

CONSULTANTS • ENVIRONMENTAL • GEOTECHNICAL • MATERIALS

• FORENSICS

# 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

### www.amengtest.com



CONSULTANTS • ENVIRONMENTAL • GEOTECHNICAL • MATERIALS • FORENSICS

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.

lery

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

Page i



**Report of Geotechnical Exploration and Review** Shallow SWLRT Tunnel- Kenilworth Corridor, Minneapolis, Minnesota August 25, 2014 Report No. 01-05697.02

AMERICAN ENGINEERING TESTING, INC.

### SIGNATURE PAGE

Prepared for:

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

Authored By:

Jeffery K. Voyen, PE Vice President/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: Jeffery K. Voyen

Date: <u>8/25/14</u> License #: 15928

Prepared by:

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

Reviewed By:

Gregory R. Reuter, PE, PG **Principal Engineer** 

Copyright 2014 American Engineering Testing, Inc. All Rights Reserved

Unauthorized use or copying of this document is strictly prohibited by anyone other than the client for the specific project.

Page ii

## TABLE OF CONTENTS

Transmittal Letter	i
Signature Page	ii
TABLE OF CONTENTS	iii
1.0 INTRODUCTION	
2.0 SCOPE OF SERVICES	
3.0 PROJECT INFORMATION	. 2
4.0 SUBSURFACE EXPLORATION AND TESTING	. 5
4.1 Field Exploration Program	. 5
4.2 Laboratory Testing of Soils	. 7
5.0 SITE CONDITIONS	. 7
5.1 General Geology Review	. 7
5.2 Subsurface Soils	. 8
5.3 Ground Water 1	
6.0 RECOMMENDATIONS 1	
6.1 Soil Support Suitability Discussion	12
6.2 Track Subgrade Preparation Outside of Tunnels	13
6.3 Driven Pile Support in Areas of Buried Swamp Deposits	15
6.4 Buoyancy/Uplift Resistance 1	
7.0 CONSTRUCTION CONSIDERATIONS 1	18
7.1 Excavation Backsloping 1	18
7.2 Observation and Testing	
8.0 LIMITATIONS	19

- APPENDIX A Geotechnical Field Exploration and Testing Boring Log Notes
   Unified Soil Classification System
   AASHTO Soil Classification System
   Figures 1 to 3 – Boring/CPT Locations
   Table A.1 – Piezometer Water Level Data
   Figures 4 to 6 – Fence Diagrams
- APPENDIX B Subsurface Boring and Cone Penetration Test Logs Piezometer Logs Sieve and Hydrometer Analysis Test Results

APPENDIX C – Geotechnical Report Limitations and Guidelines for Use

## **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 101<sup>1</sup>/<sub>2</sub> 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<sub>u</sub>) 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

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

Page 2 of 19

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.

Boring/CPT No.	Boring Surface	Track 2	Approx. TOR	Depth to Approx.
	Elevation	Station	Elevation	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

Table 3.0 -	Approximate	Top of Rail	<b>Elevations/Depths</b>
	rpp: ommere	rop or rean	Lie, actons, b ep ths

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  $\frac{1}{2}$  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<sub>u</sub> test method is described in Appendix A. The logs of the CPT<sub>u</sub> 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  $28^{th}$  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<sub>u</sub> 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.

**Report of Geotechnical Exploration and Review** Shallow SWLRT Tunnel- Kenilworth Corridor, Minneapolis, Minnesota August 25, 2014 Report No. 01-05697.02

AMERICAN ENGINEERING TESTING, INC.

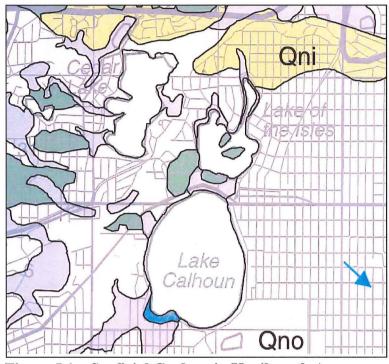


Figure 5.1 – Surficial Geology in Kenilworth Area

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 21<sup>st</sup> 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

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. Manplaced 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

Page 9 of 19

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.

Report of Geotechnical Exploration and Review Shallow SWLRT Tunnel- Kenilworth Corridor, Minneapolis, Minnesota August 25, 2014 Report No. 01-05697.02

AMERICAN ENGINEERING TESTING, INC.

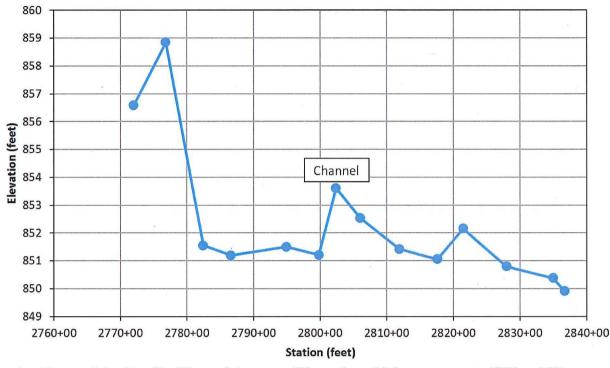


Figure 5.3 – Profile View of Average Water Level Measurements (SW to NE), for measurements taken between October 14, 2013 and August 25, 2014

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.

Page 11 of 19

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

AMERICAN ENGINEERING TESTING, INC.

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, <u>excluding</u> 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

oversizing of the excavation bottom. This lateral excavation oversizing should be a minimum of <sup>1</sup>/<sub>2</sub>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 ( $\varphi R_n$ ) of up to 100 tons, assuming a pile wall thickness of 0.250 inches.

## 6.3.2 Pile Foundation Analysis Methods

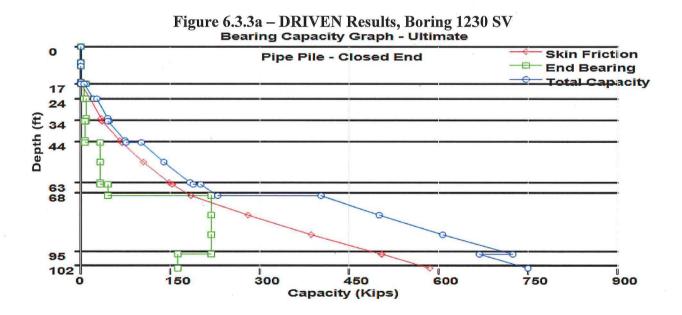
Pile bearing resistance versus pile length was analyzed using *DRIVEN* software (FHWA). This program uses the Nordlund method for granular soils and the Tomlinson method for cohesive soils. The granular soil internal friction angle used was based on its relationship to standard penetration test values 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 ( $\varphi$ ) of 0.65 can be used when dynamic analysis (High Strain Dynamic Pile Testing) is employed and a Resistance Factor ( $\varphi$ ) 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).

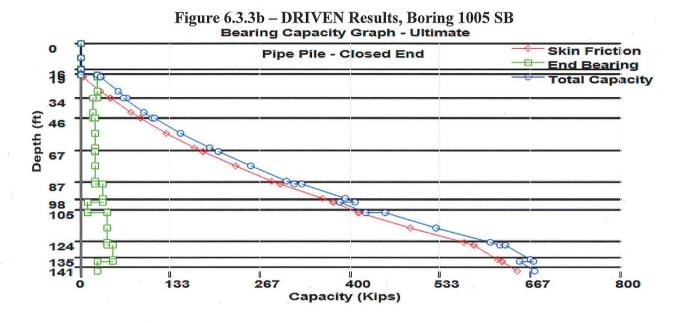


For the south bridge approach area, we used Boring 1005 SB soil parameters below elevation 849<sup>1</sup>/<sub>2</sub> feet (which is the elevation of the bottom of the swamp deposit at Boring 1042 ST).

Page 16 of 19

Report of Geotechnical Exploration and Review Shallow SWLRT Tunnel- Kenilworth Corridor, Minneapolis, Minnesota August 25, 2014 Report No. 01-05697.02

AMERICAN ENGINEERING TESTING, INC.



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  $\varphi R_n = 100$  tons and the use of dynamic analysis for the field evaluation method (allowing  $\varphi = 0.65$ ).

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	8491/2	784

 Table 6.3.3 – Estimated Pile Lengths from DRIVEN Analyses

\*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 ( $\varphi_{up}$ ) 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 <u>www.osha.gov</u>). 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."

**Report of Geotechnical Exploration and Review** Shallow SWLRT Tunnel- Kenilworth Corridor, Minneapolis, Minnesota August 25, 2014 Report No. 01-05697.02

AMERICAN ENGINEERING TESTING, INC.

# **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  $(CPT_u)$  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 N<sub>60</sub> 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  $N_{60}$  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  $N_{60}$  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<sub>u</sub>) 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 Report No. 01-05697.02

During the testing, a penetrometer tip with a conical point having a  $60^{\circ}$  apex angle and a cone base area of  $10 \text{ cm}^2 \text{ or } 15 \text{ cm}^2$  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<sub>t</sub>) is calculated by dividing the measured total cone force by the cone base area. The friction sleeve resistance (f<sub>s</sub>) is obtained by dividing the measured force exerted on the sleeve by its surface area. Pore pressure is measured directly behind the cone (U<sub>2</sub> position).

### A.9 SEISMIC PIEZOCONE METHODS

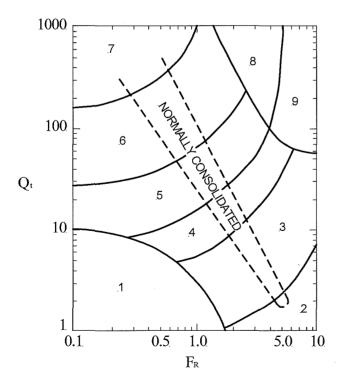
A seismic cone is similar to the standard piezocone (described above) with geophones added to the cone. During a normal piezocone sounding (where tip resistance, sleeve friction and pore pressure are measured), the sounding is paused at various depths where shear (S) wave velocities are measured. The 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<sub>u</sub> 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

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

where . . .  $Q_T$ .....normalized cone resistance  $F_R$ .....normalized 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.

### 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: DS:	Driller (initials) Disturbed sample from auger flights
DP:	Direct push drilling; a 2.125 inch OD outer casing
DIT	with an inner $1\frac{1}{2}$ 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
SS:	indicates no sample recovered.
33.	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
17 111	hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
<u>▼:</u>	Water level directly measured in boring
<u>\\</u> :	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 <sub>p</sub> :	Pocket Penetrometer strength, tsf (approximate)
q <sub>c</sub> :	Static cone bearing pressure, tsf
q <sub>u</sub> :	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  $N_{60}$  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



A

		ASTM De	signatio	ons: D 2	2487, D248	38					ENGINEER TESTING, I		
								oil Classific			A 1 - 1	Notes	
	or Assigning Group Syr	-				Sy	roup mbol		p Name <sup>B</sup>		<sup>A</sup> Based on the ma (75-mm) sieve.	-	-
Coarse-Grained Soils More	Gravels More than 50% coarse	Clean Gravels Less than 5%	Cu≥	4 and $1 \le C$	c≤3 <sup>E</sup>	(	GW	Well grad	ed gravel	7	<sup>B</sup> If field sample of boulders, or both		
than 50% retained on	fraction retained on No. 4 sieve	fines <sup>C</sup>	Cu<	4 and/or 12	>Cc>3 <sup>E</sup>		GP	Poorly gra	ided grave	el <sup>r</sup>	boulders, or both <sup>C</sup> Gravels with 5 t	" to group n	name.
No. 200 sieve	011 110. 4 51070	Gravels with Fines more	Fine	s classify a	as ML or MH	(	GM	Silty grav	el <sup>F.G.H</sup>		symbols: GW-GM well		
ъ.		than 12% fines	c Fine	s classify a	as CL or CH	(	GC	Clayey gr	avel <sup>F.G.H</sup>		GW-GC well-	-graded grav	vel with clay
	Sands 50% or	Clean Sands	Cu≥	6 and 1≤C	c≤3 <sup>E</sup>		SW	Well-grad	ed sand <sup>1</sup>		GP-GM poorl GP-GC poorl	v graded gra	avel with clay
	more of coarse fraction passes	Less than 5% fines <sup>D</sup>	Cu<	6 and/or 1	>Cc>3 <sup>E</sup>		SP	Poorly-gr	ided sand	Г	<sup>D</sup> Sands with 5 to symbols:		
	No. 4 sieve	Sands with	Fine	s classify a	as ML or MH		SM	Silty sand	G.H.I		SW-SM well- SW-SC well-	graded sand	with clay
		Fines more than 12% fines	D Fine	s classify a	as CL or CH	<b></b>	SC	Clayey sa	nd <sup>G.H.I</sup>		SP-SM poorly SP-SC poorly		
Fine-Grained Soils 50% or	Silts and Clays Liquid limit less	inorganic		7 and plots	on or above		CL	Lean clay	K.L.M			2	$(D_{30})^2$
more passes the No. 200	than 50		PI<4	f or plots b	elow	. 1	ML	Silt <sup>K.L.M</sup>			$^{\rm E}Cu = D_{60} / D_{10}$	Cc=	
sieve		organic		line <sup>3</sup> id limit-o	ven dried <0.75		OL	Organic c	lay <sup>K.L.M.N</sup>		Fro	1.50/ 1	D <sub>10</sub> x D <sub>60</sub>
(see Plasticity				id limit – i				Organic s	ilt <sup>K.L.M.O</sup>		<sup>F</sup> If soil contains sand" to group na	ame.	
Chart below)	Silts and Clays	inorganic	PI p	lots on or a	bove "A" line	. (	СН	Fat clay <sup>K.I</sup>	M		<sup>G</sup> If fines classify symbol GC-GM,	or SC-SM.	
	Liquid limit 50 or more	-	PI p	lots below	"A" line	1	MH	Elastic sil			<sup>H</sup> If fines are orga fines" to group n	ame.	-
		organic					OH	Organic c			<sup>I</sup> If soil contains ≥ gravel" to group	>15% gravel	l, add "with
		organie	<u>Liqu</u> Liqu	iid limit-o iid limit - i	<u>ven dried</u> <0.75 not dried	·	011	Organic s	-		If Atterberg limi	its plot is ha	tched area,
Highly organic		<u></u>	Prin	narily org	anic matter, o	lark	РТ	Peat <sup>R</sup>			<sup>K</sup> If soil contains	15 to 29% p	
soil			in c	olor, and c	organic in odo	r					add "with sand" of whichever is pred	dominant.	
	SIEVE ANALYSIS		60	Far da sita di sa			1				<sup>L</sup> If soil contains predominantly		
Screen Opening 3 2 1% 1 % 100	(in.) Sieve Number % 4 10 20 40 50 140 20	0	.50		of fine-grained soils and on of coarse-grained so	· /	//				group name. <sup>M</sup> If soil contains	>30% plus	No. 200,
80		20		Equation of "A"-lin Horizontal at PI = then PI = 0.73 (L	ne ⊧4 to LL ≈ 25.5, LL-20)	.17.11ME	3	·ALLINE			predominantly to group name	y gravel, add	i "gravelly"
	D <sub>200</sub> ≃ 15mm		QN <u>A</u> 0-	Equation of "U"-lin Vertical at LL = 10 then PI = 0.9 (LL	ne 6 to Pl = 7.	(d)	OH V				<sup>N</sup> Pl≥4 and plots o <sup>O</sup> Pl<4 or plots be	on or above	"A" line.
PAG PAG			PLASTICITY INDEX (PI)	ulen F) = 0.9 (L							<sup>P</sup> Pl plots on or ab	ove "A" lin	ie.
BERCENT PASSING	D <sub>20</sub> = 2.5mm	8 8 PERCENT RETAINED	료 <sub>20</sub> -	. /	Ch or	×					<sup>Q</sup> Pl plots below " <sup>R</sup> Fiber Content d	A fine. escription sl	hown below.
20		6. 80 D₀ = 0.075mm	.10				MH of	NOH	<u> </u>	[]			
		100	4	////CL-ML	ML or			_					
PARTICL	e size in millimeters		.0.0	.10 .16 2	20 30 40	50 LIQUID LIMIT	60 7 F (LL)	0 80	90 .100	,110			
$C_{u} = \frac{D_{00}}{D_{10}} = \frac{.15}{0.075}$	= 200 $C_{e} = \frac{(Dw)^{2}}{D_{10} \times Dw} = \frac{2.5^{2}}{0.075 \times 15} = 5$	5.6				Plasticity	Chart						
	ADDITI Grain Size	ONAL TERMI		NOTES U				NTIFICAT				of Man Dia	atia Calla
Term	Particle S	ize	<u>Term</u>	avei reicei	Percent	<u>Term</u>	istency		ie, BPF	E	Relative Density Term	<u>N-Valu</u>	
Boulders	Over 12		A Little G		3% - 14%	Very So	ft	less t	han 2	Ve	ery Loose	(	0 - 4
Cobbles Gravel	3" to 12 #4 sieve		With Grav Gravelly	rel	15% - 29% 30% - 50%	Soft Firm		2 - 5 -			oose edium Dense		5 - 10 1 - 30
Sand Fines (silt & c	#200 to #4 lay) Pass #200					Stiff Very Sti	ff	9 - 16 -	15 - 30	1	ense ery Dense	31	1 - 50 ter than 50
	bisture/Frost Condition		т	ayering No.	otes	Hard			than 30		Organic Descrip		
	(MC Column)	dunda dan ta	Ē	ayering in	0100		I cal D	<u>comption</u>			s are described as	<i>organic</i> , if s	soil is not peat
D (Dry):	Absence of moisture touch.		Laminatio		less than ick of	Term		Fiber Co (Visual Es		cont	is judged to have ent to influence the	e Liquid Lir	mit properties.
M (Moist):	Damp, although free visible. Soil may stil	ll have a high		differi	ng material		ot:			_	htly organic used for Root Incl	<u>usions</u>	
W (Wet/	water content (over " Free water visible int	optimum").		or col		Fibric Pe Hemic Pe	eat:	Greater th 33 – 67	%	Witl	h roots: Judged to of roots t	have suffic to influence	cient quantity the soil
Waterbearing)		soils.	Lenses:	greate	ets or layers or than ½"	Sapric Pe	eat:	Less thar	33%	Trac	propertie	s.	but not judged
E (Erozan)	sands and sand with Soil frozen				of differing ial or color.						to be in su	ufficient qua	antity to
F (Frozen):	Son nozen									L	significan	my affect sc	oil properties.

### AASHTO SOIL CLASSIFICATION SYSTEM AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

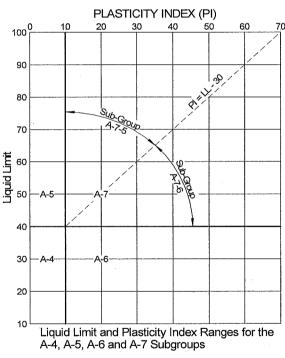
			Gra	nular Mate	rials				Silt-Clay	Materials	
General Classification		(3	5% or less	passing N	o. 200 sie	ve)		(More the	in 35% pa	ssing No. 2	200 sieve
	A	-1	·		A	-2					A-7
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5 A-7-6
Sieve Analysis, Percent passing:											
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	ļ			40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity index	6 n	nax.	N.P.	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min.
Usual Types of Significant Constituent Materials		agments, and Sand	Fine Sand	Silty	or Clayey (	Gravel and	Sand	Silty	Soils	Claye	y Soils
General Ratings as Subgrade			Exc	cellent to G	bood				Fair te	o Poor	

### Classification of Soils and Soil-Aggregate Mixtures

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 relained on the No. 10 sieve.

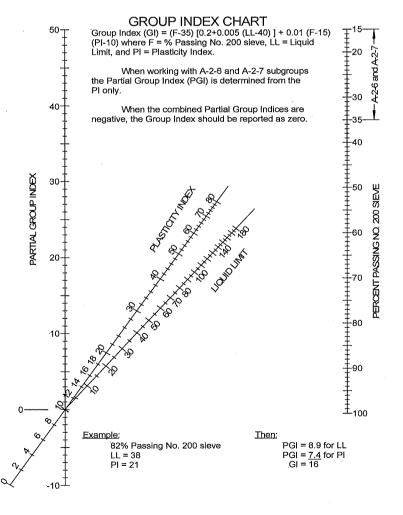
COARSE SAND - Material passing the No. 10 sieve and retained on the No. 40 sieve.

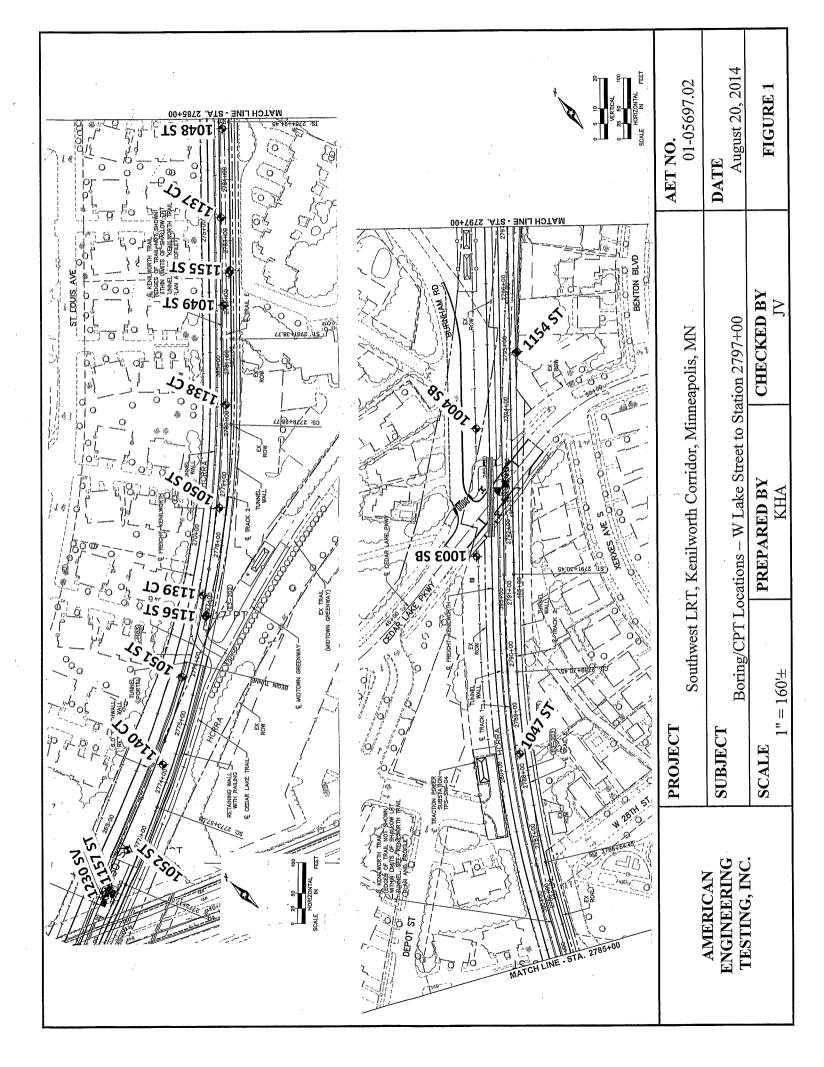
FINE SAND - Material passing the No. 40 sieve and retained on the No. 200 sieve.

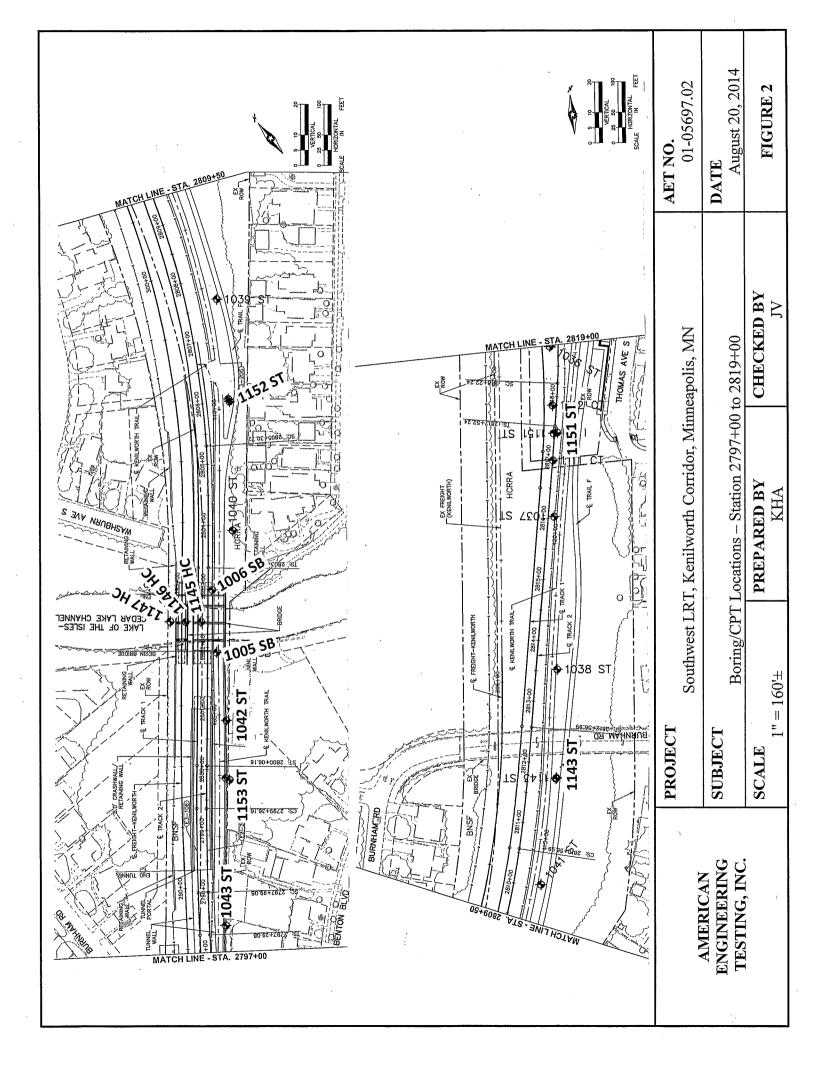
COMBINED SILT AND CLAY - Material passing the No. 200 sieve

BOULDERS (retained on 3-in. sieve) should be excluded from the portion of the sample to which the classificaiton 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.







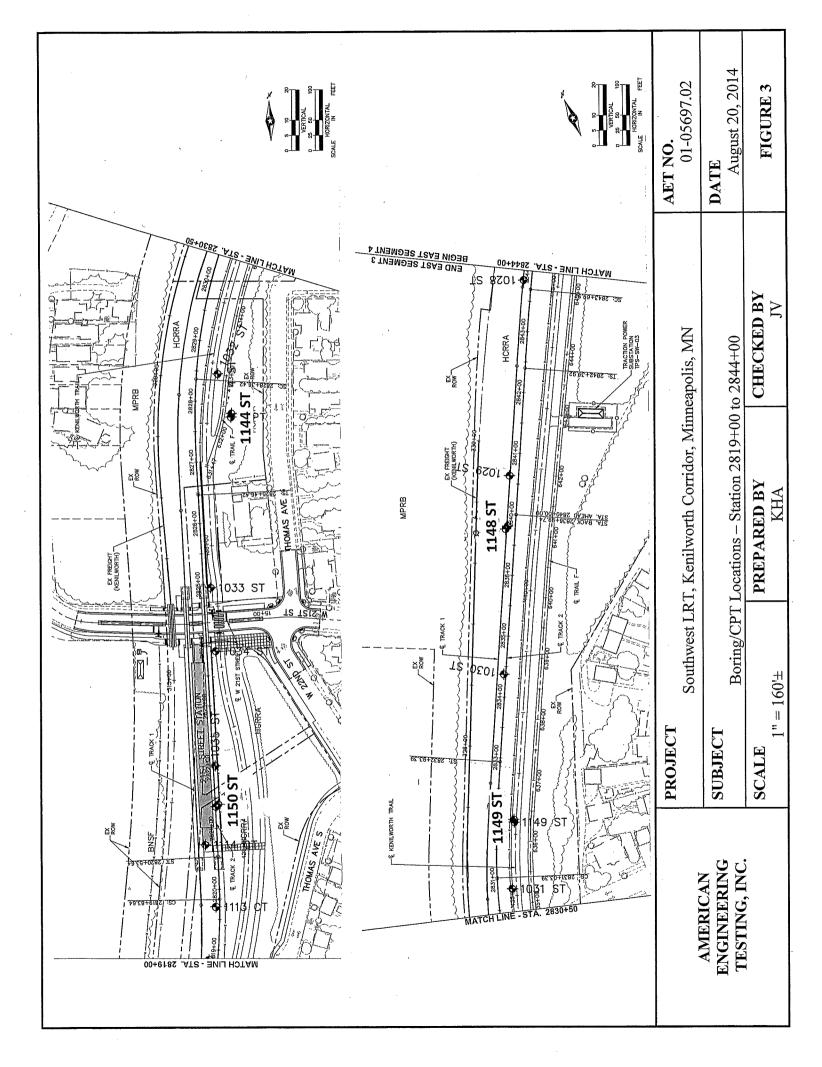


Table A.1 - Piezometer Water Level Data Southwest LRT Kenilworth Corridor, Minneapolis AET No. 01-05697

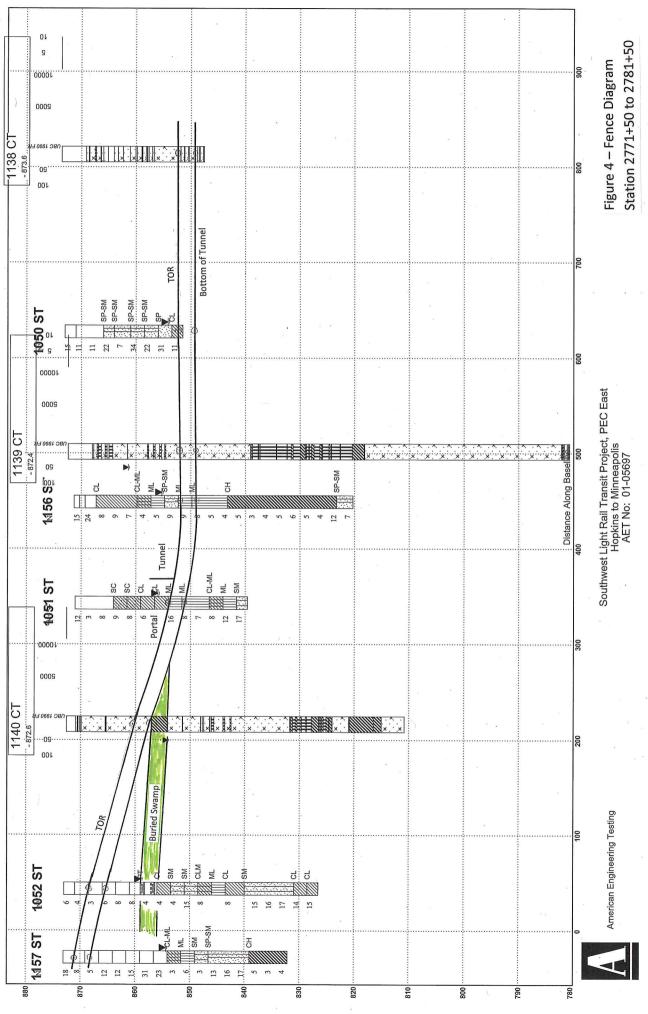
Piezo No.	1157 PT	1156 PT	1155 PT	MCES P-38	1154 PT	1153 PT	channel	1152 PT	1143 PT	1151 PT	1150 PT	1144 PT	1149 PT	1148 PT
Station	2771+98	2776+82	2782+46	2786+64	2794+95	2799+83	2802+43	2806+02	2811+89	2817+56	2821+49	2827+98	2831+97	2836+76
Track 2 offset	20' LT	7' LT	3' LT	20' RT	12' RT	38' RT	ı	37' RT	2' LT	2' RT	22' RT	39' RT	c/L	25' LT
Northing	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		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	1	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		849.78	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		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 - Piezométer Water Level Data Southwest LRT Kenilworth Corridor, Minneapolis AET No. 01-05697

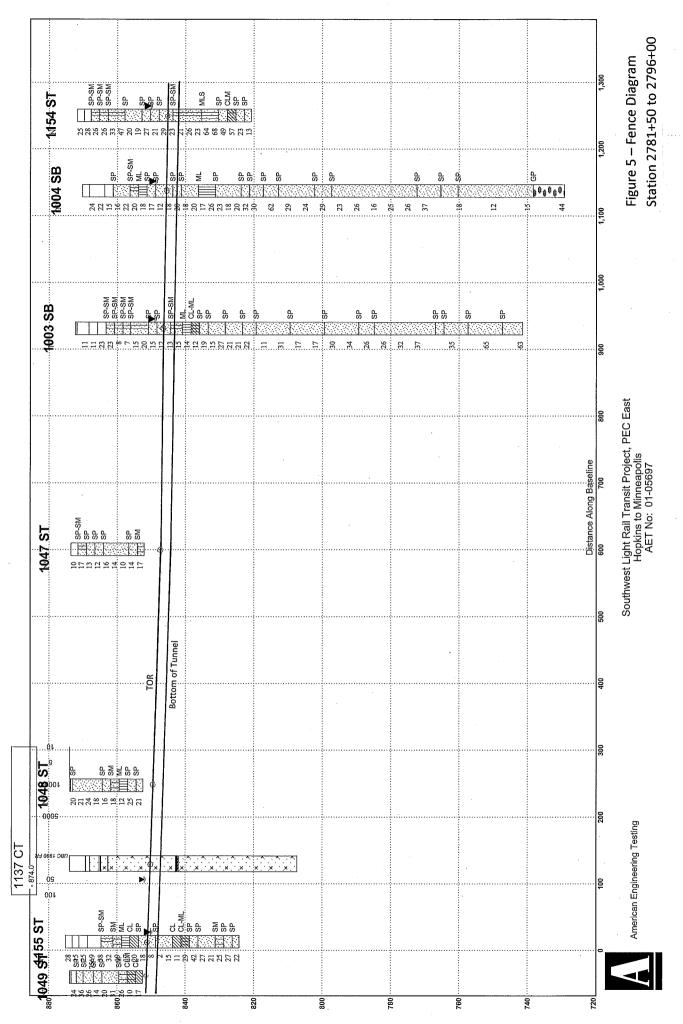
4/21/2014	855.78	858.41	850.71	850.64	850.48	850.47	852.67	852.06	850.61	850.24	852.08	849.72	849.54	849.14
4/28/2014	856.55	860.52	850.89	850.89	850.73	850.95	853.30	852.36	850.95	850.60	852.83	849.92	849.73	849.32
5/5/2014	857.93	860.70	851.44	851.68	851.71	851.91	853.66	853.36	852.01	851.51	855.23	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	water level r	.uemeniseeu	t taken											

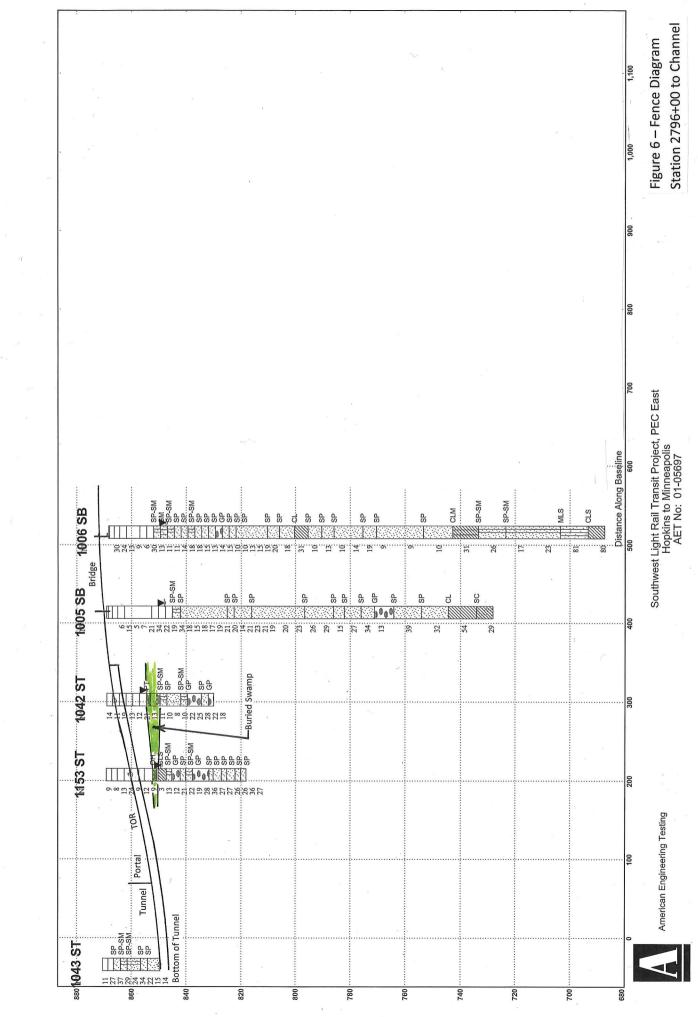
\* ice present, no water level measurement taken

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



Elevation





Elevation

# **Appendix B**

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



AET JO	B NO: <b>01-05697</b>					LC	OG OF	BORING 1	NO	1003	SB SB	<b>(p.</b> ]	l of 4	<del>1</del> )
PROJEC	CT: Southwest Ligh	nt Rail Tr	ansit Pro	oject,	PEC East	; Нор	kins	to Min	neapo	olis, N	MN			
SURFA	CE ELEVATION: 872.4	ŀ	Jennepin C	o. Cooi	dinates:	N 1	59149	)	E :	51653	8			
DEPTH					CEOLOCY			SAMPLE	REC	FIELI	) & LA	BORA	FORY 1	res'
IN FEET	MATERIAL D	DESCRIPTIO	N IN		GEOLOGY	N	MC	TYPE	ÎN.	WC	DEN	qu	PL	<b>%-</b> #
1	FILL, mostly silty sand wi	(A-2-4)			FILL		F F/M	B SU SU						
2 - 3 -	FILL, mixture of silty sand with gravel, trace roots, da frozen to 1.5' (A-2-4)	d and claye Irk brown a	y sand, and black,		ł.	11	M	ss	2					
4 5 6	FILL, mostly silty sand, a ashes/cinders, pieces of gl. (A-2-4)	little grave ass, dark br	l and rown			11	M	SS SS	4					
7 - 8 -	FILL, mostly silty sand wiglass, brown (A-2-4)	th gravel, p	pieces of			23	M	SS SS	5					
9 10 11	SAND WITH SILT AND medium grained, light gray medium dense (SP-SM) (2	yish brown	, moist,		COARSE ALLUVIUM OR FILL	[ 23	M	SS A SS	5					
12 — 13 —	SAND WITH SILT, a littl grained, grayish brown, m (A-1-b)	e gravel, m oist, loose	nedium (SP-SM)		COARSE ALLUVIUM	۲ 8	М	되 Ss 日	7		-			
14 — 15 — 16 —	SAND WITH SILT, a littl medium grained, light bro loose, laminations of claye $\gamma$ (A-3)	wnish gray	, moist,			7	M	b X ss ₽	10				- -	
17 — 18 — 19 —	SAND WITH SILT AND to fine grained, grayish brobrown, moist, medium der	own to ligh	t grayish	-		15	М	B X ss ₽	6					
19 — 20 — 21 —						20	M	SS R	15					
22 - 23 - 24 -	SAND, fine grained, light waterbearing, medium der	nse (SP) (A	3)		· · ·	15		∦ ∑ ss ₽	15					
25 — 26 —	SAND, a little gravel, med brownish gray to gray, wa dense (SP) (A-1-b)	dium to fine terbearing,	e grained, medium		· · ·	12	W	ss	15			·		
27 — 28 — 29 —	SAND WITH SILT, fine gray, waterbearing, mediu	grained, bro	ownish SP-SM)			13	w	ss	10					
30 31	(A-3)				· ·	15	W	ss	6					
DEF	PTH: DRILLING METHOD		<u></u>	WAT	ER LEVEL MI	EASUR	EMEN	TS		.1		NOTE:	REFF	R 1
		DATE	TIME	SAMP DEP	LED CASING	G CA	VE-IN EPTH	DRILL FLUID L	ING	WAT LEVI		THE A		
0-2	4½' 3.25" HSA							FLUIDL	EVEL				IT FOI	
241/2-12	9½' RDF w/DM	3/21/13	9:45	26.			4.3			23.		EXPLA		
DOPP		3/21/13	9:57	26.	0 24.5	2	4.3			23.4		ERMI		
COMP	IG LETED: 3/21/13										1			
DR· J	M LG: SB Rig: 68C											11	IIS LO	<u>u</u>



AET JOB NO:	01-05697			LO	G OF	BOF	RING N	0	1003	SB	(p. 4	2 01 4	4)
PROJECT:	Southwest Light Rail Transit Proj	ect,	PEC East;	Hop	kins	to	Minn	eapo	lis, N	/IN			
	Hennepin Co.				59149				51653				
EPTH	· · · · · · · · · · · · · · · · · · ·					SA	MPLE	REC	FIELI	) & LA	BORA	(ORY	TEST
ÎN EET	MATERIAL DESCRIPTION		GEOLOGY	Ν	MC	T	YPE	IN.	WC	DEN	qu	PL	<b>%-#</b> 2
33 – dens	NDY SILT, brownish gray, wet, medium se (ML) (A-4) <i>(continued)</i>		FINE ALLUVIUM (continued)	14	М	Å	SS	12	25				64
35 - (A-4	ΓΥ CLAY, brownish gray, stiff (CL-ML) 4)			12	M	X	SS	14	27				
brov	ND WITH GRAVEL, medium grained, whish gray, waterbearing, medium dense, a of fine grained sand (SP) (A-1-b)	444	COARSE	19	w		SS	7					
40 – brov	ND, a little gravel, medium to fine grained, whish gray, waterbearing, medium dense (A-1-b)			15	W	X	SS	10					
42 - 43 -				27	w	Å	SS	10					
44 - SAN 45 - wate 46 -	ND, fine to medium grained, grayish brown, erbearing, medium dense (SP) (A-3)			21	w	Å	SS	13					
47 — 48 —				21	w	Å	SS	12					
49 - SAN 50 - brov 51 -	ND, a little gravel, fine grained, grayish wn, waterbearing, medium dense (SP) (A-3)			22	w	X	SS	14					
52 -	ND, a little gravel, medium to fine grained,												
54 – brov	whish gray, waterbearing, medium dense to se (SP) (A-1-b)			11	w	X	SS	8					
57 — 58 —													
59 60 61				31	w	X	SS	. 14					
62 -	ND a little aroual modium around						•.						
64 – bro	ND, a little gravel, medium grained, wnish gray, waterbearing, medium dense ) (A-1-b)			17	W	X	SS	10					
66 — 67 —													
68 69					•								



	B NO: 01-05697						RING N			SB	<b>U</b> <sup>11</sup>		
PROJEC	T: Southwest Light Rail Transit Proj	ect,	PEC East;	Нор	kins	to	Minn	eapo	olis, N	/IN			
	Hennepin Co.	Coo	rdinates: <u>N</u>	1	59149	)		E ť	51653	8			
EPTH					1.00	SA	MPL F	REC	FIELI	) & LA	BORAT	FORY '	TEST
IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	Î	MPLE YPE	ÎN.	WC	DEN	qu	PL	<b>%-#</b> 2
- 71 - 72 -	SAND, a little gravel, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b) <i>(continued)</i>		COARSE ALLUVIUM (continued)	17	W	X	SS	12					
73 — 74 — 75 —	SAND, fine to medium grained, brownish gray, waterbearing, medium dense to dense (SP) (A-3)			30	W		SS	13	~				
76 — 77 — 78 —													
78 — 79 — 80 —				34	w	$\left  \right\rangle$	SS	13					
81 - 82 - 83 -			· · · · · · · · · · · · · · · · · · ·			$\sum_{i=1}^{n}$							
84 - 85 -	SAND, a little gravel, medium to fine grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)			26	w	X	SS	12					
86 87 88	SAND, apparent cobbles and gravel at 94', medium grained, brownish gray, waterbearing,				-	2							
89 - 90 -	medium dense to dense, lenses of medium to fine grained sand (SP) (A-1-b)			26	w		SS	13					
91 - 92 - 93 -						K							
94 — 95 —				32	W	X	SS	13					
96 — 97 —						$\left  \right\rangle$							
98 99													
100				37	W	X	SS	13					
102 — 103 — 104 —													
105 — 106 — 107 —	SAND WITH GRAVEL, medium to fine grained, brownish gray, waterbearing, dense, a lens of fine to medium grained (SP) (A-1-b)												

03/2011



AET J	OB NO:	01-05697			LO	G OF I	BOR	ING'N	0	1003	SB	<b>(p.</b> 4	of 4	<b>1</b> )
PROJE	ECT:	Southwest Light Rail Transit Proj	ect,	PEC East;	Hop	kins	to I	Minn	eapo	olis, N	ÍN			
		Hennepin Co.	Coor	rdinates: <u>N</u>	1	59149	)	]	E 5	516538				
DEPTH IN FEET		MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAN TY	APLE YPE	REC IN.	FIELD WC	& LAI	3ORAT qu		FESTS %-#200
108 -	SANI	O WITH GRAVEL, apparent cobbles at		COARSE			27							
109 -	- 114', 1	medium to fine grained, brownish gray,		ALLUVIUM (continued)			$[\Delta]$							
110 -	graine	bearing, dense, a lens of fine to medium ed (SP) (A-1-b)		(commonly	35	W	X	SS	13					
111 -	-						5							
112 -	-													
113 -	-						$\mathbb{S}$							
114 -	-						S							
115 -	GRA	VELLY SAND, apparent cobbles at 123',					$\left \left\langle \cdot\right\rangle \right $							
116 -	- medu very d	im grained, brownish gray, waterbearing, lense (SP) (A-1-b)					K¢							
117 - 118 -							K¢							
118							$\langle \langle$							-
120 -	_				65	м	М	SS	9					
120	_			•	.05	IVI	Д	22	9					
122 -	_			•			K							
123 -	_						K							
124 -	_			•			$\mathbb{Z}$							
125	GPA	VELLY SAND, apparent cobbles, medium		•			2							
126	- to coa	rse grained, dark brownish gray,		•			$\left \right\rangle$							
127	water	bearing, very dense (SP) (A-1-b)					$\left \right\rangle$							
128				· · ·			$\left \right\rangle$							
129	-			•			D)							
130	-			•	63	M	Х	SS	9					
131	END	OF BORING												
13														
8/5/1														
L GD1														
+WEL										-			-	
1+CP1														
JAE														
97.GP				4										
01-05														
TES		•												
RDINA														
000					1									
RP W														
NET_CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 8/5/13														



AET JOI	B NO: 01-05697						LO	GOF	BOR	LING N	O	1004	SB	<b>(p.</b> ]	L of 4	4)
PROJEC	T: Southwest Ligh	ıt Rail Tr	ansit Pro	oject,	PEC	East; ]	Нор	kins	to ]	Minn	eapo	olis, N	/Ņ			
SURFAC	CE ELEVATION: 870.3	H	lennepin Co	o. Cooi	rdinates	s: <u>N</u>	1	<b>5931</b> 4	l	_]	E 5	51666	6			
DEPTH	- r				CEO	LOGY	N	MC	SA	MPLE	REC	FIELD	) & LA	BORA	FORY '	TES'
IN FEET	MATERIAL D	DESCRIPTIO.	IN				IN	IVIC	Т	YPE	IN.	WC	DEN	qu	PL	<b>%-</b> #
· 1 2	FILL, mostly gravelly silty clay, trace roots, dark brow frozen to 1.5' (A-1-b)	vn, a little l	olack,		FILL			F/M		SU						
3 4	FILL, mostly gravelly sand cobbles, light brown to light (A-1-b)	ht brownish	apparent n gray				24	M	X	SS	12					
5	FILL, mostly sand with sil	t a little or	avel light				22	M	X	SS	10					
7 8 9	brownish gray (A-1-b)						15	М	R	SS	7					-
10 - 11 -	SAND, a little gravel, med brown, moist, medium der	lium graine ise (SP) (A	d, light -1-b)		COAR ALLU	RSE IVIUM	16	M		SS	12					
12 - 13 - 14 -					• • •		22	M	R	SS	8					
15 — 16 —	SAND WITH SILT AND medium grained, light bro medium dense (SP-SM) (A	wnish gray 4-3)	, moist,		•		20	M	FI FI	SS	12					
17 - 18 -	SILT, brown, moist, media of sandy silt (ML) (A-4)	um dense, l	aminations	5		VIUM	18	М	H H	SS	14	- 21			•	
19	SAND, fine grained, brow dense, lenses of sand with		nedium		COAF	RSE JVIUM	17	M V		SS	14		-			
22 – 23 –	SAND, a little gravel, mec brown, waterbearing, med (A-1-b)	lium to fine ium dense	e grained, (SP)		•		12	W	ł	SS	11					
24 - 25 - 26 -							18	W	Å	SS	15					
27 – 28 –	SAND, a little gravel, fine brown, waterbearing, med	to mediun ium dense	n grained, (SP) (A-3)			-	20	w	Å	SS	10					
29 - 30 - 31 -	SAND, fine grained, light waterbearing, medium der						18	W	Å	SS	16					
DEP	TH: DRILLING METHOD			WAT	ER LEV	/EL MEA	L SURI	L EMEN	IC (I TS		<u>.</u>	1		NOTE:	PEE	ר קר
			<b>T</b> (C)				1		Г	RILLI	NG	WAT		THE A		
0-	-22' 3.25" HSA	DATE	TIME	SAMP DEP	ĨĦ Ì	CASING DEPTH		VE-IN PTH	FĹ	UID LE	EVEL	WAT LEVI				
22-13	9½' RDF w/DM	3/19/13	9:50	23.	5	22.0		2.0				21.			TS FO	
		3/19/13	10:00	23.	5	22.0	2	2.0				21.	0	EXPLA		
BORIN	IG LETED: <b>3/20/13</b>		-											FERMI		
	M LG: SB Rig: 68C													Tŀ	IIS LO	G

AFT 03/2011



ET JO	B NO:01-05697						RING N			SB	(P. 4	- 01 .	<u> </u>
ROJEC	T: Southwest Light Rail Transit Proj	ject	, PEC East;				Minn						
	Hennepin Co.	Coc	ordinates: <u>N</u>	1:	<u>5931</u> 4	4	. <u> </u>	E <b>'</b>	51666	6			
PTH	NATEDIAL DESCRIPTION		GEOLOGY	NT	MC	SA	MPLE YPE	REC	FIELI	) & LA	BORA	FORY '	TEST
PTH N EET	MATERIAL DESCRIPTION		GEOLOGI	N	MC	ן ן	YPE	IN.	WC	DEN	qu	PL	<b>%-</b> #
	SAND, fine grained, light brown to brown,		COARSE ALLUVIUM	20	W	Μ	SS	15					
33 -	waterbearing, medium dense (SP) (A-3) (continued)		(continued)			Ю							
34 -	SILT, brownish gray to brown, wet, medium		FINE ALLUVIUM			H							
35 -	dense (ML)			17	W	М	SS	15	24				9
36 -						$\left \right\rangle$							
37 –	· · · · · · · · · · · · · · · · · · ·			26	w	Μ	SS	14	20				
38 -						Ą							
39 -	SAND, a little gravel, medium grained, grayish		COARSE			H							
40 -	brown, waterbearing, medium dense (SP) (A-1-b)			23	W	Х	SS	13					
41 -						$[\mathcal{I}]$							
42 -				18	W	M	SS	14					
43 -				10		Д	00	17					
44 –						4							
45 –				20	W	X	SS	13					
46 -						Б							
47 -	SAND, a little gravel, medium grained, grayish brown, waterbearing, dense, a lens of fine			22	w	$\square$	SS	14					
48 -	grained sand (SP) (A-1-b)			32	W	Д	22	14					
49 -	SAND, fine to medium grained, grayish brown,					4							
50 -	waterbearing, medium dense (SP) (A-3)			30	W	Х	SS	13					
51 -			•]	1		Б							
52 –						$\left \right\rangle$							
53 -	SAND, fine grained, brown, waterbearing, very					K							
54 —						$\square$					- -		
55 -				62	W	M	SS	15					
56 -	· · · · · · · · · · · · · · · · · · ·					Б							
57 —						$\left \left\langle \right\rangle \right $							
58 -	SAND, a little gravel, fine to medium grained, brown to grayish brown, waterbearing, medium					$ \langle \langle$							
59 -	dense (SP) (A-3)					$\langle \langle$							
60 -				29	W	M	SS	12					
61 -						6						-	
62 –						$\left \left\langle \right\rangle \right $							
63 –						$\langle \langle$							
64 —						$\left \left\langle \right\rangle \right $							
65 —				24	W	$\mathbf{N}$	SS	7					
66 —						Ŗ							
67 —						$\left \left\langle \cdot\right\rangle \right $							
68 —		-				$\left \left\langle \cdot\right\rangle \right $							
69 -						$\left \right $							
			··			${\succ}$	1						



AETJO	B NO: <b>01-05697</b>			LO	G OF	BOI	RING N	0	1004	28	(p. :	01	4)
PROJEC	T: Southwest Light Rail Transit Pro	oject,	PEC East; ]	Hop	kins	to	Minn	eapo	olis, N	/IN			
	Hennepin Co	o. Coor	dinates: N	1:	59314	4		E :	51666	6			
EPTH	t.					S A	MDIE	REC	FIELD	) & LA	BORAT	FORY	TEST
EPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	Ĩ	MPLE YPE	IN.	WC	DEN	qu	PL	<b>%-</b> #2
- 71 - 72 -	SAND, a little gravel, medium to fine grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b) <i>(continued)</i>		COARSE ALLUVIUM (continued)	29	W	X	SS	12					
73 — 74 — 75 —	SAND, medium grained, brownish gray, waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b)			23	w	X	SS	11					
76 — 77 —						$\left\{ \right\}$							
78 - 79 - 80 -				26		$\sum_{i=1}^{n}$	0.0						
80 81 82				26	W	Å	SS	15					
83 - 84 -						$\left \right\rangle$							
85 –				16	w	M	SS	7			-		
86 87						2							
88 -						K							
89 - 90 -				25	w	$\left  \right\rangle$	SS	12					
91 -				25		A	55	12					
92 - 93 -					-	$\left \right\rangle$							
94 -						K							
95 – 96 –				26	W	Å	SS	13			-		
97 98			• • •			$\left \right\rangle$							
99	SAND WITH GRAVEL, apparent cobble at 98', fine to medium grained, brownish gray, waterbearing, dense (SP) (A-1-b)					R							
100 — 101 —			• • •	37	W	Д	SS	12		,			
102 — 103 —			· • • •										
104 — 105 —	SAND, medium grained, brownish gray,												
106 — 107 —	waterbearing, medium dense, lenses of fine to medium grained sand (SP) (A-1-b)					$\left \right\rangle$							

03/2011



.

#### SUBSURFACE BORING LOG

AET JOB	NO:	01-05697			LO	G OF	BOR	LING N	IO	1004	SB	( <b>p.</b> 4	4 of 4	4)
PROJECT	-	Southwest Light Rail Transit Pro	ject,	PEC East; l	Hop	kins	to ]	Minn	leapo	olis, N	ΛN			
- 1000001	-	Hennepin Co				59314				51666				
DEPTH		and an and a second					<u> </u>	MPI F	REC	FIELI	) & LA	BORAT	FORY	TEST
IN FEET	and the second sec	MATERIAL DESCRIPTION		GEOLOGY	Ν	MC	T	MPLE YPE	ÎN,	WC	DEN	qu	PL	<b>%-</b> #
	waterb	, medium grained, brownish gray, bearing, medium dense, lenses of fine to		COARSE ALLUVIUM			24			-				
107	mediu	m grained sand (SP) (A-1-b) (continued)		(continued)			H							
110	SANE	WITH GRAVEL, medium grained, ish gray, waterbearing, medium dense			18	W	Д	SS	7					
112 -	(SP) (.	A-1-b)					K							
113 -							21							
114 -							2							
115 —							$\left \right\rangle$							
116 -							$\left \right\rangle$							
117 -							$\left \right\rangle$							
118 -														
119 -							51							
120 -					12	w	$\square$	SS	5					
121 -							H							
122 -							$ \langle  $							
123 -							$\left \left\langle \right\rangle \right $			- * -				
124 -							K							
125 -							K							
126 -							$\left \right\rangle$							
127 -							$\left \right\rangle$							
128 -				•			$\left \right\rangle$							
129 -				•			Д							
130 -					15	W	X	SS	1					
131 -				•			Б							
132	GRAV	/EL WITH SAND, apparent cobbles,		COARSE	,		$\left \right\rangle$							
133 -	brown (A-1-a	hish gray, waterbearing, dense (GP)		ALLUVIUM OR										
134 -	(1 1-1-4	*)		COLLUVIUM			$\left \left\langle \right\rangle \right $							
135 —							$\langle \langle \langle \rangle \rangle$							
136 -							$\langle \langle$							
137 -							$\langle \langle$							
138 -							2							
139 -			₩ ₩ ₩				Н							
140 -					44	W	М	SS	3					_
141	END	OF BORING												
				10	-									
		· 4												



AET JO	B NO: 01-05697						LO	G OF	BORI	NG N	0	1005	5 SB	<b>(p.</b> ]	l of a	4)
PROJEC	CT: Southwest Light	nt Rail Tr	ansit Pr	oject,	PEC	East; ]	Нор	kins	to N	/linn	eapo	olis, N	ΛN			
SURFAG	CE ELEVATION: 869.1	ŀ	Iennepin C	o. Cooi	rdinate	s: <u>N</u>	1:	59918	8	]	3	51723	0			
DEPTH					aro	LOCK			SAN	1PLE	REC	FIELI	) & LA	BORA	FORY	TES
IN FEET	MATERIAL I	DESCRIPTIO	N		GEO	LOGY	N	MC	TY	'PE	IN.	WC	DEN	LL	PL	<b>%-</b> #
1 —	FILL, mostly silty sand wi	•)			FILL			F F	$\overline{\Lambda}$	SU SS			-			
2 — 3 —	FILL, mostly crushed lime silty sand, light brown, a li (A-1-b)	ittle brown,	frozen		-			F		SS	14					
4 — 5 —	FILL, mostly silty sand wi little dark brown, frozen (A FILL, mostly silty sand wi	A-2-4)					6	М		SS	4	9				1
6 — 7 —	dark brown (A-1-b) FILL, mostly silty sand wi	ith gravel, a	a little sand	1 .					E							
8 - 9 -	with silt and clayey sand, j below 11', pieces of wood brown and dark brown (A	, brown, a l	bbles ittle light				15	М	X FJ	SS	12					
10 - 11 -							5	М		SS	3					
12 - 13 -							7	М		SS	5					
14 — 15 —		•					21	M	Ŧ	SS	2					
16 — 17 —	FILL, mostly gravelly silt	y sand, piec	ces of		1		- 21	171	ET .							
18 — 19 —	brick, brownish gray (A-1				_		34	M	X FJ	SS	14					
20 - 21 -	FILL, mostly sand with silbrownish gray, a little brownish						. 22	⊻		SS	14					
22 - 23 -	FILL, mostly sand with sil clayey sand, brownish gra	lt and grave y (A-1-b)	el, a little				19	W		SS	16					
24	SAND WITH SILT AND to fine grained, gray, wate (SP-SM) (A-1-b)				COAI ALLU	RSE JVIUM	34	w		SS	3			-		
20 – 27 – 28 –	SAND, fine grained, brow medium dense (SP) (A-3)	n, waterbe	aring,				18	w	Å	SS	14					
29 — 30 —					•		15	w		SS	13			-		
31 -									$\mathbb{H}$							
DEP	TH: DRILLING METHOD			WAT	I ER LEV	VEL MEA	SURE	EMEN	<u>⊮_∥_</u> TS				<u> </u>	L NOTE:	BEEE	т 93
		DATE	TIME	SAMPI	··· ·	CASING DEPTH		/E-IN PTH	DH	RILLIN	1G	WAT	ER	THE A		
0-	-22' 3.25" HSA								FLU	ID LE	VEL	LEVE	<u>SL</u>	SHEE		
22-13	9 <sup>1</sup> /2' RDF w/DM	3/25/13	10:50	23.		22.0		2.4				21.1				
DOBB	10	3/25/13	11:00	23.	5	22.0	22	2.3				21.3	,	EXPLA		
COMP	IG LETED: <b>3/27/13</b>		·····						<u> </u>	-			1	ERMIN		
	M LG: SB Rig: 68C													TH	IIS LO	G

03/2011



AMERICAN ENGINEERING TESTING, INC.

## SUBSURFACE BORING LOG

AET JOE							RING N			SB			4)
PROJEC	T: Southwest Light Rail Transit P	roje	ect, PEC Ea	ist;	Нор	ki	ns to				MN		
	Hennepin Co.	Coor	dinates: <u>N</u>	1	59918	<u> </u>	]	E É	51723	· · · · · · · · · · · · · · · · · · ·			
DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	мс	SA	MPLE YPE	REC	FIELL	& LAI	BORAT	ORY	TEST
FEET							YPE	IN.	WC	DEN	LL	PL	<b>%</b> -#2
33 —	SAND, fine grained, brown, waterbearing, medium dense (SP) (A-3) (continued)		COARSE ALLUVIUM	18	W	M	SS	12					
34 -			(continued)			$\left[ \right]$							
35				17	w	M	SS	15					
36 -				17	vv	Д	55	15					
37 —						4							
38 —				19	W	М	SS	13					
39 -						$\sum$							
40 -				21	W	$\square$	SS	14					
41 -						H							
42 —						$\mathbb{H}$		10				-	
43 -				20	W	Щ	SS	13					
44 -	SAND, a little gravel, medium grained, grayish					Ц							
45 —	brown, waterbearing, medium dense (SP) (A-1-b)			14	W	X	SS	10					
46 –						$\left[ \right]$							
47 —	SAND, fine grained, grayish brown, waterbearing, medium dense, laminations of			21	w	$\square$	SS	14					
48 -	fine to medium grained sand (SP) (A-3)			<u> </u>		Ĥ							
49 -						H	,						
50 -				23	W	Д	SS	15					
51 — 52 —						$\left \right\rangle$							
53			•			$\left \right\rangle$							
54 -	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense,					$\left \right\rangle$			-				
55 -	brownish gray, waterbearing, medium dense, lenses of fine grained sand, a lens of medium		•	21	w	$\square$	SS	12					
56 -	grained sand with gravel at 70.5' (SP) (A-3)		•	~1		A	55	144					
57 —			·			K							
58 —						$\langle \langle$							
59 —						$\square$							
60 -				19	W	X	SS	14					
61 -						$\left[ \right]$							
62 -													
63 –													
64 -			- 		,	$\left \right $							
65 -			• • •	20	W	X	SS	14					
66 -						$\left \right\rangle$							
67 — 68 —			•			$\left \right\rangle$							
68 -						$ \rangle$							
09 -						$\geq$							

01-DHR-060

03/2011



AET JC	B NO:	01-05697			LO	GOF	BORING	NO	1005	5 SB	(p. 3	3 of 4	4)
PROJE	CT:	Southwest Light Rail Transit P	roje	ect, PEC E	ast;	Hop	okins to	Min	neaj	polis,	MN	[	
		Hennepin Co.				5991			51723				
DEPTH				GEOLOGY		MC	SAMPLE	REC	FIELI	) & LA	BORAT	FORY	TESTS
DEPTH IN FEET		MATERIAL DESCRIPTION		GEOLOGI	N	MC	TYPE	IN.	WC	DEN	LL	PL	<b>%-</b> #200
71 -				COARSE ALLUVIUM (continued)	23	W	ss	11					
72 -	CANT	D, fine to medium grained, brownish gray,		-									
73 –	water	bearing, medium dense, lenses of fine											
74 –	graine	ed sand (SP) (A-3)					KJ -						
75 –					26	W	X ss	13					
76 -							$\sum$						
77 –	-			•									
78 -	-						59						
79 -				· ·			KJ .						
80 -	1				29	W	X ss	12					
81 -							$\sum$						
82 -	-												
83 -	SANI	D, medium grained, brownish gray,		<u>.</u>			IS 9						
84 -	water	bearing, medium dense (SP) (A-1-b)		•			K						
85 -	-				15	W	X ss	12					
86 -	-			•									
87 -	SANI	D, a little gravel, medium grained,					St.						
. 88 -	brown	nish gray, waterbearing, medium dense, a of fine to medium grained sand (SP)					5						
89 -	(A-1-						Q						
90 -		, ,			27	W	ss	11					
91 -	-						FJ ·						
92 -	-	· · · · · ·					59						
93 -	SAN	D, medium to fine grained, brownish gray,	+				KI						
94 -	water	bearing, dense, a lens of fine to medium		· • •			K						
95 -	grain	ed sand (SP) (A-1-b)			34	W	ss s	5		•			
96 -	4						51						
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-						51						
98 -	GRA	VEL WITH SAND, possible cobbles,					K						
99 -	brow	nish gray, waterbearing, medium dense											
100 -	$\downarrow$ (GP)	(A-1-a)	-		13	W	ss s	2	1				
101 -	-						61						1
102 -	-						$ \zeta $						
103 -	4						$\left \left\langle \right\rangle \right $						
104 -	4			=			2						1
105 -	CANT	D WITH GRAVEL, medium grained, dark	-				2						
106 -	grayi	sh brown, waterbearing, dense, a lens of					$\left \right\rangle$						
107 -	grave	elly sand with silt (SP) (A-1-b)					$\left \right\rangle$						
							( ``[	_					



AET JOI	B NO:	01-05697							RING N					l of 4	+)
PROJEC	CT:	Southwest Light Rail Tr	ansit Pro	oje	ct, PEC Ea				ns to				MN		
		Hen	nepin Co. C	oor	linates: <u>N</u>	15	59918	<b>}</b>	]	3 5	51723				
DEPTH		MATERIAL DESCRIPTION			GEOLOGY	N	MC	SA	MPLE YPE	REC		) & LAI	BORAT	ORY '	TES'
DEPTH IN FEET		MATERIAL DESCRIPTION			GEOLOGI	- N -	IVIC	Т	YPE	IN.	WC	DEN	LL	PL	%-#
108 -	SANI	WITH GRAVEL, medium graine	ed, dark 🗄		COARSE			27							
109 -	grayis	h brown, waterbearing, dense, a le ly sand with silt (SP) (A-1-b) (con	ns of [.:		ALLUVIUM (continued)			$\sum$				· ·			· .
110 -	Bruter				(commea)	39	W	М	SS	7					
111 -								6							
112 -								$\langle \langle \langle \rangle \rangle$							
113 -								$\langle \langle$							
114 -		· · · · · · · · · · · · · · · · · · ·						$\left \left\langle \right.\right\rangle$							
115 -	CANT	a little marial medium ansiered						$\left \right\rangle$							1
116 -	brown	), a little gravel, medium grained, ish gray, waterbearing, dense (SP)	)					$\left \right\rangle$					,		
117 -	(A-1-	)) ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( ( (						$\left \right\rangle$							
118 -								S							
119								$ \langle  $							
120 -						32	w	M	SS	4					
121 -						52	٧Ÿ	Д		-					
122 -								$\langle \langle$							
122			•				۰.	$\left \right\rangle$							
123								$\left \right\rangle$							
124	LEAN	VCLAY WITH SAND, brown, ha	rd (CL)		TILL OR			$\left \right\rangle$							
125 -	(A-6)	, - <u>,</u>	· ·		FINE ALLUVIUM			$ \rangle $							
120				$\parallel  heta$				S							
127 -				$\langle \rangle \rangle$				$ \langle  $							
128 -								K							
129 -						<b>.</b> .		Ю	00	10	10				
						54	M	Å	SS	18	13				
131 -								$\left \right\rangle$							
132 -								$\left \right\rangle$							
133 -	.			$\langle \rangle \rangle$				$\left \right\rangle$					1		
134 -								$\left \right\rangle$							
135 -	CLA	YEY SAND, a little gravel, brown	, very		TILL			$ \langle \langle   \rangle  $							
136 -		SC) (A-6)						$\left \left\langle \right\rangle \right $							
137 —	1							$\langle \langle$							
138 -								$\left \right\rangle$							
139 —	1							R-							
140 —						29	M	X	SS	16	11				
141	END	OF BORING	(												
	Note:	Lost mud circulation at 120 feet, collapsed at 40 feet, re-augered v HSA down to 50 feet and re-drill rotary methods to continue advar	vith led with												
		•												01-E	



AET JO	DB NO: 01-05697					i.	LO	G OF	BOR	ING N	iO	1006	SB	<b>(p.</b> 1	lof	5)
PROJEC	CT: Southwest Lig	ht Rail 7	[ransit]	Proje	ect, PE	C Ea	st;	Нор	kin	is to	Min	near	oolis	, MN	[	
SURFA	CE ELEVATION: <b>868.4</b>	Н	lennepin Co	o. Cooi	dinates:	N	1	60002	2		E 🗧	51728	9			
DEPTH	MATERIAL D	ESCRIPTIO	N		GEOL	oov	N	мс	SAI	MPLE	REC	FIELI	) & LA	BORAT	rory '	TESTS
IN FEET	MATERIAL D	ESCRIPTION	N .			501	IN	IVIC	T	YPE	IN.	wc	DEN	LL	PL	%-#20
1	FILL, mostly silty sand with little gravel and clayey sand trace roots, dark brown, fro FILL, mostly gravel with c	d with orga ozen (A-2-4	nic fines, 4)	<u></u>	FILL			F F/M	TE-FE	SU SU						
3	brown, frozen to 1.5' (A-1- FILL, mixture of silty sand	b) l and sand v	with silt,	/ 			30	M	X	SS	12					•
5 — 6 —	gravelly, dark brown and li black (A-2-4) FILL, mostly sand with sil	t and grave					24	М	R	SS	12					
7 — 8 —	Clayey sand, brown (A-1-b FILL, mostly clayey sand, slightly organic lean clay a ashes/cinders, trace roots, o	a little grav	nd,				13	М	LA LA	SS	10	10		×		
9 10 11	(A-6, A-4)						9	М		SS	6	16				
12 — 13 —	FILL, mostly slightly orga little gravel and sandy lean black and brownish gray (A	a clay, trace	ean clay, a e roots,				6	M		SS	12	20				
14 15 16	FILL, mostly silty sand wi clayey sand, brownish gra		1 little				30	M	H H	SS	11					
17 18 19	SAND WITH SILT AND medium grained, brown, a moist, medium dense, lam sand (SP-SM) (A-2-4)	little brow	nish gray,		COARS		13	M	LT LT	SS	5					
19 - 20 - 21 -	GRAVELLY SILTY SAN grained, brown, wet, medi medium grained sand with (A-1-b)	um dense,	a lens of		· · · ·	-	11	<u> </u>	H H H	SS	6			· .		
22 - 23 -	GRAVELLY SAND WIT fine grained, light grayish medium dense (SP-SM) (A	brown, wa A-1-b)	terbearing,				11	W		SS	4					
24 25 26	SAND WITH GRAVEL, medium grained, brownish medium dense (SP) (A-1-b	n gray, wate o)	erbearing,		•		14	w	Å	SS	6					
27 -	GRAVELLY SAND, poss to coarse grained, gray, wa dense (SP) (A-1-b)	sible cobble aterbearing	es, medium , medium	1	* * *		18	w	Å	SS	5					
29 - 30 - 31 -	waterbearing medium der	rained, grav	y,				18	w	X	SS	4					
25 - 26 - 27 - 28 - 29 - 30 - 31 - DE	PTH: DRILLING METHOD			WAT	ER LEVI	EL MEA	SUR	EMEN	ITS					NOTE:	REF	ER TO
		DATE	TIME	SAMP DEP	LED CA	ASING EPTH	CA	VE-IN EPTH		RILLI	NG	WAT LEV	ER	THE A		
	)-22' 3.25" HSA					ертн 24.5	<u>+</u>	3.7	FL	UID LI	VEL	22.		SHEE		
22-17	79 <sup>1</sup> /2' RDF w/DM	3/27/13	3:10	23. 23.		24.5		3.7 3.3				22.		EXPLA	NATI	ON C
BORI	NG	3/27/13	3:20	23.		41.J		J.J	_			.1 <i>4</i>		fermi	NOLO	GY (
COME	PLETED: 3/27/13								+					Tŀ	HS LC	G
DR: J	M LG: JB Rig: 68C														01-1	



PROJEC	CT: Southwest Light Rail Transit P	roje	ct, PEC Ea	ist; ]	Нор	kir	is to I	Min	neap	olis,	MN		
. KOJLA	Hennepin Co. C	•			60002				51728				
EDTU						Ī			FIELI	) & LA	BORAT	ORY '	TEST
EPTH IN TEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SA T	MPLE YPE	REC IN.	WC	DEN	LL	PL	<b>%-</b> #:
33 — 34 —	SAND, a little gravel, possible cobbles, medium grained, gray, waterbearing, medium dense, a lens of fine to medium grained sand with silt $\langle SP \rangle$ (A-1-b) (continued)		COARSE ALLUVIUM (continued)	15	w	X	SS	5					
35 — 36 —	SAND, a little gravel, possible cobbles, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-3)			13	w	A	SS	5					
37 — 38 — 39 —	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-3)			14	w	Ŗ	SS	12					
40 — 41 —	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	X	SS	11	23	-			
42 — 43 — 44 —	SAND, medium to fine grained, brownish gray, waterbearing, loose, a lens of fine to medium grained sand (SP) (A-1-b)			10	W	Ŗ	SS	9					
45 — 46 —	SAND, a little gravel, medium grained, brownish gray, waterbearing, loose (SP) (A-1-b)			10	w	Å	SS	10					
47 48 49	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	Å	SS	12					
49 - 50 - 51 -			•	15	w	X	SS	12					
52 - 53 -			•			S							
54 55				19	w	K	SS	13					
56 - 57 -													
58 - 59 - 60 -	SAND, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-3)			20	w	X	SS	12			-		
61 - 62 -						$\left  \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	20						
63 - 64 - 65 -	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	X	SS	12					
66 - 67 -			· · · · · · · · · · · · · · · · · · ·			$\left[ \right]$							
68 -				-		$ \langle  $							
69 -			FINE ALLUVIUM	-		$\left \right\rangle$							



AET JOE	NO: <b>01-05697</b>				LO	GOF	BORI	ŃGN	0.	1006	5 SB	(p. 3	6 of 5	5)
PROJEC	T: Southwest		Proje	ct, PEC Ea	ast; ]	Нор	kin	s to	Min	neap	olis,	MN		
		Hennepin Co				60002				51728				
EPTH	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·					SAN	APLE	REC	FIELI	) & LAI	BORAT	ORY 1	ΈS
EPTH IN EET	MATER	IAL DESCRIPTION		GEOLOGY	N	MC	TY	/PE	IN.	WC	DEN	LL	PL	<b>%-</b> #
71 – 72 –	LEAN CLAY WITH laminations of waterbo grained sand (CL) (A-	earing fine to medium		FINE ALLUVIUM (continued)	31	M/W	X	SS	13	17				
73 <del>-</del> 74 -	SAND, a little gravel, waterbearing, loose (S	medium grained, brown, P) (A-1-b)		COARSE ALLUVIUM										
75 — 76 — 77 —					10	W	X	SS	6					
78	brownish gray, waterb	fine to medium grained, earing, medium dense, n grained sand (SP) (A-3)			13	w		SS	14					
81 - 82 -	SAND	ad brownish area												
83 — 84 — 85 —	SAND, medium grain waterbearing, loose to (A-1-b)	medium dense (SP)			10	w	X	SS	8					
86 87 88					10	٧٧		50	0					
89 90 91					14	w	X	SS	11					
92 - 93 - 94 - 95 -	SAND, a little gravel, gray, waterbearing, m to medium grained sa	medium grained, brownis edium dense, a lens of fin nd (SP) (A-1-b)	sh e		10				10					
95 - 96 - 97 - 98 -				· · · · ·	19	W	Å	SS	12					
98 - 99 - 100 - 101 -	SAND WITH GRAV medium grained, brow loose (SP) (A-1-b)	EL, possible cobbles, vnish gray, waterbearing,			9	w		SS	4					
102 103 104														
107 105 106							$\left \right\rangle$							
107 —				•			$\left \right\rangle$							



AET JO	B NO: <b>01-05697</b>			LO	GOF	BORING 1	۷O	1006	5 SB	(p. 4	1 of 5	5)
PROJE	CT: Southwest Light Rail Transit Pro	ject,	PEC East;	Нор	kins	to Min	neapo	olis				
	Hennepin Co	. Coo	rdinates: <u>N</u>	1	60002	2	E É	51728	9			
DEPTH			GEOLOGY			SAMPLE	REC	FIELI	) & LAI	BORAT	FORY 1	rests
DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL 9	<b>%-</b> #20
108	SAND WITH GRAVEL, possible cobbles,		COARSE			21						
109 —	medium grained, brownish gray, waterbearing, loose (SP) (A-1-b) <i>(continued)</i>		ALLUVIUM (continued)			$\sum$						
110 -				9	W	$\times$ ss	. 5	1994 - 19				
111 -						5						
112 -						S						
113 —						SI						
114 -						KI						
115 —	SAND, a little gravel, medium grained,					K						
116 —	brownish gray, waterbearing, loose, a lens of medium to fine grained sand (SP) (A-1-b)					K						
117 —			, ,									
118 —						2						
119 -						P)						
120				10	W	SS SS	4					
121 -			•			2						
122 -												
123 -			•									
124 — 125 —			•									
125 -	SILTY CLAY, brown, hard (CL-ML) (A-4)	XX	FINE			S						
120 -			ALLUVIUM			$\left \left\langle \cdot\right\rangle \right $					· .	
127						$\langle \langle$			м.			
129 -	•					$\langle \langle$						
130 -				21	24	ss	17	27				
131 -				31	M	$A^{33}$	1/	21			,	
132 -						$\langle \langle$						
133 -						$\langle \langle \cdot \rangle \rangle$						
134 -						2						
135 -	SAND WITH SUT a little ground medium to		COARSE	-		$\left \right\rangle$						
136 -	SAND WITH SILT, a little gravel, medium to fine grained, brown, waterbearing, medium		ALLUVIUM			$\left \right\rangle$						•
137 -	dense, a lens of clayey sand at 140' (SP-SM) (A-1-b)											
138 -						$\left \right\rangle$						
139 -			•			$\sum$		***				
140 -				26	W	ss 🕅	15					
141 -						Б						
142 -						$\left  \left\langle \right\rangle \right $						
143 -						$\left \left\langle \right\rangle \right $						
144 -						K						
145 -	· · · · · · · · · · · · · · · · · · ·					2						
03/2011				1	1						01-D	

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



1	Hennepin Co. ( MATERIAL DESCRIPTION SAND WITH SILT, possible cobbles, fine to medium grained, grayish brown, waterbearing, medium dense (SP-SM) (A-3) (continued)		GEOLOGY COARSE ALLUVIUM (continued)	N 17	MC W	SAMPLE TYPE	REC IN.	FIELI	D & LAI	BORAT		rests %-#20
146 - 5 $147 - 1$ $148 - 149 - 150 - 151 - 152 - 153 - 154 - 155 - 156 - 15$	SAND WITH SILT, possible cobbles, fine to nedium grained, grayish brown, waterbearing,		COARSE ALLUVIUM					WC	DEN	LL	PL	<b>%-#</b> 2(
146 - 5 $147 - 1$ $148 - 149 - 150 - 151 - 152 - 153 - 154 - 155 - 156 - 15$	nedium grained, gravish brown, waterbearing,		ALLUVIUM	17	w	X SS	5					
$ \begin{array}{c} 147 - 1 \\ 148 - \\ 149 - \\ 150 - \\ 151 - \\ 152 - \\ 153 - \\ 154 - \\ 155 - \\ 156 - \\ \end{array} $	nedium grained, grayish brown, waterbearing, nedium dense (SP-SM) (A-3) <i>(continued)</i>		(continued)	17	W	× ss	5					
148 149 150 151 152 153 154 155 156				17	W	> X ss	5					
150 — 151 — 152 — 153 — 154 — 155 — 156 —				17	w	) X ss	5					
151 — 152 — 153 — 154 — 155 — 156 —				17	w	$\bigvee$ ss	5					
152 — 153 — 154 — 155 — 156 —									11			
153 — 154 — 155 — 156 —						6						
154 — 155 — 156 —						5	-					
155 — 156 —						$\left \left\langle \cdot\right\rangle \right $						
156 —		1 + 1 1.1				$\left \left\langle \cdot\right\rangle \right $						
1 1 L						$\langle \langle$						
157 -						K						
1						R						
158 —												
159 -						P.						
160 —				23	W	X ss	4					
161 -						$\overline{\lambda}$						
162 -						$\rangle\rangle$						
163 -						$\left \right\rangle$						
164 -						5						
165	SANDY SILT, a little gravel, possible cobbles, brownish gray, wet, very dense (ML) (A-4)		FINE ALLUVIUM			$\left  \right\rangle$						
166 — 167 —	brownish gray, wet, very dense (ML) (X-4)					51						
168 -						$\left\{ \left\{ \right\} \right\}$						
169 -		· · .				$\langle \langle$						
109 -				81	w	ss	12	24				
171 -				10	w	$A^{33}$	12	24				
172 -						$\langle \langle$						
173 -						K						
174 —					-	2					,	
	CANDY I DAN CLAY a little grouph doub		TILL	-		121						
	SANDY LEAN CLAY, a little gravel, dark brownish gray, hard (CL) (A-6)					$\left \right\rangle$						
177 -						$\left \right\rangle$						
178 —				. 		$\left \right\rangle$						
179 -						$\sum$						
180 —				80	·M	ss s	18	13				
181	END OF BORING		1		+			-				+



AMERICAN ENGINEERING TESTING, INC.

#### SUBSURFACE BORING LOG

	AET JOI	B NO: <b>01-05697</b>		·· •1214.14				LO	G OF	BO	RING N	IO	1042	ST	<b>(p.</b> )	lof	2)
	PROJEC	T: Southwest Ligh	t Rail Tr	ansit Pro	oject,	PEC	C East; ]	Нор	kins	to	Minn	ieapo	olis, N	/IN			
	SURFAC	CE ELEVATION: <b>869.0</b>	H	Iennepin Co	o. Cooi	rdinat	tes: <u>N</u>	. 1:	59822	2		E É	51717	2			
ſ	DEPTH	MATERIAL D	FSCRIPTIO	N		GE	OLOGY	N	MC	SA	MPLE TYPE	REC	FIELD	)&L/	BORA	FORY	TESTS
	IN FEET										TYPE	IN.	WC	DEN	LL	PL	<b>%-</b> #20
	1 -	FILL, mostly clayey sand v silty sand, brown (A-2-4)	vith gravel	, a little		FILI		14	М	M	SS	6	16				-
	2 3 4	FILL, mostly silty sand wit with silt, trace roots, black, (A-2-4)	h gravel, a a little bro	ı little sand own				11	М		SS	18					
	5	FILL, mostly sand with silt brown (A-3)	, a little gr	ravel,				19	M		SS	2					*
	7 <del>-</del> 8 - 9 -	FILL, mixture of clayey sa with gravel, brown (A-2-4)		ld with silt,				13	M		SS	12	7				
	10 11	FILL, mostly gravelly silty	sand, brov	wn (A-1-b)				12	M	X	SS	2					
	12 — 13 — 14 —	FILL, mostly sand with sill clayey sand, brown (A-1-b		el, a little				21	M		SS	12					
	14 15 — 16 —	HEMIC PEAT, brown to d (A-8)	lark brown	(PT)	<u>- 112</u> 112		AMP POSIT	13	M	X	SS	18	317				
	17 — 18 —					1		11	М	K	SS	3	164			-	
	19 - 20 - 21 -	SAND WITH SILT AND medium grained, light brow waterbearing, loose, a lens (SP-SM) (A-1-b)	wnish gray	,		CO	ARSE LUVIUM	10	W	R K K	SS	18					
	22 — 23 — 24 —	SAND WITH GRAVEL, r brownish gray to gray, wat (A-1-b)	nedium gr erbearing,	ained, loose (SP)				8	w		SS	24					
DT 5/10/13	25 - 26 -							10	w		SS	24					
CPT+WELL.GI	27 — 28 — 29 —	GRAVELLY SAND WIT fine grained, gray, waterbe (SP-SM) (A-1-b)	H SILT, m earing, med	edium to lium dense				22	w	X	SS	18					
01-05697.GPJ AET+CPT+WELL.GDT 5/10/13	29 30 31	GRAVEL WITH SAND, g medium dense (GP) (A-1-		rbearing,		=		25	w		SS	2					
1-0565	חנות	TH: DRILLING METHOD					EVEL MEA	SUR	EMEN		L	1			NOTE		
	0-2-		DATE	TIMĖ	SAMP DEP	·····		1 .	VE-IN EPTH	1	DRILLI LUID LI	NG EVEL	WAT LEVI	ER EL	NOTE THE A		
AIDAC	241/2-		5/8/13	9:30	16.		14.5		4.6				Nor		SHEE	TS FO	R AN
N-CO	4-t/2-		5/8/13	9:38	16.		14.5		4.6	-			14.	5	EXPLA	NATI	ON OF
CORP W-COORDINATES	BORIN	IG LETED: <b>5/8/13</b>	5/8/13	10:03	26.		24.5	2	4.0	$\uparrow$			20.	8	TERMI	NOLO	GY OI
ŏL		H LG: <b>JMM</b> Rig: <b>1C</b>	5/8/13	10:10	26.		24.5		4.0	1			19.	0	Tł	HS LO	)G



NO:	01-05697	7							LO	G OF	BOI	RING N	0	1042	ST	(p. 2	2 of 2	2)
:	Southwest	Light	Rail T	ransit	t Proj	ect,	PEC	East;	Hop	kins	to	Minn	eapo	olis, N	/IN			
	· · · · · · ·										SA	MPLE	REC	FIELI	) & LA	BORAT	TORY	TEST
	MATE	KIAL DES	SCRIPTI(	JN			GEO	LUGY	N	MC	T	YPE	ĨÑ.	WC	DEN	LL	PL	<b>%-</b> #2
GRAV nediu	/EL WITH SA m dense (GP)	AND, gra (A-1-a)	iy, wate (contini	rbearin <i>ied)</i>	ng,				28	W	M	SS	16					
SANI gray, y	), a little grave waterbearing,	el, mediu medium	m to fin dense (S	ne grain SP) (A-	ned, -1-b)				22	w	$\sum$	SS	16					
GRAV	VEL WITH SA Im dense (GP)	AND, gra (A-1-a)	iy, wate	rbearin	ıg,			•	18	w	X	SS	2					
END	OF BORING					<u> </u>					$\mathbb{P}$							
							5 5											
															-			
						-			-									
			•															
				÷														
									-									
							1			1			1	1		1		
	GRAV nediu SANE gray, v GRAV nediu	Southwest MATE GRAVEL WITH SA nedium dense (GP) GAND, a little grave gray, waterbearing, GRAVEL WITH SA nedium dense (GP)	Southwest Light MATERIAL DES GRAVEL WITH SAND, gra nedium dense (GP) (A-1-a) GAND, a little gravel, medium gray, waterbearing, medium	Southwest Light Rail T MATERIAL DESCRIPTION GRAVEL WITH SAND, gray, waten nedium dense (GP) (A-1-a) (continu GAND, a little gravel, medium to fir gray, waterbearing, medium dense (GP) GRAVEL WITH SAND, gray, waten nedium dense (GP) (A-1-a)	Southwest Light Rail Transit Henney MATERIAL DESCRIPTION GRAVEL WITH SAND, gray, waterbearin nedium dense (GP) (A-1-a) (continued) GAND, a little gravel, medium to fine grain gray, waterbearing, medium dense (SP) (A GRAVEL WITH SAND, gray, waterbearin nedium dense (GP) (A-1-a)	Southwest Light Rail Transit Proj Hennepin Co. MATERIAL DESCRIPTION GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued) GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b) GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)	Southwest Light Rail Transit Project, Hennepin Co. Coor         MATERIAL DESCRIPTION         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)         GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)	Southwest Light Rail Transit Project, PEC         Hennepin Co. Coordinates         MATERIAL DESCRIPTION       GEO         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       Image: Continued (Continued)         GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)       Image: Continue (Continued)         GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue (Continue (Co	Southwest Light Rail Transit Project, PEC East;         Hennepin Co. Coordinates:       N         MATERIAL DESCRIPTION       GEOLOGY         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       Image: Continued (Continued)         GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)       Image: Continue (Continued)         GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue (Continue (Contin	Southwest Light Rail Transit Project, PEC East; HopHennepin Co. Coordinates:NMATERIAL DESCRIPTIONGEOLOGYNGRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)28GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)22GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)18	Southwest Light Rail Transit Project, PEC East; HopkinsHennepin Co. Coordinates:N15982.MATERIAL DESCRIPTIONGEOLOGYNMCGRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)28WGAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)22WGRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)18W	Southwest Light Rail Transit Project, PEC East; Hopkins to         Hennepin Co. Coordinates:       N       159822         MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAT         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       28       W       X         GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)       22       W       X         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)       18       W       X	Southwest Light Rail Transit Project, PEC East; Hopkins to Minn         Hennepin Co. Coordinates:       N       159822         MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE TYPE         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       28       W       SS         GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)       22       W       SS         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)       18       W       SS	Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapor         Hennepin Co. Coordinates:       N       159822       E       E         MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE TYPE       REC IN.         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       28       W       SS       16         GAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)       22       W       SS       16         GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a)       18       W       SS       2	Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MHennepin Co. Coordinates:N159822E51717MATERIAL DESCRIPTIONGEOLOGYNMCSAMPLE TYPEREC IN.FIELD WCGRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)28WSS16GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a)22WSS16GRAVEL WITH SAND, gray, waterbearing, medium dense (GP) (A-1-a)18WSS2	Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN         Hennepin Co. Coordinates:       N       159822       E       517172         MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE TYPE       REC IN.       FIELD & LAX         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       28       W       SS       16       WC       DEN         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)       22       W       SS       16       In       In         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)       In       In       SS       16       In         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)       In       In       SS       16       In	Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN         Hennepin Co. Coordinates:       N       159822       E       517172         MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE TYPE       REC TYPE       FIELD & LABORATION         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       28       W       SS       16       In       In         GRAVEL WITH SAND, gray, waterbearing, nedium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)       22       W       SS       16       In       In         GRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a)       In       In <td>Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN         Hennepin Co. Coordinates:       N       159822       E       517172         MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE TYPE       REC       FIELD &amp; LABORATORY         JRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       Image: Continue of the grained, gray, waterbearing, medium dense (SP) (A-1-b)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the gray of the gra</td>	Southwest Light Rail Transit Project, PEC East; Hopkins to Minneapolis, MN         Hennepin Co. Coordinates:       N       159822       E       517172         MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE TYPE       REC       FIELD & LABORATORY         JRAVEL WITH SAND, gray, waterbearing, nedium dense (GP) (A-1-a) (continued)       Image: Continue of the grained, gray, waterbearing, medium dense (SP) (A-1-b)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the grained, gray, waterbearing, medium dense (GP) (A-1-a)       Image: Continue of the gray of the gra



AET JO				•					RING N				<b>(p.</b> ]	L OI .	1)
PROJEC									Minn						
SURFAC	CE ELEVATION: 870.5	H	Iennepin Co	o. Coo	rdinates: <u>N</u>	1	<u>59562</u>	2		<u>E</u> :	51695				
DEPTH IN FEET	MATERIAL D	ESCRIPTIO	N		GEOLOGY	N	MC	SA T	MPLE YPE	REC IN.	FIELI WC	D & LA	BORA	FORY PL	1
1 -	FILL, mostly silty sand, a roots, dark brown (A-2-4)	little grave	l, trace		FILL	11	M	M	SS	12					
2 -	FILL, mixture of silty sand	1 and clave	v sand. a					A		,					
3 - 4 -	little gravel, dark brown (A	A-2-4)				27	M	Å	SS	14	11				
4	SAND WITH GRAVEL, 1 grained, brown, moist, der (possible fill)	fine to med ise (SP) (A	ium -1-b)		COARSE ALLUVIUM OR FILL	37	М		SS	12					
7 — 8 —	SAND WITH SILT, fine g moist, medium dense (SP-	grained, lig SM) (A-3)	ht brown,		COARSE	29	M	ł	SS	12			1		
9 — 10 — 11 —	SAND WITH SILT AND medium grained, light bro dense to dense (SP) (A-1-1	wn, moist,				24	M		SS	8					
12 – 13 –					· • •	34	М	ł	SS	12					
14 — 15 — 16 —	SAND, a little gravel, fine light brown, moist, mediu				- - - - - - -	22	М		SS	12					
17 — 18 —	SAND, fine grained, light 19' then waterbearing, me (A-3)	brown, mo dium dense	ist to abou (SP)	t		15	M		SS	12					
19 - 20 -					•	14	_⊻_  w	1] \	SS	12					
21 -	END OF BORING												-		
									· .						
DEP	TH: DRILLING METHOD			WAT	ER LEVEL ME.	ASURI	EMEN	TS					NOTE:	REFE	ER 7
0-1	9½' 3.25" HSA	DATE	TIME	SAMP DEP	LED CASING TH DEPTH	CAV DE	VE-IN PTH	FL	ORILLI UID LE	NG EVEL	WAT LEV	ER	THE A		
		5/16/13	1:40	21.	0 19.5	1	9.5				Nor	ie	SHEE	TS FO	RĂ
		5/16/13	1:50	21.	0 19.5	1	9.5				Nor	le 1	EXPLA	NATI	ON
BORIN	IG LETED: <b>5/16/13</b>											l l	FERMI	NOLO	GΥ
(TAND	NAMES AND A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTION														



AET JO	B NO: <b>01-05697</b>				· · · · · · · · · · · · · · · · · · ·	LC	G OF	BORI	NG N	0	1047	ST	<b>(p.</b> 1	lof	1)
PROJEC	CT: Southwest Ligh	t Rail Tr	ansit Pro	ject,	PEC East;	Нор	kins	to N	<u> Ainn</u>	eapo	olis, N	/IN			
SURFA	CE ELEVATION: 873.6	H	Iennepin Co	, Cooi	rdinates: <u>1</u>	v 1	5885(	)	I	<u>-</u> :	51639	6			
DEPTH	MATERIAL D	FSCRIPTIO	N		GEOLOGY	N	MC	SAM	IPLE	REC	FIELD	) & LA	BORAT	ORY	TEST
ÎN FEET									PE	IN.	WC	DEN	LL	PL	<b>%-</b> #2
1 —	FILL, mostly silty sand wit ashes/cinders, black (A-1-b		ı little		FILL	10	М	M	SS	18					
2 — 3 — 4 —	SAND WITH SILT AND medium grained, light brow dense (SP-SM) (A-1-b)				COARSE ALLUVIUM	17	М	R	SS	18					-
5	SAND WITH GRAVEL, r grained, light brown, moist (A-1-b)	nedium to t, medium o	fine dense (SP)			13	М		SS	18		-			
7 — 8 — 9 —	SAND WITH GRAVEL, r grained, light brown, moist (A-1-b)	nedium to t, medium	coarse dense (SP)			12	М	R R	SS	12		- -			
10 — 11 — 12 —	SAND WITH GRAVEL, f grained, light brown, moist loose, a lens of medium gra (A-3)	t, medium	dense to			16	М	N F	SS	18		-			
12 — 13 — 14 —					- - - - - -	14	M	R	SS	18					
15 16					• • •	10	M	X H	SS	18					
17 18 19	SAND, fine grained, light medium dense, a lens of fin sand at 18' (SP) (A-3)	brown, mo ne to medi	ist, um grained		-	14	M		SS	18					
20 – 21 –	SILTY SAND, fine graine medium dense, a lens of si				- - - - -	17	М	X	SS	18					
	END OF BORING														
DEI															
	PTH: DRILLING METHOD			WAT	ER LEVEL MI	EASUR	L EMEN	TS			<u> </u>	T			 ср. ту
	9½' 3.25" HSA	DATE	TIME	SAMP DEP			VE-IN EPTH		RILLI ID LE	NG VEL	WAT LEVI	ER	NOTÉ: THE A	TTA	CHEE
		5/7/13	12:47	21.			1.0				Non		SHEE		
	10	5/7/13	12:57	21.	5 19.5	2	1.0	<u> </u>			Nor	IC	EXPLA		
BORIN COMP	NG PLETED: 5/7/13												TERMIN TL		
	GH LG: JMM Rig: 1C												1F	IIS LC	

03/2011



	AET JO		01-05697						10	GOF	BOI	RING N	0.	1048	ST	(p. 1	lof	1)
			Southwest Ligh	nt Rail Tr	ansit Pro	iect.	PEC	East: 1										<u> </u>
	PROJEC	CT: CE ELEV	072.0		ennepin Co					5853(				51624		-		
	DEPTH		Anon								SA	MPLE	REC	FIELD	) & LA	BORAT	FORY	TESTS
	IN FEET		MATERIAL I	DESCRIPTIO	N		GEO.	LOGY	N	MC	Γ	MPLE YPE	IN.	WC	DEN	LL	PL	<b>%-</b> #200
F		<u>\</u> 2.5" B	ituminous pavement	t		/	FILL		20	М	M	SS	16					
	1 — 2 —	]   7.5" F	ILL, mostly sand wi ean clay, pieces of c	th silt and g	gravel, a		COAR ALLU	IVIUM	20	IVI	Д	00	10					
	2	bitum	inous, brown, a little	gray (A-1-	b)				21	М	М	SS	16					
	- - -	brown	), a little gravel, fine to light brown, a lit	tle black, m	oist,						Д							
	5		m dense, a laminatio ) (A-3)	ons of sand	with silt at				~ (		M	0.0	10					
	6 -	- 0 (51	)(A-5)						24	M	Ŵ	SS	16					
	7	_					•				R			а. 1. т.				
	8 -	-	·•						18	М	X	SS	18					
	9 -	4					•				R							
	10 -	SANI	), a little gravel, med 1, moist, medium der	lium graine	d, light		•		16	М	М	SS	18					
	11 -		i, moist, meatum dei	130 (DI ) (A	-1-0)				10		Д	00						
	12 -		Y SAND, fine graine		noist,	-					M							
	13 -	- mediu	um dense (SM) (A-2	-4)			•		18.	M	Ŵ	SS	16					
	14		, brown, wet, mediur	n danca a l	one of cilty		FINE				E		· .					
	15 -	clay (	ML) (A-4)	n dense, a r	ens of sinty			JVIUM	12	W	X	SS	20	24				
	16 -							•			R							
	17 -	SANI	$\overline{O}$ , fine grained, brow	/n, moist, m	edium			RSE JVIUM	25	M	M	SS	18					
	18 - 19 -		(SP) (Å-3)								Д	55						
	- 20	SANI	D, a little gravel, fine	e to medium	grained,						K							
	20	light l	brown, moist, mediu	m dense (S	P) (A-3)				21	M	X	SS	20					
	21	END	OF BORING		<u> </u>	_	•				1			-		_		
0/13																		
T 5/10																		
G L													1					
T+WE				•														
1+CP			- -	·														
PJ AE										-								
697.G																		
01-05	DE	PTH:	DRILLING METHOD			WAT	ER LE	VEL MEA	SUR	EMEN	ITS					NOTE:	REF	ER TO.
ATES		101/1	2 2511 116 4	DATE	TIME	SAMP DEP	LED ( TH	CASING DEPTH	CA	VE-IN EPTH	FI	DRILLI LUID LI	NG EVEL	WAT LEV		THE A	ATTA	CHED
RDIN	0	191/2'	3.25" HSA	5/7/13	10:47	21		19.5		0.3				Nor		SHEE	TS FC	R AN
CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 5/10/13				5/7/13	10:57	21		19.5		0.3				Noi	ne	EXPLA	NATI	ON OF
V ARC	BORI	NG PLETED:	5/7/13	5/7/13	11:10	21		19.5		0.3				Noi	ne	FERMI	NOLC	GY ON
AET_CO			: JMMRig: 1C													Tŀ	HIS LO	)G
	03/2011				L												01-I	OHR-0



1       2" Bituminous pavement       FILL       24       M       SS       12         2	1)	of	(p. 1	ST	1049	iO	RING N	BOI	G OF I	LC				*****	01-05697	AET JOB NO:
SINTALE ELEVATION.       MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE TYPE       REC IN       FIELD & LABORATOR         1       2" Bituminous pavement       FIELD & TABORATOR       FIELD & LABORATOR       WC       DEN       LL       PI         2       Bituminous pavement       FIELD & CABORATOR       FIELD & CABORATOR       WC       DEN       LL       PI         3       4       4       ATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE       FIELD & CABORATOR         3       4       4       ATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMDATOR       WC       DEN       LL       PI         4       4       4       ATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMD       SS       18       ILL       PI         4       4       ATERIAL DESCRIPTION       FILL       COARSE       ALLUVIUM       36       M       SS       18       ILL       PI       ILL       <							Minn	to	kins	Нор	EC East;	oject, F	ansit Pr	t Rail Ti	Southwest Ligh	PROJECT:
DET T       MATERIAL DESCRIPTION       GEOLOGY       N       MC       SAMPLE       Rec WC       DEN       LL       PI         1       2" Bituminous pavement       FILL, mostly sand with silt and gravel, pieces of concrete and bituminous, brown (A-1-b)       FILL       24       M       SS       12       Image: Concrete and bituminous, brown (A-1-b)       FILL, mostly silty sand, a little gravel, black       FILL       26       M       SS       18       Image: Concrete and bituminous, brown (A-1-b)       26       M       SS       18       Image: Concrete and bituminous, brown (A-1-b)       26       M       SS       18       Image: Concrete and bituminous, brown (A-1-b)       26       M       SS       18       Image: Concrete and bituminous, brown, moist, medium dense, a       26       M       SS       18       Image: Concrete and						E :		2	58262	1	nates: <u>N</u>	o. Coord	lennepin C	I	LEVATION: 874.0	SURFACE EL
1       -4" FILL, mostly sand with silt and gravel, pieces of concrete and bituminous, brown       COARSE         2       -4" FILL, mostly silty sand, a little gravel, black       COARSE         4       -4.2-4)       SS 12         5       -1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	7 TESTS %-#20					REC IN.	MPLE YPE	SA T	MC	N	GEOLOGY		Ň	ESCRIPTIC	MATERIAL D	DEPTH IN FEET
4       (A-2-4)         SAND, a little gravel, fine to medium grained, light brown, moist, dense (SP) (A-3)       26       M       SS       18         6       SAND, fine grained, light brown, moist, medium dense (SP) (A-3)       26       M       SS       18         7       medium dense (SP) (A-3)       20       M       SS       18         9       lens of fine grained, light brown, moist, medium dense to dense (SP) (A-3)       20       M       SS       20         10       SAND, fine grained, light brown, moist, medium dense to dense (SP) (A-3)       20       M       SS       20         11       I       I       I       II       II       II       III       IIII       IIII       IIII       IIII       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	· · · · · · · · · · · · · · · · · · ·										OARSE		rown	minous, b	FILL, mostly sand with ces of concrete and bitu -1-b)	1 - 4"F $2 - piec$ $(A - 4)$
SAND WITH GRAVEL, fine to medium         grained, light brown, moist, medium dense, a         lens of fine grained sand (SP) (A-3)         10         SAND, fine grained, light brown, moist, medium dense to dense (SP) (A-3)         11         12         13         14         15         SILTY SAND, fine grained, light brown, moist, medium dense (SM) (A-4)         16         17         SILTY CLAY, brown, stiff (CL-ML) (A-4)         18         19         20         LEAN CLAY, brown, very stiff, a lamination of waterbearing sand with silt (CL)         11         12         13         14         15         SILTY CLAY, brown, stiff (CL-ML) (A-4)         18         19         20         10         11         12         13         14         15         SILTY CLAY, brown, very stiff, a lamination of waterbearing sand with silt (CL)         17         10         11         12         13         14         15         16						-	·						n grained,	to mediun (SP) (A-3)	-2-4) ND, a little gravel, fine ht brown, moist, dense ( ND, fine grained, light	$4 - \sqrt{\frac{A-2}{SA}}$ $5 - \sqrt{\frac{SA}{ligh}}$ 6 - SA
11 -       medium dense to dense (SP) (A-3)       20       M       SS       20         11 -       12 -       13 -       31       M       SS       20         13 -       31       M       SS       20       10         14 -       15       SILTY SAND, fine grained, light brown, moist, medium dense (SM) (A-4)       26       M       SS       20         16 -       17       SILTY CLAY, brown, stiff (CL-ML) (A-4)       FINE ALLUVIUM       10       M/W       SS       24       27         19 -       10       M/W       SS       24       27       11         20 -       LEAN CLAY, brown, very stiff, a lamination of waterbearing sand with silt (CL)       17       M/W       SS       24       28         21 -       END OF BORING       10       M/W       SS       24       28		*				18	SS	R A A A A	M	14			dense, a	t, medium SP) (A-3)	ND WITH GRAVEL, 1 ined, light brown, mois s of fine grained sand (	8 -  grai 9 -  lens
14								X R V					oist,	brown, mc P) (A-3)	ND, fine grained, light dium dense to dense (S	11 – 12 –
17       SILTY CLAY, brown, stiff (CL-ML) (A-4)       FINE       10       M/W       SS       24       27         18       -       -       -       10       M/W       SS       24       27         19       -								A R X					own, moist	d, light bro	TY SAND, fine graine dium dense (SM) (A-4)	14 – 15 – SIL mec
21     waterbearing sand with silt (CL)     17     M/W     SS     24     28       END OF BORING     10     10     10     10     10     10					27	24	SS	R X R	M/W	10					• •	17 - SIL 18 - 19 -
					28	24	SS	γM	M/W	17		f	mination c	y stiff, a la t (CL)	EAN CLAY, brown, ver terbearing sand with sil	wat
														-	ND OF BORING	
2001.GPU AET+					- -											
	FER TO	REF	NOTE:					ITS	EMEN	ASUR	LEVEL MEA	WATE			DRILLING METHOD	DEPTH:
0-19½'3.25" HSADATETIMESAMPLED DEPTHCASING DEPTHCAVE-IN DEPTHDRILLING FLUID LEVELWATER LEVELTHE ATTA SHEETS F0-19½'3.25" HSA5/7/139:3621.519.521.5NoneSHEETS F5/7/139:4621.519.521.5NoneEXPLANATBORING COMPLETED:5/7/13				ER EL	WAT LEVI	NG EVEL	DRILLI LUID LH	FL	VE-IN PTH	CA DE	D CASING DEPTH	SAMPL DEPTI	TIME	DATE	al an	
5/7/13         9:36         21.5         19.5         21.5         None         SHEETS F					Nor				1.5	2	19.5	21.5	9:36	5/7/13	0-19 <sup>1</sup> / <sub>2</sub> ' 3.25" HSA	
5/7/13 9:46 21.5 19.5 21.5 None EXPLANA				le	Nor				1.5	2	19.5	21.5	9:46	5/7/13		•
BORING COMPLETED: 5/7/13				T											ED: 5/7/13	BORING COMPLETE
DR: GH LG: JMMRig: 1C	OG DHR-(		TE												LG: JMM Rig: 1C	DR: GH



	<b>01-05697</b>						IO	GOEI	BOI	RING NO	<u>)</u>	1050	ST	(p. 1	of	1)
AET JO		<b>Dail Tr</b> e	ansit Proi	ect.]	PEC Ea	st: H								Gr.		
PROJEC			ennepin Co. C			N		57958				51600				
DEPTH	CE ELEVATION: 8/3.0									MPLE	REC	FIELD	) & LA	BORAT	ORY '	TESTS
IN FEET	MATERIAL DI				GEOLOC	θY	N	MC		YPE	IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly sand with silt brown (A-1-b)	and gravel,	grayish		FILL		15	Μ	X	SS	18	-				
2 - 3 - 3 - 1	FILL, mostly sand with silt, silty sand with organic fines black (A-2-4)						11	М	M	SS	12		-			
4 5 6				-			11	М	X	SS	10				-	
7 — 8 — 9 —	SAND WITH SILT AND C medium grained, brown, mo (SP-SM) (A-1-b)	oist, mediu	n dense		COARSE ALLUVII	ЛМ	22	м	M	SS	5					
10 11	SAND WITH SILT, a little fine grained, brown, moist,	gravel, me loose (SP-	dium to SM) (A-3)				7	М	A A A A	SS	12					
12 13 14	GRAVELLY SAND WITH fine grained, light grayish b (SP-SM) (A-1-b)	I SILT, me rown, mois	dium to st, dense				34	М	XXX	SS	12					
15 - 16 -	SAND WITH GRAVEL, m grained, light grayish brown dense (SP-SM) (A-1-b)	ı, moist, m	edium		• • • •		22	M	X A	SS	16					
17 18 19	GRAVELLY SAND, medi brown, moist to wet, dense	um grained (SP) (A-1-	l, light b)				31			SS	18					
20 - 21 -	LEAN CLAY, brownish gr and light gray, stiff, lamina (CL/CH) (A-7-6)	ay, a little tions of fat	dark gray clay		FINE ALLUVI	UM	11	М	X	SS	18	41				
L.GDT 5/10/13	END OF BORING															
CORP W-COORDINATES 01-05697.GPJ AET+CPT+WELL.GDT 5/10/13 -0 BDD BDD BDD BDD BDD BDD BDD BD																
5 DE	EPTH: DRILLING METHOD			WAT	TER LEVEI									NOTE	: REF	ER TO
-0 NATES	19½' 3.25" HSA	DATE	TIME	SAMP DEP	LED CAS TH DE	SING PTH	CA DI	VE-IN EPTH	F	DRILLI LUID LI	NG EVEL	WA1 LEV	ER EL			CHED
ORDI		5/6/13	1:25	21.	.5 19	9.5	1	9.0				18				DR AN
M-CO		5/6/13	1:35	21	.5 19	9.5	1	9.0				18	.0			ION OF )GY ON
BORI COM	NG PLETED: <b>5/6/13</b>						ļ								HIS L	
DR:	GH LG: JMM Rig: 69C			<u>.</u>												DHR-0



AET JO	B NO:	01-05697						LO	G OF H	BOR	ING NO	D	1051	ST	(p. 1	of 1	.)
PROJEC	CT:	Southwest Light	Rail Tra	ansit Proj	ect, ]	PEC	East; F	Iopk	ins t	o N	linne	eapol	is, M	[ <b>N</b>		-	
SURFA	CE ELEV	ATION: 871.1	He	ennepin Co. C	Coordir	nates:	<u>N</u>	15	57725		]	Е :	51583				
DEPTH IN FEET		MATERIAL DE	SCRIPTION	1		GEO	OLOGY	N	мс	SAN T	MPLE YPE	REC IN.	FIELI WC	D & LA	BORAT	ORY 1 PL	ESTS qu
1	silty s	mostly sand with silt a and and sand, trace roo and light brown (A-1-	ots, brown,	a little a little		FILL	,	12	М	X	SS	8					
3 - 4 -								3	М	R	SS	12					
5 6	<b>F</b>							8	М		SS	16					
7 8 9		YEY SAND, with orga l, black, stiff (SC) (A-		a little		MIX ALL	ED UVIUM	9	М		SS	16	13				
10 -	CLAY (SC)	YEY SAND WITH GI (A-6)	RAVEL, bi	rown, firm				8	М	R	SS	16	9				
12 - 13 - 14 -	LEAN lamin	N CLAY, gray and bro ations of silt (CL) (A-	wn mottleo 6)	1, firm,		FINI	e JUVIUM	6	M		SS	18	35		39	28	
15 - 16 -	dark	N CLAY, brown and g brownish gray, laminat	ray mottled tions of fat	d, a little clay (CL)					<b>M</b>		TW	18	35	84			1090
17 - 18 - 19 -	- medi	DY SILT, brown and g um dense (ML) (A-4)						16	w	M R	SS	18	28			-	
20 - 21 -	- SILT (A-4)	, gray to brownish gra )	y, wet, loos	se (ML)				8	w	M	SS	24	37				
22 - 23 - 24 -	-						·	7	w	X	SS	24	27				
25 - 26 -	A-4	Y CLAY, brownish g )	ray, firm (C	CL-ML)				8	M/W		SS	18	30				
27 - 27 - 28 - 28 - 29 - 29 - 29 - 29 - 29 - 29		', brownish gray, medi	um dense (	(ML) (A-4)				12	w	A	SS	24	32				
26 - 27 - 27 - 27 - 28 - 27 - 28 - 29 - 28 - 29 - 29 - 29 - 29 - 29	– SILT medi	Y SAND, fine grained um dense (SM) (A-4)	l, brownisl	n gray, wet,	, , , , , , , , , , , , , , , , , , ,		ARSE LUVIUM	17	w		SS	24	28				
397.GP	ENI	OF BORING															
5 DE	EPTH:	DRILLING METHOD			WA	TER L	EVEL ME.	ASUR	EMEN						NOTE	: REF	ER TO
ATES			DATE	TIME	SAMI DEF	PLED	CASING DEPTH	CA DI	VE-IN EPTH	[] FI	DRILL JUID L	ING EVEL	WAT LEV	TER TEL	THE	ATTA	CHED
	291/2'	3.25" HSA	5/6/13	10:49	19		17.0		7.5				16		SHEE	ETS FC	R AN
			5/6/13	10:59	19		17.0		7.5	+			15	.1	EXPL	ANATI	ON OF
0- NACOORDINATES	ING	: 5/6/13	5/6/13	10:35	31		29.5		51.0	+			28	.5	TERM	NOLC	GY ON
			5/6/13	11:32	31		29.5		.9.5				21	.3	Т	HIS LO	)G
DR:	GH L	G: <b>JMM</b> Rig: <b>1C</b>	0.0.10										<u> </u>			01-1	OHR-0

03/2011



AET JO	DB NO: 01-05697						LO	GOF	BO	RING N	Ю.	1052	2 ST	' <b>(p.</b> ]	l of 2	2)
PROJEC	CT: Southwest Ligh	nt Rail Tr	ansit Pr	oject,	PEC	East; ]	Нор	kins	to	Minn	eapo	olis, N	MN			
SURFA	CE ELEVATION: 873.0	I	Hennepin C	Co. Coo	rdinates	: <u>N</u>	1	57494	1	]	E :	51564	8			
DEPTH IN FEET	MATERIAL D	ESCRIPTIO	N		GEOI	.OGY	N	мс	SA T	MPLE TYPE	REC IN.	FIELI WC	D&L/	ABORAT	l	TESTS
	FILL, mostly clayey sand, brown (A-6)	a little gra	vel, dark		FILL		6	M	M	SS	16	12	DEI			10-1120
2 — 3 — 4 —	FILL, mostly sand, a little trace roots, light grayish b						4	М	$\left  \right $	SS	3					
5 6	FILL, mostly sand, a little clay, brown, a little grayis			n			3	М	A	SS	12					
7 — 8 — 9 —	FILL, mostly sand with sil (A-3)	t and grave	el, black				6	М	X X X	SS	8	10				10
10 11	FILL, mostly clayey sand, roots, dark brown (A-2-4)		-				8	М	X	SS	2	10			-	
12 — 13 — 14 —	FILL, mostly sapric peat, a wood, black (A-8)		l, pieces o	f	GHLLS	0	8	M	X	SS	2	62				
15 — 16 —	SAPRIC PEAT, black (PT	) (A-8)			SWAN DEPO		4	М		SS	18	215				
17 — 18 — 19 —	SANDY LEAN CLAY, sl roots, black, soft (CL) (A-		nic, trace		MIXE	D VIUM	4	М		SS	18	20				
20 21	SILTY SAND WITH GRA gray, wet, very loose, lens (SM) (A-2-4)				•	·	4	w		SS	6	13				
22 23 24	SILTY SAND, fine graine wet, medium dense (SM)		h gray,		COAR ALLU		15	w		SS	12					
25 – 26 –	SILTY CLAY, brownish g (A-4)	gray, firm (	(CL-ML)		FINE ALLU	VIUM	8	M	X X	SS	12	37				
27 – 28 – 28 – 29 –	SILT WITH SAND, brow silty clay (ML) (A-4)	nish gray,	lenses of					Μ		TW	18	24 32	100 90			
25         26           26         26           27         27           28         28           29         30           31         31           DEF         0	LEAN CLAY, brownish g of fat clay (CL) (A-4)	gray, firm, I	lamination	IS			8	M/W		SS	24	28				
हें DEF	PTH: DRILLING METHOD			WAT	ER LEV	EL MEA	SURI	EMEN	TS					NOTE:	REFE	ER TO
0-4 0-4 BORIN COMP	4½' 3.25" HSA	DATE	TIME	SAMP	LED C TH I	ASING DEPTH	CAV DE	/E-IN PTH	] FL	DRILLI JUID LE	NG EVEL	WAT LEVI	ER	THE A	TTAC	HED
JORDI		5/3/13	12:50	16.	5 -	14.5	1	4.5				14.	1	SHEE	IS FOI	R AN
00-M		5/3/13	1:14	24.	0	22.0	2	2.0		~		18.	6	EXPLA	NATIO	IO NC
BORIN COMP	NG PLETED: 5/3/13	5/3/13	1:24	24.	0	22.0	2	2.0				17.	8	TERMI		
VII		1		1			1		1			20.			IS LO	



PROJEC	T: Southwest Light Rail Transit Proj Hennepin Co.	 		57494	-		51564				
FDTH		 						) & LAI	BORAT	ORY T	EST
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	ĹL	PL •	<b>%-</b> #2
	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·									
33 -	SILTY SAND, fine grained, brownish gray,	COARSE ALLUVIUM			TW	0					
34 -	wet, medium dense (SM) (A-4)	ALLOVIUM			Ŕ						
35 - 36 -			15	M/W	X ss	24	25				
37 -					R						
38 -			16	M/W	$\bigvee ss$	24					ŕ
39 —					/\ R						i
40 —			17	MAN		24					
41 -			1/	M/W	X ss	24					
42 -	LEAN CLAY, brownish gray, a little dark	FINE			H M						
43 –	brown, gray, stiff, laminations of fat clay (CL/CH) (A-7-6)	ALLUVIUM	14	M	X ss	24	36				
44 -					E						ļ
45 —	LEAN CLAY, brownish gray, a little light brownish gray, stiff, laminations of silt		15	M/W	ss	24	35				-
46 —	_(CL/CH) (A-7-6)	· · · · · · · · · · · · · · · · · · ·			/\						
	END OF BORING									1	
		-									
					-						
		1				1			1	1	



AET JOB N PROJECT:		ght Rail Transit Pr	oject, PEC East; ]	Hopkins to	Minneapolis		ING NO. 7 <b>T (p. 1 of 1)</b>
Location		<u></u>		CPT Machin CPT Operato		Surface E	levation
Hennepin (	Co. Coordinates: X	=516186 Y=158396	(feet)	Cone #	4583.119xx	Date Con	npleted: 8/6/13
Depth Elevation	Interpreted Soil Behavior Type UBC 1990 FR 0 2 4 6 8 10	Sleeve Friction (psi) 100 75 50 25 0	<i>Tip Resist</i> (psi) 2000 4000 6	tance	<i>Friction R</i> (%) 10000 0 2 4 6		Pore Pressure (psi) 0 20 40 60 80
0 874.0 5 869.0 10 864.0 × 15 859.0 20 854.0 20 854.0 × 20 854.0 × 20 854.0 × 30 844.0 × 40 834.0 × 55 839.0 × 50 824.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 814.0 × 55 819.0 814.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 819.0 × 55 80 80 80 80 80 80 80 80 80 80			Bottom of Hole 66.9980	38			
					X:\01-G	EO\GINTW\1 GII	Edit: Date: 8/16/13 NT PROJECTS\01-05697.GPJ



	<u>l-05697</u> west Light Rail Transit Pr	oject, PEC East; Hopki	ns to Minneapolis	SOUNDING NO. 1138 CT (p. 1 of 1)
Location			Aachine 20 Operator Adams	Surface Elevation 873.6
Hennepin Co. Coord	nates: X=516076 Y=158110	(feet) Cone #	4583.119xx	Date Completed: 8/6/13
Depth Behav Elevation UBC 19		<i>Tip Resistance</i> (psi) 2000 4000 6000	<i>Friction F</i> (%) 8000 10000 0 2 4	Ratio Pore Pressure (psi) 6 8 10 0 20 40 60 80
$ \begin{array}{c} 0 \\ 873.6 \\ \hline 5 \\ 868.6 \\ \hline \times \\ \times \\ \hline \\ 863.6 \\ \hline \\ \times \\ \hline \\ \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$		Bottom of Hole 26.35234		Edit: Date: 8/16/13 ECOGINTWAY GINT PROJECTSION-06697.CPU



AET JOB NO	D: 01-05697	· · ·		<u></u>		SOUNDING NO.	
PROJECT:	Southwest Lig	ht Rail Transit	Project, PEC Eas	t; Hopkins to	Minneapolis	1139 CT (p. 1 of	1)
Location				CPT Machin CPT Operate		Surface Elevation <b>872.4</b>	
Hennepin C	o. Coordinates: X=	=515922 Y=157	336 (feet)	Cone #	4583.119xx	Date Completed: 8/6	/13
Depth Elevation	Interpreted Soil Behavior Type UBC 1990 FR	Sleeve Friction (psi)	n Tip Res (p	sistance si)	Friction F (%)	(psi)	)
0 - 872.4	0 2 4 6 8 10	100 75 50 25	0 2000 4000	6000 8000		6 8 10 0 20 40 6	080
872.4         5         867.4         10         867.4         15         857.4         20         857.4         20         857.4         20         857.4         20         857.4         20         857.4         20         857.4         857.4         857.4         857.4         837.4         837.4         40         832.4         55         837.4         40         832.4         50         827.4         60         822.4         55         817.4         50         802.4         70         70         70         70         70         70         70         80         770         770         770         770         770         770         770			Bottom of Hole 91.9	4178	W we we we we we we we we we will be a star with the second of the second with the second of the sec	iters water water	₩ 
			AET CPT GF	RAPH	X:\01-G	Edit: Date: EO\GINTW1 GINT PROJECTS\01	8/16/13 -05697.GPJ



AET JOB NO							~ ~			NDING 1	NO.
PROJECT:	Southwest Li	ght Rail T	ransit Proje	ect, PEC E	East; H	opkins to	Minn	eapolis	_ 114	0 CT (p.	1 of 1)
Location						CPT Machir			Surfac	e Elevati	on
	Coordinators V		V-157604	(feat)		CPT Operate				872.6	
Hennepin Co	o. Coordinates: X	=515/56	Y=15/604	(feet)		Cone #	4583	.119xx	Date C	Completed	1: 8/6/13
Depth	Interpreted Soil Behavior Type UBC 1990 FR		Friction si)	Tip.I	Resistaı (psi)	nce		Friction (%		Por	e Pressure (psi)
Elevation 0	0 2 4 6 8 10	100 75	50 25 0	2000 400	00 600	0008 00	10000	0 2 4	681	0 0 20	40 60 80
872.6         5         867.6         10         862.6         10         857.6         10         852.6         10         852.6         10         852.6         10         852.6         10         857.6         10         852.6         10         115         115         115         115         115         115         115         115         115 <td></td> <td></td> <td>When he was we want when he was a series of the series of</td> <td></td> <td></td> <td></td> <td></td> <td>And the second of the second o</td> <td></td> <td>month have have have have have have have hav</td> <td></td>			When he was we want when he was a series of the series of					And the second of the second o		month have have have have have have have hav	
3 5 -			В	ottom of Hole 6	62.07336						
				AET CPT	GRAPH			 X:10	1-geo\gintw	Edit: 1 GINT PROJ	Date: 8/16/13 ECTS\01-05697.GPJ



AET JO	DB NO: 01-05697	· · · ·					LO	GOF	BOF	RINGN	0	1143	S ST	<b>(p.</b> 1	l of	2)
PROJEC	CT: Southwest Ligh	t Rail Tra	ansit Pro	ject, ]	PEC Ea	st; H				Minno						
SURFAC	CE ELEVATION:866.2	Н	ennepin Co.	Coordin	ates:	<u>N</u>	16	50773	}	]	E :	51772				
DEPTH IN FEET	MATERIAL D	ESCRIPTION	Ń		GEOLO	GY	N	MC	SA T	MPLE YPE	REC IN.	FIELI WC	D & LA	BORAT	l	TESTS %-#20
1	FILL, mostly silty sand, tra \to black (A-2-4)	ce roots, da	rk brown		FILL		22	М	M	SS	16					
2 -	FILL, mostly sand with silt roots, dark brown (A-1-b)	-		/			23	M	$\bigwedge$	SS	14	11				
3	FILL, mixture of clayey san a little gravel, dark brown a (A-2-4)	nd and sand and light bro	l with silt, own		FINE				E							
5 — 6 —	SANDY ORGANIC CLA roots, black, stiff (OH) (A-				ALLUVI OR FILL		9	М	X	SS	10	39				
7 — 8 —	SILTY SAND, a little grav grained, dark brown, moist (A-2-4) (possible fill)	el, medium , loose (SM	to fine /SC)		COARSE ALLUVI OR FILL	UM	7	М		SS	16					
9 10 11	GRAVELLY SAND WITT cobbles, trace roots, mediu light brownish gray, a little laminations of clayey sand	m to fine gr brown, mo	ained, ist, dense,				33	М		SS	6					1
12	(possible fill) GRAVELLY SAND, med grayish brown and brown,	um grained moist to 14	, light ½' then		COARSE ALLUVI		20	M	Ц К И	SS	16					
14	waterbearing, medium den medium grained sand with	silt (SP) (A	1 Inne to 1-1-b)				25	W		SS	6					
16 - 17 - 18 -							14	w	¥ V	SS	10					
19 -	SAND WITH GRAVEL, 1 brown, waterbearing, medi	nedium gra	ined,		· · ·		. 10				10		-			
20	(A-1-b)	uni dense (	51)		•		18	W	Å	SS	12					
22 - 23 -	- - -				•		21	w	Ķ	SS	10					
24 - 25 - 26 -	-				•		22	W	Ķ	SS	12	L.		-		
27 - 28 -	SAND, a little gravel, med waterbearing, medium den	lium grained se (SP) (A-	d, gray, ·1-b)				19	w	K	SS	14					
$ \begin{array}{c} 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ 31 \\ \hline 0 \\ \hline \hline \hline \hline 0 \\ \hline \hline \hline \hline \hline 0 \\ \hline \hline$	GRAVELLY SAND, med waterbearing, medium den				4 • • • •		22	w		SS	10					
		1		11/ 4 7			CI IDI			1			<u> </u>			
; DE	PTH: DRILLING METHOD				ER LEVE				1		NG	WAT	ER	NOTE		
	)-17' 3.25" HSA	DATE	TIME	SAMP DEP	TH DE	SING PTH		VE-IN EPTH	FI	DRILLI JUID LI	ËVEL	WAT LEV				CHED
17-5	59½' RDF w/DM	8/28/13	3:00	16.	0 1	4.5		4.5				14.				DR AN
۲ ۸		8/29/13	8:15	16.	0 1	4.5	1	4.5				14.	.4	EXPLA		
BORI COMI	NG PLETED: <b>8/29/13</b>	8/29/13	8:30	18.		7.0		7.0	_			15.		TERMI		
- 1	GH LG: TK Rig: 1C	8/29/13	8:40	18.	5 1	7.0	1	7.0				15	.0	1	HIS LO	DG DHR-



$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Y TES' L Vo-#
33       SAND, a little gravel, medium to fine grained, gray, waterbearing, medium dense (SP) (A-1-b)       22       W       SS       14         34       (continued)       18       W       SS       14         35       -       -       18       W       SS       14         36       -       -       18       W       SS       14         36       -       -       -       -       -       -       -         37       - <td< th=""><th>L %-+</th></td<>	L %-+
33 - gray, waterbearing, medium dense (SP) (A-1-b)       22       W       33       14         44 - (A-4)       SANDY SILT, gray, wet, medium dense (ML)       IPNE       22       W       SS       14       20         40 - (A-4)       (A-4)       (A-4)       COARSE       23       W       SS       12         41 - waterbearing, medium dense (SP-SM) (A-1-b)       (A-1-b)       (A-4)       COARSE       23       W       SS       12         42 - 43       (SP) (A-1-b)       (SP) (A-1-b)       (A-1-b) <t< th=""><th></th></t<>	
34       (continued)         35       18         36       18         37       22         38       SANDY SILT, gray, wet, medium dense (ML)         (A.4)       CA         40       GRAVELLY SAND WITH SILT, possible         cobbles, medium to fine grained, brownish gray,         41       Waterbearing, medium dense (SP-SM) (A-1-b)         42       23         43       44         44       5         44       5         50       (SP) (A-1-b)         44       (SP) (A-1-b)         45       SAND WITH GRAVEL, medium grained, grayish brown, a little brown, waterbearing, medium dense to very dense, a lens of silt at 55'         51       W         52       9         53       55         54       55         55       51         56       51         57       51         58       51         59       SAND WITH SILT, fine grained, brown, waterbearing, very dense, laminations of medium grained and (SP-SM) (A-3)         51       W       SS         51       W       SS         51       W       SS         51       W	
35       -       18       W       X       SS       14         36       -       -       22       W       X       SS       14       20         38       SANDY SILT, gray, wet, medium dense (ML)       III       FINE       22       W       SS       14       20         39       (A-4)       CRAVELLY SAND WITH SILT, possible cobles, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)       COARSE       23       W       SS       12         41       -	
36       -	
37       -       22       W       SS       14       20         38       SANDY SILT, gray, wet, medium dense (ML)       PINE       A.4.4       -	
38       SANDY SILT, gray, wet, medium dense (ML)       PINE       22       W       SS       14       20         39       (A.4)       GRAVELLY SAND WITH SILT, possible cobles, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)       23       W       SS       12         41       -       <	
SANDY SIL1, gray, wet, includin dense (WL)       ILLUVIUM         0       GRAVELLY SAND WITH SIL7, possible cobbles, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)       23       W       SS       12         42       -	
40 -       GRAVELLY SAND WITH SILT, possible cobbles, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)       23       W       SS       12         41 -       -	
41       -	
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         47       -	
44       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         47       (SP) (A-1-b)       29       W       SS       6         51       29       W       SS       6         51       51       SS       1       1         52       51       51       W       SS       6         53       54       51       51       W       SS       12         54       51       51       W       SS       12         56       51       51       W       SS       10         58       SAND WITH SILT, fine grained, brown, waterbearing, very dense, laminations of medium grained sand (SP-SM) (A-3)       61       W       SS       10	
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         48       - <td< td=""><td></td></td<>	
AAND WITH SILT, fine grained, brown, waterbearing, yery dense, laminations of medium grained sand (SP-SM) (A-3) AAND WITH SILT, fine grained, brown, baseline of the second s	
46 - grayish brown, a little brown, waterbearing, medium dense to very dense, a lens of silt at 55'       Image: Second sec	
47 - (SP) (A-1-b)       29       W       SS       6         48 -       - </td <td></td>	
49 -       29       W       SS       6         51 -       29       W       SS       6         52 -       53 -       51       W       SS       12         53 -       54 -       51       W       SS       12         56 -       57 -       51       W       SS       12         58       SAND WITH SILT, fine grained, brown,       61       W       SS       10	
50 -       29       W       SS       6         51 -       52 -       53       54       51       V       SS       1         53 -       54 -       55       51       W       SS       12       1         56 -       57 -       51       W       SS       12       1       1         58 -       SAND WITH SILT, fine grained, brown, waterbearing, very dense, laminations of medium grained sand (SP-SM) (A-3)       61       W       SS       10	
51 -         52 -         53 -         54 -         55 -         56 -         57 -         58         SAND WITH SILT, fine grained, brown,         59 -         waterbearing, very dense, laminations of medium         60 -         grained sand (SP-SM) (A-3)	
52 - 53 - 53 - 54 - 55 - 55 - 55 - 57 - 58 - 57 - 58 - 58	
53 - 54 - 55 - 55 - 56 - 57 - 58 - 57 - 58 - 58 - 58 - 58 - 59 - waterbearing, very dense, laminations of medium grained sand (SP-SM) (A-3) - 61 W SS 10 - 61 W	
54 - 55 - 55 - 55 - 56 - 57 - 58 - 57 - 58 - 58 - 58 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 58 - 59 - 59	
55 - 56 - 57 - 57 - 58 - 51 W SS 12 $51 W SS 12$ $51 - 58 - 57 - 58 - 57 - 58 - 57 - 58 - 57 - 58 - 51 - 58 - 58 - 58 - 58 - 58 - 58$	
56     -       57     -       58     SAND WITH SILT, fine grained, brown,       59     waterbearing, very dense, laminations of medium       60     -       61     W       SS     10	
58     SAND WITH SILT, fine grained, brown,       59     waterbearing, very dense, laminations of medium       60     grained sand (SP-SM) (A-3)       61     W	
SAND WITH SILT, the granted, brown, waterbearing, very dense, laminations of medium grained sand (SP-SM) (A-3) 61 W SS 10	
$\begin{array}{c c} 59 - \\ 60 - \\ grained \text{ sand (SP-SM) (A-3)} \end{array} \end{array} \begin{array}{c c} 61 & W & SS & 10 \end{array}$	
61 END OF BORING	
	-



AET JOB	NO: <b>01-05697</b>	21,21,11 - 11 - 11 - 11 - 11 - 11 - 11 -	·				LO	G OF :	BOF	RING NO	0. <sup>,</sup>	1144	ST	(p. 1	l of	2)
PROJECT		t Rail Tra	ansit Pro	ject, I	PEC	East; I	Topk	cins (	to I	Minne	eapol	lis				
SURFACI	E ELEVATION: <b>868.9</b>	He	ennepin Co.	Coordir	nates:	<u>N</u>	10	52372	2	]	E Ś	51782				
DEPTH IN FEET	MATERIAL D	ESCRIPTION	1		GEO	OLOGY	N	MC	SA T	MPLE YPE	REC IN.	FIELI WC	1	BORAT		TESTS %-#200
	FILL, mostly silty sand, a l concrete, glass, trace roots, 8" Crushed limestone base, FILL, mostly sand with silt	dark brown , light brown	n (A-2-4) n (A-1-b)		FILL	, ,	30	М	M	SS	16					
3	sand and clayey sand, brow grayish brown (A-3) \FILL, mostly sand, a little	vn, a little lig gravel, brow	ght vn (A-3)	]			7	M	Å FI	SS	14					
6 - 7 -	FILL, mostly sand with silt brown (A-3) SAND WITH SILT, mediu brown to dark brown, wate	im to fine gi	rained,			ARSE UVIUM	6	M		SS SS	12 10					
8 9 10	(SP-SM) (A-1-b)	ioouning, ve	xy 10050					W V W		SS	10					
	SANDY LEAN CLAY, a to very stiff (CL) (A-6)	little gravel,	gray, firm	1	TILL		2	M	$\left\{ \begin{array}{c} \\ \\ \\ \end{array} \right\}$	SS	10	19				
13 - 14 - 15 -							17	W		SS	10	13				
16 – 17 –	CLAYEY SAND, a little g (SC) (A-6)	gravel, brow	n, hard				37	M	FI V	SS	16	13				
18 — 19 — 20 —	SAND WITH SILT, a little medium grained, brown, w lens of silty sand (SP-SM) SAND, a little gravel, med	aterbearing, (A-2-4)	, dense, a		COA ALL	ARSE JUVIUM	19	W		SS	10					
21 22 23	brown, waterbearing, medi fine grained silty sand (SP	ium dense, l					25	w		SS	. 10					
24	SILTY SAND, a little grav dense (SM) (A-2-4)	vel, brown, 1	medium		TILI	L	30	W		SS	12					
$ \begin{array}{c} 25 \\ 26 \\ 27 \\ 28 \\ 29 \\ 30 \\ 31 \\ \hline \\ 0 \\ 9 \\ 29 \\ 30 \\ 9 \\ 29 \\ 5 \\ 0 \\ 9 \\ 29 \\ 5 \\ 0 \\ 9 \\ 29 \\ 5 \\ 0 \\ 9 \\ 29 \\ 0 \\ 9 \\ 20 \\ 0 \\ 9 \\ 20 \\ 0 \\ 9 \\ 20 \\ 0 \\ 0 \\ 9 \\ 20 \\ 0 \\ 0 \\ 9 \\ 20 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ $	CLAYEY SAND, a little g hard, laminations of sand b (A-6)	gravel, brow from 29½' to	vnish gray, o 33' (SC)				46	М	X	SS	16	10				
29 - 30 - 31 -							34	Ň	Ķ	SS	14	10		4		
					TEPII	EVEL ME			<u>1/ (</u> 179				<u> </u>			
DEP	TH: DRILLING METHOD			· · ·	r		·		-	DRILLI	NG	WAT		NOTE: THE A		
0-9	0 <sup>1</sup> / <sub>2</sub> ' 3.25" HSA	DATE	TIME	SAMP DEP		CASING DEPTH		VE-IN PTH	FI	DRILLI JUID LE	EVEL	WAT LEV		SHEE		
<u>91/2-59</u>	0 <sup>1</sup> / <sub>2</sub> ' RDF w/DM	8/28/13	9:30	11.		9.5		9.5				9.3				ION OF
BORIN	G	8/28/13	9:40	11.		9,5		).5				9.2	<u> </u>			OT ON
	LETED: 8/28/13	8/28/13	9:50	11.	.0	9.5	9	9.5				9.2	<u>.</u>		HIS LO	
$\overline{\mathbf{U}}$ DR: $\mathbf{G}$	H LG: TK Rig: 1C															DHR-0

03/2011



	T: Southwest Light Rail Transit Pro	iect	· PEC East: F	Ionl	tins	to 1	Minn	eano	lis				
ROJEC	T: Southwest Light Kan Transit Pro				62372				51782	9			
	Hennepin Co. (	Coordin	<u>inates:</u>	1		<u> </u>			T		BUBVI		FEST
PTH   N EET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SA 1	MPLE YPE	REC IN,	WC	DEN	LL		6-#2
				41	М	M	SS	14	10				
33 +	SAND WITH SILT, fine grained, brown to		COARSE	, ••		A	00						
34 -	brown and gray, waterbearing, dense, a lens of silt at $33\frac{1}{2}$ (SP-SM) (A-3)		ALLUVIUM			H							
35 –	sint at 5572 (51-514) (1-5)			55	W	Х	SS	12					
36 –						Б							
37 –	SAND, a little gravel, fine to medium grained, brown, waterbearing, very dense, a lens of fine			70	w	М	00	10					
38 –	grained silty sand (SP) (A-3)		•	76	W	Д	SS	12					
39 +	SAND WITH SILT, a little gravel, medium					2							
40 -	grained, dark brownish gray, waterbearing, very		•	64	W	M	SS	10					
41 –	dense (SP-SM) (A-1-b)		•			6							
42 –						K							
43 -	SAND WITH SILT, fine to medium grained,		•			$\langle \langle$							
44 —	grayish brown to brownish gray, waterbearing,		e •			K							
45 -	very dense (SP-SM) (A-3)		•	65	W	M	SS	12					
46 -			•			А	55						
47 –						K							
48 -			• •			$\left \left\langle \right\rangle \right $				-			
49 -	SAND, fine grained, grayish brown, waterbearing, very dense (SP) (A-3)					$\left \right\rangle$							
50 -			•	69	w	$\square$	SS	14					
51 -						Д	00						
52 -						$\langle \langle$			×				
53 -						$\left  \right\rangle$							
54 -			•			$\left \right\rangle$							
55 -				61	111	$\forall$	66	14					
56 -				61	W	Д	SS	14					
57 -						$\left \left(\right.\right)\right $							
58 -	SAND, fine to medium grained, grayish brown,					$\left \right\rangle$							
59 —	waterbearing, very dense (SP) (A-3)		•			$\left \right\rangle$							
60 -				-		$\square$	,	10					
61 -				70	W	Å	SS	10					
01	END OF BORING												
,													
											<u> </u>	01_T	



AET JC	DB NO: 0	1-05697						LO	G OF	BÖ	RING N	íO	1145	НС	: (p.	1 of	1)
PROJE	CT: S	outhwest Lig	ht Rail T	ransit Pr	oject,	PE	C East;	Нор	kins	to	Minn	,					
SURFA	CE ELEVATI	ON: 852.8		Hennepin C	o. Coo	rdina	tes: <u>N</u>	1:	59973	3		E :	51724				
DEPTH IN FEET		MATERIAL	DESCRIPTIO	ON		GE	EOLOGY	N	мс	SĄ	AMPLE FYPE	REC IN.	FIELI WC	D&LA	BORA	<u> </u>	FESTS
	Water														1-		
1 -	-																
2 -																	
2	SAND W	ITH GRAVEL, o fine grained, b	includes or lack/dark b	rganics, prown (SP)		CO/	ARSE LUVIUM										
		, contraction of the second seco									DS		38				4
3 —	CAND -	1.41	1	· ·													
	medium to	little gravel, inc fine grained, b	ludes orgar lack/dark b	brown (SP)							Da						
											DS		39				4
4 -	SAND W	ITH SILT AND	GRAVEL	. medium		-				╉						7	
	to fine gra	ined, dark brow	vn (SP-SM)	)		~											
											-						
5 —																	-
											DS		15				7
ć														1			
6 —	-																
7 —																	
	END OF	BORING						2									
	Locations	, elevations and	denths sho	uld be		Į		~									
	considered water from	d approximate (	samples tak	cen below													
	water from	11 Doal).															
													-				
			·														
DEF	PTH: DRIL	LING METHOD			WAT	ER LI	EVEL MEA	SURE	EMEN	TS					NOTE:	REFE	R TO
	0-4' HA/	hao	DATE	TIME	SAMPI DEPT	LED TH	CASING DEPTH	CAV	/E-IN PTH	] FL	DRILLII JUID LE	NG VEL	WATH LEVE	ER EL	THE A	TTAC	HED
		probe tube	-												SHEET	rs foi	R AN
															EXPLA		
BORIN COMP	NG PLETED: 8/2	3/13												г	ERMIN		
DR: A	APN LG: AF	N Rig: HA/Tu	be												ΠĤ	IS LO	J.

03/2011



AET JO		ht Rail Tr	ransit Pr	oject.	PEC East:	Hopl	kins	to Minn	eapol	lis			
			Hennepin Co				59989			51722	2		
	CE ELEVATION:852.8	1		. Coordin		<u> </u>		<u> </u>		T		BORA	FORY
DEPTH IN FEET	MATERIAL	DESCRIPTIO	)N		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	OC	LL	PL
	Water	<u> </u>											
		*				-							
			•										
1 -			· ·										
2 —			•					DS					
			· •										
3 -													
													i i
4 -			(011)			_							
	SILT WITH SAND, blac	k/dark brow	m (OH)	<u> 1 1 5</u>	SEDIMENT								
				<u>= = =</u>								1	
5 -				1.5.5				DS		372	20		
				332									
		· .		<u>194</u>									
6 -													
Ū	SILTY SAND, with orga dark brown (SM/OH)	nic fines, fir	ne grained,										
								DS		119	15		
7 -										-			
	ORGANIC SILT WITH encountered gravel at abc	SAND, dark out 8½' (like)	c brown, lv										
	represents the top of the a	alluvium) (O	) )H)							100	1.0		
8 -								DS		108	13		
0				<u>te</u>	-								
8 -	END OF BORING		-		-								-
5													
	Locations, elevations and considered approximate (	depths shou	uld be										
	water from boat).	Sumples tak											
								-					
	PTH: DRILLING METHOD			······································	ER LEVEL ME				r			NOTE	REF
<u>م</u>	8½' HA/bag	DATE	TIME	SAMPL	LED CASING	CA	VE-IN EPTH	DRILLI FLUID LE	NG EVEL	WATI LEVI	ER EL	THE A	ATTA
0-	072 HA/Dag			1				-				SHEE	TS FO
		_				-						EXPLA	NAT
BORIN	NG LETED: 8/22/13											FERMI	
	<b>PN</b> LG: <b>APN</b> Rig: <b>HA</b>			· ·								Tŀ	IIS L



AET JO	B NO: 01-05697			I			LO	GOF	BORING N	10	1147	HC	<u>(p.</u>	1 of	1)
PROJEC	CT: Southwest Lig	ht Rail T	ransit Pr	oject,	PEC E	ast; ]	Нор	kins	to Minr	ieapo	olis				
SURFAC	CE ELEVATION: 852.8	]	Hennepin C	o. Coo	dinates:	N	10	60005	5	E ť	51720	3			
1			······						SAMPI E	REC	FIELI	)&L/	BORA	FORY	TEST
DEPTH IN FEET	MATERIAL I	DESCRIPTIC	DN		GEOLC	GY	N	MC	SAMPLE TYPE	IN.	WC	DEN	qu	PL	<b>%-#</b>
	Water														
											-				
1 —															
2 –									DS						
										,					
3 —									-					-	,
4 -	ORGANIC SANDY SILT	F block/day	rk brown		SEDIME	'NT									
	(OH)	I, Ulack/uai	IK DIOWII		<b>SEDIM</b>				-						
5 -									DS						68
													•		
						:									
6			• •												
	SILTY SAND, with organ black/dark brown (SM/OI	nic fines, fi H)	ne grained,												
		,													
7 —									DS						49
,															
			r												
8 —											5				
0	SILTY SAND WITH GR fine grained, dark brown	AVEL, me (SM)	dium to		COARS	e IUM									
	Inte Branneu, autri ere i inte	(2)							DS		20				. 14
9 -															
9	END OF BORING	denths sho	uld be												
	Locations, elevations and considered approximate (	samples tak	cen below												
	water from boat).														
DEP	TH: DRILLING METHOD				ER LEVEI								NOTE:	REFE	R TO
ſ	)-7' HA/bag	DATE	TIME	SAMPI DEPT	LED CAS	SING PTH	CAV DE	/E-IN PTH	DRILLI FLUID LE	NG EVEL	WATI LEVE	ER   EL	THE A	TTAC	HED
U	J-1 IIA DAY												SHEET	FS FOF	R AN
			1										EXPLA	NATIC	)N C
	IC.		+										ERMIN		$\overline{v}$
BORIN	IG LETED: <b>8/23/13</b>			·										NOLOC	JIC



AET JO	B NO: <b>01-05697</b>				•	LC	G OF	BORING	B NO	1148	B ST	(p. 1	1 of	2)
PROJEC	CT: Southwest Ligh	it Rail Tr	ansit Pro	oject,	PEC East;	Нор	kins	to Mi	nneap	olis		•		
SURFAG	CE ELEVATION: <b>864.6</b>	ŀ	Hennepin Co	o. Cooi	dinates: <u>N</u>	. 1	63206	5	E	51807	2			
DEPTH	MATERIAL D		NI		GEOLOGY	N	MC	SAMPI	E REC	FIELI	) & LA	BORA	FORY	TEST
IN FEET	WIATERIAL L	DESCRIPTIO	-1N		UEOLOG I	N	MC	TYPE		WC	DEN	LL	PL	Ýó-#2
1 — . 2 —	FILL, mostly silty sand wi sapric peat and ashes/cinde trace roots, dark brown and \(A-2-4)	ers, pieces	of glass,		FILL	10	M	ss						
3	FILL, mixture of silty sand a little gravel, dark brown, brownish gray (A-2-4)	a little ligi	nt			. 15	M	X ss						
5 - 6 -	FILL, mostly sand, a little light grayish brown (A-3)	_				13	M	X ss स	8			× .		
7 8 9	SAND WITH SILT AND cobbles, fine to medium g brown, medium dense (SP	rained, ligh -SM) (A-1	it grayish -b)		COARSE ALLUVIUM	27	М	ss R	8					
10 - 11 -	GRAVELLY SAND WIT medium grained, light brov (SP-SM) (A-1-b)	wn, mediur	m dense			30	M	B A B B	2			-		
12 — 13 — 14 —	SAND, a little gravel, mec grayish brown, moist, mec (A-1-b)	lium dense	(SP)			25	М	SS R	5					
14 15 — 16 —	CLAYEY SAND, a little g very stiff (SC) (A-6)	4	· .		TILL	18	М	ss R	17	15				
17 — 18 — 19 —	CLAYEY SAND, a little g stiff (SC) (A-6) CLAYEY SAND WITH C cobbles, brown, hard (SC)	GRAVEL,				17	<b>⊻</b>	SS R	16	14				
20 21						50/.2	M	NX SS	8	12				
22 — 23 — 24 —	CLAYEY SAND, a little g cobbles, brown, very stiff, (SM/SC) (A-2-6)	a lens of s	ilty sand			17	M/W	ri X se Fi	10	12				
25 26	CLAYEY SAND, a little § stiff (SC) (A-6)					19	M/W	K K K	5 17	10				
27 — 28 — 29 —	SAND WITH SILT, medi waterbearing, medium der	nse (SP-SM	1) (A-1-b)		COARSE ALLUVIUM	.12	W	R K K	5 18		×			
29 - 30 - 31 -	SAND, possible cobbles, 1 brown, waterbearing, med clayey sand (SP) (A-1-b)	medium gra ium dense,	ained, , a lens of			25	W	ss	5 10					
DEP	I DRILLING METHOD			WAT	I ER LEVEL MEA	L ASURI	i EMEN	TS			- <b>I</b>	NOTE:	יםםמ	ц FB т
		DATE	TIME					-1	LING	WAT LEVI		THE A		
0-	-29' 3.25" HSA	DATE		SAMP DEP			/E-IN PTH	DRIL FLUID	LEVEL			SHEE		
29-3	9½' RDF w/DM	10/1/13	8:57	28.		+	6.7			21.	<u> </u>	EXPLA		
DODD	IC	10/1/13	9:07	28.	5 27.0	2	4.2	ļ		18.	0	ERMI		
COMP	NG LETED: 10/1/13										·   1			
DR: S	G LG: SB Rig: 91C		· · · · · · · · · · · · · · · · · · ·									11-	IIS LO	U,



ET JO	B NO:	01-05		-									RING N			8 ST	( <b>p</b> . 4	2 01 .	<u> </u>
ROJEC	CT:	Southv	vest Li	ight R	ail Tr	ansit P	roject,	PEC Ea	st; ]	Hop	kins	to	Minn	eapo	olis				
					H	Iennepin	Co. Coo	rdinates:	N	10	63200	5	_]	E ť	51807	2			
PTH	-								13.7			SA	MPLE	REC	FIELI	) & LA	BORA	FORY	TEST
EPTH IN EET		M.	ATERIA	L DESC	RIPTIO	N		GEOLOG	řΥ	N	МС	T	MPLE YPE	IN.	WC	DEN	ĻL	PL	<b>%</b> -#2
33 -	SANI dense (conti	D, medium lenses of <i>nued</i> )	graine sand w	d, brow ith silt (	n, wate SP) (A	erbearing A-1-b)	,	COARSE		39	W	Д	SS	14					
34 — 35 — 36 —	SANI	D WITH S m grained M) (A-1-b	, browr	little gra 1, water	ivel, fii bearing	ne to g, dense		- - - - - - -		40	W	Å	SS	10				-	
37 — 38 —	cobble	O WITH S es, fine to pearing, de	mediun	n graine	d, brov	wn,		± • •		50	W	X	SS	6				-	
39 - 40 -	mediu	O WITH G m grained a lens of	, gray,	waterbe	aring,	medium				30	w	X	SS	11					
41 -		OF BORI						· .											
							1									:			
													•						
•					. •									-					
								-											
						÷													
														-					
														-					
								-											
								-											
													• •						
																		01-D	



1       FILL, mostly silty sand, a little gravel and clayey       FILL       20       M       SS       18         2       (A-2-4)       FILL, mostly silty sand with gravel, possible       51       M       SS       18         3       FILL, mostly silty sand, altitle gravel, fine grained, light       FILL       20       M       SS       18         4       FILL, mostly silty sand, altitle gravel, fine grained, light       FILL       20       M       SS       18         5       FILL, mostly silty sand, altitle gravel, fine grained, light       FILL       20       M       SS       18         6       SLTY SAND, altitle gravel, fine grained, light brown, and, most, medium dense (SP-SM) (A-1-b) (possible       19       M       SS       12         5       SAND WTH SILT, fine grained, light brown, altitle ight brown, with silt (SP) (A-1-b)       14       M       SS       14         10       CLAYEY SAND, brown, moist, very alift       Inhuber of the grained, flow, waterbearing sand       COARSE       11       M       SS       15         11       CLAYEY SAND, MUH HSILT, a liftle gravel, gra	AET JO	····	١							RING N		·····	ST	<b>(p.</b> 1	l of 2	2)
Diamance construction       Description       Description       GeoLogy       N       Mc       SAMPLE Rec TYPE       Field & LABORATORYTES         PETT       MATERIAL DESCRIPTION       GEOLOGY       N       Mc       SAMPLE Rec TYPE       Field & LABORATORYTES         PILL, mostly silly sand, a little gravel, and little provin, A2-24       Sill TYPE       Z0       M       SS       18         TLT, mostly silly sand, a little gravel, fine grained, light cobbies, pieces of concrete, a little shees/cinders, mosts, medium dense (SM) (A-2-4)       COARSE ALLUVIUM SS       SS       13         SAND WITH SILT AND GRAVEL, fine grained, light brown, a little light brown, moist, medium dense (SM) (A-2-4)       COARSE ALLUVIUM SS       IS       SS       14         SAND, modium dense (SM) (A-2-4)       GOARSE ALLUVIUM SS       IS       SS       14         SAND, modium dense (SM) (A-2-4)       MIXED ALLUVIUM SS       SS       14       M       SS       14         SAND, modium dense (SP-SM) (A-1-6)       III       MIXED ALLUVIUM SS       III       SS       14       M       SS       17       15         SAND, MITH SILT, a little gravel, medium to fine grained, brown, suff, light brown, a little laminations of waterbearing sand 21       GOARSE SILVY SAND, a little gravel, medium to fine grained, brown, suff, light brown, a little laminations of waterbearing sand 21       GOARSE SILVY SAND, a	PROJEC															
Image: Name of the problem of the p	SURFAC	CE ELEVATION:867.4	H	lennepin Co. (	Coordi	nates: <u>]</u>		62761	<u> </u>		E :	r				
FILL, mostly silty sand, a little gravel and clayey sand, three roots, dark brown, a little brown FILL, mostly silty sand, a little gravel, possible clobes, pieces of concrete, a little ashes/cinders, brown (A2-4)     PILL     20     M     SS     18       FILL, mostly silty sand, a little gravel, possible clobes, pieces of concrete, a little ashes/cinders, brown, Mist, medium dense (SM) (A-2-4)     SI     M     SS     18       SAND WITH SILT, AND GRAVEL, fine grained, light brown, moist, medium dense (SP-SM) (A-1-b) (possible fill)     II     COARSE ALLUVIUM     19     M     SS     12       SAND WITH SILT, fine grained, light brown, noist, medium dense, a lamination of lean clay intic sprince, lawin dense, a lean sof sand wist, medium dense (SP-SM) (A-1-b)     IIIL     17     M     SS     14       SAND, fine to medium grained, light brown, a moist, medium dense (SP-SM) (A-1-b)     IIIL     27     W     SS     14       SAND, fine to medium grained, light brown, a little brown, siftl, laminations of waterbearing sand (SC) (A-0)     IIIL     27     W     SS     17     13       CLAYEY SAND, siftle gravel, medium to fine grained, brown, waterbearing, medium dense (SP-SM) (A-1-b)     IIIL     27     W     SS     15       SAND, fine to medium grained, light brown, a moist, medium dense, vare soft sand dense (SP-SM) (A-1-b)     IIIL     27     W     SS     17     13       CLAYEY SAND, a little gravel, medium to fing grained, brownish gray, waterbearing, a med	DEPTH IN FEET	MATERIAL D	ESCRIPTIO	N		GEOLOGY	N	мс	SA T	MPLE YPE	REĊ IN.			ľ		FESTS %-#20
FILL, mostly sity sind with gravel, possible concrete, a little sabsecinders, brown (A-2-4)       51       M       X       SS       4         SULTY SAND, a little gravel, fine grained, light brown, moist, medium dense (SM) (A-2-4)       COARSE minimized (COARSE minimized)       19       M       SS       13         G		sand, trace roots, dark brov				FILL	20	М	M	SS	18					
SILTY SAND, a little gravel, fine grained, light       Image: Construction of the constructing and the construction of the construction of the con	3 —	cobbles, pieces of concrete brown (A-2-4)	, a little ash	es/cinders,		COADEE	51	M	X 7	SS	4					
a       grained, light brown, a little light brown, moist, medium dense (SP-SM) (A-1-b) (possible and the set of t	5 —					ALLUVIUM	25	, M	A A	SS	13					
SAND WITH SILT, fine grained, light brown, moist, medium dense, a lamination of lean clay       II       II       SS       14         12       SAND, medium to fine grained, light brown, moist, medium dense (SP-SM) (A-1-b)       II       II       M       SS       14         13       moist, medium dense, a lens of sand with silt (SP) (A-3)       II       II       M       SS       14         14       M       SS       14       M       SS       14         16       with silt (SP) (A-3)       III       III       Z2       M       SS       14         16       with silt (SP) (A-3)       III       III       Z7       NW       SS       17       15         17       CLAYEY SAND, a little gravel, gray, a little brown, stiff, laminations of waterbearing sand class (SP-SM) (A-1-b)       MIXED       III       III       XS       17       13         20       SS       15       III       IIII       IIII       IIII       IIII       IIII       IIII       IIII       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	.8	grained, light brown, a littl moist, medium dense (SP-S	e light brov	vnish gray,			19	М		SS	12					
13       moist, medium dense (SP-SM) (A-1-b)       14       M       SS       15         14       SAND, fine to medium grained, light brown, a little brown, moist, medium dense, a lens of sand       22       M       SS       14         15       little brown, moist, medium dense, a lens of sand       22       M       SS       14         16       with silt (SP) (A-3)       TILL       27       W       SS       14         16       With silt (SP) (A-3)       MIXED       MIXED       SS       17       15         18       Iaminations of waterbearing sand (SC) (A-6)       MIXED       MIXED       ALLUVIUM       14       MW       SS       17       13         20       SAND WITH SILT, a little gravel, medium to fine grained, brown, waterbearing, medium to fine grained, brownish gray, waterbearing, medium to grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)       30       W       SS       18         21       SCM (A-1-b)       SS       13       30       W       SS       14         22       GRAVELLY SAND WITH SILT, medium to fine grained, brownish gray, waterbearing, medium dense       30       W       SS       13         31       SILTY SAND, a little gravel, fine to medium 31       SMPLED       CASING       CASING       NOTE: REFER	10 -	moist, medium dense, a lar					17	M	A A A	SS	14					
SAND, The to medium granted, fight orown, a         15       15         16       -         17       CLAYEY SAND, brown, moist, very stiff, laminations of waterbearing sand (SC) (A-6)         18       -         19       CLAYEY SAND, a little gravel, gray, a little brown, stiff, laminations of waterbearing sand (SC) (A-6)         20       -         21       -         22       M         23       -         24       -         25       -         26       -         26       -         27       -         16       W         25       -         26       -         27       -         16       W         23       -         24       -         25       -         26       -         27       -         GRAVELLY SAND WITH SILT, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)         29       -         SILTY SAND, a little gravel, fine to medium grained, brownish gray, wet, medium dense (SP-SM) (A-1-b)         31       -         0       -         0       - </td <td>13 —</td> <td></td> <td></td> <td></td> <td></td> <td>•</td> <td>14</td> <td>M</td> <td>H H H H</td> <td>SS</td> <td>15</td> <td></td> <td></td> <td></td> <td></td> <td></td>	13 —					•	14	M	H H H H	SS	15					
11       Laminations of waterbearing sand (SC) (A-6)       27       SS       17       15         19       CLAYEY SAND, a little gravel, gray, a little       MIXED       ALLUVIUM       14       M/W       SS       17       13         21       CSC (A-6)       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         24       SS       15       SS       17       13         25       GRAVELLY SAND WITH SILT, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)       30       W       SS       18         26       SILTY SAND, a little gravel, fine to medium grained, brownish gray, wet, medium dense       20       W       SS       13         30       W       SS       13       NOTE: REFER       NOTE: REFER         0       DEPTH: DRILLING METHOD       WATER LEVEL MEASUREMENTS       NOTE: REFER         0       0.25½'       3.25" HSA       DATE       TIME       SAMPLED       CASING       CAVE-IN       DRILLING       NOTE: REFER         0       0.25½'       3.25" HSA       DATE       TIME       SAMPLED       CASING       CAVE-IN       DRILLING       SHEETS FOR A </td <td>15 —</td> <td>little brown, moist, mediur</td> <td>iined, light n dense, a l</td> <td>brown, a ens of sand</td> <td></td> <td></td> <td>22</td> <td>M</td> <td>A A A</td> <td>SS</td> <td>14</td> <td></td> <td></td> <td></td> <td></td> <td></td>	15 —	little brown, moist, mediur	iined, light n dense, a l	brown, a ens of sand			22	M	A A A	SS	14					
20       brown, stiff, laminations of waterbearing sand (SC) (A-6)       MILLUVIUM ALLUVIUM       14       M/W       SS       17       13         21       SAND WITH SILT, a little gravel, medium to fine grained, brown, waterbearing, medium       16       W       SS       15         23       dense (SP-SM) (A-1-b)       16       W       SS       18         24       -       15       W       SS       18         25       -       15       W       SS       18         26       -       -       15       W       SS       18         26       -       -       -       30       W       SS       2         28       medium dense (SP-SM) (A-1-b)       -       -       -       -       -         29       SILTY SAND, a little gravel, fine to medium 31       -<	18						27			SS	17	15				
22       fine grained, brown, waterbearing, medium       ALLUVIUM       16       W       SS       15         23       dense (SP-SM) (A-1-b)       15       W       SS       15         24       25       15       W       SS       18         26       15       W       SS       18         26       15       W       SS       18         27       GRAVELLY SAND WITH SILT, medium to fine grained, brownish gray, waterbearing, medium dense (SP-SM) (A-1-b)       30       W       SS       2         29       SILTY SAND, a little gravel, fine to medium grained, brownish gray, wet, medium dense       20       W       SS       13         0       EXTY SAND, a little gravel, fine to medium dense       20       W       SS       13         10       DEPTH:       DRILLING METHOD       WATER LEVEL MEASUREMENTS       NOTE: REFER       NOTE: REFER         0-25½'       3.25'' HSA       DATE       TIME       SAMPLED       CASING       CAVE-IN       DIEPTH       THE ATTACHE         25½-49½'       RDF w/DM       10/1/13       11:46       26.0       24.5       23.2       21.4       SHEETS FOR A         800RING       COMPLETED:       10/1/13       12:00       26.0	20 -	brown, stiff, laminations o	gravel, gray f waterbear	, a little ing sand			14	M/W		SS	17	13				
25 -       26 -       15       W       SS       18         26 -       -	23 -	fine grained, brown, water					16	w	R K	SS	15				-	
0-25½'3.25" HSADATETIMESAMPLED DEPTHCASING DEPTHCAVE-IN DEPTHDRILLING FLUID LEVELWATER LEVELTHE ATTACHE SHEETS FOR A25½-49½'RDF w/DM10/1/1311:4626.024.523.221.4SHEETS FOR A25½-49½'RDF w/DM10/1/1311:4626.024.522.218.5EXPLANATIONBORING COMPLETED:10/1/13		-	•				15	W	¥ X	SS	18					
0-25½'3.25" HSADATETIMESAMPLED DEPTHCASING DEPTHCAVE-IN DEPTHDRILLING FLUID LEVELWATER LEVELTHE ATTACHE SHEETS FOR A25½-49½'RDF w/DM10/1/1311:4626.024.523.221.4SHEETS FOR A25½-49½'RDF w/DM10/1/1311:4626.024.522.218.5EXPLANATIONBORING COMPLETED:10/1/13	27 - 28 - 28 -	fine grained, brownish gra	y, waterbea				30	W	Å	SS	2					
0-25½'3.25" HSADATETIMESAMPLED DEPTHCASING DEPTHCAVE-IN DEPTHDRILLING FLUID LEVELWATER LEVELTHE ATTACHE SHEETS FOR A25½-49½'RDF w/DM10/1/1311:4626.024.523.221.4SHEETS FOR A25½-49½'RDF w/DM10/1/1311:4626.024.522.218.5EXPLANATIONBORING COMPLETED:10/1/13	29 - 30 - 31 -	grained, brownish gray, w					20	w	Ķ	SS	13					
0-25½'3.25" HSADATETIMESAMPLED DEPTHCASING DEPTHCAVE-IN DEPTHDRILLING FLUID LEVELWATER LEVELTHE ATTACHE25½-49½'RDF w/DM10/1/1311:4626.024.523.221.4SHEETS FOR A25½-49½'10/1/1312:0026.024.522.218.5EXPLANATIONBORING COMPLETED:10/1/13			1			H		EMEN	_]((  TS	L	I		-			
I I I I I I I I I I I I I I I I I I I	5 DEl	PIH: DRILLING METHOD					·		~~r	DRILLI	NG	WAT				
I HIS LOO	0-2	3.25" HSA	DATE	TIME	DEP				FL	JUID LÌ	EVEL					
I I I I I I I I I I I I I I I I I I I	251/2-4	9½' RDF w/DM	10/1/13	11:46	26.	0 24.5	2	3.2								
I I I I I I I I I I I I I I I I I I I	W-C	·	10/1/13	12:00	26.	.0 24.5	2	2.2				18.	3			
I HIS LOO	BORIN COMP	NG PLETED: 10/1/13														
$ = \frac{DR: SG \ LG: SB \ Rig: 91C}{01-DHI} $	DR: S															

03/2011



PROJEC	T: Southwest Light Rail Transit Project, Hennepin Co. Coordin			6276			51789	1			
						T	1		BORAT	ORY	TEST
EPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL		<b>%-</b> #2
33 — 34 —	SAND WITH SILT, a little gravel, medium to fine grained, gray, waterbearing, dense (SP-SM) (A-1-b) (continued)	COARSE ALLUVIUM (continued)	39	W	ss	13					`
35 — 36 —	SAND WITH SILT, fine grained, brown, waterbearing, dense to medium dense (SP-SM) (A-3)		33	w	ss	10					
37 — 38 —			40	W	ss	12		-			
39 - 40 - 41 -			29	w	ss	16					-
42 - 43 -			30	W	ss	12					
44	GRAVELLY SAND WITH SILT, fine grained, brown, waterbearing, dense (SP-SM) (A-3)		47	w	ss	1					
47 — 48 —	SAND, fine to medium grained, brown, waterbearing, medium dense, a lens of sand with silt at 48' (SP) (A-3)		19	w	ss s	10					-
49 — 50 —			13	w	X ss	1/2					
51 —	END OF BORING										
											*
								-			
			,	1					-		
•											



ABIJO	DB NO: 01-05697					LO	G OF I	BORIN	IG NO	Э	1150	ST	<b>(p.</b> )	l of	2)
PROJEC	CT: Southwest Ligh	t Rail Tr	ansit Pro	oject, l	PEC East; 1	Iopl	cins t	o Mi	inne	eapol	lis				
SURFA	CE ELEVATION: 864.8	H	Iennepin Co.	Coordin	ates: <u>N</u>	1	61728	<u> </u>		3	51780	2			
DEPTH	MATERIAL I	FSCRIPTIO	N		GEOLOGY	N	MC	SAMI TYF	PLE	REC	FIELD	) & LA	BORA	FORY	TEST
IN FEET	WATENAL L	ESCIAL HO					IVIC	TYF	PE	IN.	WC	DEN	LL	PL	<b>%-</b> #2
1 — 2 — 3 —	FILL, mostly silty sand with little gravel and ashes/cind (A-2-4) FILL, mostly sand with silt silty sand, trace roots, brow	ers, trace ro	oots, black		FILL	9 15	M M	$\left( \right)$	SS SS	20 10		, ,			
4 — 5 — 6 —	(A-2-4, A-1-b) SAND WITH SILT AND medium grained, brown, m (SP-SM) (A-1-b)	GRAVEL,	fine to		COARSE ALLUVIUM	11	М		SS	6					
7 — 8 — 9 —	SAND, a little gravel, med brown, a little brown, mois waterbearing, loose, lenses (A-1-b)	t to about 9	1/2' then			5	M .		SS	16					
10						5	M/W	र ह	SS	12	-		-		
12 — 13 — 14 —	SAND WITH SILT, a little grayish brown, a little dark medium dense, lenses of si fines (SP-SM) (A-2-4)	brownish g lty sand wi	gray, wet, th organic			16	W/M	H K F	SS	10					
15 - 16 -	SAND WITH SILT AND medium grained, grayish b waterbearing (SP-SM) (A-	rown, wet t 1-b)	0			13	W	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	SS	10					
17 18 19	SAND WITH GRAVEL, 1 a little dark brownish gray, to very loose, lenses of fin with organic fines (SP) (A	, waterbeari e grained si	ing, loose			5	W	s F	SS	10					
20 - 21 -						4	w	R R	SS	.18				-	
22	SAPRIC PEAT, black (PT	r) (A-8)	. •		SWAMP DEPOSIT	9	w		SS	18	188				
24 25 26	ORGANIC CLAY, trace s brownish gray, soft to very	hells, gray v soft (OH)	to (A-8)			3	M/W		SS	16	57				•
27 28 29						WR	M/W		SS	20	87				
25 26 27 28 29 30 31 DEJ	SAND WITH GRAVEL, 1 a little dark brownish gray (SP) (A-1-b)	medium gra , waterbear	uined, gray ing, loose	,	COARSE ALLUVIUM	9	W	Ă.	SŞ	16					
	PTH: DRILLING METHOD			r	ER LEVEL MEA	SURI	EMEN	1		····· ,			NOTE	REF	ER TO
	01/1 3 2511 119 4	DATE	TIME	SAMPI DEPT	ED CASING H DEPTH	CAV	VE-IN PTH	DR FLUI	ILLI D LE	NG VEL	WAT LEVI	ER   EL	THE A	ATTA(	CHEI
	29½' 3.25" HSA 19½' RDF w/DM	9/26/13	11:15	11.0		-	).8	+			9.5		SHEE	TS FO	R AN
291/2-4		9/26/13	11:25	11.0			).5				9.5		EXPLA	NATI	ON C
BORD	NG PLETED: 9/26/13	9/26/13	11:40	18.5		+	6.9				15.		TERMI	NOLO	GY C
1 7717												,			



AET JOI	3 NO: 01-05697			LC	G OF	BORING	NO	115(	) ST	(p. 2	2 of 2	2)
PROJEC	T: Southwest Light Rail Transit Proj	ject,	PEC East;	Нор	kins	to Min	neapo	olis				•
	Hennepin Co.	Coor	dinates: N	1	6172	8	E	51780	2			
DEPTH				· ·				FIELI	) & LA	BORA	ORY '	TEST
DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	<b>%-#</b> 2
	SAND, a little gravel, medium grained, gray,											
33 —	waterbearing, medium dense (SP) (A-1-b)			12	W	$ \chi $ ss	12					
34 -						E .						
35 —	GRAVELLY SAND, medium to fine grained, gray, waterbearing, medium dense to loose (SP)			11	w	M ss	4					
36 —	(A-1-b)				vv.	M <sup>33</sup>	4					
37 —						R						
38 —				8	W	X ss	3					
39 -												
40 —	SAND, a little gravel, medium to fine grained, gray, waterbearing, loose (SP) (A-1-b)			0	w	S ss	0					
41 -	G, · · · · · · · · · · · · · · · · ·			8	W.	$\square$ ss	8					
42 -	SAND, fine to medium grained, brownish gray,					Ц						
42 - 43 -	waterbearing, medium dense, lenses of fine			12	W	$\bigvee$ ss	14					
43	grained sand with silt (SP) (A-1-b)					61						
						$\left\{ \right\}$						ŀ
45 -	· •			19	W	X ss	16					
46 -						$\sum$						
47 -				18	W	S ss	8					
48 —						Д						
49 —	SAND WITH SILT, fine grained, brownish					4						
50 -	gray, waterbearing, medium dense (SP) (A-3)			23	W	X ss	16					
51 -	END OF BORING											
										*		
							;					
			·				i.					
			-									
			-									
							-					
		1		1	1			1			1	

03/2011



AET JO	B NO: 01-05697					LO	GOF	BOF	RING N	0	1151	ST	(p. 1	lof	2)
PROJEC		ht Rail Tr	ansit Pro	ject, ]	PEC East;				Minno						
SURFA	CE ELEVATION: <b>865.3</b>	ŀ	Hennepin Co.	Coordin	ates: <u>N</u>	1	61335	5	<u> </u>	E Ś	51778				. <u>.</u>
DEPTH IN FEET	MATERIAL	DESCRIPTIO	'n		GEOLOGY	N	мс	SA T	MPLE YPE	REC IN.	FIELD WC	) & LA DEN	BORAT		FEST
1 -	FILL, mostly silty sand w little gravel, trace roots, d				FILL	19	M	M	SS	18					
2 — 3 —	FILL, mostly sand with s (A-1-b)	It and gravel	l, brown		с. Х.	20	M		SS	18					
4 — 5 —	CLAYEY SAND, a little very stiff, laminations of and sandy silt (SC)				MIXED ALLUVIUM	16	М	E	SS	18	13				
6 — 7 — 8 —	SAND WITH SILT, a litt brown, moist, medium de clay with sand (SP-SM) (	nse, laminati	ne grained, ions of lean		COARSE ALLUVIUM	12	M		ŜS	18					
9 — 10 — 11 —	SAND WITH SILT, fine brown, moist, loose, a ler (SP-SM) (A-1-b, A-6)					9	M/W		SS	18		· ·			
12 — 13 — 14 —	SAND WITH SILT, a litt fine grained, gray, a little very loose, lenses of sapr clayey sand (SP-SM) (A-	black, water	bearing,			3	<b>▼</b> ₩		SS	18					
14 15 - 16 - 16						3	W	K	SS	18					
10 – 17 – 18 –	HEMIC PEAT, dark brow black, a lens of sapric pea				SWAMP DEPOSIT	5	w		SS	18	290				
19 — 20 —						.10	W	ł	SS	16	292				
21 — 22 —	SAND WITH SILT ANI	GRAVEL,	medium to		COARSE			E	SS	12				,	
23 — 24 —	fine grained, brownish gr medium dense (SP-SM) ( SAND WITH SILT ANI	A-1-b)			ALLUVIUM	24	W	∧ ₹]	33	12					
25 — 26 —	medium grained, dark bro light gray, waterbearing, a lamination of lean clay	ownish gray, medium den	a little se to loose,			14	w	X	ŚS	10			-		
27 28 29	- (A-1-b)		· ·			7	w		SS	5					
29	GRAVEL WITH SAND medium dense to loose ((		bearing,			19	w	H H	SS	1					
DEI	PTH: DRILLING METHOD				ER LEVEL ME.	ASURI	EMEN	1) TS		L .		L			
DEI							VE-IN	T	ORILLI	NG	WAT		NOTE:		
0-2	4 <sup>1</sup> / <sub>2</sub> ' 3.25" HSA	DATE	TIME	SAMPI DEP1	LED CASING TH DEPTH		EPTH ·	FL	UIDLE	VEL	WAT		THE A		
241⁄2-4	9½' RDF w/DM	9/27/13	9:36	13.5	5 12.0	1	2.5	ļ			12.3		SHEE		
		9/27/13	9:45	13.5	5 12.0	1	2.4				11.0	3	EXPLA		
BORIN COMP	NG LETED: 9/27/13	9/27/13	10:05	23.5	5 22.0	2	2.3				18.	)	ERMI		
DR: S		9/27/13	10:10	23.5	5 22.0	2	1.5		14		17.	)	TH	IIS LO	G

03/2011



PROJEC	T: Southwest Light Rail Transit Pro Hennepin Co				61335			51778	2			
EPTH									) & LAI	BORAT	ORY (	TEST
EPTH IN TEET	MATERIAL DESCRIPTION	-	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	<b>%-#</b>
	GRAVEL WITH SAND, gray, waterbearing,			10	W	ss s	1/2					
33 -	medium dense to loose (GP) (A-1-b) (continued)			12	w	$\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i$	72					
34 -						R						
35 - 36 -				14	W	X ss	6				-	
37 -		-					-					
38 -				19	w	ss 🛛	2					
39 -		-	· · ·			Д						
40 -						М́аа						
41 -		* *		8	W	X ss	4					
42 —						P						
43 -				17	W	$ \chi $ ss	4 ·					
44 -						<u> </u>						
45 —				18	W	$\propto$ ss	6					
46 -						Б						
47 —				18	w	ss	8					
48 —				10	vv	A						
49 —		-				4.						
50 -				45	W	X ss	. 2					
51 —	END OF BORING											
								-				
			,									
	<i>c</i>											



AET JOI										RING NO			01	<b>(p.</b> 1		<u> </u>
PROJEC								-					7		-	
SURFAC	CE ELEVATION: <u>867.9</u>	H	ennepin Co.	Coordii	nates:	<u>N</u>	1	60223	5	]	E <b>:</b>	51750				
DEPTH IN FEET	MATERIAL I	DESCRIPTION	V		GE	OLOGY	N	MC	SA T	MPLE YPE	REC IN,	FIELI WC	D & LA	BORAT	[	TEST: %-#2
1 - 2 -	FILL, mixture of clayey sa and silty sand, a little grave brown (A-2-4)	nd with orga el, trace root	anic fines ts, dark		FILI		16	M	M	SS	12	19				
2 — 3 — 4 —	FILL, mostly sand with silt silty sand, grayish brown, a (A-1-b)	t and gravel, a little dark	, a little brown				33	М	X FI	SS	12					
5 - 6 -	FILL, mostly gravelly sand clayey sand, brown and bro dark brown (A-1-b)	l with silt, a ownish gray	little , a little			-	22	-	R	SS	0					
7 — 8 — 9 —							18	М	2	SS	4					
10 — 11 —							19	M		SS	16				-	
12 — 13 — 14 —		uning to	up maist		- CO/	ARSE	48	М	X Z	SS	6				-	
15 - 16 -	SAND WITH SILT, fine g medium dense (SP-SM) (A	A-3)				LUVIUM	20	M T	R	SS	12					
17	SAND WITH GRAVEL, 1 brown, waterbearing, med (A-1-b)	ium dense (	SP-SM)		•		13	w		SS	12					
19 — 20 — 21 —	SAND, a little gravel, mec waterbearing (SP) (A-1-b)		l, brown,				13	w	Å	SS	10	-				
22 23	SAND WITH SILT, fine g waterbearing, medium der					•	21	w	Å	SS	12					
24 — 25 — 26 —	SAND, a little gravel, mec brown, waterbearing, loos	e (SP) (A-1-	-b)			•	10	W		SS	6					
27 — 28 — 29 —	SAND WITH GRAVEL, brownish gray, waterbeari (SP) (A-1-b)	ng, medium	dense				11	W	Ì	SS	6					
30 - 31 -	SAND, a little gravel, med brown, waterbearing, med (A-1-b)	lium grained ium dense (	d, grayish SP)		***	•	18	w	Ķ	SS	10					
DEF	PTH: DRILLING METHOD			WAT	ER L	EVEL MEA	ASUR	EMEN	ITS	ł		1	·	NOTE	REF	ER T
	-17' 3.25" HSA	DATE	TIME	SAMP DEP	LED TH	CASING DEPTH	CA	VE-IN EPTH	FI	DRILLI JUID LI	NG EVEL	WAT LEV	ER EL	THE A		
		10/7/13	11:36	18.		17.0		7.2	-	· .		16.		SHEE	TS FC	R AN
17-4	772 <b>KUF W/D</b> M	12:09	18		17.0		7.1	-			16.		EXPLA	NATI	ON C	
BORIN	IG LETED: 10/7/13	10/7/13	14.07	10.			*		+					TERMI	NOLC	GY C
									+-					TI	HIS LO	)G
DR: S	G LG: SHS Rig: 91C														01-1	



		Honn	epin Co. Coor	dinates	Ν	16022	3	Е	51750	7			
PTH							T				BORAT	ORY	TEST
N ET	MATERIA	L DESCRIPTION		GEOLO	GY N	MC	SAMI TYP	PLE REC E IN.	WC	DEN	LL		<b>‰-</b> #2
34 - dense	D WITH SILT, a l um grained, brown (SP-SM) (A-3)	, waterbearing, m	edium	COARSE ALLUVI (continue	UM   30	W	X s	S 12					
35 – SANI 36 – gray,	D, a little gravel, n waterbearing, mec	lium dense (SP) (A	A-1-b)		14	W	s s	S 10					
$\begin{array}{c} 38 \\ 38 \\ 20 \end{array}$		edium dense (SP-	SM)		26	W	s s	S 2					
40 - gravis	D WITH GRAVE sh brown, waterbe (A-1-b)	L, medium graine aring, medium der	d, nse		21	w	S s	S 12					
42 — 43 —					24	w	s s	S 10					
	D WITH GRAVE bearing, medium o				17	w	× s	SS 10					
47 — 48 —					13	W	X s	SS 10					
50 - water	D, fine grained, br bearing, medium o	ownish gray, lense (SP) (A-3)			24	w		SS 12					
51 - END	OF BORING												
						-							
	•	·											
		ł											
х. Х													



FILL, mostly gravelly sind, pieces of concrete, tace roots, dark brown (A-1-b)FILL, mostly sand with silt, a little gravel, sand with silt, brown (A-1-b)FILL, mostly gravelly sand with silt, a little gravel, brown (A-1-b)SS18MSS12FILL, mostly gravelly sand with silt, a little clavey gravelly gravelly sand with silt, a little clavey gravelly sand with silt, a little or clavey gravelly sand with silt, a little for mostly gravelly sand with silt, a little for mostly gravelly gravelly sand with silt, a little for mostly gravelly gravelly sand with silt, a little for mostly gravelly gravelly sand (GP-GM)FILL, mostly gravelly sand with silt, a little for mostly gravelly sand (GP-GM)SS12MSS12I3MSS12I310GRAVELLY SAND WITH SILT, a little gravel, medium dense (GP-GM)FILL, mostly gravelly gravelly gravel, medium to fine grained, dark gravy, waterbearing, medium dense (GP-GM)TIMESWAMP GRAVELSS1419I9WSS1020GRAVELLY SAND WITH SILT, a little gravel, medium dense (GP-GM)FILLFILLSS3IIIIIIIIIIIII <t< th=""><th>AET JO</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>RING N</th><th></th><th>1153</th><th>S ST</th><th>(p. 1</th><th>1 of</th><th>2)</th></t<>	AET JO										RING N		1153	S ST	(p. 1	1 of	2)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	PROJEC							-				-					
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	SURFA	CE ELEVATION: 869.2	I	Hennepin C	co. Coor	dinates:	N	15	<u>9749</u>	)		<u>E</u> :	1				
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	DEPTH IN FEET	MATERIAL I	DESCRIPTIO	N		GEOLOG	Y	N	MC	SA T	MPLE YPE			1	1		TEST %-#2
PLL, mostly sand with silt, a little gravel, slitly black8MXSS12FILL, mostly gravelly sand with silt, brown (A-1-b)13MSS10FILL, mostly gravelly sand with silt, brown (A-1-b)13MSS10FILL, mostly gravelly sand with silt, a little clayey sand, brown (A-1-b)24MSS8FILL, mostly gravelly sand with silt, a little clayey sand, brown (A-1-b)24MSS8FILL, mostly gravelly sand with silt, a little clayey sand, a little gravel, dark brown (A-6)9MSS12FILL, mostly gravelly sand with silt, a little brown (A-6)112MSS1213FILL, mostly gravelly sand with silt, a little brown (A-6)112MSS1213FILL, mostly gravelly sand with silt, a little brown (A-6)112MSS1213FILL, mostly gravelly sand with silt, a little brown in gray, stilf (CL) (A-7-6)11113MSS1878SANDY LEAN CLAY WITH GRAVEL, dark commin drase, a lens of silty sand (SP-SM) (A-1-b)11113MSS1419GRAVELLY SAND WITH SILT, gray, waterbearing, medium dense (SP)21WSS31419GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP-SM)21WSS1010DEPTHDRILLING METHODWATER LEVEL MEASUREMENTSNOTE: REFE024/2499/*RDF wIDM10/4/139:4026.024.5<		FILL, mostly gravelly silt concrete, trace roots, dark	y sand, piec brown (A-	ces of 1-b)		FILL		9	М	M	SS	18					
FILL, mostly gravelly sand with silt, brown (A-1-b)7FILL, mostly gravelly sand with gravel, brown (A-1-b)9FILL, mostly gravelly sand with silt, a little clayey sand, brown (A-1-b)11FILL, mostly gravelly sand with silt, a little brown (A-6)12MSS13MSS14FILL, mostly gravelly sand with silt, a little brown (A-6)15Henci peat, brown, a little dark brown (A-1-b)16If16If17ORGANIC CLAY, black, soft (OH) (A-8)18SANDY LEAN CLAY WITH GRAVEL, dark brownish gray, stiff (CL) (A-7-6)18GRAVELLY SAND WITH SILT, gray, 	3 —	sand and ashes/cinders, da			-			8	М	H	SS	12					
7       FILL, mostly silty sand with gravel, brown (A-1-b)       24       M       SS       8         9       FILL, mostly gravelly sand with silt, a little clayey sand, brown (A-1-b)       9       M       SS       12         11       FILL, mostly gravelly sand with silt, a little clayey sand, brown (A-6)       9       M       SS       12       13         12       FILL, mostly gravelly sand with silt, a little bemic peat, brown, a little dark brown (A-1-b)       9       M       SS       12       13         14       FILL, mostly gravelly sand with silt, a little bemic peat, brown, a little dark brown (A-1-b)       9       M       SS       12       13         16       ORGANIC CLAY, black, soft (OH) (A-8)       SWAMP       9       M       SS       18       78         18       GRAVELLY SAND WITH GRAVEL, dark brownish gray, stiff (CL) (A-7-6)       13       M       SS       6       14         20       GRAVELLY SAND WITH SILT, gray, (A-1-b)       12       W       SS       8       14       19         24       GRAVEL WITH SILT AND SAND, gray, waterbearing, medium dense (GP-GM)       21       W       SS       8       10         25       SAND WITH SILT, a little gravel, medium to m fine grained, dark gray, waterbearing, medium to m fine grained, dark gray, waterbearing, medium	5 —		d with silt,	brown				13	М	K	SS	10					
FILL, mostly gravelly sand with silt, a little       9       M       SS       12         FILL, mostly clayey sand, a little gravel, dark brown (A-6)       12       M       SS       12       13         FILL, mostly gravelly sand, a little gravel, dark brown (A-6)       12       M       SS       12       13         FILL, mostly gravelly sand, a little gravel, dark brown (A-6)       12       M       SS       12       13         M       SS       12       13       M       SS       12       13         M       SS       12       13       M       SS       12       13         M       SS       14       19       19       SANDY LEAN CLAY WITH GRAVEL, dark obrownish gray, stiff (CL) (A-7-6)       11       13       M       SS       14       19         20       GRAVELLY SAND WITH SILT, gray, medium dense, a lens of silty sand (SP-SM)       11       13       M       SS       3       14       19         24       GRAVEL WITH SILT AND SAND, gray, waterbearing, medium dense (SP)       21       W       SS       8       10         25       SAND WITH SILT, a little gravel, medium dense (SP-SM) (A-1-b)       WATER LEVEL MEXUREMENT       NOTE: REFE         24/4-49%'       SS       DATE	7 -		ith gravel, l	orown				24	М		SS	8					
FILL, mostly clayey sand, a little gravel, dark brown (A-6)       12       M       SS       12       13         IA       FILL, mostly gravelly sand with silt, a little hemic peat, brown, a little dark brown (A-1-b)       9       M       SS       12       13         IA       FILL, mostly gravelly sand with silt, a little hemic peat, brown, a little dark brown (A-1-b)       9       M       SS       12       13         IA       ORGANIC CLAY, black, soft (OH) (A-8)       Image: SwaMP DEPOSIT       3       M       SS       18       78         IA       brownish gray, stiff (CL) (A-7-6)       Image: Site stift sand (SP-SM) (A-1-b)       Image: Site stift sand stift sand (SP-SM) (A-1-b)       Image: Site stift sand stift	10 —			a little				9	М		SS	12	-				
FILL, mostly gravely sand with sit, a fittle       9       M       SS       12         16       hemic peat, brown, a little dark brown (A-1-b)       9       M       SS       12         16       ORGANIC CLAY, black, soft (OH) (A-8)       SWAMP       3       M       SS       18       78         18       ORGANIC CLAY, black, soft (OH) (A-8)       SWAMP       3       M       SS       18       78         19       SANDY LEAN CLAY WITH GRAVEL, dark       TILL       13       M       SS       14       19         20       brownish gray, stiff (CL) (A-7-6)       TILL       13       M       SS       6         21       GRAVELLY SAND WITH SILT, gray, medium dense, a lens of silty sand (SP-SM)       COARSE       12       W       SS       6         24       GRAVEL WITH SILT, and the gravel, medium dense (GP-GM)       21       W       SS       8       3         25       waterbearing, medium dense (SP)       21       W       SS       8       10       19       W       SS       8       10         26	13 —		, a little gra	vel, dark				12	M		SS	12	13				-
0RGANIC CLAY, black, soft (OH) (A-8)       SWAMP         18       DEPOSIT       3       M       SS       18       78         19       SANDY LEAN CLAY WITH GRAVEL, dark       TILL       13       M       SS       14       19         20       brownish gray, stiff (CL) (A-7-6)       13       M       SS       14       19         21       GRAVELLY SAND WITH SILT, gray, (A-1-b)       GRAVEL WITH SILT AND SAND, gray, waterbearing, medium dense (GP-GM)       12       W       SS       6       14         24       GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP)       21       W       SS       8       14         25       GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP)       21       W       SS       8       14         26       GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP)       21       W       SS       8       14         29       SAND WITH SILT, a little gravel, medium 31       19       W       SS       10       14         24       GRAVELLY SAND, and the gravel, medium 31       10/4/13       9:13       18.5       17.0       17.0       Nore       14         24       V       SS       10       10/4/13       9:13	15 —	FILL, mostly gravelly san hemic peat, brown, a little	d with silt, dark brow	a little n (A-1-b)		-		9	M		SS	12					
20       brownish gray, stiff (CL) (A-7-6)       13       IILL       13       M       SS       14       19         21       - <td< td=""><td>18 —</td><td>ORGANIC CLAY, black,</td><td>soft (OH)</td><td>(A-8)</td><td></td><td></td><td></td><td>3</td><td>M</td><td>ł</td><td>SS</td><td>18</td><td>78</td><td></td><td>-</td><td></td><td></td></td<>	18 —	ORGANIC CLAY, black,	soft (OH)	(A-8)				3	M	ł	SS	18	78		-		
GRAVELLY SAND WITH SILT, gray, medium dense, a lens of silty sand (SP-SM) (A-1-b)       I2       W       SS       6         GRAVEL WITH SILT AND SAND, gray, waterbearing, medium dense (GP-GM)       I2       W       SS       6         GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP)       I1       W       SS       8         GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP)       I2       W       SS       8         SAND WITH SILT, a little gravel, medium to fine grained, dark gray, waterbearing, medium dense (SP-SM) (A-1-b)       I1       I9       W       SS       10         DEPTH:       DRILLING METHOD       V       VATER LEVEL MEASUREMENTS       NOTE: REFE         0-24½'       3.25" HSA       DATE       TIME       SAMPLED DEPTH       CASING DEPTH       DEPTH       DEPTH       DEPTH       None         24½-49½'       RDF w/DM       10/4/13       9:13       18.5       17.0       17.0       None       SHEETS FOR EXPLANATIO         CMNG COMPLETED:       10/4/13       9:40       26.0       24.5       24.0       20.0       THS LOW	20 —			VEL, dark		TILL		13	M	ł	SS	14	19	-			
24       GRAVEL WITH SILT AND SAND, gray, waterbearing, medium dense (GP-GM)       21       W       SS       3         26       - <td>23 —</td> <td>medium dense, a lens of s</td> <td></td> <td></td> <td></td> <td>COARSE ALLUVIU</td> <td>ЛМ</td> <td>12</td> <td>W</td> <td>ł</td> <td>SS</td> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td>	23 —	medium dense, a lens of s				COARSE ALLUVIU	ЛМ	12	W	ł	SS	6					
27       GRAVELLY SAND, medium grained, gray, waterbearing, medium dense (SP)       22       W       SS       8       1       1         29       SAND WITH SILT, a little gravel, medium to fine grained, dark gray, waterbearing, medium dense (SP-SM) (A-1-b)       19       W       SS       10       19       W       SS       10       10       NOTE: REFE         0-24½'       3.25" HSA       DATE       TIME       SAMPLED DEPTH       CASING DEPTH       DRILLING WATER       NOTE: REFE       THE ATTAC         24½-49½'       RDF w/DM       10/4/13       9:13       18.5       17.0       17.0       None       SHEETS FOR         BORING COMPLETED:       10/4/13       9:40       26.0       24.5       24.0       20.0       THINIOLOC	25 —	GRAVEL WITH SILT A						21	W	ł	SS	3					
30 - fine grained, dark gray, waterbearing, medium to dense (SP-SM) (A-1-b)       19       W       SS       10       NOTE: REFE         31 - DEPTH:       DRILLING METHOD       VATER LEVEL MEASUREMENTS       NOTE: REFE       NOTE: REFE         0-24½'       3.25'' HSA       DATE       TIME       SAMPLED DEPTH       CASING DEPTH       DEPTH       DRILLING WATER LEVEL MEASUREMENTS       NOTE: REFE         24½-49½'       RDF w/DM       10/4/13       9:13       18.5       17.0       17.0       None       SHEETS FOR         BORING COMPLETED:       10/4/13       9:40       26.0       24.5       24.0       20.0       THE ANTACO	28 —			ed, gray,				22	W	Å	SS	8					
0-24½' 3.25" HSA         DATE         TIME         SAMPLED DEPTH         CASING DEPTH         DRILLING DEPTH         WATER LEVEL         THE ATTAC           24½-49½' RDF w/DM         10/4/13         9:13         18.5         *17.0         17.0         None         SHEETS FOR           BORING COMPLETED: 10/4/13         10/4/13         9:40         26.0         24.5         24.0         20.0         THERMINOLOGY	30 —	fine grained, dark gray, w						19	W	Ķ	SS	10					
0-24½' 3.25" HSA         DATE         TIME         SAMPLED DEPTH         CASING DEPTH         DRILLING LEVEL         WATER LEVEL         THE ATTAC           24½-49½' RDF w/DM         10/4/13         9:13         18.5         '17.0         17.0         None         SHEETS FOR           BORING COMPLETED: 10/4/13         10/4/13         9:40         26.0         24.5         24.0         20.0         THERMINOLOGY	ייזרו							יםסו	MENT	1 <u>( 1</u> TS		I	I	L			
24½-49½'         RDF w/DM         10/4/13         9:13         18.5         17.0         17.0         None         SHEETS FOR           24½-49½'         RDF w/DM         10/4/13         9:17         26.0         24.5         24.6         20.5         EXPLANATIO           BORING COMPLETED:         10/4/13         9:40         26.0         24.5         24.0         20.0         TERMINOLOO	DEP	TH: DKILLING METHOD			r · · · · ·					1	יידוסר	NG	<b>W</b> 4 TT	- n			
24½-49½' RDF w/DM         10/4/13         9:13         18.5         17.0         17.0         None         SHEETS FOR           10/4/13         9:17         26.0         24.5         24.6         20.5         EXPLANATIO           BORING COMPLETED:         10/4/13         9:40         26.0         24.5         24.0         20.0         TERMINOLOG	0-2-	4½' 3.25" HSA	DATE	TIME	DEPT	H DEP		DEP	E-IIN PTH	FL	UID LE	VEL	LEVE	EL			
10/4/13         9:17         26.0         24.5         24.6         20.5         EXPLANATION           BORING COMPLETED:         10/4/13         9:40         26.0         24.5         24.0         20.0         TERMINOLOO			10/4/13	9:13	18.	5 17.	0	17	.0				Non	e	SHEE	TS FO	RAN
COMPLETED:         10/4/13         10/4/13         9.40         20.0         24.3         24.0         20.0		A42	10/4/13	9:17	26.	0 24.	5	24	.6				20.5	,			
THISLO	BORIN	IG LETED: 10/4/13	10/4/13	9:40	26.	0 24.	5	24	.0				20.0	<b>)</b> T			•
DR: JM LG: SHS Rig: 1C															TH	IIS LC	G



1101 001	3 NO: .	01-05697									ORING N			ST	<u>vp. 4</u>		-)
PROJEC	T:	Southwest	t Light R	ail Transi	t Projec	t, Pl	EC East	; Ho	pkin	s to	Minn	eapol	lis		-		
•	-	•		Hennep	in Co. Coo	rdinat	es:	N	1597	49		E É	51711	1			
DEPTH	•						AFOI OON				SAMPLE	REC	FIELD	) & LAI	BORAT	ORY	TES
DEPTH IN FEET		MAIE	RIAL DESC	RIPTION			GEOLOGY		M		TYPE	IN.	WC	DEN	LL	PL	<b>%-</b> #
	GRAV	EL WITH SI	LT AND S	AND, gray,		= C ■ Δ	OARSE LLUVIUN	1 2	3 W	, \	ss	12					1
33 -	(A-1-b	earing, mediu	m dense to	dense (GP-0	(IVI) ⊨		continued)	1 -		K							
34 -										K	ł						
35 — 36 —					=	<b>⇒</b>		30	5   W		SS .	12					
30 -									ŀ	2							
37 -	SAND	), a little grave	l. medium	to fine grain		<u>₽</u>		2	7   W	/ \	ss	10					
	brown	, waterbearing	, medium (	dense (SP)						Ь	1.						
40 -	\(A-1-b SAND	) ) WITH GRA	VEL medi	um to coarse	/					. (							
41 -	graine	d, dark gray, v	vaterbearin	ig, medium d	ense			2'	7   W	′ - [2	ss	10					
42	(SP) (4	·								2	4						
43 -	SAND light b	), a little grave rown, waterbe	el, medium earing, med	to fine grain lium dense,	ed,			2	5   W	$\left \right\rangle$	ss	12	-				
44 🕂	lamina	ations of lean of	clay (SP) (A	A-1-b)						5	Ĵ					•	
45 —	SANL brown	WITH GRA , waterbearing	vel, medi g, medium	dense (SP)				2	5 W	, 1	ss	12					
46 —	(A-1-t									K		12		-			
47 -	SAND	), a little grave	el medium	to fine grain	ed i					. (	4						
48 —	brown	, a little gray,	waterbeari	ng, dense, le	nses			3	5   W	$^{\prime}$	ss	10					
49 —		n clay (SP) (A D, fine grained		rown				·.		2	4						
50 —	waterb	bearing, mediu	ım dense, l	aminations o	f			2	7   V	/ )	ss	· 10					
51 -		m grained san		3)		<u>: .:</u>				$\uparrow$							
	2																
												-					
													- -				
	· ·																
r																	
* .		·															
							•										
				,	·			-								· .	
	,																
						·			· .							01-E	L



AET JO	B NO: 01-05697					LO	G OF I	BOF	RING N	0.	1154	ST	<b>(p.</b> 1	lof	2)
PROJEC	CT: Southwest Ligh	t Rail Tr	ansit Pro	ject, l	PEC East; ]	Hopl	cins t	to I	Minn	eapo	lis				
SURFAC	CE ELEVATION:871.8	H	Iennepin Co.	Coordin	ates: <u>N</u>	1	59372	2		E :	51679				
DEPTH IN FEET	MATERIAL I	DESCRIPTIO	N		GEOLOGY	N	мс	SA T	MPLE YPE	REC IN	FIELD WC	D & LA	BORAT	I	TESTS
1 -	FILL, mostly clayey sand v little gravel, trace roots, bla				FILL	25	М	M	SS	6	13				
2	FILL, mostly gravelly silty trace roots, brown (A-1-b)	sand, piece	es of wood,			28	М	$\bigwedge$	SS	8		_			
4 5 6	GRAVELLY SAND WITT medium grained, brown, m (SP-SM) (A-1-b)	H SILT, fin oist, mediu	e to m dense		COARSE ALLUVIUM	26	м		SS	10					
7 — 8 — 9 —	SAND WITH SILT AND medium grained, grayish b dense (SP-SM)	rown, mois	t, medium			26	М	13 	SS	12					
10 — 11 —	SAND WITH SILT AND medium grained, brown to dense (SP-SM) (A-1-b)					33	M	2	SS	10					
12 — 13 — 14 —	SAND, fine grained, light	huonum a lit	ttla brown			47	М	2	SS -	14					
15	Market (A-3)					20	M		SS	16					
17 — 18 — 19 —						19	M		SS	14					
20 - 21 -	SAND, a little gravel, fine light brown, moist, mediur of silt (SP) (A-3)	n dense, lar	ninations			27	M V	R R	SS	12					
22 - 23 -	SAND, a little gravel, med brown, waterbearing, med (A-1-b)					21	w		SS	12					
24 - 25 - 26 -	GRAVELLY SAND, med brown, waterbearing, med (A-1-b)	ium graineo ium dense (	d, light (SP)			29	w	Å	SS	6	•				
27 – 28 – 29 –	SAND WITH SILT, fine g waterbearing, medium den			,		23	-	Ķ	SS	0					
25 - 25 - 26 - 27 - 28 - 27 - 28 - 29 - 29 - 28 - 29 - 29 - 29 - 29						21	w	Ŕ	SS	12					
5 DEI	PTH: DRILLING METHOD			WAT	ER LEVEL ME.	ASUR	EMEN	TS	L	-l		-	NOTE:	REF	ER TO
	-22' 3.25" HSA	DATE	TIME	SAMPI DEPT	LED CASING H DEPTH	CA	VE-IN PTH	FI	DRILLI JUID LI	NG EVEL	WAT LEVI	ER EL	THE A		
22-4		10/8/13	11:37	23.5			2.0	1			21.		SHEE	TS FO	R AN
		10/8/12	12:00	23.		-	1.5				22.		EXPLA	NATI	ON OF
0 22-4 RORINATION OF COMP	NG PLETED: 10/8/13												TERMI	NOLO	GY OI
$\mathbf{S} = \mathbf{COMP}$ $\mathbf{W} = \mathbf{DR}; \mathbf{S}$								1					Tŀ	IIS LO	)G
W DR: 5		1			1					I		l		01-I	OHR-(



AET JO	B NO:	01-05697				LO	G OF I	BORII	NG NO	•	1154	ST	(p. 2	c of 2	2)
PROJEC	CT:	Southwest Light Rail T	'ransit Proje	ct, ]	PEC East; F				inne				-		
	· · ·		Hennepin Co. Coo	ordin	ates: N	1:	59372	<u> </u>	<u> </u>		51679				
DEPTH IN FEET		MATERIAL DESCRIPTI	ON		GEOLOGY	Ν	MC	SAM TY	PLE PE	REC IN,	FIELL WC	0 & LAI DEN	LL		rests %-#20
33 — 34 —	SAND waterb (contin	WITH SILT, fine grained, br earing, medium dense (SP-SN nued)	rown to gray, A) (A-3)		COARSE ALLUVIUM (continued)	26	<b>W</b>	X	SS	14					
35 - 36 -						23	W	Å	SS	12					
37 - 38 - 39 -	SAND dense	Y SILT, gray to grayish brow (ML) (A-4)	n, wet, very		FINE ALLUVIUM	64	W	X	SS	14	20		-		
40 - 41 -			• • • •			68	w	Ă.	SS	12	20				
42 - 43 -	SAND waterb	, fine grained, grayish brown, bearing, dense (SP) (A-3)			COARSE ALLUVIUM	49	w	Å	SS	14					
44 — 45 — 46 —	SILTY (A-4)	CLAY, grayish brown, hard	(CL-ML)		FINE ALLUVIUM	57	М	Å	ss	12	20			÷	
47 — 48 —	SANE waterb	), fine to medium grained, bro bearing, medium dense (SP) (A	wn, A-3)	<u> </u>	COARSE ALLUVIUM	23	w	X	SS	14					
49 — 50 — 51 —	graine	WITH GRAVEL, medium to d, brown, waterbearing, mediu A-1-b)	o coarse um dense			13	w	X	SS	4					
	END	OF BORING													
	e K									•				-	
•															-
					n I										

03/2011



AET JO	B NO: <b>01-05697</b>								NG N(			51	(p. 1	<b>ot</b> 2	2)
PROJEC	077.0					-						2			
	CE ELEVATION: 875.2	H	lennepin Co.	Coordinat	es: <u>N</u>		58307	<u>`````````````````````````````````````</u>		3 :	51616				TECT
DEPTH IN FEET	MATERIAL	DESCRIPTIO	N		GEOLOGY	N	MC	SAN TY	APLE PE	REC IN.	WC	DEN	BORAT		1ES %-#
1 -	FILL, mostly silty sand w possible cobbles, trace roo	ith organic fi ots, dark brov	ines, wn (A-2-4)		ILL ·	28	М	$\mathbf{X}^{-}$	ŚS	2					
2 <del>-</del> 3 -	FILL, mostly sand with si roots, light brown (A-3)	lt, a little gra	vel, trace			15	М	Å	SS	7				T	
4 — 5 — 6 —	FILL, mostly silty sand w dark brown (A-1-b)	ith gravel, tra	ace roots,			25	М		SS	6		-			
7	FILL, mostly gravelly silt cobbles, grayish brown (A		ble			75/.9	М		SS	6					
9 10 11	SAND WITH SILT, fine	grained, ligh	t grayish		COARSE	38	М		SS	0					
12 — 13 —	brown, a little light brown of silt (SP-SM) (A-3) (po		se, a lens		DR FILL	32	M		SS	7					
14 — 15 — 16 —	SILTY SAND, fine grain medium dense, a lens of s				COARSE	19	М		SS	13		-			
17 — 18 —	SILT, light brown, moist, laminations of silty sand (		ise,		TINE ALLUVIUM	17	М		SS	15	23				
19 20 21	LEAN CLAY, brown, ve silty sand (CL) (A-4)	ry stiff, lamin	nations of			20	М		SS .	15	26				
22 — 23 —	SAND, fine to medium gr moist to waterbearing, me (SP) (A-3)				COARSE ALLUVIUM	18	M		SS	12		-			
24 — 25 — 26 —	-					8	M <del>/</del> W		SS	15					
27 — 28 —	SAND, fine grained, ligh very loose to medium der					2	w		SS	15					
29 30 31					-	15	w		SS	13					
·····								1 <u>(                                    </u>							
DEF	PTH: DRILLING METHOD				R LEVEL ME			1			WAT		NOTE:		
0.	-29' 3.25" HSA	DATE	TIME	SAMPLE DEPTH	ED CASING		/E <b>-</b> IN PTH	FLU	RILLI ЛD LE	VEL	WAT LEVI	EK EL	THE A	TTAC	CHE
29-4		10/11/13	12:55	26.0	24.5	2	4.7				Non	e	SHEE	rs fo	R A
<u></u> =		10/11/13	1:15	28.5	27.0	2	6.4	1			26.	0	EXPLA	NATI	ON (
BORIN	NG LETED: 10/11/13	10/11/12	1:30	28.5	27.0		6.0	1			25.		ERMI	VOLO	GY
COM															

03/2011



	Hennepin Co. C	oordi	nates: N	1	58307		E :	51616	3			
EPTH	· · · · · · · · · · · · · · · · · · ·		GEOLOGY	NT		SAMPLE	REC	FIELD	) & LAI	BORAT	ORY 7	rest
EPTH IN EET	MATERIAL DESCRIPTION			N	MC	TYPE	IN.	WC	DEN	LL	PL	<b>%-</b> #2
33 —	LEAN CLAY, brownish, gray, stiff, laminations of silt (CL) (A-7-6) <i>(continued)</i>		FINE ALLUVIUM (continued)	11	M/W	ss	18	26				
34 — 35 — 36 —	SILTY CLAY, brownish gray, very stiff (CL-ML) (A-4)			29	M/W	ss	8	20				
37 — 38 —	SAND, fine grained, grayish brown, waterbearing, dense (SP) (A-3)		COARSE ALLUVIUM	42	w	ss	13					
39 40 41	SAND, fine to medium grained, grayish brown, a little brown, waterbearing, medium dense, laminations of silty sand around $42\frac{1}{2}$ (SP) (A-3)			27	w	ss	13					
42 — 43 —			· · · ·	21	W	ss	12					
44 — 45 — 46 —	SILTY SAND, fine grained, grayish brown, wet, medium dense, laminations of sand with silt (SM) (A-2-4)			25	W	ss	13					
47 48	SAND, a little gravel, fine to medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)			27	w	ss	15					
49 - 50 -	SAND, medium grained, brownish gray, waterbearing, medium dense (SP) (A-1-b)			22	w	ss	10					
51 —	END OF BORING											
											-	
										•		
									-			
				-								
		-										



AET JO	OB NO:	01-05697						LO	G OF I	30R	UNG NO	Э.	1156	ST	<b>(p.</b> ]	l of	2)
PROJE	CT:	Southwest Light	t Rail Tra	ansit Pro	ject, ]	PEC	East; H	lopk	tins t	o I	Ainne	eapol	lis			.`	
SURFA	CE ELEV	ATION: 871.3	Н	ennepin Co.	Coordir	ates:	<u>N</u>	15	57802		]	E Ś	51591				
DEPTH IN FEET		MATERIAL D	ESCRIPTION	٧		GEO	LOGY	N	МС	SA T	MPLE YPE	REC IN.	FIELI WC	) & LA DEN	BORA1		TESTS %-#200
1 - 2 -	+ clayey	mostly sand with silt sand with organic fir and dark brown (A-1	nes, trace ro			FILL		15	М		SS	18					
3 -	ashes/	mostly silty sand with cinders, black (A-1-b mostly clayey sand w	)					24	М	X स	SS	7	6				
4 - 5 - 6 -	LEAN	s, brown (A-2-6) CLAY, trace roots, I f, laminations of silt (	brown mott			FINE ALLU	VIUM	8	M		SS	13	32				
7 - 8 - 9 -								9	М		SS	13	37				
10 - 11 -							· .	7	М	X	SS	17	40				
12 -		Y CLAY, trace roots, ations of silt (CL-ML		tled, soft,				4	M/W	Ц К К	SS	18	32				×
14 - 15 - 16 -	SILT,	, gray and brown, wet	, loose (ML	L) (A-4)				5	<b>₩</b>		SS	13	32				
17 -	mottle	D WITH SILT, fine g ed, waterbearing, loos	e (SP-SM)	(A-3)			JVIUM	9	Ŵ	R R R	SS	14					
19 - 20 - 21 -	- (A-4)					FINE	JVIUM	9	w		SS	16	31				
22 - 23 -	– SILT	WITH SAND, gray,	wet, loose (	(ML) (A-4	)			8	W	X	SS	13	33				
24 25 25 26								5	W		SS	13	25				
27 28 28 29	FAT	CLAY, gray, soft to f CH) (A-7-6)	īrm, lamina	ations of				4	-	X	SS	0					
25 - 25 - 26 - 27 - 28 - 28	_							· 5	M/W		SS	18	38		-		
5 DI	 EPTH:	DRILLING METHOD			WAT	ER LE	VEL MEA	SUR	EMEN	ITS					NOTE	: REF	ER TO
VTES			DATE	TIME	SAMP	LED	CASING DEPTH	CA	VE-IN EPTH	FI	DRILLI JUID LI	NG EVEL	WA1 LEV	ER	THE	ATTA	CHED
		3.25" HSA	10/9/13	11:52	21.		19.5		<b>8.7</b>			_,,,,,,	17.		SHEE	ETS FO	DR AN
<sup>19</sup> / <sub>2</sub> -	-491/2'	RDF w/DM	10/9/13	12:11	21.		19.5	·	7.0				16		EXPLA	ANAT	ION OF
S BOR	ING IPLETED:	10/9/13	10/2/10			-		+		+	•				TERMI	NOLO	OGY ON
S COM		<b>SB</b> Rig: 91C		1						1					T	HIS LO	ŊĠ
₹L_ <u>DR</u>			L	1	L					<b>I</b>				ł.		01-	DHR-0

03/2011



	3 NO:	01-05697 Southwest Light	Rail Trancit Pro	niect	PEC East.			BORING N to Minn		<u>1156</u> olis				Arran (1)
PROJEC	1:	Southwest Light	Hennepin Co				57802			51591	3			·····
				0. 0001			T				) & LA	BORAT	FORY	TES
DEPTH IN FEET		MATERIAL DE	SCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	1
33 -	FAT C silt (C	CLAY, gray, soft to fir H) (A-7-6) <i>(continued</i> )	m, laminations of )			3	M/W	ss	18	39			•	
34 —		· ·						$\sum$		-				
35 —			•			4	M/W	ss 🕅	18	41				
36 -								$\overline{)}$						
37 -			• •											
38 -						5	M/W	X ss	18	39				
39 —			-					4						
40 —						6	M/W	ss	18	39				
41 -								, , , , ,						
42 —					:	5	M/W	ss	18	37				
43 —								A $33$	10					
44 -														
45 —						4	M/W	X ss	18	37				
46 -								$\sum$						
47 -						12	M/W	ss 🕅	18	29				
48	SANI	WITH SILT, medium waterbearing, medium	n to fine grained,		COARSE ALLUVIUM			)						
49 50 -	(SP-S	M) (A-1-b)	401150 10 10050			7	w	X ss	0					Ì
· 51 -		OFDODDIC				7	<b>VV</b>	<u> </u>						
	END	OF BORING												
											•	÷.,		
		•	· · · · ·											
										-				
÷														
		•											-	
		• •	• •		-									



AET JO	B NO: <b>01-05697</b>						LO	G OF I	BOR	ING N	D	1157	ST	<b>(p.</b> ]	lof	2)
PROJEC	CT: Southwest Light	t Rail Tra	ansit Pro	ject, ]	PEC	C East; F	Iopk	ins (	to I	Ainne	eapol	is				
	CE ELEVATION: <b>873.1</b>		ennepin Co.			<u>N</u>		57443				51559	6			
DEPTH IN FEET	MATERIAL D	ESCRIPTION	N .		GE	OLOGY	N	мс	SA T	MPLE YPE	REC IN.	FIELI WC	D & LA	BORAT		FESTS %-#200
1	FILL, mixture of silty sand clayey sand with organic fin and dark brown (A-1-b, A-2	nes, trace ro	l and bots, black		FILI		18	M	M	SS	6					
2	FILL, mostly sand with silt, grayish brown (A-3)		vel, light				8	М	N R	SS	5					
4	FILL, mostly sand with silt (A-1-b)	and gravel,	, brown				5	M	Å	SS	<b>5</b>					
7	FILL, mostly silty sand with with silt, trace roots, dark b (A-2-4)	h gravel, a rown, a litt	little sand le brown				12	M		SS	8		-			
9 10 11	FILL, mostly sand with silt clayey sand with organic fir black (A-1-b)	and gravel nes, brown,	, a little , a little				12	М		SS	4					
12 13	FILL, mostly clayey sand, a roots, dark brown (A-6)	a little grave	el, trace				15	М	H K K	SS	4	11				
14 15 16	FILL, mostly gravelly sand	, light brow	vn (A-1-b)				31	М	R R R	SS	5	-				
17 -	FILL, mostly sand with silt (A-1-b)	and gravel	, brown				23	N/W	R K	SS	12					
19 - 20 - 21 -	SILTY CLAY, grayish bro (A-4)	wn, soft (C	L-ML)		FIN ALI	E LUVIUM	3	M/W		SS	17	37				
22 - 23 -	SILT, gray, wet, loose (MI	L) (A-4)					6	W		SS	16	38				
24 - 25 - 25 - 26 - 26 - 26 - 26 - 26 - 26	SILTY SAND, fine graine loose (SM) (A-4)	d, dark gray	y, wet, very			ARSE LUVIUM	3	w	H H	SS	18					
25 - 26 - 27 - 27 - 28 - 29 - 29 - 29 - 29 - 30 - 31 - 31 - 31 - 31 - 31 - 31 - 31	SAND WITH SILT, possil grained, gray, waterbearing (SP-SM)	ole cobbles g, medium o	, fine lense				13	w	Ķ	SS	10					
29 - 29 - 30 - 29 - 31 -					•••••••••••		16	w	Ķ	SS	10					
1990-				<u>іііі</u> тауд	EB I	EVEL MEA		EMEN			.1	<u> </u>				
S DE	PTH: DRILLING METHOD	DATE	TIME	SAMP		CASING DEPTH	1	VE-IN	-	DRILLI JUID LI	NG	WAT LEV	ER	NOTE	: REF. ATTA	
END 0-2	24 <sup>1</sup> / <sub>2</sub> ' 3.25" HSA	DATE							FL	JUID LI	SVEL				TS FC	
	2-41' RDF w/DM	10/9/13 10/10/13	2:25	26.		24.5		$\frac{2.1}{0.8}$				<u>21.</u>				ON OF
S ≥ BORII	NG	8:00	26.	.0	24.5		0.8	+			18.				GY ON	
	PLETED: 10/9/13														HIS LO	
DR: S	SG LG: SB Rig: 91C					·										DHR-0



ROJEC				2					pin Co					Ň		57443				51559	6			
PTH					DEG	CDID												MPLE	REC	FIELI	) & LA	BORAT	ORY	TESTS
EPTH IN EET			MAI	ERIAL	, DES	CRIP	HON	N .				GE	OLO	JI JI	N	MC	Ĩ	MPLE YPE	ĪN.	WC	DEN	LL	PL	<b>%-</b> #2
33 -															17	w	Д	SS	13					
34 — 35 —	FAT lamin	CLAY,	gray, of lean	a little clay a	darl and v	c gray vaterł	y, fir bear	m to ing s	o sof sand	Ì,		FINI ALL	E UVII	ЛМ	5	M/W	X	SS	18	49				
36 - 37 -	(CH)	(A-7-6	)						,						_				10					
38 — 39 —	·	•				×									3	M/W	Å	SS	18	46			÷ .	
40 - 41 -		0000				•									4	M/W	X	SS	18	40				
	END	OF BO	ORINO	<b>ў</b>																				-
													•											
												-							×					
												-			•									-
2																								
															-									
·.																						-		
												-												
								÷	•												1.1			
					÷													-						
											- N.													
	•	•							,															
		,																			-			



AET JOI						1				RING N			SV	<b>(p.</b> ]	lof	3)
PROJEC																
	E ELEVATION: <b>873.0</b>	H	lennepin Co	o. Coor	dinates:	<u>N</u>	1:	57440	)		E É	51558		DOD 1/	CODV	
DEPTH IN FEET	MATERIAL I	DESCRIPTIO	N		GEOLOO	GY	N	MC	SA T	MPLE YPE	REC IN.	WC	DEN	BORA		T
1 2	FILL, mostly clayey sand, little gravel and silty sand, brown (A-2-6, A-2-4)				FILL		6	M	X	SS	14					
3 <del>-</del> 4 - 5 -	FILL, mostly sand, a little and silty sand, pieces of w brown, a little black (A-1-	ood, trace ro					5 7	M M		SS SS	12 4					
6 - 7 - 8 -							7	М	ł	SS	8					
9	FILL, mostly clayey sand, roots, brown and dark brown	a little grav wn (A-6)	el, trace				7	М		SS	14	13				
12 - 13 - 14 -	FILL, mostly sand with sil little dark brown (A-1-b)	t and gravel	, brown, a				6	М		SS	10					
15 — 16 —							22	<b>₩</b> _		SS	10					
17	SILT, brown, wet, loose (l LEAN CLAY, light grayis		little		FINE ALLUVIU	JM	9	W		SS	14	34				
20 - 21 - 22 -	SILTY CLAY, gray, soft	of silt (CL) (	A-4)				8	M/W		SS	18	37				
23 – 24 –	SAND WITH SILT. fine	grained, grav	V.		COARSE		4	М	X	SS	18	35				
25 - 26 - 27 -	waterbearing, medium der SANDY SILT, gray, wet,				ALLUVIU		12	w	X	SS	6					
28 - 29 -	SILTY SAND, fine graine	ed, gray, we	t, loose		ALLUVI		8	W	X	SS	12	31				
30 - 31 -	(SM) (A-4)	1			ALLUVI		8	W	X	SS	16					
DEP	TH: DRILLING METHOD	ļ	· · ·		ER LEVEL				· · · · · ·					NOTE:	REF	ER 1
0-	49' 3.25'' HSA	DATE	TIME	SAMPI DEPT	LED CAS TH DEP	ING 'TH	CAV DE	/E-IN PTH	FL	DRILLI UID LE	NG EVEL	WAT LEVI	ER EL	THE A		
49-99	9½' RDF w/DM	5/14/14	9:36	21.	0 19	.5	19	9.5				18.		SHEE		
BORIN	G	5/14/14	9:48	21.	0 19	.5	1	9.0				16.	4	EXPLA ERMIÌ		
COMPI	G LETED: <b>5/15/14</b>												1		IIS LC	
DR: S	G LG: CD Rig: 91C													11:	us lu	U'



AET JO	B NO: 01-05697			LC	OG OF	BO	RING N	IO	1230	SV	(p. 2	2 of	3)
PROJEC	CT: Southwest Light Rail Transit Proj	ect,	PEC East; l	Hopl	kins	to ]	Minn	eapo	lis				
	Hennepin Co.	Coor	rdinates: <u>N</u>	1	5744	)		E :	51558	•			
DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SA	MPLE TYPE	REC		) & LA		· · · · · ·	T
FEET	CHITY CAND Fire proined group wat loose	1.1.1.	COARSE		<u> </u>			118.	WC	DEN	LL	PL	<b>%-</b> #20
33 —	SILTY SAND, fine grained, gray, wet, loose (SM) (A-4) <i>(continued)</i>		ALLUVIUM	6	W	М	SS	18					
34 —	LEAN CLAY, gray, firm (CL/CH) (A-7-6)		(continued) FINE			3							
35 —			ALLUVIUM	6	Μ	M	SS	18	41				
36 —	PATEORAN PULL 11 14					Ł							
37 —	FAT CLAY, gray, a little light grayish brown, firm, laminations of silt (CH) (A-7-6)			8	М	$\square$	SS	18	43				
38 -						A	00						
39 — 40 —						붠							
40				6	M	Å	SS	18	28				
42	LEAN CLAY, gray, stiff, laminations of sand					I							
43 —	(CL) (A-6)			15	M	Х	SS	16	20				
44 —	SANDY LEAN CLAY, gray, very stiff, a lens of		TILL			Ł							
45 —	waterbearing gravelly sand at 45' (CL) (A-6)		TILL	17	M/W	γM	SS	18	18				
46 —						मि							
47 —	CLAYEY SAND, a little gravel, trace roots, brownish gray, a little black, very stiff to hard, a				N	R	SS	10	07				
48 —	lamination of organic clay at $47\frac{1}{2}$ (SC) (A-6)			20	M	$\square$	22	18	27				
49 —						Į.							
50 -				27	M	Х	SS	18	15				
51 -						$\sum$							
52 -						$\left \right\rangle$	-						
53 54						$\left \right\rangle$							
55 -						$\flat$	00	10	177				
56 -				24	M	Ą	SS	18	17				
						K							
58 -						K							
59 -	· · · ·					2							
60 -				32	M	$\mathbf{N}$	SS	12	17				
61 -						6	-						
62 -						$\left \right\rangle$	1						
63 -	SAND WITH SILT AND GRAVEL, fine to		COARSE			5	1						
64 -	medium grained, brown, waterbearing, medium dense (SP-SM) (A-1-b)		ALLUVIUM			$\left  \left( \right) \right $							
65 -	uchise (SF-SIVI) (A-1-0)			30	W	X	SS	8					
66 -						$\sum$							
67 -			•			$\left \right\rangle$	ĺ						
68 -	GRAVEL WITH SAND, brown, moist, very		-			$\left \right\rangle$			1				
57 - 58 - 59 - 59 - 60 - 61 - 62 - 63 - 64 - 65 - 66 - 67 - 68 - 69 - 69 - 69 - 69 - 69 - 69 - 69	dense (GP) (A-1-b)												
03/2011	<u> </u>			<u> </u>				1			<u> </u>	01_T	 DHR-0



AET JO	в NO: <b>01-05697</b>			LC	G OF	BORI	NG NC	)	1230	SV	(p. 3	3 of	3)
PROJEC	T: Southwest Light Rail Transit Pro	ject,	PEC East; l	Hopl	<b>cins</b> 1	to M	inne	apol	lis				
	Hennepin Co				5744(		E		51558	4			
DEPTH	MATERIAL DESCRIPTION		GEOLOGY	N	мс	SAM	PLE I	REC	FIELI	) & LA	BORAT	FORY	TESTS
DEPTH IN FEET				×1	IVIC	TY	PE	IN.	WC	DEN	LL	PL	<b>%-</b> #20
_	GRAVEL WITH SAND, brown, moist, very		COARSE	82	M/W	М	SS	8					
71 -	dense (GP) (A-1-b) (continued)		ALLUVIUM (continued)			$\left[ \right]$					-		
72 –						$\left \right\rangle$							
73 —						$\left \right\rangle$							
74 -		<b>*</b>				$\square$							
75 —				64	M/W	Х	ss	-					
76 –						$[\mathcal{T}]$							
77 –						$\left \right\rangle$							
78 -						$\left \right\rangle$							
79 -						$\square$							
80 -				57	M/W	ΙXΙ	SS	10					
81 -						H							
82 -		-				$\langle \langle$							
83 -						$\langle \langle$							
84 -						H							
85 -				70	M/W	ľW	SS	12					
86 -						$\sum$							
87 -						$\left \right\rangle$							
88 -													
89 -		1 1 1				H							
90 -		<b>₩</b>		88	M/W	'W	SS	8					
91 -	· · · · · · · · · · · · · · · · · · ·					$\sum$							
92 -						$\left \right\rangle$							
93 -													
94 -						$\mathbb{H}$							
95 – 96 –	SAND, fine to medium grained, brown, moist, very dense (SP) (A-3)			80	-	М	SS	0					
90 -	Very delise (Sr) (A-5)					$\mathbb{R}$							
97 - 98 -			•			$\left \right\rangle$							
99 -			•			$\left \right\rangle$							
99 – 100 –						$\left  \right\rangle$							
				64	M/W	/ Χ	SS	16					
	END OF BORING					$\left  \right $							
95 96 97 98 99 100 101													
200													
02/2011	•			• • •								01 5	HR-0

#### **Monitoring Well/Piezometer Log** American Engineering Testing, Inc. 1143 PT 01-05697 Well No.: AET Job No.: Southwest Light Rail Transit Project, PEC East Project: Unique Well No.: 3.25" HSA N160768, E517723 Location: Drilling Method: 8/29/13 Drilling Fluids (type): Date Installed: GH/TK JV Completed by: Project Manager: **Annular Space Details** Top of Protective Casing 3.0 2.6 Top of Riser Pipe Concrete Type of Surface Seal: 0.0 Ground Surface Type of Annular Sealant: Bentonite Grout Bentonite 3/8 Chips Type of Bentonite Seal (Granular Pellet): 1.0 Top of Annular Sealant Type of Sand Pack: #30 Red Flint Sand Bottom of Protective Casing 4.0 Well Construction Materials Steel Specify Type Type Type Stainless PVC Specify 7 Other Specify 7 16.0 Top of Seal 18.0 Top of Sand **Riser** Coupling Joint 2 " FT ------2 " FT Riser Pipe Above w.t. \_\_\_ ----2 " FT Riser Pipe Below w.t. --------Screen 2 " FT --------20.0 Top of Screen Protective Posts None -------Protective Casing ------6" Steel Measurements to 0.1 ft (where applicable) Protective Casing Length 7' Steel 22.6' Riser Pipe Length 10' Screen Length .010" Screen Slot Size 868.50 Top of Riser Elevation 865.9 Ground Surface Elevation 14.65' (8/30/13) Depth to Water Water Elevation 851.25 (8/30/13) Other 850.58 (11/4/13) 81⁄4' 30.0 Bottom of Screen Do Bottom of Borehole 61'

American Eng	ineering Te	sting, Inc		Monitori	ng We	ll/Pi	ezometer Log
AET Job No.: 01-056	597		Wel	No.:	1144	РТ	
Project: Southwest Light		roject PEC E		jue Well No.:			
Location: N162367, E51		<u>10]000, 1 1 0 1</u>				HSA	
Date Installed:8/29/1				ing Fluids (type):			
Project Manager: JV				pleted by:	-		
							· · · · · · · · · · · · · · · · · · ·
Annular Space Details							
						3.0	Top of Protective Casing
Type of Surface Seal: <u>C</u>	oncrete	-			· -	2.5	Top of Riser Pipe
Type of Annular Sealant:B	entonite Grout			4	<u> </u>	0.0	Ground Surface
Type of Bentonite Seal (Granular	Pellet): Ben	tonite 3/8 Chips			-	1.0	Top of Annular Sealant
Type of Sand Pack: #30 Re	d Flint Sand						
Type of Salid Fack:		-					Pottom of Protoctive Cosing
					-	4.0	Bottom of Protective Casing
Well Construction Mate	erials						
				_			
	be	be	Ъе				
	ss y Ty	y Ty	y Ty			16.0	Top of Seal
	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type		- 🗮		-
	St St	ds Vd	Sp Qt		- 🗮	18.0	Top of Sand
Riser Coupling Joint		2 " FT					
Riser Pipe Above w.t.		2 " FT	`				
Riser Pipe Below w.t.		2 " FT	400 KB 100				
Screen		2 " FT			· · · · · · _	20.0	Top of Screen
Protective Posts		None					
Protective Casing			6" Steel		• • • •		
		-					
Measurements	to 0.1 ft (where	applicable)	•		• • • • • • • •		
					• • • • • • • • • • • • • • • • • • •		. •
Protective Casing Length	7' Stee	el					
Riser Pipe Length	22.5						
Screen Length	10'						
Screen Slot Size	.010'	•					· · ·
Top of Riser Elevation	871.3	8		••••	••••		
Ground Surface Elevation	868.9	)					
Depth to Water	17.9' (8/3	0/13)			••••		
Water Elevation	850.98 (8/	30/13)					
Other	850.08 (11	/4/13)					
			Do	81/4"	° • • • •	30.0	Bottom of Screen

#### American Engineering Testing, Inc. Monitoring Well/Piezometer Log 1148 PT 01-05697 Well No.: AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA Drilling Method: N163209, E518078 Location: Drilling Fluids (type): None 10/2/13 Date Installed: SG/SB Completed by: Project Manager: JV **Annular Space Details** Top of Protective Casing 2.5 Top of Riser Pipe 2.4 Type of Surface Seal: Portland Cement 0.0 Ground Surface Type of Annular Sealant: \_\_\_\_Bentonite Grout Top of Annular Sealant 1.0 N/A Type of Bentonite Seal (Granular Pellet): #30 Red Flint Sand Type of Sand Pack: Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other Specify Type Stainless Steel Specify Type N/A Top of Seal 18.0 Top of Sand 2 " FT -------Riser Coupling Joint 2 " FT ---Riser Pipe Above w.t. ---Riser Pipe Below w.t. 2 " FT ---\_\_\_ 2 " FT -------Screen 20.0 Top of Screen \_\_\_\_ Protective Posts . .... None \_\_\_ 6" Steel Protective Casing ----Measurements to 0.1 ft (where applicable) 7' Steel Protective Casing Length 22.5' Riser Pipe Length 10' · Screen Length .010" Screen Slot Size 867.29 Top of Riser Elevation 864.9 Ground Surface Elevation 15.7' (10/14/13) Depth to Water Water Elevation 849.22 (10/14/13) 849.25 (11/4/13) Other Bottom of Screen 30.0 81/4 Do Bottom of Borehole 32'

#### **Monitoring Well/Piezometer Log** American Engineering Testing, Inc. 1149 PT Well No.: 01-05697 AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA Drilling Method: N162767, E517892 Location: Drilling Fluids (type): None Date Installed: 10/2/13 SG/SB Completed by: JV Project Manager: **Annular Space Details** Top of Protective Casing 2.6 Top of Riser Pipe 2.3 Type of Surface Seal: Portland Cement Ground Surface 0.0 Type of Annular Sealant: \_\_\_\_Bentonite Grout 1.0 Top of Annular Sealant Type of Bentonite Seal (Granular Pellet): N/A #30 Red Flint Sand Type of Sand Pack: Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other Specify Type Stainless Steel Specify Type N/A Top of Seal 18.0 Top of Sand 2 " FT ---**Riser** Coupling Joint \_\_\_\_ 2 " FT ---Riser Pipe Above w.t. \_\_\_\_ 2 " FT--------Riser Pipe Below w.t. 2 " FT ------Top of Screen Screen 20.0 Protective Posts ---None ---6" Steel ~--Protective Casing --to 0.1 ft (where applicable) Measurements 7' Steel Protective Casing Length 22.5' Riser Pipe Length 10' Screen Length .010" Screen Slot Size 869.87 Top of Riser Elevation 867.6 Ground Surface Elevation 18.0' (10/14/13) Depth to Water 849.60 (10/14/13) Water Elevation 849.69 (11/4/13) Other Bottom of Screen 81/4' 30.0 Do Bottom of Borehole 32'

#### American Engineering Testing, Inc. Monitoring Well/Piezometer Log Well No.: 1150 PT 01-05697 AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA N161734, E517806 Drilling Method: Location: Drilling Fluids (type): None 9/30/13 Date Installed: SG/SB Completed by: JV Project Manager: **Annular Space Details** Top of Protective Casing 2.7 Top of Riser Pipe 2.6 Type of Surface Seal: Portland Cement Ground Surface 0.0 Type of Annular Sealant: \_\_\_\_Bentonite Grout Top of Annular Sealant 1.0 Type of Bentonite Seal (Granular Pellet): N/A #30 Red Flint Sand Type of Sand Pack: Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other' Specify Type Stainless Steel Specify Type N/A Top of Seal 18.0 Top of Sand 2 " FT ---Riser Coupling Joint ---2 " FT \_\_\_ Riser Pipe Above w.t. ---2 " FT ---\_\_\_\_ Riser Pipe Below w.t. 2 " FT ------Top of Screen Screen 20.0 Protective Posts ---None ----6" Steel ---Protective Casing --to 0.1 ft (where applicable) Measurements 7' Steel Protective Casing Length 22.5' Riser Pipe Length 10' Screen Length .010" Screen Slot Size 867.51 Top of Riser Elevation 864.94 Ground Surface Elevation 14.5' (10/14/13) Depth to Water 850.45 (10/14/13) Water Elevation 850.74 (11/4/13) Other 81⁄4" 30.0 Bottom of Screen Do 32' Bottom of Borehole

#### **Monitoring Well/Piezometer Log** American Engineering Testing, Inc. 1151 PT 01-05697 Well No.: AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA Drilling Method: N161336, E517786 Location: None Drilling Fluids (type): 9/30/13 Date Installed: SG/SB Completed by: JV Project Manager: **Annular Space Details** Top of Protective Casing 2.7 Top of Riser Pipe 2.6 Type of Surface Seal: Portland Cement 0.0 Ground Surface Type of Annular Sealant: Bentonite Grout 1.0 Top of Annular Sealant N/A Type of Bentonite Seal (Granular Pellet): #30 Red Flint Sand Type of Sand Pack: Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other Specify Type Stainless Steel Specify Type Top of Seal N/A Top of Sand 18.0 2 " FT ---**Riser** Coupling Joint ---2 " FT ----Riser Pipe Above w.t. \_\_\_\_ 2 " FT ---Riser Pipe Below w.t. ---2 " FT ------20.0 Top of Screen Screen None ---Protective Posts \_\_\_\_ \_\_\_ 6" Steel Protective Casing ---Measurements to 0.1 ft (where applicable) 7' Steel Protective Casing Length 22.5' **Riser Pipe Length** 10' Screen Length .010" Screen Slot Size 867.89 Top of Riser Elevation 865.3 Ground Surface Elevation 15.2' (10/14/13) Depth to Water 850.08 (10/14/13) Water Elevation 850.24 (11/4/13) Other Bottom of Screen 81/4" 30.0 Do Bottom of Borehole 32'

#### American Engineering Testing, Inc. Monitoring Well/Piezometer Log 1152 PT 01-05697 Well No.: AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA N160225, E517508 Drilling Method: Location: None Drilling Fluids (type): 10/7/13 Date Installed: SG/SHS Completed by: JV Project Manager: **Annular Space Details** Top of Protective Casing 2.6 Top of Riser Pipe 2.3 Portland Cement Type of Surface Seal: Ground Surface 0.0 Type of Annular Sealant: Bentonite Grout 1.0 Top of Annular Sealant Type of Bentonite Seal (Granular Pellet): N/A #30 Red Flint Sand Type of Sand Pack: Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other Specify Type Steel Specify Type Stainless N/A Top of Seal 17.0 Top of Sand 2 " FT ------Riser Coupling Joint 2 " FT -------Riser Pipe Above w.t. ----2 " FT ----Riser Pipe Below w.t. 2 " FT .... ----Screen 19.0 Top of Screen ---Protective Posts ----None ----6" Steel ---Protective Casing to 0.1 ft (where applicable) Measurements 7' Steel Protective Casing Length 21.5 Riser Pipe Length 10' Screen Length .010" Screen Slot Size 870.56 Top of Riser Elevation 868.3 Ground Surface Elevation 16.7' (10/14/13) Depth to Water 851.64 (10/14/13) Water Elevation 851.73 (11/4/13) Other Bottom of Screen 81/4' 29.0 Do Bottom of Borehole 32'

## American Engineering Testing, Inc.

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

#### **Monitoring Well/Piezometer Log**

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

#### **Annular Space Details**

2.6 Top of Protective Casing 2.5 Top of Riser Pipe Portland Cement Type of Surface Seal: 0.0 Ground Surface Type of Annular Sealant: \_ Bentonite Grout Top of Annular Sealant 1.0 ·N/A Type of Bentonite Seal (Granular Pellet): #30 Red Flint Sand Type of Sand Pack: Bottom of Protective Casing 4.5 **Well Construction Materials** Other Specify Type PVC Specify Type Stainless Steel Specify Type Top of Seal N/A 17.0 Top of Sand 2 " FT ----**Riser Coupling Joint** \_\_\_\_ 2 " FT ----Riser Pipe Above w.t. \_\_\_ 2 " FT ---Riser Pipe Below w.t. \_\_\_ 2 " FT .... ---Screen 19.5 Top of Screen None ---Protective Posts ------6" Steel ---Protective Casing to 0.1 ft (where applicable) Measurements 7' Steel Protective Casing Length 22.0 Riser Pipe Length 10' Screen Length .010" Screen Slot Size 871.66 Top of Riser Elevation 869.2 Ground Surface Elevation 19.1' (10/14/13) Depth to Water 850.10 (10/14/13) Water Elevation 850.29 (11/4/13) Other

Do

\_\_\_\_\_

81/4'

Bottom of Screen Bottom of Borehole

29.5

32'

.

#### **Monitoring Well/Piezometer Log** American Engineering Testing, Inc. 1154 PT 01-05697 Well No.: AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA N159370, E516798 Drilling Method: Location: None Drilling Fluids (type): 10/9/13 Date Installed: SG/SB JV Completed by: Project Manager: **Annular Space Details** Top of Protective Casing 2.7 Top of Riser Pipe 2.4 Portland Cement Type of Surface Seal: Ground Surface 0.0 Type of Annular Sealant: Bentonite Grout Top of Annular Sealant 1.0 Type of Bentonite Seal (Granular Pellet): N/A Type of Sand Pack: #30 Red Flint Sand Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Stainless Steel Specify Type Other Specify Type N/A Top of Seal 18.0 Top of Sand 2 " FT \_\_\_ **Riser** Coupling Joint ---2 " FT \_\_\_\_ Riser Pipe Above w.t. ---2 " FT ------Riser Pipe Below w.t. 2 " FT ---. \_\_\_\_ Screen 20.0 Top of Screen Protective Posts ---None ---6" Steel ------Protective Casing Measurements to 0.1 ft (where applicable) 7' Steel Protective Casing Length 22.5' Riser Pipe Length 10' Screen Length .010" Screen Slot Size Top of Riser Elevation 874.48 872.1 Ground Surface Elevation 21.7' (10/14/13) Depth to Water 850.37 (10/14/13) Water Elevation 850.61 (11/4/13) Other Bottom of Screen 81/41 30.0 Do 32' Bottom of Borehole

#### **Monitoring Well/Piezometer Log** American Engineering Testing, Inc. 1155 PT Well No.: 01-05697 AET Job No.: Southwest Light Rail Transit Project, PEC East\_ Unique Well No.: Project: 4.25" HSA N158305, E516166 Drilling Method: Location: None 10/11/13 Drilling Fluids (type): Date Installed: SG/SB Completed by: JV Project Manager: **Annular Space Details** Top of Protective Casing 3.0 Top of Riser Pipe 2.8 Portland Cement Type of Surface Seal: Ground Surface 0.0 Type of Annular Sealant: \_\_\_\_\_Bentonite Grout Top of Annular Sealant 1.0 N/A Type of Bentonite Seal (Granular Pellet): Type of Sand Pack: #30 Red Flint Sand Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other Specify Type Stainless Steel Specify Type N/A Top of Seal 17.5 Top of Sand 2 " FT **Riser** Coupling Joint ---2 " FT ---Riser Pipe Above w.t. ---2 " FT ------Riser Pipe Below w.t. 2 " FT \_\_\_\_ Screen ----19.5 Top of Screen \_\_\_\_ None ---Protective Posts 6" Steel \_\_\_\_ Protective Casing --to 0.1 ft (where applicable) Measurements 7' Steel Protective Casing Length 22.0 **Riser Pipe Length** 10' Screen Length .010" Screen Slot Size Top of Riser Elevation 879.59 876.8 Ground Surface Elevation 26.2' (10/14/13) Depth to Water 850.63 (10/14/13) Water Elevation 850.91 (11/4/13) Other Bottom of Screen 81/4' 32.0 Do Bottom of Borehole 33'

#### American Engineering Testing, Inc. **Monitoring Well/Piezometer Log** 1156 PT 01-05697 Well No.: AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA Drilling Method: N157802, E515919 Location: None Drilling Fluids (type): 10/10/13 Date Installed: SG/SB JV Completed by: Project Manager: **Annular Space Details** Top of Protective Casing 2.7 2.5 Top of Riser Pipe Type of Surface Seal: Portland Cement Ground Surface 0.0 Type of Annular Sealant: Bentonite Grout Top of Annular Sealant 1.0 Type of Bentonite Seal (Granular Pellet): N/A Type of Sand Pack: #30 Red Flint Sand Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other Specify Type Stainless Steel Specify Type N/A Top of Seal 17.0 Top of Sand 2 " FT \_\_\_\_ **Riser** Coupling Joint ----2 " FT ---Riser Pipe Above w.t. ---2 " FT ------Riser Pipe Below w.t. 2 " FT ------20.0 Top of Screen Screen ---None ---Protective Posts 6" Steel ------Protective Casing to 0.1 ft (where applicable) Measurements 7' Steel Protective Casing Length 22.5' Riser Pipe Length 10' Screen Length .010" Screen Slot Size Top of Riser Elevation 873.63 871.1 Ground Surface Elevation 13.4' (10/14/13) Depth to Water 857.70 (10/14/13) Water Elevation 858.06 (11/4/13) Other Bottom of Screen 81/4" 30.0 Do Bottom of Borehole 32'

#### American Engineering Testing, Inc. Monitoring Well/Piezometer Log 1157 PT 01-05697 Well No.: AET Job No.: Southwest Light Rail Transit Project, PEC East Unique Well No.: Project: 4.25" HSA N157451, E515598 Drilling Method: Location: Drilling Fluids (type): None Date Installed: 10/10/13 SG/SB JV Completed by: Project Manager: **Annular Space Details** Top of Protective Casing 2.7 Top of Riser Pipe 2.5 Portland Cement Type of Surface Seal: Ground Surface 0.0 Type of Annular Sealant: Bentonite Grout Top of Annular Sealant 1.0 Type of Bentonite Seal (Granular Pellet): N/A #30 Red Flint Sand Type of Sand Pack: Bottom of Protective Casing 4.5 **Well Construction Materials** PVC Specify Type Other Specify Type Stainless Steel Specify Type N/A Top of Seal 18.0 Top of Sand 2 " FT ---Riser Coupling Joint ---2 " FT \_\_\_\_ Riser Pipe Above w.t. ---2 " FT ---Riser Pipe Below w.t. ---2 " FT \_\_\_\_ Screen ----20.0 Top of Screen Protective Posts ---None ---6" Steel ---Protective Casing --to 0.1 ft (where applicable) Measurements 7' Steel Protective Casing Length 22.5' Riser Pipe Length 10' Screen Length .010" Screen Slot Size 875.18 Top of Riser Elevation 872.7 Ground Surface Elevation 17.4' (10/14/13) Depth to Water 855.34 (10/14/13) Water Elevation 855.68 (11/4/13) Other 8¼" 30.0 Bottom of Screen Do 32' Bottom of Borehole

#### American Engineering Testing, Inc. **Monitoring Well/Piezometer Log** MCES P-38 Well No.: 01-04905 AET Job No.: None MCES L-27 Hopkins Interceptor, Minneapolis Unique Well No.: Project: 3:25" HSA Location: N158684, E516342 Drilling Method: Drilling Fluids (type): None 9/1/10 Date Installed: Completed by: SSJeff Voyen Project Manager: **Annular Space Details** Top of Protective Casing 2.9 2.7 Top of Riser Pipe Type of Surface Seal: \_\_\_\_\_ Bentonite Grout 0 Ground Surface Type of Annular Sealant: Bentonite Grout 0 Top of Annular Sealant 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)

13.4 Top of Seal 16.4 Top of Sand

4.5' Bottom of Protective Casing

23.4 Top of Screen

<u>28.4</u> 36.5'

Do

Bottom of Screen Bottom of Borehole

# SIEVE ANALYSIS TEST RESULTS

PROJECT:	<b>AET NO.:</b> 01-05697
Southwest LRT – Kenilworth Corridor	
Minneapolis, Minnesota	<b>DATE:</b> August 20, 2014

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

# **RESULTS:**

Boring Number	1003 SB	1003 SB	1004 SB
Sample Depth	241⁄2'-26'	49½'-51'	291⁄2'-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  $\frac{1}{2}$ -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.

# SIEVE AND HYDROMETER ANALYSIS TEST RESULTS

# **PROJECT:**

**AET NO.:** 01-05697

Southwest LRT – Kenilworth Channel Minneapolis, Minnesota

**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		
11/2"	100	100	100
1"	94	100	100
3/4"	93	100	94
5/8"	92	100	92
1/2"	91	100	86
3/8"	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

## SIEVE AND HYDROMETER ANALYSIS TEST RESULTS

# **PROJECT:**

**AET NO.:** 01-05697

Southwest LRT – Kenilworth Channel Minneapolis, Minnesota

**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

# SIEVE AND HYDROMETER ANALYSIS TEST RESULTS

# **PROJECT:**

**AET NO.:** 01-05697

Southwest LRT – Kenilworth Channel		
Minneapolis, Minnesota	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

# **Appendix C**

Geotechnical Report Limitations and Guidelines for Use

#### **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 ASFE<sup>1</sup>, 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.

<sup>1</sup> 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.