# **Geotechnical Evaluation Report**

Former Ford Twin Cities Assembly Plant Redevelopment -Infrastructure Phase 2192 Ford Parkway St. Paul, Minnesota

Prepared for

# Ryan Companies US, Inc.



## **Professional Certification:**

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

Joshua J. Van Abel, PE

Vice President, Principal Engineer

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May 22, 2020



Project B1806527.00

**Braun Intertec Corporation** 



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May 22, 2020

Project B1806527.00

Mr. Nick Koch Ryan Companies US, Inc. 533 South 3rd Street, Suite 100 Minneapolis, MN 55415

Re: Geotechnical Evaluation

Former Ford Twin Cities Assembly Plant Redevelopment - Infrastructure Phase

2192 Ford Parkway St. Paul, Minnesota

Dear Mr. Koch:

We are pleased to present this Geotechnical Evaluation Report for the Infrastructure Phase of the proposed redevelopment of the Former Ford Twin Cities Assembly Plant in St. Paul, Minnesota.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Josh Van Abel at 952.995.2310 (jvanabel@braunintertec.com), Bob Janssen at 651.487.7017 (bjanssen@braunintertec.com) or Brandon Rounsville at 612.221.9007 (brounsville@braunintertec.com).

Sincerely,

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Application for Site Plan Review Phase 1, 2, and 3, Large Scale Demolition, Twin Cities Assembly Plant,

St. Paul, Minnesota, Prepared by Devon Industrial Group, dated November 9, 2012

**Reference Information and Documents** 



## A. Introduction

# A.1. Project Description and Ownership

This Geotechnical Evaluation Report addresses the geotechnical design and construction aspects associated with the infrastructure improvements for the redevelopment of the Former Ford Twin Cities Assembly Plant Site located at Ford Parkway and Mississippi River Boulevard (general site address of 2192 Ford Parkway) in St. Paul, Minnesota. The City of St. Paul has developed a master plan for redevelopment and Ford Motor Company has selected Ryan Companies US, Inc. (Ryan Companies) to develop the site. Ryan Companies, which has denoted the site as Project Paul, is currently developing project documents for the redevelopment of the site.

The master plan outlines a new "urban village" that encompasses a multi-use project that could bring more than 4,000 new residents, along with various commercial facilities and amenities, to the Highland Park neighborhood of St. Paul. Proposed development plans show a mix of one- to six-unit residential housing, multi-family residential housing, and commercial and mixed-use properties, along with supporting infrastructure improvements. The public infrastructure phase of the development will include streets, pedestrian bridges, sidewalks and paths, plaza areas, below-grade utilities, and various stormwater features. Figure 1 displays a potential Ryan Development Scenario rendering of the Ford Site.





Figure 1. Proposed Rendering of Ryan's Development Scenario of the Ford Site

Provided by Alternative Urban Areawide Review (AUAR) prepared by Kimley-Horn.

Table 1 displays the details of the Ryan Development Scenario, as well as the maximum use (density) allowed under the current regulating documents on all four parcels within the AUAR study area. Figure 2 displays the AUAR study area.

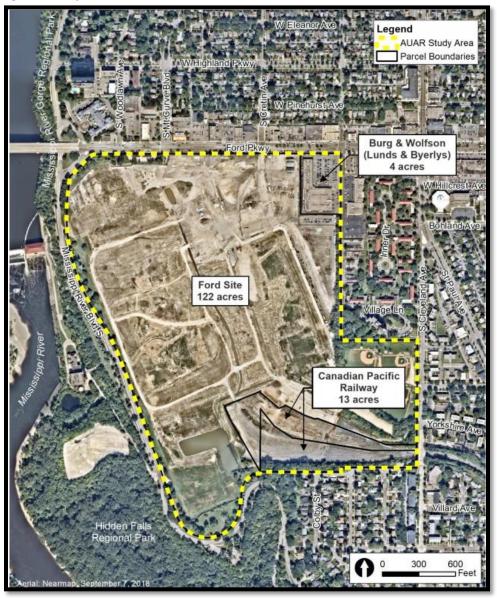


**Table 1. Development Scenarios** 

Land Use	Ryan Development Scenario*	Master Plan Maximum Development Scenario*
Residential (dwelling units)	3,800	4,000
Retail and Service (square feet of gross floor area)	150,000	300,000
Office and Employment (square feet of gross floor area)	265,000	450,000
Civic and Institutional (square feet of gross floor area)	50,000	150,000

<sup>\*</sup>Provided within AUAR.

Figure 2. Project Area



Provided within AUAR.



Figure A1, Appendix A (provided by Ryan Companies), shows an illustration of the current proposed site layout. The redevelopment is currently separated into a total of 36 individual blocks, 4 outlots, and 4 parks. Figure 3 (below) and Figure A2 (Appendix A) display the end ownership for the different portions of the redevelopment. Based on the provided plan, Ramsey County will be responsible for the right-of-way along Ford Parkway; private development will be responsible for Blocks 1 to 29, and 31 to 36; the City of St. Paul will be responsible for the public roadways, utilities (including stormwater facilities), and the 4 park locations; the master association will be responsible for the civic plaza, civic square, and the central water feature; and St. Paul Highland Ball will be responsible for Block 30.



Figure 3. Ownership Plan



Provided by Ryan Companies.



# A.2. Development and Construction Schedule

From a planning standpoint, the northern portion of the site (along Ford Parkway) is planned for commercial and mixed-used development, eastern portions of the site (east of the Central Water Feature) are planned for multi-family development, and the western portions of the site (between the Central Water Feature and Mississippi River Boulevard) are planned for single-family housing. Figure 4 displays the current zoning map for the proposed redevelopment.



Figure 4. Site Zoning and Public Realm Master Plan Zoning Map

Provided within AUAR.



Most of the proposed mixed-use, commercial and multi-family buildings on the site will be three- to six-story structures with light to moderate foundation loads. Preliminary planning includes one level of underground parking for the multi-family housing, commercial, and mixed-use buildings and probable basements for the one- to six-unit residential housing. However, current development plans are conceptual and specific development on each block will be site dependent.

We understand construction of the infrastructure improvements is slated to begin in the spring of 2020. Ryan Companies provided us with a preliminary schedule as of September 26, 2019. A generalized overview of the schedule is listed below. Figure A4 in Appendix A, dated January 21, 2020, provides a visualization of the proposed construction completion schedule for the right-of-way improvements and private development.

- Mass grading to start May of 2020.
- Phase 1 of utilities to start May of 2020.
- Phase 1 of public right-of-way improvements to start late 2020.
- Central Water Feature: Retaining walls, below-grade storm systems and open air filtration basin to start July of 2020, with the remainder of the feature completed in 2021.
- Hidden Falls Headwater Creek Channel: Below-grade storm systems and open air filtration basin to start in mid-2020, with the remainder of the feature completed in 2021.
- Gateway Park: Storm pond and open air filtrations to start in fall of 2020.
- Civic Plaza: Below-grade storm system and retaining walls to start in 2020, remainder of the plaza completed in 2021.
- Neighborhood Park and City Park to start in summer of 2022.
- Phase 2 through 5 utilities and right-of-way to be completed from 2022 to 2026.



# A.3. Proposed Infrastructure Details

As depicted within the figures included in Appendix A, the public infrastructure phase of the development will include streets, pedestrian bridges, sidewalks and paths, plaza areas, below-grade utilities, and various stormwater features.

# A.3.a. Grade Changes

Based on the proposed grading plan provided by Ryan Companies, cuts up to 8 feet and fills up to 18 feet are expected to rough grade the site (excluding basements and stormwater features). Figure A3, Appendix A, and Figure 5, below, display the preliminary cut and fill plan for the project site. Cuts ups to approximately 20 feet below grade are anticipated for new stormwater ponds with the deepest cuts in the Hidden Falls Headwater Feature. The greatest fills are associated with the Civic Plaza area and east of the Central Water Feature.



Figure 5. Preliminary Cut/Fill Illustration





#### A.3.b. Pavements

Initial development will include the construction of public streets, trails and sidewalks. Table 2 provides information regarding the new paved areas across the site.

**Table 2. Proposed Roadway Improvements** 

Roadway Type	Name/Details		
Primary Road	Cretin Avenue, Mount Curve Boulevard, Montreal Avenue, Bohland Avenue, Finn Street, Hillcrest Avenue, Woodlawn Avenue (STA. 102+73 to STA. 106+21), Village Way* (STA. 196+74 to STA. 201+46) and (STA. 206+36 to STA. 214+22)		
Secondary Road	Ranger Way* (STA. 121+66 to STA. 129+47), Woodlawn Avenue (STA. 80+00 to STA. 102+73)		
Shared Path	Beechwood Avenue, Village Way*, Ranger Way*, Saunders Avenue, Yorkshire Avenue		
Bike Trail/Pedestrian-Use Only	Falls Passage (East and West), Mississippi River Boulevard Bike Trail, Ford Parkway Bike Trail, Sidewalks, and Various Park Trails		

<sup>\*</sup>Portions of Village Way and Ranger Way will be either a Primary or Secondary Road with portions of the road being a Shared Path. Woodland Avenue will include Primary and Secondary Road segments.

Figure 6 denotes the anticipated 2040 traffic volumes for the new internal streets associated with the development. Table 3 provides the estimated 20-year design ESALs for the streets based on the anticipated traffic volumes (based on the potential maximum volumes).

2040 Ryan - 6,100 2040 Ryan - 9,350 2040 Ryan - 1,800 VATHA 2040 Max - 7,600 2040 Max - 2,200 2040 Max - 10,200 Ford Pkwy 2040 Ryan - 6,900 2040 Max - 8,150 2040 Ryan - 2,200 2040 Max - 2,600 Montreal Ave 2040 Ryan - 9,300 2040 Ryan - 3,000 2040 Max - 3,300 2040 Max - 10,800 HIGHL

Figure 6. Site Zoning and Public Realm Master Plan Zoning Map

Provided in AUAR.



Table 3. Maximum Estimated 20-year Design ESALs<sup>1</sup>

Roadway/Structure Type	Design ESALs
Primary Road	1,300,000
Secondary Road	250,000
Shared Path	50,000²

<sup>&</sup>lt;sup>1</sup> Equivalent 18,000-pound axle loads for flexible pavement design.

In addition to the pavement areas defined above, development of the Civic Plaza and Square, Central Water Feature, and other green spaces will include paved (bituminous or concrete) sidewalk and plaza areas for pedestrian and public use. These pavements will generally not be subject to vehicle loads, with the exception of maintenance (including vac trucks) and emergency vehicles for select portions or segments of the pavements.

#### A.3.c. Underground Utilities

Sanitary sewer lines serving the development will be installed below Woodlawn Avenue, Mount Curve Boulevard, Cretin Avenue, Montreal Avenue, Hillcrest Avenue, Bohland Avenue, Beechwood Avenue, Village Way, Saunders Avenue, and Yorkshire Avenue. All of the sanitary sewer lines for the project discharge to Saunders Avenue, which connects into the sanitary sewer on Mississippi River Boulevard. Table 4 displays the manhole structure heights and outlet elevations for the manholes on each of the streets that contain sanitary sewer lines. Figures 7 and 8 display the depth from proposed finished grades to the depth of the sanitary sewer lines and manholes for the entire development. In general, the sanitary sewer lines and manholes are anticipated be installed at depths ranging from about 8 to 28 feet below finished road elevations with elevations ranging from about 788 to 842 feet MSL. The exception will be a new sanitary sewer drop shaft west of Saunders Avenue that will connect the new system to the existing sanitary sewer system west of the site. The drop shaft will extend near elevation 751.



<sup>&</sup>lt;sup>2</sup> Subject to occasional maintenance and emergency vehicle traffic.

**Table 4. Sanitary Sewer Manhole Build Heights and Outlet Elevations** 

	Manhole Build Heights		Manhole Pipe Outlet Elevation		
Street	Low (ft)	High (ft)	Low (ft MSL)	High (ft MSL)	
Mount Curve Boulevard	10.6	18.0	794.3	806.8	
Cretin Avenue	10.2	18.6	798.8	832.8	
Woodlawn Avenue	9.4	28.4	787.6	804.6	
Hillcrest Avenue	8.0	18.0	805.1	829.4	
Bohland Avenue	7.7	16.7	802.3	842.0	
Beechwood Avenue	9.4	18.6	800.1	834.2	
Village Way	8.5	19.9	798.1	834.3	
Saunders Avenue	13.0	60.1*	751.2*	819.3	
Montreal Avenue	8.7	18.6	789.5	824.8	
Yorkshire Avenue	12.0	13.9	792.2	794.9	

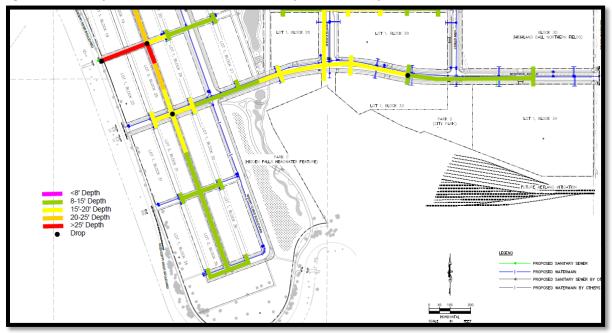
<sup>\*</sup>Reflective of sanitary sewer drop shaft west of Saunders Avenue.



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Figure 7. Sanitary Sewer Lines and Manholes Depths from Proposed Grades (North)







Water main lines serving the development are anticipated to be installed below Mount Curve Boulevard, Cretin Avenue, Montreal Avenue, Hillcrest Avenue, Bohland Avenue, Beechwood Avenue, Village Way, Saunders Avenue, Woodlawn Avenue, Finn Street, and Yorkshire Avenue. The water line installation depths are to be installed with minimum depths ranging from 6 1/2 to 8 feet below finished road elevations, with a majority of the water main lines to be installed at a depth of at least 8 feet below finished road elevations.

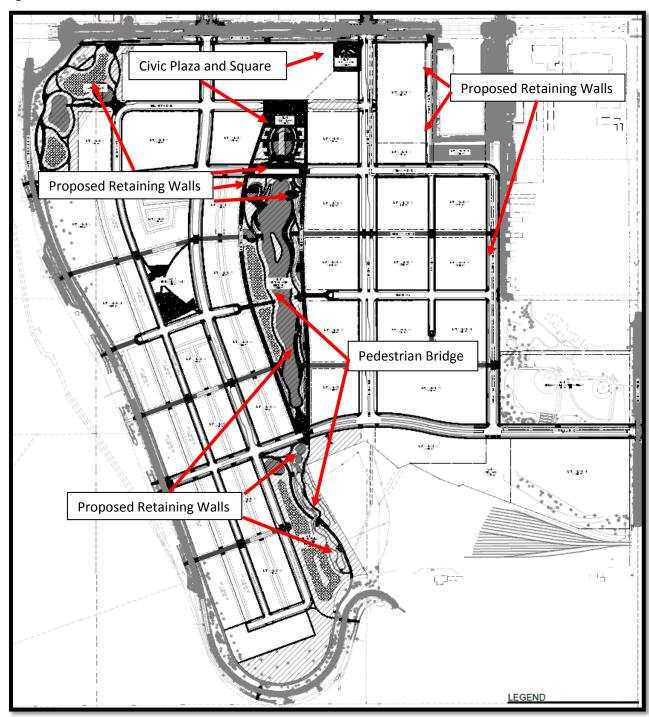
See Section A.3.e for proposed stormwater improvement details.

#### A.3.d. Site Structure and Features

The infrastructure improvements for the site will include two pedestrian bridges. Proposed retaining walls are to be constructed as part of but not limited to Bohland Avenue, Gateway Park, the Central Water Feature, Hidden Falls Headwater Feature, in Outlot A, and along Finn Street. Figure 9 displays the locations of the proposed site structures and features.



Figure 9. Site Structures and Features





## A.3.d.1. Pedestrian Bridges

Two stand-alone pedestrian bridges will be constructed as part of the overall development. The bridges, as located in Figure 9 will be denoted as the Central Water Bridge and the Hidden Falls Bridge. The Central Water Bridge will be a streel structure and the Hidden Falls Bridge will consist of precast concrete. Both structures will be supported on cast-in-place concrete piers and footings.

STEEL HOS POST (TYP)

BOLTED GUISSET PL
CONNECTION (TYP)

BL = 800"-0"

Figure 9A. Central Water Bridge Detail

Plan from 60% Park Submittal Plan Set.

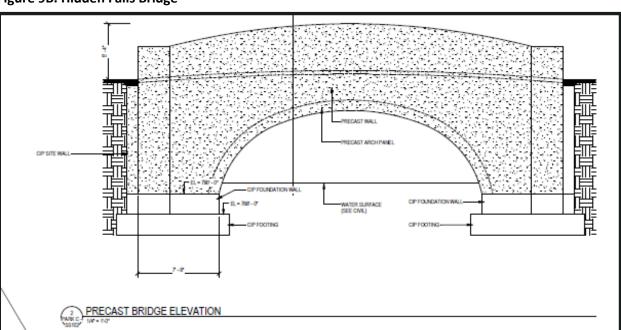


Figure 9B. Hidden Falls Bridge

Plan from 60% Park Submittal Plan Set



#### A.3.d.2. Civic Plaza and Civic Square

The majority of Civic Plaza and Square will consist of concrete pavement and flatwork designed to support pedestrian activities, but also occasional event or maintenance vehicle traffic. The spaces will include the construction of benches and other amenities. Grades will be raised 10 to 15 feet in the Civic Plaza area.

#### A.3.d.3. Retaining Walls

The development of the site will include the construction of many site retaining walls. Figure 9 displays the general locations of the primary retaining walls; however, shallow walls associated with civic and park spaces are not all shown (or fully designed). The majority of these retaining walls will be cast-in-place concrete footings and walls. The majority of the walls will be less than 10 feet in height; the retaining wall along Bohland Avenue may exceed 20 feet in height.

#### A.3.e. Proposed Stormwater Improvements and Water Features

Stormwater improvements will include the construction of two wet pond areas, four biofiltration basin areas, five underground detention (Stormtrap) systems, a creek and dry detention basin for stormwater management. Figure 10 displays the current layout of stormwater improvement and water features.



Underground Detention Structures

| Section 2015 |

Figure 10. Proposed Stormwater Layout

Provided by Ryan Companies.

From a generalized standpoint, all of the features are designed to retain or treat stormwater and not infiltrate stormwater into the existing subgrade. Specifically, the Gateway Park Retention Pond and Central Water Feature Retention Pond are designed to hold water to specific elevation and will include a liner system.

Surface biofiltration basins will fluctuate from wet to dry, depending on stormwater flow, similar to the underground detention systems or structures. Biofiltration systems will include treatment media and also a liner system. Underground detention systems or structures will typically consist of precast concrete.

Variable water levels are anticipated within the Hidden Falls Creek Feature (and dry basin), although the creek and basin are not designed to maintain a specific water level, but they will also include a liner system.



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Table 5 provides the approximate wet pond (permanent retention pond) elevations. The subsections below provide additional details.

**Table 5. Permanent Stormwater Pond Summary** 

Pond Location	Design	Approximate Permanent Retention Pond/Creek Bottom Elevations (feet MSL)	Approximate Cuts to Reach Pond Bottom Elevations
Gateway Park	Wet pond	Bottom – 797.0 NWL – 802.0	Up to 15 feet
Central Water Feature	Wet pond	Bottom – 802.0 NWL – 809.0	Up to 12 feet (north end only) Up to 8 feet (middle and south areas)

## A.3.e.1. Gateway Park

The current layout of Gateway Park will consist of two biofiltration basins (B1 and B2) connected to a permanent retention pond (P2) between the basins. Figure 11 displays the preliminary stormwater layout for Gateway Park. Excluding surface runoff, stormwater will enter the biofiltration basins and flow into the permanent retention pond. The retention pond is to have a bottom elevation of 797 with a normal water elevation of 802. The pond is designed to handle a high water level of 807.7 and has an outlet in the northwest corner at an elevation of 802.



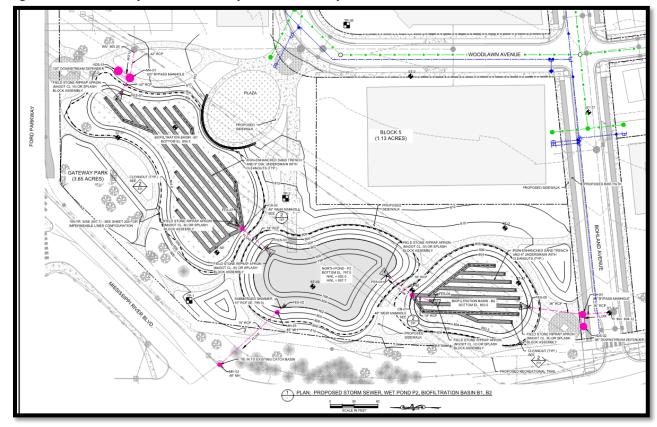


Figure 11. Preliminary Stormwater Layout for Gateway Park

Provided by Ryan Companies.

#### A.3.e.2. Central Water Feature

The current layout of the Central Water Feature will consist of a central permanent retention pond (P1), a biofiltration basin (B3) west of the pond, and three underground detention systems (one of the underground detention systems is part of Civic Plaza). Figures 12 and 13 display the preliminary stormwater layout for the north and south portions of the Central Water Feature. Excluding surface runoff, stormwater will enter the biofiltration basin B3 from the northwest and flow into the west side of the permanent retention pond at an elevation of 809 feet. The two underground water detention systems (one under Civic Plaza and one northeast of the retention pond) will filter stormwater flow into the retention pond on the north side. The southern underground water detention system will fill filter stormwater flow into the retention pond on the west side. The retention pond is to have a bottom elevation of 802 feet with a normal water elevation of 809 feet. The pond is designed to handle a high water level of 813.5 feet and has an outlet in the southernmost portion of the pond at an elevation of 806 feet and an overflow at 812.2 feet (60-foot weir).



Figure 12. Preliminary Stormwater Layout for the Central Water Feature (North)

Provided by Ryan Companies.

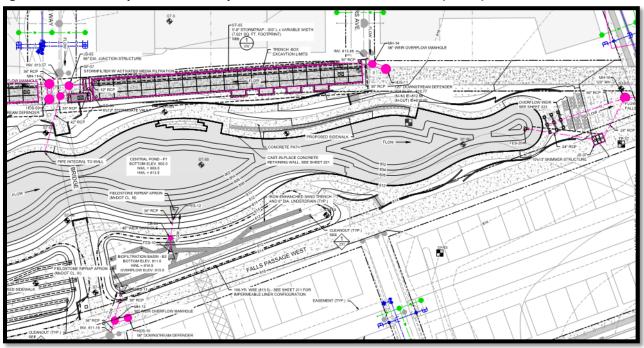


Figure 13. Preliminary Stormwater Layout for the Central Water Feature (South)

Provided by Ryan Companies.



#### A.3.e.3. Hidden Falls Headwater Feature

The current layout of the Hidden Falls Headwater Feature will include a central creek feature and dry basin (reservoir) that will collect stormwater from a biofiltration basin (B4) to the west and underground detention systems to the northeast and northwest. Stormwater flow will also occur from the Central Water Feature (to the north). Excluding surface runoff, stormwater will enter the biofiltration basin from the northwest, west, and southwest, and flow into the creek in the northwest, west, and southwest. Stormwater from the Central Water Feature will have stormwater flow into the creek feature at an elevation of about 804 feet. The creek feature is to have a bottom elevation that will vary from about 793 to 788 feet. The creek feature has an outlet in the southernmost portion.

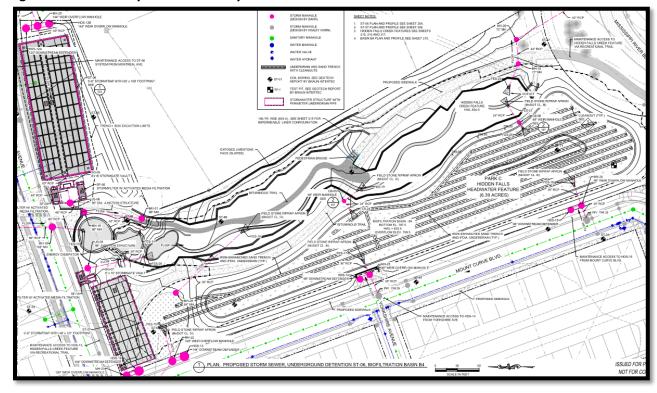


Figure 14. Preliminary Stormwater Layout for Hidden Falls Headwater Feature

Provided by Ryan Companies.



#### A.4. Site Conditions and Historical Information

#### A.4.a. General

The site is located on the southeast quadrant of the intersection of Ford Parkway and Mississippi River Boulevard in St. Paul, Minnesota. The site is located in a mixed industrial, commercial, and residential use area. The site is approximately 130 acres and bound to the west by the Mississippi River and Mississippi River Boulevard, to the north by Ford Parkway, to the east by South Cleveland Avenue and existing development, and to the south by Mississippi River Boulevard and former railroad tracks leading to the project site.

Modified by historic development, overall site grades slope downward from east to west (and the river beyond). The existing surface elevations range from approximately 810 to 855 feet, with the highest elevations along the northeastern property line. Matching the overall slope, site grades decrease about 10 to 15 feet from the former finished car parking lot (eastern boundary of the site) to the former paint building, and decrease another 10 to 15 feet between the paint building and former main assembly building (see Figure 15 below).

#### A.4.b. Site History and Historical Photos

Although currently vacant, former Ford Assembly Plant operations at the project site consisted of the assembly and painting of cars and trucks, using parts manufactured off site. Assembly processes included welding, metal cleaning, painting and curing, windshield and trim installation, and preparation of the vehicles for final delivery. The primary production buildings consisted of the main assembly building, which also included a warehouse and a paint building (Figure 15).





Figure 15. Former Ford Assembly Plant Layout

Figure provided by Arcadis dated 2015.

Aerial photographs 1, 2, and 3 display the site conditions in 1923, 2011, and 2018, respectively. The red outline indicates the approximate location of the site. The main assembly building was constructed in 1923 with various building additions occurring between the 1960s and 1980s. The paint building was constructed in 1985. Assembly operations at the project site ceased in December of 2011. The aerial photograph of the site in 1923 displays what the site looked like prior to the construction of the Ford Plant. The aerial photograph of the site in 2011 displays the site prior to when operations ceased on site, and the photograph of the site in 2018 displays site post demolition.



Photograph 1. Aerial Photograph of the Site in 1923

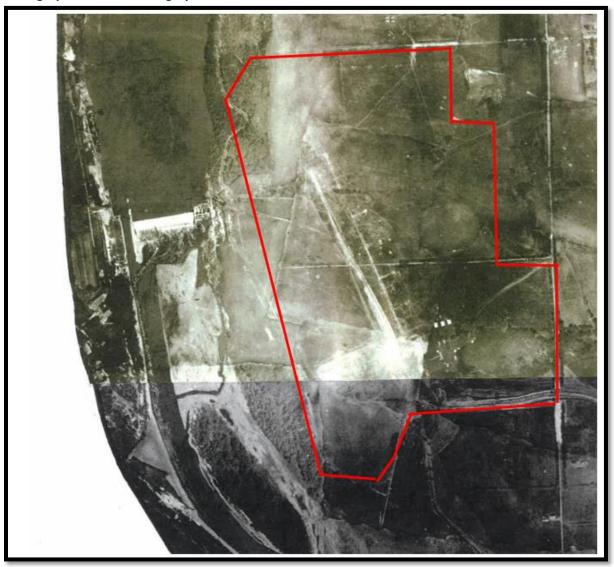


Photo provided by University of Minnesota, John R. Borchert Map Library Online.



Photograph 2. Aerial Photograph of the Site in 2011



Photograph provided by Ramsey County GIS.



Photograph 3. Aerial Photograph of the Site in 2018



Photograph provided by Ramsey County GIS.

#### A.4.c. Environmental Remediation

The site was decommissioned in 2014 and 2015, including the demolition of buildings and the removal of a majority of the slabs and subsurface structures (including footings, pits, sumps, and utilities). However, Arcadis US, Inc. (Arcadis), Ford's environmental consultant for the site remediation, indicated that subsurface structures (tunnels, shafts, footings, slabs, etc.) that extended greater than 10 feet below the existing ground surface were cut off at that depth, bulk headed (for tunnels and shafts), and backfilled to the existing ground elevation. Figure F1 in Appendix F (provided by Arcadis) indicates the documented areas where known subsurface structures were left in place. Section A.4.c.2 provides additional information on the tunnels that were bulk-headed and left in place.



Based on the environmental investigation completed by Arcadis, select locations across the project site were excavated to remove the presence of environmentally-impacted soils. Figure B2 (Remedial Activities Completed Sketch) in Appendix B shows the areas excavated and identified by Arcadis (Arcadis's map is overlaid on our boring sketch); Arcadis identified these areas as Consolidated Impact Areas, Isolated Impact Areas, and SDRAP Addendums Areas. It is our understanding these impact areas were excavated to soils that were tested and indicated non-detect for environmental impacts or excavated to hard, unweathered bedrock. After the impacted soils were removed, they were backfilled with compacted soils.

## A.4.c.1. Previous Compaction Testing

Based on conversations with Carl Bolander & Sons Inc. (environmental remediation excavation contractor) and Arcadis, the impact areas were backfilled with either off-site sand fill or non-impacted soils from the project site. The backfilled soils were compacted in the excavations and periodically tested for compaction efforts. Figure F2 in Appendix F shows a location map of excavations and backfill and compaction testing.

Braun Intertec was contracted by Arcadis to complete periodic compaction testing on an on-call basis. We made approximately 25 visits to the site between December of 2014 and June of 2018 and approximately 190 compaction tests were completed using a nuclear density gauge. Additionally, we completed dynamic cone penetrometer (DCP) testing in areas where the nuclear density gauge tests could not give consistent results due to varying fill types or high amounts of coarse aggregate. Based on our review of the test reports, the fill soil types that were tested consisted of clayey sand (SC), silty sand (SM), poorly graded sand with silt (SP-SM), poorly graded sand (SP), poorly graded gravel (GP), and poorly graded gravel with silt (GP-GM). The test results indicate all tested fill met or exceeded 95 percent of standard Proctor density. Figure F2 in Appendix F, provided by Arcadis, shows the general compaction test locations in regards to their denoted environmental remediation areas (shown as IRAP, SDRAP, and NPL).

Note, Figure F2 does not include the location of tests performed between December of 2014 and August of 2015. These tests appear to be for the main assembly building and areas east of the main assembly building, which would be the areas labeled as MAB and AS-1/AS-5/FAB on Figure F2.

Our compaction testing scope of services did not include site observations or documentation of subgrade material or strength prior to fill placement. Furthermore, the fill we tested was directed to us by Arcadis, and it is not known whether all of the fill placed during remediation efforts was tested.



#### A.4.c.2. Structures Left in Place

Seven documented tunnel systems were constructed in the subsurface below the former Ford Assembly Plant at various depths and configurations. Table 6 provides a summary of the known tunnel systems.

**Table 6. Summary of Existing Tunnel Systems** 

Tunnel System	Concrete Lined	Size (width x height; ft)	Elevation of Tunnel Invert (ft)	Geologic Condition at Invert	Demolished (Yes or No)
Traffic Tunnels	Fully	10 x 11	711 to 718	Sandstone	No
Gas Tunnel	Unlined	8 x 6	731	Sandstone	No
Cable Tunnel	Unlined	3-6 x 6-7	691 to 741	Sandstone	No
Oil Tunnel	Fully	5 x 5	800	Soil	Yes
Steam Tunnel	Fully	13 x 10	798	Soil	Yes
Sewer Tunnels	Partially	2.5 x 6	756 to 760	Limestone	No
Mined Sand Tunnels	Unlined	15 x 15	725	Sandstone	No

Based on information provided by Ford, the shallow oil tunnel was completely removed and backfilled. Additionally, the steam tunnel was demolished and removed down to the bottom slab of the tunnel. The bottom slab of the steam tunnel was punctured to provide drainage and the tunnel area was backfilled with Class 5 fill material. The remaining tunnels were bulk-headed at the entrances and left in existing condition.

Elevator, air and other shafts that extended from the tunnels to the site buildings were excavated down at a depth of approximately 10 feet below existing surface grades and capped with reinforced concrete.

A detailed description of the tunnels is summarized within Appendix F in an attachment to the Application for Site Plan Review, Phases 1, 2, and 3, Large Site Demolition, Twin Cities Assembly Plant, St. Paul, Minnesota prepared by Devon Industrial Group c/o Ford TCAP dated November 9, 2012.



## A.5. Reference Information and Documents

Appendix F includes a list of the information and documents referenced in preparation of this report.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experiences with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

## A.6. Scope of Services

#### A.6.a. Purpose

The purpose of our geotechnical evaluation was to characterize and evaluate subsurface geologic conditions at selected exploration locations and provide geotechnical recommendations to support infrastructure development, design, and construction.

#### A.6.b. Services

We performed our scope of services for the project in accordance with the Project Agreement between Braun Intertec and Ryan Companies dated June 29, 2018 (Contract Number 39585) and Change Order Number 3 dated August 21, 2019. The following list describes the geotechnical tasks completed thus far in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.
- Staking and clearing the exploration locations of underground utilities. Terracon, along with our input, selected borings and test pits and we staked the exploration locations for the Preliminary Geotechnical Report. Ryan Companies and Braun Intertec selected and we staked the new exploration locations (ST-47 to ST-126). We acquired the surface elevations and locations with GPS technology using the State of Minnesota's permanent GPS base station network. The Soil Boring Location Sketch included in Appendix B shows the approximate locations of the borings.



- Performing 126 borings, denoted as ST-1 to ST-126, to nominal depths of 5 to 71 feet below current surface grades across the site using standard penetration test (SPT) and rock coring methods to collect soil and rock samples. Borings ST-47 to ST-126 were specifically performed for the infrastructure phase on the project.
- Performing 10 standard penetration test (SPT) borings for temporary wells, denoted as TW-1 to TW-10, to nominal depths of 5 to 20 feet below grade across the site.
- Observing the excavation of 46 test pits (excavated by Bolander), denoted as TP-1 to TP-46, to nominal depths of 5 to 15 feet below current surface grades across the site.
- Observing the excavation of 13 test pits (excavated by Bolander), denoted with an "ENV" prefix (i.e. ENV-TP-1), to nominal depths of 4 to 12 feet below current surface grades across the site at locations identified with anomalies during the GPR survey described below in Section C.2.e.
- Performing geotechnical laboratory testing on select samples to aid in soil classification and engineering analysis.
- Preparing this report containing an exploration location sketch and other supporting figures, logs of soil borings and test pits, a summary of the soils encountered and groundwater observations, results of laboratory tests, and recommendations to support site evaluation, grading and redevelopment, including:
  - Subgrade preparation for infrastructure improvements.
  - Placement and compaction of fill.
  - Design of pavements, below-grade utilities, retaining walls, and stormwater improvements.

Terracon is the environmental consultant for the project. Our scope of services did not include environmental testing, evaluation or consulting.



## B. Results

## **B.1.** Geologic Overview

Surficial geology and bedrock geology maps of Ramsey County show that the geology of the project site is comprised of stream sediments (alluvial or terrace deposits) consisting of sand and gravel and some clay and silt and then clayey glacial till beneath the stream sediments. The soils are underlain by shallow bedrock consisting of Decorah Shale, Platteville Limestone, Glenwood Shale, and St. Peter Sandstone (in descending order). Although not shown on the geologic maps, our review of the site specific data indicates that the site also contains varying amounts of undocumented fill from historic site development.

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

#### **B.2.** Previous Geotechnical Information

Environmental evaluations started at the project site in the early 1990s, based on requests by the MPCA. Arcadis began work at the site for Ford in 2007 with the completion of a Phase I Environmental Site Assessment (ESA). Various phases of work were completed by Arcadis between 2007 and 2015 to evaluate environmental conditions at the project site, which included 1,320 soil borings (push-probe, roto-sonic, and hand auger). Additionally, 20 permanent monitoring wells were installed to evaluate groundwater conditions in the shallow perched zone and within the bedrock zones. Borings were drilled to depths ranging from approximately 3 feet (hand augers) to 150 feet (deep monitoring wells) below ground surface. Most soil borings were drilled at depths ranging from 8 to 20 feet below ground surface. The borings were terminated both in the overburden soil and in the upper bedrock. Because a push-probe type drill rig was used for the majority of the borings, penetration into the bedrock was minimal and most borings were stopped at practical refusal. Fill soils were not called out on the majority of the Arcadis boring logs. However, debris was noted in the fill soils, including construction materials, glass, metal, and ash. Our review of the boring logs also indicated buried asphalt, concrete, and ballast rock.



Where remediation efforts were performed, select areas across the site were excavated and backfilled (remediation fill) to remove environmentally-impacted soils. Impacted areas were excavated to depths and widths to remove the impacted soils and to provide documentation that the remaining soils left in place were below the required environmental regulatory levels. Additionally, many of the impacted areas were excavated to sound (unweathered) bedrock. Excavations within identified impact areas were documented to depths up to 22 feet below ground surface. It is our understanding that existing non-impacted soils, along with off-site sand fill materials, were used to backfill the excavated impacted areas. Arcadis indicated the remediation fill was occasionally mixed with crushed concrete that was approved for reuse. Furthermore, select areas were backfilled with concrete crushed to aggregate base specifications.

Related to construction of some of the previous Ford Plant facilities, we performed soil borings at this site in 1966, 1968, and 1977 for various locations across the existing plant in the areas of the main assembly building, the paint building, and the finished vehicle parking areas.

Approximately 250 boring logs were included within those available reports and we used that information to further assist us in the review of the site soil conditions; however, the majority of these borings likely do not represent current site conditions and are not included as reference documents in the Appendices of this report.

## **B.3.** Exploration Results

The following sections summarize the findings of our recent exploration program. Please refer to the Log of Boring sheets, Log of Coring sheets, and Test Pits in Appendix B, along with the Site Exploration Location Map (Figure B1), for additional details. Table E1 in Appendix E displays a subsurface profile summary for each of the borings and test pits across the site. The Descriptive Terminology sheet in Appendix B includes definitions of abbreviations used below.

#### **B.3.a.** Surface Materials

Asphalt and concrete pavements were encountered in some of our borings and test pits, primarily in the north and eastern portions of the project site where pavements were left in place to support site decommissioning and cleanup efforts. Asphalt pavements ranged in thickness from about 2 to 9 inches and were generally underlain by about 2 to 12 inches of aggregate base. Concrete pavements ranged in thickness from 4 to 10 inches and were generally underlain by about 6 to 12 inches of aggregate base. We did not encounter aggregate base underneath the bituminous and/or concrete pavement in ST-72, ST-96, or ST-109. Much of the concrete pavement encountered was reinforced with steel.



Topsoil or identified topsoil fill was present in limited areas across the site. Where encountered, the thicknesses ranged from 0 to 4 feet, but were typically less than 1-foot thick. The topsoil material generally varied from dark brown to black with soil types varying from poorly graded sand with silt, silty sand, clayey sand, sandy lean clay, lean clay, sandy fat clay, organic clay, and weathered shale with varying amounts of organic material. Some of the topsoil contained debris (concrete and bituminous), gravel, or shale and limestone fragments.

#### B.3.b. Fill Soils

Existing fill was the predominant material encountered overlying the bedrock. For simplicity, during our evaluation, we delineated the fill into: 1) undocumented fill, or fill associated with historic development on the site, and 2) remediation fill, which included fill placed during recent remediation efforts coordinated by Ford and Arcadis. Figure B2 in Appendix B displays our boring and test pit locations in relation to the remediation efforts completed on site. The following subsections provide additional details; however, it should be noted undocumented fill may be present below remediation fill and differentiation between the materials was not practical in these areas.

#### **B.3.b.1. Undocumented Fill**

The undocumented fill generally consisted of weathered shale, shale, organic silt, organic clay, fat clay, lean clay, sandy lean clay, clayey sand, silty sand, poorly graded sand with silt, and poorly graded sand. The fill contained varying amounts (and sometimes significant amounts) of gravel, shale and limestone fragments, organic soils (and layers) such as peat and organic clay, concrete, and bituminous debris. Additionally, we encountered larger sized building debris in the undocumented fill that included concrete fragments (footings, slabs, walls, etc.), clay pipes, rebar, metal, wood, PVC, and ash. Undocumented fill included material below existing buildings, pavement areas and landscaped or green areas.

The undocumented fill was encountered at depths up to approximately 17 feet below existing surface grades.

Penetration resistances within the undocumented fill ranged from 2 blows per foot (BPF) to 50 blows per 1/8 inch of penetration, indicating the soils were poorly (or uncompacted) to well compacted. Some of the higher penetration resistances could be the result of larger debris, gravel/cobbles/boulders, or bedrock chucks within the fill being encountered by the SPT sampler during drilling.



## **B.3.b.2.** Remediation Fill

Fill placed during recent remediation efforts coordinated by Ford and Arcadis was encountered to depths up to 22 feet below existing grade. The remediation fill primarily consisted of the following materials:

- Imported sand fill (poorly graded sands). The imported sand was fine- to medium-grained and contained varying amounts of gravel and silt with classifications ranging from poorly graded sand, poorly graded sand with silt, and silty sand. Although generally consistent, the sand occasionally contained layers of crushed concrete or other fill soils. The thickness of the sand fill ranged from about 4 to 14 feet.
- On-site fill (generally lean clay, sandy lean clay, clayey sand and silty sand). On-site soils that were determined to not have environmental impacts were reused as fill for remediation areas across the site. The on-site fill contained varying amounts of gravel, concrete and bituminous debris, and shale and limestone fragments. We also encountered traces of organic material or slightly organic layers. The thicknesses of the on-site fill ranged from about 1 to 8 feet. Additionally, the on-site fill was often used to cap the other remediation fill (sand or concrete) at the surface in less than 1-foot to 3-foot layers.
- Crushed concrete fill. On-site concrete, that was non-impacted, was crushed and placed as fill. Often this concrete appeared to be crushed similar to general aggregate base specifications (with a size of 2 inches or less). The thickness of the crushed concrete varied from about 1 1/2 to 12 feet. The crushed concrete was commonly covered at the surface by on-site fill soils ranging from silty sand to lean clay.

Penetration resistances within the remediation fill ranged from 2 to over 35 BPF, but generally ranged from 6 to 25 BPF. Overall the remediation fill appeared moderately to well compacted; however, the lower blow counts recorded within the borings also indicate layers or areas of low or minimal compaction are present.

## **B.3.c.** Native Soils

Native soils were generally encountered below the fill, but were most prevalent on the south and western portions of the site (in some areas weathered or sound bedrock was present directly below the fill soils). Native soils consisted of buried topsoil or swamp deposits, terrace (or alluvial) deposits, or glacial till.



A layer of organic topsoil or swamp deposited soil was common below the fill within the northeastern portion of the site, generally outside of previous building areas, but was also occasionally present throughout the entire site. Borings or test pits where buried organic soils were encountered included ST-8, ST-15, ST-18, ST-61, ST-73, ST-109, ST-110, TP-4 to TP-7, TP-20, TP-26, TP-35, ENV-TP-6, ENV-TP-58, ENV-TP-63, and ENV-TP-94. Organic soils consist of organic clay, sandy organic clay, peat, or slightly organic to organic sands and clays. The thicknesses of the organic soils was generally 4 feet or less.

Terrace or alluvial deposits were encountered at Borings ST-15, ST-43, ST-45, ST-49, ST-73, ST-78, ST-89, ST-98, ST-107, ST-108, ST-110, ST-111, ST-115, ST-117, ST-118, ST-124 and Test Pits TP-30, TP-31, TP-35, ENV-TP-4, ENV-TP-58, ENV-TP-63, and ENV-TP-94. These soils consisted of lean clay, lean clay with sand, clayey sand, silty sand, poorly graded sand with silt, and poorly graded sand and were generally in a loose/soft to very dense/hard condition.

Glacial till soils consisting of sandy lean clay, lean clay, clayey sand and silty sand were encountered in Borings ST-35, ST-36, ST-49, ST-59, ST-61, ST-77, ST-80, ST-82, ST-83, ST-88, ST-92, ST-93, ST-114, TW-7 and Test Pits TP-19, TP-20, TP-21, TP-22, TP-23, TP-27, TP-28, TP-30, TP-44, ENV-TP-6, ENV-TP-8, and ENV-TP-58. As indicated by the penetration resistances, the general consistency of the clayey soils ranged from soft to hard and the sandy soils from loose to medium dense.

Terrace and glacial soils contained varying amounts of gravel, cobbles and potentially boulders, as well as shale and limestone fragments. Shale and limestone fragments were more prevalent closer to the bedrock interfaces.

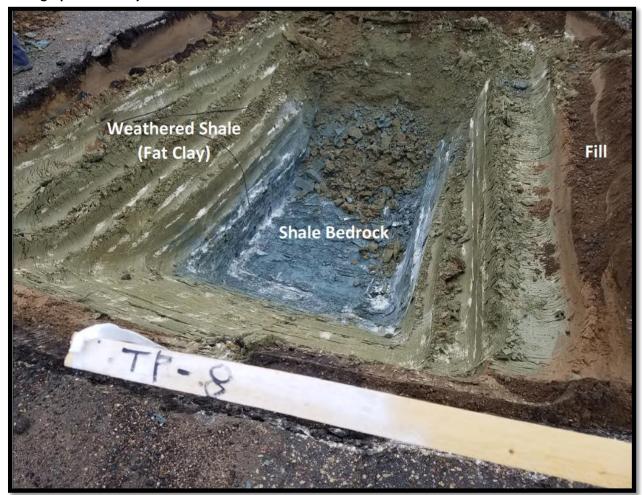
#### B.3.d. Bedrock

#### B.3.d.1. General

The on-site soils are underlain by shallow bedrock consisting of the Decorah Shale, Platteville Limestone, Glenwood Shale, and St. Peter Sandstone, in descending order. Decorah Shale was the most common bedrock encountered and was often present within 15 feet of existing surface grades. The Decorah Shale was generally present in two geologic conditions: highly weathered shale bedrock (shown on the boring and test pit logs as fat clay [CH] or lean clay [CL]) and shale bedrock (shown on the logs as Decorah Shale bedrock). The subsection below provides additional details. Photograph 4 shows the difference between the weathered shale (fat clay and lean clay) and shale bedrock (Decorah Shale) layer at TP-8.



Photograph 4. Fat Clay and Shale Bedrock





#### **B.3.d.2.** Decorah Shale

Although shown as two distinct layers on the boring and test pit logs, the transition between the weathered shale (fat clay and lean clay) and less weathered shale bedrock was generally more gradual.

- Highly Weathered Shale Bedrock (fat clay and lean clay). Based on our field logging and laboratory testing, the highly weathered shale bedrock was primarily a fat clay (CH) with lesser amounts of lean clay (CL). The fat clay and lean clay had varying amounts of sand, gravel, shale, and limestone fragments. The fat clay and lean clay were primarily a gray to greenish-gray and brown in color. The upper limits of the highly weathered shale bedrock were encountered at depths ranging from about 1 to 21 1/2 feet below ground surface (elevations 799 to 852 feet), with an average depth of about 7 feet. The thickness of the fat and lean clay varied from about 1 to 10 feet, but was more commonly 1 to 4 feet thick. In some remediation fill areas, the fat and lean clay was removed down to the underlying less weathered (massive) shale bedrock.
- Decorah Shale Bedrock. The shale bedrock was moderately to intensely fractured, fissile, and horizontally bedded, including areas of thin limestone interbedding. A layer of highly weathered shale bedrock (as described above) commonly overlaid the shale bedrock, although it some remediation areas the weathered shale (fat and lean clay) was removed. The shale bedrock was primarily gray to dark gray in color. The upper limits of the shale bedrock were encountered at depths ranging from 1 to 15 feet below ground surface (elevations 794 to 854 feet), but more commonly encountered at depths ranging from 7 to 12 feet below grade surface.

#### B.3.d.3. Platteville Limestone

Platteville Limestone was encountered at elevations ranging from approximately 794 to 805 feet, but more commonly encountered at elevations ranging from 796 to 802 feet. Based on our review of available data, the Platteville Limestone is common at an elevation of about 800 feet or below. When intact, the overall thickness of the Platteville Limestone is generally about 30 feet, and in Boring ST-85, we encountered 33 feet of Platteville Limestone from coring. The limestone was slightly to very intensely fractured, and is commonly interbedded within the shale at the shale-limestone transition. In the test pits that encountered the moderately fractured limestone, the excavator could not excavate into the limestone and the test pit was stopped.



#### **B.3.d.4.** Glenwood Shale

The Glenwood Shale is typically present between the Platteville Limestone and St. Peter Sandstone. The typical thickness of the Glenwood Shale is 2 to 3 feet in the Twin Cities area, but the thickness can vary from 2 to 18 feet in thickness. The thickness of the Glenwood Shale increases as you move southward from the Twin Cities area to the Cannon Falls area, and then decreases in thickness as you move southward from the Cannon Falls area. In Boring ST-85, we encountered about 6 feet of the Glenwood Shale Formation. The last 3 feet of the Glenwood Shale we encountered was shaly sandstone, often a common occurrence in the transition zone between the shale and underlying sandstone.

#### B.3.d.5. St. Peter Sandstone

Based on review of the Arcadis borings, St. Peter Sandstone was encountered in the central and western portions of the project site (including AMW-01 to AMW-04) at depths ranging from 11 to 64 feet below ground surface. The sandstone was described primarily as a sand soil, fine-grained, well-grounded sand grains, trace silt and clay, and varying amounts of cementation. We encountered St. Peter Sandstone in Boring ST-85. The sandstone was encountered at a depth of about 50 feet below grade at an elevation of 763 1/2 feet. The sandstone was yellow, light brown to white in color, fine- to very fine-grained, and moderately to highly weathered.

#### **B.4.** Groundwater

Groundwater was observed at varying depths within the undocumented fill, remediation fill, native soils, at the bedrock contact, and within the bedrock during our exploration; however, groundwater was also not present all exploration locations. In general, groundwater observations included the following:

- Observed depths to groundwater ranged from at the ground surface to approximately
   16 1/2 feet below existing grade, with an average depth of about 6 feet.
- Observed groundwater elevations ranged from approximately 800 1/2 to 848 feet, with a general flow (trend) down to the west and south towards the river.
- Most commonly, the groundwater was perched above the low permeability weathered shale (fat clay or lean clay) or shale bedrock.
- Groundwater was also commonly observed perched or trapped within the clean sands and crushed rock/concrete (remediation fill) overlying the fat clay/shale bedrock. The shallowest observed groundwater depths were present within the sand fill, including at the ground surface.



- Horizontal bedding within the shale and limestone bedrock will promote lateral movement of groundwater within the bedrock.
- Water conditions observed within the borings and test pits are judged to be perched water conditions; perched water conditions will vary significantly based on annual and seasonal fluctuations, as well as subsurface conditions.
- Hydrostatic water levels exists within the underlying St. Peter Sandstone near elevation 700±.
- Although not observed, perched and trapped groundwater conditions may also be present within the Platteville Limestone, as the underlying Glenwood Shale can act as a confining layer.

Table E2 in Appendix E depicts the general observed groundwater elevations within the borings and test pits across the site.

#### **B.5.** Karst Review

Karst is a landscape formed by the dissolution of a layer or layers of soluble bedrock. Geologic maps developed by Ramsey County and the Minnesota Department of Natural Resources (DNR) identify the Platteville Limestone and St. Peter Sandstone to have the potential for karst features, typically in the form of natural caves, sinkholes, or other landforms. During our geotechnical evaluations of the site, we did not observe karst-type features during on-site reconnaissance, review of historical information, or within the soil borings (or test pits) that were drilled into the limestone and sandstone. Figure F3 in Appendix F displays the known karst locations within a 1-mile radius. As displayed in Figure F3, there are no known karst locations at the site.

## **B.6.** Laboratory Test Results

The boring and test pit logs show the results of moisture content, percent passing the #200 sieve testing, Atterberg limits, and organic content tests we performed, next to the tested sample depth. Appendix B contains the results of these tests. Appendix D displays the results of the laboratory testing that was not included on the boring and test pit logs. Appendix D also includes the illustrations of the Atterberg Limits results for fill soils, alluvial or glacial till soils, weathered shale bedrock, and shale bedrock, sieve analysis, standard Proctor moisture-density relationship, hydraulic conductivity, and swell testing results. Laboratory testing was completed in general accordance with ASTM Standards.



## B.6.a. Existing Fill

#### **B.6.a.1.** Moisture Content

The moisture contents (ASTM D 2216) of the fine-grained fill soils (clayey sand, sandy lean clay, lean clay, fat clay, shale, and weathered shale) varied from approximately 5 to 60 percent, indicating the moisture contents of the tested clayey soils ranged from below to above their probable optimum moisture contents. The moisture contents of the sandy soils (poorly graded sand to silty sand, including crushed concrete) varied from approximately 1 to 27 percent, indicating the moisture contents of the tested sands were below to above their probable optimum moisture contents, likely varying in relation to the presence of perched groundwater.

## **B.6.a.2. Sieve Analysis**

Our mechanical analyses (ASTM C 117) indicated that the sandy fill soil tested contained approximately 1 to 43 percent silt and clay by weight, indicating that the soil tested is classified as a poorly graded sand (SP) to a clayey or silty sand (SC or SM).

Our sieve analysis (ASTM D 6913) were completed on four samples of existing fill. The sieve analysis results determined the fill soils tested were generally poorly graded and contained 6 percent or less passing the #200 sieve. This would classify the soils as either poorly graded sand or poorly graded sand with silt.

## **B.6.a.3.** Atterberg Limits

Atterberg limit tests (ASTM D 4318) were completed on four samples of existing fill. Liquid limits determined for the clayey soils tested ranged from 30 to 61 and plasticity indices ranged from 16 to 34. These results indicate that the clayey soils ranged from lean clay (CL) to fat clay (CH). Graphics depicting the results of the Atterberg limits tests is displayed in Appendix D.

### **B.6.a.4. Organic Content**

Organic content tests (ASTM D 2974) were completed on 19 samples of existing fill and ranged from approximately 2 to 12 percent. The results indicated the tested fill soils were slightly to highly organic. Moisture contents of the organic soils ranged from 13 to 36 percent.



#### B.6.b. Native Soil and Bedrock

#### **B.6.b.1.** Moisture Content

The moisture contents of the clayey soils (clayey sand, sandy lean clay, lean clay and fat clay) varied from approximately 10 to 40 percent, indicating the moisture contents of the tested soils were generally near to above their probable optimum moisture content. The moisture contents of samples of the weathered shale bedrock (fat clay and lean clay) and Decorah Shale Bedrock varied from approximately 6 to 39 percent. The moisture contents of the sandy soils (poorly graded sands to silty sands) varied from approximately 9 to 30 percent, indicating the moisture contents of the tested sands were generally near to above their probable optimum moisture contents.

#### **B.6.b.2. Sieve Analysis**

Our mechanical analyses indicated that the native soils (sandy and fine-grained soils) tested contained approximately 20 to 62 percent silt and clay by weight, indicating the soils were classified as a silty sand (SM), clayey sand (SC), or sandy lean clay (CL).

## **B.6.b.3.** Organic Content

Organic content tests were completed on 11 samples of native soils (buried topsoil or swamp deposits) and the tests ranged from approximately 3 to 25 percent. The results indicate slightly to highly organic soils. Moisture contents of the native organic soils ranged from 17 to 36 percent.

### **B.6.b.4.** Atterberg Limits

Atterberg limit tests were completed on three samples of native clay. Liquid limits determined for the clayey soils tested ranged from 20 to 39 and plasticity indices ranged from 8 to 20. These results indicate that the native clay ranges from clayey sand (SC) to lean clay (CL).

Atterberg limit tests were completed on 36 samples of weathered bedrock soils. Liquid limits determined for the weathered bedrock soils tested ranged from 40 to 79 and plasticity indices ranged from 20 to 52. These results indicate that the clay ranges from lean clay (CL) to fat clay (CH), with the majority of the highly weathered shale bedrock tested as fat clay.

Atterberg limit tests were completed on nine samples of Decorah Shale bedrock. Liquid limits determined for the bedrock tested ranged from 35 to 66 and plasticity indices ranged from 21 to 37. These results indicate that the bedrock ranges from lean clay (CL) to fat clay (CH), with the majority of the Decorah Shale bedrock tested as fat clay. Graphics depicting the results of the Atterberg limits tests are included within Appendix D.



### **B.6.b.5. Standard Proctor**

Standard Proctor moisture-density relationship (ASTM D698) testing was completed on bag samples of fat clay (weathered shale bedrock) recovered from Borings ST-52 and ST-91. The standard Proctor tests yielded maximum dry densities of 91.8 and 102.3 pounds per cubic foot (pcf) with optimum moisture contents of 25 and 20 percent, respectively. The standard Proctor test results are displayed Appendix D.

## **B.6.b.6.** Hydraulic Conductivity

Hydraulic conductivity testing (ASTM D 5084) was also completed on the bag samples from Borings ST-52 and ST-91. The samples were remolded to 95 percent of their respective maximum dry densities before the hydraulic conductivity testing was completed. The average hydraulic conductivity for sample ST-52 was 1.8E-08 cm/sec and for sample ST-91 was 6.8E-09 cm/sec. The hydraulic conductivity test results are displayed Appendix D.

### **B.6.b.7. Swell Testing**

Swell testing (oedometer testing) was completed on three samples of Decorah Shale bedrock (in-situ condition). The results of the swell testing are displayed in Table 7. The swell testing results are displayed in Appendix D.

Table 7. Consolidation-Swell (CS) Testing Results

Boring	Depth Below Surface Grade (feet)	Overburden Pressure Applied (tsf)	Swell Pressure (tsf)	Swell (%)
ST-52	10 1/2	0.08	1.5	0.4
ST-73	12	0.08	0.8	0.6
ST-94	9 1/2	0.08	1.4	2.2

Consolidation-swell (CS) and constant-volume (CV) swell tests performed to date for private development on the site yielded slightly lower results, with swell pressures ranging from 0.25 to 1 tsf and percent swell ranging from 0.5 to 1.1 percent.

## **B.6.c.** Swelling Potential Based on Laboratory Test Correlations

The liquid limit and plasticity index can be used to estimate the qualitative swelling potential of the clays and weathered shale. Swelling of the highly plastic clays can create engineering problems under foundations, structures, and pavements with changes in the moisture contents in the clay. Unweathered Decorah Shale is known to have a low to moderate swell potential. Table 8, adapted from the Geotechnical Reference by Holtz et al, 1969, provides general correlations of swelling potential related to common soil tests.



**Table 8. Correlation of Swelling Potential with Comment Soil Tests** 

Liquid Limit	Plasticity Index	Swelling Potential	Probable Expansion %*
<39	<18	Low	<1
39 to 50	15 to 26	Medium	1 to 5
50 to 63	25 to 41	High	3 to 10
>63	>35	Very High	>10

<sup>\*</sup>Percent volume change when subjected to a stress of 1 kip/sq. ft.

The majority of the weathered shale bedrock (fat clays) tested had liquid limits greater than 50 and plasticity index values greater than 25 indicating the potential for swelling. However, published data on the Decorah Shale states that it generally has a medium swell potential. Swelling potential increases when the soil is desiccated or dry and moisture is added. As stated above, the moisture contents of the fat clays tested ranged from about 9 to 39 percent. These recorded moisture contents are estimated to range from well below to slightly above the optimum moisture contents. The fat clay or shale with natural moisture contents below optimum will have the greatest swell potential.

# C. Geotechnical Design and Construction Discussion

## C.1. General Geology

The Ford Redevelopment Project has a complex subsurface profile that is unique to the region given the overall scale of the project. Subject to large-scale historic industrial development, and subsequent removal and remediation efforts, a cap of existing fill overlies a majority of the site. The fill is variable in regards to age, depth, composition, and in-place consistency. The fill often extends to the underlying bedrock, however, where native soil deposits were present below the fill, they were generally a combination of terrace (or alluvial) and glacial till. The native soils varied from sands to clays, were generally competent, and typical of deposits within the region. Localized layers of buried topsoil and other native organic soils were also present in select areas of the site.



Bedrock was prevalent throughout the site, often at a depth of 12 feet or less below the surface. The near surface bedrock is a combination of weathered shale and shale (Decorah Formation), and limestone (Platteville Formation), depending on location and elevation. In general, elevation 800± is the division between Decorah Shale (above) and Platteville Limestone (below). St. Peter Sandstone is also present at depth below the limestone. The shale, which often includes an upper zone of material weathered to a consistency of lean or fat clay, is considered potentially expansive. Although of limited impact to the project, a secondary shale formation (Glenwood) is also present between the Platteville Limestone and the St. Peter Sandstone.

Perched or trapped groundwater is common at relatively shallow depths below portions of the site, often where sandy fill is present over bedrock or other lower permeability soils.

Some physical remnants of the historic site development also remain, including utility tunnels, as well as caverns and tunnels within the sandstone from past mining operations.

The balance of the section of the report discusses impacts of the site geology to design and construction of the infrastructure phase of the project.

## C.2. Geotechnical Impacts

### C.2.a. Existing Fill

The existing fill is a combination of fill associated with historic development of the site (undocumented fill) and fill placed during recent environmental remediation efforts (remediation fill) as described in Section B.3. Fill soils were present to depths up to 22 feet below existing surface grade, but fill thicknesses generally ranged from 5 to 15 feet below current grades. Some of the fill consisted of clean sand and appears to be compacted; however, overall the fill was variable in composition and compaction. Some of the fill contained construction debris (mostly concrete, but also other debris), shale fragments, and organic material or soils. Crushed concrete was used as mass fill in limited remediation areas. The fill was also occasionally underlain by native organic soils or soft clayey soils.

Given the overall undocumented and variable composition of the fill, there is a risk of soil consolidation and subsequent settlement from additional loads associated with new fill placement and infrastructure improvements. The greatest risk exists where grades are raised 5 feet or more and/or where structures are placed, such as retaining walls and bridges (and future buildings).



Overall, it is our opinion the existing fill can generally be left in place below right-of-way areas, new pavements, exterior slabs, and similar infrastructure improvements. These structures are generally more tolerant of subgrade movement and the cost of removal and replacement of the fill is likely prohibitive, when compared to the performance benefit. Furthermore, the considerations and recommendations within Sections D.1 (subgrade preparation) and D.1.j. (construction delay) are provided to help reduce settlement risks through subgrade improvement and construction sequencing.

Alternatively, select removal of existing fill (and other unsuitable soils) may be required below infrastructure features less tolerant to movement and/or with higher subgrade loads, such as the pedestrian bridge and retaining walls.

## C.2.b. Bedrock

#### C.2.b.1. Removal

Bedrock will affect excavation and construction of 1) roads within the northeast and southern portions of the site, 2) all three stormwater basins (and the creek), 3) select below grade stormwater structures, and 4) utility pipes and structures throughout the site. Other features, such as bridge and retaining wall foundations, may also encounter bedrock. Generally, the upper bedrock layer on site is Decorah Shale, with the upper 1 to 4 feet typically being weathered to a consistency of fat or lean clay (rather than bedrock). Below approximate elevation 800 (+/-), Platteville Limestone may be present, although interbedded limestone seams and layers are also common within the lower portion of the Decorah Shale.

It has been our experience and from observing the test pit excavations that an excavator with a toothed bucket can often remove shale bedrock. However, larger equipment, pneumatic chisels or rippers may also be required to remove more competent shale bedrock or where limestone is interbedded. Alternate rock removal methods should also be assumed where massive limestone is present.

The shale and limestone is horizontally bedded. During removal, the bedrock will frequently break off at natural seams, fractures or bedding planes. As such, actual bedrock removal quantities can exceed the quantities established by the plans.

## C.2.b.2. Support

In general, bedrock provides a high capacity bearing surface for pavements and structures; however, subcutting the bedrock below pavement, slabs, and utility pipes is typically required to reduce point loading and reflective cracking. Shale and weathered shale, while generally structurally competent, require additional precautions as outlined below related to expansive forces and volume changes.



### C.2.b.3. Shale and Expansive Clays

Weathered shale (generally fat clay), and more competent shale bedrock, can be expansive and subject to volume changes when exposed to moisture variations and when confining pressure is removed. Conversely, the material can also shrink if dried. If not properly managed, volume changes and associated expansive forces can be detrimental to footings, slabs, pavements, utilities or other items bearing on or above the shale. The shale with the greatest risk for volume change and expansion is where the material is partially weathered and/or its natural moisture content is dry of its optimum moisture content.

Methods for best managing the fat clay and shale include limiting their exposure to moisture variations by selective removal and sealing off exposed surfaces with other non-expansive, low permeability material (such as lean clay) and not leaving surfaces exposed for extended periods of time. Utilizing confining pressures that exceed the swell pressure of the fat clay and shale will also negate the expansive forces.

#### C.2.c. Groundwater

Static groundwater is present at depth within the underlying sandstone bedrock; however, shallow perched (or trapped) groundwater was also present throughout the site. The observed perched groundwater depths were variable, likely indicative of the variable subsurface stratigraphy. Overall, the perched groundwater was typically present on top of the weathered shale/bedrock surface and where high permeability fill (clean sand, crushed rock or concrete) was present. Groundwater depths were shallowest where these conditions were present, including within the eastern and southern areas (where bedrock is shallow) and across the central portion of the site (where extensive sand fill was used for remediation efforts).

Groundwater impacts to infrastructure design and construction may include:

- Utility, pond, and other excavations approaching or intercepting the weathered shale or bedrock surface will likely encounter groundwater.
- The Central Water Feature and associated retaining walls, flatwork, below-grade stormwater basins, etc. will likely encounter substantial perched/trapped groundwater within the fill.
- Sumps and pumps may be suitable for groundwater control within low permeability soils; however, dewatering within high permeability sands may require wells, cut-off trenches, or other more extensive means. Dewatering should be in accordance with the approved environmental requirements for the project.



- Trenches excavated into the shale or limestone bedrock will likely become below-grade conduits for groundwater collection and transmission. Using clay fill to backfill trenches may be necessary to help control groundwater or to cut off water from entering future building excavations (or below-grade areas) and other areas such as the Central Water Feature.
- Pond liners may need to consider hydrostatic buoyancy forces.

### C.2.d. Existing Structures and Tunnels

#### C.2.d.1. General

Provided records indicate subsurface structures (tunnels, shafts, footings, slabs, etc.) that extended greater than 10 feet below the existing ground surface were cut off at that depth, bulk-headed (for tunnels and shafts), and backfilled to the existing ground elevation. Figure F1 in Appendix F (provided by Arcadis) indicates the documented areas where subsurface structures were left in place. In addition, seven documented tunnel systems were constructed in the soil and bedrock below the former Ford Assembly Plant at various depths and configurations (see Appendix F). The documented tunnels include historic sand mining within the St. Peter Sandstone. Excluding the oil tunnel and steam tunnel (note, floor slab of the steam tunnel was left in place), the remaining tunnels were sealed at the entrances and left in existing condition. Elevator, air and other shafts that extended from the tunnels to the surface buildings were excavated down at a depth of approximately 10 feet and capped with reinforced concrete.

The majority of the tunnels that remain in place beneath the site were excavated in the sandstone at elevations ranging from 691 to 725. Based on proposed site grades, the existing tunnels will be approximately 55 to 100 feet below the lowest planned construction elevations and the Platteville Limestone will typically be in place over the tunnels.

The 2012 Mannik and Smith Group, Inc. report stated that based on the NTH inspection in 2007, the vast majority of the sand tunnels inspected were stable with only minor signs of deterioration. The 2012 report also states that the tunnels in the Platteville Limestone Formation and the St. Peter Sandstone are currently stable with an anticipated low risk of collapse in the sandstone and very low risk of collapse in the limestone. Finally, the 2012 report states that the hard limestone formation above the sandstone would likely provide a bridge that would mitigate ground subsidence at the surface.

Similar to the conclusions provided in the 2012 report, it is our opinion the risk for settlement or stability issues to the proposed infrastructure improvements related to the existing tunnels or structures is low.



## C.2.d.2. Removals

Ground Penetrating Radar Systems, LLC (GPRS) performed a ground penetrating radar (GPR) and electromagnetic induction (EMI) survey of the site to review the potential for underground storage tanks, near surface structures or other anomalies for Terracon (2018). Sixteen locations were identified for additional test pits to determine the source of the anomalies. The majority of the anomalies consisted of large pieces of concrete, existing column footings from former buildings, or other concrete structures.

It is likely other shallow structures are also present on site that are undocumented and undiscovered. However, unless in close proximity or in conflict with infrastructure features, we assume existing structures will have a negligible impact and can be left in place. The exception would be below retaining walls, bridges, or other structures with higher or more localized loads. Existing structures, including vertical shafts or utilities, should also be reviewed for impacts to stormwater features, specifically those designed to retain water.

#### C.2.e. Frost Protection

The project will include extensive concrete pavement and sidewalk areas. Subgrade soils within these areas are generally anticipated to be controlled by engineered fill, although some areas may bear on existing soils depending on final site grades. Frost heave-related movement can affect surface grades, as well as pavement/slab performance and maintenance. Where frost-related movement is a concern, such as plazas and sidewalks, we recommend additional considerations such as a thickened layer of non-frost-susceptible sand backfill and drain tile be considered as outlined in Section C.6. Note, concrete pavements (such as concrete sidewalks) are considered rigid and will typically be more susceptible to differential frost-related movement and associated trip hazards at joints.

## C.2.f. Reuse of Existing Soil and Material

Soil reuse will significantly affect mass grading and infrastructure construction. Soil, bedrock and material reuse should consider the following:

- Organic soils containing greater than 5 percent organic content should not be reused as structural below pavements (or greater than 3 percent below structures).
- Large debris (greater than 6 inches in size), compressible debris (i.e. wood or organic material) or debris that cannot be properly compacted should be removed from structural or pavement fill prior to reuse.



- Remaining on-site concrete structures may be crushed and reused as structural fill, assuming the crushed product can be properly compacted for the intended use. Remaining bituminous pavement can be milled and reused as pavement base or subbase material depending on the gradation of the reclaimed material, but should not be used as general fill material and placed in building areas.
- On-site silty sands and clayey soils (SC, CL) are moisture sensitive and, in general, are at or above their estimated optimum moisture contents. Reuse of these soils should assume some moisture conditioning (drying or wetting) will be required to achieve required compaction levels.
- Fat clay or shale should not be reused as structural fill below structures, pavements, slabs, or adjacent to below-grade walls. Similarly, soils containing fat clay/shale fragments or chunks should not be reused as defined above unless these materials are removed or the percentage of these materials is low enough to not impact performance or add risk to the supported structure. Shale removed from utility trenches is not recommended for use as trench backfill. Fat clay may be considered for reuse as pond liner material, but should be reviewed for conformance with applicable stormwater design requirements. Shale should not be reused as pond liner. Moisture conditioning of fat clay (or crushed shale) to achieve compaction levels will be difficult. Chemical modification or stabilization of the fat clay or shale may be considered, but is likely not cost effective.
- Limestone bedrock may be crushed and reused as general site fill, stabilizing aggregate, or aggregate base, depending on the amount of processing.
- Reuse of all on-site soils should be in accordance with the approved environmental requirements for the project.

#### C.2.g. Karst

Based on our understanding of the project and that site improvements and stormwater features will typically be designed to limit or prevent water infiltration into the existing bedrock, it is our opinion the potential for karst features or conditions is low on the project site. The potential for karst conditions or features developing can be further reduced by observation of soil and bedrock conditions by qualified engineering technicians, geotechnical engineers, or geologists during mass grading and construction.



## C.3. Structure/Feature Specific Commentary

#### C.3.a. General Site Grading

As referenced in Figure A.3, Appendix A, a majority of the site will be subject to fill placement and increased site grades as part of the overall site grading, requiring substantial amounts of material to be imported to the site. The general exceptions where site grades will be lowered or cut includes the three primary stormwater basins/features, the extreme northeast corner of the site (Block 3), and the southern portion of the site (Blocks 25-27, 31, 32, 35 and 36).

Within fill areas, fill placement will generally allow for control of subgrade design, including materials and compaction levels, without removal of existing materials. However, as discussed in Section C.2.a, fill placement over the existing subgrade (including existing fill and native soils) will result in the risk of surface settlement related to the consolidation of the existing subgrade soils under the weight of the new fill.

#### C.3.b. Public ROW, Pavements, and Exterior Slabs

Extensive new exterior pavements and slabs, including public roads, trails, plazas, sidewalks, etc., will be constructed as part of the infrastructure project. In addition to standard considerations for subgrade preparation, the following geotechnical factors or comments should be considered for pavement and exterior slab design and construction:

- Potentially expansive shale and fat clay, or fill containing these materials, may be present at subgrade elevations where grades will remain similar or be lowered. Provisions as outlined in Sections C.2.b and D.1 are recommended to mitigate the risks associated with expansive forces and volume changes.
- Frost heave-related movement will affect long-term performance and maintenance of pavements and exterior slabs. Section C.6 includes recommendations for reducing the risk of frost-related movement and its subsequent effects.
- Frost protection is recommended to include all sidewalks within ROW areas, and consider the impact of adjacent features (such as landscaping islands) that will allow water to enter the subgrade.
- The use of a construction delay or sequencing to allow for settlement related to fill consolidation (including fill consolidation of deep utility trench backfill) to generally occur prior to construction of pavements, sidewalks, etc.



### C.3.c. Central Plaza and Square

The Central Plaza and Square will be prominent site features that will include substantial grade raises (up to 16 feet), below-grade stormwater structures, and a large retaining wall on the south side of Bohland Avenue. Design and construction should include the following considerations:

- Substantial grade changes will increase the risk of settlement after fill placement related to consolidation of the existing soils, as well as consolidation of the fill under its own weight. We recommend construction of site features such as pavements/slabs, the retaining wall, and stormwater structures/pipes be staged or delayed to allow for the majority of this settlement to occur prior to construction.
- The use of non-frost-susceptible sands as fill within the Central Plaza Area, including as backfill behind the retaining wall on the south side of Bohland Avenue and around the stormwater structure, will reduce the risk of frost heave and also help reduce the risk of fill consolidation.

## C.3.d. Retaining Walls and Pedestrian Bridges

Several free-standing retaining walls are planned on site, including on the south side of Bohland Avenue, the east side of Finn Street, the east side of the Central Water Feature, within the Civic Plaza, and at other locations within the parks areas. Pedestrian bridges are also planned over the Central Water and Hidden Falls features. Although design is still preliminary, we recommend design and construction consider the following:

- If present, existing fill and soft/compressible soils should be removed below the proposed walls and bridge foundations to reduce the risk of settlement (and possibly to improve bearing capacity for support).
- If present, shale or fat clay should be partially subcut and capped with low-permeability fill below retaining wall and bridge foundations.
- The use of non-frost-susceptible sands as wall (and abutment) backfill will improve long-term performance, and reduce the lateral earth pressures used for wall design.
- Impact of groundwater, possibly stormwater (for the walls around the Central Water Feature), and potential saturated soil conditions on wall design and performance.



#### C.3.e. Utilities

Extensive new below-grade utilities are planned throughout the site, including sanitary sewer pipes that will bear up to 28 feet below final grade and a deep drop shaft west of Saunders Avenue. Below-grade utility design and construction should consider the following geotechnical impacts:

- Groundwater will be encountered throughout the site and substantial dewatering and groundwater control should be anticipated, per Section C.2.c. Perched groundwater (above the bedrock) may also impact utility trench stability.
- Substantial bedrock removal is anticipated; weathered shale, shale, and fill containing shale should not be reused as utility trench backfill.
- Sequencing of utility construction in regards to general fill placement (and placement of other utilities) should be evaluated to reduce impacts to new utility pipes, as well as site features bearing within/over trench backfill zones, from settlement.
- Differential settlement between shallow utility pipes (bearing over fill) connected to deep structures bearing on bedrock (that will not be subject to settlement) should be reviewed.

### C.3.f. Stormwater Features

Stormwater features planned for the project include retention ponds, biofiltration basins, a creek channel, and below-grade systems and structures. The following should be considered for stormwater design and construction:

- Substantial bedrock removal is anticipated; shale and fill containing shale should not be reused as structural backfill.
- Limited additional subcutting of shale or fat clay may be required below structures or pipes.
- Exposed and unconfined shale or fat clay surfaces will expand over time.
- Bedrock surfaces (limestone and shale) should be reviewed for voids, cracks, anomalies, and existing structures (such as vertical shafts) that may impact stormwater feature performance.



- Fat clay (not shale bedrock) may be considered for reuse as low permeability pond liner material; however, fat clay is subject to volume changes with moisture variations. If this material is allowed to dry, it will be subject to shrinkage and cracking that may affect liner performance.
- Constructability of soil pond liners over slopes, and well as bedrock surfaces.
- Protection of soil pond liners during and after construction from erosion.
- Perched groundwater is prevalent throughout the central portion of the site where the Central Water Feature is planned; groundwater control should be planned to help reduce impacts to design and construction, including the potential for buoyancy forces on the liner.

## D. Geotechnical Recommendations

Recommendations provided within this section are intended to support development, design, and construction of the infrastructure improvements.

## D.1. Site Grading and Subgrade Preparation

### D.1.a. General Site Grading

We understand mass grading of the site may or may not include site-specific soil corrections for individual private buildings or blocks (i.e. pad ready); this report does not address block-specific private development. For areas where initial mass grading is limited to rough grading of the site and does not include performing additional below-grade soil corrections for individual private buildings or blocks, we recommend the following:

- 1. Strip vegetation, pavements, and other near surface structures.
- 2. Scarify, moisture condition and surface compact the subgrade with at least 5 passes of a large roller with a minimum drum diameter of 3 1/2 feet or as recommended by the geotechnical engineer.
- 3. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.
- 4. Place fill in accordance with Section D.1.m.



It should be noted that settlement may occur in areas where new fill will be placed on top of existing fill and/or underlying organic soils or compressible native soils. The amount and time rate of settlement will be dependent on the amount of fill placed and existing subgrade soils. Additional recommendations should be provided for private development of each individual block.

Road, pavement, structure and utility subgrades should be prepared in accordance with the recommendations provided in their respective sections below.

## D.1.b. Retaining Wall, Bridge, and Culvert (Structures) Subgrade Preparation

We recommend subgrade preparation below retaining walls, bridges, culverts and other structures associated with the infrastructure improvements include the steps outlined below. Recommendations for bridge foundations should be reviewed after design proceeds.

- 1. Excavate to the proposed structure subgrade elevation (in cut areas).
- 2. Remove unsuitable soils consisting of surficial topsoil or organic soils, vegetation, pavements/slabs, existing structures, uncontrolled or poorly compacted existing fill, and soft/unstable clayey or silty soils from below the structure and 1:1 lateral oversizing zone. If MSE walls are used, we recommend the lateral oversizing extend outward and downward from the back of the lateral reinforcement behind the wall.
- 3. Additional removal of bedrock (limestone, shale, weathered shale), fat clay (CH), and fill containing shale, weathered shale, or fat clay may be required if these materials are present at or near structure foundation/slab subgrades. These conditions should be reviewed on a case-by-case basis as design proceeds. For preliminary purposes, we recommend removal of shale bedrock, weathered shale, or fat clay (or fill containing these materials) within 12 inches of wall foundations or structure bearing depths.
- 4. Loose or unstable bedrock should be removed below foundations or structure inverts; bedrock bearing surfaces should be relatively level.
- 5. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.
- 6. Surface compact exposed subgrade as recommended by the geotechnical engineer. Surface compaction does not apply to exposed bedrock surfaces.



- 7. Place engineered fill to grade and compact in accordance with Section D.1.m (and Step 7 below). Fill placement should also include placement of non-frost-susceptible fill as applicable (see Section D.6).
- 8. If shale bedrock, weathered shale, or fat clay (or fill containing these materials) are present at the retaining wall foundation, they should be capped with a minimum of 12 inches of non-expansive clayey soil with a PI between 8 and 25. Other structures should be reviewed on a case-by-case basis.

Contractors should use techniques which would limit the disturbance. Provisions to subcut and replace soils with crushed aggregate base should be anticipated to provide a stable working platform.

We recommend fill be placed on level surfaces. Therefore, any fill placed on or against sloping ground should begin from the bottom of the slope where a level surface can be established and properly 'keyed' into the slope. Keys should consist of a level bench excavated to a convenient width for the equipment used. This will provide a more stable fill condition and reduce the potential for slip surface to occur along the existing soil/new fill interface.

## D.1.c. Public Street and Alley Subgrade Preparation

We recommend the following general steps for subgrade preparation of public streets and alleys.

- 1. Excavate to the proposed pavement section subgrade elevation (in cut areas).
- 2. Strip unsuitable soils consisting of surficial topsoil or organic soils, vegetation, pavements/slab, and existing near-surface structures to a minimum depth of 3 feet below pavement subgrades (defined as the bottom of aggregate base, or sand subbase if utilized).
- 3. If present, we recommend bedrock (limestone, shale, weathered shale), fat clay (CH), and fill containing shale, weathered shale, or fat clay be removed within and to a minimum depth of 12 inches below pavement subgrades (defined as the bottom of aggregate base, or sand subbase if utilized).
- 4. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.
- 5. Slope subgrade soils to areas of sand and drain tile to allow the removal of accumulating water.



- 6. Prior to filling or placement of new pavements, scarify, moisture condition and surface compact the exposed subgrade to at least 95 percent of standard Proctor density at depths deeper than 3 feet and to 100 percent of standard Proctor density within the upper 3 feet of the pavement subgrade. Scarification and surface compaction does not apply to exposed bedrock surfaces.
- 7. Place engineered fill to grade and compact in accordance with Section D.1.m to bottom of pavement (and Step 8 below). Fill placement should also include placement of non-frost-susceptible fill as applicable (see Section D.6).
- 8. Where shale bedrock, weathered shale, or fat clay (or fill containing these materials) are present at the pavement section subgrade (bottom of aggregate base, or sand subbase if utilized), they should be capped with a minimum of 12 inches of non-expansive clayey soil with a PI between 8 and 25.
- 9. Proofroll the pavement subgrades as described in Section D.1.i.

### D.1.d. Sidewalk and Trail Subgrade Preparation

We recommend sidewalk and trail subgrades be prepared in accordance with the general recommendations provided in Section D.1.c for pavement subgrades. For flatwork generally not subject to vehicle loads (such as sidewalks), the minimum compaction level for the upper 3 feet may be reduced to 95 percent of standard Proctor density.

### D.1.e. Civic Plaza and Square and Central Water Flatwork Subgrade Preparation

We recommend subgrades within the Civic Plaza and Square be prepared in accordance with the general recommendations provided in Section D.1.c for pavement subgrades.

For increased frost protection within these areas, we recommend the upper 4 feet of the subgrade (below the pavement section) consist of non-frost-susceptible fill in accordance with Sections D.1.m and D.6. This recommendations is also applicable for paved or flatwork areas around the Central Water Feature or other specific areas where reduced effects of frost heave are desired.

## D.1.f. Utility Pipe and Structure Subgrade Preparation

Soils present at utility pipe and structure invert elevations are anticipated to be a combination of bedrock, native soils, and fill. In general, we anticipate these materials will be directly suitable for pipe and structure support, although additional subcutting may be required as recommended below.



Earthwork activities associated with utility pipe and structure installations should adhere to the recommendations in Section D.1.b. In addition, we recommend the following for utility excavations (applies to pipes and structures):

- If bedrock (including limestone, shale, weathered shale) are present at or above the invert elevation, we recommend they be over-excavated a minimum of 12 inches beneath the invert to reduce the risk of point loads.
- If existing structures are present at or above the invert elevation, we recommend they be removed to a minimum depth of 12 inches beneath the invert to reduce the risk of point loads.
- If existing organic soils, unstable or soft clays or fill are present at or above the invert elevation, we recommend they be removed to a minimum of 12 inches beneath the invert and be backfilled with sand with less than 12 percent passing the #200 sieve (Select or Deep Structural Fill) or crushed aggregate to help provide a stable base for utility support.

We recommend selecting, placing and compacting utility fill in accordance with the recommendations provided above in Section D.1.m. Additional considerations pertaining to utility trench fill/backfill include the following:

- If settlement at or around utilities is a concern due to deep utility trench backfill, we recommend backfilling around the structure with sand with less than 12 percent passing the #200 sieve (Deep Structural Fill). Alternatively, project planning can include a construction delay between trench/structure backfill and construction of surface features, as discussed in Section D.1.m.
- As discussed in Section C.2, additional trench backfill considerations may be required within specific areas depending on the presence of perched/trapped groundwater and proximity of other below-grade structures. Low permeability backfill (non-expansive) may be required to reduce or impede groundwater flow along utility trenches into below-grade building areas, behind retaining wall, ponds, or other structures or features. These conditions should be reviewed on an individual basis.
- Pipe or structure bedding should be in accordance with manufacturer requirements.



• In general, capping of shale, weathered shale, or fat clay subgrades within utility trenches with low-permeability, non-expansive soil or material is not anticipated to be required due to the confining pressure of the overburden materials (or below grade structures). However, the exception would be shallow utility pipes or structures with insufficient confining pressure and where water subsurface may collect. These pipes and structures should be reviewed on an individual basis.

## D.1.g. Stormwater Pond and Basin Subgrade Preparation

In general, pond subgrades will not be subject to loading and we recommend they be prepared in accordance with Section D.1.a. However, additional removal of soil or material may be required if the subgrade is not stable enough to allow of proper construction of the pond liner as outlined below.

After excavation to the planned subgrade elevation, we recommend stormwater pond subgrades be reviewed by a geotechnical engineer or qualified engineering technician. Additional review may also be required by the stormwater designer. Exposed bedrock surfaces should be reviewed for voids, cracks, anomalies, and existing structures (such as vertical shafts) that may impact stormwater feature performance.

The stormwater design plans or submittal documents may provide additional subgrade preparation requirements.

Section D.5 provides additional commentary and recommendations pertaining to pond and basin liners.

### D.1.h. Additional Recommendations for Fat Clay and Shale Subgrades

Depending on site grades, fat clay or shale may be present at pavement, slab, structure, utility, or other site feature subgrades. As discussed, depending on the condition of the soil or bedrock, these materials have the potential for volume change and expansive forces. To reduce the risk for volume change and expansive force, we recommend the following general steps be taken to help manage the fat clay or shale exposed within or below subgrades that would be affected by volume changes or expansive forces.

- Subcutting these materials as defined within their respective subgrade preparation subsections for the various infrastructure improvements.
- Where exposed, seal off fat clay, weathered shale, or shale subgrades from moisture variations within 48 hours of exposure with low permeability clayey fill with a PI between 8 and 25 or lean fill. Chemical modification can also be considered for fat clay subgrades.



- Promptly remove water from fat clay or shale subgrades.
- Have a geotechnical representative observe the exposed subgrades to evaluate if additional subgrade improvements are necessary.

## D.1.i. Pavement Subgrade Proofroll

After preparing the subgrade as described above and prior to the placement of the aggregate base (or sand subbase, if utilized), we recommend proofrolling the subgrade soils with a fully loaded tandem-axle truck (minimum weight of load and truck of 50,000 pounds). We also recommend having a geotechnical representative observe the proofroll. Areas that fail the proofroll likely indicate soft or weak areas that will require additional soil correction work to support pavements.

The contractor should correct areas that display excessive yielding or rutting during the proofroll (generally defined as greater than 1 to 2 inches), as determined by the geotechnical representative. Possible options for subgrade correction include moisture conditioning and recompaction, subcutting and replacement with soil or crushed aggregate, chemical stabilization and/or geotextiles. We recommend performing a second proofroll after the aggregate base material is in place, and prior to placing bituminous or concrete pavement. Yielding or rutting during the proofroll of the aggregate base material should be negligible.

### D.1.j. Construction Delay

For preliminary design and planning, we recommend a construction delay between the completion of subgrade fill placement and the construction of infrastructure features (pavement, flatwork, utilities, structures, etc.) be utilized when the following conditions apply:

New fill placement exceeds 5 feet over existing grades.

AND

- Existing fill depth exceeds 5 feet, or
- Buried topsoil or organic soils are present at depth (and will be left in place), or
- Soft/loose native soils are present (and will be left in place).

The intent of the delay is to allow for all or a portion of the settlement of the existing soils from new fill loads to occur prior to placement of site features. We recommend a minimum delay of 4 weeks; however, the actual length of the construction delay will be dependent on the specific site feature and tolerance to potential settlement, amount and type of fill placement, and existing subgrade conditions.



### D.1.k. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will vary from lean clay to poorly graded sand. These soils are typically considered Type B and C Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type C soils should have a gradient no steeper than 1.5H:1V. Slopes constructed in this manner may still exhibit surface sloughing, especially where wet or saturated soils are present. Excavations within competent bedrock may be excavated as a vertical face; however, loose or highly fractured zones may require additional removal. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

#### D.1.I. Excavation Dewatering

Where present, we recommend removing groundwater from the excavations as promptly as possible. Allowing water to pond on subgrades for extended periods will cause them to become saturated and make them more susceptible to disturbance and strength loss during construction, or swelling (for shale and fat clay subgrades). We recommend the contractor develop and submit a dewatering plan for review and approval to the design team prior to construction.

#### D.1.m. Engineered Fill Materials and Compaction

Table 9 below contains our recommendations for engineered fill materials for the infrastructure phase of the project. All prospective fill materials should be reviewed by the geotechnical engineer.



Table 9. Recommended Engineered Fill Materials<sup>1</sup>

Locations To Be Used	Engineered Fill Classification	Possible Soil Type Descriptions	Gradation	Additional Requirements
<ul> <li>General site fill</li> <li>Below retaining walls and site structures</li> <li>Pavements, exterior slabs, flatwork, trails</li> </ul>	<ul><li>Structural fill</li><li>Pavement fill</li></ul>	SP, SP-SM, SM, SC, CL (excludes ML, MH, CH, Shale)	100% passing 3-inch sieve (within upper 3 feet of subgrade) 100% passing 6-inch sieve (below 3 feet of subgrade)	< 3% Organic Content (OC) below structures < 5% OC below pavements, exterior slabs, etc. Plasticity Index (PI) < 20%
<ul> <li>Deep structural fill (fill placed more than 10 feet below proposed structures or site features where settlement is a concern)<sup>2</sup></li> <li>Pavement subbase</li> <li>Behind retaining walls and below- grade walls, beyond drainage layer<sup>3</sup></li> </ul>	<ul> <li>Select or deep structural fill<sup>2</sup></li> <li>Pavement subbase</li> <li>Retained fill<sup>3</sup></li> </ul>	GP, GW, SP, SW, SP-SM	100% passing 2-inch sieve < 50% passing #40 sieve < 12% passing #200 sieve	< 3% OC
<ul><li>Drainage layer</li><li>Non-frost- susceptible</li></ul>	<ul><li>Free-draining</li><li>Non-frost- susceptible fill</li></ul>	GP, GW, SP, SW, SP-SM	100% passing 1-inch sieve < 50% passing #40 sieve < 7% passing #200 sieve	< 3% OC
Below landscaped surfaces, where subsidence is not a concern	Non-structural fill		100% passing 6-inch sieve	< 10% OC
Pond liner <sup>4</sup> Pond liner <sup>4</sup>		CL, CH	100% passing 2-inch sieve	Hydraulic Conductivity < 1x10 <sup>-7</sup> cm/sec
Low permeability fill to cap shale or fat clay subgrades	Non-expansive clay fill	CL	100% passing 2-inch sieve	PI between 8 and 25

<sup>&</sup>lt;sup>1</sup> Reuse of all on-site soils should be in accordance with the approved environmental requirements for the project.



<sup>&</sup>lt;sup>2</sup> Recommended to limit the risk of settlement associated with fill consolidation under its own weight.

<sup>&</sup>lt;sup>3</sup> Should be in accordance with retaining wall design wall design plans and specifications.

<sup>&</sup>lt;sup>4</sup> Should be in accordance with any applicable stormwater design requirements and requirements of design engineer.

We recommend spreading engineered fill in loose lifts of approximately 8 inches thick. We recommend compacting engineered fill in accordance with the criteria presented below in Table 10. The project documents should specify relative compaction of engineered fill, based on the structure located above the engineered fill, and vertical proximity to that structure.

**Table 10. Minimum Compaction Recommendations Summary** 

	Relative Compaction, percent	Moisture Content Variance from Optimum, percentage points		
Reference	(ASTM D698 – Standard Proctor)	< 12% Passing #200 Sieve (typically SP, SP-SM)	> 12% Passing #200 Sieve (typically CL, SC, ML, SM)	
Below structure foundations or slabs (includes stormwater/utility structures)	98	±3	-1 to +3	
Below public streets/roads and other pavements/slabs subject to regular vehicle traffic (upper 3 feet of subgrade, only)	100	±3	-2 to +1	
Below public streets/roads (below upper 3 feet of subgrade)	95	±3	±3	
Below sidewalks, trails, and exterior slabs not subject to regular vehicle loading	95	±3	±3	
Below landscaped surface (see Section D.5 for pond liners)	90	±5	-3 to +5	
Behind/adjacent to retaining or below-grade walls		±3	-1 to +3	
General utilities	95 <sup>1</sup>	±3	-1 to +3	
Pond liners <sup>2</sup>	95		0 to +3	

<sup>&</sup>lt;sup>1</sup> Increase compaction requirement to meet compaction required for structure supported by this engineered fill.

The project documents should not allow the contractor to use frozen material as engineered fill or to place engineered fill on frozen material. Frost should not penetrate under foundations during construction.

We recommend performing density tests in engineered fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.



<sup>&</sup>lt;sup>2</sup> Recommendations should be in accordance with any applicable stormwater design requirements and requirements of design engineer.

## **D.2.** Structures

### D.2.a. Retaining Walls

The following comments and recommendations may be used in retaining wall design and construction, however, final design responsibility will rest with the wall design engineer. Retaining wall designers should be informed of site features and utilities that would influence their design. Our scope of services did not include global stability analysis. If desired, we can provide global stability analysis of the proposed walls.

#### D.2.a.1. Subgrade Support and Net Allowable Bearing Pressure

We recommend the retaining walls bear in soils prepared as described in Section D.1.b; however, further direction regarding soil correction depths and suitable subgrade soils should be provided by the retaining wall designer. For walls with reinforced fill, we recommend the lateral oversizing extend outward and downward from the back of the fill reinforcement.

We anticipate foundations for the proposed retaining walls will bear on engineered fill placed for this project, or suitable native glacial soils or bedrock. However, depending on final design, retaining walls may be constructed within engineered fill placed during mass grading over areas of existing fill. Areas where walls are placed on existing fill should be expected to have greater amount of post-construction settlement, both differential and total settlements. Usually retaining walls can accommodate this movement, however, if potential wall settlement is not acceptable, existing fill should be removed from below wall foundations and reinforced zones. When soil conditions allow, surface compaction with the largest practical compactor will improve subgrade uniformity and strength.

For preliminary wall design purposes, we recommend foundations bearing on these soils be designed to exert an allowable soil bearing pressure up to 2,000 pounds per square foot (psf). The Boland Avenue retaining wall may bear on or near limestone bedrock. If retaining wall foundations bear directly on competent limestone bedrock, the bearing capacity may be increased to 10,000 psf.

All foundation subgrades should be reviewed by a geotechnical engineer. We anticipate total settlement of the wall will not exceed 1 inch; however, we recommend additional settlement analysis be performed as part of final wall design.

#### D.2.a.2. Drainage

Drainage behind the walls is critical. Unless a drainage composite is placed against the backs of the retaining walls, we recommend that fill placed within 2 horizontal feet of the walls consist of freedraining sand or gravel in accordance with Table 9, Section D.1.m. If "clear" gravel only (such as MnDOT



3149.2H Coarse Filter Aggregate) is used for drainage, a fabric separator may be needed to keep sand from washing into the gravel. Water within this zone should be removed and routed away from the wall and its foundation zone.

Wall fill not capped with slabs or pavement should be capped with a low-permeability soil to limit the infiltration of surface drainage into the fill. Grades should also be sloped to divert water away from the walls and the reinforced zone. We recommend the wall designer be consulted if water is introduced to the area of the wall.

Walls around the Central Water Feature may require more robust subsurface drainage systems depending on final grades, locations, and subsurface conditions. We recommend these walls be further reviewed as the park plans are further developed.

### D.2.a.3. Lateral Design Parameters

Free-standing retaining wall design can use active earth pressure conditions, assuming the walls can rotate slightly. If the wall design cannot tolerate rotation, then design should use at-rest earth pressure conditions. Rotation up to 0.002 times the wall height is generally required for walls supporting sand. Rotation up to 0.02 times the wall height is required when the wall supports clay.

To improve long-term performance and for ease of backfilling and compaction, we recommend the retaining walls be backfilled with sand with less than 12 percent passing the #200 sieve (per Table 9, Section D.1.m). Table 11 below provides recommended design values for the retaining walls. Alternate design values are also provided if the project team and wall designer use other on-site or imported material for retaining wall backfill.

Table 11. Recommended Retaining Wall/Below-Grade Wall Design Parameters - Drained Conditions

Retained Soil <sup>1</sup>	Wet Unit Weight (pcf)	Friction Angle (degrees)	Active Equivalent Fluid Pressure <sup>2</sup> (pcf)	At-Rest Equivalent Fluid Pressure <sup>2</sup> (pcf)	Passive Equivalent Fluid Pressure <sup>2</sup> (pcf)
Sand with less than 12% fines (SP, SP-SM)	120	32	35	55	320
Other structural fill (SM, SC, CL)	125	26	50	70	320

<sup>&</sup>lt;sup>1</sup>Per Table 9, Section D.1.m.



<sup>&</sup>lt;sup>2</sup> Based on Rankine model for soils in a region behind the wall extending at least 2 horizontal feet beyond the bottom outer edges of the wall footings and then rising up and away from the wall at an angle no steeper than 60 degrees from horizontal.

Consideration needs to be given for sloping fill or other dead or live loads that are placed within a horizontal distance behind the walls that is equal to the height of the walls. Our design values also assume that the walls are drained so that water cannot accumulate behind the walls (not saturated conditions).

Resistance to lateral earth pressures will be provided by passive resistance along the base of the wall and reinforced zone, and by sliding resistance along the bottoms of the wall footings. We recommend assuming a sliding coefficient equal to 0.4. These values are unfactored.

#### D.2.a.4. Global Factor of Safety

In addition to other applicable stability and performance demonstrations, we recommend retaining wall design documents or submittals contain demonstrations of global stability with a minimum factor of safety against global failure of 1.5 or greater.

## D.2.b. Pedestrian Bridges

#### D.2.b.1. Design

We were provided with the axial service loads listed in Table 12 for each bridge structure by Ericksen-Roed and Associates (ERA). ERA indicated the lateral loads on the bridge foundations were minimal.

We used LRFD methodology for design of the anticipated bridge foundations supported on shallow foundations. Resistance factors were obtained from the current edition of the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications. For the service limit state, we applied a resistance factor of 1.0. We assume a maximum settlement of 1-inch will be specified for each bridge. For evaluation of the strength limit state, we applied a resistance factor of 0.45 per Table 10.5.5.2.2-1 of the AASHTO LRFD Bridge Design Specifications.

# D.2.b.2. Bearing Capacity and Settlement

Our recommended bridge foundation design parameters are provided within Table 12 below. If lateral pressure values are required for abutment design, we recommend utilizing the values provided in Table 11, Section D.2.a.3.



**Table 12. Pedestrian Bridge Foundation Recommendations** 

Structure	Foundation Element	Service Load (kips)	Bearing Elevation	Referenced Boring(s)	Anticipated Subgrade Material	Recommended Design Bearing Capacity <sup>1</sup> (psf)
Central	Abutments	50	806		Fill <sup>2</sup>	2000
Water Bridge	Central Piers	110	797	ST-57, ST-58	Limestone Bedrock <sup>3</sup>	10000
Hidden Falls Bridge	Abutments	220	786	ST-68	Limestone Bedrock <sup>3</sup>	10000

<sup>&</sup>lt;sup>1</sup>Recommended design (factored) bearing resistance is for both strength and service limit states.

## D.3. Pavement

# D.3.a. Subgrade Design

After site grading and subgrade preparation per Section D.1, we anticipate the pavement subgrade soils will be variable, consisting of both sands and clays. Given the anticipated subgrades and experience with similar soils, we recommend designing pavements for a composite clayey and silty sand (SM/SC) subgrade and using an assumed R-value of 20 for flexible pavement design. We recommend rigid (concrete) pavements be designed for a modulus of subgrade reaction (k) of 150 pci.

## **D.3.b.** Public Street Pavement Sections

Table 13 includes our recommended minimum pavement sections for the public streets based on the anticipated subgrade soils and provided traffic loads.



<sup>&</sup>lt;sup>2</sup>Remove unstable or organic fill and replace with select structural fill per Section D.1.m, Tables 9 and 10.

<sup>&</sup>lt;sup>3</sup>Remove any remaining shale to expose limestone bedrock

Table 13. Recommended Minimum Bituminous Pavement Sections

Use	Primary Roads <sup>1</sup>	Secondary Roads	Shared Paths	Pedestrian/Bike/ Park Trails <sup>2</sup>
Feature	Cretin Ave., Mount Curve Blvd., Montreal Ave., Bohland Ave., Finn St., Hillcrest Ave., Woodlawn Ave. <sup>3</sup> (STA. 102+73 to STA. 106+21), Village Way <sup>3</sup> (STA. 196+74 to STA. 201+46 and STA. 206+35 to STA. 214+22)	Ranger Way <sup>3</sup> , Woodlawn Ave. <sup>3</sup> (STA. 80+00 to STA. 102+73)	Beechwood Ave., Village Way <sup>3</sup> , Ranger Way <sup>3</sup> , Saunders Ave., Yorkshire Ave.	Falls Passage (East and West), Mississippi River Blvd. and Ford Parkway Bike Trail, Various Park Trails
Minimum asphalt thickness (inches)	5	4	4	3.5
Minimum aggregate base thickness (inches)	12	10	6	8
Minimum sand subbase thickness (inches)	18	18	12	

<sup>&</sup>lt;sup>1</sup>Bituminous section thickened to support construction traffic.

#### **D.3.c.** Bituminous Pavement Materials

We recommend specifying crushed aggregate base meeting the requirements of Minnesota Department of Transportation (MnDOT) Specification 3138 for Class 5. We recommend that the bituminous wear and non-wear courses meet the requirements of Specifications 2360, with the following designations:

Wear: SPWEA340CNon-wear: SPNWB330C

If increased protection against thermal cracking and rutting is desired, we recommend using a PG Grade "F" oil.

We recommend compacting the aggregate base to meet the requirements of MnDOT Specification 2211.3.D.2.c (Penetration Index Method for the dynamic cone penetrometer [DCP]). We recommend compacting bituminous pavements to an average of at least 92 percent of their maximum theoretical (Rice) density with no individual result less than 90 percent.



<sup>&</sup>lt;sup>2</sup> Design includes additional 2 inches of aggregate base to meet support requirements for maintenance vehicles and vac-trucks.

<sup>&</sup>lt;sup>3</sup> Portions of Village Way and Ranger Way will be either a Primary or Secondary Road with portions of the road being a Shared Path. Woodlawn Avenue will include both Primary and Secondary Road segments.

#### D.3.d. Concrete Pavements

Table 14 includes our recommended minimum pavement sections for the exterior concrete pavements; most of the public streets will consist of bituminous pavement.

**Table 14. Recommended Minimum Concrete Pavement Sections** 

Use	Pavement Subject to Vehicle Loads <sup>2</sup>	Sidewalks				
Minimum concrete thickness (inches)	6	4				
Minimum aggregate base thickness (inches)	6	4				
Minimum sand subbase thickness (inches)	1	1				

<sup>&</sup>lt;sup>1</sup> Dependent on desired frost protection and area.

We recommend specifying concrete for pavements that have a minimum 28-day compressive strength of 4,500 psi, and a modulus of rupture ( $M_r$ ) of at least 600 psi. We also recommend Type I cement meeting the requirements of ASTM C 150. We recommend specifying 5 to 8.5 percent entrained air for exposed concrete to provide resistance to freeze-thaw deterioration. We also recommend using a water/cement ratio of 0.45 or less for concrete exposed to deicers.

#### D.3.e. Subgrade Drainage

We recommend installing perforated drainpipes throughout pavement areas at low points and around catch basins and along the perimeter of pavement areas where adjacent surface grades will promote drainage towards the pavement. Additional drain tile should be installed along the full length of road/pavement subgrades where shale, fat clay, or soils with low permeability are present at the pavement section subgrade.

The drainpipes should be placed in small trenches slightly below the bottom of the aggregate base material or sand subbase, where present.

#### D.3.f. Performance and Maintenance

We based the above pavement designs on a 20-year performance life for bituminous and a 30-year life for concrete. This is the amount of time before we anticipate the pavement will require reconstruction. This performance life assumes routine maintenance, such as seal coating and crack sealing. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.



<sup>&</sup>lt;sup>2</sup> Designed to include Falls Passage East and West, and concrete pavement areas subject to maintenance, vac-truck and other vehicle traffic.

It is common to place the non-wear course of bituminous and then delay placement of wear course. For this situation, we recommend evaluating if the reduced pavement section will have sufficient structure to support traffic (including construction traffic).

Many conditions affect the overall performance of the exterior slabs and pavements. Some of these conditions include the environment, loading conditions and the level of ongoing maintenance. With regard to bituminous pavements in particular, it is common to have thermal cracking develop within the first few years of placement, and continue throughout the life of the pavement. We recommend developing a regular maintenance plan for filling cracks in exterior slabs and pavements to lessen the potential impacts for cold weather distress due to frost heave or warm weather distress due to wetting and softening of the subgrade.

#### D.4. Below Grade Utilities and Structures

## D.4.a. Pipe Design and Support

Soils present at utility pipe and structure invert elevations are anticipated to be a combination of bedrock, native soils, and fill. In general, we anticipate these materials will be directly suitable for pipe and structure support, although additional subcutting may be required as recommended below.

Reference Section D.1.f for subgrade preparation and trench fill recommendations.

In general, we recommend project design and construction not place utilities within the 1H:1V oversizing of foundations (including future private structures). However, for structures supported on bedrock, this influence zone may be reduced and should be reviewed on a case-by-case basis.

The on-site soils varied from sand to clay. Based on our experience, the clayey soils encountered by the borings are moderately corrosive to metallic conduits, but only marginally corrosive to concrete. We recommend specifying non-corrosive materials or providing corrosion protection, unless project planning chooses to perform additional tests to demonstrate the soils are not corrosive.

#### D.4.b. Sanitary Sewer Drop Shaft

The new sanitary sewer system will include a vertical drop shaft west of Saunders Avenue and then tie into the existing sanitary sewer system via a horizontal connection. Boring ST-85 was extended to an approximate elevation of 742 utilizing rock coring to provide additional subsurface information for the drop shaft (note, the drop shaft was originally located west of Village Way).



Only preliminary design and construction details were provided, but we understand installation will be achieved with a cased, drilled shaft and the structure will consist of precast concrete. We also understand the annulus between the concrete structure and shaft walls will be fully grouted upon completion. We recommend shaft design and construction consider the following:

- Variable overburden soils and perched groundwater may be present on top of the bedrock.
- Perched groundwater may be present within the Platteville Limestone. The Glenwood Shale
  can act as a confining layer and trap substantial amounts of water within the lower bounds of
  the limestone. The perched water can adversely affect installation and construction.
- Shaft installation will likely penetrate four bedrock formations, including two layers of shale.
- The shaft and structure will ultimately bear within St. Peter Sandstone, which is considered to have a high bearing capacity, but is susceptible to disturbance, strength loss, and weathering if left exposed.
- Settlement of the material around the outside drop shaft may affect connecting horizontal pipes and surface features.

### D.5. Stormwater Ponds and Basins

Final design of the stormwater ponds, basins, and features, and associated liner systems, is the responsibility of the stormwater design engineer. Recommendations within this section are provided to aid design.

To aid design and construction, we recommend the following for liners intended to retain or hold water:

- If soil is desired for use a liner, we recommend a minimum of 2 feet of soil meeting the requirements outlined in Table 9, Section D.1.m. The minimum thickness should be increased in slope areas to accommodate constructability and loss of material through contamination with the existing subgrade during placement.
- On-site soils meeting these requirements will largely consist of fat clays; fat clays are considered expansive and subject to volume changes with moisture fluctuations. The clay pond liner should be protected from drying during construction and until filled to reduce the risk of shrinkage and cracking. The shrinkage cracks may not seal when the pond is filled and would serve as conduits for water loss. After filling, the water level should be maintained to prevent shrinkage and cracking of the clay liner.



- Within ponds (or portions of ponds) subject to water level fluctuations or designed to occasionally be dry, we recommend the pond liner include a stand-alone synthetic liner or a similar liner in-conjunction with a clay liner. The minimum clay layer thickness could potentially be reduced when used in conjunction with a synthetic liner.
- Design of synthetic liners should consider on-site debris, crushed concrete fill, and presence of bedrock.
- Where soil (not bedrock) is present at the pond subgrade, prior to liner placement, the subgrade should be scarified to a minimum depth of 18 inches and recompacted to break up any sand seams or layers.

The clay liner fill should be placed in maximum 8-inch lifts and be thoroughly compacted to minimum of 95 percent of standard Proctor density, unless otherwise specified by the design engineer. We recommend soil placed as fill be placed at a moisture content ranging from optimum moisture to 3 percentage points above its optimum moisture content. Fill should be compacted with a large self-propelled sheepsfoot compactor.

#### D.6. Frost Protection

#### D.6.a. General

The project will include extensive areas of pavements and exterior slabs that will be subject to freeze-thaw conditions. The subgrade soils are highly variable, but in general we consider the on-site silty and clayey soils (including weathered bedrock) to be moderately to highly frost susceptible. Soils of this type can retain moisture and heave upon freezing. In general, this characteristic is not an issue unless these soils become saturated due to surface runoff or infiltration or are excessively wet in-situ. Once frozen, unfavorable amounts of general and isolated heaving of the soils and the surface structures supported on them could develop. This type of heaving could impact design drainage patterns and the performance of exterior slabs, sidewalks, and pavements, as well as any isolated exterior footings and piers. To address most of the heave related issues, we recommend that general site grades and grades for exterior surface features be set to direct surface drainage away from buildings, across large paved areas and away from walkways and plazas to limit the potential for saturation of the subgrade and any subsequent heaving. General grades should also have enough "slope" to tolerate potential larger areas of heave which may not fully settle when thawed.



It should be noted that general runoff and infiltration from precipitation are not the only sources of water that can saturate subgrade soils and contribute to frost heave. Roof drainage, stormwater features, and the irrigation of landscaped areas in close proximity to exterior slabs, pavements, and isolated footings and piers, contribute as well.

We recommend subgrade details for landscaping within boulevard and ROW areas be reviewed to help reduce subgrade water flow into the subgrades of the adjacent pavements and exterior slabs (sidewalks).

## D.6.b. Additional Mitigation

One method to help limit the potential for heaving to occur is to remove frost-susceptible soils present below the overlying slab or pavement area down to the desired frost protection depth, and replace the excavated material with non-frost-susceptible, engineered fill. Non-frost-susceptible fill as defined in Table 9 as sand with less than 7 percent passing the #200 sieve and less than 50 percent passing the #40 sieve. If free draining sands are not present at the base of the subcut, we recommend providing drainage, as well as gradual transitions from this subcut (3H:1V or flatter gradient).

As discussed with the project team, Table 15 provides the recommended minimum removal and replacement depths for placing non-frost susceptible sand for increased frost protection for select features.

Table 15. Recommended Minimum Removal and Replacement Depths for Frost Protection

Feature	Minimum Depth (feet)
Central Plaza and Square	4
Plazas and walkways around Central Water Feature	4
Sidewalks and exterior slabs adjacent to public streets	Match sand subbase of adjacent road*

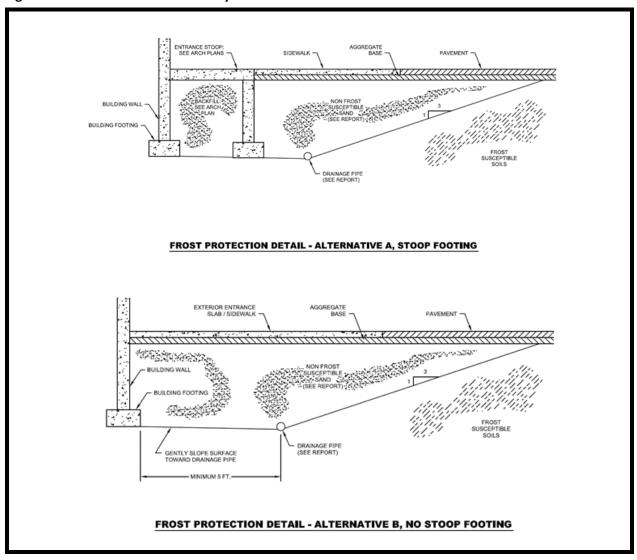
<sup>\*</sup>Depths may need to be increased or transition zones may be required for stoops and flatwork for adjacent buildings or other areas of increased frost protection.



Another option is to limit frost heave in critical areas, such as doorways and entrances, via frost-depth footings or localized excavations with sloped transitions between frost-susceptible and non-frost-susceptible soils, as described above.

Figure 16 shows an illustration summarizing some of the recommendations above.

Figure 16. Frost Protection Geometry Illustration





#### D.6.c. Maintenance

Over the life of slabs and pavements, cracks will develop and joints will open up, which will expose the subgrade and allow water to enter from the surface and either saturate or perch atop the subgrade soils. This water intrusion increases the potential for frost heave or moisture-related distress near the crack or joint. Therefore, we recommend implementing a detailed maintenance program to seal and/or fill any cracks and joints. The maintenance program should give special attention to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

# D.7. Testing and Quality Control

We recommend sampling and testing of materials for this project in accordance with the State-Aid for Local Transportation (SALT) 2019 Schedule of Materials Control- Local Government Agency; while following the specification requirements set forth in this Geotechnical Evaluation Report, the City of St. Paul Standard Supplemental Specifications for Construction, and the Minnesota Department of Transportation's Standard Specification for Construction 2018 Edition.

# E. Procedures

# **E.1.** Penetration Test Borings

We drilled the penetration test borings with a truck-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at continuous, 2 1/2- or 5-foot intervals in general accordance to ASTM D1586. We collected thin-walled tube samples in general accordance with ASTM D1587 at selected depths. The boring logs show the actual sample intervals and corresponding depths. We also collected bulk samples of auger cuttings at selected locations for laboratory testing.

We sealed penetration test boreholes meeting the Minnesota Department of Health (MDH) Environmental Borehole criteria with an MDH-approved grout. We will forward sealing records for those boreholes to the Minnesota Department of Health Well Management Section.



#### E.2. Rock Cores

We performed rock cores with an NQ-3 core barrel. First, we lowered the bit and casing to the bottom of the previously advanced borehole. Then we lowered the core barrel into the casing with a wire line, and locked into place. We advanced the bit and barrel by rotating the assembly while applying crowd pressure. We used bentonite-drilling mud to cool the bit and wash cuttings to the surface. Our drillers noted bit pressure, rate of advance, fluid pressure and fluid return as coring progressed. They also noted intervals with a rapid rate of advance, a sudden loss of fluid pressure or return and intervals with a loss of bit pressure.

After completing each 5-foot core run, the drillers unlocked the core barrel from the bit and brought the barrel to the surface. They then extruded the split inner tube from the barrel and opened the tube to reveal the core sample. After field classification and logging, the drillers packed the core into a cardboard storage box, arranged into 2-foot long sections.

# **E.3.** Exploratory Test Pits

Bolander excavated the test pits with a 345 excavator, under the direction and observation of our staff. We prepared Test Pit Logs by visually examining the sidewalls of the test pits and classifying the materials brought to the surface by the excavator bucket. We measured strata boundary depths with a metal tape and generally rounded to the nearest 1/2 foot.

# **E.4.** Exploration Logs

#### E.4.a. Log of Boring Sheets

Appendix A includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on penetration test samples, and groundwater measurements.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.



## E.4.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

# E.5. Material Classification and Testing

#### E.5.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

## E.5.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM or AASHTO procedures.

## **E.6.** Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes or allowed them to remain open for an extended period of observation, as noted on the boring logs.



# F. Qualifications

#### F.1. Variations in Subsurface Conditions

#### F.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

#### F.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

# F.2. Continuity of Professional Responsibility

#### F.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.



## F.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

# F.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

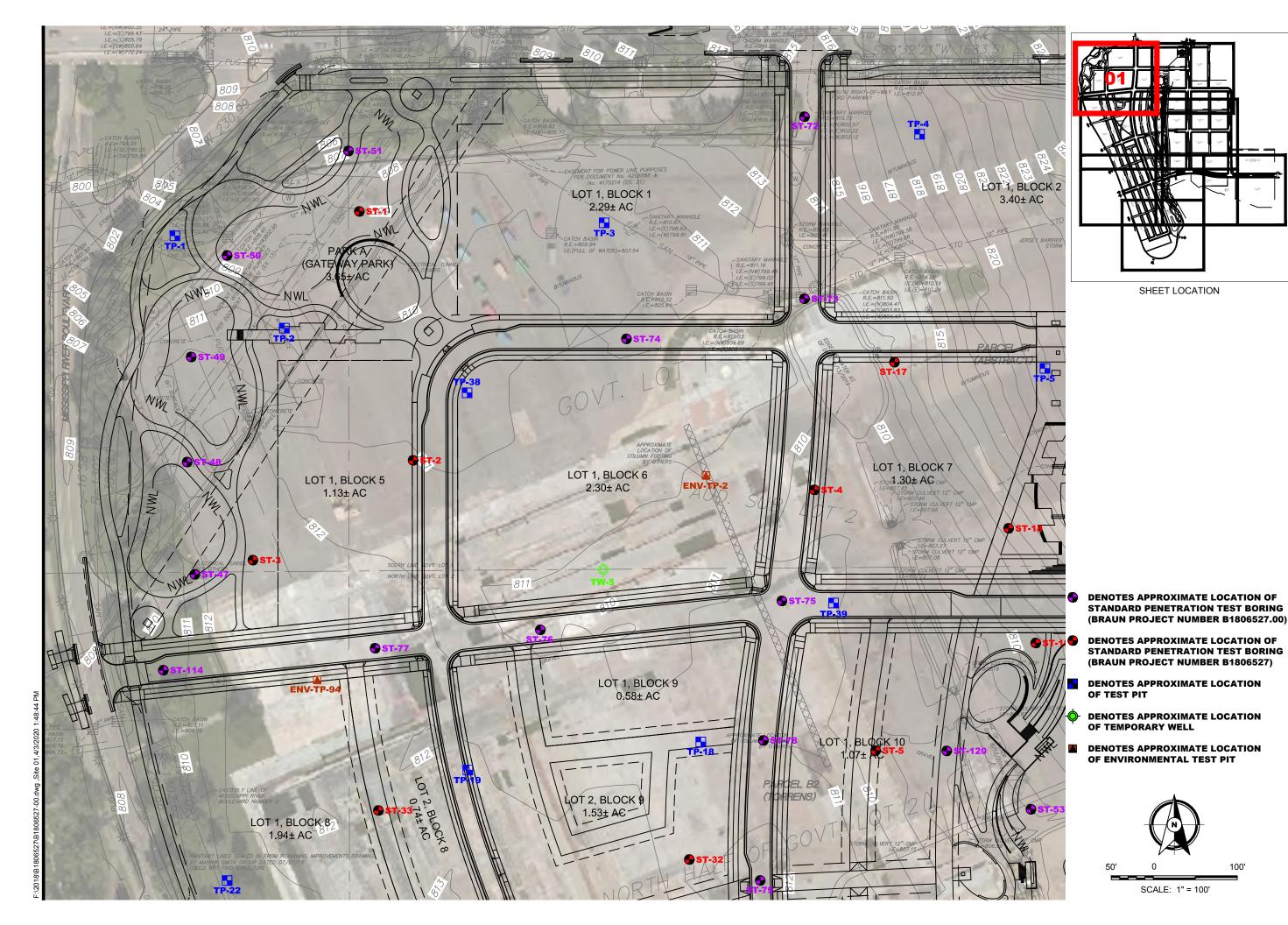
## F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.



# Appendix B Borings and Test Pits







Minneapolis, MN 55438 952.995.2000

Project No: B1806527.00

B1806527-00

Drawn By: Date Drawn: Checked By: JJV Last Modified: 4/3/20

Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

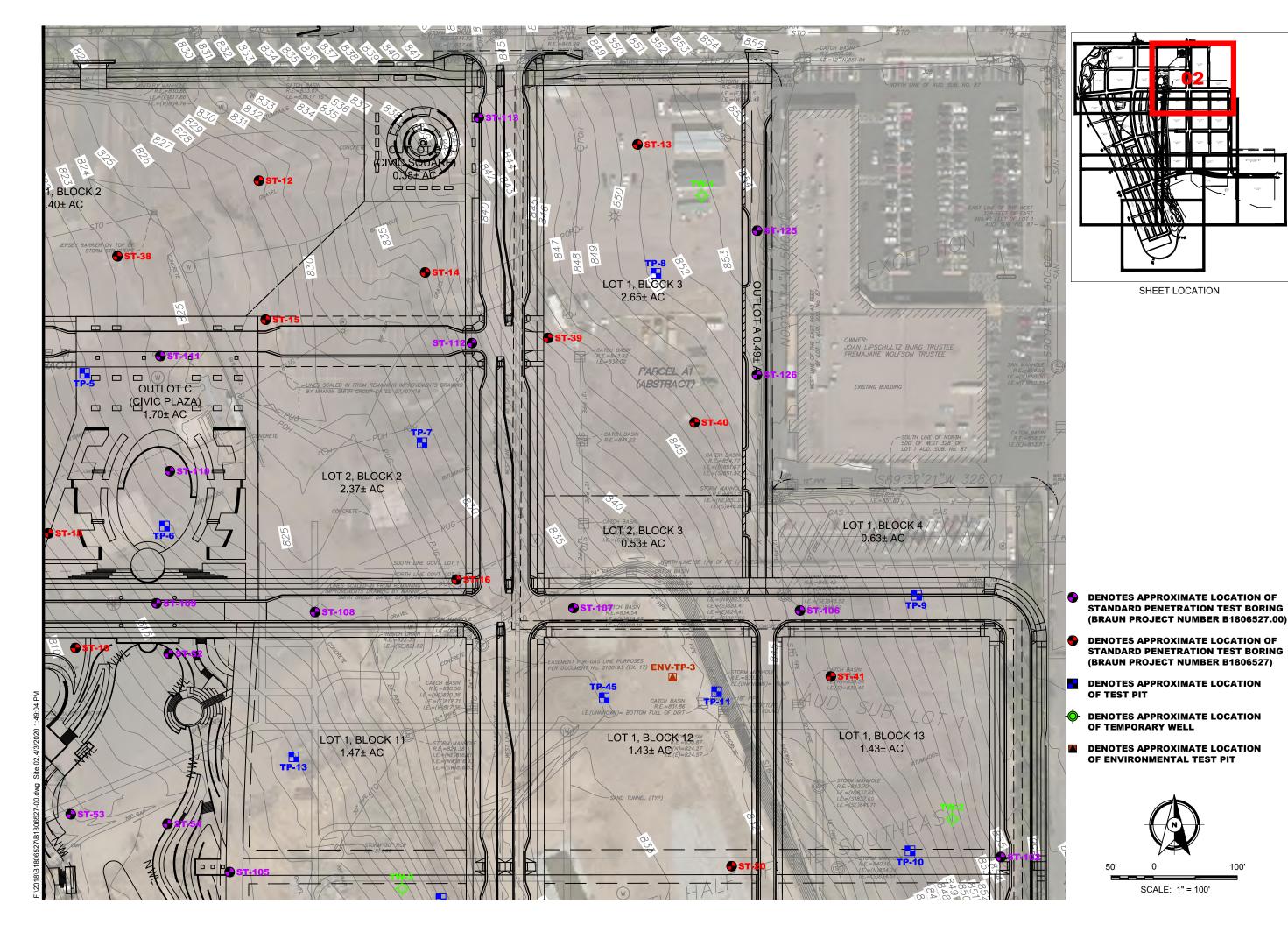
Saint Paul, Minnesota

Figure B1

Site Plan

Sheet: 01 of 08

100'





Minneapolis, MN 55438 952.995.2000

Project No: B1806527.00

B1806527-00

Drawn By: Date Drawn: Checked By: Last Modified: 4/3/20

JJV

Project Paul Infrastructure Phase

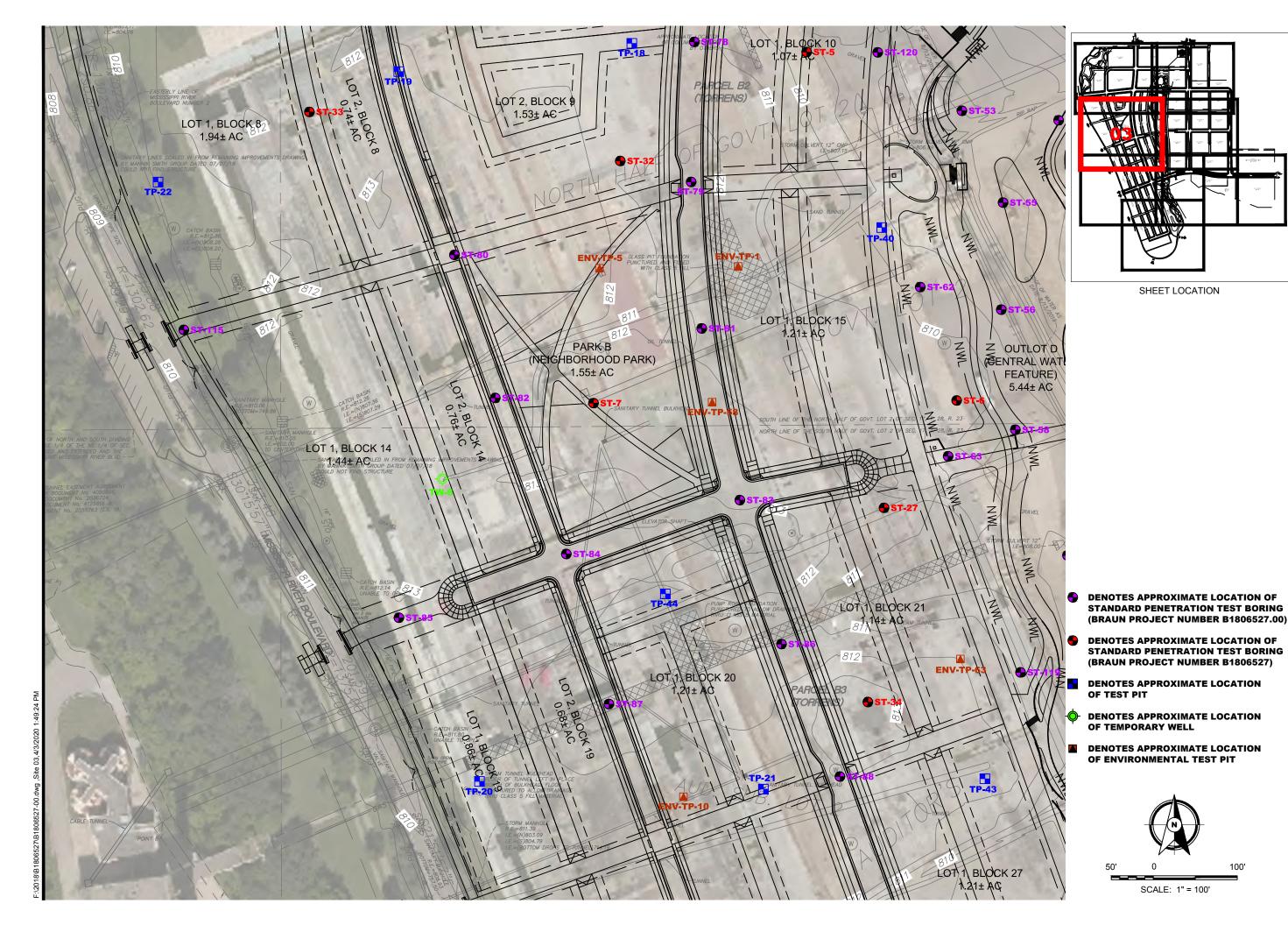
966 Mississippi River Boulevard South

Saint Paul, Minnesota

Figure B1

Site Plan

02 of 08





11001 Hampshire Avenue S Minneapolis, MN 55438 952.995.2000

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Drawing No: B1806527-00

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Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

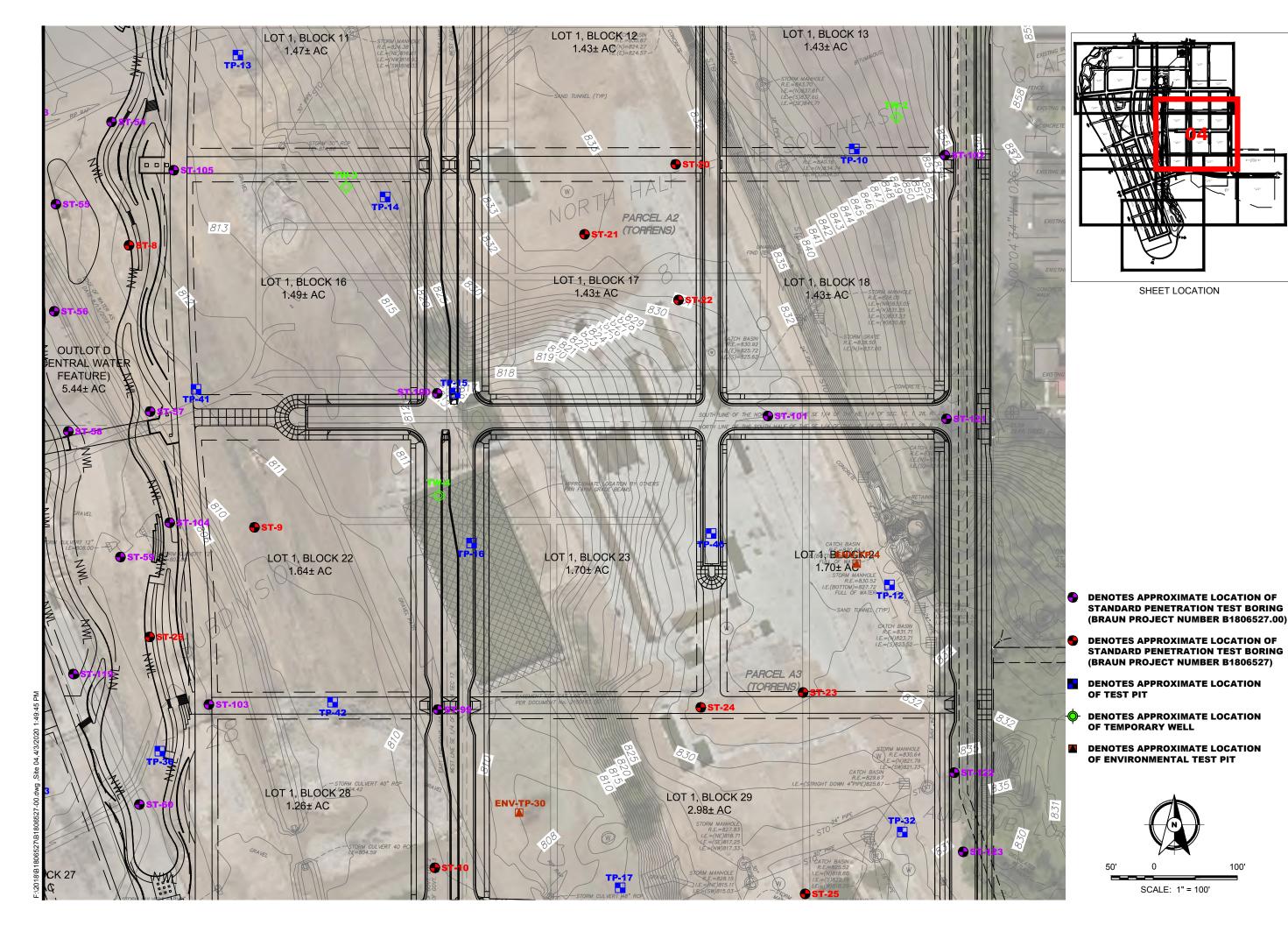
Saint Paul, Minnesota

Figure B1

Site Plan

Sheet: 03 of 08

100'





Minneapolis, MN 55438 952.995.2000

Project No: B1806527.00

B1806527-00

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Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

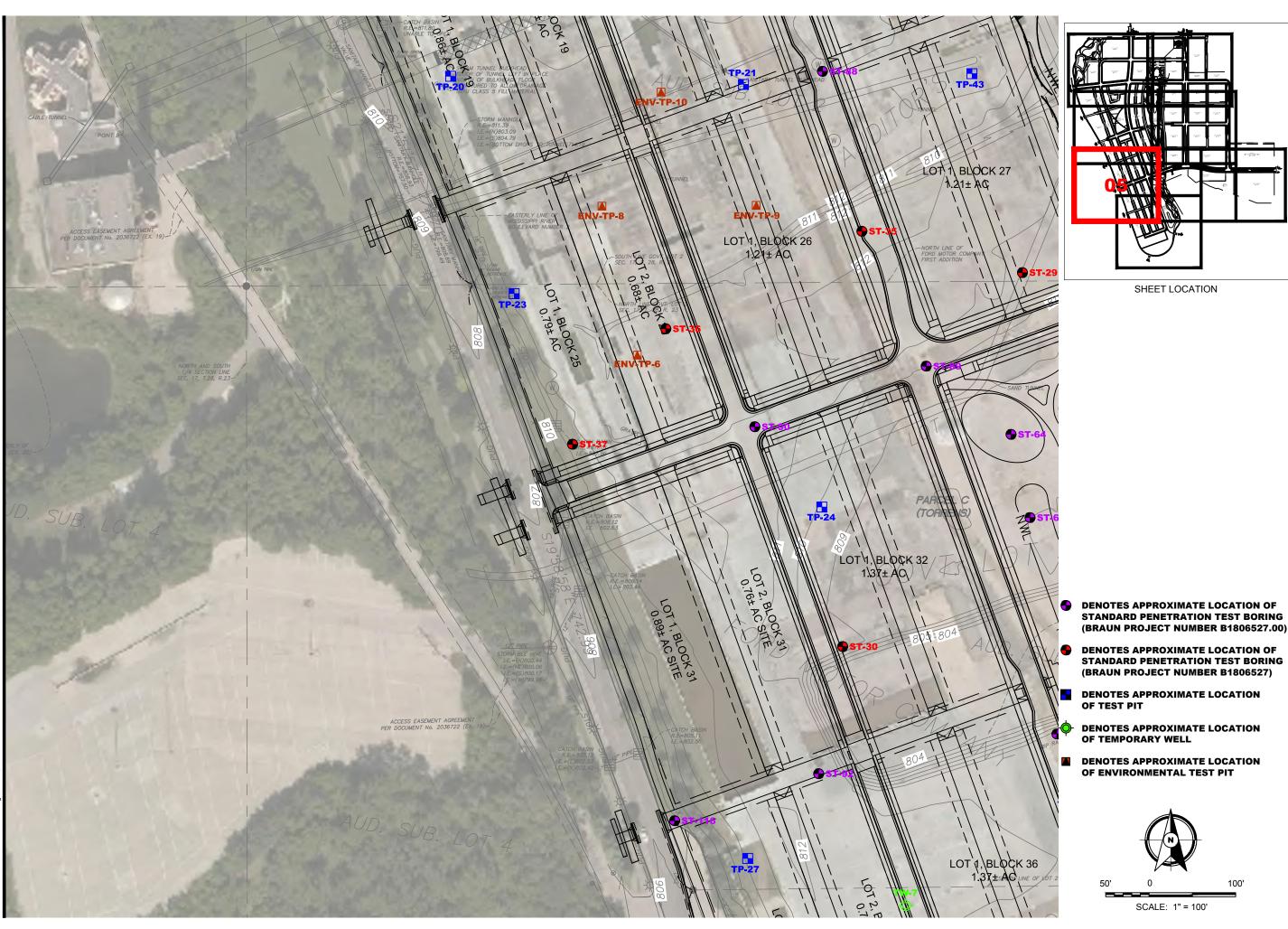
Saint Paul, Minnesota

Figure B1

Site Plan

04 of 08

100'





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Last Modified:

Project No: B1806527.00

Drawing No: B1806527-00

Project Paul

Infrastructure Phase

966 Mississippi River

Saint Paul, Minnesota

Figure B1

Site Plan

Boulevard South

JJV

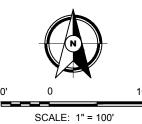
4/3/20

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

**DENOTES APPROXIMATE LOCATION OF** STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)

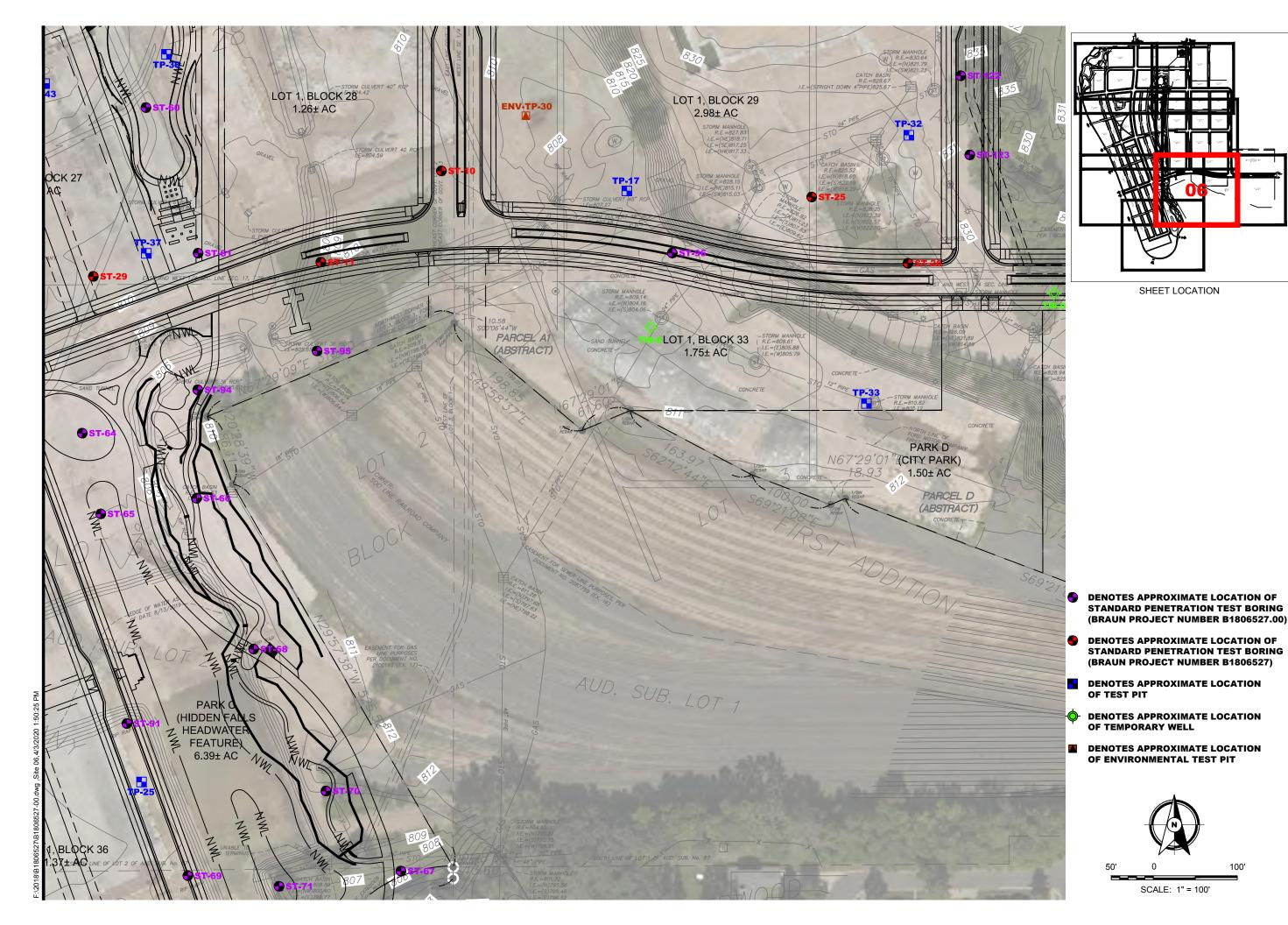
SHEET LOCATION

- DENOTES APPROXIMATE LOCATION **OF TEST PIT**
- DENOTES APPROXIMATE LOCATION
  OF TEMPORARY WELL
  - DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT



100'

Sheet: 05 of 08





11001 Hampshire Avenue S Minneapolis, MN 55438 952.995.2000



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Drawn By: Date Drawn: 7/30/19 Checked By: JJV

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4/3/20

Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

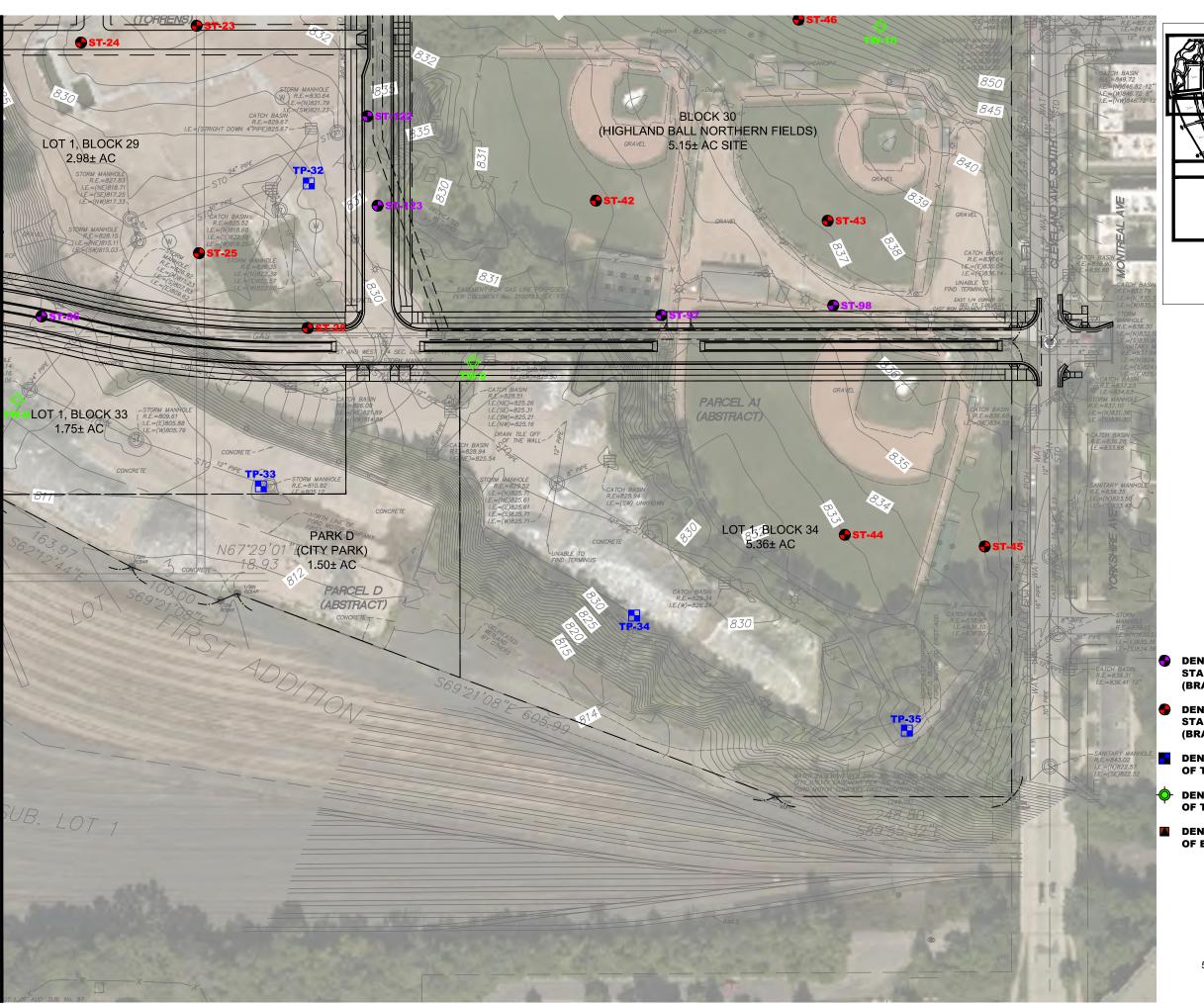
Saint Paul, Minnesota

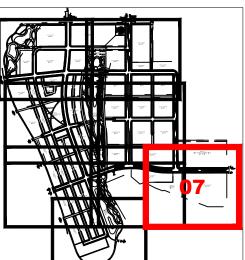
Figure B1

Site Plan

Sheet: 06 of 08

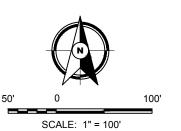
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SHEET LOCATION

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- DENOTES APPROXIMATE LOCATION **OF TEST PIT**
- DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL
- DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT



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Project Paul Infrastructure Phase

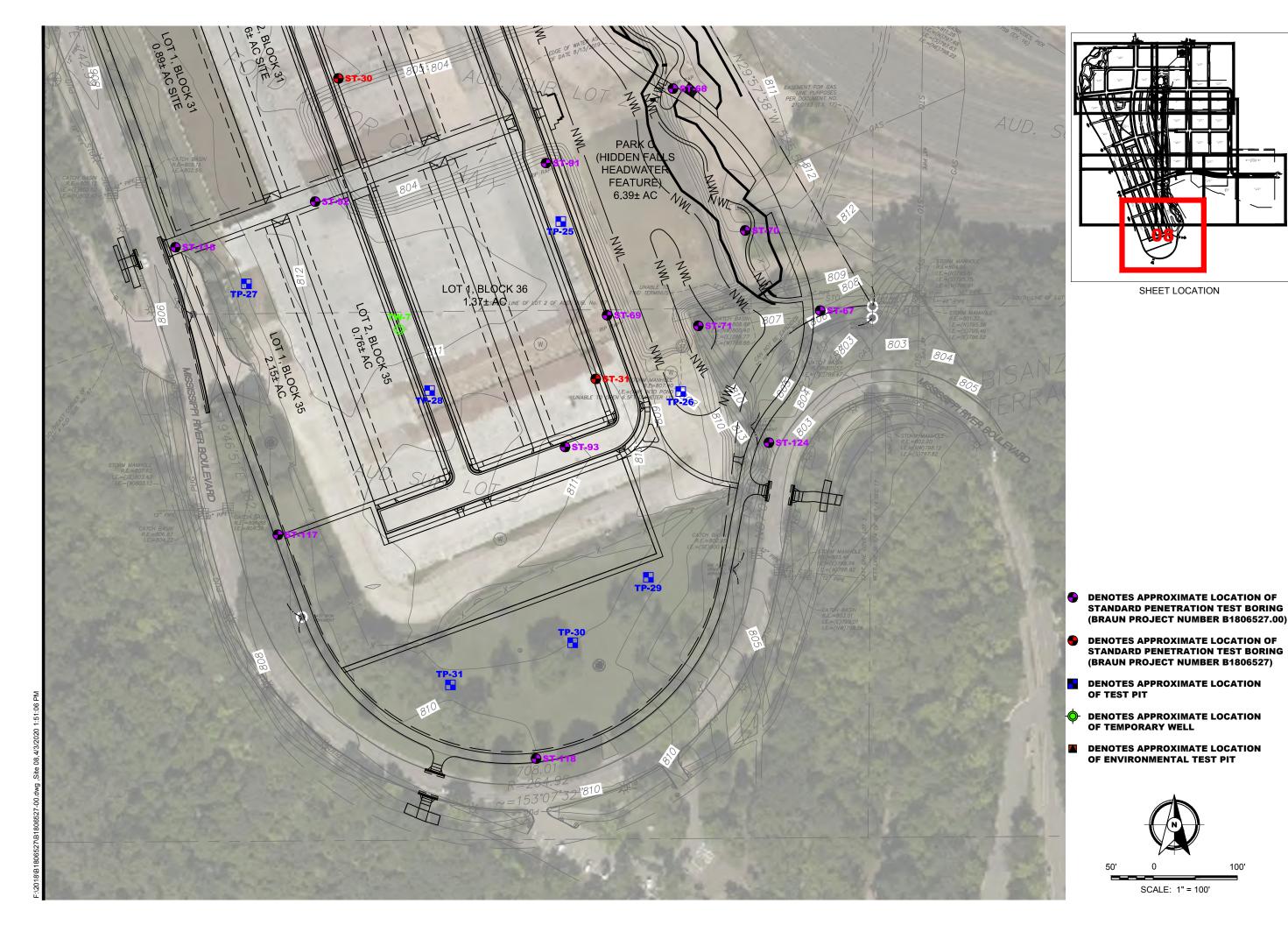
966 Mississippi River Boulevard South

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Figure B1

Site Plan

Sheet: 07 of 08





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Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

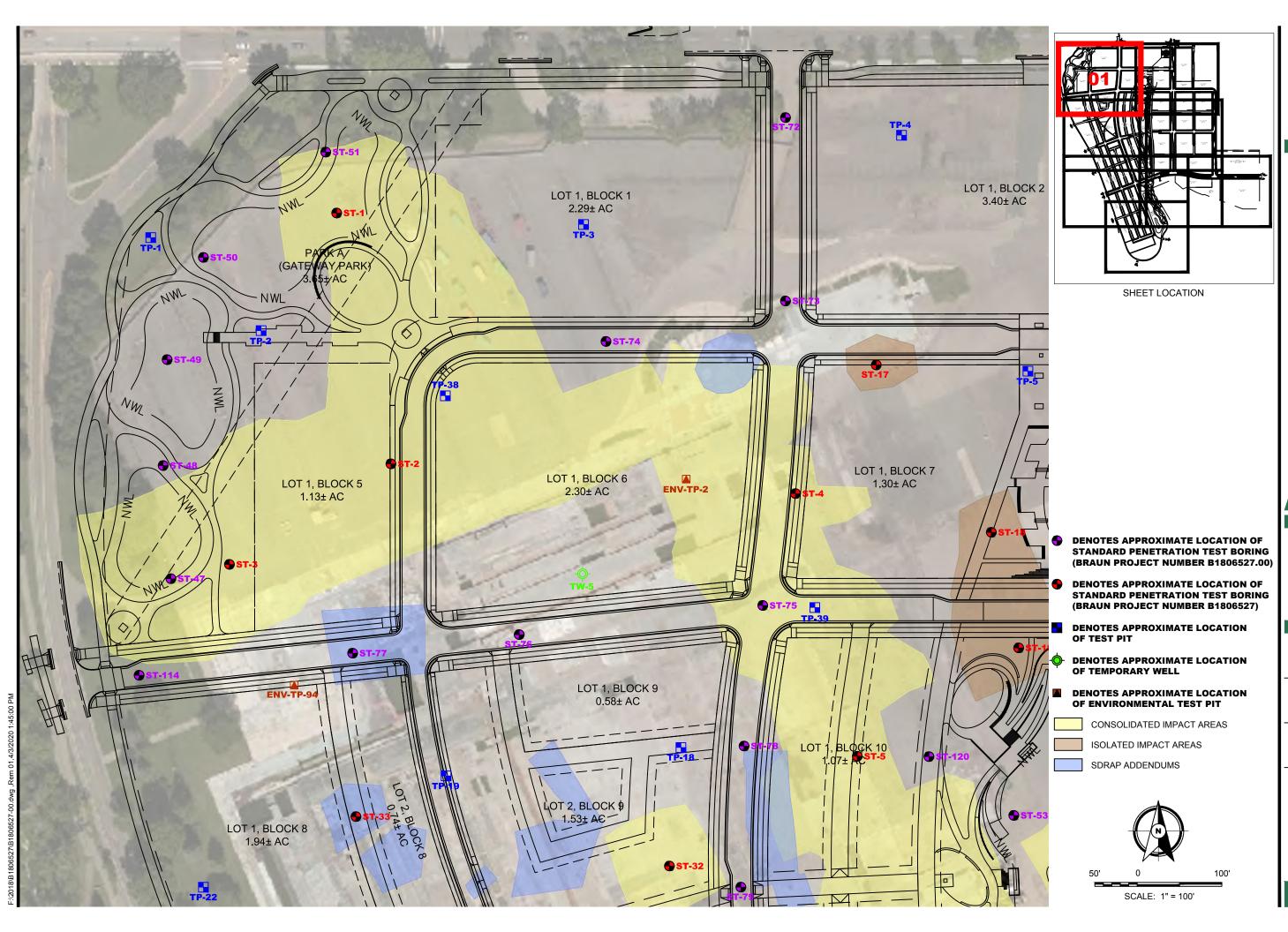
Saint Paul, Minnesota

Figure B1

Site Plan

100'

Sheet: 08 of 08



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Drawing Information

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Drawing No: B1806527-00

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Date Drawn: 7/30/19
Checked By: JJV
Last Modified: 4/3/20

#### Project Information

Project Paul Infrastructure Phase

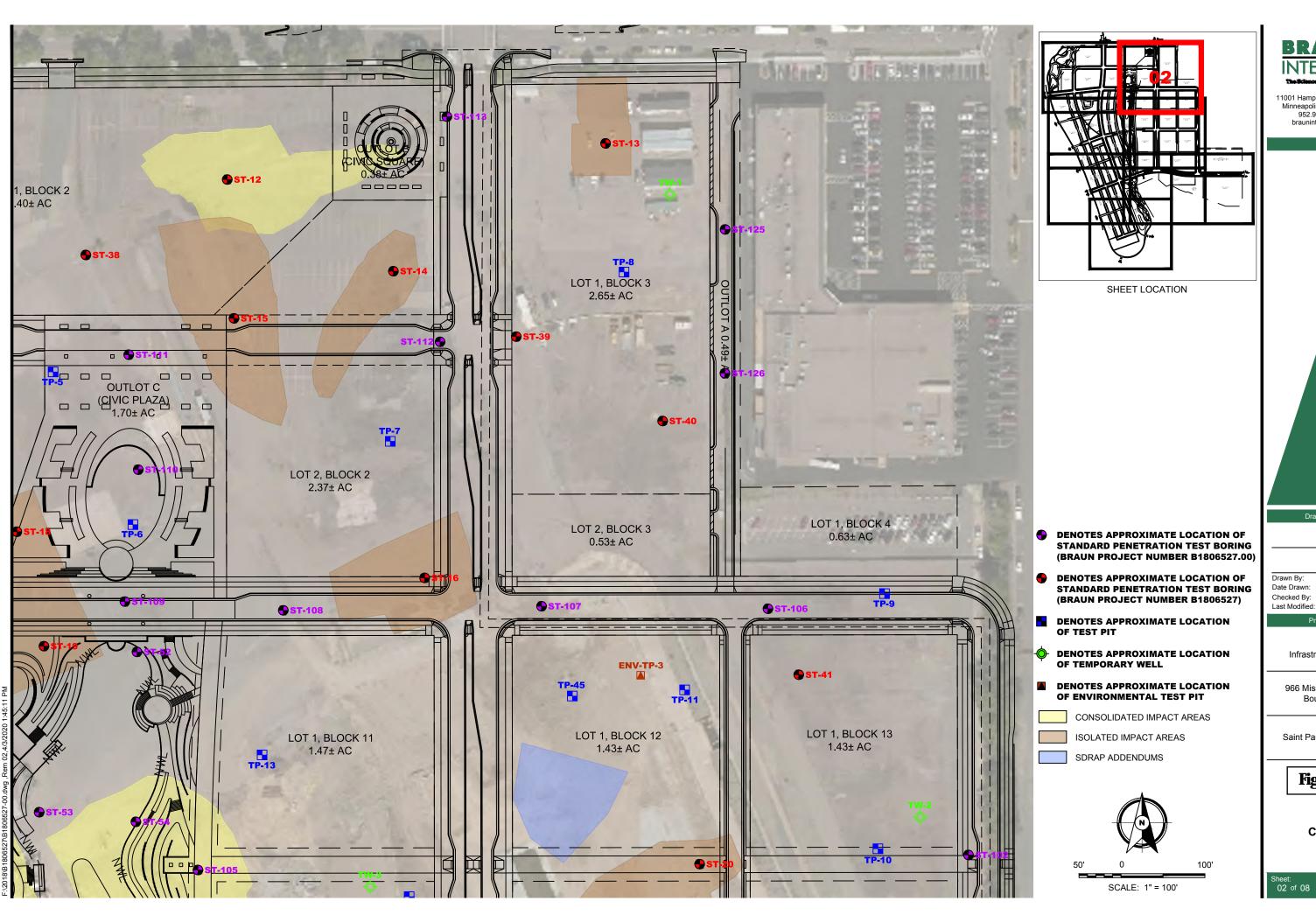
966 Mississippi River Boulevard South

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# Figure B2

Remedial Activities Completed

Sheet: 01 of 08



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4/3/20

Project Paul Infrastructure Phase

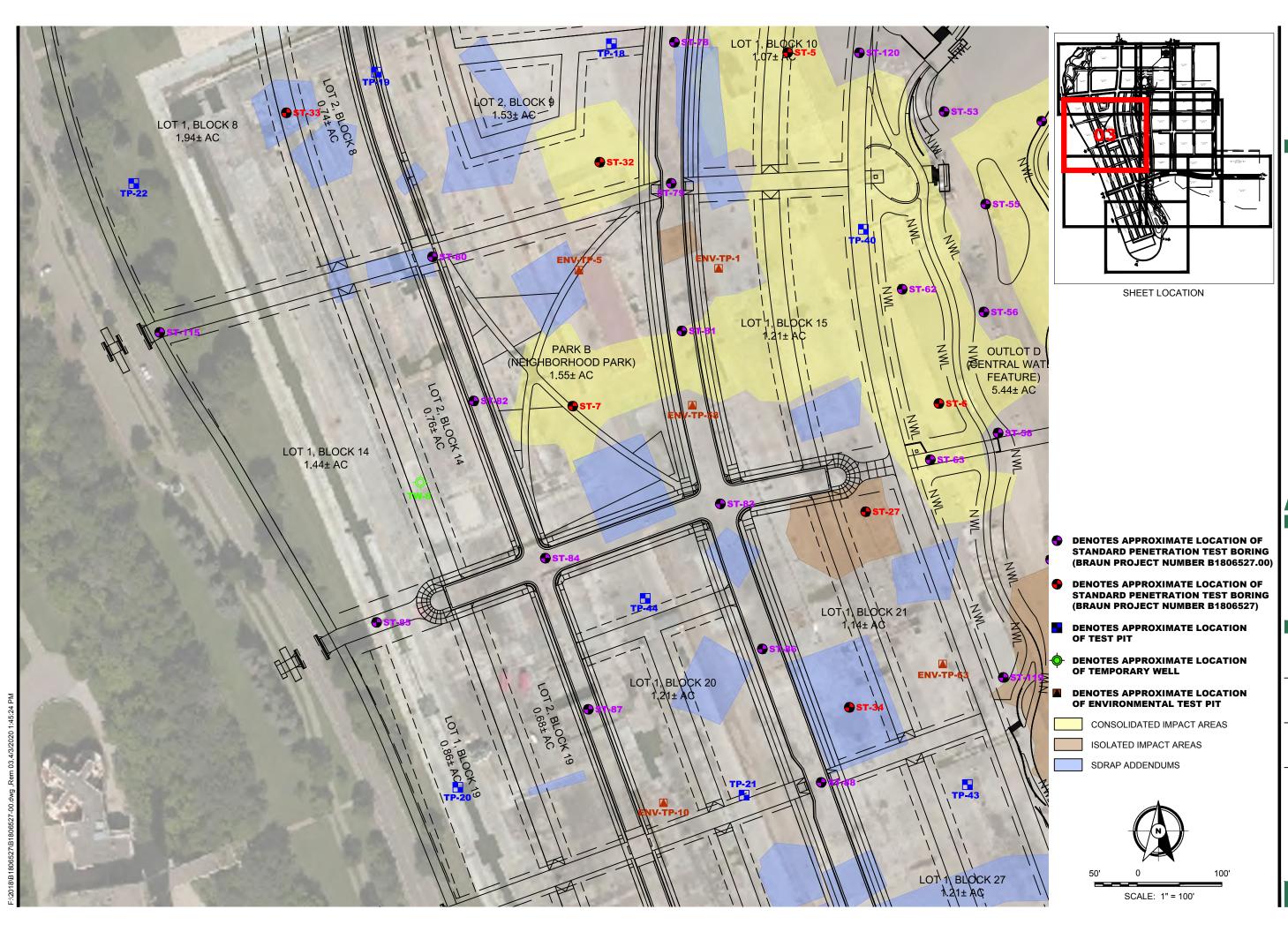
966 Mississippi River Boulevard South

Saint Paul, Minnesota

Figure B2

Remedial **Activities** Completed

02 of 08



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Project Paul Infrastructure Phase

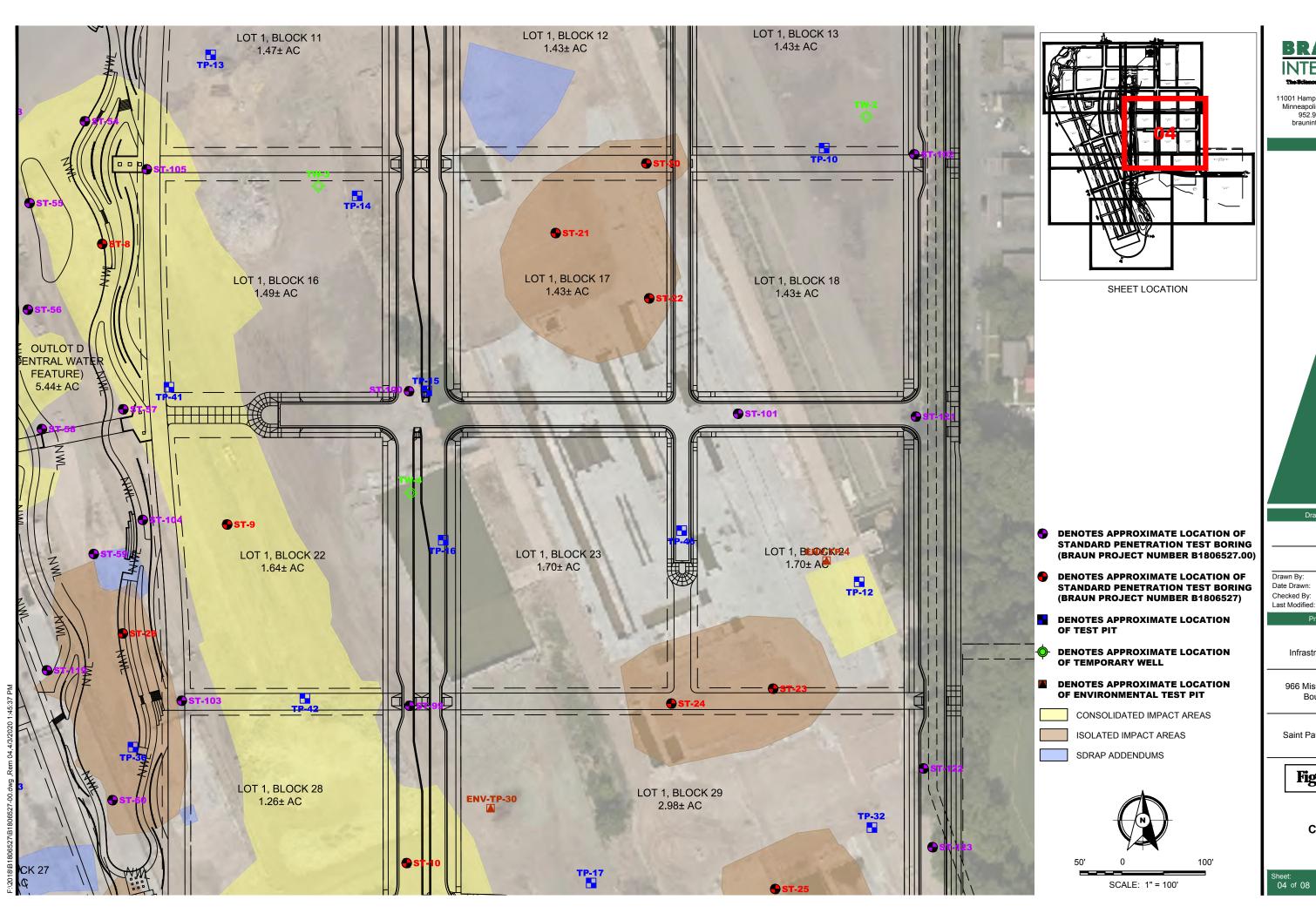
966 Mississippi River Boulevard South

Saint Paul, Minnesota

Figure B2

Remedial **Activities** Completed

Sheet: 03 of 08



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Project Paul Infrastructure Phase

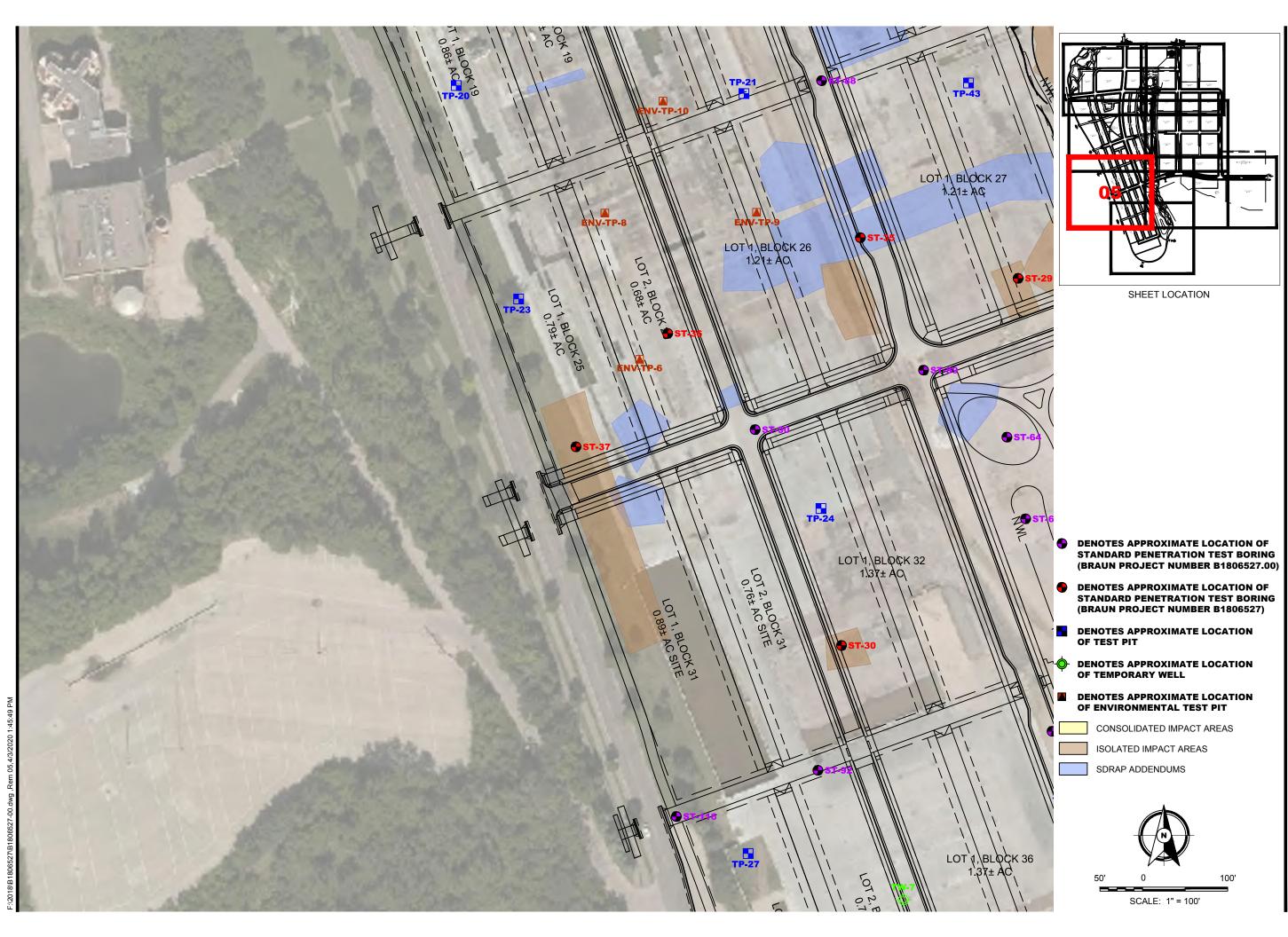
966 Mississippi River Boulevard South

Saint Paul, Minnesota

Figure B2

Remedial **Activities** Completed

04 of 08



**BRAUN** INTERTEC

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Drawing Information

Project No: B1806527.00

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Project Information

JJV

4/3/20

Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

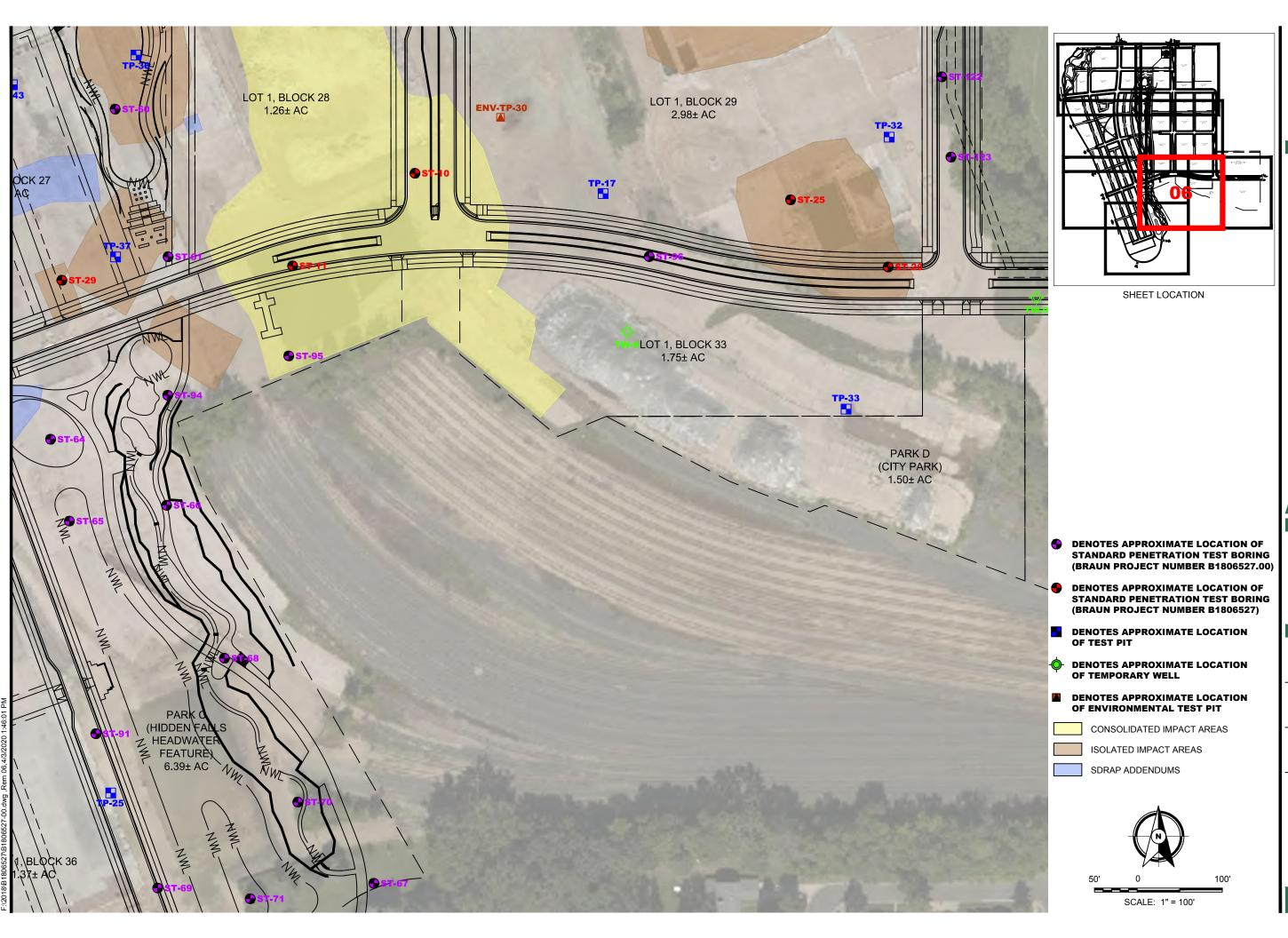
Saint Paul, Minnesota

Figure B2

Remedial Activities Completed

Sheet: 05 of 08

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Project Paul Infrastructure Phase

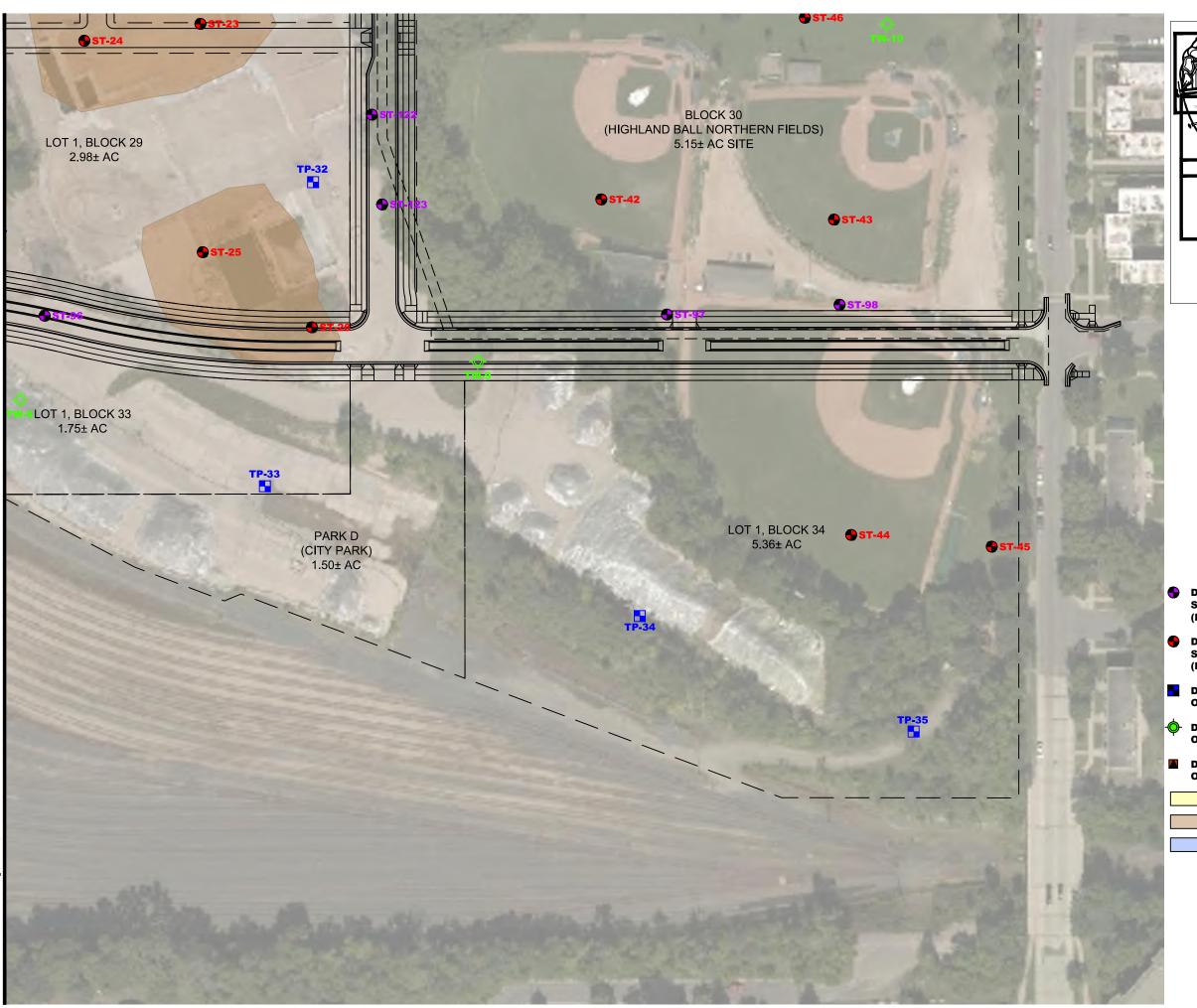
966 Mississippi River Boulevard South

Saint Paul, Minnesota

# Figure B2

Remedial **Activities** Completed

Sheet: 06 of 08





SHEET LOCATION

- DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527.00)
- DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)
- DENOTES APPROXIMATE LOCATION OF TEST PIT
- DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL
- DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

SDRAP ADDENDUMS



SCALE: 1" = 100'

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Drawing Information

Project No: B1806527.00

Drawing No: B1806527-00 BJB

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Date Drawn: 7/30/19
Checked By: JJV
Last Modified: 4/3/20

Project Information

Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

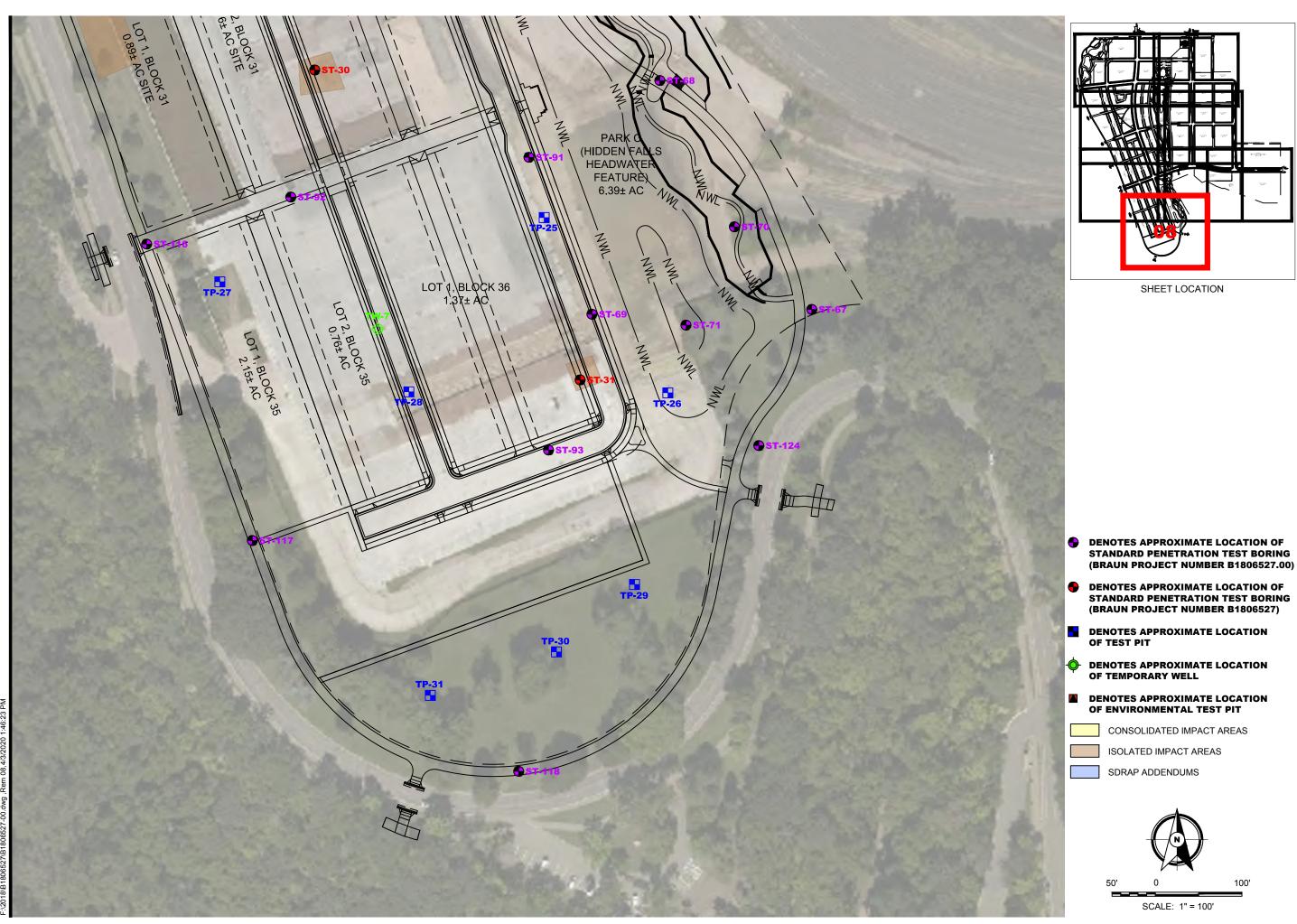
Saint Paul, Minnesota

Figure B2

Remedial Activities Completed

Sheet: 07 of 08

Fig





Minneapolis, MN 55438 952.995.2000

 DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

● DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)

SHEET LOCATION

DENOTES APPROXIMATE LOCATION OF TEST PIT

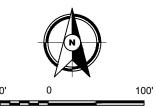
DENOTES APPROXIMATE LOCATION **OF TEMPORARY WELL** 

■ DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

SDRAP ADDENDUMS



SCALE: 1" = 100'

Project No: B1806527.00

Drawing No: B1806527-00

Drawn By: Date Drawn: Checked By: JJV Last Modified: 4/3/20

Project Paul Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

Figure B2

Remedial **Activities** Completed

Sheet: 08 of 08



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DRILLE	R: K.	Miller		METHOD:	3 1/4" H	SA, Autohamm	er	DATE:	7/18	8/18		SCAI	_E:	1" = 4'
e b lev. feet 809.2	Depth feet 0.0	Symbol		I-ASTM D2488	or D2487,	of Materials Rock-USACE E			BPF	WL	MC %	P200 %	Tests	s or Notes
LOG OF BORING NYGINITY PROJECTS/AX PROJECTS/2018/06527.6PJ BRAUN_V8_CURRENT.GDT 11/22/1912:26       (See Descriptive Terminology sheet for explanation of abbreviations)         LOG OF BORING NYGINITY PROJECTS/AX PROJECTS/2018/06527.6PJ BRAUN_V8_CURRENT.GDT 11/22/1912:26       1/2 1/22/1912:26         LOG OF BORING NYGINITY PROJECTS/2018/06527.6PJ BRAUN_V8_CURRENT.GDT 11/22/1912:26       1/2 1/22/1912:26	8.0 10.0 13.0	FILL CH SH	FILL trace Wet  FILL with  FAT 10 1/ SHA  END  Wate auge	: Poorly Grade Gravel, brown at 4 feet.  : Poorly Grade Gravel, brown (CLAY, layer /2 feet, gray, (Wealte, gray, moint (D) OF BORING	ded Sand vn, moist. ded Grave n, wet. of Poorly wet, very eathered S ist. ecorah SI is. t 3 feet w	, fine- to media	rse-grawith G	ained,	8	\sum_{1} \tag{2}	9	3	*100 to	set 2 1/2"
B1806527					Π-	aun Intertec Corpo	ration							T-5 page 1 of



		Proje	ct B180	6527	7			BORING	):			ST-6	
Ιр	rojec 66 M	t Paul	AL EVALU oi River B esota					LOCATION attached					25.873. See
DI Di	RILLE	R: K. I	Miller		METHOD:	3 1/4" HSA,	Autohammer	DATE:	7/	17/18		SCALE:	1" = 4'
nation of a	lev. eet 310.6	Depth feet 0.0	Symbol	(Soi		scription of N or D2487, Roc	Materials k-USACE EM1110	0-1-2908)	BPF	WL	MC %	Tests	or Notes
(See Descriptive Terminology sheet for explanatic				FILL with  FAT  END  Wathollo	at 7 1/2 feet.  CLAY, traces (We)  O OF BORING er observed a	Sand, gray, vathered Shall	th Gravel, gray, in the control of the course-grain vet, medium to have the bedrock)	moist. ined,	6 -\ 10 -\ 14 -\ 9 -\ 16 -\ 5 *	Δ			=23, PI=36
	06527						ntertec Corporation	-					ST-6 nage 1 of



Braun Pr								BORING	G:			5	T-7		
GEOTECHN Project Pau 966 Mississ St. Paul, M	ıl sippi Riv	er Bo						LOCATI attached				008.2	98 E:	548579.	370. See
DRILLER:	K. Miller			METHOD:	3 ′	1/4" HSA, Auto	hammer	DATE:		7/16	6/18		SCA	LE:	1" = 4'
b Elev. Dep		nbol	(Soil-			ption of Mate 2487, Rock-U	erials SACE EM1110	)-1-2908)		BPF	WL	MC %	P200 %	Tests	or Notes
911 5	FILL						ravel, gray, r			24					
See Descriptive Terminology sheet for 6	1.0 FILL		Wet a	at 8 feet.  LE, gray, wef (D)  OF BORING	t. ecor G.	ah Shale Beet with 10 fo	drock) eet of hollow-	et		21 10 13 14 *	$\nabla$	4	3	*100 to	set 3"



	-	ect B180						BORING:			S	8T-8	
Proie	ct Paul	AL EVALU pi River B nesota		S				LOCATIO attached			97.90	03 E: 54906	67.949. See
DRILL	ER: K.	Miller	МІ	ETHOD:	3 1/4" H	SA, Autohamm	ier	DATE:	7/1	7/18		SCALE:	1" = 4'
Elev. 6 Elev. 811.9	Depth feet 0 0.0	Symbol FILL	FILL: Le	TM D2488 ean Clay v	or D2487, l vith Sand,	of Materials Rock-USACE		)-1-2908)	BPF	WL	MC %	Tests	or Notes
ology sheet for ex — — — — — — — — — — — — — — — — — —	3.5	FILL	FILL: P	ne fragme	led Sand,	fine- to med	ium-gra		4				
St. Pa  DRILL  Elev. feet 811.9  - 808.4  - 808.4			trace Gr Wet at 7		estone fra	gments, brov	n, moi:	st	7	Δ			
802.9	9.0	OL -	ODCAN		trace Car	nd, Gravel, bl	ook w		3		31	OC=6%	
801.9	10.0	CH ///		(Si	wamp Dep	posit/Topsoil)	)	_					
_ 799.9	12.0		feet, bla	ck to gray (We	, wet, very athered S	Shale Bedroc	k)		28		28	LL=52, PL:	=18, PI=34
_		SH	SHALE, to wet.		-	of Fat Clay, da		y, moist	16				
<u> </u>	14.5		END OF	BORING		nale Bedrock)	)	_	*			*100 to set	t <b>5</b> "
GDT 11/22/19 12:26			Water of auger in		t 7 feet wi d.	ith 8 feet of h	ollow-s	tem _					
CURRENT			Bonng ti	ien backii	ileu.			-					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8								- -					
DIECTS\2018\06								_					
OJECTS\AX PRC								<u>-</u>					
JG N:\GINT\PR								-					
P1806527	,				n	aun Intertec Corpo	oration	_					ST-8 page 1 of 1



CEOTECHNICAL EVALUATION		un Proje	oject B180	6527	BORING:				ST-9		
CL LEAN CLAY, black to gray, moist, very soft to hard.  (Weathered Shale Bedrock)  - 797.7 13.1  END OF BORING.  Water observed at 7 feet with 8 feet of hollow-stem	GEOTI Projec	TECHNICA ect Paul Mississipp	IIČAL EVALU <i>l</i> al sippi River Bo	ATION	LOCATIO	N: N:					See
CL LEAN CLAY, black to gray, moist, very soft to hard.  (Weathered Shale Bedrock)  - 797.7 13.1  END OF BORING.  Water observed at 7 feet with 8 feet of hollow-stem	g DRILLE	LER: K.	K. Miller	METHOD: 3 1/4" HSA, Autohammer	DATE:	7/17	7/18		SCA	LE: <b>1" =</b> 4	1'
CL LEAN CLAY, black to gray, moist, very soft to hard.  (Weathered Shale Bedrock)  - 797.7 13.1  END OF BORING.  Water observed at 7 feet with 8 feet of hollow-stem	Flev. feet 810.8	feet	et   0.0 Symbol	(Soil-ASTM D2488 or D2487, Rock-USACE EM11	10-1-2908)	BPF	WL			Tests or Not	tes
Boring then backfilled.	OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:26	8 1.0	9.0 CL	FILL: Lean Clay with Sand, gray, moist.  FILL: Poorly Graded Sand, fine- to medium-gwith Gravel, brown, moist.  Wet at 7 feet.  LEAN CLAY, black to gray, moist, very soft to (Weathered Shale Bedrock)  END OF BORING.  Water observed at 7 feet with 8 feet of hollow auger in the ground.	rained,  hard	28 8 3 1	Σ	3		LL=45, PL=14 Pl=31 *100 to set 2"	



			ct B180					BORING	:		S	T-10		
iations)	Projec 966 M	t Paul	AL EVALU oi River Bo esota					LOCATIO attached				89 E: 5494	31.812. Se	ee
bbrev	DRILLE	:R: K. I	Miller		METHOD:	3 1/4" HS	A, Autohammer	DATE:	7/1	7/18		SCALE:	1" = 4'	
ation of a	Elev. feet 810.1	Depth feet 0.0	Symbol	(Soil		•	f Materials ock-USACE EM111	0-1-2908)	BPF	WL		Tests or	Notes	
xplan	809.6	0.5	FILL XX	_ FILL	: Lean Clay w		trace Gravel, dark		W 6					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:27				FILL with  Wet  SHA  END  Wate auge	E Lean Clay west. E Poorly Grad Gravel, brown  at 6 feet.  LE, gray, moin  O OF BORING  er observed after in the groun	with Sand, the ded Sand, the st. ecorah Shade decorah Shade decora		rained,	6 15 14 7 6 *	$\nabla$	*100	O to set 1"		
JG OF BO.	_							_	-					
۲ ا	B1806527					Pro	ın Intertec Corporation		Ш				ST-10 page	4 . 6 4



GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chemak METHOD: 3 1/4" HSA, Autohammer DATE: 7/20/18 SCALE: 1" = 4"  Elev. Depth feet feet 805.9 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)  805.9 1.0.5 FILL FILL: Lean Clay, trace Gravel and Limestone fragments, gray and brown, moist. FILL Poptly Graded Sand, fine- to medium-grained, 13 13  Wet at 5 feet.  Wet at 5 feet.  Wet at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water observed to cave-in depth of 10 feet. Boring then backfilled.	GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer DATE: 7/20/18 SCALE: 1" = 4"  Elev. Depth feet feet feet 0.0 Symbol (Soil-ASTM D2486 or D2487, Rock-USACE EM1110-1-2908)  805.9 0.0 Symbol (Soil-ASTM D2486 or D2487, Rock-USACE EM1110-1-2908)  805.4 0.5 FILL FILL: Lean Clay, trace Gravel and Limestone frace Gravel and Limestone frace Gravel, brown, moist.  FILL: Poppy Graded Sand, fine- to medium-grained, 13 13  Wet at 5 feet.  9 9 13.0 LS  LIMESTONE, weathered, light brown, moist.  (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 10 feet.  Boring then backfilled.			Proje		6527	BORING	<u> </u>		9	T-11		
793.9 12.0  792.9 13.0 LS LIMESTONE, weathered, light brown, moist. (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 10 feet.  Boring then backfilled.	793.9 12.0  792.9 13.0 LS LIMESTONE, weathered, light brown, moist. (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 10 feet.  Boring then backfilled.	G	EOTE roject 66 M	CHNICA t Paul ississipp	AL EVALU <i>i</i> oi River Bo	ATION	LOCATIO	N: N:				549288.377	. See
793.9 12.0  792.9 13.0 LS LIMESTONE, weathered, light brown, moist. (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 10 feet.  Boring then backfilled.	793.9 12.0  792.9 13.0 LS LIMESTONE, weathered, light brown, moist. (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 10 feet.  Boring then backfilled.	Dbrev				METHOD: 3 1/4" HSA, Autohammer	DATE:	7/2	0/18		SCAL	E: <b>1"</b> :	= 4'
793.9 12.0  792.9 13.0 LS LIMESTONE, weathered, light brown, moist. (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 10 feet.  Boring then backfilled.	793.9 12.0  792.9 13.0 LS LIMESTONE, weathered, light brown, moist. (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 12 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 10 feet.  Boring then backfilled.	ation of at	eet	feet	Symbol	-	0-1-2908)	BPF	WL			Tests or N	lotes
91			- 793.9	12.0	FILL	\text{\rmsq} fragments, gray and brown, moist.} FILL: Poorly Graded Sand, fine- to medium-gratrace Gravel, brown, moist.  Wet at 5 feet.  LIMESTONE, weathered, light brown, moist.  (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow-sauger in the ground.  Water observed at 6 feet with 12 feet of hollow-auger in the ground.  Water not observed to cave-in depth of 10 feet	stem	13 17 9 11 13	$\nabla$	7	4		



			ct B180						BORING	<b>3</b> :			S	T-12	
/iations)	Projec 966 M	t Paul	AL EVALU oi River Bo esota						LOCATI attached				09.6	58 E: 5491	55.979. See
ibbre\	DRILLE	R: K. I	Miller		METHOD:	3	3 1/4" HSA, Autohan	nmer	DATE:		7/19	9/18		SCALE:	1" = 4'
nation of a	Elev. feet 828.9	Depth feet 0.0	Symbol	-	-ASTM D2488	or	ription of Material D2487, Rock-USAC	E EM1110	-		BPF	WL	MC %	Tests	or Notes
See Descriptive Terminology sheet for explanation of abbreviations)		8.0	FILL	trace	e Gravel, brov	wn,	avel, gray, moist, nered Shale Bedre		ained,		18 9	ig	45		-05 DI-00
3)		12.0			(We	eath	nered Shale Bedro	ock)		- <u>X</u> - <u>X</u>	75		15	LL=53, Pl=	=25, PI=28
	816.9 - -	12.0		Wate	OF BORING er observed a er in the groun	at 3	1/2 feet with 6 fee	et of hollo	ow-stem	_					
/19 12:27	_			Wate	er not observe ediately after	ed wit	to cave-in depth o hdrawal of auger.	of 2 feet							
LOG OF BORING  N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ  BRAUN_V8_CURRENT.GDT  11/22/19 12:27	- - - - - - -			Borir	ng then backf	fille	d.								
LOG OF BORIN	B1806527						Braun Intertec Co								ST-12 page 1 of 1



Γ			ct B180						BORING:			ST-13	
riations)	Projec 966 M	t Paul	AL EVALUA oi River Bo esota						LOCATIC attached			2.676 E: 54960	06.522. See
bbre	DRILLE	R: K.	Miller		METHOD:	3 1/4" H	HSA, Autoha	mmer	DATE:	7/2	0/18	SCALE:	1" = 4'
planation of a	Elev. feet 851.1	Depth feet 0.0	Symbol		De -ASTM D2488 : Poorly Grae	or D2487		CE EM1110	)-1-2908)	BPF	WL	Tests or	Notes
See Descriptive Terminology sheet for explanation of abbreviations)	- - 848.1	3.0	SH	medi brow	ium-grained, n, moist. LE, gray, mo	trace Gra		ncrete del	bris, _	19			
otive Terminol	-  845.1	6.0		FND	OF BORING		опате вечто	ock)		72			
(See Descrip	-			Wate the g	er not observ pround.	ed with 4	feet of holl	low-stem a	auger in — —				
-				Bour	ng then backt	illea.							
-	- - -								- -				
GDT 11/22/19 12:27	_								_				
	-								- -				
SPJ BRAUN_V8_	-												
TS\2018\06527.C	-								_				
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT	 - -								 -				
G N:\GINT\PROJ	-								- -				
LOG OF BORING	- 31806527						Braun Intertec C	Cornoration					ST-13 page 1 of 1



		1 Proje	ct B180	6527		BORING:			S	T-14	<u> </u>	
iations)	GEOTE Projec	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo			LOCATIO attached						.854. See
bbrev	DRILLE	R: K.	Miller	METHOD: 3	1/4" HSA, Autohammer	DATE:	7/19	9/18		SCAI	_E:	1" = 4'
nation of a	Elev. feet 834.2	Depth feet 0.0	Symbol		iption of Materials 02487, Rock-USACE EM1110	)-1-2908)	BPF	WL	MC %	P200 %	Tests	s or Notes
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\05527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27		5.5 6.0 8.0	FILL	FILL: Fat Clay, with words and gray, moist.  FILL: Fat Clay, with words and gray, moist.  FILL: Poorly Graded coarse-grained, with words and gray, moist.  FAT CLAY, gray, moist.  END OF BORING.  Water observed at 7 auger in the ground.	weathered Shale fragment it.  Sand with Silt, fine- to Gravel, Clay nodules, Sha, brown, moist to wet. st, hard. ered Shale Bedrock)  feet with 6 feet of hollow-s	s, / / / / / / / / / / / / / / / / / / /	8 14 4 16 33 36	$\nabla$	12 22	8	LL=53, PI=27	PL=26,
LOG 0F	B1806527				Braun Intertec Corporation							-14 nage 1 of 1



ſ	Braur		ct B180	6527		П	BORING:			S	T-15	
iations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo				LOCATIO attached					64.112. See
bbrev	DRILLE	R: K. I	Miller	METHOD:	3 1/4" HSA, Autohammer		DATE:	7/19	9/18		SCALE:	1" = 4'
nation of a	Elev. feet 827.7	Depth feet 0.0	Symbol	(Soil-ASTM D2488	escription of Materials 3 or D2487, Rock-USACE EM			BPF	WL	MC %	Tests	or Notes
OF BORING N'GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27	1		Symbol FILL OL CL SM SH	ORGANIC CLAY ORGANIC CLAY (Swall LEAN CLAY, trace SILTY SAND, finewet, loose.  FAT CLAY, olive stiff. (We SHALE, gray, module of the company	B or D2487, Rock-USACE EM, fine- to coarse-grained, was gments, brown, moist.  T, black, moist. T, black, moist. The peposit/Buried Topsoil ce fibers, light gray, moist, (Alluvium) The to medium-grained, gray (Alluvium) The gray, moist to wet, med eathered Shale Bedrock) The period of the period	l) medi y, mo	um. —  ist to  o very —  v-stem —	17 5 5 19 56	▼		OC=4% LL=65, PL=	
LOG OF BORING N:\GINT\PR	- - 						- - -					
	B1806527			I	Braun Intertec Corporati							ST-15 nage 1 of 1



ſ		n Proje	ct B180	6527		BORING:			S	T-16	
iations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU oi River B				N: N:			71 E: 54939	1.095. See
bbrev	DRILLE	R: K.	Miller	METHOD: 3 1/4" HSA	, Autohammer	DATE:	7/18	3/18		SCALE:	1" = 4'
xplanation of a	Elev. feet 827.9	Depth feet 0.0	Symbol FILL	Description of (Soil-ASTM D2488 or D2487, Ro FILL: Poorly Graded Sand, fi with Silty Sand layers, brown,	ock-USACE EM1110 ne- to medium-gra		BPF	WL	MC %	Tests	or Notes
See Descriptive Terminology sheet for explanation of abbreviations)		3.5	FILL	FILL: Lean Clay with Sand, v		gments,	12 7 7		21	LL=46, PL=	:20, PI=26
(See Desc	- 819.4 - - -	8.5	CH	FAT CLAY, dark gray, moist, (Weathered Sh	medium to hard. ale Bedrock)		6 32				
	815.9	12.0	SH	SHALE, gray, moist. (Decorah Sha	le Bedrock)		*			*100 to set	3"
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:27		13.5		END OF BORING.  Water not observed to cave-i immediately after withdrawal water not observed to cave-i immediately after withdrawal water backfilled.	n depth of 9 feet of auger.						
0 901	D1906E37				Intertoe Corneration						T 16 nogo 1 of 1



			ct B180						BORING	G:			S	T-17	
riations)	Proiec	t Paul	AL EVALU oi River B esota						LOCAT				887.8	77 E: 54876	69.723. See
bbrev	DRILLE	R: K.	Miller		METHOD:	3 1/4" F	HSA, Autohammer		DATE:		7/19	9/18		SCALE:	1" = 4'
lanation of a	Elev. feet 812.5	Depth feet 0.0	Symbol FILL XX		I-ASTM D2488	or D2487	of Materials , Rock-USACE EM prown and gray, r				BPF	WL	MC %	Tests	or Notes
See Descriptive Terminology sheet for explanation of abbreviations)		6.0	CH	X X X X X X X X X X X X X X X X X X X			noist, medium. Shale Bedrock)		_	-X -X -X -X	<ul><li>19</li><li>34</li><li>20</li></ul>				
e Descri	_ _ <sub>804.0</sub>	8.5			(W€	eathered	Shale Bedrock)				7		23	LL=62, PI=	:20, PI=42
S)	802.5	10.0	SH		LE, gray, mo (D OF BORING	ecorah S	shale Bedrock)			_\	43				
12:27	- - - -			Wate		ed with 8	feet of hollow-sto	em a	auger in _	- - - - -					
BRAUN_V8_CURRENT.GDT 11/22/19 12:27	- - - -								_	-   -   -   -					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_	- - - -								_						
	  B1806527						raun Intertec Corporati			_ _ _					ST-17 page 1 of <sup>2</sup>



Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: K. Miller  Description of Materials Flev. Depth feet feet 813.5 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-11-2908)  B12.5 1.0 FILL FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, brown, moist.  FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Solty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Solty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist.  FILL: Solty Sand, fine- to coarse-grained, with Gravel, brown, moist.  Sand Sand Sand Sand Sand Sand Sand Sand	7/19		690.2		: 548905.548. S	ŗ
803.5 10.0 SINGLE, gray, most. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 5 1/2 feet with 6 feet of hollow-stem auger in the ground.  Water not observed with 8 feet of hollow-stem auger in the ground.  Boring immediately backfilled.	BPF 18 12 4 4 14	WL	MC %	P200 %	0 Tests or Note	
803.5 10.0 END OF BORING.  Water observed at 5 1/2 feet with 6 feet of hollow-stem auger in the ground.  Water not observed with 8 feet of hollow-stem auger in the ground.  Boring immediately backfilled.	18 12 4 14		6	%		es
803.5 10.0 SINGLE, gray, most. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 5 1/2 feet with 6 feet of hollow-stem auger in the ground.  Water not observed with 8 feet of hollow-stem auger in the ground.  Boring immediately backfilled.	12 4	Ā		6	OC=4%	
803.5 10.0 Shale, gray, most.  (Decorah Shale Bedrock)  END OF BORING.  Water observed at 5 1/2 feet with 6 feet of hollow-stem auger in the ground.  Water not observed with 8 feet of hollow-stem auger in the ground.  Boring immediately backfilled.	14	Ā	20		OC=4%	
803.5 10.0 Shale Bedrock)  END OF BORING.  Water observed at 5 1/2 feet with 6 feet of hollow-stem auger in the ground.  Water not observed with 8 feet of hollow-stem auger in the ground.  Boring immediately backfilled.	33					
END OF BORING.  Water observed at 5 1/2 feet with 6 feet of hollow-stem auger in the ground.  Water not observed with 8 feet of hollow-stem auger in the ground.  Boring immediately backfilled.						
OF BORING N\GINT\PROJECTS\AX PROJECTS\Z018\06527.GPJ BRAUN_V8_CURRENT						



	n Proje	ct B180			BORING:			S	T-19	
Proiec	t Paul		ATION oulevard S		LOCATIO attached			547.8	39 E: 54894	0.659. See
g DRILLE	R: K.	Miller	METHOD: 3	1/4" HSA, Autohammer	DATE:	7/19	9/18		SCALE:	1" = 4'
Elev. feet 810.9	Depth feet 0.0	Symbol	(Soil-ASTM D2488 or D	iption of Materials 12487, Rock-USACE EM1110		BPF	WL	MC %	Tests	or Notes
St. Pau  DRILLE Elev. feet 810.9  809.9  804.9  802.4	1.0	FILL	_ dark brown, moist.	- to medium-grained, trac Sand, fine- to coarse-grai noist to wet.	_	35				
804.9 804.9 - 802.4	6.0	CH	gray, moist, very stiff.	Sand lenses, tan to greer ered Shale Bedrock)	nish —	9 22	Ā	22	LL=59, PL=	=23, PI=36
800.9	10.0	SH	SHALE, gray, moist. (Decor	rah Shale Bedrock)	_	107				
_ _ _			Water observed at 5 f auger in the ground.	feet with 6 feet of hollow-s	_					
CURRENT.GDT 11/22/19 12:27			Boring immediately ba	ackfilled.						
GPJ BRAUN_V8_										
NG N:\GINT\PROJECTS\AX PROJECTS\2018\06527					 _ _ _ _					
90 LO 90 P1806527				Braun Intertec Corporation	_					ST-19 page 1 of



			ct B180					BORING:			S	T-20	
/iations)	Projec 966 M	t Paul	AL EVALU pi River B lesota					LOCATIC attached			294.2	82 E: 54971	8.451. See
lbbre\	DRILLE	R: J. (	Chermak		METHOD:	3 1/4" HSA,	Autohammer	DATE:	7/1	9/18		SCALE:	1" = 4'
anation of a	Elev. feet 833.0	Depth feet 0.0	Symbol		I-ASTM D2488		k-USACE EM1110		BPF	WL	MC %	Tests	or Notes
t for expla	- 831.0	2.0	FILL	and	Clay nodules,	brown, moist		_	3				
erminology shee	_		FILL	FILL mois		ncrete, trace	Clay, gray and b	orown,	20				
(See Descriptive Terminology sheet for explanation of abbreviations)	827.0 	6.0	CH	FAT very	stiff.	Gravel, black	to gray, moist, s e Bedrock)	stiff to	14		29	LL=67, PL=	=30, PI=37
	823.0	10.0	SH	SHA	LE, gray, mois	st. corah Shale	Redrock)		M 57				
	821.0	12.0		END	OF BORING.				N OI				
	_				er not observe e ground.	d with 10 fee	et of hollow-stem	auger –					
12:27				Wate	er not observe	d to cave-in	depth of 10 feet.						
11/22/19 12:27	_			Borii	ng then backfil	led.		-					
RENT.GDT	_							_					
BRAUN_V8_CURRENT													
3PJ BRAU	_							_					
18\06527.0	_							_					
DJECTS\20	_							_					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ	_							-					
NT\PROJE(	_												
ING N:\GI	_							_					
LOG OF BOR	_							-					
۲L	B1806527					Braun Ir	ntertec Corporation		1			1	ST-20 page 1 of 1



			6527					BORING:			S	T-21	
Proie	ct Paul	AL EVALU oi River B							N: N:				10.013. See
DRILL	-	Miller	METI	HOD:	3 1/4" H	ISA, Autohar	nmer	DATE:	7/1	9/18		SCALE:	1" = 4'
Elev. feet 833.6	Depth feet 0.0	Symbol		D2488	or D2487,	of Material Rock-USAC	E EM1110		BPF	WL	MC %	Tests	or Notes
OF BORING N/GINT/PROJECTS/2018/06527.6PJ BRAUN _/8_ CURRENT.GDT 11/22/1912:27    See Descriptive Terminology sheet for explanation of abbreviations)   See Descriptive Terminology sheet for explanation of abbreviations   See Descriptive Terminology sheet for explanation of abbreviations   See Descriptive Terminology sheet for explanation of abbreviation   See Descriptive Terminology sheet for explanation   See Descriptive Terminology   See Descriptive Terminology	21.5 22.5 24.0	FILL FILL SH	FAT CLAY, SHALE, gra END OF Bo Water obseauger in the Water obseauger in me Boring imm	trace of (Weay, mointenance) (Particular of the Cooling of the Coo	Clay, tracents, dark concrete mixed with ents from ncrete, but the concrete mixed with ents from the concrete c	reen to grashale Bedrowith 20 feet with carvithdrawal of the carvithdraw	y, moist, sock)  t of hollow ve-in dept of auger.	and — — — — — — — — — — — — — — — — — — —	4 32 7 8 18 10 26 15 23 10 15 69	Σ	17	LL=30, PL	=14, PI=16
						aun Intertec Co							ST-21 nage 1 of



ſ		n Proje	ct B180					BORING:			S	T-22	
riations)	Projec 966 M	t Paul		ATION oulevard S				LOCATIC attached					21.803. See
bbre	DRILLE	:R: J. (	Chermak	METHO	D:	3 1/4" HSA, Autoh	ammer	DATE:	7/19	9/18		SCALE:	1" = 4'
nation of a	Elev. feet 831.8	Depth feet 0.0	,	,	488	escription of Materi or D2487, Rock-USA	CE EM1110	,	BPF	WL	MC %	Tests	or Notes
expla	830.8	1.0	FILL	FILL: Poorly trace Gravel,	Grad	ded Sand, fine- to r vn. moist.	medium-gra	ained,	V 2				
See Descriptive Terminology sheet for explanation of abbreviations)	_		FILL	FILL: Lean C	ay v	with Sand, trace Gr fragments, gray, m	ravel and oist.	-	7		19	LL=33, PL:	=14, PI=19
Term	_								10				
Descriptive	825.8 - -	6.0	FILL	FILL: Crushe moist.	d cc	oncrete, trace Clay,	brown and	d gray, 	12				
See	_							_	9				
	<u>820.8</u> 	11.0	SH	SHALE, gray,	mo (D	ist. ecorah Shale Bedr	rock)		7 7 50				
	817.8	14.0							^\				
27	_			END OF BOF									
GDT 11/22/19 12:27	_			Water not obs in the ground	erv	ed with 12 feet of h	ollow-stem	auger –					
	- -			Boring then b	ackf	îlled.		_					
8_CURRENT	_							_					
BRAUN_V	_												
)6527.GPJ	_							_					
TS\2018\0	_							_					
AX PROJE	 _							_					
PROJECTS	_							_					
N:\GINT\I	_ _							_					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8													
	B1806527					Braun Intertec	0						ST-22 page 1 of 2



		ct B180							BORIN	G:			S	T-23		
Proie	ect Paul	AL EVALU pi River Bo iesota							LOCAT attache				66.0	78 E: 5498	69.913	3. See
DRILL	.ER: J. (	Chermak		METHOD:	3	3 1/4" HSA,	Autohamm	er	DATE:		7/19	9/18		SCALE:	1"	= 4'
Flev. feet 832.4	feet	•		I-ASTM D2488	or I		k-USACE E				BPF	WL	MC %	Tests	or No	tes
ology sheet for expla 	4 4.0	FILL		: Clayey Sar e fragments,				avel aı	nd	-X	15		15			
See Descriptive Terminology sheet for explanation of abbreviations)  St. P  DRILL  Elev. feet 832.4  - 828.4  - 828.4		FILL	FILL: Grav	: Poorly Grad vel, brown, mo	ded oist	d Sand, find t.	e- to medi	um-gra	ained, -	——————————————————————————————————————	8					
	4 12.0		Wet					-X	2	Ā						
- 818.9	9 13.5	СН	FAT	CLAY, trace (We	nestone fra hered Shal	agments, g le Bedrock	gray, w ()	et, hard.	_	*			*50 to set	3"		
_			END	OF BORING	3.					7						
/19 12:27				er observed a er in the grour			3 feet of ho	ollow-s	tem -							
GDT 11/22/19 12:27			auge	er observed a er in the grour	nd.				v-stem	-						
CURRENT			imme	er not observe ediately after	wit	thdrawal of	depth of 1 auger.	0 feet								
_OG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\05527.GPJ BRAUN_V8_			BOIII	ng then backf	me	:a.										
AX PROJECTS\2018\C									-	_						
N:\GINT\PROJECTS\ 																
F180652							ntertec Corpo									page 1 of



		ct B180							BORIN	G:			S	T-24	4	
Projec	t Paul	AL EVALU pi River B iesota						_	LOCAT attache				348.3	58 E:	549748	.241. See
DRILLE	:R: J. (	Chermak		METHOD:	3 1	/4" HSA, A	utohammer		DATE:		7/19	9/18		SCA	LE:	1" = 4'
Elev. feet 831.9	Depth feet 0.0			I-ASTM D2488	or D2		-USACE EM1				BPF	WL	MC %	P200 %	Tests	or Notes
ology sheet for expla 	4.0	FILL	and mois		ents, f	trace cond	crete debris,	bro	wn,	-\ <u>\</u>	12					
St. Pau  DRILLE  Elev. feet 831.9  827.9		FILL	FILL Grav	.: Poorly Gra vel, brown, m	ded S oist.	Sand, fine	- to medium-	-gra	ined, -		10		2	5		
			Wet	at 9 feet.					_	- <u>X</u> - <u>X</u> - <u>X</u>	23	$  \underline{\nabla}  $				
817.9 817.1 —	14.8	СН		`	eathe	hard. ered Shale	Bedrock)			<del>-</del>	*				*50 to s	set 2"
GDT 11/22/19 12:27			Wate	OF BORING er observed a er in the grou	at 9 fe	eet with 8	feet of hollo	w-st	em	_						
CURRENT.G				er observed a ow-stem auge				f		-						
			imm	er not observ ediately after	witho	drawal of a	epth of 10 fe auger.	eet								
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\05527.GPJ BRAUN_V8_			Borir	ng then backt	rillea.											
\AX PROJECTS\z									_							
SINT\PROJECTS																
DF BORING N:\(									_							
B1806527						Proup Int	ertec Corporatio	n							QT.	-24 page 1 of



1		n Proje	ct B180	6527	BORING			ST-25
iations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU oi River Bo			ON: N:		26.547 E: 549872.413. See
bbrev	DRILLE	R: J. (	Chermak	METHOD: 3 1/4" HSA, Autohammer	DATE:	7/2	0/18	SCALE: 1" = 4'
nation of a	Elev. feet 826.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1	110-1-2908)	BPF	WL	Tests or Notes
explai	825.6	1.0	FILL	FILL: Lean Clay with Sand, gray, moist.		M 10		
nology sheet for e	_		FILL	FILL: Poorly Graded Sand, fine- to medium- Gravel, brown, moist.	grained, - - -	12		
See Descriptive Terminology sheet for explanation of abbreviations)				Wet at 7 feet.	- - -	12	Δ	
(See		9.5 10.0	CH ZZZ	FAT CLAY, trace Sand, gray, wet.		12		
		10.0	СП	(Weathered Shale Bedrock) END OF BORING.		-		
	_			Water observed at 7 feet with 6 feet of hollow auger in the ground.	v-stem -			
72	_			Water observed at 7 feet with 8 feet of hollow auger in the ground.	v-stem _			
GDT 11/22/19 12:27	_			Water not observed to cave-in depth of 7 1/2 immediately after withdrawal of auger.	? feet -			
	_			Boring then backfilled.	-	-		
_V8_CURRENT								
BRAUN_V8	_				-	-		
	_				-	-		
8\0652	_				_	1		
TS\201	_				_			
PROJEC								
CTS\AX	_				_			
PROJE	_				_			
N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ	_				_			
BORING N								
P	_				_	-		
106	D1906E37			Proug Intertee Corporation				CT 25 nago 1 of



	aun Pro										BORI	NG:			S	T-26		
Pro	OTECHN oject Pau 6 Mississ Paul, Mi	ıl ippi f	River Bo										N: N: sketch.		347.70	04 E: 54	9986.9	140. See
DRI	ILLER:	J. Che	ermak		METHOD		3 1/4"	HSA, Au	tohammer		DATE	<u>:</u>	7/20	0/18		SCALE:	,	1" = 4'
e Ele fee 82	et fee 8.0 0	t ).0 S	Symbol		-ASTM D248	8 oı	r D2487		ISACE EM			3)	BPF	WL	MC %	Te	sts or N	Notes
(See Descriptive Terminology sheet for explan	7.5	1.5 FI FI	-	FILL: \gray, FILL: trace  Wet a  LEAN stiff.  END  Wate auge  Wate auge  Wate imme	E Lean Clay, moist. E Poorly Gr. Gravel, broat 7 feet.	th S  /ea  at und und vecer w	ace Sanda, moise Shale for the red shale for the	ragment I Shale E with 10 r	Shale fra to mediun s, gray, w Bedrock) eet of holle feet of ho	wet, s	nts, nined, off to tem		6 15 26 3 2 12	$\nabla$	16	LL=49,	PI=19,	PI=30
B1806	527							Rraun Inter	tec Corporat	tion			•	-			ST-2	6 page 1 of



			ct B180					BORIN	G:		ST-27	
	Proiec		AL EVALU	ATION	J				ION: Ned sketc		3.732 E: 54883	39.431. See
ations)	966 M		oi River Bo	oulev	ard S			diadric	d onoto			
obrevi	DRILLE		Miller		METHOD:	3 1/4" H	SA, Autohammer	DATE:	7/	18/18	SCALE:	1" = 4'
ion of at	Elev. feet	Depth feet					of Materials	•	BPF	WL	Tests or	Notes
anat	812.2	0.0	Symbol				Rock-USACE EM11					
See Descriptive Terminology sheet for explanation of abbreviations)	811.7_ _ _ _ _ _ 	0.5	FILL	∖mois	t. : Crushed co		, with Gravel, dark		28 - - 32 - 25			
ee Descriptiv	_ _ _ 803.7	8.5							19			
S)	- 802.2	10.0	SH		LE, gray, moi (De	ecorah Sh	nale Bedrock)		_X92/6	5"		
	_			Wate			feet of hollow-sten	n auger in				
	_			Borir	ng then backfi	illed.			-			
.GDT 11/22/19 12:27	_								_			
ENT.GDT 11,	_											
JN_V8_CURRENT								_				
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_	_											
rs\2018\065	_								-			
\AX PROJEC	 _							-				
T\PROJECTS	_ _											
ING N:\GIN	_											
	B1806527						aun Intertec Corporation		-			ST-27 page 1 of 1



			ct B180						BORING	:			S	T-28	3	
iations)	Projec 966 M	t Paul	AL EVALU oi River Bo esota						LOCATIO attached				'32.19	96 E:	54909	2.530. See
bbrev	DRILLE	R: K.	Miller		METHOD:		3 1/4" HSA, Autohamme	er	DATE:		7/12	2/18		SCA	LE:	1" = 4'
anation of a	Elev. feet 808.2	Depth feet 0.0	Symbol	_	-ASTM D2488	or	cription of Materials  D2487, Rock-USACE E			ı	3PF	WL	MC %	P200 %	Tes	ts or Notes
See Descriptive Terminology sheet for explanation of abbreviations)	_ _ _ _ 	4.0		trace	e Gravel, brov at 3 feet.	wn			ainea, - - -	X	12	Σ				
ptive Termind	802.7 _	5.5	FILL		: Organic Cl	•	, trace Sand, black, we	et.			12		48		OC=1	5%
(See Descrip	- - 799.2	9.0		Lens	of Gravel at	t 8 <sup>-</sup>	feet.		-	-\\ \ M	10		14	19		
7	<del></del>	10.2	CH	END Wate	n, wet, stiff to (We OF BORING	o h eat 3. at 3 nd.	thered Shale Bedrock 3 feet with 6 feet of ho	)		-	*				*100 to	o set 2 1/2"
RAUN_V8_CURRENT.GDT 11/22/19 12:27									- - - -	-						
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_	- - - -								- - - - -	-						
LOG OF BORING N:\GIN	  B1806527						Braun Intertec Corpor			-						T-28 page 1 of 1



ſ		n Proie	ct B180	6527		BORING:			S	T-29	<u> </u>	
ations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo				N: N:					678. See
obrevi	DRILLE	-	Miller	METHOD: 3 1/4" HSA, A	utohammer	DATE:	7/1	7/18		SCA	LE:	1" = 4'
nation of a	Elev. feet 810.8	Depth feet 0.0	Symbol	Description of Ma (Soil-ASTM D2488 or D2487, Rock-		)-1-2908)	BPF	WL	MC %	P200 %	Tests	or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:27	feet	feet	FILL SH		USACE EM1110, trace Gravel, own and gray, roll, brown and gray, moist Bedrock)	Clay noist	BPF 10 9 5 20 *	WL				set 1 1/2"
DRING N:\GINT\PROJECTS\AX						- - -						
	B1806527				ertec Corporation	_					0.7	.29 nage 1 of 1



			ct B180						BORING	:		S	T-30		
riations)	Projec 966 M	t Paul	AL EVALU oi River Bo esota						LOCATIO attached			901.0	05 E: 54881	10.369. Se	ee
ıbbre√	DRILLE	R: K.	Miller		METHOD:	3 1/4" H	ISA, Autoham	nmer	DATE:	7/1	6/18		SCALE:	1" = 4'	
nation of a	Elev. feet 809.7	Depth feet 0.0	Symbol	(Soil	De I-ASTM D2488	-	of Materials		-1-2908)	BPF	WL		Tests or	Notes	
(See Descriptive Terminology sheet for explanation of abbreviations)	- - -		FILL	mois	rly Graded Sa				-	3 10					
(See Descriptive Te	803.7 - - -	6.0	CH		estone fragme CLAY, with S (We	hale laye		oist, stiff t	to hard _ _ _	*		*100	0 to set 4"		
LOG OF BORING  N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ  BRAUN_V8_CURRENT.GDT  11/22/19 12:27		10.5	SH	END Wate	LE, gray, moi (De ) OF BORING er not observe e ground. ng then backfi	ecorah S ed with 10	hale Bedroo		auger -	*		*100	0 to set 0"		
ľ	B1806527					Br	raun Intertec Co	rnoration						ST-30 page	1 of



ſ	Brauı		ct B180	6527			BORING:			ST-31	
riations)	GEOTE Projec	ECHNICA t Paul	AL EVALU <i>i</i> oi River Bo					N: N:		3.481 E: 54911	6.547. See
lbbre\	DRILLE	:R: J. (	Chermak	METHOD	): 3 1/4" HSA, Autohai	mmer	DATE:	7/1	6/18	SCALE:	1" = 4'
nation of a	Elev. feet 810.7	Depth feet 0.0	Symbol		Description of Materia 88 or D2487, Rock-USAC		)-1-2908)	BPF	WL	Tests or	Notes
See Descriptive Terminology sheet for explanation of abbreviations)		6.0 7.5	FILL	roots, brown, m	(Topsoil Fill) concrete, with Limesto wn and gray, moist to v	one fragm vet at 3 fe	ents, – et. –	25 17 8 70/9"	Ā		
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:27		7.5		END OF BORII  Auger met refus  Water observed auger in the gro  Water observed auger in the gro  Water not obse	NG. sal at the 6-foot depth. d at 3 1/2 feet with 2 febund. d at 3 feet with 6 feet obund. erved to cave-in depth of er withdrawal of auger	et of hollow-s	- ow-stem				
	B1806527				Braun Intertec C						ST-31 nage 1 of 1



GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: K. Miller METHOD: 3 1/4" HSA, Autohammer DATE: 7/17/18 SCALE: 1" = 4'  Elev. Depth feet 812.2 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)  FILL: Clayey Sand, fine- to medium-grained, trace Gravel, roots and concrete debris, dark brown, moist.	ſ	Brauı		ct B180	6527	7			ВС	RING:	:		S	T-32	
TO THE PROPERTY OF THE PROPERT	riations)	Projec 966 M	t Paul ississipp	oi River B											25.611. See
TO THE PROPERTY OF THE PROPERT	bbrev	DRILLE	R: K.	Miller		METHOD:	3 1/4" HS/	A, Autohammer	DA	TE:	7/1	7/18		SCALE:	1" = 4'
TO THE PROPERTY OF THE PROPERT	nation of a	feet	feet			il-ASTM D2488	or D2487, R	ock-USACE EM1		908)	BPF	WL		Tests	or Notes
	_CURRENT.GDT 11/22/19 12:27	812.2 - - 808.2 - - - - -	4.0	FILL	FILL trace Wet Wateauge Wateauge Wateauge	il-ASTM D2488  :: Clayey Sandvel, roots and  :: Poorly Grace Gravel, brown  :: at 7 feet.  :: OOF BORING  :: er observed a ger in the ground a ger	d, fine- to r concrete de ded Sand, f vn, moist. t 7 feet with nd. t 10 1/2 fee nd.	nedium-grained ebris, dark brown ine- to medium-	, trace /n, mois -grained w-stem f hand	d,	6 14 15 11 13		%		OI NOTES
	OG OF BORING N:\G														



			ct B180						BORING	:		ST-33	3	
iations)	Proiec	t Paul	AL EVALU oi River Bo esota					-	LOCATIO attached			54.679 E:	548155	5.728. See
bbrev	DRILLE	R: J. 0	Chermak		METHOD:	3 1/4" HS	A, Autohammer		DATE:	7/1	6/18	SCAL	_E:	1" = 4'
nation of a	Elev. feet 812.5	Depth feet 0.0	Symbol		I-ASTM D2488	or D2487, R	f Materials lock-USACE EM11			BPF	WL	Te	sts or N	lotes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\AX PROJECTS		12.0	FILL	Wet  END Wate in the	at 7 1/2 feet.  OF BORING or observed a e ground.	t 7 1/2 feet ed to cave-withdrawal lled.	and gray, moist with 10 feet of hin depth of 3 fee of auger.	nan	- - - - - - -	15 35 47 22 8 13	$\sqrt{2}$			Γ-33 page 1 of



- 1			ct B180					BORING:			S	T-34	
riations)	Projec 966 M	t Paul	AL EVALU pi River B iesota					LOCATIC attached			352.8	21 E: 54882	20.192. See
abbre	DRILLE	R: K.	Miller		METHOD:	3 1/4" HSA, A	utohammer	DATE:	7/1	8/18		SCALE:	1" = 4'
nation of a	Elev. feet 814.2	Depth feet 0.0	Symbol	(Soi		escription of Ma or D2487, Rock	aterials -USACE EM1110	)-1-2908)	BPF	WL	MC %	Tests	or Notes
t for explai	- 812.2	2.0	FILL	trace	e concrete del	oris, brown, mo		_	11				
ology shee	- 810.2	4.0	FILL	FILL debr	.: Lean Clay v ris, brown and	vith Sand, with gray, moist.	Gravel, trace of	organic –	8		16		
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:27 (See Descriptive Terminology sheet for explanation of abbreviations)	810.2          -	12.0 12.1)	FILL	SHA END Wate auge Wate imme	ALE, gray, moi (De ) OF BORING er observed a er in the groun er not observe	st. ecorah Shale B t 7 1/2 feet wit id. ed to cave-in d withdrawal of a	h 8 feet of hollo		11 18 23 17 *	$\bar{\Sigma}$		*100 to set	1"
OG OF BORING	_												



		ct B180						BORING	<b>;</b> :			S	T-3	5	
Project	t Paul ississip <sub>l</sub>	AL EVALU pi River B sesota						LOCATION attached				379.7	'95 E:	548832	2.583. See
DRILLEI	R: K.	Miller		METHOD:		3 1/4" HSA, Auto	hammer	DATE:		7/16	6/18		SCA	LE:	1" = 4'
Elev. feet 813.0	Depth feet 0.0	Symbol	(Soil			cription of Mate		)-1-2908)	E	3PF	WL	MC %	P200	) Test	ts or Notes
feet	feet	Symbol FILL FILL SC	FILL trace mois  FILL with  CLA soft  Wea  END  Wate auge	: Lean Clay : Silty Sand e Shale and et. : Poorly Gra Clay nodule:  YEY SAND, to hard.  athered Shale o OF BORING er observed er in the grouer	with the second strained at a cerial second	r D2487, Rock-US th Sand, with G ne- to medium- nestone fragme ed Gravel, fine- prown, wet.  e- to medium-g (Glacial Till)  t 11 1/2 feet in 4 feet with 4 feet in the ground.	sampler.	moist.  Gravel, nd gray, - ained, - , wet,		13 23 45 43 12 *	WL				o set 1"
_								- - -							
B1806527							ec Corporation	-		_					T-35 page 1 o



		n Proje	ct B180		BORING	:		S	T-36	3
iations)	Projec 966 M	t Paul		ATION  oulevard S	LOCATIO attached			267.3	32 E:	548606.426. See
bbrev	DRILLE	R: K.	Miller	METHOD: 3 1/4" HSA, Autohammer	DATE:	7/1	7/18		SCA	LE: <b>1" = 4'</b>
nation of a	Elev. feet 812.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM111		BPF	WL	MC %	P200 %	Tests or Notes
See Descriptive Terminology sheet for explanation of abbreviations)	_ _ 809.4	3.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace nodules and fibers, brown, moist.	ce Clay - -	7 M 12		13	42	
ogy s	808.4	4.0	SM	SILTY SAND, fine- to medium-grained, trace S	Shale	12		13	42	
ptive Terminol			SC	fragments and Gravel, brown, moist. (Glacial Till) CLAYEY SAND, fine-grained, gray, moist, stiff (Glacial Till)	. <u> </u>	12		13		
(See Descrip	<u>805.4</u> _	7.0	SH	SHALE, moderately to highly weathered, gray, (Decorah Shale Bedrock)	moist.	∏ 14 ∏ 29				
	 801.3	11.1		END OF BORING.		<u>\</u>				*100 to set 2"
	_			Water not observed with 10 feet of hollow-sten in the ground.	n auger –					
19 12:27	_			Boring then backfilled.	_					
IT.GDT 11/22/19 12:27	_				-					
BRAUN_V8_CURRENT	_									
.GPJ BRAL	_ _				-					
118\06527.	_				_					
OJECTS\2C	<del>-</del>									
CTS\AX PR	_				_					
N:\GINT\PROJECTS\AX PROJECTS\2018\06527	_				_					
OF BORING N:\(										
10G				Rraun Intertec Corporation	_					ST-36 nage 1 c



		n Proie	ct B180	6527					BORING:			S	T-37	7	
iations)	GEOTE Proiec	CHNICA t Paul	AL EVALU pi River B		6				LOCATIC attached	N: N:					320. See
bbrev	DRILLE	:R: J. (	Chermak	ME <sup>-</sup>	THOD:	3 1/4" H	HSA, Autoham	mer	DATE:	7/1	6/18		SCA	LE:	1" = 4'
nation of a	Elev. feet 811.4	Depth feet 0.0	Symbol		M D2488 d	or D2487	n of Materials , Rock-USACE	EM1110		BPF	WL	MC %	P200 %	Tests	or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:27		6.0 10.0 11.0 12.0	FILL FILL CH	FILL: Crufragments  FILL: Silt and Limes  FILL: Poor medium-greet.  FAT CLA'  END OF It water obsauger in the	k brown, ushed cores, Clay ar  y Sand, f stone frag  orly Grad grained, to  Y, gray, v  (Wea BORING served at the ground	moist. (Top ncrete fr nd Grave  ine- to n gments,  ed Sanc race Gra  vet, stiff, athered d. ed to cav  lled.	nedium-grain asoil Fill) agments, tra el, brown and medium-grain dark brown,  d with Silt, fin avel, dark brown,  Shale Bedro with 10 feet	e- to own, wet	e Gravel at 11	5 26 44 20 22 12	\sqrt{\sq}}}}}}}}}} \end{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sq}}}}}}}}} \end{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sq}}}}}}}}}} \end{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sq}}}}}}}}} \end{\sqititith}}}}} \end{\sqititin}}} \end{\sqititintit{\sintinity}}}}}} \end{\sqititithintitagenitta}}}}} \sqititit	13	10	OC=2%	



	n Proje	ct B18		BORING	:		S	T-38	
Projec	t Paul		ATION oulevard S	LOCATIO attached			019.7	71 E: 54898	37.632. See
DRILLE	R: K.	Miller	METHOD: 3 1/4" HSA, Autohammer	DATE:	7/19	9/18		SCALE:	1" = 4'
Elev. feet 823.7	Depth feet 0.0		Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM11		BPF	WL	MC %	Tests	or Notes
5 - 822.4	1.3	PAV	3 inches of bituminous over 11 1/2 inches of a base.	aggregate –	∬ AS				
8 819.7	4.0	FILL	FILL: Lean Clay, with Gravel and Silty Sand, brown and brown, moist.	dark _	40				
966 M St. Par DRILLE Elev. feet 823.7 8 – 822.4 – 819.7		СН	FAT CLAY, with Lean Clay Sand seams, olive stiff to very stiff. (Weathered Shale Bedrock)	e, moist, 	16		17	LL=52, PL=	=24, PI=28
815.7	8.0	SH	SHALE, gray, moist,						
813.7	10.0		(Decorah Shale Bedrock)	_	39				
_			END OF BORING.	_					
_			Water not observed with 8 feet of hollow-sten the ground.	n auger in –	-				
_			Boring immediately backfilled.	_					
_					-				
_				_					
_				_	-				
_				_	-				
_				_					
				-	-				
_				_					
				-					
B1806527			Braun Intertec Cornoration	_					



		ct B180					BORING:	•		ST-39	
Project	t Paul	AL EVALU oi River B esota					LOCATIO attached			2.513 E: 54950	00.149. See
DRILLEI	R: K. I	Miller		METHOD:	3 1/4" HSA	, Autohammer	DATE:	7/2	0/18	SCALE:	1" = 4'
Elev. feet 844.2	Depth feet 0.0	Symbol	(Soil		scription of or D2487, Ro	Materials ck-USACE EM11	10-1-2908)	BPF	WL	Tests or	Notes
843.8	0.3			hes of bitumin				13			
842.2	2.0	FILL		:  Silty Sand, ¹ ⁄n, moist.	fine- to med	ium-grained, wit	th Gravel, –	13			
966 Mi St. Pau DRILLEI Elev. feet 844.2 842.2 842.2 838.2	2.0	CH	N .	CLAY, trace	Gravel, gray athered Sha	, moist, medium ale Bedrock)	n. — —	7			
838.2	6.0		END	OF BORING							
_			Wate	er not observe		t of hollow-stem	n auger in				
-			the g	round.			_				
1-			Borir	ng then backfi	illed.		_				
_							_				
_							_				
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											ST-39 page 1



1		1 Proie	ct B180	6527				BORING	Э·			2	T-40	
iations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU oi River B						101					74.388. See
bbrev	DRILLE	R: K.	Miller	MET	HOD:	3 1/4" HSA	, Autohammer	DATE:		7/20	0/18		SCALE:	1" = 4'
See Descriptive Terminology sheet for explanation of abbreviations)	Elev. feet 847.5	Depth feet 0.0	Symbol FILL XX		/I D2488		Materials ock-USACE EM11 lium-grained, tra			BPF	WL	MC %	Tests	or Notes
for expl	- 845.5	2.0	FILL	Gravel, Cl	ay nodu	les and bitu	iminous, brown,	moist.	-\	18				
gy sheel	_		CH	FAT CLAY	/, light g (We	ray, moist, athered Sh	very stiff. ale Bedrock)			19		24	LL=62, PL	=29, PI=33
Ferminolo	<u>843.5</u>	4.0	SH	SHALE, da	ark gray (De	, moist. ecorah Sha	le Bedrock)	_	-\ -\X	55				
otive	841.5	6.0		END OF E	BORING									
ee Descri	_			Water not the ground	observe 1.	ed with 4 fee	et of hollow-sten	n auger in	_					
S)	_			Boring the	n backfi	lled.			_					
	_								-					
	_													
:27	_								_					
GDT 11/22/19 12:27	_													
	_								_					
N_V8_CURRENT									_					
.GPJ BRAU	- -								_					
018\06527	_													
PROJECTS\2	_							_						
JECTS\AX I	- -								<del>-</del>					
I:\GINT\PRC	- -								_					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8								<del></del>						
LOG 0f	D1906E27						Intertoe Corneration							ST 40 page 1 of 1



ſ	Braur		ct B180	6527				BORING:			S	T-41	
iations)	Projec 966 M	t Paul	AL EVALUA Di River Bo Jesota		S			LOCATIO attached	N: N: sketch	1455			36.449. See
bbre\	DRILLE	R: K.	Miller	ME	THOD:	3 1/4" HSA, Au	tohammer	DATE:	7/18	8/18		SCALE:	1" = 4'
See Descriptive Terminology sheet for explanation of abbreviations)	Elev. feet 848.5	Depth feet 0.0	Symbol		M D2488	scription of Mat or D2487, Rock-L	ISACE EM1110		BPF	WL	MC %	Tests	or Notes
for expla	_ 847.0	1.5	FILL	moist.		ine- to medium		Gravel,	8				
ogy sheet	_ _ 844.5	4.0	СН	FAT CLA	(We	Sand, gray, moi athered Shale E	st, very stiff. Bedrock)	_ _ _	19		24	LL=61, PL	=28, PI=33
Terminol		4.0	SH	SHALE,	gray, mois (De	st. ecorah Shale Be	edrock)		52				
<b>Descriptive</b>	_							_ _ _	39				
(See [	_							_ _ _	47				
		40.0							61				
	836.5	12.0	=	END OF	BORING								
	_			Water no in the gro	ot observe ound.	d with 10 feet o	f hollow-stem	auger –					
/19 12:27				Boring th	en backfil	lled.							
.GDT 11/22/19 12:27	_							_					
8_CURRENT	_							_					
J BRAUN_V	_							_					
18\06527.GF	_												
OJECTS\20	_							_					
JECTS\AX PF	_ _							- -					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8	_							_					
BORING N													
	B1806527					Description	tec Cornoration						ST-41 nage 1 of 2



1	Braur		ct B180				BORING:			6.	T-42	
ations)	GEOTE Proiec	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo					N: N:	1444			90.430. See
obrevi	DRILLE		Barber	METHOD:	3 1/4" HSA, Autohamme	r	DATE:	8/10	0/18		SCALE:	1" = 4'
ination of ak	Elev. feet 833.0	Depth feet 0.0	Symbol	(Soil-ASTM D2488	scription of Materials or D2487, Rock-USACE EN			BPF	WL		Tests or	Notes
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27	Elev. feet 833.0  - 831.0  - 829.5  - 826.5	feet	Symbol FILL CH	(Soil-ASTM D2488 FILL: Silty Sand, to black, moist.  FILL: Poorly Grad coarse-grained, transfer, greenish brown (We END OF BORING Auger met refusal	or D2487, Rock-USACE ENfine- to medium-grained  (Topsoil Fill)  led Sand with Silt, fine- tace Gravel, brown, moisedded Limestone from 4 wn, moist, stiff to hard, athered Shale Bedrock)  at the 6 1/2-foot depth.  ed with 6 1/2 feet of hollowd.	to to tt. 1/2 t	e roots,	BPF 3 12 15 *	WL	*50 t	Tests or	Notes
G OF BORING N:\GINT\PROJECT	- - -						- - - 					
106	D1906E37				Proup Intertoe Corpore							CT 42 nago 1 of 1



ſ	Brauı		ct B180	6527	ВС	ORING:			ST-43	
riations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU oi River B			OCATIO tached s			0.674 E: 55053	4.468. See
bbrev	DRILLE	R: M.	Barber	METHOD: 3 1/4" HSA, Autohamm	er DA	ATE:	8/10	0/18	SCALE:	1" = 4'
anation of a	Elev. feet 837.7	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE I		_	BPF	WL	Tests or I	Notes
See Descriptive Terminology sheet for explanation of abbreviations)	_		FILL	FILL: Silty Sand, fine- to medium-graine trace Gravel, dark brown, moist. (Topsoil Fill)  Weathered Shale fragments at 1 1/2 fee		ois,	7			
erminology s	833.7	4.0	FILL	FILL: Poorly Graded Sand with Silt, fine- medium-grained, trace Gravel, brown, m			19			
Descriptive T	<u>831.7</u> _	6.0	SP	POORLY GRADED SAND, fine- to medi trace Gravel, weathered Shale fragments Limestone fragments, brown, moist, den	s, trace	d,	43			
(See	828.7 	9.0		dense. (Terrace Deposit)  END OF BORING.			55			
	_			Auger met refusal at the 9-foot depth.  Water not observed with 9 feet of hollow the ground.	-stem auge	er in _				
7	_			Boring then backfilled.		-				
11/22/19 12:27						_				
CURRENT.GDT	_					-				
018\06527.GP	_									
XX PROJECTS\2						_				
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8	_					-				
OF BORING N:\										
	B1806527			Braun Intertee Corne					-	ST-43 nage 1 of :



Γ			ct B180					BORING	:		S	T-44	
/iations)	Project 966 M	t Paul	AL EVALU oi River B esota					LOCATIO attached			129.8	30 E: 55055	52.496. See
pbre	DRILLE	R: M.	Barber		METHOD:	3 1/4" ⊢	ISA, Autohammer	DATE:	8/1	0/18		SCALE:	1" = 4'
See Descriptive Terminology sheet for explanation of abbreviations)	Elev. feet 833.2	Depth feet 0.0	Symbol		-ASTM D2488	or D2487,	of Materials Rock-USACE EM1		BPF	WL		Tests or	Notes
et for expla	- 831.2	2.0	FILL	trace	roots, trace	Gravel, b (Top:	soil Fill)	ace Clay, -	3				
gy shee	829.7	3.5	FILL	med	ium-grained,	Gravel, b			6				
Ferminolo	828.7 —	4.5	CH SH	1	(Wo	eathered beds of L	reen gray, moist. Shale Bedrock) imestone, green g	ray, moist.	16				
criptive	- 826.2	7.0			·		hale Bedrock)	_	*		*92	to set 11"	
See Des	-				OF BORING er met refusa		foot depth.	_					
- J					er not observ ground.	ed with 7	feet of hollow-ste	m auger in ——					
-	_			Borii	ng then back	filled.		-					
-	_							-	-				
2:27	_							_					
GDT 11/22/19 12:27	-							-	-				
CURRENT.GDT	-							-	-				
GPJ BRAU	-							-	-				
018\06527	-							-					
ROJECTS\2								_					
OF BORING N:\GinT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_	-							-					
\GINT\PRO	-							-					
30RING N:									-				
99	31806527						raun Intertec Corporation	_	-				ST-44 page 1 of



	n Proje						BORING:			ST-45		
Proiec	ECHNICA et Paul lississipp ul, Minn	oi River					LOCATIC attached			117.516 E: 550	0699.93	5. See
g DRILLE	R: M.	Barber		METHOD:	3 1/4" HSA,	, Autohammer	DATE:	8/1	0/18	SCALE:	1"	= 4'
Elev. feet 835.0	Depth feet 0.0	Symbol	(So		escription of lor D2487, Ro	Materials ck-USACE EM1110	)-1-2908)	BPF	WL	Tests	or Notes	<b>.</b>
$\sim$	1	Symbol TS Market SP	Frace  Wether  Wether  Wather  Wather	AN CLAY, with who and green erbedded wear at 14 feet.  DOF BORING ger met refusal ter observed are in the grounder observed observ	Sand, Grave gray, moist, with 14 feet with and.  at 13 1/2 feet er. eed to cave-in	ck-USACE EM1110 -grained, roots, d oil) ne- to medium-gra ravel, brown, mois eposit)  12 feet.  2-foot depth. 12 feet of hollov 18 feet of hollov immediately afte	estone, Bedrock)  w-stem  w-stem  w-stem	BPF 10 10 17 22 41 59 82 *	VL	*50 to set 4"	or Notes	
90 0 90 0 90 0 90 0 90 0 90 0 90 0 90					Droug	Intertec Corporation					QT 45	page 1 of



ſ		n Proje	ct B180	6527		BORING:			ST-46	
riations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo			LOCATIO attached			2.550 E: 55050	3.906. See
bbre	DRILLE	R: M.	Barber	METHOD: 3 1/4" HSA, Autol	nammer	DATE:	8/10	0/18	SCALE:	1" = 4'
ination of a	Elev. feet 844.2	Depth feet 0.0	Symbol	Description of Mater (Soil-ASTM D2488 or D2487, Rock-US	ACE EM1110		BPF	WL	Tests or	Notes
sheet for expla	_ _ 841.2	3.0	FILL	FILL: Silty Sand, fine- to medium-g dark brown, moist.  (Topsoil Fill)	rained, trac	e roots, _ _ _ _	2			
See Descriptive Terminology sheet for explanation of abbreviations)	_		CH	FAT CLAY, trace Sand, trace Grave Limestone, green brown, moist. (Weathered Shale Be		bedded -	57			
(See Descr	- -						26			
	_						28			
	830.2	14.0		END OF BORING.		_	41			
9 12:27				Auger met refusal at the 14-foot de	oth.					
GDT 11/22/19 12:27	_			Water not observed with 14 feet of in the ground.	hollow-stem	auger _				
CURRENT.	_			Boring then backfilled.		_				
3PJ BRAUN_V	_									
\$\2018\06527.	_					- -				
TS\AX PROJECT.	_									
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8	- - -					- - -				
	 									ST-46 page 1 of 2



Braun Pi	•							BORING	:		S	T-47	7	
GEOTECHI Project Pa 966 Missis Saint Paul	ul - Infr ssippi R	astrud iver Bo	cture	Phase			-	LOCATIO attached		1456	35.5	23 E: (	547937	.290. See
DRILLER:	B. Kam	mermei	er	METHOD:	3 1/4" HS	A, Autohamr	mer	DATE:	10/	1/19		SCA	LE:	1" = 4'
Elev. De feet fe	pth et 0.0 Sy	/mbol	(Soil	De I-ASTM D2488 (	•	of Materials Rock-USACE	EM1110	-1-2908)	BPF	WL	MC %	P200 %	Test	s or Notes
- - 798.0 - - - -	6.5 FIL 9.0 FIL 11.5 SH	L	FILL with wet.  FILL trace  FILL with wet.  FILL with wet.	ESTONE, Cariments, gray, w (For or or observed after in the grounder observed after in the grounder observed after observed af	(Topsoled Sand, 1 Lean Clay fine- to me ces, dark to led Sand, 1 Lean Clay st, hard. ecorah Shaimona Mervet, very de Platteville I to 9 feet with d. to 9 feet immed.	poil Fill) fine- to mediane inclusions, redium-graine prown, mois fine- to mediale Bedrock mber, trace ense. Formation)  h 10 feet of mediately a	ed, with st.  dium-graphy of hollow-st fter with st.	ined, - moist to -  Gravel, - ined, -  ined, -  stem -	13 7 32 11 50/2*'		14	5	*2-inch	recovery recovery



Γ	Braur	•	ct B180					BORING	:		S	T-48	
viations)	Project 966 M	t Paul - ississipp	AL EVALU Infrastru oi River B nnesota	cture				LOCATION attached			769.0	45 E: 54792	8.172. See
bbre	DRILLE	R: B.	Kammerme	ier	METHOD:	3 1/4" HSA, Au	itohammer	DATE:	9/	30/19		SCALE:	1" = 4'
nation of a	Elev. feet 811.7	Depth feet 0.0	Symbol		oil-ASTM D2488		JSACE EM1110		BPF	WL	MC %	Tests	or Notes
OF BORING N.\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21 (See Descriptive Terminology sheet for explanation of abbreviations)			* * * * * * * * * * * * * * * * * * * *	FILL med brow FILL frag  FILL frag  Wat aug  Wat imm	cil-ASTM D2488 of L: Clayey Sand st.  L: Fat Clay, no a Shale fragment L: Silty Sand, for strace Limes who, moist.  L: Poorly Grad dium-grained, vestone fragment L: Sandy Lean gments, trace L	or D2487, Rock-lot, with roots an (Topsoil Fill on- to slightly or nts, gray and become fragments) and the stone fragments of the stone fragments of the stone fragments, gray, wet.  Clay, with Sarimestone fragments, gray, wet.  Clay, with Sarimestone fragments of the stone f	JSACE EM1110 d Gravel, dark l) rganic, trace G lack, moist.  th weathered S s, dark brown Silt, fine- to ments, trace ad seams and ments, gray, we edrock)  eet of hollow- ave-in depth ouger.	shale to Shale et tem	56/	9"	_		hemical odor
901									-				ST-48 nage 1 of 1



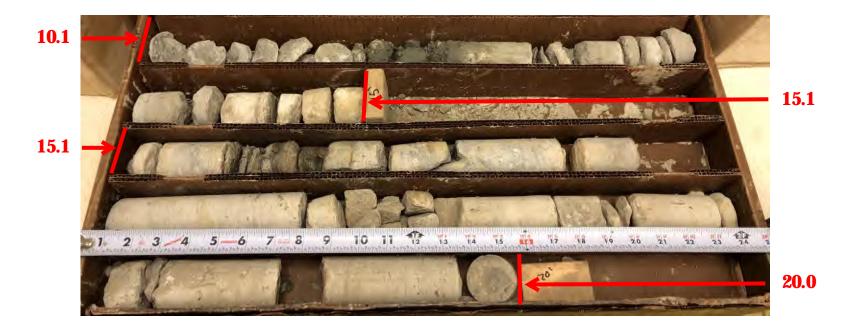
		Proje		.80	6527.00	BORING:			S	T-49	)
Pr	rojec 56 Mi		Infrasi pi Rive	truc er Bo	ATION cture Phase oulevard South	LOCATIO attached		1458			547932.893. See
DF DF	RILLEI	R: M.	Barber		METHOD: 3 1/4" HSA, Autohammer	DATE:	9/20	0/19		SCA	LE: <b>1" = 4</b> '
ation of ab	ev. eet 10.9	Depth feet 0.0	Symbo	ol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110	0-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
V8_CURRENT.GDT 11/27/19 09:47       (See Descriptive Terminology sheet for explanation of the control	eet	feet	N		•	brown, — noist, soft. — edium. — light gray, — n Shale — eet. — htly to	BPF  17  4  7  50/2"		1		Run 1 Switched to coring at 10.1 feet. See Log of Coring for additional information.  Run 2
OF BORING N:\GINT\PROJE	-					- - -					
90]	06527.0	0			Braun Intertec Corporation						ST-49 page 1 of 1

**Braun Project B1806527.00** ST-49 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145894.098 E: **Project Paul - Infrastructure Phase** 547932.893. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 9/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % % (psi) 8.008 10.1 (min/ft) (psi) (%) LIMESTONE, Carimona Member, dark gray to light gray, 4,650 2 3/4 500 100 56 0 Run 1 8.008 10.1 moderately to highly weathered, soft to hard, thin bedded, Carimona highly to intensely fractured, with 3-inch Shale layer at 11 feet Member and 2-inch Shale layer at 15.3 feet. (Platteville Formation) 4 6 3/4 3 1/4 2 1/2 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-49** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145894.098 E: **Project Paul - Infrastructure Phase** 547932.893. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 9/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % % (psi) 795.8 15.1 (min/ft) (psi) (%) LIMESTONE, Carimona Member, dark gray to light gray, 5 3/4 100 4,650 500 93 34 Run 2 moderately to highly weathered, soft to hard, thin bedded, highly to intensely fractured, with 3-inch Shale layer at 11 feet and 2-inch Shale layer at 15.3 feet. (Platteville Formation) (continued) 3 1/4 793.9 17.0 LIMESTONE, Magnolia Member, light gray, slightly to 3 Magnolia moderately weathered, moderately hard to hard, thick Member bedded, highly to intensely fractured, vuggy. (Platteville Formation) 1 1/2 1 3/4 END OF CORING. 20.0 790.9 NOTES:



# **ST-49**



NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.



	ın Proje		6527.00	BORING:			S	T-50	
Proje	ct Paul -	pi River Bo	ATION cture Phase pulevard South	LOCATIO attached		1460	)14.7	70 E: 54797	5.611. See
DRILL	ER: M.	Barber	METHOD: 3 1/4" HSA, Autohammer	DATE:	9/20	0/19		SCALE:	1" = 4'
Flev. feet 809.3	Depth feet 0.0		Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110		BPF	WL	MC %	Tests	or Notes
ogy sheet for expla 	3 2.0	FILL	FILL: Silty Sand, fine- to coarse-grained, Grave Limestone fragments, brown, dry.  FILL: Shale, with non- to slightly organic Silty Sand Lean Clay seams, with Sand lenses, trace Limestone fragments, black and brown, moist.	_	9		22	OC=2%	
See Descriptive Terminology sheet for explanation of abbreviations)  Below:  B				- - -	10		22		
	9.0	SH	SHALE, gray, dry, hard. (Decorah Shale Bedrock)		12		16		
		LS	LIMESTONE, Carimona Member, dark gray, moderately to highly weathered, moderately har hard, thin bedded, highly to intensely fractured. (Platteville Formation)	rd to _	<sup>×</sup> 50/2"			Run 1 Switched to 12 1/2 feet Coring for a information	See Log of additional
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21		LS	LIMESTONE, Magnolia Member, light gray, slig moderately weathered, moderately hard to hard bedded, moderately to highly fractured, vuggy. (Platteville Formation)  END OF BORING.  Auger met refusal at 12 1/2 feet.  Switched to coring at 12 1/2 feet.  Water not observed while drilling.  Boring immediately backfilled with cement.					iniomation	
LOG OF BORING N:\GINT\PROJEC			Braun Intertee Corporation	- - - 					ST-50 page 1 of 1

**Braun Project B1806527.00 ST-50** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 146014.770 E: **Project Paul - Infrastructure Phase** 547975.611. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 9/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % % (psi) 796.8 12.5 (min/ft) (psi) (%) LIMESTONE, Carimona Member, dark gray, moderately to 500 100 4,650 4 80 43 Run 1 highly weathered, moderately hard to hard, thin bedded, Carimona highly to intensely fractured. Member (Platteville Formation) (continued) 3 1/2 3 3/4 793.8 15.5 LIMESTONE, Magnolia Member, light gray, slightly to Magnolia 4 moderately weathered, moderately hard to hard, thick Member bedded, moderately to highly fractured, vuggy. (Platteville Formation) 1 3/4 END OF CORING. 791.8 NOTES:



**ST-50** 

**12.5** 



**17.5** 

NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.



	-	ct B180					BORING:			S	T-51		
Proje	ct Paul - lississip <sub>l</sub>	AL EVALUA Infrastruc oi River Bo Innesota	cture				LOCATIO attached		1461	39.0	98 E:	548120.0	65. See
DRILLI	ER: B.	Kammermei	er	METHOD:	3 1/4" HSA,	, Autohammer	DATE:	10/1	1/19		SCA	LE:	1" = 4'
Elev. feet 806.2	1	•		I-ASTM D2488		ck-USACE EM111		BPF	WL ∑	MC %	P200 %	Tests	or Notes
CURRENT.GDT 11/22/19 12:21  CURRENT.GDT 11/22/19 12:21  CSee Descriptive Terminology sheet for explanation of the companies o	0.0	•	FILL Shal brow FILL with WEA gray.	I-ASTM D2488  : Weathered le, with roots, rn and gray, n  : Poorly Grac Gravel, brown  CLAY, with L	or D2487, Roi Shale, mixe trace Limest noist. (Topsoil ded Sand, fir n, wet.	ck-USACE EM111 d with Fat Clay a tone fragments, of Fill) ne- to medium-grayers, gray, wet, vale Bedrock)	ained, ery stiff	3 3 11 26 50/5"	<u> </u>			Slight chodor.	emical
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_													
B1806527.	00				Rraun	Intertec Corporation						ST-5	51 page 1 of 1



ſ		n Proje	ct B180		)				BORING	3:			S	T-52	
/iations)	Projec 966 M	t Paul - ississipp	AL EVALUA Infrastruction Di River Bo nnesota	cture Pha					LOCATI attached			1455	547.0	02 E: 54904	48.612. See
abbre	DRILLE	R: B.	Kammermei	er ME	ETHOD:	3 1/4" HS	A, Autoham	mer	DATE:		8/6	/19		SCALE:	1" = 4'
nation of a	Elev. feet 815.7	Depth feet 0.0	Symbol		TM D2488 o	r D2487, R		E EM1110			BPF	WL	MC %	Tests	s or Notes
expla	_ 814.6	1.1	PAV	5 inches base.	of bitumin	ous over	8 inches o	f aggreg	ate						
sheet for	_ 812.7	3.0	FILL	Limestor	ean Clay, s ne fragmen	its, black,	moist.				6		20	OC=4%	
minology	_		СН	FAT CLA medium	AY, trace fi to very stif (Wea	f.	vn and gra nale Bedro	-		_^\					
See Descriptive Terminology sheet for explanation of abbreviations)	_									X	5		36	q <sub>p</sub> =1 1/4 to LL=77, PL	sf _=28, PI=49
(See Des	- 806.7	9.0	SH ==	CHAIE	gray maia	t hard				_X	24		26		
			эп	SHALE,	gray, mois (De		ale Bedroc	k)		X	48		19		.=24, PI=31
2:21	_ _ _									_ _X _	80		15	feet, and or samples v	from 3 to 9 California tube vere taken o 12 feet from borehole
CURRENT.GDT 11/22/19 12:21	_										81 87/11'			testing. So for test res	ee appendix sults.
URREN	- 796.7	19.0								Ä	D//II				
	795.7	20.0	LS	WEATH	ERED LIM	ESTONE	, gray, dry	, very de	nse.						
BRAUN				END OF	BORING.					×	50/1"				
0.GPJ	_			Water no	ot observed	d to cave-	in depth o	f 19 feet.							
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8	_			Boring in	nmediately	backfilled	d with ben	onite gro	out.						
AX PROJECTS	<del>-</del>								_						
JT\PROJECTS\	_ _									$\left  \cdot \right $					
DRING N:\GIN	_														
501	 B1806527 (						ın Intertec Co		-						ST-52 nage 1 of 1



		•	ct B180						BORING	:		S	T-53		
viations)	Proiec	t Paul - ississipp	AL EVALUA Infrastruc Di River Bo nnesota	ture				•	LOCATIO attached		1453	356.0	91 E: 5	48932.044	4. See
bbre	DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" F	ISA, Autohammer		DATE:	8/7	/19		SCAL	E: <b>1</b> '	' = 4'
nation of a	Elev. feet 808.0	Depth feet 0.0	Symbol	(Soil		•	of Materials Rock-USACE EM	11110	-1-2908)	BPF	WL	MC %	P200 %	Tests or	Notes
xplar	807.0	1.0	FILL		: Silty Sand, n, moist.	fine-grair	ned, trace Grave	l, da	rk						
(See Descriptive Terminology sheet for explanation of abbreviations)			FILL	FILL	: Poorly Grad	led Sand h Gravel	l, fine- to coarse- , brown, moist to	-graii o wet	ned,	8	Ā	14	5		
		9.5	SH	SHA	LE, gray, moi	st, hard. (Decor	ah Shale)			×50/5"		20			
	_ 795.9	12.1		∖With	Limestone fr	agments	at 12 feet		Ī	50/1"					
	_				OF BORING		ut 12 100t.								
912:21	_				er observed a er in the grour		vith 2 feet of hollo	ow-s	tem -	-					
NT.GDT 11/22/19 12:21	_				er not observe e ground.	ed with 1	2 feet of hollow-s	stem	auger _	-					
RRENT.GD	_						et with cave-in d drawal of auger.	lepth	of 5						
N_V8_CURRE	_			Borir	ng immediate	y backfil	led.								
ا BRAU	_								-	-					
527.00.GI	_								_	-					
2018\06	_								_						
OJECTS\;										-					
S\AX PR	_								-	_					
PROJECT	_								_	1					
:\GINT\	_								_						
RING N															
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8	_								_						
의	B1806527.0	00				В	raun Intertec Corporati	ion		Ш				ST-53	page 1 of



1		n Proie		6527.00	BORING	<u>.                                    </u>			T-54	1
riations)	GEOTE Projec 966 M	CHNICA t Paul - ississipp	AL EVALUA Infrastru			ON: N:	1453			549047.219. See
lbbre\	DRILLE	R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:	8/7	/19		SCA	LE: <b>1" = 4</b> '
nation of a	Elev. feet 810.3	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM11		BPF	WL	MC %	P200 %	Tests or Notes
OF BORING NIYGINT\PROJECTS\AX PROJECTS\2018\05527.00.GPJ BRAUN_V8_CURRENT.GDT 12/5/19 13:45	810.3 	9.0 11.0		Sil-ASTM D2488 or D2487, Rock-USACE EM11 SILTY SAND, fine- to medium-grained, mixed Shale fragments, brown and gray, moist. FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, trace Gravel to with Gravel, be moist.  FILL: Poorly Graded Sand, fine- to coarse-grained fragments at 14 silt, fine- to coarse-grained, little Gravel, brown, moist to with Gravel fragments at 14 silt, fine- to coarse-grained, little Gravel, brown, wet.  SHALE, gray, dry, hard.  (Decorah Shale)  With Limestone fragments at 14 silt feet.  END OF BORING.  Water observed at 6 feet with 7 feet of hollow auger in the ground.  Water observed at 6 silt feet with 14 silt feet hollow-stem auger in the ground.  Water observed at 5 feet with cave-in depth of immediately after withdrawal of auger.  Boring immediately backfilled with bentonite of the silt feet feet with silt feet feet feet with silt feet feet feet with silt feet feet feet with silt fee	ained, ret	18 -\ 18 -\ 7 -\ 75/9" -\ 50/1"		9 111	9 5	See appendix for sieve analysis results.
106	D1906E37.0			Proup Intertee Corporation						ST E4 mage 1 of 1



Braui	n Proje	ct B180	6527	7.00			BORING:			S	T-5	5	
Projec	t Paul - Iississip <sub>l</sub>	AL EVALU Infrastruc pi River B innesota	cture				LOCATIO attached		1452	246.8	33 E:	548981.028	3. See
DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" HSA	A, Autohammer	DATE:	8/7	'/19		SCA	LE: <b>1</b> "	' = 4'
Flev. Fleet 810.4	Depth feet 0.0	Symbol	(Soi		scription of	f Materials ock-USACE EM1110	0-1-2908)	BPF	WL	MC %	P200 %	Tests or	Notes
809.9	0.5	•	,	: Weathered	-								
ology sheet for exp	4.0	FILL	FILL		led Sand, f	ine- to coarse-grai	ined, – –	5		7	4		
See Descriptive Lerwinology sheet for explanation of appreviations of appr	7.0	FILL	coar	rse-grained, lit	tle Gravel,			6	Σ			See apper sieve analy results.	
99 	12.0	FILL	FILL trace	.: Poorly Grad e Gravel, brow	led Sand, f n, wet.	ine- to coarse-grai	ined,	17					
_		SH	SHA	ALE, gray, moi	st, hard. (Decorah	Shale)	_	X54/8"		25			
NT.GDT 12/5/19 13:45	14.6		END	n Limestone fra O OF BORING		14 1/2 feet. with 4 1/2 feet of		50/1"					
CURRENT.GDT			hollo Wat	ow-stem auger er observed a	r in the grout t 6 feet with	und. n 14 1/2 feet of	-						
3AUN_V8_CU			Wat	ow-stem auger er observed a lediately after	t 5 feet with	n cave-in depth of	5 feet						
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_			Bori	ng immediatel	y backfilled	d with bentonite gro	out						
ECTS\AX PROJECTS													
NG N:\GINT\PROJ							<u>-</u>						
B1806527.0	20				Rrau	n Intertec Corporation						ST-55	page 1 of 1



			ct B180					BORING	:		S	T-56		
/iations)	Projec 966 M	t Paul - ississipp	AL EVALUA Infrastruc Di River Bo nnesota	cture				LOCATIO attached		1451	19.4	69 E: 54	48979.00	)3. See
ibbre\	DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" HSA	, Autohammer	DATE:	8/8	/19		SCAL	E: 1	1" = 4'
nation of a	Elev. feet 808.7	Depth feet 0.0	Symbol	,	I-ASTM D2488		ck-USACE EM111		BPF	WL	%	P200 %	Tests o	or Notes
See Descriptive Terminology sheet for explanation of abbreyiations)		4.5	FILL		: Weathered le, brown and		ed with Fat Clay a moist.	nd – – – –	2	Σ	17			
(See Descriptive Termi		12.0	FILL	FILL trace	.: Poorly Grade e Gravel, brow	led Sand, fir n, wet.	ne- to coarse-gra	ined,	5		16	2		
11	- - 794.1	14.6	LS	WEA	ATHERED LIN (I	MESTONE, Platteville Fo	gray, dry, very de ormation)	ense. -	50/1"					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21				Wate auge Wate hollo Wate after	er in the groun er observed a ow-stem auger er not observe withdrawal of	t 4 feet with ad. t 5 1/2 feet vir in the grouled to cave-infauger.	4 1/2 feet of hollowith 14 1/2 feet ond.  In depth of 5 immediately with bentonite growth and the second se	f gediately	50/1"					
507	B1806527.0						Intertec Corporation	_					a= : :	5 page 1 of 1



ſ	Brauı			6527.00		BORING	:		S	T-57	,	
riations)	Projec 966 M	t Paul - ississipp		ATION cture Phase oulevard South		LOCATIO attached		1450			549093.127. S	See
bbre	DRILLE	:R: J. (	Chermak	METHOD: 3	5 1/4" HSA, Autohammer	DATE:	8/23	3/19		SCA	_E: <b>1" =</b> 4	4'
nation of a	Elev. feet 810.3	Depth feet 0.0	Symbol		ription of Materials D2487, Rock-USACE EM1110	-1-2908)	BPF	WL	MC %	P200 %	Tests or Not	tes
expla	809.6	0.7	FILL FILL	FILL: Sandy Lean Cl ∖Shale fragments, dar	lay, trace roots, with Grave	l and	-					
heet for e	_ _ _ 	2.0	FILL		(Topsoil Fill) lay, with Gravel and Shale				40			
inology s		3.0	FILL	FILL: Poorly Graded	Sand, fine- to medium-gra ale lenses, brown, wet.	nined,	8	Ψ	13			
See Descriptive Terminology sheet for explanation of abbreviations)							6				See appendix sieve analysis results.	for
(See Desc	_					- -	4		15	3		
				With a 2-inch Lean C	clay layer at 10 feet.		4					
	797.6	12.7		END OF BODING		_	50/1/8	•				
				END OF BORING.	40.7 fact							
12:21				Auger met refusal at								
NT.GDT 11/22/1912:21	_			auger in the ground.	feet with 3 feet of hollow-s	_						
	_			auger in the ground.	feet with 13 feet of hollow-	_	-					
V8_CURRE	_			immediately after with	_	f 3 feet –						
BRAUN_V8				Boring immediately b	packfilled.							
						_						
)6527.0	_					_						
\2018\	_					_	-					
OJECTS							-					
S\AX PR	_					_						
ROJECT	_					_						
GINT\PI	_					_						
NG N:\	_					_						
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ												
501	R1806527 (	20			Braun Intertec Corporation						ST-57 pag	



ſ		n Proje	ct B180		00			BORING:			S	T-58	
/iations)	Projec 966 M	t Paul - ississipį	AL EVALU Infrastruc oi River Bo innesota	cture Ph				LOCATIC attached		1449	976.63	35 E: 54899	5.755. See
bbre	DRILLE	:R: B.	Kammermei	er M	IETHOD:	3 1/4" HSA, Aı	utohammer	DATE:	8/8	/19		SCALE:	1" = 4'
nation of a	Elev. feet 810.2	Depth feet 0.0	Symbol	(Soil-AS		cription of Ma D2487, Rock-	iterials USACE EM1110	)-1-2908)	BPF	WL	MC %	Tests	or Notes
expla	809.2	1.0	FILL		Silty Sand, fir nts, brown, d		ace Gravel and	d Shale			1		
ogy sheet for e	- - 806.2	4.0	FILL	FILL: S		ne- to coarse-	grained, with (	Gravel,	13		7		
See Descriptive Terminology sheet for explanation of abbreviations)		7.0	FILL	FILL: C	Organic Silt, I	black, moist.			7	ĮΣ	25	OC=7%	
See Desc	- 801.2	9.0	FILL	FILL: S gray, we		ne- to mediun	n-grained, brov	vn and –	3	\ <u>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</u>	19		
			FILL			, with Gravel, nd gray, wet.	Limestone fraç	gments	10				
	798.2 	12.0	SH	SHALE		moist, hard. (Decorah Sh	ale)	-	50/1"				
19 12:21	796.2 795.6 —	14.0 14.6	LS	$\bigcap$	HERED LIME (PI F BORING.	ESTONE, gra latteville Form	ıy, wet, very de nation)	ense.	50/1"				
NT.GDT 11/22/19 12:21	_			Water o	observed at 7	7 1/2 feet with n the ground.	n 7 1/2 feet of	-					
CURRE	- -				not observed n the ground		eet of hollow-s	tem –					
BRAUN_V8				Water of immedia	observed at 7 ately after wi	7 feet with ca ithdrawal of a	ve-in depth of suger.	9 feet					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	_			Boring i	immediately	backfilled wit	h bentonite gro	out					
AX PROJECTS\2	_												
3INT\PROJECTS	_							-					
F BORING N:\C													
507	B1806527 (					Danua late	ertec Corporation						ST-58 page 1 of



	•	ct B180					BORING			S	T-59	)	
Projec	t Paul - Iississip <sub>l</sub>	AL EVALU Infrastruci oi River B Innesota	cture				LOCATIC attached		1448	327.2	27 E:	549057.7	'42. See
DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" HSA,	Autohammer	DATE:	8/8	/19		SCA	LE:	1" = 4'
Elev. feet 809.1	Depth feet 0.0	Symbol		I-ASTM D2488		k-USACE EM1110		BPF	WL	MC %	P200 %	Tests	or Notes
See Describtive Lerwinology sheet for explanation of appreviations)  Elev. feet 809.1  Blev. feet 809.1	7.0	SC	CLA brow	YEY SAND, won and gray, work, stiff.	with Gravel a ret, very stiff. (Glacial	Till) d Shale seams, ç	wet	3* 17 10	Ā	13	16	*Only G recovery LL=68, PI=40	<i>(</i>
797.1 - - - 794.3	12.0	LS	WEA	ATHERED LIN		gray, wet, very de	ense. -	50/3"					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:21	14.0		Wate auge Wate hollo	er in the groun er observed a ow-stem auger	t 4 feet with 4  t 7 feet with 5  in the grour		- -	× 50/3"					
B1806527.0	00		<u> </u>		Braun	Intertec Corporation						ST-	59 page 1 of



		n Proje	ct B180	6527	<b>'.00</b>			BORING:			S	T-60	)	
riations)	Proiec	t Paul - ississipp	AL EVALUA Infrastruc pi River Bo Innesota	cture l				LOCATIC attached		1445				29. See
bbrev	DRILLE	:R: B.	Kammermei	er	METHOD:	3 1/4" HSA, Au	ıtohammer	DATE:	8/12	2/19		SCA	LE:	1" = 4'
nation of a	Elev. feet 810.5	Depth feet 0.0	Symbol	(Soil		scription of Ma or D2487, Rock-l		)-1-2908)	BPF	WL	MC %	P200 %	Tests	or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21		7.0 12.0 14.6	FILL SH LS	FILL: medi inclus  FILL: Medi inclus  FILL: WEA  WEA  WEA  WEA  Water  Water  Water	E Gravel, brown: Poorly Gradium-grained, visions, brown, E Lean Clay, resides and layers,  LE, gray, mois (Death Company)  ATHERED LIMITES.  OF BORING or not observe the company of the c	(Topsoil Fill led Sand with S with Gravel, trac wet.  non- to slightly black and gray st, hard. ecorah Shale B Platteville Form	organic, with Son, moist.  edrock)  k gray, dry, venation)	n Clay  - Shale	17 8 2* \$50/3"*		10 10 23	9	*1-inch	



ſ	Braur			6527.00				BORING	:			S	T-61	
/iations)	Projec 966 M	t Paul - ississip <sub>l</sub>		ATION cture Phase oulevard So				LOCATIO attached			1443	359.7	39 E: 54914	2.338. See
bbre	DRILLE	R: B.	Kammerme	er MET	HOD:	3 1/4" HSA, A	utohammer	DATE:		8/9	/19		SCALE:	1" = 4'
nation of a	Elev. feet 810.5	Depth feet 0.0	Symbol		1 D2488 o		-USACE EM1110		Е	3PF	WL	MC %	Tests	or Notes
See Descriptive Terminology sheet for explanation of abbreviations)	- 808.5	2.0	FILL	brown, dry	-		e-grained, with G	_	- - - -					
ninology sh		4.0	OL	Gravel and moist.	CLAY, v	one fragment	s, dark brown to		\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	16		16	OC=2%	
iptive Term	 _ 	7.0			(Buried	Topsoil/Swa	mp Deposit)		X	3		33		
(See Descr	802.5	8.0	SC ///	moist, very	stiff.	(Glacial T	fragments, bro	J	X	19		36	q <sub>p</sub> =3/4 tsf	
	 	11.5		stiff.		athered Shale		—— ——	X	13	Ā	34	q <sub>p</sub> =2 tsf	
	_ 798.4	12.1	SH	SHALE, gr		t, hard. corah Shale	Redrock)	Ī	ΠE	50/1"		8	Due 4	
.9 12:21	_ 	15.2	LS	moderately	NE, Carii / to highl bedded vel layer	mona Membe y weathered, , highly to inte	er, dark gray, moderately har ensely fractured		`  -  -	JO/ 1		0	Run 1 Switched to 12.1 feet. S Coring for a information	See Log of additional
3_CURRENT.GDT 11/22/19 12:21	_ _ _		LS	moderately	/ weathe	red, moderat	r, light gray, slig ely hard to hard highly fractured nation)	,					Run 2	
NUN_V8	790.5	20.0		END OF B	ORING.				Ш					
3PJ BR,	_			Auger met		at 12 feet.		-	$\ $					
527.00.	-			Switched to				_	$\parallel$					
TS\2018\06	_			Water obse			10 feet of hollow	stem 						
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8	_			Boring imm	nediately	v backfilled w	th bentonite gro	out	- - - - - - -					
I:\GINT\PROJEC	_ _ _							- -						
OF BORING N														
501	B1806527 (	20				Danie I d	ertec Cornoration							ST-61 page 1 of 1

**Braun Project B1806527.00 ST-61** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144359.739 E: **Project Paul - Infrastructure Phase** 549142.338. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/9/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 798.4 12.1 (min/ft) (psi) (%) LIMESTONE, Carimona Member, dark gray, moderately to 12.1 4,650 2 99 0 Run 1 798.4 highly weathered, moderately hard to hard, thick bedded, Carimona highly to intensely fractured, with 3-inch Gravel layer. Member (Platteville Formation) 3 1/4 6 1/4 795.3 11 3/4 LIMESTONE, Magnolia Member, light gray, slightly to Magnolia moderately weathered, moderately hard to hard, massive Member bedded, moderately to highly fractured, vuggy. (Platteville Formation) 1 1/2 73 4,650 98 Run 2 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-61** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144359.739 E: **Project Paul - Infrastructure Phase** 549142.338. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/9/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 793.4 17.1 (min/ft) (psi) (%) LIMESTONE, Magnolia Member, light gray, slightly to 4,650 98 73 1 1/2 moderately weathered, moderately hard to hard, massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) (continued) 1 1/2 1 1/2 790.5 20.0 END OF CORING. NOTES:



## **ST-61**



NOTE: Cores run from left to right and top to bottom. Each row is 60 inches long.



GEOTECHNICAL EVALUATION Project Paul - Infrastructure Phase 966 Mississippi River Boulevard South Saint Paul, Minnesota  DRILLER: B. Kammermeier METHOD: 3 1/4" HSA, Autohammer DATE: 8/7/19 SCALE: 1" =  Elev. Depth feet feet feet s809.7 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)  809.2 0.5 FILL FILL: Weathered Shale fragments, gray, dry. FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, moist to wet.  798.7 11.0	Braun P		B1806	5527.00	BORING			S	T-62	)
798.7 11.0	GEOTECH Project Pa	HNICAL EV Paul - Infraissippi Ri	EVALUA rastruct River Bo	ATION ture Phase	LOCATIO	DN: N:	1451			
798.7 11.0	DRILLER:	B. Kamr	nmermeier	mETHOD: 3 1/4" HSA, Autohammer	DATE:	8/7	/19		SCAI	_E: <b>1" = 4'</b>
798.7 11.0	b Elev. De feet fe 809.7	feet   0.0   Sy	ymbol	(Soil-ASTM D2488 or D2487, Rock-USACE EM11		BPF	WL			Tests or Notes
Water observed at 4 feet with 4 1/2 feet of hollow-stem auger in the ground.  Water observed at 7 feet with 9 1/2 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger.  Boring immediately backfilled.	OF BORING N; GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21	FILI		FILL: Poorly Graded Sand, fine- to coarse-gratrace Gravel, brown, moist to wet.  END OF BORING.  Water observed at 4 feet with 4 1/2 feet of hol auger in the ground.  Water observed at 7 feet with 9 1/2 feet of hol auger in the ground.  Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger.	ained, –	13		11	3	



		n Proie		6527.00		BORING			9	T-63	<u> </u>
viations)	GEOTE Proiec	CHNICA t Paul - ississipp	AL EVALUA Infrastruc				DN: N:	1449			548915.713. See
ibbre	DRILLE	R: B.	Kammermei	er METHOD:	3 1/4" HSA, Autohammer	DATE:	8/8	/19		SCAL	_E: <b>1" = 4'</b>
anation of a	Elev. feet 810.9	Depth feet 0.0	Symbol	(Soil-ASTM D2488 o	scription of Materials		BPF	WL	MC %	P200 %	Tests or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21 (See Descriptive Terminology sheet for explanation of abbreviations)	810.4 	11.0	FILL	Shale fragments, but FILL: Poorly Grad trace Gravel, brown trace G	t 4 1/2 feet with 4 1/2 feet of in the ground.  t 7 feet with 9 1/2 feet of holled.  ed to cave-in depth of 4 feet withdrawal of auger.	ined,	11	$\nabla$	13	4	ST 62 page 1 of



	•	ct B180						BORING			S	T-64	
Projec	t Paul - ississip <sub>l</sub>	AL EVALUA Infrastruc pi River Bo innesota	cture					LOCATIC attached		1441	161.1	56 E: 5489	88.986. See
DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4"	' HSA, Auto	hammer	DATE:	8/29	9/19		SCALE:	1" = 4'
b Elev. feet 808.9	Depth feet 0.0	Symbol	(Soi		•	on of Mate 37, Rock-US	rials SACE EM1110	0-1-2908)	BPF	WL	MC %	Tests	s or Notes
		Symbol FILL CH SH LS LS	LIME dens  LIME mod inter  END Auge Swite Water	I-ASTM D248, YEY SAND, st.  CLAY, with  (W  ILE, with Lim  (I	with roo  (To Silt lense deathered destone f Decorah  arimona (Plattevi agnolia N hered, h erately fr (Plattevi G. al at 14 f	Member, of ille Forma  Member, ille Forma	dark gray, vetion)  ght gray, sliqive bedded, ruggy. tion)	own,  oist,  ard.  -  ard.  -  ghtly to	BPF 13 13 40 40 50/0";  \$\infty\$ 50/3";  \$\infty\$ 50/3";  \$\infty\$ 50/3";  \$\infty\$ 50/3";			*Sampler encounter 1-inch rec *3-inch re *3-inch re Run 1 Switched	only red Limestone. overy covery  to coring at 14 Log of Coring nal
LOG OF BORING N													
B1806527.0	00					Braun Interte	ec Corporation						ST-64 page 1 of '

**Braun Project B1806527.00** ST-64 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144161.156 E: **Project Paul - Infrastructure Phase** 548988.986. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/29/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 794.9 14.0 (min/ft) (psi) (%) LIMESTONE, Magnolia Member, light gray, slightly to 4,650 2 1/4 100 99 71 794.9 14.0 Run 1 moderately weathered, hard, massive bedded, intensely to Magnolia moderately fractured, vuggy. Member (Platteville Formation) 1 3/4 1 3/4 1 3/4 1 3/4 END OF CORING AT 19 FEET. 789.9 NOTES:



**ST-64** 



NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.



Γ		n Proje								BORI	NG:			S	T-65	
/iations)	Projec 966 M	CHNICA t Paul - ississipp Paul, Mi	Infra: pi Riv	struc er Bo	ture					LOCA attach				049.64	45 E: 54902	26.485. See
pbre	DRILLE	R: J. (	Cherma	ak		METHOD:	3	3 1/4" HSA, <i>F</i>	Autohammer	DATE	<u>:</u>	8/3	0/19		SCALE:	1" = 4'
nation of a	Elev. feet 807.8	Depth feet 0.0	Sym	ıbol	(Soil			ription of M D2487, Rock	aterials :-USACE EM111	10-1-2908	3)	BPF	WL	MC %	Tests	or Notes
sheet for explain	807.1 - -	0.7	FILL		Grav	vel, with Lear CLAY, gray	n Cla	ay inclusior Topsoil F	ist, stiff.	ce noist.		12		23		
See Descriptive Terminology sheet for explanation of abbreviations)	803.8 	4.0	SH			LE, gray, dry (C estone layer a	ecc)	orah Shale	Bedrock)			44		16		
(See Descrip	800.8 - - 797.8	7.0		SHA	LE, gray, slig	ghtly / fra	y weathered	d, very soft to s	soft, thin	_						
-  -  -	-	793.8 14.0 LS L				thered, mode erately to inte	rate ense	ely hard to I	er, slightly to m nard, thin bedd d, vuggy. mation)	noderatel led,	ly _ _ _	_			Run 2	
OT 11/22/19 12:21		14.0	LS		mod	erately hard erately to hig	to h hly	ard, thin to	r, slightly weat massive bedd /uggy. mation)						Run 3	
.GPJ BRAUN_V8_CURRENT.GDT	- - - - 785.8									-	_				ruiro	
2018\06527.00	-	22.0			Auge	OF BORING	ıl at				-					
AX PROJECTS\	_					ched to corin er not observ	_		g.		_					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\05527.00.GPJ	- - -			Borir	ng immediate	ely b	oackfilled w	ith bentonite g	rout. -	- - -						
901	_ 31806527.0	00						Rraun In	tertec Corporation							ST-65 page 1 of

**Braun Project B1806527.00** ST-65 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144049.645 E: **Project Paul - Infrastructure Phase** 549026.485. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/30/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 8.008 7.0 (min/ft) (psi) (%) SHALE, gray, slightly weathered, very soft to soft, thin 2,325 100 7.0 3/4 120 82 36 Run 1 8.008 bedded, intensely fractured. Core barrel (Decorah Shale Formation) dropped 6-8 inches. 3,720 2 2 797.8 10.0 LIMESTONE, Carimona Member, slightly to moderately 2 Core barrel weathered, moderately hard to hard, thin bedded, moderately dropped 2-4 to intensely fractured, vuggy. inches. (Platteville Formation) 1 3/4 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-65 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144049.645 E: **Project Paul - Infrastructure Phase** 549026.485. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/30/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 795.8 12.0 (min/ft) (psi) (%) LIMESTONE, Carimona Member, slightly to moderately 100 4,185 2 1/2 120 100 65 Run 2 weathered, moderately hard to hard, thin bedded, moderately to intensely fractured, vuggy. (Platteville Formation) (continued) 2 793.8 LIMESTONE, Magnolia Member, slightly weathered, 2 moderately hard to hard, thin to massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) 1 3/4 2 1/4 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-65 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144049.645 E: **Project Paul - Infrastructure Phase** 549026.485. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/30/19 SCALE: 1" = 1' Elev. Rate of Water Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 790.8 17.0 (min/ft) (psi) (%) LIMESTONE, Magnolia Member, slightly weathered, 4,650 2 1/4 100 92 110 Run 3 84 moderately hard to hard, thin to massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) (continued) 130 1 3/4 2 1 1/2 END OF CORING. 785.8 NOTES:



# **ST-65**



NOTE: Cores run from left to right and bottom to top. Each row is 60 inches long.



Braun Proje			BORING:			S	T-66	3
GEOTECHNICA Project Paul - 966 Mississip Saint Paul, M	Infrastruct pi River Bo		LOCATIO attached		1440	068.1	63 E:	549140.621. See
DRILLER: B.	Kammermeier	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/27	7/19		SCA	LE: <b>1" = 4'</b>
b Elev. Depth feet feet 809.1 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-	-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
966 Mississip Saint Paul, M  DRILLER: B.  Elev. Depth feet 909.1 0.0  808.9 0.2  805.1 4.0  805.1 4.0	FILL	FILL: Silty Sand, fine- to medium-grained, trace and Gravel, brown, moist.  (Topsoil Fill)  FILL: Silty Sand, fine- to medium-grained, trace Gravel, dark brown to black, wet.	H	4	Ā	16	12	
805.1 4.0 	CH	FAT CLAY, gray and brown, moist, soft. (Weathered Shale Bedrock)		4		27		
	SH SH	SHALE, gray, moist, hard. (Decorah Shale Bedrock)		42 ×50/3"*		16		*3-inch recovery
797.1 12.0 1757.1 12.0	LS	LIMESTONE, Carimona Member, dark gray, verdense.  (Platteville Formation)	ry	<sup>∞</sup> 50/2"* 50/3"*				*2-inch recovery  *3-inch recovery
CURRE	LS	LIMESTONE, Magnolia Member, light gray, very dense.  (Platteville Formation)	y	×50/3"				*3-inch recovery
OG OF BORING N:\GINT\PROJECTS\2018\06527.00.GPJ BRAUN_Vg_\(\frac{1}{2}\)		END OF BORING.  Water observed at 2 feet with 2 feet of hollow-st auger in the ground.  Water observed at 14 feet with 20 feet of hollow auger in the ground.  Water observed at 2 feet with a cave-in depth of feet immediately after withdrawal of auger.  Boring immediately backfilled with cement.	stem	<sup>™</sup> 50/3"*				*3-inch recovery



		ct B180		BORING:			S	T-67	
Proied	t Paul - lississip <sub>l</sub>		ATION ture Phase pulevard South	LOCATIC attached		1436	324.7	70 E: 549383.713. Se	е
DRILLE	R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:	9/19	9/19		SCALE: 1" = 4'	
Elev. feet 806.7	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-		BPF	WL	MC %	Tests or Notes	
Saint I  DRILLE Elev. feet 806.7  805.7  802.7  802.7  799.7	1.0	FILL	FILL: Sandy Lean Clay, trace Gravel and roots, brown, moist.  (Topsoil Fill)  FILL: Organic Clay, with fibers, black, moist.	dark	5		28	OC=6%	
	7.0	FILL	FILL: Silty Sand, fine- to medium-grained, slight organic, with Gravel, dark brown and black, mois		8		12		
- 797.7	9.0	FILL	FILL: Organic Clay, trace Gravel, black and bro moist.	wn,	22		29	OC=7%	
 	12.0	LS	LIMESTONE, Carimona Member, dark gray, movery dense.  (Platteville Formation)		<sup>×</sup> 50/2"*	i:		*1-inch recovery	
ENT.GDT 11/22/19 12:21	17 1	LS	LIMESTONE, Magnolia Member, light gray, dry, dense, trace vugs. (Platteville Formation)	very	×50/3"* ×50/2"*			*1-inch recovery  *1-inch recovery	
OF BORING N:\GINT\PROIECTS\AX PROIECTS\2018\06527.00.GPJ BRAUN_V8_CURR	17.1		END OF BORING.  Water not observed while drilling.  Boring immediately backfilled with bentonite gro	ut	50/1"*			*2-inch recovery	
B1806527.0			Braun Intertec Corporation	_				ST-67	



	Braur		ct B180	6527.0	00			BORING:			S	T-68	
/iations)	Projec 966 M	t Paul - ississip <sub>l</sub>	AL EVALUA Infrastruci Di River Bo Innesota	cture Ph				LOCATIC attached		1438	388.80	03 E: 54920	8.443. See
bbre	DRILLE	R: B.	Kammermei	er <b>N</b>	METHOD:	3 1/4" HSA, /	Autohammer	DATE:	8/27	7/19		SCALE:	1" = 4'
nation of a	Elev. feet 808.6	Depth feet 0.0	Symbol	,	STM D2488 o	•	k-USACE EM1110	,	BPF	WL	MC %	Tests	or Notes
sheet for expla	807.6 - -	1.0	FILL	dark bi	Silty Sand, fi rown, moist. Organic Clay	(Topsoil F		roots,	<u> </u>		34	OC=8%	
See Descriptive Terminology sheet for explanation of abbreviations)	804.6 — — 801.6	4.0 7.0	FILL	FILL: Clay in moist.	Silty Sand, fi clusions, tra	ine- to mediu ce Gravel, b	rm-grained, with rown to dark bro	Lean own,	10		15		
(See Desc	- 799.6	9.0	СН	stiff.	(Wea	athered Shale		_	15		25		
			LS	dense.		mona Memb	er, gray, dry, vei	-y - - -	50/2"* 50/1"*			*Sampler of encountered at 9 1/2 feed 1-inch recover	ed Limestone et. very
.CURRENT.GDT 11/22/19 12:21	794.6 — — —	14.0	LS	weathe	ered, modera ely to modera feet.	ately hard to	er, light gray, slig hard, massive b d, vuggy, large mation)	edded,					
BRAUN_V8_CL	789.6 	19.0			OF BORING.								
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRA				Switch Water	ed to coring not observed immediately	at 14 feet. d while drillin		- - - -					
LOG OF BORING N:\GINT\PRO.	 						ntertec Corporation	_ 					ST-68 page 1 of

**Braun Project B1806527.00** ST-68 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 143888.803 E: **Project Paul - Infrastructure Phase** 549208.443. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/28/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 794.6 14.0 (min/ft) (psi) (%) LIMESTONE, Magnolia Member, light gray, slightly 4,650 100 2 1/4 100 80 794.6 14.0 Run 1 weathered, moderately hard to hard, massive bedded, Magnolia intensely to moderately fractured, vuggy, large vug at 15 1/2 Member feet. (Platteville Formation) 1 1/2 1 1/2 1 3/4 2 1/4 END OF CORING AT 19 FEET. 789.6 NOTES:



## **ST-68**



NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.



		n Proje	ct B180	6527.00	BORING:			S	T-69	
viations)	Projec 966 M	t Paul - ississip <sub>l</sub>		ATION cture Phase oulevard South	LOCATIO attached		1436	319.2	35 E: 54913	0.145. See
bbre	DRILLE	:R: J. (	Chermak	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/20	6/19		SCALE:	1" = 4'
nation of a	Elev. feet 809.8	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110	)-1-2908)	BPF	WL	MC %	Tests	or Notes
et for explar	809.3 - 807.8	2.0	FILL FILL CH	FILL: Sandy Lean Clay, trace roots and Gravel Silty Sand inclusions and Silt lenses, dark brow moist.  (Topsoil Fill)	ın,					
See Descriptive Terminology sheet for explanation of abbreviations)	_ _ 			FILL: Sandy Lean Clay, trace Gravel, with Silty inclusions, dark brown, moist.  FAT CLAY, with occasional Silt lenses, with Lin fragments, gray and brown, moist, very stiff to h (Weathered Shale Bedrock)	nestone _	8 18		25 17	LL=59, PL=	=18, PI=41
(See Descrip	_ _ 800.8	9.0		With Silty Sand seams at 7 feet.	- : -	<sup>⊠</sup> 50/2"				
	799.0	10.8	SH	SHALE, with Limestone fragments, gray and br dry, hard. (Decorah Shale Bedrock)	own,	88		17		
		10.0	LS	LIMESTONE, Carimona Member, light gray to one slightly to moderately weathered, moderately hard, medium to thin bedded, highly to intensely fractured, vuggy.	ard to				Run 1 Switched to 10.8 feet. S Coring for	See Log of additional
12:21	<u>795.8</u>	14.0	LS	(Platteville Formation)  LIMESTONE, Magnolia Member, light gray, slig weathered, moderately hard to hard, thick bedd	ghtly led,				information	
Т 11/22/19 12:21	794.0 	15.8		intensely to moderately fractured, vuggy. (Platteville Formation) END OF BORING.						
CURRENT.GDT	_			Auger met refusal at 10.8 feet.	-					
8	_			Switched to coring at 10.8 feet.  Water not observed while drilling.						
\2018\06527.00.GPJ BRAUN	_ _ _			Boring immediately backfilled with bentonite gro						
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ					- -					
3 OF BORING N:\GINT	_ 				_					
P07	B1806527 (	20		Braun Intertec Corporation					1	ST-69 nage 1 of 1

**Braun Project B1806527.00 ST-69** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 143619.235 E: **Project Paul - Infrastructure Phase** 549130.145. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/29/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 799.0 10.8 (min/ft) (psi) (%) LIMESTONE, Carimona Member, light gray to gray, slightly to 10.8 1 3/4 100 Run 1 4.185 110 100 81 799.0 moderately weathered, moderately hard to hard, medium to Carimona thin bedded, highly to intensely fractured, vuggy. Member (Platteville Formation) 1 3/4 2 1/2 1 3/4 795.8 LIMESTONE, Magnolia Member, light gray, slightly Magnolia weathered, moderately hard to hard, thick bedded, intensely Member to moderately fractured, vuggy. (Platteville Formation) 2 1/4 Core barrel dropped last 3 END OF CORING. inches. 794.0 NOTES:



**ST-69** 



NOTE: Core runs from left to right. The row is 60 inches long.



ſ		n Proje		6527.00	1				BORING	:		S	T-70	)	
riations)	Projec 966 M	t Paul - ississipp		ATION cture Phas oulevard S					LOCATIO attached						415. See
bbre	DRILLE	:R: B.	Kammermei	er ME	THOD:	3 1/4" HSA	, Autohamme	er	DATE:	8	/28/19		SCA	LE:	1" = 4'
nation of a	Elev. feet 810.2	Depth feet 0.0	Symbol		M D2488 o		ck-USACE E		-1-2908)	BP	= WL	MC	P200 %	Test	s or Notes
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\05527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21	810.2 810.0 810.0 806.2 803.2 800.2 791.2 790.5	0.0 0.2 4.0 7.0 19.0 19.7	· ××××	FILL: Poor medium-growist.  FILL: Poor with Grave with	orly Grade grained, wo orly Grade el and Le by Sand, fi (Weath)  ONE, Carin (PONE, Magnetic M	ed Sand wind rith roots and (Topsoi ed Sand, find an Clay income of the company o	th Silt, fine- hd Gravel, d I Fill) he- to mediu clusions, bro I, dark brown ale Bedrock ber, dark gr ormation)  ber, light gra ormation)	to ark br um-gra wn, moi n, moi	own,	3 7 7 3 50/	7" 1"*	5 17 28 23	19	encour Limest 1-inch *1-inch	ler only itered
501	  B1806527 (						Intertec Cornor								-70 nage 1 of 1



		ect B180					BORING	:		S	T-71	
Projec	t Paul - ississip <sub>l</sub>	AL EVALU Infrastruc pi River B innesota	cture				LOCATIC attached		1436	606.6	85 E: 54923	8.665. See
DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" HSA, A	utohammer	DATE:	9/19	9/19		SCALE:	1" = 4'
Elev. feet 808.0	Depth feet 0.0	Symbol	(Soil		scription of Ma	aterials -USACE EM1110	0-1-2908)	BPF	WL	MC %	Tests	or Notes
806.9 -	1.1	FILL	blacl FILL	k to dark brow	n, moist. (Topsoil F y, trace Shale	and Shale frag ill) fragments, bla	Ī	24*			*No recove	ery
966 M Saint F DRILLE Elev. feet 808.0 806.9 804.0	4.0	CH	FAT	CLAY, olive a	and brown, mo athered Shale	ist, stiff to very Bedrock)	stiff. —	10		28	LL=71, PL:	=22, PI=49
799.5 - - -	8.5	LS	LIME dens	se.	imona Membe Platteville Forr	er, dark gray, dr	ry, very	. 18 50/1"* . 50/2"*		28	*1-inch rec	·
	14.0	LS	LIME	se, trace vugs.	gnolia Membe Platteville Forr	r, light gray, dry	y, very —	50/1"*	÷		*1-inch rec	overy
	17.1		Wate	ediately after v	ed to cave-in d withdrawal of a	epth of 12 feet auger. th bentonite gr	_	50/1"*			*1-inch rec	overy
B1806527.0						ertec Corporation						ST-71 page 1 o



		•	ct B180						BORING:			S	T-72	)	
viations)	Projec 966 M	t Paul - ississip <sub>l</sub>	AL EVALUA Infrastruc oi River Bo Innesota	cture					LOCATIC attached		1461	79.80	68 E: 5	548662.640. S	3ee
abbre	DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" I	HSA, Autohai	mmer	DATE:	9/19	9/19		SCAL	.E: <b>1" =</b>	4'
ation of a	Elev. feet 814.7	Depth feet 0.0	Symbol	(Soil	De -ASTM D2488	•	n of Materia		-1-2908)	BPF	WL	MC %	P200 %	Tests or No	tes
plan			PAV	2 inc	hes of bitumi	nous ove									
or ex	813.7	1.0	FILL	1 \	es of concrete : Organic Cla		Gravel bla	ck moist							
gy sheet f	<u>812.7</u> _	2.0	FILL	FILL	: Poorly Gradium-grained,	ded San	d with Silt, fi	ne- to	_	24		7	11		
See Descriptive Terminology sheet for explanation of abbreviations)	<u>810.7</u>	4.0	СН	FAT	CLAY, gray a (We	and brow athered	n, moist, ve Shale Bedr	ery stiff. rock)		22		26			
scriptiv	807.7	7.0	SH	ςнα	LE, gray, dry,	hard									
(See De	_			O I I	.EE, gray, ary,	ecorah S	Shale Bedro	ck)	<u> </u>	47		19			
										80					
12:21	_ _ 	15.0							_	X 50/6"		10			
_CURRENT.GDT 11/22/19 12:21	- -		LS	LIME dens			lember, dar		y, very - - -	X50/6"		10			
	_ 	19.6							_	*					
ROJECTS\2018\06527.00.GPJ BRAUN_V8				Wate Wate imme	o OF BORING er not observe er not observe ediately after ng immediatel	ed while ed to cav withdrav	e-in depth oval of auger		  out	50/1"*				*1-inch recov	ery
GOF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	- - - -								- - - -						
507	B1806527.0	00				F	Braun Intertec C	orporation						ST-72 pa	ge 1 of



		Proje		180	6527	7.00				BORING	:		S	T-7	3	
l Pr	ojec 66 M	CHNICA t Paul - ississipp aul, Mi	Infra oi Riv	strue er B	cture					LOCATIO attached			963.3	77 E:	548662	2.647. See
DR DR	RILLE	R: B. I	Kamm	ermei	er	METHOD:	3 1/4" HS	A, Autoham	mer	DATE:	8/2	0/19		SCA	LE:	1" = 4'
nation of a	ev. eet 12.2	Depth feet 0.0	Sym	nbol	,	I-ASTM D2488	or D2487, F		EM1110		BPF	WL	MC %	P200 %	Tes	ts or Notes
ee Descriptive Terminology sheet for exi	08.2 05.2	7.0 9.0	CL		SAN lense	DY LEAN CLes, dark brow  CLAY, with Set, stiff.  (We	ck, moist. (Topso black, mo d Topsoil/S  AY, fine-gr n, moist, sr (Alluv  Silty Sand le eathered Si , hard.	rained, with oft. rium) enses, browhale Bedro	oosit)  Silty Sa  wn and g  ck)	and	7 4		23	62	OC=7	%
NT.GDT 11/22/19 12:21	795.2 17.0					Limestone la	ecorah Sha	ale Bedroci	k)	- - - -	×50/6"		15		Califo sample taken 12 1/2	3, PL=21, rnia tube es were from 10 to 2 feet from fset borehole
BRAUN_V8_CURREI	92.6	19.6	LS		dens	ESTONE, Ma se.	Platteville gnolia Mer	Formation)	gray, ver	_	50/1"				comp	eted for lab g. See idix for test
LOG OF BORING N:\Gint\Projects\ax Projects\2018\	v					OF BORING er not observ ng immediate	ed while dr ly backfille	_		- 	¥50/3"					ST-73 page 1 of 1



1		n Proie		06527.00	BORING			S	T-74	1
(5	GEOTE Projec	CHNICA t Paul -	AL EVALU Infrastru	ATION cture Phase		N: N:	1459			48450.78. See
/iations			oi River B Innesota	oulevard South						
lbbre\	DRILLE	:R: J. <sup>-</sup>	Tatro	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/12	2/19		SCA	LE: 1" = 4'
ation of a	Elev. feet 811.5	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110	0-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
plan	810.9	0.6	PAV	2 inches of bituminous over 5 inches of aggreg						
See Descriptive Terminology sheet for explanation of abbreviations)	- - - -		FILL	\base. FILL: Clayey Sand, non- to slightly organic, wit Limestone fragments, with Gravel, black, brown dark brown, moist.	th n, and — — — —	8 9*		14	31	OC=2% *1-inch recovery
Des	803.5	8.0						16		q <sub>n</sub> =2 1/4 tsf
(See	_		СН	FAT CLAY, with Silt lenses, gray and brown, m medium to stiff. (Weathered Shale Bedrock)	oist,	M				чр — се.
21	_ _ _			Limestone layer at 12 feet.	- - -	50/1"		28		q <sub>p</sub> =2 1/4 tsf
9 12:2	796.4	15.1	LS	LIMESTONE Carimana Mambar dark gray to		П				Run 1
8ENT.GDT 11/22/19 12:21	_ _ _ 793.1	18.4		LIMESTONE, Carimona Member, dark gray to moderately to highly weathered, moderately ha hard, thin to medium bedded, highly to intensel fractured.  (Platteville Formation) Shale seam at 15.6 feet.	rd to -	<u>.</u>				Switched to coring at 15.1 feet. See Log of Coring for additional information.
PJ BRAUN_V8_CURREI			LS	LIMESTONE, Magnolia Member, light gray, slig moderately weathered, moderately hard to hard to massive bedded, moderately to intensely fra vuggy.  (Platteville Formation)	d, thick					Run 2
27.00.G	_ 789.4	22.1		END OF BORING.	_	Ц				
18\065	_			Auger met refusal at 15.1 feet.	_					
ECTS\20	_			Switched to coring at 15.1 feet.	_					
X PROJI	_			Water not observed while drilling.	_					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	_ _			Boring then grouted.	- - -					
LOG OF BORING										

**Braun Project B1806527.00 ST-74** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145915.570 E: **Project Paul - Infrastructure Phase** 548450.780. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/12/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % % (psi) 796.4 15.1 (min/ft) (psi) (%) LIMESTONE, dark gray to gray, moderately to highly 2 1/4 75 Run 1 4,185 100 95 46 weathered, moderately hard to hard, thin to medium bedded, Carimona highly to intensely fractured. Member (Platteville Formation) (continued) Shale seam at 15.6 feet. 1 1/2 50-100 4,650 2 50-70 95 92 57 Run 2 1 3/4 70-100 793.1 18.4 LIMESTONE, light gray, slightly to moderately weathered, Magnolia moderately hard to hard, thick to massive bedded, moderately Member to intensely fractured, vuggy. (Platteville Formation) 2 100 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-74** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145915.570 E: **Project Paul - Infrastructure Phase** 548450.780. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/12/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 791.4 20.1 (min/ft) (psi) (%) LIMESTONE, light gray, slightly to moderately weathered, 4,650 92 2 95 57 80-110 moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) (continued) 1 3/4 90-110 789.4 END OF CORING. NOTES:



**ST-74** 



NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.



16	Projec 966 M Saint F DRILLE Elev. feet	t Paul - ississipp Paul, Mi		ATION cture Phase oulevard South	LOCATIC attached		1456	03.9	02 F · /	E4962E 706 Coo
t for explanation of abbrev	Elev. feet	R: J. 1				sketcn			υ <b>Σ</b> Ε. <b>.</b>	546033.790. See
t for explanation of a	feet		Γatro	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/9	/19		SCA	LE: <b>1" = 4</b> '
t for explai	810.8	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110	)-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
CTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21	798.3 797.4 792.9 786.3	12.5 13.4 17.9 24.5	FILL FILL  CH LS  LS  LS	FILL: Silty Sand, fine- to medium-grained, trace Gravel, with roots, dark brown, moist. (Topsoil Fill)  FILL: Poorly Graded Sand, fine- to coarse-grait trace Gravel, brown, wet.  FAT CLAY, gray and brown, moist, stiff. (Weathered Shale Bedrock)  LIMESTONE, Carimona Member, dark gray to slightly to moderately weathered, soft to hard, not to thin bedded, highly to intensely fractured. (Platteville Formation)  3-inch Shale layer at 16.2 feet.  LIMESTONE, Magnolia Member, light gray, unweathered to slightly weathered, moderately hard, massive bedded, moderately to intensely fractured, vuggy.  (Platteville Formation)  LIMESTONE, Hidden Falls Member, dark gray unweathered to slightly weathered, moderately hard, massive bedded, moderately to highly fractured. (Platteville Formation)  END OF BORING.  Auger met refusal at 14.2 feet.	ned, —  gray, — hard to —  to gray, — hard to	9 9 118 12 150/1"	Σ	10 18 39	2	q <sub>p</sub> =1 tsf LL=76, PL=28, Pl=48 Run 1 Switched to coring at 14.2 feet. See Log of Coring for additional information. Run 2
LOG OF BORING N	_			Switched to coring at 14.2 feet.  Water observed at 7 feet with 7 feet of hollow-s auger in the ground.*						*Boring immediately backfilled with bentonite grout.

**Braun Project B1806527.00 ST-75** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145603.902 E: **Project Paul - Infrastructure Phase** 548635.796. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/9/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % % (psi) 796.6 14.2 (min/ft) (psi) (%) LIMESTONE, dark gray to gray, slightly to moderately 100 97 45 3,720 100 Run 1 weathered, soft to hard, medium to thin bedded, highly to Carimona intensely fractured. Member (Platteville Formation) (continued) 1 1/2 50-80 4,650 3-inch Shale layer at 16.2 feet. 4,185 4 3/4 40 2 1/2 4 1/4 40 4,650 50-100 99 69 Run 2 792.9 17.9 LIMESTONE, light gray, unweathered to slightly weathered, -Magnolia moderately hard to hard, massive bedded, moderately to Member intensely fractured, vuggy. (Platteville Formation) 4 1/2 80-100 80 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-75** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145603.902 E: **Project Paul - Infrastructure Phase** 548635.796. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/9/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 19.2 791.6 (min/ft) (psi) (%) LIMESTONE, light gray, unweathered to slightly weathered, 4,650 4 1/2 80-100 80 99 69 moderately hard to hard, massive bedded, moderately to intensely fractured, vuggy. 3 70-100 (Platteville Formation) (continued) 1 3/4 90-100 1 3/4 100 4,650 1 1/4 80-100 75 99 88 Run 3 1 1/2 90 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-75** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BerrDes@Tptive/Tehthriblogy sheet for explanation of abbreviations) LOCATION: N: 145603.902 E: **Project Paul - Infrastructure Phase** 548635.796. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/9/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 786.6 24.2 (min/ft) (psi) (%) 24.5 80-100 4,650 1 1/2 90 99 88 786.3 LIMESTONE, dark gray to gray, unweathered to slightly weathered, moderately hard to hard, thin to thick bedded, Hidden Falls 1 1/4 Member moderately to highly fractured. (Platteville Formation) 1 1/4 1 1/2 80-110 27.6 783.2 END OF CORING. NOTES:



**ST-75** 



NOTE: Cores run from left to right and top to bottom in each column. Each row is 24 inches long.



		n Proje		06527.00		BORING:			S	T-76	•	
riations)	GEOTE Projec 966 M	ECHNICA t Paul - ississipp	AL EVALU Infrastru			LOCATIO attached		1455				4. See
bbre	DRILLE	:R: J. 1	Tatro	METHOD: 3 1/4" HSA,	Autohammer	DATE:	8/8	/19		SCA	LE: <b>1</b>	" = 4'
nation of a	Elev. feet 811.2	Depth feet 0.0	Symbol	Description of I (Soil-ASTM D2488 or D2487, Roo	ck-USACE EM1110	)-1-2908)	BPF	WL	MC %	P200 %	Tests o	r Notes
OF BORING NIYGINTY PROJECTS\2018\05527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21			Symbol FILL FILL CH LS	(Soil-ASTM D2488 or D2487, Roo FILL: Silty Sand, fine-grained,	black, dry. Fill) Se-grained, trace s, dark brown, more brown to gray, m le Bedrock) ight gray, dry, ver browntion)	Gravel, oist. –	10 6 9 10 50/2"				q <sub>p</sub> =2 tsf LL=65, Pl PL=24 q <sub>p</sub> =2 tsf LL=53, Pl PL=24	=41,
LOG OF E	P1906E37 (				Intertoe Corneration	_					ST 76	nogo 1 of 1



		-	ct B180						BORING:			S	T-77	7	
viations)	Projec 966 M	t Paul - ississip <sub>l</sub>	AL EVALU Infrastruc oi River Bo nnesota	cture				-	LOCATIO attached		1455	547.5	77 E: (	548151.	82. See
bbre	DRILLE	:R: B.	Kammermei	er	METHOD:	3 1/4" HS/	A, Autohammer	r	DATE:	8/16	6/19		SCA	LE:	1" = 4'
nation of a	Elev. feet 812.9	Depth feet 0.0	Symbol	(Soil		escription of or D2487, R	f Materials ock-USACE EN	M1110	-1-2908)	BPF	WL	MC %	P200 %	Tests	s or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21			-	FILL dark FILL Grav SAN stiff. With With SHA	I-ASTM D2488 : Silty Sand, brown and bits: Silty Sand, cel, brown, we will be solded by the silty Sand letter at 10 1/2 feet the silty Sand letter at 10 1/2 fe	or D2487, R fine-grained lack, wet. (Topso fine- to medet.  AY, with Gi (Glacial enses at 5 fe at 8 feet.  et.  et.  et.  et.  et.  et.  et.	ock-USACE ENd, with roots, sil Fill) dium-grained, ravel, brown a al Till) eet.  stone layer at ments, gray, cale Bedrock)	trace, trace	et	6 12 14 11 150/2"*  50/2"*				*1-inch	recovery
OG OF BORING N:\GINT\PROJ.	_ 														
_	B1806527.0	00				Brau	n Intertec Corpora	ation		_			-	ST	-77 page 1 of



	Braur	Proje		306	6527.00	BORING			S	T-78	3	
riations)	Proiec		Infrastı Di River	ruct Bo	ATION ture Phase pulevard South	LOCATION: N: 145437.994 E: 548613.698. See attached sketch						
bbre\	DRILLE	R: J. 1	Γatro		METHOD: 3 1/4" HSA, Autohammer	DATE:	1	3/8/19		SCA	LE: <b>1" = 4'</b>	
nation of a	Elev. feet 811.6	Depth feet 0.0	Symbo	ol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM111	0-1-2908)	BP	F WL	MC %	P200 %	Tests or Notes	
OF BORING NYGINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21	811.6 				·	s, gray to		2	1		OC=4%	
106	 				Braun Intertec Corporation	- 					ST-78 nage 1 of	



	•		6527.00	BORING: ST-79							
Proje	ect Paul -	oi River Bo	ATION cture Phase oulevard South		LOCATIC attached		1452	271.42	25 E: 54860 <sup>1</sup>	9.949. See	
DRILI	ER: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohamn	ner	DATE:	8/19	9/19		SCALE:	1" = 4'	
Flev. feet 812.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE	EM1110	-1-2908)	BPF	WL	MC %	Tests	or Notes	
812.	1 0.5		FILL: Silty Sand, fine- to medium-graine		_						
See Descriptive Terminology sheet for explanation of abbreviations)  DRILLI Elev. feet 812.6  812.6		FILL	concrete pieces and roots, dark brown, in FILL: Crushed concrete (gravel-sized), Shale fragments, brown, moist.								
See Descrip — — — — — — — — — — — — — — — — — — —	7.0	CH	Limestone fragments, brown and gray to gray, moist, stiff to very stiff.	T CLAY, with Silt lenses at 7 1/2 feet, trace nestone fragments, brown and gray to 10 feet then y, moist, stiff to very stiff.  (Weathered Shale Bedrock)							
 	3 12.0			SHALE, gray, dry, hard.							
NT.GDT 11/22/19 12:21		SH IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	SHALE, gray, dry, hard. (Decorah Shale Bedrock	)	_	×50/5"		17	LL=55, PL=	=26, PI=29	
BRAUN_V8_CURRENT.GDT 11	5 17.0	LS	LIMESTONE, Carimona Member, dark of dense.  (Platteville Formation)	gray, ve	ry	50/1" 50/2"					
0.GPJ											
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	22.6		END OF BORING.  Water not observed while drilling.  Boring immediately backfilled with bento	nite gro	- - - - - -	50/1"					
LOG OF BORING N:\G	7.00		Braun Intertec Corp	oration						ST-79 page 1 of	



Continue   Continue		Brauı			06527.00		BORING:			S	T-80	)	$\neg$
12	riations)	GEOTE Projec	CHNICA t Paul - ississipp	AL EVALU Infrastru pi River B	ATION cture Phase	Phase attached sketch							e
12	bbrev	DRILLE	:R: J. 7	Tatro	METHOD:	3 1/4" HSA, Autohammer	DATE:	8/8	/19		SCA	LE: 1" = 4'	
12	nation of a	Elev. feet 813.2	feet	Symbol		•	0-1-2908)	BPF	WL			Tests or Notes	ŝ
	_CURRENT.GDT 11/22/19 12:21	  	7.0	FILL	(Soil-ASTM D248i FILL: Silty Sand Gravel, with roots FILL: Clayey Sa with Gravel, dark  With waterbearin  CLAYEY SAND,  LIMESTONE, gra END OF BORIN  Water observed	8 or D2487, Rock-USACE EM111 , fine- to medium-grained, traces, dark brown, moist.	gments, –  -	14 21 10 12	$\bar{\Delta}$	9 13	%	q <sub>p</sub> =2 1/2 tsf	
	OG OF BORING N:\C												



ſ	Brauı			180	6527.00		BORING	<del></del>		S	T-81	
iations)	Projec 966 M		Infras oi Rive	struc er Bo	ATION cture Phase oulevard South		LOCATIO attached			097.1	57 E: 54862	2.584. See
bbrev	DRILLE	:R: J. 7	Γatro		METHOD:	3 1/4" HSA, Autohammer	DATE:	8/8	3/19		SCALE:	1" = 4'
nation of a	Elev. feet 812.2	Depth feet 0.0	Sym	bol		escription of Materials 3 or D2487, Rock-USACE EM1	110-1-2908)	BPF	WL	MC %	Tests	or Notes
xplar	811.7	0.5	FILL FILL		FILL: Silty Sand, ∖and Gravel, dark	, fine- to coarse-grained, tra	ice roots					
See Descriptive Terminology sheet for explanation of abbreviations)		4.0	FILL		FILL: Poorly Gra coarse-grained, v	aded Sand with Silt, fine- to with Gravel and Cobbles, or prown, dry to moist.	ccasional -	21		7		
e Terminol		4.0	FILL		FILL: Silty Sand, and Cobbles, dar	, fine- to coarse-grained, wi rk brown and brown, moist.	th Gravel —	12*			*No sample	e recovery
Descriptiv	805.1	7.1			With Limestone for END OF BORING	ragments at 7 feet.	- 	50/1"	,			
(See					Auger met refusa		_					
						ved with 7.1 feet of hollow-s						
	_				Boring immediate	ely backfilled.	-	_				
21	_						-					
1/22/19 12:	_						-	-				
CURRENT.GDT 11/22/19 12:21	_						-	-				
8	_											
00.GPJ BRAI	_						-	-				
2018\06527.	_						-					
PROJECTS\:							_					
ROJECTS\AX	_						-					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN	_						-					
G OF BORING							-	-				
907	B1806527 (	20				Braun Intertec Corporation						ST-81 nage 1 of 1



1		n Proje		6527.00	BORING: ST-82							
riations)	GEOTE Projec 966 M	CHNICA t Paul - ississipp	AL EVALUA Infrastruc			N: N:	1450			548376.889. See		
bbre	DRILLE	R: J. 7	Γatro	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/8	/19		SCA	LE: <b>1" = 4'</b>		
nation of a	Elev. feet 813.2	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110		BPF	WL	MC %	P200 %	Tests or Notes		
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21	813.2  - 811.2	12.2	Symbol FILL SC	(Soil-ASTM D2488 or D2487, Rock-USACE EM1110 FILL: Silty Sand, fine- to coarse-grained, with 0 brown, dry.  CLAYEY SAND, trace Gravel, brown to 8 feet t gray, moist, medium to stiff.  (Glacial Till)  With Limestone fragments at 12 feet.  END OF BORING.  Auger met refusal at 12.2 feet.  Water not observed with 12.2 feet of hollow-stein the ground.  Boring immediately backfilled.	Gravel,  hen	9 10 7 9 ×50/2"		12 14 14	42	$q_p$ =1 1/2 tsf $q_p$ =2 tsf $q_p$ =1 1/2 tsf		



Braun Proj			BORING: ST-83							
GEOTECHNIC Project Paul - 966 Mississip Saint Paul, M	Infrastruc pi River B		LOCATIO attached		92.9	2.991 E: 548667.923. See				
DRILLER: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:	8/19	9/19		SCA	LE: <b>1</b>	" = 4'	
Elev. Depth feet feet 813.1 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM111	0-1-2908)	BPF	WL	MC %	P200 %	Tests or	· Notes	
966 Mississip Saint Paul, M  DRILLER: B.  Elev. Depth feet feet 813.1 0.0  812.9 \ 0.2	LS	FILL: Silty Sand, fine- to medium-grained, with trace concrete pieces and roots, dark brown, n (Topsoil Fill)  CLAYEY SAND, with Shale fragments, brown then gray, moist to wet, medium to very stiff. (Glacial Till)  LIMESTONE, Carimona Member, gray, very d (Platteville Formation)  With Shale lenses at 17 1/2 feet.  LIMESTONE, Magnolia Member, light gray, vedense. (Platteville Formation)	ense.	20 18 17 8 3 50/4" ×50/5" 50/2"		14 12 13	34	q <sub>p</sub> =1 3/4 t	sf	
		END OF BORING.  Water not observed while drilling.  Boring immediately backfilled with bentonite gr	-out	50/2"						
B1806527.00		Braun Intertec Corporation	_					ST-83	page 1 o	



1		n Proje		6527.00	BORING:			S	T-84		
viations)	Projec 966 M	t Paul - ississipp		ATION cture Phase oulevard South	LOCATION: N: 144828.851 E: 548461.419. See attached sketch						
bbre	DRILLE	:R: J. 7	Tatro	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/13	3/19		SCAL	.E: 1" = 4'	
nation of a	Elev. feet 812.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM111		BPF	WL	MC %	P200 %	Tests or Notes	
OF BORING NYGINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21	812.4/ 808.6 805.6	7.0 10.2	, NAAA	FILL: Silty Sand, fine-grained, Gravelly, with r dark brown, moist.  (Topsoil Fill)  FILL: Silty Sand, fine- to medium-grained, wit dark brown, moist.  FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel and Lean Clay inclusions, brown, wet.  FILL: Poorly Graded Sand, fine- to medium-g with Gravel, trace Shale fragments, Limestone fragments in tip of sampler, brown, wet.  END OF BORING.  Auger met refusal at 10.2 feet.  Water observed at 7 feet with 7 feet of hollowauger in the ground.  Water not observed to cave-in depth of 4 1/2 fimmediately after withdrawal of auger.  Boring immediately backfilled.	rained,	110	¥	3 7	7		
0 507	B1806527 (			Braun Intertee Corporation						ST-84 nage 1 of 2	



ſ		n Proje		6527.00	BORING: <b>ST-85</b>								
iations)	Projec 966 M	t Paul - ississipp		ATION cture Phase oulevard South	LOCATIC attached	TION: N: 144753.088 E: 548262.265. Send sketch							
bbrev	DRILLE	:R: J. (	Chermak	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/20	0/19		SCALE: 1" = 4'				
nation of a	Elev. feet 813.2	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110	)-1-2908)	BPF	WL	MC %	Tests or Notes				
See Descriptive Terminology sheet for explanation of abbreviations)	812.6 - - - -	0.6	FILL FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel and Lean Clay inclusions, brown, moist.  (Topsoil Fill)  FILL: Poorly Graded Sand, fine- to medium-grawith Gravel, trace Silty Sand seams, brown, mo	12	Σ	42						
escriptive T	_ 806.2	7.0	CL	LEAN CLAY, trace Limestone fragments, brown	n and	20		13					
(See D	804.2	9.0	SH	gray, moist, very stiff. (Weathered Shale Bedrock)  SHALE, gray, moist, hard.		24		23	LL=43, PL=18, PI=25				
	 802.2	11.0		(Decorah Shale Bedrock)		68		11					
NT.GDT 11/22/19 12:21		17.6	LS	LIMESTONE, Carimona Member, light gray to g slightly to moderately weathered, very soft to ha to medium bedded, moderately to intensely frac Shale layer from 11.4 to 13.8 feet. (Platteville Formation)	ard, thin _				Run 1 Switched to coring at 1 feet. See Log of Coring for additional information.  Void - core barrel dropped last 4 inches. Run 2				
BRAUN_V8_CURREI			LS	LIMESTONE, Magnolia Member, light gray, slig moderately weathered, moderately hard to hard massive bedded, moderately to intensely fractu vuggy.  (Platteville Formation)	Run 3								
OG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ		25.9	LS	LIMESTONE, Hidden Falls Member, gray, sligh unweathered, hard, thin to thick bedded, moder highly fractured. (Platteville Formation)					Run 4				
	781.8	31.4	LS	Braun Intertec Corporation	_				Run 5				



	-	ct B180			BORING:	:	S	Γ-85	cont.	)		
Project	: Paul - ssissipp	AL EVALU Infrastru oi River B nnesota	cture				LOCATIC attached		1447		88 E: 54826	
DRILLE	R: J. (	Chermak		METHOD:	3 1/4" HSA, /	Autohammer	DATE:	8/2	0/19		SCALE:	1" = 4'
Flev. Fleet Feet Feet Feet	Depth feet 32.0	Symbol	(Soil		escription of M or D2487, Rock	Materials k-USACE EM1110	)-1-2908)	BPF	WL	MC %	Tests	or Notes
Paint   Pain	43.2 44.0	Symbol LS SH SS	LIME to sli inten	ESTONE, Miffightly weathernsely fractured (Platternsel) fractured (Platternsel	flin Member, li ed, hard, thin d. ville Formation dided, moderat Platteville For htly to highly to highly to inter Glenwood For at 47 feet.	ber, gray, unweately fractured, vermation)  wento white, modine-to very fractured.	athered / to athered,ggy soft to			%	Run 6  Run 7  Run 8  Run 9  Run 10	
B1806527.0	າ				Braun Ir	ntertec Corporation		Ш				ST-85 page 2 of 3



		-	ct B180						BORING:		S	Γ-85	cont.	)
/iations)	Proiec	t Paul - ississipp	AL EVALUA Infrastruc Di River Bo nnesota	ture					LOCATIO attached			2.265. See		
ibbre\	DRILLE	:R: J. (	Chermak		METHOD:	3 1/4"	HSA, Autohamn	ner	DATE:	8/2	0/19		SCALE:	1" = 4'
nation of a	Elev. feet 749.2	Depth feet 64.0	Symbol		I-ASTM D2488	or D248	n of Materials 7, Rock-USACE			BPF	WL	MC %	Tests	or Notes
See Descriptive Terminology sheet for explanation of abbreviations)	- - -			to hi	ghly weathere grained, high	d, very y to inte	ht brown to wh soft, fine- to ve ensely fractured e Formation) (	ery d.	-				Run 13	
escrip	742.2	71.0		FND	OF BORING	<u> </u>			_	Ц				
see De	_				er met refusal		eet.		_					
9)	_				ched to coring				_					
	_				ater observed at 4 1/2 feet with 7 1/2 feet of ollow-stem auger in the ground.									
	_			Wate	Water observed at 6 feet with 11 feet of hollow-stem auger in the ground.									
:21	_			Borir	ng immediate	y backf	illed with bento	nite gro	out					
_CURRENT.GDT 11/22/19 12:21														
.GDT 11	_								_					
JRRENT	_								_					
	_								_					
BRAUN	_													
.00.GPJ	_								_					
3\06527	_								_					
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PROJEC	_								_					
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r\ PROJE	_								_					
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ORING	_								_					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_	_													
ᅬ	B1806527.0	)O					Braun Intertec Corp	oration			1	I	1	ST-85 page 3 of 3

**Braun Project B1806527.00 ST-85** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 802.2 11.0 (min/ft) (psi) (%) LIMESTONE, Carimona Member, light gray to gray, slightly to 3,720 1 3/4 100 52 100 802.2 120 Run 1 11.0 moderately weathered, very soft to hard, thin to medium Carimona bedded, moderately to intensely fractured, Shale layer from Member 11.4 to 13.8 feet. (Platteville Formation) 1 3/4 1 3/4 160 1 3/4 1 3/4 Core barrel dropped last 4 inches. Continued Next Page NOTES:

**Braun Project B1806527.00 ST-85** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 797.2 16.0 (min/ft) (psi) (%) LIMESTONE, Carimona Member, light gray to gray, slightly to 3,720 100 2 1/2 120 95 81 Run 2 moderately weathered, very soft to hard, thin to medium bedded, moderately to intensely fractured. Shale layer from 11.4 to 13.8 feet. 160 (Platteville Formation) (continued) 2 1/4 795.6 17.6 LIMESTONE, Magnolia Member, light gray, slightly to Magnolia moderately weathered, moderately hard to hard, thin to Member massive bedded, moderately to intensely fractured, vuggy. 2 1/4 (Platteville Formation) 2 1/4 2 1/4 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-85 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 792.2 21.0 (min/ft) (psi) (%) LIMESTONE, Magnolia Member, light gray, slightly to 3,720 2 1/4 100 100 120 80 Run 3 moderately weathered, moderately hard to hard, thin to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) (continued) 2 1/4 2 2 1 1/2 787.3 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-85** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 787.2 26.0 (min/ft) (psi) (%) LIMESTONE, Hidden Falls Member, gray, slightly to unweathered, hard, thin to thick bedded, moderately to highly 3,720 2 1/4 100 100 120 81 Run 4 Hidden Falls fractured. Member (Platteville Formation) (continued) 140 2 1/2 3 2 1/2 2 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-85 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BerrDess)ptWetTetMarellogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 782.2 31.0 (min/ft) (psi) (%) 3,720 2 1/2 100 100 93 120 Run 5 31.4 781.8 LIMESTONE, Mifflin Member, light gray, unweathered to 160 Mifflin slightly weathered, hard, thin bedded, slightly to intensely Member fractured. (Platteville Formation) 3 2 1/2 2 3/4 2 1/4 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-85 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 777.2 36.0 (min/ft) (psi) (%) LIMESTONE, Mifflin Member, light gray, unweathered to 3,720 2 3/4 100 98 120 90 Run 6 slightly weathered, hard, thin bedded, slightly to intensely fractured. (Platteville Formation) (continued) 160 2 3/4 2 3/4 2 3/4 2 1/2 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-85** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 772.2 41.0 (min/ft) (psi) (%) LIMESTONE, Mifflin Member, light gray, unweathered to 1 3/4 100 100 3,720 120 65 Run 7 slightly weathered, hard, thin bedded, slightly to intensely fractured. (Platteville Formation) (continued) 160 2 1/4 2 1/2 770.0 LIMESTONE, Pecatonica Member, gray, unweathered, hard, Pecatonica medium bedded, moderately fractured, vuggy. Member (Platteville Formation) 769.2 SHALE, gray, slightly to highly weathered, very soft to soft, 2 1/2 thin bedded, highly to intensely fractured. (Glenwood Formation) 1 3/4 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-85** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % % (psi) 767.2 46.0 (min/ft) (psi) (%) SHALE, gray, slightly to highly weathered, very soft to soft, 2 1/4 100 72 3,720 120 25 Run 8 thin bedded, highly to intensely fractured. (Glenwood Formation) (continued) 160 Shaly Sandstone at 47 feet. 1/4 Run 9 1 3/4 1/2 763.5 49.7 SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. 1/2 (St. Peter Sandstone Formation) Continued Next Page NOTES:

**Braun Project B1806527.00** ST-85 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 762.2 51.0 (min/ft) (psi) (%) SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly 2,325 Run 10 1/2 120 100 93 to intensely fractured. (St. Peter Sandstone Formation) (continued) 1/2 1/2 1/2 3/4 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-85 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 757.2 56.0 (min/ft) (psi) (%) SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly 2,325 1 1/4 100 90 8 120 Run 11 to intensely fractured. (St. Peter Sandstone Formation) (continued) 3/4 1/2 12 3/4 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-85 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 752.2 61.0 (min/ft) (psi) (%) SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly 2,325 Run 12 1 1/4 100 92 8 120 to intensely fractured. (St. Peter Sandstone Formation) (continued) 1 1/2 1 1/4 100 3/4 2 Continued Next Page NOTES:

**Braun Project B1806527.00** ST-85 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144753.088 E: **Project Paul - Infrastructure Phase** 548262.265. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/20/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 66.0 747.2 (min/ft) (psi) (%) SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly 2,325 75 140 100 14 Run 13 to intensely fractured. (St. Peter Sandstone Formation) (continued) 3/4 1 1/4 1 1/4 3/4 END OF CORING AT 71 feet. 71.0 NOTES:



# Photograph of Rock Cores Project Paul B1806527.00

**ST-85** 

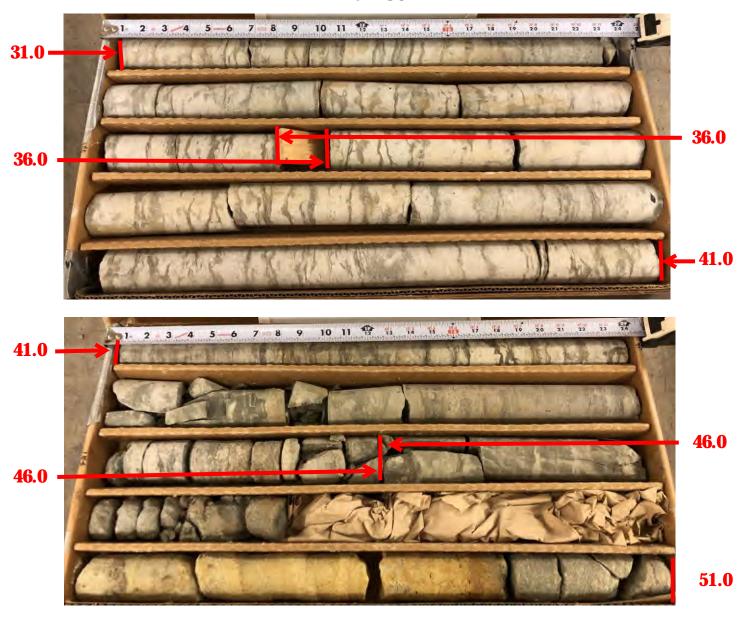


NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

# BRAUN INTERTEC The Science You Build On.

# Photograph of Rock Cores Project Paul B1806527.00

**ST-85** 



NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.



### Photograph of Rock Cores Project Paul B1806527.00

**ST-85** 



NOTE: Cores run from left to right and top to bottom. Each row is 60 inches long.



	-	ct B180						BORING:			S	T-86	
Project	Paul - ssissipp	AL EVALUA Infrastruc Di River Bo nnesota	ture l					LOCATIC attached		1447	'21.69	98 E: 54871	7.464. See
DRILLER	R: J. T	Tatro		METHOD:	3 1/4" HS	SA, Autohammer		DATE:	8/1:	3/19		SCALE:	1" = 4'
Elev. feet 811.3	Depth feet 0.0	Symbol	(Soil			of Materials Rock-USACE EN	11110	-1-2908)	BPF	WL	MC %	Tests	or Notes
966 Mis Saint Pa DRILLER Elev. feet 811.3 B11.0 A B11.	9.0	FILL	WEA END Auge Wate	: Clayey San nents, with Sl n, moist.	MESTONE Platteville 3. at 9.7 fee ed while dr ly backfille	bil Fill) ots and Limest ions and Grave  , gray, dry, ver Formation)  t. illing.	ry del		19 10 10* × 50/2"		12	*No recove	•



ſ		n Proje		6527.00		BORING:			S	T-87	
iations)	Projec 966 M	t Paul - ississipp		ATION cture Phase oulevard South		LOCATIO attached		1446	650.44	4 E: 548512	.173. See
bbrev	DRILLE	:R: J. 7	Гatro	METHOD: 3 1/4" HS	A, Autohammer	DATE:	8/13	3/19		SCALE:	1" = 4'
nation of a	Elev. feet 811.9	Depth feet 0.0	Symbol	Description of (Soil-ASTM D2488 or D2487, F		-1-2908)	BPF	WL	MC %	Tests	or Notes
:S\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21 (See Descriptive Terminology sheet for explanation of abbreviations)	feet	feet		•	dium-grained, trace Shale inclusions, voil Fill) dium-grained, with increte pieces, trace in Shale fragments, nic, brown, dark brown, dark brown, dark brown, gray and increments and shale fragments and increments and	e Shale trace with and diblack,	BPF    18	WL		Tests	or Notes
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ						- - - -					
501	 	20			in Intertec Cornoration	_					ST-87 nage 1 of 1



	•	ct B180			BORING:			S	T-88	3			
Project 966 M	t Paul - Iississip <sub>l</sub>	AL EVALUA Infrastruc oi River Bo Innesota	cture l	Phase			LOCATIC attached		1445	64.1	37 E: \$	548787.	011. See
DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" HSA, A	utohammer	DATE:	8/23	3/19		SCA	LE:	1" = 4'
b Elev. feet 812.8 812.6	Depth feet 0.0	Symbol	,	-ASTM D2488 c		USACE EM1110	,	BPF	WL	MC %	P200 %	Tests	or Notes
	4.0	FILL	and (	Gravel, brown	, dry. (Topsoil Fi Gravelly, brow	n, wet.		32		8	12		
See Descriptive Terminology sheet for Control of See Descriptive Terminology sheet for	7.0	FILL		•	·	h Cobbles, bro		24*	Σ			*6-inch	recovery
90 – 803.8	03.8 9.0 CL			n, wet.	Shale seams, m.	trace Sand len	· -	14* V 7		13		*1-inch	recovery
- 800.8 799.8	12.0 13.0	СН	FAT	CLAY, gray, n (Wea	(Glacial Ti		_	X ′		20			
	3 13.0 CH FA SH			E, gray, mois		Bedrock)		<u>/</u> 50/1"*				*1-inch	recovery
CURRE - TOO 2	17.0	LS		gray, very der		r, trace Shale lo	enses, –	×50/1"*	r			*1-inch	recovery
.00.GPJ BRAUN_V8	10.0	LS	LIME dens	e.	nolia Member Platteville Forn	r, light gray, ver	ту 	<sup>⊠</sup> 50/1"*	r			*1-inch	recovery
OF BORING N;GINT\PROJECTS\2018\06527.00.GPJ BRAUN_V8	23.1		Wate auge Wate in the	r in the ground or not observe or ground.	6 feet with 7 td.	feet of hollow-s of hollow-stem th cement.	tem	X50/2"*				*7-inch	recovery
B1806527.	00				Proup late	ertec Corporation						ę.	-88 page 1 of <sup>2</sup>



		•	ct B180					BORING:			S	T-89	9	
/iations)	Projec 966 M	t Paul - ississipp	AL EVALUA Infrastruc Di River Bo nnesota	cture				LOCATIC attached			224.2	43 E:	548906.7	711. See
bbre	DRILLE	R: B.	Kammermei	er	METHOD:	3 1/4" HSA	A, Autohammer	DATE:	8/1	2/19		SCA	LE:	1" = 4'
nation of a	Elev. feet 810.3	Depth feet 0.0	Symbol	(Soil		escription of or D2487, Ro	Materials	0-1-2908)	BPF	WL	MC %	P200 %	Tests	or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21		7.0 8.0 9.3 11.8 21.5	SP CT ST	POC with brow FAT 4-inc SHA weat LIME mode intens vugg	CLAY, with Control of the control of	D SAND, fin, wet, loose (Terrace It Gravel, gray sathered Shale imona Memmoderately moderately moderately Platteville For at 9 feet.  den Falls Memmoderately moderately moderately platteville For at 9 feet.  gat 9 feet.  gat 9 feet.  ed while dril	ne- to coarse-grae. Deposit) , wet. ale Bedrock) eet. eathered to slightly intensely fracture e Formation) nber, gray to dark ed, soft to hard, h formation) e layer at 13.2 fee ber, light gray, sli y hard to hard, thic to intensely fracture formation)	ined,  gray, ighly to ck to ured,  ark gray, ard to tensely	8 5 9		12 14 19	26		al
ا نـ	B1806527.0	10				Braur	n Intertec Corporation			_			ST-	89 page 1 of 1

**Braun Project B1806527.00 ST-89** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144224.243 E: **Project Paul - Infrastructure Phase** 548906.711. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/12/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 801.3 9.0 (min/ft) (psi) (%) FAT CLAY, with Gravel, gray, wet. 4,650 2 1/2 92 0 Run 1 9.3 (Weathered Shale Bedrock) (continued) 801.0 \4-inch Limestone layer at 9 feet. SHALE, gray and olive, unweathered to slightly weathered, soft, thin bedded, intensely fractured. (Decorah Shale Formation) 2 3/4 2 1/4 798.5 11.8 LIMESTONE, gray to dark gray, moderately to highly Carimona weathered, soft to hard, highly to intensely fractured. Member 2 1/2 (Platteville Formation) 2 1/2 With 4-inch Gravel and Shale layer at 13.2 feet. Continued Next Page NOTES:

**Braun Project B1806527.00 ST-89** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144224.243 E: **Project Paul - Infrastructure Phase** 548906.711. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/12/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 796.3 14.0 (min/ft) (psi) (%) LIMESTONE, gray to dark gray, moderately to highly 3 3/4 4.650 93 59 Run 2 weathered, soft to hard, highly to intensely fractured. (Platteville Formation) (continued) 4 795.1 LIMESTONE, light gray, slightly to highly weathered, Magnolia moderately hard to hard, thick to massive bedded, moderately Member to intensely fractured, vuggy. (Platteville Formation) 1 1 1 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-89** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144224.243 E: **Project Paul - Infrastructure Phase** 548906.711. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/12/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 791.3 19.0 (min/ft) (psi) (%) LIMESTONE, light gray, slightly to highly weathered, 1 3/4 4,650 100 79 Run 3 moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) (continued) 1 3/4 1 3/4 788.8 21.5 LIMESTONE, gray to dark gray, slightly to moderately Hidden Falls weathered, moderately hard to hard, thin to medium bedded, Member moderately to intensely fractured. (Platteville Formation) 2 1 3/4 END OF CORING. 786.3 NOTES:



# Photograph of Rock Cores Project Paul B1806527.00





NOTE: Cores run from left to right and top to bottom in each column. Each row is 24 inches long.



ſ		n Proie		6527.00	BORING			S	T-90	)
	GEOTE	CHNICA	AL EVALU	ATION			1441			548709.074. See
ns)	-			cture Phase oulevard South	attached	sketch				
iatio			nnesota	Sulevaru South						
See Descriptive Terminology sheet for explanation of abbreviations)	DRILLE	R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:	8/14	l/19		SCA	LE: <b>1" = 4</b> '
ofa	Elev.	Depth		Description of Materials		DDE	١٨/١	MC	Dago	T . N .
atior	feet 811.7	feet 0.0	Symbol	(Soil-ASTM D2488 or D2487, Rock-USACE EM1110	)-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
xplar	811.6	0.1		FILL: Silty Sand, fine- to medium-grained, with brown, moist.	roots,					
for e	_		FILL	(Topsoil Fill)						
sheet	_			FILL: Silty Sand, fine- to medium-grained, with trace concrete pieces and Lean Clay inclusions	Gravel, - s, moist.	     10		9	14	
ogy 8	_			•		<u> </u>		"	17	
minol	_				_	1				
. Ter	_					9*				*No recovery
iptive	- 804.7	7.0			_					
Sescr	004.7	7.0	FILL	FILL: Fat Clay, trace Gravel, with Sandy Lean		<del> </del>				
See [	-			seams and layers, trace Sand seams, gray and moist.	l olive, _	5		14		
	-				_	-				
				Concrete pieces at 10 feet, 3 inches.		50/5"				*3-inch recovery
		40.0			_	-				
	799.7	12.0	SH SH	SHALE, gray to olive, moist, hard.						
	-			(Decorah Shale Bedrock)	_	<sup>™</sup> 50/4"		20		
21	797.7	14.0	LS	LIMESTONE, Carimona Member, dark gray, ve	ery	-				
19 12:				dense. (Platteville Formation)		50/0"				
11/22/19 12:21	<sup>-</sup> 795.2	16.5			_					
NT.GDT 1	_ 794.8	16.9	LS	LIMESTONE, Carimona Member, dark gray, sli weathered, hard, thin bedded, highly fractured.	ightly	1				Run 1 Switched to coring
RENT.	_			(Platteville Formation)						at 16.5 feet. See Log of Coring for
8_CURRE	_			LIMESTONE, Magnolia Member, light gray, slig moderately weathered, moderately hard to hard	j, -	$\ $				additional
BRAUN_V8				medium to thick bedded, highly to slightly fractuouggy.	ıred,					information.
PJ BR/	_			(Platteville Formation) Partially filled vug at 20.4 feet.	_					
7.00.G	_			,	_	1				Run 2
\0652	_				_	$\ $				
3\2018	<u> 787.8</u>	23.9	LS	LIMESTONE, Hidden Falls Member, gray, sligh	ntlv –					
SJECTS		25.5		weathered, moderately hard to hard, thin bedde moderately to intensely fractured.						
AX PR	-	20.0		END OF BORING.		<b>[</b> ]				
N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	_			Auger met refusal at 16.5 feet.	_					
T\PRO.	_			Switched to coring at 16.5 feet.	_					
.\B\:	_			Water not observed while drilling.	_	-				
				-						
OF BORING	_			Boring immediately backfilled with bentonite gro	Jul. –					
507	D1906E37.0			Prous Intertos Corporation						ST 00 page 1 of 1

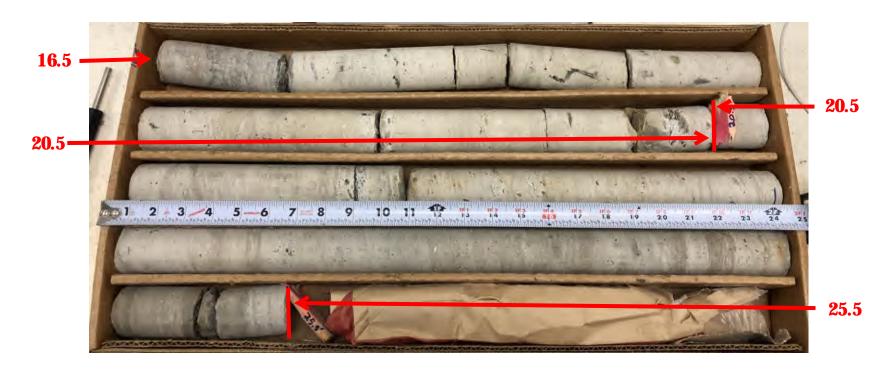
**Braun Project B1806527.00 ST-90** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144154.378 E: **Project Paul - Infrastructure Phase** 548709.074. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/14/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 795.2 16.5 (min/ft) (psi) (%) LIMESTONE, dark gray, slightly weathered, hard, thin 76 16.5 4,650 1 1/2 95 Run 1 795.2 bedded, highly fractured. Carimona 16.9 794.8 (Platteville Formation) Member Magnolia LIMESTONE, light gray, slightly to moderately weathered, Member moderately hard to hard, medium to thick bedded, highly to slightly fractured, vuggy. (Platteville Formation) 2 1 1/2 2 Partially filled vug at 20.4 feet. 2 1/4 Continued Next Page NOTES:

**Braun Project B1806527.00 ST-90** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144154.378 E: **Project Paul - Infrastructure Phase** 548709.074. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/14/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 790.2 21.5 (min/ft) (psi) (%) LIMESTONE, light gray, slightly to moderately weathered, 2 1/4 4,650 94 77 Run 2 moderately hard to hard, medium to thick bedded, highly to slightly fractured, vuggy.
(Platteville Formation) (continued) 3 3 <u>787</u>.8 23.9 LIMESTONE, gray, slightly weathered, moderately hard to Hidden Falls hard, thin bedded, moderately to intensely fractured. Member 2 3/4 END OF CORING. 786.2 NOTES:



### Photograph of Rock Cores Project Paul B1806527.00

### **ST-90**



NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.



Braun Project B180		BORING:			S	T-91	
GEOTECHNICAL EVALU Project Paul - Infrastru 966 Mississippi River B Saint Paul, Minnesota	cture Phase	LOCATIC attached		143800	0.23	33 E: 549057.9	514. See
DRILLER: J. Tatro	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/13/	/19		SCALE:	1" = 4'
Elev. Depth feet feet 810.7 0.0 Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110		BPF		/С %	Tests or	Notes
966 Mississippi River B Saint Paul, Minnesota  DRILLER: J. Tatro  Elev. Depth feet 810.7 0.0 Symbol  810.5 0.2 FILL  803.7 7.0 SH  802.7 8.0 SH	FILL: Silty Sand, fine- to medium-grained, with and roots, dark brown, moist.  (Topsoil Fill)  FAT CLAY, gray, olive and brown, moist, stiff to stiff.  (Weathered Shale Bedrock)  With Silt seam and trace Gravel at 2 1/2 feet.  SHALE, gray, dry, hard.  (Decorah Shale Bedrock)  END OF BORING.  Auger met refusal at 8 feet.  Water not observed while drilling.  Boring immediately backfilled.	o very	9 20 50/6"		14	q <sub>p</sub> =2 1/2 tsf  A bag sample collected from the borehole com lab testing. Sappendix for results.	n 2 to 6 offset opleted for ee
B1806527.00	Braun Intertec Corporation					ST-	.91 page 1 of 1



Commonwealth   Comm		-	ct B180					BORING:			S	T-92	2		
*1-inch recovery  *21  *No recovery  *1-inch recovery  *2-inch recovery  *2-inch recovery  *3-inch recovery  *5-inch recovery	Projec	ct Paul - Iississip <sub>l</sub>	Infrastruc pi River Bo	cture	Phase						1437	754.4	29 E:	548782	.697. See
*1-inch recovery  *21  *No recovery  *1-inch recovery  *2-inch recovery  *2-inch recovery  *3-inch recovery  *5-inch recovery	DRILLE	ER: B.	Kammermei	er	METHOD	: 3 1/4"	HSA, Autoh	ammer	DATE:	8/1	5/19		SCA	LE:	1" = 4'
*1-inch recovery  *21  *No recovery  *1-inch recovery  *2-inch recovery  *2-inch recovery  *3-inch recovery	Elev. feet 811.4	feet	Symbol	(Soil					)-1-2908)	BPF	WL	1		Test	s or Notes
DG OF BORING N:\GINTY	BRAUN_V8_CURRENT.GDT 11/22/1912:22	0.0 0.5 4.0	FILL	FILL and FILL brown SAN very LIME dens END Water	ESTONE, Coe.	as or D2487 y, with roo t.  (Top d, fine- to recommend of the commend of the comm	7, Rock-USA ts, trace G psoil Fill) medium-gr n Gravel, gr acial Till) Member, da le Formation le Formation drilling.	ark gray, veron)	Gravel, —  stiff to — — ery — — — — — — — — — — — — — — — — — — —	9 10 21 50/1"		9	%	*No red *No red *1-inch	covery covery n recovery
B1806527.00 Braun Intertec Corporation ST-92 page 1	901														Г-92 page 1 of <sup>7</sup>



				BORING:			S	T-93	3
ct Paul - lississip <sub>l</sub>	Infrastru pi River B	cture Phase				1434	62.55	53 E: 5	549080.02. See
R: B. I	Kammermeie	r METHOD: 3 1/4" HSA, Autoh	ammer	DATE:	8/1	5/19		SCA	_E: <b>1" = 4'</b>
Depth feet 0.0	Symbol	·		-2908)	BPF	WL	MC %	P200 %	Tests or Notes
	FILL FILL SC	(Soil-ASTM D2488 or D2487, Rock-US, FILL: Silty Sand, fine- to medium-grabrown, moist.  (Topsoil Fill)  FILL: Silty Sand, fine- to medium-grabrown, moist.  CLAYEY SAND, with Silt seam and lenses, brown, moist, very stiff.  (Glacial Till)  CLAYEY SAND, with Gravel, with St seams, brown and gray, wet, hard to (Glacial Till)  LIMESTONE, Carimona Member, w seams at 12 feet, dark gray, very der (Platteville Formati Platteville Formati END OF BORING.	ACE EM1110-1 ained, with roc ained, trace G Gravel, trace S male lenses and medium.  ith Shale lenses. on)	ots, Gravel, — Sand  es and  vugs, —	50/2"*		l	41	*No recovery.  q <sub>p</sub> =2 1/4 tsf  LL=30, PL=16, Pl=14  *No recovery  *1 1/2-inch recovery  *2-inch recovery
		in the ground.  Water observed at 8 feet with 17.1 feauger in the ground.	eet of hollow-s	stem _					
	ECHNICATE Paul - lississip Paul, MER: B.  Depth feet 0.0  4.0  7.0  17.0  17.1	ECHNICAL EVALUET Paul - Infrastruitsissispipi River B Paul, Minnesota ER: B. Kammermeie  Depth feet 0.0 Symbol A 0.2 FILL FILL  4.0 SC  7.0 SC  12.0 LS	Depth feet 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-US, FILL Silty Sand, fine- to medium-gr. brown, moist. (Topsoil Fill) FILL: Silty Sand, fine- to medium-gr. brown, moist. (Topsoil Fill) FILL: Silty Sand, fine- to medium-gr. brown, moist. (Glacial Till) SC CLAYEY SAND, with Silt seam and lenses, brown, moist, very stiff. (Glacial Till) (Glacial Till) SC CLAYEY SAND, with Gravel, with Sr. seams, brown and gray, wet, hard to (Glacial Till) Seams at 12 feet, dark gray, very der (Platteville Formation END OF BORING.  Water observed at 7 feet with 7 feet in the ground.  Water observed at 8 feet with 17.1 feauger in the ground.  Boring immediately backfilled with be	ECHNICAL EVALUATION tt Paul - Infrastructure Phase lississippi River Boulevard South Paul, Minnesota  R: B. Kammermeier METHOD: 3 1/4" HSA, Autohammer  Depth feet 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1 FILL: Silty Sand, fine- to medium-grained, with robrown, moist. (Topsoil Fill) FILL: Silty Sand, fine- to medium-grained, trace of brown, moist, very stiff. (Glacial Till)  7.0 SC CLAYEY SAND, with Silt seam and Gravel, trace is lenses, brown, moist, very stiff. (Glacial Till)  7.0 SC CLAYEY SAND, with Gravel, with Shale lenses are seams, brown and gray, wet, hard to medium. (Glacial Till)  12.0 LS LIMESTONE, Carimona Member, with Shale lense seams at 12 feet, dark gray, very dense. (Platteville Formation)  END OF BORING.  Water observed at 8 feet with 7 feet of hollow-sauger in the ground.  Boring immediately backfilled with bentonite grout	ECHNICAL EVALUATION the Paul - Infrastructure Phase lississippi River Boulevard South Paul, Minnesota  R: B. Kammermeier METHOD: 3 1/4" HSA, Autohammer DATE:    Depth feet	ECHNICAL EVALUATION the Paul - Infrastructure Phase lississippi River Boulevard South Paul, Minnesota  R: B. Kammermeier METHOD: 3 1/4" HSA, Autohammer DATE: 8/19  Depth feet 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	ECHNICAL EVALUATION: the Plase lississippi River Boulevard South Paul, Minnesota  R: B. Kammermeler METHOD: 3 1/4" HSA, Autohammer DATE: 8/15/19  Depth feet 0.0 Symbol (Soli-ASTM D2488 or D2487, Rook-USACE EM1110-1-2908)  D. 0.2 FILL Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil Fill)  FILL: Silty Sand, fine- to medium-grained, trace Gravel, brown, moist. (Glacial Till)  7.0 SC CLAYEY SAND, with Silt seam and Gravel, trace Sand lenses, brown and gray, wet, hard to medium. (Glacial Till)  7.0 SC CLAYEY SAND, with Gravel, with Shale lenses and seams, brown and gray, wet, hard to medium. (Glacial Till)  8 LIMESTONE, Carimona Member, with Shale lenses and seams at 12 feet, dark gray, very dense. (Platteville Formation)  17.0 LIMESTONE, Magnolia Member, light gray, trace vugs, very dense. (Platteville Formation)  END OF BORING.  Water observed at 7 feet with 7 feet of hollow-stem auger in the ground.  Boring immediately backfilled with bentonite grout.	ECHNICAL EVALUATION: training and seams at 12 feet, dark gray, very dense.  LIMESTONE, Carimona Member, with Shale lenses and seams at 12 feet, dark gray, very dense.  (Platteville Formation)  LIMESTONE, Magnolia Member, light gray, trace vugs, very dense. (Platteville Formation)  END OF BORING. Water observed at 8 feet with 17.1 feet of hollow-stem auger in the ground.  LOCATION: N: 143462.55 attached sketch attached sketch attached sketch statched sketch s	ECHNICAL EVALUATION to Pase lississippi River Boulevard South Paul, Minnesota  R. B. Kammermeler  METHOD: 3 1/4" HSA, Autohammer  DATE: 8/15/19  SCA  Depth feet 0,0 Symbol (Sol-ASTM D2486 or D2487, Rock-USACE EM11/0-1-2908)  FILL  FILL: Silty Sand, fine- to medium-grained, with roots, brown, moist.  (Topsoil Fill)  FILL: Silty Sand, fine- to medium-grained, trace Gravel, brown, moist.  (Giacial Till)  7.0  SC  CLAYEY SAND, with Silt seam and Gravel, trace Sand lenses, brown and gray, wet, hard to medium.  (Giacial Till)  7.0  SC  CLAYEY SAND, with Gravet, with Shale lenses and seams, brown and gray, wet, hard to medium.  (Giacial Till)  8  8  8  12.0  LIMESTONE, Carimona Member, with Shale lenses and seams at 12 feet, dark gray very dense.  (Platteville Formation)  FIND OF BORING.  Water observed at 8 feet with 7 feet of hollow-stem auger in the ground.  Boring immediately backfilled with bentonite grout.



ſ		n Proje	ct B180	6527.00	BORING:			S	T-94	
/iations)	Projec 966 M	t Paul - ississip <sub>l</sub>		ATION cture Phase oulevard South	LOCATIO attached		1441	197.1	90 E: 54914	1.975. See
bbre\	DRILLE	:R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:	8/2	1/19		SCALE:	1" = 4'
nation of a	Elev. feet 809.3	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM111		BPF	WL	MC %	Tests	or Notes
sheet for expla	808.5 - -	0.8	FILL	FILL: Sandy Lean Clay, with roots, Shale frag and Gravel, brown, moist. (Topsoil Fill) FILL: Silty Sand, fine-grained, dark brown, mo	f	     		17		
See Descriptive Terminology sheet for explanation of abbreviations)		4.0	CH	FAT CLAY, gray and brown, moist, stiff. (Weathered Shale Bedrock)		9		28	q <sub>p</sub> =3 tsf	
(See Descr	802.3 - -	7.0	SH	SHALE, trace Limestone fragments, gray, moi (Decorah Shale Bedrock)		50/1"*			in sample.	ents of encountered
		12.0	LS	LIMESTONE, Carimona Member, dark gray, v dense. (Platteville Formation)	_	×50/5"*		8	California t samples we from 9 to 1 the offset b completed	=23, PI=32. ube ere taken 1 feet from orehole for lab
NT.GDT 11/22/19 12:22		17.0				<sup>™</sup> 50/2"*	t t		for test res *1-inch rec *2-inch rec	overy
CURRE	- - 789.7	19.6	LS	LIMESTONE, Magnolia Member, trace vugs, li very dense. (Platteville Formation)	ignt gray, - -	×50/2"*	t		*2-inch rec	overy
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8		13.0		END OF BORING.  Auger met refusal at 19.6 feet.  Water not observed while drilling.  Boring immediately backfilled with bentonite gr		50/1"*			*1-inch rec	overy
901	B1806527 (	20		Rraun Intertec Corporation						ST-94 nage 1 of 1



	Braur		ct B180	6527	7.00			BORING:			S	T-9	5	
riations)	Projec 966 M	t Paul - ississip <sub>l</sub>	AL EVALUA Infrastruc pi River Be Innesota	cture				LOCATIO attached		1442	243.3	42 E:	549283.	843. See
bbrev	DRILLE	:R: B.	Kammermei	er	METHOD:	3 1/4" HSA, Au	utohammer	DATE:	8/12	2/19		SCA	LE:	1" = 4'
nation of a	Elev. feet 810.7	Depth feet 0.0	Symbol	(Soi		scription of Ma or D2487, Rock-l		)-1-2908)	BPF	WL	MC %	P200 %	Tests	or Notes
OF BORING NYGINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 12/5/19 13:45	- 810.5) - 810.5) - 806.7 - 803.7 - 798.7 - 796.1	7.0 12.0	· NAAA	FILL with  FILL coar  FILL with  LIME and dens  END  Wate auge  Wate in th  Wate imm	ESTONE, Car seams at 12 for se	(Topsoil Filled Sand, fine- n, moist.  ed Sand with Sace Gravel, brown ed Sand, fine- n, wet.  imona Member eet, brown and Platteville Form t 2 feet with 7 fe	to medium-gra  Silt, fine- to own, wet.  To medium-gra  To medium-	brown, sained,	17 14 27 6 ×50/5"		3 9	4	sieve a results.	cal odor at
LOG 0F							ertec Corporation	_						-95 page 1 of 1



1	Brauı			06527.00	BORING:	:		S	T-96	
iations)	GEOTE Projec 966 M	CHNICA t Paul - ississipp	AL EVALU Infrastru			N: N:			05 E: 54970	6.493. See
bbrev	DRILLE	:R: J. 1	Γatro	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/1	3/19		SCALE:	1" = 4'
nation of a	Elev. feet 810.2	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM111	0-1-2908)	BPF	WL	MC %	Tests	or Notes
plar	809.6	0.6	CONC 🕍	7 1/2 inches of concrete.	_					
et for ex		2.0	FILL SH	FILL: Silty Sand, fine- to coarse-grained, with brown, dry.  SHALE, gray, dry, hard.	Gravel, -					
See Descriptive Terminology sheet for explanation of abbreviations)	- - -			(Decorah Shale Bedrock)	- - -	48 × 90/6"		15		
Desc	- 802.3	7.9			_	∐ ⊠50/3"		15	    =53 PL:	-25 PI=28
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:22				END OF BORING. Auger met refusal at 7.9 feet. Water not observed while drilling. Boring immediately backfilled.		A50/3"		15	LL=53, PL=	=25, PI=28
90										
	B1806527 (	10		Braun Intertec Corporation		•				ST-96 nage 1 of 1



	-	ct B180						BORING	:		S	T-97	
Proje	ct Paul - Iississip <sub>l</sub>	AL EVALUA Infrastruc pi River Bo Innesota	cture					LOCATIO attached			361.1	64 E: 550359	.237. See
DRILLI	ER: B.	Kammermei	er	METHOD:	3 1/4" HSA	, Autohamme	er	DATE:	9/30	0/19		SCALE:	1" = 4'
b Elev. feet 833.9	Depth feet 0.0	Symbol		-ASTM D2488 (		ck-USACE E			BPF	WL	MC %	Tests o	r Notes
833.4 833.4 829.9 80.9	0.5	FILL	brow	: Silty Sand, f rn, moist. : Silty Sand, v enses, brown	(Topsoil with Gravel	Fill) and Fat Cla		F	17				
See Descriptive Terminology sheet for explanation of spanning and spanning	8.0	CH		CLAY, trace S nents, gray an (Wea	nd brown, m		iff.	one	22 M72/9"		22	q <sub>p</sub> =3 1/2 tsf	
CURRENT.GDT 11/22/19 12:22		SH	SHA		estone fragi		, moist	- to dry,	75/11 <sup>1</sup> 96/11 <sup>1</sup> 95		14		
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_	20.4		Wate Wate imme	OF BORING. er not observe er not observe ediately after v ng immediately	ed while drill ed to cave-ir withdrawal c	n depth of 16 of auger.			⊠50/5"				
81806527.	00				D==:	Intertec Corpor	ation					0-	Г-97 page 1 of



	Projec 966 M	t Paul -		ation			Braun Project B1806527.00							
bbre\		GEOTECHNICAL EVALUATION Project Paul - Infrastructure Phase 966 Mississippi River Boulevard South Saint Paul, Minnesota						BORING: ST-98  LOCATION: N: 144371.391 E: 550540.353. S attached sketch						
	DRILLER: B. Kammermeie			er METHOD: 3 1/4" HSA, Autohammer			utohammer	DATE:	9/30/19			SCALE:	1" = 4'	
ation of a	Elev. feet 836.3	Depth feet 0.0	Symbol	(Soi	Des -ASTM D2488 o	)-1-2908)	BPF	WL	MC %	Tests	or Notes			
See Descriptive Terminology sheet for explanation of abbreviations)	835.8	0.5	FILL FILL	∖Grav FILL	el, brown, moi	st.	n-grained, trace		21		5			
criptive Terminolo	832.3	7.0	FILL	FILL and mois	Silt lenses, trad	ne- to mediun ce Shale fragr	n-grained, with ments, brown a	Gravel and gray,—	21					
(See Desc	827.3	9.0	FILL		FILL: Fat Clay, trace Gravel and Sand inclusions, gray and brown, moist.									
-  -  -			FILL	Lime			sions, Gravelly fragments, gra		38		8			
NT.GDT 11/22/19 12:22	822.3	14.0	FILL		: Poorly Grade se-grained, po				31	Σ				
CURRE	819.3	17.0	SP		Gravel, brown		to medium-gra o medium dens osit)		6					
BRAUN_V8	815.3	21.0							15					
06527.00.GPJ				Wate	OF BORING.  er observed at er in the ground		5 feet of hollov	v-stem						
ECTS\2018\					er observed at er in the ground		0 feet of hollow	v-stem –						
TS\AX PRO					er not observed ediately after w		epth of 10 feet luger.	_						
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ				Borii	ng immediately	backfilled wit	h bentonite gro	out. – – –						
907	1806527.0						ertec Corporation	_					ST-98 page 1 o	



ſ									RING: ST-99						
riations)	GEOTECHNICAL EVALUATION Project Paul - Infrastructure Phase							LOCATION: N: 144645.669 E: 549435.233. See attached sketch							
ppre	DRILLE	RILLER: J. Chermak			METHOD: 3 1/4" HSA, Autohammer DAT				8/28	8/19		SCALE:	1" = 4'		
nation of a	Elev. feet 811.1	Depth feet 0.0	Symbo	(So	Description of Materials Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)			)-1-2908)	BPF	PF WL	MC %	Tests or Notes			
plar	810.3	0.8	PAV	10 i	inches of aggre	egate base with cor	crete piec	es.							
See Descriptive Terminology sheet for explanation of abbreviations)			FILL	gray	L: Fat Clay, wi y and brown, m h concrete pied		Sand incl	usions,	14 14 16		23	*Sampler e	ncountered		
es)	-  - 799.1	12.0						- 	50/1/8'			*1/8-inch re	No recovery.		
	_ 798.0	798.0 13.1 SH SHALE, with Gravel, gray at 12.8 feet, of (Decorah Shale Bedrock							∑50/6" •••		18	D 4			
NT.GDT 11/22/1912:22	-  - 794.1	17.0	LS	gray to h frac	ESTONE, Car y, slightly to mo lard, medium to tured. (F	imona Member, ligli oderately weathered o thin bedded, high Platteville Formatio gnolia Member, ligh	nt gray to od, moderally to intens	tely hard – sely 				Run 1 Switched to 12.8 feet. S Coring for a information.	ee Log of Idditional		
BRAUN_V8_CURRE	_    788.3	22.8		☐ wea	athered, moder ensely to highly	ritional Member, light ately hard to hard, fractured, vuggy. Platteville Formatio	massive b	edded, _ - - - -				Run 2			
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	788.3 - - - - - -	22.8		Aug Swit		at 12.8 feet.	ntonite gro								
LOG OF B	_							_							
	B1806527 (	00				Braun Intertec (	Corporation						ST-99 nage 1 of		

**Braun Project B1806527.00** ST-99 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDescriptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 144645.669 E: **Project Paul - Infrastructure Phase** 549435.233. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/28/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % % (psi) 798.3 12.8 (min/ft) (psi) (%) SHALE, with Gravel, gray at 12.8 feet, dry, hard. 1 3/4 2,790 110 100 100 59 Run 1 (Decorah Shale Bedrock) (continued) 13.1 798.0 Carimona LIMESTONE, Carimona Member, light gray to dark gray, Member slightly to moderately weathered, moderately hard to hard, medium to thin bedded, highly to intensely fractured. (Platteville Formation) 1 1/2 4,650 1 1/4 85 1 3/4 1 3/4 794.1 17.0 LIMESTONE, Magnolia Member, light gray, slightly Magnolia weathered, moderately hard to hard, massive bedded, Member intensely to highly fractured, vuggy. (Platteville Formation) Continued Next Page NOTES:

## LOG OF CORING

**Braun Project B1806527.00 ST-99** (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BerrDess)ptWetTetMarellogy sheet for explanation of abbreviations) LOCATION: N: 144645.669 E: **Project Paul - Infrastructure Phase** 549435.233. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/28/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 793.3 17.8 (min/ft) (psi) (%) LIMESTONE, Magnolia Member, light gray, slightly 4,650 1 3/4 100 100 99 120 Run 2 weathered, moderately hard to hard, massive bedded, intensely to highly fractured, vuggy.
(Platteville Formation) (continued) 1 3/4 1 3/4 1 3/4 1 3/4 115 END OF CORING. 788.3 NOTES:



# Photograph of Rock Cores Project Paul B1806527.00

**ST-99** 



NOTE: Cores run from left to right and top to bottom. Each row is 60 inches long.



ſ	Brauı			6527.00	BORING:			S	Γ-100	
/iations)	Projec 966 M	t Paul - ississipį		ATION cture Phase oulevard South	LOCATIC attached			021.8	64 E: 54943	4.663. See
bbre	DRILLE	:R: J. (	Chermak	METHOD: 3 1/4" HSA, Autohammer	DATE:	8/2	9/19		SCALE:	1" = 4'
nation of a	Elev. feet 813.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110	)-1-2908)	BPF	WL	MC %	Tests	or Notes
expla	812.6 —	0.8	FILL SILL	FILL: Sandy Lean Clay, trace roots and Shale/ $\gamma$ dark brown, moist.	Gravel, <i>F</i>					
See Descriptive Terminology sheet for explanation of abbreviations)	_			(Topsoil Fill)  FILL: Silty Sand, fine- to medium-grained, with and concrete pieces, dark brown, moist.	Gravel –	31		12		
rminc	808.9	4.5	CH //	Limestone fragments at 4 1/2 feet.	niet					
e Te	FAT CLAY, with Limestone fragments, gray, moist. (Weathered Shale Bedrock)									
riptiv	SHALE, with Limestone fragments, gray, moist, hard.  (Decorah Shale Formation)									
(See Desc	_			(Boostan Ghale i Ghilation)	17					
	5-inch Limestone layer at 10 feet.  50							12	Refusal of Limestone	hammer on at 10 feet.
2:23		14.9								
11/22/19 1	 _ 796.4	17.0	T T T	SHALE, gray, slightly weathered, soft, thin bedointensely fractured. (Decorah Shale Formation)	ded, —				Run 1 Switched to 14.9 feet. S Coring for	See Log of
N_V8_CURRENT.GDT 11/22/19 12:23	- - - 793.5	19.9	LS	LIMESTONE, Carimona Member, light gray to g slightly to moderately weathered, moderately hard, thin to medium bedded, moderately to hig fractured.  (Platteville Formation)  Shale lenses at 19 feet.	ard to				information	
BRAUN_V8	_			END OF BORING.	/_					
	_			Auger met refusal at 14.9 feet.						
)6527.(	_			Switched to coring at 14.9 feet.						
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	_			Water not observed while drilling.						
)JECTS\				Boring immediately backfilled with bentonite gro	out. —					
AX PRC	_				4					
JECTS	_				4					
IT\ PRO	_				-					
N:\GIN	_				-					
RING										
OF BO	_				=					
501	B1806527 (	20		Braun Intertec Corporation						T-100 page 1 of 1

## LOG OF CORING

**Braun Project B1806527.00** ST-100 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDess)ptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145021.864 E: **Project Paul - Infrastructure Phase** 549434.663. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/29/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 798.5 14.9 (min/ft) (psi) (%) SHALE, gray, slightly weathered, soft, thin bedded, intensely -1 3/4 100 14.9 4,185 120 93 48 Run 1 798.5 fractured. (Decorah Shale Formation) 1 3/4 796.4 17.0 2 LIMESTONE, Carimona Member, light gray to gray, slightly to Carimona moderately weathered, moderately hard to hard, thin to Member medium bedded, moderately to highly fractured. (Platteville Formation) 1 3/4 1 1/2 Shale lenses at 19 feet. END OF CORING. 793.5 NOTES:



# Photograph of Rock Cores Project Paul B1806527.00

**ST-100** 



NOTE: Core runs from left to right. The row is 60 inches long.



Ė		n Proje		6527.00	BORING	:		S	Г-101	
riations)	GEOTE Projec 966 M	CHNICA t Paul - ississipp	AL EVALUA Infrastruc			ON: N:	1449		65 E: 54982	8.121. See
bbre	DRILLE	R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:	8/10	6/19		SCALE:	1" = 4'
ination of a	Elev. feet 832.3	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM11		BPF	WL	MC %	Tests	or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\AX PROJECTS	831.8	7.0		FILL: Silty Sand, fine- to medium-grained, wibrown, moist.  (Topsoil Fill)  FILL: Sandy Lean Clay, non- to slightly orgar Gravel, with Shale and Limestone fragments, brown to black, moist.  FAT CLAY, Gravelly with Sand seams, with L fragments, gray and brown, moist, hard. (Weathered Shale Bedrock)  SHALE, gray, moist, hard. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 12 feet with 12 feet of hollauger in the ground.  Water not observed to cave-in depth of 9 feet Boring immediately backfilled.	th roots,  nic, trace - dark - imestone	17 35 39 39 43	₽	13 18 10 23	LL=52, PL=	=26, PI=26



			6527.00	BORIN	NG:			S	Γ-102
Proiec	t Paul - ississip <sub>l</sub>		ATION cture Phase oulevard South	LOCA <sup>-</sup> attache				305.1	85 E: 550038.562. See
DRILLE	:R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:					SCALE: 1" = 4'
Elev. feet 855.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM	/1110-1-2908)		BPF	WL	MC %	Tests or Notes
854.5 — 854.5	1.1	PAV	5 inches of bituminous over 8 inches of ag base.	gregate					
otive lerminology sneet for		CH	FAT CLAY, brown and gray, moist, stiff to (Weathered Shale Bedrock)	very stiff.		12		21	
848.6 80 – 848.6 80 – 848.6	7.0	SH	SHALE, with occasional Limestone fragme dry to moist, hard. (Decorah Shale Bedrock)	ents, gray,		36			
				_		70		16	
						48		16	
						58			
. NORVIA CLESCO (1750A)				_	_	50/5" 72		21	LL=59, PL=28, PI=31
0.000 POORING IN. (BIN 1/PROJECT S/ADIA/ORDZ 7.000 POORING IN. (BI	26.0		END OF BORING.		_	69		20	
			Water not observed while drilling.  Boring immediately backfilled with cement.						
B1806527.0	200		Braun Intertec Corpora	tion.					ST-102 page 1 of



ſ		n Proje		6527.00	ORING:			Sī	Γ-10	3			
riations)	Proiec	t Paul - ississipp		ATION cture Phase oulevard South	h		OCATIO tached s		1446				033. See
bbrev	DRILLE	:R: B.	Kammermei	er METHOD	D: 3 1/4" HSA, Autohammer	Di	ATE:	8/9	/19		SCA	LE:	1" = 4'
nation of a	Elev. feet 808.4	Depth feet 0.0	Symbol		Description of Materials 488 or D2487, Rock-USACE EM	1110-1-2	2908)	BPF	WL	MC %	P200 %	Tests	s or Notes
explai	807.4	1.0	FILL	FILL: Silty San	nd, fine- to medium-grained,	with Gra	avel,						
See Descriptive Terminology sheet for explanation of abbreviations)	_		FILL	FILL: Poorly G	Graded Sand with Silt, fine- to d, with Gravel, brown, moist to	o wet.		17	Δ	11	12		
iptive Term		5.0	FILL	FILL: Clayey S brown, wet.	Sand, with Gravel, brown and	l dark		7		17			a couple of ind drilled and
Sescr	801.4	7.0	FILL		nd, fine-grained, slightly orga	nic, bla	ck,	*					sampling.
See [	800.4 	8.0	СН	wet. FAT CLAY, trac (\	ce fibers, gray and brown, m Weathered Shale Bedrock)	oist, ha	rd.	11		24		q <sub>p</sub> =1.0 OC=4%	tst 6
	797.9	10.5		011415 111 0				50/1"		29			
	700.0	40.4	SH	moist, hard.	Silty Sand lenses and laminat	ions, gr	ay, _						
	_ 796.3	12.1		\With Limestone	(Decorah Shale Bedrock) e fragments at 12.1 feet.		/	50/1"					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:23				Water observed auger in the grown of auger.	NG. ed at 7 feet with 7 1/2 feet of I	withdra	iwal _						
501	B1806527 (				Braun Intertec Corporati								103 nage 1 of 1



		n Proie		06527.00		BORING:			91	Γ-10	<u>/</u>
tions)	GEOTE Projec	ECHNICA t Paul - ississip <sub>l</sub>	AL EVALU Infrastru				N: N:	1448			549116.362. See
brevia	DRILLE		Kammermeie	er METHOD: 3 1/4" HSA, Autohamme	r	DATE:	8/8	/19		SCA	LE: <b>1" = 4'</b>
nation of ab	Elev. feet 808.3	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE E		-	BPF	WL	MC %	P200 %	Tests or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 09:29 (See Descriptive Terminology sheet for explanation of abbreviations)		6.5 8.0 10.5 11.0	FILL CH SH	FILL: Silty Sand, fine- to medium-grained weathered Shale fragments, gray, dry.  FILL: Clayey Sand, with Gravel and Limes fragments, brown and dark brown, moist.  FILL: Silty Sand, fine- to medium-grained brown, moist.  FAT CLAY, gray and brown, moist, mediu (Weathered Shale Bedrock)  SHALE, with Silty Sand lenses and lamina Limestone fragments, gray and brown, moist.  END OF BORING.  Water observed at 4 1/2 feet with 4 1/2 feet hollow-stem auger in the ground.  Boring immediately backfilled.	m. et of	Gravel, _	12 5 * 6 × 54	Σ	7 8 29	16	*Offset boring 5 feet to complete additional sampling from 6 1/2 to 11 feet.  q <sub>p</sub> =0.75 tsf



		1 Proie		06527.00	BORING:			S	Γ-10	5
ations)	GEOTE Projec	CHNICA t Paul - ississip <sub>l</sub>	AL EVALU Infrastru			N: N:	1452			549121.153. See
brevi	DRILLE	R: B. I	Kammermeie	er METHOD: 3 1/4" HSA, Autohammer	DATE:	8/7	/19		SCA	LE: <b>1" = 4</b> '
nation of ab	Elev. feet 812.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110		BPF	WL	MC %	P200 %	Tests or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 09:31 (See Descriptive Terminology sheet for explanation of abbreviations)	812.1	11.5 12.1	FILL SH	FILL: Silty Sand, fine- to medium-grained, mixed Shale fragments, brown and gray, dry.  FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, trace Gravel to with Gravel, brown to wet.  SHALE, gray, moist, hard. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 7 feet with 7 feet of hollow-st in the ground.  Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger.  Boring immediately backfilled.	wn, moist — — — — — — — — — — — — — — — — — — —	25 13 * 8 3 * 50/1"*	∇	16	5	*Offset boring 5 feet to complete additional sampling from 7 to 12.1 feet.  *1-inch recovery



ſ	Brauı			6527.00		BORING:			Sī	Г-106	
/iations)	Projec 966 M	t Paul - ississipp		ATION ture Phase pulevard South		LOCATIO attached s		1455		68 E: 54979	9.805. See
bbre	DRILLE	:R: J. (	Chermak	METHOD: 3 1/4	" HSA, Autohammer	DATE:	8/27	7/19		SCALE:	1" = 4'
nation of a	Elev. feet 847.1	Depth feet 0.0	Symbol	(Soil-ASTM D2488 or D248			BPF	WL	MC %	Tests	or Notes
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\05527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23	847.1 _ 846.0 _ 843.1 	22.2	Symbol PAV  CH  SH  SH  SH  SH  SH  SH  SH  SH  SH	5 1/2 inches of bituminous base.  FAT CLAY, with Limesto moist, very stiff.  (Weathere  SHALE, with occasional and brown to 7 1/2 feet ti	us over 8 inches of agg ine fragments, olive and id Shale Bedrock)  Limestone fragments, olive hen gray, dry, hard. Shale Bedrock)  at 10 feet.  2 feet. et with 10 feet of hollow et with 15 feet of hollow	olive  olive  v-stem  v-stem	27 64 60 48 72 78 89 50/6"	$\Box$	25 23		
501	 B1806527 (				Braun Intertec Corporation	_					F-106 page 1 of 2



ſ	Braur		ct B180	652	7.00			BORING:			Sī	Γ-107	
/iations)	Projec 966 M	t Paul - ississipp	AL EVALUA Infrastruci Di River Bo nnesota	cture				LOCATIO attached		1456		25 E: 54953(	0.201. See
bbre	DRILLE	:R: B. I	Kammermei	er	METHOD:	3 1/4" HSA, Au	tohammer	DATE:	8/2	1/19		SCALE:	1" = 4'
nation of a	Elev. feet 832.8	Depth feet 0.0	Symbol	_	il-ASTM D2488 o		JSACE EM1110		BPF	WL	MC %	Tests	or Notes
OF BORING N'\GINT\PROJECTS\AX PROJECTS\2018\05527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23			Symbol FILL SM  SH	SIL and FAT frag	il-ASTM D2488 of L: Silty Sand, fix brown, dry.  TY SAND, fine-Lean Clay lens  CCLAY, with Silments, brown a (Weather County)	r D2487, Rock-Line- to medium  (Topsoil Fill grained, with Lises, brown, mo (Terrace Depotity Sand lenses and gray, meditathered Shale Bettone fragment corah Shale Bettone distribution of the stone fragment corah Shale Bettone fragment corah Shale	JSACE EM1110 -grained, trace ) imestone frag ist, medium dosit) s, trace Limesoum. Bedrock) s, gray, moist edrock)	to dry,	8 32 32 50/5" 84 61 50/5"			q <sub>p</sub> =2 tsf	or Notes
LOG OF BORING N:\GINT	_							- 					
	R1806527 (	10				Drawn Inter	tec Corporation						T-107 nage 1 of 1



ſ		-	ct B180					BORING:			S	Г-108	
riations)	Projec 966 M	t Paul - ississip <sub>l</sub>	AL EVALU Infrastruci pi River B innesota	cture l				LOCATIC attached			596.5	42 E: 54922	2.764. See
bbre	DRILLE	:R: J. (	Chermak		METHOD:	3 1/4" HSA,	Autohammer	DATE:	8/1	6/19		SCALE:	1" = 4'
ation of a	Elev. feet 823.1	Depth feet 0.0	Symbol	(Soil		escription of N or D2487. Roc	/laterials k-USACE EM111	0-1-2908)	BPF	WL	MC %	Tests	or Notes
plan			PAV	5 inc	hes of bitumi		nches of aggreg						
See Descriptive Terminology sheet for explanation of abbreviations)	822.0 _ _ _ _ _ _ 819.1	4.0	SP- SM	medi	RLY GRADE	ED SAND with with Gravel, b	n SILT, fine- to prown to dark br posit)	rown, –	32				
ptive Termino	_		CH	FAT	CLAY, gray a (We	and brown, dr eathered Shal	y, very stiff. e Bedrock)	_	26		22		
(See Descri	816.1 - -	7.0	SH	SHA	LE, gray, dry (D	, hard. ecorah Shale	Bedrock)	_	51		15		
									63				
	_							- - -	54				
NT.GDT 11/22/19 12:23	_								52		18		
CURRE	_							- -	70				
00.GPJ BRAUN_V8									89				
06527.	_ 800.0	23.1						_					
ROJECTS\2018\	_		LS	weat	hered, soft to erately to inte	rimona Memb hard, thin to ensely fracture Platteville Fo		oderately d, – —				Run 1 Switched to 23.1 feet. S Coring for information	See Log of additional
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	- - -	00.4		Shal	e layer from 2	25.6 to 27.5 fe	eet.	_				inioimatior	i.
G N:\GINT\P	_ 795.0 _	28.1			OF BORING			<del>-</del>				**Boring im backfilled v grout.	nmediately vith bentonite
BORIN				Swite	ched to coring	g at 23.1 feet.							
LOG OF	_			Wate	er not observe	ed while drillir	ng.*	_					
	B1806527.0	10					ntertec Corporation					S	T-108 page 1 of

## LOG OF CORING

**Braun Project B1806527.00** ST-108 (cont.) CORING: **GEOTECHNICAL EVALUATION** .OG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN\_V8(BeerDess)ptWe7TerH#HBlogy sheet for explanation of abbreviations) LOCATION: N: 145596.542 E: **Project Paul - Infrastructure Phase** 549222.764. See attached sketch 966 Mississippi River Boulevard South Saint Paul, Minnesota DATE: 8/16/19 SCALE: 1" = 1' Rate of Water Elev. Depth Bit Pressure **RQD** Rec. feet feet Advance Remarks Description of Core Press Return % (psi) 0.008 23.1 (min/ft) (psi) (%) LIMESTONE, Carimona Member, slightly to moderately 1 3/4 3,488 45 100 46 96 Run 1 0.008 23.1 weathered, soft to hard, thin to medium bedded, moderately Carimona to intensely fractured. Member (Platteville Formation) 3,720 2 1/4 2 1/4 Shale layer from 25.6 to 27.5 feet. 2 1/4 2 1/4 END OF CORING AT 28.1 FEET. 795.0 NOTES:



## **Photograph of Rock Cores Project Paul** B1806527.00

**ST-108** 



NOTE: Cores run from left to right and bottom to top. Each row is 24 inches long.



	-	ct B180					BORING:			S	Г-109	
Proje	ct Paul -		cture				LOCATIC attached		1456	606.9	26 E: 549034	l.189. See
g DRILL	ER: B.	Kammermei	er	METHOD:	3 1/4" HSA, A	utohammer	DATE:	8/5	/19		SCALE:	1" = 4'
Flev. feet 816.9	Depth feet 0.0	Symbol	(Soil		escription of Ma or D2487, Rock	aterials -USACE EM1110	)-1-2908)	BPF	WL	MC %	Tests o	or Notes
816.1	0.8	PAV		hes of bitumi								
한 한814.9		OL	SAN		C CLAY, with One Deposit/Bur	Gravel, black, n ried Topsoil)	noist. –			36	OC=10%	
See Describitive Terminology sheet for explanation of abbreviations of abb		CH	FAT and I	CLAY, trace brown, moist,		ments and fibe	ers, gray -	5		23	q <sub>p</sub> =1 1/2 tsf LL=67, PL=	23, PI=44
Criptive Tern  - 809.6	7.0						_	17		25		
(See Desc		SH	SHA	LE, gray, dry (D	, hard. ecorah Shale E	Bedrock)	_	32		21		
TS/2018/06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23		LS	dens	e.	(Limestone Be	eathered, gray. drock)	- - - -	X 50/6"  X 50/5"  X 50/1"		9		
106 OF BORING N; GINT, PROJECTS, 2018, 06527, 00.691					ly backfilled wi	epth of 20 feet. th bentonite gro						-109 page 1 of



		Proje			BORING	G:			S	Γ-110					
	Projec 966 M	t Paul - ississip <sub>l</sub>	AL EVALU Infrastru pi River E innesota	icture Boulev					LOCAT			1457	64.10	07 E: 54905	0.104. See
brevi	DRILLE	R: B. I	Kammermei	er	METHOD:	3 1/4" HS	A, Autohammer		DATE:		8/5	/19		SCALE:	1" = 4'
nation of ab	Elev. feet 823.2	Depth feet 0.0	Symbol	,	oil-ASTM D2488	or D2487, F	of Materials Rock-USACE EM <sup>2</sup>				BPF	WL	MC %	Tests	or Notes
plan	822.8	0.4	PAV				2 inches of aggr	regat	te base.	$\overline{A}$					
or ex	821.2	2.0	OL	ORG			el, black, moist. t/Buried Topsoil	l)					21	OC=7%	
See Descriptive Terminology sheet for explanation of abbreviations)	_	2.0	SC		YEY SAND, fii ments, brown,			h Lim	nestone -		34	Δ		*No recove	ery
(See Descrip	816.2 814.2	7.0 9.0	CL	LEAI fragr	ments, brown a	and gray, v	es and Limesto wet, very stiff. hale Bedrock)	ne		 _}	25		23	LL=42, PL:	=22, PI=20
  -  -  -			SH	SHA	LE, gray, mois (D	st, hard. ecorah Sh	ale Bedrock)		_		53		21		
RENT.GDT 11/27/19 09:35	805.7	17.5							_		76		26		
REN1	000.1	11.0		END	OF BORING					7	1				
PJ BRAUN_V8_CUR				in the	e ground.	:11 feet wi	n 5 feet of hollow th 17 feet of ho			· _					
018\06527.00.6				imme	ediately after w	vithdrawal	n a cave-in dept of auger.								
N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	_			5011	.g minediatal	, baokineu	. The Dornoring	9100	-	_					
LOG OF BORING	1806527.0	00				Broi	un Intertec Corporat	tion						c	Γ-110 page 1 of



ſ	Brauı			6527.00				BORING	:			S	<u></u> Γ-111	
/iations)	Projec 966 M	t Paul - ississip <sub>l</sub>		ATION cture Phase oulevard So				LOCATIO attached			1459	901.0	18 E: 54903	88.73. See
abbre	DRILLE	R: B.	Kammermei	er MET	HOD:	3 1/4" HSA, A	utohammer	DATE:		8/5	/19		SCALE:	1" = 4'
nation of a	Elev. feet 824.6	Depth feet 0.0	Symbol		1 D2488 d		USACE EM1110		ı	BPF	WL	MC %	Tests	or Notes
expla	823.7	0.8	PAV	3 inches of	f bitumin	ous over 7 inc	ches of aggrega	ate _						
sheet for	- 821.6	3.0	FILL	FILL: Lear	-	race Gravel, b (Topsoil Fi	ll)		<u> </u>	13		22		
ology	_		CL	fragments,			nestone and Sl d brown, moist							
See Descriptive Terminology sheet for explanation of abbreviations)	_			very stiff.		(Alluvium)	)	-	X	13		14	LL=39, PL	=19, PI=20
(See Desc	_ 815.6	9.0						_		26		13		
			GP	POORLY 0 brown, wet			ith Shale lense	S, 			Δ			
	813.6	11.0	SH	CHALE an		(Alluvium)	)		M	36				
3	- -		SIT I	SHALE, gr	ay, mois (De	st, nard. corah Shale E	Bedrock)	- -	-X	38		26		
NT.GDT 11/22/19 12:23	 808.6	16.0		END OF B	ORING				X	56		30		
RENT.GDT 11	_				erved at	10 feet with 1	0 feet of hollow	v-stem –						
N_V8_CURRE	_					11 1/2 feet wi in the ground		_						
.GPJ BRAUN_V8	_			Water obse	erved at diately a	5 feet with a of fter withdrawa	cave-in depth o I of auger.	of 12 _						
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ	_			Boring imm	nediately	/ backfilled wit	h bentonite gro	out. –						
ROJECTS\2														
PROJECTS\AX	_							_						
G N:\GINT\F	<del>-</del> -							_						
LOG OF BORING														
	B1806527 (	00				Broup Into	ertec Cornoration						· c	T-111 nage 1 of



			ct B180						BORING			Sī	Г-112	
	Project 966 M	t Paul - ississipp	AL EVALUA Infrastruc Di River Bo nnesota	cture I					LOCATIC attached			)16.3	45 E: 54940 <sup>1</sup>	9.517. See
lbbre [	DRILLE	R: J. (	Chermak		METHOD:	3 1/4	" HSA, Autoha	mmer	DATE:	8/2	7/19		SCALE:	1" = 4'
nation of a	Elev. feet 836.5	Depth feet 0.0	Symbol	(Soil		•	on of Materia 87, Rock-USA		)-1-2908)	BPF	WL	MC %	Tests	or Notes
(See Descriptive Terminology sheet for	835.4	11.0	CH SH	FAT olive	CLAY, trace, brown and (W	(To Limest gray, meathere	ver 8 1/2 inclupsoil Fill) cone fragmen toist, medium d Shale Bedi	ts and Silt to very st rock)	lenses, — tiff. — — — — — — — —	7 14 20 20 55 66 70 63 68		25 24 22 18	*Water not while drillin	g. nediately
BORING N:\GIF	805.5	31.0								87			grout.	vith bentonite
00 OG				END	OF BORING	G.*			-	П				
ے <u>ا</u>	L806527.0	Λ					Braun Intertec C	Corporation			1		S <sup>-</sup>	T-112 page 1 of



ſ		n Proje	ct B180	6527.00				BORING	:			Sī	Г-113	
/iations)	Projec	t Paul - ississip <sub>l</sub>		ATION cture Phase oulevard Sout	h			LOCATIO attached				184.5	34 E: 549417	.588. See
bbre	DRILLE	:R: B.	Kammermei	er METHO	D:	3 1/4" HSA, Aut	ohammer	DATE:		8/2	2/19		SCALE:	1" = 4'
nation of a	Elev. feet 843.0	Depth feet 0.0	Symbol		488 oı	cription of Mat r D2487, Rock-U	SACE EM1110		В	PF	WL	MC %	Tests o	r Notes
t for expla	_ 841.0	2.0	FILL	dark brown, m	oist.	ne- to medium-		_						
See Descriptive Terminology sheet for explanation of abbreviations)		7.0	CH	and gray, moi	st, stif	ravel and Silty ff. thered Shale E		, brown – – – –		11 14		29	q <sub>p</sub> =2 1/4 tsf	
(See Descri	836.0 	7.0	SH IIII	SHALE, gray,	dry to (Dec	o moist, hard. corah Shale Be	edrock)	- - - -		37* 36			*No recover	у
CURRENT.GDT 11/22/19 12:23		18.5		With Limestor	e fraç	gments at 15 fe	eet.	- - - -		39 68 0/11		22		
	_			END OF BOR	ING.			_						
NUN_V8				Water not obs	ervec	d while drilling.			-					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN	- - - - -			Boring immed	iately	backfilled with	bentonite gro	out. –						
LOG OF	_							_						
	B1806527 (	10				Danier Intern	tec Cornoration		-		_			113 nage 1 of



_		Proje	ct B180	6527.	00			BORING	<b>-</b> -			Sī	Г-114	
- 1 1	Project 966 Mi	: Paul - ssissipp	AL EVALUA Infrastruc Di River Bo nnesota	ture Pl				LOCATI attached			1455			9.777. See
abbre [	DRILLE	R: B. I	Kammermei	er I	METHOD:	3 1/4" HSA, Aı	utohammer	DATE:		8/16	5/19		SCALE:	1" = 4'
nation of a	Elev. feet 811.0	Depth feet 0.0	Symbol	•	ASTM D2488	scription of Ma or D2487, Rock-	USACE EM1110			BPF	WL	MC %	Tests	or Notes
(See Descriptive Terminology sheet for explan	811.0 810.2 807.0 - 802.0 - 800.0	9.0	Symbol FILL FILL  CL  SH	FILL: FILL: brown  SAND Limest With S  SHALI	Silty Sand, to Silty Sand, to dark brown of LEAN CLATOR fragme Silty Sand see E, gray, moi: (De	fine-grained, w (Topsoil Fil fine-grained, no fine-graine	ith roots, black  ith roots, b	organic,		4 9 8 45		19	LL=20, PL= q <sub>p</sub> =1 1/4 ts	
501	806527 0					_	ertec Cornoration	-						T-114 page 1 of 1



Bi	raur		ct B180					BORING	:		S	Г-115	
l Pr	oject 66 Mi	t Paul - ississipp	AL EVALU Infrastruci Di River B Innesota	cture				LOCATIO attached			095.4	21 E: 548000	5.286. See
p DR	RILLE	R: B.	Kammermei	er	METHOD:	3 1/4" HSA, Au	tohammer	DATE:	9/1	8/19		SCALE:	1" = 4'
te Ele 8	ev. eet 10.6	Depth feet 0.0	Symbol		I-ASTM D2488	scription of Mat or D2487, Rock-L	ISACE EM1110		BPF	WL	MC %	Tests	or Notes
et for explanation   80   10   10   10   10   10   10   10	08.5	2.1	FILL	blac	k, moist.	fine- to medium (Topsoil Fill	)	roots, –					
ology shee	06.6	4.0	FILL			d, brown, moist.		_	7		13		
See Descriptive Terminology sheet for explanation of abbreviations)	03.6	7.0	SP	with		D SAND, fine- t Shale fragment (Terrace Depo	s, brown, wet		22				
(See Descr	33.0	7.0	CH	FAT wet,	stiff to hard.	Gravel to with Gathered Shale E		noist to	9		17	q <sub>p</sub> =2 1/2 tst	
CURRENT.GDT 11/22/19 12:23	99.6	11.0		Wate	O OF BORING er not observe ng immediatel	ed while drilling.			81*			*3-inch reco	overy
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8								- - - - - -					



Brau		ct B180	6527.00		ВО	RING:			S	Г-116	
Projec	t Paul - Iississip <sub>l</sub>		ATION cture Phase oulevard Sout	th			ON: N: sketch		700.1	69 E: 54861	6.518. See
DRILLE	R: B.	Kammermei	er METHC	DD: 3 1/4" HSA, Autohamme	r DA	TE:	9/18	8/19		SCALE:	1" = 4'
Flev. feet 807.1	Depth feet 0.0	Symbol	(Soil-ASTM D2	Description of Materials 2488 or D2487, Rock-USACE El	M1110-1-29	908)	BPF	WL	MC %	Tests	or Notes
See Descriptive Terminology sheet for explanation of the state of th	feet	Symbol FILL FILL LS	FILL: Silty Sadark brown, m FILL: Weather trace Gravel,  FILL: Poorly with Shale lay gray, wet.  WEATHERED  END OF BOR  Water observauger in the g  Water observauger in the g  Water observauger in the g	2488 or D2487, Rock-USACE El and, fine- to medium-grained noist.  (Topsoil Fill) ered Shale, with Silty Sand ir brown and olive, moist.  Graded Sand, fine- to mediu yers and seams, with Gravel, D LIMESTONE, gray, dry, versions.	, with roots nclusions, m-grained, brown an ery dense.	s,	BPF  11  50/2"*  50/5"*	∇.	1	*No recove 1/2-inch sa had 1-inch	ery with 1 impler and recovery nch sampler
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V						-					



ſ	Braur			6527.00				BORING:			9	Г-117	
/iations)	GEOTE Projec 966 M	CHNICA t Paul - ississipp	AL EVALU. Infrastru						N: 1				8.358. See
bbre	DRILLE	R: B.	Kammermei	er MET	HOD:	3 1/4" HSA, Auto	ohammer	DATE:	9	18/19		SCALE:	1" = 4'
anation of a	Elev. feet 808.8	Depth feet 0.0	Symbol		D2488	escription of Mate or D2487, Rock-U	SACE EM1110	)-1-2908)	BPI	WL	MC %	Tests	or Notes
et for expla	_ 806.8	2.0	FILL			ay, trace roots, bl (Topsoil Fill)		_					
ology shee	- 804.8	4.0	FILL	Gravel, bro	wn, gra	fine- to medium- ay and reddish b	rown, moist.	_	8		15		
See Descriptive Terminology sheet for explanation of abbreviations)	 _   _		SM	SILTY SAN brown, moi	ID, fine st, med	e-grained, trace S dium dense. (Terrace Depos		ay and  _ _ _	18		15		
ėS)	799.8	9.0	SP	POORLY ( trace Grave	GRADE el, brow	ED SAND, fine- to vn, moist, mediur (Terrace Depos	m dense.	ained,	/\ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	3			
	797.8	11.0		END OF B	ORING				Δ				
	_			Water not	observe	ed while drilling.		_					
	-					ly backfilled.		_					
::23	_			3		,		_					
2/19 12	_												
NT.GDT 11/22/19 12:23	_							_					
ENT.G	_							_					
8_CURREI	_							_					
BRAUN_V8													
	-							_					
527.00.	_							_					
018/06	_												
JECTS\2	_												
XX PRO	_							_					
JECTS\	_							_					
ıπ\ PRO	_							_					
N:\GII	_							_					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ													
507	D1906E37.0						oo Corporation						T 117 page 1 of 1



ſ		1 Proje		6527.00		BORING:			S	 Γ-118	
/iations)	GEOTE Projec 966 M	CHNICA t Paul - ississipp	AL EVALUA Infrastruc				N: N:	1430		98 E: 54904	5.652. See
pbre	DRILLE	R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autoh	ammer	DATE:	9/18	8/19		SCALE:	1" = 4'
nation of a	Elev. feet 810.3	Depth feet 0.0	Symbol	Description of Materi (Soil-ASTM D2488 or D2487, Rock-USA	CE EM1110		BPF	WL	MC %	Tests	or Notes
y sheet for expla	- 808.3	2.0	FILL	FILL: Silty Sand, fine- to medium-gr black, moist. (Topsoil Fill) FILL: Silty Sand, fine- to medium-gr and Shale fragments, brown, moist.		_	18		9		
See Descriptive Terminology sheet for explanation of abbreviations)	-  - 803.3	7.0	SC	CLAYEY SAND, with Limestone frag	umanta bro		15				
ee De	<sup>-</sup> 801.8	8.5		gray, moist, hard. (Alluvium)	jments, bro	own and	51				
9)	_ 800.6	9.7	LS	WEATHERED LIMESTONE, gray, of	lry, very de	ense.	×50/3"*	ir		*2-inch rec	ovorv
5 OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23				END OF BORING.  WWater not observed while drilling.  Boring immediately backfilled.							
501	B1806527 (			Braun Intertec	_						T-118 nage 1 of



1		1 Proie		6527.00	BORING:			S	<u>11</u>	9
riations)	GEOTE Proiec	CHNICA t Paul - ississipp	AL EVALUA Infrastruc		-	N: N:	1446			549001.854. See
lbbre\	DRILLE	R: B.	Kammermei	er METHOD: 3 1/4" HSA, Autohammer	DATE:	8/9	/19		SCA	LE: 1" = 4'
nation of a	Elev. feet 811.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110	,	BPF	WL	%	P200 %	Tests or Notes
expla	810.4	1.0	FILL	FILL: Silty Sand, fine- to medium-grained, with dark brown, dry.	Gravel,			4	18	
(See Descriptive Terminology sheet for explanation of abbreviations)	- - - -		FILL	FILL: Clayey Sand, with Gravel, occasional Sa Lean Clay and Silty Sand layers, brown and da brown, moist.  With Organic Clay layer at 5 feet.	indy rk – – – – –	12* 6		16		*No sample recovery
9)	<sup>-</sup> 801.9	9.5		With concrete at 9 feet.	_					
	 _ 	12.0	СН	FAT CLAY, with Shale fragments, brownish gremoist, hard.  (Weathered Shale Bedrock)	een, —	32		29		
	798.5	12.9	SH	SHALE, gray, dry, hard. (Decorah Shale Bedrock)	_	□ ⊠50/5"		12		
PF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23				END OF BORING.  Water not observed with 12 feet of hollow-stem in the ground.  Boring immediately backfilled.						
LOG 0F	P1806E37 (			Proug Intertog Corporation						ST 110 page 1 of 1



ſ	Braur		ct B180	6527.0	00			BORIN	IG:			S	Γ-120	
viations)	Projec 966 M	t Paul - ississipį	AL EVALUA Infrastruc oi River Bo Innesota	ture Ph				LOCAT attache				125.5	13 E: 54883	2.002. See
abbre	DRILLE	R: B.	Kammermei	er M	METHOD:	3 1/4" HSA	A, Autohammer	DATE:		8/7	/19		SCALE:	1" = 4'
nation of a	Elev. feet 808.9	Depth feet 0.0	Symbol		STM D2488		ock-USACE EM11			BPF	WL	MC %	Tests	or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23	807.9 - 804.9 - 797.9 	1.0	FILL	FILL: PSand, CClayey  END Ol  Water cauger in  Water cauger in  Water cauger in	Poorly Grad Cobbles and Sand layer F BORING observed at an the groun	brown and d, with Gravel, d possible les, brown and t 4 feet with d. t 5 feet with d. t 1 foot with withdrawal	(mostly Gravel) Boulders, occas and gray, wet.  1 4 1/2 feet of ho	with ional -		8 3* 44	$ar{ar{\Sigma}}$	11	*No sample	e recovery



1		n Proje	ct B180					BORING			S	Г-121	
riations)	Proiec	t Paul - ississipį	AL EVALUA Infrastruc pi River Bo Innesota	ture				LOCATIO attached			991.5	3 E: 550040	.63. See
bbre\	DRILLE	:R: B.	Kammermei	er	METHOD:	3 1/4" HSA, /	Autohammer	DATE:	8/:	22/19		SCALE:	1" = 4'
nation of a	Elev. feet 846.8	Depth feet 0.0	Symbol		il-ASTM D2488		k-USACE EM111		BPF	WL	MC %	Tests	or Notes
sheet for expla		2.0	FILL	FILL Lime	.: Sandy Lean	Clay, with SI	ravel, brown, m hale inclusions avel, brown, dar	and			12		
See Descriptive Terminology sheet for explanation of abbreviations)	_  _ 	7.0			gray, moist.			_ 	32		13		
(See Des	_		FILL	FILL tile p	.: Fat Clay, sli pieces, black, i	ghtly organic, moist.	, with Gravel an	id Clay - -	14		18		nemical odor
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23	836.3 835.8 - - - - - - - - - - - - - - - - - - -	10.5	CH	gray END Wate	and brown, m	noist, stiff. athered Shale ed while drillin		agments,	12		26	q <sub>p</sub> =2 1/2 ts	f
LOG OF I	 B1806527 (						ntertec Corporation	_					T-121 page 1 of 1



ſ		n Proje	ct B180	6527	7.00			BOR	ING:			S	Γ-122	
/iations)	Proiec	t Paul - ississipp	AL EVALUA Infrastruc Di River Bo nnesota	ture						N: N: sketch				9.767. See
bbre	DRILLE	:R: B. I	Kammermei	er	METHOD:	3 1/4" HSA, A	utohammer	DAT	E:	8/2	2/19		SCALE:	1" = 4'
nation of a	Elev. feet 831.7	Depth feet 0.0	Symbol		il-ASTM D2488		-USACE EM11			BPF	WL	MC %	Tests	or Notes
OF BORING NYGINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23		7.0		FILL trace FILL with	: Silty Sand, te Gravel, dark : Poorly Grad Shale lenses,	fine- to mediuing brown, moist.  (Topsoil Filed Sand, fine brown, moist)  moist, very stire athered Shale bed while drilling	m-grained, wi ill) - to medium-ç ff. e Bedrock)	th roots,		8 6 7		6 9 23	LL=56, PL	=25, PI=31
501	B1806527 (					D	ertec Cornoration							T-122 nage 1 of 1



		ct B180					BORING:			Sī	Г-123	
Projec	ct Paul - lississip <sub>l</sub>	AL EVALUA Infrastruc oi River Bo Innesota	cture				LOCATIC attached		1444	76.6	03 E: 55006	0.481. See
DRILLE	ER: B.	Kammermei	er	METHOD:	3 1/4" HSA, A	utohammer	DATE:	8/2	3/19		SCALE:	1" = 4'
Elev. feet 831.9		•		-ASTM D2488		USACE EM1110		BPF	WL	MC %	Tests	or Notes
966 N Saint  DRILLE Elev. feet 831.9  831.4  - 827.9  824.9	0.5	FILL FILL	mois	t.	(Topsoil Fi	ts and Gravel, II) e- to coarse-gr	Н	38				
827.9 	7.0	CH	FAT mois	t, very stiff.	mestone fragr	ments, gray an Bedrock)	d brown,	24		26		
(See Desc		SH	SHA hard		stone fragmer corah Shale E	its at 7 feet, gr Bedrock)	ay, dry, - -	58		12		
	13.5							60		18		
	13.5		END	OF BORING			_					
12:23			Wate	er not observe	d while drilling	<b>]</b> .						
N_V8_CURRENT.GDT 11/22/1912:23			Borir	ng immediately	y backfilled.		- - - -					
ECTS/2018/06527.00.GPJ BRAU							- - -					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_							- - - -					
B1806527.	000				Proup late	ertec Corporation	_				9	T-123 page 1 of



	n Proje		6527.00	BORING:			Sī	Г-124	
Proie	t Paul - lississip <sub>l</sub>		ATION cture Phase oulevard South	LOCATIC attached		1434		08 E: 549322	2.616. See
DRILLE	R: M.	Barber	METHOD: 3 1/4" HSA, Autohammer	DATE:	9/20	)/19		SCALE:	1" = 4'
b Elev. feet 803.7	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110		BPF	WL	MC %	Tests	or Notes
966 N Saint  DRILLE Elev. feet 803.7  802.7  799.7  796.7	1.0	FILL	FILL: Silty Sand, fine-grained, with roots and considerable pieces, black, wet.  (Topsoil Fill)  FILL: Fat Clay, brown and black, moist.	oncrete	7		32		
799.7 ————————————————————————————————————	7.0	SM	SILTY SAND, fine- to medium-grained, with Lim fragments, brown, dry, very dense. (Terrace Deposit)	-	×50/4"		9		
90 90 794.7	9.0	LS	LIMESTONE, Magnolia Member, dark gray, dry dense. (Platteville Formation)	v, very	50/1"				
	9.9	LS	LIMESTONE, Carimona Member, brown and gr very dense, trace vugs. (Platteville Formation) END OF BORING. Water not observed while drilling. Boring immediately backfilled.	ray, dry,	<sup>⊠</sup> 50/5"				
JECTS/2018/06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23				- - - - - -					
LOG OF BORING N:\GINT\PROJECTS\2018\05527.00.GPJ BRAUN.			Braun Intertee Corporation	- - - -					F-124 page 1 of 1



	Braur	ո Proje	ct B180	6527.00		BORING:			Sī	Г-125	
iations)	Projec 966 M	t Paul - ississipp		ATION cture Phase oulevard South		LOCATIC attached		1460		76 E: 54974	8.848. See
bbre\	DRILLE	:R: J. (	Chermak	METHOD:	3 1/4" HSA, Autohammer	DATE:	8/2	7/19		SCALE:	1" = 4'
nation of a	Elev. feet 854.6	Depth feet 0.0	Symbol		escription of Materials or D2487, Rock-USACE EM111	10-1-2908)	BPF	WL	MC %	Tests	or Notes
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:23 (See Descriptive Terminology sheet for explanation of abbreviations)	853.9	16.0	SH S	Cark brown, dry. SHALE, trace Limfeet then moist, has (D)  END OF BORING  Water observed a auger in the ground water not observed immediately after	ecorah Shale Bedrock)  3.  3.  3.  3.  3.  3.  3.  3.  3.  3	to 12 1/2	49 72 52 57 62 67	∇	14 26		T-125 page 1 of



ſ	Braur			6527.00		BORING:			S1	Г-126	
iations)	Projec 966 M	t Paul - ississipp		ATION cture Phase oulevard South		LOCATION: N: 145878.842 E: 54974 attached sketch					3.604. See
bbrev	DRILLE	:R: J. (	Chermak	METHOD:	3 1/4" HSA, Autohammer	DATE:	8/27	7/19		SCALE:	1" = 4'
See Descriptive Terminology sheet for explanation of abbreviations)	Elev. feet 852.2	Depth feet 0.0	Symbol	(Soil-ASTM D2488 or	cription of Materials - D2487, Rock-USACE EM1110		BPF	WL	MC %	Tests	or Notes
expla	_ 851.1	1.1	PAV	5 1/2 inches of bitur base.	minous over 8 inches of agg	gregate					
et for 6	_		CL		imestone fragments, gray, o	dry,					
ıy she	- 848.7	3.5			thered Shale Bedrock)	_	37		14	LL=44, PL=	=22, PI=22
polouic	_	0.0	SH	SHALE, with Limes (Dec	tone fragments, gray, hard. corah Shale Bedrock)						
3 Term				,	·		79		14		
criptive	_										
e Des	_					_	54				
(Se	_					-					
							50		16		
	_					_/					
	_						63				
	_					_					
CURRENT.GDT 11/22/19 12:23							73		19		
11/22/1	836.2	16.0		END OF BORING.							
T.GDT	_			Water not observed	I while drilling.	-					
CURREN	_			Boring immediately	backfilled with bentonite gro	out.					
PJ BRAU	_					_					
27.00.G	_					-					
18\065	_					-					
ECTS\20	_										
AX PROJ	_					_					
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8	_					_					
INT\PR	_					-					
IG N:\G	_					-					
F BORIN											
	B1806527 (	20			Braun Intertec Corporation					07	[-126 nage 1 of 1



ſ	Braur		ct B180		BORING	:		TW-1				
ations)	GEOTE Projec 966 M	GEOTECHNICAL EVALUATION Project Paul 166 Mississippi River Boulevard S t. Paul, Minnesota				LOCATION: N: 146091.573 E: 549683.054. attached sketch.						
bbrev	DRILLE	-	Chermak	METHOD: 3 1/4" HSA, Autohammer	DATE:	7/18	8/18	SCALE: 1" = 4'				
nation of al	Elev. feet 853.1	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM111		BPF	WL	Tests or Notes				
LOG OF BORING NYGINTY PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/1912:27	852.7	10.0	SH S	2 inches of bituminous over 3 inches of aggree base.  SHALE, gray, moist.  (Decorah Shale Bedrock)  END OF BORING.  Water not observed with 10 feet of hollow-sten in the ground.  Boring then backfilled.  Temporary wells set with a 1" pvc and 5' screet installed on 7/18/18 to depth of 10.5' bgs.  Water measured on 7/18/18 at 9.5' bgs. Let reovernight.  On 7/19/18 water measured at 5.4' bgs. Ground sample collected and well sealed.	m auger	X 50/6"  * *		*50 to set 3" *50 to set 5"				
	B1806527			Braun Intertec Corporation		<u> </u>	1	TW-1 page 1 of 1				



ſ		n Proje	ct B180	6527	BORING			TW-2	
			AL EVALU		LOCATION: N: 145350.327 E: 549981.218.				
(S	Projec				attached sketch.				
ation		ississipp al, Minn		oulevard S					
bbrevi	DRILLER: J. Chermak			METHOD: 3 1/4" HSA, Autohammer	DATE:	7/18	8/18	SCALE: 1" = 4'	
n of a	Elev. feet	Depth feet		Description of Materials		BPF	WL	Tests or Notes	
ınatio	851.3	0.0	Symbol	(Soil-ASTM D2488 or D2487, Rock-USACE EM1110		J		Tools of Holes	
r expla	- 849.8	1.5	FILL	FILL: Silty Sand, fine- to medium-grained, trac Gravel, bituminous and concrete, dark brown, r		6			
See Descriptive Terminology sheet for explanation of abbreviations)	_		СН	FAT CLAY, trace Gravel, brown and gray, mois (Weathered Shale Bedrock)	st, stiff	M 9			
logy s	- 847.3	4.0			_	N 3			
ermino	_		SH	SHALE, gray, moist. (Decorah Shale Bedrock)	_	52			
tive T	_				_				
escrip	-			Limestone layer at 7 feet	_	80/8"			
See [	_				_	∬85/9"			
	- 841.3	10.0			_	103/9			
				END OF BORING.					
	_			Water not observed with 10 feet of hollow-stem in the ground.	auger –				
	_			Boring then backfilled.	_				
	_			Temporary wells set with a 1" pvc and 5' screen	n. –	-			
9 12:27				Installed on 7/18/18 to depth of 10.5' bgs.					
GDT 11/22/19 12:27	_			Water measured on 7/18/18 at 10' bgs. Let recovernight.	charge				
CURRENT.GD	_			On 7/19/18, water measured at approximately 8 Let recharge overnight.	8.5' bgs _				
				On 7/20/18, water measured at 7.7' bgs. Ground sample collected and well sealed.	ndwater ——	-			
J BRAU	_				_	-			
527.GP	_				_	-			
018/06	_				_				
JECTS\2									
AX PRO	_				_	-			
)JECTS\	_				_	-			
INT\PR(	_				_	-			
3 N:\G	-				_				
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8						-			
LOG OF	D1906E37			Proup Intertoe Corporation	_			TW 2 page 1 of 1	



			6527		BORING:			Т	W-3	}	
Project Paul											5.258. See
DRILLE	R: J. (	Chermak	METHOD: 3 1/4" HSA, Autor	ammer	DATE:	7/18	3/18		SCA	LE:	1" = 4'
Elev. feet 814.9	Depth feet 0.0	Symbol	(Soil-ASTM D2488 or D2487, Rock-US/	ACE EM1110		BPF	WL	MC %	P200 %	Tests	s or Notes
<b>I</b>		Symbol FILL SH	(Soil-ASTM D2488 or D2487, Rock-US/FILL: Silty Sand, fine- to medium-grace Clay, concrete and bituminous moist.  LEAN CLAY, trace Sand and Grave (Weathered Shale Be SHALE, gray, wet. (Decorah Shale Bed Decorated Shale Bed SHALE, gray) wet.  END OF BORING.  Water observed at 5 feet with 6 feet auger in the ground.  Water observed at 6 feet with 8 feet auger in the ground.  Water not observed to cave-in depth immediately after withdrawal of auger Boring then backfilled.  Temporary wells set with a 1" pvc and Installed on 7/18/18 to depth of 10' be water was too silty to sample, so we settle overnight.  On 7/19/2018, water measured at 0.	I, gray, wet drock)  of hollow-s of hollow-s of 6 feet er. d 5' screen ogs. ' bgs on 7/1 Il was allow 8'bgs. Star	Gravel, own,,,,,,,,,,,,,,,,,,	WH 2 2 2 28	ΨL	l			PL=19,
- - - - -			sample collected and well sealed.	on. Ground	- - - - - - -						
	Braur GEOTE Project 966 M St. Pau DRILLE Elev. feet 814.9	Braun Project GEOTECHNICA Project Paul 966 Mississipp St. Paul, Minn DRILLER: J. O.	GEOTECHNICAL EVALUA Project Paul 966 Mississippi River Bo St. Paul, Minnesota  DRILLER: J. Chermak  Elev. Depth feet 814.9 0.0 Symbol FILL	Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autorifeet B14.9 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-US/B14.9 Symbol)  FILL: Silty Sand, fine- to medium-gutrace Clay, concrete and bituminous moist.  SH SHALE, gray, wet. (Weathered Shale Bell SHALE, gray, wet. (Decorah Shale Bell SHALE, gray)  Water observed at 5 feet with 6 feet auger in the ground.  Water observed at 6 feet with 8 feet auger in the ground.  Water not observed to cave-in depth immediately after withdrawal of auger in the ground.  Water not observed to cave-in depth immediately after withdrawal of auger in the ground.  Water not observed to cave-in depth immediately after withdrawal of auger in the ground.  Water measured at approximately 5 water was too silty to sample, so we settle overnight.  On 7/19/2018, water measured at 0.0 water was observed around top of wa	Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer  Elev. Depth feet 814.9 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110 FILL: Silty Sand, fine- to medium-grained, with trace Clay, concrete and bituminous debris, bromoist.  B08.9 6.0 CL LEAN CLAY, trace Sand and Gravel, gray, wet (Weathered Shale Bedrock)  SHALE, gray, wet. (Decorah Shale Bedrock)  SHALE, gray, wet. (Decorah Shale Bedrock)  Water observed at 5 feet with 6 feet of hollow-sauger in the ground.  Water observed at 6 feet with 8 feet of hollow-sauger in the ground.  Water observed to cave-in depth of 6 feet immediately after withdrawal of auger.  Boring then backfilled.  Temporary wells set with a 1" pvc and 5' screet Installed on 7/18/18 to depth of 10' bgs.  Water measured at approximately 5' bgs on 7/' water was too silty to sample, so well was allow settle overnight.  On 7/19/2018, water measured at 0.8'bgs. Star water was observed around top of well. Groun	BORING:  GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer DATE:  Elev. feet feet 814.9 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)  FILL Sitty Sand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, moist.  SH SHALE, gray, wet. (Weathered Shale Bedrock)  SHALE, gray, wet. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 5 feet with 6 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 8 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger.  Boring then backfilled.  Temporary wells set with a 1" pvc and 5' screen.  Installed on 7/18/18 to depth of 10' bgs.  Water measured at approximately 5' bgs on 7/18/18; water was too silty to sample, so well was allowed to settle overnight.  On 7/19/2018, water measured at 0.8'bgs. Standing water was observed around top of well. Groundwater	Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer DATE: 7/18 Elev. feet feet 814.9 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)  FILL FILL: Silty Sand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, moist.  SHALE, gray, wet. (Weathered Shale Bedrock)  SHALE, gray, wet. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 5 feet with 6 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 8 feet of hollow-stem auger in the ground.  Water observed to cave-in depth of 6 feet immediately after withdrawal of auger.  Boring then backfilled.  Temporary wells set with a 1" pvc and 5' screen. Installed on 7/18/18 to depth of 10' bgs.  Water measured at approximately 5' bgs on 7/18/18; water was too silty to sample, so well was allowed to settle overnight.  On 7/19/2018, water measured at 0.8'bgs. Standing water was observed around top of well. Groundwater	Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer DATE: 7/18/18  Elev. Depth feet feet feet feet feet feet al. Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)  FILL FILL: Sitty Sand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, moist.  SHALE, gray, wet. (Weathered Shale Bedrock)  SHALE, gray, wet. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 5 feet with 6 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger.  Boring then backfilled.  Temporary wells set with a 1" pvc and 5' screen. Installed on 7/18/18 to depth of 10' bgs.  Water measured at approximately 5' bgs on 7/18/18; water was too silty to sample, so well was allowed to settle overnight.  On 7/19/2018, water measured at 0.8'bgs. Standing water was observed around top of well. Groundwater	Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer DATE: 7/18/18  Elev. Depth feet feet feet 814.9 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) FILL Sity Sand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, moist.  BORNES: T LOCATION: N: 145267.3: attached sketch.  BORING: T LOCATION: N MACH PALE ST LOCATION: N MACH PA	Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississispi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer DATE: 7/18/18 SCA.  Elev feet feet feet 814.9 0.0 Symbol (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)  FILL Silty Sand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, moist.  BPF WL MC P200  ### WH	Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: J. Chermak METHOD: 3 1/4" HSA, Autohammer DATE: 7/18/18 SCALE:  Elev. feet feet feet 814.9 0.0 Symbol (Soil-ASTM D2489 or D2487, Rook-USACE EM1110-1-2908)  FILL: Silf Syand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, with moist.  FILL: Silf Syand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, with Gravel, trace Clay, concrete and bituminous debris, brown.  SHALE, gray, wet. (Weathered Shale Bedrock)  SHALE, gray, wet. (Decorah Shale Bedrock)  END OF BORING.  Water observed at 5 feet with 6 feet of hollow-stem auger in the ground.  Water observed at 6 feet with 8 feet of hollow-stem auger in the ground.  Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger.  Boring then backfilled.  Temporary wells set with a 1" pvc and 5' screen.  Installed on 7/18/18 to depth of 10' bgs.  Water was too silty to sample, so well was allowed to water was too silty to sample, so well was allowed to water was observed around top of well. Groundwater



ſ	Braur		ct B180	6527		BORING:	:		Т	W-4	
riations)	Proiec	t Paul		ATION oulevard S		LOCATIO attached					6.580. See
bbre\	DRILLE	R: J. (	Chermak	METHOD:	3 1/4" HSA, Autohammer	DATE:	7/1	7/18		SCALE:	1" = 4'
nation of a	Elev. feet 811.4	Depth feet 0.0	Symbol	(Soil-ASTM D2488 o	scription of Materials or D2487, Rock-USACE EM11		BPF	WL	MC %	Tests	or Notes
See Descriptive Terminology sheet for explanation of abbreviations)	_ _ _ _ _ 	6.0	FILL	and crushed concre	ine- to coarse-grained, with	i. –	14	Ţ	13		
e Descripti	_ 803.4	8.0	FILL	-	th Sand lenses, blue and g	_	2		31	LL=61, PL=	=27, PI=34
(Sec	_ 801.4	10.0	FILL	fragments, gray, m		_	10				
	<sup>-</sup> 799.9	11.5	FILL	and Shale/Limesto	ine- to coarse-grained, with one fragments, gray, wet.	n Gravel –	*			*50 to set 4	ļ."
::27	- - -			auger in the ground	6 feet with 4 feet of hollow d. 11 feet with 10 feet of holl	_					
GDT 11/22/19 12:27	_			immediately after w	d to cave-in depth of 10 fe withdrawal of auger.	et – –					
CURRENT.GE	_			Boring then backfill Temporary wells se	lled. et with a 1" pvc and 5' scre	- en					
					8 to depth of 12' bgs.						
s\2018\06527.GPJ BRAUN_V8	- - -			Water measured or sample collected a	n 7/17/18 at 4' bgs. Grour and well sealed.	ndwater – – –					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ						 - -					
501	 				Braun Intertec Cornoration						TW-4 page 1 of



ſ	Braur		ct B180	6527					BORING	:			т	W-5		
riations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo	ATION	I				LOCATION attached							3.106. See
bbre	DRILLE	R: J. (	Chermak		METHOD:	3 1/4	4" HSA, Auto	hammer	DATE:		7/17	7/18		SCAL	.E:	1" = 4'
nation of a	Elev. feet 810.7	Depth feet 0.0	Symbol		-ASTM D2488	or D24		SACE EM1110		ВІ	PF	WL	MC %	P200 %	Test	s or Notes
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\05527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27			FILL FILL	FILL: and control of the state	Sandy Lear organic debris  Silty Sand, Sandy Lear organic debris  Silty Sand, el, dark brow	or D24 fine- t fine- t stone f  Clay s, gray fine- t n, mo  Gravel tiff. t 7 fee d. t 3 fee d. t 3 fee d. t 3 fee d. t 3 fee d. t 18 to c on 7/1	et with 6 feed ave-in deprawal of aug.  The and Limes and Limes and Limes and Limes are with 8 feed ave-in deprawal of aug.  The and I'' pvc and a feet with 6 feed ave-in deprawal of aug.  The and I'' pvc and a feet with 6 feed ave-in deprawal of aug.	estone fragmer edrock) et of hollow-set of hollow-set of screer bgs.	e Clay t  nents  e  nts, blue  tem  attern   nt		PF 25 117 118 4 115	VL		1 1	Test	s or Notes
IG N:\GINT\PROJECTS	- - -								- - -	- - - - -						
501							B	ec Cornoration		-						W-5 nage 1.0



		n Proje	ct B180	06527	BORING	:		т	W-6	
riations)	GEOTE Proiec	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo			ON: N:				548314.009. See
bbrev	DRILLE	:R: J. (	Chermak	METHOD: 3 1/4" HSA, Autohammer	DATE:	7/1	7/18		SCAL	_E: <b>1" = 4'</b>
nation of a	Elev. feet 812.1	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1)		BPF	WL	MC %	P200 %	Tests or Notes
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27	812.1  - 810.1  805.1  804.1	7.0 8.0	FILL LS	FILL: Poorly Graded Sand, fine- to medium-trace concrete debris, brown, moist.  FILL: Silty Sand, fine- to coarse-grained, tra Limestone fragments and Gravel, brown, mo at 4 feet.  LIMESTONE, highly fractured, weathered, liquand gray, wet.  (Platteville Limestone)  END OF BORING.  Water observed at 5 feet with 4 feet of hollow auger in the ground.  Water observed at 4 feet with 6 feet of hollow auger in the ground.  Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger.  Temporary wells set with a 1" pvc and 5' screen linestalled on 7/17/18 to depth of 8' bgs.  Water measured on 7/17/18 at 5' bgs. Ground sample collected and well sealed.	grained,  ce ist to wet  - ght brown  - v-stem  t - t - ce	15 19 16 20	$\nabla$	10	14	
LOG 0F	D1906E27			Proup Intertog Corporation	_					TW 6 _ page 1 of 1



Γ		Proje	ct B180	6527	7			BORING:			т	W-7	,
iations)	Project 966 Mi	t Paul	AL EVALU oi River B esota					LOCATIC attached					548883.053. See
bbrev	DRILLE	R: J. (	Chermak		METHOD:	3 1/4" HSA, A	utohammer	DATE:	7/1	7/18		SCA	LE: <b>1" = 4'</b>
nation of a	Elev. feet 811.7	Depth feet 0.0	Symbol	(Soi		escription of Ma or D2487, Rock	aterials -USACE EM1110	)-1-2908)	BPF	WL	MC %	P200 %	Tests or Notes
OF BORING NY, GINT/PROJECTS\2018\06527.2918\06527.597 BRAUN_V8_CURRENT.GDT 11/22/19 12:27 (See Descriptive Terminology sheet for explanation of abbreviations)			NAAA	SHA END Wate in th Borin Tem Insta Well	I-ASTM D2488  II-ASTM D2488 III-ASTM D2488 IIII-ASTM D2488 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	or D2487, Rock fine- to mediun frown, moist.  (Topsoil F fine- to mediun fine-	-USACE EM1110 m-grained, Grav ill) m-grained, trace d gray, moist.  ce Shale/Limes st, stiff to very s ill)  Bedrock)  c of hollow-stem //c and 5' screer 12.5' bgs. charge overnigh 9' bgs. Ground	e Gravel —  stone stiff. —  auger —  auger —  aut. —	BPF 10 6 12 28 21 11	WL	1		No recovery. Shale in tip of sampler.
501	1806527						tertec Corporation						TW-7 page 1 of



Ві	raun	Proje	ct B180	6527	7			BORING:			TW-8	
Pr	oject 66 Mi	Paul	AL EVALU oi River Bo esota					LOCATIO attached			I.667 E: 54968	0.982. See
DF DF	RILLEF	₹: J. (	Chermak		METHOD:	3 1/4" HSA,	Autohammer	DATE:	7/18	8/18	SCALE:	1" = 4'
explanation of a	ev. eet 09.7	Depth feet 0.0	Symbol	FILL	I-ASTM D2488	ded Sand, fin	ck-USACE EM1110 ne- to coarse-grai		BPF	WL	Tests or I	Notes
See Descriptive Terminology sheet for explanation of abbreviations)    See Descriptive Terminology sheet for explanation of abbreviations)   1	03.7	6.0						- - -	/\ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\			
ee Descriptive	02.7	7.0	FILL	and	: Silty Sand, Limestone fra OF BORING	igments, gra	se-grained, with S y, moist.	Shale	X50/6"			
S)				Wate	er met refusal er not observe ediately after	ed to cave-in	depth of 7 feet	_				
-				Borii	ng then backf	illed.		_				
				Tem	porary wells s	set with a 1"	pvc and 5' screer	n				
_					alled on 7/18/	-	_	_				
GDT 11/22/19 12:27				chec colle	cked again. Vected a partial	Vater measu sample, but	arge for a few ho red at 6.8' bgs. V well would not re t recharge overni	We ── echarge				
CURRENT.GDT 11,							at 7' bgs. Able to es and well was s					
	-											
SPJ BRAU								_				
1								_				
ECTS\2018								_				
S\AX PROJ	_							_				
\PROJECT:	-							_				
N:\GINT								_				
_OG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8.	-											
B180	6527					Braun	Intertec Corporation				-	TW-8 page 1 of <sup>2</sup>



ſ		n Proje	ct B180	6527	BORING	:		Т	W-9	
iations)	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo			DN: N:			70 E: 55016	0.939. See
bbrev	DRILLE	R: J. (	Chermak	METHOD: 3 1/4" HSA, Autohammer	DATE:	7/18	3/18		SCALE:	1" = 4'
nation of a	Elev. feet 830.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110		BPF	WL	MC %	Tests o	or Notes
See Descriptive Terminology sheet for explanation of abbreviations)	_		FILL	FILL: Silty Sand, fine- to medium-grained, trace organic debris, Gravel and Shale/Limestone fra brown, moist.	e igments, _ -	8				
ology she	827.4	3.0	СН	FAT CLAY, blue and gray, moist, stiff to hard. (Weathered Shale Bedrock)		16				
• Termino	— 824.4	6.0		(	_	40		26	LL=70, PL=	29, PI=41
Descriptive	— <del>024.4</del> —	0.0	SH	SHALE, gray, moist. (Decorah Shale Bedrock)	_					
(See	_ _ _ 820.4	10.0			_	*			*50 to set 2	ıı
	020.1	10.0		END OF BORING.		1				
	_			Water not observed with 10 feet of hollow-stem in the ground.	auger –	-				
	_			Boring then backfilled.	_	-				
	_			Temporary wells set with a 1" pvc and 5' screer	ı. –	-				
12:27	_			Installed on 7/18/18 to depth of 10' bgs.		-				
/22/19	_			Well dry. Let recharge overnight.	_	-				
ENT.GDT 11/22/19 12:27	_			On 7/19/18, water measured a 5.5' bgs. Groun samples collected and well sealed.	dwater –					
N_V8_CURRENT	_ 				_					
GPJ BRAU	- -				-	-				
018\06527	_				_					
PROJECTS\						-				
OJECTS\AX	_				-					
OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN	- -				-	-				
OF BORING						-				
507	D1906E27			Proun Intertoe Corporation						TW 0



			ct B180						BORING:			TW-10	
/iations)	Proiec	t Paul	AL EVALUA pi River Bo lesota						LOCATIC attached			5.575 E: 55059	00.182. See
bbre	DRILLE	R: M.	Barber		METHOD:	3	3 1/4" HSA, Aut	ohammer	DATE:	8/1	0/18	SCALE:	1" = 4'
planation of a	Elev. feet 848.7	Depth feet 0.0	Symbol	SILT	-ASTM D2488 Y SAND, fine	or le- to		erials SACE EM1110 ined, trace ro		BPF	WL	Tests or	Notes
for ex	_ 846.7	2.0	<u>17 211</u>	dark	brown, mois	t.	(Topsoil)		-				
See Descriptive Terminology sheet for explanation of abbreviations)		7.0	СН	FAT	CLAY, greer (W	n br eath	own, moist. nered Shale E	Bedrock)	- - -	5 12			
(See Desc			SH			)eco	orah Shale Be	·	- - -	21			
	_ 836.2	12.5					ne at 11 feet.		_	37			
	_				OF BORING		the 11-foot d	onth	-				
9 12:27	_			Wate		ed '		et of hollow-s	tem —				
LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27				_	ng then back		d.		- - - - - - - -				
OG OF BORIN	_								_				
_ '	B1806527			-			Droup Intor	tec Corporation				Т	W-10 page 1 of 1



	n Proje		180	6527	7			TEST PIT	<del>.</del> :		TP-1	
GEOTI Project 966 M	ECHNICA	AL EVA oi Rive	ALU <i>A</i> er Bo	ATION	I			LOCATIO	N: N:		9.530 E: 5479 ee attached ske	
DRILLE	R: Bo	lander			METHOD:	Backhoe		DATE:	7/1 <sup>-</sup>	1/18	SCALE:	1" = 4'
Elev. feet 808.4	Depth feet 0.0	AST Syml				escription of Ma STM D2488 or			BPF	WL	Tests or	Notes
808.4  807.4  807.4		l .		FILL brow  FILL Bedr BOT  Test	(AS: Silty Sand, fivel, with roots, ation and cond: Poorly Gradium-grained, Constitution of the control of the	STM D2488 or ine- to medium black, moist. (Topsoil Filuit line at 1 for ed Sand with Sand with Coravelly with Coravelly with Gravelly with Gravel, o be Shale. T PIT.	D2487) n-grained, trace II) ot. Silt, fine- to obbles, brown,	gravel,	BPF	WL	Tests or	Notes
LOG OF IEST PTI N:\dini\project\s\AA FROJECT\s\AA FROJECT\s\AA FROJECT\s\AB FROJECT												



	Braur		ct B180	6527	TEST PIT	 Г:		TP-2
	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU oi River Bo		-	N: N:		28.377 E: 548043.796. See
	DRILLE	R: Bol	ander	METHOD: Backhoe	DATE:	7/1 <sup>-</sup>	1/18	SCALE: 1" = 4'
eviations)	Elev. feet 809.6	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	Tests or Notes
obre	<u> 809.3</u> .	0.3	BIT 🚎	3 1/2 inches bituminous.				
a	<del>- 808.3</del>	1.3	AGG	1 foot aggregate base.				
nation c	807.8 -	1.8	FILL FILL	FILL: Poorly Graded Sand, fine- to medium-gratrace Gravel, brown, moist.				
(See Descriptive Terminology sheet for explanation of abbreviations)		4.0	FILL	FILL: Lean Clay, with Gravel, non to slightly or with Limestone fragments, with chemical odor, and gray, moist.  Concrete debris at 2 1/2 feet.  FILL: Silty Sand, fine- to medium-grained, with Clay inclusions, with fibers, with chemical odor, with gray, moist.	black Lean			
õ	802.6	7.0			$ \nabla $			
nji	802.1	7.0 7.5	FILL XX	FILL: Lean Clay, with fibers, gray with black, w	et.		-	
iptive Terr	_ _		FILL	FILL: Poorly Graded Sand, fine- to medium-grabrown, wet.				
escr	799.6	10.0		Bedrock either Limestone or Shale. Couldn't b	e seen			
ee [	_			\due to cave-in. BOTTOM OF TEST PIT.				
8)	_			Test pit immediately backfilled.	_			
09:47	_			Water seepage observed at 7 feet during test.	_			
11/26/15	_							
CURRENT.GDT 11/26/19 09:47	_							
	_				_			
BRAUN_V8	_				_			
- TEST PITS.GPJ	_				_			
76527 - 1	_				_			
\$\2018\(	_				_			
N:\GINT\PROJECTS\2018\06527								
CTS\AX F	_				_			
\PROJE(	_				_			
N:\GINT	_				_			
ΡΉ								
LOG OF TEST	_				_			
_	D1006E27			Proug Intertee Corporation Pleamington I	41.55400			TD 2nogo 1 of 1



ſ			ct B180					TEST PIT	<del>-</del> :		7	P-3		
	Projec 966 M	t Paul	AL EVALU pi River B iesota					LOCATIC attached			053.7	22 E:	548424.	386. See
İ	DRILLE	R: Bo	lander		METHOD:	Backhoe		DATE:	7/1	1/18		SCA	LE:	1" = 4'
viations)	Elev. feet 810.2	Depth feet 0.0	ASTM Symbol			escription of Ma STM D2488 or			BPF	WL	MC %	P200 %	Tests	or Notes
gge	809.8	0.4			hes bituminou	IS.								
aç	_ 809.1	1.1	AGG	8 inc	hes aggregate	e base.								
(See Descriptive Terminology sheet for explanation of abbreviations)	_ _ 806.2	4.0	FILL	FILL	: Clayey Sand	d, with Gravel a n concrete deb	and Cobbles, v ris, brown and	vith black, –			29		OC=9%	
eet for		1.0	FILL	FILL gray	: Clayey Sand and black, mo	d, with Gravel, pist.	non to slightly	organic,			17	43		
ninology st	- - <sub>801.7</sub>   <sub>8.5</sub>				CLAY, trace (	Gravel, green g athered Shale	gray, moist. Bedrock)							
e'	_ 004 7	0.5						_						
[e]	801.2	9.0	LS	LIME	STONE, wea	thered, tan.								
ipi				Τ\		Limestone Bed	Irock)	Π						
SSCI				ВОТ	TOM OF TES		•							
(See D	_				pit immediate	ly backfilled.		_						
1/26/19 09:47	_			vvate	er seepage no	t observed dur	ing test pit exc	cavation.						
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47	_							<u>-</u>						
BRAUN_V8_0	_							_						
ST PITS.GPJ														
\06527 - TE	- -							_						
JECTS\2018	_							_						
TS\AX PRG	_							_						
NT\PROJEC	_							_						
PIT N:\GII	_							_						
OG OF TEST	_							_						
	B1806527			-	Dro	un Intertec Corpora	tion Diagninaton N	ANI EE 120						-3 page 1 of



	Braur		ct B18	0652	7			TEST PIT	 Г:		т	P-4	
	GEOTE Projec 966 M	CHNICA t Paul	AL EVALI oi River I	JATIO	N				N: N:				799.737. See
	DRILLE		ander		METHOD:	Backhoe		DATE:	7/1:	3/18		SCALE:	1" = 4'
eviations)	Elev. feet 819.0	Depth feet 0.0	ASTM Symbol		(Α	escription of STM D2488			BPF	WL	MC %	Test	s or Notes
527 - TEST PITS.GPJ BRAUN V8_CURRENT.GDT 11/26/19 09:47 (See Descriptive Terminology sheet for explanation of abbreviations)	819.0  818.7  818.0  817.5  817.0   815.0   -  811.0  -  -  -  -  -  -  -  -  -  -  -  -  -	0.0	Symbol	8 inn OR(  SIL <sup>-</sup> Cob  FAT  WE.  BOT  Tes:	(A 2 inches bitur ches aggrega GANIC CLAY (Swar TY SAND, fine bles and Lime CLAY, little ( (We ATHERED SI (D s weathered, TTOM OF TE	ASTM D2488 minous. te base. with Gravel, mp Deposit/Be-to medium- estone fragm (Terrace De Gravel, gray weathered Sha HALE, gray welecorah Shale gray at 7 feet ST PIT. ely backfilled	or D2487)  black, moist. curied Topsoil) -grained, Gravell ents, brown, moise eposit) with brown, moist ale Bedrock) with brown, moist. Bedrock)	st	BPF	WL		OC=9%	=30, PI=37
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527								- - - -					



	Braur		ct B18	6527	1	TEST PIT	<del>-</del> :		Т	P-5	
	GEOTE	CHNICA	AL EVALU		ŀ			1458		25 E: 54894	8.709. See
	Project 966 M		ni River F	oulevard S		attached	sketch.				
		ıl, Minn		Juic varu 3							
	DRILLE	R: Bol	lander	METHOD: Backhoe		DATE:	7/1:	3/18		SCALE:	1" = 4'
abbreviations)	Elev. feet 821.1	Depth feet 0.0	ASTM Symbol	Description (ASTM D248			BPF	WL	MC %	Tests	or Notes
bre	820.8	0.3	BIT	√4 inches bituminous.	•						
of ak	<u> 820.3</u> 819.3	0.8	AGG/	√5 inches aggregate base.		A					
ıtion (	_	1.8	OL	ORGANIC CLAY, trace fiber (Swamp Deposit		A			31	OC=9%	
(See Descriptive Terminology sheet for explanation of	818.3 	2.8	CH	SILTY SAND, fine- to mediu Cobbles and Limestone frag (Terrace	ments, brown, mois	y, with st.					
et fo				FAT CLAY, little Gravel, trac	e Limestone fragm	ents,			21	LL=58, PL=	:23, PI=35
yy she	_			gray with brown, moist. (Weathered S	nale Bedrock)						
minolog	_					_					
ve Teri	_					-		ĮΨ			
scripti		10.0		Waterbearing Sand seam at	9 feet.			<u> </u>			
e De	_		SH	SHALE, gray, moist. (Decorah Sha	ale Bedrock)	_					
(Se	809.1	12.0				_					
	_			BOTTOM OF TEST PIT.							
09:47				Test pit immediately backfille	ed.						
.CURRENT.GDT 11/26/19 09:47	_			Water seepage observed at excavation.	9 feet during test p	it _					
T.GDT	_					-					
CURRE	_										
BRAUN_V8	_										
- TEST PITS.GPJ	_					-					
527 - TE	_					-					
2018\06	_										
JECTS											
N:\GINT\PROJECTS\AX PROJECTS\2018\06527	_					_					
OJECTS	_					-					
SINT\PR	_					-					
PIT N:\G	_					-					
OF TEST P											
LOG OF	P1906E27				orneration Pleamington N						TD 5 page 1 of 1



	n Proje		0652	7		TEST PIT	-:			TP-6	
GEOT Proje 966 N	ECHNICA ct Paul lississipp ul, Minn	AL EVALI oi River	JATIO	N			N: N:				3.752. See
DRILLI	ER: Bol	ander		METHOD: Backhoe		DATE:	7/1:	3/18		SCALE:	1" = 4'
(supplied to see the second se	Depth feet 0.0	ASTM Symbol		Description (ASTM D248			BPF	WL	MC %	Tests	or Notes
820.5	0.3	BIT	4 in	ches bituminous.							
de   819.8   817.8   817.8	3.0	AGG	OR	ches aggregate base. GANIC CLAY, trace fiber ck, moist. (Swamp Deposit		avel,			23	OC=6%	
816.8 ————————————————————————————————————	4.0	SP CH	→ Gra	ORLY GRADED SAND, velly, trace Cobbles and wn, wet. (Terrace	Limestone fragmer				16	LL=60, PL=	=25, PI=35
- 813.8	7.0		Cok	CLAY, little Gravel, trace obles and Boulders, gray (Weathered S	ce Limestone fragm with brown, moist. hale Bedrock)						
See Descriptive Terminology sheet for explanation of abbreviations)    See Descriptive Terminology sheet for explanation of abbreviations		SH	SH/ moi	ALE, trace Cobbles and I st. (Decorah Sh		brown,					
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47	13.0		Tes	TTOM OF TEST PIT. It pit immediately backfille ter seepage not observe		cavation					



		n Proje		306	<b>6527</b>	TEST PIT	 Г:		7	P-7	
	GEOTE Projec 966 M	CHNICA t Paul	AL EVAL oi River	.UA			N: N:			72 E: 54935	0.276. See
	DRILLE	R: Bol	ander		METHOD: Backhoe	DATE:	7/1:	3/18		SCALE:	1" = 4'
abbreviations)	Elev. feet 829.3	Depth feet 0.0	ASTM Symbo	- 1	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	Tests	or Notes
bbre	<u> 829.0</u> ∕		BIT	ःश	4 inches bituminous.						
of a	<u>     828.5</u> / 827.5	0.8 <i>/</i> 1.8	AGG L	$\exists$	\6 inches aggregate base.	F					
ion	_		OL _	7	ORGANIC CLAY, with fibers, black, moist. (Swamp Deposit/Buried Topsoil)	F			35	OC=25%	
anat	826.5 -	2.8	SP		SANDY LEAN CLAY, with Limestone fragments	 s, trace			25		
yple	825.5	3.8			Cobbles, gray with brown, moist.				11		
for 6	⊂ 825.3	4.0	\ / <del></del>	Ħ	(Glacial Till) POORLY GRADED SAND, fine- to medium-gra	ninod T					
eet			SH		Gravelly, with Cobbles, brown, moist.	allieu,			31		
y sh	_				(Terrace Deposit)						
ologi					3 inch layer of Weathered Limestone.						
minc	_				SHALE, gray with brown, moist. (Decorah Shale Bedrock)	_					
Teri	821.3	8.0		=	Less fractured from 6 to 8 feet.	$\mathcal{I}$					
tive	_				BOTTOM OF TEST PIT.						
scrip					Test pit immediately backfilled.						
(See Descriptive Terminology sheet for explanation of					Water seepage not observed during test pit exc	cavation					
(Se	_				vide occpage not observed during tool pit oxe						
	_					_					
39:47	_					_					
26/19	_					_					
T 11/2											
NT.GD	_					_					
CURRENT.GDT 11/26/19 09:47	_					_					
BRAUN_V8_	_					_					
J BRAL	_					_					
ITS.GPJ											
- TEST PITS.											
5527 - "	_					_					
PROJECTS\2018\06527	_										
ECTS\2	_					_					
K PROJ											
N:\GINT\PROJECTS\AX											
PROJE											
\GINT\											
PIT N:	_										
TEST											
G OF	_					_					
2	D1906E37				Proug Intertoe Corporation Planmington N			1		1	TD 7 page 1 of 1



Γ	Braur	n Proje	ct B	180	6527	7		TEST PIT	·:		TP-8	
	Projec 966 M	CHNICA t Paul ississip <sub>l</sub> ul, Minn	oi Rivo	er Bo				LOCATIC attached			).507 E: 54962	28.585. See
	DRILLE	R: Bo	lander			METHOD: Backhoe		DATE:	7/1:	3/18	SCALE:	1" = 4'
eviations)	Elev. feet 851.3	Depth feet 0.0	AST Sym			Description of Mat (ASTM D2488 or D			BPF	WL	Tests or	Notes
bbre	850.9	0.4	BIT	ૢૢૢૢૢ૽ૢૢ૽૽ૢૢૢ		hes bituminous.						
J a	- 850.3 849.8	1.0_ 1.5_	AGG			thes aggregate base.						
(See Descriptive Terminology sheet for explanation of abbreviations)	- - - 846.3	5.0	FILL CH		brow Burie FAT with	: Silty Sand, fine- to medium- /n, moist. ed pvc pipe with electrical line CLAY, with fractured Limesto brown, moist. (Weathered Shale B	s at 1 1/2 fee ne fragments	t				
logy she	- 044 2	7.0	SH		SHA	LE, gray, moist. (Decorah Shale Be	edrock)	_				
min_	844.3	7.0			ВОТ	TOM OF TEST PIT.						
ive Teri	-				Test	pit immediately backfilled.						
CURRENT.GDT 11/26/19 09:47 (See Descri					wate	er seepage not observed durii	ig test þit ext					
TEST PITS.GPJ BRAUN_V8_CUR	-							- - 				
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_	- - - - -							- - - - -				
ãГ	1806527					Braun Intertec Corporati	on Planmington M	AN 55439				TP-8 page 1 of 1



ſ			ct B180			TEST PIT	:		TP-9
	Projec 966 M	t Paul		ATION oulevard S	-	LOCATIC attached			16.527 E: 549938.771. See
	DRILLE	R: Bol	lander	METHOD: Backhoe		DATE:	7/1:	2/18	SCALE: 1" = 4'
(See Descriptive Terminology sheet for explanation of abbreviations)	Elev. feet 853.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)			BPF	WL	Tests or Notes
bbre	<u>    853.5</u> ∕	0.3	BIT						
of al	<u> 852.5</u>	1.3	AGG	1 foot aggregate base.					
ő	851.9	1.9	, <del>, , , , , , , , , , , , , , , , , , </del>	FILL: Poorly Graded Sand with Silt, fine- medium-grained, brown, moist.	to	A			
nati			SH	SHALE, gray, moist.		/			
pla	_			(Decorah Shale Bedrock)					
ê	_			, , , , , , , , , , , , , , , , , , ,		-			
뮕									
she(									
g	-					-			
일	_								
Ē				Not as fractured, harder at 7 feet.					
<u>–</u>	-					-		$  \overline{\Delta}  $	
tive	844.8	9.0		DOTTOM OF TEST BIT					
crip				BOTTOM OF TEST PIT.					
ee Des	_			Test pit immediately backfilled.		_			
S	_			Water seepage observed at 8 feet during excavation.	test p	it _			
09:47	_								
1/26/19	_								
GDT 1	_					_			
URRENT	_					-			
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47	_					-			
PJ BRAU						_			
TS.G									
ST P	_								
7 - TE	-					$\dashv$			
652.	_								
18/0									
s\20	-					-			
JECT									
PRO									
S/AX	_								
JECT	_					-			
PRO									
Į.	_					٦			
N:\G	-					$\dashv$			
ΡΗ									
TEST									
. PF	-					$\dashv$			
50									



			ct B180			TEST PIT	T:		TP-10	
	Projec 966 M	t Paul		ATION pulevard S		LOCATIC attached	N: N: sketch	145312	2.595 E: 54993	30.929. See
	DRILLE	R: Bo	lander	METHOD: Backhoe		DATE:	7/1	2/18	SCALE:	1" = 4'
viations)	Elev. feet 846.8	Depth feet 0.0	ASTM Symbol	Description of (ASTM D248			BPF	WL	Tests or	Notes
ppre	846.4	0.4		5 inches bituminous.						
fak	<del>-</del> 845.5	1.3		10 inches aggregate base.		_				
tion c	844.8	2.0	FILL CH	FILL: Silty Sand, fine- to me brown, moist.	dium-grained, with	Gravel,				
or explanat	843.8 	3.0	SH	FAT CLAY, with Limestone f moist.  (Weathered St	nale Bedrock)					
gy sheet fo	_			SHALE, with Limestone frag brown, moist. (Decorah Sha	_	ay with				
(See Descriptive Terminology sheet for explanation of abbreviations)	- -			Gray, harder at 8 feet.		- -		Ā		
(See Descr										
∞	833.8	13.0		DOTTOM OF TEST DIT		_				
26/19 09:4	_			BOTTOM OF TEST PIT.  Test pit immediately backfille	ed.	_				
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48	_			Water seepage observed at excavation.	7 feet during test p	it				
J_V8_CURRE	_ _					_				
GPJ BRAUN										
' - TEST PITS	_ _					- -				
2018\06527	_					_				
PROJECTS\	_									
OJECTS\AX	_ _					-				
V:\GINT\PR	_ _					- -				
F TEST PIT 1										
100 01	B1806527			Proup Intertoe C	orporation, Bloomington N	AN 55439				ΓΡ-10 page 1 of <sup>2</sup>



ſ	Braur	n Proje		180	6527	,	TEST PIT	·:		Т	P-11			
	GEOTE Projec 966 M	CHNICA	AL EV pi Riv	ALUA er Bo	ATION	I			LOCATIC attached					00.706. See
	DRILLE	R: Bo	lander			METHOD:	Backhoe		DATE:	7/12	2/18		SCALE:	1" = 4'
viations)	Elev. feet 832.0	Depth feet 0.0	AS <sup>-</sup> Sym	nbol			escription of Ma STM D2488 or			BPF	WL	MC %	Tests	or Notes
	831.3	0.7	CONC				reinforced slab	on grade.						
(see Descriptive Terminology sheet for explanation of abbreviations)	830.3 - - 828.0	4.0	AGG CH SH		FAT mois	t. (We LE, trace frac t.	fractured Limes eathered Shale c ctured Limeston ecorah Shale B	Bedrock) e, gray with br	_			26	LL=63, PL:	=29, PI=34
gy sr	<sup>-</sup> 825.5	6.5				(D	ecorari Sriale b	ediock)	_					
	825.0	7.0	LS	戸	LIME	STONE.	/Limostona Dad	lrook)	Т					
	_				BOT	TOM OF TES	(Limestone Bed ST PIT.	ilock)						
iptive	_				Test	pit immediate	ely backfilled.		_					
Descr					Wate	er seepage no	ot observed dur	ing test pit exc	cavation.					
See	_								_					
ľ	_								_					
9 09:48	_								_					
CURRENT.GDT 11/26/19 09:48														
GDT 1:	_								_					
RRENT.	_								_					
!	_								_					
RAUN.	_								_					
S.GPJ E														
EST PIT	_								_					
527 - TI	-								_					
018/06	_								_					
ECTS\2	_								_					
X PROJI														
ECTS\A.														
PROJE	_								_					
:\GINT	_								_					
T PIT N														
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8	_								_					
⊒ L	D1006E37						aun Intertee Cornera					l		TD 11 naga 1 of 1



	n Proje	ct B180	6527	TEST PIT: TP-12					
GEOT Projec 966 M	ECHNICA	AL EVALU <i>i</i> oi River Bo		LOCATIO	N: N:	1448 outh (	346.2	71 E:	549972.225. ss. See attached
DRILLE	ER: Bo	lander	METHOD: Backhoe	DATE:	7/1:	2/18		SCA	LE: <b>1" = 4</b> '
Seving Elev. feet 831.6		ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	P200 %	Tests or Notes
BRAUN_V8_CURRENT.GDT 11/26/19 09:48       (See Descriptive Terminology sheet for explanation of abbreviat         1	0.0				BPF	VL			Tests or Notes  LL=66, PL=29, Pl=37
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ									



Brau		ct B180	6527	TEST PIT	T:		Т	P-13	
Projec 966 M	t Paul		ATION pulevard S	LOCATIO attached					97.590. See
DRILLE	R: Bo	lander	METHOD: Backhoe	DATE:	7/12	2/18		SCALE:	1" = 4'
Skignonia (School School Schoo	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	Tests	or Notes
				, moist	BPF	VL		LL=67, PL	
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_C			Prove Interted Corporation, Planmington N	- - - - - - -					



ſ		n Proje		180	6527	1	TEST PIT	·		Т	P-14				
	GEOTE Projec 966 M	CHNICA	AL EV	ALU <i>A</i> er Bo	AOITA	I			LOCATIC Offset 50	N: N:		205.6	07 E: 5	549372.0	
ĺ	DRILLE	R: Bol	lander			METHOD:	Backhoe		DATE:	7/12	2/18		SCAL	.E:	1" = 4'
viations)	Elev. feet 813.6	Depth feet 0.0	AST Sym			(AS	escription of Ma STM D2488 or	D2487)		BPF	WL	MC %	P200 %	Tests	or Notes
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48 (See Descriptive Terminology sheet for explanation of abbreviations)	feet	feet	l .		FILL: medi brow Cond Appr FAT BOT Test	(As: Clayey Sandtly organic, dated the control of t	STM D2488 or d, with Gravel, ark brown, mois led Sand with Swith Gravel and broximately 12 1 arch layer of bitu Gravel, gray with athered Shale left.	D2487) trace Cobbles st.  Silt, fine- to Lean Clay inc  1/2 x 50 feet at  uminous at 7 fe th brown, mois Bedrock)	clusions, _ t 4 feet eet st	BPF	WL			Tests	or Notes
N:\GINT\PROJECTS\AX PROJEC									- - - -						
LOG OF TEST PIT					tion Planmington N							4 page 1 of (			



Brau		ct B180	6527				TEST PIT	:		Т	P-15		
Project 966 M	t Paul	AL EVALUA oi River Bo esota		d S			LOCATIC attached					55.977. See	
DRILLE	R: Bo	lander	M	METHOD:	Backhoe		DATE:	7/12	2/18		SCALE:	1" = 4'	
Elev. feet 813.7	Depth feet 0.0	ASTM Symbol		(AS	escription of Ma	D2487)		BPF	WL	MC %	Tests	or Notes	
of approximation of	3.0	FILL		n-grained, w	ed Sand with S vith Gravel, trad		nd steel _ _						
reminology sneet for explicit		CH	FAT CL	AY, trace r (Wea	oots, gray with athered Shale I	brown, moist. Bedrock)	- - -			24	LL=60, PL=	=24, PI=36	
804.7 809 — — — — — — — — — — — — — — — — — — —	9.0	SH	SHALE	, gray, mois (De	st. corah Shale B	edrock)							
801.7	12.0	=	вотто	OM OF TES	T PIT.		_						
- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1			Test pit	Fest pit immediately backfilled.									
CURRENT.GDT 11/26/19 09:48			Water s	seepage no	t observed dur	ing test pit exc	cavation.						
RENT.GDT							_						
							_						
GPJ BKAU													
							-						
018/06527							_						
ROJECTS/2													
JECTS/AX P							-						
:\GINT\PRC							_						
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8													
D1806537					un Intertee Cornere		_					FD 15 _ page 1 of 1	



Braun	Proje	ct B180	6527	1	TEST	PIT	:		Т	P-16	<del></del>	
Project	Paul sissipp	AL EVALUA Di River Bo esota					N: N: ketch.					.661. See
DRILLER	R: Bol	ander		METHOD: Backhoe	DATE	Ξ:	7/10	)/18		SCAL	.E:	1" = 4'
Elev. I feet 811.3	Depth feet 0.0	ASTM Symbol		Description of Materials (ASTM D2488 or D2487)			BPF	WL	MC %	P200 %	Tests	s or Notes
Elec or 153 PH N: Glant PROJECTS/AX PROJ	8.0	FILL	FILL Clay  Mois  FILL Lime  Trac  Refubuck BOT  Test  Wate	: Gravel, with Sand (road cover).  : Silty Sand, fine- to medium-grained, with nodules and clay pipe fragments, brown at to wet at 6 feet.  : Sandy Lean Clay, with Gravel, Shale a stone fragments, gray and brown mottle e concrete and asphalt chunks at 10 feet as all on concrete in place at 12 feet, chuntet, scrapping test pit bottom.  TOM OF TEST PIT.  pit immediately backfilled.  er seepage observed at 6 feet during test vation.	and d, moist. t.			$ar{ar{ abla}}$	20	15		



Braun Pr	oject B180	6527	TEST PIT	Γ:		TP-17	
GEOTECHI Project Pa	NICAL EVALU ul ssippi River B	ATION		N: N:		3.804 E: 549652	2.475. See
DRILLER:	Bolander	METHOD: Backhoe	DATE:	7/1:	3/18	SCALE:	1" = 4'
Elev. De feet fe	oth et ASTM 0.0 Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	Tests or N	lotes
planatic	2.0 SH 4.0	FILL: Silty Sand, fine- to medium-grained, littl brown, moist.  Pieces of bituminous and occasional layers of aggregate base, pvc pipe with a piece of lumb at 2 feet.  SHALE, gray, moist.  (Decorah Shale Bedrock)  BOTTOM OF TEST PIT.  Test pit immediately backfilled.  Water seepage not observed during test pit experiments of the piece of lumb at 2 feet.  Water seepage not observed during test pit experiments of the piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and provided the piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and provided the piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and Piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and Piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and Piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and Piece of lumb at 2 feet.  Brown latertes Generation, Bloomington and Piece of lumb at 2 feet.  Brown latertes Generation and Piece of lumb at 2 feet.  Brown latertes Generation and Piece of lumb at 2 feet.  Brown latertes Generation and Piece of lumb at 2 feet.	er above				247. 2000 4 of



GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota		TION: I		436 2			
			:h.	+00.Z	50 E:	548539	0.369. See
DRILLER: Bolander METHOD: Backhoe	DATE	: 7	/11/18		SCA	LE:	1" = 4'
Elev. Depth feet feet ASTM Description of Mater 811.3 0.0 Symbol (ASTM D2488 or D2	487)	BP	= WL	MC %	P200 %	Tests	s or Notes
FILL: Silty Sand, fine- to medium-graph to be supposed by the composition of the composit	nd concrete, with	,		13	34	OC=3%	6
Elev   feet   feet   811.3   0.0   Symbol   (ASTM D2488 or D2				26		LL=72, PI=50	PL=22,
799.3 12.0 (Decorah Shale Bed	ock)						
BOTTOM OF TEST PIT.  Test pit immediately backfilled.  Water seepage observed at 9 feet of excavation.	uring test pit						



	Braur		ct B180	6527	TEST PIT	 Г:		Т	P-19	)
	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU <i>i</i> oi River Bo		<u> </u>	N: N:				548262.134. See
	DRILLE	R: Bol	ander	METHOD: Backhoe	DATE:	7/1	1/18		SCAL	.E: <b>1" = 4'</b>
viations)	Elev. feet 812.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	P200 %	Tests or Notes
ation of abbre	_		FILL	FILL: Silty Sand, fine- to medium-grained, with trace brick, concrete and broken clay pipe, broblack, and dark brown, moist.	n Gravel, wn, _ _			11	27	
CURRENT.GDT 11/26/19 09:48 (See Descriptive Terminology sheet for explanation of abbreviations)		7.0	SH	CLAYEY SAND, trace Gravel and Shale fragm gray and brown mottled, moist.  (Glacial Till)  SHALE, trace Gravel, gray, wet. (Decorah Shale Bedrock)  BOTTOM OF TEST PIT.  Test pit immediately backfilled.  Water seepage not observed during test pit exceptions.	- - - - - -			15		
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT				Braun Intertec Corporation, Bloomington						TP-19 page 1 of 1



		n Proje	ct B180	6527	TEST PIT	-:		Т	P-20	
	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU		LOCATIO	N: N:		558.40	05 E: 54835 e. See attac	
	DRILLE	R: Bol	lander	METHOD: Backhoe	DATE:	7/10	0/18		SCALE:	1" = 4'
eviations)	Elev. feet 812.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	Tests	or Notes
nation of abbre	811.8 _ _ _ _ 809.3	3.0	FILL FILL	FILL: Gravel (road cover), trace Sand and Silt.  FILL: Poorly Graded Sand, fine- to coarse-grain with Gravel, trace Clay and construction debris (concrete and rebar).	ned, –					
for explai		5.0	FILL	FILL: Poorly Graded Sand with Silt, with Grave Clay, brown, moist.	I, trace					
(See Descriptive Terminology sheet for explanation of abbreviations)	806.3	6.0	CL SC	LEAN CLAY, slightly organic, with Sand and Gr (Buried Topsoil) CLAYEY SAND, fine- to medium-grained, with 0 grayish brown, moist. (Glacial Till)				17	OC=3%	
e Descriptiv	- 802.3	10.0	SH	SHALE, trace Gravel, gray, moist. (Decorah Shale Bedrock)						
PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 11:24 (See	- 800.3 	12.0		Refusal on Limestone Bedrock at 12 feet. BOTTOM OF TEST PIT. Test pit immediately backfilled. Water seepage not observed during test pit exc						
LOG OF TEST PI	_				_					



		n Proje	ct B180	6527	TEST PIT	 Г:		Т	P-21	
	GEOTE Projec 966 M	CHNICA t Paul	AL EVALU oi River Bo			N: N:				548696.040. See
	DRILLE	R: Bol	ander	METHOD: Backhoe	DATE:	7/1	0/18		SCAL	.E: <b>1" = 4'</b>
viations)	Elev. feet 812.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	P200 %	Tests or Notes
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48 (See Descriptive Terminology sheet for explanation of abbreviations)	feet	feet			ace	BPF	WL			Tests or Notes
LOG OF TEST PIT N	  B1806527			Braun Intertec Corporation, Bloomington						TP-21 page 1 of



	n Proje		180	6527		TEST PI	Γ:		TP-22	
Projec 966 M		oi Riv	er Bo	ATION oulevard S		LOCATIC attached			71.358 E: 54797	75.706. See
DRILLE	R: Bol	lander		METHOD: Backhoe		DATE:	7/1	1/18	SCALE:	1" = 4'
Elev. feet 811.3	Depth feet 0.0	AS <sup>-</sup> Sym		Description of Materials (ASTM D2488 or D2487) FILL: Silty Sand, fine- to medium-grained	trac	re.	BPF	WL	Tests or	Notes
Elev. feet 811.3	3.0	1122		Gravel, with roots, black, moist. (Topsoil)	, trao	- -				
806.3	5.0	SM		SILTY SAND, fine- to medium-grained, wi Cobbles, brown, moist. (Glacial Till)		_				
		SC		CLAYEY SAND, trace Gravel, brown and moist.  (Glacial Till)	gray	mottled, -				
802.3	9.0			With wet Sand seam, Limestone and Shal \at 9 feet. BOTTOM OF TEST PIT.	e fra	gments		Ā		
				Test pit then backfilled.  Water seepage observed at 9 feet during	test r	-				
				excavation.		- -				
						_ _ _				
						<u> </u>				
						_				
						- -				
						_				
P1806E37				Proun Intertee Corneration, Please		_				ID 22 page 1 of



Į	Braur	n Proje	ct B	180	6527	•			TEST PI	Г:		Т	P-23		
	GEOTE Projec 966 M	CHNICA t Paul ississipp	AL EV	ALU <i>A</i> er Bo	ATION	I			LOCATION Offset 8 f	DN: N:		306.6	01 E: 5	548423.0	
	DRILLE	R: Bol	ander			METHOD:	Backhoe		DATE:	7/10	0/18		SCAL	E:	1" = 4'
eviations)	Elev. feet 811.9	Depth feet 0.0				(AS	escription of Ma STM D2488 or	D2487)		BPF	WL	MC %	P200 %	Tests	or Notes
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48 (See Descriptive Terminology sheet for explanation of abbreviations)		Paul ssissippi River Bould, Minnesota R: Bolander  Depth feet ASTM 0.0 Symbol FILL Find b  8.0 SM SC C			FILL: medi brow	(AS: Gravel, with: Poorly Gradum-grained, vin, moist.)  Il debris at 7 for Y SAND, fine, light brown.  CLAY, with G (We.)  TOM OF TES pit then backt	STM D2488 or Sand (road co led Sand with Swith Gravel, trade (Glacial Till Gravel, green grathered Shale)	D2487)  over).  Silt, fine- to ce Cobbles and from 7 to 8 ained, with Grant and Gran	s feet.		⊻			16313	
OG OF TEST PIT N:\GINT\									- - -						



ſ		n Proje		306	527	$\top$	TEST PI	 Γ:		Т	P-24	
	Projec 966 M		oi River		TION ulevard S		LOCATIC attached				90 E: 54878	86.486. See
Į	DRILLE	R: Bol	ander		METHOD: Backhoe		DATE:	7/10	0/18		SCALE:	1" = 4'
eviations)	Elev. feet 809.7	Depth feet 0.0	ASTM Symbo	ol	Description of Materials (ASTM D2488 or D2487)			BPF	WL	MC %	Tests	or Notes
On or abbi	- 807.7	2.0	FILL		FILL: Poorly Graded Sand with Silt, with Gra Cobbles, concrete debris and Clay, brown, m	noist						
anan	806.7	3.0	FILL	$\otimes$	FILL: Lean Clay, organic, dark brown to blac		_					
et ror expi	- 804.7	5.0	FILL		FILL: Lean Clay with Sand, with Gravel, gray stiff. Perched water from 3 1/2 to 4 feet, east side Gravel.	-	_			18		
(see Descriptive Terminology sneet for explanation of abbreviations)	-		СН		FAT CLAY with SAND, with Gravel, greenish (Weathered Shale Bedrock)	n gra	ay, stiff					
<u>.</u>	801.7	8.0			BOTTOM OF TEST PIT.							
scripuve	_				Test pit then backfilled.		_					
See De	_				Water seepage observed at 3 1/2 feet during excavation.	g tes	t pit –					
ľ	_						_					
CURRENT.GDT 11/26/19 09:48	_						_					
ENI.GDI	_						_					
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טיאום נאטיט												
./ - 1531 -/	_						_					
> CUU) OT U2/	_						_					
A PROJECTS												
PROJECTS (F	_						_					
LOG OF IEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\U6527 - TEST PITS.GPJ BRAUN_V8	_						_					
י וכטו ירט פ	_						_					



		n Proje									TEST PI	Τ:		Т	P-25	
	Projec 966 M	CHNICA t Paul ississipp ul, Minn	oi Riv	er Bo							LOCATIO attached			730.7	60 E: 5490	75.079. See
	DRILLE	R: Bol	lander			METHO	D:	Backhoe			DATE:	7/1	0/18		SCALE:	1" = 4'
eviations)	Elev. feet 810.1	Depth feet 0.0	AST Sym		- Eur		(AS	escription of	8 or D248	87)		BPF	WL	MC %	Test	s or Notes
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48 (See Descriptive Terminology sheet for explanation of abbreviations)					Shall bedde BOT	um-graine el, brown, N CLAY, tr ( e Bedrock ed. TOM OF	(AS) raded, we more acceptions acceptions acceptions.	STM D248 led Sand with roots, oist. e Gravel ar athered Sh	e8 or D24k vith Silt, fi concrete, and Sand, hale Bedr highly fra	ne- to rock, and gray and ock)	brown.	BPF				=18, PI=23
OG OF TEST F	_															



ſ		Proje		80	6527	•			TEST PIT	·		Т	P-26		
	GEOTE Project 966 M	CHNICA	AL EVAI oi River	LUA	ATION	I			LOCATIC attached						769. See
	DRILLE	R: Bol	lander			METHOD:	Backhoe		DATE:	7/10	0/18		SCAL	.E:	1" = 4'
eviations)	Elev. feet 807.8	Depth feet 0.0	ASTN Symbo			(A)	escription of M STM D2488 or	D2487)		BPF	WL	MC %	P200 %	Tests	or Notes
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 11:24 (See Descriptive Terminology sheet for explanation of abbreviations)	804.8	3.0 4.0 6.0	CL CH		LEAN mois FAT mottl Lime brow BOT	N CLAY, trace t. (Burier CLAY, trace ed, moist. (We estone, crystal in. TOM OF TES	e Sand and org d Topsoil/Swar Gravel and Sa eathered Shale lline, medium h	nd, gray and bi	own,  rown  J			13	43		



ſ	· ·	n Proje		180	6527	7			TEST PIT	 Г:		Т	P-27	
	GEOTE	CHNICA							LOCATIO	N: N:				00.987. See
		ississip			oulev	ard S			attached	sketch				
ŀ		ul, Minn		<b>a</b>		==								
إ	DRILLE Elev.	R: Bo	lander			METHOD:	Backhoe		DATE:	7/1	0/18		SCALE:	1" = 4'
eviations	feet 810.1	feet 0.0	AS1 Sym			(A	escription of M STM D2488 or	D2487)		BPF	WL		Tests or	Notes
_V8_CURRENT.GDT 11/26/19 09:48 (See Descriptive Terminology sheet for explanation of abbreviations)			I		FILL LEA fragr FAT stiff to BOT Test Water	(A : Poorly Grace ium-grained, visit from old utilities, brown and : Crushed co N CLAY with ments, gray and CLAY, with Coto very stiff. (Weinstein Company)  TOM OF TES	STM D2488 or ded Sand with Swith Gravel, traditity at 2 feet, so d dark brown, reportere.  SAND, with Grand brown mottle (Glacial Till Gravel and some eathered Shale)	D2487) Silt, fine- to ce Clay and roome Cobbles a moist.  avel and Limes ed. I) e Sand, greeni Bedrock)	nd Clay  stone  - ish gray,		Ţ	Per		ge in concrete
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_							our Intortee Corpore		- - - - - - - - -					TD 37 page 1 of 4



Braui	n Proje	ct B180	6527	,		TEST PIT	:		Т	P-28		
Projec 966 M	t Paul	AL EVALU oi River Bo esota				LOCATIO attached						)47. See
DRILLE	R: Bol	ander		METHOD: Backhoo	9	DATE:	7/10	)/18		SCAL	E:	1" = 4'
Elev. feet 810.3	Depth feet 0.0	ASTM Symbol		(ASTM D24	of Materials 88 or D2487)		BPF	WL	MC %	P200 %	Tests	or Notes
Coc Of Test PII in:\daily Project Syx Pr	8.0	SM	SILT Clay  LEA fragr Clay  Lime BOT Test	N CLAY with SAND, tra nents, Limestone chun or on top of Clay, gray	fragments and bitum um-grained, with Gra cial Till) ace Gravel and Shal iks up to 1 to 2 incher or, moist. cial Till)	avel and			14	20		



٢		Proje		180	6527	,			TEST PIT	·:		TP-29	
	Projec 966 M	CHNICA t Paul ississipp il, Minn	oi Riv	er Bo					LOCATIC attached			07.595 E: 54917	79.409. See
	DRILLE	R: Bol	lander			METHOD:	Backhoe		DATE:	7/1	1/18	SCALE:	1" = 4'
reviations)	Elev. feet 810.2	Depth feet 0.0	AS <sup>-</sup> Sym		FILL	(A	escription of M STM D2488 or	D2487)		BPF	WL	Tests or	Notes
(See Descriptive Terminology sheet for explanation of abbreviations)	-	0.0	FILL		Grav	el, irrigation l	fine- to mediun ine at 1 foot, bl (Topsoil)	ack.	e - -				
For expiaira	807.4 - -	2.8	SM	***		Y SAND, fine	e- to medium-gr ist. (Terrace Dep		at –				
ogy sneet r	805.2	5.0	СН		FAT	CLAY, trace (We	Gravel, gray ar eathered Shale	nd brown, mois Bedrock)	st				
ĕ  -	803.2	7.0			\ \Lime	stone Bedroo	ck at 7 feet.		7				
-   E	-				ВОТ	TOM OF TES	ST PIT.						
otive -	-				Test	pit then back	filled.		_				
e Descri					Wate	er seepage no	ot observed du	ring test pit exc	cavatio <del>n.</del>				
<u>,</u>	-								_				
CURRENT.GDT 11/26/19 09:48	-								_				
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7 - IESI PIIS	-								- -				
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N:\GINI	-								_				
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Br	aun	Proje	ct B	180	6527	,			TEST PI	T:		Т	P-30	)	
96	oject 6 Mi	CHNICA Paul ssissipp I, Minn	oi Riv	er Bo					LOCATI Offset 24			199.5	48 E:	549084	
DR	ILLEF	R: Bol	lander			METHOD:	Backhoe		DATE:	7/1	1/18		SCAL	.E:	1" = 4'
Sylations) fee 81		Depth feet 0.0	AST Sym			(A	escription of Ma STM D2488 or	D2487)		BPF	WL	MC %	P200 %	Tests	or Notes
explanation of abore	08.7	1.7	SC		CLA'	YEY SAND, v	fine- to medium (Topsoil) with Gravel, Cob Boulders, brown (Terrace Depo	obles and Lime to light brown	estone -	-		20	40		
9 sneet 10 - 80	5.4	5.0	SC			YEY SAND, v , moist.	with Limestone f	ragments, bro	wn and						
60 80	3.4	7.0					(Glacial Till	•			$ \nabla$				
See Descriptive reminionally sneet for expandations   See Descriptive reminionally sneet for expanda	02.4	8.0	SM		BOT Test	n. TOM OF TES pit then back		)		-					
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\05527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48															
06 Or -									-						



	un Proje		06527	7		TEST PIT	<del>.</del>		т	P-31	
GEO	TECHNICA					LOCATIO	N: N:				548943.815. See
	ect Paul Mississipp	oi River I	Boulev	ard S		attached	sketch.				
	aul, Minn			T							
DRILI	_	lander		METHOD: Backhoe		DATE:	7/10	0/18		SCAL	.E: <b>1" = 4'</b>
Elev. feet   6   6   6   6   6   6   6   6   6	feet	ASTM Symbol		Description of Mater (ASTM D2488 or D2-	487)		BPF	WL	MC %	P200 %	Tests or Notes
	2 1.2	FILL		<ul> <li>Silty Sand, fine- to medium-gr vel, black.</li> </ul>	ained, trac	e _					
o		SM	Irrig	(Topsoil) ation pipe at 14 inches.					10	20	
  -  -				ΓΥ SAND, fine- to medium-grain tured Limestone pieces, dark bro					12	36	
805.	9 4.5		mois			_					
		SP- SM		ORLY GRADED SAND with SILT lium-grained, with Gravel and fra	Γ, fine- to	estone					
ਲੋਂ <u>804.</u> ਨੇਰਿ	4 6.0		piec	es, brown, moist. (Terrace Deposit		T					
			ВОТ	TTOM OF TEST PIT.	)						
<u> </u>			Test	t pit then backfilled.		_					
<u>}</u>			Wat	er seepage not observed during	test pit exc	cavation.					
)  -						_					
CURRENT.GDT 11/26/19 09:48						_					
1/26/1											
- GDT 1						_					
- RRENT						_					
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- PROJE											
-\GINT						-					
LOG OF TEST PIT N:\din\T\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8						-					
D1806E3				Proup Intertee Corporation							TD 21page 1 of



GEOT	n Proje ECHNICA				ON: N:		109.0	<b>P-32</b> 31 E: 55003	
966 M	t Paul lississip <sub>l</sub> ul, Minn		oulevard S	Offset 10 attached			west :	305° on com	ipass. S
DRILLE	R: Bo	lander	METHOD: Backhoe	DATE:	7/1:	2/18		SCALE:	1" =
Elev. feet 829.7	Depth feet 0.0	AST Syml	 Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	Tests	or Notes
- -		FILL	FILL: Sandy Lean Clay, with Fat Clay and Silty inclusions, Limestone fragments, and Gravel, t Cobbles, pvc conduit, concrete and wood debroccasional slightly organic to organic layers, br moist.	race _ is, with			20	OC=3%	
825.7 	4.0	СН	FAT CLAY, trace Gravel, with Limestone fragm grayish green, moist. (Weathered Shale Bedrock)	nents,	-				
<u>823.7</u> –	6.0	SH	SHALE, trace Gravel, gray, wet. (Decorah Shale Bedrock)		-				
-  -				-	-				
 818.7	11.0		BOTTOM OF TEST PIT.		-				
_			Test pit then backfilled.	_	-				
- - - -			Water seepage observed at 6 feet during test percayation.	- Dit - 	-				
-  -				-	-				
-  - 									
  -  -				-	-				
  -				-	_				
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- 					-				
-				_	1				



ſ		n Proje						TEST PIT	:		TP-33	
	Projec 966 M	ECHNICA t Paul ississip <sub>l</sub> al, Minr	pi Riv	er Bo				LOCATIO attached			31.062 E: 54993	7.650. See
İ	DRILLE		lander			METHOD: Backhoe		DATE:	7/1:	3/18	SCALE:	1" = 4'
viations)	Elev. feet 811.0	Depth feet 0.0	AST Sym			Description of Materials (ASTM D2488 or D2487)			BPF	WL	Tests or	Notes
bbre	810.2	0.8	CONC	2 4 4		crete reinforced slab.						
of a	809.5	1.5	FILL	$\bowtie$		: Silty Sand, fine- to medium-grained,	, with	Gravel,				
(See Descriptive Terminology sheet for explanation of abbreviations)	- - -		SH			/n, wet. ،LE, gray, moist. (Decorah Shale Bedrock)		/				
gy S	805.0	6.0		=	∖Hard	der at 6 feet.		7				
olo -	_					TOM OF TEST PIT.						
Termir	_				Test	pit then backfilled.		_				
riptive	_				Wate	er seepage not observed during test p	it exc	cavation. –				
e Desc												
S)	_							_				
9:48	_							-				
./26/19	_											
GDT 11	_							_				
CURRENT	-							_				
UN_V8_0	_											
GPJ BRA												
EST PITS.	_							-				
)6527 - T	_											
\$\2018\(	_							_				
PROJECT												
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T\PROJE	_							_				
N:\GIN	-							-				
TEST PIT												
LOG 0F	31806527					Braun Intertec Corporation, Bloomic						



		n Proje	ct B180	06527	TEST PI	 Т:		Т	P-34	
	Projec 966 M	t Paul		ATION oulevard S	LOCATIO					550330.882. See
	DRILLE	R: Bol	lander	METHOD: Backhoe	DATE:	7/1	3/18		SCAL	LE: <b>1" = 4'</b>
eviations)	Elev. feet 831.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	P200 %	Tests or Notes
bbre	830.4	0.7	CONC 7 2 1	8 inch concrete slab.		1				
of a	<del>−</del> 830.1.	1.0_	FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, brown, moist.	Ţ	1				
(See Descriptive Terminology sheet for explanation of abbreviations)	_ _ 827.1	4.0	CH	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, Gravelly, with fractured Lim fragments, brown to light brown, moist.  FAT CLAY, trace Gravel, gray with brown, m		-		9	11	
eet fo	_			(Weathered Shale Bedrock)	Jist. 	-				
ıy sh	825.1	6.0		∖Limestone at 5.8 feet.	T	1				
goloc	_			BOTTOM OF TEST PIT.	/					
ermir	_			Test pit then backfilled.	_					
ive T	_			Water seepage not observed during test pit 6	excavation –					
cript				Water seepage not observed daring test pice	xoavation.					
Des						]				
(See	_				_	1				
	_				_	11				
9:48	_				_	1				
6/190	_				-	11				
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T.GDT	-				-	+				
JRREN	_				-	$\left\{ \right\}$				
- 11	_				-	$\left\{ \right\}$				
BRAUN_V8	_				-	$\left\{ \right\}$				
GPJ BR						-				
PITS.0	_				_					
- TEST PITS.	_				_					
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ST PIT						-				
OF TEST	_				_	-				
LOG	D1906E27			Proun Intertoe Corporation, Planningto						TD 24 page 1 of 1



Braur	n Proje		180	6527	7			TEST PIT	·:		Т	P-35	
Projec 966 M	CHNICA t Paul ississip <sub>l</sub> ıl, Minr	pi Riv	er Bo								923.6	54 E: 55061 ttached sket	
DRILLE	R: Bo	lander			METHOD:	Backhoe		DATE:	7/1 <sup>-</sup>	1/18		SCALE:	1" = 4'
Elev. feet 832.3	Depth feet 0.0	AST Sym	bol			escription of Mate STM D2488 or D2			BPF	WL	MC %	Tests	or Notes
831.6	0.7	AGG	ø		hes of aggre								
 830.6	1.7	OL		ORG		fibrous, black, mod Topsoil/Swamp		_			32	OC=13%	
_ _ 	4.0	SM		inclu	Y SAND, fine	e- to medium-grair ravel, Cobbles, Bo	ned, with Le oulders, and				13		
		СН		FAT		Gravel, gray, mois eathered Shale Be							
826.3	6.0			Lime	estone Bedroo	ck.		7					
_					TOM OF TES								
_				Test	pit then back	filled.							
						ot observed during	a tost nit ove	cavation					
_				vvale	er seepage no	ot observed during	j test pit ext	zavalion. –					
_								_					
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		ect B1			TEST PI	T:		T	P-36	<u> </u>	
Projec 966 M	ECHNICA t Paul ississip ul, Minn	pi Rivei			LOCATIO attached			596.3	76 E:	54910	)4.778.
DRILLE	-	lander		METHOD: Backhoe	DATE:	7/1	0/18		SCA	LE:	1" =
Elev. feet 808.9	Depth feet 0.0	ASTN Symb		Description of Materials (ASTM D2488 or D2487)	•	BPF	WL	MC %	P200 %	Tes	sts or No
	9.0	FILL	FI wi br	LL: Poorly Graded Sand, fine- to medium-g th Gravel, Clay nodules and Limestone frag own.  LL: Fat Clay and Shale, trace Sand and Grade Sand Chunks of organics/Peat, gray, modules and Chunks of Organics/Peat, gray, modules Bedrock at 9 feet.  OTTOM OF TEST PIT.  Lest pit then backfilled.  Vater seepage observed at 5 feet during test accavation.	ments,		$\sqrt{2}$	9	2		



	n Proje				TEST PI	T:			P-37	<b>7</b> 
Projec 966 N		oi Rive	er Bo	ation oulevard S	LOCATIO attached			359.6	18 E:	549080.752.
DRILLE	<b>ul, Minn</b> ER: Bo	l <b>esota</b> lander		METHOD: Backhoe	DATE:	7/1	1/18		SCAI	LE: <b>1"=</b>
Elev. feet 810.3	Depth feet 0.0	AST Symb		Description of Materials (ASTM D2488 or D2487)	'	BPF	WL	MC %	P200 %	Tests or No
- - 807.3	3.0	FILL		FILL: Silty Sand, fine- to medium-grained, w fragments, Gravel, Cobbles, plastic and plas piece of rebar and cable, dark brown, brown	tic poly, _					
_	0.0	FILL		FILL: Poorly Graded Sand, fine- to medium-trace Gravel, brown, moist.  Wet at 5 feet.	grained, -			13	2	
 <u>803.3</u> -	7.0	SH		SHALE, trace Gravel, gray, moist. (Decorah Shale Bedrock)	-	- - - -	Ā			
Elev. feet 810.3  - 807.3  - 803.3  - 800.3	10.0			\Hard/Bedrock - likely Limestone. BOTTOM OF TEST PIT.						
_				Test pit then backfilled.	-					
-  - 				Water seepage observed at 6 1/2 feet during excavation.	test pit - -	-				
_ 					-	-				
-  - 					- -					
_ _ _					- - -	-				
					-	-				
_ _ _					- - -	-				
						-				
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GEOTECHNICAL EVALUATION										TEST PIT: TP-38						
		CHNICA							LOCATIC attached	N: N:					273. See	
	966 M	ississip <sub>l</sub> ıl, Minn			ouleva	ard S			allaonea	okotori.	-					
į	DRILLE		lander			METHOD:	Backhoe		DATE:	7/1	1/18		SCAL	.E:	1" = 4'	
(See Descriptive Terminology sheet for explanation of abbreviations)	Elev. feet 810.4	Depth feet 0.0	AST Sym				escription of Mat STM D2488 or D			BPF	WL	MC %	P200 %	Tests	or Notes	
appre	809.9	0.5	FILL			: Lean Clay, v , black and br	with Gravel, trace	e Cobbles an	nd roots,							
on of	_		FILL				(Topsoil) led Sand with Sil	t fine- to								
lanati	_						ittle Gravel, brow		_			4	2			
tor exp	_								-			4	3			
sheet	805.4	5.0	FILL				led Sand, fine- to		ained,							
ology	_				with (	Gravel, browr	n, moist to wet at	6 feet.	-		$ \overline{\Delta} $					
ermin	_															
ptive 1	_								_							
)escri	800.4	10.0					t. Couldn't see d	lue to cave-ir	ı. <u> </u>							
See L	_					TOM OF TES			-							
	_					pit then back			-							
09:48	_					er seepage ob vation.	served at 6 feet	during test p	it –							
/26/19	_															
GDT 11	_								_							
CURRENT.GDT 11/26/19 09:48	_								_							
	_								-							
BRAUN	_								-							
TS.GPJ																
TEST P																
,06527	_								_							
S\2018 <sup>'</sup>	_								-							
ROJECT									_							
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PROJEC	_								-							
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OF TES	_								-							
ဗ္ဗို	D1906E27					_	oun Intertoe Corneratio								9 page 1 of 1	



		ct B180 AL EVALU		TEST PI				P-39	
Projec 966 N	t Paul	oi River Bo	oulevard S	LOCATION attached			601.5	30 E:	548697.3
DRILLE		ander	METHOD: Backhoe	DATE:	7/1	1/18		SCAL	 .E:
Elev. feet 810.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	P200 %	Tests
_ 808.2	2.0	FILL	FILL: Silty Sand, fine- to medium-grained, with trace Cobbles, occasional Clay and Organic Clainclusions, dark brown with black, moist.	ay _			9	20	
- -		FILL	FILL: Poorly Graded Sand, fine- to medium-gralittle Gravel, trace Cobbles, brown, moist.	ained, - - 	-				
<u> </u>			Wet at 6 feet.	-	-	Ā			
- -									
	12.0		Shale Bedrock at 12 feet. BOTTOM OF TEST PIT.		- - -				
			Test pit then backfilled.  Water seepage observed at 6 feet during test p excavation.	– vit —	-				
_ _ _				- -	-				
_				_	-				
_				_	-				
				_	-				
_				_	_				
_									
_				_	_				



	oject B180 ICAL EVALU		TEST PI			TP-40
Project Pau	l ippi River B		LOCATIC attached			17.230 E: 548836.894.
	Bolander	METHOD: Backhoe	DATE:	7/1	0/18	SCALE: 1"=
Elev. Depression feet feet 809.2		Description of Materials (ASTM D2488 or D2487)		BPF	WL	Tests or Notes
	FILL XXX	FILL: Sandy Lean Clay, with Gravel and a few				
808.2 1	.0 FILL	FILL: Sandy Lean Clay, with Gravel and a few concrete fragments, dark brown and gray, moist FILL: Poorly Graded Sand, fine- to medium-gra Gravel, brown, moist.  Clay/Shale inclusions below 8 feet.  Bedrock - likely Shale. BOTTOM OF TEST PIT.  Test pit then backfilled.  Water seepage observed at 9 feet during test pi	ined,		Ā	
- - - - - - - - -		excavation.	- - - - - - - -			



GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota  DRILLER: Bolander METHOD: Backhoe DATE: 7/10/18 SCALE: 1" = 4'  Elev. Depth feet B1.0 0.0 Symbol (ASTM D2488 or D2487) 811.0 0.0 FILL Gravel, trace Cobbles and occasional Fat Clay inclusions, dark brown, moist.  FILL FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, occasional Clay inclusions, brown, moist.  798.0 15.0 Bedrock - unknown. Did not observe due to side collapse. BOTTOM OF TEST PIT. Test pit then backfilled. Water seepage observed at 8 feet during test pit excavation.			n Proje	ct B180	6527	TEST PI	Γ:		TP-41			
Elev.   Depth   feet   State	GEOTE Projec 966 M	CHNICA t Paul ississipp	AL EVALU <i>i</i> oi River Bo	ATION		ed sketch.						
Feet   Symbol   Castri D2488 or D2487   Symbol   Castri D248 or D2487   Symbol   Symbol   Castri D248 or D2487   Symbol   Symbol   Castri D248 or D2487   Symbol   Symb		DRILLE	R: Bol	lander	METHOD: Backhoe	DATE:	7/1	0/18	SCALE: 1" = 4'			
Bedrock - unknown. Did not observe due to side collapse. BOTTOM OF TEST PIT.  Test pit then backfilled.  Water seepage observed at 8 feet during test pit excavation.	viations)	feet	feet				BPF	WL	Tests or Notes			
	BRAUN_V8_CURRENT.GDT 11/26/19 09:48	- 809.0 	2.0	FILL	FILL: Clayey Sand, fine- to medium-grained, we Gravel, trace Cobbles and occasional Fat Clay inclusions, dark brown, moist.  FILL: Poorly Graded Sand, fine- to medium-grained, we with Gravel, occasional Clay inclusions, brown with Gravel, occasional Clay inclusions, brown because the collapse.  BOTTOM OF TEST PIT.  Test pit then backfilled.  Water seepage observed at 8 feet during test	rained, n, moist.	14	Σ				



Braun		AL EVALU		TEST PI				P-42		_
Project 966 Mi	Paul	pi River B	oulevard S	LOCATIO attached			654.5	88 E:	549310.2	28
RILLEF		lander	METHOD: Backhoe	DATE:	7/10	0/18		SCAI	 _E:	1
Elev. feet 809.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	•	BPF	WL	MC %	P200 %	Tests	c
		FILL XX	FILL: Sandy Lean Clay, with Gravel, trace or	ganics			/0	/0		-
796.8	13.0	FILL	and Limestone fragments, dark brown.  FILL: Poorly Graded Sand, fine- to medium-g with Gravel and some Clay nodules, brown.  Likely Limestone Bedrock.  BOTTOM OF TEST PIT.  Test pit then backfilled.  Water seepage not observed during test pit experience.	- - - - - - - -			3	1		



Braun Project B180	6527	TEST PIT	·:		Т	P-43	
GEOTECHNICAL EVALUA Project Paul 966 Mississippi River Bo St. Paul, Minnesota	ATION		N: N: ′	1445		55 E: 54895	9.652. See
DRILLER: Bolander	METHOD: Backhoe	DATE:	7/10	/18		SCALE:	1" = 4'
Elev. Depth feet ASTM 812.2 0.0 Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	Tests	or Notes
Strong   Elev.   Depth   feet   ASTM   Symbol   Strong   FILL: Silty Sand, fine- to medium-grained, with and concrete debris, brown, moist.  FILL: Sandy Lean Clay mixed with Silty Sand, Gravel, Cobbles and concrete fragments, browl gray.  Wood debris at 3 feet.  Concrete/rebar debris at 4 feet. Ceramic drain pipe fragments from 4 to 5 feet.  FILL: Crushed concrete layer (gravel-sized), gray brown.  In-place concrete footing/slab at 10 feet, observed during in concrete.  BOTTOM OF TEST PIT.  Test pit then backfilled.  Water seepage not observed during test pit exceptions.	with n and -			21			



		n Proje						TEST PIT	Γ:		Т	P-44	
	Projec 966 M		oi Rivo	er Bo	ATION  oulevard S			LOCATIO attached			781.5	11 E: 54857	9.370. See
	DRILLE	R: Bo	lander		METHOD: E	Backhoe		DATE:	7/10	0/18		SCALE:	1" = 4'
viations)	Elev. feet 811.5	Depth feet 0.0	AST Sym			cription of Materials FM D2488 or D2487)			BPF	WL	MC %	Tests	or Notes
abbre	810.5	1.0	FILL		FILL: Silty Sand, fine Limestone and concr	e- to medium-grained, crete fragments.	with	Gravel,					
xplanation of		4.0	FILL			Clay, with Gravel and Li	imest	rone _			15		
(See Descriptive Terminology sheet for explanation of abbreviations)	807.5  	4.0	FILL		FILL: Lean Clay with	h Sand, with Gravel, br	rown,	moist			14		
⁄e Terminolo	- - 802.5	9.0	FILL			d Sand, fine- to coarse- y nodules, brown, mois		ned, _					
Descriptiv	800.5	11.0	FILL		FILL: Fat Clay, with blue gray and brown,	Shale fragments, trace n, moist.	e Gra	vel,			60		
(See	799.5	12.0	CL		LEAN CLAY, with Gr	ravel and Limestone fra	agme	ents,			15		
9 09:48	_	12.0		/////	Limestone Bedrock a								
1/26/1					Test pit then backfille	ed.							
CURRENT.GDT 11/26/19 09:48	- -				Water seepage not o	observed during test pi	it exc	avation _					
	- -							-					
ST PITS.GPJ B													
18\06527 - TE	- -							_					
PROJECTS\20	_							_					
GINT\PROJECTS\AX P	- -							_					
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_													



	n Proje		180	6527	7			TEST PIT	:		Т	P-45	5	
Project 966 M	CHNICA t Paul ississipp ul, Minn	oi Rive	er Bo					LOCATIO attached						5.977. See
DRILLE	R: Bo	lander			METHOD:	Backhoe		DATE:	7/1:	2/18		SCAL	_E:	1" = 4'
Elev. feet 832.6	Depth feet 0.0	AST Sym			(A	escription of STM D2488	or D2487)		BPF	WL	MC %	P200 %	Test	s or Notes
feet	feet			Con- FAT gray Dolc BOT	Crete pipe at St. CLAY, trace and brown, no (Webmitte Limesto TOM OF TESt.)	STM D2488 of fine- to media e concrete ar Clay inclusion ist.  5 feet.  Gravel and Louist.  6 teathered Shale layer at 7  6 FIT.  filled.	or D2487) um-grained, with nd brick debris, v s and slightly org imestone fragme	vith _ ganic	BPF	WL			Test	s or Notes
*KOJEC 13/4018/UB3Z								_ 						
HI N. YOUN VEX.DECTS AND								- - -						
B1806527							oration Bloomington N	_						2-45 nage 1 of 3



	n Proje		180	6527	,			TEST PIT	 Г:		Т	P-40	 6	
GEOTI Project 966 M	ECHNICA ct Paul lississip <sub>l</sub> ul, Minn	AL EV	ALU <i>i</i> er Bo	ATION	N			LOCATIC attached						0.792. See
DRILLE	ER: Bo	lander			METHOD:	Backhoe		DATE:	7/1:	2/18		SCA	LE:	1" = 4'
Elev. feet 831.4	Depth feet 0.0	AST Sym			(A)	escription of Mat STM D2488 or D	2487)		BPF	WL	MC %	P200 %	Test	s or Notes
Electron of the project Syzual Result of the project of the proj	14.0	FILL		Peat FILL with fragr Weat Bedracolla BOT Test Water	: Silty Sand, e concrete det e concrete det e concrete det e layer at 2 fee e Poorly Gracium-grained, v e Poorly Gravel, Lean ments, gray w e e concrete det e concrete de la concrete de	fine- to medium- bris, brown, mois  et.  led Sand with Si with Gravel, brow  led Sand, fine- te Clay inclusions ith brown, wet.  at 7 feet.	grained, with st.  It, fine- to vn, moist.  To medium-graand Limestor  we due to sid  during test p	e foit		⊻	36 6	6	Shale excava sidewa feet to pit. To near 7 adjace	Weathered present in ation all from 7 end of test p of bedrock



		ect B180 AL EVALU		TEST PI			ENV-TP-1
Projec 966 M	t Paul	oi River B	oulevard S	attached			71.047 E: 548665.9
DRILLE	-	lander	METHOD: Backhoe	DATE:	8/9	9/18	SCALE:
Elev. feet 812.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	Tests or Not
- 810.0	2.0	FILL	FILL: Sandy Lean Clay, with Gravel, trace con debris, non- to slightly organic, dark brown, mo (Topsoil)	crete ist			
- - - -	2.0	FILL	FILL: Crushed concrete (gravel-sized), brown,	moist			
- 802.0	10.0		Apparent concrete slab.	_		$  \overline{\Delta}  $	
_			BOTTOM OF TEST PIT.  Test pit immediately backfilled.	_	-		
_			Water seepage observed at 9 1/2 feet during to excavation.	est pit _			
_				_			
_				_	-		
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- -				_			
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_				_			
B1806527			Braun Intertec Corporation, Bloomington I	MN 55438			ENV-TP-



Γ	Braur	n Proje		180	6527	TEST PI	 Т:		FN۱	V-TP-2	
	GEOTE	CHNICA								46 E: 54854	5.451. See
	Project 966 M		oi Rive	er Bo	oulevard S	attached	sketch				
L		ıl, Minn									
	DRILLE	R: Bol	ander		METHOD: Backhoe	DATE:	8/9	/18		SCALE:	1" = 4'
(See Descriptive Terminology sneet for explanation of abbreviations)	Elev. feet	Depth feet	AST		Description of Materials		BPF	WL	1	Tests	or Notes
	810.6	0.0	Sym FILL	DOI	(ASTM D2488 or D2487) FILL: Clayey Sand, with occasional Fat Clay	1			%		
_ ab	809.6	1.0	FILL		inclusions, non- to slightly organic, brown, m	oist.	-				
-   Eg	-				FILL: Poorly Graded Sand, fine- to medium-trace Cobbles, little Gravel, brown, moist to	grained, I0 feet	-		9		
ana -	-			$\bowtie$	then wet.	_	-				
<u>  ex</u>	_			$\bowtie$		_					
et 10  -	_			$\bowtie$							
sue	_					_					
olog											
<u> </u>	-					_					
e  -	-					_					
	-	40.0				-	1				
Jesc  -	800.6	10.0	CONC		CONCRETE.		-				
-   See	799.1	11.5		7 4 4 4 4	Top of footing at 10 feet (left in place)Approximately 6'x6'x16" deep.	_	-				
<u>"</u>  -	798.6	12.0	СН		FAT CLAY, little Gravel, trace Limestone fra	gments, T	]				
_ و	-				\gray and brown, wet. \(\text{(Weathered Shale Bedrock)}\)	-					
7:60 61 -	_				BOTTOM OF TEST PIT.						
CURRENT.GDT 11/26/19 09:49					Test pit immediately backfilled.						
3DT 1	_				Water seepage observed at 10 feet during to	est pit –					
ZENT.(	_				excavation.	_					
CUR											
8 N											
BRAL	-					_					
TS.GP.							11				
EST PI	-					_	11				
27 - Ti	-					_	1				
8/065	-					_	1				
\$\201	-					_	-				
	_										
AX PR	-					_					
ECTS/	_					_					
PRO	_					_					
/GINT	_						]				
ij ⊢						_					
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8							11				
96 OF	-					_	1				
<b>⊔</b> ك	1906527				Prous Intertoe Corneration Pleaming	_	Ш	1			TD 2 nage 1 of 1



Γ		Proje		180	6527	1			TEST PIT	:		EN\	/-TP-3	
	GEOTE	CHNICA							LOCATIO	N: N:	1455			18.451. See
	Project 966 M	t Paui ississipp	oi Rivo	er Bo	ouleva	ard S			attached	sketch.				
L	St. Pau	ıl, Minn												
ļ	DRILLE		ander			METHOD:	Backhoe		DATE:	8/10	0/18	$\perp$	SCALE:	1" = 4'
viations)	Elev. feet 832.7	Depth feet 0.0	AST Sym	- 1		(A)	escription of M STM D2488 or	r D2487)		BPF	WL	MC %	Tests	or Notes
appre	831.7	1.0	FILL				fine- to mediur sions, brown,	m-grained, trac moist.	e Gravel					
(See Descriptive Terminology sneet for explanation of abbreviations)	- - - -		FILL		FILL trace piece occa	: Fat Clay, or e concrete, tile e of porcelain sional Gravel	ganic layer be e, bituminous a at 1 foot, with lly layers.	tween 1 and 1 and plastic debi Sand inclusion	ris, a <del> </del>			19		
5  -   Sign	825.7	7.0					arts at 7 to 8 fe edrock and wa	eet. as left in place.	7					
	824.7	8.0	SH		SHA	LE, hard, gray (De	y, moist. ecorah Shale I	Bedrock)						
otive –	-				ВОТ	TOM OF TES		,						
escrip					Test	pit immediate	ely backfilled.							
See D	-				Wate	er seepage no	ot observed du	ring test pit exc	cavation					
<u> </u>	-								_					
9 09:49	-								_					
CURRENT.GDT 11/26/19 09:49	_													
T.GDT _	-								_					
ORREN -	-								_					
!	-								_					
J BRAU	-								_					
PITS.GP														
- TEST	-													
06527	-								_					
S\2018 	-								_					
(OJECT)	_								_					
S\AX PF	-								_					
COJECT	-								-					
SINT\PR	-								_					
5\:\  -	-								_					
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8														
-06 OF	-													



	n Proje	ct B180	6527		TEST PIT	·	E	NV-TP-4	
GEOTI Project 966 M	ECHNICA t Paul	AL EVALU oi River Bo		-	LOCATIO attached		14481	9.371 E: 54993	3.722. See
DRILLE	R: Bol	lander	METHOD: Backhoe		DATE:	8/10	0/18	SCALE:	1" = 4'
Schalars (Scholars) (S	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)			BPF	WL	Tests or f	Notes
Log of Test Pt Tr. Na. Nationary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations)  Log of Test Pt Tr. Squary Project St. Action of abbreviations of action of abbreviations of action of abbreviations of action of abbreviations of action of abbreviations of action of acti	4.0 5.0 6.0	SM SP SH	FILL: Silty Sand, fine- to medium-grained brown, moist.  FILL: Fat Clay, with Silty Sand inclusions occasional slightly organic layers, trace st plastic, bituminous and clay pipe debris, b black, moist.  SILTY SAND, fine- to medium-grained, witrace Limestone fragments, brown, moist.  (Terrace Deposit)  POORLY GRADED SAND, fine- to mediutrace Gravel, brown, moist.  (Terrace Deposit)  SHALE, trace Limestone fragments, harder gray with brown to 7 feet then gray, moist.  (Decorah Shale Bedrock)  BOTTOM OF TEST PIT.  Test pit immediately backfilled.  Water seepage not observed during test processes and processes are processed in the processes of the processes and processes are placed to the processes of the processes and processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the processes are placed to the plac	and eel, re rown a th Gram-gram-gram-gram-gram-gram-gram-gram-g	avel, feet, avation.	7			



	ect B180		TEST PIT	Γ:	E	NV-TP-5	
GEOTECHNIC Project Paul 966 Mississip St. Paul, Mini	pi River B		LOCATIC attached			3.877 E: 54850	)1.000. S€
DRILLER: Bo	olander	METHOD: Backhoe	DATE:	8/9	9/18	SCALE:	1" = 4'
Elev. Depth feet feet 812.5 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	Tests or	Notes
810.5 2.0 801.5 11.0 801.3 11.2	FILL	FILL: Silty Sand, fine- to medium-grained, with occasional non- to slightly organic layers and Finclusions, trace concrete, Cobbles, wood and debris, brown, moist.  FILL: Crushed concrete (gravel-sized), brown,  SHALE, gray, moist.  (Decorah Shale Bedrock)  BOTTOM OF TEST PIT.  Test pit immediately backfilled.  Water seepage observed at 9 feet during test pexcavation.	fat Clay _ rebar		$\nabla$		



Braun Proje			TEST PIT	:		EN۱	/-TP-6	
GEOTECHNICA Project Paul 966 Mississipp St. Paul, Minn	oi River Bo		LOCATIO attached			237.0	76 E: 548573	3.565. See
DRILLER: Bol	ander	METHOD: Backhoe	DATE:	8/9	/18		SCALE:	1" = 4'
Elev. Depth feet feet 812.5 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	MC %	Tests o	or Notes
Coe Describitive   Feet   Prize   Pr	SH	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, little Gravel, trace Cobbles, C at 1 foot, brown, moist.  ORGANIC CLAY, trace Gravel, black, moist. (Swamp Deposit/Buried Topsoil)  CLAYEY SAND, with Poorly Graded Sand sear layers, trace Limestone fragments, brownish gray with brown, moist.  (Glacial Till)  SHALE, trace Gravel and Limestone fragments moist.  (Decorah Shale Bedrock)  BOTTOM OF TEST PIT.  Test pit immediately backfilled.  Water seepage not observed during test pit exceeds the service of the service o	ms and ay to			15	65" X 65" co footing and approximate feet below c	pier ely 1 to 4



	-	ct B180		TEST PI	T:		EN'	V-TP-8	
Projec 966 M	t Paul		oulevard S	LOCATIO attached			108.8	09 E: 54853	2.792. S
DRILLE	R: Bol	ander	METHOD: Backhoe	DATE:	8/9	9/18		SCALE:	1" = 4'
Elev. feet 812.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487		BPF	WL	MC %	Tests	or Notes
- 810.9	2.0	SC SC	FILL: Silty Sand, fine- to medium-graine occasional slightly organic layers, Lean Clay inclusions, Clay pipe at 1/2 foot, br CLAYEY SAND, with Sand seams/layer Limestone fragments, trace Gravel, brownoist.	Clay and Fat _ own, moist.	-				
-  806.9	6.0	SH	(Glacial Till)  SHALE, with Limestone fragments, gray (Decorah Shale Bedrock		-	$\Box$	26		
804.9	8.0		BOTTOM OF TEST PIT.  Test pit immediately backfilled.	-	-				
			Water seepage observed at 6 feet durin excavation.	g test pit	-				
-				-	-				
				-	-				
-				- -	-				
					_				
-				-	-				
-  -				_  _					
-				-	-				
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-				_	1				



	n Proje	ct B180	)6527	7		TEST PIT: ENV-TP-9				
GEOTI Project 966 M	ECHNIC <i>A</i> t Paul	AL EVALU oi River B	ATIOI	N	F		N: N:	14440	9.717 E: 54871	0.801. See
DRILLE	R: Bol	ander		METHOD: Backhoe		DATE:	8/9	/18	SCALE:	1" = 4'
Elev. feet 812.6	Depth feet 0.0	ASTM Symbol		Description of Materials (ASTM D2488 or D2487)			BPF	WL	Tests or	Notes
Log of Test Pit n:\circ@ntsts.ptf v:\circ@ntsts.ptf v:\circ@ntst	4.0	FILL	Pipe of pi BOT Test	Erun latates Consertion. Placesies.	outh p	e pit — — — — — — — — — — — — — — — — — — —				



ſ	Braun Project B1806527								TEST PIT: ENV-TP-10						
		CHNICA							LOCATION: N: 144540.174 E: 548600.912. See attached sketch.						
ı	966 M	ississipp			ouleva	ard S			attached	sketch	•				
ŀ	DRILLE	<b>II, Minn</b> R: Bol	esota lander	1		METHOD:	Backhoe		DATE:	8/10/18			SCALE:	1" = 4'	
us)	Elev.	Depth		-			i-4:£ N4-4	la si a la				140			
eviatio	feet 812.9	feet 0.0	AS1 Sym			(AS	escription of Mat STM D2488 or D	)2487)		BPF	WL	MC %		or Notes h portion of	
(See Descriptive Terminology sneet for explanation of abbreviations)	808.9	4.0	CH		orga (colu Main FAT brow	nic, with steel umn pad and control uly concrete at CLAY, with L un with gray, n	imestone fragme noist. athered Shale B	crete masses own, moist.	S _ - -		∑	18	test pit had crushed concrete fill to approximately 6 feet.  LL=35, PL=14, PI=21		
riptive i erminoio	- - 803.9	9.0				TOM OF TES	ecorah Shale Be	edrock)	_			10	LL-33, F L-	-14, [1–2]	
Desc					Test	pit immediate	ely backfilled.			-					
eec)	_					er seepage obvation.	served at 6 feet	during test p	oit –						
6/19 09:49	_								_	-					
CURRENT.GDT 11/26/19 09:49	_								_						
!	_								_						
GPJ BRAUN	_														
' - TEST PITS	_								-						
\2018\0652	_								-						
X PROJECTS															
ROJECTS\A.	_								_						
T N:\GINT\F	_								_						
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8															
Ľ L	21906527						aun Intertee Cornerati			Ш	1			TD 10 page 1 of	



ſ		n Proje	ct B180	6527	TEST PIT: ENV-TP-30				
	Projec 966 M	t Paul		ATION oulevard S	LOCATIO attached		14452	23.224 E: 549532.296. See	
	DRILLE	R: Bo	lander	METHOD: Backhoe	DATE:	8/1	0/18	SCALE: 1" = 4'	
eviations)	Elev. feet 808.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)		BPF	WL	Tests or Notes	
(See Descriptive Terminology sheet for explanation of abbreviations)	807.5 - - 805.0 -	3.0	FILL	FILL: Organic Clay, trace Gravel, black, moi (Topsoil Fill)  FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, concrete, rebaggregate base and bituminous fragments, bomoist.  SHALE, trace Gravel, gray with brown to 5 fe gray, moist.  (Decorah Shale Bedrock) Less weathered at 5 feet.	ar, PVC, – prown,		Ā		
minology	801.0	7.0		BOTTOM OF TEST PIT.					
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49 (See Descriptive Ter				Test pit immediately backfilled.  Water seepage observed at 3 feet during test excavation.	et pit				
LOG OF TE.	_				_				



			ct B180				TEST PIT: ENV-TP-58					
	Projec 966 M	t Paul	AL EVALU oi River B esota				LOCATION: N: 145009.482 E: 548634.932. See attached sketch.					
	DRILLE	R: Bol	lander		METHOD: Backhoe		DATE:	8/9/18			SCALE:	1" = 4'
eviations)	Elev. feet 812.2	Depth feet 0.0	ASTM Symbol		Description of (ASTM D2488	or D2487)		BPF WL MC			Tests or Notes	
on of abbre	811.2 810.7	1.0 1.5	SM SP-	and √pipe	<ul> <li>Silty Sand, fine- to med occasional Fat Clay depo at 1 feet, brown, moist.</li> <li>SAND, fine-grained, sl</li> </ul>	sits and concrete	debris,					
ır explanatid	809.2 -	3.0	SM SC	Grav	vel and roots, black, mois (Buried To ORLY GRADED SAND wi	t. opsoil) th SILT, fine- to				13		
(See Descriptive Terminology sheet for explanation of abbreviations)	— 	6.0	SH	and CLA	dium-grained, with Gravel, Limestone fragments, bro (Terrace D AYEY SAND, with Gravel a wn with gray, moist.	own, moist. Deposit)	$\perp$					
ve Terminol	- - 803.2	9.0		∄ \	(Glacial) (Glacial) (Glacial) (Glacial) (Glacial) (Glacial) (Decorah Shal	ments, gray, mois	t					
escripti					TTOM OF TEST PIT. t pit immediately backfilled	1						
(See	_				ter seepage not observed		avation.					
:49	_											
- TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49	_						_					
T.GDT 11	_						_					
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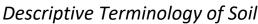


	n Proje	,			TEST PIT: ENV-TP-63							
Projec 966 M	CHNICA t Paul ississipp ul, Minn	oi Rive					LOCATIO attached		1447			30.299. See
DRILLE	R: Bol	ander		METHOD:	Backhoe		DATE:	8/10	0/18		SCALE:	1" = 4'
Elev. feet 812.2	Depth feet 0.0	ASTI Symb		(A : Silty Sand,	escription of Ma STM D2488 or fine- to medium	D2487) n-grained, with		BPF	WL	MC %	Tests	or Notes
Elev. feet 812.2  - 809.7  - 807.2  - 806.7  - 803.2	2.5	SM	conc	rete debris at	egments, trace ( 1 foot, brown, e-grained, non- oist. (Buried Tops	moist. to slightly orga	_			13	OC=2%	
806.7	5.5	SM CH	Cobb	oles, brown, n	e- to coarse-gra noist. (Terrace Depo Gravel, brown v	osit)	-					
804.2	8.0	SH		(We LE, gray, moi	athered Shale I	Bedrock.)						
803.2	9.0	ЗП			ecorah Shale B	edrock)						
_			Wate	Test pit immediately backfilled. Water seepage observed at 5 1/2 fee excavation.			est pit _					
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		n Proje	ct B180	06527	TEST PIT: ENV-TP-94				
	GEOTE Project 966 M	CHNICA t Paul	AL EVALU oi River E		LOCATION: N: 145509.874 E: 548082.913. See attached sketch.				
	DRILLE	R: Bol	lander	METHOD: Backhoe	DATE:	8/9/	/18	SCALE: 1" = 4'	
oreviations)	Elev. feet 812.5	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487) FILL: Poorly Graded Sand with Silt, fine- to		BPF	WL	Tests or Notes	
on of ab	<u>811.5</u>	1.0	SM	medium-grained, trace Gravel, with occasion Clay and Fat Clay inclusions, pipe at 1 to 2 fe moist.	al Lean et, brown, [				
lanatic	810.0 809.0	2.5 3.5	SM	SILTY SAND, fine-grained, slightly organic, b	lack,				
(See Descriptive Terminology sheet for explanation of abbreviations)	- - -		CH	(Buried Topsoil/Swamp Deposit)  SILTY SAND, fine-grained, little Gravel, brow (Terrace Deposit)  FAT CLAY, with fractured Limestone and Colbrown with gray, moist. (Weathered Shale Bedrock)					
See Descriptive	803.5 —— —	9.0	SH	SHALE, trace Gravel and Limestone fragmer moist.  (Decorah Shale Bedrock)	its, gray, ——	-			
)	800.5	12.0	=	BOTTOM OF TEST PIT.		_			
26/19 09:49	_			Test pit immediately backfilled.  Water seepage observed at 12 feet during te	- st pit	-			
PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49	- - - - - - - -			excavation.					
LOG OF TEST				Proun Intertee Corporation, Pleamington	_	-		ENV TD 04 page 4 of 1	





Particle Size Identification

Based on Standards ASTM D2487/2488 (Unified Soil Classification System)



	Criteria fo	or Assigning G	roun Symh	ols and		Soil Classification
		lames Using La			Group Symbol	Group Name <sup>B</sup>
c c	Gravels	Clean Gravels		$C_u \ge 4$ and $1 \le C_c \le 3^D$	GW	Well-graded gravel <sup>E</sup>
ls led o	(More than 50% of coarse fraction	(Less than 5	% fines <sup>c</sup> )	$C_u < 4 \text{ and/or } (C_c < 1 \text{ or } C_c > 3)^D$	GP	Poorly graded gravel <sup>E</sup>
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	retained on No. 4	Gravels wit	th Fines	Fines classify as ML or MH	GM	Silty gravel <sup>E F G</sup>
aine 0% ra 0 sie	sieve)	(More than 1	2% fines <sup>c</sup> )	Fines Classify as CL or CH	GC	Clayey gravel <sup>E F G</sup>
<b>e-grai</b> l an 50% o. 200	Sands	Clean S		$C_u \ge 6$ and $1 \le C_c \le 3^D$	SW	Well-graded sand <sup>1</sup>
oarse- e than No.	(50% or more coarse	(Less than 5	% fines <sup>H</sup> )	$C_u < 6 \text{ and/or} (C_c < 1 \text{ or } C_c > 3)^D$	SP	Poorly graded sand
mor (m	fraction passes No. 4 sieve)	Sands with Fines (More than 12% fines <sup>H</sup> )		Fines classify as ML or MH	SM	Silty sand <sup>FGI</sup>
	sieve)			Fines classify as CL or CH	SC	Clayey sand <sup>F G I</sup>
	City and Claus	Inorganic PI > 7 and		I plots on or above "A" line I	CL	Lean clay <sup>KLM</sup>
s the	Silts and Clays (Liquid limit less than		PI < 4 or plots below "A" line <sup>J</sup>		ML	Silt <sup>KLM</sup>
Fine-grained Soils 50% or more passes the No. 200 sieve)	50)	Organic	Organic Liquid Limit – oven dried Liquid Limit – not dried <0.75		OL	Organic clay KLMN Organic silt KLMO
grain more		Inorganic	PI plots o	n or above "A" line	СН	Fat clay <sup>KLM</sup>
Fine-g % or r No.	Silts and Clays (Liquid limit 50 or	morganic	PI plots b	elow "A" line	МН	Elastic silt <sup>K L M</sup>
(50	more)	Organic	ic Liquid Limit – oven dried Liquid Limit – not dried <0.75		ОН	Organic clay KLMP Organic silt KLMQ
Hig	hly Organic Soils	Primarily org	anic matte	r, dark in color, and organic odor	PT	Peat

- A. Based on the material passing the 3-inch (75-mm) sieve.
- If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- Gravels with 5 to 12% fines require dual symbols:

GW-GM well-graded gravel with silt

GW-GC well-graded gravel with clay

GP-GM poorly graded gravel with silt

GP-GC poorly graded gravel with clay

- $C_c = (D_{30})^2 / (D_{10} \times D_{60})$ D.  $C_u = D_{60} / D_{10}$
- If soil contains ≥ 15% sand, add "with sand" to group name.
- If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
- If fines are organic, add "with organic fines" to group name.
- Sands with 5 to 12% fines require dual symbols:

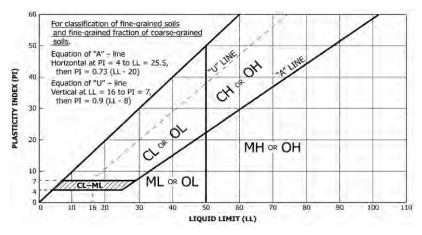
SW-SM well-graded sand with silt

SW-SC well-graded sand with clay

SP-SM poorly graded sand with silt

poorly graded sand with clay

- I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
- If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
- If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is
- If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
- M. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
- N. PI ≥ 4 and plots on or above "A" line.
- O. PI < 4 or plots below "A" line.
- PI plots on or above "A" line.
- PI plots below "A" line.



Dry density, pcf

Wet density, pcf

% Passing #200 sieve

DD

WD

P200

### **Laboratory Tests**

OC Organic content. % Pocket penetrometer strength, tsf MC Moisture content, %  $\mathbf{q}_{\upsilon}$ Unconfined compression test, tsf

ш Liquid limit PL Plastic limit Plasticity index

raiticle size identification
Boulders over 12"
Cobbles 3" to 12"
Gravel
Coarse 3/4" to 3" (19.00 mm to 75.00 mm)
Fine No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
Coarse No. 10 to No. 4 (2.00 mm to 4.75 mm)
Medium No. 40 to No. 10 (0.425 mm to 2.00 mm)
Fine No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt No. 200 (0.075 mm) to .005 mm
Clay< .005 mm
Relative Proportions <sup>L, M</sup>

	Inclusion Thicknesses
with	≥ 15%
little	6 to 14%

## lens...... 0 to 1/8" seam...... 1/8" to 1"

trace..... 0 to 5%

#### **Apparent Relative Density of Cohesionless Soils**

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of	Blows	<b>Approximate Unconfined</b>
Cohesive Soils	Per Foot	Compressive Strength
Very soft	0 to 1 BPF	< 0.25 tsf
Soft	2 to 4 BPF	0.25 to 0.5 tsf
Medium	5 to 8 BPF	0.5 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF.	> 4 tsf

#### **Moisture Content:**

Dry: Absence of moisture, dusty, dry to the touch.

Moist: Damp but no visible water.

Wet: Visible free water, usually soil is below water table.

#### **Drilling Notes:**

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

**Recovery:** Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

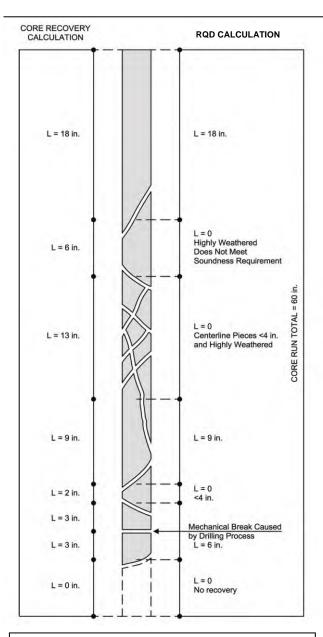
WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (  $\bigcirc$  ), at the end of drilling (  $\bigcirc$  ), or at some time after drilling ( ).



# Descriptive Terminology of Rock

Based on U.S. Army Corps of Engineers EM 1110-1-2908



### **Example Calculations**

Core Recovery, CR = <u>Total length of rock recovered</u>
Total core run length

Example: CR = (18 + 6 + 13 + 9 + 2 + 3 + 3)(60)

CR = 90%

RQD = <u>Sum of sound pieces 4 inches or larger</u> Total core run length

RQD Percent	Rock Quality
< 25	very poor
25 < 50	poor
50 < 75	fair
75 < 90	good
90 < 100	excellent

Example: RQD = (18 + 9 + 6)

RQD = 55%

# Weathering

Unweathered: No evidence of chemical or mechanical alteration.

*Slightly weathered:* Slight discoloration on surface, slight alteration along discontinuities, less than 10% of rock volume altered.

Moderately Weathered: Discoloration evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering halos evident, 10% to 50% of the rock altered.

Highly Weathered: Entire mass discolored, alteration pervading nearly all of the rock, with some pockets of slightly weathered rock noticeable, some mineral leached away.

Decomposed: Rock reduced to a soil consistency with relict rock texture, generally molded and crumbled by hand.

## **Hardness**

Very soft: Can be deformed by hand

Soft: Can be scratched with a fingernail Moderately hard: Can be scratched easily with a knife

Hard: Can be scratched with difficulty with a knife

Very hard: Cannot be scratched with a knife

## **Texture**

Sedimentary Rocks: Grain Size
Coarse grained 2 – 5 mm
Medium grained 0.4 – 2 mm
Fine grained 0.1 – 0.4 mm
Very fine grained < 0.1 mm

Igneous and Metamorphic Rocks:

Coarse grained 5 mm

Medium grained 1 – 5 mm

Fine grained 0.1 – 1 mm

Aphanitic < 0.1 mm

## **Thickness of Bedding**

Massive: 3 ft. thick or greater
Thick bedded: 1 to 3 ft. thick
Medium bedded: 4 in. to 1 ft. thick
Thin bedded: 4 in. thick or less

# **Degree of Fracturing (Jointing)**

Unfractured: Fracture spacing 6 ft. of more Slightly fractured: Fracture spacing 2 to 6 ft.

Moderately fractured: Fracture spacing 8 in. to 2 ft.

Highly fractured: Fracture spacing 2 in. to 8 in.

Intensely fractured: Fracture spacing 2 in. or less