

Design Phase Geotechnical Evaluation:

Proposed Ramsey Business Park Infrastructure
Repair McKinley St NW, Unity St NE, Radium St.
NW, 140th Ave NW
Ramsey, Minnesota

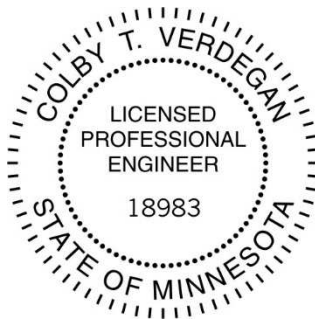
Prepared for:

City of Ramsey
c/o: Joe Feriancek

December 10, 2020
17624.20.MNS

Certification:

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



A handwritten signature in black ink that reads 'Colby Verdegan'.

Colby T. Verdegan, PE
Geotechnical Engineer
Registration Number 18983
Date: December 10, 2020

Chosen Valley Testing, Inc.

Geotechnical Engineering and Testing, 141 37th Ave. N., St. Cloud, Minnesota 56303 (320) 774-3500 fax (320) 393-3309

City of Ramsey
c/o: Joe Feriancek
7550 Sunwood Drive NW
Ramsey, MN 55303
mweidner@ic.ramsey.mn.us

December 9, 2020

**Re: Design Phase Geotechnical Evaluation
Proposed Business Park 95 Infrastructure Improvements
McKinley St. NW, Unity St. NW, Radium St. NW, 140th Ave. NW
Ramsey, Minnesota
CVT Number: 17624.20.MNS**

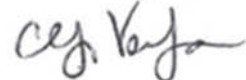
Dear Mr. Feriancek,

As authorized, we have completed the geotechnical evaluation for the proposed infrastructure improvements of McKinley St. NW, Unity St. NW, Radium St. NW., 140th St NW in Ramsey, Minnesota. The attached report provides details of our findings and recommendations for the proposed project. Photographs of the pavement cores taken at each location are also attached. CVT appreciates the opportunity to provide geotechnical services on this project. If you have any questions about our report, please feel free to contact us at (320) 774-3500.

Sincerely,
Chosen Valley Testing, Inc.



Hannah Fischer
Graduate Engineer



Colby T. Verdegan, PE
President/Chief Engineer

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BORING LOCATION SKETCH
LOG OF BORING # 1-8
LEGEND TO SOIL DESCRIPTION

Design Phase Geotechnical Report
Proposed Business Park 95 Infrastructure Improvements
McKinley St. NW, Radium St NW., Unity St. NW 140th Ave NW.
Ramsey, Minnesota

CVT Project Number: 17624.20.MNS

Date: December 9, 2020

A. Introduction

The intent of this report is to present our findings and describe the means used to collect the data. The data was collected for a specific purpose and may not be suitable for other purposes. We should be consulted before attempting to use the data for other uses. A complete and thorough review of the entire document, including its assumptions and its appendices, should be undertaken immediately upon receipt.

A.1. Purpose

This geotechnical report was prepared to assist planning for proposed infrastructure improvements of McKinley St. NW, Unity St. NW, Radium St, NW., 140th St NW in Ramsey, Minnesota. Our services were authorized by Mr. Joe Feriancek from The City of Ramsey.

A.2. Scope

To obtain data for analysis, a total of 8 penetration test borings were performed. The borings were drilled to depths of about 10 feet. Our engineering scope consisted of providing this report of our findings and including geotechnical recommendations for construction and design of potential utility replacements and paved areas.

A.3. Boring Locations and Elevations

The preferred boring locations were indicated to Chosen Valley Testing (CVT) on a site plan provided by the city. Several of the borings were relocated due to the proximity of utilities. The Boring Location Sketch in the Appendix shows the approximate locations as drilled on aerial imagery using Google Earth software. Ground surface elevations were estimated using MnTOPO software from the Minnesota DNR and are indicated on the Log of Boring sheets in the Appendix. The elevations should be considered approximate.

A.4. Geologic Background

A geotechnical report is based on subsurface data collected for the specific structure or problem. Available geologic data from the region can help interpretation of the data and is briefly summarized in this section.

Geologic maps indicate the soils in the area are dominated by terrace deposited sands. Bedrock is commonly more than 50 feet below the surface and is not a consideration for this project.

B. Subsurface Data

The borings were performed using penetration test procedures (Method of Test D1586 of the American Society for Testing and Materials). This procedure allows for the extraction of intact soil specimen from deep in the ground. With this method, a hollow-stem auger is drilled to the desired sampling depth. A 2-inch OD sampling tube is then screwed onto the end of a sampling rod, inserted through the hole in the auger's tip, and then driven into the soil with a 140-pound hammer dropped repeatedly from a height of 30 inches above the sampling rod. The sampler is driven 18 inches into the soil unless the material is too hard. The samples are generally taken at 2½ to 5-foot intervals. The core of soil obtained was classified and logged by our drilling personnel at the site and a representative portion was then sealed and delivered to our laboratory for further review.

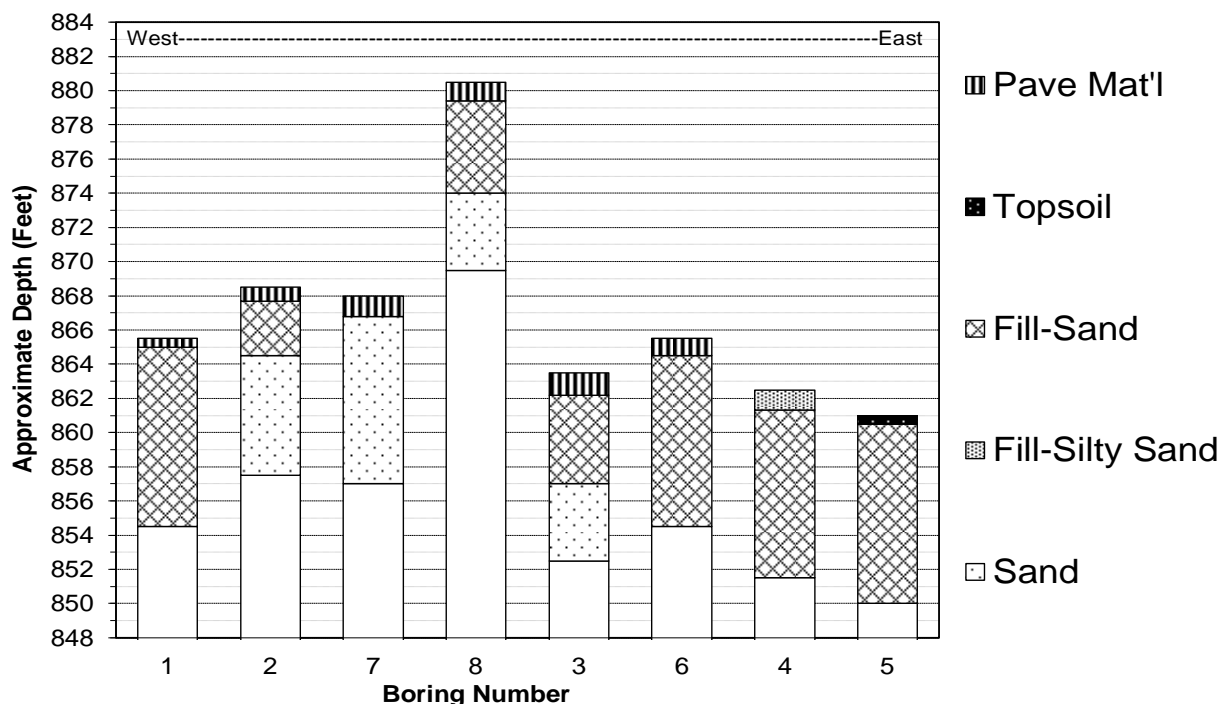
B.1. Strata

At the surface, the pavement borings encountered about 3 to 6 ½ inches of asphalt over 3 to 12 inches of aggregate base. Boring B-04 encountered about 1 foot of silty sand fill at the surface. About ½ foot of topsoil was encountered in Boring B-05 at the surface.

Below the surface materials, most of the borings encountered fill to possible fill to depths of 4 feet or more. The fill consisted primarily of rather clean sands but Boring B-06 contained some silty sand.

Below the surface materials and fill, most of the borings were dominated by clean sands natural sands (poorly graded sand and poorly graded sand with silt).

For the reader's convenience, we have summarized the soil boring data in the following cross-section. The reader is referred to the boring logs in the Appendix for more detailed information.



B.2. Penetration Test Results

Penetration Test Results: The number of blows needed for the hammer to advance the penetration test sampler is an indicator of soil characteristics. The results tend to be more meaningful for natural mineral soils, than for fill soils. In fill soils, density tests are more meaningful.

Penetration resistance values ("N" Value) of 5 to 25 blows per foot (BPF) were recorded in the fill and possible materials.

The natural sands on site returned values of 5 to 12 BPF, indicating they were very loose to medium dense.

A key to descriptors used to qualify the relative density of soil (such as *soft*, *stiff*, *loose*, and *dense*) can be found on the Legend to Soil Description in the Appendix.

B.3. Groundwater Data

During drilling, the drillers may note the presence of moisture on the sampler, in the cuttings, or in the borehole itself. These findings are reported on the Logs of Boring. Because water levels vary with weather, time of year, and other factors, the presence or lack of water during exploration is subject to interpretation and is not always conclusive.

Water was not observed in any of the borings. Groundwater levels at the site are expected to fluctuate seasonally similar to levels in the nearby Mississippi River and ponds, as well as with local weather patterns.

C. Project Design Data

Each structure has a different loading configuration and intensity, different grades, and different structural and performance tolerances. Therefore, the geotechnical exploration will be construed differently from one structure to another. If the initial structure should change design, we should be engaged to review these conditions with respect to the prevailing soil conditions. Without the opportunity to review any such changes, the recommendations may no longer be valid or appropriate.

The project consists of complete reconstruction of pavements and the installation of watermain, storm sewer and sanitary sewer along McKinley St. NE, Unity St. NW., Radium St NW., and 140th Ave. NW. CVT assumes the pipes will be installed at depths between 5 and 10 feet using open cut excavations or direction drilling.

We have assumed final grades will be at or close to the existing grades. The new pavement is expected to consist of asphalt over aggregate base.

D. Utility Recommendations

D.1. Groundwater/De-watering

As mentioned earlier, water was not observed in the borings. If water is encountered during the

excavation, well-points or dewatering wells will likely be required.

D.2. Trench Sidewalls

The contractor will be required to slope or shore the excavations as needed to meet OSHA requirements for safety. The soils encountered would be expected to classify as Type C soils as defined by OSHA. Trench boxes or other stabilization methods may be necessary if excavations encroach near existing utilities or structures.

D.3. Trench Bottom Stability

Depending upon location and depth, the utilities are expected to bear rather clean sands. These materials are considered generally suitable for support of pipes. If soft and unstable conditions are encountered, we recommend placing bedding of coarse sand or gravel at the base of the trenches to provide a more stable bottom for crews laying the pipes. Based on the data, we do not expect this will be needed.

In order to reduce the potential for point loads on the pipes, we recommend removing any cobbles or boulders to a depth of at least 6 to 8 inches from around pipes and replacing those materials with clean sand or gravel that can more readily conform to the culvert.

D.4. Fill Placement and Compaction

Soils placed as backfill below paved areas should ideally be compacted to 100% of their maximum standard Proctor density (ASTM D 698) in the upper 3 feet, and to at least 95% below. In green areas, 90% compaction is normally adequate.

The onsite soils are considered generally suitable for use as backfill above utilities, provided they can be adequately compacted. To reduce potential for differential frost action, fill placed in upper part of the trenches should ideally be placed in layers that align reasonably similar to the soil stratification on the trench side walls. In this case, all the soils appear to be reasonably uniform and layering does not appear to be necessary.

E. Pavement Recommendations

E.1. Stripping and Grading

We recommend removing the existing asphalt, aggregate base, and any organics soils from within 3 feet of the proposed pavement section subgrade before placing any new pavement material sections. The existing paving materials appeared to be quite varied, especially with regard to the depth of the aggregate base materials. It may be possible to reclaim and reuse the existing asphalt and aggregate for use as part of the new pavement's aggregate base, provided it meets MnDOT specifications.

After the removals, utility construction, and grading, the near-surface soils are expected to primarily consist of clean sands and silty sands. We recommend scarifying and compacting all near-surface soils in order to even out any localized discontinuities in the subgrade materials and to provide a more

gradational transition between differing materials. This action is intended to limit differential frost heave and provide more uniform pavement support.

Subgrades should be test rolled using a tandem axle truck. Any soft areas detected should be scarified, dried, and recompact. If time constraints prohibit drying, soil corrections, extra aggregate base, breaker run, sand subbase, and/or geotextiles may be necessary for stabilization.

E.2. Preliminary Pavement Design

As mentioned earlier, subgrade soils are expected to consist primarily of clean sands and silty sands. The effective Hveem-stabilometer R-values for dominant sands and silty sands would be expected to range from 30 to 70, and associated Soil Factors from 50 to 75.

As noted before, the existing pavements could possibly be milled and then reused as base material provided the reclaimed material meets Mn/DOT Specification 3138 for Class 5 Aggregate Base.

F. Construction Testing and Documentation

F.1. Excavation

A variety of equipment is expected to be capable of performing earthwork and grading. An excavator or backhoe with a smooth-lipped bucket is recommended for completing any excavations. This is intended to limit disturbance to the supporting soils being left in place, while also producing a smooth working surface.

F.2. Compaction

Fill should be placed in lifts adjusted to the compactor being used and the material being compacted. We recommend limiting lifts to no more than 1 foot, assuming large, self-propelled or tow-behind compactors are used. Thinner lifts should be used for lighter compaction equipment.

F.3. Cold Weather

If the earthwork occurs during freezing temperatures, good winter construction practices should be used. No frozen fill should be used nor should structural filling take place on frozen ground.

F.4. Construction Phase Testing and Documentation

The bottom of all excavations, grading, and roadway subgrade should be evaluated and documented by geotechnical personnel after the unsuitable materials are removed and before placement of any fill or pavement. Samples of any fill materials and/or alternative gradations of materials proposed for use should be submitted for approval before use. The City may wish to have, or may be obligated to have tests performed regarding the other various paving components. Specification of such requirements is normally the responsibility of the City or their designated design consultant.

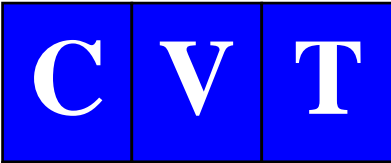
G. Level of Care

The services provided for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area, under similar budget and time constraints. This is our professional responsibility. No other warranty, expressed or implied, is made.

Appendix


Boring Location Sketch

Log of Boring # 1-8



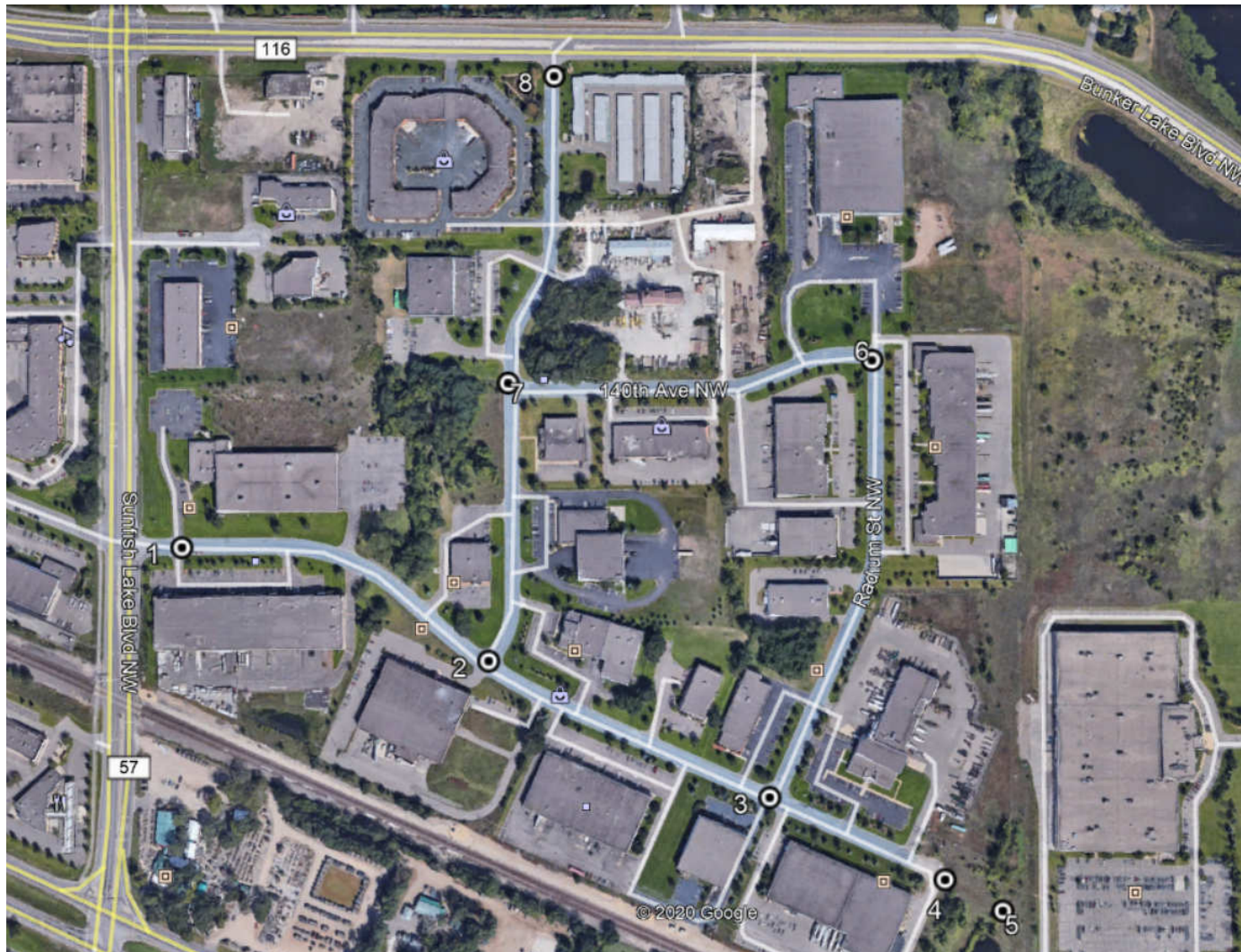
Chosen Valley Testing, Inc.

Legend

-  Boring Locations

Boring Location Sketch

Ramsey Business Park 95 Infrastructure Improvement
McKinley St NW., Unity St NW., Radium St NW., 140th
Ave NW,
Ramsey, Minnesota
17624.20.MNS



LOG OF BORING

CHOSEN VALLEY TESTING



| | | |
|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|
| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-1 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. | Depth | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|-------|-------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| 865.5 | 0.0 | | | | | |
| 865.3 | 0.2 | | 1.5" BITUMINOUS | | | |
| | | | 1.5" RECYCLED BITUMINOUS | | | |
| 865.2 | 0.3 | SP SM | 3" AGGREGATE BASE | | | |
| 865.0 | 0.5 | | POORLY GRADED SAND with SILT , mostly fine to medium grained, trace gravel, brown, moist, loose to medium dense. (Possible Fill) | | | |
| | | | | 15 | | |
| | | | | 11 | | |
| | | | | 10 | | |
| | | | | 8 | | |
| 854.5 | 11.0 | | End of boring. Water not encountered during drilling. Boring sealed upon completion. | | | |

CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG-A.GNND06.GDT 12/10/20

LOG OF BORING

CHOSEN VALLEY TESTING



| | | |
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| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-2 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. | Depth | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|-------|-------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| 868.5 | 0.0 | | | | | |
| 868.1 | 0.4 | | 5" BITUMINOUS | | | |
| 868.0 | 0.5 | | 1.5" RECYCLED BITUMINOUS | | | |
| 867.8 | 0.8 | SP SM | 3" AGGREGATE BASE POORLY GRADED SAND with SILT , mostly fine grained, trace gravel, brown, moist, medium dense. (Possible Fill) | | | |
| 864.5 | 4.0 | SP | POORLY GRADED SAND , mostly fine grained, trace gravel, brown, moist, loose to medium dense. (Terrace Deposit) | | | |
| | | | Brown to orange brown around 7.5 feet | | | |
| | | | Light brown around 10 feet | | | |
| 857.5 | 11.0 | | End of boring. Water not encountered during drilling. Boring sealed upon completion. | | | |

CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG-A.GNND06.GDT 12/10/20

LOG OF BORING

CHOSEN VALLEY TESTING



| | | |
|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|
| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-3 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. | Depth | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|-------|-------|-------------|-----------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| 863.5 | 0.0 | | | | | |
| 863.2 | 0.3 | | 4" BITUMINOUS | | | |
| | | | 12" AGGREGATE BASE | | | |
| 862.2 | 1.3 | | | | | |
| | | SP | POORLY GRADED SAND , mostly fine to medium grained, trace gravel, brown, moist, loose. (Possible Fill) | | | |
| | | | | 9 | | |
| | | | | | | |
| | | | | 8 | | |
| | | | | | | |
| 857.0 | 6.5 | | | | | |
| | | SP | POORLY GRADED SAND , mostly fine to medium grained, trace gravel, light brown, moist, loose. (Terrace Deposit) | | | |
| | | | | 6 | | |
| | | | | | | |
| | | | | 5 | | |
| 852.5 | 11.0 | | | | | |
| | | | End of boring. Water not encountered during drilling. Boring sealed upon completion. | | | |

CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG.A.GNND06.GDT 12/10/20

LOG OF BORING

CHOSEN VALLEY TESTING



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|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|
| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-4 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. 862.5 | Depth 0.0 | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|----------------|--------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| | | SM | SILTY SAND , dark brown to black, moist. (Fill) | | | |
| 861.3 | 1.2 | SP | POORLY GRADED SAND , mostly fine to medium grained, trace gravel and dark brown Silty Sand inclusions, brown, moist, loose. (Possible Fill) | | | |
| | | | | 6 | | |
| | | | | 5 | | |
| | | | | 7 | | |
| | | | | 7 | | |
| 851.5 | 11.0 | | End of boring. Water not encountered during drilling. Boring sealed upon completion | | | |

CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG A GNNN06.GDT 12/10/20

LOG OF BORING

CHOSEN VALLEY TESTING



| | | |
|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|
| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-5 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. 861.0 | Depth 0.0 | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|----------------|--------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| 860.5 | 0.5 | SM | SILTY SAND , trace roots, black. (Topsoil) | | | |
| | | SP SM | POORLY GRADED SAND with SILT , mostly fine grained, trace gravel, brown, moist, medium dense. (Possible Fill) | | | |
| | | | | 16 | | |
| 857.0 | 4.0 | SP | POORLY GRADED SAND , mostly fine grained, trace gravel, brown to light brown, moist, loose to medium dense. (Possible Fill) | | | |
| | | | | 10 | | |
| | | | Dark brown and grey Silty Sand inclusions around 7.5 feet | 11 | | |
| | | | Trace organic fibers around 10 feet | 11 | | |
| 850.0 | 11.0 | | End of boring. Water not encountered during drilling. Boring sealed upon completion. | | | |

CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG.A.GNND06.GDT 12/10/20

LOG OF BORING

CHOSEN VALLEY TESTING



| | | |
|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|
| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-6 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. 865.5 | Depth 0.0 | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|----------------|--------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| 865.1 | 0.4 | | 5" BITUMINOUS | | | |
| 864.5 | 1.0 | | 7" AGGREGATE BASE | | | |
| | | SM | POORLY GRADED SAND with SILT to SILTY SAND , mostly fine grained, dark brown to brown, moist, loose to medium dense. (Fill) | | | |
| | | | Trace gravel below 5 feet | 25 | | |
| | | | | 23 | | |
| | | | | 9 | | |
| | | | Trace roots around 10 feet | 10 | | |
| 854.5 | 11.0 | | | | | |

CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG.A.GNND06.GDT 12/10/20

LOG OF BORING

CHOSEN VALLEY TESTING



| | | |
|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|
| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-7 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. 868.0 | Depth 0.0 | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|----------------|--------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| 867.5 | 0.5 | | 6" BITUMINOUS | | | |
| 866.8 | 1.2 | | 8" AGGREGATE BASE | | | |
| | | SP | POORLY GRADED SAND , mostly fine to medium grained, trace gravel, light brown, moist, loose to medium dense. (Terrace Deposit) | | | |
| | | | Mostly medium grained below 7.5 feet | | | |
| 857.0 | 11.0 | | End of boring. Water not encountered during drilling. Boring sealed upon completion. | | | |

CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG.A.GNND06.GDT 12/10/20

LOG OF BORING

CHOSEN VALLEY TESTING

















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|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|
| PROJECT: 17624.20.MNS Design Phase Geotechnical Evaluation Proposed Business Park Unity Street NW Ramsey, Minnesota | BORING: B-8 | |
| | LOCATION: See attached sketch | |
| | DATE: 11/24/2020 | SCALE: 1" = 2' |

| Elev. 880.5 | Depth 0.0 | USCS Symbol | Description of Materials (ASTM D 2487/2488) | BPF | WL | Tests and Notes |
|----------------|--------------|----------------|------------------------------------------------------------------------------------------------------------------------------------|-----|----|-----------------|
| 880.1 | 0.4 | | 5" BITUMINOUS | | | |
| 879.4 | 1.1 | | 8" AGGREGATE BASE | | | |
| | | SP SM | POORLY GRADED SAND with SILT , mostly fine grained, trace gravel, brown to dark brown, moist, medium dense. (Fill) | | | |
| 874.0 | 6.5 | SP | POORLY GRADED SAND , mostly fine grained, trace gravel, light brown, moist, loose to medium dense. (Terrace Deposit) | | | |
| 869.5 | 11.0 | | End of boring. Water not encountered during drilling. Boring sealed upon completion. | | | |



CVT STANDARD 17624.20.MNS (RAMSEY BUSINESS PARK).GPJ LOG.A.GNND06.GDT 12/10/20

UNIFIED SOIL CLASSIFICATION (ASTM D-2487/2488)

| MATERIAL TYPES | CRITERIA FOR ASSIGNING SOIL GROUP NAMES | | | GROUP SYMBOL | SOIL GROUP NAMES & LEGEND | |
|-----------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------|-------------------------|---------------------------|--------------------------------------------------------------------------------------|
| COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE | GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE | CLEAN GRAVELS <5% FINES | Cu>4 AND 1<Cc<3 | GW | WELL-GRADED GRAVEL |  |
| | | GRAVELS WITH FINES >12% FINES | FINES CLASSIFY AS ML OR CL | GM | SILTY GRAVEL |  |
| | | GRAVELS WITH FINES >12% FINES | FINES CLASSIFY AS CL OR CH | GC | CLAYEY GRAVEL |  |
| | | CLEAN SANDS <5% FINES | Cu>6 AND 1<Cc<3 | SW | WELL-GRADED SAND |  |
| | SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE | CLEAN SANDS <5% FINES | Cu>6 AND 1>Cc>3 | SP | POORLY-GRADED SAND |  |
| | | SANDS AND FINES >12% FINES | FINES CLASSIFY AS ML OR CL | SM | SILTY SAND |  |
| | | SANDS AND FINES >12% FINES | FINES CLASSIFY AS CL OR CH | SC | CLAYEY SAND |  |
| | | SILTS AND CLAYS LIQUID LIMIT<50 | INORGANIC | PI>7 AND PLOTS>"A" LINE | CL | LEAN CLAY |
| FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE | SILTS AND CLAYS LIQUID LIMIT<50 | INORGANIC | PI>4 AND PLOTS<"A" LINE | ML | SILT |  |
| | | ORGANIC | LL (oven dried)/LL (not dried)<0.75 | OL | ORGANIC CLAY OR SILT |  |
| | SILTS AND CLAYS LIQUID LIMIT>50 | INORGANIC | PI PLOTS >"A" LINE | CH | FAT CLAY |  |
| | | INORGANIC | PI PLOTS <"A" LINE | MH | ELASTIC SILT |  |
| | | ORGANIC | LL (oven dried)/LL (not dried)<0.75 | OH | ORGANIC CLAY OR SILT |  |
| | | ORGANIC | LL (oven dried)/LL (not dried)<0.75 | PT | PEAT |  |
| HIGHLY ORGANIC SOILS | | PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR | | PT | PEAT |  |


| Relative Proportions of Sand and Gravel | |
|-----------------------------------------|------------------------|
| TERM | PERCENT |
| Trace | < 15 |
| With | 15 - 29 |
| Modifier | > 30 |
| Relative Proportions of Fines | |
| TERM | PERCENT |
| Trace | < 5 |
| With | 5 - 12 |
| Modifier | > 12 |
| Grain Size Terminology | |
| TERM | SIZE |
| Boulder | < 12 in. |
| Cobble | 3 in. - 12 in. |
| Gravel | #4 sieve to 3 in. |
| Sand | #200 sieve to #4 sieve |
| Silt or Clay | Passing #200 sieve |

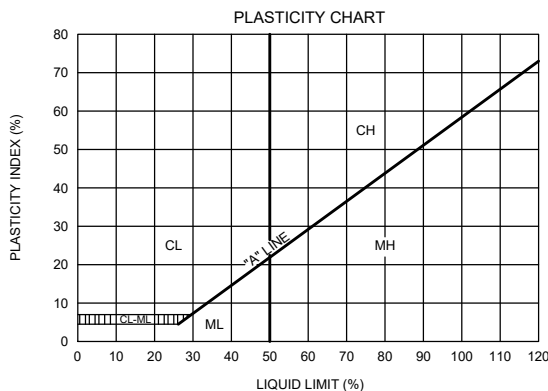
SAMPLE TYPES

-  Hollow Stem
-  Standard Penetration Test

TEST SYMBOLS

- | | |
|-----------------------------|----------------------------------------|
| MC - MOISTURE CONTENT | LL - LIQUID LIMIT |
| OC - ORGANIC CONTENT | PI - PLASTISITY INDEX |
| CN - CONSOLIDATION | SW - SWELL TEST |
| DD - DRY DENSITY | UU - Unconsolidated Undrained triaxial |
| PP - POCKET PENETROMETER | |
| RV - R-VALUE | |
| SA - SIEVE ANALYSIS | |
| P200 - % PASSING #200 SIEVE | |

-  WATER LEVEL (WITH TIME OF) MEASUREMENT



| PENETRATION RESISTANCE (RECORDED AS BLOWS / 0.5 FT) | | | | |
|--------------------------------------------------------|-------------|--------------|-------------|----------------------------|
| SAND & GRAVEL | | SILT & CLAY | | |
| RELATIVE DENSITY | BLOWS/FOOT* | CONSISTENCY | BLOWS/FOOT* | COMPRESSIVE STRENGTH (TSF) |
| VERY LOOSE | 0 - 4 | VERY SOFT | 0 - 1 | 0 - 0.25 |
| LOOSE | 4 - 10 | SOFT | 2 - 3 | 0.25 - 0.50 |
| MEDIUM DENSE | 10 - 30 | RATHER SOFT | 4 - 5 | 0.50 - 1.0 |
| DENSE | 30 - 50 | MEDIUM | 6 - 8 | 1.0 - 2.0 |
| VERY DENSE | OVER 50 | RATHER STIFF | 9 - 12 | 1.0 - 2.0 |
| | | STIFF | 13 - 16 | 2.0 - 4.0 |
| | | VERY STIFF | 17 - 30 | OVER 4.0 |
| | | HARD | OVER 30 | OVER 4.0 |

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

CVT-16987.20.MNR (DODGE CENTER AIRPORT WATERMAIN EXTENSION).GPJ 8/4/20

Chosen Valley Testing

Job No. 16987.20.MNR

LEGEND TO SOIL DESCRIPTIONS



City of Ramsey Business Park 95 Infrastructure
Improvements

Boring B-01



City of Ramsey Business Park 95 Infrastructure
Improvements

Boring B-02



City of Ramsey Business Park 95 Infrastructure
Improvements

Boring B-03



City of Ramsey Business Park 95 Infrastructure
Improvements

Boring B-06



City of Ramsey Business Park 95 Infrastructure
Improvements

Boring B-07

