FINAL REPORT

Geotechnical Investigation for
CBC National Alarm Centre
Addition and Renovation
2415 Richardson Side Road
Ottawa, Ontario

c/o David Mailing Architect Limited

PROJECT NO. 1009000

REPORT NO. 1009000

REPORT TO	**Canadian Broadcasting Corp.** **c/o David Mailing Architect Ltd.** **1347 Stittsville Main Street** **Stittsville, ON, K2S 1C6**
FOR	**Geotechnical Investigation for** **CBC National Alarm Centre** **Addition and Renovation** **2415 Richardson Side Road** **Ottawa, Ontario K0A 1L0**

January 27, 2006

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1.0 INTRODUCTION

This report presents the results of the Geotechnical Investigation carried out for the proposed building expansion to the northwest of the existing two-storey office building at the Canadian Broadcasting Corporation (CBC) National Alarm Centre property which is located at 2415 Richardson Sideroad, Ottawa, Ontario. The work was carried out in conformance with Jacques Whitford revised Proposal No. 1008138 submitted to David Mailing Architect Ltd (DMA) on January 12, 2006. Authorization to carry out the work was received from Mr. Jim Bell of DMA on behalf of CBC, on January 16, 2006.

This report presents the factual results of the geotechnical investigation and provides geotechnical recommendations for the design and construction of the proposed building expansion.

2.0 PROJECT DESCRIPTION

The CBC site is located on the northeast corner of Richardson Side Road and east of William Mooney Road in Ottawa, Ontario. The site is currently occupied by a two-storey office building, two garages and a paved parking lot.

It is understood that a proposed one storey warehouse will be constructed, approximately, 15 m north of the existing two-storey building. An additional septic system is proposed to the west of the existing building. The site location is shown on the Key Plan, Drawing 1009000-1 in Appendix A. The proposed layout at the site is shown on the Test Pit Location Plan, Drawing 1009000-2, which was prepared based on Drawings A-1 and A-2 Site Plans (version 1), provided by David Mailing Architect Ltd. and issued in January 9, 2006. Should the proposed warehouse location and septic system be shifted on future plans or for any other future buildings/facilities, additional field investigation will be required.

The warehouse is proposed to consist of a one storey structure with no basement and to cover an approximate area of 642 square metres, landscaped areas, access roads, paved parking areas, new fire routes and relocation of existing building entrance are proposed as part of this project. It is anticipated that the finished floor elevation of the proposed warehouse building be set at 99.65 m local elevation.

3.0 SCOPE OF WORK

The scope of work for this geotechnical investigation was defined as follows:

- Carry out a test pitting program consisting of five test pits to assess the subsurface and ground water conditions in the study area.
- Perform laboratory tests including moisture content determination and grain size distribution analyses on selected samples.
- Document the results of the field and laboratory programs in a Detailed Geotechnical Report complete with Geotechnical Recommendations concerning the following:
  - design and construction of the proposed warehouse building foundations, parking lots, roadways, services and excavation and backfilling.
  - provide an estimated percolation "T"-time for use to design the proposed septic system.

Environmental issues are beyond the scope of work for the present assignment.

4.0 METHOD OF INVESTIGATION

4.1 Field Investigation

Prior to commencement of the investigation, the test pit locations were established in the field and cleared of existing underground services. Due to the complexity of the present underground cables and utilities, the test pits were relocated, as per the discussion with DMA.

On January 20, 2006, five test pits numbered TP06-1 through TP06-5, were excavated at the site. The test pits were, generally, excavated within and/or near the proposed warehouse footprint and septic system area. The test pit locations are shown on Drawings 1009000-2 in Appendix A.

The test pits were excavated using a rubber tire backhoe excavator. Grab soil samples were collected from the different encountered soil strata in the open pits. The depths of groundwater entering the excavations were measured prior to backfilling the test pits with the excavated material. Soil profiles, at test pit locations, were visually identified and carefully recorded by Jacques Whitford personnel on site.

All test pits were backfilled with excavated material tamped in place.

All samples were stored in moisture-proof bags and were returned to our Ottawa laboratory for detailed classification and laboratory testing. Samples remaining after testing will be stored for a period of one (1) month after issuance of this report unless Jacques Whitford is otherwise directed by the client.

4.2 Survey

The test pit locations were established with reference to the existing site features (existing building, garages, poles, fence lines, etc.). The ground surface elevations at the test pit locations were surveyed with respect to a temporary benchmark. The temporary benchmark was established on top of the finished floor elevation of the existing office building. This benchmark has a known local elevation of 99.77 m.

4.3 Laboratory Testing

All samples obtained were carefully examined as to their visual and textural characteristics by a geotechnical engineer. Selected samples were tested for moisture contents and particle size distribution analyses. One representative soil sample was submitted to Paracel Laboratories in Ottawa, Ontario for resistivity, pH, sulphate and chloride testing.

5.0 RESULTS OF INVESTIGATION

The study area is indicated on the Key Plan, Drawing No. 1009000-1, in Appendix A. The Jacques Whitford test pit locations are indicated on Drawings No. 1009000-2 in Appendix A. Detailed descriptions of the ground surface and subsoil/groundwater conditions encountered are presented on the Test Pit Records provided in Appendix B. A detailed subsoil description is provided in the following sections.

5.1 Surface Conditions

The existing study area is generally flat with a gentle downward slope toward the north. A maximum ground surface elevation difference of 0.5 m was recorded at the test pit locations. The property is enclosed by chain link fence. The property is partially paved. Satellite dishes, short wave antenna and steel tower were observed across the site during the course of the investigation. The study area is located to the north and west of the existing two storey building. Parts of the study area are occupied with sheds and garages.

The ground surface was largely covered by snow at the time of the field investigation. The general site features are shown on Drawing 1009000-2 in Appendix A.

5.2 Subsurface Information

In general, the observed stratigraphy consisted of topsoil over clayey silt over glacial till over bedrock. Bedrock was inferred upon reaching refusal at the base of the test pits.

5.2.1 Surficial Material

A surficial layer of topsoil ranging in thickness from 100 mm to 500 mm was encountered at all test pit locations.

A 500 mm thick layer of mixed fill material was encountered at the location of TP06-03. The fill was covered by 100 mm of topsoil and is overlain a buried layer of topsoil. The fill consisted of brown to dark brown sand and gravel with some cobbles.

5.2.2 Clayey Silt

A grey brown clayey silt, trace sand deposit was encountered underlying the surficial materials stated above, at all test pit locations. The clayey silt extended to depths ranging between 0.8 m to 2.0 m below existing grades.

Laboratory testing conducted on the clayey silt revealed moisture contents between 16% and 32%. A grain size distribution test analysis revealed that the clayey silt consisted of 33% clay, 57% silt and 10% sand size particles. This deposit can be classified as CL-ML using the Unified Soil Classification System. The results of the grain size distribution test conducted on one sample from TP06-04 are presented in Appendix C of this report.

5.2.3 Glacial Till

Native glacial till deposit was encountered underlying the clayey silt deposit in all test pits. The till extended to the maximum depth of exploration. The till consisted of brown grey silty sand deposit with trace gravel, trace clay and occasional cobbles and boulders.

Laboratory testing conducted on the selected samples indicated moisture contents between 9% and 18% for the tested samples. One grain size distribution analysis was completed on a selected sample from 2.3 m depth in TP06-04. The results of the gradation test indicated that the till consisted of 11% gravel, 52% sand, 29% silt and 8% clay size particles. The till is classified as SM in accordance with the Unified Soil Classification System. The results of the gradation test are presented in Appendix C of this report.

5.2.4 Bedrock

Bedrock refusal was inferred at depths ranging between 2.6 m to 3.7 m below ground surface. Boulders were occasionally observed over the bedrock.

5.3 Groundwater

Groundwater was encountered in the open test pits during the course of the investigation. Minor to moderate in-flow ground water was observed at depths ranging from 1.3 m to 3.2 m.

Fluctuations due to seasonal variations or precipitation events should be expected.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 Geotechnical Issues

The following geotechnical issues are observed at this site:

- Slab on grade and conventional spread footings situated in the undisturbed native soil are considered suitable for the proposed warehouse.
- Bedrock excavation should not be anticipated for foundations installation, however, it may be required for service installation below 2.5 m.
- All trees and bushes, existing structures, satellite dishes and towers present within the proposed warehouse will need to be demolished and/or removed.
- Based on the provided finished floor elevation for the proposed warehouse, a maximum grade raise of 500 mm is anticipated within the building footprint. A grade raise of up to 1.0 m should be acceptable at this site without risk of future excessive settlements.

The following sections outline our recommendations for the design of the proposed warehouse building, parking lot and access road pavement structures and underground service connections. In addition, percolation "T"-time is provided for use to design the proposed septic system to the west of the existing building.

6.2 Site Grading and Preparation

6.2.1 Subgrade Preparation for Foundations of Building

Surficial vegetation, topsoil/organics/rootmat, trees, shrubs, existing above ground and all buried/surficial fill materials, all buried organics/topsoil, existing structures, underground service lines, manholes, catchbasins, existing asphaltic concrete and other deleterious materials should be entirely removed from beneath the proposed warehouse building footprint, footings for the building, signs, poles and light standards, as well as from within the influence zone of these footings. Native material which is disturbed or loose encountered within the influence zone of the footings should be subexcavated and replaced with Structural Fill as defined below.

The influence zone is defined by a line drawn at 1 horizontal to 1 vertical outward and downward from the edge of the footings, down to the competent native soil. Prepared subgrade surfaces must be inspected by experienced geotechnical personnel.

6.2.2 Pavement Subgrade Preparation

All surficial vegetation, topsoil, organic materials, trees, structures and underground services, buried topsoil or organics, and any deleterious materials should be removed from beneath the proposed parking areas and access roads to the satisfaction of geotechnical personnel. Existing fill material (i.e. organics, etc.) may remain in proposed pavement areas provided it is free of organics, not overlaying organics/topsoil and is proven competent by proof rolling in the presence of geotechnical personnel. All soft, loose or disturbed areas revealed during subgrade inspections or proofrolling should be removed to a maximum depth of 500 mm and replaced with compacted Subgrade Fill, as defined below. Transitions around subexcavations within the upper 1.2 m below finished grade, where backfill and native soils are not of similar nature, should be sloped at 3 horizontal to 1 vertical.

6.2.3 General

Structural Fill should be used to raise the grade to the underside of footings and beneath the building footprint as required. Structural Fill should conform to OPSS Granular B Type I. Structural Fill placed beneath the building footprint should consist of virgin material with no recycled materials, such as pyritic shale, asphaltic concrete, or Portland cement concrete. This material should be tested and approved by a geotechnical engineer prior to delivery to the site. Structural Fill should be placed in lifts no thicker than 300 mm and compacted using suitable compaction equipment. Structural Fill should be compacted to at least 98% Standard Proctor maximum dry density (SPMDD).

Subgrade Fill used for grading beneath the parking areas and access roads should consist of material meeting the requirements of OPSS Select Subgrade Material. This material should be tested and approved prior to delivery to the site. The Subgrade Fill should be placed in lifts no thicker than 300 mm and compacted using suitable compaction equipment. Subgrade Fill placed beneath the parking areas and access roads should be compacted to at least 95% SPMDD.

It is the responsibility of the contractor to protect soil and fill surfaces from disturbance due to construction activities, groundwater, and weather.

Excavations should be inspected by a geotechnical engineer prior to placement of fill. Material inspection and testing services will be critical to ensure that all fill used is suitable and is placed and compacted to the specifications.

The native overburden material observed on site mainly consists of clayey silt and glacial till. These materials, when excavated, will not be suitable for foundation backfill due to their frost susceptible characteristics. Portions of the overburden materials may be re-used as grading fills within landscaped areas or as subgrade fill within the proposed paved areas, provided the proper degree of compaction is attained. Existing fill materials should be tested and approved prior to re-use as subgrade fill material by the geotechnical consultant.

Subgrade surfaces will be prone to disturbance by weather and traffic. Surface run-off from precipitation should be controlled during construction. Furthermore, groundwater may be encountered in the open excavations. Preparation of subgrade should be scheduled such that the protective cover of overlying granulars is placed and compacted as quickly as possible. Construction traffic should be routed onto access or haul roads.

Provisions should be made for erosion and sediment control measures prior to stripping of the site. Construction and maintenance of measures such as phased stripping, vegetation buffer zones, silt fences, sediment control fences, straw bales, sediment traps/basins and rock check dams should be considered in the planning and designing of the development in order to control sediment.

6.3 Foundation Considerations for Building

The following section discusses the design considerations for the proposed warehouse building. Conventional spread/strip footings located within the native soil may be used for the proposed warehouse.

Spread/strip footings should be placed on native soils or on Structural Fill placed on native soils as detailed in Section 6.2. The foundation subgrade should be prepared as described in Section 6.2. A net allowable bearing pressure of 100 kPa may be utilized for foundations placed on native soils or on Structural Fill placed on native soils. All loose soils should be removed from the footings subgrade prior to placement of concrete.

The base of all footing excavations should be inspected by a geotechnical engineer prior to placing concrete to confirm the design pressures and to ensure that there is no disturbance of the founding soils.

A factor of safety of 3 has been utilized in the analysis of allowable bearing pressures. For footings placed on undisturbed native soil, the total and differential settlements associated with the recommended bearing pressure have been estimated to be less than 25 mm and 19 mm, respectively. Strip footing widths must not be smaller than 0.6 m or larger than 1.5 m. Square footings must be sized between 0.6 m by 0.6 m and 2.0 m by 2.0 m. Larger footings must be reviewed by the geotechnical engineer during the detailed structural design.

All perimeter footings and interior footings located within 1 m distance from the exterior walls require a minimum frost protection equivalent to a soil cover of 1.5 m. Footings in unheated areas or exterior footings such as for signs, light standards, or canopies must have a minimum frost protection equivalent to a soil cover of at least 1.8 m.

A Select Subgrade material that is compactable and has less than 25% passing 0.075 mm should be used as backfill on the exterior side of the foundation walls and where the exterior finish consists of concrete slabs or sidewalks.

The foundation subgrade consists of soil with high silt and clay content. This soil is considered highly frost susceptible and can be disturbed easily by traffic and weather conditions. Footings subgrade should be protected immediately after exposure by placing concrete or approved granular fill. Where construction is undertaken during winter conditions, footing subgrades should be protected from freezing. Foundation walls and columns should be protected against heave due to soil adfreeze.

6.4 Concrete Floor Slabs for Building

The recommendations provided herein are based on the assumption that the average net floor slab loads will not exceed 12 kPa, the finished floor elevations (F.F.E.) will not be higher than 100.00 m local elevation, and that the subgrades for the floor slabs and under the footings are prepared as detailed in Section 6.2. Should these conditions not be met, the geotechnical consultant must review the recommendations presented herein.

Conventional slab-on-grade units are suitable for use for the proposed structure. A layer of free draining granular material such as OPSS Granular A or clean stone, at least 200 mm in thickness, should be placed immediately beneath the floor slab for leveling and supporting purposes. This material shall be compacted to 100% Standard Proctor Maximum Dry Density. Perimeter drains should be installed at all locations where final grades around the building are higher than the underside of the slab and at all cut locations. The drains should be connected to a frost-free outlet.

The slab-on-grade floor slabs constructed as recommended above may be designed using a soil modulus of subgrade reaction, k, of 30 MPa/m. The slab-on-grade units should float independently of all load-bearing walls and columns.

Where construction is undertaken during winter months, floor slab subgrades should be protected from freezing. Alternatively, the floor slab subgrades should be completely thawed then proof rolled prior to placing concrete.

The soils at this site are susceptible to frost heave. Potential damage from frost heave beneath exterior slabs-on-grade and sidewalks can be minimized by constructing frost tapers at 3H:1V using approved Select Subgrade Material (SSM).

6.5 Below-Grade Loading Docks/Retaining Walls

As indicated in Site Plan provided by DMA, it is anticipated that below-grade loading docks will be constructed as part of the proposed warehouse. It is recommended that the ramps be constructed with a concrete base pad. Consideration should also be given to placing concrete pads to support semi-trailer jack legs at specific truck parking areas.

Where concrete pads are placed, some deterioration of the asphalt abutting the concrete should be anticipated as a result of the differential behaviour of each in response to frost heave and temperature change. The concrete pads should have a minimum thickness of 200 mm.

In the area of the below-grade truck ramp, it is recommended that the following granular thicknesses be used for drainage purposes:

- OPSS Granular A 150 mm
- OPSS Granular B Type I 250 mm

The granular materials should be compacted to at least 98% Standard Proctor maximum dry density (SPMDD). The granulars should be connected to a perimeter drainage system provided around the ramp. Potential damage from frost heave beneath exterior slabs-on-grade can be minimized by placing of 100 mm of insulation beneath the concrete or non frost susceptible granular fill to a depth of 1200 mm below finished grades.

The grade change between the below-grade ramps and the adjacent areas will likely be constructed as a permanent slope or as a small retaining structure. Permanent slopes in native soils or structural fill should be no steeper than 3 horizontal to 1 vertical.

To prevent hydrostatic pressure buildup, backfill against retaining structures shall consist of free draining granular materials. The granular materials must be at least 0.9 m wide and be connected to a drainage system at the base of the wall.

The earth pressures recommended below are based on the assumption that a permanent horizontal back slope will be utilized behind the retaining wall. In order to use the coefficients of pressures for the granular materials, the granular backfill must be provided within a wedge extending from the base of the wall at 45 degrees (or smaller) to the horizontal. If a smaller wedge is used, the coefficients of earth pressures of the materials outside the backfill wedge must be used for lateral pressure design calculations.

For retaining walls that are designed to allow rotation, active earth pressure may be used for design. For rigidly tied structures, the at rest pressure should be used for design, unless the wall can deflect enough (approximately 0.05% of the wall height) to establish the active pressure.

Lateral earth pressures may be calculated using the following parameters:

Table 6.1: Coefficients for Earth Pressure Calculations

Parameters	OPSS Granular A	OPSS Granular B Type I	Glacial Till	Clayey Silt
Unit Weight (kN/m^3)	22.0	21.0	20	18
Angle of Internal Friction, ø	35°	32°	30°	27°
Coeff. of Active Earth Pressure, K_a	0.28	0.31	0.33	0.37
Coeff. of Passive Earth Pressure, K_p	3.5	3.2	3.0	2.66
Coeff. of Earth Pressure at Rest, K_o	0.43	0.47	0.5	0.54

The bearing surface preparation comments that are provided in Section 6.2 are applicable to foundations for retaining walls. Retaining wall foundations can be design as conventional spread footings as described in Section 6.3. The underside of the retaining walls should be provided with a minimum of 1.8 m of soil cover or equivalent insulation for frost protection.

Sliding resistance can be calculated using the following unfactored friction coefficients:

Table 6.2: Unfactored Friction Coefficients

Condition	Unfactored Friction Coefficient
Between Concrete and Structural Fill	0.55
Between Concrete and Native Glacial Till	0.45
Between Concrete and Clayey Silt	0.30

A minimum factor of safety of 1.5 should be used to assess stability with respect to sliding.

6.6 Earthquake Considerations

As outlined in the National Building Code of Canada (NBCC), building and its foundations must be designed to resist a minimum earthquake force. The NBCC formula for obtaining the minimum earthquake force is dependent on several factors, including the Foundation Factor. The recommended Foundation Factor, F, is 1.0 for the soils encountered at this site.

6.7 Excavation and Backfilling

Temporary excavations in the overburden should be carried out as per the requirements of the Occupational Health and Safety Act (OHSA) and local regulations. Compact glacial till is generally considered as Type 3. Unsupported excavation should be sloped no steeper than 1 horizontal to 1 vertical from the base of cuts. All excavations must be inspected regularly for signs of instability and flattened as required. Bedrock excavation for service line installations may be achieved by blasting or hoe-ramming.

Groundwater inflow was minor at the time of field investigation. If encountered during excavation and construction, it is expected that groundwater and any surface run-off water may be controlled by sump and pumping methods.

Foundation backfill should be placed and compacted in lifts. Interior foundation wall backfill shall consist of Structural Fill as described in Section 6.2. Exterior foundation backfill shall consist of a Select Subgrade material and compacted as described for Subgrade Fill in Section 6.2. Care should be taken immediately adjacent to walls to avoid over compaction of the soil, resulting in damage to the walls.

Bedding for utilities should be placed in accordance with the pipe design requirements. It is recommended that a minimum of 150 mm to 200 mm of OPSS Granular A be placed below the pipe invert as bedding material. Granular pipe backfill placed above the invert shall consist of Granular A material. A minimum of 300 mm vertical and side cover should be provided. These materials must be compacted to at least 95% of SPMDD.

Backfill for service trenches in landscaped areas may consist of excavated material replaced and compacted in lifts. Where the service trenches extend below paved areas, the trench should be backfilled with Subgrade Fill material, as defined in Section 6.2, from the top of the pipe cover to within 1.2 m of the proposed pavement surface, placed in lifts and compacted to at least 95% of SPMDD. The material used within the upper 1.2 m and below the subgrade line should be similar to that exposed in the trench walls to prevent differential frost heave, placed in lifts and compacted to at least 95% of SPMDD. Different abutting materials within this zone will require a 3H:1V frost taper in order to minimize the effects of differential frost heaving.

Service line trenches should incorporate “water stops” where the lines exit the property to prevent ground water draw down. The water stops should consist of compacted silty clay placed the full depth from bottom of trench to the pavement subgrade line. The water stops should be at least 1.5 m in width.

Excavations for catch basins and manholes should be backfilled with compacted granular material. A 3H:1V frost taper should be built within the upper 1.2 m. The joints between catch basin or manhole sections should be wrapped with non-woven geotextile.

6.8 Main Access Roads and Parking Areas

The subgrade in pavement areas immediately adjacent to the building should be prepared as described in Section 6.2 above. It has been assumed that the parking areas will be used mostly by passenger vehicles, and the access roads will be used by delivery trucks and fire vehicles. The following minimum pavement designs are recommended for pavement on soil or fill subgrades.

Table 6.3: Recommended Pavement Structures for Access Roads and Parking Areas

Material	Light Duty Parking Areas	Access Roads
HL-3 Asphaltic Concrete	50 mm	40 mm
HL-8 Asphaltic Concrete	-	50 mm
Granular Base Course, OPSS Granular A	150 mm	150 mm
Granular Subbase Course, OPSS Granular B Type I	300 mm[(1)]	400 mm[(1)]

Note (1) = Transitions in the subgrade within 1.2 m from top of pavement should include 3H:1V transitions.

It is recommended that an asphalt cement grade of PG 58-34 be used for the paved areas.

Both subgrade and finished pavement surfaces must be graded to direct water towards suitable drainage. Perforated subdrains 3 m in length should be installed and connected to the catch basins, where wet conditions are encountered at the subgrade line. A frost taper of 3 horizontal to 1 vertical should be incorporated into the subgrade surface as a transition between differing pavement structures. The lateral extent of the subbase and base layers must not be terminated vertically behind curb lines. A taper with a grade of 3 horizontal to 1 vertical should be incorporated into the subgrade line to minimize differential frost heave problems under curbs and sidewalks.

All granular materials should be in conformance with Ontario Provincial Standards Specifications (OPSS) Form 1010 for select granular material. The materials should be tested and approved by a geotechnical engineer prior to delivery to the site. The base and subbase should be compacted to at least 100% SPMDD. Asphalt should be compacted to at least 96% of the Marshall density.

6.9 Cement Type and Corrosion Potential

One representative sample of the native silty clay was submitted to Paracel Laboratories in Ottawa, Ontario for analysis of pH, water soluble sulphate, chloride concentrations, and resistivity. The testing results are not available at the time of preparation of this report. A separate letter report will be submitted as soon as the results become available.

6.10 Permeability and Percolation “T”-Time

It is understood that a septic system is proposed on the west side of the proposed building. At TP 06-04, two soil samples were obtained and subjected to soil gradation laboratory testing. The permeability was assessed from the results of the gradation testing using an empirical method. The calculated permeability was correlated to approximate percolation “T”-time. Our results are summarized in the table below.

Table 6.4: Percolation "T"-Time

Sample/Depth	Approximate Soil Permeability cm/s	Approximate Percolation “T”-Time min/cm
TP06-4-GS3 1.1 m CL-ML	$<10^{-6}$	>50
TP06-4-GS-4 2.3 m SM	2×10^{-5}	20

7.0 CLOSURE

This report has been prepared for the sole benefit of CBC National Alarm Centre, David Mailing Architect Limited and their design engineers. It may not be used by any third party without the express written consent of Jacques Whitford Limited, CBC and David Mailing Architect Limited. Any use which a third party makes of this report is the responsibility of such third party.

The recommendations made in this report are in accordance with our present understanding of your project. We request that we be permitted to review our recommendations when your drawings and specifications are complete.

This report is based on the site conditions encountered by Jacques Whitford at the time of the work, and at the specific testing and/or sampling locations, and can only be extrapolated to a limited extent around these locations. The extent depends on the variability of soil and groundwater conditions as influenced by geological processes, construction activities and site use. Should any conditions at the site be encountered which differ from those at the test locations, we require that we be notified immediately in order to permit reassessment of our findings.

We trust the above meets your present requirements. Should you require any further information please do not hesitate to contact us. We thank you for the opportunity to be of service to you and look forward to our next assignment from CBC and David Mailing Architect Limited.

Yours truly,

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