416e-295
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5.35	1462.5	4.416e-295
5.35	1487.5	4.416e-295
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5.35	1562.5	4.416e-295
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5.35	1762.5	4.416e-295
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5.35	2012.5	4.416e-295
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5.45	237.5	9.052e-004
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5.45	337.5	1.881e-004
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5.55	1962.5	4.416e-295
5.55	1987.5	4.416e-295
5.55	2012.5	2.511e-014
5.65	12.5	3.446e-004
5.65	37.5	1.126e-003
5.65	62.5	2.042e-003
5.65	87.5	1.822e-003
5.65	112.5	2.433e-003
5.65	137.5	2.875e-003
5.65	162.5	1.463e-003
5.65	187.5	1.496e-003
5.65	212.5	1.373e-003
5.65	237.5	1.123e-003
5.65	262.5	8.390e-004
5.65	287.5	5.590e-004
5.65	312.5	4.416e-295
5.65	337.5	3.169e-004
5.65	362.5	1.728e-004
5.65	387.5	4.416e-295
5.65	412.5	8.051e-005

5.65	437.5	4.416e-295
5.65	462.5	3.234e-005
5.65	487.5	4.416e-295
5.65	512.5	4.416e-295
5.65	537.5	1.275e-005
5.65	562.5	4.416e-295
5.65	587.5	5.767e-006
5.65	612.5	4.416e-295
5.65	637.5	4.416e-295
5.65	662.5	2.712e-006
5.65	687.5	4.416e-295
5.65	712.5	4.416e-295
5.65	737.5	8.651e-007
5.65	762.5	4.416e-295
5.65	787.5	4.416e-295
5.65	812.5	4.416e-295
5.65	837.5	2.136e-007
5.65	862.5	4.416e-295
5.65	887.5	4.416e-295
5.65	912.5	4.416e-295
5.65	937.5	1.025e-007
5.65	962.5	4.416e-295
5.65	987.5	4.416e-295
5.65	1012.5	4.416e-295
5.65	1037.5	4.416e-295
5.65	1062.5	4.119e-008
5.65	1087.5	4.416e-295
5.65	1112.5	4.416e-295
5.65	1137.5	4.416e-295
5.65	1162.5	4.416e-295
5.65	1187.5	1.382e-008
5.65	1212.5	4.416e-295
5.65	1237.5	4.416e-295
5.65	1262.5	4.416e-295
5.65	1287.5	4.416e-295
5.65	1312.5	4.416e-295
5.65	1337.5	3.927e-009
5.65	1362.5	4.416e-295
5.65	1387.5	4.416e-295
5.65	1412.5	4.416e-295
5.65	1437.5	4.416e-295
5.65	1462.5	4.416e-295
5.65	1487.5	1.029e-009
5.65	1512.5	4.416e-295
5.65	1537.5	4.416e-295

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5.65	1587.5	4.416e-295
5.65	1612.5	4.416e-295
5.65	1637.5	4.416e-295
5.65	1662.5	2.055e-010
5.65	1687.5	4.416e-295
5.65	1712.5	4.416e-295
5.65	1737.5	4.416e-295
5.65	1762.5	4.416e-295
5.65	1787.5	4.416e-295
5.65	1812.5	4.416e-295
5.65	1837.5	4.416e-295
5.65	1862.5	4.416e-295
5.65	1887.5	2.197e-011
5.65	1912.5	4.416e-295
5.65	1937.5	4.416e-295
5.65	1962.5	4.416e-295
5.65	1987.5	4.416e-295
5.65	2012.5	1.384e-013
5.75	12.5	2.770e-004
5.75	37.5	9.108e-004
5.75	62.5	1.694e-003
5.75	87.5	1.559e-003
5.75	112.5	2.142e-003
5.75	137.5	2.629e-003
5.75	162.5	1.396e-003
5.75	187.5	1.478e-003
5.75	212.5	1.411e-003
5.75	237.5	1.206e-003
5.75	262.5	9.458e-004
5.75	287.5	6.637e-004
5.75	312.5	4.416e-295
5.75	337.5	3.974e-004
5.75	362.5	2.293e-004
5.75	387.5	4.416e-295
5.75	412.5	1.132e-004
5.75	437.5	4.416e-295
5.75	462.5	4.816e-005
5.75	487.5	4.416e-295
5.75	512.5	4.416e-295
5.75	537.5	2.017e-005
5.75	562.5	4.416e-295
5.75	587.5	9.744e-006
5.75	612.5	4.416e-295
5.75	637.5	4.416e-295

5.75	662.5	4.932e-006
5.75	687.5	4.416e-295
5.75	712.5	4.416e-295
5.75	737.5	1.734e-006
5.75	762.5	4.416e-295
5.75	787.5	4.416e-295
5.75	812.5	4.416e-295
5.75	837.5	4.885e-007
5.75	862.5	4.416e-295
5.75	887.5	4.416e-295
5.75	912.5	4.416e-295
5.75	937.5	2.734e-007
5.75	962.5	4.416e-295
5.75	987.5	4.416e-295
5.75	1012.5	4.416e-295
5.75	1037.5	4.416e-295
5.75	1062.5	1.244e-007
5.75	1087.5	4.416e-295
5.75	1112.5	4.416e-295
5.75	1137.5	4.416e-295
5.75	1162.5	4.416e-295
5.75	1187.5	4.656e-008
5.75	1212.5	4.416e-295
5.75	1237.5	4.416e-295
5.75	1262.5	4.416e-295
5.75	1287.5	4.416e-295
5.75	1312.5	4.416e-295
5.75	1337.5	1.456e-008
5.75	1362.5	4.416e-295
5.75	1387.5	4.416e-295
5.75	1412.5	4.416e-295
5.75	1437.5	4.416e-295
5.75	1462.5	4.416e-295
5.75	1487.5	4.210e-009
5.75	1512.5	4.416e-295
5.75	1537.5	4.416e-295
5.75	1562.5	4.416e-295
5.75	1587.5	4.416e-295
5.75	1612.5	4.416e-295
5.75	1637.5	4.416e-295
5.75	1662.5	9.225e-010
5.75	1687.5	4.416e-295
5.75	1712.5	4.416e-295
5.75	1737.5	4.416e-295
5.75	1762.5	4.416e-295

5.75	1787.5	4.416e-295
5.75	1812.5	4.416e-295
5.75	1837.5	4.416e-295
5.75	1862.5	4.416e-295
5.75	1887.5	1.084e-010
5.75	1912.5	4.416e-295
5.75	1937.5	4.416e-295
5.75	1962.5	4.416e-295
5.75	1987.5	4.416e-295
5.75	2012.5	7.228e-013
5.85	12.5	2.226e-004
5.85	37.5	7.353e-004
5.85	62.5	1.397e-003
5.85	87.5	1.320e-003
5.85	112.5	1.861e-003
5.85	137.5	2.366e-003
5.85	162.5	1.307e-003
5.85	187.5	1.431e-003
5.85	212.5	1.418e-003
5.85	237.5	1.265e-003
5.85	262.5	1.039e-003
5.85	287.5	7.678e-004
5.85	312.5	4.416e-295
5.85	337.5	4.858e-004
5.85	362.5	2.974e-004
5.85	387.5	4.416e-295
5.85	412.5	1.559e-004
5.85	437.5	4.416e-295
5.85	462.5	7.062e-005
5.85	487.5	4.416e-295
5.85	512.5	4.416e-295
5.85	537.5	3.158e-005
5.85	562.5	4.416e-295
5.85	587.5	1.641e-005
5.85	612.5	4.416e-295
5.85	637.5	4.416e-295
5.85	662.5	8.978e-006
5.85	687.5	4.416e-295
5.85	712.5	4.416e-295
5.85	737.5	3.481e-006
5.85	762.5	4.416e-295
5.85	787.5	4.416e-295
5.85	812.5	4.416e-295
5.85	837.5	1.109e-006
5.85	862.5	4.416e-295

5.85	887.5	4.416e-295
5.85	912.5	4.416e-295
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5.85	987.5	4.416e-295
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5.85	1087.5	4.416e-295
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5.85	1162.5	4.416e-295
5.85	1187.5	1.493e-007
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5.85	1237.5	4.416e-295
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5.85	1287.5	4.416e-295
5.85	1312.5	4.416e-295
5.85	1337.5	5.123e-008
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5.85	1387.5	4.416e-295
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5.85	1437.5	4.416e-295
5.85	1462.5	4.416e-295
5.85	1487.5	1.632e-008
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5.85	1787.5	4.416e-295
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5.85	1937.5	4.416e-295
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5.85	1987.5	4.416e-295

5.85	2012.5	3.565e-012
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5.95	87.5	4.416e-295
5.95	112.5	4.416e-295
5.95	137.5	4.416e-295
5.95	162.5	4.416e-295
5.95	187.5	4.416e-295
5.95	212.5	4.416e-295
5.95	237.5	4.416e-295
5.95	262.5	4.416e-295
5.95	287.5	4.416e-295
5.95	312.5	4.416e-295
5.95	337.5	4.416e-295
5.95	362.5	4.416e-295
5.95	387.5	4.416e-295
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5.95	537.5	4.416e-295
5.95	562.5	4.416e-295
5.95	587.5	4.416e-295
5.95	612.5	4.416e-295
5.95	637.5	4.416e-295
5.95	662.5	4.416e-295
5.95	687.5	4.416e-295
5.95	712.5	4.416e-295
5.95	737.5	4.416e-295
5.95	762.5	4.416e-295
5.95	787.5	4.416e-295
5.95	812.5	4.416e-295
5.95	837.5	4.416e-295
5.95	862.5	4.416e-295
5.95	887.5	4.416e-295
5.95	912.5	4.416e-295
5.95	937.5	4.416e-295
5.95	962.5	4.416e-295
5.95	987.5	4.416e-295
5.95	1012.5	4.416e-295
5.95	1037.5	4.416e-295
5.95	1062.5	4.416e-295
5.95	1087.5	4.416e-295

5.95	1112.5	4.416e-295
5.95	1137.5	4.416e-295
5.95	1162.5	4.416e-295
5.95	1187.5	4.416e-295
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5.95	1262.5	4.416e-295
5.95	1287.5	4.416e-295
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5.95	1337.5	4.416e-295
5.95	1362.5	4.416e-295
5.95	1387.5	4.416e-295
5.95	1412.5	4.416e-295
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5.95	1487.5	4.416e-295
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6.05	237.5	1.283e-003
6.05	262.5	1.127e-003
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6.05	337.5	5.834e-004
6.05	362.5	3.740e-004
6.05	387.5	4.416e-295
6.05	412.5	2.114e-004
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6.05	487.5	4.416e-295
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6.05	562.5	4.416e-295
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6.05	637.5	4.416e-295
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6.05	1312.5	4.416e-295

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6.05	1862.5	4.416e-295
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6.15	712.5	4.416e-295
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6.15	937.5	4.373e-006
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6.15	1287.5	4.416e-295
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6.15	1537.5	4.416e-295

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6.15	1762.5	4.416e-295
6.15	1787.5	4.416e-295
6.15	1812.5	4.416e-295
6.15	1837.5	4.416e-295
6.15	1862.5	4.416e-295
6.15	1887.5	9.122e-009
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6.15	1962.5	4.416e-295
6.15	1987.5	4.416e-295
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6.25	137.5	1.655e-003
6.25	162.5	1.020e-003
6.25	187.5	1.184e-003
6.25	212.5	1.277e-003
6.25	237.5	1.261e-003
6.25	262.5	1.201e-003
6.25	287.5	1.020e-003
6.25	312.5	4.416e-295
6.25	337.5	7.637e-004
6.25	362.5	5.482e-004
6.25	387.5	4.416e-295
6.25	412.5	3.519e-004
6.25	437.5	4.416e-295
6.25	462.5	1.949e-004
6.25	487.5	4.416e-295
6.25	512.5	4.416e-295
6.25	537.5	1.094e-004
6.25	562.5	4.416e-295
6.25	587.5	7.443e-005
6.25	612.5	4.416e-295
6.25	637.5	4.416e-295

6.25	662.5	5.132e-005
6.25	687.5	4.416e-295
6.25	712.5	4.416e-295
6.25	737.5	2.591e-005
6.25	762.5	4.416e-295
6.25	787.5	4.416e-295
6.25	812.5	4.416e-295
6.25	837.5	1.117e-005
6.25	862.5	4.416e-295
6.25	887.5	4.416e-295
6.25	912.5	4.416e-295
6.25	937.5	1.008e-005
6.25	962.5	4.416e-295
6.25	987.5	4.416e-295
6.25	1012.5	4.416e-295
6.25	1037.5	4.416e-295
6.25	1062.5	6.538e-006
6.25	1087.5	4.416e-295
6.25	1112.5	4.416e-295
6.25	1137.5	4.416e-295
6.25	1162.5	4.416e-295
6.25	1187.5	3.549e-006
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6.35	162.5	4.416e-295
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6.35	312.5	4.416e-295
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6.35	362.5	4.416e-295
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6.35	437.5	4.416e-295
6.35	462.5	4.416e-295
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6.35	2012.5	4.416e-295
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6.45	162.5	8.980e-004
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6.45	237.5	1.240e-003
6.45	262.5	1.180e-003
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6.45	362.5	6.382e-004
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6.45	412.5	4.336e-004
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6.45	462.5	2.578e-004
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6.45	737.5	4.751e-005
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6.45	887.5	4.416e-295
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6.55	162.5	7.680e-004
6.55	187.5	8.855e-004

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6.55	362.5	6.804e-004
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6.55	462.5	3.110e-004
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6.55	512.5	4.416e-295
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6.55	787.5	4.416e-295
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6.85	262.5	5.661e-004
6.85	287.5	5.519e-004
6.85	312.5	4.416e-295
6.85	337.5	5.000e-004
6.85	362.5	4.549e-004
6.85	387.5	4.416e-295
6.85	412.5	3.576e-004
6.85	437.5	4.416e-295
6.85	462.5	2.631e-004
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6.85	512.5	4.416e-295
6.85	537.5	2.058e-004
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6.85	587.5	1.958e-004
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6.85	737.5	1.249e-004
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7.05	112.5	2.626e-004
7.05	137.5	3.999e-004
7.05	162.5	2.744e-004
7.05	187.5	3.504e-004

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7.05	237.5	4.707e-004
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7.05	637.5	4.416e-295
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7.05	737.5	1.908e-004
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7.15	412.5	2.518e-004

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7.15	887.5	4.416e-295
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7.25	1787.5	4.416e-295
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7.45	662.5	4.416e-295
7.45	687.5	4.416e-295
7.45	712.5	4.416e-295
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7.45	837.5	3.819e-005
7.45	862.5	4.416e-295
7.45	887.5	4.416e-295
7.45	912.5	4.416e-295
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7.45	987.5	4.416e-295
7.45	1012.5	4.416e-295
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7.45	1087.5	4.416e-295

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8.65	987.5	4.416e-295
8.65	1012.5	4.416e-295
8.65	1037.5	4.416e-295
8.65	1062.5	4.416e-295
8.65	1087.5	4.416e-295
8.65	1112.5	4.416e-295
8.65	1137.5	4.416e-295
8.65	1162.5	4.416e-295
8.65	1187.5	4.416e-295
8.65	1212.5	4.416e-295
8.65	1237.5	4.416e-295
8.65	1262.5	4.416e-295
8.65	1287.5	4.416e-295
8.65	1312.5	4.416e-295
8.65	1337.5	4.416e-295
8.65	1362.5	4.416e-295
8.65	1387.5	4.416e-295
8.65	1412.5	4.416e-295
8.65	1437.5	4.416e-295
8.65	1462.5	4.416e-295
8.65	1487.5	4.416e-295
8.65	1512.5	4.416e-295
8.65	1537.5	4.416e-295

8.65	1562.5	4.416e-295
8.65	1587.5	4.416e-295
8.65	1612.5	4.416e-295
8.65	1637.5	4.416e-295
8.65	1662.5	4.416e-295
8.65	1687.5	4.416e-295
8.65	1712.5	4.416e-295
8.65	1737.5	4.416e-295
8.65	1762.5	4.416e-295
8.65	1787.5	4.416e-295
8.65	1812.5	4.416e-295
8.65	1837.5	4.416e-295
8.65	1862.5	4.416e-295
8.65	1887.5	4.416e-295
8.65	1912.5	4.416e-295
8.65	1937.5	4.416e-295
8.65	1962.5	4.416e-295
8.65	1987.5	4.416e-295
8.65	2012.5	4.416e-295
8.75	12.5	4.416e-295
8.75	37.5	4.416e-295
8.75	62.5	4.416e-295
8.75	87.5	4.416e-295
8.75	112.5	4.416e-295
8.75	137.5	4.416e-295
8.75	162.5	4.416e-295
8.75	187.5	4.416e-295
8.75	212.5	4.416e-295
8.75	237.5	4.416e-295
8.75	262.5	4.416e-295
8.75	287.5	4.416e-295
8.75	312.5	4.416e-295
8.75	337.5	4.416e-295
8.75	362.5	4.416e-295
8.75	387.5	4.416e-295
8.75	412.5	4.416e-295
8.75	437.5	4.416e-295
8.75	462.5	4.416e-295
8.75	487.5	4.416e-295
8.75	512.5	4.416e-295
8.75	537.5	4.416e-295
8.75	562.5	4.416e-295
8.75	587.5	4.416e-295
8.75	612.5	4.416e-295
8.75	637.5	4.416e-295

8.75	662.5	4.416e-295
8.75	687.5	4.416e-295
8.75	712.5	4.416e-295
8.75	737.5	4.416e-295
8.75	762.5	4.416e-295
8.75	787.5	4.416e-295
8.75	812.5	4.416e-295
8.75	837.5	4.416e-295
8.75	862.5	4.416e-295
8.75	887.5	4.416e-295
8.75	912.5	4.416e-295
8.75	937.5	4.416e-295
8.75	962.5	4.416e-295
8.75	987.5	4.416e-295
8.75	1012.5	4.416e-295
8.75	1037.5	4.416e-295
8.75	1062.5	4.416e-295
8.75	1087.5	4.416e-295
8.75	1112.5	4.416e-295
8.75	1137.5	4.416e-295
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8.75	1187.5	4.416e-295
8.75	1212.5	4.416e-295
8.75	1237.5	4.416e-295
8.75	1262.5	4.416e-295
8.75	1287.5	4.416e-295
8.75	1312.5	4.416e-295
8.75	1337.5	4.416e-295
8.75	1362.5	4.416e-295
8.75	1387.5	4.416e-295
8.75	1412.5	4.416e-295
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8.75	1487.5	4.416e-295
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8.75	1537.5	4.416e-295
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8.75	1587.5	4.416e-295
8.75	1612.5	4.416e-295
8.75	1637.5	4.416e-295
8.75	1662.5	4.416e-295
8.75	1687.5	4.416e-295
8.75	1712.5	4.416e-295
8.75	1737.5	4.416e-295
8.75	1762.5	4.416e-295

8.75	1787.5	4.416e-295
8.75	1812.5	4.416e-295
8.75	1837.5	4.416e-295
8.75	1862.5	4.416e-295
8.75	1887.5	4.416e-295
8.75	1912.5	4.416e-295
8.75	1937.5	4.416e-295
8.75	1962.5	4.416e-295
8.75	1987.5	4.416e-295
8.75	2012.5	4.416e-295
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8.85	62.5	4.416e-295
8.85	87.5	4.416e-295
8.85	112.5	4.416e-295
8.85	137.5	4.416e-295
8.85	162.5	4.416e-295
8.85	187.5	4.416e-295
8.85	212.5	4.416e-295
8.85	237.5	4.416e-295
8.85	262.5	4.416e-295
8.85	287.5	4.416e-295
8.85	312.5	4.416e-295
8.85	337.5	4.416e-295
8.85	362.5	4.416e-295
8.85	387.5	4.416e-295
8.85	412.5	4.416e-295
8.85	437.5	4.416e-295
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8.85	512.5	4.416e-295
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8.85	562.5	4.416e-295
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8.85	612.5	4.416e-295
8.85	637.5	4.416e-295
8.85	662.5	4.416e-295
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8.85	712.5	4.416e-295
8.85	737.5	4.416e-295
8.85	762.5	4.416e-295
8.85	787.5	4.416e-295
8.85	812.5	4.416e-295
8.85	837.5	4.416e-295
8.85	862.5	4.416e-295

8.85	887.5	4.416e-295
8.85	912.5	4.416e-295
8.85	937.5	4.416e-295
8.85	962.5	4.416e-295
8.85	987.5	4.416e-295
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8.85	1062.5	4.416e-295
8.85	1087.5	4.416e-295
8.85	1112.5	4.416e-295
8.85	1137.5	4.416e-295
8.85	1162.5	4.416e-295
8.85	1187.5	4.416e-295
8.85	1212.5	4.416e-295
8.85	1237.5	4.416e-295
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8.85	1287.5	4.416e-295
8.85	1312.5	4.416e-295
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8.85	1387.5	4.416e-295
8.85	1412.5	4.416e-295
8.85	1437.5	4.416e-295
8.85	1462.5	4.416e-295
8.85	1487.5	4.416e-295
8.85	1512.5	4.416e-295
8.85	1537.5	4.416e-295
8.85	1562.5	4.416e-295
8.85	1587.5	4.416e-295
8.85	1612.5	4.416e-295
8.85	1637.5	4.416e-295
8.85	1662.5	4.416e-295
8.85	1687.5	4.416e-295
8.85	1712.5	4.416e-295
8.85	1737.5	4.416e-295
8.85	1762.5	4.416e-295
8.85	1787.5	4.416e-295
8.85	1812.5	4.416e-295
8.85	1837.5	4.416e-295
8.85	1862.5	4.416e-295
8.85	1887.5	4.416e-295
8.85	1912.5	4.416e-295
8.85	1937.5	4.416e-295
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8.85	1987.5	4.416e-295

8.85	2012.5	4.416e-295
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8.95	187.5	4.416e-295
8.95	212.5	4.416e-295
8.95	237.5	4.416e-295
8.95	262.5	4.416e-295
8.95	287.5	4.416e-295
8.95	312.5	4.416e-295
8.95	337.5	4.416e-295
8.95	362.5	4.416e-295
8.95	387.5	4.416e-295
8.95	412.5	4.416e-295
8.95	437.5	4.416e-295
8.95	462.5	4.416e-295
8.95	487.5	4.416e-295
8.95	512.5	4.416e-295
8.95	537.5	4.416e-295
8.95	562.5	4.416e-295
8.95	587.5	4.416e-295
8.95	612.5	4.416e-295
8.95	637.5	4.416e-295
8.95	662.5	4.416e-295
8.95	687.5	4.416e-295
8.95	712.5	4.416e-295
8.95	737.5	4.416e-295
8.95	762.5	4.416e-295
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8.95	887.5	4.416e-295
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8.95	937.5	4.416e-295
8.95	962.5	4.416e-295
8.95	987.5	4.416e-295
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8.95	1087.5	4.416e-295

8.95	1112.5	4.416e-295
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8.95	1212.5	4.416e-295
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8.95	1262.5	4.416e-295
8.95	1287.5	4.416e-295
8.95	1312.5	4.416e-295
8.95	1337.5	4.416e-295
8.95	1362.5	4.416e-295
8.95	1387.5	4.416e-295
8.95	1412.5	4.416e-295
8.95	1437.5	4.416e-295
8.95	1462.5	4.416e-295
8.95	1487.5	4.416e-295
8.95	1512.5	4.416e-295
8.95	1537.5	4.416e-295
8.95	1562.5	4.416e-295
8.95	1587.5	4.416e-295
8.95	1612.5	4.416e-295
8.95	1637.5	4.416e-295
8.95	1662.5	4.416e-295
8.95	1687.5	4.416e-295
8.95	1712.5	4.416e-295
8.95	1737.5	4.416e-295
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8.95	1787.5	4.416e-295
8.95	1812.5	4.416e-295
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8.95	1862.5	4.416e-295
8.95	1887.5	4.416e-295
8.95	1912.5	4.416e-295
8.95	1937.5	4.416e-295
8.95	1962.5	4.416e-295
8.95	1987.5	4.416e-295
8.95	2012.5	4.416e-295

Integral: 1.000e+000

DEAGGREGATION: Summary by Source

Spectral Period: PGA
Amplitude: 0.02

Annual Frequency of Exceedance: 6.641e-004

Magnitude		Distance		Epsilon		Contribution	Source Region
Mode	Mean	Mode	Mean	Mode	Mean	%	
CEUS Gridded - AB							USGS 2008 Central and Eastern US
4.75	5.71	137.50	194.25	-2.10	-0.04	45.46	
CEUS Gridded - J							USGS 2008 Central and Eastern US
4.75	5.55	62.50	157.90	-2.10	-0.06	40.54	
New Madrid - Composite							USGS 2008 New Madrid
7.65	7.72	1137.50	1178.90	0.90	1.40	13.99	

DEAGGREGATION: Conditional Mean Spectrum by Source

Period													
	0.01	0.05	0.1	0.2	0.3	0.4	0.5	0.75	1	2	3	4	
CEUS Gridded - AB (USGS 2008 Central and Eastern US)	0.020000	0.035022	0.042882	0.042153	0.031772	0.025129	0.020966	0.014714	0.011111	0.003883	0.002258	0.001520	
CEUS Gridded - J (USGS 2008 Central and Eastern US)	0.020000	0.038037	0.045635	0.041784	0.030189	0.023088	0.018775	0.012709	0.009379	0.003094	0.001811	0.001229	
New Madrid - Composite (USGS 2008 New Madrid)	0.020000	0.032510	0.042026	0.038568	0.029203	0.025609	0.023128	0.019089	0.016494	0.012152	0.008457	0.006401	
Conditional Mean Spectrum (all sources)	0.020000	0.035893	0.043878	0.041502	0.030771	0.024369	0.020380	0.014514	0.011162	0.004720	0.002944	0.002085	

Activity Rate Report for EZ-FRISK 7.62 Build 000

Source: CEUS Gridded - AB
Region: USGS 2008 Central and Eastern US
Magnitude Scale: MbLg

MAGNITUDE, MbLg	RATE
5.000	2.499e-001
5.100	2.006e-001
5.200	1.609e-001
5.300	1.290e-001
5.400	1.033e-001
5.500	8.262e-002
5.600	6.598e-002
5.700	5.259e-002
5.800	4.181e-002
5.900	3.314e-002
6.000	2.616e-002
6.100	2.053e-002
6.200	1.601e-002
6.300	1.236e-002
6.400	9.429e-003
6.500	7.065e-003
6.600	5.162e-003
6.700	3.609e-003
6.800	2.434e-003
6.900	1.515e-003
7.000	8.312e-004
7.100	4.464e-004
7.200	2.179e-004
7.300	4.735e-005

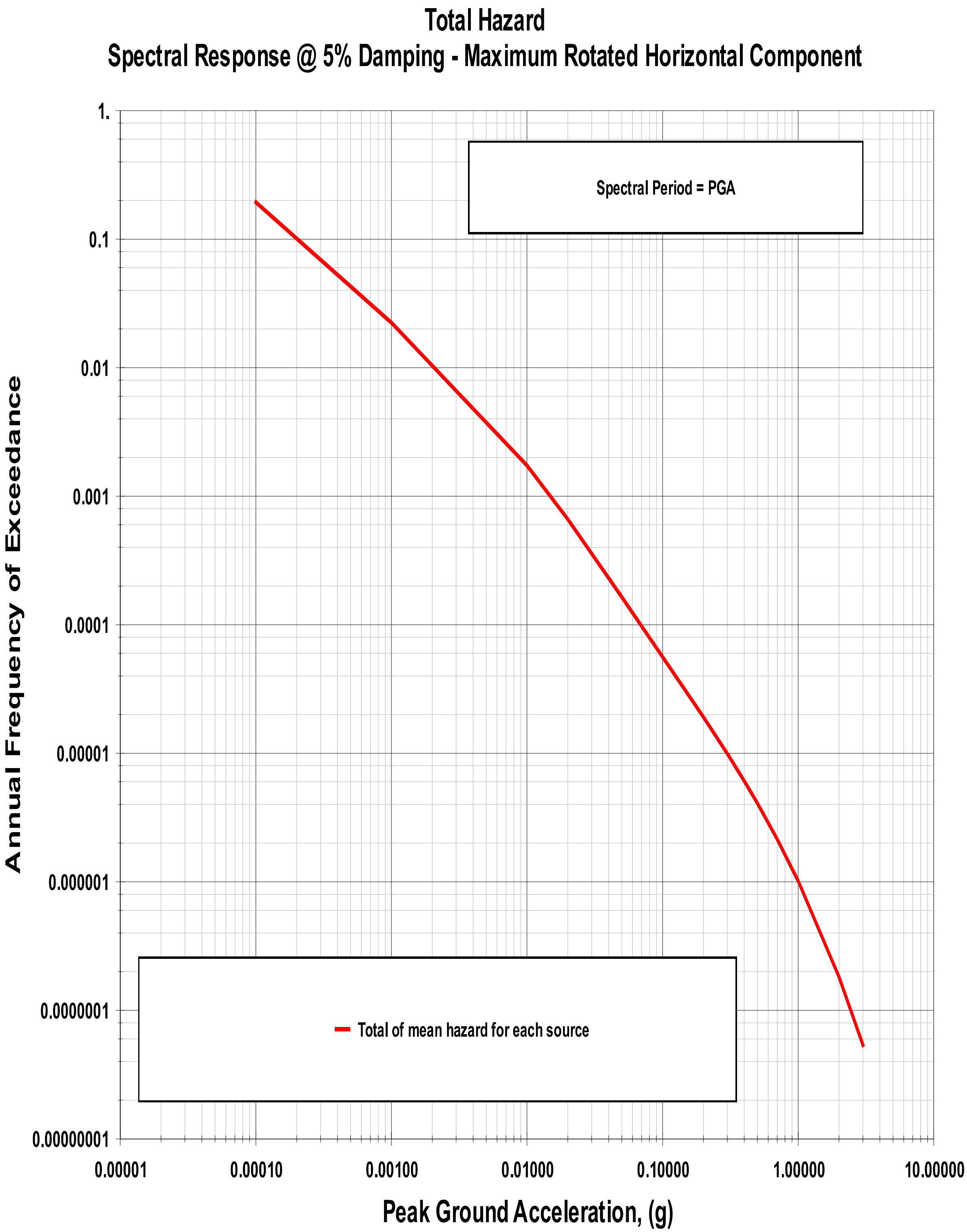
Source: CEUS Gridded - J
Region: USGS 2008 Central and Eastern US
Magnitude Scale: MbLg

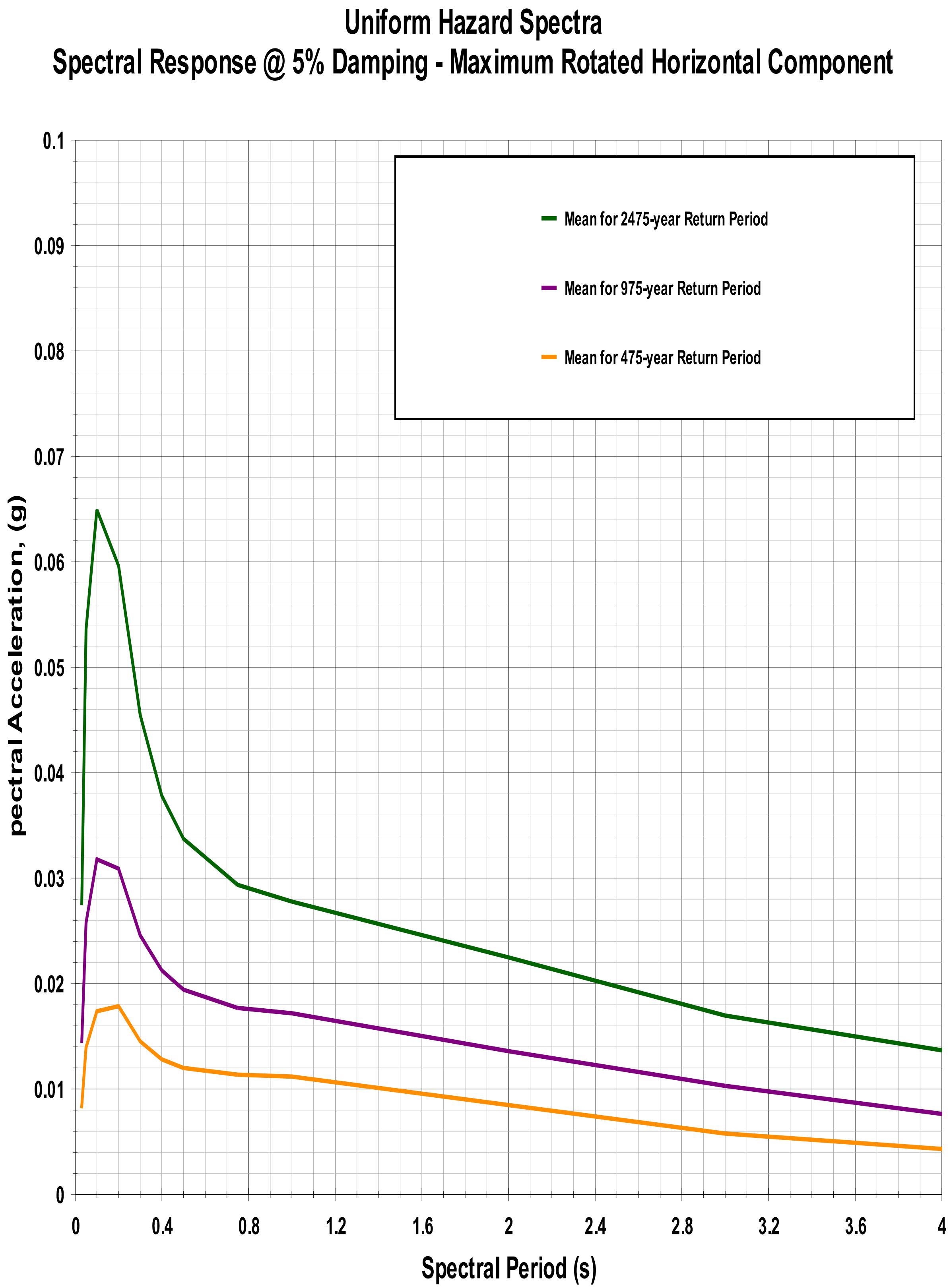
MAGNITUDE, MbLg	RATE
5.000	2.479e-001
5.100	1.986e-001
5.200	1.589e-001
5.300	1.270e-001
5.400	1.013e-001
5.500	8.062e-002
5.600	6.398e-002
5.700	5.059e-002
5.800	3.981e-002
5.900	3.114e-002

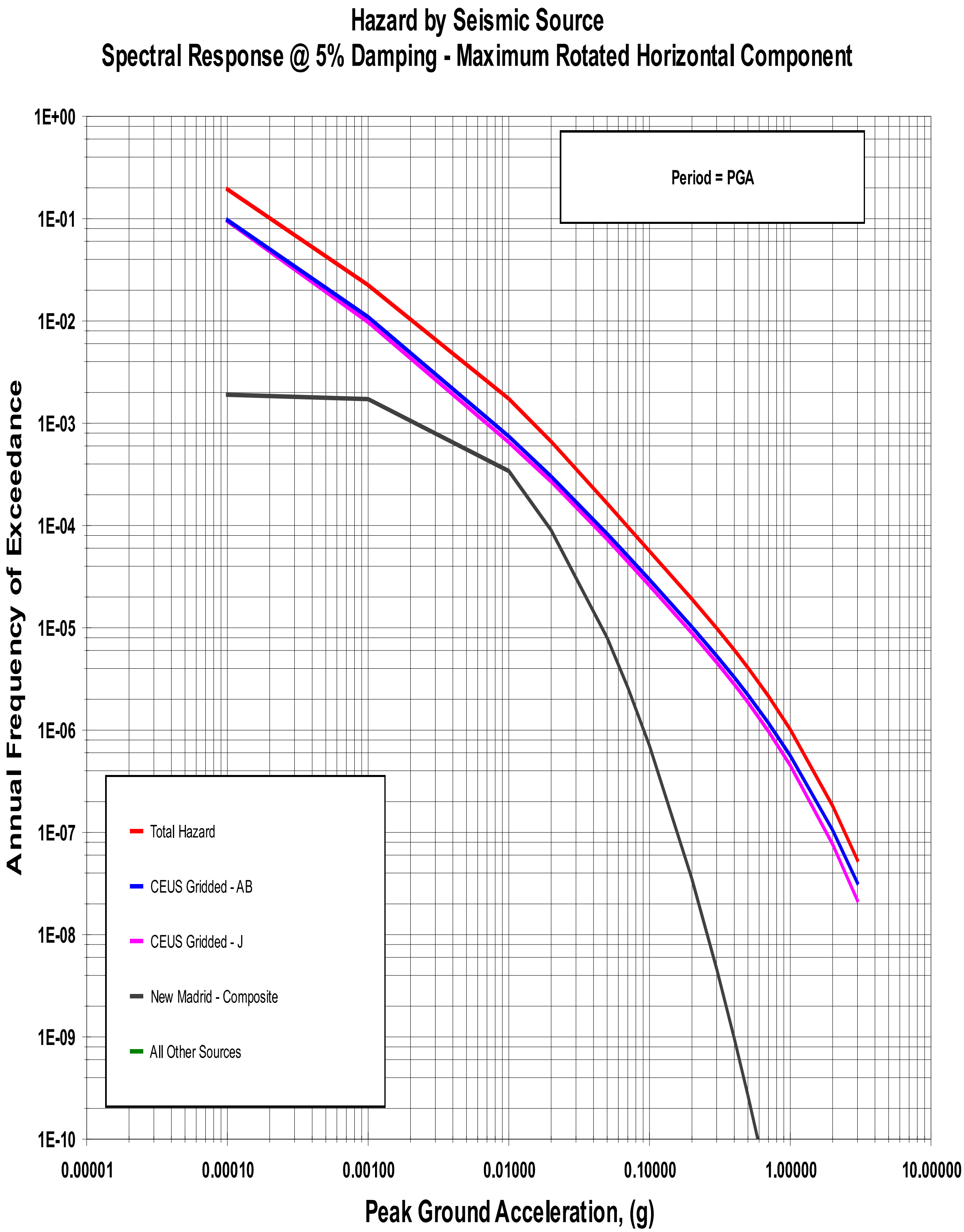
6.000	2.415e-002
6.100	1.853e-002
6.200	1.401e-002
6.300	1.036e-002
6.400	7.428e-003
6.500	5.097e-003
6.600	3.271e-003
6.700	1.835e-003
6.800	1.081e-003
6.900	5.194e-004
7.000	2.270e-004
7.100	5.077e-005

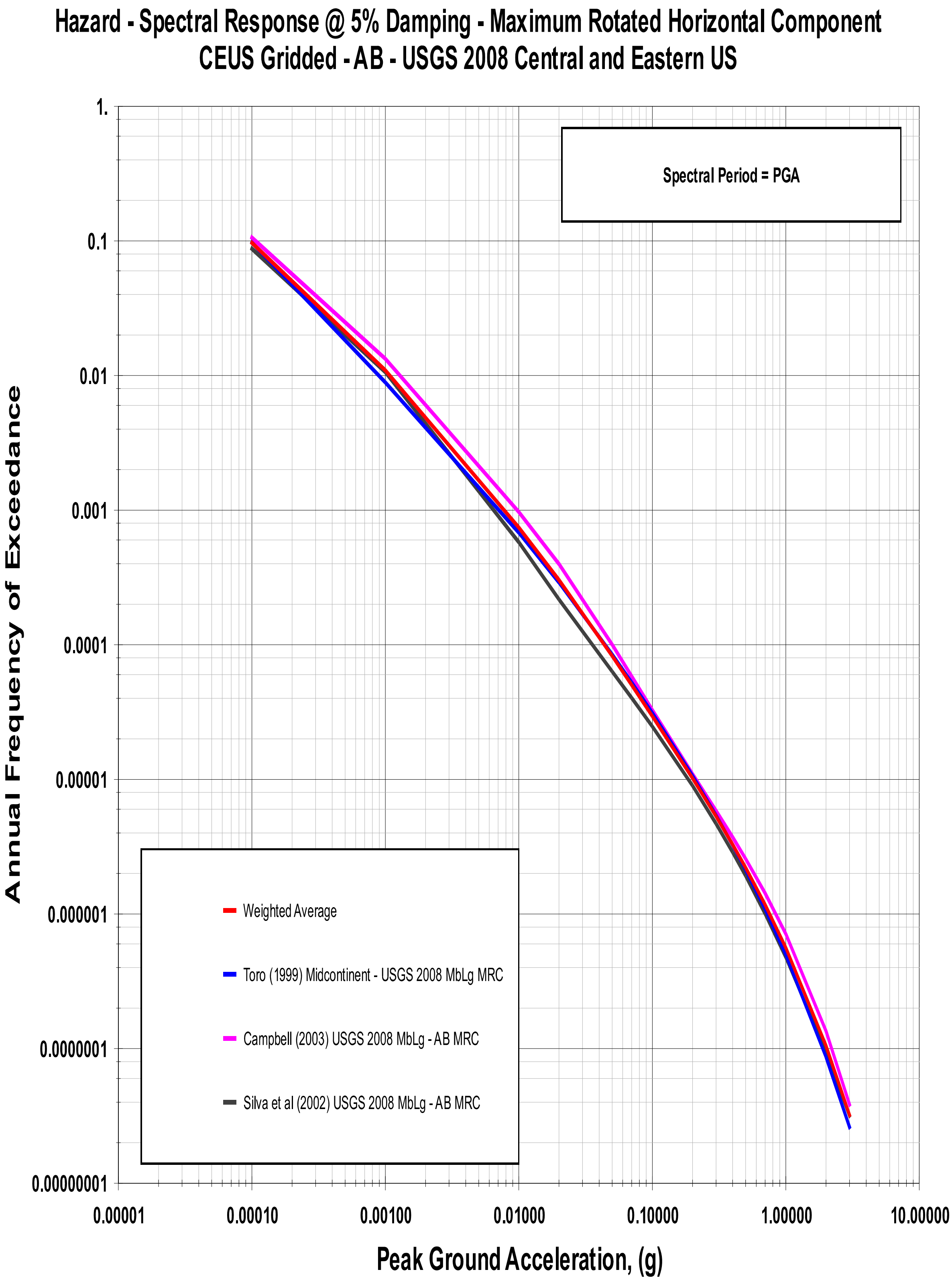
Source: New Madrid - Composite
Region: USGS 2008 New Madrid
Magnitude Scale: Moment Magnitude

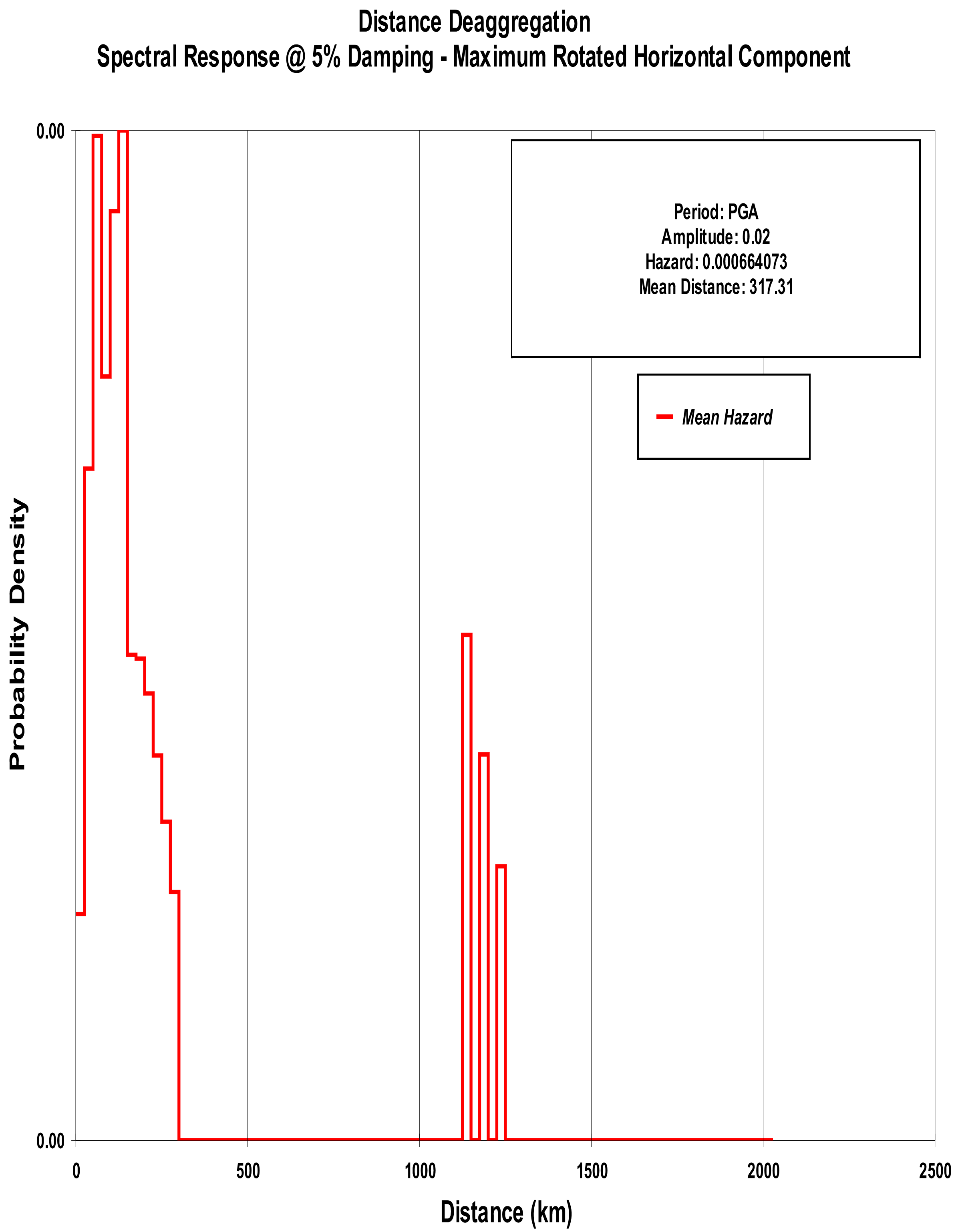
MAGNITUDE, Mw	RATE
7.090	1.900e-003
7.290	1.860e-003
7.490	1.562e-003
7.590	1.103e-003
7.690	1.103e-003
7.790	2.865e-004
7.890	2.465e-004
7.990	2.450e-004

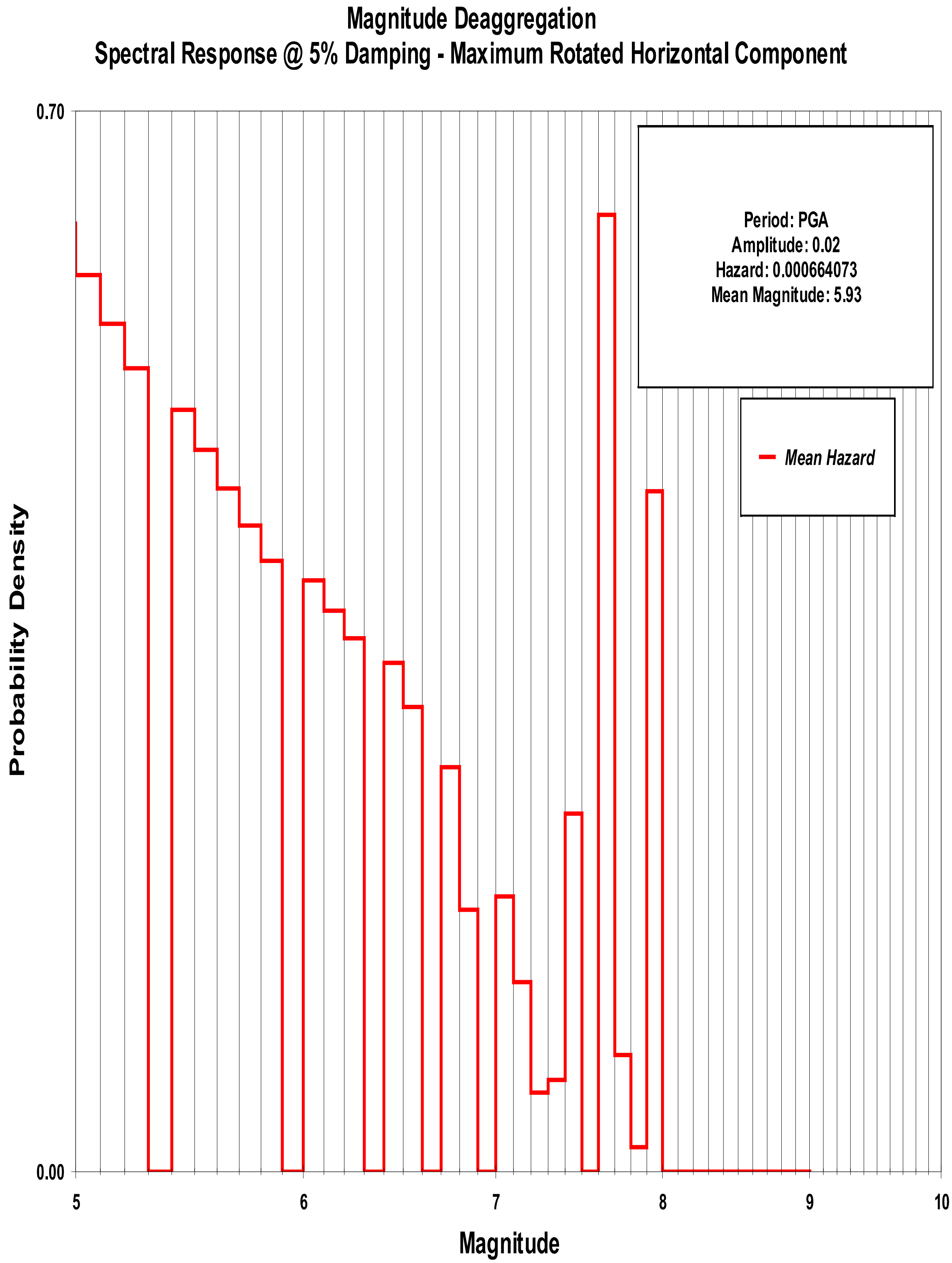

Total Hazard
Spectral Response @ 5% Damping - Maximum Rotated Horizontal Component
Spectral Period = PGA
Total of mean hazard for each source
Annual Frequency of Exceedance
Peak Ground Acceleration, (g)
1.
0.1
0.01
0.001
0.0001
0.00001
0.000001
0.0000001
0.00000001
0.00001
0.00010
0.00100
0.01000
0.10000
1.00000
10.00000


Uniform Hazard Spectra
Spectral Response @ 5% Damping - Maximum Rotated Horizontal Component
Mean for 2475-year Return Period
Mean for 975-year Return Period
Mean for 475-year Return Period
pectral Acceleration, (g)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
0.4
0.8
1.2
1.6
2
2.4
2.8
3.2
3.6
4
Spectral Period (s)

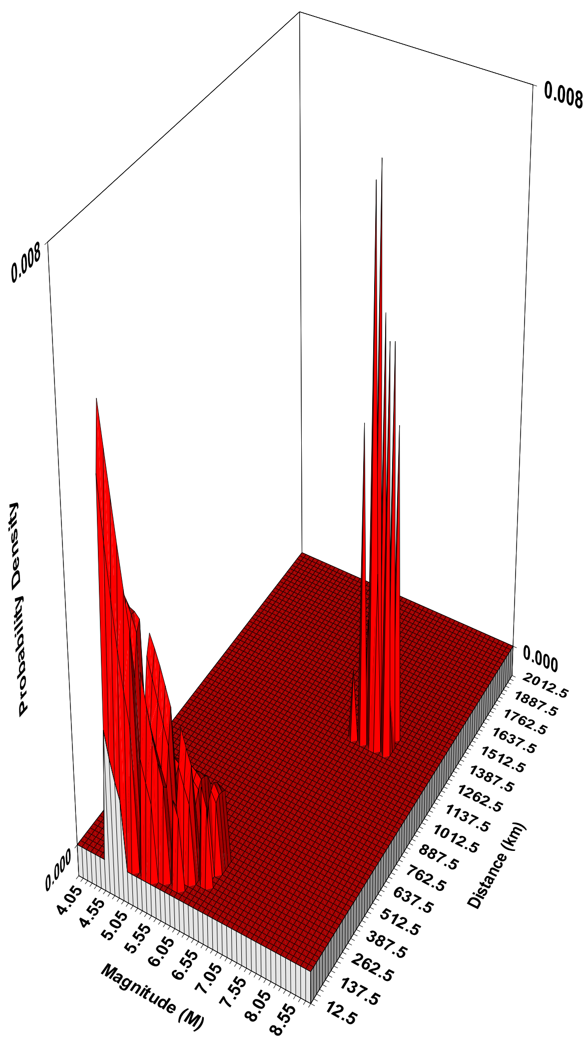

Hazard by Seismic Source
Spectral Response @ 5% Damping - Maximum Rotated Horizontal Component
Period = PGA
Annual Frequency of Exceedance
1E+00
1E-01
1E-02
1E-03
1E-04
1E-05
1E-06
1E-07
1E-08
1E-09
1E-10
Total Hazard
CEUS Gridded - AB
CEUS Gridded - J
New Madrid - Composite
All Other Sources
0.00001
0.00010
0.00100
0.01000
0.10000
1.00000
10.00000
Peak Ground Acceleration, (g)


Hazard - Spectral Response @ 5% Damping - Maximum Rotated Horizontal Component
CEUS Gridded - AB - USGS 2008 Central and Eastern US
Spectral Period = PGA
Annual Frequency of Exceedance
1.
0.1
0.01
0.001
0.0001
0.00001
0.000001
0.0000001
0.00000001
Weighted Average
Toro (1999) Midcontinent - USGS 2008 MbLg MRC
Campbell (2003) USGS 2008 MbLg - AB MRC
Silva et al (2002) USGS 2008 MbLg - AB MRC
0.00001
0.00010
0.00100
0.01000
0.10000
1.00000
10.00000
Peak Ground Acceleration, (g)


Distance Deaggregation
Spectral Response @ 5% Damping - Maximum Rotated Horizontal Component
Period: PGA
Amplitude: 0.02
Hazard: 0.000664073
Mean Distance: 317.31
Mean Hazard
Probability Density
0.00
0.00
0
500
1000
1500
2000
2500
Distance (km)

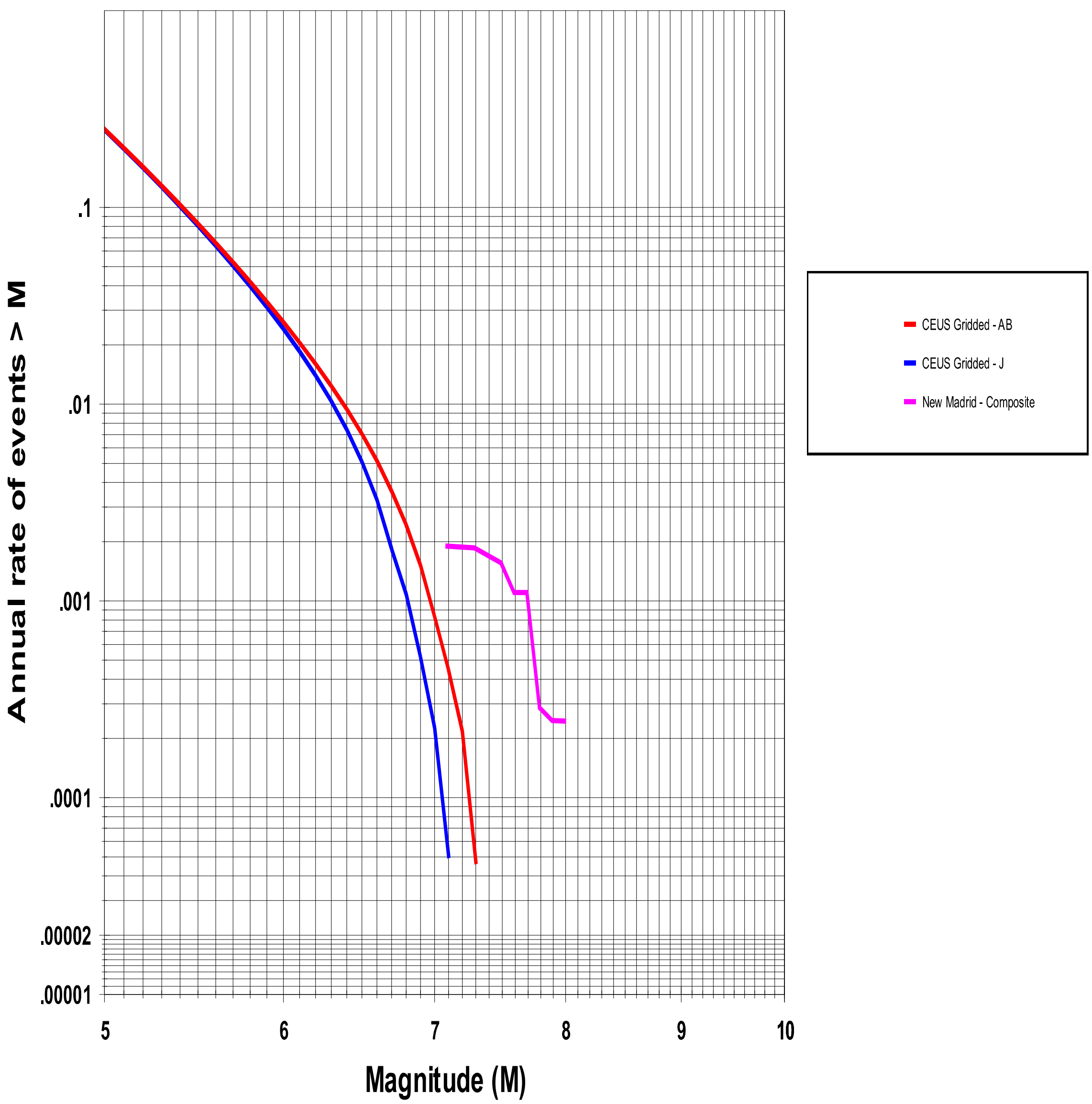

Magnitude Deaggregation
Spectral Response @ 5% Damping - Maximum Rotated Horizontal Component
Probability Density
0.70
0.00
5
6
7
8
9
10
Magnitude
Period: PGA
Amplitude: 0.02
Hazard: 0.000664073
Mean Magnitude: 5.93
Mean Hazard

Magnitude-Distance Deaggregation
Spectral Response @ 5% Damping - Maximum Rotated Horizontal Component

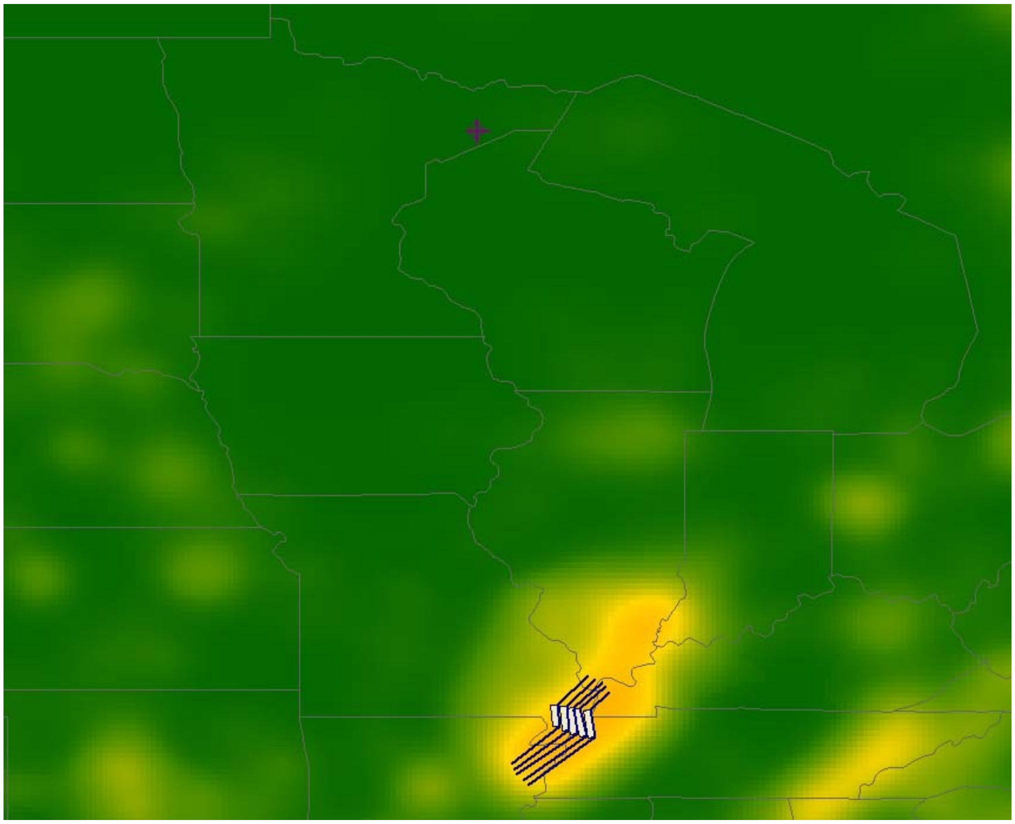


Period: PGA
Amplitude: 0.02
Hazard: 0.000664073
Mean Magnitude: 5.93
Mean Distance: 317.31

Activity Rate by Seismic Source



Note: Magnitudes are shown in the scale used by each source, which do vary.



MAP LEGEND

Site

Faults

Included

Not included

Activity Rate

(rate of M>5

0.0e+000

1.0e-005

5.0e-005

1.0e-004

5.0e-004

1.0e+000