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**PRELIMINARY
REPORT OF GEOTECHNICAL
EXPLORATION AND REVIEW**
Shallow LRT Tunnel- Kenilworth Corridor
Southwest Light Rail Transit Project, PEC East
Minneapolis, Minnesota

Report No. 01-05697.02

Date:

August 25, 2014

Prepared for:

Kimley-Horn and Associates, Inc.
Southwest Project Office
6465 Wayzata Boulevard, Suite 500
St. Louis Park, MN 55426





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August 25, 2014

Kimley-Horn and Associates, Inc.
Southwest Project Office
6465 Wayzata Boulevard, Suite 500
St. Louis Park, MN 55426

Attn: Mark C. Bishop, PE

RE: Geotechnical Exploration and Review
Shallow LRT Tunnel- Kenilworth Corridor
Southwest Light Rail Transit Project, PEC East
Minneapolis, Minnesota
Report No. 01-05697.02

Dear Mr. Bishop:

American Engineering Testing, Inc. (AET) is pleased to present the results of the subsurface exploration and testing program performed to date and our associated geotechnical engineering review for the shallow LRT tunnel proposed to be constructed within the Kenilworth area of Minneapolis, Minnesota. This report supersedes the June 24, 2014 report submitted under AET No. 01-05697.02.

In addition to the pdf electronic copy, we are submitting four copies of the report to you.

Sincerely,
American Engineering Testing, Inc.

A handwritten signature in blue ink that reads 'Jeffery K. Voyer' with a long, sweeping underline.

Jeffery K. Voyer, PE
Vice President/Principal Engineer
Phone: (651) 659-1305
Cell: (612) 961-9186
jvoyer@amengtest.com

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SIGNATURE PAGE

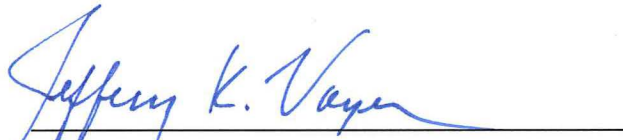
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Kimley-Horn and Associates, Inc.
Southwest Project Office
6465 Wayzata Blvd, Suite 500
St. Louis Park, MN 55426
Attn: Mark Bishop


Prepared by:

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, MN 55114
(651) 659-9001/www.amengtest.com

Authored By:


Jeffery K. Voyer, PE
Vice President/Principal Engineer

Reviewed By:


Gregory R. Reuter, PE, PG
Principal Engineer

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 Minnesota Statute Section 326.02 to 326.15

Name: Jeffrey K. Voyer

Date: 8/25/14 License #: 15928

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1.0 INTRODUCTION

A shallow light rail transit (LRT) tunnel is proposed to allow co-location of a freight rail, pedestrian trail, and light-rail tracks through a segment of the Kenilworth Corridor in Minneapolis, Minnesota. The segment is located between the West Lake Street bridge and the proposed bridges planned to accommodate all three modes over the channel located between Cedar Lake and Lake of the Isles. Recommendations for foundation support of those bridges are presented in a separate report. To assist planning and design of this portion of the Southwest LRT, PEC East project, you have authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration/testing program at the site and to perform geotechnical engineering review. This report presents the results of these services and our associated engineering recommendations.

2.0 SCOPE OF SERVICES

AET's services for the SWLRT PEC East project are being performed per our on-going Master Agreement for Continuing Professional Services (January 1, 2011) and our Individual Project Order. The scope relative to the tunnel portion of the project contained in this report consists of the following:

- Drill and sample four standard penetration test (SPT) "bridge" foundation borings which extended to depths of 131 feet to 181 feet. Boring 1230 SV drilled next to the West Lake Street bridge has also been included, which extended to 101½ feet.
- Drill and sample thirteen SPT "track/station" borings which extended to depths of 21 feet to 61 feet.
- Conduct four piezocone penetration test (CPT_u) soundings to depths of about 26 feet to 92 feet to better define stratigraphy in selected areas.
- Install and monitor water levels in twelve piezometers which extended to depths of about

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30 feet. Seven of these piezometers lie north of the channel, where a second shallow tunnel was previously under consideration. We have included those piezometers and the adjacent borings in this report to maintain the full ground-water program and review under this single cover.

- Explore sediment depth and type by means of hand augering/probing from a boat in the Lake of the Isles-Cedar Lake channel.
- Perform soil laboratory index testing.
- Conduct engineering analysis based on the gained data, and prepare this geotechnical engineering report.

These services were intended for geotechnical purposes. The scope was not intended to explore for the presence or extent of environmental contamination.

3.0 PROJECT INFORMATION

This report focuses on the shallow tunnel segment within the Kenilworth Corridor portion of the PEC East project, which lies within East Segment 3. The Kenilworth Corridor is a relatively narrow right-of-way which currently serves a low-volume freight rail line and pedestrian/bike trails. Most of the segment lies between Cedar Lake and Lake of the Isles, which are connected by a man-excavated channel (excavated in the early 1900's). The subject of this report is the shallow tunnel and associated portals proposed between approximate Station 2771+00 at the West Lake Street bridge to approximate Station 2801+00 located just south of the Lake of the Isles-Cedar Lake channel.

The Corridor will need to continue to serve the freight rail line and the pedestrian/bike trail, both of which will remain above grade. The freight rail alignment will be shifted to the northwest. The

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LRT line is then proposed to be constructed within a shallow tunnel located to the southeast of the on-grade freight rail, with the trail located above this. The freight rail and the combined LRT/pedestrian trail will cross the Lake of the Isles – Cedar Lake Channel with side-by-side overpass bridges.

Table 3.0 shows the approximate top of rail (TOR) elevation proposed at each boring and CPT location.

Table 3.0 - Approximate Top of Rail Elevations/Depths

Boring/CPT No.	Boring Surface Elevation	Track 2 Station	Approx. TOR Elevation	Depth to Approx. TOR (ft)
1157 ST	873.1	2771+98	871.2	1.9
1052 ST	873.0	2772+71	868.3	4.7
1140 CT	872.6	2774+26	860.6	12.0
1051 ST	871.1	2775+74	854.2	16.9
1156 ST	871.3	2776+82	852.2	19.1
1139 CT	872.4	2777+14	851.7	20.7
1050 ST	873.0	2778+61	852.4	20.6
1138 CT	873.6	2780+31	850.9	22.7
1049 ST	874.0	2781+94	850.7	23.3
1155 ST	875.2	2782+46	850.6	24.6
1137 CT	874.0	2783+38	850.3	23.7
1048 ST	873.9	2784+84	849.3	24.6
1047 ST	873.6	2788+37	847.6	26.0
1003 SB	872.4	2791+61	846.6	25.8
1004 SB	870.3	2793+70	845.9	24.4
1154 ST	871.8	2794+95	845.6	26.2
1043 ST	870.5	2797+43	849.9	20.6
1153 ST	869.2	2799+86	861.9	7.3

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Boring/CPT No.	Boring Surface Elevation	Track 2 Station	Approx. TOR Elevation	Depth to Approx. TOR (ft)
1042 ST	869.0	2800+81	866.4	2.6
1005 SB	869.1	2801+92	869.9	Fill 0.8

The tunnel structure will be about 36 feet wide and about 24 feet high to accommodate two divided directions of Direct Fixation Track. The bottom of the tunnel structure will be 3 feet lower than the TOR. Because of the need to place the tunnel below the hydrostatic ground-water level, the tunnel is proposed to be constructed within a sheet pile wall/concrete seal “shell” to control water seepage. The shell will be constructed as a series of interior-braced cofferdams which are constructed in segments and designed to resist buoyancy prior to interior dewatering. The final tunnel will include water-proofing measures between the shell and tunnel structure.

The enclosed tunnel segment will be located from Station 2776+00 to 2798+35.9. Portal segments will then be required at each end of the tunnel. The portals will be retained wall trenches, open at the top. The tunnel portals will incorporate Direct Fixation Track. The Direct Fixation Track will include a 30-inch thick structural track slab beneath a rail and concrete plinth, placing the track slab bottom about 3 feet below TOR. An 8-inch thick subballast (aggregate base) will be placed beneath the slab. For ballasted track, the bottom of the ballast zone is a minimum of 2.25 feet below TOR; this is again underlain by 8 inches of subballast.

Maximum allowable differential settlement tolerances established for Direct Fixation Track is ½ inch over 31 feet longitudinal and lateral (cross level variation). These tolerances relate to “geotechnical” settlement following construction, and not construction tolerance or maintenance tolerance. As the above settlement tolerances relate to vertical post-construction movement, we also assume the above tolerances can be applied to differential frost-heave movements.

The stated information represents our current understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted along the Kenilworth Corridor which is included with this report consisted of 25 standard penetration test (SPT) borings, four electronic piezocone penetration test (CPT_u) soundings, three hand samples/geoprobes within the channel, and 12 piezometers. The test locations appear graphically on the figures in Appendix A (the piezometers were located near the SPT boring having a common number).

4.1.1 Standard Penetration Test Borings

The standard penetration test (SPT) methods used are described in Appendix A. The logs of the SPT borings appear in Appendix B. The logs contain information concerning soil layering, soil classification, geologic description, and moisture condition. Relative density or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value). The test locations were measured by AET using GPS (submeter accuracy, but not surveyor accuracy). The boring surface elevations were measured by AET using an engineer's level and rod. These were based on various benchmarks provided to us by the project surveyor (MFRA).

4.1.2 Piezocone Penetration Test Soundings

The CPT_u test method is described in Appendix A. The logs of the CPT_u soundings appear in

Appendix B. The piezocone penetration test (CPT_u) logs are computer-generated plots which include data on tip resistance, sleeve friction, friction ratio, pore pressure, and soil behavior (interpreted estimate of soil classification based on tip resistance and friction ratio). The test locations were measured by AET using GPS (submeter accuracy, but not surveyor accuracy). The sounding surface elevations were measured by AET using an engineer's level and rod. These were based on various benchmarks provided to us by the project surveyor (MFRA).

4.1.3 Channel Sediment Sampling

The sediment in the channel bottom was explored from a boat using hand auger/geoprobe tube sampling. The logs of the recovered samples (which were somewhat limited) appear in Appendix A. The coordinates shown were estimated from spotting (generally center of channel) and measuring from the existing bridge (the coordinates should be considered approximate).

4.1.4 Piezometer Installation and Monitoring

To assist evaluation of the hydrostatic ground-water level through the corridor, thirteen piezometers were installed, twelve as a part of this project and one (MCES P-38) as a part of a past MCES interceptor crossing at 28th Street. However, the MCES piezometer was abandoned by the MCES contractor following the July 28, 2014 water level measurement. The logs of the piezometer installations also appear in Appendix A, following the SPT boring and CPT_u logs.

The piezometers were installed at locations offset from the SPT borings having a common number. Specific location coordinates appear on the piezometer logs and on Table A.1 in Appendix A. The piezometer locations and the top of riser elevations (used as the reference for the water level elevation measurements) were surveyed by MFRA for improved accuracy.

Water level elevation monitoring has been on-going on a weekly basis since October 14, 2013; the results appearing on appended Table A.1.

4.2 Laboratory Testing of Soils

During laboratory classification logging, water content tests were conducted on cohesive soil samples. In addition, the following tests were performed:

- Seven sieve analysis tests, not including hydrometer analysis
- Five sieve analysis tests with hydrometer analysis
- One unconfined compression tests with density
- One Atterberg Limits test
- Two density tests with water content

The test results appear on the individual boring logs, opposite the samples upon which they were performed and/or on the data sheets following the logs.

5.0 SITE CONDITIONS

5.1 General Geology Review

Figure 5.1 shown below is taken from *Surficial Geology of the Twin Cities Metropolitan Area, Minnesota* prepared and published by the Minnesota Geological Survey (MGS). The figure presents the regional geology in and surrounding the Kenilworth Corridor.

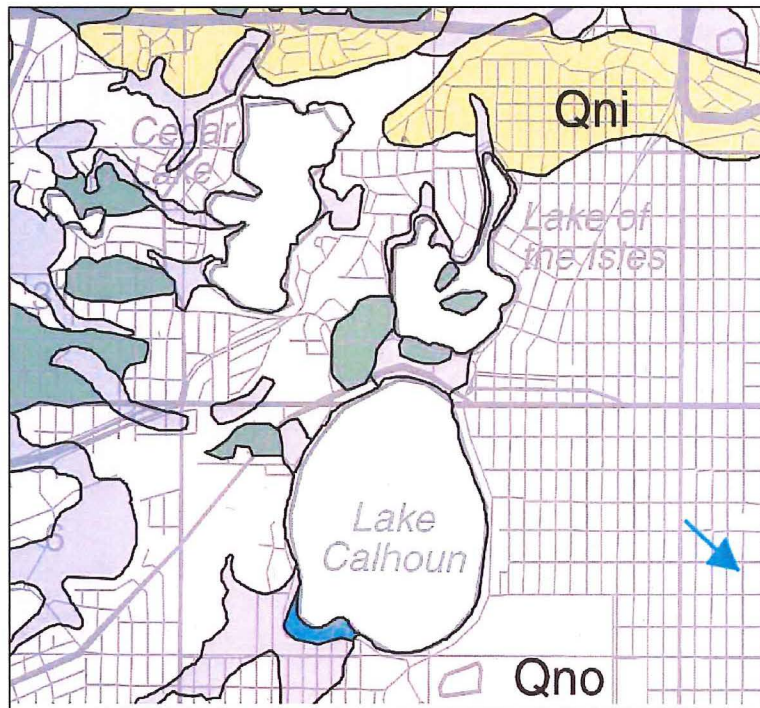


Figure 5.1 – Surficial Geology in Kenilworth Area

The primary deposit in pink (Qno) is described as “outwash” which is sand and gravel deposited glacial meltwater. The blue arrow indicates the glacial meltwater flowed in a southeasterly direction. The tan “Qni” in the north end of the corridor is described as “ice-contact stratified deposit” which is also primarily a sand and gravel deposit, but can be variable with interbeds of loamy and silty soils. Finally, the localized lavender zones shown around Lake Street and 21st Street are “peat and muck” deposits.

5.2 Subsurface Soils

To assist review of in-place soil conditions portrayed by the SPT borings and CPT_u soundings, a series of three fence diagrams (profile view of soils data) have been generated, which we have

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included in Appendix A. The proposed bottom of tunnel (3 feet below top of rail) has also been drawn on the figures (should be considered approximate as minor tweaks have been made since these were drawn). The borings include the Unified Soil Classification System symbol in addition to a graphic symbol. The CPT_u soundings only show the graphic symbol, so the logs should be referred to for the specific soil behavior types. In general, the lined or cross-hatched (darker) symbols represent the finer grained soils and the dotted symbols represent the granular and more pervious soils.

Consistent with the MGS mapping, the primary geology though the Kenilworth Corridor consists of alluvial (water-deposited) sands and gravels with occasional silty sand to silt layers. Man-placed fill usually appears above the alluvium, although the tunnel will penetrate deeper than these fill soils. Based on deep borings placed at Cedar Lake Parkway and at the channel, the alluvial sands extend greater than 120 feet deep. Exceptions to the above generalized profile appear as described below. Again, these exceptions are generally consistent with the MGS mapping.

A buried swamp is located in the vicinity of elevation 850 to 854 feet to the south of the channel, portrayed by Borings 1042 ST and 1153 ST. Borings 1005 SB and 1006 SB indicate the swamp is not present (likely excavated) in the bridge abutment areas, although the swamp presence will impact the LRT portal and may have an impact on the freight rail approach and bridge (yet to be determined).

In the south end of the tunnel near Lake Street, the profile becomes interlayered with silt and clay. A profile view of this geology is shown on page 1 of the fence diagrams. Although some silts/clays may be located beneath the tunnel, the profile view shows there are substantial

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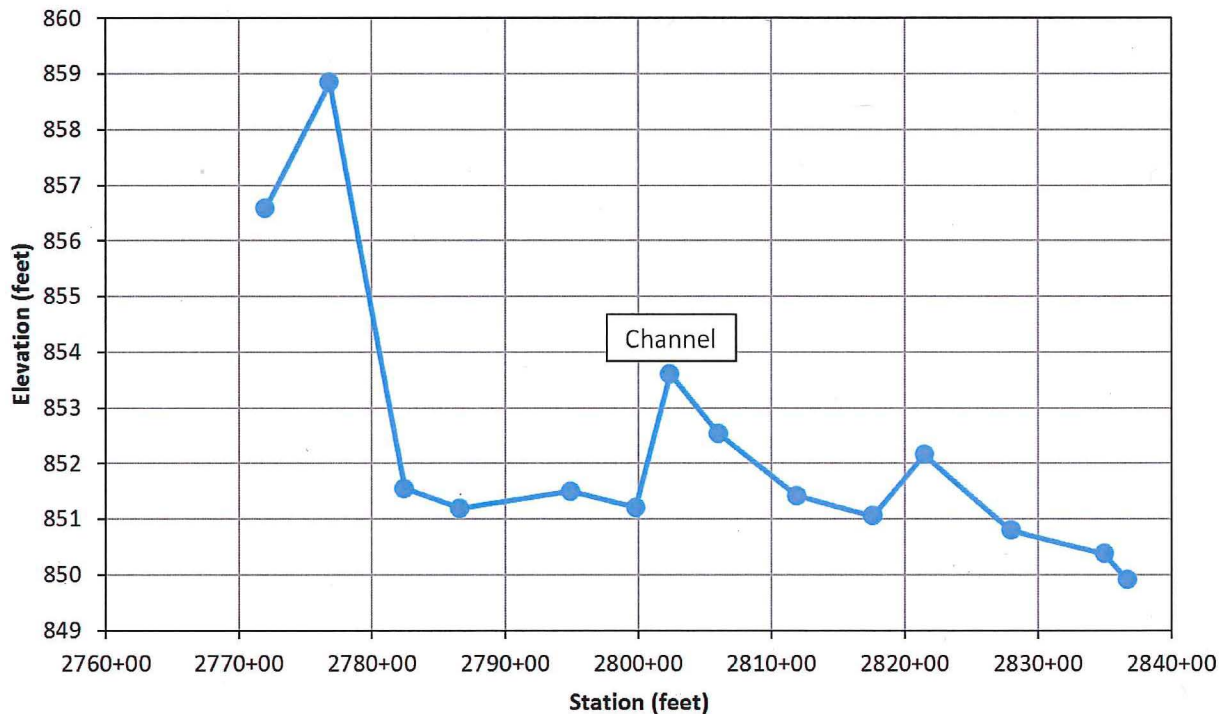
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thicknesses of sand below the tunnel which provide a conduit for flow within the granular media. A similar condition exists in the north end, mainly where the retained wall/open “boat” section is planned for tunnel entry/exit.

A buried swamp is again located in the vicinity of elevation 854 to 859 feet in the most southerly portal area near Lake Street, portrayed by CPT 1140 CT and Boring 1052 ST. This is located to the south of the tunnel area. The swamp thickens in the Lake Street Station area further south. Boring 1157 ST did not include swamp deposits, although fill soils extended to the general swamp bottom elevation, suggesting that the swamp was likely excavated in the local existing bridge area.

5.3 Ground Water

Ground-water levels have been measured on a weekly basis in the 13 piezometers since October 14. These measured levels provide a better indication of the hydrostatic ground-water level than those recorded in the boring boreholes, and are the basis of our review. The average water levels measured to date since October 14 are shown on Figure 5.3.



**Figure 5.3 – Profile View of Average Water Level Measurements (SW to NE),
for measurements taken between October 14, 2013 and August 25, 2014**

The data shows a general ground-water level gradient from southwest to northeast. This gradient is supported by the water levels measured beyond the Kenilworth Area (e.g., piezometer in Beltline area to the southwest showing a water level in the vicinity of elevation 874 feet and borings in the Penn Avenue Station area having water levels below elevation 842 feet). The ground surface elevation also generally follows the gradient.

There does not appear to be a significant gradient in the channel area in the direction perpendicular to the proposed tunnel as the channel has essentially balanced the Cedar Lake and Lake of the Isles lake levels to a common elevation.

Figure 5.3 supports the fact that the channel and lakes feed the ground-water level rather than the ground-water level feeding the open water areas. Except for the higher levels in the Lake Street area, where water is migrating from the southwest and perhaps being somewhat held up on finer grained soils, the ground-water levels in the core of the corridor located between the lakes has hydrostatic levels deeper than the channel and lake levels. The lakes and channel take on surface runoff, which then infiltrates into the granular alluvial deposit and migrates away from the channel.

6.0 RECOMMENDATIONS

6.1 Soil Support Suitability Discussion

Most of the soils which will support the tunnels and portals will be competent alluvial granular soils (sands to sands with silt, having varying gravel content). In the south end, alluvial silts and possibly clays are expected. Where the portal trenches become shallower and in the bridge approach areas, existing fill is in-place. The existing fill can be expected to support the track system, provided compressible swamp deposits are not buried beneath the fill.

There are two locations where buried swamp deposits are present beneath proposed track grade. These are located in the following areas:

- South portal area near Lake Street (approximate Station 2772+50 to 2775+00)
- South channel bridge approach area (approximate Station 2799+00 to 2801+50)

The above noted areas could be improved with an excavate/refill correction approach, although we anticipate that this process may be impractical due to space limitations (i.e., excavations would need to be oversized). Therefore, these track systems may need to be supported on driven piles. The track in the Lake Street area could then be a continuation of the pile foundation system

which will be needed for support of the vertical circulation structure serving the Lake Street bridge. The south bridge approach track may need to be a continuation of the channel bridge and associated retaining wall systems.

6.2 Track Subgrade Preparation Outside of Tunnels

6.2.1 Material Definitions

Suitable Grading Material is an environmentally acceptable mineral soil, which can be from the project site, excluding the following soils:

- soils with Unified Classifications of ML, MH, CL, CH,
- soils which have an organic content exceeding 2%
- soils which include debris and/or boulders

The soil must also be capable of attaining the specified compaction level at its current water content or at a water content that can be reasonably scarified, blended, and moisture conditioned to a uniform water content to meet the specified compaction level.

Select Granular Material is defined as soils which meet the requirements of MnDOT Standard Specification 3149.2B2.

6.2.2 Excavation/Select Granular Placement Needs

The Direct Fixation Track within the portal areas will be exposed to freezing temperatures and has tighter movement tolerance requirements than ballasted track. To control frost movements, we recommend that *Select Granular Material* be placed directly beneath the subballast layer in Direct Fixation Track areas. The total thickness of the structural track slab, the subballast layer, and the *Select Granular Material* should be a minimum of 56 inches. Therefore, based on a 30-inch thick structural slab and an 8-inch subballast layer, the *Select Granular Material* should be at least 18 inches thick.

Excavations and subsequent engineered fill placement should maintain minimum lateral

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oversizing of the excavation bottom. This lateral excavation oversizing should be a minimum of $\frac{1}{2}H:1V$. The exception would be if organic soils are present. If excavation sides expose organic soils, the lateral excavation bottom oversize requirement should be increased to at least 1:1.

Looser granular soils should be surface compacted when exposed in a non-saturated excavation bottom. This would apply to the natural sands to silty sands (typically coarse alluvium) having N-values of 8 bpf or lower. In those areas of granular fill, we recommend surface compaction be applied regardless of N-value due to the increased potential for soil variability. Surface compaction should involve at least six passes of a vibratory roller compactor (3 foot minimum drum diameter, minimum static weight of 6 tons). The deflections under the compaction process should be observed for the purpose of evaluating whether unstable soils may still exist within the subgrade. The instability would likely be caused by wet, clayey zones or inclusions within the fill. If unstable zones are detected, they should be subcut and replaced with more favorable granular soils.

6.2.3 Fill Placement and Compaction

Suitable Grading Material fill can be used to re-attain bottom of *Select Granular Material* layer grade in the Direct Fixation Track areas.

The fill should be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 100% of the *standard maximum dry unit weight* per ASTM:D698 (Standard Proctor test). The minimum compaction level can be reduced to 95% for fill placed deeper than 3 feet below the subballast layer. The fill lift thicknesses should be no greater than 12 inches for granular soils and no greater than 8 inches for more clayey/silty soils. The lifts should be thinner than the above if needed to achieve the minimum specified compaction level with the type of

compaction equipment being used.

6.3 Driven Pile Support in Areas of Buried Swamp Deposits

6.3.1 Foundation Type

The borings did not reach bedrock or obvious highly resistant material within the bored depth. In this case, it is preferred to gain pile capacity through a combination of end bearing and side skin friction. Accordingly, 12-inch diameter CIP steel pipe pile is commonly used and was the pile type analyzed. Per normal MnDOT limits, this pile can be designed for a Factored Pile Bearing Resistance value (ϕR_n) of up to 100 tons, assuming a pile wall thickness of 0.250 inches.

6.3.2 Pile Foundation Analysis Methods

Pile bearing resistance versus pile length was analyzed using *DRIVEN* software (FHWA). This program uses the Nordlund method for granular soils and the Tomlinson method for cohesive soils. The granular soil internal friction angle used was based on its relationship to standard penetration test values as presented by Peck, Hanson, and Thorburn (1974), with the N-values being corrected for the influence of the effective overburden pressure. For cohesive soils, we estimated undrained shear strength based on correlations with the SPT data. The “ultimate capacity” determined from this *DRIVEN* analysis is considered the Nominal Resistance of Single Pile in Axial Compression (R_n) using LRFD terminology.

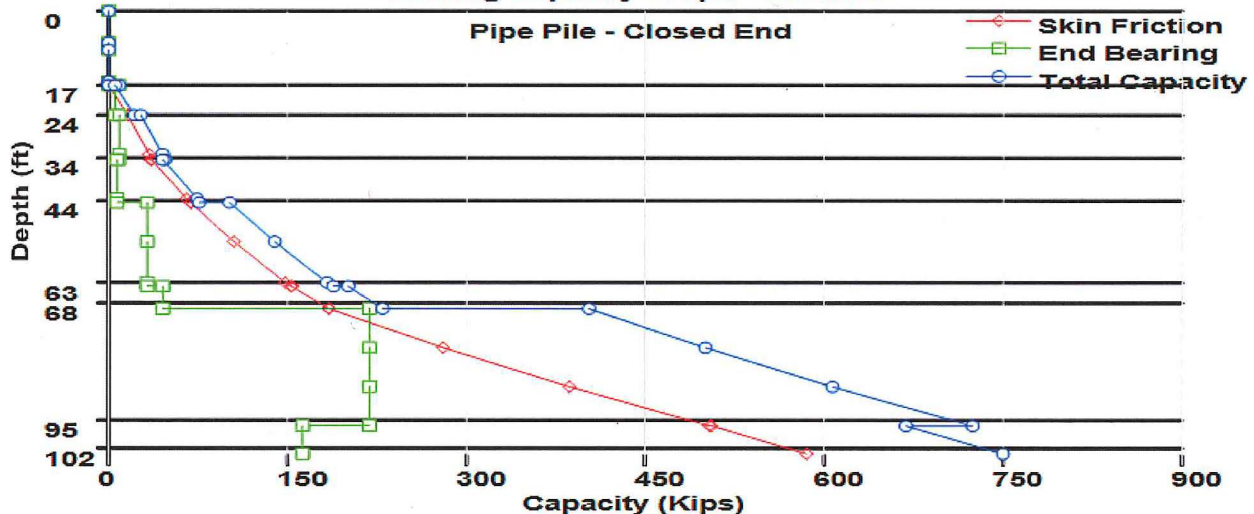
6.3.3 Analysis Results

The nominal resistance (ultimate capacity) needed to be demonstrated in the field depends on the Resistance Factor allowed by the “Condition/Resistance Determination Method” used. A Resistance Factor (ϕ) of 0.65 can be used when dynamic analysis (High Strain Dynamic Pile Testing) is employed and a Resistance Factor (ϕ) of 0.50 should be used when field evaluation of

steel pipe pile is based on the MPF12 driving formula (MnDOT's new formula). We recommend using dynamic analysis for pile evaluation on these bridges. In this case, a nominal resistance of 308 kips would then need to be demonstrated.

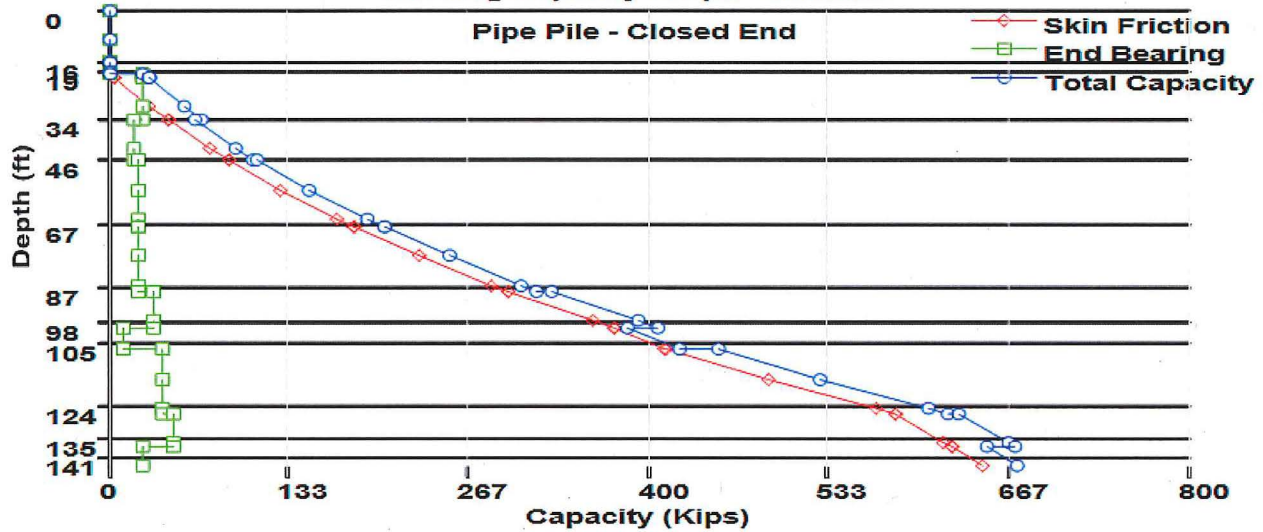
For the south portal area near Lake Street, the analysis was based on Boring 1230 SV. The *DRIVEN* results for 12-inch diameter CIP steel pipe pile at this location is shown on the Figure 6.3.3a. The analysis assumes no resistance contribution from the upper 17 feet. Boring 1052 ST shows the swamp extending to this depth, even though it was not specifically present at Boring 1230 SV (presumed to have been removed in the immediate bridge area).

Figure 6.3.3a – DRIVEN Results, Boring 1230 SV
Bearing Capacity Graph - Ultimate



For the south bridge approach area, we used Boring 1005 SB soil parameters below elevation 849½ feet (which is the elevation of the bottom of the swamp deposit at Boring 1042 ST).

**Figure 6.3.3b – DRIVEN Results, Boring 1005 SB
 Bearing Capacity Graph - Ultimate**



The lengths predicted by the preceding computer analyses in order to attain a nominal resistance of 308 kips are shown in Table 6.3.3. This assumes a design $\phi R_n = 100$ tons and the use of dynamic analysis for the field evaluation method (allowing $\phi = 0.65$).

Table 6.3.3 – Estimated Pile Lengths from DRIVEN Analyses

Location	Boring Used	Assumed Bottom of Swamp Elevation, ft	Estimated Pile Tip Elevation, ft
Portal by Lake Street	1230 SV	854	805
South Bridge Approach	1005 SB	849½	784

*from bottom of footing/seal

6.4 Buoyancy/Uplift Resistance

The sheet pile/concrete seal “cofferdam” system will be installed below the ground-water level

without dewatering. This cofferdam system will need to be designed to properly resist the potential buoyancy forces which will act after the water is removed from within the cofferdam shell. In addition to the weight of the concrete seal and steel members, skin friction between steel piles and the in-place soils can contribute to this resistance.

For resistance to uplift by means of friction at the contact between inorganic soil and vertical steel pile (whether pipe pile or sheet pile), the unit nominal skin resistance can be assumed to be 0.85 ksf. A Resistance Factor (ϕ_{up}) of 0.35 is considered appropriate for use with this unit value.

We understand helical piles are also being considered as needed to assist uplift resistance. Uplift resistance data is normally determined by the specialty contractor, although final lengths and spacing should be reviewed during advanced design relative to the specific soil conditions and geotechnical design assumptions.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Excavation Backsloping

Where excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce side-slope erosion or running which could require slope maintenance. The responsibility for excavation face maintenance in accordance with OSHA requirements should lie with the contractor, and we recommend the construction documents be prepared as such.

7.2 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at the boring/CPT locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by an AET geotechnical engineer or technician during construction to evaluate these potential changes.

Sieve analysis tests should be performed on engineered fill in order to document that materials used meet the intended gradation specifications.

Soil density and Proctor testing should be performed on new fill placed in order to document that project specifications for compaction have been satisfied. If on-site soils are to be re-used, we recommend the fill placement and compaction be monitored on a full-time basis.

8.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, our services have been conducted according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, either express or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix C entitled "Geotechnical Report Limitations and Guidelines for Use."

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
AASHTO Soil Classification System
Figures 1 to 3– Boring Locations
Table A.1 – Piezometer Water Level Data
Figures 4 to 6 – Fence Diagrams

Appendix A
Geotechnical Field Exploration and Testing
Report No. 01-05697.02

A.1 FIELD EXPLORATION

The subsurface conditions were explored by drilling and sampling 25 standard penetration test (SPT) borings, sampling/probing three hand auger borings/probes in the channel, and conducting four piezocone penetration test (CPT_v) soundings. The test locations appear on Figures 1 to 3 preceding the Subsurface Boring Logs in this appendix.

A.2 SOIL BORING SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N₆₀ Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM:D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N₆₀ blow count.

Most newer drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N₆₀ values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

A.3 SOIL BORING CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM:D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM:D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

Visual-manual judgment of the AASHTO Soil Group is also noted as a part of the soil description. A chart presenting details of the AASHTO Soil Classification System is also attached.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

Appendix A
Geotechnical Field Exploration and Testing
Report No. 01-05697.02

A.4 SOIL BORING WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under “Water Level Measurements” on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests

Conducted in general accordance with ASTM:D2216.

A.5.2 Sieve Analysis of Soils (thru #200 Sieve)

Conducted in general conformance with ASTM:D6913, Method A.

A.5.3 Sieve and Hydrometer Analysis of Soils

Conducted in general conformance with ASTM:D422.

A.5.4 Atterberg Limits Test

Conducted in general conformance with ASTM:D4318.

A.5.5 Unconfined Compressive Strength of Cohesive Soil

Conducted in general accordance with ASTM:D2166. Dry density is also determined during this test (sample is trimmed to known diameter and height).

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

A.8 PIEZOCONE PENETRATION TEST (CPT_u) METHODS

The test method is described in ASTM: D5778. This cone test method determines the resistance to penetration of a conical pointed penetrometer and the frictional resistance of a cylindrical sleeve located behind the conical point as the cone is advanced through subsurface soils at a slow and steady rate. The piezocone adds the measurement of pore pressure development behind the tip. The equipment provides a detailed record of cone resistance which is useful for evaluation of site stratigraphy, homogeneity and depth to firm layers, voids or cavities, and other discontinuities. In addition, the cone resistance and friction data can be used to estimate soil classification, and correlations with engineering properties of soils. The pore pressure readings also provide information on soil type and water table depth. Pore pressure dissipation, after a push, can also be monitored for correlation to soil consolidation and permeability. Therefore, the test provides a rapid means for determining subsurface conditions, and can be used for estimating engineering properties of soils for structures, and the behavior of soils under static and dynamic loads.

Appendix A
Geotechnical Field Exploration and Testing
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During the testing, a penetrometer tip with a conical point having a 60° apex angle and a cone base area of 10 cm² or 15cm² is advanced through the soil at a constant rate of 2 cm/sec. The friction sleeve is present on the penetrometer immediately behind the cone tip. The forces exerted on the conical point (cone) and the friction sleeve required to penetrate the soil are measured by electrical methods, at every 2 cm of penetration. The cone resistance (q_t) is calculated by dividing the measured total cone force by the cone base area. The friction sleeve resistance (f_s) is obtained by dividing the measured force exerted on the sleeve by its surface area. Pore pressure is measured directly behind the cone (U_2 position).

A.9 SEISMIC PIEZOCONE METHODS

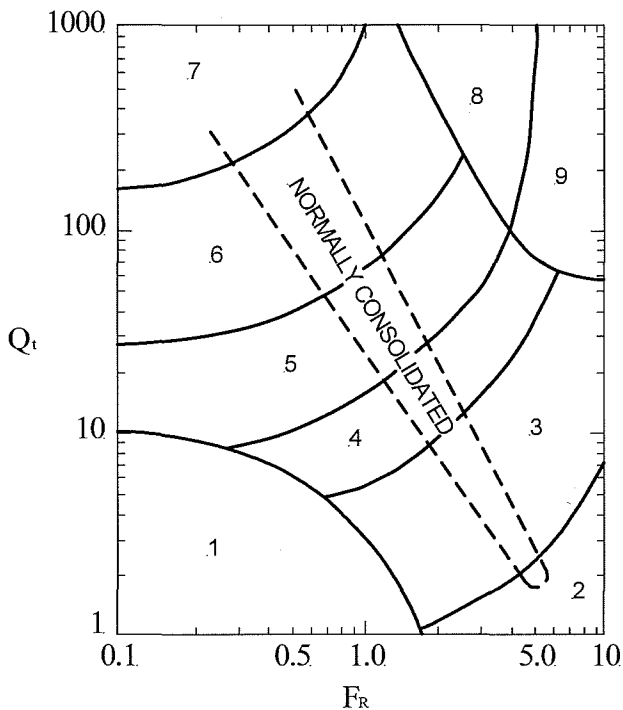
A seismic cone is similar to the standard piezocone (described above) with geophones added to the cone. During a normal piezocone sounding (where tip resistance, sleeve friction and pore pressure are measured), the sounding is paused at various depths where shear (S) wave velocities are measured. The S wave source is a wooded beam pressed against the ground surface. The S waves are generated by striking the beam with a hammer with an electronic trigger. The measured S wave velocities can be used to evaluate the stress-strain modulus of the various soil layers.

A.9 CPT_u SOIL BEHAVIOR TYPE

Soil Classification methods for the Cone Penetration Test is based on correlation charts developed from observations of CPT data and conventional borings. Please note that these classification charts are meant to provide a guide to Soil Behavior Type and should not be used to infer a soil classification based on grain size distribution.

The following chart is used to provide a Soil Behavior Type of the CPT Data.

Figure 1: Robertson CPT 1990 (Soil Behavior Type based on Friction Ratio)



The numbers corresponding to different regions on the Charts represent the following soil behavior types:

1. Sensitive, Fine Grained
2. Organic Soils - Peats
3. Clays - Clay to Silty Clay
4. Silt Mixtures - Clayey Silt to Silty Clay
5. Sand Mixtures - Silty Sand to Sandy Silt
6. Sands - Clean Sand to Silty Sand
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff, Fine Grained

$$Q_t = \frac{q_t - \sigma_{vo}}{\sigma'_{vo}} \quad F_R = \frac{f_s}{q_t - \sigma_{vo}} \times 100\%$$

where . . .

- Q_tnormalized cone resistance
 F_Rnormalized friction ratio

Note that engineering judgment and comparison with conventional borings is especially important in the proper interpretation of CPT data in certain geo-materials.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
AR:	Sample of material obtained from cuttings blown out the top of the borehole during air rotary procedure.
B, H, N:	Size of flush-joint casing
CAS:	Pipe casing, number indicates nominal diameter in inches
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
DP:	Direct push drilling; a 2.125 inch OD outer casing with an inner 1½ inch ID plastic tube is driven continuously into the ground.
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RDA:	Rotary drilling with compressed air and roller or drag bit.
RDF:	Rotary drilling with drilling fluid and roller or drag bit
REC:	In split-spoon (see notes), direct push and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
SS:	Standard split-spoon sampler (steel; 1.5" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
∇:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q _p :	Pocket Penetrometer strength, tsf (<u>approximate</u>)
q _c :	Static cone bearing pressure, tsf
q _u :	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

(Calibrated Hammer Weight)

The standard penetration test consists of driving a split-spoon sampler with a drop hammer (calibrated weight varies to provide N₆₀ values) and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

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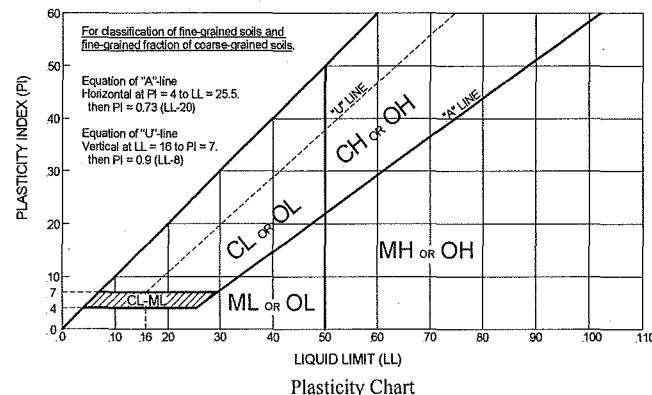
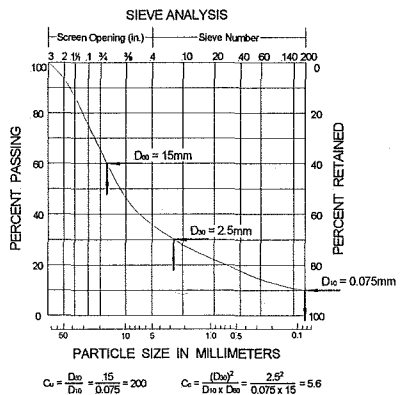


Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification		
				Group Symbol	Group Name ^B	
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 < Cc \leq 3^E$	GW	Well graded gravel ^F	
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel ^F	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^D	Fines classify as ML or MH		GM	Silty gravel ^{F,G,H}
			Fines classify as CL or CH		GC	Clayey gravel ^{F,G,H}
		Sands with Fines more than 12% fines ^D	Fines classify as ML or MH		SM	Silty sand ^{G,H,I}
			Fines classify as CL or CH		SC	Clayey sand ^{G,H,I}
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}	
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}	
		organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OL	Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,O}	
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay ^{K,L,M}
			PI plots below "A" line		MH	Elastic silt ^{K,L,M}
		organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OH	Organic clay ^{K,L,M,P} Organic silt ^{K,L,M,Q}	
Highly organic soil		Primarily organic matter, dark in color, and organic in odor		PT	Peat ^R	

Notes
^ABased on the material passing the 3-in (75-mm) sieve.
^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
^CGravels with 5 to 12% fines require dual symbols:
 GW-GM well-graded gravel with silt
 GW-GC well-graded gravel with clay
 GP-GM poorly graded gravel with silt
 GP-GC poorly graded gravel with clay
^DSands with 5 to 12% fines require dual symbols:
 SW-SM well-graded sand with silt
 SW-SC well-graded sand with clay
 SP-SM poorly graded sand with silt
 SP-SC poorly graded sand with clay

$$F_c Cu = D_{60} / D_{10}, \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.
^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
^HIf fines are organic, add "with organic fines" to group name.
^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
^JIf Atterberg limits plot is hatched area, soils is a CL-ML silty clay.
^KIf soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
^LIf soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.
^N $PI \geq 4$ and plots on or above "A" line.
^O $PI < 4$ or plots below "A" line.
^P PI plots on or above "A" line.
^Q PI plots below "A" line.
^RFiber Content description shown below.



ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Term	Grain Size	Gravel Percentages		Consistency of Plastic Soils		Relative Density of Non-Plastic Soils	
	Particle Size	Term	Percent	Term	N-Value, BPF	Term	N-Value, BPF
Boulders	Over 12"	A Little Gravel	3% - 14%	Very Soft	less than 2	Very Loose	0 - 4
Cobbles	3" to 12"	With Gravel	15% - 29%	Soft	2 - 4	Loose	5 - 10
Gravel	#4 sieve to 3"	Gravelly	30% - 50%	Firm	5 - 8	Medium Dense	11 - 30
Sand	#200 to #4 sieve			Stiff	9 - 15	Dense	31 - 50
Fines (silt & clay)	Pass #200 sieve			Very Stiff	16 - 30	Very Dense	Greater than 50
				Hard	Greater than 30		
	Moisture/Frost Condition (MC Column)	Layering Notes		Peat Description		Organic Description (if no lab tests)	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations: Layers less than 1/2" thick of differing material or color.	Lenses: Pockets or layers greater than 1/2" thick of differing material or color.	Term	Fiber Content (Visual Estimate)	Soils are described as <i>organic</i> , if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. <i>Slightly organic</i> used for borderline cases.	
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").					Root Inclusions	
W (Wet/Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.			Fibric Peat:	Greater than 67%	With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
F (Frozen):	Soil frozen			Hemic Peat:	33 - 67%	Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.
				Sapric Peat:	Less than 33%		

AASHTO SOIL CLASSIFICATION SYSTEM

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

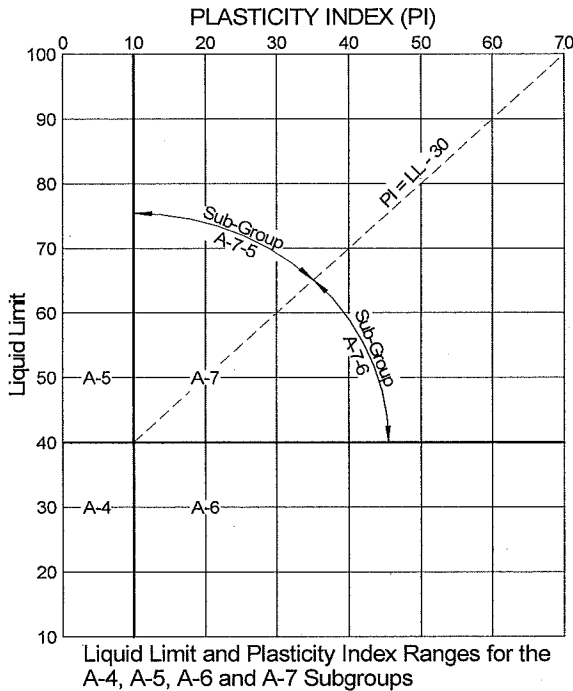
Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35% or less passing No. 200 sieve)							Silt-Clay Materials (More than 35% passing No. 200 sieve)			
	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent passing:											
No. 10 (2.00 mm)	50 max.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 40 (0.425 mm)	30 max.	50 max.	51 min.	.....	.....	.....	.....	.....	.....	.....	.....
No. 200 (0.075 mm)	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of Fraction Passing No. 40 (0.425 mm)											
Liquid limit .....	.....	.....	.....	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity index	6 max.	.....	N.P.	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min.
Usual Types of Significant Constituent Materials	Stone Fragments, Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils	
General Ratings as Subgrade	Excellent to Good							Fair to Poor			

The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30.

Group A-8 soils are organic clays or peat with organic content >5%.



Definitions of Gravel, Sand and Silt-Clay

The terms "gravel", "coarse sand", "fine sand" and "silt-clay", as determinable from the minimum test data required in this classification arrangement and as used in subsequent word descriptions are defined as follows:

GRAVEL - Material passing sieve with 3-in. square openings and retained on the No. 10 sieve.

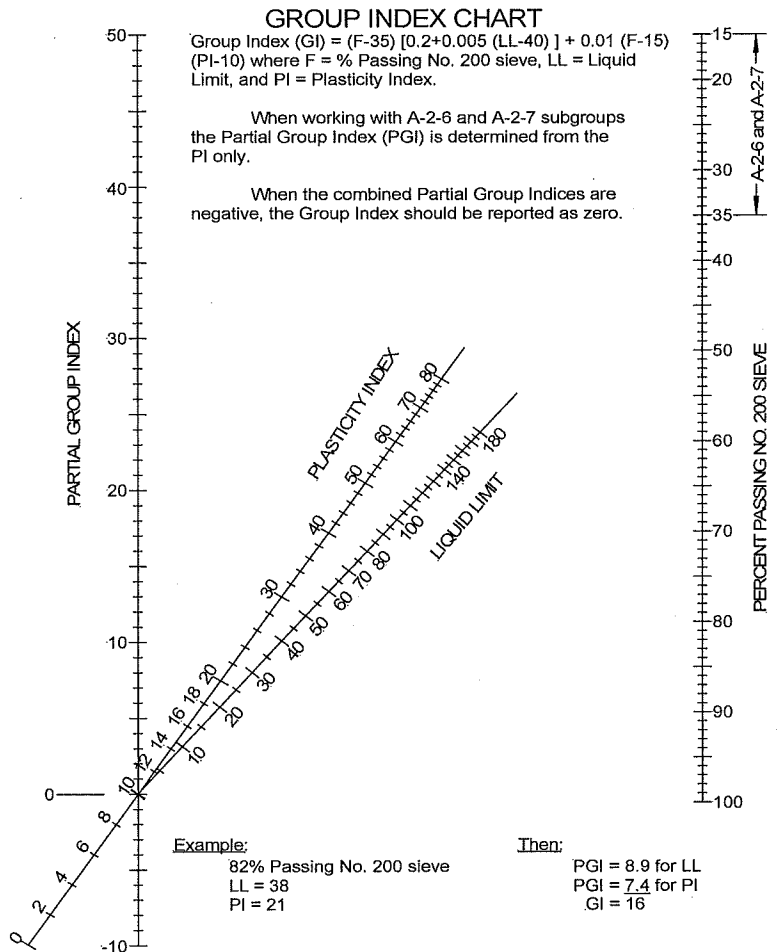
COARSE SAND - Material passing the No. 10 sieve and retained on the No. 40 sieve.

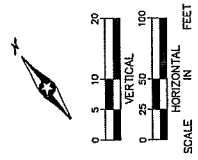
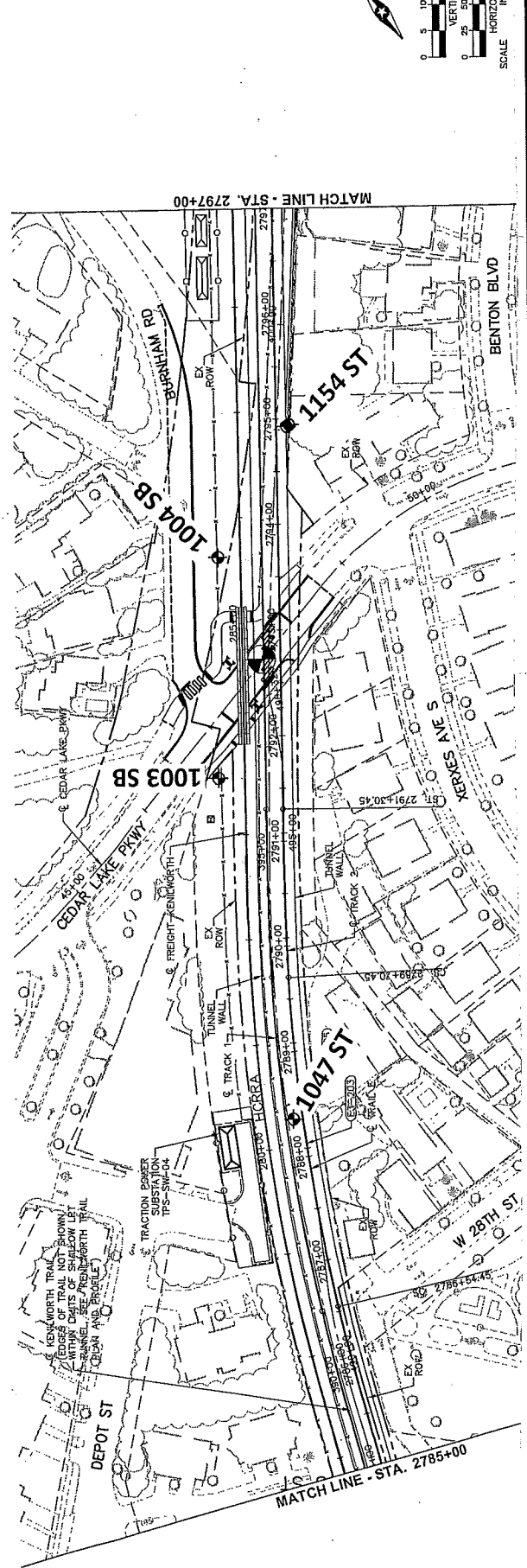
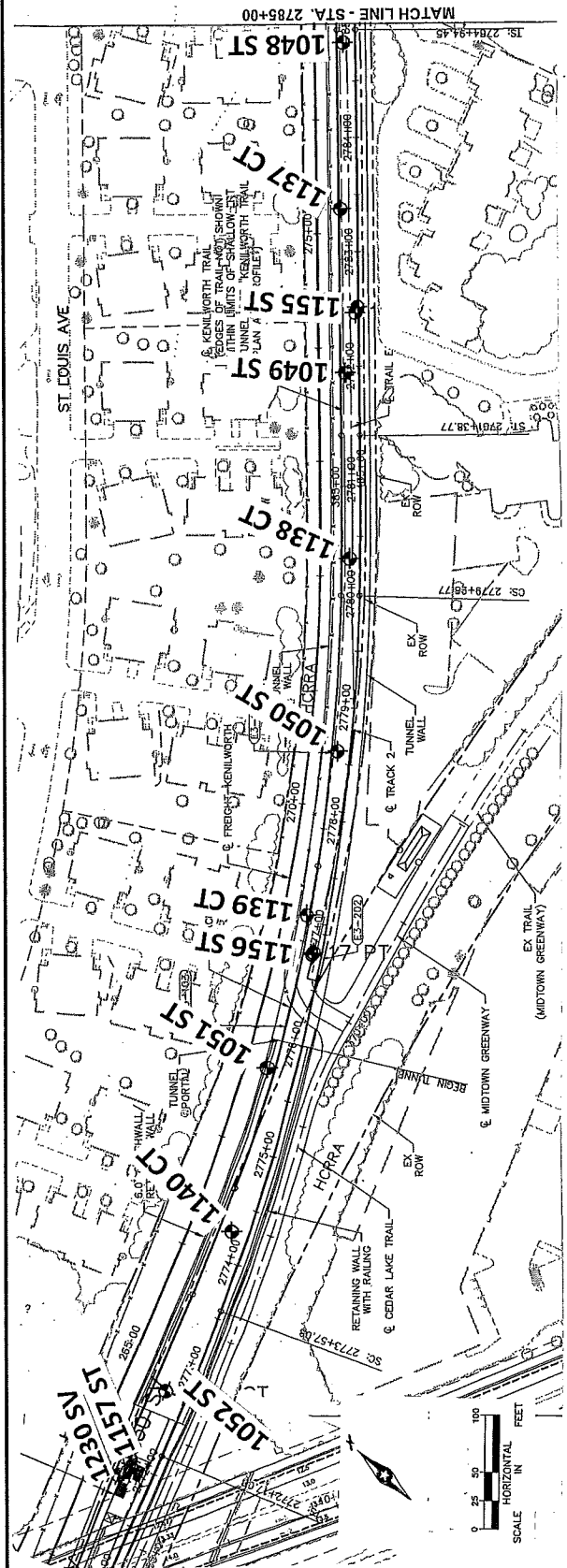
FINE SAND - Material passing the No. 40 sieve and retained on the No. 200 sieve.

COMBINED SILT AND CLAY - Material passing the No. 200 sieve

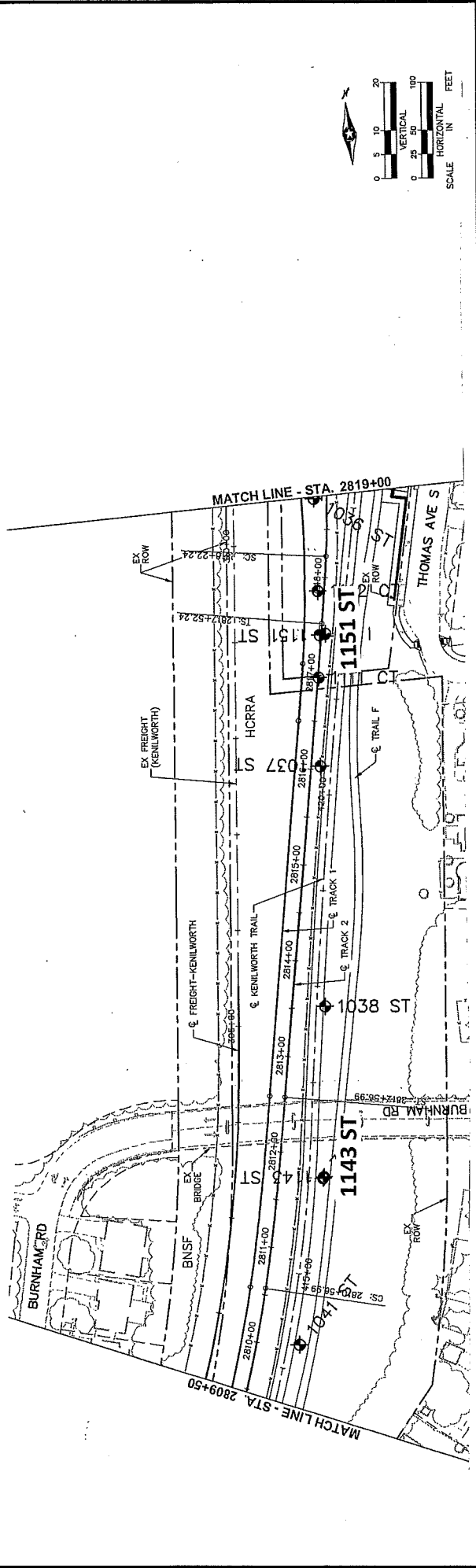
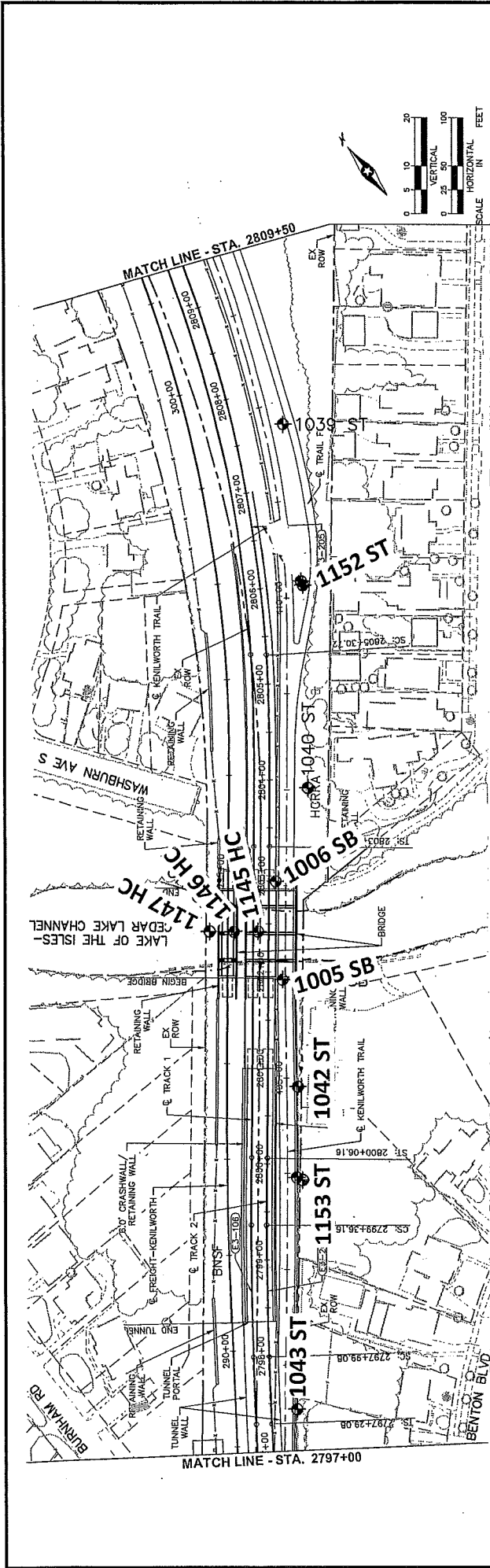
BOULDERS (retained on 3-in. sieve) should be excluded from the portion of the sample to which the classification is applied, but the percentage of such material, if any, in the sample should be recorded.

The term "silty" is applied to fine material having plasticity index of 10 or less and the term "clayey" is applied to fine material having plasticity index of 11 or greater.

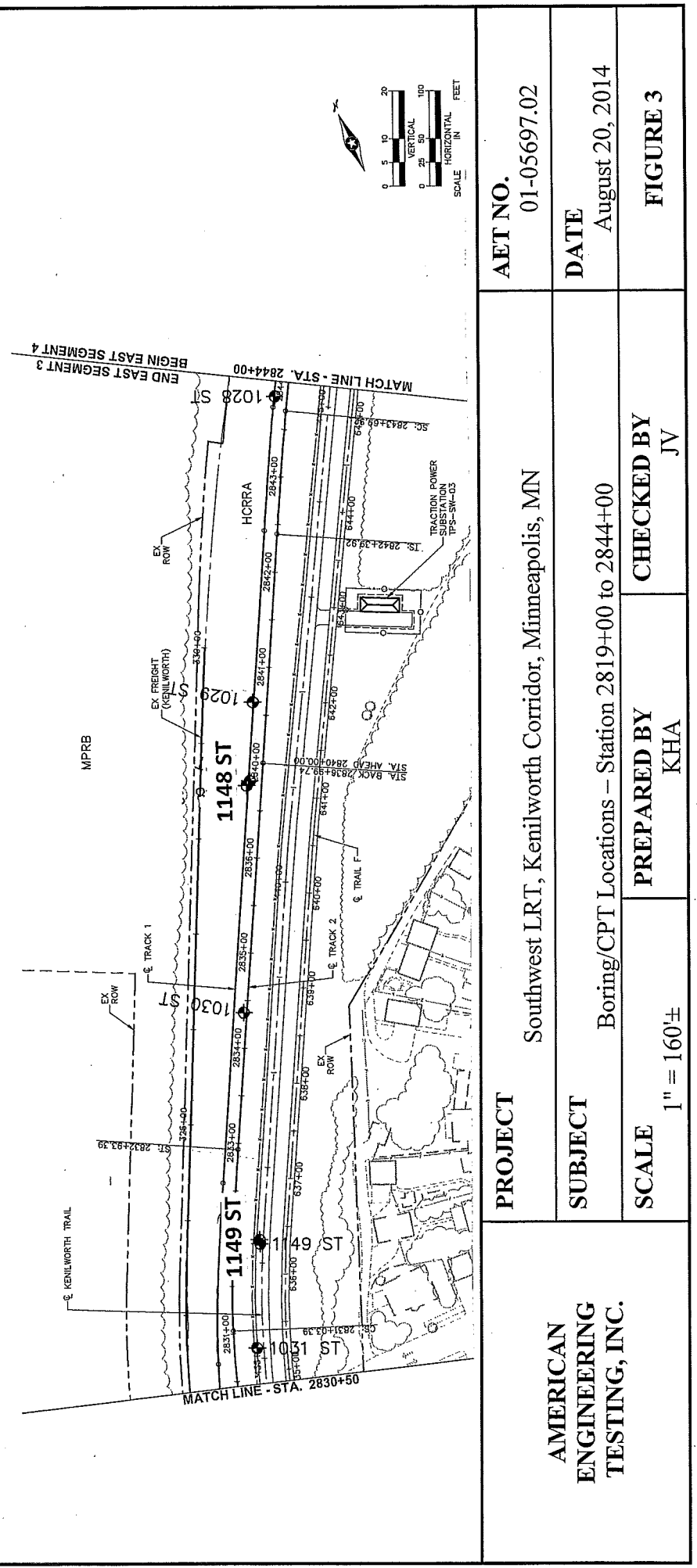
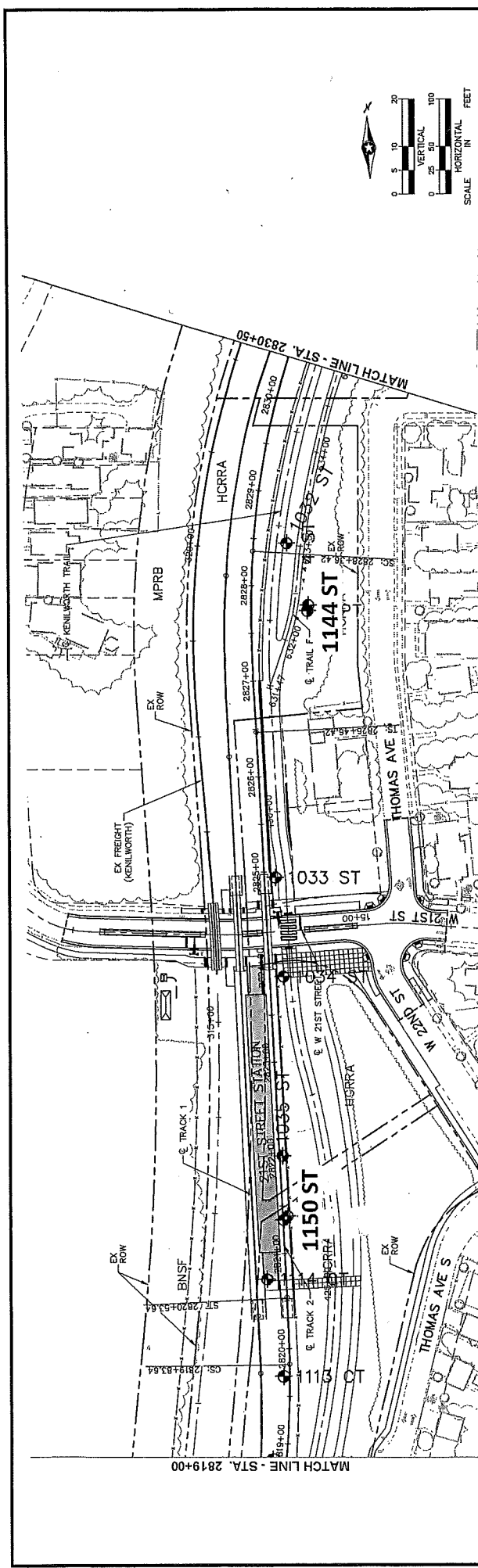




AMERICAN ENGINEERING TESTING, INC.	PROJECT Southwest LRT, Kenilworth Corridor, Minneapolis, MN	AET NO. 01-05697.02
	SUBJECT Boring/CPT Locations – W Lake Street to Station 2797+00	DATE August 20, 2014
SCALE 1" = 160'±	PREPARED BY KHA	CHECKED BY JV
		FIGURE 1



AMERICAN ENGINEERING TESTING, INC.	PROJECT Southwest LRT, Kenilworth Corridor, Minneapolis, MN	AET NO. 01-05697.02
	SUBJECT Boring/CPT Locations - Station 2797+00 to 2819+00	DATE August 20, 2014
SCALE 1" = 160'±	PREPARED BY KHA	CHECKED BY JV
		FIGURE 2



AMERICAN ENGINEERING TESTING, INC.	PROJECT	Southwest LRT, Kenilworth Corridor, Minneapolis, MN		AET NO.	01-05697.02
	SUBJECT	Boring/CPT Locations - Station 2819+00 to 2844+00		DATE	August 20, 2014
	SCALE	1" = 160'±	PREPARED BY	KHA	CHECKED BY	JV
				FIGURE 3	

Table A.1 - Piezometer Water Level Data
 Southwest LRT Kenilworth Corridor, Minneapolis
 AET No. 01-05697

Piezometer No.	1157 PT	1156 PT	1155 PT	MCES P-38	1154 PT	1153 PT	channel	1152 PT	1143 PT	1151 PT	1150 PT	1144 PT	1149 PT	1148 PT
Station	2771+98	2776+82	2782+46	2786+64	2794+95	2799+83	2802+43	2806+02	2811+89	2817+56	2821+49	2827+98	2831+97	2836+76
Track 2 offset	20' LT	7' LT	3' LT	20' RT	12' RT	38' RT	-	37' RT	2' LT	2' RT	22' RT	39' RT	C/L	25' LT
Nothing	157451	157802	158305	158684	159370	159746	159959	160225	160768	161336	161734	162367	162767	163209
Easting	515598	515919	516166	516342	516798	517114	517256	517508	517723	517786	517806	517827	517892	518078
Riser Top Elev.	875.18	873.63	879.59	876.62	874.48	871.66	-	870.56	868.50	867.89	867.51	871.38	869.87	867.29
Ground Elev.	872.7	871.1	876.8	873.9	872.1	869.2	-	868.3	865.9	865.3	864.9	868.9	867.6	864.9
Date														
10/14/2013	855.34	857.70	850.63	850.43	850.37	850.10	852.27	851.64	850.41	850.08	850.45	850.20	849.60	849.22
10/21/2013	855.69	857.98	850.81	850.69	850.60	850.34	-	851.86	850.61	850.27	850.88	850.10	849.72	849.25
10/28/2013	855.68	858.03	850.84	850.62	850.58	850.26	852.44	851.76	850.60	850.19	850.91	849.98	849.77	849.19
11/4/2013	855.68	858.06	850.91	850.69	850.61	850.29	852.34	851.73	850.58	850.24	850.74	850.08	849.69	849.25
11/11/2013	855.57	857.92	850.82	850.60	850.55	850.21	852.29	851.66	850.52	850.14	850.61	849.95	849.55	849.06
11/18/2013	855.55	857.83	850.82	850.56	850.52	850.15	852.20	851.61	850.50	850.09	850.56	849.93	849.54	849.09
11/25/2013	855.64	857.98	850.89	850.61	850.57	850.19	852.20	851.60	850.49	850.14	850.57	850.04	849.65	849.19
12/2/2013	855.58	857.89	850.80	850.56	850.46	850.12	852.13	851.51	850.39	850.07	850.49	849.95	849.57	849.14
12/9/2013	855.49	857.74	850.70	850.51	850.38	850.06	852.26	851.47	850.35	850.00	850.41	849.86	849.51	849.07
12/16/2013	855.44	857.68	850.68	850.46	850.33	850.01	852.29	851.45	850.30	849.97	850.37	849.80	849.45	849.01
12/23/2013	855.28	857.47	850.58	850.35	850.27	849.92	852.27	851.41	850.24	849.87	850.30	849.71	849.36	848.90
12/30/2013	855.31	857.51	850.62	850.37	850.24	849.90	852.26	851.39	850.20	849.86	850.27	849.71	849.37	848.94
1/6/2014	855.25	857.43	850.56	850.30	850.18	849.84	*	851.35	850.13	849.79	850.21	849.58	849.31	848.87
1/13/2014	855.19	857.34	850.50	850.25	850.15	849.77	*	851.33	850.10	849.73	850.16	849.58	849.27	848.82
1/20/2014	855.06	857.18	850.40	850.15	850.08	849.71	*	851.30	850.03	849.64	850.10	849.48	849.15	848.71
1/27/2014	854.98	857.08	850.37	850.11	850.02	849.64	*	851.26	849.97	849.58	850.03	849.43	849.11	848.64
2/3/2014	854.97	857.09	850.32	850.09	849.98	849.61	*	851.26	849.94	849.55	850.00	849.40	849.08	848.64
2/10/2014	854.89	856.98	850.26	850.02	849.90	849.53	*	851.22	849.87	849.47	849.92	849.34	849.01	848.53
2/17/2014	854.95	857.08	850.27	850.03	849.88	849.55	*	851.22	849.86	849.49	849.91	849.39	849.06	848.61
2/24/2014	854.78	856.88	850.18	849.94	849.81	849.44	*	851.19	849.78	849.39	849.81	849.25	848.93	848.48
3/3/2014	854.76	856.84	850.14	849.91	849.77	849.42	*	851.19	849.75	849.37	849.79	849.23	848.90	848.46
3/10/2014	854.75	856.90	850.11	849.91	849.78	849.43	*	851.19	849.74	849.39	849.79	849.27	848.95	848.50
3/17/2014	854.99	857.56	850.18	849.98	849.83	849.50	*	851.36	849.82	849.49	850.22	849.29	848.97	848.56
3/24/2014	854.93	857.53	850.15	849.95	849.78	849.48	*	851.41	849.82	849.44	850.40	849.23	848.91	848.47
3/31/2014	855.17	858.04	850.21	850.04	849.88	849.58	852.39	851.51	849.93	849.54	850.60	849.28	848.77	848.54
4/7/2014	855.52	858.30	850.37	850.26	850.07	849.85	852.54	851.84	850.20	849.81	851.40	849.40	849.17	848.77
4/14/2014	855.69	858.17	850.51	850.41	850.24	850.22	852.60	852.01	850.46	850.03	851.96	849.53	849.36	848.99

Table A.1 - Piezometer Water Level Data
 Southwest LRT Kenilworth Corridor, Minneapolis
 AET No. 01-05697

4/21/2014	855.78	858.41	850.71	850.64	850.48	850.47	852.67	852.06	850.61	850.24	852.08	849.72	849.54	849.14
4/28/2014	856.55	860.52	850.89	850.89	850.73	850.95	853.30	852.36	850.95	850.60	852.83	849.92	849.73	849.32
5/5/2014	857.93	860.70	851.44	851.68	851.71	851.91	853.66	853.36	852.01	851.51	855.23	850.48	850.32	849.95
5/12/2014	857.97	860.99	851.92	852.00	852.16	852.16	853.84	853.35	852.22	851.79	855.00	850.94	850.69	850.23
5/19/2014	858.06	860.51	852.33	852.28	852.50	852.36	853.74	853.47	852.46	852.04	854.71	851.33	851.01	850.53
5/27/2014	858.54	860.74	852.66	852.57	853.00	852.75	854.00	853.80	852.88	852.43	854.94	851.79	851.37	850.89
6/2/2014	858.51	861.53	852.73	852.57	853.12	852.84	854.32	853.76	852.88	852.49	855.24	852.02	851.52	851.00
6/9/2014	858.35	860.69	852.87	852.72	853.24	852.88	854.26	853.79	852.99	852.60	854.55	852.25	851.65	851.10
6/16/2014	858.70	861.73	853.00	852.85	853.35	853.14	854.57	854.02	853.08	852.75	854.23	852.45	851.77	851.27
6/23/2014	860.88	863.15	853.58	853.78	854.39	854.46	855.74	855.12	854.39	853.98	857.35	853.08	852.42	851.96
6/30/2014	860.23	862.17	854.27	854.21	854.84	854.69	855.79	855.07	854.57	854.20	856.22	853.66	852.92	852.34
7/7/2014	859.69	861.15	854.42	854.19	854.94	854.52	855.51	854.92	854.52	854.17	855.50	853.93	853.15	852.56
7/14/2014	859.73	861.58	854.40	854.22	854.92	854.63	855.70	854.95	854.55	854.23	855.89	854.01	853.23	852.68
7/21/2014	859.22	860.73	854.34	854.07	854.74	854.36	855.42	854.80	854.40	854.07	855.01	853.99	853.26	852.73
7/28/2014	858.10	860.26	854.08	853.83	854.52	854.16	855.24	854.66	854.21	853.87	854.61	853.82	853.43	852.58
8/4/2014	858.48	859.91	853.83	**	854.27	853.82	854.96	854.42	853.94	853.59	854.11	853.67	852.92	852.43
8/11/2014	858.18	859.68	853.59	**	854.03	853.46	854.99	855.26	853.70	853.39	854.21	853.48	852.72	852.19
8/18/2014	858.05	859.63	853.39	**	853.73	853.21	854.44	854.01	853.44	853.09	853.46	853.26	852.58	852.10
8/25/2014	857.79	859.44	853.15	**	853.43	852.97	854.28	853.80	853.20	852.89	853.24	852.98	852.37	851.89
Piezo No.	1157 PT	1156 PT	1155 PT	MCES P-38	1154 PT	1153 PT	channel	1152 PT	1143 PT	1151 PT	1150 PT	1144 PT	1149 PT	1148 PT
Average Elev.	856.58	858.86	851.55	851.20	851.50	851.21	853.60	852.54	851.43	851.06	852.16	850.80	850.38	849.91
Highest Elev.	860.88	863.15	854.42	854.22	854.94	854.69	855.79	855.26	854.57	854.23	857.35	854.01	853.43	852.73
Lowest Elev.	854.75	856.84	850.11	849.91	849.77	849.42	852.13	851.19	849.74	849.37	849.79	849.23	848.77	848.46
Range	6.13	6.31	4.31	4.31	5.17	5.27	3.66	4.07	4.83	4.86	7.56	4.78	4.66	4.27

* ice present, no water level measurement taken

** Piezometer abandoned by MCES contractor after 7/28/2014 measurement

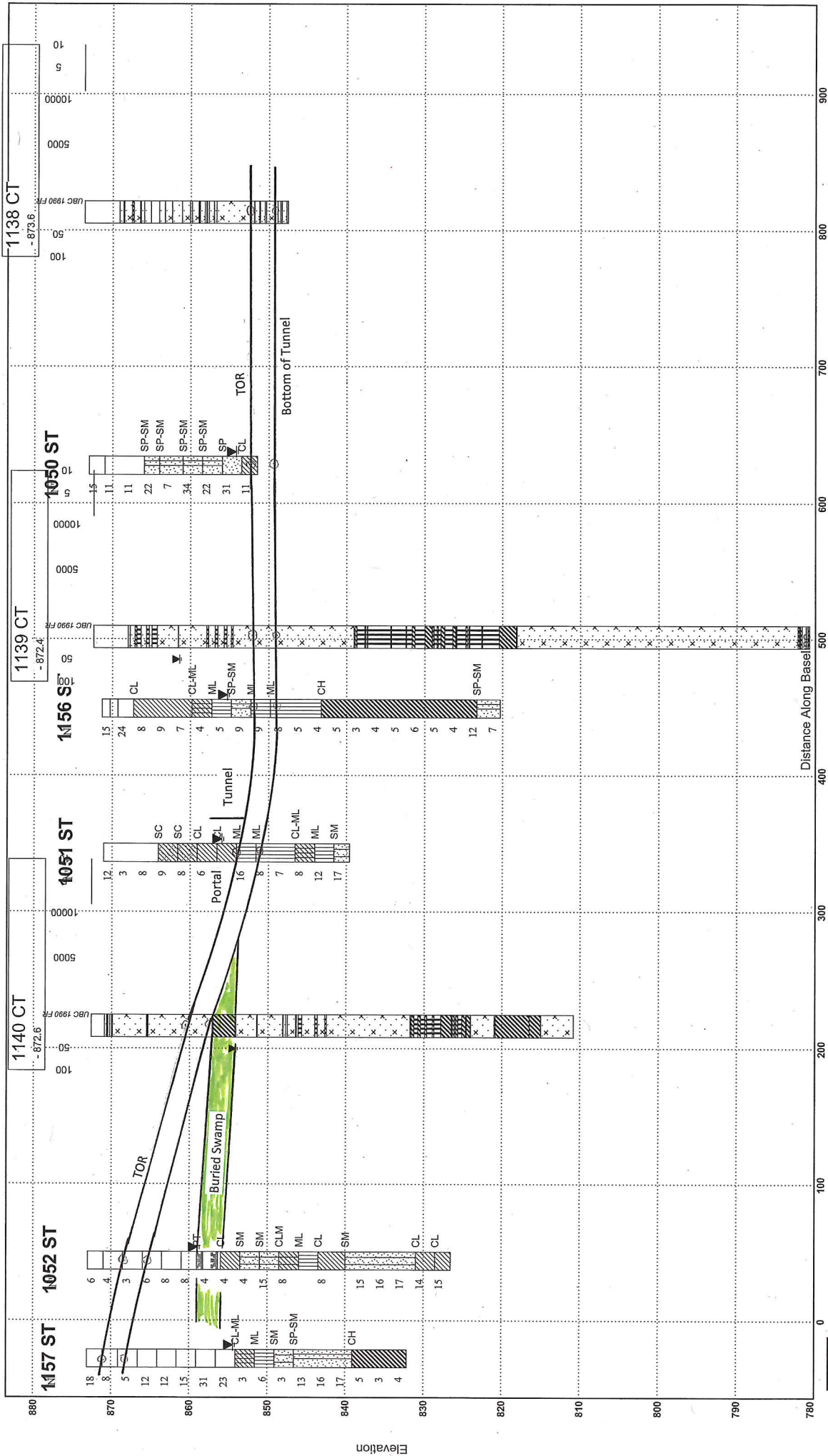


Figure 4 – Fence Diagram
Station 2771+50 to 2781+50

Southwest Light Rail Transit Project, PEC East
Hopkins to Minneapolis
AET No: 01-05697

American Engineering Testing



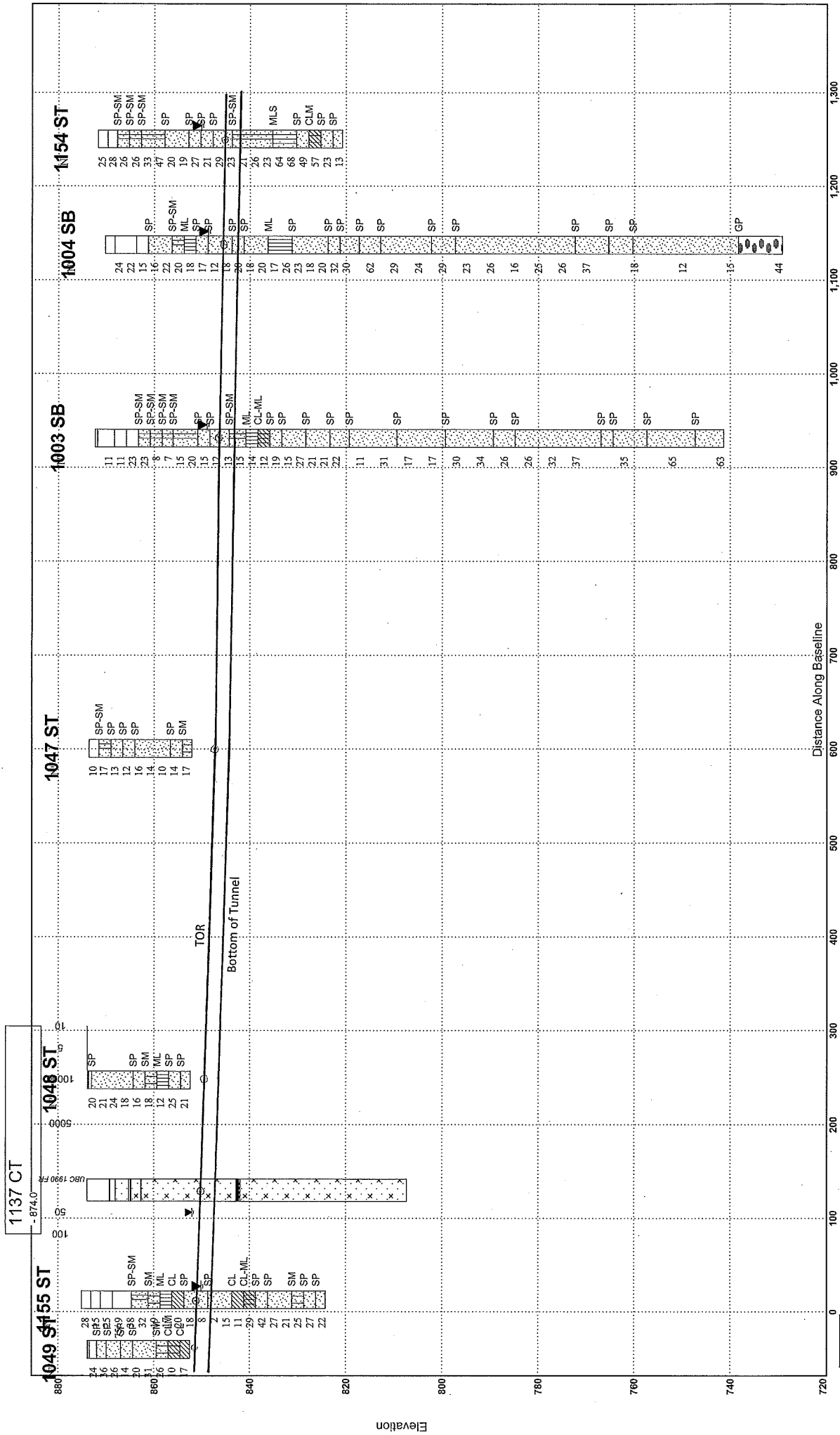


Figure 5 – Fence Diagram
Station 2781+50 to 2796+00

Southwest Light Rail Transit Project, PEC East
Hopkins to Minneapolis
AET No: 01-05697

American Engineering Testing



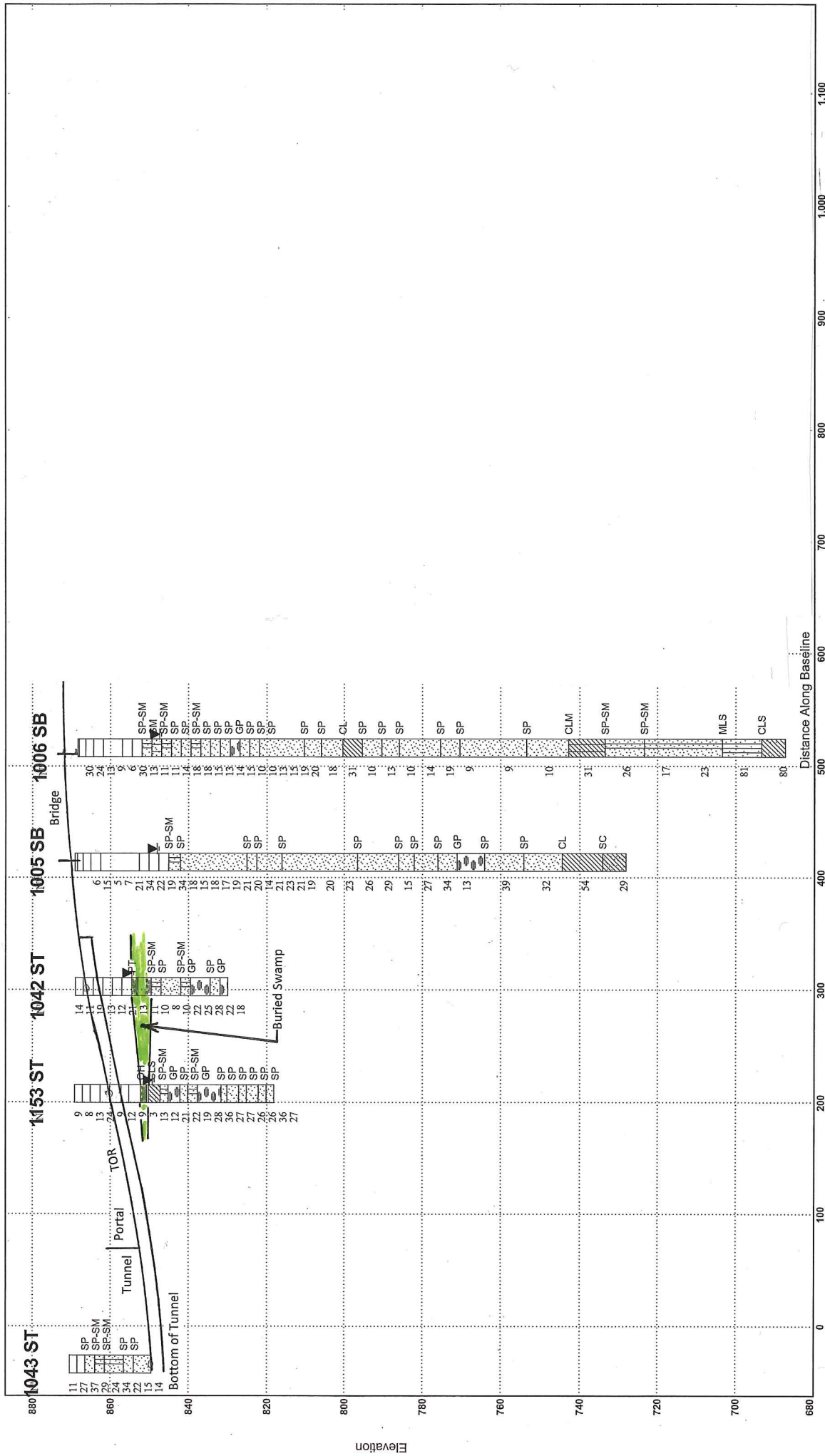


Figure 6 – Fence Diagram
 Station 2796+00 to Channel

Southwest Light Rail Transit Project, PEC East
 Hopkins to Minneapolis
 AET No: 01-05697

American Engineering Testing



Appendix B

Subsurface Boring and Cone Penetration Test Logs
Piezometer Logs
Sieve/Hydrometer Analysis Test Results

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1003 SB (p. 1 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

SURFACE ELEVATION: **872.4** Hennepin Co. Coordinates: **N 159149 E 516538**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	qu	PL	%-#200
1	FILL, mostly silty sand with organic fines, trace roots, dark brown, frozen (A-2-4)	FILL		F	SU						
2	FILL, mixture of silty sand and clayey sand, with gravel, trace roots, dark brown and black, frozen to 1.5' (A-2-4)			F/M	SU						
3	FILL, mostly silty sand with gravel, pieces of glass, brown (A-2-4)		11	M	SS	2					
4	FILL, mostly silty sand, a little gravel and ashes/cinders, pieces of glass, dark brown (A-2-4)	COARSE ALLUVIUM OR FILL	11	M	SS	4					
5	FILL, mostly silty sand with gravel, pieces of glass, brown (A-2-4)		23	M	SS	5					
6	FILL, mostly silty sand with gravel, pieces of glass, brown (A-2-4)		23	M	SS	5					
7	SAND WITH SILT AND GRAVEL, fine to medium grained, light grayish brown, moist, medium dense (SP-SM) (A-1-b) (possible fill)	COARSE ALLUVIUM	8	M	SS	7					
8	SAND WITH SILT, a little gravel, medium grained, grayish brown, moist, loose (SP-SM) (A-1-b)		7	M	SS	10					
9	SAND WITH SILT, a little gravel, fine to medium grained, light brownish gray, moist, loose, laminations of clayey sand (SP-SM) (A-3)		15	M	SS	6					
10	SAND WITH SILT AND GRAVEL, medium to fine grained, grayish brown to light grayish brown, moist, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	20	M	SS	15					
11	SAND, fine grained, light brown, moist to waterbearing, medium dense (SP) (A-3)		15	W	SS	15					
12	SAND, a little gravel, medium to fine grained, brownish gray to gray, waterbearing, medium dense (SP) (A-1-b)		12	W	SS	15					3
13	SAND WITH SILT, fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-3)	COARSE ALLUVIUM	13	W	SS	10					
14	SAND WITH SILT, fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-3)		15	W	SS	6					
15	SAND WITH SILT, fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-3)		15	W	SS	6					

AET CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 8/5/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	3.25" HSA								
24½-129½'	RDF w/DM	3/21/13	9:45	26.0	24.5	24.3		23.5	
		3/21/13	9:57	26.0	24.5	24.3		23.4	
BORING COMPLETED: 3/21/13									
DR: JM LG: SB Rig: 68C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1003 SB (p. 2 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: N **159149** E **516538**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	qu	PL	%-#200	
33	SANDY SILT, brownish gray, wet, medium dense (ML) (A-4) <i>(continued)</i>	FINE ALLUVIUM <i>(continued)</i>	14	M		SS	12	25				64
34	SILTY CLAY, brownish gray, stiff (CL-ML) (A-4)			12	M		SS	14	27			
36		COARSE ALLUVIUM										
37	SAND WITH GRAVEL, medium grained, brownish gray, waterbearing, medium dense, a lens of fine grained sand (SP) (A-1-b)			19	W		SS	7				
38												
39	SAND, a little gravel, medium to fine grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)			15	W		SS	10				
40												
41												
42												
43												
44	SAND, fine to medium grained, grayish brown, waterbearing, medium dense (SP) (A-3)		21	W		SS	13					
45												
46												
47												
48												
49	SAND, a little gravel, fine grained, grayish brown, waterbearing, medium dense (SP) (A-3)		22	W		SS	14				2	
50												
51												
52												
53	SAND, a little gravel, medium to fine grained, brownish gray, waterbearing, medium dense to dense (SP) (A-1-b)		11	W		SS	8					
54												
55												
56												
57												
58												
59												
60												
61												
62												
63	SAND, a little gravel, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)		17	W		SS	10					
64												
65												
66												
67												
68												
69												

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 8/5/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1003 SB (p. 3 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: **N 159149 E 516538**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	qu	PL	%-#200	
71	SAND, a little gravel, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	17	W	X	SS	12					
72												
73	SAND, fine to medium grained, brownish gray, waterbearing, medium dense to dense (SP) (A-3)		30	W	X	SS	13					
74												
75												
76												
77	SAND, a little gravel, medium to fine grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)		34	W	X	SS	13					
78												
79												
80												
81	SAND, apparent cobbles and gravel at 94', medium grained, brownish gray, waterbearing, medium dense to dense, lenses of medium to fine grained sand (SP) (A-1-b)		26	W	X	SS	12					
82												
83												
84												
85	SAND, apparent cobbles and gravel at 94', medium grained, brownish gray, waterbearing, medium dense to dense, lenses of medium to fine grained sand (SP) (A-1-b)		26	W	X	SS	13					
86												
87												
88												
89	SAND WITH GRAVEL, medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained (SP) (A-1-b)		32	W	X	SS	13					
90												
91												
92												
93	SAND WITH GRAVEL, medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained (SP) (A-1-b)		37	W	X	SS	13					
94												
95												
96												
97	SAND WITH GRAVEL, medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained (SP) (A-1-b)		37	W	X	SS	13					
98												
99												
100												
101	SAND WITH GRAVEL, medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained (SP) (A-1-b)		37	W	X	SS	13					
102												
103												
104												
105	SAND WITH GRAVEL, medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained (SP) (A-1-b)		37	W	X	SS	13					
106												
107												

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 8/5/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1003 SB (p. 4 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: **N 159149 E 516538**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	qu	PL	%-#200
108	SAND WITH GRAVEL, apparent cobbles at 114', medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained (SP) (A-1-b)	COARSE ALLUVIUM (continued)	35	W	SS	13					
109											
110											
111											
112											
113											
114											
115	GRAVELLY SAND, apparent cobbles at 123', medium grained, brownish gray, waterbearing, very dense (SP) (A-1-b)		65	M	SS	9					
116											
117											
118											
119											
120											
121											
122											
123											
124											
125	GRAVELLY SAND, apparent cobbles, medium to coarse grained, dark brownish gray, waterbearing, very dense (SP) (A-1-b)		63	M	SS	9					
126											
127											
128											
129											
130											
131	END OF BORING										

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 8/5/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1004 SB (p. 1 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

SURFACE ELEVATION: **870.3** Hennepin Co. Coordinates: **N 159314 E 516666**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS							
							WC	DEN	qu	PL	%-#200			
1	FILL, mostly gravelly silty sand, a little lean clay, trace roots, dark brown, a little black, frozen to 1.5' (A-1-b)	FILL			F/M	SU								
2	FILL, mostly gravelly sand with silt, apparent cobbles, light brown to light brownish gray (A-1-b)		24		M	SS	12							
3														
4														
5	FILL, mostly sand with silt, a little gravel, light brownish gray (A-1-b)		22		M	SS	10							
6														
7	SAND, a little gravel, medium grained, light brown, moist, medium dense (SP) (A-1-b)		16		M	SS	12							
8														
9														
10	SAND WITH SILT AND GRAVEL, fine to medium grained, light brownish gray, moist, medium dense (SP-SM) (A-3)		22		M	SS	8							
11														
12	SILT, brown, moist, medium dense, laminations of sandy silt (ML) (A-4)	FINE ALLUVIUM	20		M	SS	12							
13														
14														
15	SAND, fine grained, brown, moist, medium dense, lenses of sand with silt (SP)	COARSE ALLUVIUM	18		M	SS	14	21						
16														
17	SAND, a little gravel, medium to fine grained, brown, waterbearing, medium dense (SP) (A-1-b)		17		M	SS	14							
18														
19														
20	SAND, a little gravel, fine to medium grained, brown, waterbearing, medium dense (SP) (A-3)		12		W	SS	11							
21														
22	SAND, a little gravel, fine to medium grained, brown, waterbearing, medium dense (SP) (A-3)		18		W	SS	15							
23														
24														
25	SAND, a little gravel, fine to medium grained, brown, waterbearing, medium dense (SP) (A-3)		20		W	SS	10							
26														
27	SAND, fine grained, light brown to brown, waterbearing, medium dense (SP) (A-3)		18		W	SS	16							
28														
29														
30														
31														4

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 8/5/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-22'	3.25" HSA								
22-139½'	RDF w/DM	3/19/13	9:50	23.5	22.0	22.0		21.8	
		3/19/13	10:00	23.5	22.0	22.0		21.6	
BORING COMPLETED: 3/20/13									
DR: JM LG: SB Rig: 68C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1004 SB (p. 2 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: **N 159314 E 516666**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	qu	PL	%-#200
33	SAND, fine grained, light brown to brown, waterbearing, medium dense (SP) (A-3) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>	20	W	SS	15					
34	SILT, brownish gray to brown, wet, medium dense (ML)	FINE ALLUVIUM	17	W	SS	15	24				95
35											
36											
37	SAND, a little gravel, medium grained, grayish brown, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM	23	W	SS	13					
38											
39											
40											
41											
42	SAND, a little gravel, medium grained, grayish brown, waterbearing, dense, a lens of fine grained sand (SP) (A-1-b)		32	W	SS	14					
43											
44											
45	SAND, fine to medium grained, grayish brown, waterbearing, medium dense (SP) (A-3)		30	W	SS	13					
46											
47	SAND, fine grained, brown, waterbearing, very dense (SP) (A-3)		62	W	SS	15					
48											
49											
50											
51	SAND, a little gravel, fine to medium grained, brown to grayish brown, waterbearing, medium dense (SP) (A-3)		29	W	SS	12					
52											
53											
54											
55											
56											
57											
58	SAND, a little gravel, fine to medium grained, brown to grayish brown, waterbearing, medium dense (SP) (A-3)		24	W	SS	7					
59											
60											
61											
62											
63											
64											
65											
66											
67											
68											
69											

AET_CORP W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT 8/5/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1004 SB (p. 3 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: **N 159314 E 516666**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	qu	PL	%-#200	
71	SAND, a little gravel, medium to fine grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	29	W	X	SS	12					
72												
73	SAND, medium grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b)				X	SS						
74												
75												
76												
77												
78												
79												
80												
81												
82												
83	SAND WITH GRAVEL, apparent cobble at 98', fine to medium grained, brownish gray, waterbearing, dense (SP) (A-1-b)				X	SS						
84												
85												
86												
87												
88												
89												
90												
91												
92												
93	SAND, medium grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b)				X	SS						
94												
95												
96												
97												
98	SAND, medium grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b)				X	SS						
99												
100												
101												
102												
103	SAND, medium grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b)				X	SS						
104												
105												
106												
107												

AET_CORP W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT 8/5/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1004 SB (p. 4 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: N **159314** E **516666**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	qu	PL	%-#200
108	SAND, medium grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>	18	W	SS	7					
109											
110	SAND WITH GRAVEL, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM OR COLLUVIUM	12	W	SS	5					
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											
121											
122	GRAVEL WITH SAND, apparent cobbles, brownish gray, waterbearing, dense (GP) (A-1-a)	COARSE ALLUVIUM OR COLLUVIUM	15	W	SS	1					
123											
124											
125											
126											
127	END OF BORING		44	W	SS	3					
128											
129											
130											
131	END OF BORING										
132											
133											
134											
135											
136											
137											
138											
139											
140											
141											

AET_CORP W.COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 8/5/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1005 SB (p. 1 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

SURFACE ELEVATION: **869.1** Hennepin Co. Coordinates: **N 159918 E 517230**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand with gravel, trace roots, dark brown, frozen (A-2-4)	FILL		F	SU						
2	FILL, mostly crushed limestone base, a little silty sand, light brown, a little brown, frozen (A-1-b)			F	SS						
3	FILL, mostly silty sand with gravel, brown, a little dark brown, frozen (A-2-4)			F	SS	14					
4	FILL, mostly silty sand with gravel, brown, a little dark brown, frozen (A-2-4)										
5	FILL, mostly silty sand with gravel and wood, dark brown (A-1-b)			6	M	SS	4	9			14
6	FILL, mostly silty sand with gravel, a little sand with silt and clayey sand, possible cobbles below 11', pieces of wood, brown, a little light brown and dark brown (A-2-4)			15	M	SS	12				
7	FILL, mostly silty sand with gravel, a little sand with silt and clayey sand, possible cobbles below 11', pieces of wood, brown, a little light brown and dark brown (A-2-4)			5	M	SS	3				
8				7	M	SS	5				
9				21	M	SS	2				
10											
11											
12											
13											
14											
15											
16											
17	FILL, mostly gravelly silty sand, pieces of brick, brownish gray (A-1-b)			34	M	SS	14				
18	FILL, mostly sand with silt and gravel, brownish gray, a little brown (A-1-b)		22	M	SS	14					
19	FILL, mostly sand with silt and gravel, a little clayey sand, brownish gray (A-1-b)		19	W	SS	16					
20	FILL, mostly sand with silt and gravel, a little clayey sand, brownish gray (A-1-b)										
21	FILL, mostly sand with silt and gravel, a little clayey sand, brownish gray (A-1-b)										
22	FILL, mostly sand with silt and gravel, a little clayey sand, brownish gray (A-1-b)										
23	FILL, mostly sand with silt and gravel, a little clayey sand, brownish gray (A-1-b)										
24	SAND WITH SILT AND GRAVEL, medium to fine grained, gray, waterbearing, dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	34	W	SS	3					
25	SAND, fine grained, brown, waterbearing, medium dense (SP) (A-3)			18	W	SS	14				
26	SAND, fine grained, brown, waterbearing, medium dense (SP) (A-3)			15	W	SS	13				
27											
28											
29											
30											
31											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-22'	3.25" HSA								
22-139½'	RDF w/DM	3/25/13	10:50	23.5	22.0	22.4		21.1	
		3/25/13	11:00	23.5	22.0	22.3		21.3	
BORING COMPLETED: 3/27/13									
DR: JM LG: SB Rig: 68C									

AET_CORP_WCOORDINATES_01-05697.GPJ_AET+CPT+WELL.GDT 7/19/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1005 SB (p. 2 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: N **159918** E **517230**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
33	SAND, fine grained, brown, waterbearing, medium dense (SP) (A-3) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>	18	W	X	SS	12						
34													
35													
36					17	W	X	SS	15				
37													
38					19	W	X	SS	13				
39													
40			21	W	X	SS	14						
41													
42			20	W	X	SS	13						
43													
44	SAND, a little gravel, medium grained, grayish brown, waterbearing, medium dense (SP) (A-1-b)		14	W	X	SS	10						
45													
46													
47	SAND, fine grained, grayish brown, waterbearing, medium dense, laminations of fine to medium grained sand (SP) (A-3)		21	W	X	SS	14						
48													
49													
50					23	W	X	SS	15				
51													
52													
53	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense, lenses of fine grained sand, a lens of medium grained sand with gravel at 70.5' (SP) (A-3)		21	W	X	SS	12						
54													
55													
56													
57													
58													
59													
60			19	W	X	SS	14						
61													
62													
63													
64													
65			20	W	X	SS	14						
66													
67													
68													
69													

AET_CORP W-COORDINATES_01-05697.GPJ_AET+CPT+WELL.GDT_4/1/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1005 SB (p. 3 of 4)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: N **159918** E **517230**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
71		COARSE ALLUVIUM (continued)	23	W	X	SS	11					
72												
73	SAND, fine to medium grained, brownish gray, waterbearing, medium dense, lenses of fine grained sand (SP) (A-3)		26	W	X	SS	13					
74												
75												
76												
77	SAND, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)		29	W	X	SS	12					
78												
79												
80												
81	SAND, a little gravel, medium grained, brownish gray, waterbearing, medium dense, a lens of fine to medium grained sand (SP) (A-1-b)		15	W	X	SS	12					
82												
83												
84												
85	SAND, medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained sand (SP) (A-1-b)		27	W	X	SS	11					
86												
87												
88												
89	GRAVEL WITH SAND, possible cobbles, brownish gray, waterbearing, medium dense (GP) (A-1-a)		34	W	X	SS	5					
90												
91												
92												
93	SAND WITH GRAVEL, medium grained, dark grayish brown, waterbearing, dense, a lens of gravelly sand with silt (SP) (A-1-b)		13	W	X	SS	2					
94												
95												
96												
97												
98												
99												
100												
101												
102												
103												
104												
105												
106												
107												

AET_CORP W-COORDINATES_01-05697.GPJ_AET+CPT+WELL.GDT_4/1/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1005 SB (p. 4 of 4)**
 PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**
 Hennepin Co. Coordinates: N **159918** E **517230**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
108	SAND WITH GRAVEL, medium grained, dark grayish brown, waterbearing, dense, a lens of gravelly sand with silt (SP) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	39	W	SS	7					
109											
110											
111											
112											
113	SAND, a little gravel, medium grained, brownish gray, waterbearing, dense (SP) (A-1-b)	COARSE ALLUVIUM (continued)	32	W	SS	4					
114											
115											
116											
117											
118	LEAN CLAY WITH SAND, brown, hard (CL) (A-6)	TILL OR FINE ALLUVIUM	54	M	SS	18	13				
119											
120											
121											
122											
123	CLAYEY SAND, a little gravel, brown, very stiff (SC) (A-6)	TILL	29	M	SS	16	11				
124											
125											
126											
127											
128	END OF BORING Note: Lost mud circulation at 120 feet, hole collapsed at 40 feet, re-augered with HSA down to 50 feet and re-drilled with rotary methods to continue advancement										
129											
130											
131											
132											
133											
134											
135											
136											
137											
138											
139											
140											
141											

AET CORP W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT 4/1/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1006 SB (p. 1 of 5)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

SURFACE ELEVATION: **868.4** Hennepin Co. Coordinates: **N 160002 E 517289**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand with organic fines, a little gravel and clayey sand with organic fines, trace roots, dark brown, frozen (A-2-4)	FILL		F	SU						
2				F/M	SU						
3	FILL, mostly gravel with clay and sand, dark brown, frozen to 1.5' (A-1-b)	FILL	30	M	SS	12					
4											
5	FILL, mixture of silty sand and sand with silt, gravelly, dark brown and light brown, a little black (A-2-4)	FILL	24	M	SS	12					
6											
7	FILL, mostly sand with silt and gravel, a little clayey sand, brown (A-1-b)	FILL									
8											
9	FILL, mostly clayey sand, a little gravel, slightly organic lean clay and silty sand, ashes/cinders, trace roots, dark brown and black (A-6, A-4)	FILL	13	M	SS	10	10				
10											
11	FILL, mostly slightly organic sandy lean clay, a little gravel and sandy lean clay, trace roots, black and brownish gray (A-6)	FILL	9	M	SS	6	16				
12											
13	FILL, mostly slightly organic sandy lean clay, a little gravel and sandy lean clay, trace roots, black and brownish gray (A-6)	FILL	6	M	SS	12	20				
14											
15	FILL, mostly silty sand with gravel, a little clayey sand, brownish gray (A-1-b)	FILL	30	M	SS	11					
16											
17	SAND WITH SILT AND GRAVEL, fine to medium grained, brown, a little brownish gray, moist, medium dense, laminations of clayey sand (SP-SM) (A-2-4)	COARSE ALLUVIUM	13	M	SS	5					
18											
19	GRAVELLY SILTY SAND, fine to medium grained, brown, wet, medium dense, a lens of medium grained sand with silt and gravel (SM) (A-1-b)	COARSE ALLUVIUM	11	W	SS	6					
20											
21	GRAVELLY SAND WITH SILT, medium to fine grained, light grayish brown, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	11	W	SS	4					
22											
23	SAND WITH GRAVEL, possible cobbles, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM	14	W	SS	6					
24											
25	GRAVELLY SAND, possible cobbles, medium to coarse grained, gray, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM	18	W	SS	5					
26											
27	SAND WITH SILT AND GRAVEL, possible cobbles, medium to fine grained, gray, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	18	W	SS	4					
28											
29	SAND WITH SILT AND GRAVEL, possible cobbles, medium to fine grained, gray, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM									
30											
31											

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 4/5/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-22'	3.25" HSA								
22-179½'	RDF w/DM	3/27/13	3:10	23.5	24.5	23.7			22.3
		3/27/13	3:20	23.5	24.5	23.3		21.0	
BORING COMPLETED: 3/27/13									
DR: JM LG: JB Rig: 68C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1006 SB (p. 2 of 5)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: N **160002** E **517289**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
33	SAND, a little gravel, possible cobbles, medium grained, gray, waterbearing, medium dense, a lens of fine to medium grained sand with silt (SP) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	15	W	SS	5					
34											
35	SAND, a little gravel, possible cobbles, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-3)		13	W	SS	5					
36											
37	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-3)		14	W	SS	12					
38											
39	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense, lenses of fine grained sand with silt and lean clay (SP) (A-3)		15	W	SS	11	23				
40											
41											
42	SAND, medium to fine grained, brownish gray, waterbearing, loose, a lens of fine to medium grained sand (SP) (A-1-b)		10	W	SS	9					
43											
44	SAND, a little gravel, medium grained, brownish gray, waterbearing, loose (SP) (A-1-b)		10	W	SS	10					
45											
46	SAND, a little gravel, medium to fine grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b)		13	W	SS	12					
47											
48											
49											
50											
51											
52	SAND, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-3)		19	W	SS	13					
53											
54											
55											
56											
57											
58	SAND WITH GRAVEL, medium to fine grained, brownish gray, a little dark brownish gray, waterbearing, medium dense, a lens of lean clay with sand (SP) (A-1-b)		20	W	SS	12					
59											
60											
61											
62	SAND WITH GRAVEL, medium to fine grained, brownish gray, a little dark brownish gray, waterbearing, medium dense, a lens of lean clay with sand (SP) (A-1-b)		18	W	SS	12					
63											
64											
65											
66	FINE ALLUVIUM										
67											
68											
69											

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT-WELL.GDT 4/4/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1006 SB (p. 3 of 5)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: **N 160002 E 517289**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
71	LEAN CLAY WITH SAND, brown, hard, laminations of waterbearing fine to medium grained sand (CL) (A-4) (continued)	FINE ALLUVIUM (continued)	31	M/W	SS	13	17					
72												
73	SAND, a little gravel, medium grained, brown, waterbearing, loose (SP) (A-1-b)	COARSE ALLUVIUM										
74												
75			10	W	SS	6						
76												
77												
78	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense, laminations of medium grained sand (SP) (A-3)											
79												
80			13	W	SS	14						
81												
82												
83	SAND, medium grained, brownish gray, waterbearing, loose to medium dense (SP) (A-1-b)											
84												
85			10	W	SS	8						
86												
87												
88												
89												
90			14	W	SS	11						
91												
92												
93	SAND, a little gravel, medium grained, brownish gray, waterbearing, medium dense, a lens of fine to medium grained sand (SP) (A-1-b)											
94												
95			19	W	SS	12						
96												
97												
98	SAND WITH GRAVEL, possible cobbles, medium grained, brownish gray, waterbearing, loose (SP) (A-1-b)											
99												
100			9	W	SS	4						
101												
102												
103												
104												
105												
106												
107												

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 4/4/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1006 SB (p. 4 of 5)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **160002** E **517289**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
108	SAND WITH GRAVEL, possible cobbles, medium grained, brownish gray, waterbearing, loose (SP) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	9	W	SS	5					
109											
110											
111											
112											
113	SAND, a little gravel, medium grained, brownish gray, waterbearing, loose, a lens of medium to fine grained sand (SP) (A-1-b)	COARSE ALLUVIUM	10	W	SS	4					
114											
115											
116											
117											
118											
119											
120											
121											
122											
123	SILTY CLAY, brown, hard (CL-ML) (A-4)	FINE ALLUVIUM	31	M	SS	17	27				
124											
125											
126											
127											
128											
129											
130											
131											
132											
133	SAND WITH SILT, a little gravel, medium to fine grained, brown, waterbearing, medium dense, a lens of clayey sand at 140' (SP-SM) (A-1-b)	COARSE ALLUVIUM	26	W	SS	15					
134											
135											
136											
137											
138											
139											
140											
141											
142											
143											
144											
145											

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 11/26/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1006 SB (p. 5 of 5)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: N **160002** E **517289**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS											
							WC	DEN	LL	PL	%-#200							
146	SAND WITH SILT, possible cobbles, fine to medium grained, grayish brown, waterbearing, medium dense (SP-SM) (A-3) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>																
147																		
148																		
149																		
150															17	W	SS	5
151																		
152																		
153																		
154																		
155																		
156																		
157																		
158																		
159																		
160	23	W	SS	4														
161																		
162																		
163																		
164																		
165	SANDY SILT, a little gravel, possible cobbles, brownish gray, wet, very dense (ML) (A-4)	FINE ALLUVIUM																
166																		
167																		
168																		
169																		
170															81	W	SS	12	24
171																		
172																		
173																		
174																		
175	SANDY LEAN CLAY, a little gravel, dark brownish gray, hard (CL) (A-6)	TILL																
176																		
177																		
178																		
179																		
180	80	M	SS	18	13													
181	END OF BORING																	

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 4/4/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1042 ST (p. 1 of 2)**
 PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**
 SURFACE ELEVATION: **869.0** Hennepin Co. Coordinates: **N 159822 E 517172**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
1	FILL, mostly clayey sand with gravel, a little silty sand, brown (A-2-4)	FILL	14	M	SS	6	16					
2	FILL, mostly silty sand with gravel, a little sand with silt, trace roots, black, a little brown (A-2-4)			11	M	SS	18					
3	FILL, mostly sand with silt, a little gravel, brown (A-3)			19	M	SS	2					
4	FILL, mixture of clayey sand and sand with silt, with gravel, brown (A-2-4)			13	M	SS	12	7				
5	FILL, mostly gravelly silty sand, brown (A-1-b)			12	M	SS	2					
6	FILL, mostly sand with silt and gravel, a little clayey sand, brown (A-1-b)			21	M	SS	12					
7	HEMIC PEAT, brown to dark brown (PT) (A-8)		SWAMP DEPOSIT	13	M	SS	18	317				
8	HEMIC PEAT, brown to dark brown (PT) (A-8)				11	M	SS	3	164			
9	HEMIC PEAT, brown to dark brown (PT) (A-8)											
10	SAND WITH SILT AND GRAVEL, fine to medium grained, light brownish gray, waterbearing, loose, a lens of clayey sand (SP-SM) (A-1-b)		COARSE ALLUVIUM	10	W	SS	18					
11	SAND WITH GRAVEL, medium grained, brownish gray to gray, waterbearing, loose (SP) (A-1-b)				8	W	SS	24				
12	SAND WITH GRAVEL, medium grained, brownish gray to gray, waterbearing, loose (SP) (A-1-b)				10	W	SS	24				
13	GRAVELLY SAND WITH SILT, medium to fine grained, gray, waterbearing, medium dense (SP-SM) (A-1-b)				22	W	SS	18				
14	GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a)				25	W	SS	2				

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-24½'	3.25" HSA								None
24½-37'	RDF w/DM	5/8/13	9:30	16.5	14.5	14.6			14.5
BORING COMPLETED: 5/8/13		5/8/13	10:03	26.5	24.5	24.0			20.8
DR: GH LG: JMM Rig: 1C		5/8/13	10:10	26.5	24.5	24.0		19.0	

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 5/10/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1042 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: **N 159822 E 517172**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
33	GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a) <i>(continued)</i>		28	W	X	SS	16					
34												
35	SAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)		22	W	X	SS	16					
36												
37												
38	GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a)		18	W	X	SS	2					
39	END OF BORING											

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 5/10/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1043 ST (p. 1 of 1)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

SURFACE ELEVATION: **870.5** Hennepin Co. Coordinates: **N 159562 E 516958**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
1	FILL, mostly silty sand, a little gravel, trace roots, dark brown (A-2-4)	FILL	11	M		SS	12						
2	FILL, mixture of silty sand and clayey sand, a little gravel, dark brown (A-2-4)		27	M		SS	14	11					
4	SAND WITH GRAVEL, fine to medium grained, brown, moist, dense (SP) (A-1-b) (possible fill)	COARSE ALLUVIUM OR FILL	37	M		SS	12						
5	SAND WITH SILT, fine grained, light brown, moist, medium dense (SP-SM) (A-3)	COARSE ALLUVIUM	29	M		SS	12						
7	SAND WITH SILT AND GRAVEL, fine to medium grained, light brown, moist, medium dense to dense (SP) (A-1-b)		24	M		SS	8						
10			34	M		SS	12						
14	SAND, a little gravel, fine to medium grained, light brown, moist, medium dense (SP) (A-3)		22	M		SS	12						
15	SAND, fine grained, light brown, moist to about 19' then waterbearing, medium dense (SP) (A-3)		15	M		SS	12						
17			14	W		SS	12						
21	END OF BORING												

DEPTH: DRILLING METHOD

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

0-19½' **3.25" HSA**

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
5/16/13	1:40	21.0	19.5	19.5		None
5/16/13	1:50	21.0	19.5	19.5		None

BORING COMPLETED: **5/16/13**

DR: **DTS** LG: **TM** Rig: **1C**

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 5/21/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1047 ST (p. 1 of 1)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

SURFACE ELEVATION: **873.6** Hennepin Co. Coordinates: **N 158850 E 516396**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand with gravel, a little ashes/cinders, black (A-1-b)	FILL	10	M	SS	18					
2	SAND WITH SILT AND GRAVEL, fine to medium grained, light brown, moist, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	17	M	SS	18					
3											
4	SAND WITH GRAVEL, medium to fine grained, light brown, moist, medium dense (SP) (A-1-b)		13	M	SS	18					
5											
6	SAND WITH GRAVEL, medium to coarse grained, light brown, moist, medium dense (SP) (A-1-b)		12	M	SS	12					
7											
8	SAND WITH GRAVEL, fine to medium grained, light brown, moist, medium dense to loose, a lens of medium grained sand at 15' (SP) (A-3)		16	M	SS	18					
9											
10	SAND WITH GRAVEL, fine to medium grained, light brown, moist, medium dense to loose, a lens of medium grained sand at 15' (SP) (A-3)		14	M	SS	18					
11											
12	SAND, fine grained, light brown, moist, medium dense, a lens of fine to medium grained sand at 18' (SP) (A-3)		14	M	SS	18					
13											
14	SAND, fine grained, light brown, moist, medium dense, a lens of fine to medium grained sand at 18' (SP) (A-3)		17	M	SS	18					
15											
16	SAND, fine grained, light brown, moist, medium dense, a lens of fine to medium grained sand at 18' (SP) (A-3)		17	M	SS	18					
17											
18	SAND, fine grained, light brown, moist, medium dense, a lens of fine to medium grained sand at 18' (SP) (A-3)		17	M	SS	18					
19											
20	SILTY SAND, fine grained, brown, moist, medium dense, a lens of silt (SM) (A-4)		17	M	SS	18					
21											
END OF BORING											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-19½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
		5/7/13	12:47	21.5	19.5	21.0			None
		5/7/13	12:57	21.5	19.5	21.0			None
BORING COMPLETED: 5/7/13									
DR: GH LG: JMM Rig: 1C									

AET CORP W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT 5/10/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1048 ST (p. 1 of 1)**
 PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**
 SURFACE ELEVATION: **873.9** Hennepin Co. Coordinates: **N 158530 E 516244**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS								
							WC	DEN	LL	PL	%-#200				
1	2.5" Bituminous pavement	FILL													
2	7.5" FILL, mostly sand with silt and gravel, a little lean clay, pieces of concrete and bituminous, brown, a little gray (A-1-b) SAND, a little gravel, fine to medium grained, brown to light brown, a little black, moist, medium dense, a laminations of sand with silt at 6' (SP) (A-3)	COARSE ALLUVIUM	20	M	SS	16									
3			21	M	SS	16									
4			24	M	SS	16									
5			18	M	SS	18									
6			16	M	SS	18									
7															
8	SAND, a little gravel, medium grained, light brown, moist, medium dense (SP) (A-1-b)		16	M	SS	18									
9	SILTY SAND, fine grained, brown, moist, medium dense (SM) (A-2-4)		18	M	SS	16									
10															
11	SILT, brown, wet, medium dense, a lens of silty clay (ML) (A-4)	FINE ALLUVIUM	12	W	SS	20	24								
12															
13	SAND, fine grained, brown, moist, medium dense (SP) (A-3)	COARSE ALLUVIUM	25	M	SS	18									
14															
15	SAND, a little gravel, fine to medium grained, light brown, moist, medium dense (SP) (A-3)		21	M	SS	20									
16															
17	END OF BORING														

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-19½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
		5/7/13	10:47	21.5	19.5	20.3			None
		5/7/13	10:57	21.5	19.5	20.3			None
BORING COMPLETED:	5/7/13	5/7/13	11:10	21.5	19.5	20.3			None
DR: GH	LG: JMM	Rig: 1C							

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 5/10/13



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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1049 ST (p. 1 of 1)**
 PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**
 SURFACE ELEVATION: **874.0** Hennepin Co. Coordinates: **N 158262 E 516135**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS							
							WC	DEN	LL	PL	%-#200			
1	2" Bituminous pavement	FILL												
2	4" FILL, mostly sand with silt and gravel, pieces of concrete and bituminous, brown (A-1-b)	COARSE ALLUVIUM	24	M	SS	12								
3	FILL, mostly silty sand, a little gravel, black (A-2-4)		36	M	SS	18								
4	SAND, a little gravel, fine to medium grained, light brown, moist, dense (SP) (A-3)		26	M	SS	18								
5	SAND, fine grained, light brown, moist, medium dense (SP) (A-3)		14	M	SS	18								
6	SAND WITH GRAVEL, fine to medium grained, light brown, moist, medium dense, a lens of fine grained sand (SP) (A-3)		20	M	SS	20								
7	SAND, fine grained, light brown, moist, medium dense to dense (SP) (A-3)		31	M	SS	20								
8	SAND, fine grained, light brown, moist, medium dense (SM) (A-4)		26	M	SS	20								
9	SILTY SAND, fine grained, light brown, moist, medium dense (SM) (A-4)		10	M/W	SS	24	27							
10	SILTY CLAY, brown, stiff (CL-ML) (A-4)		FINE ALLUVIUM	17	M/W	SS	24	28						
11	LEAN CLAY, brown, very stiff, a lamination of waterbearing sand with silt (CL)													
12	END OF BORING													

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-19½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/7/13	9:36	21.5	19.5	21.5		None	
		5/7/13	9:46	21.5	19.5	21.5		None	
BORING COMPLETED: 5/7/13									
DR: GH LG: JMM Rig: 1C									

AET CORP W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT 5/10/13



AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1050 ST (p. 1 of 1)**
 PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**
 SURFACE ELEVATION: **873.0** Hennepin Co. Coordinates: **N 157958 E 516002**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly sand with silt and gravel, grayish brown (A-1-b)	FILL	15	M	SS	18					
2	FILL, mostly sand with silt, a little gravel and silty sand with organic fines, dark brown, a little black (A-2-4)		11	M	SS	12					
3											
4											
5											
6											
7	SAND WITH SILT AND GRAVEL, fine to medium grained, brown, moist, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	22	M	SS	5					
8	SAND WITH SILT, a little gravel, medium to fine grained, brown, moist, loose (SP-SM) (A-3)		7	M	SS	12					
9											
10											
11											
12	GRAVELLY SAND WITH SILT, medium to fine grained, light grayish brown, moist, dense (SP-SM) (A-1-b)		34	M	SS	12					
13	SAND WITH GRAVEL, medium to fine grained, light grayish brown, moist, medium dense (SP-SM) (A-1-b)		22	M	SS	16					
14											
15	GRAVELLY SAND, medium grained, light brown, moist to wet, dense (SP) (A-1-b)		31	M	SS	18					
16	LEAN CLAY, brownish gray, a little dark gray and light gray, stiff, laminations of fat clay (CL/CH) (A-7-6)	FINE ALLUVIUM	11	M	SS	18	41				
17											
18	END OF BORING										

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 5/10/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-19½'	3.25" HSA	5/6/13	1:25	21.5	19.5	19.0			18.8
		5/6/13	1:35	21.5	19.5	19.0			18.8
BORING COMPLETED: 5/6/13									
DR: GH LG: JMM Rig: 69C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1051 ST (p. 1 of 1)**
 PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**
 SURFACE ELEVATION: **871.1** Hennepin Co. Coordinates: **N 157725 E 515839**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	qu
1	FILL, mostly sand with silt and gravel, a little silty sand and sand, trace roots, brown, a little black and light brown (A-1-b)	FILL	12	M	SS	8					
2			3	M	SS	12					
3			8	M	SS	16					
4											
5											
6											
7	CLAYEY SAND, with organic fines, a little gravel, black, stiff (SC) (A-6)	MIXED ALLUVIUM	9	M	SS	16	13				
8											
9	CLAYEY SAND WITH GRAVEL, brown, firm (SC) (A-6)		8	M	SS	16	9				
10											
11	LEAN CLAY, gray and brown mottled, firm, laminations of silt (CL) (A-6)	FINE ALLUVIUM	6	M	SS	18	35		39	28	
12											
13	LEAN CLAY, brown and gray mottled, a little dark brownish gray, laminations of fat clay (CL) (A-4)			M	TW	18	35	84			1090
14											
15	SANDY SILT, brown and grayish brown, wet, medium dense (ML) (A-4)		16	W	SS	18	28				
16											
17	SILT, gray to brownish gray, wet, loose (ML) (A-4)		8	W	SS	24	37				
18											
19											
20											
21											
22											
23											
24	SILTY CLAY, brownish gray, firm (CL-ML) (A-4)		8	M/W	SS	18	30				
25											
26											
27	SILT, brownish gray, medium dense (ML) (A-4)		12	W	SS	24	32				
28											
29											
30	SILTY SAND, fine grained, brownish gray, wet, medium dense (SM) (A-4)	COARSE ALLUVIUM	17	W	SS	24	28				
31	END OF BORING										

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 5/14/13

DEPTH	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	3.25" HSA	5/6/13	10:49	19.0	17.0	17.5		16.8	
		5/6/13	10:59	19.0	17.0	17.5		15.1	
BORING COMPLETED: 5/6/13		5/6/13	11:22	31.5	29.5	31.0		28.5	
DR: GH LG: JMM Rig: 1C		5/6/13	11:32	31.5	29.5	29.5		21.3	

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1052 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

SURFACE ELEVATION: **873.0** Hennepin Co. Coordinates: **N 157494 E 515648**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
1	FILL, mostly clayey sand, a little gravel, dark brown (A-6)	FILL	6	M		SS	16	12					
2	FILL, mostly sand, a little gravel and lean clay, trace roots, light grayish brown (A-1-b)			4	M		SS	3					
3	FILL, mostly sand, a little gravel and sandy lean clay, brown, a little grayish brown (A-3)			3	M		SS	12					
4													
5	FILL, mostly sand with silt and gravel, black (A-3)			6	M		SS	8	10				10
6													
7	FILL, mostly clayey sand, a little gravel, trace roots, dark brown (A-2-4)			8	M		SS	2	10				
8	FILL, mostly sapric peat, a little sand, pieces of wood, black (A-8)			8	M		SS	2	62				
9													
10	SAPRIC PEAT, black (PT) (A-8)		SWAMP DEPOSIT	4	M		SS	18	215				
11													
12	SANDY LEAN CLAY, slightly organic, trace roots, black, soft (CL) (A-6)		MIXED ALLUVIUM	4	M		SS	18	20				
13													
14	SILTY SAND WITH GRAVEL, brownish gray, wet, very loose, lenses of clayey sand (SM) (A-2-4)		4	W		SS	6	13					
15													
16	SILTY SAND, fine grained, brownish gray, wet, medium dense (SM) (A-4)	COARSE ALLUVIUM	15	W		SS	12						
17													
18	SILTY CLAY, brownish gray, firm (CL-ML) (A-4)	FINE ALLUVIUM	8	M		SS	12	37					
19													
20	SILT WITH SAND, brownish gray, lenses of silty clay (ML) (A-4)			M		TW	18	24 32	100 90				
21													
22	LEAN CLAY, brownish gray, firm, laminations of fat clay (CL) (A-4)		8	M/W		SS	24	28					
23													

DEPTH: DRILLING METHOD

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

0-44½' 3.25" HSA

DATE TIME SAMPLED DEPTH CASING DEPTH CAVE-IN DEPTH DRILLING FLUID LEVEL WATER LEVEL

5/3/13 12:50 16.5 -14.5 14.5 14.1

5/3/13 1:14 24.0 22.0 22.0 18.6

BORING COMPLETED: 5/3/13 5/3/13 1:24 24.0 22.0 22.0 17.8

DR: GH LG: JMM Rig: 1C 5/6/13 8:15 46.5 44.5 44.5 20.1

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 7/19/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1052 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN**

Hennepin Co. Coordinates: N **157494** E **515648**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
33	SILTY SAND, fine grained, brownish gray, wet, medium dense (SM) (A-4)	COARSE ALLUVIUM			TW	0						
34												
35												
36												
37	LEAN CLAY, brownish gray, a little dark brown, gray, stiff, laminations of fat clay (CL/CH) (A-7-6)	FINE ALLUVIUM	15	M/W	SS	24	25					
38												
39												
40	LEAN CLAY, brownish gray, a little light brownish gray, stiff, laminations of silt (CL/CH) (A-7-6)	FINE ALLUVIUM	16	M/W	SS	24						
41												
42	LEAN CLAY, brownish gray, a little light brownish gray, stiff, laminations of silt (CL/CH) (A-7-6)	FINE ALLUVIUM	17	M/W	SS	24						
43												
44	LEAN CLAY, brownish gray, a little light brownish gray, stiff, laminations of silt (CL/CH) (A-7-6)	FINE ALLUVIUM	14	M	SS	24	36					
45												
46	LEAN CLAY, brownish gray, a little light brownish gray, stiff, laminations of silt (CL/CH) (A-7-6)	FINE ALLUVIUM	15	M/W	SS	24	35					
46												
END OF BORING												

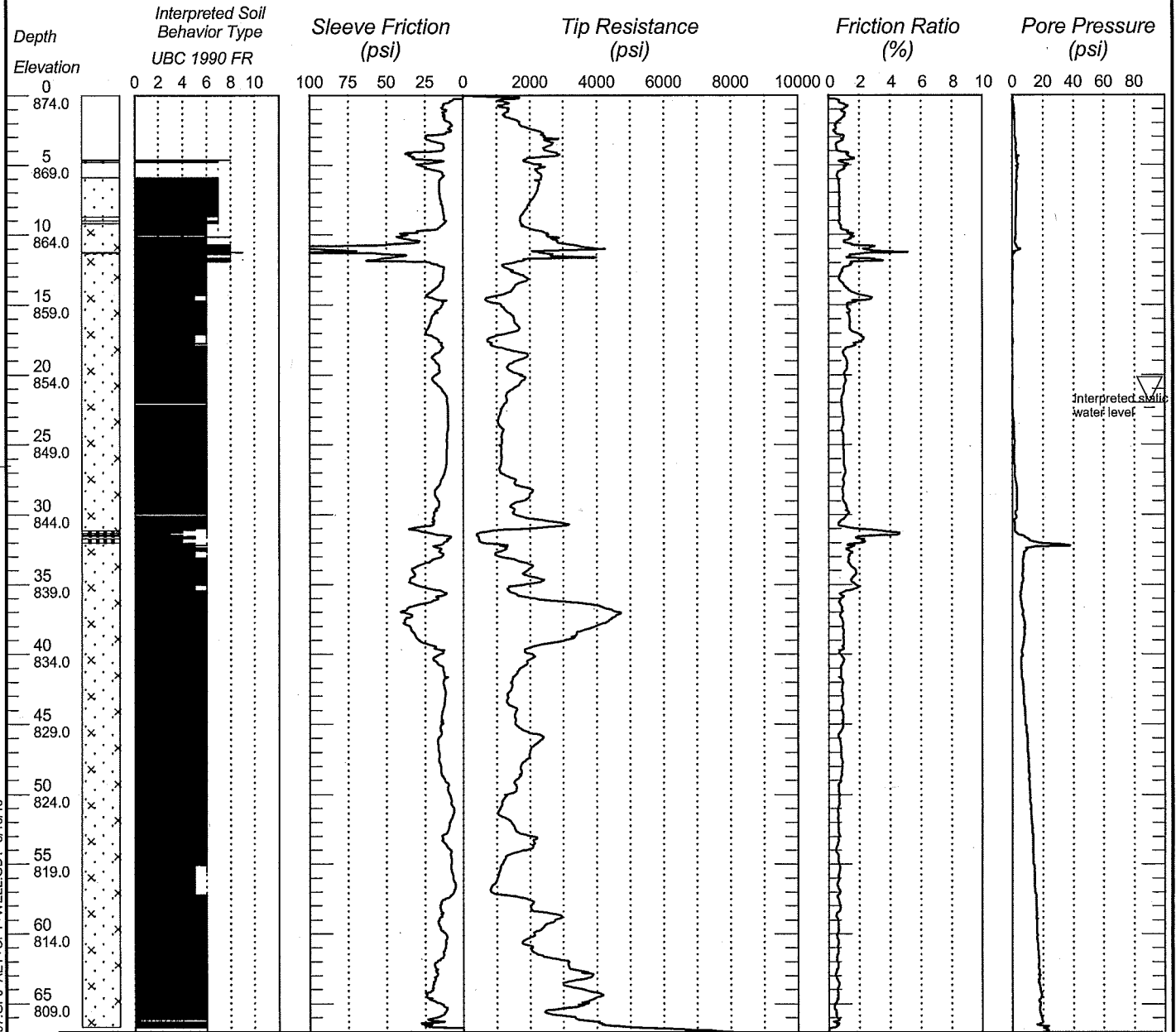
AET_CORP.W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT 5/10/13



AMERICAN
ENGINEERING
TESTING

CONE PENETRATION TEST RESULTS

AET JOB NO: <u>01-05697</u>		SOUNDING NO. 1137 CT (p. 1 of 1)
PROJECT: <u>Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis</u>		
Location _____	CPT Machine 20	Surface Elevation 874.0
	CPT Operator Adams	
Hennepin Co. Coordinates: X=516186 Y=158396 (feet)		Cone # 4583.119xx Date Completed: 8/6/13



Bottom of Hole 66.99869

AET CPT GRAPH

Edit: Date: 8/16/13
X:\01-GEO\GINTW1 GINT PROJECTS\01-05697.GPJ

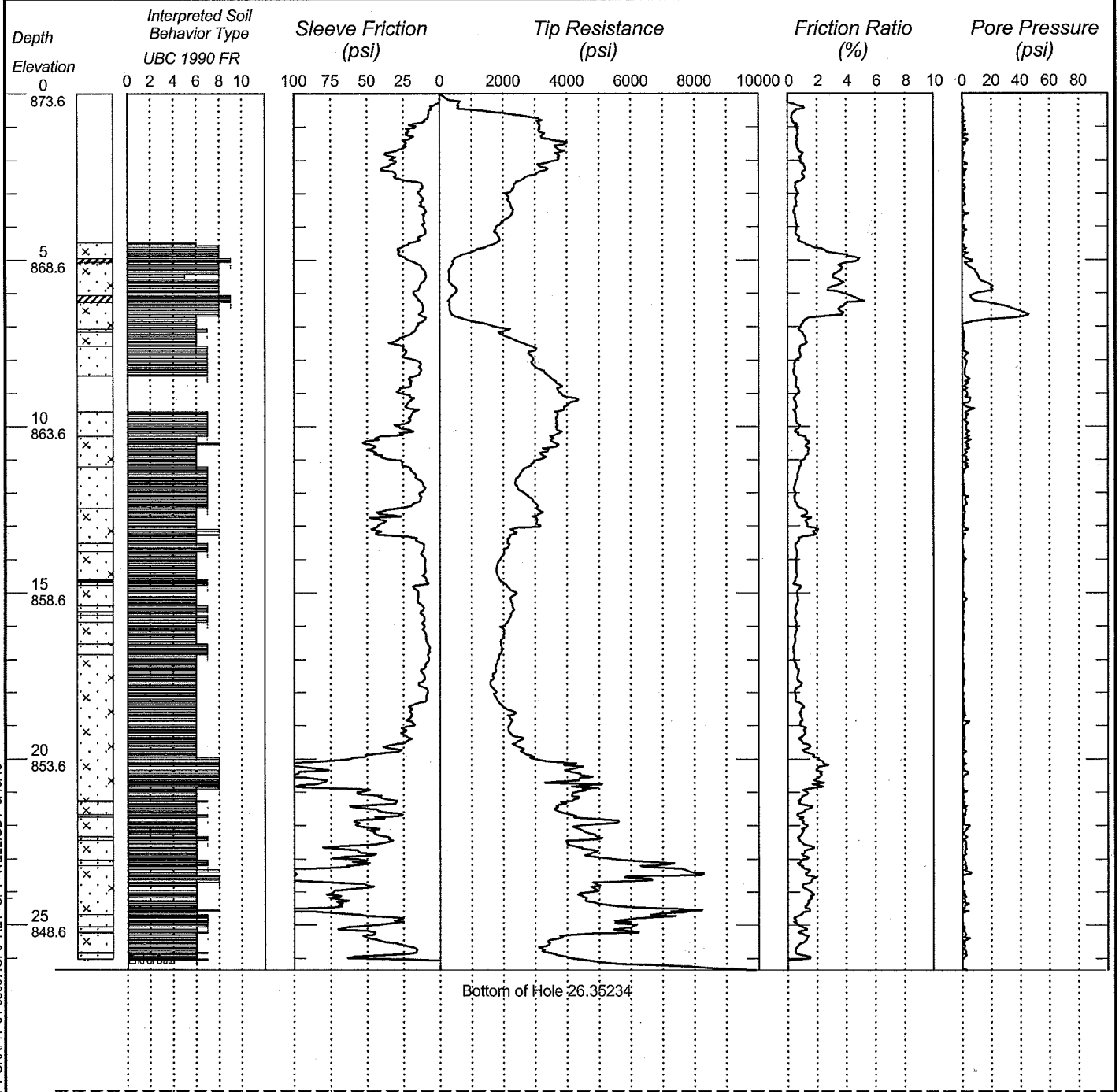
AET CPT GRAPH 01-05697.GPJ AET+CPT+WELL.GDT 8/16/13



AMERICAN
ENGINEERING
TESTING

CONE PENETRATION TEST RESULTS

AET JOB NO: 01-05697		SOUNDING NO. 1138 CT (p. 1 of 1)
PROJECT: Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis		
Location	CPT Machine 20	Surface Elevation 873.6
	CPT Operator Adams	
Hennepin Co. Coordinates: X=516076 Y=158110 (feet)	Cone # 4583.119xx	Date Completed: 8/6/13



AET CPT GRAPH 01-05697.GPJ AET+CPT+WELL.GDT 8/16/13

AET CPT GRAPH

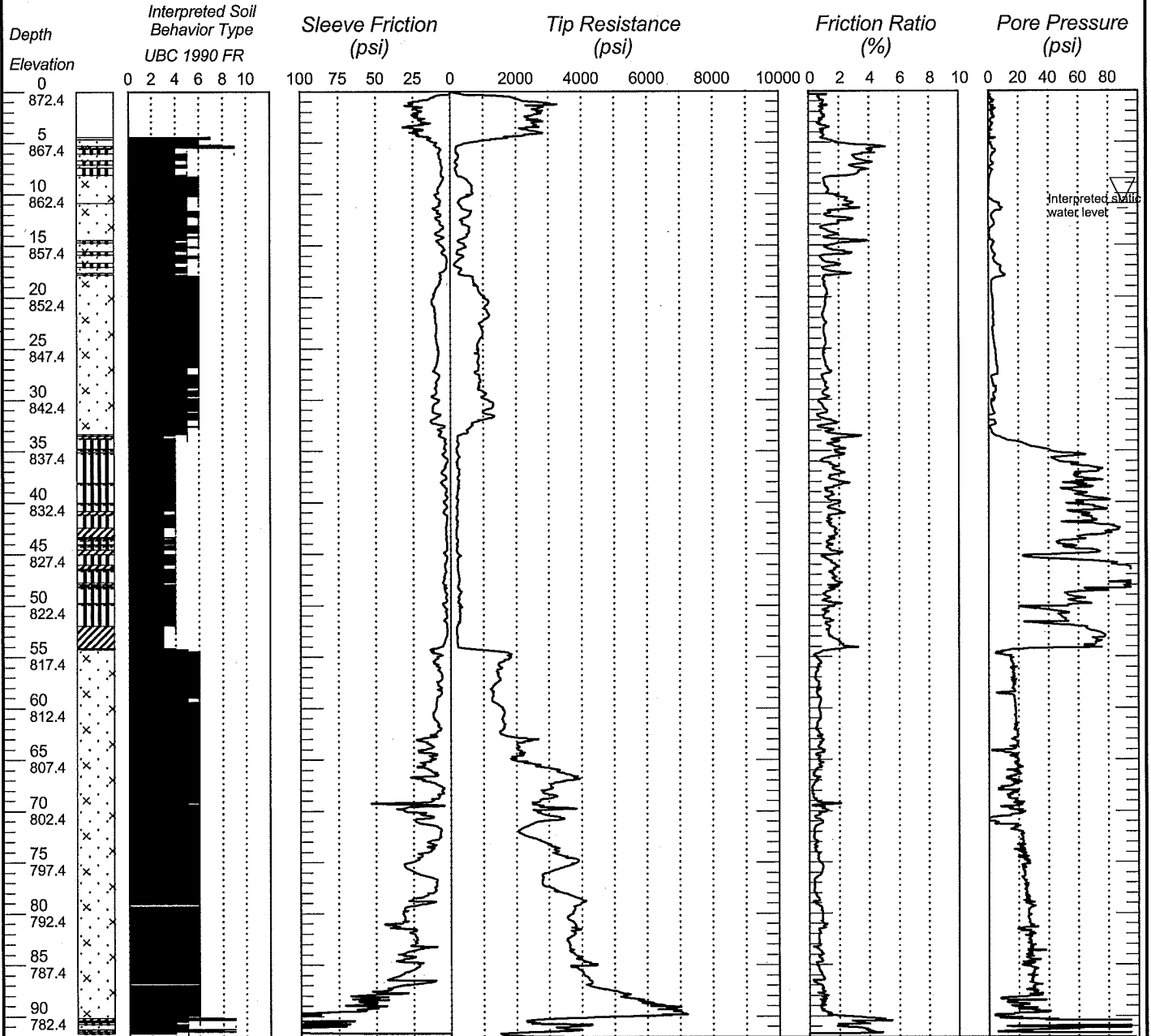
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AMERICAN
ENGINEERING
TESTING

CONE PENETRATION TEST RESULTS

AET JOB NO: <u>01-05697</u>		SOUNDING NO. 1139 CT (p. 1 of 1)
PROJECT: <u>Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis</u>		Surface Elevation 872.4
Location _____	CPT Machine 20	CPT Operator Adams
Hennepin Co. Coordinates: X=515922 Y=157836 (feet)	Cone # 4583.119xx	Date Completed: 8/6/13



Bottom of Hole 91.94178

AET CPT GRAPH

Edit: Date: 8/16/13
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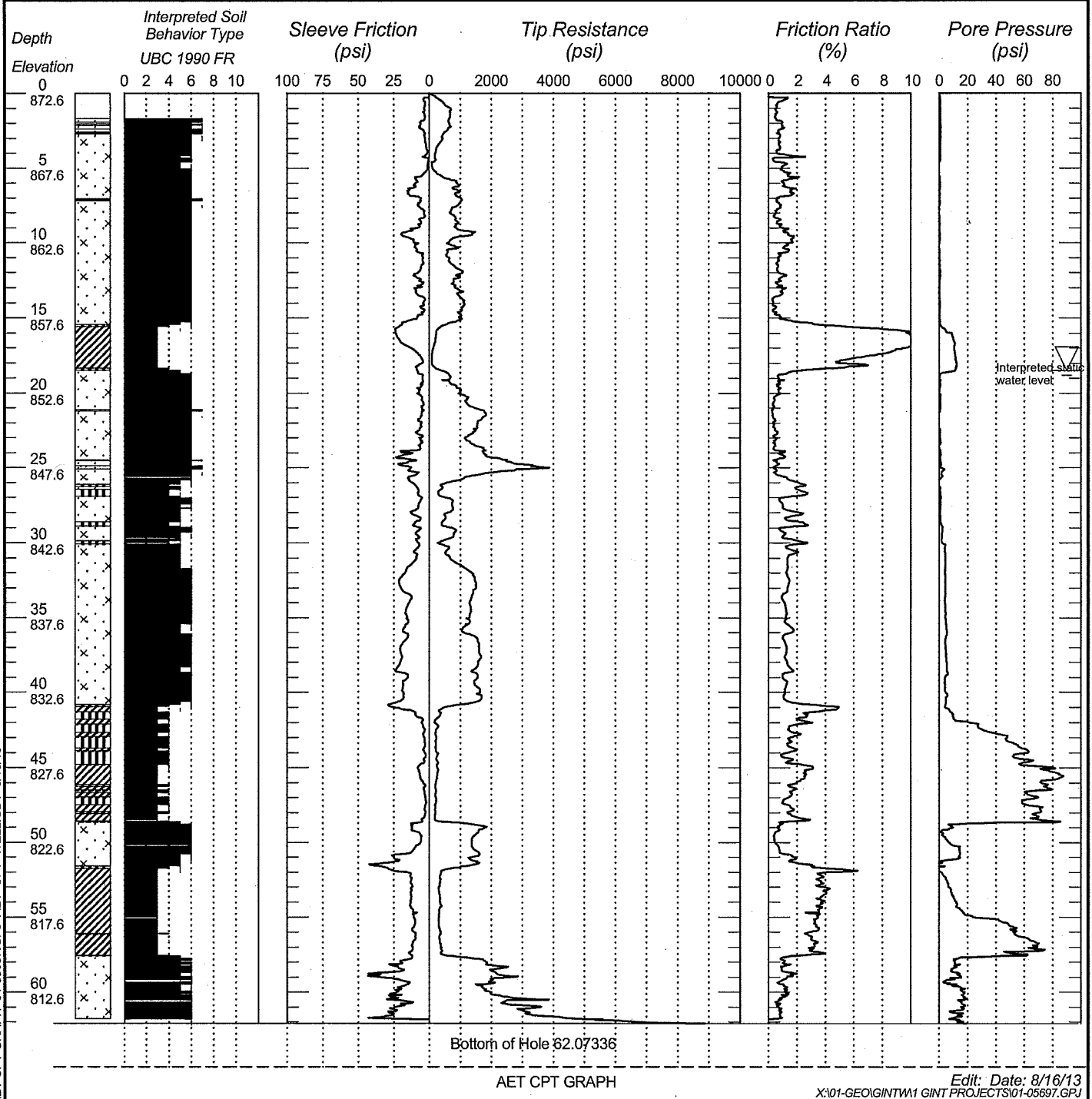
AET CPT GRAPH 01-05697.GPJ AET+CPT+WELL.GDT 8/16/13



AMERICAN
ENGINEERING
TESTING

CONE PENETRATION TEST RESULTS

AET JOB NO: 01-05697		SOUNDING NO. 1140 CT (p. 1 of 1)
PROJECT: Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis		Surface Elevation 872.6
Location _____	CPT Machine 20	Date Completed: 8/6/13
	CPT Operator Adams	
Hennepin Co. Coordinates: X=515756 Y=157604 (feet)		Cone # 4583.119xx



AET CPT GRAPH 01-05697.GPJ AET-CPT+WELL.GDT 8/16/13

Edit: Date: 8/16/13
X:\01-GEOGINTW1 GINT PROJECTS\01-05697.GPJ

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1143 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **866.2** Hennepin Co. Coordinates: **N 160773 E 517726**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, trace roots, dark brown to black (A-2-4)	FILL	22	M	SS	16					
2	FILL, mostly sand with silt and gravel, trace roots, dark brown (A-1-b)		23	M	SS	14	11				
3	FILL, mixture of clayey sand and sand with silt, a little gravel, dark brown and light brown (A-2-4)										
4		FINE ALLUVIUM OR FILL	9	M	SS	10	39				
5	SANDY ORGANIC CLAY, a little gravel, trace roots, black, stiff (OH) (A-6) (possible fill)										
6		COARSE ALLUVIUM OR FILL	7	M	SS	16					
7	SILTY SAND, a little gravel, medium to fine grained, dark brown, moist, loose (SM/SC) (A-2-4) (possible fill)										
8											
9		COARSE ALLUVIUM	33	M	SS	6					
10	GRAVELLY SAND WITH SILT, possible cobbles, trace roots, medium to fine grained, light brownish gray, a little brown, moist, dense, laminations of clayey sand (SP-SM) (A-1-b) (possible fill)										
11											
12		COARSE ALLUVIUM	20	M	SS	16					
13	GRAVELLY SAND, medium grained, light grayish brown and brown, moist to 14½' then waterbearing, medium dense, lenses of fine to medium grained sand with silt (SP) (A-1-b)										
14											
15		COARSE ALLUVIUM	25	W	SS	6					
16											
17											
18		COARSE ALLUVIUM	14	W	SS	10					
19											
20											
21		COARSE ALLUVIUM	18	W	SS	12					
22											
23											
24		COARSE ALLUVIUM	21	W	SS	10					
25											
26											
27		COARSE ALLUVIUM	22	W	SS	12					
28											
29											
30		COARSE ALLUVIUM	19	W	SS	14					
31											
		COARSE ALLUVIUM	22	W	SS	10					
27	SAND, a little gravel, medium grained, gray, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM	19	W	SS	14					
28											
29											
30	GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM	22	W	SS	10					
31											

AET CORP W-COORDINATES 01-05697.GPJ AET-CPT-Well.GDT 9/4/13

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-17'	3.25" HSA								
17-59½'	RDF w/DM	8/28/13	3:00	16.0	14.5	14.5		14.4	
		8/29/13	8:15	16.0	14.5	14.5		14.4	
BORING COMPLETED:	8/29/13	8/29/13	8:30	18.5	17.0	17.0		15.0	
DR:	GH LG: TK Rig: 1C	8/29/13	8:40	18.5	17.0	17.0		15.0	

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1143 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: **N 160773 E 517726**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS										
							WC	DEN	LL	PL	%-#200						
33	SAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b) (continued)		22	W	SS	14	20										
34																	
35																	
36			18	W	SS	14											
37																	
38	SANDY SILT, gray, wet, medium dense (ML) (A-4)	FINE ALLUVIUM	22	W	SS	14											
39	GRAVELLY SAND WITH SILT, possible cobbles, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	23	W	SS	12											
40																	
41																	
42																	
43																	
44																	
45	SAND WITH GRAVEL, medium grained, grayish brown, a little brown, waterbearing, medium dense to very dense, a lens of silt at 55' (SP) (A-1-b)		55	W	SS	0											
46																	
47																	
48																	
49																	
50			29	W	SS	6											
51																	
52																	
53																	
54																	
55			51	W	SS	12											
56																	
57																	
58	SAND WITH SILT, fine grained, brown, waterbearing, very dense, laminations of medium grained sand (SP-SM) (A-3)		61	W	SS	10											
59																	
60																	
61	END OF BORING																

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 9/4/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1144 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **868.9** Hennepin Co. Coordinates: **N 162372 E 517829**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, a little gravel, pieces of concrete, glass, trace roots, dark brown (A-2-4)	FILL	30	M	SS	16					
2	8" Crushed limestone base, light brown (A-1-b)										
3	FILL, mostly sand with silt, a little gravel, silty sand and clayey sand, brown, a little light grayish brown (A-3)			7	M	SS	14				
4	FILL, mostly sand, a little gravel, brown (A-3)										
5	FILL, mostly sand with silt, trace roots, dark brown (A-3)			6	M	SS	12				
6	FILL, mostly sand with silt, trace roots, dark brown (A-3)										
7	SAND WITH SILT, medium to fine grained, brown to dark brown, waterbearing, very loose (SP-SM) (A-1-b)	COARSE ALLUVIUM	3	W	SS	10					
8											
9				2	W	SS	10				
10											
11											
12	SANDY LEAN CLAY, a little gravel, gray, firm to very stiff (CL) (A-6)	TILL	8	M	SS	10	19				
13											
14											
15			17	W	SS	14	13				
16											
17	CLAYEY SAND, a little gravel, brown, hard (SC) (A-6)	COARSE ALLUVIUM	37	M	SS	16	13				
18	SAND WITH SILT, a little gravel, fine to medium grained, brown, waterbearing, dense, a lens of silty sand (SP-SM) (A-2-4)										
19	SAND, a little gravel, medium to fine grained, brown, waterbearing, medium dense, lenses of fine grained silty sand (SP) (A-1-b)			19	W	SS	12				
20											
21			25	W	SS	10					
22											
23											
24	SILTY SAND, a little gravel, brown, medium dense (SM) (A-2-4)	TILL	30	W	SS	12					
25											
26											
27	CLAYEY SAND, a little gravel, brownish gray, hard, laminations of sand from 29½' to 33' (SC) (A-6)	TILL	46	M	SS	16	10				
28											
29											
30			34	M	SS	14	10				
31											

AET_CORP_WCOORDINATES_01-05697.GPJ_AET+CPT+WELL_GDT_9/4/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-9½'	3.25" HSA								
9½-59½'	RDF w/DM	8/28/13	9:30	11.0	9.5	9.5			9.3
		8/28/13	9:40	11.0	9.5	9.5			9.2
BORING COMPLETED: 8/28/13		8/28/13	9:50	11.0	9.5	9.5		9.2	
DR: GH LG: TK Rig: 1C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1144 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: **N 162372 E 517829**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
33	SAND WITH SILT, fine grained, brown to brown and gray, waterbearing, dense, a lens of silt at 33½' (SP-SM) (A-3)	COARSE ALLUVIUM	41	M	X	SS	14	10				
34												
35			55	W	X	SS	12					
36												
37	SAND, a little gravel, fine to medium grained, brown, waterbearing, very dense, a lens of fine grained silty sand (SP) (A-3)		76	W	X	SS	12					
38												
39	SAND WITH SILT, a little gravel, medium grained, dark brownish gray, waterbearing, very dense (SP-SM) (A-1-b)		64	W	X	SS	10					
40												
41												
42												
43	SAND WITH SILT, fine to medium grained, grayish brown to brownish gray, waterbearing, very dense (SP-SM) (A-3)		65	W	X	SS	12					
44												
45												
46												
47												
48	SAND, fine grained, grayish brown, waterbearing, very dense (SP) (A-3)		69	W	X	SS	14					
49												
50												
51												
52												
53												
54												
55			61	W	X	SS	14					
56												
57												
58	SAND, fine to medium grained, grayish brown, waterbearing, very dense (SP) (A-3)		70	W	X	SS	10					
59												
60												
61	END OF BORING											

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 9/4/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1145 HC (p. 1 of 1)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **852.8** Hennepin Co. Coordinates: **N 159973 E 517242**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	qu	PL	%-#200	
1	Water											
2	SAND WITH GRAVEL, includes organics, medium to fine grained, black/dark brown (SP)	COARSE ALLUVIUM			DS		38					4
3	SAND, a little gravel, includes organics, medium to fine grained, black/dark brown (SP)				DS		39					4
4	SAND WITH SILT AND GRAVEL, medium to fine grained, dark brown (SP-SM)				DS		15					7
5												
6												
7	END OF BORING											

Locations, elevations and depths should be considered approximate (samples taken below water from boat).

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-4'	HA/bag								
4-7'	Geoprobe tube								

BORING COMPLETED: **8/23/13**

DR: **APN** LG: **APN** Rig: **HA/Tube**

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 9/16/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1146 HC (p. 1 of 1)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **852.8** Hennepin Co. Coordinates: **N 159989 E 517222**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	OC	LL	PL	%-#200	
1	Water											
2					DS							
3												
4	SILT WITH SAND, black/dark brown (OH)	SEDIMENT										
5					DS		372	20				75
6	SILTY SAND, with organic fines, fine grained, dark brown (SM/OH)				DS		119	15				50
7	ORGANIC SILT WITH SAND, dark brown, encountered gravel at about 8½' (likely represents the top of the alluvium) (OH)				DS		108	13				74
8												
<p>END OF BORING</p> <p>Locations, elevations and depths should be considered approximate (samples taken below water from boat).</p>												

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-8½'	HA/bag								
BORING COMPLETED: 8/22/13									
DR: APN LG: APN Rig: HA									

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 9/17/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1147 HC (p. 1 of 1)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **852.8** Hennepin Co. Coordinates: **N 160005 E 517203**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	qu	PL	%-#200		
1	Water												
2					DS								
3													
4	ORGANIC SANDY SILT, black/dark brown (OH)	SEDIMENT											
5					DS							68	
6	SILTY SAND, with organic fines, fine grained, black/dark brown (SM/OH)												
7					DS							49	
8	SILTY SAND WITH GRAVEL, medium to fine grained, dark brown (SM)	COARSE ALLUVIUM											
9					DS		20					14	
9	END OF BORING Locations, elevations and depths should be considered approximate (samples taken below water from boat).												

AET CORP W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT_9/16/13

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-7'	HA/bag								
BORING COMPLETED: 8/23/13									
DR: APN LG: APN Rig: HA									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1148 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **864.6** Hennepin Co. Coordinates: N **163206** E **518072**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand with gravel, a little sapric peat and ashes/cinders, pieces of glass, trace roots, dark brown and brown, a little black (A-2-4)	FILL	10	M	SS	15					
2			15	M		7					
3	FILL, mixture of silty sand and sandy lean clay, a little gravel, dark brown, a little light brownish gray (A-2-4)	FILL	13	M	SS	8					
4			13	M		8					
5	FILL, mostly sand, a little gravel, trace roots, light grayish brown (A-3)	FILL	27	M	SS	8					
6			27	M		8					
7	SAND WITH SILT AND GRAVEL, possible cobbles, fine to medium grained, light grayish brown, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	30	M	SS	2					
8	30		M	2							
9	GRAVELLY SAND WITH SILT, fine to medium grained, light brown, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	25	M	SS	5					
10	25		M	5							
11	SAND, a little gravel, medium grained, light grayish brown, moist, medium dense (SP) (A-1-b)	TILL	18	M	SS	17	15				
12	18		M	17		15					
13	CLAYEY SAND, a little gravel, grayish brown, very stiff (SC) (A-6)	TILL	17	▼	SS	16	14				
14	17		▼	16		14					
15	CLAYEY SAND, a little gravel, brown, very stiff (SC) (A-6)	TILL	50/2	M	SS	8	12				
16	50/2		M	8		12					
17	CLAYEY SAND WITH GRAVEL, possible cobbles, brown, hard (SC)	TILL	17	M/W	SS	10	12				
18	17		M/W	10		12					
19	CLAYEY SAND, a little gravel, brown, very stiff (SC) (A-6)	TILL	19	M/W	SS	17	10				
20	19		M/W	17		10					
21	SAND WITH SILT, medium grained, brown, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	12	W	SS	18					
22	12		W	18							
23	SAND, possible cobbles, medium grained, brown, waterbearing, medium dense, a lens of clayey sand (SP) (A-1-b)	COARSE ALLUVIUM	25	W	SS	10					
24	25		W	10							

AET CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/15/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-29'	3.25" HSA								
29-39½'	RDF w/DM	10/1/13	8:57	28.5	27.0	26.7			21.5
		10/1/13	9:07	28.5	27.0	24.2			18.6
BORING COMPLETED: 10/1/13									
DR: SG LG: SB Rig: 91C									



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1148 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **163206** E **518072**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
33	SAND, medium grained, brown, waterbearing, dense, lenses of sand with silt (SP) (A-1-b) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>	39	W	X	SS	14						
34													
35	SAND WITH SILT, a little gravel, fine to medium grained, brown, waterbearing, dense (SP-SM) (A-1-b)			40	W	X	SS	10					
36													
37	SAND WITH SILT AND GRAVEL, possible cobbles, fine to medium grained, brown, waterbearing, dense (SP-SM) (A-1-b)			50	W	X	SS	6					
38													
39	SAND WITH GRAVEL, possible cobbles, medium grained, gray, waterbearing, medium dense, a lens of sand with silt (SP) (A-1-b)		30	W	X	SS	11						
40													
41	END OF BORING												

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL_GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1149 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **867.4** Hennepin Co. Coordinates: **N 162761 E 517891**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, a little gravel and clayey sand, trace roots, dark brown, a little brown (A-2-4)	FILL	20	M	SS	18					
2	FILL, mostly silty sand with gravel, possible cobbles, pieces of concrete, a little ashes/cinders, brown (A-2-4)		51	M	SS	4					
3											
4	SILTY SAND, a little gravel, fine grained, light brown, moist, medium dense (SM) (A-2-4)	COARSE ALLUVIUM OR FILL	25	M	SS	13					
5											
6	SAND WITH SILT AND GRAVEL, fine grained, light brown, a little light brownish gray, moist, medium dense (SP-SM) (A-1-b) (possible fill)		19	M	SS	12					
7											
8	SAND WITH SILT, fine grained, light brown, moist, medium dense, a lamination of lean clay (SP-SM) (A-3)	COARSE ALLUVIUM	17	M	SS	14					
9											
10	SAND, medium to fine grained, light brown, moist, medium dense (SP-SM) (A-1-b)		14	M	SS	15					
11											
12	SAND, fine to medium grained, light brown, a little brown, moist, medium dense, a lens of sand with silt (SP) (A-3)		22	M	SS	14					
13											
14	CLAYEY SAND, brown, moist, very stiff, laminations of waterbearing sand (SC) (A-6)	TILL	27	M/W	SS	17	15				
15											
16	CLAYEY SAND, a little gravel, gray, a little brown, stiff, laminations of waterbearing sand (SC) (A-6)	MIXED ALLUVIUM	14	M/W	SS	17	13				
17											
18	SAND WITH SILT, a little gravel, medium to fine grained, brown, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	16	W	SS	15					
19											
20											
21											
22											
23											
24											
25											
26											
27	GRAVELLY SAND WITH SILT, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)		30	W	SS	2					
28											
29	SILTY SAND, a little gravel, fine to medium grained, brownish gray, wet, medium dense (SM) (A-1-b)		20	W	SS	13					
30											
31											

AET CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/15/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-25½'	3.25" HSA								
25½-49½'	RDF w/DM	10/1/13	11:46	26.0	24.5	23.2		21.4	
		10/1/13	12:00	26.0	24.5	22.2		18.5	
BORING COMPLETED: 10/1/13									
DR: SG LG: SB Rig: 91C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1149 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **162761** E **517891**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
33	SAND WITH SILT, a little gravel, medium to fine grained, gray, waterbearing, dense (SP-SM) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	39	W	X	SS	13					
34												
35	SAND WITH SILT, fine grained, brown, waterbearing, dense to medium dense (SP-SM) (A-3)		33	W	X	SS	10					
36												
37												
38			40	W	X	SS	12					
39												
40			29	W	X	SS	16					
41												
42												
43			30	W	X	SS	12					
44	GRAVELLY SAND WITH SILT, fine grained, brown, waterbearing, dense (SP-SM) (A-3)											
45												
46			47	W	X	SS	1					
47	SAND, fine to medium grained, brown, waterbearing, medium dense, a lens of sand with silt at 48' (SP) (A-3)											
48												
49												
50			19	W	X	SS	10					
51												
50			13	W	X	SS	½					
51	END OF BORING											

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1150 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **864.8** Hennepin Co. Coordinates: **N 161728 E 517802**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand with organic fines, a little gravel and ashes/cinders, trace roots, black (A-2-4)	FILL	9	M	SS	20					
2											
3	FILL, mostly sand with silt, a little gravel and silty sand, trace roots, brown, a little black (A-2-4, A-1-b)		15	M	SS	10					
4											
5	SAND WITH SILT AND GRAVEL, fine to medium grained, brown, moist, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	11	M	SS	6					
6											
7	SAND, a little gravel, medium grained, light brown, a little brown, moist to about 9½' then waterbearing, loose, lenses of clayey sand (SP) (A-1-b)		5	M	SS	16					
8											
9											
10											
11											
12	SAND WITH SILT, a little gravel, fine grained, grayish brown, a little dark brownish gray, wet, medium dense, lenses of silty sand with organic fines (SP-SM) (A-2-4)		16	W/M	SS	10					
13											
14	SAND WITH SILT AND GRAVEL, fine to medium grained, grayish brown, wet to waterbearing (SP-SM) (A-1-b)		13	W	SS	10					
15											
16											
17	SAND WITH GRAVEL, medium grained, gray, a little dark brownish gray, waterbearing, loose to very loose, lenses of fine grained silty sand with organic fines (SP) (A-1-b)		5	W	SS	10					
18											
19											
20											
21											
22	SAPRIC PEAT, black (PT) (A-8)	SWAMP DEPOSIT	9	W	SS	18	188				
23											
24	ORGANIC CLAY, trace shells, gray to brownish gray, soft to very soft (OH) (A-8)		3	M/W	SS	16	57				
25											
26											
27											
28											
29											
30	SAND WITH GRAVEL, medium grained, gray, a little dark brownish gray, waterbearing, loose (SP) (A-1-b)	COARSE ALLUVIUM	9	W	SS	16					
31											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	3.25" HSA								
29½-49½'	RDF w/DM	9/26/13	11:15	11.0	9.5	9.8		9.5	
		9/26/13	11:25	11.0	9.5	9.5		9.5	
BORING COMPLETED: 9/26/13		9/26/13	11:40	18.5	17.0	16.9		15.1	
DR: SS LG: GH Rig: 41C		9/26/13	11:45	18.5	17.0	16.8		14.9	

AET_CORP_WCOORDINATES_01-05697.GPJ_AET+CPT+WELL.GDT_10/16/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1150 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **161728** E **517802**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
33	SAND, a little gravel, medium grained, gray, waterbearing, medium dense (SP) (A-1-b)		12	W	SS	12					
34											
35	GRAVELLY SAND, medium to fine grained, gray, waterbearing, medium dense to loose (SP) (A-1-b)		11	W	SS	4					
36											
37											
38			8	W	SS	3					
39											
40	SAND, a little gravel, medium to fine grained, gray, waterbearing, loose (SP) (A-1-b)		8	W	SS	8					
41											
42	SAND, fine to medium grained, brownish gray, waterbearing, medium dense, lenses of fine grained sand with silt (SP) (A-1-b)		12	W	SS	14					
43											
44											
45			19	W	SS	16					
46											
47											
48			18	W	SS	8					
49											
50	SAND WITH SILT, fine grained, brownish gray, waterbearing, medium dense (SP) (A-3)		23	W	SS	16					
51	END OF BORING										

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL_GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1151 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **865.3** Hennepin Co. Coordinates: **N 161335 E 517782**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand with organic fines, a little gravel, trace roots, dark brown (A-2-4)	FILL	19	M	SS	18					
2	FILL, mostly sand with silt and gravel, brown (A-1-b)		20	M	SS	18					
4	CLAYEY SAND, a little gravel, brown mottled, very stiff, laminations of medium grained sand and sandy silt (SC)	MIXED ALLUVIUM	16	M	SS	18	13				
5	SAND WITH SILT, a little gravel, fine grained, brown, moist, medium dense, laminations of lean clay with sand (SP-SM) (A-2-4)	COARSE ALLUVIUM	12	M	SS	18					
6	SAND WITH SILT, fine to medium grained, brown, moist, loose, a lens of clayey sand (SP-SM) (A-1-b, A-6)		9	M/W	SS	18					
7	SAND WITH SILT, a little gravel, medium to fine grained, gray, a little black, waterbearing, very loose, lenses of sapric peat with sand and clayey sand (SP-SM) (A-1-b, A-8)		3	W	SS	18					
8			3	W	SS	18					
9	HEMIC PEAT, dark brown and brown, a little black, a lens of sapric peat at 20½' (PT) (A-8)	SWAMP DEPOSIT	5	W	SS	18	290				
10			10	W	SS	16	292				
11	SAND WITH SILT AND GRAVEL, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	24	W	SS	12					
12	SAND WITH SILT AND GRAVEL, fine to medium grained, dark brownish gray, a little light gray, waterbearing, medium dense to loose, a lamination of lean clay at 25½' (SP-SM) (A-1-b)		14	W	SS	10					
13			7	W	SS	5					
14	GRAVEL WITH SAND, gray, waterbearing, medium dense to loose (GP) (A-1-b)		19	W	SS	1					

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/15/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-24½'	3.25" HSA								
24½-49½'	RDF w/DM	9/27/13	9:36	13.5	12.0	12.5			12.3
		9/27/13	9:45	13.5	12.0	12.4			11.6
BORING COMPLETED:	9/27/13	9/27/13	10:05	23.5	22.0	22.3		18.0	
DR: SS LG: GH Rig: 41C		9/27/13	10:10	23.5	22.0	21.5		17.0	

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1151 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **161335** E **517782**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
33	GRAVEL WITH SAND, gray, waterbearing; medium dense to loose (GP) (A-1-b) <i>(continued)</i>		12	W	SS	½						
34												
35												
36					14	W	SS	6				
37												
38					19	W	SS	2				
39												
40					8	W	SS	4				
41												
42												
43			17	W	SS	4						
44												
45			18	W	SS	6						
46												
47												
48			18	W	SS	8						
49												
50			45	W	SS	2						
51	END OF BORING											

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1152 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **867.9** Hennepin Co. Coordinates: **N 160223 E 517507**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mixture of clayey sand with organic fines and silty sand, a little gravel, trace roots, dark brown (A-2-4)	FILL	16	M	SS	12	19				
2											
3	FILL, mostly sand with silt and gravel, a little silty sand, grayish brown, a little dark brown (A-1-b)			33	M	SS	12				
4											
5	FILL, mostly gravelly sand with silt, a little clayey sand, brown and brownish gray, a little dark brown (A-1-b)			22	-	SS	0				
6											
7											
8				18	M	SS	4				
9											
10				19	M	SS	16				
11											
12											
13				48	M	SS	6				
14											
15	SAND WITH SILT, fine grained, brown, moist, medium dense (SP-SM) (A-3)	COARSE ALLUVIUM	20	M	SS	12					
16											
17	SAND WITH GRAVEL, medium grained, brown, waterbearing, medium dense (SP-SM) (A-1-b)			13	W	SS	12				
18											
19	SAND, a little gravel, medium grained, brown, waterbearing (SP) (A-1-b)			13	W	SS	10				
20											
21	SAND WITH SILT, fine grained, brown, waterbearing, medium dense (SP-SM) (A-3)			21	W	SS	12				
22											
23	SAND, a little gravel, medium grained, grayish brown, waterbearing, loose (SP) (A-1-b)			10	W	SS	6				
24											
25	SAND WITH GRAVEL, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)		11	W	SS	6					
26											
27	SAND, a little gravel, medium grained, grayish brown, waterbearing, medium dense (SP) (A-1-b)		18	W	SS	10					
28											
29											
30											
31											

AET CORP W-COORDINATES 01-05697.GPJ AET-CPT-WELL.GDT 10/15/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-17'	3.25" HSA								
17-49½'	RDF w/DM	10/7/13	11:36	18.5	17.0	17.2			16.8
		10/7/13	12:09	18.5	17.0	17.1			16.4
BORING COMPLETED: 10/7/13									
DR: SG LG: SHS Rig: 91C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1152 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **160223** E **517507**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
33	SAND WITH SILT, a little gravel, fine to medium grained, brown, waterbearing, medium dense (SP-SM) (A-3)	COARSE ALLUVIUM <i>(continued)</i>	38	W	X	SS	12					
34												
35	SAND, a little gravel, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)		14	W	X	SS	10					
36												
37	SAND WITH SILT, fine grained, grayish brown, waterbearing, medium dense (SP-SM) (A-3)		26	W	X	SS	2					
38												
39	SAND WITH GRAVEL, medium grained, grayish brown, waterbearing, medium dense (SP) (A-1-b)		21	W	X	SS	12					
40												
41												
42												
43	SAND WITH GRAVEL, medium grained, gray, waterbearing, medium dense (SP) (A-1-b)	24	W	X	SS	10						
44												
45												
46	SAND, fine grained, brownish gray, waterbearing, medium dense (SP) (A-3)	17	W	X	SS	10						
47												
48												
49	SAND, fine grained, brownish gray, waterbearing, medium dense (SP) (A-3)	13	W	X	SS	10						
50												
51	END OF BORING											

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1153 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **869.2** Hennepin Co. Coordinates: **N 159749 E 517111**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly gravelly silty sand, pieces of concrete, trace roots, dark brown (A-1-b)	FILL	9	M		18					
2	FILL, mostly sand with silt, a little gravel, silty sand and ashes/cinders, dark brown, a little black		8	M		12					
3	FILL, mostly gravelly sand with silt, brown (A-1-b)		13	M		10					
4	FILL, mostly silty sand with gravel, brown (A-1-b)		24	M		8					
5	FILL, mostly gravelly sand with silt, a little clayey sand, brown (A-1-b)		9	M		12					
6	FILL, mostly clayey sand, a little gravel, dark brown (A-6)		12	M		12	13				
7	FILL, mostly gravelly sand with silt, a little hemic peat, brown, a little dark brown (A-1-b)		9	M		12					
8	ORGANIC CLAY, black, soft (OH) (A-8)		SWAMP DEPOSIT	3	M		18	78			
9	SANDY LEAN CLAY WITH GRAVEL, dark brownish gray, stiff (CL) (A-7-6)		TILL	13			14	19			
10	GRAVELLY SAND WITH SILT, gray, medium dense, a lens of silty sand (SP-SM) (A-1-b)		COARSE ALLUVIUM	12	W		6				
11	GRAVEL WITH SILT AND SAND, gray, waterbearing, medium dense (GP-GM)			21	W		3				
12	GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP)			22	W		8				
13	SAND WITH SILT, a little gravel, medium to fine grained, dark gray, waterbearing, medium dense (SP-SM) (A-1-b)			19	W		10				
14											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	3.25" HSA								
24½-49½'	RDF w/DM	10/4/13	9:13	18.5	17.0	17.0		None	
		10/4/13	9:17	26.0	24.5	24.6		20.5	
BORING COMPLETED: 10/4/13		10/4/13	9:40	26.0	24.5	24.0		20.0	

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 10/15/13



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1153 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **159749** E **517111**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
33	GRAVEL WITH SILT AND SAND, gray, waterbearing, medium dense to dense (GP-GM) (A-1-b) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>	28	W	X	SS	12						
34													
35													
36													
37													
38	SAND, a little gravel, medium to fine grained, brown, waterbearing, medium dense (SP) (A-1-b)		27	W	X	SS	10						
39	SAND WITH GRAVEL, medium to coarse grained, dark gray, waterbearing, medium dense (SP) (A-1-b)		27	W	X	SS	10						
40													
41	SAND, a little gravel, medium to fine grained, light brown, waterbearing, medium dense, laminations of lean clay (SP) (A-1-b)		26	W	X	SS	12						
42													
43	SAND WITH GRAVEL, medium grained, brown, waterbearing, medium dense (SP) (A-1-b)		26	W	X	SS	12						
44													
45	SAND, a little gravel, medium to fine grained, brown, a little gray, waterbearing, dense, lenses of lean clay (SP) (A-1-b)		36	W	X	SS	10						
46													
47	SAND, fine grained, grayish brown, waterbearing, medium dense, laminations of medium grained sand (SP) (A-3)		27	W	X	SS	10						
48													
49	END OF BORING												
50													
51													

AET CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1154 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **871.8**

Hennepin Co. Coordinates:

N **159372**

E **516794**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly clayey sand with organic fines, a little gravel, trace roots, black (A-2-6)	FILL	25	M	SS	6	13				
2	FILL, mostly gravelly silty sand, pieces of wood, trace roots, brown (A-1-b)		28	M	SS	8					
4	GRAVELLY SAND WITH SILT, fine to medium grained, brown, moist, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	26	M	SS	10					
5			26	M	SS	12					
7	SAND WITH SILT AND GRAVEL, fine to medium grained, grayish brown, moist, medium dense (SP-SM)		33	M	SS	10					
8			47	M	SS	14					
9	SAND WITH SILT AND GRAVEL, fine to medium grained, brown to grayish brown, moist, dense (SP-SM) (A-1-b)		20	M	SS	16					
10			19	M	SS	14					
14	SAND, fine grained, light brown, a little brown, moist, medium dense, laminations of silt (SP) (A-3)		27	M	SS	12					
15			21	W	SS	12					
19	SAND, a little gravel, fine to medium grained, light brown, moist, medium dense, laminations of silt (SP) (A-3)		29	W	SS	6					
20			23	-	SS	0					
22	SAND, a little gravel, medium grained, light brown, waterbearing, medium dense (SP) (A-1-b)	21	W	SS	12						
24	GRAVELLY SAND, medium grained, light brown, waterbearing, medium dense (SP) (A-1-b)										
25											
28	SAND WITH SILT, fine grained, brown to gray, waterbearing, medium dense (SP-SM) (A-3)										
29											
30											
31											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-22'	3.25" HSA								
22-49½'	RDF w/DM	10/8/13	11:37	23.5	22.0	22.0			21.7
		10/8/13	12:00	23.5	22.0	21.5			22.0
BORING COMPLETED: 10/8/13									
DR: SG LG: SHS Rig: 91C									

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1154 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **159372** E **516794**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
33	SAND WITH SILT, fine grained, brown to gray, waterbearing, medium dense (SP-SM) (A-3) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>	26	W	X	SS	14					
34												
35			23	W	X	SS	12					
36												
37	SANDY SILT, gray to grayish brown, wet, very dense (ML) (A-4)	FINE ALLUVIUM	64	W	X	SS	14	20				
38												
39												
40			68	W	X	SS	12	20				
41												
42	SAND, fine grained, grayish brown, waterbearing, dense (SP) (A-3)	COARSE ALLUVIUM	49	W	X	SS	14					
43												
44	SILTY CLAY, grayish brown, hard (CL-ML) (A-4)	FINE ALLUVIUM	57	M	X	SS	12	20				
45												
46												
47	SAND, fine to medium grained, brown, waterbearing, medium dense (SP) (A-3)	COARSE ALLUVIUM	23	W	X	SS	14					
48												
49	SAND WITH GRAVEL, medium to coarse grained, brown, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM	13	W	X	SS	4					
50												
51	END OF BORING											

AET_CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/16/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1155 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **875.2** Hennepin Co. Coordinates: **N 158307 E 516163**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
1	FILL, mostly silty sand with organic fines, possible cobbles, trace roots, dark brown (A-2-4)	FILL	28	M		SS	2					
2	FILL, mostly sand with silt, a little gravel, trace roots, light brown (A-3)		15	M		SS	7					
4	FILL, mostly silty sand with gravel, trace roots, dark brown (A-1-b)		25	M		SS	6					
6	FILL, mostly gravelly silty sand, possible cobbles, grayish brown (A-1-b)		75/9	M		SS	6					
8												
9												
10												
11	SAND WITH SILT, fine grained, light grayish brown, a little light brown, moist, dense, a lens of silt (SP-SM) (A-3) (possible fill)	COARSE ALLUVIUM OR FILL	38	M		SS	0					
12			32	M		SS	7					
13												
14	SILTY SAND, fine grained, light brown, moist, medium dense, a lens of silt (SM) (A-2-4)	COARSE ALLUVIUM	19	M		SS	13					
15			17	M		SS	15	23				
16												
17	SILT, light brown, moist, medium dense, laminations of silty sand (ML) (A-4)	FINE ALLUVIUM	17	M		SS	15	23				
18			20	M		SS	15	26				
19	LEAN CLAY, brown, very stiff, laminations of silty sand (CL) (A-4)	COARSE ALLUVIUM	18	M		SS	12					
20			8	M/W		SS	15					
21												
22	SAND, fine to medium grained, light brown, moist to waterbearing, medium dense to loose (SP) (A-3)	COARSE ALLUVIUM	2	W		SS	15					
23			15	W		SS	13					
24												
25												
26												
27	SAND, fine grained, light brown, waterbearing, very loose to medium dense (SP) (A-3)		2	W		SS	15					
28												
29												
30												
31												

DEPTH: DRILLING METHOD

WATER LEVEL MEASUREMENTS

NOTE: REFER TO
THE ATTACHED
SHEETS FOR AN
EXPLANATION OF
TERMINOLOGY ON
THIS LOG

0-29' 3.25" HSA

DATE

TIME

SAMPLED
DEPTH

CASING
DEPTH

CAVE-IN
DEPTH

DRILLING
FLUID LEVEL

WATER
LEVEL

BORING
COMPLETED: **10/11/13**

10/11/13

1:15

26.0

24.5

24.7

26.4

None

DR: **SG** LG: **SB** Rig: **91C**

10/11/13

1:30

28.5

27.0

26.0

25.1

AET_CORP_W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1155 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: **N 158307 E 516163**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
33	LEAN CLAY, brownish, gray, stiff, laminations of silt (CL) (A-7-6) (continued)	FINE ALLUVIUM (continued)	11	M/W	X	SS	18	26					
34	SILTY CLAY, brownish gray, very stiff (CL-ML) (A-4)		29	M/W									8	20
37	SAND, fine grained, grayish brown, waterbearing, dense (SP) (A-3)	COARSE ALLUVIUM	42	W	X	SS	13						
39	SAND, fine to medium grained, grayish brown, a little brown, waterbearing, medium dense, laminations of silty sand around 42½' (SP) (A-3)		27	W									13
42			21	W									12
44	SILTY SAND, fine grained, grayish brown, wet, medium dense, laminations of sand with silt (SM) (A-2-4)		25	W									13
47	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)		27	W									15
49	SAND, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)	22	W	10									
51	END OF BORING												

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1156 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **871.3** Hennepin Co. Coordinates: **N 157802 E 515913**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly sand with silt and gravel, a little clayey sand with organic fines, trace roots, brown and dark brown (A-1-b, A-6)	FILL	15	M	SS	18					
2	FILL, mostly silty sand with gravel, a little ashes/cinders, black (A-1-b)		24	M	SS	7	6				
3	FILL, mostly clayey sand with gravel, possible cobbles, brown (A-2-6)										
4	LEAN CLAY, trace roots, brown mottled, firm to stiff, laminations of silt (CL) (A-4)	FINE ALLUVIUM	8	M	SS	13	32				
5			9	M	SS	13	37				
6			7	M	SS	17	40				
7	SILTY CLAY, trace roots, brown mottled, soft, laminations of silt (CL-ML) (A-4)		4	M/W	SS	18	32				
8	SILT, gray and brown, wet, loose (ML) (A-4)		5	W	SS	13	32				
9	SAND WITH SILT, fine grained, brown mottled, waterbearing, loose (SP-SM) (A-3)	COARSE ALLUVIUM	9	W	SS	14					
10	SANDY SILT, brown mottled, wet, loose (ML) (A-4)	FINE ALLUVIUM	9	W	SS	16	31				
11	SILT WITH SAND, gray, wet, loose (ML) (A-4)		8	W	SS	13	33				
12			5	W	SS	13	25				
13			4	-	SS	0					
14	FAT CLAY, gray, soft to firm, laminations of silt (CH) (A-7-6)		5	M/W	SS	18	38				

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 10/16/13

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'	3.25" HSA								
19½-49½'	RDF w/DM	10/9/13	11:52	21.0	19.5	18.7		17.2	
		10/9/13	12:11	21.0	19.5	17.0		16.0	
BORING COMPLETED: 10/9/13									
DR: SG LG: SB Rig: 91C									





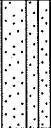

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1156 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: **N 157802 E 515913**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
33	FAT CLAY, gray, soft to firm, laminations of silt (CH) (A-7-6) (continued)		3	M/W		SS	18	39					
34													
35													
36													
37													
38													
39													
40													
41													
42													
43													
44													
45													
46													
47													
48													
48	SAND WITH SILT, medium to fine grained, gray, waterbearing, medium dense to loose (SP-SM) (A-1-b)		12	M/W		SS	18	29					
49													
50													
50													
51	END OF BORING												

AET_CORP W-COORDINATES 01-05697.GPJ_AET+CPT+WELL.GDT 10/15/13

SUBSURFACE BORING LOG

AET JOB NO: **01-05697** LOG OF BORING NO. **1157 ST (p. 1 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **873.1** Hennepin Co. Coordinates: **N 157443 E 515596**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
1	FILL, mixture of silty sand with gravel and clayey sand with organic fines, trace roots, black and dark brown (A-1-b, A-2-6)	FILL	18	M		SS	6					
2	FILL, mostly sand with silt, a little gravel, light grayish brown (A-3)		8	M		SS	5					
4	FILL, mostly sand with silt and gravel, brown (A-1-b)		5	M		SS	5					
7	FILL, mostly silty sand with gravel, a little sand with silt, trace roots, dark brown, a little brown (A-2-4)		12	M		SS	8					
9	FILL, mostly sand with silt and gravel, a little clayey sand with organic fines, brown, a little black (A-1-b)		12	M		SS	4					
12	FILL, mostly clayey sand, a little gravel, trace roots, dark brown (A-6)		15	M		SS	4	11				
14	FILL, mostly gravelly sand, light brown (A-1-b)		31	M		SS	5					
17	FILL, mostly sand with silt and gravel, brown (A-1-b)		23	M/W		SS	12					
19	SILTY CLAY, grayish brown, soft (CL-ML) (A-4)		FINE ALLUVIUM	3	M/W		SS	17	37			
22	SILT, gray, wet, loose (ML) (A-4)			6	W		SS	16	38			
24	SILTY SAND, fine grained, dark gray, wet, very loose (SM) (A-4)			COARSE ALLUVIUM	3	W		SS	18			
27	SAND WITH SILT, possible cobbles, fine grained, gray, waterbearing, medium dense (SP-SM)		13		W		SS	10				
30			16		W		SS	10				
31												

AET_CORP_W-COORDINATES_01-05697.GPJ_AET+CPT+WELL_GDT_10/16/13

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	3.25" HSA							21.7	
24½'-41'	RDF w/DM	10/9/13	2:25	26.0	24.5	22.1		18.7	
		10/10/13	8:00	26.0	24.5	20.8			
BORING COMPLETED: 10/9/13									
DR: SG LG: SB Rig: 91C									

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1157 ST (p. 2 of 2)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **157443** E **515596**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
33			17	W	SS	13					
34	FAT CLAY, gray, a little dark gray, firm to soft, laminations of lean clay and waterbearing sand (CH) (A-7-6)	FINE ALLUVIUM	5	M/W	SS	18	49				
35			3	M/W	SS	18	46				
36			4	M/W	SS	18	40				
37											
38											
39											
40											
41	END OF BORING										

SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1230 SV (p. 1 of 3)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

SURFACE ELEVATION: **873.0** Hennepin Co. Coordinates: N **157440** E **515584**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly clayey sand, with organic fines, a little gravel and silty sand, trace roots, dark brown (A-2-6, A-2-4)	FILL	6	M	SS	14					
2			5	M		12					
3	FILL, mostly sand, a little gravel, sand with silt and silty sand, pieces of wood, trace roots, brown, a little black (A-1-b)		7	M	SS	4					
4			7	M		8					
5			7	M		14	13				
6			6	M		10					
7	FILL, mostly clayey sand, a little gravel, trace roots, brown and dark brown (A-6)		22	M	SS	10					
8			9	W		14	34				
9	SILT, brown, wet, loose (ML) (A-4)	FINE ALLUVIUM	8	M/W	SS	18	37				
10	LEAN CLAY, light grayish brown, a little brown, firm, laminations of silt (CL) (A-4)		4	M	SS	18	35				
11	SILTY CLAY, gray, soft (CL-ML) (A-4)		12	W	SS	6					
12	SAND WITH SILT, fine grained, gray, waterbearing, medium dense (SP-SM) (A-3)	COARSE ALLUVIUM	8	W	SS	12	31				
13	SANDY SILT, gray, wet, loose (ML) (A-4)	FINE ALLUVIUM	8	W	SS	16					
14	SILTY SAND, fine grained, gray, wet, loose (SM) (A-4)	COARSE ALLUVIUM									

AET CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 6/20/14

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-49'	3.25" HSA								
49-99½'	RDF w/DM	5/14/14	9:36	21.0	19.5	19.5			18.9
		5/14/14	9:48	21.0	19.5	19.0			16.2
BORING COMPLETED: 5/15/14									
DR: SG LG: CD Rig: 91C									



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1230 SV (p. 2 of 3)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **157440** E **515584**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
33	SILTY SAND, fine grained, gray, wet, loose (SM) (A-4) (continued)	COARSE ALLUVIUM (continued)	6	W	SS	18					
34	LEAN CLAY, gray, firm (CL/CH) (A-7-6)	FINE ALLUVIUM	6	M	SS	18	41				
35											
36	FAT CLAY, gray, a little light grayish brown, firm, laminations of silt (CH) (A-7-6)	TILL	8	M	SS	18	43				
37											
38											
39	LEAN CLAY, gray, stiff, laminations of sand (CL) (A-6)	TILL	6	M	SS	18	28				
40											
41	SANDY LEAN CLAY, gray, very stiff, a lens of waterbearing gravelly sand at 45' (CL) (A-6)	TILL	15	M	SS	16	20				
42											
43											
44	CLAYEY SAND, a little gravel, trace roots, brownish gray, a little black, very stiff to hard, a lamination of organic clay at 47½ (SC) (A-6)	TILL	17	M/W	SS	18	18				
45											
46		TILL	20	M	SS	18	27				
47											
48											
49		TILL	27	M	SS	18	15				
50											
51		TILL	24	M	SS	18	17				
52											
53											
54		TILL	32	M	SS	12	17				
55											
56	SAND WITH SILT AND GRAVEL, fine to medium grained, brown, waterbearing, medium dense (SP-SM) (A-1-b)	COARSE ALLUVIUM	30	W	SS	8					
57											
58	GRAVEL WITH SAND, brown, moist, very dense (GP) (A-1-b)	TILL									
59											
60		TILL									
61											
62		TILL									
63											
64		TILL									
65											
66		TILL									
67											
68		TILL									
69											

AET CORP W-COORDINATES 01-05697.GPJ AET-CPT+WELL.GDT 6/20/14



SUBSURFACE BORING LOG

AET JOB NO: **01-05697**

LOG OF BORING NO. **1230 SV (p. 3 of 3)**

PROJECT: **Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis**

Hennepin Co. Coordinates: N **157440** E **515584**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
71	GRAVEL WITH SAND, brown, moist, very dense (GP) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	82	M/W	SS	8					
72											
73											
74											
75											
76											
77											
78											
79											
80											
81											
82											
83											
84											
85											
86			64	M/W	SS	-					
87											
88											
89											
90											
91											
92											
93											
94											
95	SAND, fine to medium grained, brown, moist, very dense (SP) (A-3)		80	-	SS	0					
96											
97											
98											
99											
100											
101											
	END OF BORING										

AET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 6/20/14



American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N160768, E517723
 Date Installed: 8/29/13
 Project Manager: JV

Well No.: 1143 PT
 Unique Well No.: _____
 Drilling Method: 3.25" HSA
 Drilling Fluids (type): _____
 Completed by: GH/TK

Annular Space Details

Type of Surface Seal: Concrete
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): Bentonite 3/8 Chips
 Type of Sand Pack: #30 Red Flint Sand

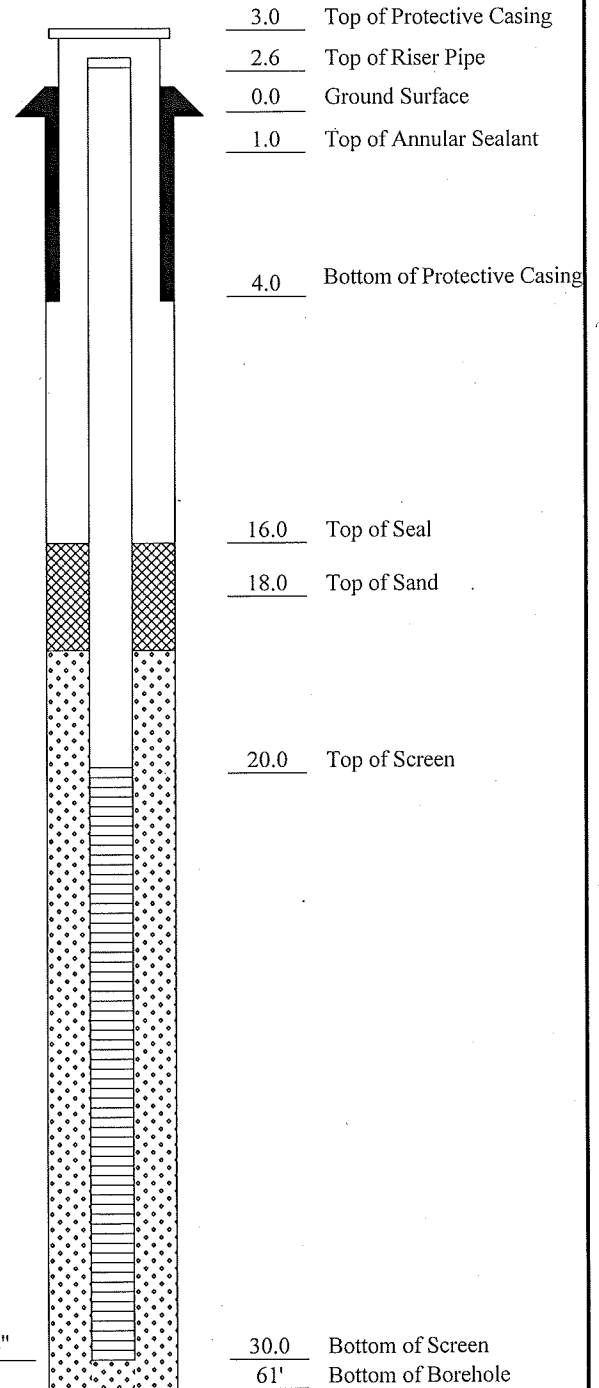
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	--	2" FT	--
Riser Pipe Above w.t.	--	2" FT	--
Riser Pipe Below w.t.	--	2" FT	--
Screen	--	2" FT	--
Protective Posts	--	None	--
Protective Casing	--	--	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.6'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	868.50
Ground Surface Elevation	865.9
Depth to Water	14.65' (8/30/13)
Water Elevation	851.25 (8/30/13)
Other	850.58 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697

Well No.: 1144 PT

Project: Southwest Light Rail Transit Project, PEC East

Unique Well No.: _____

Location: N162367, E517827

Drilling Method: 3.25" HSA

Date Installed: 8/29/13

Drilling Fluids (type): _____

Project Manager: JV

Completed by: GH/TK

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Grout

Type of Bentonite Seal (Granular Pellet): Bentonite 3/8 Chips

Type of Sand Pack: #30 Red Flint Sand

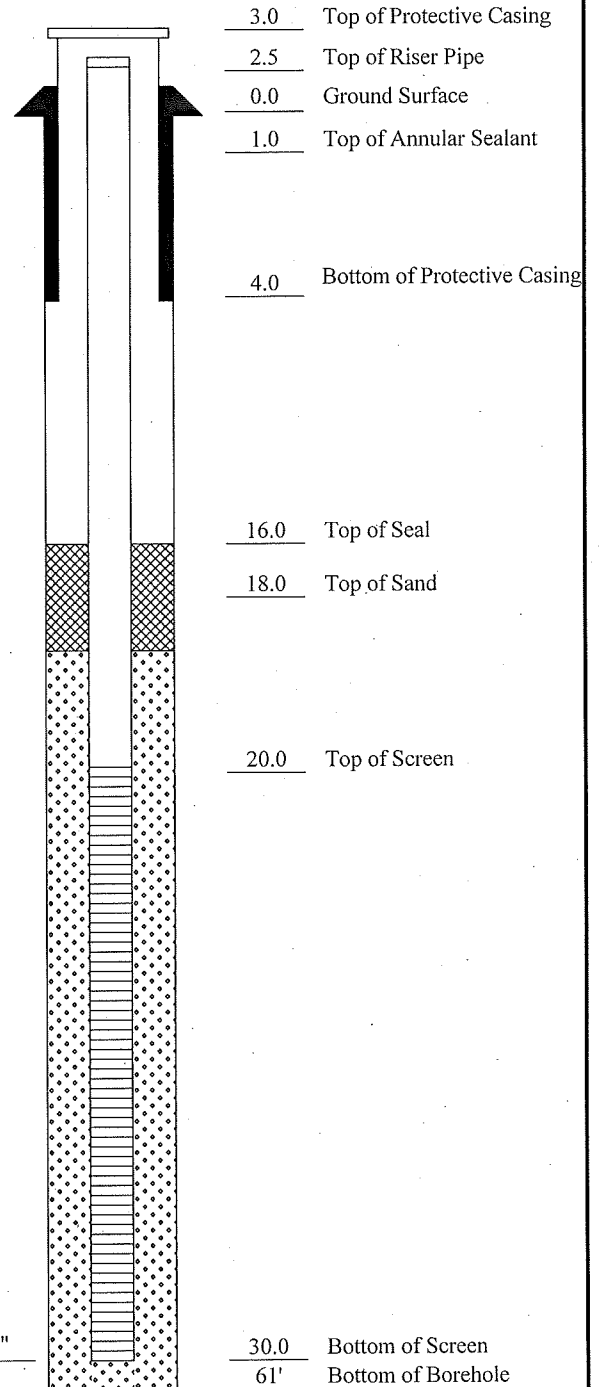
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2 " FT	---
Riser Pipe Above w.t.	---	2 " FT	---
Riser Pipe Below w.t.	---	2 " FT	---
Screen	---	2 " FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	871.38
Ground Surface Elevation	868.9
Depth to Water	17.9' (8/30/13)
Water Elevation	850.98 (8/30/13)
Other	850.08 (11/4/13)



Do 8 1/4"



American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N163209, E518078
 Date Installed: 10/2/13
 Project Manager: JV

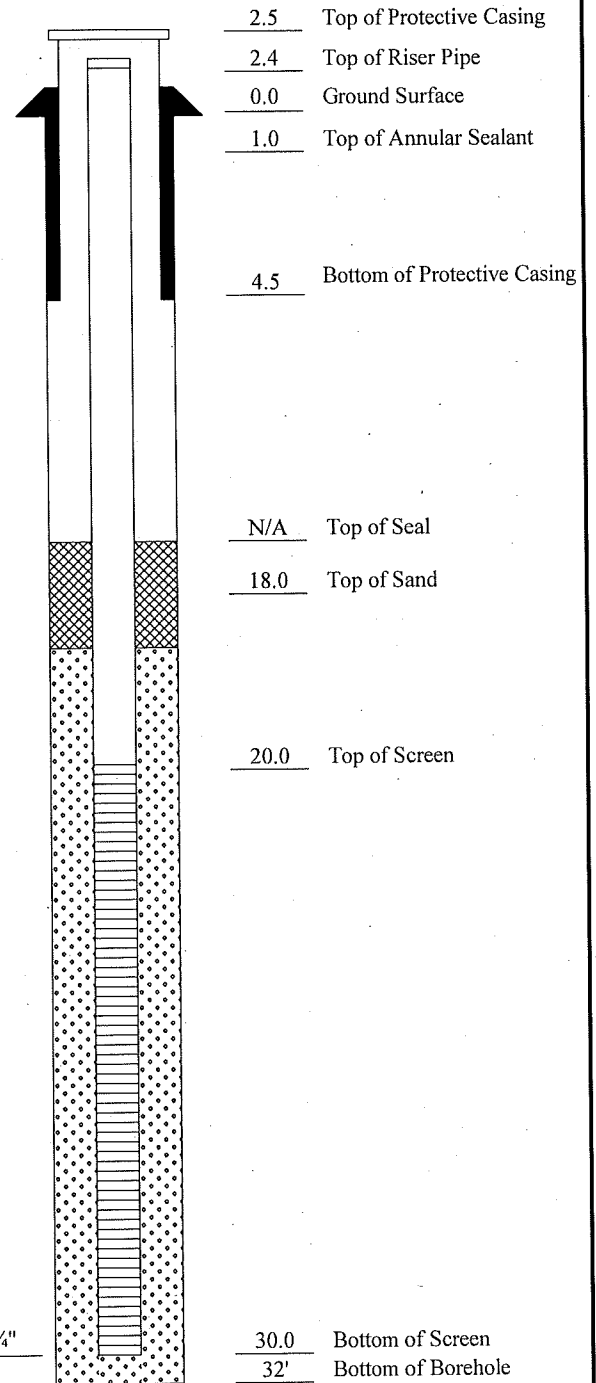
Well No.: 1148 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Rising Coupling Joint	---	2" FT	--
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	--
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel



Measurements

to 0.1 ft (where applicable).

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	867.29
Ground Surface Elevation	864.9
Depth to Water	15.7' (10/14/13)
Water Elevation	849.22 (10/14/13)
Other	849.25 (11/4/13)

Do 8 1/4"



American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N162767, E517892
 Date Installed: 10/2/13
 Project Manager: JV

Well No.: 1149 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

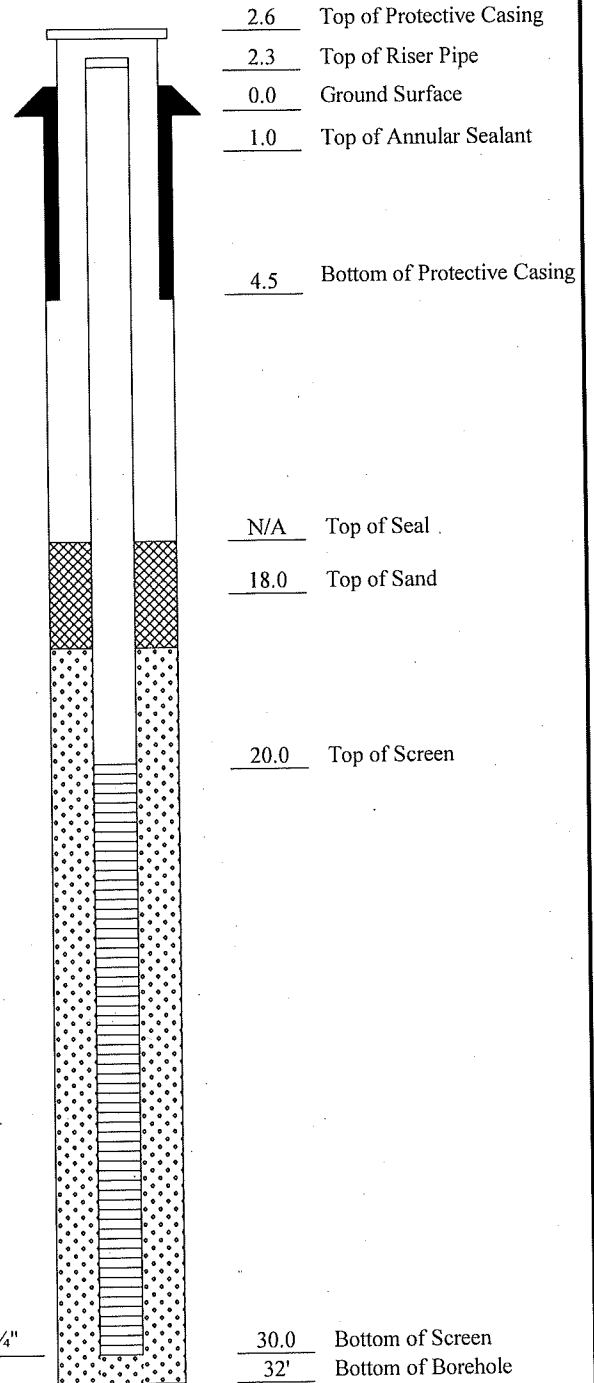
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2" FT	---
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	---
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	869.87
Ground Surface Elevation	867.6
Depth to Water	18.0' (10/14/13)
Water Elevation	849.60 (10/14/13)
Other	849.69 (11/4/13)



Do 8 1/4"



American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N161734, E517806
 Date Installed: 9/30/13
 Project Manager: JV

Well No.: 1150 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

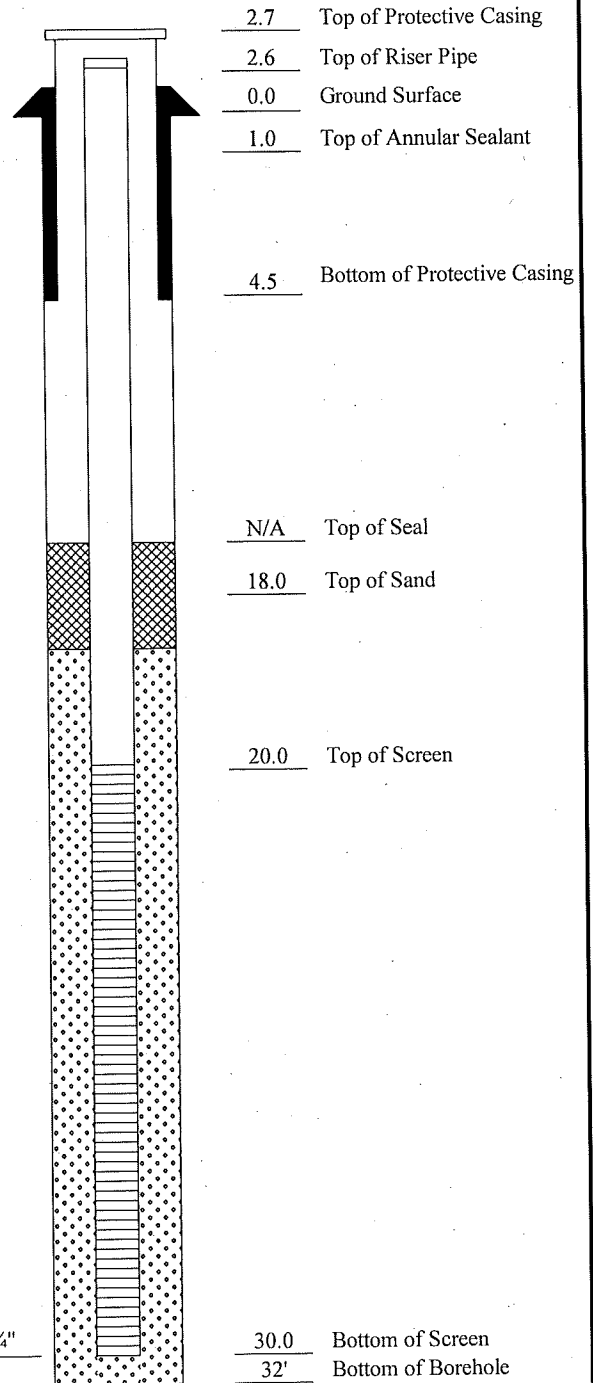
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2" FT	---
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	---
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	867.51
Ground Surface Elevation	864.94
Depth to Water	14.5' (10/14/13)
Water Elevation	850.45 (10/14/13)
Other	850.74 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N161336, E517786
 Date Installed: 9/30/13
 Project Manager: JV

Well No.: 1151 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

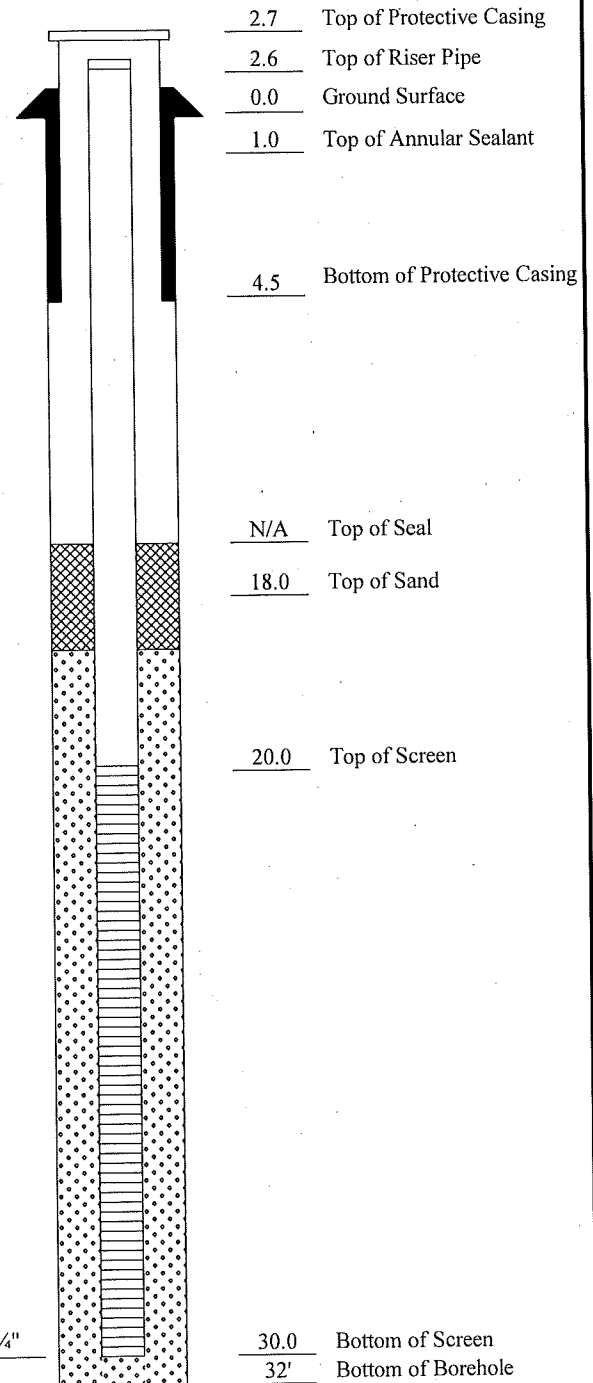
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2" FT	---
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	---
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	867.89
Ground Surface Elevation	865.3
Depth to Water	15.2' (10/14/13)
Water Elevation	850.08 (10/14/13)
Other	850.24 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N160225, E517508
 Date Installed: 10/7/13
 Project Manager: JV

Well No.: 1152 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SHS

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

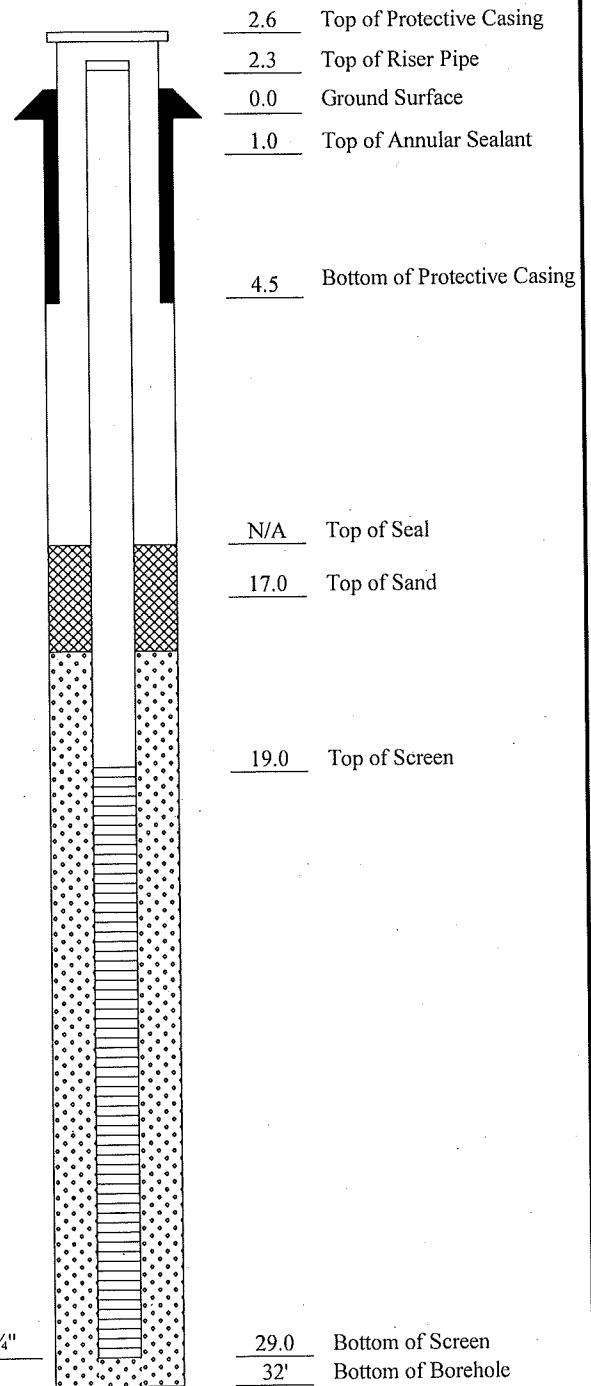
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2" FT	--
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	--
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	21.5
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	870.56
Ground Surface Elevation	868.3
Depth to Water	16.7' (10/14/13)
Water Elevation	851.64 (10/14/13)
Other	851.73 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N159746, E517114
 Date Installed: 10/8/13
 Project Manager: JV

Well No.: 1153 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SHS

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

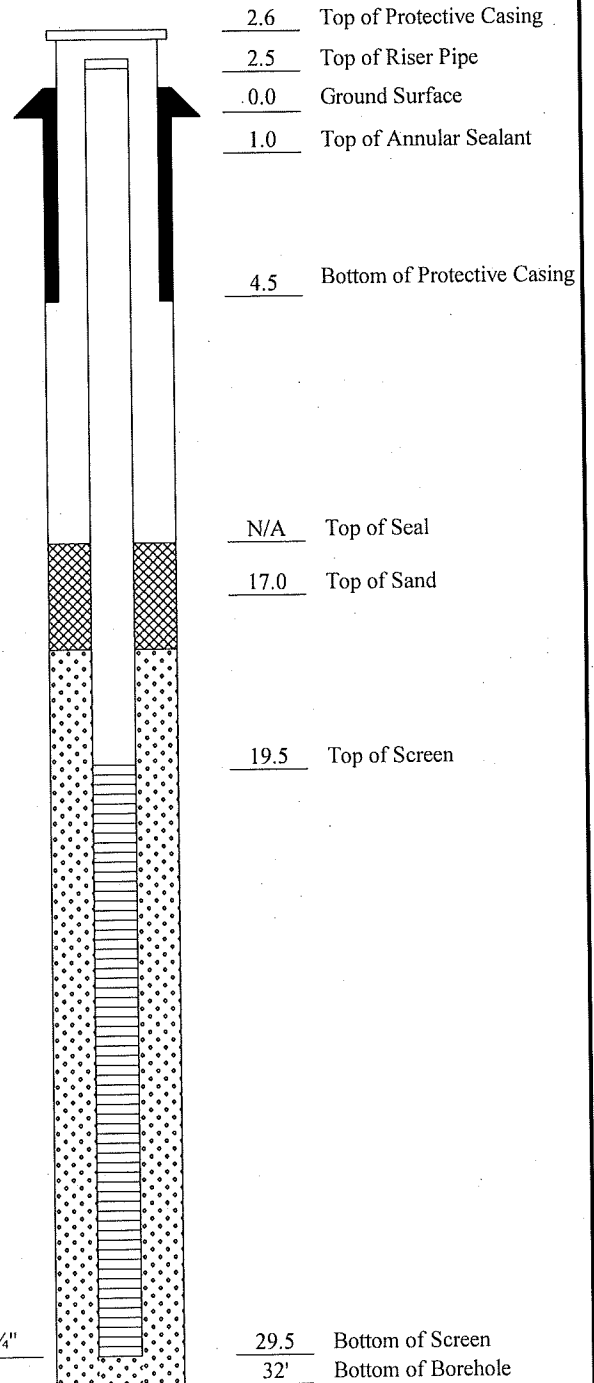
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2" FT	---
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	---
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.0
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	871.66
Ground Surface Elevation	869.2
Depth to Water	19.1' (10/14/13)
Water Elevation	850.10 (10/14/13)
Other	850.29 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N159370, E516798
 Date Installed: 10/9/13
 Project Manager: JV

Well No.: 1154 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

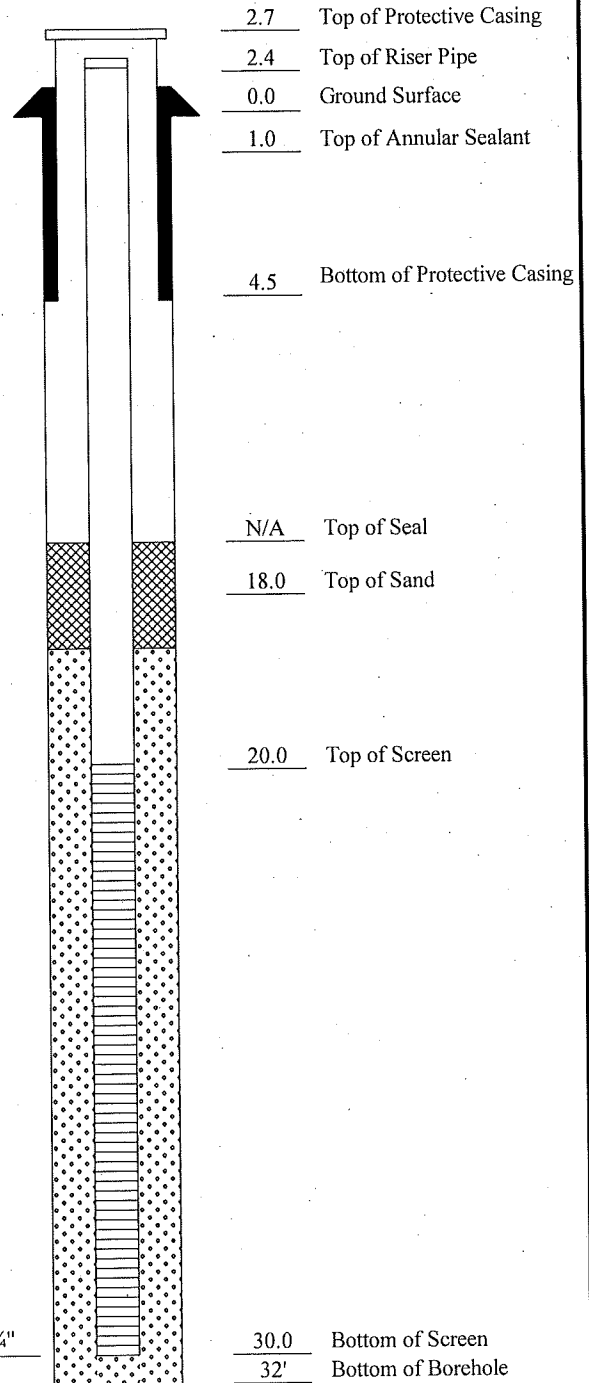
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2" FT	---
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	---
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	874.48
Ground Surface Elevation	872.1
Depth to Water	21.7' (10/14/13)
Water Elevation	850.37 (10/14/13)
Other	850.61 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N158305, E516166
 Date Installed: 10/11/13
 Project Manager: JV

Well No.: 1155 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

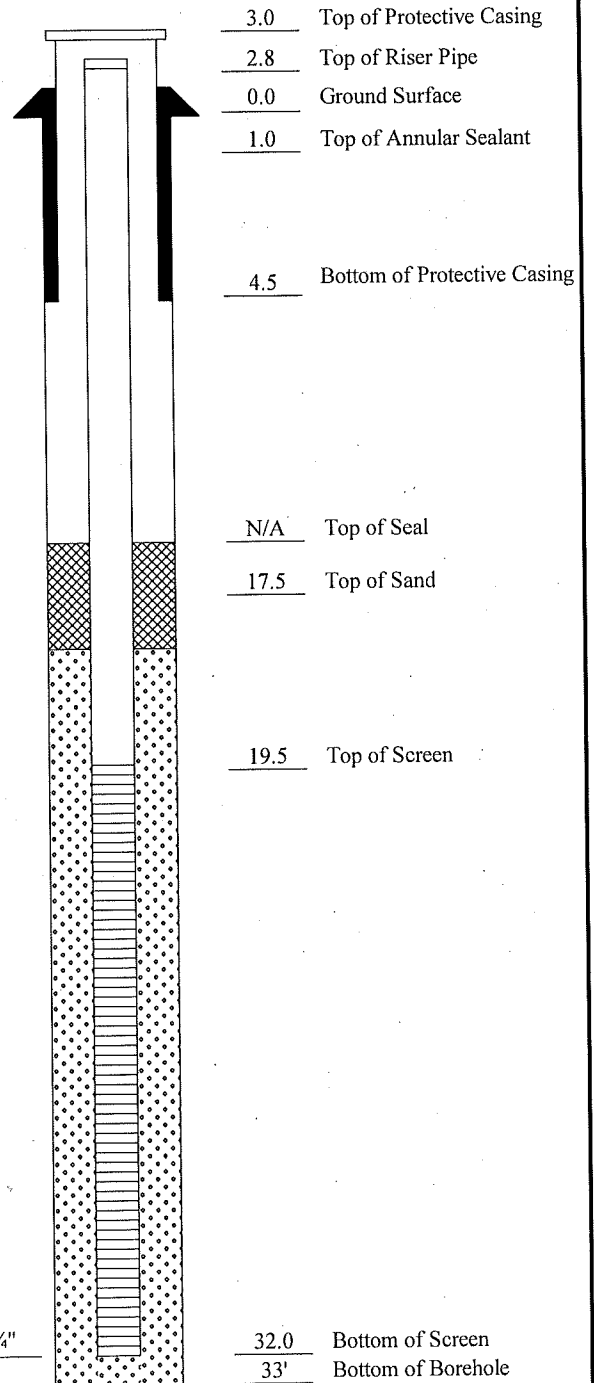
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2 " FT	---
Riser Pipe Above w.t.	--	2 " FT	---
Riser Pipe Below w.t.	---	2 " FT	---
Screen	---	2 " FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.0
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	879.59
Ground Surface Elevation	876.8
Depth to Water	26.2' (10/14/13)
Water Elevation	850.63 (10/14/13)
Other	850.91 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N157802, E515919
 Date Installed: 10/10/13
 Project Manager: JV

Well No.: 1156 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

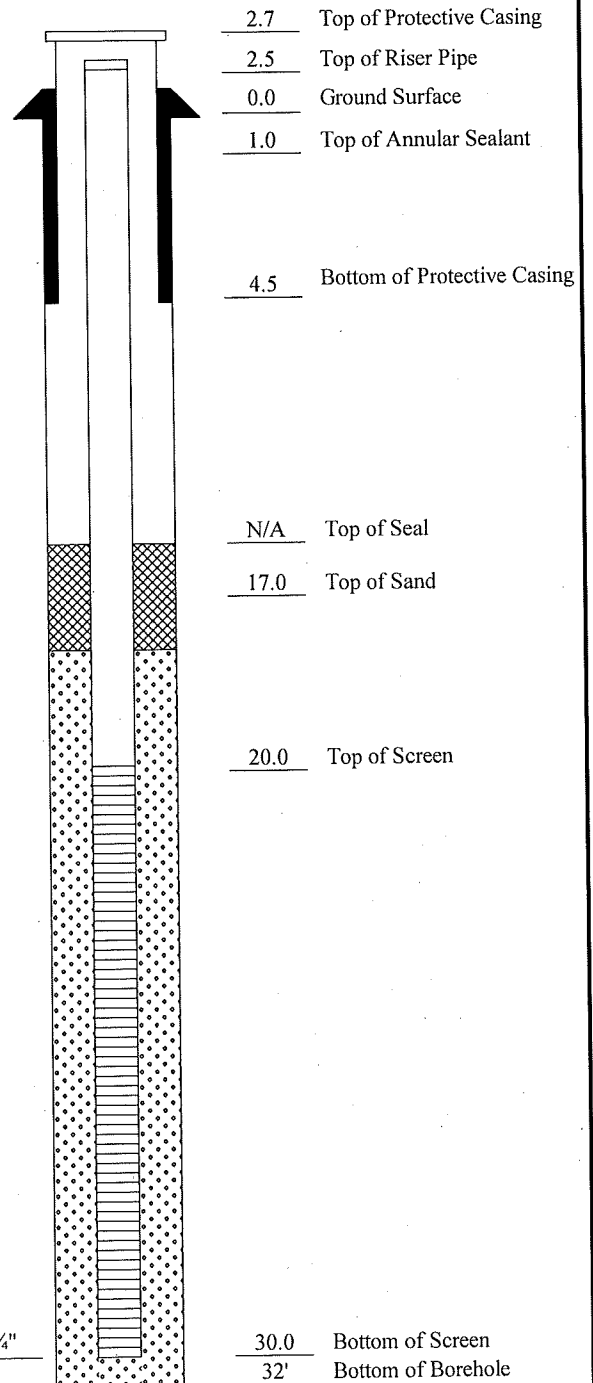
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2 " FT	---
Riser Pipe Above w.t.	---	2 " FT	---
Riser Pipe Below w.t.	---	2 " FT	---
Screen	---	2 " FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	873.63
Ground Surface Elevation	871.1
Depth to Water	13.4' (10/14/13)
Water Elevation	857.70 (10/14/13)
Other	858.06 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-05697
 Project: Southwest Light Rail Transit Project, PEC East
 Location: N157451, E515598
 Date Installed: 10/10/13
 Project Manager: JV

Well No.: 1157 PT
 Unique Well No.: _____
 Drilling Method: 4.25" HSA
 Drilling Fluids (type): None
 Completed by: SG/SB

Annular Space Details

Type of Surface Seal: Portland Cement
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): N/A
 Type of Sand Pack: #30 Red Flint Sand

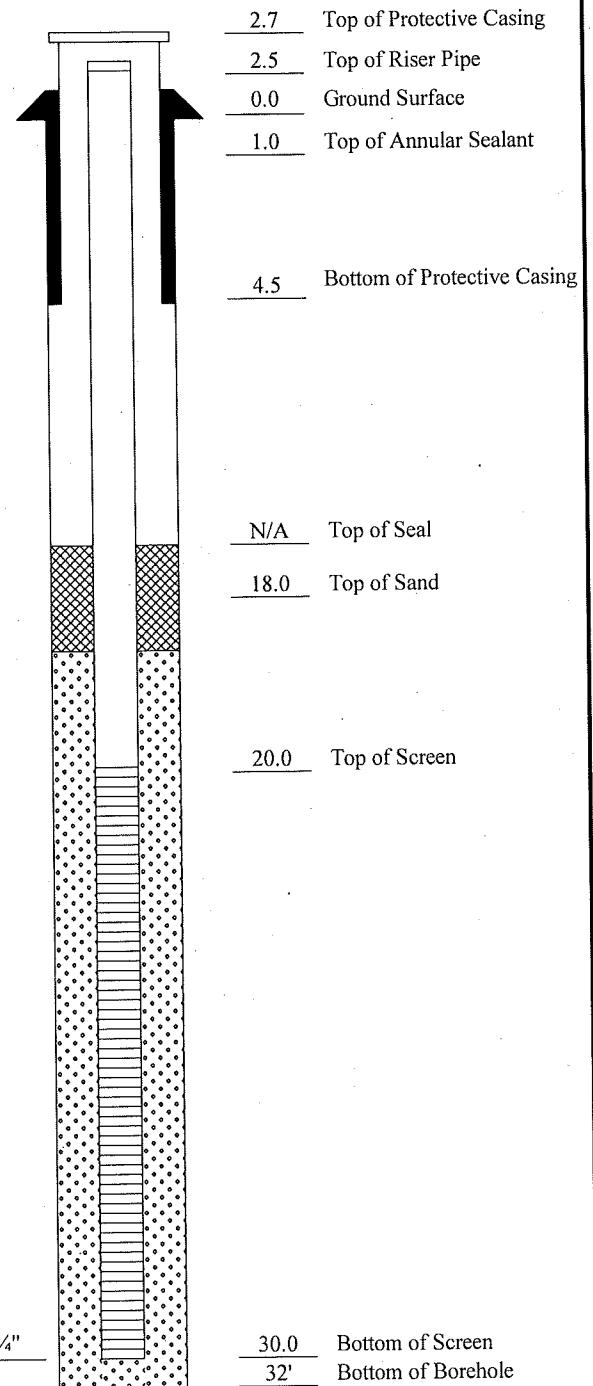
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	2" FT	---
Riser Pipe Above w.t.	---	2" FT	---
Riser Pipe Below w.t.	---	2" FT	---
Screen	---	2" FT	---
Protective Posts	---	None	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7' Steel
Riser Pipe Length	22.5'
Screen Length	10'
Screen Slot Size	.010"
Top of Riser Elevation	875.18
Ground Surface Elevation	872.7
Depth to Water	17.4' (10/14/13)
Water Elevation	855.34 (10/14/13)
Other	855.68 (11/4/13)





American Engineering Testing, Inc.

Monitoring Well/Piezometer Log

AET Job No.: 01-04905
 Project: MCES L-27 Hopkins Interceptor, Minneapolis
 Location: N158684, E516342
 Date Installed: 9/1/10
 Project Manager: Jeff Voyen

Well No.: MCES P-38
 Unique Well No.: None
 Drilling Method: 3.25" HSA
 Drilling Fluids (type): None
 Completed by: SS

Annular Space Details

Type of Surface Seal: Bentonite Grout
 Type of Annular Sealant: Bentonite Grout
 Type of Bentonite Seal (Granular Pellet): 3/8" Bentonite Chips
 Type of Sand Pack: #30 Red Flint Filter Sand

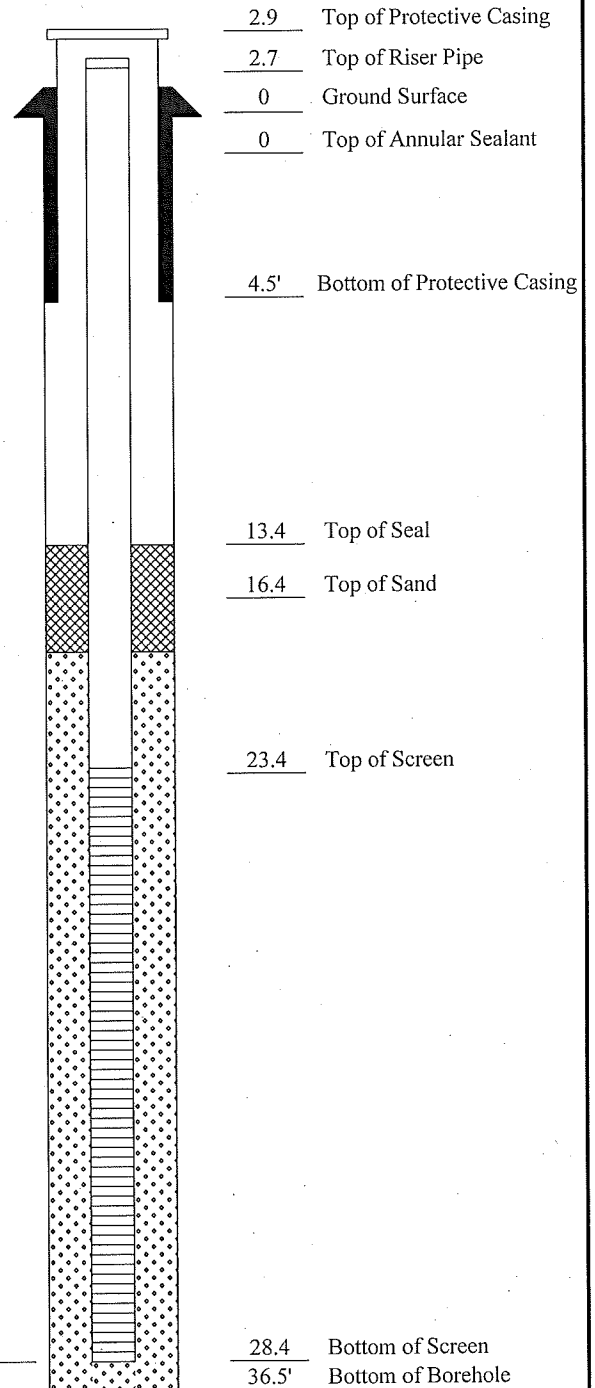
Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser Coupling Joint	---	Flush Thread	---
Riser Pipe Above w.t.	---	2" SCH 40	---
Riser Pipe Below w.t.	---	2" SCH 40	---
Screen	---	2" SCH 40	---
Protective Posts	---	---	---
Protective Casing	---	---	6" Steel

Measurements

to 0.1 ft (where applicable)

Protective Casing Length	7'
Riser Pipe Length	23.4
Screen Length	5'
Screen Slot Size	0.010"
Top of Riser Elevation	876.62
Ground Surface Elevation	873.9
Depth to Water	23.8 (9-14-10)
Water Elevation	850.1 (9/14/10)
Other	850.43 (10/14/13)
	850.69 (11/4/13)



SIEVE ANALYSIS TEST RESULTS

PROJECT:
 Southwest LRT – Kenilworth Corridor
 Minneapolis, Minnesota

AET NO.: 01-05697

DATE: August 20, 2014

TEST METHOD: General conformance with ASTM:D6913, Method A

RESULTS:

Boring Number	1003 SB	1003 SB	1004 SB
Sample Depth	24½'-26'	49½'-51'	29½'-31'
Dry Sample Weight (gms)	305.22	228.23	140.64
Sieve Size or Number	Percent Passing by Weight		
5/8"	100	100	100
1/2"	94	100	100
3/8"	93	99	100
#4	90	97	100
#10	85	95	99
#20	74	93	99
#40	39	66	98
#100	4.1	4.8	12
#200	2.5	2.3	4.3
Assumed porosity	0.30	0.30	0.30
*Estimated Hydraulic Conductivity, in/hr	37.9	24.0	12.6

* Based on Kozeny-Carman formula, with only the minus ½-inch component of the sample considered.
 Formula assumptions: porosity as shown above; shape factor=6.6

No safety/corrections factors have been applied to the hydraulic conductivity estimates.

Note: The small sample size limits the accuracy of the test, and the sample may not necessarily be representative of the entire layer shown on the boring log

SIEVE AND HYDROMETER ANALYSIS TEST RESULTS

PROJECT:
 Southwest LRT – Kenilworth Channel
 Minneapolis, Minnesota

AET NO.: 01-05697
DATE: December 5, 2013

TEST METHOD:

Sieve Analysis: General conformance with ASTM:D6913, Method A

RESULTS:

Boring Number	1145 HC	1145 HC	1145 HC
Sample Depth	2'-3'	3'-4'	4'-7'
Dry Sample Weight (gms)	662.14	277.97	262.22
Sieve Size or Number	Percent Passing by Weight		
1½"	100	100	100
1"	94	100	100
¾"	93	100	94
⅝"	92	100	92
½"	91	100	86
⅜"	90	100	86
#4	84	96	80
#10	73	81	73
#20	57	63	58
#40	31	36	34
#100	5.7	6.6	10
#200	3.6	3.7	7.0
Silt %/Clay %	*	*	*
Geologic origin	alluvium	alluvium	alluvium

** hydrometer analysis not performed*

Note: The small sample size limits the accuracy of the test, and the sample may not necessarily be representative of the entire layer shown on the boring log

SIEVE AND HYDROMETER ANALYSIS TEST RESULTS

PROJECT:
 Southwest LRT – Kenilworth Channel
 Minneapolis, Minnesota

AET NO.: 01-05697
DATE: December 5, 2013

TEST METHOD:
 Sieve/Hydrometer Analysis: General conformance with ASTM:D422

RESULTS:

Boring Number	1146 HC	1146 HC	1146 HC
Sample Depth	4'-5'	5'-6'	6'-8½'
Dry Sample Weight (gms)	126.74	117.12	115.34
Sieve Size or Number	Percent Passing by Weight		
3/8"	100	100	100
#4	99	99	100
#10	99	98	99
#20	97	94	98
#40	94	89	97
#100	83	60	88
#200	75	50	74
Silt %/Clay %*	56.8/18.5	36.5/13.0	56.9/16.8
Geologic origin	sediment	sediment	sediment

* Clay taken to be particles smaller than 0.005 mm

Note: The small sample size limits the accuracy of the test, and the sample may not necessarily be representative of the entire layer shown on the boring log

SIEVE AND HYDROMETER ANALYSIS TEST RESULTS

PROJECT:
Southwest LRT – Kenilworth Channel
Minneapolis, Minnesota

AET NO.: 01-05697
DATE: December 5, 2013

TEST METHODS:

Sieve Analysis Only: General conformance with ASTM:D6913, Method A
Sieve/Hydrometer Analysis: General conformance with ASTM:D422

RESULTS:

Boring Number	1147 HC	1147 HC	1147 HC
Sample Depth	4'-6'	6'-8'	8'-9'
Dry Sample Weight (gms)	139.5	144.62	615.04
Sieve Size or Number	Percent Passing by Weight		
3/4"	100	100	100
5/8"	100	100	99
1/2"	100	100	97
3/8"	100	100	94
#4	100	100	85
#10	99	98	73
#20	97	95	57
#40	91	89	42
#100	75	60	20
#200	68	49	14
Silt %/Clay %*	52.1/16.1	37.5/11.8	**
Geologic origin	sediment	sediment	alluvium

* Clay taken to be particles smaller than 0.005 mm

** hydrometer analysis not performed

Note: The small sample size limits the accuracy of the test, and the sample may not necessarily be representative of the entire layer shown on the boring log

Appendix C

Geotechnical Report Limitations and Guidelines for Use

Appendix C

Geotechnical Report Limitations and Guidelines for Use

Report No. 01-05697.02

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE¹, of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

B.2.2 Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

B.2.4 Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

¹ ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 : www.asfe.org

Appendix C

Geotechnical Report Limitations and Guidelines for Use Report No. 01-05697.02

B.2.5 Most Geotechnical Findings Are Professional Opinions

Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

B.2.6 A Report's Recommendations Are Not Final

Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

B.2.8 Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

B.2.9 Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need to prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

B.2.10 Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.11 Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.