SUBSURFACE GEOTECHNICAL ASSESSMENT

Solid Rock Construction
956 Geranium Avenue East
Saint Paul, Minnesota 55106

Project 2016.001

PREPARED BY
MTM ENVIRONMENTAL, INC.
1871 MELROSE AVENUE SOUTH
ST LOUIS PARK, MN 55426

January 11, 2016

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1871 MELROSE AVENUE SOUTH
ST LOUIS PARK, MN 55426
651.776.6211

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OBJECTIVES AND SCOPE OF SERVICES

MTM Environmental, Inc., 1871 Melrose Avenue South, St Louis Park, Minnesota, 55426 was retained by Solid Rock Construction, herein after referred to as the Client, to perform a subsurface geotechnical assessment on a parcel of land located at the address in the above title block. The purpose of this investigation is to identify and evaluate soil properties on the site with respect to building a new single family structure, to be determined in the future and is not known at the time this report.

On January 8, 2016, one (1) soil boring was performed to nominal depths of 36.5± feet within the project area at locations directed by the client. From the resulting data, conclusions are drawn regarding site suitability for the proposed use and recommendations are presented regarding site correction procedures and foundation and slab design.

SCOPE OF SERVICES

The client authorized the following scope of services:

Perform two (2) standard penetration test borings to nominal depths of 20± feet below grade or refusal.

Sample soil using a 2" O.D. split-barrel sampler driven into the soil by a 140 lb 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 internal friction of cohesionless soil, the consistency of cohesive soils, and the density of all soils. Sampling will conform to the methods set forth in ASTM procedure D1586-84.

Classify recovered soil samples by the Visual-Manual method in accordance with ASTM D-2488. Representative portions of the samples may be submitted to the laboratory for further examination and for verification of the field classification in accordance with ASTM D2487-85. Information indicating depth and identification of the various strata, the N-value, water level information and pertinent information regarding the drilling method will be documented on comprehensive soil boring logs.

Prepare an engineering report including a log of each boring along with our recommendations for allowable soil bearing pressures and estimates of foundation settlement.

The purpose of this report is to present the results of our field and laboratory exploration assessment and the associated engineering review. Please note that this report is for geotechnical purposes only and is not intended to document the presence or absence of any environmental contaminants that could be present at the site.

SITE OBSERVATIONS

The site is currently has an existing house and garage on the lot. The Client proposes to build a new house and garage.

BORING LOCATIONS AND ELEVATION

The number of borings and their locations were determined by the Client and site access ability, as shown on the enclosed sketch. Please refer to the sketch attached to this report for boring locations.

FIELD INVESTIGATION

The borings were accomplished using the Standard Penetration Test (SPT) method of investigation using a Split-Barrel Sampler (SBS) and the Flight Auger (FA) method. An attachment describes the soil classification system used (Unified).

SOIL BORING RESULTS

Refer to the individual boring logs for a detailed description of soils and moisture conditions encountered. Attached to the soil boring logs is a key explaining terms and entries. The depth of individual layers of soils may vary somewhat from those indicated on the logs due to unsampled intervals between split-barrel sampler tests and, most importantly, the occurrence of transition between soil layers. Also, soil profiles not in the vicinity of the borings may vary. Refusal to auger advancement was not encountered indicating no bedrock to depths tested.

Perched groundwater was found 8± feet to 12.5± feet below existing ground grade in the borehole. Please refer to the Log of Boring for the groundwater level readings. Groundwater levels may occur and vary according to various climatological and meteorological influences undetermined within the time frame, scope and budget allowed in this investigation. In addition, area development patterns can influence groundwater. The indicated groundwater results are for conditions at the time of testing only.

CONCLUSIONS AND RECOMMENDATIONS

1. General Site Suitability

Based upon interpreted results of the borings, it appears that the site has limitations regarding suitability for construction. These limitations consist of the presence of Fill, Debris, and Organic Sediments, which is unsuitable for foundation or slab support in the upper 19± feet of the soil profile. Due to existing adjacent houses, located north and south of the site, the cut and fill approach, with proper oversizing, at depths of 19± feet is not practical.

2. Recommendation - Screw Anchor System

I) Screw Anchor System

A. Foundations

Install steel screw anchors (such as Helical Pier Foundation Systems, installed as per manufacturer's specifications). Foundation is to be constructed of poured concrete walls with steel reinforcement, or with grade beams and poured concrete wall with steel reinforcement, please consult a structural engineer for design.

B. Garage and Basement Floor Slabs

All Garage and Basement Floor Slabs shall be structural, concrete with steel reinforcement, please consult a structural engineer for design.

Basement Slabs should have clearance from maximum anticipated groundwater level and should be protected from intrusion by surface waters. As per the International Building Code 1803.5.4, the elevation of the lowest floor level, where such floor is located below the finished ground level, shall have a clearance of five feet or more from known groundwater level. According to the boring evidence this advisory is met when the assumed basement slab elevation is 3± feet below existing grade.

Site grading should be controlled so that no opportunity is provided for water to enter subsoil or foundation wall backfill areas.

Please refer to the standard data sheet at the end of this report entitled "Floor Slab Moisture/Vapor Protection".

3. Final Site Topography

There should be no opportunity for surface water runoff to enter the subsoil or foundation wall backfill areas. Finished site grading must allow for surface water runoff to be directed away from the house and garage. The house and garage should be at a higher elevation than the surrounding yard in order for water to run away from the house and garage. Final soil surfaces should be graded to provide adequate drainage from structures and hard surfaces so that as little water as possible infiltrates into soils adjacent to the structures. The areas adjacent to the foundation walls should be adequately compacted, not loosely placed, to avoid this zone acting as a sump and creating nuisance conditions in the building area.

All topsoil and any other unsuitable material should be stripped from the all proposed building structure areas and driveways. All excavated organic material, uncontrolled fill, wet unstable soil or other soil contaminated with topsoil, vegetation, etc, should be disposed of offsite, or in non-load bearing landscaping areas.

LIMITATIONS OF INVESTIGATION

The Geotechnical Engineer has prepared this report using an ordinary level of care and in accordance with generally accepted foundation and soil engineering practices. Because the borings represent only a small portion of the total site and for other reasons, MTM Environmental, Inc. does not warrant that the borings are necessarily representative of the entire site but only of the boring locations at the time of investigation. No warranty of the site is made or implied. The boring logs should only be used in preliminary design and estimating work and in conjunction with corrective procedures.

The scope of this report is limited strictly to geotechnical issues which include the establishment of soil profile and only those conclusions expressly made. Please note that this work is not intended to document the presence or absence of any environmental contaminants at the site, nor for identifying applicable local, state or federal laws or regulations of a non-geotechnical nature which may or may not be applicable to this site. Further, MTM Environmental, Inc. will not be held responsible for facts not disclosed to the Geotechnical Engineer.

The bore hole voids were backfilled by MTM Environmental, Inc. using native cuttings or sealed as per the Minnesota Department of Health Rules. Some continuing settlement may occur if construction does not take place in the near future. If settlement does occur, the Client should backfill with additional material.

This report and all supporting information is furnished only to the Client and his assigns for the designated purpose. No representations to other parties or for other uses are made.

Soil samples retrieved during the investigation process will be retained in the office of MTM Environmental, Inc. for a period of 30 days from the date of testing. After 30 days, the samples may be discarded unless a request is received to retain for a longer period.

STANDARD OF CARE

Services performed by MTM Environmental, Inc. for this project have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time constraints. No warranties, expressed or implied, are made. The material contained in this report is to be considered confidential. Distribution, sale or publication of this report or any part thereof without the expressed written consent of MTM Environmental, Inc. is prohibited. Additional copies of this report and their associated reliance may be obtained by contacting us.

ENGINEERS CERTIFICATE

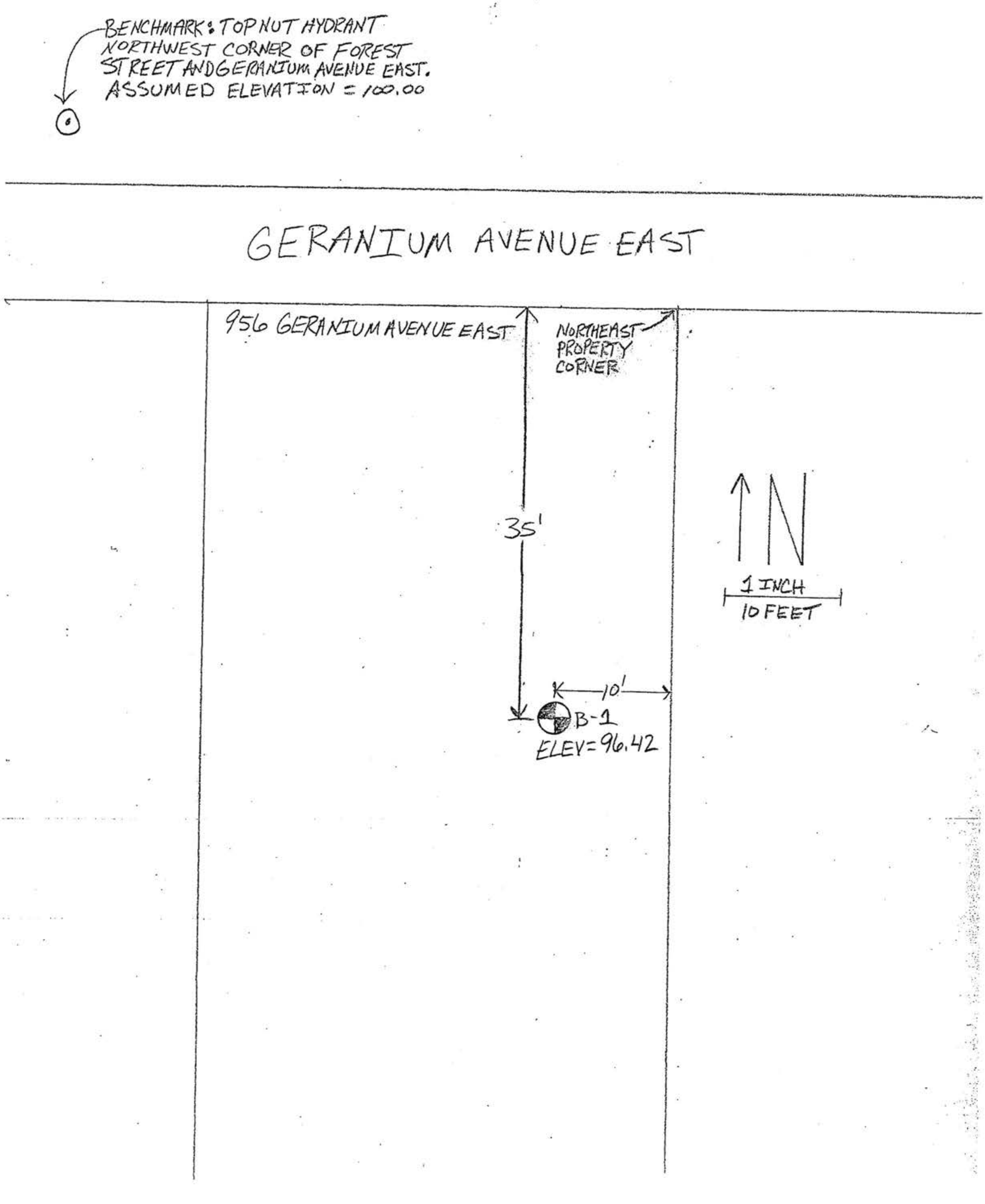
I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the Laws of the State of Minnesota.

MTM ENVIRONMENTAL, INC.

Jonathan L. Faraci, PE
Minnesota Registration No. 16464

QA/QC Reviewed.

By
Mike Malinowski, CES


BENCHMARK: TOP NUT HYDRANT
NORTHWEST CORNER OF FOREST
STREET AND GERANIUM AVENUE EAST.
ASSUMED ELEVATION = 100.00
GERANIUM AVENUE EAST
956 GERANIUM AVENUE EAST
NORTHEAST
PROPERTY
CORNER
35'
10'
B-1
ELEV=96.42
N
1 INCH
10 FEET

SOIL BORING LOG

MTM ENVIRONMENTAL, INC.
1871 Melrose Avenue South
St Louis Park, Mn 55426

PROJECT: 956 Geranium Avenue East, Saint Paul, MN

LOG OF BORING NO: 1

DEPTH IN FEET	SURFACE ELEVATION: 96.42 DESCRIPTION & CLASSIFICATION	GEOLOGY	N	WB	SAMPLE #	SAMPLE TYPE	SAMPLE R	LAB & OTHER TESTS W	DEN	L.L./P.L.	
1- 2-	(0'-3') Fill consisting of Black, Organic Silt, (OL), and Brown, Clayey Sand, fine grained, poorly graded, (SC), Moist	Fill	F	N	1	FA	N/A				
3- 4- 5-	(3'-5') Fill consisting of Brown, Silty Sand, fine grained, poorly graded, (SM), Moist, Medium Dense		24	N	2	SBS	13				
6- 7-	(5'-7.8') Fill consisting of Brown, Silty Sand, with Clayey Sand lenses, and some Silt and Debris, fine grained, poorly graded, (SM-SC), Loose		9	N	3	SBS	12				
8- 9- 10-	(7.8'-10') Fill consisting of Brown, Silty, Clayey Sand, fine grained, poorly graded, (SC), Waterbearing, Very Loose		4	N	4	SBS	14				
11- 12-	(10'-15') Fill consisting of Brown, Silty Sand, fine grained, poorly graded, (SM), Waterbearing, Very Loose		4	Y	5	SBS	7				
13- 14- 15-	— with Organic Silt, (OL), Peat, (Pt), and Debris from 12.5 feet to 15 feet. Medium Dense and Moist at 12.5 feet.		11	N	6	SBS	10				
16- 17- 18-	(15'-19') Gray, Organic Clay, with Black Peat Lenses, (OL-Pt), Moist, Medium	Organic Sediments	6	N	7	SBS	13				
19-			14	N	8	SBS	18				
20- 21-	(19'-23.5') Gray, Sandy, Clayey Silt, (ML), Moist, Medium Dense	Glacial Till						WEATHER: Cloudy/Snow TEMP: 33°			

Continued on next page.

WATER LEVEL MEASUREMENTS

DATE	TIME (HRS)	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL
1/8/16	12:10 pm	36.5'	35'	N/A	N/A	Dry
1/8/16	12:20 pm			9.0'	N/A	Dry
1/8/16	12:30 pm			9.0'	N/A	Dry

DRILLING DATA

CREW CHIEF: ML/DL
METHOD: 3 1/4" HAS / FA
2" OD SBS
CME 45
BORING COMPLETED: 1/8/16

SOIL BORING LOG

MTM ENVIRONMENTAL, INC.
1871 Melrose Avenue South
St. Louis Park, Mn 55426

PROJECT: 956 Geranium Avenue East, Saint Paul, MN

LOG OF BORING NO: 1

DEPTH IN FEET	SURFACE ELEVATION: 96.42 DESCRIPTION & CLASSIFICATION	GEOLOGY	N	WB	SAMPLE #	SAMPLE TYPE	SAMPLE R	LAB & OTHER TESTS W	DEN	L.L./P.L.	
21-	Continued	Glacial Till									
22-											
23-			37	N	9	SBS	12				
24-	(23.5'-36.5') Brown, Silty Sand, with a little Gravel, fine grained, poorly graded, (SM), Moist, Dense										
25-											
26-											
27-											
28-											
29-											
30-											
31-			50+	N	10	SBS	3				
32-											
33-											
33-											
35-											
36-											
37-	End of Boring at 36.5 feet. No Refusal.		50+	N	11	SBS	12				
38-											
39-											
40-											
41-											

WEATHER: Cloudy/Snow

TEMP: 33°

WATER LEVEL MEASUREMENTS

DATE	TIME (HRS)	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL
1/8/16	1:10 pm	36.5'	35'	N/A	N/A	Dry
1/8/16	1:20 pm			9.0'	N/A	Dry
1/8/16	1:30 pm			9.0'	N/A	Dry

CREW CHIEF: ML/DL

METHOD: 3 1/4" HAS / FA

2" OD SBS

CME 45

BORING COMPLETED: 1/8/16

SOIL BORING LOG

PROJECT: BORING LOG KEY

LOG OF BORING NO: ____________

DEPTH IN FEET	SURFACE ELEVATION: / DESCRIPTION AND CLASSIFICATION	GEOLOGY	N	WB	SAMPLE #	SAMPLE TYPE	SAMPLE R	LAB & OTHER TESTS W	DEN	L.L. P.L.	
1–21											

Soil Classification, using visual-manual and/or laboratory methods, according to the Unified Soil Classification System, or to other system as appropriate

Origin of Soil

Other Data as necessary

Atterberg Limits*

Penetration "N" Value - Number of blows to drive Split-Barrel Sampler one foot

Inplace Density* pcf

Moisture Content* %

Water Bearing
Y = Yes
N = No
▼ = Water Level Symbol

Length of Sample Recovered

Sample Number

Indicates Type of Sample:
SBS = Split-barrel
FA = Flight Auger
HA = Hand Auger
ST = Shelby Tube (thinwall)

* = Lab test on recovered sample

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING MUD LEVEL	WATER LEVEL

DRILLING DATA

Crew Chief: ____________

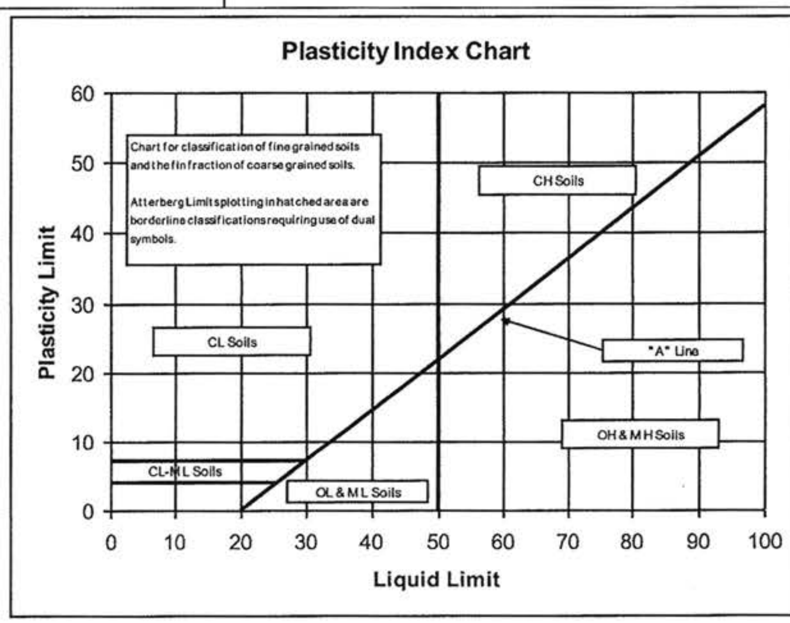
Method: ____________

Boring Completed: ____________

Classification of Soils for Engineering Purposes

ASTM Designation D-2487 and D 2488 (Unified Soil Classification System)

Major Divisions			Group Symbols	Typical Names	Classification Criteria	
Course Grained Soils More than 50% retained on No. 200 sieve *	***Gravels*** 50% or more of coarse fraction retained on No. 4 sieve.	Clean Gravels	**GW**	Well –graded gravels and gravel-sand mixtures, little or no fines.	***Classification on basis of percentage of fines.*** Less than 5% passing No. 200 Sieve: GW, GP, SW, SP More than 12% passing No. 200 Sieve: GM, GC, SM, SC From 5% to 12% passing No. 200 Sieve: Borderline Classification requiring use of duel symbols.	$C_u = D_{60} / D_{10}$ greater than 4. $C_z = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 & 3.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.		Not meeting both criteria for GW materials.
		Gravels with Fines	**GM**	Silty gravels, gravel-sand-silt mixtures.		Atterberg limits below "A" line, or P.I. less than 4. / Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.		Atterberg limits above "A" line with P.I. greater than 7.
	Sands More than 50% of coarse fraction passes No 4 sieve.	Clean Sands	**SW**	Well-graded sands and gravelly sands, little or no fines.		$C_u = D_{60} / D_{10}$ greater than 6. $C_z = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 & 3.
			SP	Poorly-graded sands and gravelly sands, little or no fines.		Not meeting both criteria for SW materials.
		Sands with Fines	**SM**	Silty sands, sand-silt mixtures.		Atterberg limits below "A" line, or P.I. less than 4. / Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.		Atterberg limits above "A" line with P.I. greater than 7.
Fine Grained Soils More than 50% passes No. 200 sieve *	***Silts and Clays*** Liquid Limit of 50% or less		**ML**	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.		
			OL	Organic silts and organic silty clays of low plasticity.		
	Silts and Clays Liquid Limit greater than 50%.		**MH**	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.		
			CH	Inorganic clays of high plasticity, fat clays.		
			OH	Organic clays of medium to high plasticity.		
	Highly Organic Soils		**Pt**	Peat, muck and other highly organic soils.		



GENERAL TERMINOLOGY NOTES FOR SOIL IDENTIFICATION AND DESCRIPTION

GRAIN SIZE

Term	ASTM
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt and clay)	Pass #200 sieve

GRAVEL PERCENTAGES

Term	Percent
A little Gravel	3% to 15%
With Gravel	15% to 30%
Gravelly	30% to 50%

CONSISTENCY OF PLASTIC SOILS

Term	N-Value. BPF
Very Soft	less than 2
Soft	2-4
Medium	5-8
Stiff	9-15
Very Stiff	16-30
Hard	Greater than 30

RELATIVE DENSITY OF NON-PLASTIC SOILS

Term	N-Value. BPF
Very Loose	0-4
Loose	5-10
Medium Dense	11-30
Dense	31-50
Very Dense	Greater than 50

MOISTURE/FROST CONDITION

D (Dry):	Absence of moisture, dusty, dry to touch.
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over 'optimum").
W (Wet/ Waterbearing):	Free water visible. Intended to describe non-plastic soils.
F (Frozen):	Soil frozen.

LAYERING NOTES.

Laminations:	Layers less than ½"thick of differingmaterial or color.
Lenses:	Pockets of layers greater than ½" thick of differing material or color.

FIBER CONTENT OF PEAT

Term	Fiber Content (Visual Estimate)
Fibric	Greater than 67%
Hemic	33 to 67%
Sapric	Less than 33%

ORGANIC DESCRIPTION

Non-peat soils are described as organic, if soil is judged to have sufficient organic content to influence the soil properties.

FLOOR SLAB MOISTURE/VAPOR PROTECTION

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1-96, a "base material" is recommended, rather than the conventional cleaner "sand cushion" material. The manual maintains that clean sand (common "cushion" sand) is difficult to compact and maintain until concrete placement is complete. ACI recommends a clean, fine graded material (with at least 10% to 30% of particles passing a #100 sieve) which is not contaminated with clay, silt or organic material. We refer you to ACI 302.1-96 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an underfloor drainage system may be needed wherein a draintile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types an rate/head or water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require a vapor membrane to maintain a specified maximum slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A numberr of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed below the granular layer, include reduction of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane over the granular layer include the following:

- The moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used to vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled area (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where the precipitation will not intrude into the slab area. Considerations should be given to slight sloping of the membrane to edges where draintile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, you decision will need to weigh the cost of subgrade options and the performance risks.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater is soils with higher percentage of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about ¼" to ⅜" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence, or similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where backfill soils are poorly compacted and become saturated. Additional footing embedment and/or widened footings below the frost zones (which includes tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

BASEMENT/RETAINING WALL BACKFILL AND WATER CONTROL

DRAINAGE

Below grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump pump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior daylighting, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, damp/water proofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2', and then upward and outward from the wall at a 30° or greater angle from vertical. The sands should contain no greater than 10% by weight passing the #200 sieve, which would include (SP) and (SP-SM) soils. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slab/pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

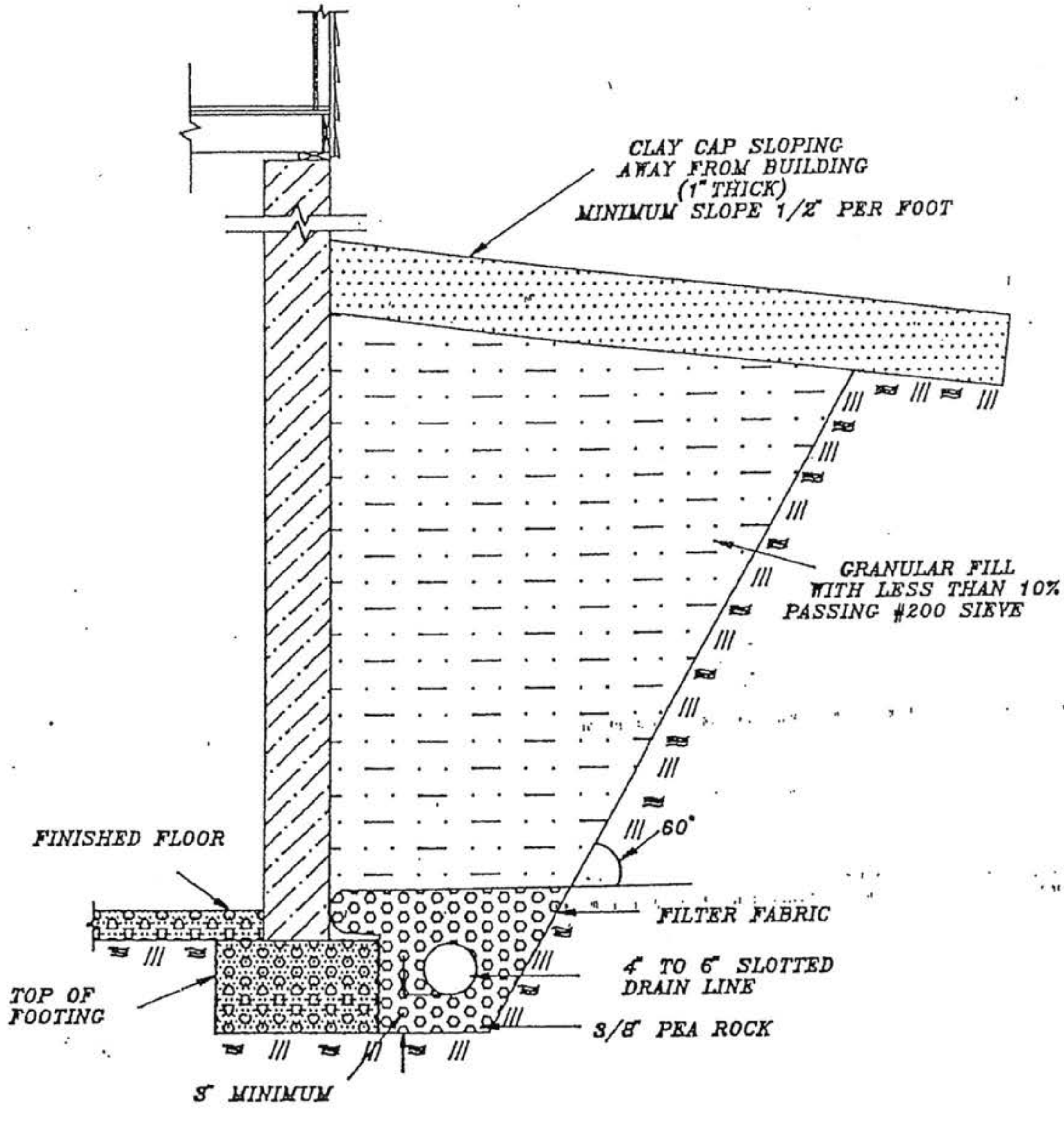
LATERAL PRESSURES

Lateral earth pressures on below grade walls vary, depending on backfill soil classification, backfill compaction and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the standard Proctor density and a level ground surface.

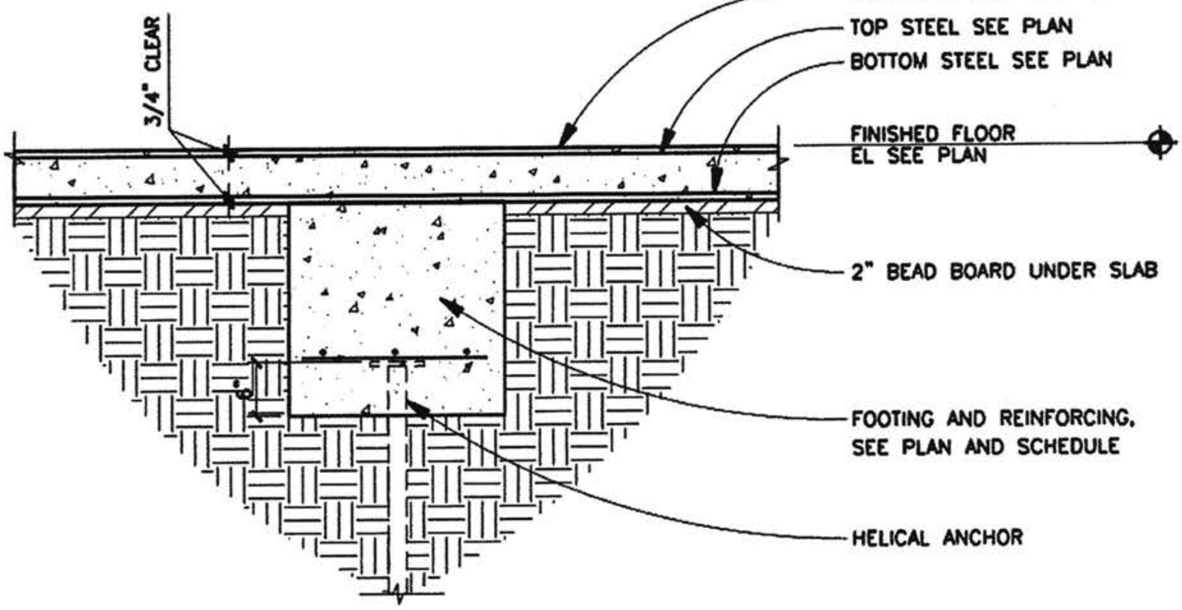
Equivalent Fluid Density

Soil Type	Active (pcf)	At-Rest (pcf)
Sands (SP or SP-SM)	30	45
Silty Sands (SM)	40	60
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the "at-rest" pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.



TYPICAL PERIMETER
DRAIN DETAIL



4 PILE CAP SECTION

3/4"=1'-0"

Gmail by Google

Solid Rock Construction <service@srcmn.com>

956 Geranium - Engineer's Report

1 message

Karpen, Brian (CI-StPaul) <brian.karpen@ci.stpaul.mn.us> Thu, Jun 9, 2016 at 10:36 AM
To: "service@srcmn.com" <service@srcmn.com>

Harlan:

As I mentioned I spoke with Stephanie Young of MMY regarding the report they had previously provided. She does not have an issue with me providing that report to you, with the following caveat. MMY has no interest in providing further engineering to rehabilitate the existing structure, as stated in the report they believe rehabilitation is not feasible and the wood structure of the house is not salvageable in its current condition.

SAINT PAUL

Brian Karpen, P.E.
Structural Engineer
Department of Safety and Inspection
375 Jackson St. Suite 220
Saint Paul, MN 55101

P: 651-266-9072

The Most Livable City in America **F:** 651-266-9124

brian.karpen@ci.stpaul.mn.us

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"DSI's Mission: To preserve and improve the quality of life in Saint Paul by protecting and promoting public health and safety for all."

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956 Geranium - MMY Engineering.pdf
1225K

Mattson
Macdonald
Young
structural
engineers

Bassett Creek Business Center
901 North 3rd Street, #100
Minneapolis, MN 55401

612-827-7825 voice
612-827-0805 fax

February 10, 2016

Mr. John Ellering
Select Associates Realty
2233 Hamline Avenue N
Roseville, MN 55113

RE: Foundation Assessment
956 Geranium Ave E
St. Paul, Minnesota

Dear Mr. Ellering:

As requested, I visited the above referenced site to assess the condition of the residential foundation. The home is currently vacant and on the market for sale. The 1 1/2 story, single family residence (see Photo 1) sits atop a foundation system of exterior stone walls and interior heavy timber support beams. My review was limited to the main level structure and the foundation area below. No lighting was available in the lower level, so my review was limited to those areas I could illuminate with a flash light.

Along the perimeter of the house, a poured concrete ledge was visible, projecting out from the face of the exterior wall (see Photo 2). This ledge is a source of standing water which has been allowed to enter the rim joist and main floor framing members. The water intrusion appears to have resulted in damage/rot throughout the perimeter of the house (see Photo 3).

Other areas were noted as locations where water has been allowed to penetrate the foundation system. Poorly constructed window wells (see Photo 4), window sills located near exterior grade level (see Photo 5), and an exterior stair providing access to the lower level (see Photos 6 &7) have all contributed to the moisture problem. In addition, the lower level stair structure did not appear to have adequate frost coverage at the foundation, so heave/settlement due to frost effects have also been an issue.

The majority of the existing stone foundation walls had been covered in a concrete/stucco parge coat, so identifying particular areas of deterioration was difficult. However, in locations where applying a finish was difficult, there are numerous signs of deterioration and settlement (see Photos 8 & 9).

The main floor framing consisted of 2 x 8 floor joists, spaced at 16" o.c. In most areas, the joists were inadequately supported (no joist hangers, insufficient bearing length). Many of the headers over openings were undersized and in many cases, the joists were heavily notched or drilled (see Photos 10, 11 & 12), decreasing their load carrying capacity.

I walked the through the lower level, testing the concrete slab. There is evidence of large pockets of voids below the slab. The slab suffers throughout from general cracking, but given more soil settlement, it is likely that areas of the concrete will fail. When conducting a "heel drop" test, the sound is quite hollow and there are areas where the slab has settled quite differently from the surrounding concrete. This is fairly typical with poor quality soils that are prone to differential settlement and compaction rates.

Based on the data above, I do not believe that foundation repair is a feasible option. For this, the foundation walls and floor system should be capable of accommodating some movement without distress. I do not believe this is the case. It may be possible to simply stabilize the foundation against further movement and/or settlement, but even if this is accomplished, the remaining structure should be evaluated and reinforced appropriately to allow it to perform adequately in the future. In either case, repair or stabilization, it would also be necessary to design a supported floor structure to replace the damaged slab. This could be accomplished through the addition of a structural concrete slab or a wood floor framing system, supported off of the exterior perimeter walls and the addition of a center support beam other foundation pier system.

Please contact me if you have questions or require additional information.

Sincerely,

Mattson Macdonald Young, Inc.

Stephanie J Young

Stephanie J. Young, P.E.
MN License – 21520

Photo 1 – North Elevation of 956 Geranium Ave

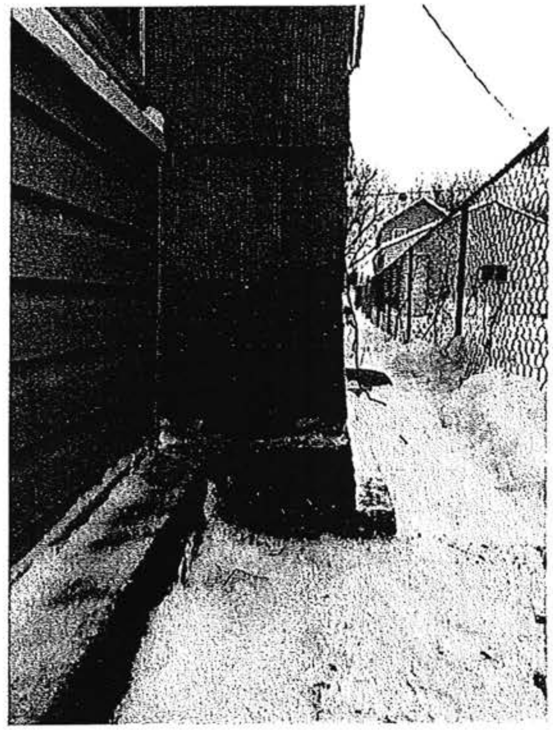

Photo 2 – Poured Concrete Ledge at Perimeter

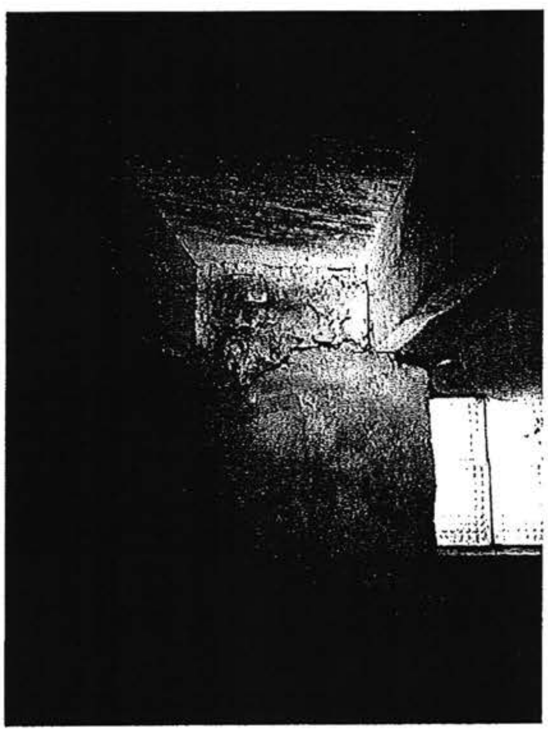

Photo 3 – Damaged/Rotted Wood Floor Joists

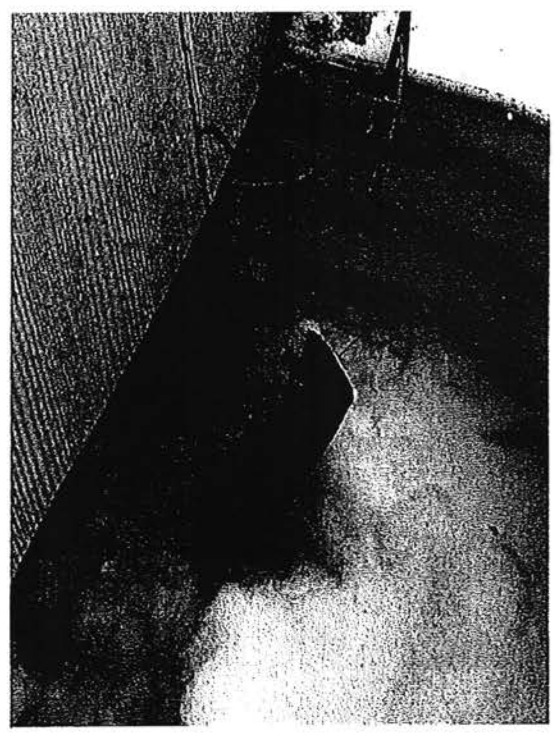

Photo 4 – Window Well with High Interior Grade Level

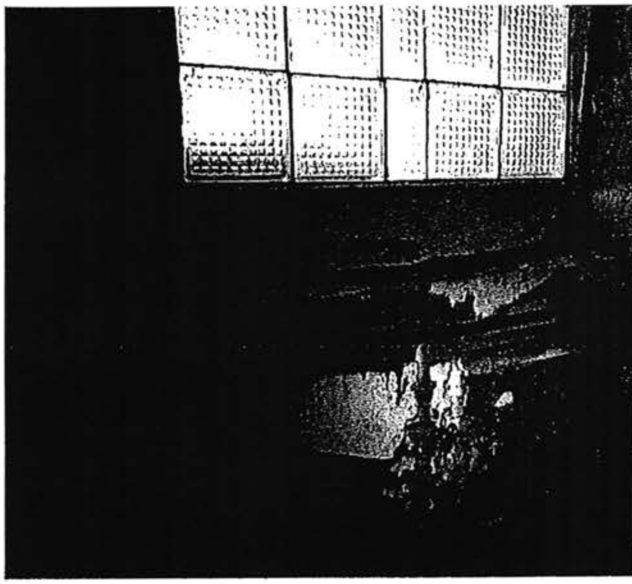

Photo 5 – Low Window Sill Allowing Moisture Infiltration

Photo 6 – Uninsulated, Unprotected Exterior Stair Access

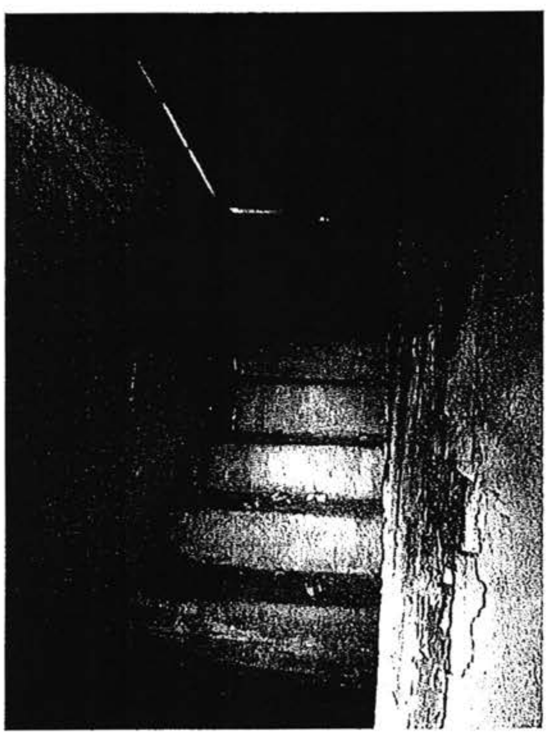

Photo 7 – Stair Access Allowing Moisture Infiltration

Photo 8 – Cracked, Settling Stone/Brick Foundation Wall

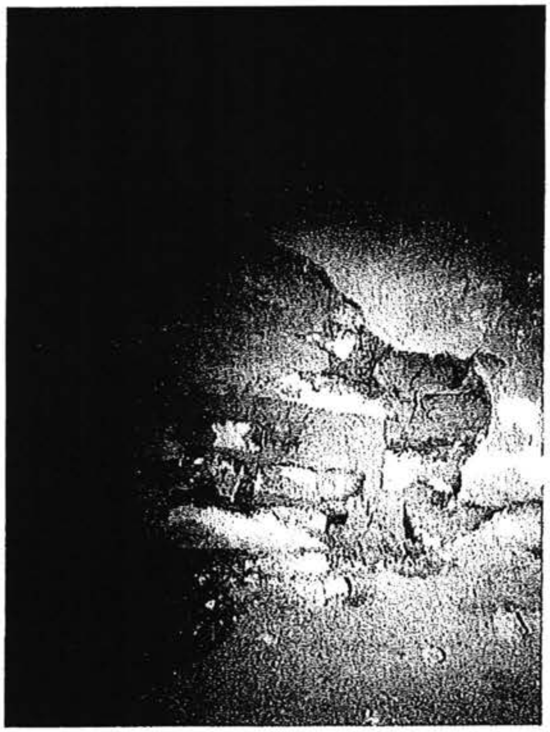

Photo 9 – Damaged Parge Coat and Crumbling Foundation Wall

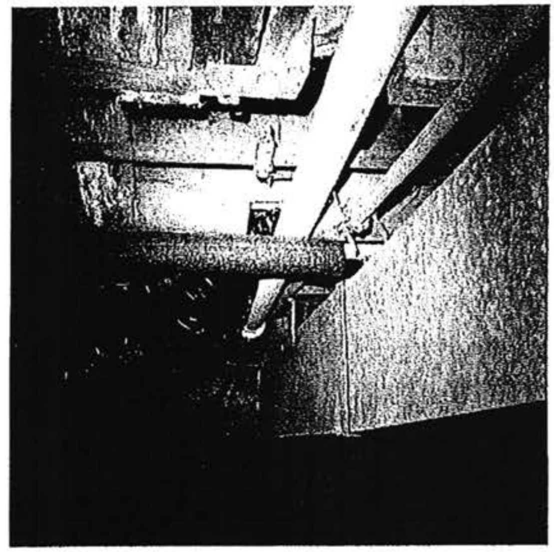

Photo 10 – Notched Floor Joists

Photo 11 – Notched Floor Joist without Joist Hanger

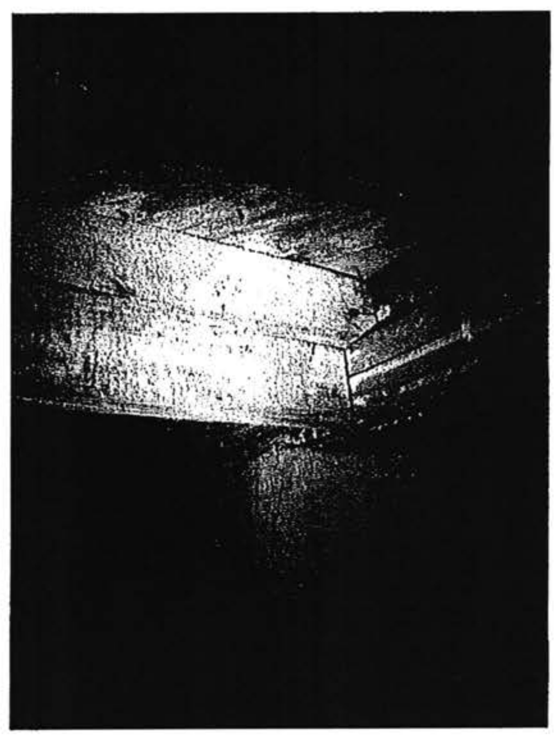

Photo 12 – Notch and Cracked Floor Joist