A Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment for Hennepin County Regional Railroad Authority

Proposed Roadway and Bridge
Sumner-Olson Redevelopment Area
Dunwoody Boulevard to Girard Avenue North
Minneapolis, Minnesota

Service Contract Number: A02177
Project Number: 9970111

Project BABX-98-908

March 26, 1999

Braun Intertec Corporation

BRAUN INTERTEC

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Engineers and Scientists Serving the Built and Natural Environments

March 26, 1999

Project BABX-98-908

Mr. Dean Michalko, PE
Hennepin County Regional Railroad Authority
417 North Fifth Street, Suite 320
Minneapolis, MN 55401-1362

Dear Mr. Michalko:

Re: Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment, Proposed Roadway and Bridge, Sumner-Olson Redevelopment Area, Dunwoody Boulevard to Girard Avenue North, Minneapolis, Minnesota

Service Contract Number: A02177
Project Number: 9970111

As authorized, we have completed our Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment. The purposes of the work were to conduct geotechnical and environmental evaluations to provide information for making design decisions and for estimating the costs of potential environmental remediation and construction of the embankment, roadways and bridge. Based on the results of this preliminary assessment, we are also providing our recommendations for additional investigation to collect information for the final design, construction specifications and possible remedial actions.

Summary of Results

Seven standard penetration test borings were completed along the proposed alignment. The borings encountered 2.7 to 9.1 meters of fill. The fill is deepest north of the two active railroad tracks. Organic soils were encountered below the fill. A relatively thin stratum of peat was encountered in Borings ST-2, ST-3 and ST-7. A stratum of organic silts with shells was encountered below the fill or peat in all borings. The thickness of this stratum varied from 3 m to 9.4 m in the borings. Three of the borings were terminated in the stratum at depths of 12.2 m to 15.2 m. In the remaining borings, fat clays and silty sands were encountered below the organic soils.

Two borings were extended to a depth of 24.4 m and terminated in the fat clays and silty sands. Previous deeper borings indicate the fat clays and silty sands are underlain by a variety of lean clays and sands which generally increase in density and strength with depth.

Geological information for the area indicates the alignment crosses the south slope of a buried bedrock valley. The bedrock elevation changes from approximately 200 meters (650 feet on USGS datum) to 165 m (550 feet) from south to north.

The environmental assessment of the samples from the borings found contaminants in only one boring, ST-7. In this boring diesel range organics (DRO) and benzene, ethylbenzene, toluene, and xylenes (BTEX) were detected from the surface to 7.5 feet below the surface. Soil samples from three borings were tested for the eight RCRA metals. None of the metals detected exceeded the applicable MPCA Residential or Industrial Soil Reference Values.

An environmental scientist also performed a reconnaissance along the proposed alignment. No recognized environmental conditions were documented.

Summary of Preliminary Recommendations

Earthwork and Foundations. Our analysis indicates the embankment will be marginally stable if our assumed soils strengths are available and if embankment construction proceeds in a continuous manner. The strengths of the soils, particularly the organic soils, must be further evaluated during the final design investigation. If the strengths are not as high as we estimated based on the available data, construction of the embankment would still be possible using staged construction with delays of one to three months between stages of filling. Alternatively, the embankment could be built with lightweight fill.

The embankment will settle significantly during construction (assumed to take one year from start of embankment construction to paving) and over the lifetime of the bridge. Settlement during construction has been estimated to be about 1 meter at the location of ST-2, the approximate south end of the bridge, and about 1.3 meters at the location of ST-3, the approximate north end of the bridge. Long term (50 years) settlement at these borings has been estimated to be 0.1 and 0.2 meters respectively. Settlement along the alignment north and south of the bridge will be reduced approximately proportional to the amount of new fill required to reach grade.

The pile foundation for the bridge will require relatively long, heavy piles. The depth to a good bearing stratum appears to vary from approximately 40 meters at the south abutment to 50 meters at the north abutment. There will be significant negative skin friction (downdrag) on the pile because of the consolidation of the organic and soft fat clay soils so piles will have to have an ultimate capacity in the range of 125 to 200 metric tons.

Environmental Remediation. Petroleum-contaminated soils were encountered at the north end of the proposed alignment. We recommend the site be entered into the MPCA Voluntary Petroleum Investigation and Cleanup program to obtain expedited review and approval of a Development Response Action Plan, which is a contingency plan with provisions for managing petroleum impacted soil. A letter of assurance may be available to you through this voluntary program to limit your potential environmental liability associated with the removal, disposal, or on-site use of the petroleum impacted soil.

General

Please refer to the attached report for a more detailed summary of our analysis and preliminary recommendations. Thank you for the opportunity to be of service on this project. If we can answer any questions please call Cameron Kruse at (612) 942-4800.

Sincerely,

Cameron G. Kruse, PE
Chief Technical Officer

Mike Bratrud
Senior Scientist

Bruce M. Thorson, PE
Principal Engineer

Attachment:
Geotechnical Evaluation and Environmental Assessment Report

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A. Introduction

A.1. Purpose

This report includes a preliminary geotechnical evaluation and a Limited Phase II Environmental Site Assessment. The preliminary geotechnical evaluation was undertaken to evaluate the subsurface soil, bedrock and groundwater conditions along the proposed roadway and bridge alignment and to provide preliminary foundation design options for the roadway and bridge which will allow budget estimates of the cost of construction. The evaluation was not adequate for final design recommendations, which will require additional investigation and analysis.

The Limited Phase II Environmental Site Assessment was undertaken to see whether or not contaminants were present at the boring locations and in areas that were identified as potentially being contaminated in the Phase I study reported to the Minneapolis Community Development Authority on August 19, 1998.

A.2. Scope

Our work was performed in general accordance with our proposal to Hennepin County dated December 9, 1998. It was authorized under Service Contract Number A02177 and Project Number 9970111 on December 21, 1998.

Our scope of geotechnical services was limited to:

- accumulating available geotechnical data from previous evaluations in the area;
- staking the boring locations and determining ground surface elevations;
- coordinating the clearing of underground utilities;
- conducting seven penetration test borings within the proposed alignment area (a proposed eight boring on railroad property was eliminated);
- returning the samples to our laboratory for visual classification and logging by a geotechnical engineer;
- conducting laboratory tests;

- analyzing the results of the soil borings and laboratory tests;
- formulating preliminary recommendations for embankment construction and bridge foundation design; and
- submitting a report of the preliminary geotechnical evaluation containing logs of the borings, laboratory test results, our analyses of the soil borings and laboratory tests, and preliminary recommendations for embankment and foundation design.

Our scope of environmental services was limited to:

- observing the soil samples produced while drilling the seven geotechnical borings for the presence of visual and olfactory indications of contamination and screening for the presence of volatile organic vapors utilizing a photoionization detector (PID) equipped with a 10.6 eV lamp;
- performing a reconnaissance along the proposed alignment documenting observable, recognized environmental conditions. Soils near identified areas of concern were to be observed for the presence of visual and olfactory indications of contamination, and screened using a PID;
- collecting a minimum of three near-surface (approximately two feet below grade) samples and analyzing them for Resource Conservation and Recovery (RCRA) metals;
- formulate recommendations for any remediation which appears necessary and any further investigation which is indicated by the current data; and
- submitting the results of the testing and our recommendations in a report.

A.3. Available Information

We were provided a copy of a preliminary alignment showing the beginning and end of the project, the approximate location of the bridge being considered and some of the existing features of the properties along the alignment. Mr. Dean Michalko, of Hennepin County Railroad Authority, indicated the alignment would be approximately 9 meters above the top of the rail, that 2:1 (two

meters horizontal to one meter vertical) or 3:1 embankment slopes would be acceptable, and that the slope of the alignment grade would be approximately 5.5 percent to attain the height necessary to clear the railroad tracks.

We have done limited evaluations of the geotechnical and environmental conditions of the area. For the Minneapolis Community Development Agency we conducted a Phase I Environmental Site Assessment (Phase I ESA) of a broad area around the proposed roadway and a Limited Phase II Environmental Site Assessment (Phase II ESA) of the area between I-394 and the first set of railroad tracks north of I-394 (our project number BABX 98-632). A preliminary geotechnical investigation was also a part of the study of the Phase II ESA area. We also studied a proposed bike trail just west of the proposed alignment for the Minneapolis Park and Recreation Board (our project number BABX 96-227). Information from those projects was used as a part of this evaluation.

Relevant boring logs from these studies are included in the Appendix of this report.

The information from these projects indicated there is a potential for contaminated soils and groundwater along the proposed alignment. The Phase I ESA identified recognized environmental conditions to be evaluated as part of this Limited Phase II Environmental Site Assessment. The objective of this Limited Phase II ESA is to evaluate whether the soils at the site were adversely impacted by the recognized environmental conditions previously identified.

A.4. Locations and Elevations

Seven borings were performed at the approximate locations indicated on the attached sketch. The boring locations were chosen and staked in the field by our personnel, referenced to existing features shown on the preliminary alignment. One of the locations originally proposed, located on railroad property, was not accessible without extensive time delays and costs. Thus, it was omitted after discussions with Mr. Michalko.

We also determined ground surface elevations at the borings. They were referenced to three bench marks, as noted on the Log of Boring sheets.

B. Results

B.1. Logs

Log of Boring sheets indicating the depths and identifications of the various soil strata, penetration resistances, laboratory test data and groundwater observations are attached. The strata changes were inferred from the changes in the penetration test samples and auger cuttings. The depths shown as changes between the strata are only approximate. The changes are likely transitions and the depths of the changes vary between the borings.

The boring logs are also shown on the fence diagram of Figure 1. Note that this diagram is to scale vertically but not horizontally. Therefore, it cannot be used as a soils profile.

Geologic origins presented for each stratum on the Log of Boring sheets are based on the soil types, blows per foot, and available common knowledge of the depositional history of the site. Because of the complex glacial and post-glacial depositional environments, geologic origins can be difficult to ascertain. A detailed investigation of the geologic history of the site was not performed.

B.2. Site Conditions

The south end of the alignment is occupied by City of Minneapolis storage yards for construction equipment and materials. The area between the two active railroad tracks is undeveloped and overgrown with small trees and brush. The area north of the active railroad tracks is partially covered by a City storage lot for impounded autos. North of the Bassett Creek the alignment borders a metal scrap processing operation.

The surface elevations along the alignment slope down to the north. Boring elevations varied from 250.3 m at the south end to 245.7 m at the north end. Fill is evident at the surface along most of the alignment. Bassett Creek flows in a ditch near the north end, at an approximate elevation of 242 m.

B.3. Soils

All of the current borings encountered fill underlain by organic soils. Some of the borings then encountered strata of silty sands and/or fat clay. Only one of the borings in this investigation penetrated a silty sand below the fat clay.

B.3.a. Existing Fill. The fill layer was generally a silty sand, clayey sand or sandy lean clay. Some organic soils were encountered within the fill. There were varying amounts of rubble from razed buildings - wood, concrete, brick and glass. The fill was generally black. Fill depths were 3.6 and 2.6 m at Borings ST-1 and ST-2 at the south end and ST-7 at the north end. Fill depths in the middle of the alignment, ST-3 through ST-6, varied from 5.5 to 9.1 m.

B.3.b. Peat. A thin stratum of fibrous peat was encountered below the fill in Borings ST-2, ST-3 and ST-7. This stratum was thickest (2 m) at ST-3. The moisture content of a sample of the peat in Boring ST-3 was 167 percent with an organic content of 21 percent.

B.3.c. Organic Silt. All of the borings encountered a stratum of organic silt with some shells below the fill and peat. This stratum was thinnest (1.8 m) at the southerly boring, ST-1, and thickest (9.8 m) in the middle of the alignment, ST-3. Laboratory tests indicated the moisture contents of the samples ranged from 148 percent to 60 percent, but generally from 122 percent to 96 percent. Organic contents of the samples ranged from 6 percent to 12 percent, but generally from 9 percent to 12 percent.

B.3.d. Silty Sand. Borings ST-1 and ST-2 encountered a stratum of silty sand below the organic silt. The stratum was about 4.9 m thick in both borings.

B.3.e. Fat Clay. Borings ST-1, ST-2 and ST-7 terminated in strata of fat clay. Fat clay stratum was also encountered in ST-3 between the organic silt and the silty sand.

B.3.f. Penetration Resistances. The fill had N (blows required to drive the sampler 0.3 m) values ranging from 2 to 23 but generally less than 10. The higher penetration resistances were a result of encountering wood or concrete during the sampling process. In the organic silts the N values ranged from penetration under the weight of the hammer (WH), without driving, to 3, indicating the very soft nature of this stratum. The N values of the fat clays varied from 6 to 14 indicating a medium to stiff consistency. These soils generally were stiffer with depth. The silty sands had N values ranging from 8 to 20, increasing with depth, indicating loose to medium dense conditions.

B.4. Groundwater

Water was not observed in the auger while drilling the borings. The need to grout the bore holes prevented further water level readings. Water was observed in the fill samples in two of the borings. In ST-3 the samples were waterbearing below a depth of 4.0 m, elevation 243.8 m. In ST-5 the samples were waterbearing below a depth of 3.7 m, elevation 243.8 m. This is the approximate elevation of the water level in Bassett Creek at the alignment.

B.5. Soil Laboratory Tests

Some laboratory tests were run on samples of the organic soils and underlying fat clay from Borings ST-2 and ST-3. The test results are indicated in the right-hand margin of the Log of Boring sheets in the Appendix of this report, opposite the sample depth. These tests were conducted in general accordance with American Society for Testing and Materials (ASTM) standards.

The following table indicates the results of the laboratory tests.

Table 1. Results of Soil Laboratory Tests

Boring	Sample Depth (m)	Soil Type	Organic Content (%)	Moisture Content (%)	Dry Density (kg/m^3)	Liquid Limit (%)	Plasticity Index (%)
ST 2	4.6	Fat Clay	2	60	833	—	—
	5.3	Organic Silt	7	148	593	104	52
	6.1	Organic Silt	7	137	640	120	57
	7.6	Organic Silt	6	80	913	82	32
	9.4	Organic Silt	4	47	945	58	39
	17.0	Organic Silt	—	38	1345	70	47
ST-3	7.6	Peat	21	167	—	—	—
	9.1	Organic Silt	12	122	—	107	48
	10.7	Organic Silt	11	114	—	104	45
	13.7	Organic Silt	12	121	—	98	38
	16.8	Organic Silt	10	96	—	91	43

Boring	Sample Depth (m)	Soil Type	Organic Content (%)	Moisture Content (%)	Dry Density (kg/m^3)	Liquid Limit (%)	Plasticity Index (%)
	18.3	Fat Clay	6	74	—	—	—
ST-5*	10.7	Organic Silt	—	—	—	114	46
ST-5**	10.7	Organic Silt	—	—	—	79	13

* Sample before oven-drying
** Sample after oven-drying

B.6. Environmental Tests

A Braun Intertec environmental scientist was present while the soil borings were being drilled to monitor the subsurface materials encountered. Soil samples were observed for the presence of visual and olfactory evidence of contamination and screened for the presence of organic vapors with a photoionization detector (PID) equipped with a 10.6 eV lamp using both direct readings from split-barrel samples and using the bag-headspace method of analysis recommended in "Soil Sample Collection and Analysis Procedures" in Minnesota Pollution Control Agency (MPCA) Tanks and Emergency Response Section Fact Sheet #3.22 (April, 1996).

No visible discoloration, odors, or elevated PID readings were detected in Borings ST-1 through ST-6. Therefore, no soil or groundwater samples were collected for laboratory analysis of volatile organic compounds or petroleum related constituents.

Indications of contamination were apparent in ST-7. Elevated PID readings were detected and a diesel odor was noted from the surface to a depth of 2.3 m. A soil sample was collected from the 0.8 m depth at the location where the highest PID reading was documented. The sample was submitted to our analytical laboratory for analysis of diesel range organics (DRO) and benzene, ethylbenzene, toluene, and xylenes (BTEX). DRO and BTEX were detected in the sample. Test results are shown in the following table.

Table 2. Results of DRO and BETX Laboratory Tests

Boring	Depth (meters)	PID (ppm)	DRO (mg/kg)	Benzene (mg/kg)	Ethyl-benzene (mg/kg)	Toluene (mg/kg)	Xylenes (mg/kg)
ST-7	0 - 0.8	105	—	—	—	—	—
	0.8 - 1.5	51	—	—	—	—	—
	1.5 - 2.3	35	—	—	—	—	—
	0.8	—	18,000	0.08	0.75	0.60	3.1

Because metals are difficult to detect by soil screening techniques, confirmation soil samples were collected from Borings ST-3, ST-4 and ST-5 for analysis of the eight RCRA metals. None of the metals detected exceeded the applicable MPCA Residential or Industrial Soil Reference Values (SRV).

C. Analysis and Preliminary Recommendations

C.1. Proposed Construction

Hennepin County is considering construction of a roadway with a bridge over two existing railroad tracks and would like to know the potential environmental and geotechnical issues that might be an impediment to this construction. The roadway would begin at Dunwoody Boulevard and progress northwesterly and northerly to Girard Avenue North, approximately 685 meters in length. The vertical profile starts at the existing Dunwoody Boulevard and rises to a height of approximately 9 meters above the two high volume railroad tracks and goes down to existing grade roughly at Bassett Creek. Two additional railroad tracks, near the intersection of Girard Avenue and Currie Avenue, will be crossed at grade. The roadway will have one lane in each direction. We have assumed a top width of approximately 19 meters.

The bridge will be supported on pile foundations. Steel pipe or H piles will most likely be used because relatively long piles will be required and relatively high negative skin friction is expected.

C.2. Embankment

The embankment will consist of imported fill placed above the existing grade. There may be limited clearing and grubbing of the embankment area. We assume that granular fill will be used for ease of construction but other mineral soils could also be used.

Construction and long term maintenance will be affected by the low strength and compressibility of the existing fill, organic silts and fat clays which exist along the alignment. These poor soils extended to a depth of 17 m in Boring ST-3 and may be deeper along the northern part of the alignment.

C.2.a. Slope Failure Evaluation. We evaluated the potential for a slope failure of the embankment and underlying soils during fill placement. This type of failure could cause the embankment to subside rapidly while pushing up a "mud wave" beyond the edge (toe) of the new fill. This failure would occur if the load of the fill placed exceeded the strength of the organic silts and the fill was placed faster than the organic silts can gain the necessary strength to resist the new loads of the embankment. We assumed the side slopes of the embankment will be 2:1 (two horizontal to one vertical). We estimated the strengths of the organic silts from correlations with the Atterberg limits of the soils and the current overburden pressures imposed by the existing fill. Our analysis indicates the embankment construction will be marginally safe (factor of safety = 1.0) for construction at a normal rate and without planned delays to allow the underlying soils to gain strength. We recommend this approach be assumed for budgeting and planning.

For final design a factor of safety of at least 1.3 is recommended. It is our opinion that our estimated soil strengths are conservative and higher strengths will likely be confirmed by additional testing during the final design evaluation. If the final design evaluation finds soil strengths only equal our estimates we will recommend including planned delays of one to three months, likely at the midpoint of filling, to allow the soils to gain strength. An alternative would be to use light-weight fill to reduce new loads in the critical lengths of embankment.

C.2.b. Settlement Evaluation. As the embankment is built it will compress water out of the underlying fill, organic silts and fat clays and settle. During and soon after placement of the embankment, the rate of settlement will be limited by the rate at which the water can be squeezed out of the organic silts and fat clays. This phase is called "primary" consolidation, and the pore water pressures exceed the hydrostatic pressures. After primary consolidation is complete, and the excess pore water pressures have dissipated, "secondary" or "long-term" consolidation (creep)

begins and continues at a diminishing rate, essentially forever. The settlement due to secondary consolidation is only a fraction of the settlement due to primary consolidation, but with the thick organic deposits of this site this settlement can be substantial and necessitate continued maintenance.

We predict the settlement during construction will be approximately 1.3 meters in the area of Boring ST-3, the northerly abutment of the bridge. This area has the highest new loads and the poorest soils. We predict the area of Boring ST-2, near the southerly abutment of the bridge, will settle an estimated 1.0 meter during construction. Away from the bridge, settlement will be less, proportionate with the height of the new fill. Cost estimates must include the additional fill required to correct for the settlement.

We have assumed that construction will take at least one year from start of filling to paving and that primary consolidation will be complete before the roadway is paved. This is faster than indicated by calculations based on consolidation tests of similar soils for an adjacent project. The consolidation tests conducted for the bike trail project indicated primary consolidation could take five years. If primary consolidation does take this long, the amount of settlement that occurs during construction will be less but the amount occurring after paving will be significantly more.

We assumed that primary consolidation will occur in a year because that has been our experience on other projects and because the laboratory tests have only vertical drainage of pore water while construction projects have both vertical and horizontal drainage. Horizontal drainage is typically much faster than vertical drainage for water-deposited soils such as these because of horizontal lenses and seams of sands. The risk of longer primary consolidation time should be further evaluated in the final design evaluation.

Secondary settlement of the embankment and paving adjacent to the bridge abutment has been estimated to be approximately 0.2 m at Boring ST-3 and 0.1 m at Boring ST-2, over a period of 50 years. Periodic maintenance will be required to correct for the settlement.

The long-term settlement could be reduced or possibly eliminated by placing a surcharge over the embankment area for up to one year. The surcharge causes the expected secondary settlement to occur as primary consolidation. However, the required height of surcharge would be on the order of 3 meters of soil because of the height of the new fill and the thickness of the compressible soils. Depending on the interests of the County regarding long-term maintenance, surcharging could be studied further during the final design evaluation.

C.3. Bridge Foundation

The soil and bedrock conditions at this site appear to be most amenable to a pile foundation with piles deriving their supporting strength from a combination of friction and end bearing in the stronger soils at depth. It is not likely that the piles will reach bedrock, based on data available from other geotechnical evaluations. The existing fill and compressible soils will cause a downdrag load on the piles through negative skin friction as they consolidate and settle.

Typical pile types would be a nominal 324 mm (12 3/4 inch) diameter, concrete-filled pipe driven closed-end or a HP 310 millimeter, 110 kg/m (12 inch by 74 pound per foot) H-pile. These will need to be driven for structural loads of 36 to 54 metric tons plus downdrag loads up to 75 metric tons. For cost estimating purposes we suggest that the lengths of these piles will be on the order of 45 meters on the south abutment, 55 meters on the north abutment and 40 to 50 meters at the piers. This assumes a top cut-off approximately 3 m below the pavement for the abutments and 2 m below the existing ground surface for the piers.

The above pile length estimates are based on information available from other investigations not immediately at the location of the bridge and are therefore are approximate. The final design evaluation must obtain information specific to the finalized bridge foundation locations.

C.4. Pavement Design

Because of the long term settlement which will occur you may wish to use a bituminous pavement surface. This "flexible" pavement is somewhat more tolerant of differential settlement and easier to repair when settlement becomes objectionable to traffic.

Subgrade corrections will be required at the ends of the alignment to replace existing fill close to the finished grade. It is recommended that a subgrade correction be included to result in a minimum of 1.5 m of well compacted granular fill below the top of the embankment.

C.5. Environmental Considerations

Petroleum impacted soil was encountered in the sample collected from Boring ST-7. Although the PID readings indicate that the impacted soil is limited to a depth of approximately 2.3 meters, the lateral extent of impacted soil is not defined. It is likely that the proposed road and bridge construction will involve excavation in the area of impacted soil.

Based on information provided to Braun Intertec in conversations with representatives from the City of Minneapolis, soil contaminated with lead generated from the realignment of Bassett Creek is stock-piled on the property on or adjacent the alignment, near the Minneapolis Impound Lot under conditions approved by MPCA. Lead was not detected above the Industrial or Residential SRVs in the soil samples collected from Borings ST-3, ST-4, and ST-5. This does not appear to be an issue for the proposed road and bridge construction.

Because petroleum contaminated soils were encountered along the proposed alignment, we recommend the site be entered into the MPCA Voluntary Petroleum Investigation and Cleanup (VPIC) program to obtain expedited review and approval of a Development Response Action Plan (DRAP), which is a contingency plan with provisions for managing petroleum impacted soil. A letter of assurance may be available to the County through VPIC to limit their potential environmental liability associated with the removal, disposal, or on-site use of the petroleum impacted soil.

D. Construction

It is our opinion that typical Minnesota Department of Transportation (Mn/DOT) specifications for design and construction will be suitable. The construction of the embankments must include piezometers and settlement devices to monitor the stability of the underlying soils and actual rate of settlement during filling of the embankment. Significant amounts of engineering time will be necessary to read the monitoring devices and evaluate the information. The devices and evaluation are an additional cost compared to construction on good soils.

E. Recommended Additional Evaluation for Final Design

E.1. Geotechnical Evaluation

When final design begins for this project, we recommend a complete geotechnical evaluation of the alignment. The evaluation for the embankment should include soil borings into relatively incompressible soils at a maximum spacing of 30 m along the centerline, plus borings right and left of centerline where the new fill will be more than 4 m high. The borings should include vane shear tests of the low-strength soils and samples for undisturbed consolidation testing. Borings at the bridge location should be located at each end of the abutments and piers. These borings should extend well into the underlying dense soils for pile capacity evaluations.

Laboratory testing should include a number of consolidation tests and the index tests such as moisture content and density, organic content and Atterberg limits, to permit extrapolation of the consolidation and vane shear tests.

A pile load test program is recommended to evaluate the severity of negative skin friction for the piles and to assist in developing final pile design and driving criteria. The load test program should include testing the piles while being driven and after some "set-up" has occurred, using a Pile Dynamic Analyzer. This will provide information on the skin friction and end-bearing capacities of the piles tested, and an indication of the requirements for the pile driving hammer.

E.2. Environmental Evaluation

Additional environmental testing does not appear warranted. In preparation for bidding and construction we recommend you make application to enter into the MPCA Voluntary Petroleum Investigation and Cleanup (VPIC) program to obtain expedited review and approval of a Development Response Action Plan (DRAP), which is a contingency plan with provisions for managing petroleum impacted soil. This will allow better bidding by contractors and avoid delays during construction because a plan for dealing with contaminated soils will be in place if needed.

F. Procedures

F.1. Drilling and Sampling

The standard penetration test borings were performed on January 8 through 14, 1999 with a truck-mounted core and auger drill equipped with 83-millimeter inside diameter hollow-stem auger. Sampling for the borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." Using this method, we advanced the borehole with the hollow-stem auger to the desired test depth. A 63.5-kilogram hammer falling 0.76 m was then used to drive the standard 51-millimeter split-barrel sampler a total penetration of 0.46 m below the tip of the hollow-stem auger. The blows for the last 0.30 m of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 0.76-meter vertical intervals to the 4.6- or 6.1-meter depths and then at 1.5-meter intervals to the termination depths of the borings. A representative portion of each sample was then sealed in a glass jar.

Undisturbed samples of the cohesive soils were taken with a 76-millimeter diameter sampler in accordance with ASTM D 1587, "Thin-walled Tube Sampling of Soils."

F.2. Soil Classification

Soils encountered in the borings were visually and manually classified in the field by the crew chief in general accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedures)." A summary of the ASTM classification system is attached. All samples were then returned to our laboratory for review of the field classifications by a geotechnical engineer. Representative samples will remain in our Minneapolis office for a period of 60 days to be available for your examination.

F.3. Groundwater Observations

Groundwater observations were limited by the need to grout the borings immediately after taking the last sample. Each boring was grouted immediately after completing the last sample.

G. General Recommendations

G.1. Basis of Preliminary Recommendations

The analyses and preliminary recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the attached sketch or available from other studies. Often, variations occur between these borings, the nature and extent of which do not become evident until additional exploration or construction is conducted. Additional borings will be necessary before a final geotechnical recommendation can be made. The final recommendation may change from this preliminary recommendation based on the new information. A reevaluation of the recommendations in this report and the future report should be made after performing on-site observations during construction to note the characteristics of any variations. The variations may result in additional subgrade preparation or foundation costs, and it is suggested that a contingency be provided for this purpose.

It is recommended that we be retained to perform the additional borings and tests and the observation and testing program for the construction of this project. This will allow correlation of the soil conditions encountered during construction to the soil borings, and will provide continuity of professional responsibility.

G.2. Review of Design

This report is based on the preliminary design of the proposed alignment and bridge as related to us for preparation of this report. If further borings and tests are not made it is recommended that we be retained to review the geotechnical aspects of the final designs and specifications. With the

review, we will evaluate whether any changes in design have affected the validity of the recommendations, and whether our recommendations have been correctly interpreted and implemented in the design and specifications.

G.3. Groundwater Fluctuations

We made water level observations in the borings at the times and under the conditions stated on the boring logs. These data were interpreted in the text of this report. The period of observation was relatively short, and fluctuation in the groundwater level may occur due to rainfall, flooding, irrigation, spring thaw, drainage, and other seasonal and annual factors not evident at the time the observations were made. Design drawings and specifications and construction planning should recognize the possibility of fluctuations.

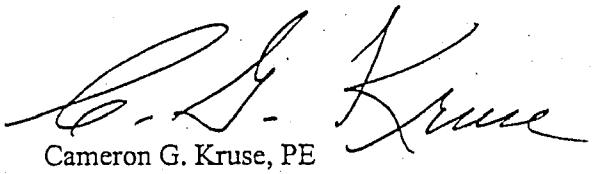
G.4. Use of Report

This report is for the exclusive use of Hennepin County to make a preliminary design of the proposed project and prepare construction cost estimates. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report. The data, analyses and recommendations may not be appropriate for other purposes. We recommend that parties contemplating other purposes contact us.

G.5. Level of Care

Services performed by Braun Intertec Corporation personnel for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is made.

Professional Certification:
I hereby certify that this report was prepared by me and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.



Cameron G. Kruse, PE
Principal Engineer
Registration Number: 8733

Appendix

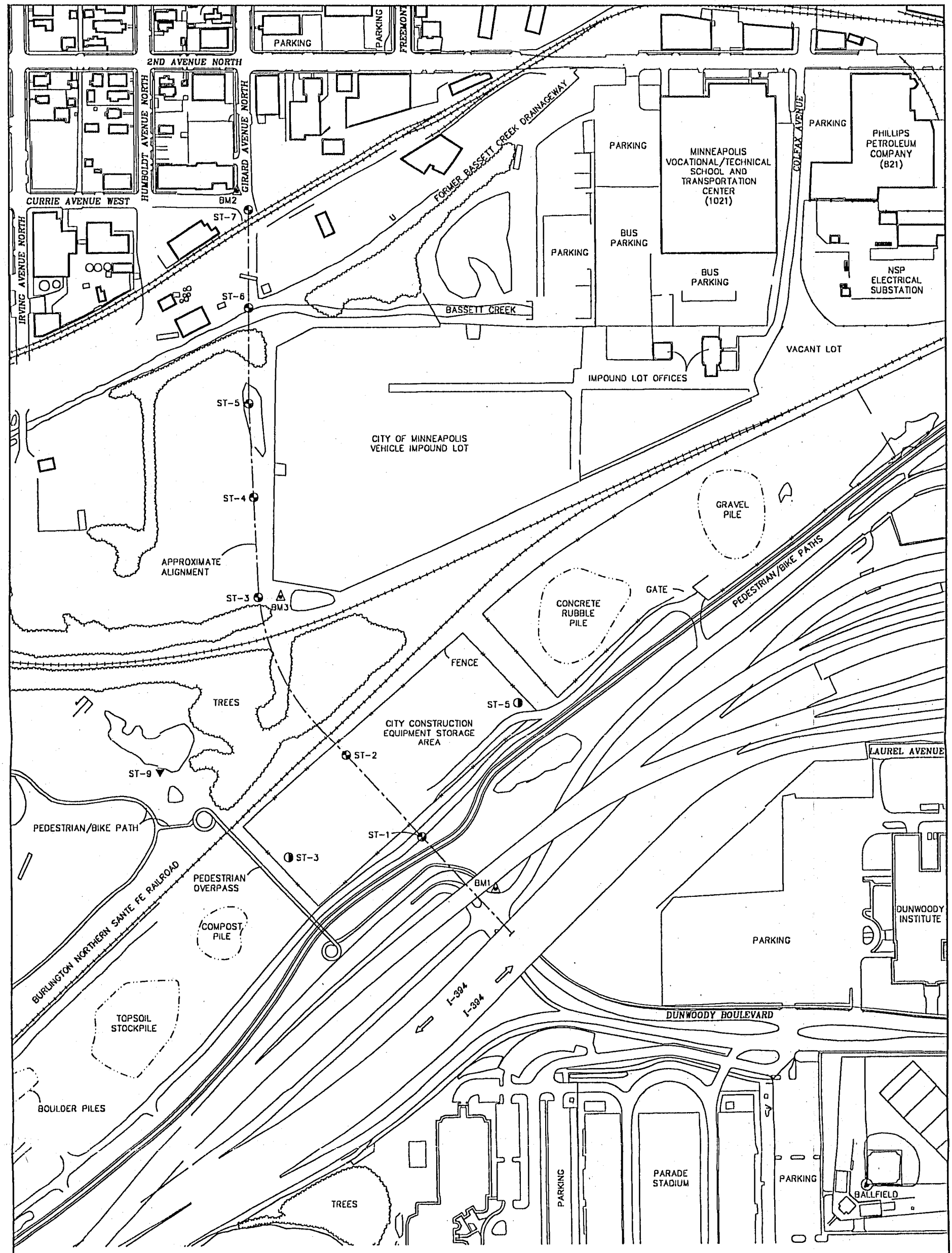


FIGURE NO.	INT	DATE
	DRAWN BY: COM	7-17-98
	APP'D BY: CK	3-9-99
	JOB NO. BABX-98-908	
	DWG. NO. MX801998	SHEET / OF
	SCALE 1cm = 100m	

SOIL BORING LOCATIONS
PRELIMINARY GEOTECHNICAL EVALUATION AND LIMITED PHASE II ENVIRONMENTAL ASSESSMENT
PROPOSED ROADWAY AND BRIDGE – DUNWOODY AVENUE TO CURRIE AVENUE
HENNEPIN COUNTY REGIONAL RAILROAD AUTHORITY – MINNEAPOLIS, MINNESOTA

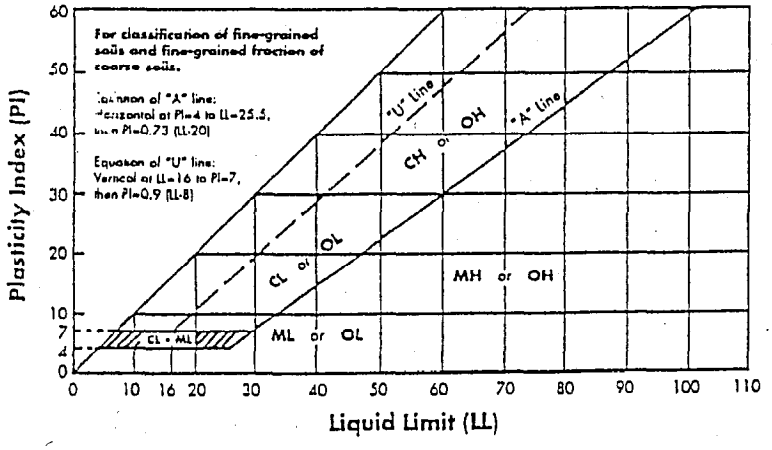
BRAUN INTERTEC

Descriptive Terminology

Standard D 2487 - 93
Classification of Soils for Engineering Purposes
(Unified Soil Classiication System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soil Classification	
				Group Symbol	Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines [c]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [e]	GW	Well-graded gravel [f]
			$C_u < 4$ and/or $1 > C_c > 3$ [e]	GP	Poorly graded gravel [f]
		Gravels with Fines More than 12% fines [c]	Fines classify as ML or MH	GM	Silty gravel [f,g,h]
			Fines classify as CL or CH	GC	Clayey gravel [f,g,h]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines [d]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [e]	SW	Well-graded sand [i]
			$C_u < 6$ and/or $1 > C_c > 3$ [e]	SP	Poorly graded sand [i]
		Sands with Fines More than 12% fines [d]	Fines classify as ML or MH	SM	Silty sand [g,h,i]
			Fines classify as CL or CH	SC	Clayey sand [g,h,i]
Fine-grained Soils 50% or more passed the No. 200 sieve	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	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k,l,m,o] Organic silt [k,l,m,o]
	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	Liquid limit - oven dried / 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. 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
e. $C_u = D_{60}/D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
f. If soil contains ≥ 15% sand, add "with sand" to group name.
g. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
h. If fines are organic, add "with organic fines" to group name.
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 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	Ø	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	No. 200 to .005 mm
Clay	less than .005 mm

Relative Density of Cohesionless Soils

very loose	0 to 4 BPF
loose	5 to 10 BPF
medium dense	11 to 30 BPF
dense	31 to 50 BPF
very dense	over 50 BPF

Consistency of Cohesive Soils

very soft	0 to 1 BPF
soft	2 to 3 BPF
rather soft	4 to 5 BPF
medium	6 to 8 BPF
rather stiff	9 to 12 BPF
stiff	13 to 16 BPF
very stiff	17 to 30 BPF
hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube).

Power auger borings were advanced by 4" or 6" diameter, continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B".

Hand auger borings were advanced manually with a 1 1/2" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H".

Sampling: All samples were taken with the standard 2" OD split-tube sampler, except where noted. TW indicates thin-walled (undisturbed) tube sample.

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

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

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

Note: All tests were run in general accordance with applicable ASTM standards.

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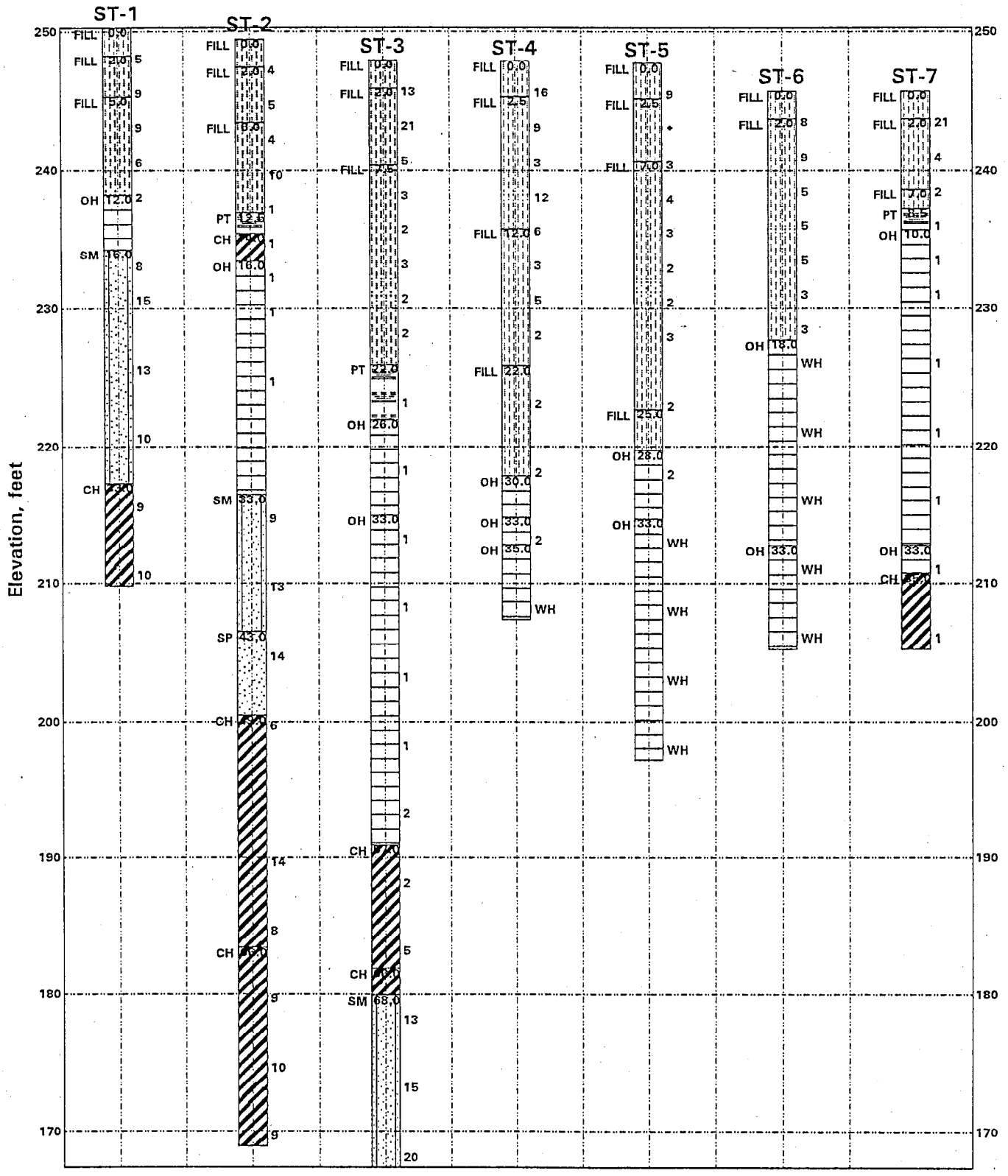
Rev. 2/97



Fence Diagram:

(Horizontal distance not to scale)

Braun Project BABX-98-908

PRELIMINARY GEOTECHNICAL EVALUATION
AND LIMITED PHASE II ENVIRONMENTAL SITE ASSESSMENT
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

Braun Intertec Corporation
March 11, 1999

Figure 1

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-1

LOCATION: See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/12/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
250.30	0.0	FILL	FILL: Silty Sand, with Gravel, brown, moist.			BMI: Top of concrete base of "Bike Path" sign at Dunwoody Boulevard and HOV Lane on-ramp to I394 = 250.12m.
249.7	0.6	FILL	FILL: Silty Sand, black, moist.	5		
248.8	1.5	FILL	FILL: Silty Sand, with a trace of Gravel, brown, moist.	9		
				9		
				6		
246.6	3.7	OH	ORGANIC SILT, with shells, gray, wet, soft. (Swamp Deposit)	2		
245.4	4.9	SM	SILTY SAND, fine- to medium-grained, with lenses of Silt and Clay, gray, wet, medium dense. (Alluvium)	8		
				15		
				13		
				10		
240.2	10.1					

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-1 (cont.)

LOCATION: See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/12/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
		CH	FAT CLAY, gray, wet, rather stiff. (Lacustrine)	9		
238.0	12.3			10		
			END OF BORING. Boring grouted immediately after withdrawal of the auger.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-2

LOCATION: See attached sketch.

DRILLER: S. McLean | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/14/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
249.45	0.0					
248.8	0.6	FILL	FILL: Silty Clayey Sand, fine- to medium-grained, with gravel, brown, frozen to moist.			
247.6	1.8	FILL	FILL: Silty Clayey Sand, with some cinders, brick, and peat, black, moist to wet.	4 5		
245.6	3.8	FILL	FILL: Silty Sand, fine- to medium-grained, with wood, black, wet.	4 * 1		*Sample all wood.
245.2	4.3	PT	PEAT, fibers, black, wet. (Swamp Deposit)			
244.6	4.9	CH	FAT CLAY, light gray, wet. (Swamp Deposit)	1		MC = 60% OC = 2% DD = 52 pcf
		OH	ORGANIC SILT, with shells, light gray, wet. (Swamp Deposit)	1 1 1		MC = 148% OC = 7% DD = 37 pcf LL = 104% PI = 52% MC = 137% OC = 7% DD = 40 pcf LL = 120% PI = 57% MC = 80% OC = 6% DD = 57 pcf LL = 82% PI = 32%
239.3	10.1					TW #1 from 29 feet to 31 feet. MC = 47% OC = 4% DD = 59 pcf LL = 58% PI = 39%

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-2 (cont.)

LOCATION:
See attached sketch.

DRILLER: S. McLean | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/14/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
		SM	SILTY SAND, fine- to medium-grained, gray, waterbearing, loose to medium dense. (Alluvium)	9		
				13		
236.3	13.1					
		SP	POORLY GRADED SAND, fine- to medium-grained, gray, waterbearing, medium dense. (Alluvium)	14		
234.5	14.9					
		CH	FAT CLAY, gray, wet, medium to stiff. (Lacustrine)	6		TW #2 from 54 feet to 56 feet. MC = 38% DD = 84 pcf LL = 70% PI = 47%
			With a few layers of Poorly Graded Sand between 57 feet and 60 feet.	14		
				8		
229.2	20.2					

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908 Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave Minneapolis, Minnesota	BORING: ST-2 (cont.) LOCATION: See attached sketch.
DRILLER: S. McLean METHOD: 3 1/4" HSA Autohmr.	DATE: 1/14/99 SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
		CH	FAT CLAY. (Continued from previous page)	9		
				10		
224.9	24.5			9		
			END OF BORING. Boring then grouted immediately after withdrawal of auger.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-3

LOCATION: See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/11/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
247.95	0.0	FILL	FILL: Silty Sand, brown, frozen to moist.			Benchmark 3: Top of RR spike in west face of west pole of double-pole transmission line tower at SW corner of Impound Lot fence = 247.16m (810.92 ft.) * Sampler encountered Concrete.
247.3	0.6	FILL	FILL: Sandy Lean Clay, with pieces of Concrete, with fibers and a trace of Gravel, black, moist.	13		
				21		
245.7	2.3	FILL	FILL: Silty Sand, with brick and Concrete, dark brown, wet to 3.9m.	5		
				3		
			Waterbearing at 3.9m.	2		
				3		
				2		
241.2	6.7	PT	PEAT, fibrous, black and dark brown, moist, very soft. (Swamp Deposit)	2		
240.0	7.9	OH	ORGANIC SILT, with shells, gray, wet, very soft. (Swamp Deposit)	1		MC = 167% OC = 21%
237.8	10.1			1		MC = 122% OC = 12% LL = 107% PI = 48%

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-3 (cont.)

LOCATION:
See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/11/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
		OH	ORGANIC SILT. (Continued from previous page)	1		MC = 114% OC = 11% LL = 104% PI = 35%
				1		
				1		MC = 121% OC = 12% LL = 98% PI = 38%
				1		
230.6	17.4			2		MC = 96% OC = 10% LL = 91% PI = 43%
		CH	FAT CLAY, gray, wet, soft. (Lacustrine)			
				2		MC = 74% OC = 6%
				5		
227.7	20.2					

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-3 (cont.)

LOCATION: See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/11/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
227.2	20.7	CH	FAT CLAY, with seams of Silt, gray, wet, rather soft.			
		SM	SILTY SAND, fine- to medium-grained, gray, wet, medium dense. (Alluvium)	13		Jetting water used to wash sand out of the auger between the 68 and 80 foot depths.
				15		
223.4	24.5			20		
			END OF BORING. Boring grouted immediately after withdrawal of the auger.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908 Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave Minneapolis, Minnesota	BORING: ST-4 LOCATION: See attached sketch.
DRILLER: D. Lovaasen — METHOD: 3 1/4" HSA Autohmr.	DATE: 1/8/99 — SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
247.83	0.0					
247.1	0.8	FILL	FILL: Silty Sand, brown, frozen to moist.	16		
244.2	3.7	FILL	FILL: Clayey Sand with a little fine Gravel, brown, moist. With pieces of glass and wood at 2.3m. With some Peat at 2.4 to 2.7m.	9 3 12		
241.1	6.7	FILL	FILL: Silty Sand, fine- to coarse-grained, with fine to medium Gravel, with lenses of Lean Clay, with some brick and Concrete pieces, brown, waterbearing.	6 3 5 2		
238.7	9.1	FILL	FILL: Silty Sand, brown and black, waterbearing.	2		
237.7	10.1	OH	ORGANIC SILT, with shells, dark brown, wet, soft. (Swamp Deposit)	2		

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-4 (cont.)

LOCATION:
See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/8/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
237.2	10.7	OH	ORGANIC SILT. (Continued from previous page)	2		
235.5	12.3	OH	ORGANIC SILT, with shells and fibers, brown, wet, soft. (Swamp Deposit)	WH		
			END OF BORING. Boring grouted immediately after withdrawal of the auger.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-5

LOCATION: See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/8/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
247.68	0.0					
246.9	0.8	FILL	FILL: Silty Sand, brown.	9		
245.5	2.1	FILL	FILL: Sandy Lean Clay, with a little Gravel, with some wood debris, dark gray, moist.	*		* Sampler encountered wood.
240.1	7.6	FILL	FILL: Organic Clays, with a little brick and glass, with a little Gravel and wood, black, moist to 3.8m.	3 4		
			Waterbearing at 3.8m.	3 2 2 3		
239.1	8.5	FILL	FILL: Poorly Graded Sand, black, waterbearing.	2		
237.5	10.1	OH	ORGANIC SILT, dark brown, wet, soft. (Swamp Deposit)	2		

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-5 (cont.)

LOCATION:
See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/8/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
		OH	ORGANIC SILT. (Continued from previous page)	WH		LL = 114% * PI = 46% * LL = 79% ** PI = 13% ** * Before drying ** After Oven drying
				WH		
			Brown at 45 feet.	WH		
232.3	15.4			WH		
			END OF BORING. Boring grouted immediately after withdrawal of the auger.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908
Preliminary Geotechnical Evaluation
and Limited Phase II Environmental Site Assessment
Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave
Minneapolis, Minnesota

BORING: ST-6

LOCATION: See attached sketch.

DRILLER: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 1/12/99 | SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
245.73	0.0	FILL	FILL: Silty Sand, brown, frozen to moist.			BM3: top of westerly bolt on top flange of hydrant in NW corner of Currie and Girard = 246.51m.
245.1	0.6	FILL	FILL: Sandy Lean Clay, with a trace of Gravel, dark brown, moist, soft to medium.	8		
				9		
				5		
				5		
			With layers of Silty Sand at 3.8m.	5		
				3		
240.2	5.5		With some glass and cinders at 5.1 to 5.5m.	3		
		OH	ORGANIC SILT, with shells, dark brown, wet, soft. (Swamp Deposit)	WH		
				WH		
				WH		
235.6	10.1					

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908 Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave Minneapolis, Minnesota	BORING: ST-6 (cont.) LOCATION: See attached sketch.
DRILLER: D. Lovaasen — METHOD: 3 1/4" HSA Autohmr.	DATE: 1/12/99 — SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
		OH	ORGANIC SILT. (Continued from previous page)	WH		
233.4	12.3			WH		
			END OF BORING.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908 Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave Minneapolis, Minnesota	BORING: ST-7 LOCATION: See attached sketch.
DRILLER: S. McLean — METHOD: 3 1/4" HSA Autohmr.	DATE: 1/14/99 — SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
245.73	0.0					
245.1	0.6	FILL	FILL: Silty Sand, fine- to medium-grained, with gravel, brown, frozen to moist.			
243.6	2.1	FILL	FILL: Silty Sand, fine- to medium-grained, with little cinders, with petroleum odor, black, dry.	21 4		
243.1	2.6	FILL	FILL: Silty Sand, fine- to medium-grained, some fiber and wood, black, wet.	2		
242.7	3.0	PT	PEAT, fibrous, dark brown, wet. (Swamp Deposit)	1		
235.6	10.1	OH	ORGANIC SILT, with shells, dark gray, wet, very soft. (Swamp Deposit)	1 1 1 1 1		

BRAUN INTERTEC

LOG OF BORING

PROJECT: BABX-98-908 Preliminary Geotechnical Evaluation and Limited Phase II Environmental Site Assessment Proposed Roadway and Bridges/Dunwoody Blvd to Girard Ave Minneapolis, Minnesota	BORING: ST-7 (cont.) LOCATION: See attached sketch.
DRILLER: S. McLean METHOD: 3 1/4" HSA Autohmr.	DATE: 1/14/99 SCALE: 1:50

(See Report and Standard Plates for elevation and descriptive terminology.)

Elev. meters	Depth meters	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	N	WL	Test or Notes
235.1	10.7	OH	ORGANIC SILT. (Continued from previous page)	1		
233.4	12.3	CH	FAT CLAY, gray, wet, very soft. (Lacustrine)	1		
			END OF BORING. Boring then grouted immediately after withdrawal of auger.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632
GEOTECHNICAL EVALUATION
Minneapolis Community Development Agency
Linden Avenue Corridor Property
Minneapolis, Minnesota

BORING: ST-3

LOCATION:
See attached sketch.

CREW CHIEF:D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 6/12/98 | SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
298.1	0.0	FILL	FILL: Poorly Graded Sand, fine- to medium-grained, with a trace of Gravel, brown.	8		The benchmark used as a reference for the elevations of borings ST-3 and ST-5 was the catch basin on the high occupancy vehicle on-ramp to Interstate 394 with an assumed elevation of 300.0.
293.6	4.5	FILL	FILL: Silty Sand, fine- to coarse-grained, with a trace of Gravel, with cinders, black, moist.	9		
291.1	7.0	FILL	FILL: Clayey Sand, fine- to medium-grained, with brick and cinders, black, wet.	4		
288.6	9.5	SP	POORLY GRADED SAND, fine-grained, with a trace of Gravel, light brown, medium dense. (Possible Fill)	13 12		
283.6	14.5	SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of Gravel, grayish brown, waterbearing, loose. (Possible Fill)	8	▽	
281.1	17.0	SP	POORLY GRADED SAND, fine- to medium-grained, brown, waterbearing, loose to medium dense. (Possible Fill)	8 10		Jetting water used to wash sand out of the auger between the 18 and 24 foot depths.
273.6	24.5	CH	FAT CLAY, gray, wet, rather soft. (Alluvium)	12 5 5		No sample recovered.
266.1	32.0					

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632 GEOTECHNICAL EVALUATION Minneapolis Community Development Agency Linden Avenue Corridor Property Minneapolis, Minnesota	BORING: ST-3 (cont.) LOCATION: See attached sketch.
CREW CHIEF: D. Lovaasen / METHOD: 3 1/4" HSA Autohmr.	DATE: 6/12/98 / SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
		CH	FAT CLAY, gray, wet, rather soft to rather stiff. (Alluvium)			
				4		
						No sample recovered.
				6		
				3		
				8		
				7		
234.1	64.0					

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632
GEOTECHNICAL EVALUATION
Minneapolis Community Development Agency
Linden Avenue Corridor Property
Minneapolis, Minnesota

BORING: ST-3 (cont.)

LOCATION:
See attached sketch.

CREW CHIEF: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 6/12/98 | SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
		CH	FAT CLAY, gray, wet, rather soft to rather stiff. (Alluvium)	10		
229.1	69.0	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, moist, rather stiff to very stiff. (Glacial Till)	9		
				11		
				12		
				14		
				14		
				17		
202.1	96.0					

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632
GEOTECHNICAL EVALUATION
Minneapolis Community Development Agency
Linden Avenue Corridor Property
Minneapolis, Minnesota

BORING: ST-3 (cont.)

LOCATION:
See attached sketch.

CREW CHIEF: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 6/12/98 | SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
198.6	99.5	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, moist, rather stiff to very stiff. (Glacial Till)			
193.6	104.5	CL	LEAN CLAY, gray, moist, very stiff. (Glacial Till)	17		Rotary drilling with mud 100-120'.
188.6	109.5	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, wet, stiff. (Glacial Till)	15		
179.6	118.5	CL	LEAN CLAY, gray, wet, stiff to very stiff. (Glacial Till)	16 25		No sample recovered.
177.6	120.5	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, wet, very stiff. (Glacial Till)	22		
			END OF BORING. Water down 15 feet with 19 feet of hollow-stem auger in the ground. Boring then grouted.			

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632
GEOTECHNICAL EVALUATION
Minneapolis Community Development Agency
Linden Avenue Corridor Property
Minneapolis, Minnesota

BORING: ST-5

LOCATION:
See attached sketch.

CREW CHIEF: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 6/14/98 | SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
296.4	0.0	FILL	FILL: Silty Sand, fine- to medium-grained, with Gravel, black, moist.			
294.9	1.5	FILL	FILL: Clayey Sand, fine- to medium-grained, with Gravel, light brown, moist.	17		
291.9	4.5	FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, light brown, moist.	17		
289.4	7.0	FILL	FILL: Sandy Lean Clay, with a trace of Gravel, brown, wet.	4		
286.4	10.0	FILL	FILL: Silty Sand, fine- to medium-grained, with a trace of Gravel, black and brown, wet.	6		
283.9	12.5	PT	PEAT, fibrous, black, wet, very soft. (Swamp Deposit)	2		
282.4	14.0	OH	ORGANIC FAT CLAY, with vegetation and shells, gray, wet, soft. (Swamp Deposit)	2		
279.9	16.5	OH	ORGANIC FAT CLAY, plastic, with a trace of vegetation and shells, greenish gray, wet, soft. (Swamp Deposit)	3		
273.9	22.5	SM	SILTY SAND, fine-grained, gray, waterbearing, medium dense. (Alluvium)	13		
				15		
						No sample recovered.
				14		
264.4	32.0					

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632
GEOTECHNICAL EVALUATION
Minneapolis Community Development Agency
Linden Avenue Corridor Property
Minneapolis, Minnesota

BORING: ST-5 (cont.)

LOCATION:
See attached sketch.

CREW CHIEF: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 6/14/98 | SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
		SM	SILTY SAND, fine-grained, gray, waterbearing, medium dense. (Alluvium)	12		
256.9	39.5					
		CH	FAT CLAY, gray, moist, stiff. (Glacial Till)	13		
				10		
				12		
				11		
236.9	59.5					
		SC	CLAYEY SAND, fine-grained, with a trace of Gravel, gray, wet, medium dense. (Glacial Till)	12		

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632
GEOTECHNICAL EVALUATION
Minneapolis Community Development Agency
Linden Avenue Corridor Property
Minneapolis, Minnesota

BORING: ST-5 (cont.)

LOCATION:
See attached sketch.

CREW CHIEF: D. Lovaasen | METHOD: 3 1/4" HSA Autohmr. | DATE: 6/14/98 | SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
231.9	64.5	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with a trace of Gravel, gray, wet, medium dense. (Glacial Outwash)	12		
				11		
221.9	74.5	CL	SANDY LEAN CLAY, with a trace of Gravel, gray, moist, rather stiff to very stiff. (Glacial Till)	12		
				14		
				16		
				18		
				20		
200.4	96.0					

BRAUN INTERTEC

LOG OF BORING

PROJECT: CMXX98416/BABX98632 GEOTECHNICAL EVALUATION Minneapolis Community Development Agency Linden Avenue Corridor Property Minneapolis, Minnesota	BORING: ST-5 (cont.) LOCATION: See attached sketch.
CREW CHIEF: D. Lovaasen / METHOD: 3 1/4" HSA Autohmr.	DATE: 6/14/98 / SCALE: 1" = 4'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
		CL	SANDY LEAN CLAY, with a trace of Gravel, gray, moist, rather stiff to very stiff. (Glacial Till)	28		
				24		
				26		
				24		
175.9	120.5			26		
			END OF BORING. Boring then grouted.			

LOG OF BORING

PROJECT: BABX-96-227
GEOTECHNICAL EVALUATION
Minneapolis Parks & Recreation Board
Basset Creek Trail
Minneapolis, Minnesota

BORING: ST-9

LOCATION:
STA 114+75

DRILLER: Scott McLean | METHOD: 3 1/4" HSA | DATE: 5/9/96 | SCALE: 1" = 6'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
814.0	0.0	FILL	FILL: Mixed Silty Sand, Poorly Graded Sand and Gravel, brown and dark brown, moist.	16		
811.0	3.0	FILL	FILL: Wood mixed with Silty Sand, brown, wet.	23		
				3		
805.0	9.0	OL	ORGANIC CLAY, with a trace of shells and fibers, olive green, wet. (Swamp Deposit)	2		
				3	▽	
				2		
				TW #1		Thinwall #1 from 17 to 19 feet. MC = 120%; DD = 38 pcf; OC = 18.0%
				3		
				WH		
783.0	31.0			3		
		CH	FAT CLAY, dark gray, wet, very soft. (Alluvium)	TW #2		Thinwall #2 from 32 to 34 1/2 feet. MC = 108%; OC = 12.6%; LL = 136%; PI = 48%
				WH		
				TW #3		Thinwall #3 from 37 to 39 1/2 feet. MC = 85%; DD = 49 pcf; LL = 82%; PI = 55%
				WH		
766.0	48.0		(Continued on next page)	TW #4		Thinwall #4 from 47 to 49 1/2 feet. MC = 81%; DD = 55 pcf;

LOG OF BORING

PROJECT: BABX-96-227
GEOTECHNICAL EVALUATION
Minneapolis Parks & Recreation Board
Basset Creek Trail
Minneapolis, Minnesota

BORING: ST-9 (cont.)

LOCATION:
STA 114+75

DRILLER: Scott McLean | METHOD: 3 1/4" HSA | DATE: 5/9/96 | SCALE: 1" = 6'

Elev.	Depth	ASTM Symbol	Description of Materials	BPF	WL	Tests or Notes
		CH	(Continued from previous page) FAT CLAY, dark gray, wet, very soft. (Alluvium)	WH		LL = 80%; PI = 53%
				WH		
				2		
				3		
744.5	69.5			TW #5		Thinwall #5 from 67 to 69 1/2 feet. MC = 37%; DD = 87% LL = 42%; PI = 20%
		CL	LEAN CLAY, with a trace of Gravel and lenses of Poorly Graded Sand, gray, wet, rather stiff to stiff. (Alluvium)	10		
736.0	78.0			13		
		CH	FAT CLAY, dark gray, wet, rather stiff. (Alluvium)	10		
				12		
726.0	88.0					
723.5	90.5	CLS	SANDY LEAN CLAY, with a trace of Gravel, brownish gray, wet, very stiff. (Glacial Till)	26		
			END OF BORING. Water down 13' with 89' of hollow-stem auger in the ground.*			*Borehole immediately grouted with bentonite.