# FEASIBILITY REPORT

# WOOD POND HILLS & CHESTNUT RIDGE STREET RECONSTRUCTIONS

## CITY IMPROVEMENT PROJECT NO. 19-03

**October 18, 2018**

**Prepared By:**

**City of Ramsey**
**Engineering Department**
**7550 Sunwood Drive NW**
**Ramsey, MN 55303**
**763-433-9839**
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October 18, 2018

Honorable Mayor and City Council
City of Ramsey
7550 Sunwood Drive NW
Ramsey, MN 55303

Re: Feasibility Report - City of Ramsey Improvement Project #19-03
Wood Pond Hills & Chestnut Ridge Street Reconstructions

Dear Mayor and City Council Members:

Transmitted herewith is a Feasibility Report for the proposed Wood Pond Hills & Chestnut Ridge Street Reconstructions project including; 146th Avenue from Nowthen Boulevard to Junkite Street, Helium Street from Sunwood Drive to 146th Avenue, and Krypton Street from Sunwood Drive to its termini cul-de-sac. The report examines the feasibility of reconstructing the bituminous street section and completing other appurtenant improvements.

This Feasibility Report examines the scope of the proposed improvements, explores estimated costs and available funding sources, defines a preliminary project schedule, and determines the necessity, feasibility and general cost-effectiveness of the proposed improvements, including any alternate designs, as well as whether the improvements would best be completed separately or in conjunction with another project.

I would be happy to discuss this report with you at your convenience. Please feel free to contact me at 763-433-9825 or bwestby@cityoframsey.com with any questions.

Sincerely,
***City of Ramsey***

Bruce Westby, PE
City Engineer

Enclosure

C: Kurt Ulrich, City Administrator
Leonard Linton, Civil Engineer IV

## 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.

Bruce Westby, PE

Date: October 18, 2018 License No. 40116

I hereby certify that this plan, specification or report was reviewed for Quality Control and Quality Assurance purposes and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Leonard Linton, PE

Date: October 18, 2018 License No. 21112

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## 1. EXECUTIVE SUMMARY

City Improvement Project No. 19-03 proposes to reconstruct streets within the Wood Pond Hills and Chestnut Ridge neighborhoods including 146th Avenue, Helium Street, and Krypton Street. The streets total approximately 3,310 linear feet (0.63 miles) in length. A map showing the location and scope of the proposed improvements is included as ***Figure 1*** in ***Appendix A***.

The streets were constructed between 1992 and 1994 with bituminous pavement, surmountable concrete curb and gutter, and concrete storm sewer. The streets were constructed to a width of 30-feet from face-of-curb to face-of-curb, and are centered within a 60-foot wide right-of-way.

The existing bituminous pavement section ranges from 1.6 to 5.0 inches thick, with a median thickness of 2.5-inches. This was determined from Ground Penetrating Radar (GPR) analysis performed by Braun Intertec in 2017, as well as from field observations and record plan documents. Copies of Braun Intertec's GPR results are attached in ***Appendix C***. The pavement section was built on generally poorly graded sand with silt subgrade material generally considered usable for pavement support with proper conditioning.

City staff evaluates and rates the condition of pavement sections on all City streets on an annual basis using the Pavement Surface Evaluation and Rating (PASER) system. In the summer of 2018, the pavement sections of the above referenced street segments were rated with a PASER rating of 2, with the exception of the south half of Krypton Street receiving a rating of 4. Ratings of 4 and below indicate these streets require complete reconstruction. City Staff patch the streets at least once per year, particularly before winter so the streets can be plowed without further damaging the pavement in the process. Pictures of the streets are located in ***Appendix A***.

Proposed improvements include removing and replacing all damaged concrete curb and gutter sections, and reconstructing the existing bituminous pavement section using the Full Depth Reclamation (FDR) process. This process would involve reclaiming the entire existing bituminous pavement section, along with the existing aggregate base. This reclaim material would then be spread over the reshaped and compacted subgrade between the curb and gutter, then the top 3 ½ -inches of reclaim material would be removed and hauled off site, after which 3 ½ -inches of new bituminous pavement would be installed over the remaining compacted reclaim material. This would result in a 7-ton pavement design, which is standard for residential streets.

Existing sanitary sewer and watermain infrastructure are in good condition. The existing storm sewer system is also in good condition with only minor work being proposed.

The engineer's opinion of probable costs for completing the proposed improvements outlined in this report is $372,236.52. Estimated costs include 5-percent contingency costs plus 23-percent indirect costs for administrative, engineering, finance and legal costs. A summary of the engineer's opinion of probably costs is included in ***Appendix B***.

A total of 59 assessable parcels have been identified. Staff recommends applying 25-percent of the eligible project costs equally across the 59 assessable properties using the "per lot" assessment

method. Eligible project costs include everything except subgrade correction costs. This results in a proposed preliminary assessment rate of $1,303.70 per assessable parcel.

Staff recommends ordering a special benefit consultation report for this project to verify the proposed assessment amount will not exceed the benefit to the properties. If the report concludes the benefit to the properties is less than the proposed preliminary assessment rate, Staff will then propose to lower the assessment rate accordingly during the Assessment Hearing, which is scheduled for October 8, 2019. If the report verifies the assessment rate as proposed is justified, Staff will propose to adopt the final assessment roll using the rate as preliminarily proposed.

Ten (10) soil borings were completed by Northern Technologies (NTI) to assist with the preparation of this report. Pavement design recommendations were offered by NTI, and Staff considered and incorporated NTI's recommendations to varying degrees while preparing this report. Ground Penetrating Radar (GPR) was conducted on street segments within the project. The GPR identifies existing bituminous pavement and aggregate base thicknesses, and is used to help Staff determine the appropriate treatment. Copies of Braun Intertec's GPR results and NTI's Geotechnical Exploration Report are attached in ***Appendix C***.

This improvement project, which is listed in the City's current 10-year Capital Improvement Plan, is proposed to be funded using a combination of special assessments to benefiting properties, street reconstruction bond proceeds, and storm sewer funds.

Staff has not yet discussed the proposed improvements with local property owners. However, Staff has scheduled a neighborhood information meeting for November 7, 2018 for the purpose of explaining the proposed improvements and assessments in more detail, and to gather public input on the project, including any information which should be explored in more detail during development of plans and specifications. Staff will incorporate comments and present this information to Council during the Public Hearing on November 13, 2018.

This project would best be constructed as a stand-alone project and is necessary, feasible, and cost-effective from an engineering standpoint, and can be constructed as proposed herein.

## 2. INTRODUCTION

### 2.1 Authorization

The preparation of this report was authorized by the Ramsey City Council on August 28, 2018. This project has been designated as City Improvement Project No. 19-03.

### 2.2 Program Overview

In support of the City's long-term Street Maintenance Program, the existing bituminous pavement section will be reconstructed. Damaged concrete curb and gutter will be replaced and minor storm sewer repairs will be made. Other appurtenant work will be completed as outlined in this report.

The City's pavement evaluation process involves a visual evaluation of each street's pavement surface based on the type, extent and severity of each pavement distress observed. Numerous types of pavement distresses may exist within a pavement section including, but not limited to, alligator cracking, block cracking, longitudinal cracking, transverse cracking, rutting, raveling, shoving, potholes and patches. This field data is then used to rate the pavement condition.

The City uses the Pavement Surface Evaluation and Rating (PASER) system to rate pavement condition. A PASER rating is a numerical index between 1 and 10 indicating the condition of a pavement based on the various pavement distresses recorded during visual observations. A PASER rating of 10 represents brand new pavement, while a PASER rating of 1 represents a pavement section that has fallen into complete disrepair requiring full reconstruction.

In the summer of 2018, City Staff evaluated and rated the condition of the pavement along the Wood Pond Hills and Chestnut Ridge street segments. A PASER rating of 2 was assigned to 146$^{th}$ Avenue, Helium Street, and the northern half of Krypton Street. A PASER rating of 4 was assigned to the southern half of Krypton Street, including its termini cul-de-sac.

### 2.3 Scope

City of Ramsey Improvement project 19-03 proposes to reconstruct the existing bituminous pavement, to remove and replace damaged concrete curb and gutter sections, and to complete other appurtenant work on three street segments within the Wood Pond Hills and Chestnut Ridge residential neighborhood including; 146$^{th}$ Avenue between Nowthen Boulevard and Junkite Street, Helium Street between Sunwood Drive and 146$^{th}$ Avenue, and Krypton Street from Sunwood Drive to its termini cul-de-sc. These street segments total approximately 3,310 lineal feet (0.63 miles) in length.

The existing bituminous pavement is proposed to be reconstructed using the Full Depth Reclamation (FDR) process. This involves reclaiming the bituminous pavement section between the existing concrete curb and gutter sections, along with the existing aggregate base, then hauling and disposing of any excess reclaim material off site, spreading and compacting the remaining reclaim material on top of the reshaped and compacted subgrade, then placing 3 ½ -inches of new

bituminous pavement on top of the compacted reclaim material. The resulting pavement design would meet current City design standards for residential pavement sections.

A map showing the location and scope of the proposed improvements is included as ***Figure 1*** in ***Appendix A***.

# 3. EXISTING CONDITIONS

## 3.1 Existing Pavement, Soil, and Traffic Conditions

The streets proposed to be improved were constructed between 1992 and 1994 with approximately 2.5-inches of bituminous pavement, 4-inches of aggregate base, and surmountable concrete curb and gutter. The streets were all constructed to a width of 30-feet from face-of-curb to face-of-curb, and are all centered within a 60-foot wide right-of-way.

Pavement maintenance treatments applied to the street segments included crack seal and seal coat improvements in 1998 and 2005. Spot patching has been performed on an as-needed basis, and has been a yearly treatment recently. In 2018, Staff assigned a PASER rating of 2 on all the street segments with the exception of the southern half of Krypton Street, which received a rating of 4.

In September of 2018, City Staff recorded a traffic volume of 551 average annual daily traffic (AADT) on 146$^{th}$ Avenue west of Nowthen Boulevard, 284 AADT on 146$^{th}$ Avenue east of Junkite Street, 129 AADT on Helium Street south of Sunwood Drive, and 205 AADT on Krypton Street south of Sunwood Drive. The existing speed limit is 30 mph for these street segments.

Northern Technologies, LLC (NTI) was employed to complete a Geotechnical Exploration and Engineering Review for this project, which included ten (10) soil borings spaced evenly along 146$^{th}$ Avenue, Helium Street, and Krypton Street. The locations of the borings are shown in the Soil Boring Location Map in the Appendix of NTI's report, attached in ***Appendix C***.

The soil borings provide information on existing bituminous pavement and aggregate base course thicknesses, subgrade soil conditions, existing ground water elevations, and potential issues, which may be encountered during construction. All borings terminated at a nominal depth of 10 feet below the existing ground surface. There was groundwater observed in 1 of 10 borings at an elevation of approximately 854.50, 7 feet below existing ground. Based on the work proposed and the lack of groundwater at a depth of 10 feet below the existing ground surface on 9 of 10 borings, groundwater is not anticipated to be encountered during work completed with this proposed projects.

The soil borings generally indicate the existing bituminous pavement thickness ranges between 4 to 5 inches, and aggregate base thickness is 6 inches. The subgrade generally consists of poorly graded sand with silt. This poorly graded sand with silt layer was found below the existing aggregate base and generally extends to the bottom of the borings (10 feet).

Braun Intertec was employed to complete a ground penetrating radar (GPR) analysis for the project area, which included driving the GPR equipped vehicle throughout all street segments within the project area. A summary table and charts of the GPR Analysis are attached in ***Appendix C***. The GPR data determined a median bituminous pavement thickness of 2.5-inches, and a median aggregate base thickness of 4.1-inches. The median street pavement and base section thickness was 6.5-inches, with a minimum section of 3.6-inches located on Helium Street, 403 feet south of Sunwood Drive. GPR data was unable to be obtained for 146$^{th}$ Avenue.

## 3.2 Watermain

Watermain was installed under all street segments in Wood Pond Hills and Chestnut Ridge. Staff believes the existing watermain is in good condition, and that no repairs will be required prior to reconstructing the pavement. However, if plans and specifications are ordered for the proposed improvements, Staff proposes to hire a leak detection expert to ensure there are no detectable leaks. If leaks are detected, repairs would be made under a separate contract before work commences on this project. Leak detection testing is estimated to cost $1,000.

## 3.3 Sanitary Sewer

Sanitary sewer was installed under each of the street segments in Wood Pond Hills and Chestnut Ridge. Staff believes the existing sanitary sewer is in good condition, and that no repairs will be required prior to reconstructing the pavement. However, if plans and specifications are ordered for the proposed improvements, Staff proposes to hire a firm to televise the sewer to ensure the pipes are not deformed, cracked, or broken, and that all joints are sealed. If any issues are detected, repairs would be made under a separate contract before work commences on this project. Sewer televising for this project is estimated to cost $4,500.

## 3.4 Storm Sewer / Drainage

Storm sewer was installed under all street segments in Wood Pond Hills and Chestnut Ridge. Staff believes the existing storm sewer is in good condition, and that no repairs will be required prior to reconstructing the pavement. There are no plans to modify the storm sewer due to no increase in impervious area with this project. If plans and specifications are ordered for the proposed improvements, Staff proposes to hire a firm to televise the storm sewer to ensure the pipes are not deformed, cracked, or broken, and that all joints are sealed. If any issues are detected, repairs would be added to this project. Storm sewer televising for this project is estimated to cost $1,000.

## 3.5 Streets

### *3.5.1 Existing Typical Sections*

The pavement width of 146th Avenue, Helium Street, and Krypton Street is 30-feet from face-of-curb to face-of-curb. The cul-de-sac on Krypton Street is 90-feet in diameter. The streets are generally centered within a 60-foot wide City-owned right-of-way, with a 120-foot wide right-of-way around the cul-de-sac on Krypton Street.

### *3.5.2 Maintenance History*

146th Avenue was originally constructed in 1992 and 1993, Helium Street was originally constructed in 1992, and Krypton Street was originally constructed in 1992 and 1994. All street segments received crack seal and seal coat improvements in 1998 and 2005.

## 3.6 Land Use

Properties in the Wood Pond Hills and Chestnut Ridge neighborhoods are zoned single family residential.

# 4. PROPOSED IMPROVEMENTS

## 4.1 Street and Stormwater Improvements

The street segments within the Wood Pond Hills and Chestnut Ridge neighborhood proposed to be reconstructed include 146th Avenue between Nowthen Boulevard and Junkite Street, Helium Street between Sunwood Drive and 146th Avenue, and Krypton Street from Sunwood Drive to its southern termini cul-de-sac.

The scope of the proposed surface improvements is shown in ***Figure 1*** in ***Appendix A***.

### *4.1.1 Street Improvements*

The streets in Wood Pond Hills and Chestnut Ridge are proposed to be reconstructed to match their existing width of 30-feet. All damaged surmountable concrete curb and gutter is proposed to be removed and replaced in kind. A typical section for the proposed pavement street reconstruction improvements is shown in ***Figure 2*** in ***Appendix A***.

The proposed reconstructed bituminous pavement design is designed to accommodate a 7-ton design in accordance with the City of Ramsey's design standards. City Staff is proposing a pavement section design of 1 ½ -inches bituminous wear course, 2-inches bituminous base course, over 4-inches of existing aggregate base material after reshaping and compacting the base.

The proposed pavement design should result in a minimum pavement life of 30 years, assuming that proactive, regular pavement maintenance treatments are performed during the life of the pavement. While a 60-year design life would typically be targeted for a reconstructed street, this project is not proposing a full street reconstruction due to the good condition of the majority of the existing 26-year old curb and gutter. Therefore, only the bituminous pavement is proposed to be reconstructed at this time as it may make sense to replace the pavement section at the same time the rest of the existing curb and gutter is replaced, which may be 30 or more years in the future.

### *4.1.2 Storm Sewer Improvements*

The existing storm sewer is in good condition and is not proposed to be improved. The only proposed storm sewer improvements include resetting catch basin castings and grouting the catch basins. No stormwater quality treatment improvements are required for this project since the street is proposed to be reconstructed at its current width.

### *4.1.3 Geotechnical Considerations*

Northern Technologies LLC (NTI) completed a Geotechnical Exploration and Engineering Review including ten (10) soil borings, generally evenly spaced along 146th Avenue, Helium Street, and Krypton Street. The locations of the borings are shown in the Boring

Location Map in the Appendix of NTI's report, attached in ***Appendix C***. NTI recommends stripping of the existing pavement and aggregate base course immediately prior to subgrade preparation and base aggregate installation to minimize weather induced instability of the silty subgrade soils which will be moisture-sensitive. Prior to installing the aggregate base, the existing subgrade should be scarified and re-compacted to a depth of at least 12 inches. A proof roll test should then be performed to determine soft or unstable subgrade areas. If rutting or localized unstable subgrade areas are observed, those areas should be sub cut, moisture-conditioned, and re-compacted or removed to a stable depth. Assuming AADT volumes of 600, and an estimated R-value of 30, NTI recommends a pavement section of 4 to 6 inches of aggregate base class 5 or class 6, and 4-inches of bituminous pavement. City Staff is in close agreement and proposes completing a full-depth reclamation of the existing pavement by placing 4-inches of aggregate base class 5 or reclaim material, and 3.5-inches of new bituminous pavement. 1 of 10 soil borings indicated a layer of clayey sand below the aggregate base, City Staff will be particularly observant of this area during the reclamation and proof rolling process, as it may require additional subgrade corrections.

The proposed improvements should have a service life of approximately 60-years, assuming maintenance such as overlays, crack sealing and seal coating is routinely performed.

### *4.1.4 Other Considerations*

*Driveways:*
Existing driveway aprons may need to be reconstructed to varying degrees. The limits of construction will vary with each driveway apron based on the elevation of the street abutting the driveway and the driveway pavement type. During design, Staff will evaluate the construction limits for each driveway and will incorporate this into the plans, but as with all street reconstruction projects, the exact limits of construction will be determined in the field during construction. Right-of-entry forms will be obtained from private property owners where work is required outside City right-of-ways and easements.

*Irrigation Systems:*
Developed properties along the project corridor may have private irrigation systems. Staff will notify property owners of pending construction as far in advance as practical to allow them time to move their irrigation systems out of harm's way before work begins.

*Parking Restrictions:*
Parking is currently provided along both sides of the streets and is not currently restricted except for overnight parking per City code. During this project, parking will be restricted during allowable working hours.

*Pavement Corings:*
Existing pavement thicknesses have been found to be inconsistent throughout the City. It is now standard practice to have City Staff on-site during pavement installation to insure the proper quantities are being placed. As further conformation, Staff is proposing to collect

GPR data or to have pavement corings taken at the conclusion of all reconstruction projects. This is already a requirement on all State Aid projects, and will leave more data on the pavement section for future street maintenance projects.

## 4.2 Stormwater Treatment

Stormwater retention and/or treatment improvements are not required for this project.

## 4.3 Water Main Improvements

No watermain improvements are proposed with this project.

## 4.4 Sanitary Sewer Improvements

No sanitary sewer improvements are proposed with this project.

## 4.5 Construction Method

The existing bituminous pavement section will be reconstructed using the FDR process outlined within this report.

## 4.6 Private Utilities

Staff has not yet met with the telephone, gas, power and cable utilities regarding this project. During preparation of plans and specifications, Staff will meet with the private utility companies to discuss the proposed improvements as noted in the project schedule within this report. The alignment and footprint of the streets will be considered to minimize impacts to private utilities. No impacts to power poles or street lights are anticipated with this project.

Should any utility company indicate they wish to upgrade, replace and/or otherwise modify their services during this project, any such upgrades, replacements and/or modifications will be at the sole discretion and cost of the utility company.

## 4.7 Permits

Permits that are anticipated to be required as part of the proposed improvements include:

- MPCA General Stormwater Permit (NPDES)…..Grading and Storm Water

A stormwater permit from the Lower Rum River Watershed Management Organization will not be required with this project as street reconstruction projects are exempt.

## 4.8 Right-of-Ways / Easements

It is anticipated that all improvements will occur within existing City right-of-ways and/or easements, with the possible exception of tying into private driveways and yards. It is therefore not anticipated that the City will need to acquire additional permanent right-of-way or easements for this project. As such, costs for right-of-way or easement acquisitions are not included in the probable project costs.

City Staff will obtain required right of entries on a case by case basis.

# 5. FINANCING

## 5.1 Opinion of Cost

A detailed opinion of probable costs for the proposed improvements can be found in ***Appendix B*** of this report. The opinion of probable costs incorporates anticipated 2019 construction costs for the proposed improvements with 5-percent contingency costs, plus 23-percent indirect costs for administrative, engineering, financing and legal costs.

City Staff prepared the Feasibility Report in-house as part of Staff's normal duties.

NTI prepared the Geotechnical Exploration and Engineering Review, included in ***Appendix C***, at a cost of $3,950.00.

## 5.2 Funding

### *5.2.1 Assessments*

A portion of the project costs is proposed to be recovered through special assessments levied against the 59 identified benefiting properties; 14 along 146$^{th}$ Avenue, 19 along Helium Street, and 26 along Krypton Street. Assessments are proposed to be collected for eligible improvements benefiting residential properties with direct access to the improved segments of Wood Pond Hills and Chestnut Ridge as described below. A preliminary assessment summary is included below in ***Table 1***.

*Residential Assessments:*
Special assessments are proposed to be levied against residential properties having direct access to improved streets. To be consistent with previous applications of the Special Assessments Policy, each residential property is proposed to be assessed using the "per lot" method.

Each residential property is preliminarily proposed to be assessed at the rate of $1,303.70 per lot. Since State Statute and the City Charter do not allow for assessments to exceed the benefit to the property, Staff requests Council authorization to order a benefit appraisal consultation for this project in accordance with the City's Special Assessment Policy.

The Preliminary Assessment Map and Roll are included in ***Appendix B***.

**TABLE 1**
**Proposed Preliminary Assessments – 146th Avenue, Helium Street, and Krypton Street**

| STREET SEGMENT | ASSESSMENT PER LOT | No. OF LOTS | TOTAL ASSESSMENTS |
|---|---|---|---|
| 146th Avenue | $1,303.70 | 14 | $18,251.80 |
| Helium Street | $1,303.70 | 19 | $24,770.30 |
| Krypton Street | $1,303.70 | 26 | $33,896.20 |
| **TOTAL PROJECT ASSESSMENTS** | | | **$76,918.30** |

### *5.2.2 City Contribution*

The City contribution to the project would include all funding in excess of the amount collected through special assessments to benefiting properties. No funds have been budgeted for this project. The City's share of eligible project costs related to surface (street) improvements is proposed to come from the previously encumbered 5-year Street Reconstruction and Overlay Program bonds. Stormwater Utility Funds are proposed to pay for all storm sewer improvements.

***Table 2*** illustrates the proposed project funding based on the design proposed within this report. This funding program assumes construction will occur in 2019.

**TABLE 2**
**Proposed Project Funding**

| | ASSESSMENTS | CITY FUNDS | TOTAL |
|---|---|---|---|
| **Surface** | $ 75,673.40 | $ 291,590.84 | $ 367,264.24 |
| **Storm Sewer** | $ 1,244.90 | $ 3,727.38 | $ 4,972.28 |
| **TOTAL** | $ 76,918.30 | $ 295,318.22 | $ 372,236.52 |

| | | |
|---|---|---|
| **Total Project Cost** | | **$ 372,236.52** |
| Less Special Assessments | - | $ 76,918.30 |
| **Subtotal** | = | **$ 295,318.22** |
| Less City Bonding Funds | - | $ 291,590.84 |
| **Subtotal** | = | **$ 3,727.38** |
| Less Stormwater Utility Funds | - | $ 3,727.38 |
| **TOTAL Remaining Cost** | = | **$ 0** |

## 6. PROJECT SCHEDULE

The proposed project schedule is as follows:

Council Orders Feasibility Report ..... August 28, 2018

Council Accepts Feasibility Report / Orders Public Hearing ..... October 23, 2018

Staff Conducts Neighborhood Information Meeting ..... November 7, 2018

Staff Publishes Notices of Public Hearing ..... October 26, November 2, 2018

Council Conducts Public Hearing / Authorizes Plans and Specifications ..... November 13, 2018

Staff Conducts Private Utility Coordination Meeting ..... December, 2018

Council Approves Plans and Specifications / Authorizes Ad for Bids ..... January 22, 2019

Staff Receives Bids ..... February 20, 2019

Council Awards Contract ..... February 26, 2019

Contractor Begins Construction ..... May, 2019

Contractor Completes Construction ..... August 16, 2019

Council Orders Assessment Hearing ..... September 10, 2019

Council Conducts Assessment Hearing ..... October 8, 2019

## 7. CONCLUSIONS AND RECOMMENDATIONS

City of Ramsey Improvement Project No. 19-03 proposes to reconstruct the existing bituminous pavement, remove and replace damaged concrete curb and gutter, and complete miscellaneous appurtenant work on the following street segments within the Wood Pond Hills and Chestnut Ridge residential subdivisions:

1. 146th Avenue (approx. 1160 linear feet) – Nowthen Boulevard to Junkite Street.
2. Helium Street (approx. 855 linear feet) – Sunwood Drive to 146th Avenue.
3. Krypton Street (approx. 1300 linear feet) – Sunwood Drive to south cul-de-sac.

It is the recommendation of City Staff that City Project No. 19-03 is feasible, necessary, and cost-effective from an engineering standpoint, and this project would best be constructed as a stand-alone project as proposed herein.

The following Staff recommendations related to the proposed project are presented for Council consideration and concurrence:

1. Reconstruct the existing bituminous pavement using full-depth reclamation process, meeting the City's standard residential pavement section of 4-inches aggregate base class 5 (or reclaim), 2-inches new bituminous base course, and 1 ½- inches new bituminous wear course.

2. Staff recommends excluding private irrigation system work form this project. Instead, Staff will notify property owners of pending construction as far in advance as possible, and instruct them to relocate their irrigation system(s) away from the construction area during construction, then allow replacement in or near the original location after construction is complete.

3. Staff recommends holding a neighborhood information meeting on November 7, 2018 to inform property owners of the proposed improvements and to gather their input prior to competing plans and specifications and requesting Council approval to advertise for bids as outlined in the project schedule.

4. Order an assessment appraisal consultation to ensure special assessments do not exceed the benefit received as a result of the improvements.

The City Council is asked to act on the following items related to the proposed project:

1. Accept the preliminary residential special assessment rate of $1,303.70 per lot.

2. Authorize an assessment appraisal consultation to ensure all special assessments are commensurate with benefit received from the proposed improvements.

3. Adopt Resolution #18-221 accepting this Feasibility Report and ordering the Public Hearing for November 13, 2018.

# APPENDIX A

**Figure 1 – Project Scope**
**Figure 2 – Typical Section**
**Project Site Pictures**


WOOD POND HILLS &
CHESTNUT RIDGE
PROJECT SCOPE
0
300
600
900
SCALE (FEET)
City of
RAMSEY

**FIGURE 1**

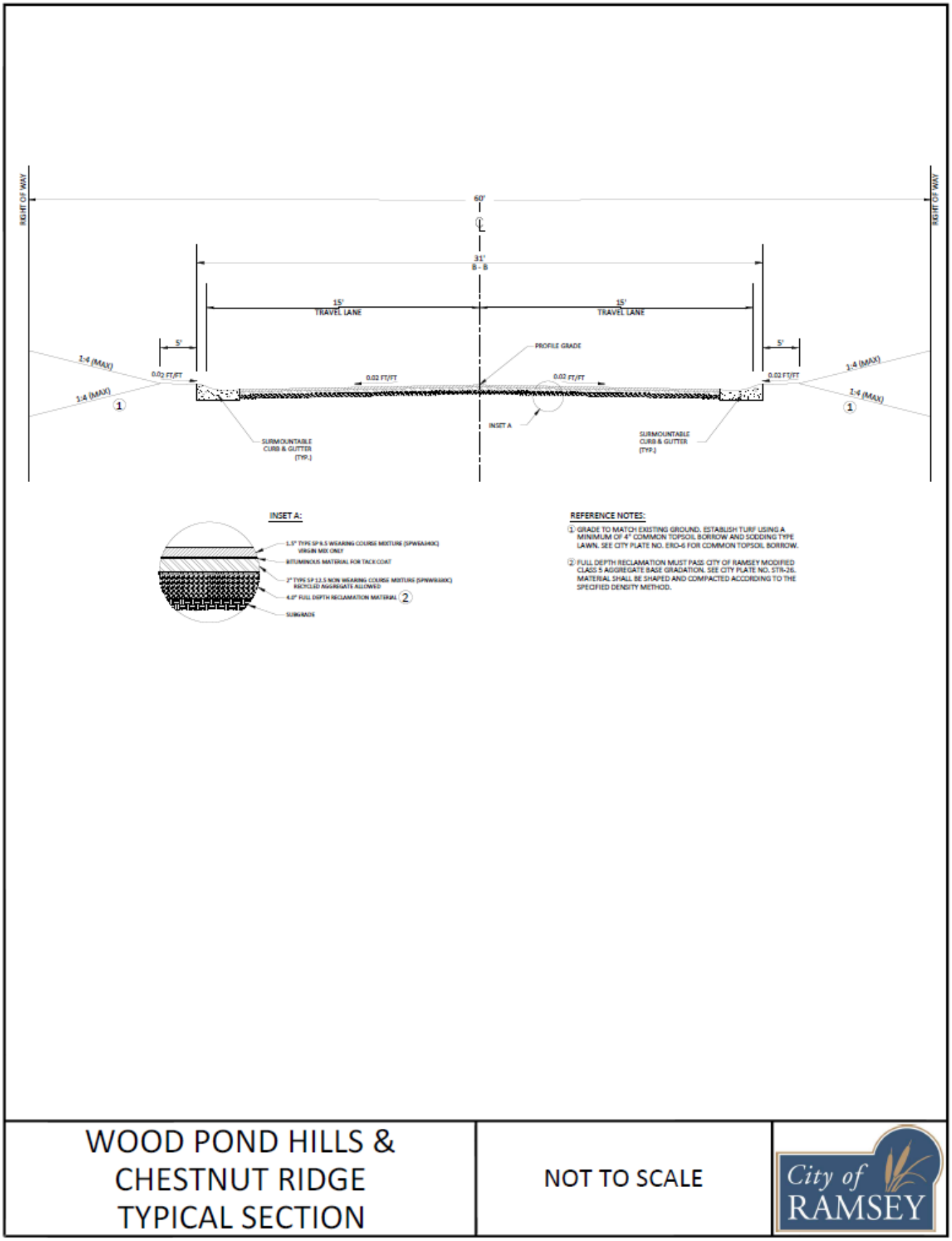

RIGHT OF WAY
60'
31'
B - B
15'
TRAVEL LANE
15'
TRAVEL LANE
5'
5'
PROFILE GRADE
1:4 (MAX)
1:4 (MAX)
0.02 FT/FT
0.02 FT/FT
0.02 FT/FT
0.02 FT/FT
1
1
INSET A
SURMOUNTABLE CURB & GUTTER (TYP.)
SURMOUNTABLE CURB & GUTTER (TYP.)
INSET A:
1.5" TYPE SP 9.5 WEARING COURSE MIXTURE (SPWEA340C) VIRGIN MIX ONLY
BITUMINOUS MATERIAL FOR TACK COAT
2" TYPE SP 12.5 NON WEARING COURSE MIXTURE (SPNWB310C) RECYCLED AGGREGATE ALLOWED
6.0" FULL DEPTH RECLAMATION MATERIAL 2
SUBGRADE
REFERENCE NOTES:
1 GRADE TO MATCH EXISTING GROUND. ESTABLISH TURF USING A MINIMUM OF 4" COMMON TOPSOIL BORROW AND SODDING TYPE LAWN. SEE CITY PLATE NO. ERO-6 FOR COMMON TOPSOIL BORROW.
2 FULL DEPTH RECLAMATION MUST PASS CITY OF RAMSEY MODIFIED CLASS 5 AGGREGATE BASE GRADATION. SEE CITY PLATE NO. STR-26. MATERIAL SHALL BE SHAPED AND COMPACTED ACCORDING TO THE SPECIFIED DENSITY METHOD.
WOOD POND HILLS & CHESTNUT RIDGE TYPICAL SECTION
NOT TO SCALE
City of RAMSEY

**FIGURE 2**

# PROJECT SITE PICTURES

**Picture 1: Krypton Street from Sunwood Drive**

**Picture 2: Krypton Street mid-block facing south**

**Picture 3: Helium Street from Sunwood Drive**

**Picture 4: Helium Street from 146th Avenue**

**Picture 5: 146th Avenue from Helium Street, facing west**

**Picture 5: 146th Avenue valley gutter at Helium Court**

# APPENDIX B

## Opinion of Probable Costs (Preliminary Engineer's Estimate)
## Preliminary Assessment Map
## Preliminary Assessment Roll

| 19-03 WOOD POND HILLS & CHESTNUT RIDGE STREET RECONSTRUCTIONS | | | | | |
|---|---|---|---|---|---|
| **Preliminary Engineer's Estimate** | | | | | |
| ***Street Construction*** | | | | | |
| **Item No.** | **Description** | **Unit** | **Estimated Quantity** | **Unit Cost** | **Cost Extension** |
| 1 | Mobilization | LS | 1 | $ 9,000.00 | $ 9,000.00 |
| 2 | Remove Concrete Curb and Gutter | LF | 750 | $ 6.00 | $ 4,500.00 |
| 3 | Remove Concrete Pavement – Driveways | SF | 80 | $ 3.50 | $ 280.00 |
| 4 | Remove Bituminous Pavement – Driveways | SY | 45 | $ 8.00 | $ 360.00 |
| 5 | Remove Bituminous Pavement | SY | 25 | $ 8.00 | $ 200.00 |
| 6 | Remove Concrete Valley Gutter | SY | 18 | $ 20.00 | $ 360.00 |
| 7 | Sawing Concrete Pavement – Full Depth | LF | 200 | $ 4.00 | $ 800.00 |
| 8 | Sawing Bituminous Pavement – Full Depth | LF | 300 | $ 2.50 | $ 750.00 |
| 9 | Common Excavation (EV) | CY | 20 | $ 32.00 | $ 640.00 |
| 10 | Subgrade Preparation | RDST | 33 | $ 200.00 | $ 6,600.00 |
| 11 | Subgrade Corrections | LS | 1 | $ 50,000.00 | $ 50,000.00 |
| 12 | Water | MGAL | 50 | $ 35.00 | $ 1,750.00 |
| 13 | Bituminous Pavement Reclamation (Full Depth) | SY | 10,286 | $ 1.50 | $ 15,429.00 |
| 14 | Mill Bituminous Pavement (2' width x 1.5" depth) | SY | 60 | $ 15.00 | $ 900.00 |
| 15 | Curing Compound for Existing Concrete Curb and Gutter | LF | 5,782 | $ 1.15 | $ 6,649.30 |
| 16 | Haul and Dispose Bit Pavement Reclamation (LV) | CY | 1,200 | $ 10.00 | $ 12,000.00 |
| 17 | Bituminous Material for Tack Coat | GAL | 720 | $ 2.50 | $ 1,800.00 |
| 18 | Type SP 9.5 Wearing Course Mixture (SPWEA340C) (1.5") | TON | 849 | $ 68.00 | $ 57,732.00 |
| 19 | Type SP 12.5 Non-Wearing Course Mixture (SPNWB330C) (2.0") | TON | 1,132 | $ 60.00 | $ 67,920.00 |
| 20 | Type SP 9.5 Wearing Course Mixture (SPWEA340C) Driveways (2.0") | TON | 5 | $ 68.00 | $ 340.00 |
| 21 | Adjust Valve Box | EA | 10 | $ 250.00 | $ 2,500.00 |
| 22 | Replace Broken Valve Box | EA | 5 | $ 250.00 | $ 1,250.00 |
| 23 | Adjust Frame and Ring Casting | EA | 15 | $ 550.00 | $ 8,250.00 |
| 24 | Concrete Curb & Gutter Design Surmountable | LF | 650 | $ 25.00 | $ 16,250.00 |
| 25 | Concrete Curb & Gutter Design B618 | LF | 100 | $ 25.00 | $ 2,500.00 |
| 26 | 6" Concrete Driveway Pavement | SY | 9 | $ 55.00 | $ 495.00 |
| 27 | 7" Concrete Valley Gutter | SY | 33 | $ 85.00 | $ 2,805.00 |
| 28 | Landscape Restoration | LS | 1 | $ 1,500.00 | $ 1,500.00 |
| 29 | Traffic Control | LS | 1 | $ 2,000.00 | $ 2,000.00 |
| 30 | Storm Drain Inlet Protection | EA | 13 | $ 200.00 | $ 2,600.00 |
| 31 | Common Topsoil Borrow (LV) | CY | 23 | $ 50.00 | $ 1,150.00 |
| 32 | Sodding Type Lawn | SY | 170 | $ 18.00 | $ 3,060.00 |
| | | | | | |
| | | | | *Total Street Construction Cost* | *$ 284,370.30* |
| | | | | *5% Contingency Cost* | *$ 14,218.52* |
| | | | | *23% Indirect Cost* | *$ 68,675.43* |
| | | | | *Total Street Project Cost* | *$ 367,264.24* |

| | | | | | |
|---|---|---|---|---|---|
| ***Storm Sewer Construction*** | | | | | |
| **Item No.** | **Description** | **Unit** | **Estimated Quantity** | **Unit Cost** | **Cost Extension** |
| 1 | Grout Catch Basin | EA | 11 | $ 350.00 | $ 3,850.00 |
| | | | | | |
| | | | | *Total Storm Sewer Construction Cost* | *$ 3,850.00* |
| | | | | *5% Contingency Cost* | *$ 192.50* |
| | | | | *23% Indirect Cost* | *$ 929.78* |
| | | | | *Total Storm Sewer Project Cost* | *$ 4,972.28* |
| | | | | | |
| | | | | **Total Estimated Project Cost** | **$ 372,236.52** |


# WOOD POND HILLS & CHESTNUT RIDGE ASSESSABLE PROPERTIES

0 125 250 375

SCALE (FEET)

City of RAMSEY

| PRELIMINARY ASSESSMENT ROLL – 19-03 WOOD POND HILLS & CHESTNUT RIDGE STREET RECONSTRUCTIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PID** | **NAME / OWNER** | **ADDRESS** | **CITY** | **STATE** | **ZIP** | **ASSESSABLE UNITS** | **PROPOSED ASSESSMENT** |
| 253225220005 | PRASKE TERESA | 14729 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225220006 | CASEY CHRISTINE | 14715 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225220007 | AUSPOS MICHAEL | 14701 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225220008 | DZANIC NURIJA | 14685 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230008 | AKENSON ANGELA | 14671 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230009 | SOLEM JAY | 14657 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230010 | POPEJOY JEREMY | 14643 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230011 | WILEY STEVEN | 14629 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230012 | KYLAS LLC | 14615 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230013 | 2015-3 IH2 BORROWER LP | 14601 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230014 | MASSA STEVEN | 14670 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230015 | LUSSIER ANGELA | 14656 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230016 | SOLTIS JAY & KONOP KAREN | 14642 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230017 | HUNTER DAVID S & ALENA M | 14628 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230018 | COOLEY STEVEN A | 14614 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230019 | DINWIDDIE JONATHAN | 14600 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230030 | JOHNSON CARTER | 5581 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230031 | CAPPS RONNEY L & CAROLANN | 5571 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 253225230054 | BAKKEN GRANT | 5560 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225110019 | HUSPEK JASON | 14714 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225110020 | ABUMAYALEH YOUSEF | 14700 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130021 | LI HUISHEN & YING | 14602 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130022 | HOVAN JOHN J & LINDA F TRUSTEE | 14588 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130023 | RE0046814 PAUL | 14574 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130024 | MOBERG JULIE | 14560 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130025 | SWINNEY ADAM | 14546 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130026 | THOMAS SCOTT G & LISA M | 14532 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130027 | RINGOLD JAMES B & JEAN K | 14531 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130028 | REINERT MICHAEL | 14545 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130029 | ALTRINGER BARBARA | 14559 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130030 | JANISCH TODD | 14573 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225130031 | ROBINSON HOLLIE | 14587 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140002 | HAWKINS JOHN | 14684 HELIUM ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140003 | CANTU RAUL & CAROL J | 14671 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140004 | HOLST CRISTON K & ANN C | 14685 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |

| PID | NAME / OWNER | ADDRESS | CITY | STATE | ZIP | ASSESSABLE UNITS | PROPOSED ASSESSMENT |
|---|---|---|---|---|---|---|---|
| 263225140005 | COUILLARD BRADLEY | 14701 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140006 | MOLER RICHARD P & CAROL J | 14715 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140007 | KOSMECKI DAVID | 14729 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140008 | FREDRICK DAVID J & MICHELLE L | 14615 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140009 | ONEILL BRETT J & PATRICIA K | 14629 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140010 | LABONNE JOSEPH T & ANNETTE | 14643 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140011 | STONE GREGORY A & TINA H | 14642 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140012 | FRIESE KELLI | 14670 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140013 | ROBERTS EARL F & MOLLY H | 14684 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140014 | PRZYBILLA THOMAS U | 14700 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140015 | SEELEY ANGELA | 14714 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140016 | RAMSEY CITY OF | | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140048 | LANTIS LANE | 5681 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140049 | GULINO EMILY | 5671 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140050 | OSTENSO KENNETH J & MICHELLE | 5651 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140051 | MANSAVAGE ERIN | 5641 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140052 | WHITSTONE CHRISTOPHER | 5631 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140053 | JACHYMOWSKI BRIAN | 5621 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140054 | REEDER CHRISTINA | 5601 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140066 | WERDER JONATHAN | 14601 KRYPTON ST NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140080 | HUTH JEFFREY | 5680 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140081 | SCHROECK TRUSTEE JASON & SCHROECK TRUSTEE SARA | 5670 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140082 | WOLFF DAVID | 5650 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| 263225140086 | ERLANDSON MANDY C & BRIAN | 5640 146$^{TH}$ AVE NW | RAMSEY | MN | 55303 | 1 | $ 1,303.70 |
| **TOTALS** | | | | | | **59** | **$ 76,918.30** |

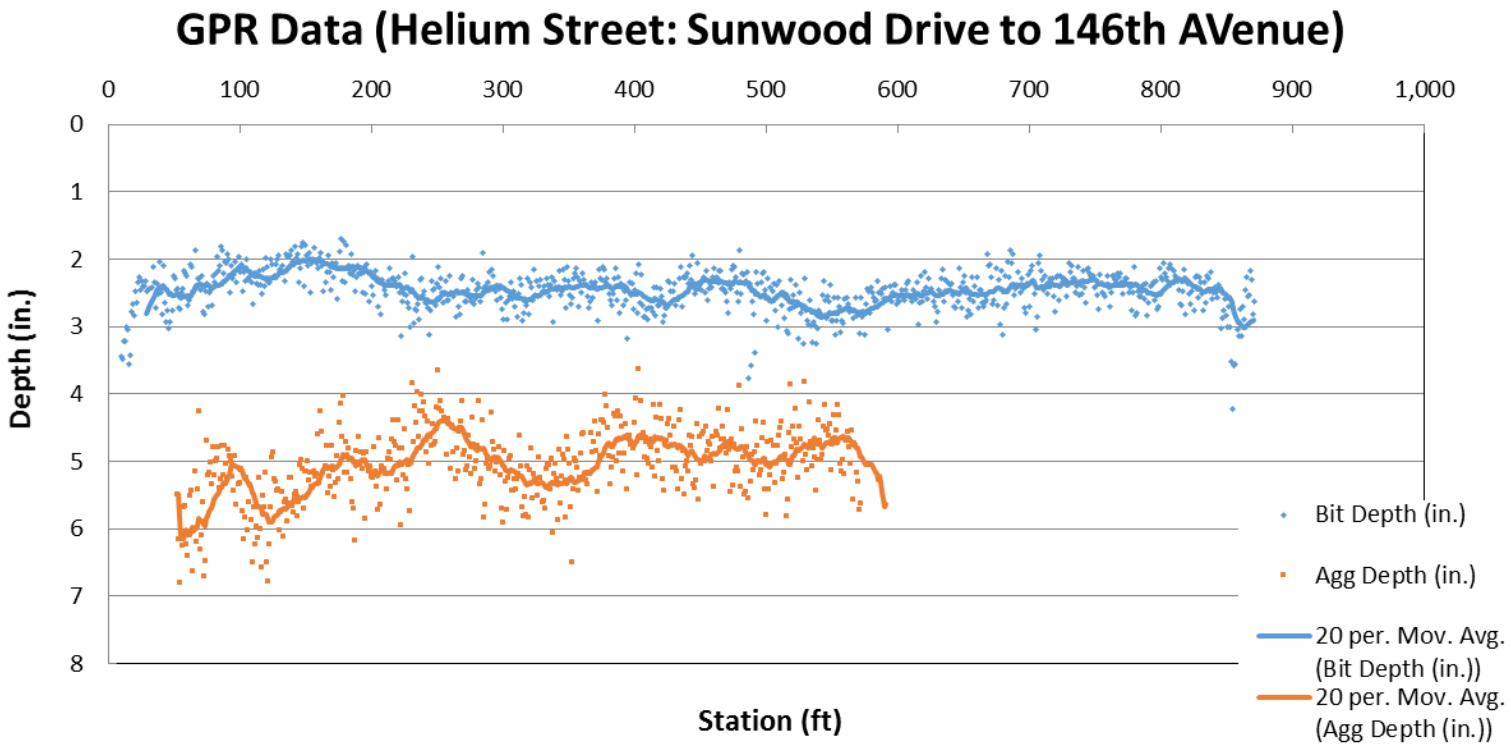
# APPENDIX C

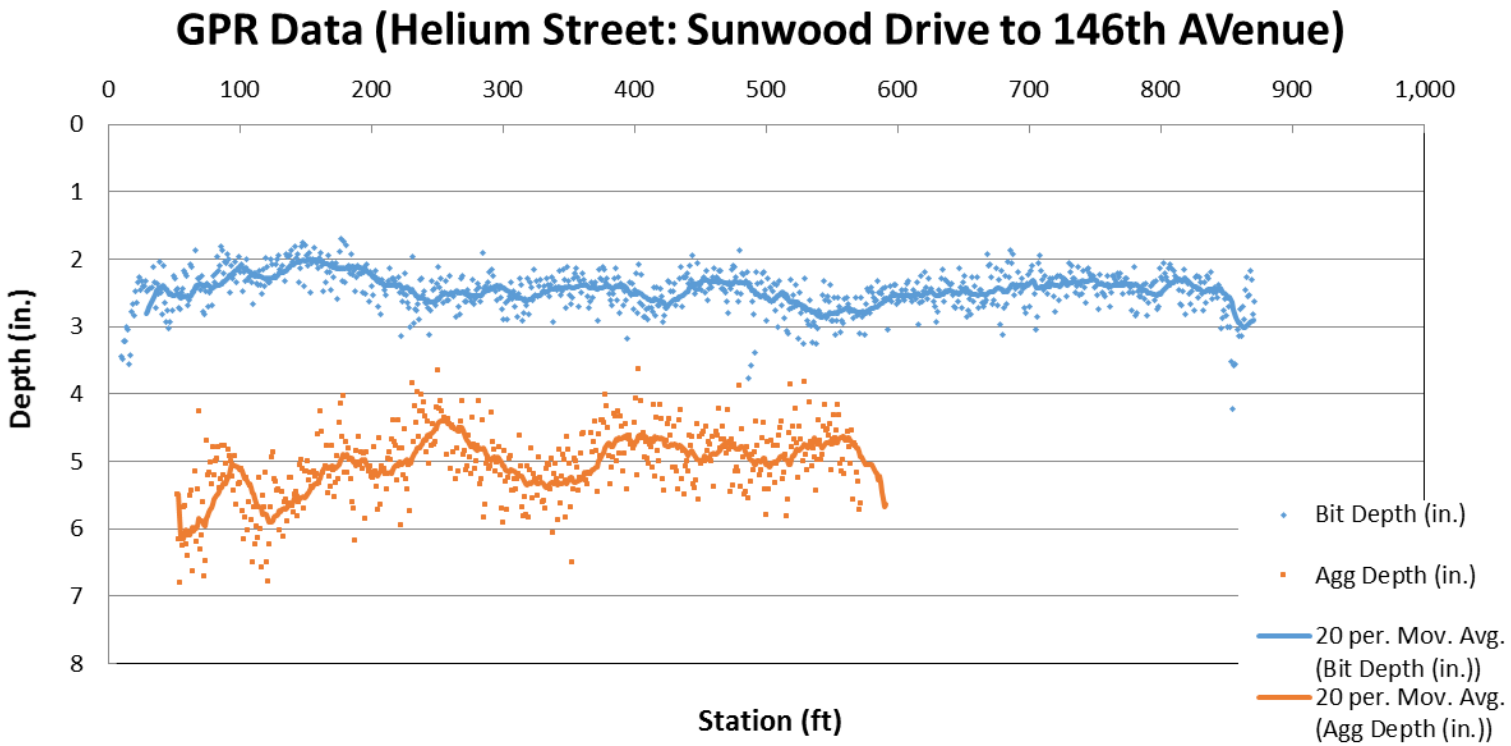
## Street Segment Summary
## Ground Penetrating Radar (GPR) Results
## Geotechnical Exploration and Engineering Review

**STREET SEGMENT SUMMARY**

| Street | Segment Description | Length | Width | Curb | 2018 Rating | Year Built | Maint. 1 | Maint. 2 |
|---|---|---|---|---|---|---|---|---|
| 146th Avenue | Nowthen Boulevard / Junkite Street | 1,158 | 31 | Concrete | 4 | 1992 / 1993 | SC 1 1998 | SC 2 2005 |
| Helium Street | Sunwood Drive / 146th Avenue | 855 | 31 | Concrete | 4 | 1992 | SC 1 1998 | SC 2 2005 |
| Krypton Street | Sunwood Drive / CDS | 1,297 | 31 | Concrete | 3 / 5 | 1992 / 1994 | SC 1 1998 | SC 2 2005 |

| Wood Pond Hills & Chestnut Ridge Estates GPR Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Segment | | Pavement | | | Aggregate | | | Section | | |
| Street | Segment Description | Min | Max | Med | Min | Max | Med | Med | Min | Location |
| 146th Avenue | CSAH 5 / Junkite Street | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | * GPR Data was not able to be obtained for 146th Ave. |
| Helium Street | Sunwood Drive / 146th Avenue | 1.7 | 4.2 | 2.4 | 1.3 | 4.4 | 2.6 | 5.0 | 3.6 | 403 feet south of Sunwood Drive |
| Krypton Street | Sunwood Drive / CDS | 1.6 | 5.0 | 2.5 | 3.8 | 8.4 | 5.6 | 7.8 | 6.0 | 1,100 feet south of Sunwood Drive |
| *Project Summary* | | *1.6* | *5.0* | *2.5* | *1.3* | *8.4* | *4.1* | *6.5* | *3.6* | *Helium Street; 403 feet south of Sunwood Drive.* |


GPR Data (Helium Street: Sunwood Drive to 146th AVenue)
0
100
200
300
400
500
600
700
800
900
1,000
0
1
2
3
4
5
6
7
8
Depth (in.)
Station (ft)
Bit Depth (in.)
Agg Depth (in.)
20 per. Mov. Avg. (Bit Depth (in.))
20 per. Mov. Avg. (Agg Depth (in.))


GPR Data (Helium Street: Sunwood Drive to 146th AVenue)
0
100
200
300
400
500
600
700
800
900
1,000
0
1
2
3
4
5
6
7
8
Depth (in.)
Station (ft)
Bit Depth (in.)
Agg Depth (in.)
20 per. Mov. Avg. (Bit Depth (in.))
20 per. Mov. Avg. (Agg Depth (in.))

# GEOTECHNICAL EXPLORATION AND ENGINEERING REVIEW

*Wood Pond Hills and Chestnut Ridge Street Improvements*

*Ramsey*

*Minnesota*

*NTI Project No. 18.MSP06853.000*

***Prepared For**:*

City of Ramsey
7550 Sunwood Drive
Ramsey, Minnesota 55303

NTI
NORTHERN TECHNOLOGIES, LLC

6160 Carmen Avenue East
Inver Grove Heights, MN 55076
P: 651.389.4191 F: 651.389.4190
www.NTIgeo.com

Unearthing confidence™

October 8, 2018

City of Ramsey
Attention: Mr. Joe Feriancek
7550 Sunwood Drive
Ramsey, Minnesota 55303

Subject: Geotechnical Exploration and Engineering Review
**Wood Pond Hills and Chestnut Ridge Street Improvement Projects**
Ramsey, Minnesota
NTI Project No. 18.MSP06853.000

Northern Technologies, LLC (NTI) has completed a total of ten (10) soil borings in the Wood Pond Hills and Chestnut Ridge areas. Our services were performed in accordance with our proposal dated September 4, 2018.

Soil samples obtained at the site will be held for 60 days at which time they will be discarded. Please advise us in writing if you wish to have us retain them for a longer period. You will be assessed an additional fee if soil samples are retained beyond 60 days.

We appreciate the opportunity to have been of service on this project. If there are any questions regarding the soils explored or our review and recommendations, please contact us at your convenience at (651) 389-4191.

**Northern Technologies, LLC**

Robert Hawkins, GIT
Staff Geologist

Steven D. Gerber, P.E.
Senior Engineer

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.

Steven D. Gerber
Date: 10/08/2018 Reg. No. 45298

# Contents

## 1.0 Scope of Services

Ten borings were performed within the project area. The scope of services included determining existing bituminous and aggregate base thicknesses, groundwater levels, subsurface conditions, and providing recommendations for site preparation, excavations, engineered fill and compaction, depths of unsuitable soils to be removed, groundwater management, potential difficulties during construction, utility construction, and pavement thickness design.

## 1.1 Project and Site Description

The project consists of the reconstruction of Helium Street, Junkite Street Krypton Street and 146th Avenue in Ramsey, Minnesota, along with associated utilities. NTI was not aware of invert elevations or other design details of the proposed utilities at the time this report was prepared.

The pavement sections are proposed to be designed with a 20-year design pavement life. NTI has assumed an AADT value of 600 for these residential streets.

## 2.0 Subsurface Exploration Summary

NTI performed the subsurface exploration program during the period of September 26, 2018 with a two-person crew using a truck-mounted CME-55 drill rig. Samples were generally collected in accordance with ASTM D 1586 "Standard Test Method for Standard Penetration Testing (SPT) and Split-Barrel Sampling of Soils." The boring locations and depths were determined by a representative of the City of Ramsey. The boring locations were marked in the field by NTI. The borings terminated at depths ranging from approximately 10. feet below the top of pavement. Elevations were determined using a Trimble GeoXH 6000 and rounded to the nearest one-half foot.

Please refer to the Boring Location Diagrams and the Boring Logs in Appendix C.

Groundwater was observed, in soils boring SB-8, at a depth of approximately 7 feet below the ground surface, correspond to an elevation of 854.5 feet.

The lack of observed groundwater in the remaining borings is likely due to the short duration for which the boreholes remained open. In addition, the seams of on-site clay and silt laden soils have the potential to be somewhat impervious and conducive to the development of zones of perched water at varying elevations and locations across the project area. Please refer to the boring log included in the appendices.

Table 1 summarizes the encountered subsurface conditions encountered.

**Table 1: Pavement and Subgrade Summary[1]**

| Boring No. | Bituminous Pavement Thickness[2] (inches) | Apparent Aggregate Base Thickness[3] (inches) | Fill Subgrade Material[4] | Native Subgrade Material [5] |
|---|---|---|---|---|
| SB-1 | 4 | 8 | SP-SM | SP |
| SB-2 | 4 | 6 | SP-SM | SP-SM |
| SB-3 | 4 | 6 | SM | SP-SM |
| SB-4 | 4 | 8 | SP-SM | SP |
| SB-5 | 5 | 6 | SP-SM | SP |
| SB-6 | 4 | 6 | SP-SM | SP-SM |
| SB-7 | 4 | 6 | SP-SM | SP-SM |
| SB-8 | 4 | 6 | SP-SM | SP-SM |
| SB-9 | 4 | 6 | SP | SP |
| SB-10 | 4 | 6 | SC/SP-SM | SP-SM |

1. Table summary is a generalization of subsurface conditions at the individual soil boring locations only. They may not reflect variations in subsurface strata occurring on site between boring locations. The general geologic origin of retained soil samples is listed on the boring logs.
2. Measured thickness of the pavement core.
3. Apparent aggregate base thickness, at time of our fieldwork, by visual inspection only and is not meant to confer conformance with DOT specifications.
4. Undocumented fill soils were encountered immediately under the aggregate base.
5. The native soils underlying the undocumented fill soils.

## 2.1 Groundwater and Groundwater Control

Groundwater was observed at the time of drilling. Groundwater was observed in one of the ten boreholes at a depth of approximately 7 feet below the top of pavement. The lack of observed groundwater at the remaining boring locations may be due to the short duration for which the boreholes remained open. In addition, the on-site clay and silt based soils have the potential to be somewhat impervious and conducive to the development of zones of perched water at varying elevations and locations across the project area.

## 2.2 Laboratory Test Program

Our analysis and recommendations of this report are based upon our interpretation of the standard penetration test resistance determined while sampling soils, laboratory test results, and experience with similar soils from other sites near the project. The results of such tests are summarized on the boring logs or attached laboratory test reports.

## 2.3 Utilities

The fill and native soils observed in soil borings were generally suitable for utility support. Due to the observed groundwater levels and depending on the installation depth of the utilities, temporary dewatering would likely be required during the utility trench excavations for deeper utilities, such as sanitary sewer. Stabilization of the trench subgrade may be required, in particular in locations with lean clay subgrade, in order to provide a stable platform for construction. Stabilization could consist of a one half to one foot layer of crushed rock or sand with a maximum 5 percent material passing the No. 200 sieve and 50 percent passing the No. 40 sieve.

The Geotechnical Engineer of Record or their designated representative should observe the project excavations to determine that unsuitable materials have been properly removed and adequate bearing support is provided by the exposed soils. The exposed soil at the base should be compacted with a vibratory roller to 95 percent standard Proctor dry density (ASTM D698). Such observations and testing should be performed prior to backfilling.

The on-site, non-organic soils are anticipated to be suitable for reuse if properly moisture conditioned and compacted. Replacement backfill required in utility trenches should consist of non-organic material similar to the surrounding soil. All import fill should be approved by NTI or the City's representative.

It is especially important that trench backfill for utility construction within paved areas be thoroughly compacted to minimize future pavement damage. We recommend that such soils be compacted in accordance with the recommendations noted in the "Placement and Compaction of Engineered Fill" section in Appendix B of this report.

The stability of embankments along utility excavations is dependent on soil strength, site geometry, moisture content, and any surcharge load for excavated soils and equipment. We present cautionary remarks concerning stability of excavation sideslopes in the "Excavation Stability" section of this report.

The Contractor is solely responsible for assessing the stability of and executing underground utility and project excavations using safe methods. The contractor is also responsible for naming the "competent individual" as per Subpart P of 29 CFR 1926.6 (Federal Register - OSHA).

## 2.4 Pavement Recommendations

### Full Reconstruction Option

The most conservative method of subgrade preparation would be to remove the undocumented fill soils and replace them in their entirety with properly compacted engineered fill. This method of subgrade preparation would provide the most uniform subgrade but would also be the most costly method of construction and would be a relatively a-typical method of subgrade preparation for improvements to existing municipal roadways.

If the City were willing to accept some risk in potential long term increased maintenance of the pavement section for the significant upfront savings, the roadway can be reconstructed over the existing fill.

The Contractor should be aware that the silty subgrade soils will be moisture-sensitive, and protecting them from inclement weather will aid in maintaining stability. The stripping of the existing pavement and aggregate base course should occur immediately prior to subgrade preparation and base aggregate installation to minimize weather-induced instability.

Prior to installing the aggregate base, the existing subgrade should be scarified and re-compacted to a depth of at least 12 inches. A proof roll test should then be performed to determine soft or unstable subgrade areas.

The proof roll should be performed with a tandem axle dump truck loaded to gross capacity (at least 20 tons). Acceptance criteria of the proof roll shall be limited to rut formation no more than one inch depth (front or rear axles) and no pumping (rolling) observed during the visual inspection. Proof roll tests should be observed by an experienced technician or geotechnical engineer prior to placement of the aggregate base course to verify the subgrade will provide adequate pavement support.

If rutting or localized unstable subgrade areas are observed, those areas should be subcut, moisture-conditioned, and re-compacted or removed to a stable depth.

If imported fill is required in paved areas, it should consist of debris-free, non-organic, mineral soil similar in composition to the subgrade soils encountered in the surrounding areas. If sand is imported into areas that are underlain by relatively impervious fine grained soils, the sand layer must be drained with drain tile in order to prevent frost heave from water trapped within the imported sand layer during freezing temperatures. Individual lifts of engineered fill should be tempered for moisture content, placed, and compacted as noted in the "Placement and Compaction of Engineered Fill" section in Appendix B of this report.

For a 20-year design pavement life, Tables 4 presents our thickness recommendations for flexible (bituminous) pavement. These recommendations were based upon the encountered subgrade conditions, estimated R-value of 30 for the existing subgrade soils, the assumed AADT volumes, and the City of Ramsey's typical pavement section for the respective project area.

**Table 4: Flexible Pavement Thickness Design[1]**
**Interstate Area – Residential Area**

| Pavement Section | Calculated Required Pavement Section[2] | City's Typical Pavement Section |
|---|---|---|
| Bituminous Wear Course (inches) | 2 | 1.5 |
| Bituminous Base Course (inches) | 2 | 2 |
| Class 5 or 6 Aggregate Base (inches) | 4 [3] | 4 |

1. Assumed AADT volume of 600 and an average R-value of 30.
2. Assumed a minimum of 12 inches of engineered subgrade.
3. Clayey sand was observed in boring SB-10. We recommend increasing the subbase to 6 inches or using a geogrid in this area.

Pavement recommendations assume the subgrade soils and aggregate section below paved surfaces will drain to subsurface piping for eventual discharge into storm sewer, or above grade to ditching, or similar acceptable systems. Lack of surface and subsurface drainage will significantly reduce the capacity and longevity of the pavement systems indicated above.

We recommend pavements receive annual maintenance, as a minimum, to correct damages to the pavement structure, clean and infill cracks which develop, and repair or resurface areas which exhibit reduced subgrade performance. The lack of maintenance can lead to moisture infiltration of the pavement structure and softening of the subgrade soils. This, in turn, can degrade the performance of the pavement system and result in poorly performing pavements with shortened life expectancy.

### Mill and Overlay Option

Portions of the roadway sections appear to have a sufficiently thick, in-place pavement section, which would lend itself to rehabilitation via mill and overlay techniques.

The existing pavement thickness generally about 4 to 5 inches thick which would likely be sufficient to perform a mill and overlay. We recommend that locally distressed pavement be removed and replaced with a full depth (6 inch) patch.

Full depth reclamation (FDR) would be feasible for this project area. Usually a blend of mineral aggregate base with the bituminous pavement is blended and the teeth of the reclaimers need to extend beyond the bituminous layers in order to prevent overheating.

The pavement could be milled off and removed and replaced with fresh bituminous pavement. The millings can be blended with on-site aggregate base, with imported aggregate base or remixed at the plant to provide fresh aggregate base. The blended material should contain no more than 50 percent bituminous millings. In general, locations suitable for FDR would have aggregate base that is about the same thickness as the pavement plus 3 to 4 inches remaining to support the weight of the heavy machinery required for FDR.

We recommend that the base be proof-rolled prior to placement of the new pavement materials to determine soft or unstable subgrade areas. The proof roll should be performed with a tandem axle dump truck loaded to gross capacity (at least 20 tons). Acceptance criteria of the proof roll shall be limited to rut formation no more than one inch (1”) depth (front or rear axles) and no pumping (rolling) observed during the visual inspection. Proof roll tests should be observed by an experienced technician or geotechnical engineer prior to placement of the aggregate base course to verify the subgrade will provide adequate pavement support.

If rutting or localized unstable subgrade areas are observed, those areas should be subcut, moisture-conditioned, and re-compacted or removed to a stable depth. Excavations for soil corrections (if any) in paved areas should allow for a 2 foot oversize beyond the edges of the pavement.

If imported fill is required in paved areas, it should consist of debris-free, non-organic, mineral soil similar in composition to the subgrade soils encountered in the surrounding areas. If sand is imported into areas that are underlain by relatively impervious fine-grained soils, the sand layer must be drained with drain tile in order to prevent frost heave from water trapped within the imported sand layer during freezing temperatures. Individual lifts of engineered fill should be tempered for moisture content, placed, and compacted as noted in the "Placement and Compaction of Engineered Fill" section in Appendix B of this report.

## 3.0 Excavation Stability

Excavation depth and sidewall inclination should not exceed those specified in local, state, or federal regulations. Excavations may need to be widened and sloped, or temporarily braced, to maintain or develop a safe work environment. Contractors must comply with local, state, and federal safety regulations including current OSHA excavation and trench safety standards. Temporary shoring must be designed in accordance with applicable regulatory requirements.

## 3.1 Engineered Fill & Winter Construction

The silt and clay laden soils encountered at the project locations will be susceptible to freezing if not provided adequate drainage, insulation, or coverage. Frozen soil should not be used as backfill. When the ambient air temperature falls below freezing for an extended period of time, frost forms, and soil near the surface grade expands. Settlement of the fill may occur as the frozen soils thaw.

If frost penetrates the soil prior to paving, soils must be thawed, scarified, and re-compacted as recommended in this report. Subgrade soils should be inspected prior to paving to verify frozen conditions are not present.

## 4.0 Closure

As the widely spaced, small diameter borings provide only a limited amount of data regarding the existing fill, the existing fill may contain soft zones, debris or significantly greater amounts of unsuitable materials than could be reasonably inferred from the boring information. Unsuitable materials may not be discovered during construction and may remain buried within the fill below the pavement, resulting in greater than anticipated settlements of the pavement. These risks cannot be eliminated without completely removing the fill, but can be reduced by thorough exploration and testing during site preparation and construction.

Our conclusions and recommendations are predicated on observation and testing of the earthwork directed by Geotechnical Engineer of Record. Our opinions are based on data assumed representative of the project area. However, the area coverage of borings in relation to the entire project is very small. For this and other reasons, we do not warrant conditions below the depth of our borings, or that the strata logged from our borings are necessarily typical of the site. Deviations from our recommendations by plans, written specifications, or field applications shall relieve us of responsibility unless our written concurrence with such deviations has been established.

The scope of services for this project does not include either specifically or by implication any environmental or biological assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of the City of Ramsey for specific application to the proposed Wood Pond Hills and Chestnut Ridge Street Reconstructions. Northern Technologies, LLC has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Northern Technologies, LLC makes no other warranty, express or implied.

**Northern Technologies, LLC**

# APPENDIX A

GEOTECHNICAL EVALUATION OF RECOVERED SOIL SAMPLES

FIELD EXPLORATION PROCEDURES

GENERAL NOTES

WATER LEVEL SYMBOL

DESCRIPTIVE TERMINOLOGY

RELATIVE PROPORTIONS

PARTICLE SIZES

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

## GEOTECHNICAL EVALUATION OF RECOVERED SOIL SAMPLES

We visually examined recovered soil samples to estimate distribution of grain sizes, plasticity, consistency, moisture condition, color, presence of lenses and seams, and apparent geologic origin. We then classified the soils according using the Unified Soil Classification System (ASTM D2488). A chart describing this classification system and general notes explaining soil sampling procedures are presented within appendices attachments.

The stratification depth lines between soil types on the logs are estimated based on the available data. In-situ, the transition between type(s) may be distinct or gradual in either the horizontal or vertical directions. The soil conditions have been established at our specific boring locations only. Variations in the soil stratigraphy may occur between and around the borings, with the nature and extent of such change not readily evident until exposed by excavation. These variations must be properly assessed when utilizing information presented on the boring logs.

We request that you, your design team or contractors contact NTI immediately if local conditions differ from those assumed by this report, as we would need to review how such changes impact our recommendations. Such contact would also allow us to revise our recommendations as necessary to account for the changed site conditions.

## FIELD EXPLORATION PROCEDURES

***Soil Sampling – Standard Penetration Boring:***

Soil sampling was performed according to the procedures described by ASTM D-1586. Using this procedure, a 2 inch O.D. split barrel sampler is driven into the soil by a 140 pound weight falling 30 inches. After an initial set of six inches, the number of blows required to drive the sampler an additional 12 inches is recorded (known as the penetration resistance (i.e. “N-value”) of the soil at the point of sampling. The N-value is an index of the relative density of cohesionless soils and an approximation of the consistency of cohesive soils.

***Soil Sampling – Power Auger Boring:***

The boring(s) was/were advanced with a 6 inch nominal diameter continuous flight auger. As a result, samples recovered from the boring are disturbed, and our determination of the depth, extend of various stratum and layers, and relative density or consistency of the soils is approximate.

***Soil Classification:***

Soil samples were visually and manually classified in general conformance with ASTM D-2488 as they were removed from the sampler(s). Representative fractions of soil samples were then sealed within respective containers and returned to the laboratory for further examination and verification of the field classification. In addition, select samples were submitted for laboratory tests. Individual sample information, identification of sampling methods, method of advancement of the samples and other pertinent information concerning the soil samples are presented on boring logs and related report attachments.

## GENERAL NOTES

| *DRILLING and SAMPLING SYMBOLS* | | *LABORATORY TEST SYMBOLS* | |
|---|---|---|---|
| **SYMBOL** | **DEFINITION** | **SYMBOL** | **DEFINITION** |
| C.S. | Continuous Sampling | W | Moisture content-percent of dry weight |
| P.D. | 2-3/8" Pipe Drill | D | Dry Density-pounds per cubic foot |
| C.O. | Cleanout Tube | LL, PL | Liquid and plastic limits determined in accordance with ASTM D 423 and D 424 |
| 3 HSA | 3 ¼" I.D. Hollow Stem Auger | $Q_U$ | Unconfined compressive strength-pounds per square foot in accordance with ASTM D 2166-66 |
| 4 FA | 4" Diameter Flight Auger | | |
| 6 FA | 6" Diameter Flight Auger | | |
| 2 ½ C | 2 ½" Casing | | |
| 4 C | 4" Casing | | |
| D.M. | Drilling Mud | Pq | Penetrometer reading-tons/square foot |
| J.W. | Jet Water | S | Torvane reading-tons/square foot |
| H.A. | Hand Auger | G | Specific Gravity – ASTM D 854-58 |
| NXC | Size NX Casing | SL | Shrinkage limit – ASTM 427-61 |
| BXC | Size BX Casing | Ph | Hydrogen ion content-meter method |
| AXC | Size AX casing | O | Organic content-combustion method |
| SS | 2" O.D. Split Spoon Sample | M.A. | Grain size analysis |
| 2T | 2" Thin Wall Tube Sample | C* | One dimensional consolidation |
| 3T | 3" Thin Wall Tube Sample | $Q_C$ | Triaxial Compression |
| | | * See attached data Sheet and/or graph | |

## WATER LEVEL SYMBOL

Water levels shown on the boring logs were determined at the time and under the conditions indicated. In sand, the indicated levels can be considered relatively reliable for most site conditions. In clay soils, it is not possible to determine the ground water level within the normal scope of a test boring investigation, except where lenses or layers of more pervious water bearing soil are present; and then a long period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed soils may not indicate the true level of the ground water table. The available water level information is given at the bottom of the log sheet.

## DESCRIPTIVE TERMINOLOGY

| *RELATIVE DENSITY* | | *CONSISTENCY* | |
|---|---|---|---|
| **TERM** | **$N_{60}$ Value** (corrected) | **TERM** | **$N_{60}$ Value** (corrected) |
| Very Loose | 0 – 4 | Soft | 0-4 |
| Loose | 5 – 8 | Medium | 5-8 |
| Medium Dense | 9 – 16 | Rather Stiff | 9 – 15 |
| Dense | 16 – 30 | Stiff | 16 – 30 |
| Very Dense | Over 30 | Very Stiff | Over 30 |

## RELATIVE PROPORTIONS

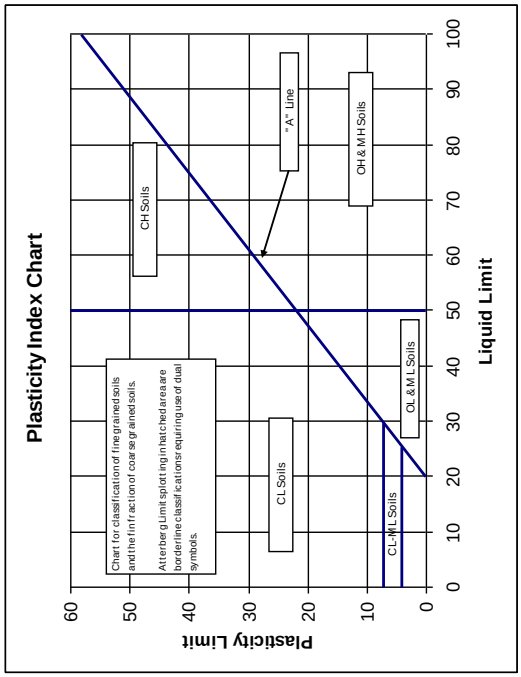
| **TERMS** | **RANGE** |
|---|---|
| Trace | 0 – 5% |
| A little | 5 – 15% |
| Some | 15 – 30% |

## PARTICLE SIZES

| **MATERIAL** | **DESCRIPTION** | **U.S. SIEVE SIZE** |
|---|---|---|
| Boulders | | Over 3" |
| Gravel | Coarse | 3" to ¾" |
| | Medium | ¾" to #4 |
| Sand | Coarse | #4 to #10 |
| | Medium | #10 to #40 |
| | Fine | #40 to #200 |
| Silt and Clay | Determined by Hydrometer Test | |

## CLASSIFICATION of SOILS for ENGINEERING PURPOSES

ASTM Designation D-2487 and D2488 (Unified Soil Classification System)

| Major Divisions | | | Group Symbol | Typical Name | Classification Criteria | | |
|---|---|---|---|---|---|---|---|
| Course Grained Soils More than 50% retained on No. 200 sieve * | Gravels 50% or more of coarse fraction retained on No. 4 sieve. | Clean Gravels | GW | Well –graded gravels and gravel-sand mixtures, little or no fines. | **Classification on basis of percentage of fines.** Less than 5% passing No. 200 Sieve: GW, GP, SW, SP. More than 12% passing No. 200 Sieve: GM, GC, SM, SC. From 5% to 12% passing No. 200 Sieve: Borderline Classification requiring use of duel symbols. | Cu = D60 / D10 greater than 4. Cz = (D30)2 / (D10 x D60) between 1 & 3. | |
| | | | GP | Poorly graded gravels and gravel-sand mixtures, little or no fines. | | Not meeting both criteria for GW materials. | |
| | | Gravels with Fines | GM | Silty gravels, gravel-sand-silt mixtures. | | Atterberg limits below "A" line, or P.I. less than 4. | Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols. |
| | | | GC | Clayey gravels, gravel-sand-clay mixtures. | | Atterberg limits above "A" line with P.I. greater than 7. | |
| | Sands More than 50% of coarse fraction passes No 4 sieve. | Clean Sands | SW | Well-graded sands and gravelly sands, little or no fines. | | Cu = D60 / D10 greater than 6. Cz = (D30)2 / (D10 x D60) between 1 & 3. | |
| | | | SP | Poorly-graded sands and gravelly sands, little or no fines. | | Not meeting both criteria for SW materials. | |
| | | Sands with Fines | SM | Silty sands, sand-silt mixtures. | | Atterberg limits below "A" line, or P.I. less than 4. | Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols. |
| | | | SC | Clayey sands, sand-clay mixtures. | | Atterberg limits above "A" line with P.I. > 7. | |
| ***Fine Grained Soils*** More than 50% passes No. 200 sieve * | Silts and Clays Liquid Limit of 50% or less | | ML | Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. |  | | |
| | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. | | | |
| | | | OL | Organic silts and organic silty clays of low plasticity. | | | |
| | Silts and Clays Liquid Limit greater than 50%. | | MH | Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. | | | |
| | | | CH | Inorganic clays of high plasticity, fat clays. | | | |
| | | | OH | Organic clays of medium to high plasticity. | | | |
| | Highly Organic Soils | | Pt | Peat, muck and other highly organic soils. | | | |

# APPENDIX B

**GROUNDWATER ISSUES**

**PLACEMENT and COMPACTION OF ENGINEERED FILL**

## GROUNDWATER ISSUES

***The following presents additional comment and soil specific issues related to measurement of groundwater conditions at your project site.***

Note that our groundwater measurements, or lack thereof, will vary depending on the time allowed for equilibrium to occur in the borings. Extended observation time was not available during the scope of the field exploration program and, therefore, groundwater measurements as noted on the borings logs may or may not accurately reflect actual conditions at your site.

Seasonal and yearly fluctuations of the ground water level, if any, occur. Perched groundwater may be present within sand and silt lenses bedded within cohesive soil formations. Groundwater typically exists at depth within cohesive and cohesionless soils.

Documentation of the local groundwater surface and any perched groundwater conditions at the project site would require installation of temporary piezometers and extended monitoring due to the relatively low permeability exhibited by the site soils. We have not performed such groundwater evaluation due to the scope of services authorized for this project.

We anticipate that a system of sump pits and pumps located outside of the foundation areas would be suitable for control if perched groundwater were to be encountered. NTI cautions that such seepage may be heavy and will vary based on seasonal and annual precipitation, and ground related impacts in the vicinity of the project.

We anticipate that a well point system would be suitable for control of groundwater if excavations were to be advanced into the ground water table at depth in free draining granular soils. However, we caution such seepage from such formations and any water entry from excavations below the groundwater table may be heavy and will vary based on seasonal and annual precipitation, and ground related impacts in the vicinity of the project.

## PLACEMENT and COMPACTION OF ENGINEERED FILL

***Unless otherwise superseded within the body of the Geotechnical Exploration Report, the following criteria shall be utilized for placement of engineered fill on project. This includes, but is not limited to earthen fill placement to improve site grades, fill placed below structural footings, fill placed interior of structure, and fill placed as backfill of foundations.***

Engineered fill placed for construction, if necessary should consist of natural, non-organic, competent soils native to the project area. Such soils may include, but are not limited to gravel, sand, or clays with Unified Soil Classification System (ASTM D2488) classifications of GW, SP, or SM. Use of silt or clayey silt as project fill will require additional review and approval of project Geotechnical Engineer of Record. Such soils have USCS classifications of ML, MH, ML-CL, MH-CH. Use of topsoil, marl, peat, other organic soils construction debris and/or other unsuitable materials as fill is not allowed. Such soils have USCS classifications of OL, OH, Pt.

Engineered fill, classified as clay, should be tempered such that the moisture content at the time of placement is equal to and no more than 3 percent above the optimum content for as defined by the appropriate proctor test. Likewise, engineered fill classified as gravel or sand should be tempered such that the moisture content at the time of placement is within 3 percent of the optimum content.

All engineered fill for construction should be placed in individual 8 inch maximum depth lifts. Each lift of fill should be compacted by large vibratory equipment until the in-place soil density is equal to or greater than the criteria established within the following tabulation.

| | **Compaction Criteria (% respective Proctor)** [1] | |
|---|---|---|
| **Type of Construction** | **Clay** | **Sand or Gravel** |
| Engineered Fill placed as Pavement Subgrade (more than 3 feet below bottom of final grade) | Min. 95 | Min. 95 |
| Engineered Fill placed as Pavement Subgrade (less than 3 feet below bottom of final grade) | Min. 100 | Min. 100 |
| Engineered Fill placed as Pavement Aggregate Base | NA | Min. 100 |

1. Note 1 Unless otherwise required, compaction criteria shall be based on the Standard Proctor Test (ASTM D698).

Density tests should be taken during engineered fill placement to document earthwork has achieved necessary compaction of the material(s). Recommendations for interior fill placement and backfill of foundation walls are presented within other sections of this report.

# APPENDIX C

BORING LOCATION DIAGRAM

SOIL BORING LOGS


N

Boring Location Diagram
Wood Pond Hills and Chestnut Ridge Street Reconstructions
Ramsey, Minnesota
NTI Project #: 18.MSP06853.000
NOTE: Boring locations are approximate.

Completed Boring Locations:

NTI NORTHERN TECHNOLOGIES, LLC

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

# BORING NUMBER SB-1



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 868 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) 867.7 | AU | | | | | | | | | |
| | | 1.0 APPARENT AGGREGATE BASE (8 Inches) 867.0 | SS 1 | 89 | 10-10-10 (20) | | | 4 | | | | 6 |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) dark brown, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | SS 2 | 89 | 5-6-8 (14) | | | | | | | |
| | | 4.0 864.0 | | | | | | | | | | |
| 5 | | POORLY GRADED SAND, (SP) brown, fine to medium grained, moist, very loose, trace gravel (Glacial Outwash) | SS 3 | 89 | 2-2-2 (4) | | | 5 | | | | 3 |
| | | | SS 4 | 89 | 2-2-2 (4) | | | | | | | |
| | | 9.0 859.0 | | | | | | | | | | |
| 10 | | SILTY SAND, (SM) brown, fine to medium grained, moist, medium dense, trace gravel (Glacial Till) | SS 5 | 89 | 4-6-6 (12) | | | | | | | |
| | | 10.5 857.5 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
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# BORING NUMBER SB-2



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 865 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) 864.7 | AU | | | | | | | | | |
| | | 0.8 APPARENT AGGREGATE BASE (6 Inches) 864.2 | | | | | | | | | | |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | SS 1 | 89 | 7-10-12 (22) | | | | | | | |
| | | | SS 2 | 89 | 8-8-9 (17) | | | 3 | | | | |
| | | 4.0 861.0 | | | | | | | | | | |
| 5 | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, medium dense, trace gravel (Glacial Outwash) | SS 3 | 89 | 5-6-6 (12) | | | | | | | |
| | | | SS 4 | 89 | 4-5-6 (11) | | | | | | | |
| 10 | | | SS 5 | 89 | 4-4-5 (9) | | | | | | | |
| | | 10.5 854.5 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

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**Inver Grove Heights**
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P: 651-389-4191

# BORING NUMBER SB-3



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 865.5 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) | 865.2 | AU | | | | | | | | | |
| | | 0.8 APPARENT AGGREGATE BASE (6 Inches) | 864.7 | | | | | | | | | | |
| | | SILTY SAND, (SM) dark brown, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | | SS 1 | 89 | 9-12-15 (27) | | | 5 | | | | |
| | | | | SS 2 | 89 | 8-14-14 (28) | | | | | | | |
| | | 4.0 | 861.5 | | | | | | | | | | |
| 5 | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, dense to medium dense, trace gravel (Glacial Outwash) | | SS 3 | 89 | 6-9-10 (19) | | | | | | | |
| | | | | SS 4 | 78 | 4-5-6 (11) | | | 5 | | | | |
| 10 | | | | SS 5 | 89 | 4-4-5 (9) | | | | | | | |
| | | 10.5 | 855.0 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

# BORING NUMBER SB-4



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 869.5 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) 869.2 | AU | | | | | | | | | |
| | | 1.0 APPARENT AGGREGATE BASE (8 Inches) 868.5 | SS 1 | 89 | 10-14-17 (31) | | | 4 | | | | |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) brown to dark brown, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | SS 2 | 67 | 6-8-10 (18) | | | | | | | |
| | | 4.0 865.5 | | | | | | | | | | |
| 5 | | POORLY GRADED SAND, (SP) light brown, fine to medium grained, moist, medium dense to loose, trace gravel (Glacial Outwash) | SS 3 | 89 | 4-5-8 (13) | | | | | | | |
| | | | SS 4 | 89 | 4-6-6 (12) | | | | | | | |
| 10 | | | SS 5 | 78 | 3-3-4 (7) | | | | | | | |
| | | 10.5 859.0 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

# BORING NUMBER SB-5



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 875.5 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.4 BITUMINOUS PAVEMENT (5 Inches) | 875.1 | AU | | | | | | | | | |
| | | 0.9 APPARENT AGGREGATE BASE (6 Inches) | 874.6 | SS 1 | 89 | 9-9-10 (19) | | | | | | | |
| | | 2.0 POORLY GRADED SAND, (SP) brown, fine grained, moist, trace gravel **(Undocumented Fill)** | 873.5 | SS 2 | 89 | 8-6-6 (12) | | | 3 | | | | 4 |
| | | POORLY GRADED SAND, (SP) light brown, fine to medium grained, moist, medium dense to very loose, trace gravel (Glacial Outwash) | | | | | | | | | | | |
| 5 | | | | SS 3 | 89 | 6-6-7 (13) | | | | | | | |
| | | | | SS 4 | 89 | 2-2-3 (5) | | | | | | | |
| | | NOTE: Fine to coarse grained below 9 feet. | | | | | | | | | | | |
| 10 | | | | SS 5 | 89 | 2-2-2 (4) | | | | | | | |
| | | 10.5 | 865.0 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

# BORING NUMBER SB-6



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 878 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) | 877.7 | AU | | | | | | | | | |
| | | 0.8 APPARENT AGGREGATE BASE (6 Inches) | 877.2 | SS 1 | 89 | 7-10-12 (22) | | | 3 | | | | |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, trace gravel | | | | | | | | | | | |
| | | 2.0 **(Undocumented Fill)** | 876.0 | SS 2 | 78 | 10-8-8 (16) | | | | | | | |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, medium dense to dense, trace gravel (Glacial Outwash) | | | | | | | | | | | |
| | | NOTE: Little gravel at 4 feet. | | | | | | | | | | | |
| 5 | | | | SS 3 | 89 | 12-11-10 (21) | | | | | | | |
| | | | | SS 4 | 89 | 7-8-10 (18) | | | 3 | | | | |
| 10 | | | | SS 5 | 89 | 6-8-9 (17) | | | | | | | |
| | | 10.5 | 867.5 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

# BORING NUMBER SB-7



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 867 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) 866.7 | AU | | | | | | | | | |
| | | 0.8 APPARENT AGGREGATE BASE (6 Inches) 866.2 | | | | | | | | | | |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | SS 1 | 89 | 8-11-13 (24) | | | 4 | | | | |
| | | | SS 2 | 89 | 10-13-13 (26) | | | 4 | | | | |
| | | 4.0 863.0 | | | | | | | | | | |
| 5 | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, dense, trace gravel (Glacial Outwash) | SS 3 | 89 | 5-9-9 (18) | | | | | | | |
| | | | SS 4 | 89 | 6-9-9 (18) | | | | | | | |
| | | 9.0 858.0 | | | | | | | | | | |
| 10 | | POORLY GRADED SAND, (SP) light brown, fine to medium grained, moist, medium dense, trace gravel (Glacial Outwash) | SS 5 | 89 | 3-5-6 (11) | | | | | | | |
| | | 10.5 856.5 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

# BORING NUMBER SB-8



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 861.5 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
▽ **AT TIME OF DRILLING** 7.00 ft / Elev 854.50 ft
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) 861.2 | AU | | | | | | | | | |
| | | 0.8 APPARENT AGGREGATE BASE (6 Inches) 860.7 | | | | | | | | | | |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) dark brown, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | SS 1 | 89 | 10-14-14 (28) | | | 5 | | | | 9 |
| | | | SS 2 | 89 | 8-11-13 (24) | | | | | | | |
| | | 4.0 857.5 | | | | | | | | | | |
| 5 | | POORLY GRADED SAND WITH SILT, (SP-SM) light brown to brown, fine to medium grained, moist, medium dense to loose, trace gravel (Glacial Outwash) | SS 3 | 89 | 5-5-6 (11) | | | | | | | |
| | | ▽ | SS 4 | 89 | 2-3-3 (6) | | | | | | | |
| 10 | | | SS 5 | 89 | 2-3-4 (7) | | | | | | | |
| | | 10.5 851.0 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
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# BORING NUMBER SB-9



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 884.5 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) | 884.2 | AU | | | | | | | | | |
| | | 0.8 APPARENT AGGREGATE BASE (6 Inches) | 883.7 | SS 1 | 89 | 10-12-12 (24) | | | | | | | |
| | | POORLY GRADED SAND, (SP) brown, fine to medium grained, moist, trace gravel | | | | | | | | | | | |
| | | 2.0 **(Undocumented Fill)** | 882.5 | SS 2 | 89 | 5-7-7 (14) | | | 3 | | | | 3 |
| | | POORLY GRADED SAND, (SP) brown, fine to medium grained, moist, medium dense, trace gravel (Glacial Outwash) | | | | | | | | | | | |
| 5 | | | | SS 3 | 89 | 5-5-6 (11) | | | | | | | |
| | | | | SS 4 | 89 | 3-6-7 (13) | | | | | | | |
| 10 | | | | SS 5 | 89 | 4-5-7 (12) | | | | | | | |
| | | 10.5 | 874.0 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.

NTI NORTHERN TECHNOLOGIES, LLC

**Inver Grove Heights**
6160 Carmen Avenue East
Inver Grove Heights, MN, 55076
P: 651-389-4191

# BORING NUMBER SB-10



**CLIENT** City of Ramsey
**PROJECT NAME** Wood Pond Hills & Chestnut Ridge Street Reconstruction
**PROJECT NUMBER** 18.MSP06853.000
**PROJECT LOCATION** Ramsey, MN
**DATE STARTED** 9/27/18 **COMPLETED** 9/27/18
**GROUND ELEVATION** 877 feet **HOLE SIZE** 6 1/2 in.
**DRILLING CONTRACTOR** NTI
**GROUND WATER LEVELS:**
**DRILLING METHOD** 3 1/4 in H.S.A
**AT TIME OF DRILLING** --- No Groundwater Observed.
**LOGGED BY** RRH **CHECKED BY** SDG
**AT END OF DRILLING** ---
**CAVE IN (ft)** --- **FROST DEPTH (ft)** ---
**AFTER DRILLING** ---
**NOTES** Elevation determined using a Trimble GeoXH 6000 (NAVD 88 GeoID 09 datum).

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | | SAMPLE TYPE NUMBER | RECOVERY % (RQD) | BLOW COUNTS (N VALUE) | POCKET PEN. (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | ATTERBERG LIMITS: LIQUID LIMIT | ATTERBERG LIMITS: PLASTIC LIMIT | ATTERBERG LIMITS: PLASTICITY INDEX | FINES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 0.3 BITUMINOUS PAVEMENT (4 Inches) | 876.7 | AU | | | | | | | | | |
| | | 0.8 APPARENT AGGREGATE BASE (6 Inches) | 876.2 | SS 1 | 89 | 9-11-9 (20) | | | 8 | | | | 16 |
| | | CLAYEY SAND, (SC) dark brown to black, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | | | | | | | | | | | |
| | | 2.0 | 875.0 | SS 2 | 89 | 5-5-6 (11) | | | | | | | |
| | | POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, trace gravel **(Undocumented Fill)** | | | | | | | | | | | |
| | | 4.0 | 873.0 | | | | | | | | | | |
| 5 | | POORLY GRADED SAND WITH SILT, (SP-SM) brown to light brown, fine to medium grained, moist, loose, trace gravel (Glacial Outwash) | | SS 3 | 89 | 3-3-4 (7) | | | 8 | | | | |
| | | 6.5 | 870.5 | | | | | | | | | | |
| | | POORLY GRADED SAND, (SP) brown, fine to medium grained, moist, loose to medium dense, trace gravel (Glacial Outwash) | | SS 4 | 89 | 2-2-3 (5) | | | | | | | |
| 10 | | | | SS 5 | 89 | 5-6-10 (16) | | | | | | | |
| | | 10.5 | 866.5 | | | | | | | | | | |

Bottom of borehole at 10.5 feet.