Feasibility Report

2020 Street Improvements

White Bear Township, Minnesota

TKDA Project No. 17127.011

October 30, 2019

WHITE BEAR TOWNSHIP
1858
RAMSEY COUNTY
MINNESOTA

TKDA
444 Cedar Street, Suite 1500
Saint Paul, MN 55101
651.292.4400
tkda.com

2020 Street Improvements
Feasibility Report
White Bear Township, Minnesota

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October 30, 2019

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

Larry Poppler, PE
Project Manager

Date: October 30, 2019 Lic. No.: 41005

TKDA
444 Cedar Street – Suite 1500
Saint Paul, MN 55101

TKDA

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Summary

2020 Street Improvements Project:

Pavement rehabilitation, concrete curb and gutter, and appurtenant work on the following areas:

- Lakewood Avenue (from County Road F East to Arbor Drive)
- Ralph Street (from Lakewood Avenue to Hammerhead)
- Arbor Drive (from Country Road F East to Homewood Avenue)
- Hillaire Road (from Arbor Drive to South Shore Boulevard)
- Summit Lane (from Arbor Drive to South Shore Boulevard)
- Forest Court (from Arbor Drive to South Shore Boulevard)
- Glen Oaks Avenue (from Arbor Drive to South Shore Boulevard)
- Lakewood Avenue (from Arbor Drive to South Shore Boulevard)
- Homewood Avenue (from Arbor Drive to South Shore Boulevard)

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Feasibility Report

2020 Street Improvements

Prepared for White Bear Township, Minnesota

1.0 Introduction

On August 21, 2019, the White Bear Township Town Board ordered the preparation of a feasibility report for the Township's 2020 street improvements. The 2020 street improvement areas are listed below:

- Lakewood Avenue (from County Road F East to Arbor Drive)
- Ralph Street (from Lakewood Avenue to Hammerhead)
- Arbor Drive (from County Road F East to Homewood Avenue)
- Hillaire Road (from Arbor Drive to South Shore Boulevard)
- Summit Lane (from Arbor Drive to South Shore Boulevard)
- Forest Court (from Arbor Drive to South Shore Boulevard)
- Glen Oaks Avenue (from Arbor Drive to South Shore Boulevard)
- Lakewood Avenue (from Arbor Drive to South Shore Boulevard)
- Homewood Avenue (from Arbor Drive to South Shore Boulevard)

Located within Section 24, Township 30, Range 22, as described on the following plats: Part of Government Lot 3, Registered Land Survey 444, Forest Park, Bellaire Second Addition, Woodcrest Addition, D.C. Addition, Swenson's Subdivision, Hillcrest Bellaire, Bellaire White Bear Lake, Summit Lane, Willenbring Second Addition, in Ramsey County, Minnesota.

This report evaluates the feasibility of street improvements in the project area. All existing infrastructure elements were evaluated, improvements recommended, cost estimates of the proposed improvements prepared, and funding strategies developed in this report.

2.0 Background

White Bear Township completed an overview in 2018 of the overall pavement system to assist in prioritizing street improvements to provide the best value to the Township. The results of this evaluation are provided in the "Pavement Management Booklet" which was approved by the Board on January 3, 2019. Ideally, completing the right improvements at the right time can assist in extending the life of the original street construction. Based on the overall system evaluation, the streets proposed for improvement in 2020 include Lakewood Avenue (from County Road F East to Arbor Drive), Ralph Street (from Lakewood Avenue to Hammerhead), Arbor Drive (from County Road F East to Homewood Avenue), Hillaire Road (from Arbor Drive to South Shore Boulevard), Summit Lane (from Arbor Drive to South Shore Boulevard), Forest Court (from Arbor Drive to South Shore Boulevard), Glen Oaks Avenue (from Arbor Drive to South Shore Boulevard), Lakewood Avenue (from Arbor Drive to South Shore Boulevard), and Homewood Avenue (from Arbor Drive to South Shore Boulevard) as shown in Appendix A.

3.0 Existing Conditions

Streets: All streets within the project area were originally constructed in 1962. The width of each street varies between 14 feet and 30 feet from edge of pavement to edge of pavement. Each street was constructed with bituminous curb, but over the lifetime of the road much of the bituminous curb has deteriorated. There is significant erosion along the edge of the pavement.

The pavement cores for the project area generally consist of 4" of bituminous over 3"-6" of base material over silty sand and sandy with silt.

The existing and proposed typical sections for the project areas are shown in Appendix B. The pavement cores and soil boring information is found in the geotechnical report in Appendix I.

Many factors account for roadway deterioration since original construction including the following:

- Drainage
- Underlying soil conditions
- Original street construction
- Traffic volumes/loading
- Time
- Weather
- Utility impacts/patches

White Bear Township completes pavement rating of its system to document the pavement condition which helps to prioritize the infrastructure improvement needs within the Township. Streets are rated on a scale of 0 to 5. A rating of 5 would indicate that the street is in good or new condition. A rating of 0 would indicate a very poor roadway or gravel roadway. The rating information can be used by staff to prioritize improvements. In general, a rating less than 3.25 signals a need for some type of improvement. Mill and overlay are generally used for streets with a rating between 2.2 and 3.25. Reclamation and reconstruction are recommended for streets with a rating below 2.2. The following table shows the ratings for the project area.

Street Name	From	To	Rating
Lakewood Avenue	County Road F East	Arbor Drive	1.76
Ralph Street	Lakewood Avenue	Hammerhead	1.93
Arbor Drive	County Road F East	Lakewood Avenue	1.5
Arbor Drive	Lakewood Avenue	Homewood Avenue	1.9
Hillaire Road	Arbor Drive	South Shore Boulevard	1.93
Summit Lane	Arbor Drive	South Shore Boulevard	1.43
Forest Court	Arbor Drive	South Shore Boulevard	1.93
Glen Oaks Avenue	Arbor Drive	South Shore Boulevard	1.43
Lakewood Avenue	Arbor Drive	South Shore Boulevard	1.93
Homewood Avenue	Arbor Drive	South Shore Boulevard	1.93

Curb and Gutter: Each street was originally constructed with bituminous curb, but over the lifetime of the road most of the bituminous curb has deteriorated.

Utilities: The public utilities were found to be acceptable with an exception of an estimated one third of the water and sanitary sewer manhole castings. There are very few storm sewer utilities in place in this project area. There are existing culverts beneath the roadway of a few of the project area roads where they intersect with South Shore Boulevard. These culvert pipes have been crushed over the length of time and/or are full of debris. The existing ditches these culvert pipes connect to hold standing water rather than drain water.

4.0 Proposed Improvements

Street: Considering the existing pavement depth, soil borings, pavement condition, deterioration factors, and coring evaluation, a reconstruction is recommended for all streets in the 2020 street improvements area. A reconstruction would involve full street section replacement including removal of the pavement, correction of poor soil discovered as a part of the geotechnical report, new aggregate base, and adding concrete curb and gutter. It is recommended that the pavement on the existing streets be fully reclaimed and used as the base for the new roadway surface. The reclaiming process grinds the existing bituminous material, pulverizing it into smaller, loose material. Once this process is complete, new aggregate material is placed on top of the new, reclaimed base as needed. Due to the relatively thin existing bituminous and aggregate base sections encountered at some borings, additional excavation and aggregate base may be required to place the new pavement section at those locations. New bituminous pavement of 4” is proposed over the roadway base across the width to provide a smooth, new surface and provide improved roadway drainage. All streets within the project area have a rating less than 2.2. The rating of the pavement condition will increase to the maximum of 5 after reconstruction.

Road Widths: The existing road widths within the project area vary between 14 and 30 feet wide. Narrow roadways make it difficult for residents to park on the street and maintain two way traffic. The suggested road width is 28 feet to be able to accommodate traffic with parking on both sides and still maintain adequate room for fire truck and other emergency vehicle access. However, narrow right of ways is an obstacle for widening the roads in this neighborhood. An exhibit showing existing road widths, suggested road widths, and road right of ways is shown in Appendix C.

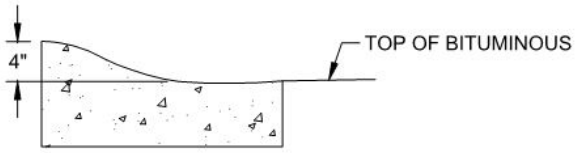
	Existing Width (ft.)	Proposed Width (ft.)
Lakewood Avenue	24	28
Ralph Street	30	28
Homewood Avenue	25	28
Glen Oaks Avenue	25	25
Forest Court	20	20
Summit Lane	14	14
Hillaire Road	20	20
Arbor Drive	25	28

Curb and Gutter: It is recommended to add concrete curb and gutter throughout the entire project area. There are advantages concrete curb and gutter have on street network systems such as:

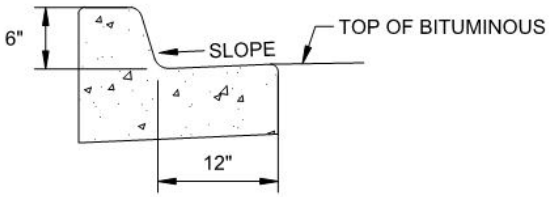
- Drainage improvement/water quality
- Reduced edge failure
- Safety – defines the street
- Reduced plow damage to yards or pavement edge
- More defined street sweeping edge
- Mowing edge
- More rigid as compared to bituminous material that is flexible during summer temperatures
- Improved aesthetics/improved property values

The most important contributor in road deterioration is drainage. If surface water is not controlled properly and removed from the roadway as well as the roadway base, the street will begin to deteriorate at a pace much higher than a street with good drainage control. Water at the street surface can freeze which can break apart the roadway surface. In a similar manner, water that cannot drain beneath the street freezes and thaws, causing material to move beneath the street. The addition of curb and gutter and storm sewer pipe assists in the control of drainage.

To minimize excavation expense, it is proposed that surmountable curb and gutter be installed with this project. The height of a surmountable curb is 2 inches less than that of a B612 type curb. This type of curb allows vehicles to easily drive onto the curb without damaging the wheel or tire while still giving the definition of the street and provides stormwater drainage. The following page has graphics of both a surmountable curb and a B612 type curb.



SURMOUNTABLE CURB



B612 CURB

Utilities: It is recommended that the manhole castings and rings be repaired as part of the project. With the addition of concrete curb and gutter, it is recommended to add storm sewer. Storm sewer can reduce flooding in the street and help prevent water overflow that can be harmful to yards, driveways, and the street pavement. It can also reduce the risk of icy patches from water pooling and freezing. Storm sewer can also minimize the spread of contaminants that can be found in storm water. Adding storm sewer would include curb inlet catch basins, manhole structures, and concrete pipes to catch and control surface and storm water. This would also include removing and replacing the existing culvert pipes and cleaning the existing ditches. An exhibit showing optional locations of storm sewer pipes and structures is shown in Appendix D.

Stormwater Treatment

Stormwater treatment and rate control will be required by Rice Creek Watershed District (RCWD) to an extent for this linear project. An underground stormwater treatment chamber is proposed to provide treatment of stormwater before discharging into White Bear Lake and is proposed to be sized to exceed the RCWD rules. This project also has limited area for stormwater treatment, so sizing around underground utilities will also be a design variable.

Rain Garden Program

The RCWD has created a dedicated grant program to assist landowners with installing Best Management Practices (BMPs) or projects aimed at improving water quality within the District. Raingardens are eligible projects for this program. The RCWD may fund 75% of eligible materials and contracted labor up to a maximum of $7,500. RCWD also partners with the Ramsey County Parks & Rec Soil and Water Conservation Division to provide technical assistance to residents interested in water quality improvement projects for their property.

The rain garden program would be a voluntary program for interested property owners. Since the public is investing in the building of the rain gardens, property owners must enter into an agreement to maintain the rain garden. Maintenance primarily includes weeding and debris removal. Not every property is suitable for a rain garden. Interested property owners can contact the Township and a site evaluation will be performed. While 75% of the costs can be covered by the Rice Creek Watershed

and Ramsey County program, the remaining costs would be included in the Township funding or assessments. The installation of rain gardens is a positive water quality and rate control benefit for the neighborhood and White Bear Lake and should be considered.

5.0 Public Input

In September 2019 an informational letter, project brochure, and questionnaire were sent to the 119 property owners in the project area. The questionnaire asked questions including drainage and erosion issues, private underground utilities, and traffic or pedestrian issues. 55 residents returned the questionnaire for a 46% return rate. The two key issues noted were drainage and traffic/pedestrian related issues, including safety concerns for pedestrians and parking. Responses indicated yard and driveway impacts and damage due to stormwater. South Shore Boulevard was highlighted as safety concern for pedestrians. The letters, questionnaires, and responses are shown in Appendix E.

6.0 Project Funding

6.1 Estimated Costs

The following costs were prepared based upon an Engineer's Estimate (Appendix F) and are subject to change depending on the final design of the project, required easements and/or right of way, soil conditions, bids received, and actual work performed.

Table 1
Estimated Project Costs

Item	Estimated Cost
Street Improvements	$ 2,441,110.00
Indirect Costs for Township[1]	$ 610,277.50
TOTAL PROJECT COST	**$ 3,051,387.50**

Table Notes:
[1]Township's Indirect Costs includes the following:
Engineering
City Administration/Financing and Bonding

6.2 Assessment Policy

The Township assessment policy was drafted and approved on April 17, 2006 and revised on March 18, 2013. The policy was created for the purpose of establishing a stable and equitable method of cost sharing for repair and reconstruction of Township streets.

In the past, the Township has consistently assessed 100% of the cost for street improvements. However, the Township can only assess up to the amount of benefit of the improvement to properties. The interest rate has not yet been determined. The term of the assessment is planned to be 10 years. The recommended properties proposed for assessment are shown in the assessment roll and assessment map. See Appendix G for the preliminary assessment roll and Appendix H for the assessment map.

6.3 Assessment Amount

The improvement cost and assessable costs were computed for the project area. The assessments were computed as a residential equivalent unit assessment. Each standard residential property was assessed as one unit. Per the assessment policy, corner lots were assessed one-half unit for each

side that abuts the improvement. The assessment rate was calculated as $11,000 per unit. The Township believes that the benefit of this project to the assessable properties exceeds this amount.

Table 2
Assessment Summary

	2020 Street Improvement Area
Overall Street Project Costs	$ 3,051,387
Overall Assessable Costs	$ 2,515,241
Assessable Units	114
Assessment Rate	$ 11,000
Assessment Funds ($11,000 x 114 units)	$ 1,254,000
Assessment Term	10 Years
Interest Rate	Undetermined (2019 Rate 3.5%)

6.4 Funding Sources

Funding for this project is proposed to come from assessments, tax levy, water utility fund, sanitary sewer utility fund, and storm sewer utility fund. The tables below show the funding source breakdown for the three different assessment rates.

Table 3
Funding Table

Assessments ($11,000 x 114 units)	$ 1,254,000
Township Funds / Bonding	$ 1,261,241
Water Fund	$ 35,947
Sanitary Fund	$ 10,462
Storm Fund	$ 489,737
Total	**$ 3,051,387**

7.0 Preliminary Project Schedule

The following project schedule outlines an approach to complete the assessment process per MN Statutes 429 for this project in 2020.

Activity	**Date**
Authorize Preparation of Feasibility Report	August 21, 2019
Neighborhood Informational Meeting	September 26, 2109
Township Accept Feasibility Report and Call for Public Hearing	November 4, 2019
Neighborhood Informational Meeting	November 2019
Public Hearing / Order Improvements / Authorize Preparation of Plans and Specifications	December 2019
Neighborhood Informational Meeting	February 2020

Activity	Date
Accept Plans and Specifications and Authorize Advertisement for Bids	March 2020
Bid Opening	March 2020
Award Contract	April 2020
Begin Construction	May 2020
Complete Construction	October 2020
Authorize Amount to be Assessed	September 2020
Assessment Hearing / Adopt Assessments	October 2020

8.0 Conclusion and Recommendations

Completing the right street improvements at the right time provides value to the Township by maximizing the initial construction investment. Considering the soil conditions, existing bituminous, and the condition of the curb, all streets are recommended for full reconstruction with the addition of concrete curb and gutter and storm sewer in 2020.

The proposed improvement is necessary, cost effective, and feasible from an engineering standpoint and should be made as proposed.

Appendix A

2020 Proposed Street Improvement Areas

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NO.	DATE	BY	DESCRIPTION OF REVISIONS

DESIGNED
DRAWN
CHECKED

TKDA
444 Cedar Street, Suite 1500
Saint Paul, MN 55101
651.292.4400
tkda.com

WHITE BEAR TOWNSHIP
2020 STREET IMPROVEMENTS

PROJECT AREA

PROJ. NO.
17127.011

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Appendix B

Typical Sections

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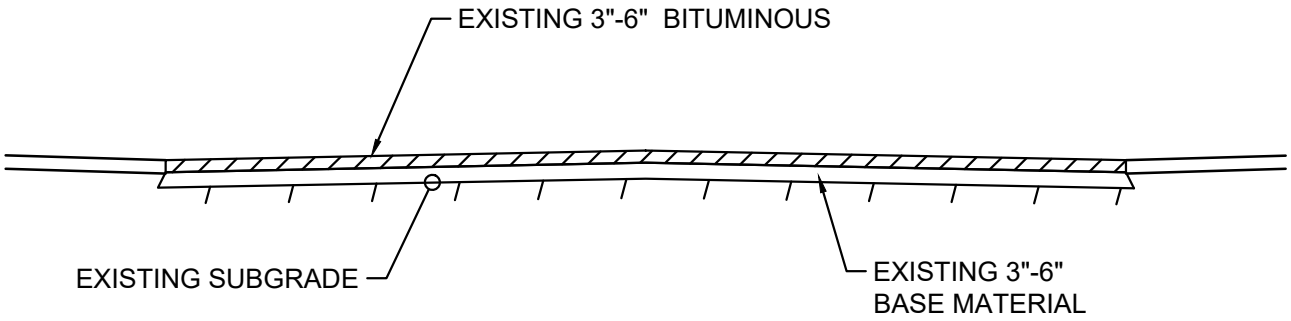
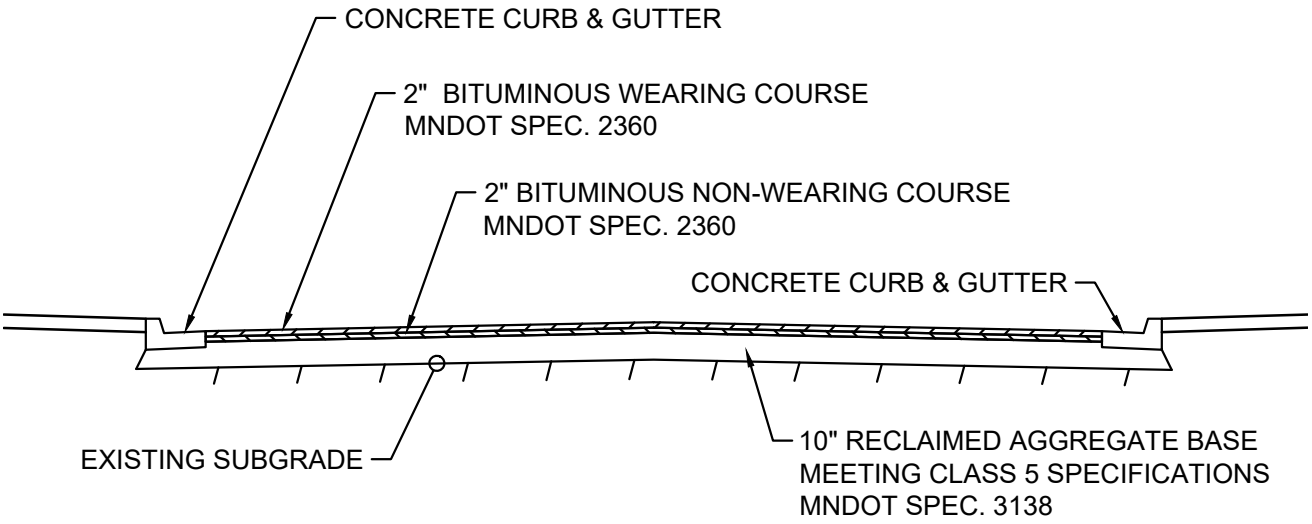
TYPICAL SECTIONS



EXISTING

LAKEWOOD AVENUE, RALPH STREET, ARBOR DRIVE, HILLAIRE ROAD, SUMMIT LANE, FOREST COURT, GLEN OAKS AVENUE, LAKEWOOD AVENUE, HOMEWOOD AVENUE



PROPOSED

LAKEWOOD AVENUE, RALPH STREET, ARBOR DRIVE, HILLAIRE ROAD, SUMMIT LANE, FOREST COURT, GLEN OAKS AVENUE, LAKEWOOD AVENUE, HOMEWOOD AVENUE

TKDA
444 Cedar Street, Suite 1500
Saint Paul, MN 55101
651.292.4400
tkda.com

WHITE BEAR TOWNSHIP
RAMSEY COUNTY MINNESOTA

WHITE BEAR TOWNSHIP
2020 STREET IMPROVEMENTS

2020-01

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Appendix C

Road Widths & Right of Ways

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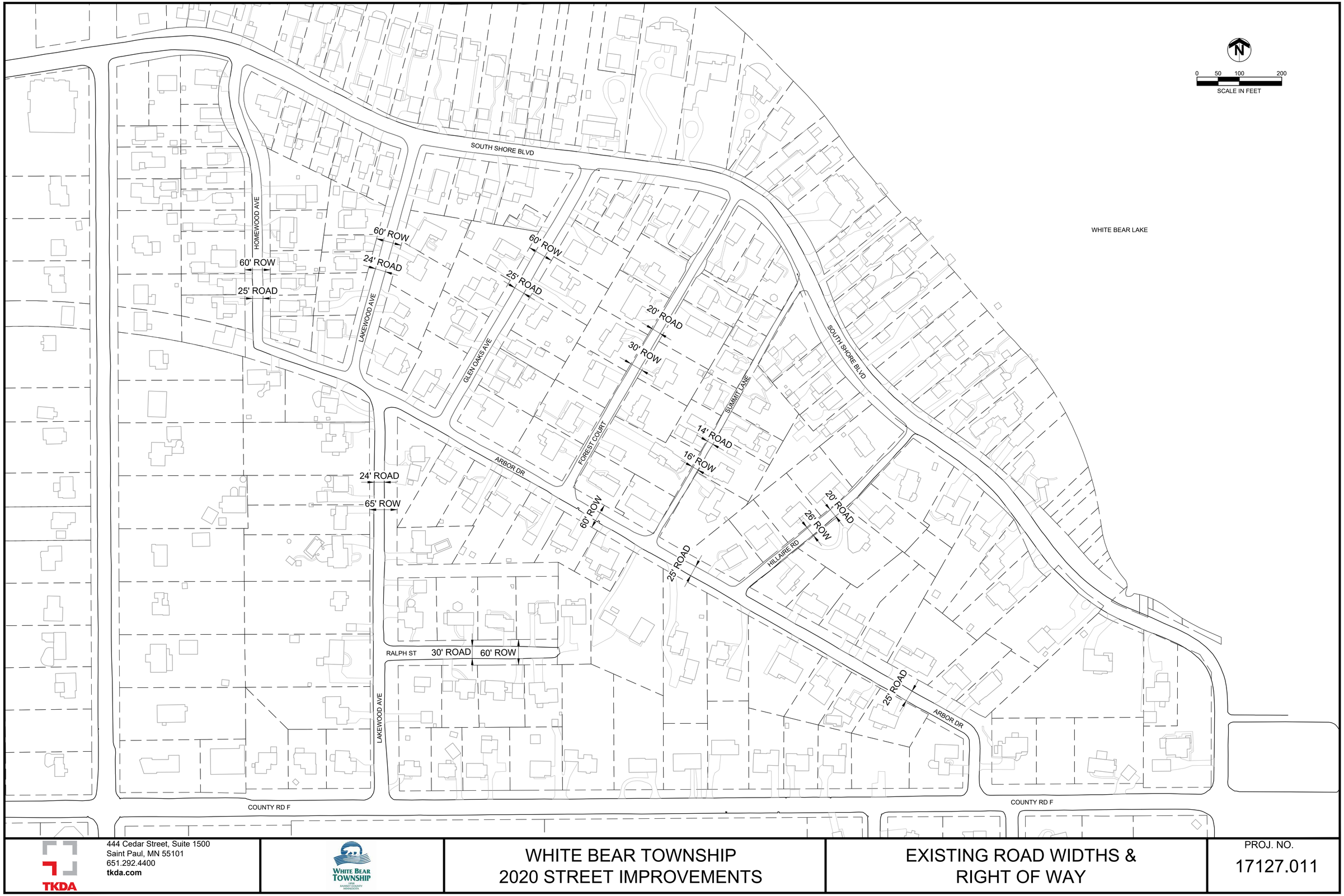

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444 Cedar Street, Suite 1500
Saint Paul, MN 55101
651.292.4400
tkda.com

WHITE BEAR TOWNSHIP
2020 STREET IMPROVEMENTS

EXISTING ROAD WIDTHS &
RIGHT OF WAY

PROJ. NO.
17127.011

N

0 50 100 200

SCALE IN FEET

WHITE BEAR LAKE

SOUTH SHORE BLVD

HOMEWOOD AVE

60' ROW

24' ROAD

28' ROAD

60' ROW

LAKEWOOD AVE

60' ROW

25' ROAD

GLEN OAKS AVE

20' ROAD

30' ROW

SUMMIT LANE

SOUTH SHORE BLVD

ARBOR DR

FOREST COURT

14' ROAD

16' ROW

28' ROAD

65' ROW

60' ROW

20' ROAD

26' ROW

HILLAIRE RD

28' ROAD

RALPH ST

28' ROAD

60' ROW

28' ROAD

ARBOR DR

LAKEWOOD AVE

COUNTY RD F

COUNTY RD F

Oct 30, 2019 - 10:30am

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444 Cedar Street, Suite 1500
Saint Paul, MN 55101
651.292.4400
tkda.com

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MINNESOTA

WHITE BEAR TOWNSHIP
2020 STREET IMPROVEMENTS

PROPOSED ROAD WIDTHS & RIGHT OF WAY

PROJ. NO.
17127.011

Appendix D

Proposed Storm Sewer

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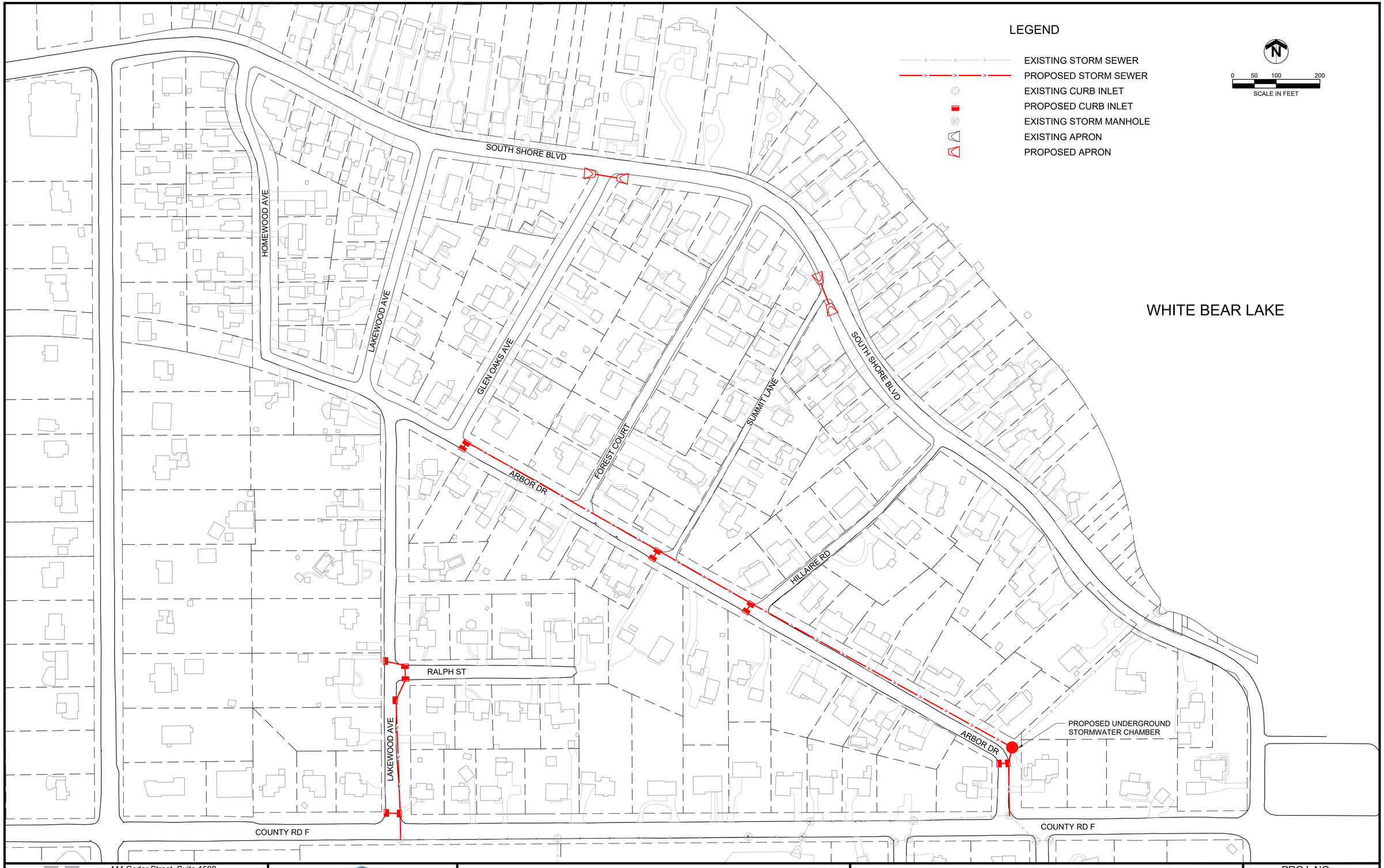

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444 Cedar Street, Suite 1500
Saint Paul, MN 55101
651.292.4400
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WHITE BEAR TOWNSHIP
2020 STREET IMPROVEMENTS

PROPOSED STORM SEWER

PROJ. NO.
17127.011

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Appendix E

Resident Input

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October 16, 2019

RE: 2020 Street Improvements – Property Owners Questionnaire

Dear Resident:

White Bear Township is considering street improvements for the summer of 2020 for the following streets:

- Homewood Avenue (South Shore to Arbor Drive)
- Lakewood Avenue (South Shore to Co. Rd. F)
- Hillaire Road
- Forest Court
- Ralph Street
- Arbor Drive
- Summit Lane
- Glen Oaks Avenue

The White Bear Township Pavement Management Program identified these streets for possible improvement in 2020. The White Bear Township Town Board ordered the preparation of a feasibility report for the Township's 2020 Street Improvements at the August 21, 2019 Town Board meeting.

The next step is to get feedback from you regarding a number of key components of the project. The information you share with us is essential in determining certain aspects of the project that may be constructed. The attached questionnaire is one way to provide feedback. Another opportunity is to attend the neighborhood meeting.

A Neighborhood meeting will be held at 7:00 pm Thursday September 26, 2019 at Heritage Hall – 4200 Otter Lake Road

Things to know and consider if an improvement project is approved:

- Drainage improvements are being considered including adding curb and gutter, storm sewer, and stormwater treatment.
- Street improvements are very costly. Residents pay a portion of the overall project cost in the form of a special assessment. You will not be billed for the special assessment until Fall 2020, if the project proceeds. Estimated special assessments for your neighborhood will not be determined until after information has been gathered from the questionnaires and a feasibility report is completed later this fall. Another neighborhood meeting will be held later this fall to share the Feasibility Report findings.
- For planning purposes, a range of assessments for this type of project is provided in the attached project brochure.
- Special assessments include the cost of the new roadway. Other utility upgrades, if needed, such as water main and sanitary sewer are funded through utility funds and are not assessed.

- Construction typically starts in summer and ends in late fall of the same year. Construction start time, end time, and length will be specific to the project being completed.

The following information explains the questionnaire that is enclosed. After reading this letter, please complete the questionnaire and return by September 25th, 2019, in the self-addressed stamped envelope or bring the questionnaire to the neighborhood meeting.

Drainage and Erosion Issues
The Township would like to know about any local drainage problems that you may have. Does storm water run-off stand in the street or in front of your house? As part of the design process, we would like to know if this or similar situations are occurring in your neighborhood. If so, please describe it in the drainage and erosion section of the questionnaire. We will review them for possible corrective action.

Private Underground Utilities
Some properties include private underground utilities in the right-of-way. Typically the right-of-way for the residential streets totals to be 60 feet wide / 30 feet from the center of the road. These utilities are usually lawn irrigation or pet containment systems. Work along the street can damage these items. During construction, if residents can mark the location of these items, the contractor can attempt to avoid damaging them.

If you have any private underground utilities, please tell us in the private underground utilities section of the questionnaire.

Traffic Safety
Please note in the questionnaire any visibility, parking, speed, or pedestrian concerns you might have for this neighborhood.

Other Issues
White Bear Township would like to know if you are seeing other issues which you would like to communicate which can be reviewed as a part of the project.

If you have questions regarding this project, please call me at 651-292-4457.

Sincerely,

Larry Poppler, PE
Town Engineer

Enclosed: Project Brochure
Property Owners Questionnaire
Self-Addressed Stamped Envelope

PROPERTY OWNERS QUESTIONNAIRE SEPTEMBER 6, 2019

2019 STREET IMPROVEMENTS
WHITE BEAR TOWNSHIP

Streets planned for improvements in 2020:

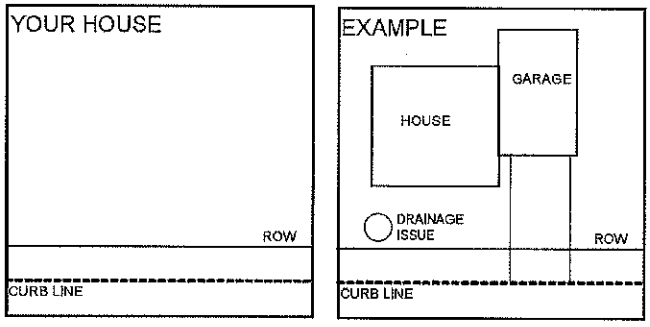
- Homewood Avenue (South Shore to Arbor Drive)
- Lakewood Avenue (South Shore to Co. Rd. F)
- Hillaire Road
- Forest Court
- Ralph Street
- Arbor Drive
- Summit Lane
- Glen Oaks Avenue

Please List Your Address:_____

Drainage and Erosion Issues

1. Does water stand in your yard after big storms? ☐ Yes ☐ No

   If yes,
   A. How long is it there? _____
   B. How far away is it from your house? _____
   C. Where is it in relation to your house (direction and feet)? _____
   D. Is the standing water creating damage to the property or is it just a nuisance? _____
   E. Please sketch in the space below: your house, garage, driveway, and where drainage problem is occurring:



2. Please list specific surface water drainage or erosion problems in your neighborhood:

   _____

   _____

   _____

   NOTE: Most private drainage problems (which are usually attributed to grades at or near the foundation) will likely **NOT** be solved by this street project. However, with this information we may be able to take a look at the whole picture and possibly address some occurrences.

Private Underground Utilities

3. Do you have an underground lawn irrigation system in the right-of-way? (Typically the right-of-way is 15' behind the roadway.)
   ☐ Yes ☐ No

4. Do you have an underground electric pet containment system in the right-of-way?
   ☐ Yes ☐ No

5. Do you have any private wiring, private pipes, etc in the right-of-way?
☐ Yes ☐ No

Traffic/Pedestrian Issues

6. Do you feel your neighborhood or roadway has any pedestrian or traffic issues (e.g. crossing adjacent to busy roadways, parking, excessive speed, traffic volumes, etc.)?
☐ Yes ☐ No

If yes, where? _____

Other Issues

7. Additional Comments/Questions:

Thank you for your cooperation. Please return this questionnaire in the enclosed self-addressed, stamped-envelope. **Please complete all questions and return to the White Bear Township by September 25th, 2019 or bring the questionnaire to the neighborhood meeting on September 26th.**

QUESTIONNAIRE RESPONSES

WHITE BEAR TOWNSHIP		QUESTIONNAIRES SENT	119
PROJECT:	2020 STREET IMPROVEMENTS	QUESTIONNAIRES RECEIVED	59
PROJECT #:	17127.011	PERCENT RETURNED	50%

GENERAL INFORMATION				**DRAINAGE AND EROSION ISSUES**						**PRIVATE UNDERGROUND UTILITIES**						**TRAFFIC AND PEDESTRIAN ISSUES**			
ADDRESS			**RETURNED SURVEY**	**DOES WATER STAND IN YOUR YARD AFTER BIG STORMS?**		**HOW LONG IS IT THERE?**	**HOW FAR AWAY IS IT FROM YOUR HOSUE?**	**WHERE IS IT IN RELATION TO YOUR HOUSE (DIRECTION & FEET)?**	**IS IT CREATING DAMAGE TO THE PROPERTY OR JUST A NUISANCE?**	**PLEASE LIST SPECIFIC DRAINAGE OR EROSION PROBLEMS ON YOUR STREET**	**LAWN IRRIGATION SYSTEM IN RIGHT OF WAY?**		**UNDERGROUND PET CONTAINMENT SYSTEM IN RIGHT OF WAY?**		**PRIVATE WIRING, PRIVATE PIPES, ETC IN RIGHT OF WAY?**		**ANY PEDESTRIAN OR TRAFFIC ISSUES ON YOUR ROADWAY?**		**IF YES, WHERE?**	**ADDITIONAL COMMENTS/QUESTIONS**
				YES	**NO**						**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**		
2576	RALPH	ST	1		X					I DON'T SEE ANY ISSUES WITH ANY OF THE ROADS		X		X		X		X	I AM AGAINST THIS PROJECT AS IT RELATES TO RALPH + LAKEWOOD. THE TWO STREETS I USE. I DO NOT BELIEVE MY PROPERTY WILL RECEIVE ANY BENEFIT + I WILL FIGHT ANY SUBSTANTIAL SPECIAL ASSESSMENT AGAINST ANY PROPERTY.
2582	RALPH	ST	1		X							X		X		X		X	
2593	RALPH	ST	1		X							X		X		X		X	WE HAVE ALMOST NO TRAFFIC - AS STREET IS SHORT + A DEAD END
2599	RALPH	ST	1	X		2 DAYS	80 FT	FRONT LOT	NUISANCE	NO SEWER DRAINS, ROAD RAISED 1/2 DOWN STREET		X		X		X		X	WE LIVE AT END OF STREET - WE HAVE TURNWAY ONLY. WE HAVE NO STREET IN FRONT OF HOME. CURBS ARE NOT REQUIRED OR COULD HELP RUNOFF.
2569	EAST CTY ROAD F		1		X							X		X		X		X	
2534	ARBOR	DR	1		X					WATER STANDS IN THE ROAD WHERE OUR YARD + DRIVEWAY MEETS THE ROAD, ESPECIALLY IN FRONT OF MAILBOX		X		X		X	X		THE SHARP BEND WHERE ARBOR MEETS HOMEWOOD THERE IS LITTLE VISIBILITY AND PEOPLE OFTEN TAKE IT QUITE FAST. OUR MAILBOX WAS STRUCK ONE TIME WHEN A CAR HAD TO SWERVE FROM HITTING ANOTHER CAR COMING FROM THE OPPOSITE DIRECTION AROUND THE BEND	WIDTH OF THE STREETS: QUITE NARROW, IF TWO CARS ARE PARKED ON OPPOSITE SIDES OF THE STREET IT IS A TIGHT FIT TO GET THROUGH. IT WOULD BE NICE IF SOUTH SHORE WAS MORE PEDESTRIAN FRIENDLY. NARROW SHOULDERS AND CARS ARE OFTEN SPEEDING BY.
2576	ARBOR	DR	1	X		CONTINUOUS WET AREA WITH MUD + STANDING WATER	AT STREET LEVEL WEST SIDE OF PROPERTY LINE		YES, DRIVEWAY	DUE TO CONSTANT SURFACE WATER + MUD HAVE BROKEN MY DRIVEWAY 12 FT WIDE + 6 FT UP FROM CURB LINE. STANDARD DRIVING INTO DRIVEWAY CRACKED ASPHALT AND GRADUAL BREAKAGE HAS OCCURRED OVER THE PAST 3 YEARS		X		X		X	X		IT IS VERY DARK THE LENGTH OF ARBOR FROM LAKWOOD AVENUE EAST TO FOREST COURT!! WE INSTALLED OUR OWN LIGHT FOR SAFETY REASONS. NE CORNER OF GLEN OAKS + ARBOR TREES/BUSHES BLOCK A CLEAR VIEW OF INTERSECTION. CANNOT SEE HEADING WEST ON ARBOR CAR ON GLEN OAKS ENTERING INTERSECTION	DIFFICULTY PARKING + HAVING CARS GO IN BOTH DIRECTIONS WIDTH OF STREETS VARY GREATLY + MAKE IT DIFFICULT FOR PARKING ON THE STREETS
2614	ARBOR	DR	1	X		1-2 DAYS	WHERE YARD MEETS STREET		NO			X		X		X	X		SOUTH SHORE IS TERRIFYING FOR PEDESTRIANS	I SUPPORT NEW ROADS IN NEIGHBORHOOD
2617	ARBOR	DR	1		X							X		X		X		X		
2622	ARBOR	DR	1	X		12 HOURS	20 FT	NORTH 20 FT	NUISANCE	STANDING WATER AT END OF DRIVEWAYS	X			X		X	X		PARKING ON NARROW STREETS	ONE SPRINKLER HEAD NEAR HYDRANT WATER SHUT OFF IN DRIVEWAY BURIED POWER + PHONE LINES
2644	ARBOR	DR	1		X					THE CURRENT CURB DRAINAGE IS SCOWLING PAVEMENT SURFACE AND CRUMBLING CURB ADJACENT TO DRIVEWAY AND MAILBOX		X		X	PRIVATE WIRING, UNDERGROUN D XCEL POWER COMES TO HOUSE FROM POWER POLE NEAR NE CORNER OF SITE		X		THERE ARE NO MARKED PEDESTRIAN SURFACES LAKEWOOD AND ARBOR ARE WIDE ENOUGH TO HAVE 2 TRAFFIC LANES AND A STRIPED/PAINTED PED-WAY ON ONE SIDE. STREET LIGHTIN IS HAPHAZARD. ON NARROW 2 LANE ROADS, PARKING BUMP-OUTS COULD HELP TRAFFIC	A) WILL TOWNSHIP MARK THE EDGE OF ROW? B)WILL TOWNSHIP GIVE APROX CONSTRUCTION LIMIT ON EACH ROAD EDGE? C) WILL NEW PONDING OR CURB SIDE GREEN CATCHMENT AREAS BE CONSIDERED? D) IS MORE STORM SEWER PIPE BEING CONSIDERED OR DIVERSION TO SURFACE PONDING? E) IS THERE A STANDARD ROAD WIDTH AND CURB DESIGN (ROLL-UP VS B612)? F) WILL PROPERTY OWNERS BE OFFERED UNDERGROUNDING OF POWER LINES AS OPTION? G) WHAT DO TOWNSHIP RECORDS SHOW AS CONDITION OF WATER AND STORM PIPES AND BASINS AND IF THESE PIPES MUST BE REPAIRED/REPLACED, HOW MUCH ADDED CONSTRUCTION TIME WILL BE NECESSARY? H) WILL TREE REMOVALS BE DONE BY ROAD CONTRACT OR ARBORIST? I) EXPLAIN OPTIONS FOR DRIVEWAY APRONS/APRON CUTS, AND CONCRETE DESIGNS? J) ALONG ARBOR THERE ARE NUMEROUS CABLE AND TELEPHONE LINES BRUIED AND SOME OVERHEAD. WHO WILL COORDINATE WITH THESE UTILITY COMPANIES TO PRESERVE/RESTORE ACTIVE LINES? K) EXPLAIN WHAT WILL HAPPEN TO MAIL BOXES AND DELIVERY DURING CONSTRUCTION L.) WILL CORNER/INTERSECTION LINE OF SIGN BE IMPROVED TO SOME ENGINEERING/STRAFFIC STANDARD? WHAT IS THIS STANDARD?
2651	ARBOR	DR	1		X					AT DRIVEWAY/STREET I HAVE TO FILL HOLES IN STREET ANNUALLY DUE TO WATER EROSION. IN WINTER A PUDDLE FORMS & FREEZES AT END OF DRIVEWAY (WHOLE WIDTH)		X		X		X		X	STOP SIGNS INSTALLED @ ARBOR + HILLAIRE THIS YEAR HAVE MADE A BIG IMPROVEMENT	
2661	ARBOR	DR	1		X							X		X		X		X		
2662	ARBOR	DR	1	X		UP TO 1 DAY	IN FRONT OF GARAGE	NE	DAMAGE	WEAK CURB CAUSES WATER TO FLOW INTO DRIVEWAY LEADING INTO GARAGE WHICH HAS CAUSED ISSUES ALONG FRONT AND FOUNDATION OF GARAGE	X			X		X		X		PRIVATE WIRING - POSSIBLY - TOP LIGHT AT SIDEWALK - WILLING TO MOVE IF NEEDED
2676	ARBOR	DR	1	S		UNTIL IT EVAPORATES	END OF DRIVEWAY	NORTH 10'	:RODES, BREAKS UP ROAD	NOTE: AFTER RAIN, OR NEIGHBOR DOING POOL MAINTENACE, WATER POOLS @ END OF DRIVEWAY/STREET AS THIS PSOT IS AT THE BOTTOM OF THE HILL. ON THE EAST SIDE OF DRIVEWAY, ON PROPERTY LINE, THE CURB WAS REBUILT DUE TO WATER FLOWING DOWN INTO RAVINE.		X		X		X		X		
2684	SOUTH SHORE	BLVD	1		X							X		X		X		X		
2688	ARBOR	DR	1		X						X			X	X - STONE RETAINING WALL					I AM VERY CONCERNED HOW TOWNSHIP INTENDS TO ACCESS PROPERTIES FOR ROAD/CURB IMPROVEMENTS, IT IS MY STRONG OPINION THAT ALL RESIDENTS PAY "EQUAL" AMOUNTS REGARDLESS OF EACH RESIDENTS STREET FRONTAGE. TOWNSHIP ROADWAYS (ALL) ARE "PUBLIC ROADS" AND THEREFORE ARE USED EQUALLY BY ALL RESIDENTS.
2562	SOUTH SHORE	BLVD	1		X					WATER FROM LAKEWOOD CROSSES S. SHORE + RUNS DOWN THE DRIVEWAY ON THE HOUSE ACROSS THE STREET		X		X		X	X		S. SHORE IS UNSAFE FOR BIKES + PEDESTRIANS. TRAFFIC DOWN LAKEWOOD IS OFTEN TOO FAST	WE ARE WORRIED ABOUT THE POSSIBILITY OF INSTALLING CURB ON LAKEWOOD BECAUSE OF THE EXISTING SLOPE ABOVE THE STREET FROM OUR YARD. WE DON'T WANT TO END UP WITH A RETAINING WALL. ALSO, THE STREETS IN THE NEIGHBORHOOD ARE TOO NARROW TO ADD CURBS. CURBS MAY MAKE ON STREET PARKING DIFFICULT ON NARROW ROADS
2580	SOUTH SHORE	BLVD	1		X							X		X		X	X		LAKEWOOD IS A DIRECT ROUTE BETWEEN COUTNY RD E + SOUTH SHORE. PEOPLE CUT THROUGH + DRIVEY WAY TOO FAST. THERE ARE CHILDREN IN OUR NEIGHBORHOOD AND IT IS A CONCERN ON OUR BLOCK. ADDITIONALLY, CONTRACTORS CONSTANTLY PARK ON OUR ROAD - BLOCKING TRAFFIC WHILE THEY WORK ON LAKEFRONT PROPERTIES	I'D LOVE A SPEED BUMP OR TWO TO SLOW PEOPLE DOWN ON LAKEWOOD + S. SHORE BLVD. I'M REALLY WORRIED ABOUT CHILDREN BEING HIT BY VEHICLES DRIVING TOO FAST.

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QUESTIONNAIRE RESPONSES

WHITE BEAR TOWNSHIP		QUESTIONNAIRES SENT	119
PROJECT:	2020 STREET IMPROVEMENTS	QUESTIONNAIRES RECEIVED	59
PROJECT #:	17127.011	PERCENT RETURNED	50%

GENERAL INFORMATION						DRAINAGE AND EROSION ISSUES					PRIVATE UNDERGROUND UTILITIES						TRAFFIC AND PEDESTRIAN ISSUES			
ADDRESS			**RETURNED SURVEY**	**DOES WATER STAND IN YOUR YARD AFTER BIG STORMS?**		**HOW LONG IS IT THERE?**	**HOW FAR AWAY IS IT FROM YOUR HOSUE?**	**WHERE IS IT IN RELATION TO YOUR HOUSE (DIRECTION & FEET)?**	**IS IT CREATING DAMAGE TO THE PROPERTY OR JUST A NUISANCE?**	**PLEASE LIST SPECIFIC DRAINAGE OR EROSION PROBLEMS ON YOUR STREET**	**LAWN IRRIGATION SYSTEM IN RIGHT OF WAY?**		**UNDERGROUND PET CONTAINMENT SYSTEM IN RIGHT OF WAY?**		**PRIVATE WIRING, PRIVATE PIPES, ETC IN RIGHT OF WAY?**		**ANY PEDESTRIAN OR TRAFFIC ISSUES ON YOUR ROADWAY?**		**IF YES, WHERE?**	**ADDITIONAL COMMENTS/QUESTIONS**
				YES	**NO**						**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**		
2608	SOUTH SHORE	BLVD	1		X							X		X		X	X		SOUTH SHORE IS VERY NARROW - ESPECIALLY CONSIDERING THE NUMBER OF PEDESTRIANS/CYCLISTS. I'VE HEARD RUMBLINGS OF TURNING SOUTH SHORE INTO A ONE-WAY, WITH A PATH. I AM VERY IN FAVOR OF THIS PLAN.	
2616	SOUTH SHORE	BLVD	1	X		SEVERAL DAYS	40 FT	40 FT NORTH	CURB SIDE SOUTH SHORE STANDING WATER FOR			X		X		X	X		FOREST COURT NEEDS STOP SIGN EXCESSIVE SPEEDING SOUTH SHORE BLVD	I PAYED TO GE THE DRIVEWAY AND SO DID MY NEIGHBORS. WE SPEND A LOT OF MONEY I DO NOT WANT MY NEW DRIVEWAY TOR UP!
2636	SOUTH SHORE	BLVD	1		X							X		X		X	X		SO SHORE EXCESSIVE SPEED	
2660	SOUTH SHORE	BLVD	1	X			100 FT	NORTH OF HOUSE	NUISANCE	DRAINAGE DITCH NEXT TO SOUTH SHORE BLVD COLLECTS WATER - NEVER DRAINS		X		X		X	X		PARKING, EXCESSIVE SPEEDS. CARS TRAVEL TOO FAST ON SOUTH SHORE BLVD	
4105	LAKEWOOD	AVE	1	X		1-2 DAYS	25-50 YARDS	IN FRONT TO RIGHT	BOTH	STREET IS ERODING AWAY, WHICH HAS CAUSED OUR DRIVEWAY TO CRACK AND ERODE AT THE ENTRANCE. TREES HAVE DIED DUE TO STANDING WATER IN THE YARD		X		X		X				
4111	LAKEWOOD	AVE	1	X		MAYBE A DAY OR TWO	NEAR STREET	90' FROM FRONT DOOR	NUISANCE	BACKYARD - DRAIN IS IN STEFFENS' YARD. ONLY A PROBLEM WITH SNOW MELT IN SPRING		X		X		X		X	ONLY IF CARS/TRUCKS PARK ALONG STREET. SPECIFICALLY CONSTRUCTION	WE ARE UPSET THAT WE WERE HIT WITH A $2500 SEWER ASSESSMENT 2 YEARS AGO. NOW THIS? IT SEEMS LIKE IT SHOULDN'T BE SO EXPENSIVE TO FIX A SIDE ROAD. WE DON'T NEED COMCRETE CURBING.
4120	LAKEWOOD	AVE	1		X							X		X		X NOT TO MY KNOWLEDGE	X		INTERSECTION OF LAKEWOOD + CO RD F THERE ARE TREES/BRUSH THAT BLOCK THE VIEW OF TRAFFIC. YOU NEED TO PUT INTO INTERSECTION TO SEE IF THERE ARE CARS COMING	TELEPHONE POLES ARE ROTTEN/LEANING

QUESTIONNAIRE RESPONSES

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PROJECT:	2020 STREET IMPROVEMENTS	QUESTIONNAIRES RECEIVED	59
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GENERAL INFORMATION						DRAINAGE AND EROSION ISSUES					PRIVATE UNDERGROUND UTILITIES						TRAFFIC AND PEDESTRIAN ISSUES			
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				YES	**NO**						**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**		
4135	LAKEWOOD	AVE	1		X							X		X		X		X		
4140	LAKEWOOD	AVE	1		X							X		X		X		X		THERE HAVE BEEN A NUMBER OF THEFTS FROM CARS AND A STOLEN VEHICLES IN THE LAST YEAR. MAYBE MORE STREET LIGHTS WOULD HELP
4198	LAKEWOOD	AVE	1		X					N/A		X		X		X	X		LARGE, OVERWEIGHT TRUCKS AND CARS SPEEDING USE STREET RATHER THAN BELLAIRE	
4160	LAKEWOOD	AVE	1		X							X		X		X		X		
4161	LAKEWOOD	AVE	1		X					NONE NOTICED	NOT SURE, HAVE SPRINKLER SYSTEM, NEVER USED			X		X		X		
4203	LAKEWOOD	AVE	1		X							X		X		X		X		
4208	LAKEWOOD	AVE	1	X		1 DAY	2 FT	2 FT N, 2'X10'	DAMAGE			X		X		X	X		NOT ON LAKEWOOD. S SHORE EXCESSIVE SPEED + TRAFFIC SHOULD BE AMELIORATED BY ONE WAY/BIKE PATH PROJECT	
	LAKEWOOD	AVE	1		X							X		X		X	X		PEOPLE LIKE TO DRIVE TOO FAST	
4166	GLEN OAKS	AVE	1	X		DEPENDING ON SEASON - SPRING LONGER	BACK YARD IN LOW SPOT - NOT NEAR HOUSE	BACK YARD 30 FT	NUISANCE			X		X	X - CABLE			X		
4191	GLEN OAKS	AVE	1		X			END OF DRIVEWAY	DRIVEWAY DAMAGE (FREEZING AND REFREEZING), WE REPLACED DRIVEWAY	SAND & WATER RUN DIRECTLY ONTO DRIVEWAY AND INTO FRONT YARD WHEN IT RAINS. DRAINAGE COMES FROM STREET.		X		X		X	X		NARROW STREET W/ REGULAR PEDESTRIAN TRAFFIC. OCCASIONAL SPEEDING CAR	
4203	GLEN OAKS	AVE			X NEVER					NONE - NO WORK NEEDED ON GLEN OAKS. 33 YEARS ON THIS BLOCK.		X		X		X		X		NO CONPLAINTS. WE ARE FINE ON GLEN OAKS AVE. PLEASE DON'T DO ANY WORK ON OUR STREET.
4211	GLEN OAKS	AVE	1	X		12-24 HOURS	20 FEET	20 FEET EAST				X		X		X	X		SOUTH SHORE BLVD IS SUPER BUSY AND FULL OF SPEEDERS	
4129	HILLAIRE	ROAD	1		X							X		X		X		X		
4130	HILLAIRE	ROAD	1		X					WATER PUDDLES AT BOTTOM OF MY DRIVEWAY				X		X		X		QUESTION 3 - I HAVE IRRIGATION SYSTEM ALONG HILLAIRE RD - DO NOT HAVE A 15 FT RIGHT OF WAY THERE.
4141	HILLAIRE	ROAD	1		X					NONE THAT I AM AWARE OF		X		X		X		X		
4150	HILLAIRE	ROAD	1		X					EROSION ALONG THE STREET ASPHALT EDGE		X		X		X			COUNTY POSTED NO PARKING SIGNAGE. IF THESE ARE NOT RETURNED TO THEIR ORIGINAL LOCATIONS, THIS NARROW, 18', STREET WILL HAVE EMERGENCY VEHICLE ACCESS PROBLEMS	1. WHAT IS THE ROW WIDTH ON HILLAIRE? 2. WILL I LOSE THE BIG COTTONWOOD ALONG THE STREET? IF SO, 3. WHAT WILL BE PLANED? 4. HOW WIDE WILL THE PAVEMENT BE AFTER COMPLETION? 5. ARE THERE RAINGARDENS PROPOSED FOR HILLAIRE TO SLOW DOWN THE RUN OFF INTO THE LAKE?
4154	HILLAIRE	ROAD	1		X							X		X		X		X		
4148	SUMMIT	LANE	1		X							X		X		X		X		
4152	SUMMIT	LANE	1		X							X		X		X		X		
4179	SUMMIT	LANE	1		X					SAND COMES DOWN HILL AND LANDS UNDER MY MAIL BOX ON THE ROAD WHERE I PUCK UP MY MAIL	X				SUMP PUMP OUTLET RIGHT NEAR MAIL BOX POST			X		
4185	SUMMIT	LANE	1		X	N/A	N/A	N/A	N/A	?		X		X		X		X		
4155	FOREST	CT	1	X		UNTIL THE FROST GOES AWAY (LATE SPRING)	IT ENTERS THE HOUSE	SEE DASHED AREA	DAMAGE	ABOUT EVERY 10 YEARS THE WATER ENTERS MY BASEMENT. A SNOWY WINTER FOLLOWED BY AN EARLY WARM RAIN CREATES A "POND" THAT ENERS MY BASEMENT (~ 1/2")	X			X		X		X		MY ISSUE IS UNIQUE IN THAT IT HAPPENS "INFREQUENTLY" BUT MY BASEMENT CARPETING GETS WET AND SOMETIMES NEEDS REPLACEMENT BUT AT LEAST PROFESSIONAL CLEANING AND DRYING

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QUESTIONNAIRE RESPONSES																							
WHITE BEAR TOWNSHIP											QUESTIONNAIRES SENT	119											
PROJECT:	2020 STREET IMPROVEMENTS										QUESTIONNAIRES RECEIVED	59											
PROJECT #:	17127.011										PERCENT RETURNED	50%											
GENERAL INFORMATION				**DRAINAGE AND EROSION ISSUES**								**PRIVATE UNDERGROUND UTILITIES**						**TRAFFIC AND PEDESTRIAN ISSUES**					
ADDRESS			**RETURNED SURVEY**	**DOES WATER STAND IN YOUR YARD AFTER BIG STORMS?**		**HOW LONG IS IT THERE?**	**HOW FAR AWAY IS IT FROM YOUR HOSUE?**	**WHERE IS IT IN RELATION TO YOUR HOUSE (DIRECTION & FEET)?**	**IS IT CREATING DAMAGE TO THE PROPERTY OR JUST A NUISANCE?**	**PLEASE LIST SPECIFIC DRAINAGE OR EROSION PROBLEMS ON YOUR STREET**	**LAWN IRRIGATION SYSTEM IN RIGHT OF WAY?**		**UNDERGROUND PET CONTAINMENT SYSTEM IN RIGHT OF WAY?**		**PRIVATE WIRING, PRIVATE PIPES, ETC IN RIGHT OF WAY?**		**ANY PEDESTRIAN OR TRAFFIC ISSUES ON YOUR ROADWAY?**		**IF YES, WHERE?**	**ADDITIONAL COMMENTS/QUESTIONS**
				YES	**NO**						**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**		
4165	FOREST	CT	1		X					NONE THAT I KNOW OF		X		X		X WIRING TO HOUSE IS SUSPENDED ABOVE GROUND		X		NONE
4166	FOREST	CT	1		X					IN HEAVY RAIN, THE RUNOFF LEAVES THE STREET AND FLOWS THROUGH MY YARD, WASHING OUT LANDSCAPING AND LEAVING DEBRIS. I HAD TO CREATE MY OWN "CURB" AT THE END OF MY DRIVEWAY TO KEEP MY YARD FORM GETTING WASHED OUT IN HEAVY RAIN.		X		X		X	X!!		1) WITHOUT CURB, MY NEIGHBORS GUESTS PARK IN MY YARD. 2) DESPITE POSTED NO PARKING SIGNS, THERE IS STILL A PARKING ISSUE NORTH END OF FORST CT! 3) INTERESCTION OF FOREST AND S. SOUTH BLVD VERY DANGEROUS DUE TO SPEEDING TRAFFIC AND LIMITED VISIBILITY OF CROSS TRAFFIC (TRY TURNING LEFT ONTO S. SHORE FROM CORESET. IT CAN BE QUITE EXCITING.)	VERY STRONG SUPPORTER OF CURB AND GUTTER
4180	FOREST	CT	1		X							X		X		X		X		OBVIOUSLY FOREST DRAINS TO SOUTH SHORE AND DEVIL LAKE BEHIND MOST FROM THERE + STANDING WATER EATS THE PAVEMENT IN WINTER THEN THE COUNTY HAS TO DEAL WITH IT
4185	FOREST	CT	1		X							X		X		X	X		SPEEDING ON SOUTH SHORE BLVD	
4185	HOMEWOOD	AVE	1		X							X		X		X		X		WHEN IT RAINS THERE IS LITERALLY A RIVER OF WATER COMING DOWN THE STREET. THE ROAD CURVES AT THE CORNER IN FRONT OF MY HOUSE. THIS CAUSES ENORMOUS WATER EROSION IN FRONT OF MY HOUSE. I HAVE BEEN DEALING WITH POT HOLES AND CHUNKS OF ASPHALT IN FRONT OF MY DRIVEWAY FOR DECADES. THE WORST THING IS IN THE WINTER. THERE IS A NEARLY CONSTANT PONT OF ICE IN THE ROAD AT THE END OF MY DRIVEWAY. EVEN WITH FOUR WHEEL DRIVE IT IS CLOSE TO IMPOSSIBLE TO GET TRACTION.
4190	HOMEWOOD	AVE	1		X							X		X		X		X		
4211	HOMEWOOD	AVE	1		X							X		X		X	X		VEHICLES TRAVELING ON THE STREET AT TOO GREAT A SPEED FOR THE LENGTH AND NARROWNESS OF THE STREET. NEIGHBORS AND VISITORS PARKING ON THE STREET CAUSE IT TO BE IMPASSABLE.	
			1		X							X		X		X		X		PROVER DRIVEWAY ON FOREST COURT
			1	X		1 HR		40'	NUISANCE	ALL OUR WATER PROBLEM COMES OFF THE STREET		X		X		X		X		RALPH STREET IS A DEAD END
			1		X					NONE	X			X		X		X		
			1		X							X		X		X		X		I AM AGAINST THIS IMPROVEMENT. I AM STILL PAYING FOR THE LAST IMPROVEMENT. YOU SHOULD COLLECT TAXES AND DO IT ACROSS THE BOARD. MY HUSBAND LOST HIS JOB AND DON'T HAVE THE MONEY. I HEAR OTHER PEOPLE IN THE TOWNSHIP PROTESTED PAYING FOR IMPROVEMENT INDIVIDUALLY AND THEN THEY DIDN'T HAVE TO. I AM AGAINST PAYING OUT OF POCKET! THIS ISN'T A PRIVATE COMMUNITY.

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Appendix F

Engineer's Estimate

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2020 STREET IMPROVEMENTS
TKDA PROJECT NO. 17127.011
WHITE BEAR TOWNSHIP, MINNESOTA

BASE BID -

ITEM	Unit	Est. Qty	Unit Price	Amount
MOBILIZATION	LS	1.00	$ 100,000.00	$ 100,000.00
TRAFFIC CONTROL	LS	1.00	$ 30,000.00	$ 30,000.00
INLET PROTECTION	EA	8.00	$ 150.00	$ 1,200.00
STREET SWEEPER	HR	19.00	$ 150.00	$ 2,850.00
SAWCUT PAVEMENT (ALL TYPES)	LF	2,460.00	$ 3.00	$ 7,380.00
TREE REMOVAL (CLEAR AND GRUB)	TREE	45.00	$ 800.00	$ 36,000.00
REMOVE BITUMINOUS DRIVEWAY PAVEMENT	SY	2,060.00	$ 10.00	$ 20,600.00
REMOVE CONCRETE DRIVEWAY PAVEMENT	SY	1,020.00	$ 20.00	$ 20,400.00
REMOVE STORM SEWER PIPE	LF	630.00	$ 10.00	$ 6,300.00
REMOVE CASTING (CB)	EA	6.00	$ 100.00	$ 600.00
REMOVE CASTING - STORM (MH)	EA	3.00	$ 100.00	$ 300.00
SALVAGE & REINSTALL MANHOLE CASTING W/ NEW RINGS	EA	33.00	$ 250.00	$ 8,250.00
REMOVE & REPLACE HYDRANT	EA	3.00	$ 7,000.00	$ 21,000.00
FULL DEPTH RECLAMATION	SY	21,610.00	$ 4.00	$ 86,440.00
BITUMINOUS MATERIAL FOR TACK COAT	GA	1,100.00	$ 2.00	$ 2,200.00
COMMON EXCAVATION	CY	7,520.00	$ 20.00	$ 150,400.00
GRANULAR BORROW	CY	760.00	$ 26.00	$ 19,760.00
1" MINUS CRUSHED ROCK	TON	3,630.00	$ 26.00	$ 94,380.00
SUBGRADE EXCAVATION	CY	760.00	$ 24.00	$ 18,240.00
SUBGRADE PREPARATION	RD STA	76.00	$ 250.00	$ 19,000.00
GEOTEXTILE FABRIC	SY	23,110.00	$ 3.00	$ 69,330.00
AGGREGATE BASE CLASS V	TON	3,100.00	$ 20.00	$ 62,000.00
TYPE SP 12.5 NON-WEARING COURSE MIX (2;B)	TN	2,590.00	$ 70.00	$ 181,300.00
TYPE SP 12.5 WEARING COURSE MIX (2;B)	TN	2,590.00	$ 75.00	$ 194,250.00
15" PIPE APRON W/ TRASH GUARD	EA	4.00	$ 1,400.00	$ 5,600.00
15" RCP STORM PIPE	LF	845.00	$ 70.00	$ 59,150.00
18" RCP STORM PIPE	LF	560.00	$ 76.00	$ 42,560.00
21" RCP STORM PIPE	LF	855.00	$ 84.00	$ 71,820.00
TELEVISE & LINE 48" STORM SEWER	LF	475.00	$ 50.00	$ 23,750.00
CONNECT INTO EXISTING DRAINAGE STRUCTURE	EA	2.00	$ 1,500.00	$ 3,000.00
ADJUST GATE VALVE BOX	EA	17.00	$ 450.00	$ 7,650.00
CASTING ASSEMBLY - STORM (MH)	EA	3.00	$ 800.00	$ 2,400.00
CATCH BASIN STRUCTURE	EA	15.00	$ 6,000.00	$ 90,000.00
CONST RAIN GARDEN	SY	110.00	$ 200.00	$ 22,000.00
RIP RAP	CY	30.00	$ 110.00	$ 3,300.00
STORMWATER TREATMENT	EA	1.00	$ 50,000.00	$ 50,000.00
CLEAN DRAINAGE DITCH	LF	750.00	$ 15.00	$ 11,250.00
CONCRETE CURB AND GUTTER DESIGN SURMOUNTABLE	LF	15,060.00	$ 25.00	$ 376,500.00
6" CONCRETE DRIVEWAY PAVEMENT (MNDOT 3F52)	SY	1,000.00	$ 70.00	$ 70,000.00
3" BITUMINOUS DRIVEWAY PAVEMENT (TYPE SP 9.5 WEARING COURSE MIX (2,B))	SY	1,960.00	$ 25.00	$ 49,000.00
TOPSOIL BORROW	CY	1,120.00	$ 30.00	$ 33,600.00
SODDING TYPE MINERAL	SY	250.00	$ 7.00	$ 1,750.00
HYDROSEED WITH SEED MIX 25-131	ACRE	1.4	$ 12,000.00	$ 16,800.00
SALVAGE AND REINSTALL SIGN	EA	33.00	$ 300.00	$ 9,900.00
FURNISH AND INSTALL SIGN	SF	100.00	$ 50.00	$ 5,000.00
SALVAGE AND REINSTALL MAILBOXES	EA	118.00	$ 50.00	$ 5,900.00
SALVAGE AND REINSTALL SPRINKLER SYSTEM	LF	100.00	$ 20.00	$ 2,000.00
STOCKPILE AGGREGATE	CY	6,200.00	$ 18.00	$ 111,600.00
SALV MILL BIT & AGG FROM STOCKPILE	CY	6,200.00	$ 18.00	$ 111,600.00
INSTALL RETAINING WALL	LF	1,930.00	$ 35.00	$ 67,550.00
RECONSTRUCT RETAINING WALL	SY	170.00	$ 45.00	$ 7,650.00
SALVAGE AND REINSTALL BRICK PAVERS	SF	1,130.00	$ 20.00	$ 22,600.00
DEWATERING	LS	1.00	$ 5,000.00	$ 5,000.00

	Estimated Construction Costs:	**$ 2,441,110.00**
25%	**Engineering, Finance, Legal:**	**$ 610,277.50**
	Estimated Project Costs:	**$ 3,051,387.50**

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Appendix G

Assessment Roll

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DESCRIPTION **2020 STREET IMPROVEMENTS**

ASSESSMENT UNIT RATE **$ 11,000**
INTEREST RATE
TERM **10**
INITIAL YEAR **2020**

TOTAL UNITS **114.0**
PYAMENT METHOD

NUMBER	PARCEL ADDRESS	PARCEL NUMBER	LEGAL DESCRIPTION	PRIMARY OWNER	JOINT OWNER	OWNER ADDRESS	CITY AND ZIP	ASSESSIBLE UNITS	STREET ASSESSMENT	TOTAL ASSESSMENT
1	2626 SOUTH SHORE BLVD	243022410008	FOREST PARK, RAMSEY COUNTY,MI LOT 2 & ALL OF LOT 1	JORGE L GONZALES		2626 SOUTH SHORE BLVD	WHITE BEAR LAKE MN 55110-3932	0.5		
2	2630 SOUTH SHORE BLVD	243022410009	FOREST PARK, RAMSEY COUNTY, MI EX S 10 FT; LOT 2	MARILYN G SVEE		2630 SOUTH SHORE BLVD	WHITE BEAR TOWN MN 55110-3932	0.5		
3	2520 SOUTH SHORE BLVD	243022420023	BELLAIRE SECOND ADDITION EX S 50 FT OF THE FOL LOTS 1 AND LOT 2 BLK 4	ANNETTE H KRUGER		8 ROBIN LN	NORTH OAKS MN 55127-6449	0.5		
4	4233 HOMEWOOD AVE	243022420024	BELLAIRE SECOND ADDITION S 50 FT OF FOL LOTS 1 AND LOT 2 BLK 4	JOSHUA R CUMMINGS		4233 HOMEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3940	1.0		
5	4209 HOMEWOOD AVE	243022420032	BELLAIRE SECOND ADDITION LOT 18 BLK 4	RUTHELLYN AREND		4209 HOMEWOOD AVE	WHITE BEAR LAKE MN 55110-3940	1.0		
6	4211 HOMEWOOD AVE	243022420033	BELLAIRE SECOND ADDITION LOT 19 BLK 4	BRUCE ALLAN CAMPBELL		4211 HOMEWOOD AVE	WHITE BEAR LAKE MN 55110-3940	1.0		
7	4213 HOMEWOOD AVE	243022420034	BELLAIRE SECOND ADDITION LOT 20 BLK 4	SWIFT HOME SOLUTIONS LLC		8362 TAMARACK VLG STE 119-355	WOODBURY MN 55125-3392	1.0		
8	4219 HOMEWOOD AVE	243022420035	BELLAIRE SECOND ADDITION LOT 21 BLK 4	TIMOTHY KUHNMUENCH	SHANNON MCLELAND	4219 HOMEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3940	1.0		
9	4223 HOMEWOOD AVE	243022420036	BELLAIRE SECOND ADDITION LOT 22 BLK 4	JANICE M BARNES		4223 HOMEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3940	1.0		
10	2562 SOUTH SHORE BLVD	243022420037	BELLAIRE SECOND ADDITION LOT 1 BLK 3	ALAN T RUPNOW	JESSICA RUPNOW	2562 S SHORE BLVD	WHITE BEAR TOWNSHIP MN 55110-3930	0.5		
11	2538 SOUTH SHORE BLVD	243022420043	BELLAIRE SECOND ADDITION LOTS 7 & LOT 8 BLK 3	DOUGLAS E HEIDER	JANE M HEIDER	2538 SOUTH SHORE BLVD	WHITE BEAR LAKE MN 55110-3930	0.5		
12	4212 HOMEWOOD AVE	243022420044	BELLAIRE SECOND ADDITION LOTS 9 & LOT 10 BLK 3	DOUGLAS H PFEFFER	KIM M PFEFFER	4212 HOMEWOOD AVE	SAINT PAUL MN 55110-3922	1.0		
13	4208 HOMEWOOD AVE	243022420045	BELLAIRE SECOND ADDITION N 45 FT OF LOT 12 AND ALL OF LOT 11 BLK 3	SEAN T HIGGINS	ALISON J WAID HIGGINS	4208 HOMEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3922	1.0		
14	4209 LAKEWOOD AVE	243022420046	BELLAIRE SECOND ADDITION NLY 10 FT OF LOT 21 AND LOTS 22 AND LOT 23 BLK	PATRICK J WELCH	VICKI LEE WELCH	4209 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3925	1.0		
15	4211 GLEN OAKS AVE	243022420048	BELLAIRE SECOND ADDITION PART OF LOTS 1 2 AND LOT 3 BLK 2	JENNIFER DUNBAR		4211 GLEN OAKS AVE	WHITE BEAR TOWNSHIP MN 55110-3936	1.0		
16	4208 LAKEWOOD AVE	243022420051	BELLAIRE SECOND ADDITION LOTS 8 AND LOT 9 BLK 2	MARJORIE K MORROW	JOSEPH J KRALJIC	4208 LAKEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3937	1.0		
17	2608 SOUTH SHORE BLVD	243022420054	BELLAIRE SECOND ADDITION LOT 3 BLK 1	CHAR C DEMULLING		2608 SOUTH SHORE BLVD	WHITE BEAR TOWNSHIP MN 55110-3932	0.5		
18	2580 SOUTH SHORE BLVD	243022420056	BELLAIRE SECOND ADDITION PART OF LOT 6 ALL OF LOT 7 BLK 2	THOMAS B WILSON	CAITLYN WILSON	2580 SOUTH SHORE BLVD	WHITE BEAR TOWNSHIP MN 55110-3931	0.5		
19	2607 ARBOR DR	243022430003	FOREST PARK, RAMSEY COUNTY, MI LOT 11	JACK C CHRISTENSON	TERRYL S CHRISTENSON	2607 ARBOR DR	WHITE BEAR LAKE MN 55110-3905	1.0		
20	2617 ARBOR DR	243022430004	BELLAIRE WHITE BEAR LAKE LOT 11 FOREST PARK & BELLAIRE LOT 15 BLK 2	JEFFREY S MCGRAW		2617 ARBOR DR	WHITE BEAR LAKE MN 55110-3905	1.0		
21	4201 FOREST CT	243022430005	FOREST PARK, RAMSEY COUNTY,MI LOT 5	ALEXANDRA C SCHOEN		4201 FOREST CT	WHITE BEAR TOWNSHIP MN 55110-3942	1.0		
22	4185 FOREST CT	243022430006	FOREST PARK, RAMSEY COUNTY,MI LOT 6	KEN VELKY	CATHERINE VELKY	4185 FOREST CT	WHITE BEAR LAKE MN 55110-3957	1.0		
23	4177 FOREST CT	243022430007	FOREST PARK, RAMSEY COUNTY,MI LOT 7	NANCY J COVERT		4177 FOREST CT	WHITE BEAR LAKE MN 55110-3957	1.0		
24	4165 FOREST CT	243022430008	FOREST PARK, RAMSEY COUNTY,MI LOT 8	ROGER C CARLSON		4165 FOREST CT	WHITE BEAR LAKE MN 55110-3957	1.0		
25	4163 FOREST CT	243022430009	FOREST PARK, RAMSEY COUNTY,MI LOT 9	PATRICK E PADDEN	BARBARA L PADDEN	4163 FOREST CT	WHITE BEAR TOWN MN 55110-3957	1.0		
26	4155 FOREST CT	243022430010	FOREST PARK, RAMSEY COUNTY,MI LOT 10	RAYMOND C PETERSON	LULABELLE W PETERSON	4155 FOREST CT	WHITE BEAR LAKE MN 55110-3957	1.0		
27	4166 GLEN OAKS AVE	243022430011	BELLAIRE SECOND ADDITION LOTS 13 & LOT 14 BLK 1	CHRISTOPHER L BROWN	NATALIE H BROWN	4166 GLEN OAKS AVE	WHITE BEAR TOWN MN 55110-3955	1.0		
28	4174 GLEN OAKS AVE	243022430012	BELLAIRE SECOND ADDITION LOTS 11 & LOT 12 BLK 1	KENNETH R KVAAL		4174 GLEN OAKS AVE	WHITE BEAR LAKE MN 55110-3955	1.0		
29	4178 GLEN OAKS AVE	243022430013	BELLAIRE SECOND ADDITION LOT 10 BLK 1	ROBERT LEDUC	TRACI LEDUC	4178 GLEN OAKS AVE	WHITE BEAR TOWNSHIP MN 55110-3955	1.0		
30	4182 GLEN OAKS AVE	243022430014	BELLAIRE SECOND ADDITION LOTS 8 AND LOT 9 BLK 1	JENNIFER JOHNSTON		4182 GLEN OAKS AVE	WHITE BEAR TOWNSHIP MN 55110-3955	1.0		
31	4194 GLEN OAKS AVE	243022430015	BELLAIRE SECOND ADDITION LOTS 6 & LOT 7 BLK 1	STEVEN RONNAN		4194 GLEN OAKS AVE	WHITE BEAR TOWNSHIP MN 55110-3955	1.0		
32	4200 GLEN OAKS AVE	243022430016	BELLAIRE SECOND ADDITION LOTS 4 AND LOT 5 BLK 1	JAMES R REESE JR	SANDRA STEFL REESE	4200 GLEN OAKS AVE	WHITE BEAR TOWN MN 55110-3953	1.0		
33	4203 GLEN OAKS AVE	243022430017	BELLAIRE SECOND ADDITION LOTS 23 & LOT 24 BLK 2	KRISTEN M BRODIE	EDWARD N BRODIE	4203 GLEN OAKS AVE	WHITE BEAR TOWNSHIP MN 55110-3936	1.0		
34	4191 GLEN OAKS AVE	243022430018	BELLAIRE SECOND ADDITION LOTS 21 AND LOT 22 BLK 2	MICHAEL S MACRAE	KATHLEEN J MACRAE	4191 GLEN OAKS AVE	WHITE BEAR LAKE MN 55110-3954	1.0		
35	4187 GLEN OAKS AVE	243022430019	BELLAIRE SECOND ADDITION LOTS 19 AND LOT 20 BLK 2	TERRANCE M ROESER	LORENE E ROESER	4187 GLEN OAKS AVE	WHITE BEAR TOWN MN 55110-3954	1.0		
36	4171 GLEN OAKS AVE	243022430020	BELLAIRE SECOND ADDITION PART OF LOTS 16 & 17 & ALL OF LOT 18 BLK 2	PAUL SOUCHERAY	JENNIFER SOUCHERAY	4171 GLEN OAKS AVE	WHITE BEAR TOWN MN 55110-3954	1.0		
37	4180 LAKEWOOD AVE	243022430021	BELLAIRE SECOND ADDITION PART OF LOTS 16 & 17 & ALL OF LOTS 14 & LOT 15	KENNETH W RIECK	DELORES J RIECK	4180 LAKEWOOD DR	ST PAUL MN 55110-3937	1.0		
38	4184 LAKEWOOD AVE	243022430022	BELLAIRE SECOND ADDITION LOTS 12 AND LOT 13 BLK 2	STEVEN T GAMBLE		4184 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3937	1.0		
39	4198 LAKEWOOD AVE	243022430023	BELLAIRE SECOND ADDITION LOT 10 & LOT 11 BLK 2	PATSY K FLODING		4198 LAKEWOOD AVE	WHITE BEAR TOWN MN 55110-3937	1.0		
40	4203 LAKEWOOD AVE	243022430024	BELLAIRE SECOND ADDITION LOT 21 BLK 3	CAREY D BURKETT		4203 LAKEWOOD AVE	WHITE BEAR TOWN MN 55110-3925	1.0		
41	4201 LAKEWOOD AVE	243022430025	BELLAIRE SECOND ADDITION LOT 20 BLK 3	JEFFREY A SHANNON		4201 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3925	1.0		
42	4195 LAKEWOOD AVE	243022430026	BELLAIRE SECOND ADDITION LOTS 18 AND LOT 19 BLK 3	LYNETTE C THOMPSON		4195 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3925	1.0		
43	4189 LAKEWOOD AVE	243022430027	BELLAIRE SECOND ADDITION LOT 17 BLK 3	RICHARD C EMERY	BRIDGET JODELL EMERY	10100 S SHORE DR	PLYMOUTH MN 55441-5013	1.0		
44	4186 HOMEWOOD AVE	243022430028	BELLAIRE SECOND ADDITION LOT 16 BLK 3	MICHAEL J PETERSON	DANIELLE R CEZANNE	4186 HOMEWOOD AVE	WHITE BEAR TOWN MN 55110-3939	1.0		
45	4190 HOMEWOOD AVE	243022430029	BELLAIRE SECOND ADDITION LOT 15 BLK 3	MARK V PLOMBON	JANET G PLOMBON	4190 HOMEWOOD AVE	WHITE BEAR LAKE MN 55110-3939	1.0		
46	4194 HOMEWOOD AVE	243022430030	BELLAIRE SECOND ADDITION LOT 14 BLK 3	STUART SAYRE		4482 SNELLING AVE N	ARDEN HILLS MN 55112-1968	1.0		
47	4198 HOMEWOOD AVE	243022430031	BELLAIRE SECOND ADDITION PART OF LOT 12 AND ALL OF LOT 13 BLK 3	JOY BERGMAN		6028 VINCENT AVE S	MINNEAPOLIS MN 55410-2843	1.0		
48	4201 HOMEWOOD AVE	243022430032	BELLAIRE SECOND ADDITION LOTS 16 & LOT 17 BLK 4	GREG J BEDELL	BRENDA L BEDELL	4201 HOMEWOOD AVE	WHITE BEAR TOWN MN 55110-3940	1.0		
49	4195 HOMEWOOD AVE	243022430033	BELLAIRE SECOND ADDITION LOT 15 BLK 4	ZACHARY SUDMAN		4195 HOMEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3921	1.0		
50	4191 HOMEWOOD AVE	243022430034	BELLAIRE SECOND ADDITION LOT 14 BLK 4	MILTON C AUSTIN		4191 HOMEWOOD AVE	WHITE BEAR LAKE MN 55110-3921	1.0		
51	4185 HOMEWOOD AVE	243022430037	SECTION 24 TOWN 30 RANGE 22 PART OF GOVT LOT 3	KENNETH R WHITE		4185 HOMEWOOD AVE	WHITE BEAR TOWN MN 5110-3921	1.0		
52	4115 LAKEWOOD AVE	243022430049	SECTION 24 TOWN 30 RANGE 22 LOT 3 W OF RHODE RD	JOHN P HENNESSEY	CLAIRE M HENNESSEY	4115 LAKEWOOD AVE	WHITE BEAR TOWN MN 55110-3908	1.0		
53	4125 LAKEWOOD AVE	243022430050	SECTION 24 TOWN 30 RANGE 22 PART OF GOVT LOT 3 W OF RHODE RD	THOMAS NAPIWOSKI		4125 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3908	1.0		
54	4135 LAKEWOOD AVE	243022430051	SECTION 24 TOWN 30 RANGE 22 PART OF GOVT LOT 3 W OF LAKEWOOD AVE	PAIGE H LEE		4135 LAKEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3908	1.0		
55	4145 LAKEWOOD AVE	243022430052	SECTION 24 TOWN 30 RANGE 22 PART W OF LAKEWOOD AVE OF GOVT LOT 3	ROBERT W PETERSON	KRISTINE M PETERSON	4145 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3908	1.0		
56	4155 LAKEWOOD AVE	243022430053	SECTION 24 TOWN 30 RANGE 22 PART W OF LAKEWOOD AVE OF GOVT LOT 3	MARCUS HOROWICKI	LISA HOROWICKI	4155 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3908	1.0		
57	4161 LAKEWOOD AVE	243022430054	SECTION 24 TOWN 30 RANGE PART OF GOVT LOT 3	MARK SCHWARTZ		4161 LAKEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3908	1.0		
58	4171 LAKEWOOD AVE	243022430056	SECTION 24 TOWN 30 RANGE 22 PART OF GOVT LOT 3	SHANE E HERBERT	KAITLYN M DICKISON	4171 LAKEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3908	1.0		
59	4160 LAKEWOOD AVE	243022430057	WOODCREST ADDITION LOT 3 BLK 1	DANIEL F PLOUSSARD		4160 LAKEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3960	1.0		
60	2534 ARBOR DR	243022430055	SECTION 24 TOWN 30 RANGE 22 PART OF GOVT LOT 3 SUB RR R/W	CHRISTOPHER M BERTZ	ALEXANDRA M BERTZ	2534 ARBOR DR	WHITE BEAR LAKE MN 55110-3902	1.0		
61	2576 ARBOR DR	243022430058	WOODCREST ADDITION LOT 2 BLK 1	ALICE A JUNGKUNZ		2576 ARBOR DR	WHITE BEAR LAKE MN 55110-3904	1.0		
62	2590 ARBOR DR	243022430059	WOODCREST ADDITION LOT 1 BLK 1	BRIAN K JABLONSKI		2590 ARBOR DR	WHITE BEAR LAKE MN 55110-3904	1.0		
63	4140 LAKEWOOD AVE	243022430060	WOODCREST ADDITION PART OF LOTS 1 & 2 BLK 1	LAURA ROTH	ANDRE LIMA	4140 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3960	1.0		
64	2592 ARBOR DR	243022430061	WOODCREST ADDITION LOT 1 BLK 1	JAMES MARTINEZ	JENNIFER MURPHY	2592 ARBOR DR	WHITE BEAR TOWNSHIP MN 55110-3904	1.0		
65	2596 ARBOR DR	243022430062	WOODCREST ADDITION LOT 1 BLK 1 ON GOVT LOT 3	JOHN M FRUCCI	CYNTHIA F FRUCCI	2596 ARBOR DR	WHITE BEAR TOWN MN 55110-3904	1.0		
66	2604 ARBOR DR	243022430063	WOODCREST ADDITION LOT 1 BLK 1 PART OF GOVT LOT 3	MICHAEL R ANDERSON		2604 ARBOR DR	SAINT PAUL MN 55110-3948	1.0		
67	2614 ARBOR DR	243022430064	WOODCREST ADDITION LOT 1 BLK 1 PART OF GOVT LOT 3	ALISON CROUCH		2614 ARBOR DR	SAINT PAUL MN 55110-3948	1.0		
68	2622 ARBOR DR	243022430065	WOODCREST ADDITION COR OF LOT 1 BLK 3	STEVEN W STONE	JANET E STONE	2622 ARBOR DR	WHITE BEAR TOWN MN 55110-3948	1.0		
69	2599 RALPH ST	243022430069	WOODCREST ADDITION N LINE OF BLK 3 OF GOVT LOT 3	KATHY M MILLER		2599 RALPH ST	WHITE BEAR TOWN MN 55110-3926	1.0		
70	2593 RALPH ST	243022430070	WOODCREST ADDITION LOT 1 BLK 2	DENNIS P FORSBERG	KATHLEEN M FORSBERG	2593 RALPH ST	WHITE BEAR TOWNSHIP MN 55110-3926	1.0		
71	2585 RALPH ST	243022430071	WOODCREST ADDITION LOT 2 BLK 2	JOSE HERRERA		2585 RALPH ST	WHITE BEAR LAKE MN 55110-3926	1.0		

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72	2579 RALPH ST	243022430072	WOODCREST ADDITION LOT 3 BLK 2	ELISABETH RUSS	TYLER RUSS	2579 RALPH ST	SAINT PAUL MN 55110-3926	1.0		
73	4120 LAKEWOOD AVE	243022430073	WOODCREST ADDITION LOT 4 BLK 2	JYNELLE GORKA		4120 LAKEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3960	1.0		
74	4100 LAKEWOOD AVE	243022430074	WOODCREST ADDITION LOT 4 BLK 3	RONALD R RIVET		4100 LAKEWOOD AVE	WHITE BEAR LAKE MN 55110-3938	1.0		
75	2576 RALPH ST	243022430075	WOODCREST ADDITION LOT 3 BLK 3	PATRICK A DORAN	ASHLEY A DORAN	2576 RALPH ST	WHITE BEAR TOWNSHIP MN 55110-3926	1.0		
76	2582 RALPH ST	243022430076	WOODCREST ADDITION LOT 2 BLK 3	EARL LARSON	MARY LARSON	2582 RALPH ST	WHITE BEAR TOWNSHIP MN 55110-3926	1.0		
77	2569 COUNTY ROAD F E	243022430081	WOODCREST ADDITION LOT 6 BLK 3	RICHARD M MURNANE	MARYLOIS MURNANE	2569 COUNTY ROAD F E	WHITE BEAR LAKE MN 55110-3946	0.5		
78	4166 FOREST CT	243022430082	FOREST PARK, RAMSEY COUNTY,MI LOT 13	JAMES A FRASER	LAURA K FRASER	4166 FOREST CT	WHITE BEAR TOWN MN 55110-3918	1.0		
79	4155 SUMMIT LN	243022430083	BELLAIRE WHITE BEAR LAKE LOT 12	MATTHEW T POSEY	JOY N POSEY	4155 SUMMIT LN	WHITE BEAR LAKE MN 55110-3949	2.0		
80	2588 RALPH ST	243022430084	WOODCREST ADDITION LOT 1 BLK 3	LARRY J SCHMID	RITA A SCHMID	2588 RALPH ST	WHITE BEAR TOWN MN 55110-3926	1.0		
81	4111 LAKEWOOD AVE	243022430087	D. C. ADDITION LOT 1 BLK 1	JEFFREY R TAYLOR	LYNN M TAYLOR	4111 LAKEWOOD AVE	WHITE BEAR TOWN MN 55110-3908	1.0		
82	4105 LAKEWOOD AVE	243022430090	D. C. ADDITION LOT 4 BLK 1	AUSTIN J HOLMES	CHELSEA J HOLMES	4105 LAKEWOOD AVE	WHITE BEAR TOWNSHIP MN 55110-3908	0.5		
83	2636 SOUTH SHORE BLVD	243022440020	FOREST PARK, RAMSEY COUNTY,MI LOT 3	JOSEPH J KRYZER	PAMELA KRYZER	2636 SOUTH SHORE BLVD	WHITE BEAR TOWN MN 55110-3933	0.5		
84	2644 SOUTH SHORE BLVD	243022440021	FOREST PARK, RAMSEY COUNTY,MI LOT 4	GILBERT L KIRKUP		2644 SOUTH SHORE BLVD	WHITE BEAR LAKE MN 55110-3933	0.5		
85	4188 FOREST CT	243022440022	FOREST PARK, RAMSEY COUNTY,MI LOT 16	ERIK R JOSEPHSON	AMANDA E JOSEPHSON	4188 FOREST CT	WHITE BEAR TOWNSHIP MN 55110-3918	1.0		
86	4180 FOREST CT	243022440023	FOREST PARK, RAMSEY COUNTY,MI LOT 15	WAYNE P TAYLOR		4180 FOREST CT	SAINT PAUL MN 55110-3918	1.0		
87	4172 FOREST CT	243022440024	FOREST PARK, RAMSEY COUNTY,MI LOT 14	CARMEL JANE WHITE		4172 FOREST CT	SAINT PAUL MN 55110-3918	1.0		
88	4191 SUMMIT LN	243022440026	BELLAIRE WHITE BEAR LAKE LOT 15 BLK 2	ANDREW G MILLER	SARAH A MILLER	4191 SUMMIT LN	WHITE BEAR TOWNSHIP MN 55110-3949	1.0		
89	4185 SUMMIT LN	243022440027	BELLAIRE WHITE BEAR LAKE LOT 15 BLK 2	MICHELE A FAIRMAN		4185 SUMMIT LN	WHITE BEAR LAKE MN 55110-3949	1.0		
90	4179 SUMMIT LN	243022440028	BELLAIRE WHITE BEAR LAKE LOT 15 BLK 2	CLARENCE E MUNSON	HELEN E MUNSON	4179 SUMMIT LN	WHITE BEAR TOWNSHIP MN 55110-3949	1.0		
91	4171 SUMMIT LN	243022440029	BELLAIRE WHITE BEAR LAKE LOT 15 BLK 2	SAMANTHA M KNUDSON	SAMUEL B KNUDSON	4171 SUMMIT LN	WHITE BEAR LAKE MN 55110-3949	1.0		
92	4163 SUMMIT LN	243022440030	BELLAIRE WHITE BEAR LAKE LOT 15 BLK 2	DEBORAH A MUNSON BADINI	JUSTIN F BADINI	4163 SUMMIT LN	WHITE BEAR LAKE MN 55110-3949	1.0		
93	2660 SOUTH SHORE BLVD	243022440031	SWENSON'S SUBDIVISION LOTS 10 & LOT 11	JEFFERY S KRASS	JANICE L MCINERNEY	2660 SOUTH SHORE BLVD	WHITE BEAR TWSP MN 55110-3923	0.5		
94	2680 SOUTH SHORE BLVD	243022440036	HILLCREST BELLAIRE LOTS 17 AND LOT 18	BRUCE SCHWARTZMAN		2680 SOUTH SHORE BLVD	WHITE BEAR LAKE MN 55110-3923	0.5		
95	4151 HILLAIRE RD	243022440037	HILLCREST BELLAIRE LOTS 15 & LOT 16	ANDREW C KNIGHT		4151 HILLAIRE RD	SAINT PAUL MN 55110-3952	1.0		
96	4141 HILLAIRE RD	243022440038	HILLCREST BELLAIRE LOTS 13 & LOT 14	MICHAEL W CASHIN	JENI K HENRICKSON	4141 HILLAIRE RD	WHITE BEAR LAKE MN 55110-3952	1.0		
97	4133 HILLAIRE RD	243022440039	HILLCREST BELLAIRE 9 11 & LOT 12	REYNOLD A MACK TRUSTEE		4133 HILLAIRE RD	WHITE BEAR TOWNSHIP MN 55110-3952	1.0		
98	4129 HILLAIRE RD	243022440040	HILLCREST BELLAIRE 9, 10 & LOT 11	MARK R HAGEN	BRENDA J HAGEN	4129 HILLAIRE RD	WHITE BEAR LAKE MN 55110-3952	1.0		
99	4148 SUMMIT LN	243022440041	SUMMIT LANE LOTS 1, 2 & LOT 3	CAROLINE R BURAU	DAVID R MCKOSKEY	4148 SUMMIT LANE	WHITE BEAR LAKE MN 55110-3927	1.0		
100	4152 SUMMIT LN	243022440042	SUMMIT LANE LOTS 4 & LOT 5	ROBERT L BARNES	BEVERLY J BARNES	4152 SUMMIT LN	ST PAUL MN 55110-3927	1.0		
101	4162 SUMMIT LN	243022440043	SUMMIT LANE LOT 6	LINDA A SIEDSCHLAG	DUANE A SIEDSCHLAG JR	4162 SUMMIT LN	SAINT PAUL MN 55110-3927	1.0		
102	4172 SUMMIT LN	243022440044	SUMMIT LANE LOT 7 AND ALL OF LOT 8	JAMES H MANTEUFEL JR	LAURIE L MANTEUFEL	4172 SUMMIT LN	ST PAUL MN 55110-3927	1.0		
103	4154 HILLAIRE RD	243022440047	HILLCREST BELLAIRE PART OF LOTS 1, 2 & 3	CARA J A CLARK		4154 HILLAIRE RD	SAINT PAUL MN 55110-3919	1.0		
104	4150 HILLAIRE RD	243022440048	HILLCREST BELLAIRE PART OF LOTS 2 3 5 6 & ALL OF LOT 4	PAUL J KELEHER	BARBARA ANN NELSON KELEHER	4150 HILLAIRE RD	WHITE BEAR TOWN MN 55110-3919	1.0		
105	4130 HILLAIRE RD	243022440049	HILLCREST BELLAIRE PART OF LOTS 6 7 AND 8	ELIZABETH A NEWMAN	DONALD J NEWMAN	4130 HILLAIRE RD	WHITE BEAR LAKE MN 55110-3919	1.0		
106	2651 ARBOR DR	243022440050	HILLCREST BELLAIRE TRACT PART OF LOTS 2 5 6 AND 7	AARON J GERTZ	SARAH A GERTZ	2651 ARBOR DR	WHITE BEAR TOWNSHIP MN 55110-3907	1.0		
107	2661 ARBOR DR	243022440051	HILLCREST BELLAIRE LOT 2	MICHAEL T FAUST	JESSICA D FAUST	2661 ARBOR DR	WHITE BEAR LAKE MN 55110-3907	1.0		
108	2667 ARBOR DR	243022440052	HILLCREST BELLAIRE LOT 2	JEFFREY SHANNON		2629 S SHORE BLVD	WHITE BEAR LAKE MN 55110-3951	1.0		
109	2677 ARBOR DR	243022440053	BELLAIRE WHITE BEAR LAKE LOT 18 BLK 2	RONALD J SASS	REBECCA H SASS	2677 ARBOR DR	WHITE BEAR LAKE MN 55110-3907	1.0		
110	2687 ARBOR DR	243022440058	BELLAIRE WHITE BEAR LAKE LOT 19 BLK 2	KAREN M ST.SAUVER		2687 ARBOR DR	WHITE BEAR LAKE MN 55110-3907	1.0		
111	2691 ARBOR DR	243022440059	BELLAIRE WHITE BEAR LAKE PART LOT 20 BLK 2	FREDERICK P BARTLING	SUSAN J BARTLING	2691 ARBOR DR	WHITE BEAR LAKE MN 55110-3907	1.0		
112	2688 ARBOR DR	243022440065	WILLENBRING 2ND ADDITION LOT 2 BLK 1	RICHARD W FISCHER		2688 ARBOR DR	WHITE BEAR LAKE MN 55110-3948	0.5		
113	2676 ARBOR DR	243022440066	WILLENBRING 2ND ADDITION LOT 3 BLK 1	KEITH HARROWER	NANCY A LYNCH	2676 ARBOR DR	WHITE BEAR LAKE MN 55110-3948	1.0		
114	2662 ARBOR DR	243022440067	WILLENBRING ADDITION LOT 4 BLK 1	ERIC J HOULE	AMANDA L LAMPHEAR	2662 ARBOR DR	WHITE BEAR LAKE MN 55110-3948	1.0		
115	2652 ARBOR DR	243022440068	WILLENBRING ADDITION LOT 5 BLK 1	SHARON K ODEGAARD		2652 ARBOR DR	WHITE BEAR TOWNSHIP MN 55110-3948	1.0		
116	2644 ARBOR DR	243022440069	WILLENBRING ADDITION LOTS 6 & LOT 7 BLK 1	DENNIS P WELSCH	MAUREEN S WELSCH	2644 ARBOR DR	WHITE BEAR LAKE MN 55110-3948	1.0		
117	2642 ARBOR DR	243022440070	SECTION 24 TOWN 30 RANGE 22 PART OF GOVT LOT 4 SWLY OF ARBOR DR	KARL J KRODEL	JUDITH S KERRIGAN KRODEL	2642 ARBOR DR	WHITE BEAR TOWN MN 55110-3948	1.0		
118	2630 ARBOR DR	243022440071	SECTION 24 TOWN 30 RANGE 22 PART OF GOVT LOT 4 S OF M AND ST P SUB RR	STEPHEN W SAWYER	PHYLLIS A SAWYER	2630 ARBOR DR	WHITE BEAR TOWN MN 55110-3948	1.0		
119	2697 ARBOR DR	243022440089	REGISTERED LAND SURVEY 444 TRACT B & WITH ESMT OVER TRACT E	PHILLIP T CARPENTIER	WANDA L CARPENTIER	2697 ARBOR DR	WHITE BEAR LAKE MN 55110-3907	0.5		
120	2684 SOUTH SHORE BLVD	243022440095	HILLCREST BELLAIRE PT OF LOT 1	JAMIE M WARNDAHL		2684 SOUTH SHORE BLVD	WHITE BEAR LAKE MN 55110-3920	0.5		
121	2592 SOUTH SHORE BLVD	243022420047	BELLAIRE SECOND ADDITION LOT 1 BLK 2	MERCER J RICHTER	NANCY R RICHTER	2592 SOUTH SHORE BLVD	WHITE BEAR LAKE MN 55110-3931	0.5		
122	2648 SOUTH SHORE BLVD	243022440025	BELLAIRE WHITE BEAR LAKE LOT 15 BLK 2	KATHERINE E HANSON		2468 SOUTH SHORE BLVD	WHITE BEAR LAKE MN 55110-3933	0.5		
								114.0		

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Appendix H

Assessment Map

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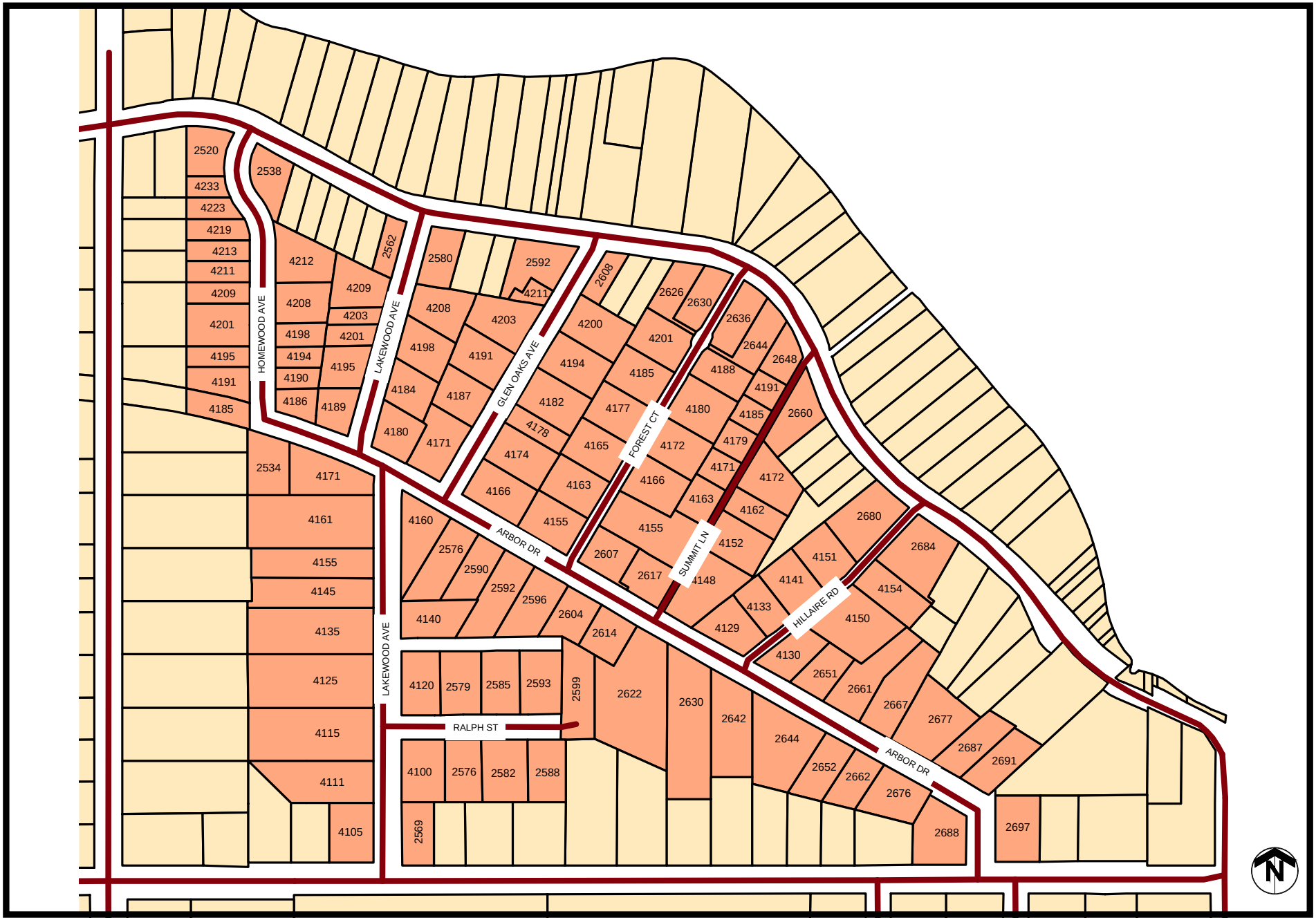
PROJ. NO. 17127.011



Legend

Assessed Parcel

Assessment Map
Figure 1

Date: 10/30/2019

TKDA

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Appendix I

Geotechnical Report

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element™

Element Materials Technology
662 Cromwell Avenue
St Paul, MN
55114-1720 USA

P 651 645 3601
F 651 659 7348
T 888 786 7555
info.stpaul@element.com
element.com

Geotechnical Exploration Program
White Bear Township Residential Street Reconstruction Project

White Bear Township, Minnesota
Element Materials Technology St. Paul Inc. Project No. ESP029495P

Prepared for:

White Bear Township
c/o TKDA

May 3, 2019

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

Mark Straight, P.E.
Senior Project Engineer
MN Reg. No. 41658

element™

May 3, 2019

TKDA
Attn: Mr. Larry Poppler, P.E.
Group Manager, Municipal Services
444 Cedar Street, Suite 1500
Saint Paul, MN 55101

RE: Geotechnical Exploration Program
White Bear Township Residential Street Reconstruction
White Bear Township, Minnesota
Element Materials Technology St. Paul Inc. Project No. ESP029495P

Dear Mr. Poppler:

We have completed the geotechnical exploration and engineering analysis for the above referenced project. This report presents the results of our field and laboratory review programs, and provides recommendations concerning the soil and groundwater conditions as they relate to the proposed construction.

The soil samples will be retained in our laboratory for 30 days, at which time we will dispose of them. If you desire Element Materials Technology St. Paul Inc. to retain the samples longer than 30 days, please notify us.

We are pleased to be of service to you in this important phase of the project. If there are any questions regarding the information contained in this report or if we can be of further service to you, please contact John Starke at (651) 645-7429, email: john.starke@element.com or Mark Straight at (651) 659-7447, email: at mark.straight@element.com.

Respectfully Submitted,

ELEMENT MATERIALS TECHNOLOGY ST. PAUL INC.

John Starke, P.E.
Senior Geotechnical Engineer
MN Reg. No. 23546

Mark Straight, P.E.
Senior Project Engineer
MN Reg. No. 41658

1.0 INTRODUCTION

This report presents the results of our recent geotechnical exploration program conducted for the proposed residential street reconstruction projects in White Bear Township, Minnesota. We understand a geotechnical exploration program was needed to evaluate existing street pavement profiles and subsurface conditions to aid in the design and reconstruction of these residential streets. This report presents the results of the field exploration, our laboratory testing, geotechnical and pavement review and analysis, and recommendations.

1.1 Scope of Work

We recently performed a geotechnical exploration program in accordance with our September 12, 2018 proposal and subsequent authorization by TKDA to proceed. The scope of our work for the project was as follows:

1. Meet and discuss with TKDA the project requirements and finalize the boring locations. Ground surface elevations of the boring locations would be provided by TKDA during the project survey.
2. Arrange to have buried public utilities marked through the Gopher-State-One-Call System. Various utilities including gas, sewer, and water main, etc. were marked on the pavement surface prior to drilling operations. Soil boring locations were adjusted slightly where applicable to allow for clearance of existing utilities.
3. Provide traffic control devices including cones and signage as needed to allow drilling to be conducted in roadways.
4. Explore the subsurface conditions by drilling eleven (11) Standard Penetration Test (SPT) borings within the project roadways. Due to the narrow road width and utility obstructions along Summit Lane, we were not able to perform a SPT boring within this roadway, instead a hand auger boring (B7) was put down at this location. In addition, eleven (11) pavement cores were cored in the project roadways either at or adjacent to the boring locations to evaluate actual pavement thickness.

5. Backfill the borings per Minnesota Department of Health (MDH) guidelines. The borings and cores performed in pavement areas were capped with bituminous cold patch matching the road existing surface profile.
6. Visually classify the extracted soil samples and perform laboratory testing including moisture content and gradation analysis as needed to aid in soil classification and to determine engineering properties.
7. Prepare a geotechnical report for the project areas providing the following information:
   a. A site plan sketch showing the approximate boring and core locations.
   b. Logs of the soil test borings showing the existing pavement profile where applicable, soil and groundwater data, including the N-Values.
   c. A summary table listing pavement and base course thicknesses at the core/boring locations.
   d. Written description of encountered soil and groundwater conditions.
   e. Results of laboratory testing performed.
   f. Recommendations for pavement reconstruction.

The scope of our work is intended for geotechnical purposes only. This scope is not intended to explore for the presence or extent of environmental contamination within the various pavement areas explored.

2.0 SITE CONDITIONS

2.1 Surface Conditions Surrounding the Project Areas

Properties surrounding the project roadways (Homewood Avenue, Lakewood Avenue, Glen Oaks Avenue, Forest Court, Summit Lane, Hillaire Road, Arbor Drive, Lakewood Avenue, and Ralph Street) are mostly residential. Single family residences occupy the majority of the properties that abut the project roadways. Topography along the project roads is generally flat, having slight elevation changes dropping to the north towards South Shore Boulevard.

Overhead utilities consisting mainly electric services are generally present along length of the project roadways. During the utility clearance process through the Gopher-State-One-Call system, several below grade utilities were identified and marked on the pavement by utility locate contractors. These included water, gas, sanitary sewer, phone and cable.

2.2 Existing Pavement Conditions

The existing pavement surface at the project roadways was generally in a poor state of service. The surface of the bituminous shows signs of medium to high severity weathering, with minor signs of pitting. Isolated portions of the pavement were observed to have fatigue block (alligator) cracking. Numerous transverse and longitudinal cracks were noted. Many of these cracks were previously filled and patched. At a number of locations the pavement surface was deteriorated having some dislodgement and "pot-holes". Many of the roadways showed areas of past repair including overlay and patch work and sealing of large cracks. In our opinion, at this point in time and given the age and state of the road surfaces we believe that further seal and patch programs will have limited value and would likely not significantly extend the service life of the roads.

In our opinion, some of the observed pavement distress may have occurred due to seasonal frost heaving, particularly from recent severe winter seasons. The presence of frost susceptible soils with the available moisture in the upper reaches of subgrade could induce noticeable frost heaving. Severe distress to pavement generally occurs in the spring season, just after the subgrade thaws but still retains moisture.

Surface water can infiltrate through cracks in the pavement especially during the fall, which upon freezing will significantly increase the frost movement of the upper layers due to the lack of good drainage. Likewise, freeze thaw cycles during the fall, winter, and spring exacerbate the situation and increase movement as well as instability in the pavement structure.

3.0 FIELD INVESTIGATION PROGRAM

3.1 Field Investigation Description

The project field investigation included drilling ten (10) SPT borings (B1, B2, B3, B4, B5, B6, B8, B9, B10, and B11), one hand auger boring (B7) and eleven (11) pavement cores (C1 through C11) within the project roadways. The boring locations were marked in the field by Element based upon a project sketch prepared by Element and approved by TKDA. At the SPT boring locations the ground surface elevations were to be measured by TKDA during the project survey and provided at a later date. The approximate locations of the borings and pavement cores are shown on the attached Boring/Core Location Plan. The SPT boring logs are attached to this report. The pavement cores were drilled near the respective boring locations to evaluate actual pavement thickness. However, pavement thickness will likely vary along the project road length especially in areas where patching and/or previous repairs has occurred.

The SPT borings were drilled within the project roadways on October 16 and 17, 2018. The pavement cores were drilled on October 19 and 26, 2018. The borings were drilled to depths as listed in the following table:

Boring No.	Boring Location, Adjacent House Address	Planned Boring Drilling Depth (ft.)	Actual Drilled boring Depth (Nearest ½ ft.)
B1	4213 Homewood Avenue	10	10½
B2	2534 Arbor Drive	10	10½
B6	2604 Arbor Drive	5	7
B9	2661 Arbor Drive	5	5½
B10	2691 Arbor Drive	10	10½
B3	4201 Lakewood Avenue	5	5½
B4	4182 Glen Oaks Avenue	5	7
B5	4180 Forest Court	10	10½
B7	Summit Lane	5	3[(1)]
B8	4150 Hillaire Road	5	5½
B11	4115 Lakewood Avenue	10	10½

[(1)]Boring B7 was put down using a hand auger device.

Standard Penetration Test (SPT) borings were drilled using a truck mounted rotary drill rig using split-barrel sampling procedures. Water level observations were made in the boreholes during and upon completion of the drilling and sampling operations. During the field operations, the drill crew maintained logs of the subsurface conditions including changes in stratigraphy and the observed groundwater levels. The SPT boring logs are attached.

As noted previously, eleven (11) four-inch diameter pavement cores were drilled and recovered from the project roadways, at or adjacent to the borings, to assess actual pavement thickness at the core location. The recovered cores were taken to our laboratory, reviewed by a geotechnical engineer and thicknesses measured.

After completion of drilling the boreholes were backfilled with auger cuttings to the existing surface in general conformance with MDH requirements. The pavement boreholes and cores were capped at the surface with bituminous cold patch matching the profile of the existing pavement.

Sampling and classification of soils were performed in general accordance with American Standards for Testing and Materials (ASTM) procedures, and are described on an attached sheet.

3.2 Subsurface Conditions

The subsurface conditions encountered at the test boring locations are shown on the attached boring logs. The boring logs also indicate the possible geologic origin of the materials encountered. We wish to point out that the subsurface conditions at other times and locations on the site may differ from those found at our test locations. If different conditions are encountered during construction, it is necessary that you contact us so that our recommendations can be reviewed.

The borings encountered a generalized soil profile of fill at the surface underlain by layers of fine and coarse alluvium. Buried topsoil was encountered beneath the fill in borings B1, B4, and B6.

Based on normal human sensing, product odors were not detected within the soil samples collected at the site. This does not eliminate the possibility that petroleum based products or other contaminates may be present in the future or at other locations within the reconstruction project area away from our boring locations. Environmental screening and laboratory tests were not included in our work scope for this project. If environmentally impacted soils are encountered during construction we recommend additional testing be performed and the soils are properly handled and if needed disposed of.

As noted in Section 3.1 actual boring depths ranged from approximately 5½' to 10½'. The pavement cores were drilled through the entire bituminous pavement section to the underlying base aggregate.

Within the project roadways the bituminous pavement thickness as measured from the core samples ranged from approximately 3" to 6". Many of the core samples (C1, C2, C3, C6, C10, and C11) were observed to be broken and friable suggesting breakdown of the pavement binder. Underlying the bituminous pavement was approximately 3" to 6" of base aggregate consisting of sand with gravel, sand with silt and gravel, or silty sand with gravel. Based on the mechanical analysis (gradation) test results the existing aggregate base did not meet current MNDOT Specifications for Class 5 Aggregate base. The attached Table 1 presents the measured bituminous and aggregate base thickness at each test location.

Beneath the pavement section, fill soil consisting of a mixture of silty sand, sand with silt, and sand with varying amounts of gravel was encountered to depths ranging from approximately 1' to 5½'. At boring B2 asphalt pieces were encountered within the fill profile from approximately 2' to 5'. At three borings (B1, B4, and B6) buried topsoil consisting of Organic Sandy Silt (ML-OL) was encountered below the fill extending to depths ranging from approximately 5' to 6'.

The fill was generally in a loose to medium dense condition based upon SPT blow counts (N-values) obtained during drilling activities.

Generally beneath the fill and buried topsoil layers and extending to the maximum depth explored were alternating deposits of natural occurring coarse alluvium soils consisting of Silty Sand (SM), Clayey Sand (SC) Sand with Silt (SP-SM), and Sand (SP) with varying amounts of gravel. The relative density of the sand deposits based upon SPT blow counts (N-values) ranged from loose to medium dense.

Layers of fine alluvium were encountered within soil borings B2, B5, and B11. At boring B2 Silt (ML) was encountered from approximately 8½' to 10' below the drilling surface. At borings B5 and B11, Sandy Lean Clay (CL) was encountered from approximately 4' to 5½' and 3' to 5½', respectively. The fine alluvium was generally in a soft condition based upon SPT blow counts (N-values) obtained during drilling activities.

3.3 Water Level Observations

Groundwater was not observed in the borings during or immediately after drilling operations. Iron oxide staining and mottling was observed on selected soil samples collected in the field at the time of drilling activities. This is noted on the soil boring logs in several locations suggesting groundwater may have been present previously within the soil profile at higher elevations.

Clayey and silty soils encountered in the borings are relatively impervious or slow draining and therefore, may take several days for groundwater in a borehole to rise to its hydrostatic level. If more accurate water level determinations are required, piezometers should be installed and the water level monitored over a period of time.

In general, water levels may fluctuate throughout the year depending on variations in the amount of precipitation, degree of evaporation, surface run-off characteristics and other related hydrogeological factors. Groundwater elevations are typically lower in the fall winter months

and generally higher in the spring summer months. However, this can vary if significant rain or snow melt events occur.

4.0 LABORATORY REVIEW AND TESTING

The soil samples obtained during the drilling operations were logged, labeled, sealed and delivered to our laboratory for further review. An Element geotechnical engineer classified the soil samples in general conformance with ASTM standards. Representative soil samples were submitted to the laboratory for moisture content and gradation testing and the results are attached or shown on the boring logs.

Moisture content tests of selected samples collected in the field ranged from approximately 4% to 14%. A total of ten (10) soil samples were collected from the pavement base aggregate section and tested for particle size distribution (gradation), which to evaluate conformance with Mn/DOT 3138 Class 5 Specifications. The test results show these samples do not meet current Class 5 gradation specifications, generally lacking in fine gravel and medium sand content (3/8 in. through #40 sieve). The sample gradation test reports showing Mn/DOT Class 5 gradation specifications are attached to this report.

5.0 REVIEW AND RECOMMENDATIONS

Based on the information obtained from our geotechnical work and our understanding or assumptions of the project data, we made our engineering review which resulted in recommendations which are presented in the following sections. If any of our understanding or assumptions are not correct, or if conditions observed during construction are significantly different than those encountered in our geotechnical work, we should be contacted immediately so we may review our recommendations.

5.1 Project Description

It is our understanding that the project is in the preliminary concept/design phase. Although we were not provided exact details of the project design we understand the project will entail a full pavement removal/reconstruction project and curb replacement within the project roadways. Due to budgetary constraints the project may include reclaiming the existing bituminous pavement if applicable and using this material as a portion of the new aggregate base section that supports the proposed new pavement. We have assumed 7-ton pavement section design standards for these residential roads. We further understand new storm water sewer drain systems will be installed at depth below all the roadway sections. Our following pavement recommendations are based on a 20-year pavement design life with associated routine maintenance being performed as applicable to the types of pavements being constructed.

5.2 Pavement Subgrade Preparation

We understand the project road surfaces will either undergo a mill and subcut to allow for the new pavement section or undergo a reclamation process, which will include removal of the existing bituminous pavement and portions of underlying aggregate base to be stockpiled and later reused as a portion of the new aggregate base layer within all the planned roadways. Due to the relatively thin existing bituminous and aggregate base sections encountered at some borings, we anticipate that additional subcuts will be required to place the new pavement section at those locations. The existing aggregate base should be removed and stockpiled, exposing the roadway subgrade in these areas. We have assumed the reconstructed road profiles will remain similar to current conditions with slight changes to correct for proper road grade alignment and enhance drainage.

Based upon the laboratory testing, the existing pavement base course material generally does not meet Mn/DOT 3138 Class 5 base specifications, generally lacking fine gravel and coarse and medium sand content. However, gradation modification could be performed by adding more gravel and sand to develop a good base material. A base mix testing program at the time of construction would need to be conducted to determine the appropriate amount of

additional aggregate in order to attain the base specification. For preliminary planning purposes only, based on the gradations performed, approximately 15% fine gravel (+ 3/8") plus approximately 2% to 10% of coarse and medium sand (+#4 through #40) would be needed. However, this may vary considerably and should be determined in the field at the time of construction.

Alternatively, in areas where reclaimed aggregate base is failing to meet MnDOT aggregate base requirements we recommend placing additional 1" minus crushed clear rock aggregate at the surface. The aggregate can then be bladed and mixed in the upper 3" to 4" during tolerancing of the aggregate base section and compacted in-place. In our opinion, the additional aggregate will help lock together and stabilize the aggregate base section supporting the roadways and save costs of removing, remixing, and blending the entire reclaimed section.

Additional aggregate base meeting Mn/DOT Class 5 Specification 3138 may also be required in street areas where reclaimed bituminous and underlying aggregate base thicknesses are insufficient to allow for the proposed new aggregate base section. Larger bituminous pieces of the reclaimed material, if encountered, should be removed or screened from the roadway base material prior to paving operations. Samples of reclaimed base aggregate should be collected during construction and tested to verify design and project requirements have been achieved.

After removal of the existing pavement and underlying base material we recommend conducting a proofroll test on the exposed subgrade surface prior to fill placement to detect any unstable zones that may require further subcutting. The proofroll should be performed with a heavy, rubber tired vehicle traveling at walking speed over the subgrade. If excessive yielding or rutting is noticed, additional soil corrections below subgrade should be performed. Any organic and soft/loose soils where encountered within the upper 3' of existing road grade should also be excavated. As observed in boring B2, fill soils having pieces of broken asphalt was encountered from approximately 2' to 5'. We recommend additional testing be performed in this area during construction to determine the suitability of the subgrade. If unstable areas

are detected due to the poor quality fill then we recommend removing the poor fill soils through this area and replacing with engineered fill to construct a stable pavement subgrade. We noted buried topsoil at depth in borings B1, B4, and B6. If the roadway reconstruction grades through these areas remains unchanged and considering the depth of the buried topsoil layers, we don't believe extensive subcutting and removal of the buried topsoil would be needed. If the road profile changes within these areas then we should be contacted to evaluate the need for additional subcuts. Also if utilities (i.e. storm sewer, etc.) extend through areas where the buried topsoil is encountered then we recommend removal of these weak soil layers and replacement with engineered fill to properly support the utility. As noted above, further subcutting may be required in the vicinity of boring B2 due to the presence of asphalt pieces encountered during drilling to a depth of approximately 5'.

The borings depicted several loose and very loose soil zones within the existing fill soil supporting the pavement that should be addressed during the street reconstruction project. The existing suitable fill soil comprising the subgrade should be thoroughly surface compacted with a large vibratory compactor prior to continued construction. Based on the moisture contents of the subgrade, moisture conditioning (i.e. wetting the soil, etc.) would be required to obtain the proper compaction of the subgrade.

We recommend where additional fill is required within the upper 3' of subgrade to establish the pavement subgrade elevation be granular soils meeting Mn/DOT Specification 3149.2B Select Granular Borrow having no greater than 12% fines passing the #200 sieve and preferably no greater than 50% passing the #40 sieve. All fill supporting pavements within the upper 3' of subgrade should be compacted to 100% of the Standard Proctor maximum dry density (ASTM D: 698). The moisture content of the compacted fill should be within 2% of the optimum as determined by the Standard Proctor tests.

The subgrade surface, as well as the pavement surface, should be uniformly sloped to facilitate drainage of the base and granular subgrade material within the pavement system, and to avoid any ponding of water beneath the pavement.

Based upon the geotechnical investigation the existing soils within the upper 3' of the pavement subgrade will be either fill soils or coarse alluvium granular sands. The following table presents estimated R–values at the boring locations performed within the project roadways.

Roadway	Boring No.	Upper 3' of Subgrade Description	Estimated R-Value at Boring Location
Homewood Avenue	B1	Mixture of loose to medium dense silty sand and sand with silt (Fill)	35
Arbor Drive	B2, B6, B9 and B10	Mixture of very loose to loose silty sand, clayey sand, and sand with silt (Fill)	30
Lakewood Avenue	B3	Mixture of loose silty sand and sand (Fill)	35
Glen Oaks Avenue	B4	Mixture of loose silty sand and sand with silt (Fill)	35
Forest Court	B5	Loose silty sand (Fill)	30
Summit Lane	B7	Mixture of loose silty sand and sand with silt (Fill)	35
Hillaire Road	B8	Mixture of loose silty sand and sand with silt (Fill)	35
Lakewood Avenue/Ralph Street	B11	Mixture of loose silty sand and sand with silt (Fill)	35

Higher R-Values may be obtained by performing soil replacement of subgrade soil with improved and less frost susceptible soil. An R-Value of 70 can be attained by performing a soil correction with removal of the existing upper 3' subgrade soil and replacing with a clean sand meeting Mn/DOT "Select Granular Borrow" Specification 3149.2b.

Proper draintile systems would need to be incorporated into the design where more granular fill was placed/encountered at the surface underlain by relatively impervious soil types and within low points within the pavement profile. The draintile should be placed at the bottom of the sand section, encapsulated with pea-gravel surrounded by geotextile fabric and properly connected to the storm sewer system and/or suitable outfalls. This is especially important at boring locations where buried topsoil (borings B1, B4, and B6) or fine alluvial soils are encountered near the surface (borings B5, B9, and B11).

Any contaminated soils encountered during construction should be properly tested and disposed of under standard construction practices per the Minnesota Department of Health (MDH) and Minnesota Pollution Control Agency (MPCA) guidelines.

A regular, conscientious maintenance program should be performed on all pavements. It is possible that seal coating may somewhat extend the pavement life somewhat. We caution that reduced minimum pavement thicknesses and lack of pavement maintenance may result in a reduced service life and increased maintenance.

We understand new curbs will be installed adjacent to the reconstructed roads. Along the curb alignment we recommend undercutting approximately 4" to 6" below the subgrade and replace with aggregate base meeting Mn/DOT Class 5 specifications. The aggregate base allows for a stable platform to construct the curbs upon and aids with drainage. This should be accomplished during the road subgrade preparation.

5.3 Pavement Thickness Design

Assuming the pavement subgrade preparation is performed as recommended in the preceding section and the subgrade soils are judged suitable based on a proof-roll test, we recommend the following pavement design be used:

Pavement Section Profile	Street Section Thickness 7-ton
Mn/DOT Spec. 2360 Type SP9.5 Bituminous Wear Course	2"
Mn/DOT Spec. 2360 Type SP12.5 Bituminous Non-wear Base Course	2"
Mn/DOT Spec. 3138 Reclaimed Aggregate Base Meeting Class 5 Specifications	10"
Approved Subgrade Per MNDOT Specifications 2111 Test Rolling and 2112 Subgrade Preparation (1)	Yes

(1) **If granular soil meeting MnDOT Specification 3149.2B is present the need for additional excavation and replacement is not required.** Based on the soil borings additional excavation to remove poor fill may be required near boring B2. The excavated soil should be replaced with select granular sand meeting MnDOT Specification 3149.2B. Alternatives to the subcut may be to increase the reclaimed aggregate base section at this locations by 6" and/or place geotextile separating fabric beneath the reclaimed aggregate base section.

The above recommended street section thicknesses are based on a minimum 20-year pavement life, site soil conditions and assumed traffic loads. For superior pavement performance we recommend placing geotextile separating fabric beneath the aggregate base section to provide additional support during freeze thaw cycles occurring typically in the fall and in spring of the year. The fabric aids in maintaining the integrity of the aggregate base section that supports the pavement. The geotextile fabric should meet Mn/DOT Specification 3733 Type V and should be placed beneath the aggregate base and lapped a minimum of 2' at all splices or sewn per Mn/DOT requirements. Construction traffic other than foot traffic should not be allowed over the fabric as to not damage the fabric during construction. Aggregate base should be placed and compacted in such a manner as to also not damage the fabric.

Transition zone tapers should be constructed where reconstructed pavement connects to existing pavement and where pavement section thicknesses vary to minimize differential movement between different pavement sections. The transition tapers should begin at the bottom of the lowest section and transition to the higher section at a grade of 20 horizontal to 1 vertical (20:1). Depending on the actual site conditions at the time of construction the transition zones may need to be adjusted to properly support the new pavement.

By reducing the sand section or having less cleaner granular sands in the upper 3' of subgrade, it is more likely that during periods of freezing and thawing that expansion and contraction of the subgrade soils may occur in a manner that may affect overall pavement performance. The Township should be made aware that additional maintenance may likely be needed to sustain the pavement life if these conditions occur.

The pavement design section specifications listed above assumes the reclaimed aggregate base will be compacted to a minimum of 100% of the Standard Proctor density and the bituminous pavement placed and compacted to a minimum of 92% of the maximum specific gravity. The pavement design also assumes that a regular, conscientious maintenance program is performed. It is possible that seal coating may extend the pavement life somewhat. We caution that reduced pavement section thicknesses may result in a reduced service life and increased maintenance. Alternative pavement designs are available upon request depending on the Township project objectives and budgetary constraints.

5.4 Utility Installation

Utility plans were not available at the time of this report. Based upon our understanding of the project, new storm sewer extensions will be installed at depth below the planned road sections. We assume the new services would be installed within the upper 10' of the soil subgrade. The soils encountered within this zone based on the deeper borings (B1, B2, B5, B10, and B11) were predominately coarse alluvium sand deposits. The natural occurring sand deposits were generally observed to be in loose to medium dense state.

The utilities should not be placed on topsoil or thick layers of uncompacted fill or very soft/loose natural soil. These unsuitable soils should be excavated and replaced with compacted engineered fill for utility support. In areas where appreciable amounts of gravel, tree roots, bituminous pieces (boring B2) cobbles or boulders are encountered we recommend over excavation and placement of a suitable pipe bedding material. The pipe bedding material should encompass the utility. Our concern is that the gravel, cobbles or boulders may damage the utilities by applying point loads to the pipes especially during backfilling operations. The gravel, cobbles, or boulders should be replaced with suitable engineered fill a suitable distance around the pipe of a minimum of 1'.

If very loose or soft soils are encountered at the planned subgrade elevations, these soils may not be suitable for pipe support. Any organic materials including buried topsoil layers found during construction should also be removed. We recommend very loose or soft natural soil be

over excavated by a minimum of 1' and replaced with a suitable foundation or bedding for pipe support. Additional aggregate bedding material may be required if very soft wet conditions are encountered at the time of construction at the bottom of pipes/manholes, etc. Manholes or utility structures may require a minimum of 2' to 3' of aggregate bedding materials.

The foundation of utilities should be of coarse granular material or pea gravel and/or approved aggregate equivalent. The granular or aggregate materials may be separated from the subgrade by geotextile fabric, especially in loose/wet conditions. We recommend at a minimum that the exposed soils in the utility trenches be recompacted prior to new utility placement unless groundwater is present.

After the foundation bedding and pipe placement, fill should be placed to attain final grades. Where pavement may be placed, the fill should be compacted to at least 95% of the Standard Proctor density (ASTM D: 698). Fill placed in the top 3 feet of subgrade for pavement areas should be compacted to at least 100% of the Standard Proctor density. In addition, the moisture content of the fill should be within +/-3% of the optimum as determined by the Standard Proctor test. Backfilling operations should be performed uniformly around structures as to not to damage them during construction. We recommend the fill soils consist of clean sand having less than 12% passing the #200 sieve and less than 50% passing the #40 sieve. Clayey and silty soils should not be used for as engineered fill due to their high moisture content resulting in poor compaction during backfilling operations. On-site existing sandy fill soils may be suitable for utility backfill provided good compaction can be attained as described above. Reworking, scarifying, drying or moisture conditioning of these soils may be required to obtain proper soil compaction.

Proper shoring or sloping of the excavation for utility placements per OSHA guidelines should be provided for at all times. Care should be provided by the contractor as to not to damage surrounding structures/properties and/or pavements.

If exposed soils supporting the utilities are disturbed or become saturated they may no longer be able to support the utility. Care should be provided by the contractor as to not to disturb supporting soils otherwise additional corrective measures may be necessary.

5.5 Groundwater Control

As stated in Section 3.3, groundwater was not observed in borings during and shortly after drilling. We should note however, given the type of soils encountered during drilling, perched groundwater could be present in other areas not detected during drilling. The contractor should be made aware of potential perched groundwater conditions and have provisions available to manage groundwater seepage into open excavations, if needed.

If the utility subgrade becomes disturbed and soft due to groundwater inflow, the soft soil should be over excavated and replaced with aggregate material or other suitable stone product and tamped into the subbase to establish a firm subgrade.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Excavation Safety

All excavations should comply with the requirements of O.S.H.A. 29 CFR, Part 1926, Subpart P, "Excavation and Trenches". This document states that excavation safety is the responsibility of the contractor. Reference to these O.S.H.A. requirements should be included in the project specifications.

6.2 Quality Control Testing

We recommend that all geotechnical related work, including subgrade preparation, and engineered fill placement, be observed by the project geotechnical engineer or their representatives. The geotechnical engineer will perform appropriate testing to verify the geotechnical conditions that have been anticipated during preparation of this report.

As variations in soil conditions may exist at locations and elevations other than those of our borings, we recommend the geotechnical engineer be retained to observe the soil conditions during site preparation. We recommend in-place field density testing be performed in the compacted new fill as needed for this project.

6.3 Cold Weather Conditions

Construction during cold weather should be exercised with care. We have included a sheet entitled "Precautions for Excavating and Refilling During Cold Weather." Please refer to this Attached sheet for specific details.

6.4 Soil Sensitivity

The silty and clayey soils are susceptible to disturbance from construction traffic, especially in wet conditions. If the soils become disturbed, additional excavation may be required. Therefore, proper excavation equipment during construction should be used to minimize the potential for disturbance.

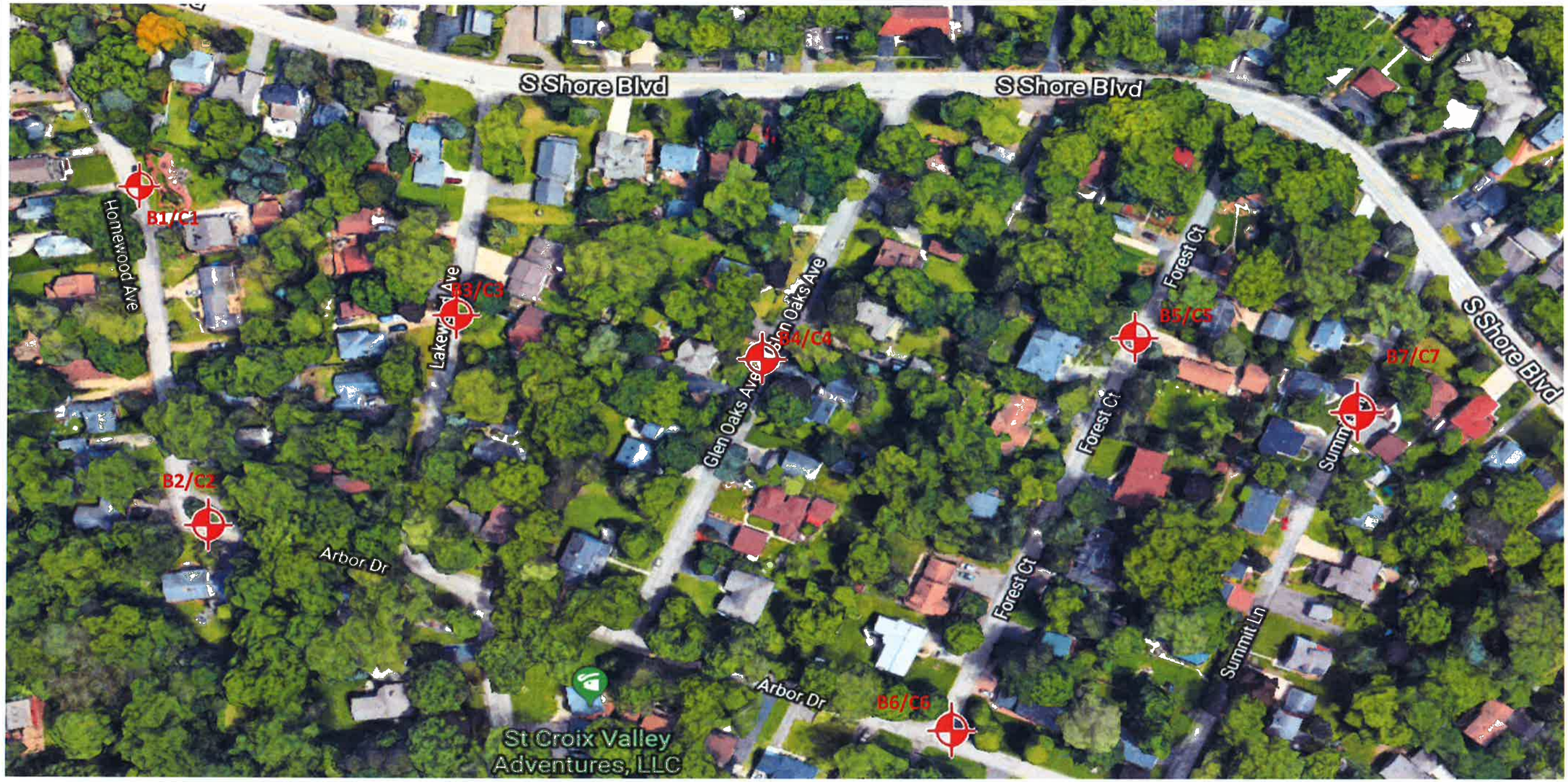
7.0 REMARKS

This report is for the exclusive use of the parties to which it is addressed. The soil testing and geotechnical engineering services performed by Element Materials Technology St. Paul Inc. for this project have been conducted in a manner with the level of skill and care ordinarily exercised by other members of the profession currently practicing in this area under similar budgetary and time constraints. No warranty, express or implied, is made.

Attachments:

-Boring Location Plan (2 pages)
-Pavement and Base Thickness – Table 1 (1 page)
-Soil Boring Logs B1-B11 (11 pages)
-Soil Laboratory Test Results (12 pages)
-Symbols and Terminology on Test Boring Logs (1 page)
-Classification of Soils for Engineering Purposes (1 page)
-Field Exploration Procedures (1 page)
-Prerequisites for Sound Engineering Practice (1 page)
-Construction Observations and Testing (1 page)
-Cold Weather Precautions (1 page)

Soil Boring/Core Location Plan-Northwestern Project Roadways



Approximate Soil Boring/Pavement Core Location

Base Map Provided by Goggle Earth

N
W E
S

element
662 Cromwell Avenue
St. Paul, MN 55114
Phone: 651-645-3601

Project: **White Bear Township Residential Street Reconstruction Projects**
Client: **White Bear Township**

Project No: ESPO29495P
Date: 10/31/2018

Soil Boring/Core Location Plan-Southeastern Project Roadways

Approximate Soil Boring/Pavement Core Location

Base Map Provided by Goggle Earth

N
W E
S

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662 Cromwell Avenue
St. Paul, MN 55114
Phone: 651-645-3601

Project: **White Bear Township Residential Street Reconstruction Projects**
Client: **White Bear Township**

Project No: ESPO29495P
Date: 10/31/2018

element

Element Materials Technology
662 Cromwell Avenue
St Paul, MN
55114-1720 USA

P 651 645 3601
F 651 659 7348
T 888 786 7555
info.stpaul@element.com
element.com

White Bear Township Residential Street Reconstruction Project

Element Materials Technology St. Paul Inc. Project. No. ESP029495P
Date: 10/29/2018

Table 1: Pavement and Base Thicknesses

Core/Boring Locations	Bituminous Thickness (inches)[1]	Base Course Thickness[2] (inches)	Base Material Description[3]	Results of field "smell test" for Hazardous Substances[4]	Comments
C1/B1	4	4	Sand w/Gravel	No Detection	Core Broken and Friable
C2/B2	3	6	Sand w/Gravel	No Detection	Core Broken and Friable
C3/B3	4	3	Silty Sand w/Gravel	No Detection	Core Bottom Broken and Friable
C4/B4	4 1/2	6	Sand w/Gravel	No Detection	Core Intact
C5/B5	4 1/2	6	Sand with Silt w/Gravel	No Detection	Core Intact
C6/B6	3	6	Sand with Silt w/Gravel	No Detection	Core Broken and Friable
C7/B7	4	6	Sand with Silt w/Gravel	No Detection	Core Intact
C8/B8	4	6	Sand w/Gravel	No Detection	Core Intact
C9/B9	6	6	Sand w/Gravel	No Detection	Core Intact
C10/B10	5	6	Sand with Silt w/Gravel	No Detection	Core Broken and Friable
C11/B11	4 1/2	5	Silty Sand w/ a little Gravel	No Detection	Core Bottom Broken and Friable

[1] Core thickness measured in the laboratory.
[2] Measurement taken in adjacent boring.
[3] Base material encountered may not meet current MnDOT Specifications for aggregate base material.
[4] Product odor is noted where detected through normal human sensing at the time of drilling activities. Environmental lab tests were not performed on the samples collected and not part of our scope of services.

Project No. ESP029495P

LOG OF BORING NO. B1

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

Depth (Ft.)	Geology	Graphic Log	Samples: Blows/12" N-Value RQD	Samples: Number	Samples: Type	Samples: In. Recovered / In. Driven	Tests: Moisture, %	Tests: Dry Density PCF	Additional Data / Remarks
	FILL, 4" of bituminous pavement underlain by 4" of sand with gravel aggregate base at the surface, underlain by a mixture of silty sand and sand with silt, with a little gravel, fine to medium grained, dark brown, moist (FILL)	FILL	AS	1	AUGER	12	7		p200=4.6%
			AS	2	AUGER	12			
			11	3	SS	18			
4.0	ORGANIC SANDY SILT TOPSOIL, black to dark brown, moist (ML-OL)	TOPSOIL	5	4	SS	18			Buried Topsoil.
5.5	(Buried Topsoil)								
5	SILTY SAND, with a trace of gravel, fine to medium grained, brown, iron oxide staining, moist, medium dense (SM)	COARSE ALLUVIUM	11	5	SS	18			
8.5									
10	CLAYEY SAND, with a trace of gravel, fine to medium grained, brown to brown and gray mottled, slight oxidation staining, moist, medium dense (SC)		12	6	SS	18			
10.5	End of Boring								

WATER LEVEL OBSERVATIONS	
WL	None

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Project No. ESP029495P

LOG OF BORING NO. B2

Sheet 1 of 1

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

Depth (Ft.)	Graphic Log	Geology	Description	Blows/12" N-Value RQD	Number	Type	In. Recovered In. Driven	Moisture, %	Dry Density PCF	Additional Data/ Remarks
		FILL	FILL, 3" of bituminous pavement underlain by 6" of sand with gravel aggregate base at the surface, underlain by a mixture of silty sand and clayey sand, with a little gravel, fine to medium grained, mixed brown and dark brown, occassional asphalt pieces from 2' to 5', moist (FILL)	AS	1	AUGER	12	7		p200=0.4%
				AS	2	AUGER	12			
				7	3	SS	18			Asphalt pieces from 2' to 5'.
				7	4	SS	18			
5										
5.5		COARSE ALLUVIUM	SAND, with a little gravel, cobbles at 7', fine to medium grained, brown, moist, loose to medium dense (SP)	36*	5	SS	18			*N-value influenced by cobbles.
8.5		FINE ALLUVIUM	SILT, with a little sand, brown, moist, medium dense (ML)	12	6	SS	18			
10.0										
10										
10.5		COARSE ALLUVIUM	SAND WITH SILT, with a trace of gravel, fine to medium grained, brown, moist, medium dense (SP-SM)							
			End of Boring							

WATER LEVEL OBSERVATIONS	
WL	None

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Project No. ESP029495P

LOG OF BORING NO. B3

Sheet 1 of 1

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

	GRAPHIC LOG	GEOLOGY	DEPTH (FT.)	SAMPLES: BLOWS/12" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: ADDITIONAL DATA/ REMARKS
FILL, 4" of bituminous pavement underlain by 3" of silty sand gravel aggregate base at the surface, underlain by a mixture of silty sand and sand, with gravel, fine to medium grained, dark brown to brown, moist (FILL)		FILL		AS	1	AUGER	12	6		p200=15.3%
				AS	2	AUGER	12			
2.0 SAND, with a little gravel, fine to medium grained, brown, moist, loose (SP)		COARSE ALLUVIUM		5	3	SS	18			
3.5 SILTY SAND, with gravel, fine to medium grained, brown, moist, loose (SM)			5	5	4	SS	18			
5.5 End of Boring										

WATER LEVEL OBSERVATIONS	
WL	None

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Project No. ESP029495P

LOG OF BORING NO. B4

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

Depth (Ft.)	Graphic Log	Geology	Blows/12" N-Value RQD	Number	Type	In. Recovered In. Driven	Moisture, %	Dry Density PCF	Additional Data/ Remarks
FILL, 4 1/2" of bituminous pavement underlain by 6" of sand with gravel aggregate base at the surface, underlain by a mixture of silty sand and sand with silt, with a little gravel, fine to medium grained, dark brown, moist (FILL)		FILL	AS	1	AUGER	12	5		p200=4.4%
			AS	2	AUGER	12			
			5	3	SS	18			
3.5									
ORGANIC SANDY SILT TOPSOIL, with occasional rootlets, black, moist (ML-OL)		TOPSOIL	4	4	SS	18			Buried Topsoil.
(Buried Topsoil)									
5.5									
SILTY SAND, with a little gravel, fine to medium grained, brown, iron oxide staining, moist, very loose to loose (SM)		COARSE ALLUVIUM	10	5	SS	18			
7.0 End of Boring									

5

WATER LEVEL OBSERVATIONS	
WL	None

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Project No. ESP029495P

LOG OF BORING NO. B5

Sheet 1 of 1

CLIENT: White Bear Township C/O TKDA

ARCHITECT/ENGINEER: TKDA

SITE: White Bear Township, Minnesota

PROJECT: White Bear Township Residential Street Reconstruction

Surface Elev.: Datum: **MSL**

Depth (Ft.)	Graphic Log	Geology	Blows/12" N-Value RQD	Number	Type	In. Recovered In. Driven	Moisture, %	Dry Density PCF	Additional Data/ Remarks
FILL, 4 1/2" of bituminous pavement underlain by 6" of sand with silt and gravel aggregate base at the surface, underlain by silty sand, with a little gravel, fine to medium grained, dark brown, moist (FILL)		FILL	AS	1	AUGER	12	5		p200=9.1%
			AS	2	AUGER	12			
			7	3	SS	18	7		p200=16.3%
4.0 SANDY LEAN CLAY, brown to brown and gray mottled, moist, soft (CL)		FINE ALLUVIUM	5	4	SS	18			
5.5 SAND, with a little gravel, fine to medium grained, brown, moist, loose to medium dense (SP)		COARSE ALLUVIUM	11	5	SS	18			
8.5 SAND WITH SILT, with a little gravel, fine to medium grained, brown, moist, medium dense (SP-SM)			29	6	SS	18			
10.5 End of Boring									

5

10

WATER LEVEL OBSERVATIONS	
WL	None

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Project No. ESP029495P

LOG OF BORING NO. B6

Sheet 1 of 1

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

Depth (Ft.)	Graphic Log	Geology	Blows/12" N-Value RQD	Number	Type	In. Recovered In. Driven	Moisture, %	Dry Density PCF	Additional Data/ Remarks
		FILL, 3" of bituminous pavement underlain by 6" of sand with silt and gravel aggregate base at the surface, underlain by mixture of silty sand and sand with silt, with a little gravel, fine to medium grained, dark brown, moist (FILL)	AS	1	AUGER	12	7		p200=6.6%
			AS	2	AUGER	12			
			4	3	SS	18			
			4	4	SS	18			
5.0									
		ORGANIC SANDY SILT TOPSOIL, black, moist (ML-OL)	8	5	SS	18			Buried Topsoil.
6.0		(Buried Topsoil)							
		COARSE ALLUVIUM							
7.0		SILTY SAND, with a trace of gravel, fine to medium grained, dark brown to brown, moist, loose (SM)							
		End of Boring							

5

WATER LEVEL OBSERVATIONS	
WL	None

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Project No. ESP029495P	LOG OF BORING NO. B7	Sheet 1 of 1

CLIENT	ARCHITECT/ENGINEER
White Bear Township C/O TKDA	TKDA
SITE	**PROJECT**
White Bear Township, Minnesota	White Bear Township Residential Street Reconstruction

Surface Elev.: Datum: **MSL**

DEPTH (FT.)	GRAPHIC LOG	GEOLOGY	SAMPLES: BLOWS/12" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	ADDITIONAL DATA/ REMARKS
FILL, 4" of bituminous pavement underlain by 6" of sand with silt gravel aggregate base at the surface, underlain by a mixture of silty sand and sand with silt, with gravel, fine to medium grained, dark brown to brown, moist (FILL)		FILL	AS	1	AUGER	12	8		p200=6.4%
			AS	2	AUGER	12			
			AS	3	AUGER	12			
3.0 End of Boring									

WATER LEVEL OBSERVATIONS	
WL	None

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DRILLER	KK	ASS'T DRILLER	XW
LOGGED BY	XW	APPROVED	MAS

Project No. ESP029495P	LOG OF BORING NO. B8	Sheet 1 of 1

CLIENT	ARCHITECT/ENGINEER
White Bear Township C/O TKDA	TKDA
SITE	**PROJECT**
White Bear Township, Minnesota	White Bear Township Residential Street Reconstruction

Surface Elev.: Datum: **MSL**

DEPTH (FT.)	GRAPHIC LOG	GEOLOGY	SAMPLES: BLOWS/12" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	ADDITIONAL DATA/ REMARKS
FILL, 4" of bituminous pavement underlain by 6" of sand with gravel aggregate base at the surface, underlain by a mixture of silty sand and sand with silt, with a little gravel, fine to medium grained, dark brown to brown, moist (FILL)		FILL	AS	1	AUGER	12	4		p200=4.7%
			AS	2	AUGER	12			
			10	3	SS	18			
			17	4	SS	18			
5									
5.5 End of Boring									

WATER LEVEL OBSERVATIONS	
WL	None

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Project No. ESP029495P

LOG OF BORING NO. B9

Sheet 1 of 1

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

DEPTH (FT.)	GEOLOGY	SAMPLES: BLOWS/12" N - VALUE RQD	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	ADDITIONAL DATA/ REMARKS
FILL, 6" of bituminous pavement underlain by 6" of sand and gravel aggregate base at the surface, underlain by sity sand, with a little gravel, fine to medium grained, dark brown, moist (FILL)	FILL	AS	1	AUGER	12	5		p200=4.7%
		AS	2	AUGER	12			
2.0 SILT, with occasional sand seams, brown, moist, loose (ML)	FINE ALLUVIUM	9	3	SS	18			
4.0 SAND WITH SILT, with a little gravel, mostly fine grained, brown, moist, loose (SP-SM)	COARSE ALLUVIUM	9	4	SS	18			
5.5 End of Boring								

WATER LEVEL OBSERVATIONS	
WL	None

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DRILLER	KK	ASS'T DRILLER	XW
LOGGED BY	XW	APPROVED	MAS

Project No. ESP029495P

LOG OF BORING NO. B10

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

DEPTH (FT.)	GEOLOGY	SAMPLES: BLOWS/12" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE, %	DRY DENSITY PCF	ADDITIONAL DATA/ REMARKS
FILL, 5" of bituminous pavement underlain by 6" of sand with silt and gravel aggregate base at the surface, underlain by a mixture of silty sand and sand with silt, with a little gravel, fine to medium grained, dark brown, moist (FILL)	FILL	AS	1	AUGER	12	7		p200=6.9%
		AS	2	AUGER	12			
2.0								
SAND WITH SILT, with a little gravel, fine to medium grained, brown, moist, loose (SP-SM)	COARSE ALLUVIUM	9	3	SS	18			
		10	4	SS	18			
5								
		8	5	SS	18			
		8	6	SS	18			
10								
10.5 End of Boring								

WATER LEVEL OBSERVATIONS

WL	None

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St. Paul, MN 55114
Telephone: 651-645-3601

STARTED	10/16/18	FINISHED	10/16/18
DRILL CO.	Element	DRILL RIG	367
DRILLER	KK	ASS'T DRILLER	XW
LOGGED BY	XW	APPROVED	MAS

Project No. ESP029495P

LOG OF BORING NO. B11

Sheet 1 of 1

CLIENT: **White Bear Township C/O TKDA**

ARCHITECT/ENGINEER: **TKDA**

SITE: **White Bear Township, Minnesota**

PROJECT: **White Bear Township Residential Street Reconstruction**

Surface Elev.: Datum: **MSL**

DEPTH (FT.)	GEOLOGY	SAMPLES: BLOWS/12" N - VALUE RQD	NUMBER	TYPE	IN. RECOVERED IN. DRIVEN	TESTS: MOISTURE, %	DRY DENSITY PCF	ADDITIONAL DATA/ REMARKS
	FILL, 4 1/2" of bituminous pavement underlain by 5" of silty sand and gravel aggregate base at the surface, underlain by a mixture of silty sand and sand with silt, with a little gravel, fine to medium grained, dark brown, moist (FILL)	AS	1	AUGER	12	14		p200=25.3%
		AS	2	AUGER	12			
		5	3	SS	18			
3.0								
	SANDY LEAN CLAY, brown and gray mottled, moist, soft (CL) — FINE ALLUVIUM	7	4	SS	18			
5								
5.5								
	SAND, with a little gravel, fine to medium grained, brown, moist, loose to medium dense (SP) — COARSE ALLUVIUM	18	5	SS	18			
		18	6	SS	18			
10								
10.5								
	End of Boring							

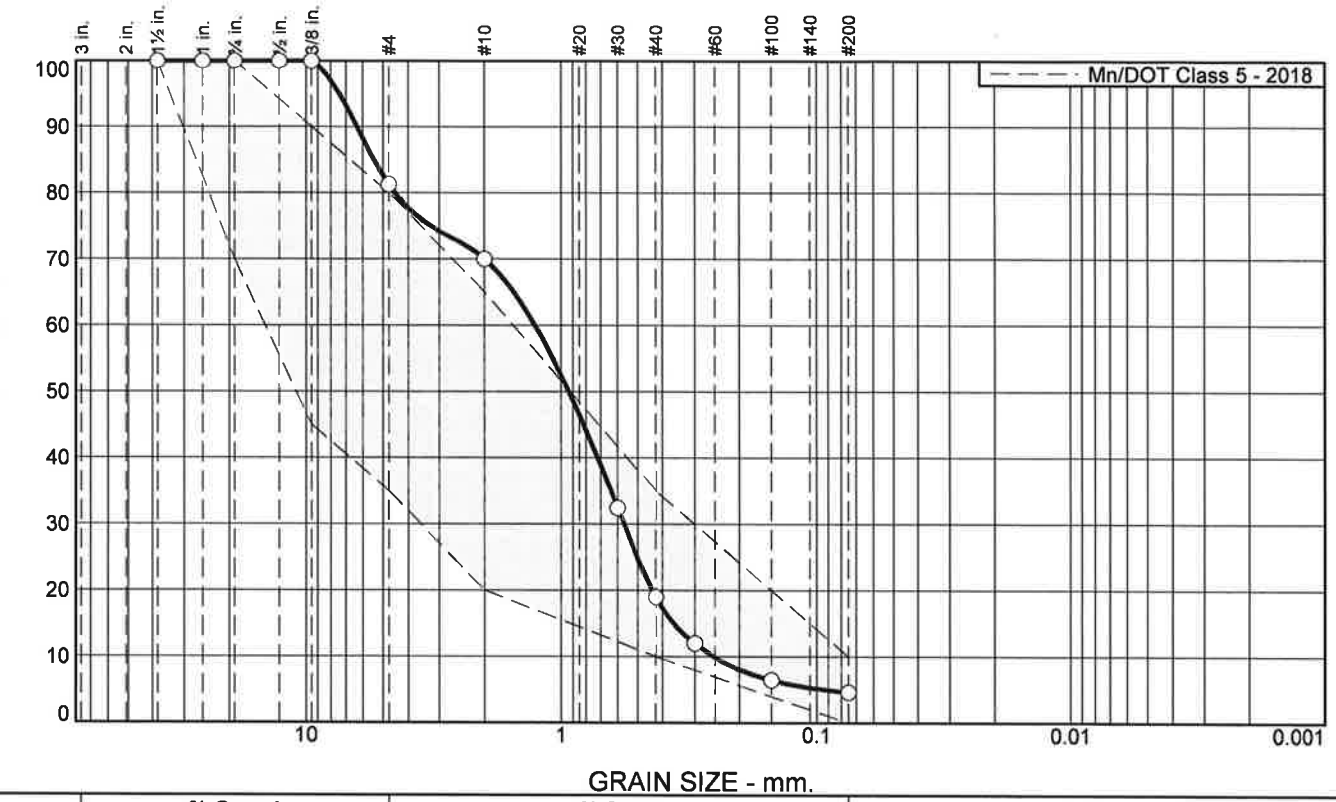
WATER LEVEL OBSERVATIONS	
WL	None

element™ materials technology
662 Cromwell Ave.
St. Paul, MN 55114
Telephone: 651-645-3601

STARTED	10/16/18	FINISHED	10/16/18
DRILL CO.	Element	DRILL RIG	367
DRILLER	KK	ASS'T DRILLER	XW
LOGGED BY	XW	APPROVED	MAS

ELEMENT LOG ESP029495P - WHITE BEAR TOWNSHIP STREET RECONSTRUCTION.GPJ LOG A GNNN08.GDT 5/6/19

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	18.8	11.2	51.0	14.4	4.6	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	81.2	35.0 - 80.0	X
#10	70.0	20.0 - 65.0	X
#30	32.5		
#40	19.0	10.0 - 35.0	
#50	12.0		
#100	6.5		
#200	4.6	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND, with gravel, mostly medium grained, brown (SP)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 6.3212 D_{85}= 5.4207 D_{60}= 1.2704
D_{50}= 0.9344 D_{30}= 0.5664 D_{15}= 0.3621
D_{10}= 0.2527 C_u= 5.03 C_c= 1.00

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 7.3%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: Soil Boring 1
Sample Number: 1, S011698 **Depth:** 4"-8" **Date Sampled:** 10-16-18

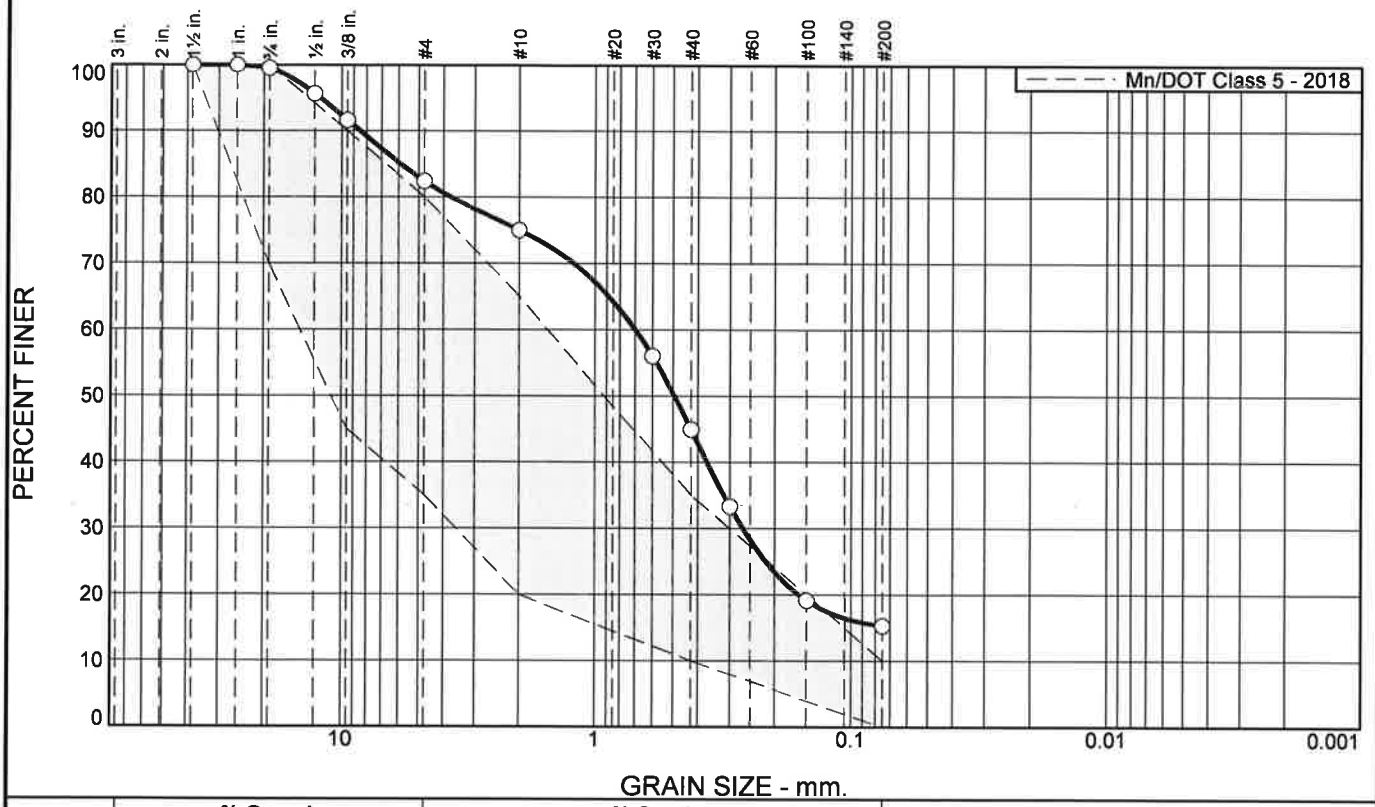
EAR-CONTROLLED DATA

Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.4	17.2	7.4	30.1	29.6	15.3	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	99.6	70.0 - 100.0	
1/2"	95.6		
3/8"	91.6	45.0 - 90.0	X
#4	82.4	35.0 - 80.0	X
#10	75.0	20.0 - 65.0	X
#30	56.0		
#40	44.9	10.0 - 35.0	X
#50	33.3		
#100	19.1		
#200	15.3	0.0 - 10.0	X

* Mn/DOT Class 5 - 2018

Material Description

SILTY SAND, with gravel, fine to medium grained, brown (SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 8.4977 D_{85}= 5.9106 D_{60}= 0.6994
D_{50}= 0.4938 D_{30}= 0.2672 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample was discarded after completion of test.

Date Received: 10-17-18 **Date Tested:** 10-25-18

Tested By: L.Tran

Checked By: M. Straight, P.E.

Title: Sr. Project Engineer

Location: Soil Boring 3

Sample Number: S011715 **Depth:** 4"-8"

Date Sampled: 10-16-18

Element Materials Technology St. Paul, MN

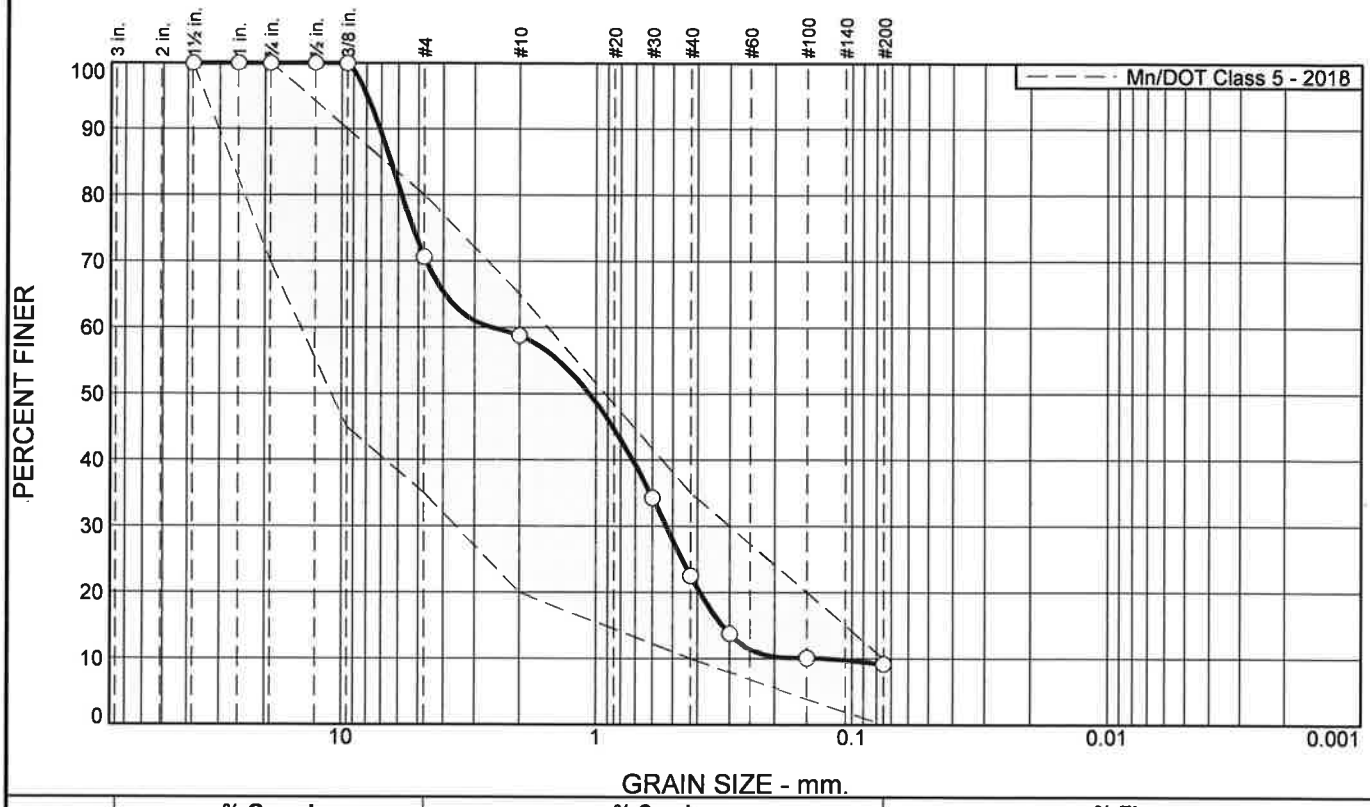
Client: TKDA

Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	29.3	11.9	36.3	13.4	9.1	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	70.7	35.0 - 80.0	
#10	58.8	20.0 - 65.0	
#30	34.3		
#40	22.5	10.0 - 35.0	
#50	13.8		
#100	10.1		
#200	9.1	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND WITH SILT, with gravel, fine to medium grained, brown (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 7.0862 D_{85}= 6.4084 D_{60}= 2.5660
D_{50}= 1.0632 D_{30}= 0.5295 D_{15}= 0.3202
D_{10}= 0.1246 C_u= 20.59 C_c= 0.88

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 5.2%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: Soil Boring 5
Sample Number: 1. S011699 **Depth:** 6"-1'

Date Sampled: 10-16-18

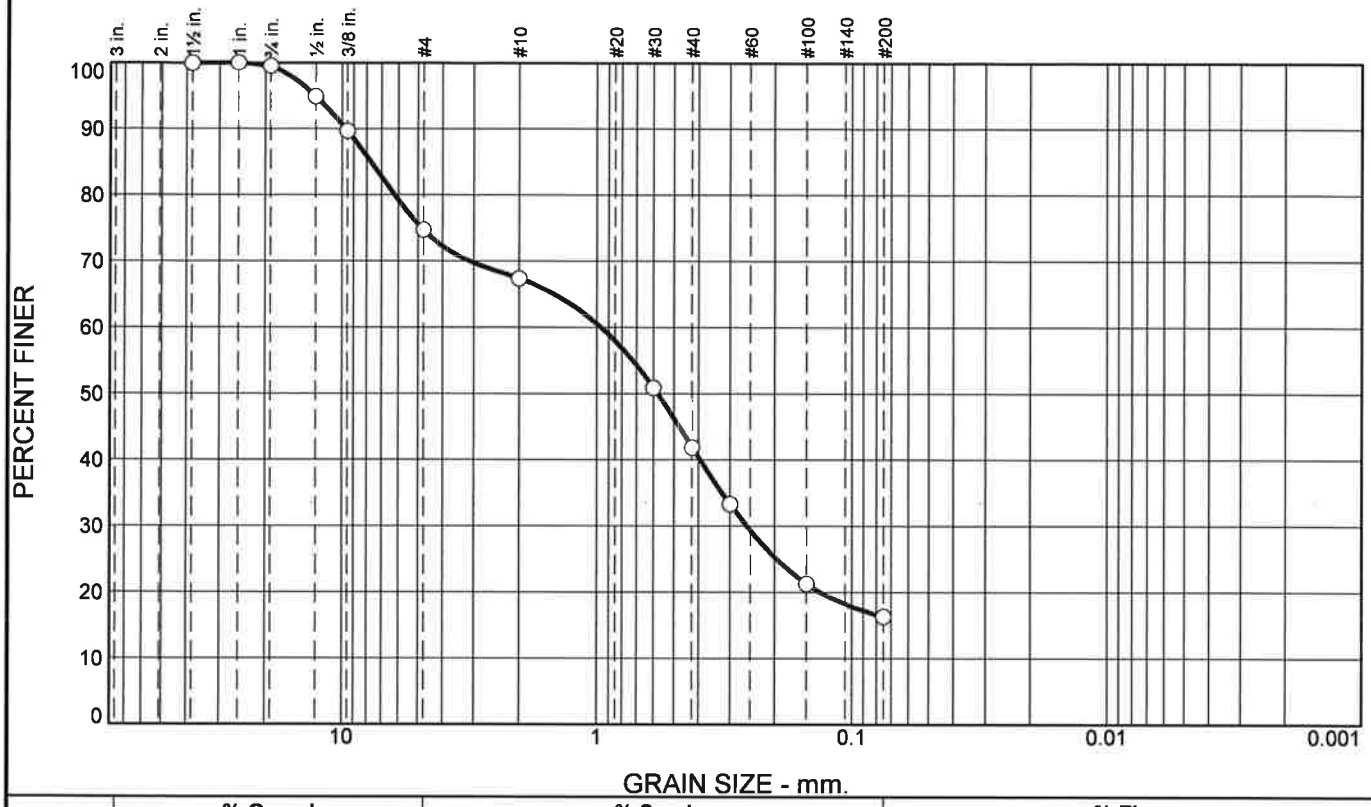
Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.5	24.9	7.2	25.4	25.7	16.3	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0		
1"	100.0		
3/4"	99.5		
1/2"	94.8		
3/8"	89.7		
#4	74.6		
#10	67.4		
#30	50.9		
#40	42.0		
#50	33.3		
#100	21.3		
#200	16.3		

* (no specification provided)

Material Description

SILTY SAND with gravel, fine to medium grained, brown (SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 9.6807 D_{85}= 7.7136 D_{60}= 0.9644
D_{50}= 0.5788 D_{30}= 0.2577 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample was discarded after completion of test.

Date Received: 10-16-18 **Date Tested:** 10-25-18

Tested By: L.Tran

Checked By: M. Straight, P.E.

Title: Sr. Project Engineer

Location: Soil Boring 5
Sample Number: 3, S011714 **Depth:** 2'-4'

Date Sampled: 10-16-18

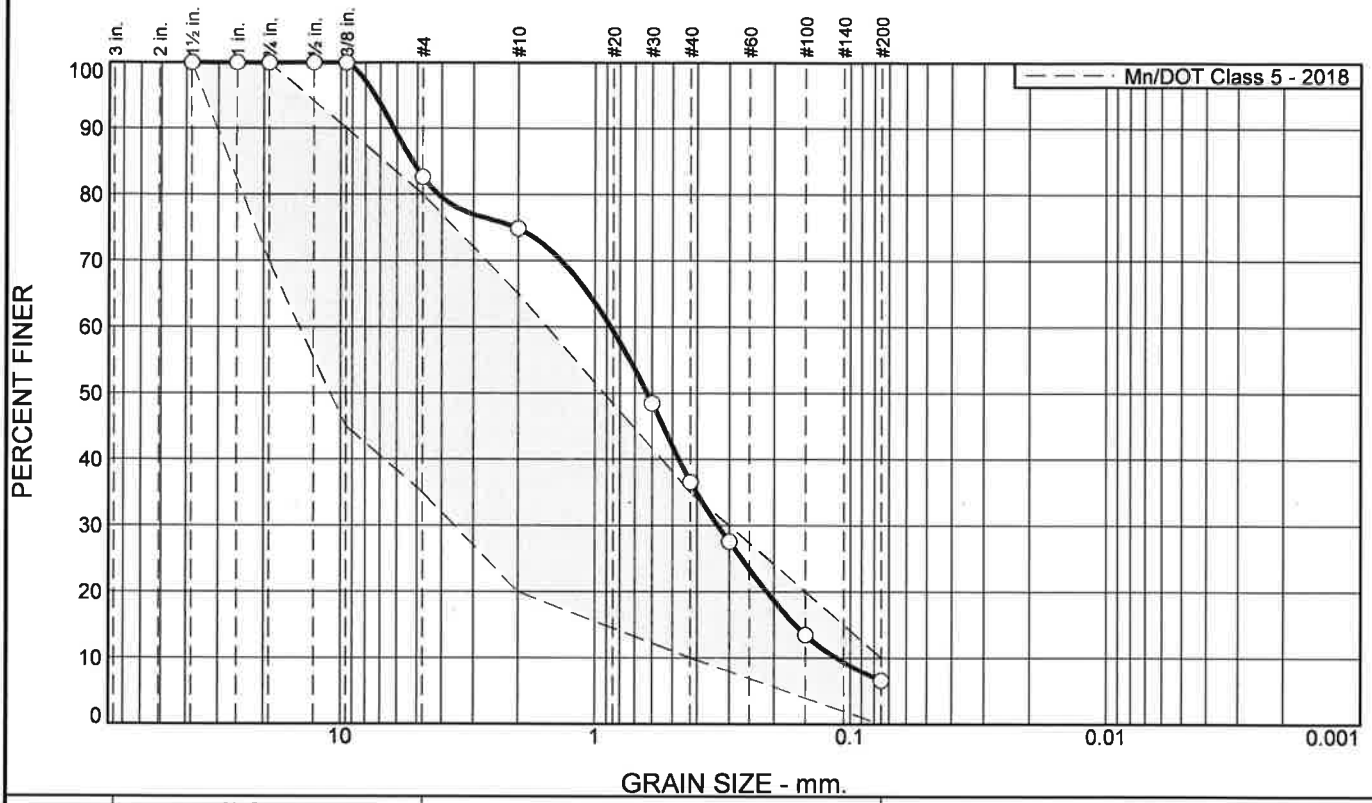
Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	17.4	7.7	38.3	30.0	6.6	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	82.6	35.0 - 80.0	X
#10	74.9	20.0 - 65.0	X
#30	48.5		
#40	36.6	10.0 - 35.0	X
#50	27.6		
#100	13.5		
#200	6.6	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND WITH SILT, with gravel, fine to medium grained, brown (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 6.1830 D_{85}= 5.2178 D_{60}= 0.8691
D_{50}= 0.6270 D_{30}= 0.3325 D_{15}= 0.1647
D_{10}= 0.1131 C_u= 7.69 C_c= 1.13

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 6.6%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: Soil Boring 6
Sample Number: 1, S011700 **Depth:** 3"-9"

Date Sampled: 10-16-18

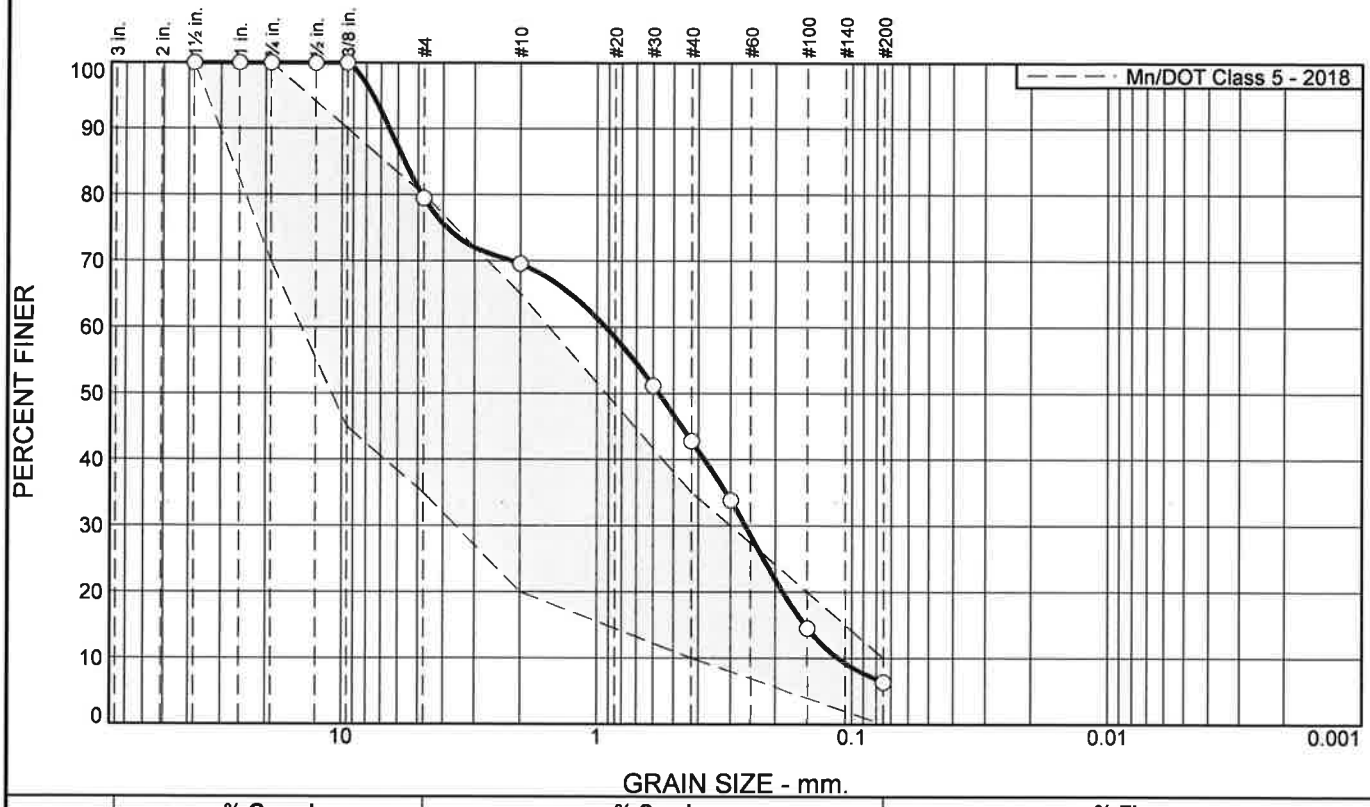
Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.5	9.9	26.8	36.4	6.4	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	79.5	35.0 - 80.0	
#10	69.6	20.0 - 65.0	X
#30	51.1		
#40	42.8	10.0 - 35.0	X
#50	33.8		
#100	14.5		
#200	6.4	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND WITH SILT, with gravel, fine to medium grained, brown (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 6.4810 D_{85}= 5.6368 D_{60}= 0.9253
D_{50}= 0.5712 D_{30}= 0.2628 D_{15}= 0.1533
D_{10}= 0.1132 C_u= 8.17 C_c= 0.66

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 7.9%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: Soil Boring 7
Sample Number: 1, S011701 **Depth:** 4"-1'

Date Sampled: 10-16-18

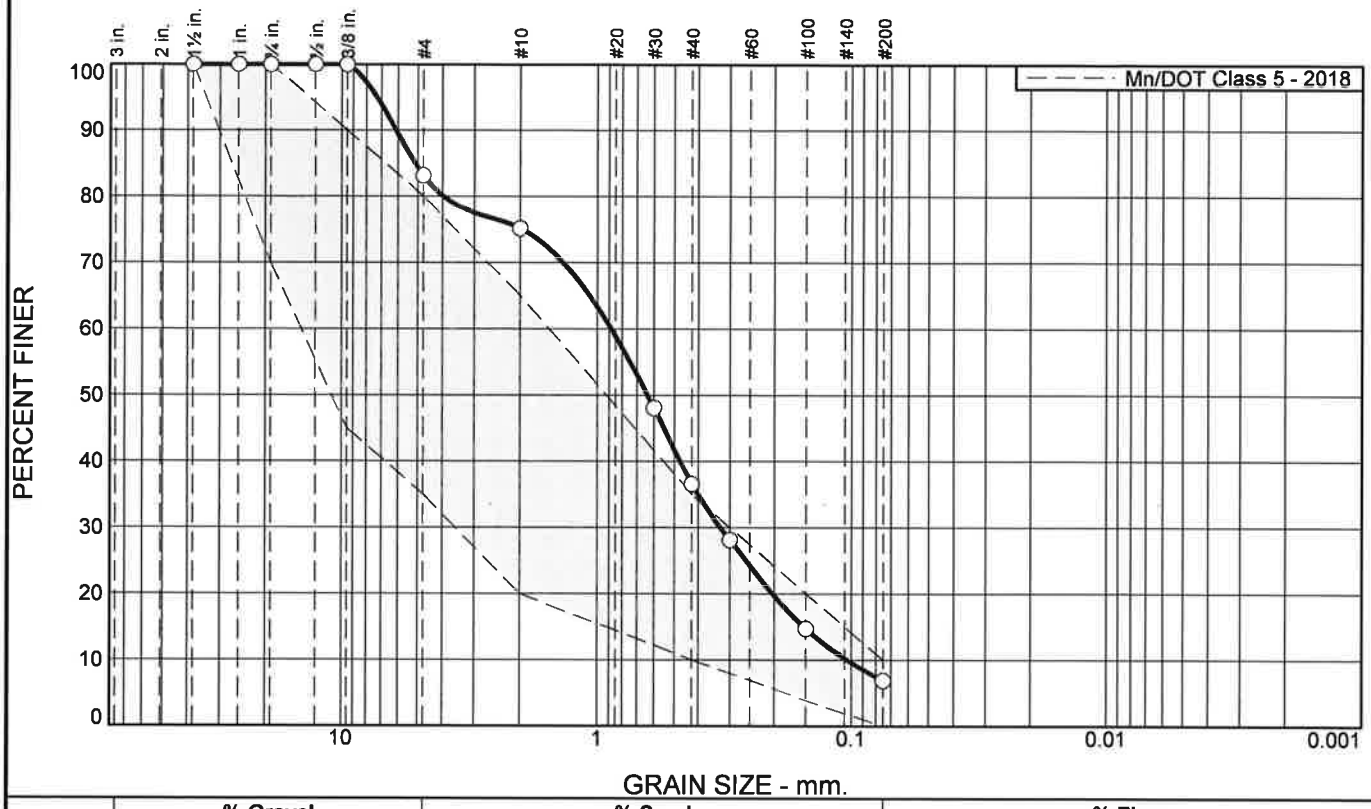
Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.9	7.9	38.6	29.7	6.9	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	83.1	35.0 - 80.0	X
#10	75.2	20.0 - 65.0	X
#30	48.1		
#40	36.6	10.0 - 35.0	X
#50	28.1		
#100	14.6		
#200	6.9	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND WITH SILT, with gravel, fine to medium grained, brown (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

D_{90}= 6.1226 D_{85}= 5.1331 D_{60}= 0.8842
D_{50}= 0.6359 D_{30}= 0.3269 D_{15}= 0.1535
D_{10}= 0.1036 C_u= 8.53 C_c= 1.17

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 6.8%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: Soil Boring 10
Sample Number: 1, S011702 **Depth:** 6"-1'

Date Sampled: 10-16-18

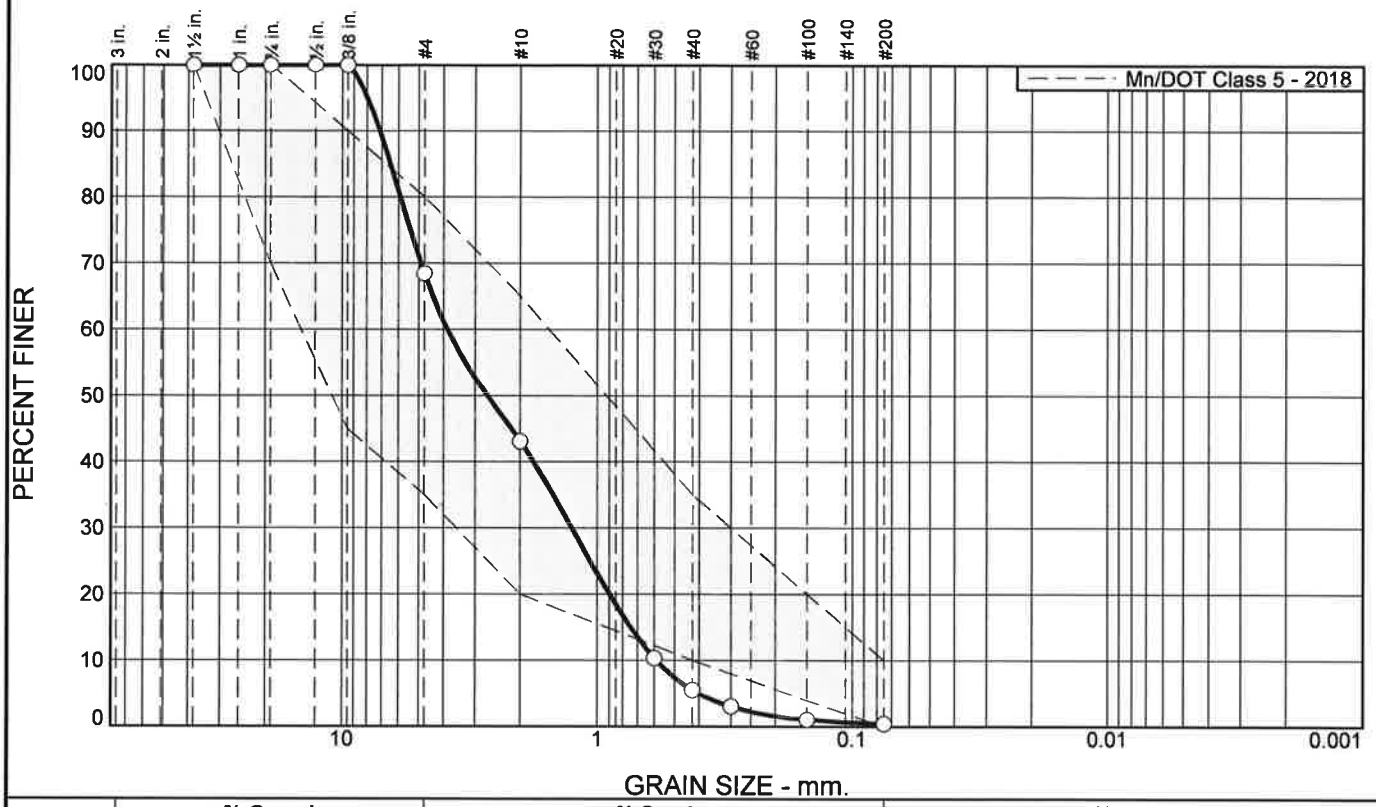
Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	31.6	25.3	37.6	5.1	0.4	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	68.4	35.0 - 80.0	
#10	43.1	20.0 - 65.0	
#30	10.3		
#40	5.5	10.0 - 35.0	X
#50	3.0		
#100	1.1		
#200	0.4	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND, with gravel, medium to coarse grained, brown (SP)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 7.1203 D_{85}= 6.4671 D_{60}= 3.8648
D_{50}= 2.6933 D_{30}= 1.2590 D_{15}= 0.7433
D_{10}= 0.5898 C_u= 6.55 C_c= 0.70

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 6.8%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: C2
Sample Number: 1, S011703 **Depth:** 6"-1'

Date Sampled: 10-16-18

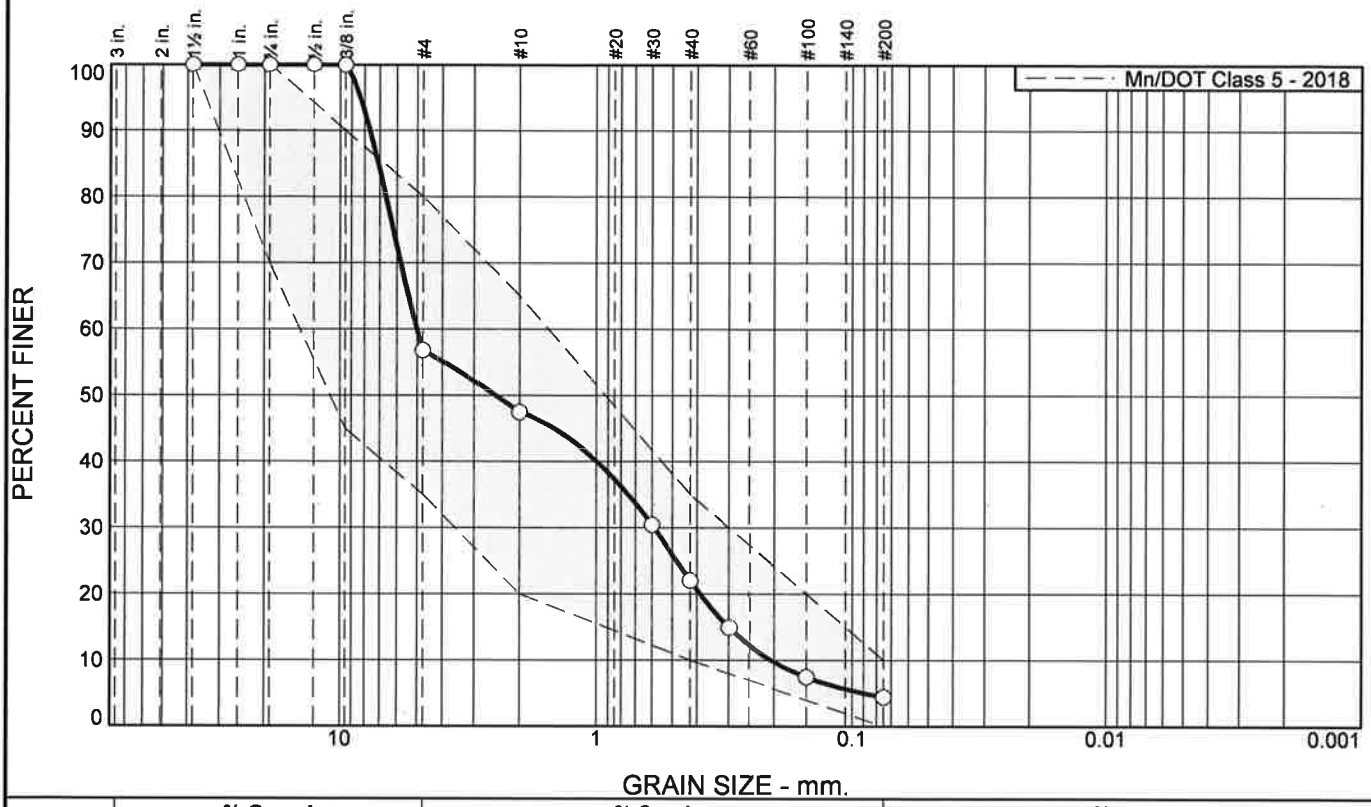
Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	43.2	9.3	25.5	17.6	4.4	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	56.8	35.0 - 80.0	
#10	47.5	20.0 - 65.0	
#30	30.5		
#40	22.0	10.0 - 35.0	
#50	15.0		
#100	7.5		
#200	4.4	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND, with gravel, fine to medium grained, brown (SP)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 7.6374 D_{85}= 7.0940 D_{60}= 5.0244
D_{50}= 2.4775 D_{30}= 0.5891 D_{15}= 0.3007
D_{10}= 0.2057 C_u= 24.42 C_c= 0.34

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 5.2%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: C4
Sample Number: 1, S011704 **Depth:** 6"-1'

Date Sampled: 10-16-18

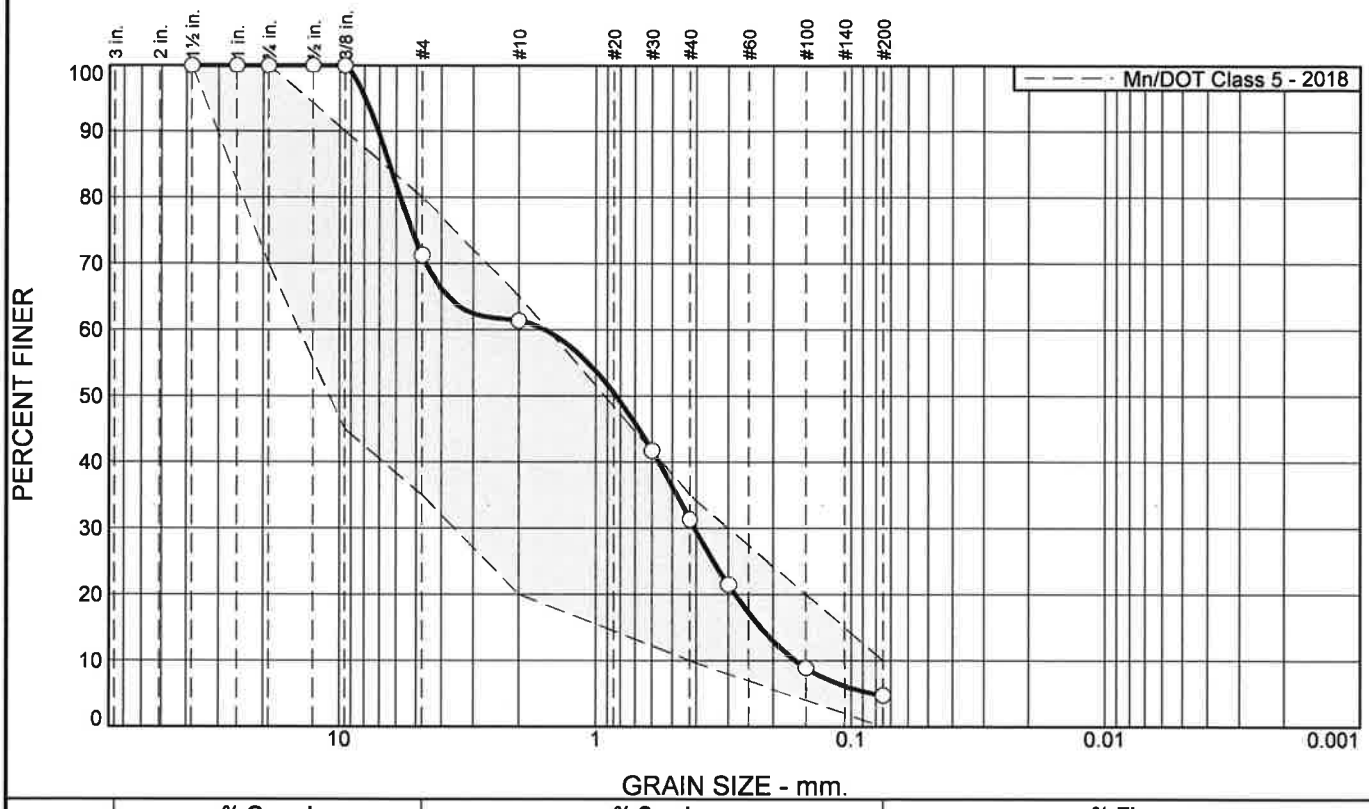
Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	28.8	9.8	30.1	26.6	4.7	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	71.2	35.0 - 80.0	
#10	61.4	20.0 - 65.0	
#30	41.7		
#40	31.3	10.0 - 35.0	
#50	21.5		
#100	8.9		
#200	4.7	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND, with gravel, fine to medium grained, brown (SP)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 7.0683 D_{85}= 6.3835 D_{60}= 1.5892
D_{50}= 0.8318 D_{30}= 0.4069 D_{15}= 0.2243
D_{10}= 0.1650 C_u= 9.63 C_c= 0.63

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 4.3%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: C8
Sample Number: 1, S011705 **Depth:** 6"-1'

Date Sampled: 10-16-18

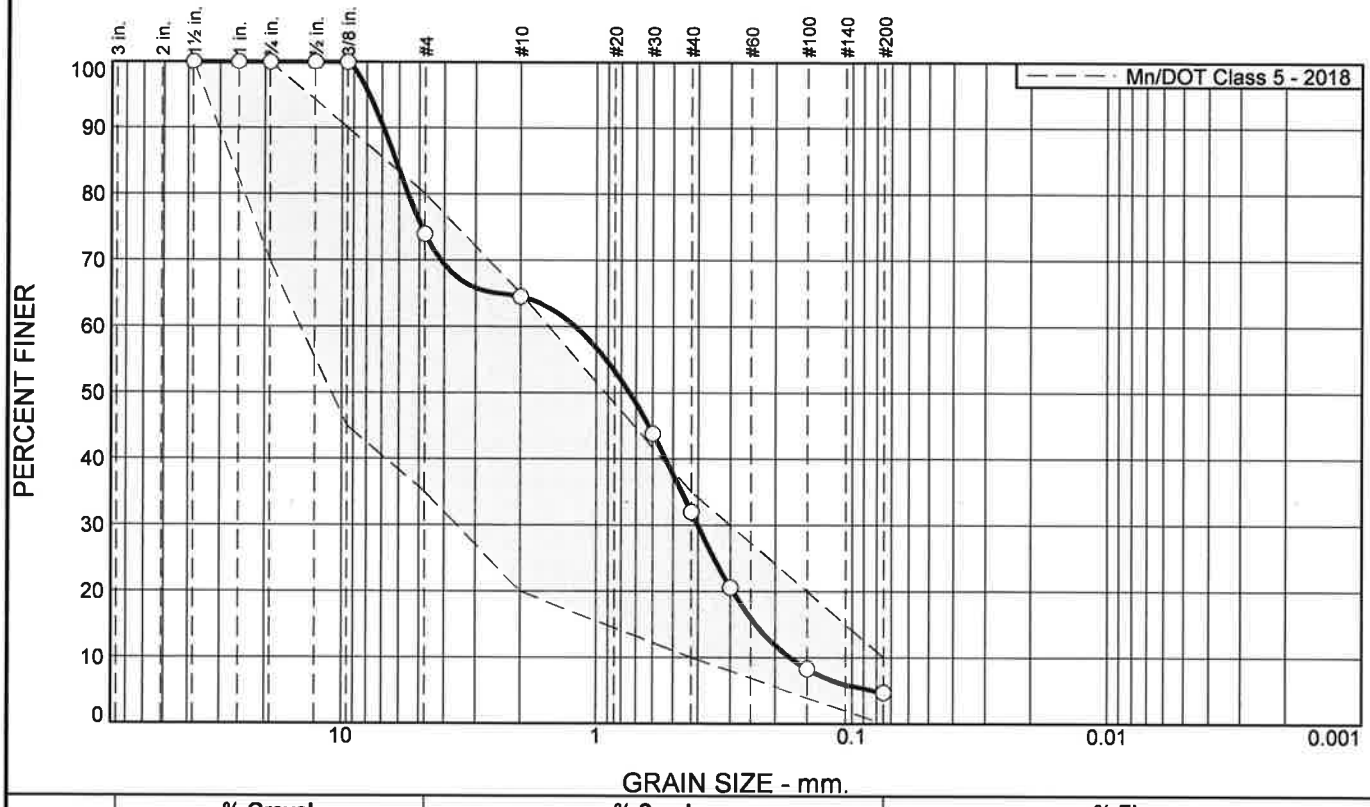
EAR-CONTROLLED DATA

Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	26.0	9.5	32.5	27.3	4.7	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	74.0	35.0 - 80.0	
#10	64.5	20.0 - 65.0	
#30	43.8		
#40	32.0	10.0 - 35.0	
#50	20.6		
#100	8.3		
#200	4.7	0.0 - 10.0	

* MN/DOT Class 5 - 2018

Material Description

SAND, with gravel, fine to medium grained, brown (SP)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 6.9097 D_{85}= 6.1830 D_{60}= 1.2174
D_{50}= 0.7432 D_{30}= 0.4015 D_{15}= 0.2382
D_{10}= 0.1750 C_u= 6.96 C_c= 0.76

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 5.3%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: C9
Sample Number: 1, S011706 **Depth:** 6"-1'

Date Sampled: 10-16-18

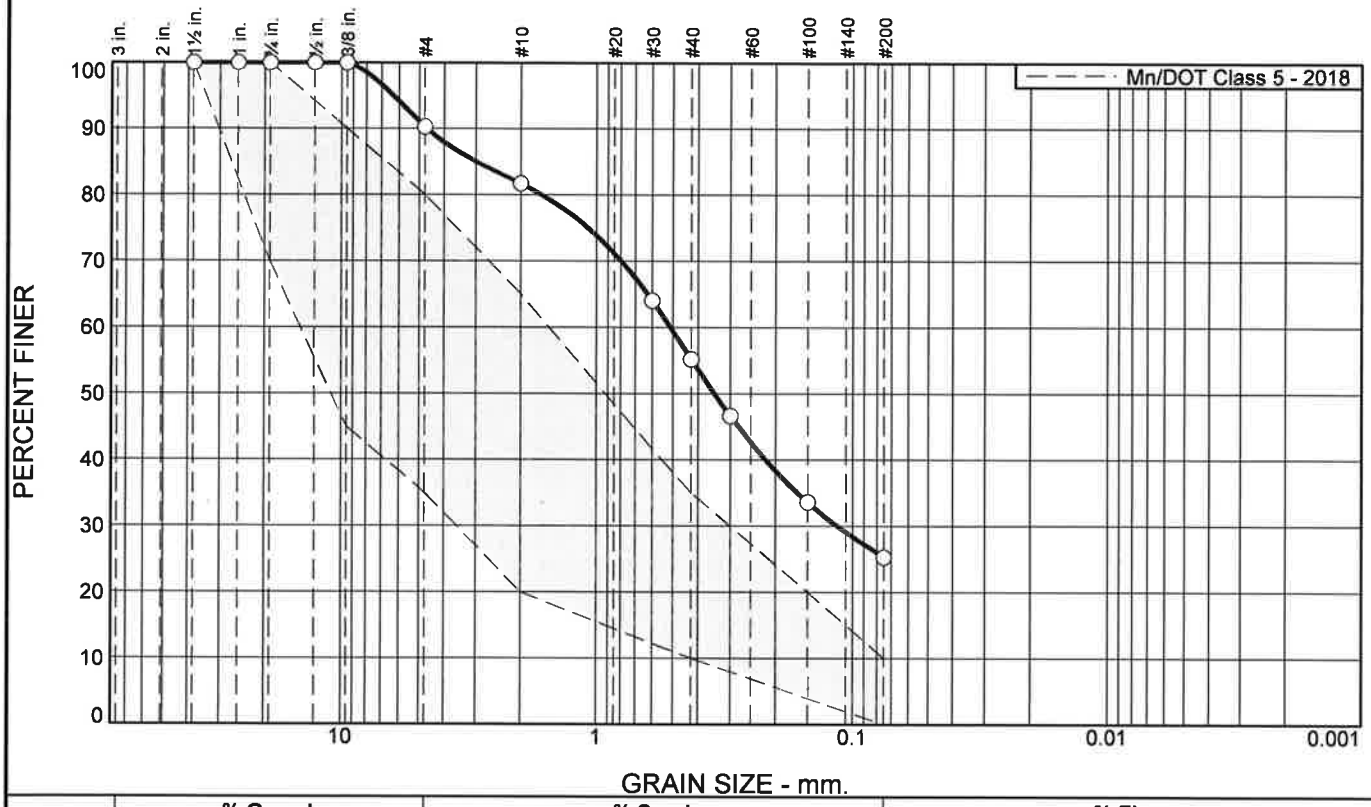
EAR-CONTROLLED DATA

Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.7	8.6	26.5	29.9	25.3	

Test Results (ASTM C136 & ASTM C117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1-1/2"	100.0	100.0	
1"	100.0		
3/4"	100.0	70.0 - 100.0	
1/2"	100.0		
3/8"	100.0	45.0 - 90.0	X
#4	90.3	35.0 - 80.0	X
#10	81.7	20.0 - 65.0	X
#30	64.0		
#40	55.2	10.0 - 35.0	X
#50	46.6		
#100	33.6		
#200	25.3	0.0 - 10.0	X

* MN/DOT Class 5 - 2018

Material Description

SILTY SAND, with a little gravel, fine to medium grained, brown (SM)

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 4.6684 D_{85}= 2.9903 D_{60}= 0.5112
D_{50}= 0.3463 D_{30}= 0.1145 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample was returned to the container after completion of test.
Moisture Content: 14.2%

Date Received: 10-16-18 **Date Tested:** 10-23-18

Tested By: L.Tran

Checked By: J. Starke, P.E.

Title: Sr. Geotechnical Engineer

Location: C11
Sample Number: 1, S011707 **Depth:** 6"-1'

Date Sampled: 10-16-18

Element Materials Technology St. Paul, MN

Client: TKDA
Project: White Bear Township Residential Street Reconstruction

Project No: ESP029495P **Figure**

EAR-CONTROLLED DATA

SYMBOLS AND TERMINOLOGY ON TEST BORING LOGS

SYMBOLS

Drilling and Sampling

Symbol	Description
HSA	3-1/4" I.D. hollow stem auger
_FA	4", 6" or 10" diameter flight auger
_HA	2", 4" or 6" hand auger
_DC	2-1/2", 4", 5" or 6" steel drive casing
_RC	Size A, B or N rotary casing
PD	Pipe drill or cleanout tube
CS	Continuous split barrel sampling
DM	Drilling mud
JW	Jetting water
SB	2" O.D. split barrel sampling
_L	2-1/2" or 3-1/2" O.D. SB liner sample
_T	2" or 3" thin walled tube sample
3TP	3" thin walled tube using pitcher sampler
_TO	2" or 3" thin walled tube suing Osterberg sampler
W	Wash sample
B	Bag sample
P	Test pit sample
_Q	BQ, NQ, or PQ wireline system
_X	AX, BX, or NX double tube barrel
N	Standard penetration test, blows per foot
CR	Core recovery, percent
WL	Water level
▼	Water level
NMR	No measurement recorded, primarily due to the presence of drilling or coring fluid

Laboratory Testing

Symbol	Description
W	Water content, % (ASTM:D2216)**
D	Dry density, pcf
LL	Liquid limit (ASTM:D4318)
PL	Plastic limit (ASTM:D4318)
	--- Inserts in Last Column (Qu or RQD) ---
Qu	Unconfined compressive strength, psf (ASTM:D2166)
Pq	Penetrometer reading, tsf (ASTM:D1558)
Ts	Torvane reading, tsf
G	Specific gravity (ASTM:D854)
SL	Shrinkage limits (ASTM:D427)
OC	Organic content – Combustion method (ASTM:D2974)
SP	Swell pressure, tsf (ASTM:D4546)
PS	Percent swell under pressure (ASTM:D4546)
FS	Free swell, % (ASTM:D4546)
SS	Shrink swell, % (ASTM:D4546)
pH	Hydrogen ion content – Meter Method (ASTM:D4972)
SC	Sulfate content, parts/million or mg/l
CC	Chloride content, parts/million, or mg/l
C*	One dimensional consolidation (ASTM:D2435)
Qc*	Triaxial compression (ASTM:D2850 and D4767)
D.S.*	Direct shear (ASTM:D3080)
K*	Coefficient of permeability, cm/sec (ASTM:D2434)
P*	Pinhole test (ASTM:D4647)
DH*	Double hydrometer (ASTM:D4221)
MA*	Particle size analysis (ASTM:D422)
R	Laboratory electrical resistivity, ohm-cm (ASTM:G57)
E*	Pressuremeter deformation modulus, tsf (ASTM:D4719)
PM*	Pressuremeter test (ASTM:D4719)
VS*	Field vane shear (ASTM:D2573)
IR*	Infiltrometer test (ASTM:D3385)
RQD	Rock quality designation, percent

* Results shown on attached data sheet or graph
** ASTM designates American Society for Testing and Materials

TERMINOLOGY

Particle Sizes

Type	Size Range
Boulders	> 12"
Cobbles	3" – 12"
Coarse gravel	3/4" – 3"
Fine gravel	#4 sieve – 3/4"
Coarse sand	#4 - #10 sieve
Medium sand	#10 - #40 sieve
Fine sand	#40 - #200 sieve
Silt	100% passing #200 sieve and > 0.005 mm
Clay	100% passing #200 sieve and < 0.005 mm

Soil Layering and Moisture

Term	Visual Observation
Lamination	Up to 1/4" thick stratum
Varved	Alternating laminations of any combination of clay, silt, fine sand, or colors
Lenses	Small pockets of different soils in a soil mass
Stratified	Alternating layers of varying materials or colors
Layer	1/4" to 12" thick stratum
Dry	Powdery, no noticeable water
Moist	Damp, below saturation
Waterbearing	Pervious soil below water
Wet	Saturated, above liquid limit

Gravel Content

Coarse-Grained Soils

% Gravel	Description
2 – 15	A little gravel
16 – 49	With gravel

Fine-Grained Soils

% Gravel	Description
< 5	Trace of gravel
5 – 15	A little gravel
16 – 30	With gravel
31 – 49	Gravelly

Standard Penetration Resistance

Cohesionless Soils

N-Value	Relative Density
0 – 4	Very loose
5 – 10	Loose
11 – 30	Medium dense
31 – 50	Dense
> 50	Very dense

Cohesive Soils

N-Value	Consistency
0 – 4	Very soft
5 – 8	Soft
9 – 15	Firm
16 – 30	Hard
> 30	Very hard

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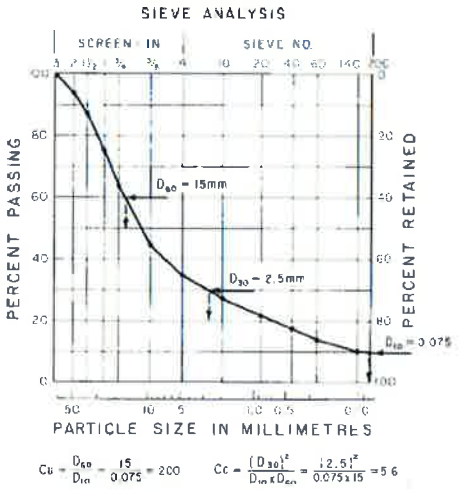
Element St. Paul

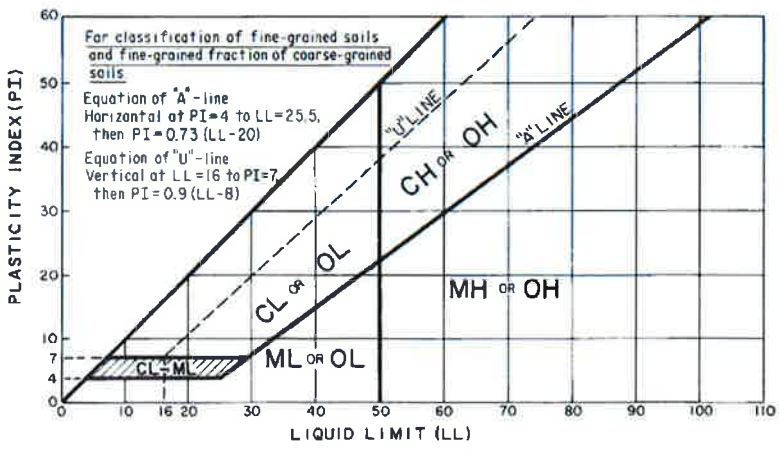
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM D2487 (Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
COARSE-GRAINED SOILS	Gravels (More than 50 % of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5 % fines[C])	$Cu \geq 4$ and $1 \leq Cc \leq 3$[D]	GW	Well-graded gravel[E]
			$Cu < 4$ and/or $[Cc < 1$ or $Cc > 3]$[D]	GP	Poorly graded gravel[E]
		Gravels with Fines (More than 12 % fines[C])	Fines classify as ML or MH	GM	Silty gravel[E,F,G]
More than 50 % retained on No. 200 sieve			Fines classify as CL or CH	GC	Clayey gravel[E,F,G]
	Sands (50 % or more of coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5 % fines[H])	$Cu \geq 6$ and $1 \leq Cc \leq 3$[D]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $[Cc < 1$ or $Cc > 3]$[D]	SP	Poorly graded sand[I]
		Sands with Fines (More than 12 % fines[H])	Fines classify as ML or MH	SM	Silty sand[F,G,I]
			Fines classify as CL or CH	SC	Clayey sand[F,G,I]
FINE-GRAINED SOILS	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
50 % or more passes the No. 200 sieve	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12 % fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
[D] $Cu = D_{60}/D_{10}$ $Cc = (D_{30})^2 / D_{10} \times D_{60}$
[E] If soil contains ≥15 % sand, add "with sand" to group name.
[F] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[G] If fines are organic, add "with organic fines" to group name.
[H] Sands with 5 to 12 % fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
[I] If soil contains ≥15 % gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to <30 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥30 % plus No. 200, predominantly sand, add "sand " to group name.
[M] If soil contains ≥30 % plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.





FIELD EXPLORATION PROCEDURES

Soil Sampling

Soil sampling was performed in accordance with ASTM D 1586. Using this procedure, a 2" O.D. split barrel sampler is driven into the soil by a 140 pound weight falling 30". After an initial set of 6", the number of blows required to drive the sampler an additional 12" is known as the penetration resistance, or N value. The N value is an index of the relative density of cohesionless soils and the consistency of cohesive soils. Thin wall tube samples were obtained according to ASTM D 1587 where indicated by the appropriate symbol on the boring logs. Rock core samples, if taken, were obtained by rotary drilling in accordance with ASTM D 2113. Power auger borings, if performed, were done in general accordance with ASTM D 1452.

Soil Classification

As the samples were obtained in the field, they were visually and manually classified by the crew chief in accordance with ASTM D 2488. Representative portions of the samples were then returned to the laboratory for further examination and for verification of the field classification. Logs of the borings indicating the depth and identification of the various strata, the N value, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the drill holes are attached. The descriptive terminology and symbols used on the boring logs are also attached.

PREREQUISITES FOR SOUND ENGINEERING PRACTICE

In order to properly evaluate the foundation soils at a building site, it is imperative for our firm to know exactly where the building will be placed, its size, and the elevation of the foundation elements. Without this information, a judgment regarding the adequacy of the preparatory foundation earthwork is not possible.

This project data is especially critical in situations when the excavation extends below the footing grade and compacted fill is required to attain building elevations. In these situations, the excavation would require lateral oversizing to provide suitable lateral distribution of the footing loads.

Offset batter boards of the building lines stakes provide the best on-site verification of the building location and size. It must be recognized that Element St. Paul does not practice in the field of surveying. Therefore, we must rely on staking by others. If Element St. Paul is required to perform the survey, we will retain a licensed surveyor and invoice our client for the amount per our current fee schedule. Provision of the building foundation plans is also important so that we may properly perform our engineering judgments.

If the construction is redesigned or otherwise moved subsequent to our work, we should be informed so our firm can assess if additional engineering observation is required or suggest sound engineering alternatives. We cannot be responsible for any soil foundation system if the structure has been relocated with respect to the excavation subsequent to our observations.

CONSTRUCTION OBSERVATIONS AND TESTING

The recommendations made in this report have been made based on the subsurface conditions found in the borings. It is possible that there are soil and water conditions on site that were not represented by the borings. Consequently, on-site observation during construction is considered integral to the successful implementation of the recommendations. We believe that qualified field personnel need to be on site at the times outlined below to observe the site conditions and effectiveness of the construction.

We recommend that the completed excavation and prepared subgrade be observed and tested by a soils engineer/technician prior to fill placement or construction of any foundation elements. These observations would be necessary to judge if all unsuitable materials have been removed from within the planned construction area and that an appropriate degree of lateral oversize has been provided for in those areas where fill will be placed below the bottom of foundation grade.

We recommend a representative number of field density tests be taken in all engineered fill placed to aid in judging its suitability. We suggest that at least one density test be performed for at least every 2,500 square feet of engineered fill placed for every 2' of fill depth. Additional tests should be taken where confined areas are compacted. Any proposed fill material should be submitted to the laboratory for tests to check compliance with our recommendations and project specifications.

PRECAUTIONS FOR EXCAVATING AND REFILLING DURING COLD WEATHER

The winter season in this area presents specific problems for foundation construction. Soils that are allowed to freeze undergo a moisture volume expansion, resulting in loss of density. These frost-expanded soils will consolidate upon thawing, causing settlement of any structure supported on them. To prevent this settlement, frost should not be allowed to penetrate into the soils below any proposed structure.

Ideally, winter excavation should be limited to areas small enough to be refilled to grade higher than footing grade on the same day. Typically, these areas should be filled to floor grade. Trenching back down to unfrozen soils for foundation construction can then be performed just prior to footing placement. The excavated trenches should be protected from freezing by means of insulating or heating during foundation construction. Backfilling of the foundation trenches should be performed immediately after the below-grade foundation construction is finished. In addition, any interior footings or footings designed without frost protection should be extended below frost depth, unless adequate precautions are taken to prevent frost intrusion until the building can be enclosed and heated.

In many cases, final grade cannot be attained in one day's time, even though small areas are worked. In the event final grade cannot be attained in one day's time, frost can be expected to develop overnight. Leaving a layer of loose soil on top of the compacted material overnight can minimize the depth of frost penetration. However, any frost that forms in this loose layer, or snow that accumulates, should be completely removed from the fill area prior to compaction and additional soil placement. Frozen soils or soils containing frozen material or snow should never be used as fill material.

After the structure has been enclosed, all floor slab areas should be subjected to ample periods of heating to allow thawing of the soil system. Alternatively, the frozen soil can be completely removed and be replaced with an engineered fill. The floor slab areas should be checked at random and representative locations for remnant areas of frost and density tests should be performed to document fill compaction to slab placement.

Due to the potential problems associated with fill placement during cold weather, a full-time, on-site soils technician should monitor any filling operations. Full-time monitoring aids in detecting areas of frozen material, or potential problems with frozen material within the fill, so the appropriate measures can be taken. The choice of fill material is particularly important during cold weather, since clean granular fill material can be placed and compacted more efficiently than silty and clayey soils. In addition, greater magnitudes of heaving can be expected with freezing of the more frost susceptible silts and clays.

If more specific frost information or cold weather data concerning other construction materials is required, please contact us.