



TECHNICAL MEMORANDUM

DATE June 24, 2024

Project No. CA0033714.1722

TO Mr. Peter Thompson
Queensway Carleton Hospital
3045 Baseline Road
Ottawa, Ontario K2H 8P4

GEOTECHNICAL DESKTOP STUDY PROPOSED QUEENSWAY-CARLETON HOSPITAL EXPANSION

WSP Canada Inc. (WSP) has been retained to provide geotechnical engineering services for the proposed Queensway-Carleton Hospital expansion, located in Ottawa, Ontario (the Site).

It is understood that the Queensway Carleton Hospital (QCH or “Client” herein) requires geotechnical information to support design and construction of several new building elements attached or adjacent to existing hospital structures, a proposed free-standing parking garage, and access road upgrades, as shown on the attached Site Plan (Figure 1). The Site Plan also presents the location of 16 boreholes proposed by the Client, to be reviewed by WSP in the context of the proposed development and available historical information. This Technical Memorandum presents the results of our geotechnical desktop review and gap analysis, and our recommendations for the detailed investigation program.

WSP (including former Golder Associates Ltd. and McRostie Genest St-Louis acquisitions) previously completed several investigations within the Queensway-Carleton Hospital campus. The following information was considered most relevant:

- Report prepared by Golder Associates titled “Geotechnical Background Information 2009, Queensway-Carleton Hospital, Baseline Road, Ottawa, Ontario”, dated August 10, 2009 (Report No. 07-1121-0002 (9000)). This Golder report also contains borehole logs from McRostie Genest report SF-1177A.
- Report prepared by Golder Associates titled “Report on Preliminary Geotechnical Investigation, Faculty Development Plan – Part 3A, Queensway-Carleton Hospital, Baseline Road, Ottawa, Ontario”, dated October 29, 2008 (Report No. 07-1121-0002 (7000)).

The historical reports document 99 borehole and test pit logs completed on site between 1968 and 2008. A plan summarizing the historical borehole and test pit locations is attached as Figure 2. Borehole and test pit logs are appended.

In general, subsurface conditions beneath the QCH site include a layer of topsoil/fill underlain by silty sandy and/or clayey deposits with variable amounts of sand and silt. This material is underlain by sandy glacial till over the dolostone bedrock of the Beekmantown Group.

The following sections provide a discussion on each proposed expansion feature from a geotechnical perspective, including an information gap analysis and commentary on geotechnical investigation requirements.

Parking Garage

A new free-standing parking garage, rectangular in shape, approximately 35 x 75 m, is proposed to be built north of the existing parking garage. A grassy area with trees and paved bike lanes currently exists in the footprint area. Design review is required to determine the number of underground levels planned, if any.

WSP found records for five boreholes and test pits completed near the proposed footprint area:

- TP97-1: located slightly outside and north of the proposed area.
- TP97-2: located at the eastern limit of the proposed area.
- TP97-3: located in the western half of the proposed area.
- BH07-04: located slightly outside and southwest of the proposed area.
- BH07-06: located in the western half of the proposed area.

Based on the borehole and test pits logs, the ground elevation is mostly flat and varies between about 76.9 and 77.7 metres above mean sea level (masl), per a geodetic datum.

Subsurface materials are consistent with other areas of the QCH site.

Topsoil, where encountered, was approximately 150 to 450 mm thick.

Fill material was encountered in three of the historical testholes and consisted primarily of sand with variable amounts of silt and gravel. Fill extended to depths varying between approximately 0.6 and 0.9 m (76.4 to 76.0 masl). No SPT 'N' values were taken within the fill layer to assess relative compactness.

The (presumed native) granular deposit was encountered in three of the testholes and consisted primarily of compact silt and sand at varying amounts. It extended to depths varying between about 0.6 to 1.2 m (i.e., 76.9 to 75.9 masl). An SPT 'N' value of 19 was noted within this layer.

A cohesive soil deposit was reported in all five testhole records and was described as hard to firm clay to silty clay with loose sand seams. At the boreholes, the deposit extended to depths varying between about 3.7 and 4.1 m (i.e., 73.5 to 72.8 masl). Penetrometer readings were taken and reported undrained shear strengths of between 260 to 400 kPa. No in situ torque vane tests were taken, which more definitively measure the shear strengths of cohesive soils.

The glacial till, where encountered, was reported to contain very loose to loose silt and sand in varying amounts, with SPT 'N' values of between 2 and 5. Results are suggestive of potential disturbed material sampling; conditions should be tested and reaffirmed in the proposed updated study. The till deposit extended to a maximum depth of approximately 5.5 m.

Bedrock was cored and identified as grey dolostone and was encountered at depths approximately 4.4 and 5.5 m (i.e., 72.7 to 71.4 masl). Test pits extended to a maximum depth of 2.2 m without noting any refusal. Dolostone was core sampled at borehole BH07-04 to a depth of 7.7 m (69.2 masl), noting an RQD varying between 51 to 63% (Fair quality).

Groundwater was noted at a depth of 4.4 m (72.1 masl) at borehole BH07-04 during drilling (no piezometer reading available). No groundwater seepage was noted in any test pits.

The following table summarizes identified information gaps that are relevant to the geotechnical design of the proposed parking garage.

Table 1 – Information Gap Analysis – Parking Garage

Gap No.	Description of Information Gap	Degree of Importance
1	Available borehole and test pit logs date from 1997 and 2007. Information on any excavation, construction or grade raise that might have happened since then is not readily available. The exact field work methodology of past investigations is unknown. A refresh of the subsurface condition information at the site is recommended.	High
2	Qualities and characteristics of the overburden soil across the proposed area are limited. <ul style="list-style-type: none"> - Limited number of SPT 'N' values. - Overburden thickness across the proposed area is limited. - Further testing is recommended to assess the extent of very loose to loose soils. 	Moderate
3	Limited information exists regarding the depth and characteristics of the bedrock underlying the site. <ul style="list-style-type: none"> - Only one borehole (BH07-04) included rock coring, however, the borehole is located outside the proposed area. - Bedrock was reported as only Fair quality; depth to Good to Excellent bedrock depth is unknown and may be applicable to the design of deep foundations for the structure. 	Moderate
4	Groundwater levels/gradient across the proposed area are unknown. <ul style="list-style-type: none"> - The only water level depth available was taken in an open hole during drilling in 2007. 	Moderate
5	Laboratory testing information is limited to non-existent. <ul style="list-style-type: none"> - No records of any grain sizes, Atterberg limits or UCS rock testing are available. 	Moderate
6	Soil corrosion potential is unknown at the proposed area (sulphate damage to concrete elements and corrosion potential to buried steel elements).	Moderate
7	Accuracy of existing topographic information is unknown.	Low

As per the attached plan, three additional boreholes are proposed to be advanced around the location of the new parking garage.

Materials Management Addition

A new single story (one-level) Materials Management Addition, rectangular in shape, approximately 45 x 60 m, is proposed to be built north of the existing main hospital building, at the location of the existing materials loading area.

WSP found records of fourteen boreholes that were completed around the proposed area:

- BH72-16: located at the southern limit of the proposed area.
- BH91-1 to BH91-4: located along the eastern limit of the proposed area.
- BH98-3: located in the southwestern corner of the proposed area.
- BH04-08: located in the southwestern corner of the proposed area.
- BH04-09: located in the south center of the proposed area.
- BH04-10: located in the east side of the proposed area.
- BH04-11: located in the southwestern corner of the proposed area.
- BH04-12: located in the south center of the proposed area.
- BH04-13: located in the southeastern corner of the proposed area.
- BH05-8: located in the northeast side of the proposed area.
- BH07-10: located in the northeast side of the proposed area.

Based on the borehole logs, the ground elevation is mostly flat and varies between about 73.9 and 75.6 masl, except at borehole BH72-16 where the ground elevation was 77.6 masl, indicating that a cut might have happened in the area after 1972.

In general, the subsurface conditions consisted of topsoil or asphalt and/or fill, underlain by granular and/or cohesive soil deposits, underlain by glacial till and dolostone bedrock (typical site profile).

Topsoil, where encountered, was approximately 300 mm thick.

A pavement structure was encountered in most boreholes and extended to depths varying between about 0.9 to 2.0 m (73.9 to 72.4 masl). It comprised asphalt layers overlying crushed limestone fill and sand and gravel fill; clay and pieces of rock and crushed stone were noted in the fill. SPT 'N' values varying between about 8 and 92 were noted, indicating loose to very dense fill layers, but more generally compact (high "N" values likely indicative of stoney inclusions).

The granular deposit was encountered in two boreholes and consisted primarily of silt and sand in varying amounts. The deposit extended to a maximum depth of 1.5 m (i.e., 73.4 to 72.6 masl depending on location). An SPT 'N' value of 20 was noted within this layer, indicating it is a compact material.

The cohesive soil deposit was encountered in six of the noted boreholes and comprised very stiff to soft sandy clay to silty clay with very fine sand seams. The deposit extended to depths varying between approximately 1.9 to 4.6 m (i.e., 77.6 to 72.3 masl). A torque vane test was completed at borehole BH72-16 and reported an in situ undrained shear strength of approximately 70 kPa. The moisture content of material sampled in borehole BH72-16 varied between approximately 30 to 50% based on laboratory tests (inferred to be wetter than the plastic limit for this material).

The glacial till was encountered in five boreholes and was predominantly sandy textured according to the logs. The till extended to depths varying between approximately 1.6 and 5.4 m (i.e., 73.0 to 72.3 masl), and was described as medium dense to dense.

Bedrock sampled in borehole cores comprised grey dolostone and was encountered at depths varying between about 1.5 and 5.4 m (i.e., 73.1 to 72.2 masl). The bedrock was cored at boreholes BH72-16, BH04-10 to BH04-12, and BH05-8 to depths varying between about 3.1 to 6.9 m (71.1 to 70.6 masl), with reported core recovery ranging between 80 to 100%.

Groundwater levels were reported in boreholes BH72-16, BH98-3, BH04-09 to BH04-13 and BH05-8, and varied between elevation 72.8 to 73.1 masl, except at borehole BH72-16 which reported a groundwater elevation of 76.0 masl.

The following table summarizes identified information gaps that are relevant to the geotechnical design of the proposed materials management addition.

Table 2 – Information Gap Analysis – Materials Management Addition

Gap No.	Description of Information Gap	Degree of Importance
1	Available borehole logs date from 1972 to 2007. Information on any excavation, construction or grade raise that might have happened since then is not readily available. The exact field work methodology of past investigations is unknown. A refresh of the subsurface condition information at the site is recommended.	High
2	Qualities and characteristics of the overburden soil across the proposed area are limited. <ul style="list-style-type: none"> - Only one SPT 'N' value available for the granular deposit. - Only one shear strength test is available for the cohesive deposit. - Further testing is recommended to assess the extent of reported loose or soft soils. 	Moderate
3	Limited information exists regarding depth and characteristics of the bedrock underlying the site. <ul style="list-style-type: none"> - No RQD values available. - The extent of weathered bedrock is unknown. 	Moderate
4	Laboratory testing information is limited to non-existent. <ul style="list-style-type: none"> - No records of any grain sizes, Atterberg limits or UCS rock testing are available. 	Moderate
5	Soil corrosion potential is unknown at the proposed area (sulphate damage to concrete elements and corrosion potential to buried steel elements).	Moderate
6	The reuse potential of existing pavement structure fills is unknown.	Low
7	Accuracy of existing topographic information is unknown.	Low

As per the attached plan, three additional boreholes are proposed to be advanced around the location of the new Materials Management Addition.

Temporary Loading Dock

A new Temporary Loading Dock, with an “L-shape” approximately 22 x 22 m in area, is proposed to be built southwest of the existing QCH Cancer Centre. The Temporary Loading Dock is to be connected to the west of the re-aligned materials loading area.

WSP found records of three boreholes that were completed around the area of this proposed structure:

- BH72-13: located slightly outside the northwestern corner of the proposed area.
- BH72-20: located at the northeastern corner of the proposed area.
- BH07-7: located at the northwestern corner of the proposed area.

Based on the borehole logs, the ground elevation varies between about 74.8 and 76.6 masl.

In general, the subsurface conditions at boreholes BH72-13 and BH72-20 comprised topsoil underlain by a cohesive deposit, granular deposit / glacial till layer, and dolostone bedrock. At borehole BH07-7 pavement structure was found directly overlying the bedrock.

Topsoil, where encountered, was clayey and approximately 300 mm thick.

The noted pavement structure extended to a depth of 2.2 m (72.6 masl) and comprised asphalt overlying crushed stone fill and compact to loose sand and gravel fill with pieces of crushed limestone.

A cohesive deposit comprising very stiff to soft sandy clay to silty clay with very fine sand seams was found to depths of between about 1.5 and 4.3 m (i.e., 74.6 to 72.2 masl). Torque (shear) vane tests were completed and reported undrained shear strengths of between 35 to 70 kPa for the in-situ material. Moisture content varied between approximately 25 to 55% in laboratory test samples.

The granular deposit was only encountered in borehole BH72-13 and consisted of loose to medium dense silty fine sand with little gravel. This material extended to a maximum depth of 3.3 m (72.8 masl) and is loose to compact based on a SPT ‘N’ value of 12.

Glacial till was only encountered in borehole BH72-20 and comprised dense sandy silty gravel. The till extended to a depth of 5.0 m (71.6 masl) and a SPT ‘N’ value of 40 was reported for this layer.

Dolostone bedrock was encountered at depths varying between about 2.2 and 5.0 m (i.e., 72.8 to 71.6 masl) and was cored to depths varying between about 3.7 to 6.5 m (i.e., 71.3 to 70.1 masl). Reported core recoveries varied between 87 and 100% and reported RQD varied between 47 and 100% (indicating Poor to Excellent quality material).

Groundwater elevations were measured in boreholes BH72-13 and BH72-20 between approximately 75.2 and 75.7 masl.

The following table summarizes identified information gaps that are relevant to the geotechnical design of the proposed temporary loading dock.

Table 3 – Information Gap Analysis – Temporary Loading Dock

Gap No.	Description of Information Gap	Degree of Importance
1	Available borehole logs date from 1972 to 2007. Information on any excavation, construction or grade raise that might have happened since then is not readily available. The exact field work methodology of past investigations is unknown. A refresh of the subsurface condition information at the site is recommended.	High
2	Qualities and characteristics of the overburden soil across the proposed area are limited. <ul style="list-style-type: none"> - Limited number of SPT 'N' values. - Available overburden thickness information across the proposed area is limited. All existing boreholes are towards the north of the proposed area. - Further testing is recommended to assess the extent of loose and soft soils. 	Moderate
3	Limited information exists regarding depth and characteristics of the bedrock underlying the site. <ul style="list-style-type: none"> - All existing boreholes are towards the north of the proposed area. 	Moderate
4	Groundwater levels/gradient across the proposed area are unknown. <ul style="list-style-type: none"> - Available water levels information date from 1972. 	Moderate
5	Laboratory testing information is limited to non-existent. <ul style="list-style-type: none"> - No records of any grain sizes, Atterberg limits or UCS rock testing are available. 	Moderate
6	Soil corrosion potential is unknown at the proposed area (sulphate damage to concrete elements and corrosion potential to buried steel elements).	Moderate
7	The reuse potential of existing pavement structure fills is unknown.	Low
8	Accuracy of existing topographic information is unknown.	Low

As per the attached plan, two additional boreholes are proposed to be advanced around the location of the temporary loading dock.

Emergency Department Addition

A new Emergency Department Addition, also 'L' shaped and approximately 60 x 100 m in area, is proposed to be built east of the main hospital building, at the location of the existing eastern paved entrance and paved access lane. An ambulance parking area is to be built northeast of the proposed Emergency Department Addition.

WSP found records of five boreholes that were completed around the proposed area:

- BH72-12: located at the northwestern corner of the proposed area.
- BH98-4: located slightly outside the southeastern corner of the proposed area.
- BH05-1 to BH05-3: located along the northern limit of the proposed area.

Based on the borehole logs, the ground elevation varies between about 76.6 and 78.6 masl.

Subsurface conditions consisted of topsoil or asphalt and/or fill, underlain by a cohesive soil deposit, glacial till, and bedrock.

Topsoil, where encountered, was clayey and approximately 150 to 300 mm thick.

The pavement structure was encountered in three boreholes and extended to depths varying between about 0.3 to 1.5 m (i.e., 76.7 to 76.4 masl). Pavement structure comprised asphalt overlying crushed stone fill and/or sand and gravel fill.

Clayey fill with topsoil was encountered in boreholes BH05-1 to BH05-3 to depths varying between about 1.5 to 3.0 m (i.e., 75.6 to 74.5 masl).

The cohesive deposit comprised hard to relatively soft sandy clay to silty clay with fine sand seams and extended to depths varying between 5.0 and 9.0 m (i.e., 72.6 to 69.6 masl). Torque (shear) vane tests were completed at select locations and reported undrained shear strengths varying between about 220 to 40 kPa. Pocket penetrometer readings in similar sampled materials widely varied between 400 and 20 kPa. Moisture content ranged between approximately 40 and 55% based on laboratory tests.

The glacial till was only encountered in borehole BH05-3 and consisted of very dense sandy textured material. The till was encountered at a depth of 9.0 m (69.0 masl) and was approximately 600 mm thick at this borehole location.

Dolostone bedrock was encountered at depths varying between approximately 5.0 and 9.6 m (i.e., 72.1 to 69.0 masl), and was core sampled to depths of approximately 6.5 to 11.1 m (i.e., 70.6 to 67.4 masl). Core recoveries varied from between 93 to 95%.

Groundwater elevations were measured in all five boreholes between approximately 74.6 and 75.7 masl.

The following table summarizes identified information gaps that are relevant to the geotechnical design of the proposed emergency department addition.

Table 4 – Information Gap Analysis – Emergency Department Addition

Gap No.	Description of Information Gap	Degree of Importance
1	Available borehole logs date from 1972 to 2005. Information on any excavation, construction or grade raise that might have happened since then is not readily available. The exact field work methodology of past investigations is unknown. A refresh of the subsurface condition information at the site is recommended.	High
2	Qualities and characteristics of the overburden soil across the proposed area are limited. <ul style="list-style-type: none"> - Extent of clay fill. - Further testing is recommended to assess the extent of soft soils. 	Moderate
3	Limited information exists regarding depth and characteristics of the bedrock underlying the site. <ul style="list-style-type: none"> - The bedrock elevation appears variable across the proposed location. 	Moderate
4	Laboratory testing information is limited to non-existent. <ul style="list-style-type: none"> - No records of any grain sizes, Atterberg limits or UCS rock testing are available. 	Moderate
5	Soil corrosion potential is unknown at the proposed area (sulphate damage to concrete elements and corrosion potential to buried steel elements).	Moderate
6	The reuse potential of existing pavement structure fills is unknown.	Low
7	Accuracy of existing topographic information is unknown.	Low

As per the attached plan, three additional boreholes are proposed to be advanced around the location of the new emergency department addition.

Urgent Care Centre Addition

A new Urgent Care Centre addition (parallelogram shape, approximately 25 x 25 m) is proposed to be built at the southeastern corner of the main hospital building, at the location of the existing paved entrance.

WSP found records of two boreholes and a test pit that were completed around the proposed area:

- TP98-8: located at the southwestern corner of the proposed area.
- BH04-3: located at the western limit of the proposed area.

Based on the testhole logs, the ground elevation is mostly flat and varies between about 78.6 and 79.0 masl.

In general, the subsurface conditions consisted of topsoil and/or fill, underlain by a cohesive deposit.

The topsoil was encountered in TP98-8 and was approximately 250 mm thick.

The fill was encountered in both testholes and consisted of variable amounts of sand, clay, gravel and silt with debris. It extended to depths of 2.3 and 2.4 m (76.7 to 76.2 masl). Variable SPT 'N' values of 47, 12, 6, 11, and 10 were noted within this layer.

The cohesive deposit comprised stiff to soft clay to silty clay and extended to depths of approximately 3.1 to 5.1 m (i.e., 75.5 to 73.9 masl). A torque vane test was completed and reported an undrained shear strength of approximately 45 kPa. Pocket penetrometer readings in recovered split spoon samples varied widely between 335 to 25 kPa. Moisture content was approximately 40% based on laboratory tests.

At borehole BH04-3, auger refusal on probable bedrock was noted at approximately 9.5 m depth (69.5 masl). Test pit TP98-8 was terminated at 3.1 m depth (75.5 masl) without reaching refusal.

A groundwater level elevation of 75.9 masl was measured at borehole BH04-3.

The following table summarizes identified information gaps that are relevant to the geotechnical design of the proposed urgent care centre addition.

Table 5 – Information Gap Analysis – Urgent Care Centre Addition

Gap No.	Description of Information Gap	Degree of Importance
1	Available borehole and test pit logs date from 1998 to 2004. Information on any excavation, construction or grade raise that might have happened since then is not readily available. The exact field work methodology of past investigations is unknown. A refresh of the subsurface condition information at the site is recommended.	High
2	Qualities and characteristics of the overburden soil across the proposed area are limited. <ul style="list-style-type: none"> - Limited number of SPT 'N' values. - Overburden thickness across the proposed area is limited. All existing boreholes are towards the west of the proposed area. - Further testing is recommended to assess the extent of soft soils. 	Moderate
3	Limited information exists regarding depth and characteristics of the bedrock underlying the site. <ul style="list-style-type: none"> - Auger refusal depth available for one borehole only. - No rock coring was conducted. 	Moderate
4	Groundwater levels/gradient information across the proposed area is limited.	Moderate
5	Laboratory testing information is limited to non-existent. <ul style="list-style-type: none"> - No records of any grain sizes, Atterberg limits or UCS rock testing are available. 	Moderate
6	Soil corrosion potential is unknown at the proposed area (sulphate damage to concrete elements and corrosion potential to buried steel elements).	Moderate
7	Accuracy of existing topographic information is unknown.	Low

As per the attached plan, one additional borehole is proposed to be advanced around the location of the new urgent care centre addition.

Realigned Loading Area

The existing loading area is planned to be moved north to make place for the new materials management addition.

WSP found records of one borehole that was completed around the proposed area:

- BH07-12: located at the center of the proposed area.

Based on the borehole log, the ground elevation is approximately 77.4 masl.

In general, the subsurface conditions are typical for the site and consist of topsoil overfill, underlain by a cohesive deposit, and a granular deposit.

The topsoil was approximately 50 mm thick.

The fill consisted of sand and gravel to 0.6 m (76.8 masl) and loose sandy silt with some clay and trace gravel to 1.3 m (76.1 masl). An SPT 'N' value of 9 was noted within this layer.

The cohesive deposit consisted of a very stiff to stiff silty clay with sand seams. It extended to a depth of about 2.7 m (74.7 masl).

The granular deposit consisted of loose to dense silty fine sand and extended to auger refusal at 4.0 m depth (73.4 masl).

Auger refusal on probable bedrock was noted at approximately 4.0 m (73.4 masl) depth.

A groundwater level elevation of 74.2 masl was measured in borehole BH07-12 (open hole measurement during drilling).

The following table summarizes identified information gaps that are relevant to the geotechnical design of the proposed urgent care centre addition.

Table 6 – Information Gap Analysis – Realigned Loading Area

Gap No.	Description of Information Gap	Degree of Importance
1	Available borehole log dates from 2007. Information on any excavation, construction or grade raise that might have happened since then is not readily available. The exact field work methodology of past investigations is unknown. A refresh of the subsurface condition information at the site is recommended.	High
2	Qualities and characteristics of the overburden soil across the proposed area are limited. <ul style="list-style-type: none"> - Limited number of SPT 'N' values. - Overburden thickness information across the proposed area is limited. - Further testing is recommended to assess the extent of loose soils. 	Moderate
3	Limited information exists regarding depth and characteristics of the bedrock underlying the site. <ul style="list-style-type: none"> - Auger refusal depth available for one borehole only. - No rock coring was conducted. 	Moderate
4	Groundwater levels/gradient information across the proposed area is limited.	Moderate
5	Laboratory testing information is limited to non-existent. <ul style="list-style-type: none"> - No records of any grain sizes, Atterberg limits or UCS rock testing are available. 	Moderate
6	Soil corrosion potential is unknown at the proposed area (sulphate damage to concrete elements and corrosion potential to buried steel elements).	Moderate
7	Accuracy of existing topographic information is unknown.	Low

As per the attached plan, one additional borehole is proposed to be advanced around the location of the realigned loading area.

New Road System

A new road system, approximately 400 to 500 m long, is proposed to be built on the west side of the QCH complex, connecting John Sutherland Drive at the north to Baseline Road at the south. A grassy area with trees and paved bike lanes exists at the proposed area.

No available borehole records were found around the proposed area.

As per the attached plan, three additional boreholes are proposed to be advanced along the location of the new road.

General Findings

Based on the 2008 Golder report, corrosivity analyses on samples of the cohesive deposit and glacial till from boreholes BH08-302 and BH08-307 indicate that concrete made with Type GU Portland cement should be acceptable. The past performance of older existing foundations exposed at the time of the 2008 investigation would support this expectation. The results also indicate moderate levels of corrosivity for buried ferrous metals with significant variations over the site possibly affected in part by de-icing chemicals in parking areas. It is to be noted that the 2008 boreholes are not in the immediate location of any of the newly proposed features and that the corrosivity levels noted at these boreholes might not be representative of the entire QCH site.

Based on that same report, point load index tests carried out of the dolostone cores retrieved from the 2008 investigation resulted in an average UCS of about 153 MPa, indicating a very strong R5 bedrock. It is to be noted that the 2008 boreholes are not in the immediate location of any of the newly proposed features. Based on the 2009 Golder report, previous site investigations revealed soil-filled vertical joints or clefts at a few locations in the dolomitic bedrock. The infilling generally consisted of dense to very dense glacial till and the widths of the joints were found to range from about 100 to 600 mm. It was noted that removal of the bedrock at the site would require drill and blast techniques.

Based on seismic Vertical Soil Profiling (VSP) completed in 2008 at borehole BH08-307, the shear wave velocity of the bedrock increases from about 1000 m/s at a depth of about 3 m to 2500 m/s at a depth of about 8 m. A Site Class A was given for footing type foundations bearing directly on the dolostone bedrock. Overburden shear wave velocities must be considered for shallower structures (e.g., slabs, pile caps) bearing on overburden.

Based on the 2009 Golder report, the site has been considerably reworked at several locations over the years due to construction activities for additions to the QCH campus, which, according to the report, would explain the presence of areas with a significant amount of fill deposits.

The 2009 Golder report indicated that one-storey slab-on-grade structures can generally be supported on conventional spread footings within the natural undisturbed clay soils. Heavier structures would require footings bearing on bedrock or deep foundation elements such as end bearing piles or caissons. The 2008 Golder report discussed geotechnical recommendations for the construction of a one- to four-level Surgical Addition to be built adjacent to the main existing building at its northwestern corner. The report noted that the existing structure was supported on concrete filled pipe piles driven to bedrock. The slab on the grade of the existing structure was based at a geodetic elevation of 79.25 m. The Surgical Addition was to be supported on footings placed directly on the dolostone bedrock. An excavation below the existing pile caps and adjacent to the existing pipe piles would have been required. The as-built pile driving records (McRostie Genest St-Louis, 1973-74), attached at the end of this document, indicate that the piles of the existing main building were driven to elevations varying between about 70.9 to 74.0 m, except pile 347A which was driven deeper to elevation 64.0 m.

Recommended Geotechnical Program

To close the above noted information gaps and provide geotechnical recommendations, a geotechnical exploration program should be carried out for the design and construction of the proposed features. The 16-borehole plan proposed by the Client is considered adequate. Indeed, given the “age” of the available historical subsurface information, and given how scattered and inconsistent the information is across multiple boreholes and investigations, WSP could not justify reducing the number of proposed boreholes and the extent of the scope

of work. The extent of the expansion project across the QCH site, the presence of potentially significant amounts of fill, the presence of loose and soft soils, the variability of the bedrock profile, the limited information on the groundwater level and the lack of geotechnical laboratory information are all important factors to be considered and to be properly assessed for an efficient and safe design.

The proposed drilling program includes:

- Preparation of a health and safety plan.
- Request of public and private locates. This will include a site visit to layout the boreholes as per the plan. The boreholes may be moved slightly from their original position to avoid drilling through underground services, to facilitate drilling setup and/or to minimize damage to existing features (landscaping, sidewalks, pavement, etc.)
- The mobilization of a geotechnical drilling rig and qualified personnel.
- The drilling and sampling of 16 boreholes to auger refusal. Six boreholes will include 3 to 4.5 m rock coring to sample and verify the bedrock condition at the location of the new parking garage and building additions.
- Soil will be sampled at regular depth intervals and in-situ testing including SPT and shear vane testing will be completed in accordance with standard industry practices. Shelby tubes may be advanced in soft to firm clay soils, if encountered, to collect relatively undisturbed samples. The entire field program will be supervised by a qualified member of WSP's geotechnical staff.
- Monitoring wells will be installed in up to 8 boreholes (6 in overburden soil, 2 in bedrock) to determine local groundwater levels following completion of the drilling program. The water levels will be allowed to stabilize after drilling for a period of approximately 2 weeks before groundwater readings are taken. Levels in existing monitoring wells, if any, will also be checked.
- Laboratory testing program to obtain site-specific parameters required for geotechnical design recommendations, including physical and chemical properties of site soils. Chemical testing (sulphate content, pH, soil resistivity, and chloride content) will be carried out on three selected soil samples from the site to determine the potential for sulphate attack and appropriate cement types per CSA A23.1, as well as the potential for corrosion of buried steel elements (e.g. AWWA rating system).

Given the depth variability of the bedrock profile and considering the distance between all newly proposed project features and the historical VSP borehole BH08-307, additional shear wave velocity testing at the site may prove beneficial, especially if basement levels and/or deep foundations are to be considered for the building additions. If a proposed feature is not to be found directly on bedrock, the soil profile may dominate seismic behavior. The materials must therefore be accurately characterized. Indeed, based on the available information on the subsurface conditions at the Site, it is expected that Seismic Site Classes E to C would apply, depending on the location. Site-specific shear wave velocity measurements are required per NBCC (2020) and OBC (2019) for Site Classes A and B. WSP proposes to include additional VSP testing to the scope of work, at up to two of the sixteen proposed boreholes (BH24-03 and BH24-15), for an additional cost of \$6,000 per borehole, to potentially justify a higher Site Class. Client approval of a scope change is required, as this testing was not anticipated prior to the desktop review. VSP testing requires that a 2" PVC pipe be installed and grouted in place in a borehole, with the pipe being encased in at least 6 m of rock to provide adequate results.

Environmental considerations are outside of the geotechnical scope of work. These include the presence of rare or endangered species at the site and the presence of or proximity to Areas of Potential Environmental Concern (APECs) which may contain contaminated soils or groundwater. During drilling, WSP will make note of any potential contaminant indicators in the sampled material, such as discolouration, staining, sheens, odours, etc. Species at risk assessments and environmental site assessments can be completed by WSP if required, separately from the aforementioned proposed geotechnical investigation.

Closure

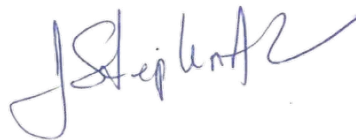
We trust that this desktop study provides sufficient information for your present requirements. If you have any questions concerning this study, please do not hesitate to contact the undersigned.

Yours truly,

WSP Canada Inc.



Othmane Benkirane, MAsc., ing., P.Eng.
Geotechnical Engineer



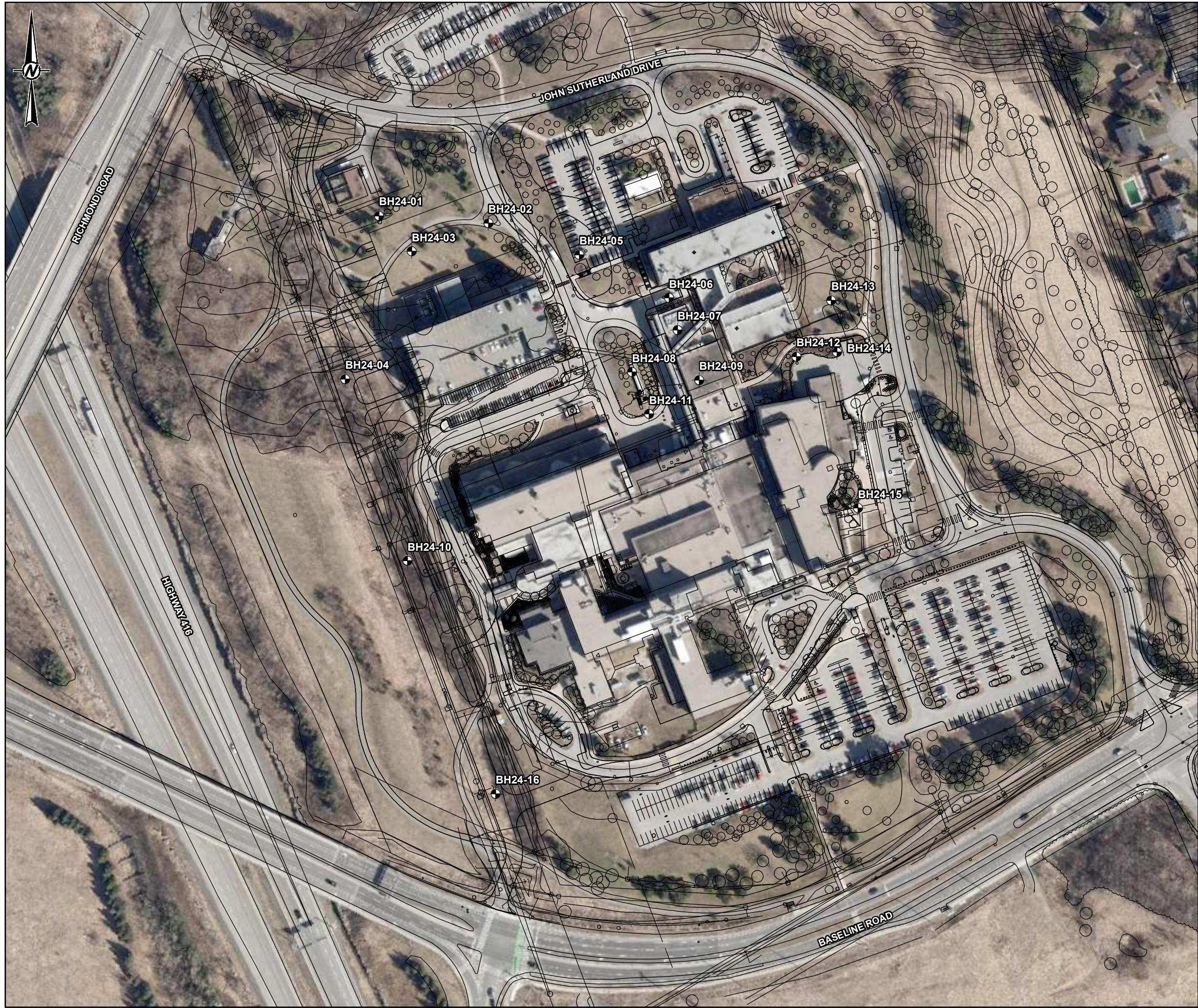
J. Stephen Ash, P.Eng. P. Geo.
Senior Principal Geotechnical Engineer

OB/SA/yj

Attachments: Figure 1 – Site Plan
Figure 2 - Historical Borehole Site Plan, Project No. 07-1121-0002, prepared by Golder, dated August 05, 2009
Relevant Historical Testhole Logs
As-Built Pile Driving Records, Report SF-1177B Part A and B, prepared by McRostie Genest St-Louis, dated March 13, 1974



https://wsonline-my.sharepoint.com/personal/yashika_jindal_wsp_com/documents/desktop/othmane/ca0033714.1722 - qch expansion - geoetchnical desktop study_jsa rev 2.docx

R:\TH: S\Client\City of Ottawa\Queensway_Carleton_Hospital\89_PROJ\CA0033714_1722-40_PROD\0001_BHPlan\CA0033714_1722-40_0001-BG-0001.mxd PRINTED ON: 2024-06-04 AT: 10:46:01 AM



SCALE 1:250,000

LEGEND

-  PROPOSED BOREHOLE LOCATION
-  SITE LAYOUT



NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18N

CLIENT

QUEENSVIEW CARLTON HOSPITAL

PROJECT

QUEENSVIEW CARLETON HOSPITAL EXPANSION PROJECT

TITLE

SITE PLAN

CONSULTANT



YYYY-MM-DD 2024-06-04

DESIGNED ---

PREPARED CGE

REVIEWED ---

APPROVED ---

PROJECT NO. CA0033714.1722

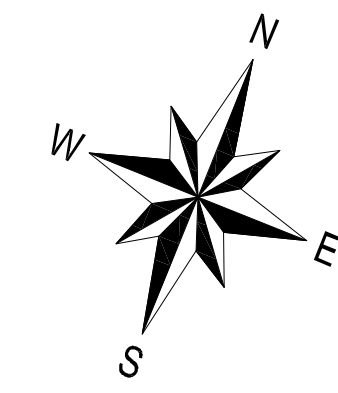
CONTROL 0001

REV. A

FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

28mm



MONROVIE LTD. & ASSOCIATES LTD. & ASSOCIÉS LTÉE
CONSULTING ENGINEERS - INGÉNIEURS CONSEILS

OTTAWA CANADA

PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

BASELINE WEST OF SIOUX CRES.

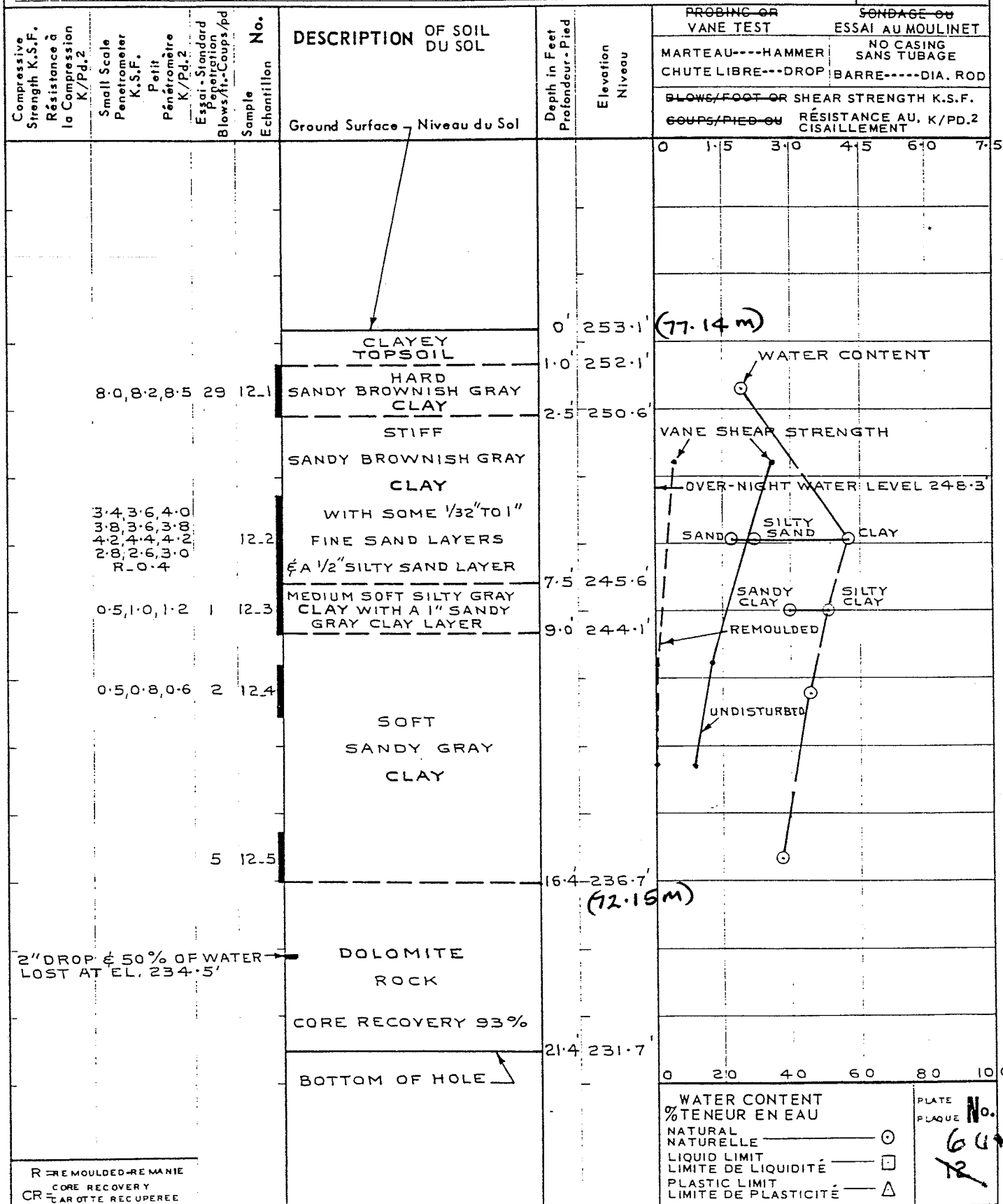
ELEVATION OF GROUND SURFACE (ZERO DEPTH) 253.1'
NIVEAU DU SOL (PROFONDEUR ZERO)

DATE FEB. 9, 1972

HOLE FORAGE No.

12

NOTES SEE PLATE No. 2



[illegible]

MICROSTIE SEIU GENESI

& ASSOCIATES LTD. & ASSOCIÉS LTÉE

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PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

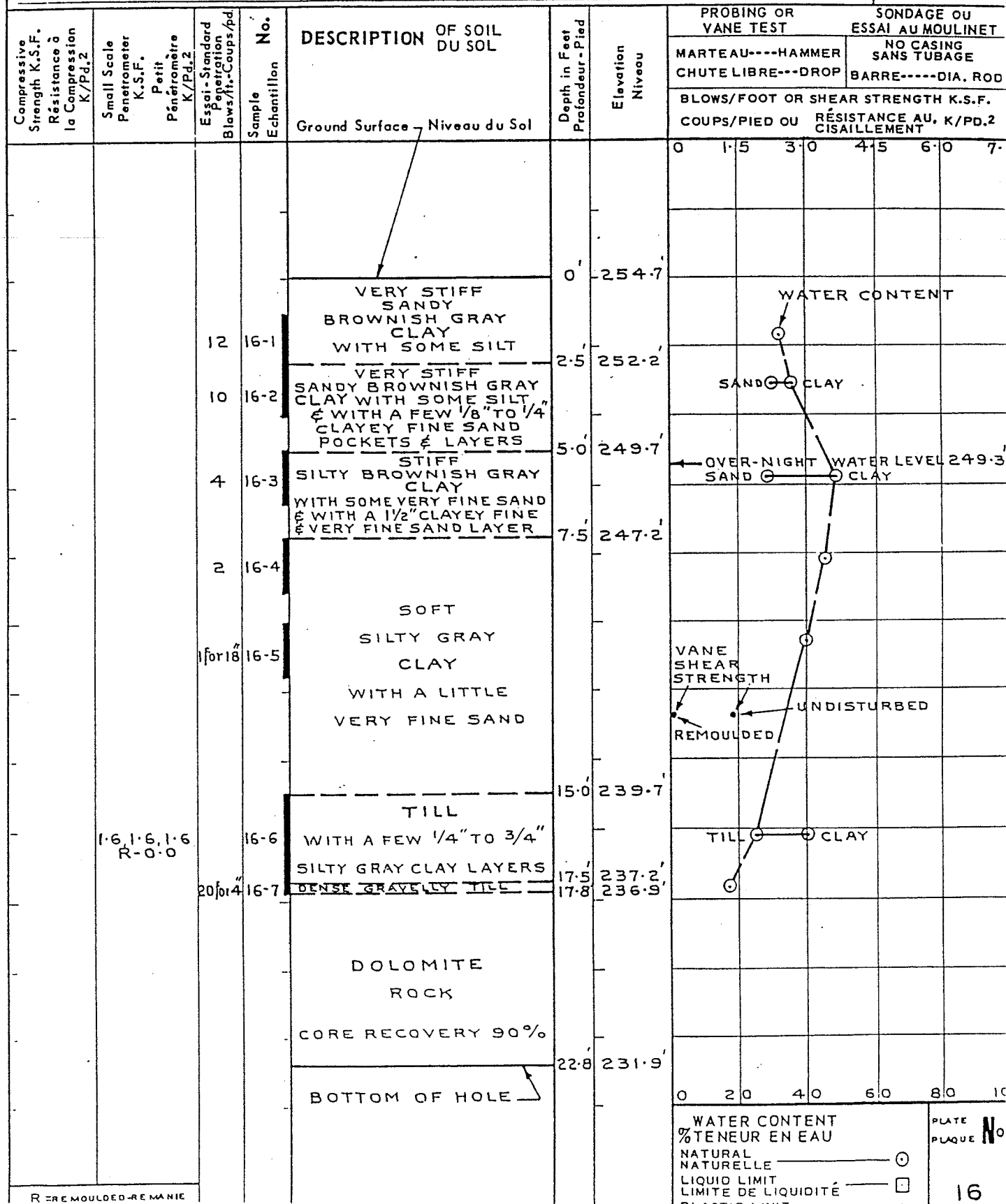
BASELINE RD. WEST OF SIOUX CRES.

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 254.7'
NIVEAU DU SOL (PROFONDEUR ZERO)

DATE MAR. 27, 1972

HOLE FORAGE No. 16

NOTES SEE PLATE No.



R = REMOULDED - REMANIE

McROSTIE SETO GENEST

& ASSOCIATES LTD. & ASSOCIÉS LTÉE

CONSULTING ENGINEERS - INGÉNIEURS CONSEILS

OTTAWA CANADA

SOIL PROFILE & TEST SUMMARIES

PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

BASELINE RD. WEST OF SIOUX CRES.

ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZÉRO)

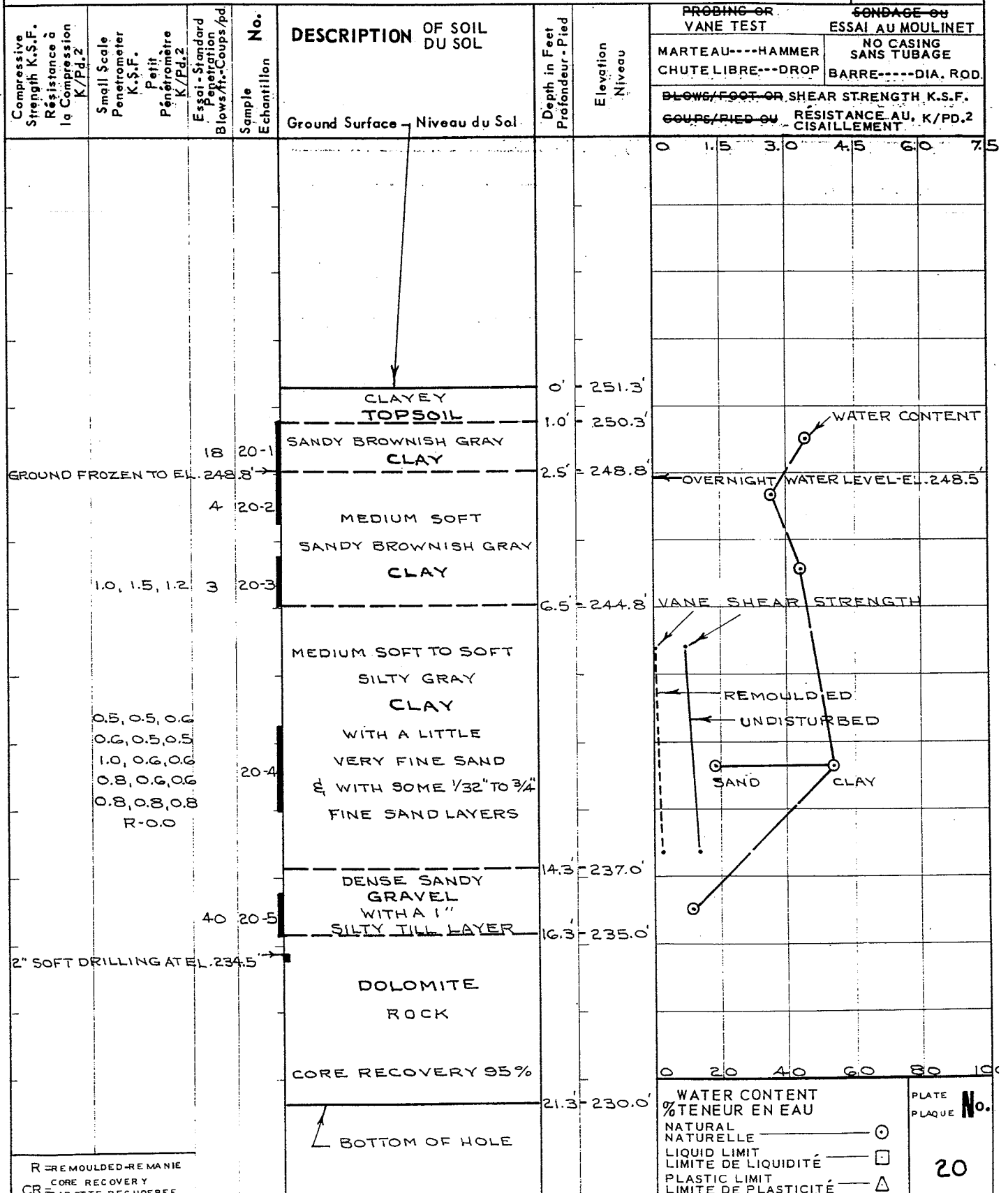
251.3'

DATE MARCH 28, 1972

HOLE FORAGE No.

20

NOTES SEE PLATE No. 2



QWEENSWAY CARLETON HOSPITAL ELECT. ROOM						B.M. (ELEV. 74.980m)geodetic: Ground								BOREHOLE No. 91-1							
MILLS ROSS ARCHITECTS						floor of existing boiler room.								Project No: E-6591							
START DATE: 15/05/91 -														ELEVATION 75.55 (m)							
SAMPLE TYPE ■ DISTURBED-AUGER / ▣ SHELBY TUBE						<input checked="" type="checkbox"/> SPLIT SPOON ▨ PROBING						<input type="checkbox"/> NO RECOVERY □ CORE									
DEPTH (m)	SMALL PEN. (kPa)	SPT (N)	SAMPLE TYPE	SAMPLE NO	USC	SOIL/ROCK DESCRIPTION	■ VANE Cu (kPa) ■ 80 160 240 320				▲ VANE Cu REMOULDED (kPa) ▲ 80 160 240 320				ELEVATION(m)						
							PLASTIC				LIQUID										
							M.C.														
							TOPSOIL								75.6						
-0.0							----- 75.25 -----														
-1.0							gray CLAY								74.6						
-2.0																					
-3.0							power auger refusal-								73.6						
							Bottom of hole 72.70								72.6						
4.0															71.6						
McROSTIE GENEST ST-LOUIS Ottawa, Canada										COMPLETION DEPTH 2.9 m				COMPLETE 15/05/91							
										LOGGED BY JML				DWG NO. 2 Page 1 of 1							

QWEENSWAY CARLETON HOSPITAL ELECT. ROOM		B.M. (ELEV. 74.980m)geodetic: Ground		BOREHOLE No. 91-2							
MILLS ROSS ARCHITECTS		floor of existing boiler room.		Project No: E-6591							
START DATE: 15/05/91 -				ELEVATION 75.36 (m)							
SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> PROBING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE											
DEPTH (m)	SMALL PEN. (kPa)	SPT (N)	SAMPLE TYPE	SAMPLE NO	USC	SOIL/ROCK DESCRIPTION	<div> <div> <div>■ VANE Cu (kPa) ■</div> <div>80 160 240 320</div> </div> <div> <div>▲ VANE Cu REMOULDED (kPa) ▲</div> <div>80 160 240 320</div> </div> </div>				ELEVATION(m)
							PLASTIC	M.C.	LIQUID		
0.0						TOPSOIL					75.4
-1.0											74.4
-2.0											73.4
-3.0											72.4
4.0											71.4
power auger refusal-						Bottom of hole 72.64					

McROSTIE GENEST ST-LOUIS
Ottawa, Canada

COMPLETION DEPTH 2.7 m
LOGGED BY JML

COMPLETE 15/05/91
DWG NO. 3

Page 1 of 1

QWEENSWAY CARLETON HOSPITAL ELECT. ROOM						B.M. (ELEV. 74.980m)geodetic: Ground						BOREHOLE No. 91-3											
MILLS ROSS ARCHITECTS						floor of existing boiler room.						Project No: E-6591											
START DATE: 15/05/91 -												ELEVATION 75.30 (m)											
SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> PROBING <input type="checkbox"/>						<input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE																	
DEPTH (m)		SMALL PEN. SPT (kPa) (N)		SAMPLE TYPE	SAMPLE NO	USC	SOIL/ROCK DESCRIPTION						<div style="text-align: right;"> ■ VANE Cu (kPa) ■ 80 160 240 320 ▲ VANE Cu REMOULDED (kPa) ▲ 80 160 240 320 PLASTIC M.C. LIQUID </div>						ELEVATION(m)				
0.0							TOPSOIL												75.3				
-1.0																			74.3				
-2.0							sandy gray CLAY												73.3				
-3.0							power auger refusal-												72.3				
							Bottom of hole												72.21				
4.0																			71.3				
McROSTIE GENEST ST-LOUIS Ottawa, Canada												COMPLETION DEPTH 3.1 m				COMPLETE 15/05/91							
												LOGGED BY JML				DWG NO. 4				Page 1 of 1			

QUEENSWAY CARLETON HOSPITAL ELECT. ROOM			B.M. (ELEV. 74.980m)geodetic: Ground			BOREHOLE No. 91-4			
MILLS ROSS ARCHITECTS			floor of existing boiler room.			Project No: E-6591			
START DATE: 15/05/91 -						ELEVATION 75.15 (m)			
SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> PROBING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE									
DEPTH (m)	SMALL PEN. (kPa)	SPT (N)	SAMPLE TYPE	SAMPLE NO	USC	SOIL/ROCK DESCRIPTION	<div> <div> <div>■ VANE Cu (kPa) ■</div> <div>80 160 240 320</div> </div> <div> <div>▲ VANE Cu REMOULDED (kPa) ▲</div> <div>80 160 240 320</div> </div> <div> <div>PLASTIC M.C. LIQUID</div> <div>20 40 60 80</div> </div> </div>		ELEVATION(m)
0.0						TOPSOIL		75.2	
						74.85			
-1.0								74.2	
						sandy gray CLAY			
-2.0								73.2	
						72.45			
	power auger refusal					sandy TILL			
						Bottom of hole 72.30		72.2	
-3.0									
-4.0								71.2	
McROSTIE GENEST ST-LOUIS						COMPLETION DEPTH 2.9 m		COMPLETE 15/05/91	
Ottawa, Canada						LOGGED BY JML		DWG NO. 5	
								Page 1 of 1	

McROSTIE GENEST ST-LOUIS
& Associates Ltd.
Consulting Engineers
OTTAWA, CANADA

TEST PIT RECORD

Test Pit No.
97-1

Date :

JAN. 14, 1997

ALZHIEMERS FACILITY
QUEENSWAY CARLETON HOSPITAL

ELEV. 77.67	DEPTH in metres	DESCRIPTION	REMARKS
		TOPSOIL	sides stable
77.22	0.45	medium dense silty fine SAND	PENETROMETER READINGS 400 kPa
76.87	0.80		
76.67	-- 1 --	very stiff sandy brownish gray CLAY	400 kPa 395 kPa 345 kPa
75.67	-- 2 --		345 kPa
75.47	2.2	Bottom of pit	no water seepage
NOTE:		ALL TEST PITS DUG WITH RUBBER TIRED BACKHOE (CASE 580C)	
		B.M. (ELEV 74.98m) geodetic: Ground floor of existing boiler plant.	
			Plate No. 2

McROSTIE GENEST ST-LOUIS & Associates Ltd. Consulting Engineers OTTAWA, CANADA		TEST PIT RECORD	Test Pit No. 97-2
		Date :	JAN. 14, 1997
ALZHIEMERS FACILITY QUEENSWAY CARLETON HOSPITAL			
ELEV. 77.18	DEPTH in metres	DESCRIPTION	REMARKS
77.03	0.15	TOPSOIL	sides stable
		medium dense silty very fine SAND	
76.58	0.60		PENETROMETER READINGS
		very stiff	260,260,260 kPa
76.18	-- 1 --	fissured sandy brownish gray CLAY	305 kPa
			305 kPa
			305 kPa
75.18	-- 2 --		305 kPa no water seepage
		Bottom of pit	
			Plate No. 3

MCROSTIE GENEST ST-LOUIS
& Associates Ltd.
Consulting Engineers
OTTAWA, CANADA

TEST PIT RECORD

Test Pit No.
97-3

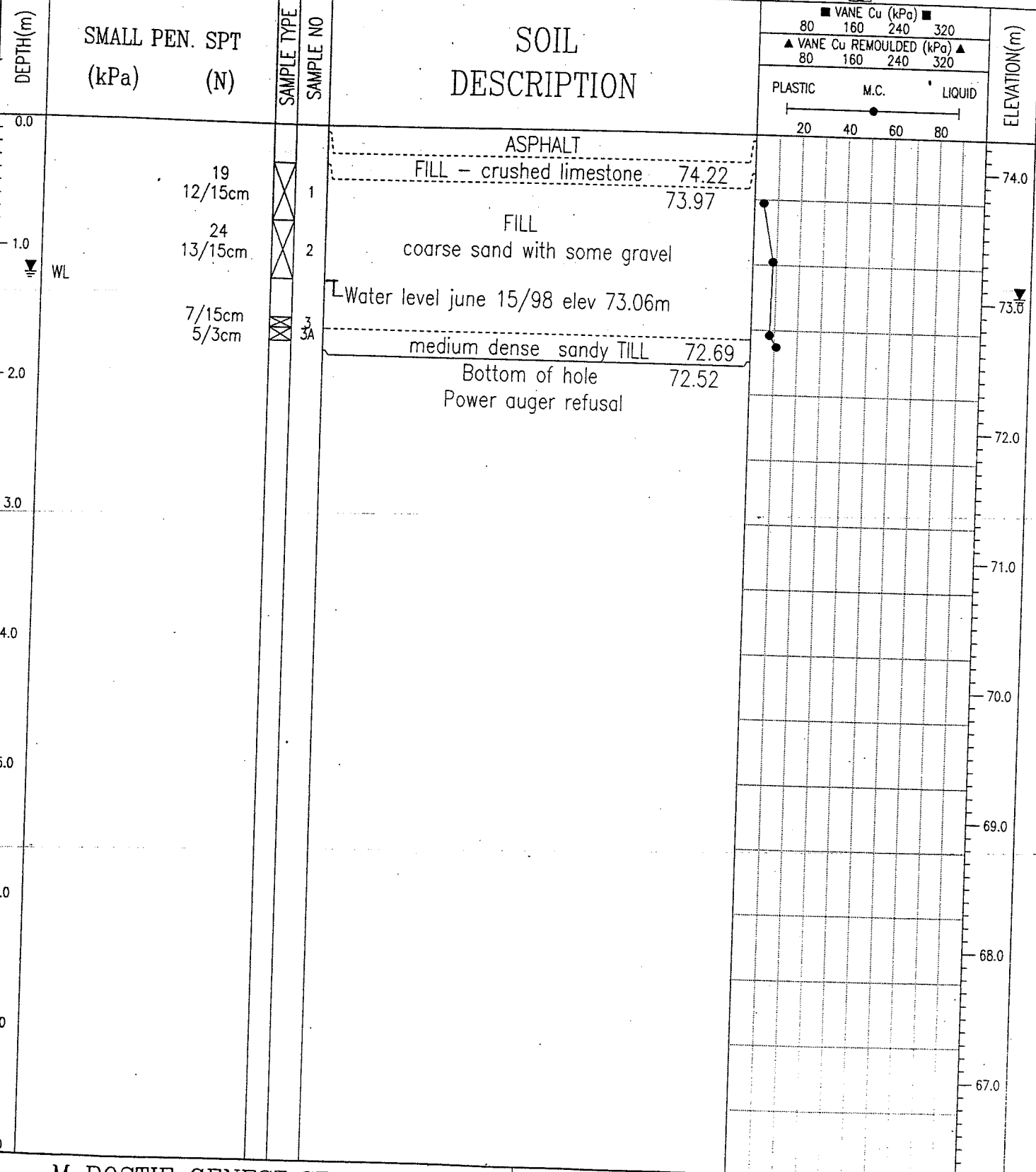
Date :

JAN. 14, 1997

ALZHIEMERS FACILITY
QUEENSWAY CARLETON HOSPITAL

ELEV. 77.03	DEPTH in metres	DESCRIPTION	REMARKS
76.88	0.15	FILL - topsoil	sides stable
		FILL fine sand	
76.43	0.60	TOPSOIL	
76.13 76.03	0.90 -- 1 --	very stiff sandy brownish gray CLAY	PENETROMETER READINGS 375 kPa 345 kPa 345 kPa 325 kPa
75.03	-- 2 --	Bottom of pit	no water seepage
			Plate No. 4

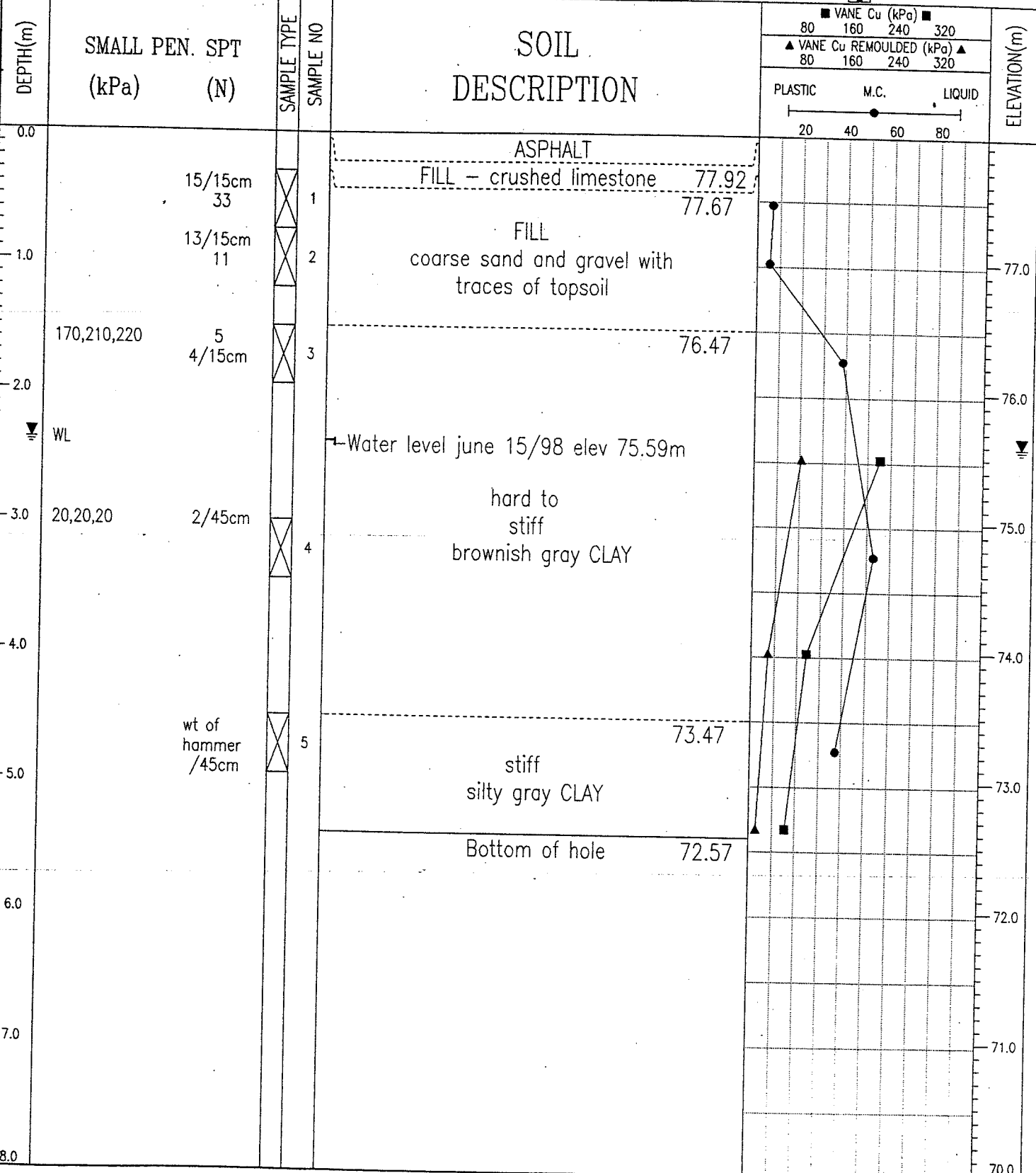
QUEENSWAY-CARLETON HOSPITAL		B.M.(ELEV 74.98m)geodetic: Ground floor	BOREHOLE NO: 98-3
CLIENT: QUEENSWAY-CARLETON HOSPITAL		of existing boiler plant.	PROJECT NO: E - 7671
START DATE: 98/06/11		ELEVATION: 74.27 m	
SAMPLE TYPE	<input checked="" type="checkbox"/> REMOULDED	<input checked="" type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT-SPOON
		<input type="checkbox"/> PROBING	<input type="checkbox"/> NO RECOVERY
			<input type="checkbox"/> CORE



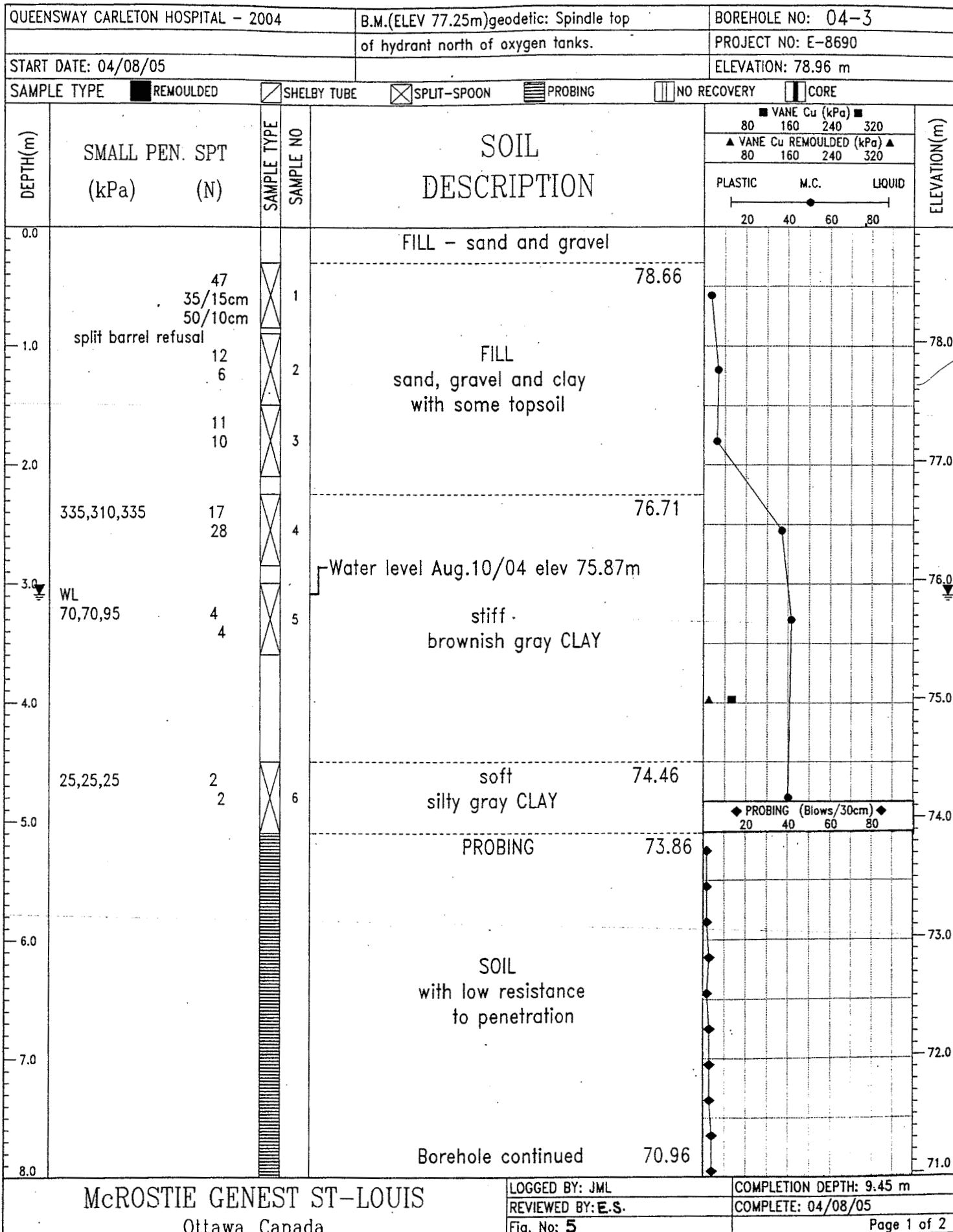
McROSTIE GENEST ST-LOUIS
Ottawa, Canada

LOGGED BY: JML	COMPLETION DEPTH: 1.75 m
REVIEWED BY: E.S.	COMPLETE: 98/06/11
4	

QUEENSWAY-CARLETON HOSPITAL		B.M.(ELEV 74.98m)geodetic: Ground floor	BOREHOLE NO: 98-4
CLIENT: QUEENSWAY-CARLETON HOSPITAL		of existing boiler plant.	PROJECT NO: E - 7671
START DATE: 98/06/11			ELEVATION: 77.97 m
SAMPLE TYPE	<input checked="" type="checkbox"/> REMOULDED	<input checked="" type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT-SPOON
		<input checked="" type="checkbox"/> PROBING	<input type="checkbox"/> NO RECOVERY
			<input checked="" type="checkbox"/> CORE



McROSTIE GENEST ST-LOUIS Ottawa, Canada	LOGGED BY: JML	COMPLETION DEPTH: 5.4 m
	REVIEWED BY: E.S	COMPLETE: 98/06/11
	5	Page 1 of 1



QUEENSWAY CARLETON HOSPITAL - 2004		B.M.(ELEV 77.25m)geodetic: Spindle top		TEST HOLE NO: 04-3	
		of hydrant north of oxygen tanks.		PROJECT NO: E-8690	
START DATE: 04/08/05				ELEVATION: 78.96 m	
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input type="checkbox"/> PROBING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE					

DEPTH(m)	COMMENTS	SAMPLE TYPE	SAMPLE NO	SOIL DESCRIPTION	PROBING (Blows/30cm)	ELEVATION(m)
8.0				SOIL with low resistance to penetration	20 40 60 80	
9.0						70.0
				Bottom of hole Probing refusal		69.51
10.0						69.0
11.0						68.0
12.0						67.0
13.0						66.0
14.0						65.0
15.0						64.0
16.0						63.0

McROSTIE GENEST ST-LOUIS Ottawa, Canada		LOGGED BY: JML	COMPLETION DEPTH: 9.45 m
		REVIEWED BY: E.S.	COMPLETE: 04/08/05
		Fig. No: 6	Page 2 of 2

QUEENSWAY CARLETON HOSPITAL - 2004				B.M.(ELEV 77.25m)geodetic: Spindle top		BOREHOLE NO: 04-8			
START DATE: 04/08/05				of hydrant north of oxygen tanks.		PROJECT NO: E-8690			
						ELEVATION: 74.36 m			
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input checked="" type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NQ CORE									
DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	<div style="display: flex; justify-content: space-between; font-size: small;"> ■ VANE Cu (kPa) ■ 80 160 240 320 </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> ▲ VANE Cu REMOULDED (kPa) ▲ 80 160 240 320 </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> PLASTIC M.C. * LIQUID </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> 20 40 60 80 </div>			ELEVATION(m)
0.0					FILL - asphalt				
	17 45	<input checked="" type="checkbox"/>	1		FILL - crushed limestone	74.28		74.0	
		<input checked="" type="checkbox"/>				74.06			
1.0	15/15cm 50/13cm	<input checked="" type="checkbox"/>	2		FILL medium and coarse sand with some gravel & traces of clay				
	split-barrel refusal power auger refusal								
					Bottom of hole	73.09		73.0	
					power auger refusal				
2.0								72.0	
3.0								71.0	
4.0								70.0	
5.0								69.0	
6.0								68.0	
7.0								67.0	
8.0									

McROSTIE GENEST ST-LOUIS Ottawa, Canada		LOGGED BY: JML	COMPLETION DEPTH: 1.27 m
		REVIEWED BY: E.S.	COMPLETE: 04/08/05
		Fig. No: 14	Page 1 of 1

QUEENSWAY CARLETON HOSPITAL - 2004			B.M.(ELEV 77.25m)geodetic: Spindle top		BOREHOLE NO: 04-9	
			of hydrant north of oxygen tanks.		PROJECT NO: E-8690	
START DATE: 04/08/03			ELEVATION: 74.28 m			
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NQ CORE						
DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	ELEVATION(m)
0.0					FILL - asphalt	
	16		1		FILL - crushed limestone	74.20
	17					73.98
1.0	12		2		FILL	
	7/15cm				medium and coarse sand with	
	50/5cm				some gravel & pieces of broken rock	
	WL				Water level Aug.10/04 elev 73.04m	73.04
2.0	split barrel refusal				Bottom of hole	72.78
	power auger refusal				power auger refusal	
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						

McROSTIE GENEST ST-LOUIS

Ottawa, Canada

LOGGED BY: JML	COMPLETION DEPTH: 1.5 m
REVIEWED BY: E.S.	COMPLETE: 04/08/03
Fig. No: 15	Page 1 of 1

QUEENSWAY CARLETON HOSPITAL - 2004				B.M.(ELEV 77.25m)geodetic: Spindle top		BOREHOLE NO: 04-10					
				of hydrant north of oxygen tanks.		PROJECT NO: E-8690					
START DATE: 04/08/03				ELEVATION: 74.19 m							
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input checked="" type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NQ CORE											
DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	<div style="display: flex; justify-content: space-between; font-size: small;"> ■ VANE Cu (kPa) ■ 80 160 240 320 </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> ▲ VANE Cu REMOULDED (kPa) ▲ 80 160 240 320 </div> <div style="display: flex; justify-content: space-between; font-size: x-small;"> PLASTIC M.C. LIQUID </div> <div style="text-align: center; font-size: x-small;"> 20 40 60 80 </div>			ELEVATION(m)		
0.0					FILL - crushed limestone			74.0			
	17	X	1			73.89					
	36										
1.0											
	21	X	2		FILL						
	24				sand and gravel with some pieces of crushed stone						
	8	X	3		FILL	72.69					
					coarse sand and gravel						
2.0	split barrel refusal					72.39		72.0			
	power auger refusal				weathered DOLOMITE	72.09					
		I		80	DOLOMITE			71.0			
3.0											
					Bottom of hole	70.59		70.0			
4.0											
								69.0			
5.0											
								68.0			
6.0											
								67.0			
7.0											
8.0											

McROSTIE GENEST ST-LOUIS

Ottawa, Canada

LOGGED BY: JML REVIEWED BY: E.S. Fig. No: 16	COMPLETION DEPTH: 3.6 m COMPLETE: 04/08/03
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QUEENSWAY CARLETON HOSPITAL - 2004			B.M.(ELEV 77.25m)geodetic: Spindle top of hydrant north of oxygen tanks.		BOREHOLE NO: 04-11	
START DATE: 04/08/16					PROJECT NO: E-8690	
					ELEVATION: 74.09 m	
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NQ CORE						

DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	VANE Cu (kPa)			ELEVATION(m)
						80 160 240 320			
						▲ VANE Cu REMOULDED (kPa) ▲ 80 160 240 320			
						PLASTIC M.C. LIQUID 20 40 60 80			
0.0					FILL - asphalt				74.0
					FILL - crushed limestone				74.04
	8		1		FILL				73.79
	10				sand with some gravel				
1.0					medium dense				73.19
	2/15cm		2		silty fine SAND with				
	20				traces of gravel				
	11/15cm		3		Water level Aug.17/04 elev 72.92m				
	50/5cm				sandy TILL				72.56
2.0									72.53
	WL			100	DOLOMITE				
	split barrel refusal								
3.0									
					Bottom of hole				71.01
4.0									
									70.0
5.0									
									69.0
6.0									
									68.0
7.0									
									67.0
8.0									

McROSTIE GENEST ST-LOUIS Ottawa, Canada		LOGGED BY: JML	COMPLETION DEPTH: 3.08 m
		REVIEWED BY: E.S.	COMPLETE: 04/08/16
		Fig. No: 17	Page 1 of 1

QUEENSWAY CARLETON HOSPITAL - 2004				B.M.(ELEV 77.25m)geodetic: Spindle top		BOREHOLE NO: 04-12			
				of hydrant north of oxygen tanks.		PROJECT NO: E-8690			
START DATE: 04/08/16				ELEVATION: 73.93 m					
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NO CORE									
DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	<div style="display: flex; justify-content: space-between;"> <div> <div>■ VANE Cu (kPa) ■</div> <div>80 160 240 320</div> </div> <div> <div>▲ VANE Cu REMOULDED (kPa) ▲</div> <div>80 160 240 320</div> </div> </div>			ELEVATION(m)
						<div style="display: flex; justify-content: space-between;"> <div>PLASTIC</div> <div>M.C.</div> <div>LIQUID</div> </div>			
						<div style="display: flex; justify-content: space-between;"> <div>20</div> <div>40</div> <div>60</div> <div>80</div> </div>			
0.0					FILL - asphalt				
					FILL - crushed limestone	73.88			
	8		1			73.63			
	11				FILL				
1.0					SAND with some gravel and traces of clay				
	3/15cm		2		Water level Aug.17/04 elev 72.78m				
	18								
	9/15cm		3						
	50/8cm				sandy TILL	72.43			
	split barrel refusal					72.35			
2.0				100	DOLOMITE				
3.0									
4.0					Bottom of hole	70.83			
5.0									
6.0									
7.0									
8.0									

McROSTIE GENEST ST-LOUIS

Ottawa, Canada

LOGGED BY: JML

REVIEWED BY: E.S.

Fig. No: 18

COMPLETION DEPTH: 3.1 m

COMPLETE: 04/08/16

QUEENSWAY - CARLETON CANCER CENTRE			B.M.(ELEV 77.25m)geod.: Spindle top of			BOREHOLE NO: 05-1		
			hyd. on west side of main road to boiler			PROJECT NO: E-8941		
START DATE: 05/12/13			plant north of propane tanks.			ELEVATION: 76.97 m		
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NQ CORE								

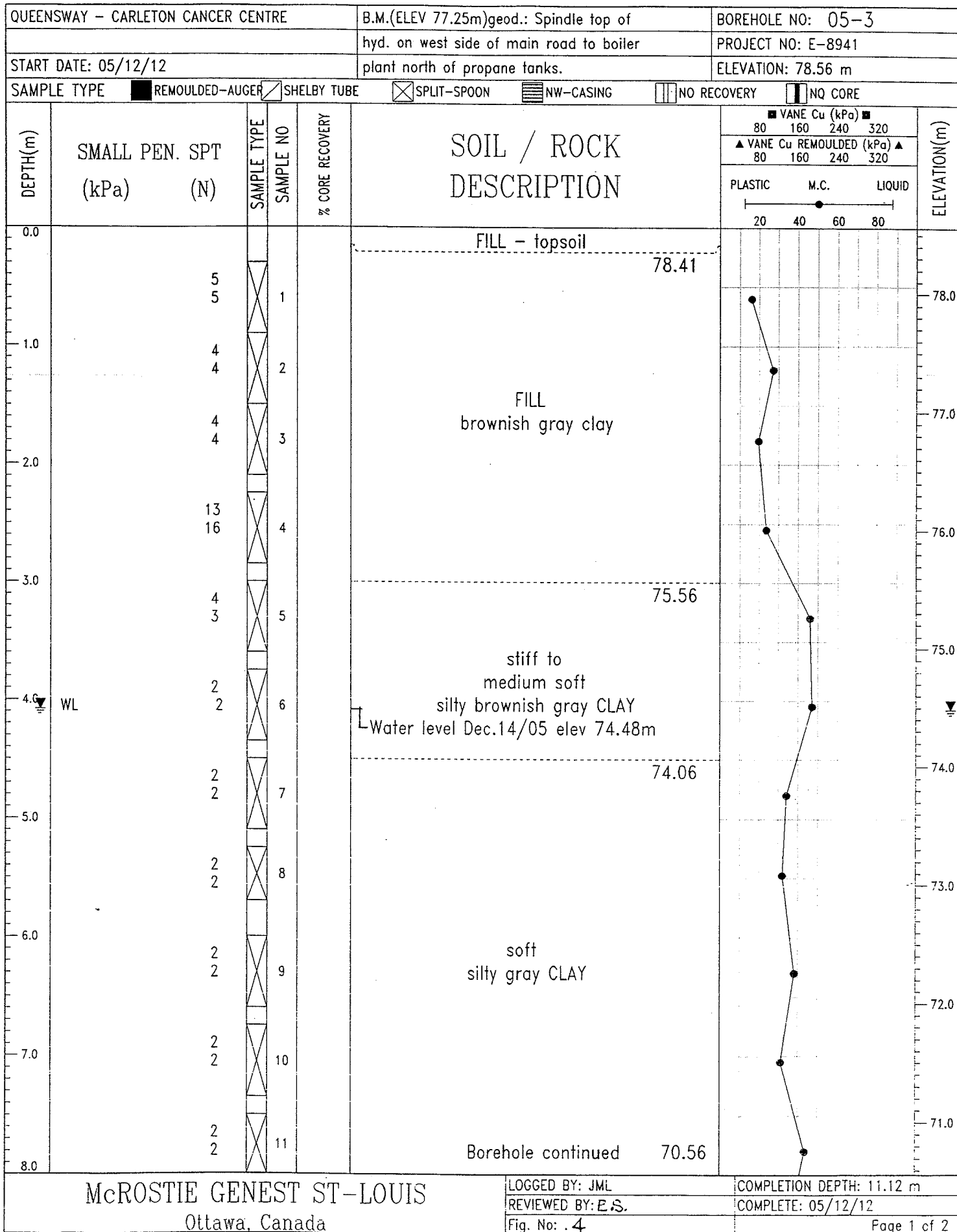
DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	VANE Cu (kPa)			ELEVATION(m)
						80	160	240	
						▲ VANE Cu REMOULDED (kPa) ▲			
						<div style="display: flex; justify-content: space-between;"> <div>PLASTIC</div> <div>M.C.</div> <div>LIQUID</div> </div> <div style="text-align: center;"> <div style="width: 100px; height: 10px; background: linear-gradient(to right, black 20%, white 20% 40%, white 40% 60%, black 60%);"></div> <div style="display: flex; justify-content: space-between; width: 100px;"> 20406080 </div> </div>			
0.0					ASPHALT				
					FILL - sand and gravel	76.89			
						76.67			
1.0					FILL clay with some topsoil				76.0
	85,95,70					75.47			
2.0					stiff to medium soft silty brownish gray CLAY				75.0
	50,65,65 WL				Water level Dec.14/05 elev 74.57m				
3.0						73.97			74.0
	50,50,50								
4.0					soft silty gray CLAY				73.0
	50,50,50								
5.0									72.0
	25,25,25								
6.0					Bottom of hole Power auger refusal	71.77			71.0
7.0									70.0
8.0									69.0

McROSTIE GENEST ST-LOUIS Ottawa, Canada		LOGGED BY: JML	COMPLETION DEPTH: 5.2 m
		REVIEWED BY: E.S.	COMPLETE: 05/12/13
		Fig. No: .2	Page 1 of 1

QUEENSWAY - CARLETON CANCER CENTRE			B.M.(ELEV 77.25m)geod.: Spindle top of		BOREHOLE NO: 05-2	
			hyd. on west side of main road to boiler		PROJECT NO: E-8941	
START DATE: 05/12/13			plant north of propane tanks.		ELEVATION: 76.74 m	
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NQ CORE						

DEPTH(m)	SMALL PEN. SPT		SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	<div style="display: flex; justify-content: space-between;"> <div> <div>■ VANE Cu (kPa) ■</div> <div>80 160 240 320</div> </div> <div> <div>▲ VANE Cu REMOULDED (kPa) ▲</div> <div>80 160 240 320</div> </div> </div>			ELEVATION(m)
	(kPa)	(N)					PLASTIC	M.C.	LIQUID	
	<div style="display: flex; justify-content: space-between;"> <div>20 40 60 80</div> </div>									
0.0						ASPHALT				
						FILL - sand and gravel				
										76.62
										76.44
1.0						FILL				
						clay with traces of gravel				
2.0										
	WL					Water level Dec.14/05 elev 75.10m				
3.0										
	70,65,65					stiff to				74.49
						medium soft				
						silty brownish gray CLAY				
4.0										
	50,50,65									73.74
5.0										
	25,50,25					soft				
						silty gray CLAY				
6.0										
	50/10cm									
	split barrel refusal									
7.0										
						Bottom of hole				70.64
8.0										

McROSTIE GENEST ST-LOUIS Ottawa, Canada		LOGGED BY: JML	COMPLETION DEPTH: 6.1 m
		REVIEWED BY: E.S.	COMPLETE: 05/12/13
		Fig. No: 3	Page 1 of 1



QUEENSWAY - CARLETON CANCER CENTRE			B.M.(ELEV 77.25m)geod.: Spindle top of		BOREHOLE NO: 05-3	
			hyd. on west side of main road to boiler		PROJECT NO: E-8941	
START DATE: 05/12/12			plant north of propane tanks.		ELEVATION: 78.56 m	
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input checked="" type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NO CORE						

DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> <div> <div>■ VANE Cu (kPa) ■</div> <div>80 160 240 320</div> </div> <div> <div>▲ VANE Cu REMOULDED (kPa) ▲</div> <div>80 160 240 320</div> </div> </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> <div>PLASTIC</div> <div>M.C.</div> <div>LIQUID</div> </div> <div style="text-align: center; margin-top: 5px;"> <div style="width: 100px; border-bottom: 1px solid black; position: relative;"> <div style="position: absolute; left: 0; bottom: -5px;">20</div> <div style="position: absolute; right: 0; bottom: -5px;">80</div> <div style="position: absolute; left: 40%; bottom: -5px;">40</div> <div style="position: absolute; left: 50%; bottom: -5px;">60</div> </div> </div>			ELEVATION(m)							
						8.0										
							2 2			11 12		soft silty gray CLAY				70.0
						9.0	50/5cm split barrel refusal			13		sandy TILL	69.56			69.0
10.0	power auger refusal			95	DOLOMITE	68.96			68.0							
11.0					Bottom of hole	67.44			67.0							
12.0									66.0							
13.0									65.0							
14.0									64.0							
15.0									63.0							
16.0																

McROSTIE GENEST ST-LOUIS Ottawa, Canada		LOGGED BY: JML REVIEWED BY: E.S. Fig. No: . 5	COMPLETION DEPTH: 11.12 m COMPLETE: 05/12/12
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QUEENSWAY - CARLETON CANCER CENTRE			B.M.(ELEV 77.25m)geod.: Spindle top of		BOREHOLE NO: 05-8	
			hyd. on west side of main road to boiler		PROJECT NO: E-8941	
START DATE: 05/12/12			plant north of propane tanks.		ELEVATION: 74.95 m	
SAMPLE TYPE <input checked="" type="checkbox"/> REMOULDED-AUGER <input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT-SPOON <input type="checkbox"/> NW-CASING <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> NQ CORE						

DEPTH(m)	SMALL PEN. SPT (kPa) (N)	SAMPLE TYPE	SAMPLE NO	% CORE RECOVERY	SOIL / ROCK DESCRIPTION	VANE Cu (kPa)			ELEVATION(m)	
						80 160 240 320				
						▲ VANE Cu REMOULDED (kPa) ▲				
						80 160 240 320				
						PLASTIC	M.C.	LIQUID		
						<div style="text-align: center;"> <div style="width: 100px; height: 10px; background: linear-gradient(to right, black 40%, white 40%);"></div> 20 40 60 80 </div>				
0.0					ASPHALT					
	92 55		1							74.80
1.0	33 33		2		FILL crushed limestone					74.0
	35 38/10cm		3							
2.0	WL split barrel refusal power auger refusal			92	DOLOMITE					73.00
				90	DOLOMITE					72.75
3.0										72.16
				89	DOLOMITE					
4.0					Bottom of hole					71.09
5.0										70.0
6.0										69.0
7.0										68.0
8.0										67.0

McROSTIE GENEST ST-LOUIS Ottawa, Canada		LOGGED BY: JML	COMPLETION DEPTH: 3.86 m
		REVIEWED BY: E.S.	COMPLETE: 05/12/12
		Fig. No: 10	Page 1 of 1

PROJECT: 07-1121-0002

RECORD OF BOREHOLE: 07-6

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 7, 2007

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
								20 40 60 80				10 ⁻⁵ 10 ⁻⁴ 10 ⁻³					
								nat V. + Q - rem V. ⊕ U - ○				Wp — W — Wi					
								20	40	60	80	20	40	60	80		
0	Power Auger 200mm Diam. (Hollow Stem)	Ground Surface		77.13													
		Grey brown sand and gravel (FILL)		0.00													
				76.72													
		Grey brown sandy silt, trace gravel and organic matter (FILL)		0.41													
				76.37													
		Grey brown SANDY SILT		0.76	1	50 DO	19										
				75.91													
		Mottled brown CLAY, occasional sand seams		1.22													
				75.00													
		Very stiff grey brown SILTY CLAY, some fine sand seams		2.13	3	50 DO	3										
1																	
2					2	50 DO	7										

Note: Unable to find standpipe in gravel surfaced parking lot. No water level taken.

BOREHOLE 07-1121-0002.GPJ HYDROGEO.GDT 3/13/07

DEPTH SCALE

1 : 50



LOGGED: D.W.M.

CHECKED: J.L.

PROJECT: 07-1121-0002

RECORD OF BOREHOLE: 07-10

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: February 1, 2007

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION									
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT													
								20		40		60		80			10 ⁻⁴		10 ⁻⁵		10 ⁻⁶		10 ⁻³		
								Cu, kPa		nat V. rem V.		+ ⊕		Q - U -			● ○		Wp		W		Wi		
								20	40	60	80					20	40	60	80						
0	Power Auger 200mm Diam. (Hollow Stem)	Ground Surface		74.93																					
		ASPHALTIC CONCRETE																							
		Grey crushed stone (FILL)		0.10																					
				74.40																					
		Brown sand and gravel, trace to some clay layers (FILL)		0.53																					
		Grey brown silty clay, trace sand (FILL)		0.76																					
1			Loose brown sand and gravel (FILL)		73.91	1	50 DO	6																	
			Loose grey SANDY SILT, trace clay		73.76																				
					1.17																				
			Firm grey SILTY CLAY with sand seams		73.41																				
				1.52	2	50 DO	8																		
2		End of Borehole Auger Refusal		73.00																					
				1.93																					
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									

Borehole dry
upon completion
of drilling

DEPTH SCALE

1 : 50



LOGGED: R.I.

CHECKED: J.L.

BOREHOLE 07-1121-0002.GPJ HYDROGEO.GDT 3/15/07

PROJECT: 07-1121-0002

RECORD OF BOREHOLE: 07-12

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 29, 2007

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION			
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT							
								Cu, kPa		nat V. + rem V. ⊕		Q - U - ○		Wp ——— W ——— WI					
								20	40	60	80	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴			10 ⁻³	20	40
0	Power Auger 200mm Diam. (Hollow Stem)	Ground Surface		77.38															
		TOPSOIL		0.05															
		Brown fine sand and gravel (FILL)																	
				76.77	1	A.S.													
		Loose brown sandy silt, some clay, trace gravel (FILL)		0.61															
1				76.11	2	50 DO	9												
		Stiff to very stiff grey brown SILTY CLAY with brown fine sand seams (Weathered Crust)		1.27															
2					3	50 DO	5												
					74.64	4	50 DO	4											
3		Loose to dense grey SILTY fine SAND		2.74															
					5	50 DO	15												
					6	50 DO	>100												
4		End of Borehole Auger Refusal		73.42 3.96															
5																			
6																			
7																			
8																			
9																			
10																			

Water level in
open hole at
elev. 74.18m
upon completion
of drilling

DEPTH SCALE

1 : 50



LOGGED: R.I.

CHECKED: J.L.

BOREHOLE 07-1121-0002.GPJ HYDROGEO.GDT 3/7/07

PROJECT: 07-1121-0002-7000

RECORD OF BOREHOLE: BH 08-307

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: July 30, 2008

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT PERCENT					
							Cu, kPa		nat V. + Q - ● rem V. ⊕ U - ○		Wp — W — WI					
							20	40	60	80	10 ⁻⁵	10 ⁻⁵	10 ⁻⁴	10 ⁻³		
							20	40	60	80	10	20	30	40		
0	Power Auger 200 mm Diam. (Hollow Stem)	Ground Surface		77.44												
		Dark brown sandy clay and organics (FILL)		0.00												
		Very stiff grey brown SILTY CLAY with silty fine sand seams (Weathered Crust)		77.14												
				0.30												
1					1	50 DO	8									Flush mount protective casing
		Loose to compact grey SANDY SILT, some gravel (GLACIAL TILL)		75.76												
				1.68		2	50 DO	4								
2					3	50 DO	13									Cement Grout
3	Rotary Drill HQ Core	Slightly weathered grey brown DOLOMITE BEDROCK, with brown sandstone seams		74.30	4	50 DO										63 mm Diam Schedule 40 Pipe
				3.14		C1	HQ RC	DD	100	93	89					
4		Fresh, grey DOLOMITE BEDROCK, occasional brown sandstone layers and bands		72.87												
				4.57		C2	HQ RC	DD	97	48	30					
5																

Flush mount
protective
casing

Cement Grout

63 mm Diam
Schedule 40
PipeWL in standpipe
at Elev. 76.88 m
on Aug. 26,
2008

BOREHOLE 0711210002-7000.GPJ HYDROGEO GDT 10/16/08

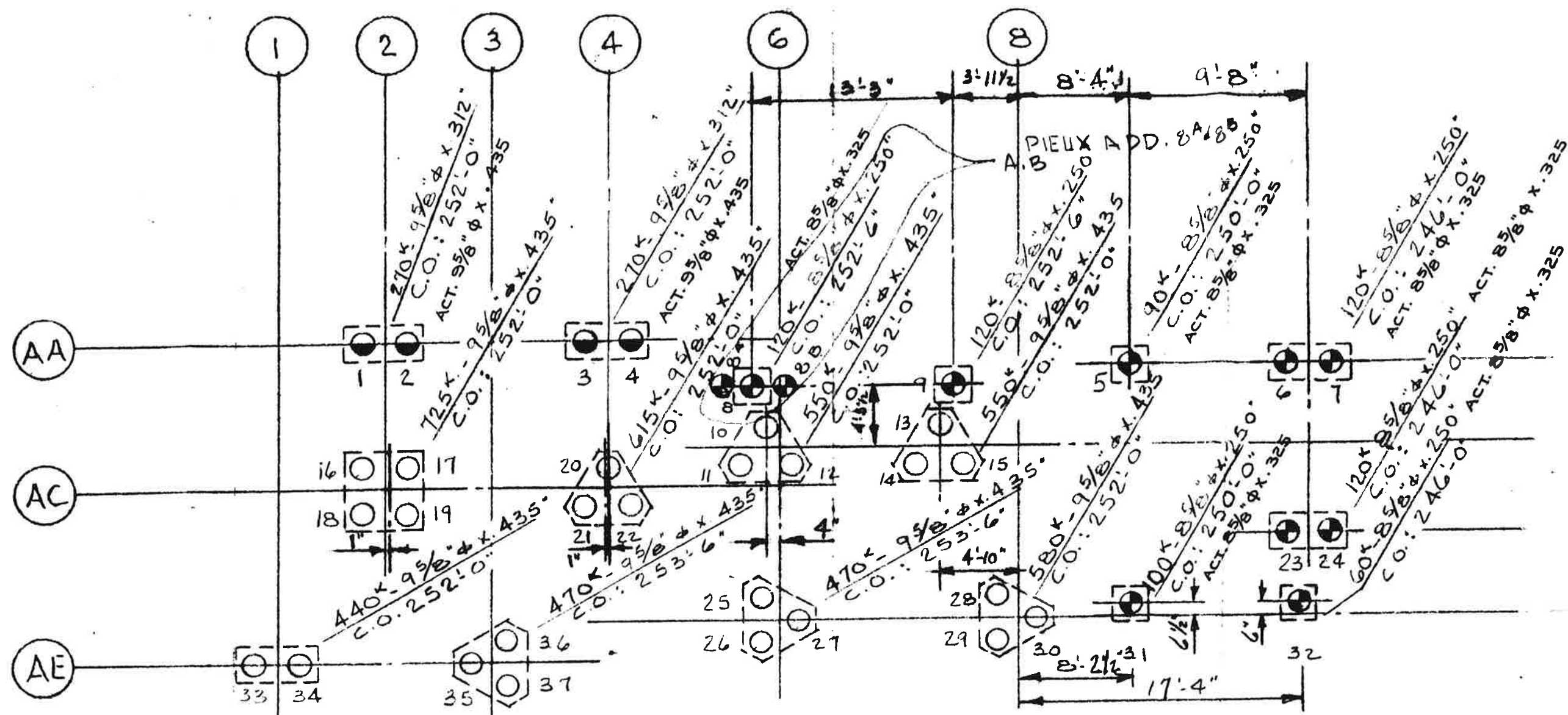
DEPTH SCALE

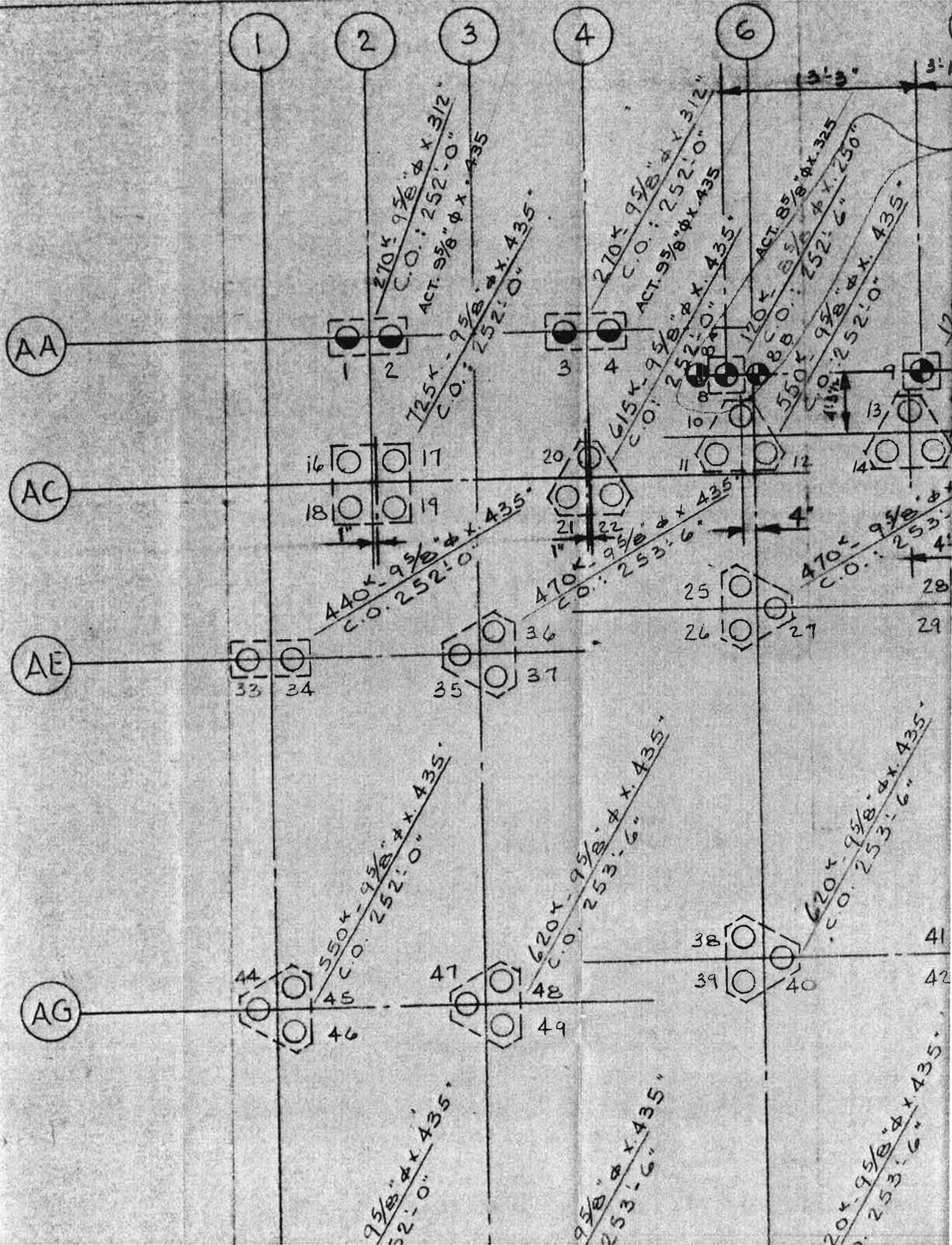
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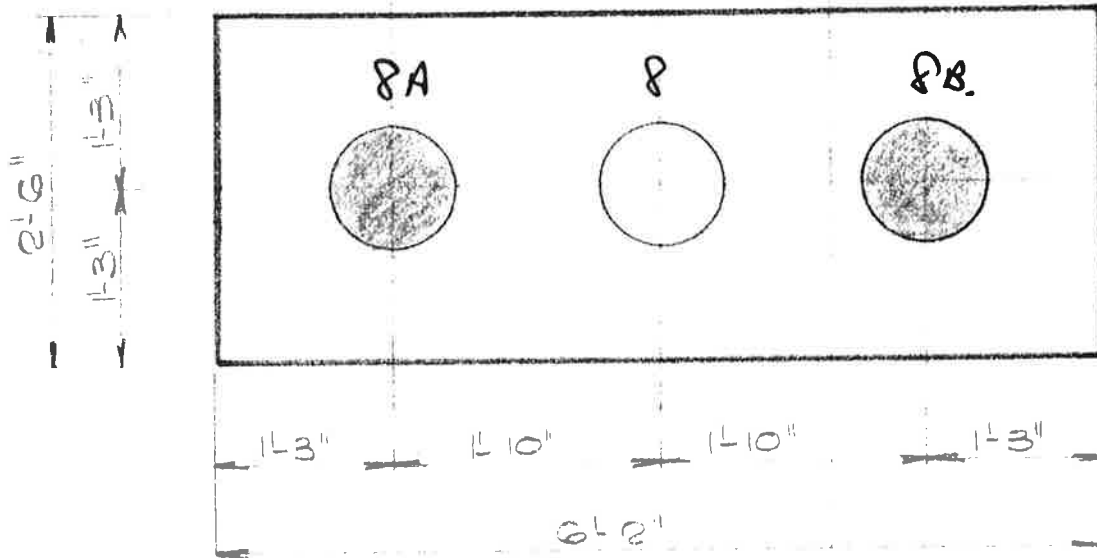
LOGGED: P.A.H.

CHECKED: *[Signature]*





6



AC

REVISED PILE LAYOUT FOR 'P3'

- 1 Add 2-120k capacity piles to existing single pile group at two locations shown shaded above
- 2 Cut off levels of piles are at elevation 252'-0"
- 3 Pile cap detail to be issued at a later date

QUEENSWAY
CARLETON
HOSPITAL

HANS L STUTZ ARCHITECT
1129 CARLING AVE. OTTAWA
ROBERT HALSALL & ASSOC LTD.
CONSULTING ENGINEERS
425 GLOUCESTER ST. OTTAWA

Oct 17th 73

S-103

07-1121-0002 (7000)

McROSTIE SETO GENEST
& Associates Ltd. — & Associés Ltée
 CONSULTING ENGINEERS — INGÉNIEURS CONSEILS
 OTTAWA, ONT.

RIG NO. 2
 PILE TYPE TUBE
 PILE SIZE 8 5/8" x 9 5/8"
 HAMMER LBS. 3,500 DROP HT. 4'
 VOL. BUCKET ✓
 DRIVE TUBE ✓

DATE JULY 30/73 JOB NO. E-2910
 JOB LOCATION Q.W.Y. CALL HOSPITAL
 JOB INSPECTOR K. BARRIS
 JOB ENGINEER H. SETO
 PILING CONTR. BENTA
 PILING SUPT. C. LEVASSEUR

PILE NUMBER		THICK	TONS	DRIVING DEPTH	PILE LENGTH	BOTT ELEV	FINAL PENETRATION			TUBE LENGTHS
BLOCK A+C	DIA						BLOWS	REFU	RETAP	
OK 17 4	9 5/8	.435	110	16'-8"	13'-3"	238'-9"	5	0	0	30'-3"
OK 16 4	9 5/8	.435	110	16'-9"	13'-5"	238'-7"	5	0	0	21'-3"
OK 18 4	9 5/8	.435	110	16'-8"	13'-5"	238'-7"	5	0	0	21'-3"
OK 19 4	9 5/8	.435	110	16'-11"	13'-4"	238'-8"	5	0	0	22'-8"
OK 33 4	9 5/8	.435	110	16'-10"	13'-1"	238'-11"	5	0	0	22'-8"
OK 34 4	9 5/8	.435	110	16'-10"	13'-0"	239'-0"	5	0	0	22'-1"
OK 36 4	9 5/8	.435	110	16'-10"	15'-1"	238'-5"	5	0	0	22'-1"
OK 35 4	9 5/8	.435	110	16'-10"	14'-11"	238'-7"	5	0	0	20'-2"
OK 37 4	9 5/8	.435	110	16'-11"	15'-1"	238'-5"	5	0	0	20'-2"
OK 20 4	9 5/8	.435	110	12'-11"	9'-7"	242'-5"	5	0	0	19'-3"
OK 21 4	9 5/8	.435	110	14'-9"	11'-5"	240'-7"	5	1/16	0	19'-3"
OK 22 4	9 5/8	.435	110	14'-1"	10'-10"	241'-2"	5	0	0	21'-4"
OK 10 4	9 5/8	.435	110	14'-3"	10'-10"	241'-2"	5	1/16	0	21'-4"
OK 11 4	9 5/8	.435	110	13'-4"	9'-11"	242'-1"	5	0	0	21'-0"
OK 12 4	9 5/8	.435	110	13'-7"	10'-0"	242'-0"	5	0	0	15'-6"
OK 25 4	9 5/8	.435	110	13'-5"	11'-6"	242'-0"	5	0	0	15'-6"
OK 27 4	9 5/8	.435	110	13'-7"	11'-7"	241'-11"	5	0	0	15'-6"
OK 26 4	9 5/8	.435	110	13'-8"	11'-8"	241'-10"	5	0	0	19'-2"
OK 58 4	9 5/8	.435	110	18'-8"	15'-0"	237'-0"	5	0	0	21'-0"
OK 56 4	9 5/8	.435	110	18'-7"	14'-10"	237'-2"	5	1/16	0	19'-2"

COMMENTS
 JULY 31/73

TO DAY 20 TO DATE 22

McROSTIE SETO GENEST
& Associates Ltd. — & Associés Ltée
CONSULTING ENGINEERS — INGÉNIEURS CONSEILS
 OTTAWA, ONT.

Noted Seto

RIG NO. 2
 PILE TYPE TUBE
 PILE SIZE 8 5/8" & 9 5/8"
 HAMMER LBS. 3,500 DROP HT. 4' & 5'
 VOL. BUCKET
 DRIVE TUBE

DATE JULY 31/73 JOB NO. E-2910
 JOB LOCATION Q/YW CARL HOSPITAL
 JOB INSPECTOR K. BALLIS
 JOB ENGINEER H. SETO
 PILING CONTR. BENTA
 PILING SUPT. C. LEVASSEUR

Δ - ACTUALLY ONLY 85 TONS REQ'D.

BLOCK A&C PILE NUMBER	DIA	THICK. TONS		DRIVING DEPTH	PILE LENGTH	130T ELEV.	FINAL PENETRATION			TUBE LENGTHS
		START	END				REFUS	BLOW	RETAP	
OK 57	9 5/8	.435	110	18'-7"	14'-11"	237'-1"	0	5	0	20'-0"
OK 45	9 5/8	.435	110	17'-8"	13'-10"	238'-2"	0	5	0	21'-8"
OK * 44	9 5/8	.435	110	17'-9"	13'-10"	238'-2"	1/16	5	0	20'-0"
OK 46	9 5/8	.435	110	17'-10"	13'-11"	238'-1"	0	5	0	21'-6"
OK * 48	9 5/8	.435	110	17'-9"	16'-0"	237'-6"	1/16	5	0	21'-0"
OK 47	9 5/8	.435	110	17'-8"	15'-10"	237'-8"	0	5	0	18'-9"
OK 49	9 5/8	.435	110	17'-9"	15'-10"	237'-8"	0	5	0	18'-9"
OK 38	9 5/8	.435	110	14'-1"	12'-2"	241'-4"	0	5	0	21'-0"
OK * 40	9 5/8	.435	110	14'-4"	12'-5"	241'-1"	1/16	5	0	17'-3"
OK * 39	9 5/8	.435	110	13'-10"	12'-0"	241'-6"	1/16	5	0	17'-3"
OK 50	9 5/8	.435	110	16'-8"	14'-10"	238'-8"	0	5	0	23'-4"
OK * 52	9 5/8	.435	110	17'-3"	15'-5"	238'-1"	1/16	5	0	19'-9"
OK * 51	9 5/8	.435	110	16'-9"	14'-10"	238'-8"	1/16	5	0	19'-10"
OK * 4	9 5/8	.435	(85)Δ 110	12'-9"	9'-5"	242'-7"	0	5	0	23'-4"
OK * 3	9 5/8	.435	(85)Δ 110	12'-8"	9'-4"	242'-8"	0	5	0	19'-9"
OK * 1	9 5/8	.435	(85)Δ 110	16'-6"	13'-0"	239'-0"	0	5	0	19'-10"
OK * 2	9 5/8	.435	(85)Δ 110	16'-6"	12'-11"	239'-1"	0	5	0	19'-10"
YODAY 17 CAST 3 CYLINDERS NOS 4-5-6 REPRESENTS										
YODATE 39 PILE # 365 (TEST PILE #1) 4" SLUMP										
XXX CEMENT 3/4 STONE 5,000 PSI										

COMMENTS

FRANCON SUPPLIER TIME 2:00 PM
 JUL 31 1973

**JOHN D. PATERSON & ASSOCIATES LTD.**

Consulting Engineers & Geologists

Soil Investigations

Inspection & Testing Services

Damage Claims

Offices & Laboratory

1479 Laperriere Ave.

Ottawa, Canada K1Z 7S8

Telephone (613) 728-3505

CONCRETE REPORT

CLIENT McRostie, Sato, Genest & Assoc. Ltd.		REPORT NO. 2651
ADDRESS 393 Ball Street, Ottawa		PRELIMINARY DATE Aug. 8, 1973
JOB E-2910	AT	FINAL DATE August 29/73
LOCATION IN WORK M Tube Piles		
CONCRETE SAMPLED BY KIMINE Client		TIME 2:00 p.m.
DATE CYLINDERS CAST July 31, 1973	BY Client	TIME 2:00
CONCRETE BY Francon	CLASS 5000	

MIX DATA

CEMENT	WATER	CONCRETE TEMP.
FINE AGG.	ADMIXTURE	STONE SIZE 3/4 IN.
COARSE AGG.	PERCENT AIR	APPROXIMATE SLUMP 4 IN.

COMPRESSIVE STRENGTH
POUNDS PER SQUARE INCH

AGE AT TEST (DAYS)	7	28	28			
LAB. STORED SPECIMEN	3470	4350	4460			
JOB STORED SPECIMEN						
WEIGHT (LBS./CU. FT.)						
CYLINDERS MARKED	4 XX	5 XX	6 XX			
CYLINDERS RECEIVED Aug. 1, 1973	TYPE OF BREAK		CONTRACTOR			
REMARKS - PRELIMINARY:						
REMARKS - FINAL:						

COPIES TO:

Client - 3

NOTED.
Alets

DATE AUG, 2/73 JOB NO. E-2910
JOB LOCATION Q Y W. CARL HOSPITAL
JOB INSPECTOR M. BALLIS
JOB ENGINEER H. SETO
PILING CONTR. BENTA
PILING SUPT. C. LEVASSEUR

BLOCK	PILE NUMBER		THICK	TONS	DRIVING DEPTH	PILE LENGTH	FINAL PENETRATION				TUBE LENGTHS	
	A & C	DIA					ELEV	REFU	B.	RETAP		
OK	8	✓	8 5/8	.325	60	13'-2"	10'-3"	242'-3"	1/16	5	0	25'-0"
OK	9	✓	8 5/8	.325	60	13'-9"	10'-10"	241'-8"	0	5	0	21'-7"
OK	5	✓	8 5/8	.325	60	14'-0"	8'-9"	241'-3"	0	5	0	19'-0"
OK	7	✓	8 5/8	.325	60	14'-5"	5'-3"	240'-9"	0	5	0	19'-1"
OK	6	✓	8 5/8	.325	60	14'-4"	5'-3"	240'-9"	0	5	0	22'-0"
OK	24	✓	8 5/8	.325	60	14'-10"	5'-7"	240'-5"	0	5	0	18'-6"
OK	23	✓	8 5/8	.325	60	14'-9"	5'-5"	240'-7"	0	5	0	19'-1"
OK	32	✓	8 5/8	.325	60	15'-0"	5'-8"	240'-4"	1/16	5	0	25'-1"
OK	31	✓	8 5/8	.325	60	15'-6"	9'-3"	240'-9"	1/16	5	0	25'-1"
OK	13	✓	9 5/8	.435	110	13'-10"	10'-5"	241'-7"	0	5	0	21'-1"
OK	15	✓	9 5/8	.435	110	14'-0"	10'-5"	241'-7"	0	5	0	20'-10"
OK	14	✓	9 5/8	.435	110	13'-9"	10'-4"	241'-8"	0	5	0	21'-1"
TO DAY 12												
TO DATE 51												
PILES NOS 8-9-5-7-6-24												
23-32 & 31 REQUIRES												
.250 THICKNESS-ACTUAL .325.												

McROSTIE SETO GENEST
& Associates Ltd. — & Associés Ltée
CONSULTING ENGINEERS — INGÉNIEURS CONSEILS
OTTAWA, ONT.

RIG NO. BENTA 212-110
PILE TYPE TUBE PILES
PILE SIZE 10 3/4" x 8 5/8"
HAMMER LBS. 6,780 DROP HT. 2' 4"
VOL. BUCKET ✓
DRIVE TUBE ✓

DATE OCT, 23/73 JOB NO. E-2910
JOB LOCATION QWY/CALL HOSPITAL
JOB INSPECTOR K. BALLIS
JOB ENGINEER N. I. Mc GILL
PILING CONTR. BENTA
PILING SUPT. L. REVIGNY

PILE NUMBER	SIZE	THICK TONS		DRIVING DEPTH	PILE LENGTH	FINAL PENETRATION			THICK LENGTH
		START	END			BOTT ELEV	NO BLOW	PENET.	
347A	10 3/4	.575	110	43'-4"	40' 16"	210'-1"	5	0	60'-11"
347B	10 3/4	.575	110	21'-0"	18' 1"	232'-11"	5	0	36'-0"
8A	8 5/8	.325	60	9'-10"	9' 8"	242'-4"	5	0	21'-7"
8B	8 5/8	.325	60	9'-10"	9' 10"	242'-2"	5	0	21'-8"
TODAY 4									
YO DATE 383									
CAST 3 CYLINDERS NOS 51-52-53									
REPRESENTS PILE NOS 426-427-428									
429-444-445-452-453-446-441									
432-433-420-421-408-409-396-397									
384-385-374-375									
5,000 PSI 3/4 STONE 3 1/2 SLUMP									
FRANCON SUPPLIER TIME 3:30									
INV. # 321109									
4 #6 REBARS MIXED TO ALL PILES.									

COMMENTS

MICROPILE SETTING
& Associates Ltd. — & Associés Ltée
CONSULTING ENGINEERS — INGÉNIEURS CONSEILS
OTTAWA, ONT.

PAGE 3
OF 4

RIG NO. 2
PILE TYPE TUBE PILES
PILE SIZE 9 5/8" x 8 5/8"
HAMMER LBS. 6,780 DROP HT. 2' 3" ± 5"
VOL. BUCKET ✓
DRIVE TUBE ✓

DATE SEPT. 28/73 JOB NO. E-2910
JOB LOCATION QWY CARL HOSPITAL
JOB INSPECTOR K. BALLIS
JOB ENGINEER N. I. Mc GILL
PILING CONTR. BENTA
PILING SUPT. C. LEVASSEUR

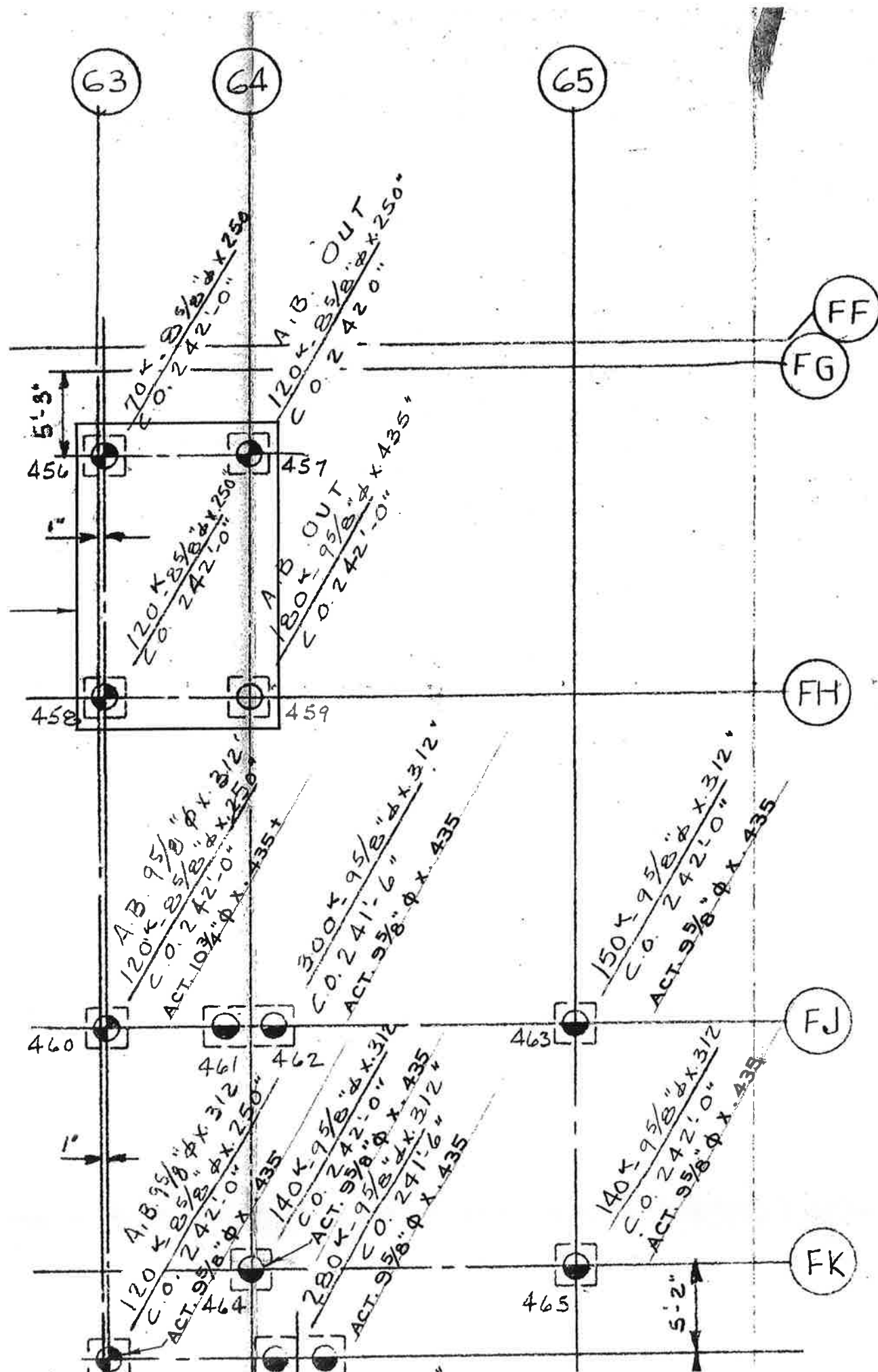
RETAPPING

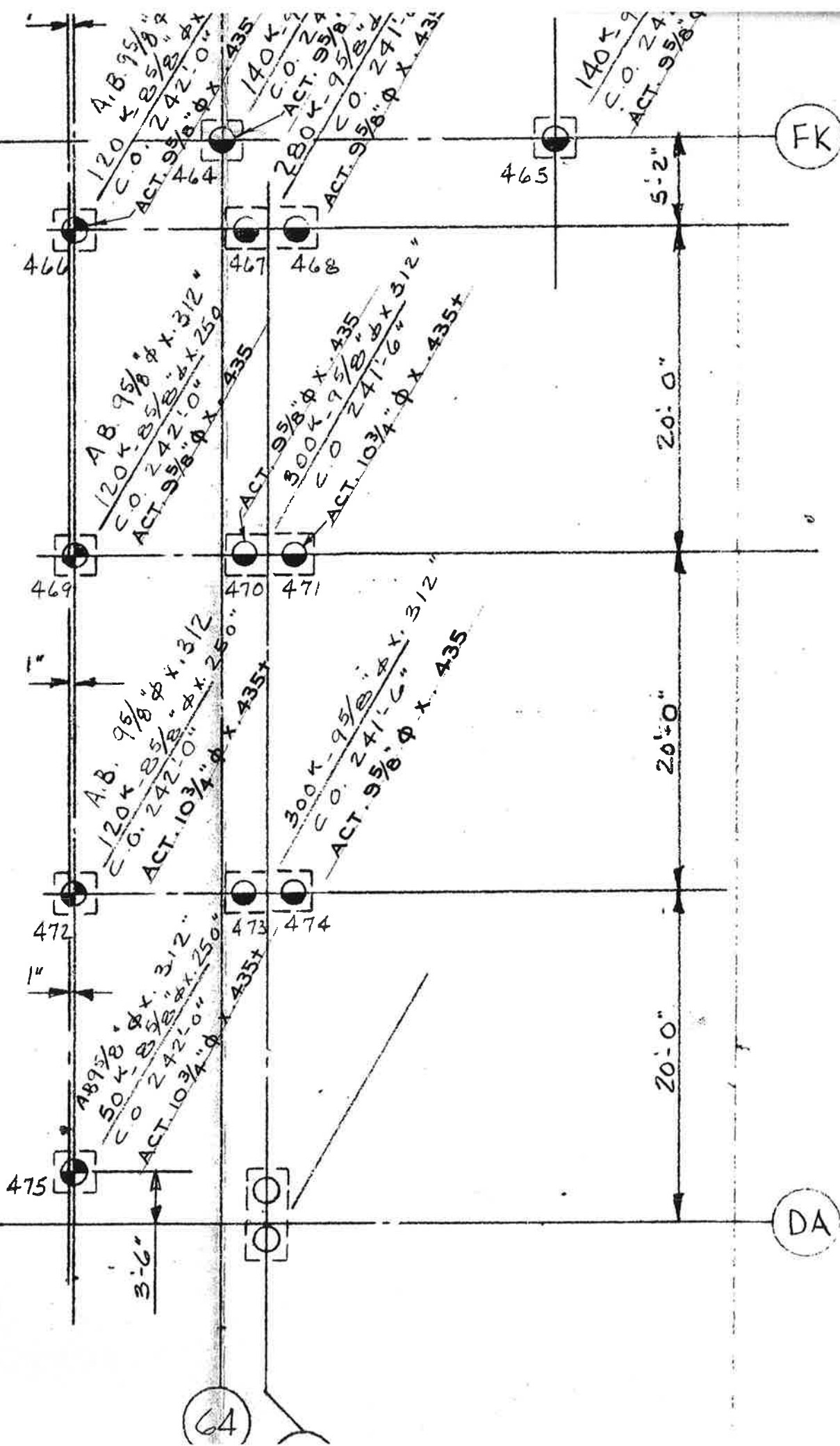
PILE NUMBER	SIZE	TIME		DRIVING DEPTH	PILE LENGTH	DROP HT. 5B	PENETRATION	DROP HT. 5B	PENETRATION
		START	FINISH						
		POURED	FOLLOW						
83	9 5/8	✓	✓	2'	1/8	5'	0		
81	9 5/8	✓	✓	2'	1/16	5'	1/4	0	
86	9 5/8	✓	✓	2'	1/16	5'	0		
85	9 5/8	✓	✓	2'	0	5'	0		
84	9 5/8	✓	✓	2'	3/16	5'	1/16	1/16	0
8	8 5/8	✓	✓	2'	7/16	5'	1/4	TOP TUBE BUCKLED	
9	8 5/8	✓	✓	2'	0	3'	0		
240	8 5/8			2'	0	TUBE BEND			
254	8 5/8			2'	1/8	3'	5/16	TUBE BEND	
253	8 5/8			2'	0	3'	5/16	TUBE BEND	
267	8 5/8			2'	1/8	2'	0	TUBE BEND	
268	8 5/8			2'	1/8	2'	1/8	TUBE BEND	
273	9 5/8			2'	0	4'	0		
272	9 5/8			2'	1/16	4'	1/16	0	
274	9 5/8			2'	0	4'	0		
282	9 5/8	1		2'	0	4'	0		
284	9 5/8	0		2'	0	4'	0		
283	9 5/8	✓		2'	0	4'	0		
305	9 5/8			2'	0	4'	0		

COMMENTS

PILE NOS 8 - 240 - 254 - 253 - 267 & 268

CONTRACTOR STOP DRIVING DUE TO TOP OF TUBES BUCKLING & BENDING.





McROSTIE SETO GENEST
& Associates Ltd. - & Associés Ltée
CONSULTING ENGINEERS - INGÉNIEURS CONSEILS
OTTAWA, ONT.

RIG NO. BENTA 212-110
 PILE TYPE TUBE PILES
 PILE SIZE 9 5/8" x 10 3/4"
 HAMMER LBS. 6.780 DROP HT. 4'
 VOL. BUCKET
 DRIVE TUBE

DATE NOV, 15/73 JOB NO. E-2910
 JOB LOCATION QWY CARL HOSPITAL
 JOB INSPECTOR R. BALLIS
 JOB ENGINEER N. I. MCGILL
 PILING CONTR. BENTA
 PILING SUPT. L. SEVIGNY

PILE NUMBER	SIZE	THICK TONS		DRIVING DEPTH	PILE LENGTH	BOTT ELEV.	FINAL PENETRATION		TUBE LENGTH
		START	FINISH				NO BLOWS	PENET.	
463	9 5/8"	.435	85	9'-1"	6'-6"	235'-6"	5	0	11'-1"
465	9 5/8"	.435	85	10'-10"	7'-0"	235'-0"	5	0	15'-6"
456	10 3/4"	.435	85		4'-5"	237'-7"	5	0	16'-1"
458	10 3/4"	.435	85		4'-9"	235'-3"	5	0	16'-1"
460	10 3/4"	.435	85	8'-5"	5'-4"	236'-8"	5	0	16'-1"
462	9 5/8"	.435	85	8'-9"	5'-2"	236'-4"	5	0	13'-2"
461	9 5/8"	.435	85	8'-5"	5'-1"	236'-5"	5	0	12'-11"
464	9 5/8"	.435	85	9'-0"	6'-2"	235'-10"	5	0	12'-0"
466	9 5/8"	.435	85	9'-0"	5'-10"	236'-2"	5	0	11'-7"
469	9 5/8"	.435	85	9'-5"	6'-3"	235'-9"	5	0	11'-11"
472	10 3/4"	.435	85	10'-0"	6'-6"	235'-6"	5	0	13'-4"
475	10 3/4"	.435	85	9'-4"	7'-1"	234'-11"	5	0	21'-3"
TODAY 9 TO DATE PILE NOS 456 & 458 PULLED OUT SHORT; NO LATERAL SUPPORT. PILE NOS 456-457-458 & 459 ABANDONED. PILE NO 475 (8 5/8") DRIVEN SEPT 7/73 PULLED OUT & REPLACED WITH 10 3/4"									

COMMENTS

OTTAWA, ONT.

DRIVE TUBE _____

PILING SUPT. A. SEVIGNY

[illegible]

COMMENTS

& Associates Ltd. — & Associés Ltée

CONSULTING ENGINEERS — INGÉNIEURS CONSEILS

RIG NO. 2
PILE TYPE TUBE
PILE SIZE 9 5/8" x 8 5/8"
HAMMER LBS. 3,500 DROP HT. 4'
VOL. BUCKET
DRIVE TUBE

DATE SEPT 7/73 JOB NO. E-2910
JOB LOCATION QUOY CARL HOSPITAL
JOB INSPECTOR K. BALLIS
JOB ENGINEER N. I. MCGILL
PILING CONTR. BENTA
PILING SUPT. C. LEVASSEUR

COMMENTS