

**GEOTECHNICAL INVESTIGATION AND
FOUNDATION ENGINEERING REPORT
FOR
ST. VITAL CEMETERY COLUMBARIA**

Prepared for
**CITY OF WINNIPEG CEMETERIES
PLANNING, PROPERTY AND DEVELOPMENT DEPARTMENT
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WINNIPEG, MANITOBA
R3H 1B8**

Prepared by
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199 HENLOW BAY
WINNIPEG, MANITOBA
R3Y 1G4**

October 12, 2007

1.0 SUMMARY

The National Testing Laboratories Limited were retained to undertake a geotechnical investigation and provide foundation recommendations for the proposed columbaria at the St. Vital Cemetery in Winnipeg, Manitoba. One testhole was drilled to a depth of 12.2 m at the location of the proposed columbaria on October 5, 2007. The investigation revealed a soil profile of clay underlain by clayey silt till. Based upon the soil and groundwater conditions encountered at the site and the anticipated foundation loads, the proposed structure may be supported on cast-in-place concrete friction piles.

2.0 INTRODUCTION

2.1 Terms of Reference

The National Testing Laboratories Limited were retained to undertake a geotechnical investigation and provide foundation recommendations for the proposed columbaria at the St. Vital Cemetery in Winnipeg, Manitoba. Authorization to proceed with the geotechnical investigation was received from Jane Saxby on September 28, 2007.

3.0 GEOTECHNICAL INVESTIGATION

3.1 Testhole Drilling and Soil Sampling

The subsurface drilling and sampling program was conducted on October 5, 2007 with drilling services provided by Maple Leaf Drilling Ltd. under the supervision of our geotechnical field personnel. The testhole was drilled using a truck-mounted drill rig equipped with 125 mm diameter solid stem augers. One testhole was drilled at the location of the proposed columbaria and was terminated within the silt till at a depth of 12.2 m. The testhole location is shown on the attached Testhole Location Plan.

Representative soil samples were obtained directly off the augers at depth intervals ranging from 0.8 to 1.5 m. Upon completion of the drilling, the testhole was examined for evidence of sloughing and groundwater seepage. The soil samples were returned to our soils laboratory for additional examination and testing.

3.2 Laboratory Testing

Strength index testing using a torvane device was performed on soil samples obtained from the clay layer. Water contents were determined for all soil samples. The torvane readings and water contents are shown on the attached testhole log.

4.0 SUBSURFACE CONDITIONS

4.1 Soil Profile

The general soil stratigraphy at the site, as interpreted from the testhole log, consisted of clay underlain by clayey silt till.

Clay

Clay was encountered beneath topsoil in the testhole. The clay extended to a depth of 12 m below grade. The clay was brown to grey, stiff to very stiff, moist, and of high plasticity, with trace silt and gypsum inclusions. It contained silt and clayey silt inclusions below a depth of 4.6 m and stone inclusions below a depth of 7.6 m. The clay became firm, with an increase in silt and stone inclusions below a depth of 10 m. Water contents of the clay ranged from 19 to 39%.

Silt Till

Silt till was encountered beneath the clay in the testhole. The glacial till was composed predominantly of silt with some fine gravel and clay. The till was grey, firm, wet, and of low plasticity. The water content of the glacial till was 15%.

4.2 Groundwater

Minor groundwater seepage was observed from the clay between a depth of 4.6 and 6.1 m. Groundwater seepage was also observed from the silt till. Sloughing occurred within the silt till at a depth of 11.9 m and the water level was observed at a depth of 7.6 m in the testhole upon completion of drilling. It should be noted that only short-term seepage and sloughing conditions were observed and ground water levels will normally fluctuate during the year and will be dependent upon precipitation and surface drainage.

5.0 DESIGN RECOMMENDATIONS AND COMMENTS

5.1 Foundation

Based upon the soil and groundwater conditions encountered at the site and the anticipated foundation loads, the proposed structure may be supported on cast-in-place concrete friction piles.

5.1.1 Cast-In-Place Concrete Friction Piles

Cast-in-place concrete friction piles are suitable for light to moderate foundation loads and may be designed based upon an allowable skin friction value of 18 kPa. The allowable skin friction value is applied to the pile circumference within the clay stratum only. Due to the presence of high plasticity clay on the site and the potential for soil drying and shrinkage near the ground surface, the frictional support should be excluded in the calculation of the pile capacity for a depth of 3 m measured from the final grade. The contribution from end-bearing should also be ignored in pile capacity calculations. Minimum pile spacing should be three pile diameters, measured centre to centre.

Piles for unheated and heated structures should have minimum pile lengths of 8 m and 6 m, respectively, measured from final grade. All piles in unheated areas should be provided with full length steel reinforcement to prevent frost jacking due to adfreeze forces. Pile holes should be poured with concrete as soon as they are drilled to minimize any potential problems of soil

sloughing and ground water seepage. Temporary steel sleeves should be available in the event that ground water seepage or sloughing of the pile holes is encountered during pile installation. Groundwater, if encountered in the pile holes, should be removed prior to concrete placement.

It is recommended that the pile depth below existing grade not exceed 10 m to avoid penetration of the softer clay and potential water seepage below this depth. A minimum void space of 200 mm should be provided beneath all pile-supported structural elements to accommodate potential heave of the high plasticity clay. Pile settlements are expected to be negligible with the use of cast-in-place concrete friction piles.

5.1.2 Foundation Concrete

The clay soils in the Winnipeg area contain sulphates that will cause deterioration of concrete. The Class of Exposure for concrete in contact with clay soil in the Winnipeg area is considered to be severe (S-2 in CSA A23.1-04 Table 3) which requires the use of type HS cement, a maximum water-to-cementing materials ratio of 0.45, an air content of 4% to 7% and 32 MPa design strength for the concrete mix.

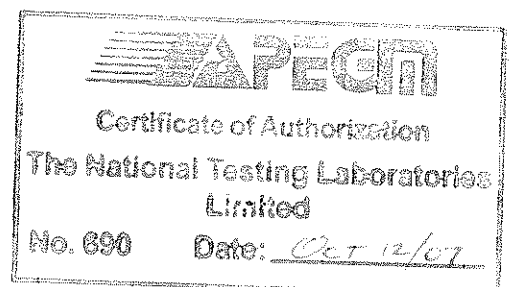
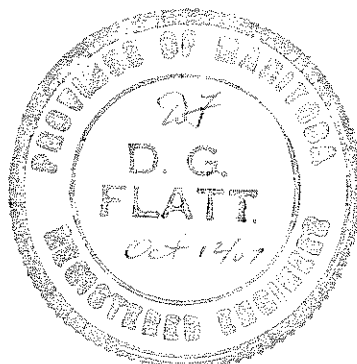
6.0 CLOSURE

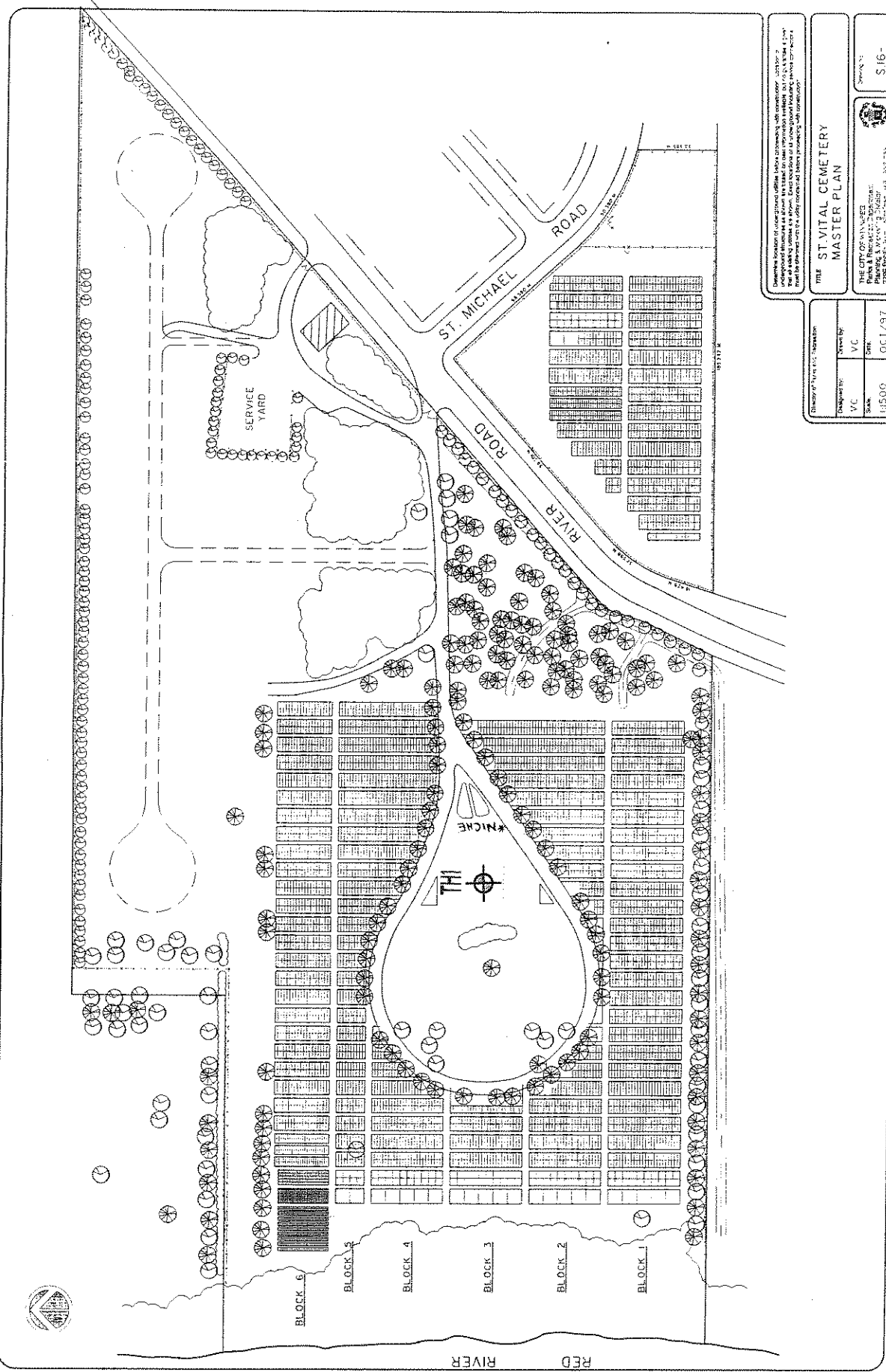
Professional judgements and recommendations are presented in this report. They are based partly on evaluation of the technical information gathered during our site investigation and partly on our general experience with subsurface conditions in the area. We do not guarantee the performance of the project in any respect other than that our engineering work and judgment rendered meet the standards and care of our profession. It should be noted that the testhole may not represent potentially unfavourable subsurface conditions on the project site. If during construction soil conditions are encountered that vary from those discussed in this report, we should be notified immediately in order that we may evaluate effects, if any, on foundation performance. The recommendations presented in this report are applicable only to this specific site. These data should not be used for other purposes.

We appreciate the opportunity to assist you in this project. Please call me if you have any questions regarding this report.



Don Flatt, M. Eng., P. Eng.
Senior Geotechnical Engineer





ST. VITAL CEMETERY
 MASTER PLAN

DESIGNED BY: VC
 DRAWN BY: VC
 DATE: 08/17/97
 SCALE: 1/8"=1'-0"

ST. VITAL CEMETERY
 MASTER PLAN
 SHEET NO. S.16-

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TESTHOLE TH1



Project Name: St. Vital Cemetery Columbaria
 Client: City of Winnipeg
 Drilling Contractor: Maple Leaf Drilling
 Drilling Method: 125 mm flight auger

Date Drilled: October 5, 2007
 Depth of Testhole: 12.2 m
 Logged by: Kurtis Kulchyski
 Reviewed by: Don Flatt

