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REPORT ON

PRELIMINARY SUBSURFACE INVESTIGATION
PROPOSED RESIDENTIAL AND COMMERCIAL DEVELOPMENT
O'KEEFE COURT AND FALLOWFIELD ROAD
OTTAWA, ONTARIO

Submitted to:

Phoenix Homes
18 Bentley Avenue
Nepean, Ontario
K2E 6T8

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August 2006 060445

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August 10, 2006 060445

Phoenix Homes
18 Bentley Avenue
Nepean, Ontario
K2E 6T8

Attention: Mr. Bill Buchanan

RE: PRELIMINARY SUBSURFACE INVESTIGATION
PROPOSED RESIDENTIAL AND
COMMERCIAL DEVELOPMENT
O'KEEFE COURT AND FALLOWFIELD ROAD
OTTAWA, ONTARIO

Dear Sirs:

This report presents the results of a preliminary subsurface investigation carried out at the site of the proposed residential and commercial development between O'Keefe Court and Fallowfield Road in the City of Ottawa, Ontario. The purpose of the investigation was to determine the general subsurface conditions at the site by means of a limited number of test pits and, based on the factual information obtained, to provide engineering guidelines on the geotechnical aspects of the preliminary design of the project, including construction considerations, which could influence design decisions.

PROJECT DESCRIPTION AND SITE

The development site in question consists of about a 10 hectare, triangular shaped property located on the south side of O'Keefe Court and bordered on the southeast and southwest by Fallowfield

Road, in the City of Ottawa, Ontario (see Key Plan, Figure 1). It is understood that a yet determined portion of the site will be developed for the construction of single family dwellings and/or rowhouses with the remaining portion used for commercial development. The dwellings are likely to be of wood frame construction with full depth conventional concrete foundations. Details regarding the proposed commercial development at the site was not available at the time of this report. The development will be provided with full municipal services and local roadways.

The ground surface across the site is relatively flat with most of the site being open grassed fields with scattered young trees and shrubs. Wooded areas exist at the west end of the site and in the central portion of the site near the south property line. A water course runs north/south through about the middle of the site

Based on a review of the surficial geology map for the site area and the results of previous geotechnical investigations carried out in proximity of the site, it is expected that the site is underlain by glacial till deposits in the east portion and marine deposited sensitive silty clay over glacial till in the west.

SUBSURFACE INVESTIGATION

The fieldwork for this investigation was carried out on July 7, 2006 at which time twenty test pits were put down across the site. The test pits were advanced to depths of some 0.6 to 3.8 metres below the existing ground surface. The subsurface conditions encountered in the test pits were classified based on visual and tactile examination of the materials exposed on the sides and bottom of the test pits. In situ vane shear testing was carried out within the softer portions of silty clay material encountered to measure the undrained shear strength of that material. The groundwater conditions were observed in the open test pits at the time of excavating.

The field work was supervised throughout by a member of our field engineering staff who directed the test pitting operation, cared for the samples obtained and logged the test pits.

A detailed account of the subsurface conditions encountered at each of the test pits is provided in the attached Table I Record of Test Pits following the text of this report. The approximate locations of the test pits are shown on the Site Plan, Figure 2.

SUBSURFACE CONDITIONS

General

As previously indicated, the soil and groundwater conditions encountered at the test pits put down for this investigation are given in Table 1 Record of Test Pits following the text of this report. The test pit logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at other than the test pit locations may vary from the conditions encountered in the test pits. In addition to soil and bedrock variability, fill of variable physical and chemical composition may be present over portions of the site.

The soil and bedrock descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and Kollaard Associates Inc. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the location and date of observations noted in the report and on the test pit logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The following presents an overview of the subsurface conditions encountered in the test holes advanced during this investigation.

Fill

Test pits 8 to 20 inclusive encountered a layer of fill from the surface. At the test pit locations the fill is some 0.3 to 2.7 metres in thickness and in general consists of grey brown silty clay, sand, gravel, and cobbles with topsoil, concrete, asphaltic concrete, bricks and wire.

Topsoil

From the surface or beneath the fill materials all of the test pits except test pits 8 and 9 encountered a layer of topsoil. The topsoil thickness varies across the site and ranges in thickness from about 0.1 to 0.5 metres at the test pit locations. The material was classified as topsoil based on colour and the presence of organic materials and is intended as identification for geotechnical purposes only and does not constitute a statement as to the suitability of this layer for cultivation and sustaining plant growth.

Sand/Silty Sand

Beneath the fill materials or topsoil, test pits 4, 5, 6, 7 and 14 encountered a layer of red brown to yellow brown sand to silty sand. The sand/silty sand layer is some 0.4 to 0.7 metres in thickness at the test pits. The sand/silty sand layer was full penetrated at the test pit locations at depths of some 0.7 to 1.8 metres below the existing ground surface.

Silty Clay

A deposit of grey brown to grey silty clay was encountered beneath the fill, topsoil, sand and/or silty sand at test pits 2, 3 and 9 to 19 inclusive. Where fully penetrated at test pits 2, 3, 10 and 19 the silty clay deposit is some 0.2 to 1.5 metres in thickness. Test pits 9 and 11 to 18 were terminated in the silty clay material at depths of some 3.2 to 3.8 metres below the existing ground surface. In situ vane shear tests were carried out in the softer silty clay material encountered and gave undrained shear strength values ranging from 52 to 110 kilopascals indicating a stiff to very stiff consistency.

Glacial Till

Beneath the fill, topsoil, sands and/or silty clay test pits 1 to 8 inclusive and 10, 19 and 20 encountered a deposit of yellow brown to grey brown glacial till. The glacial till consists of gravel, cobbles and

boulders in a matrix of silty sand with a trace to some clay. All of the test pits, except test pit 8, were terminated in the glacial till at depths of some 1.3 to 3.3 metres below the existing ground surface. Based on tactile examination of the glacial till in the walls and bottom of the test pits and on the difficulty to advance the test pits in the glacial till it is considered that the glacial till is in a compact to dense state of packing.

Bedrock

Bedrock was encountered beneath the glacial till at test pit 8 at a depth of about 0.6 metres below the existing ground surface.

Groundwater

Seepage was encountered into most of the test pits during excavating on July 7, 2006 at depths of about 1.4 to 3.3 metres below the existing ground surface. It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring.

PROPOSED RESIDENTIAL AND COMMERCIAL DEVELOPMENT

General

This section of the report provides engineering guidelines on the geotechnical aspects of the project based on our interpretation of the test hole information and project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers for the preliminary design of the project and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface

contamination resulting from previous uses or activities at this site or adjacent properties, and/or resulting from the introduction onto the site from materials from off site sources are outside the terms of reference for this report and have not been investigated or addressed.

Foundations for Proposed Rowhouses, Single Family Dwellings and Commercial Buildings

From a geotechnical point of view with regards to preliminary foundation design, the site can be divided into three areas: east, central and west, respectively. The east and west areas are represented by test pits 1 to 8 , 10, 19 and 20. The east and west areas are underlain by native materials consisting of relatively thin layers of sands and silty clay overlying glacial till or bedrock. The central area is represented by test pits 9 and 11 to 18. The central area is underlain by a significant layer of fill materials together with a deposit of silty clay. Due to the combined thickness of the fill materials and silty clay deposit the total thickness of the silty clay was not penetrated at the test pits in the central area.

East and West Areas

For the proposed rowhouses, single family dwellings and light commercial buildings founded beneath the fill and topsoil in the undisturbed, sands, silty clay, glacial till or bedrock, or on engineered fill used to replace existing fill materials, a maximum allowable bearing pressure of 150 kilopascals may be used for preliminary design of footings using the total dead and live loads which will be carried by the footings. Provided that any loose and disturbed soil is removed from the bearing surfaces prior to pouring concrete, the settlement of the footings should be less than 25 millimetres.

No grade raise restrictions adjacent to foundations or limit for footing size are necessary for the east and west areas from a geotechnical point of view.

For seismic design purposes for the east and west areas a foundation factor, F, of 1.0 should be used in accordance with the 1997 OBC Section 4.1.9.1, Table 4.1.9.1.C.

Central Area

The central area is characterized by a surficial layer of fill materials typically some 1.0 to 2.7 metres in thickness and an underlying deposit of silty clay of unknown total thickness. For areas underlain by silty clay it is usual that footing size and the height of landscape fill adjacent to foundations would be restricted and that the allowable bearing pressure for foundation design would be limited. The limited information obtained from the test pits indicate that the silty clay deposit within the central area is stiff to very stiff in consistency and based on that information the design of foundations would be similar as indicated above for the east and west areas. However, in view of the unknown depth of the silty clay deposit and that silty clay deposits typically decrease in strength with depth, it is possible that firm to soft silty clay exists within the central area. Should soft to firm silty clay exist, it will likely have a restrictive affect on the design of foundations and allowable landscape grade raises adjacent to foundations within the central area Accordingly, it is considered that information on the thickness and consistency of the silty clay deposit within the central area should be determined prior to final design planning.

All exterior footings and those in any unheated parts of the structures at this site should be provided with at least 1.5 metres of earth cover for normal frost protection purposes. Where it is not possible to provide at least 1.5 metres of earth cover, frost protection should be provided with the use of a suitable rigid insulation. All structures with a basement should be provided with a conventional, perforated perimeter exterior drain within a 150 millimetre thick surround of 20 millimetre minus crushed stone installed at founding level and positively drained to a storm sewer.

For predictable performance of concrete floor slabs on grade all exiting fill and topsoil and any deleterious materials should be removed from within the proposed building areas. The subgrade should then be inspected by geotechnical personnel and any soft of loose areas observed should be subexcavated and replaced with suitable granular materials. Material used to raise the approved subgrade to within 150 millimetres of the underside of the concrete slab should consist of sand or sand and gravel meeting the Ontario Provincial Standards Specifications (OPSS) for Granular B Type I or crushed stone meeting OPSS grading requirements for Granular B Type II. A 150 millimetre base course of OPSS Granular A should be provided immediately beneath the floor slab. All of the granular materials should be placed in maximum 250 millimetre thick loose lifts and be compacted to at least 95 percent of the standard Proctor maximum dry density for the materials used.

The native soils at this site are considered to be highly frost susceptible. As such, to prevent possible foundation frost jacking, the backfill against unheated walls or isolated walls or piers should consist of free draining, non-frost susceptible material such as sand or sand and gravel meeting OPSS

Granular B Type I grading requirements. Alternatively, foundations could be backfilled with native material in conjunction with the use of an approved proprietary drainage layer system against the foundation wall. It is pointed out that there is potential for possible frost jacking of the upper portion of some types of these drainage layer systems if frost susceptible material is used as backfill. This could be mitigated by using non-frost susceptible granular material for the upper about 0.6 metre portion of backfill.

Where the backfill will ultimately support a pavement structure or walkway, it is suggested that the foundation wall backfill material be compacted in 250 millimetre thick lifts to 95 percent of the standard Proctor maximum dry density value.

In view of the substantial thickness of the existing fill materials at the site, it is expected that engineered fill will be required to replace the existing fill and raise the subgrade to proposed footing founding levels. In preparation for engineered fill construction all of the existing fill and topsoil, and any alluvium (in the area of the existing water course), should be removed to expose the underlying undisturbed native sand, silty clay or glacial. The engineered fill should consist of crushed stone meeting OPSS requirements for Granular A or Granular B Type II and should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. To allow the spread of load beneath the footings, the engineered fill should extend down and out from the edges of the footings at 1 horizontal to 1 vertical, or flatter. The excavations for the structures should be sized to accommodate this fill placement. Currently, OPSS documents allow recycled asphaltic concrete to be used in Granular A and Granular B Type II materials. Since the source of recycled material cannot be determined, it is suggested that any granular materials used below founding level be composed of virgin material only.

Groundwater inflow from the native soils into the building excavations during construction, if any, should be handled by pumping from sumps within the excavations.

SITE SERVICES

Excavation

The excavations for the site services will be carried out through fill, topsoil, sands, silty clay, glacial till and depending on depths, possibly bedrock. The sides of the excavations in overburden materials should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Ontario Occupational Health and Safety Act. That is, open cut excavations within overburden deposits should be carried out with side slopes of 1 horizontal to 1 vertical, or flatter. Where space constraints dictate, the excavation and backfilling operations should be carried out within a tightly fitting, braced steel trench box. If excavations extend below the water table in silty sand or sandy soil, some loss of ground and groundwater inflow may occur, requiring flatter side slopes to be used. Cobbles and boulders, some of which could be large may exist within the glacial till.

Bedrock was encountered in test pit 8 at about 0.6 metres depth and practical refusal was encountered in most of the test pits in the east area of the site at depths of about 2.6 to 3.1 metres below the existing ground surface. As such, it is expected that bedrock may be encountered during excavating for site services. Small amounts of bedrock removal, if required, can most likely be carried out by hoe ramming. If larger amounts of bedrock removal are required it may be more economically feasible to use drill and blasting techniques and should be carried out under the supervision of a blasting specialist engineer. Monitoring of the blasting should be carried out throughout the blasting period to ensure that the blasting meets the limiting vibration criteria established by the specialist engineer. Pre-blast condition surveys of nearby structures and existing utilities are essential.

Groundwater seepage into the excavations, if any, should be handled by pumping from sumps in the excavation.

Pipe Bedding and Cover Materials

It is suggested that the service pipe bedding material consist of at least 150 millimetres of granular material meeting OPSS requirements for Granular A. A provisional allowance should, however, be made for sub-excavation of any disturbed material encountered at subgrade level. Granular material meeting OPSS specifications for Granular B Type II could be used as a sub-bedding material. The use of clear crushed stone as a bedding or sub-bedding material should not be permitted.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A or Granular B Type I (with a maximum particle size of 25 millimetres).

The sub-bedding, bedding and cover materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

Trench Backfill

The general backfilling procedures should be carried out in a manner that is compatible with the future use of the area above the service trenches.

In areas where the service trench will be located below or in close proximity to existing or future roadway areas, acceptable native materials should be used as backfill between the roadway subgrade level and the depth of seasonal frost penetration (i.e., 1.8 metres below finished grade) in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent section of roadway. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I. In general, the existing fill materials could be used as trench backfill provided all deleterious materials such as any soft clay, topsoil, large boulders, asphaltic concrete , wood, wire, styrofoam, etc. are culled prior to use.

The silty clay and glacial till overburden deposits at this site are sensitive to changes in moisture content. In addition, some of the native materials from the lower part of the trench excavations may be wet of optimum for compaction. Depending on the weather conditions encountered during construction, some drying of materials and/or recompaction may be required. Any wet materials that cannot be compacted to the required density should either be wasted from the site or should be used outside of existing or future roadway areas.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, sidewalks, etc., the trench backfill should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. The specified density may be reduced where the trench backfill is not located below or in close proximity to existing or future roadways, driveways, sidewalks, or any other type of permanent structure.

The permanent lowering of the groundwater level at the site can be caused by drainage through the granular bedding/backfill within the sewer trenches. Groundwater lowering can cause stress within any softer silty clay materials which may underlie a portion of the site and in turn result in settlement of underlying footings/foundations. To minimize the possibility of groundwater lowering at this site due to the presence of the proposed sewers, it is considered that clay dykes should be provided within sewer trenches at about 150 metre spacing. Details for construction of the proposed clay dykes are shown in the attached Figure 3.

ROADWAYS

Subgrade Preparation

In preparation for roadway construction, the topsoil and any soft, wet or deleterious material should be removed from the roadway area. It may be possible to leave in place any existing fill materials provided that they do not contain significant amounts of organic or deleterious materials and that the materials have been inspected and approved by the geotechnical engineer. The subgrade surface should then be proof rolled with a large steel drum roller and inspected and approved by geotechnical personnel. Any soft areas evident from the proof rolling should be subexcavated and replaced with suitable earth borrow material.

Fill sections along the proposed roadway should be brought up to proposed roadway subgrade level using acceptable earth borrow material. The earth borrow should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

The subgrade surface should be shaped and crowned to promote drainage of the roadway granulars.

Pavement Structure

It is suggested that provision be made for the following minimum pavement structure for local residential roadways:

80 millimetres of Asphaltic Concrete
(40 millimetres of HL3 over 40 millimetre of HL8), over

150 millimetres of OPSS Granular A base, over

300 millimetres of OPSS Granular B Type II subbase
(50 or 100 millimetre minus crushed stone)

Where the pavement structure will carry buses or heavy truck traffic, the subbase thickness should be increased to 450 millimetres and the asphaltic concrete thickness increased to 100 millimetres.

The pavement granular materials should be compacted in maximum 300 millimetre thick lifts to at least 100 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

In areas where the new pavement will abut existing pavement, the depths of the granular materials should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the depths of the granular material(s) exposed in the existing pavement.

The above pavement structure assumes that the trench backfill is adequately compacted and that the roadway subgrade surface is prepared as described in this report. If the roadway subgrade surface is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or to incorporate a non-woven geotextile separator between the roadway subgrade surface and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

TREE PLANTING

It should be noted that any soft silty clay soils at the site are highly sensitive to water depletion by trees of high water demand during periods of dry weather. When trees draw water from the silty clay, the silty clay undergoes shrinkage which can result in settlement of adjacent structures. The zone of influence of a tree is considered to be approximately equal to the mature height of the tree. Therefore trees, which have a high water demand, should not be planted closer to structures than the ultimate height of the trees. Table II provides a list of the common trees in decreasing order of water demand and, accordingly, decreasing risk of potential effects on structures.

WATER COURSE SLOPE STABILITY EVALUATION

As mentioned above a water course exists running north/south through about the centre of the site. A reconnaissance of the slopes of the water course was carried out to observe the general condition of the slopes. At the time of the reconnaissance visit the height and inclination of the water course slopes were measured using a hand clinometre and level and the degree of erosion of the water course channel was observed. The results of the measurements indicate that the water course slopes are typically some 3.5 metres high and inclined at about 10 to 15 degrees to the horizontal on the east side and some 2. metres high and inclined at about 10 to 12 degrees to the horizontal on the west side The water course channel walls are near vertical and some 1 to 1.5 metres high. A relatively wide flood plain exists between the water course channel and the toe of the slopes. The slopes including the relatively steep water course channel walls are well vegetated. Some minor localized erosion of the water course channel walls was observed.

Based on the results of the slope reconnaissance it is considered that the water course side slopes are stable and have a factor of safety greater than 1.5. In view of the stable condition of the slopes and the minor erosion conditions, no construction set back from the crest of the existing water course slopes is considered necessary for the design of the proposed development.

ADDITIONAL INVESTIGATION AND CONSTRUCTION OBSERVATIONS

As indicated above it is considered that the central portion of the site may be underlain by softer silty clay materials. Accordingly, prior to final design planning it is strongly suggested that additional subsurface investigation be carried out by means of a series of boreholes to determine if any soft or firm silty clay exists at depth in the central area of the site.

In view of the relatively wide spacing between test pits and the substantial thickness of fill encountered at the site, it is suggested that additional site specific investigations be carried out for the final design of each of the proposed commercial buildings.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed development do not materially differ from those given in the preliminary and final reports and that the construction activities do not adversely affect the intent of the design.

All footing areas and any engineered fill areas for the proposed single family dwellings, rowhouses and commercial buildings should be inspected by Kollaard Associates Inc. to ensure that a suitable subgrade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected to ensure that the materials used conform to the grading and compaction specifications.

The subgrade surfaces for the site services and roadways should be inspected by geotechnical personnel. In situ density testing should be carried out on the service pipe bedding and backfill and the roadway granular materials.

The native soils at this site will be sensitive to disturbance from construction operations, from rainwater or snow melt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this information or if we can be of further assistance to you for the final design investigations at this site, please do not hesitate to contact our office.

Yours truly,

KOLLAARD ASSOCIATES INC.

C.R. Morey, P. Eng.

REGISTERED PROFESSIONAL ENGINEER
C. R. MOREY
PROVINCE OF ONTARIO

Attachments: Table I, Record of Test pits
Table II, Order of Water Demand for Common Trees
Figures 1 to 3

TABLE I

RECORD OF TEST PITS
PRELIMINARY GEOTECHNICAL INVESTIGATION
O'KEEFE COURT
CITY OF OTTAWA, ONTARIO

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP1	0.00 – 0.30	TOPSOIL
	0.30 – 1.32	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)
	1.32	End of test pit

Test pit dry, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP2	0.00 – 0.33	TOPSOIL
	0.33 – 0.76	Very stiff grey brown SILTY CLAY
	0.76 – 2.80	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)
	2.80	End of test pit, refusal on large boulder or bedrock

Water observed in test pit at about 2.8 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP3	0.00 – 0.38	TOPSOIL
	0.38 – 0.69	Very stiff grey brown SILTY CLAY
	0.69 – 2.60	Grey brown silty sand, gravel, cobbles, trace clay (GLACIAL TILL)
	2.60	End of test pit, refusal on large boulder or bedrock

Water observed in test pit at about 2.0 metres below existing ground surface, July 7, 2006.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP4	0.00 – 0.33	TOPSOIL
	0.33 – 0.74	Red brown SILTY SAND, some gravel, trace clay
	0.74 – 3.10	Grey brown silty sand, some gravel, cobbles, trace clay (GLACIAL TILL)
	3.10	End of test pit, refusal on large boulder or bedrock

Water observed in test pit at about 2.1 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP5	0.00 – 0.30	TOPSOIL
	0.30 – 1.02	Red brown to yellow brown SILTY SAND, trace gravel
	1.02 – 3.00	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)
	3.00	End of test pit, refusal on large boulder or bedrock

Water observed in test pit at about 1.4 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP6	0.00 – 0.30	TOPSOIL
	0.30 – 1.00	Red brown fine SAND, trace silt, some gravel
	1.00 – 2.80	Grey brown silty sand, some gravel, cobbles (GLACIAL TILL)
	2.80	End of test pit, refusal on large boulder or bedrock

Test pit dry, July 7, 2006.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP7	0.00 – 0.36	TOPSOIL
	0.36 – 0.79	Red brown fine SAND, trace gravel
	0.79 – 2.70	Grey brown silty sand, some gravel (GLACIAL TILL)
	2.70	End of test pit, refusal on large boulder or bedrock

Test pit dry, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP8	0.00 – 0.61	Topsoil, gravel, wire, asphaltic concrete (FILL)
	0.61	Refusal, BEDROCK

Test pit dry, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP9	0.00 – 0.28	Topsoil, gravel, cobbles, styrofoam, wood, clay tile, brick, asphaltic concrete, boulders (FILL)
	0.28 – 3.60	Very stiff grey brown SILTY CLAY
	3.60	End of test pit

Test pit dry, July 7, 2006.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP10	0.00 – 2.30	Grey brown silty clay, some topsoil, gravel, boulders, concrete, asphaltic concrete (FILL)
	2.30 – 2.40	TOPSOIL
	2.40 – 2.60	Very stiff grey brown SILTY CLAY
	2.60 – 3.30	Grey brown silty clay, some gravel, boulders (GLACIAL TILL)
	3.30	End of test pit

Test pit dry, July 7, 2006.

TP11	0.00 – 1.80	Grey brown silty clay, gravel, cobbles (FILL)
	1.80 – 1.90	TOPSOIL
	1.90 – 3.60	Very stiff grey brown SILTY CLAY
	3.60	End of test pit

Water observed in test pit at about 3.3 metres below existing ground surface, July 7, 2006.

TP12	0.00 – 2.74	Topsoil, clay, gravel, asphaltic concrete (FILL)
	2.74 – 2.90	TOPSOIL
	2.90 – 3.80	Stiff grey SILTY CLAY
	3.80	End of test pit

<u>In Situ Undrained Shear Strength Test Results</u>

Depth (metres)	Cu (kilopascals)
2.90	52

Water observed in test pit at about 3.5 metres below existing ground surface, July 7, 2006.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP16	0.00 – 2.13	Topsoil, sand, clay, gravel, asphaltic concrete (FILL)
	2.13 – 2.44	TOPSOIL
	2.44 – 3.30	Stiff grey SILTY CLAY
	3.30	End of test pit

In Situ Undrained Shear Strength Test Results

Depth (metres)	Cu (kilopascals)
2.44	90

Water observed in test pit at about 2.7 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP17	0.00 – 2.13	Grey brown silty sand, topsoil, cobbles, asphaltic concrete, wire, concrete, glass (FILL)
	2.13 – 2.44	TOPSOIL
	2.44 – 3.20	Grey SILTY CLAY
	3.20	End of test pit

Water observed in test pit at about 2.7 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP18	0.00 – 2.13	Topsoil, clay, gravel, cobbles, boulders (FILL)
	2.13 – 2.60	TOPSOIL
	2.60 – 3.40	Grey SILTY CLAY
	3.40	End of test pit

Water observed in test pit at about 2.4 metres below existing ground surface, July 7, 2006.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP13	0.00 – 1.90	Grey brown silty clay, topsoil, asphaltic concrete, brick (FILL)
	1.90 – 2.20	TOPSOIL
	2.20 – 3.50	Very stiff grey brown SILTY CLAY
	3.50	End of test pit

Water observed in test pit at about 2.6 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP14	0.00 – 1.02	Topsoil, gravel, clay, asphaltic concrete, wood, brick (FILL)
	1.02 – 1.22	TOPSOIL
	1.22 – 1.83	Grey brown fine to medium SAND
	1.83 – 3.30	Very stiff grey brown SILTY CLAY
	3.30	End of test pit

Water observed in test pit at about 1.5 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP15	0.00 – 2.10	Topsoil, clay, gravel, boulders, brick (FILL)
	2.10 – 2.20	TOPSOIL
	2.20 – 3.40	Very stiff grey SILTY CLAY
	3.40	End of test pit

In Situ Undrained Shear Strength Test Results

Depth (metres)	Cu (kilopascals)
3.40	110

Water observed in test pit at about 3.0 metres below existing ground surface, July 7, 2006.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP19	0.00 – 1.22	Topsoil, sand, clay, gravel, boulders, wood (FILL)
	1.22 – 1.52	TOPSOIL
	1.52 – 2.01	Very stiff grey brown SILTY CLAY
	2.01 – 3.30	Grey brown silty sand, some clay, gravel, cobbles, boulders (GLACIAL TILL)
	3.30	End of test pit

Water observed in test pit at about 2.1 metres below existing ground surface, July 7, 2006.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP20	0.00 – 0.48	Topsoil, gravel (FILL)
	0.48 – 0.79	TOPSOIL
	0.79 – 2.40	Yellow brown to grey brown silty sand, gravel, cobbles, trace clay (GLACIAL TILL)
	2.40	End of test pit

Test pit dry, July 7, 2006.

TABLE II

ORDER OF WATER DEMAND FOR COMMON TREES

Some common trees in decreasing order of water demand:

Broad Leaved Deciduous

Poplar
Alder
Aspen
Willow
Elm
Maple
Birch
Ash
Beech
Oak

Deciduous Conifer

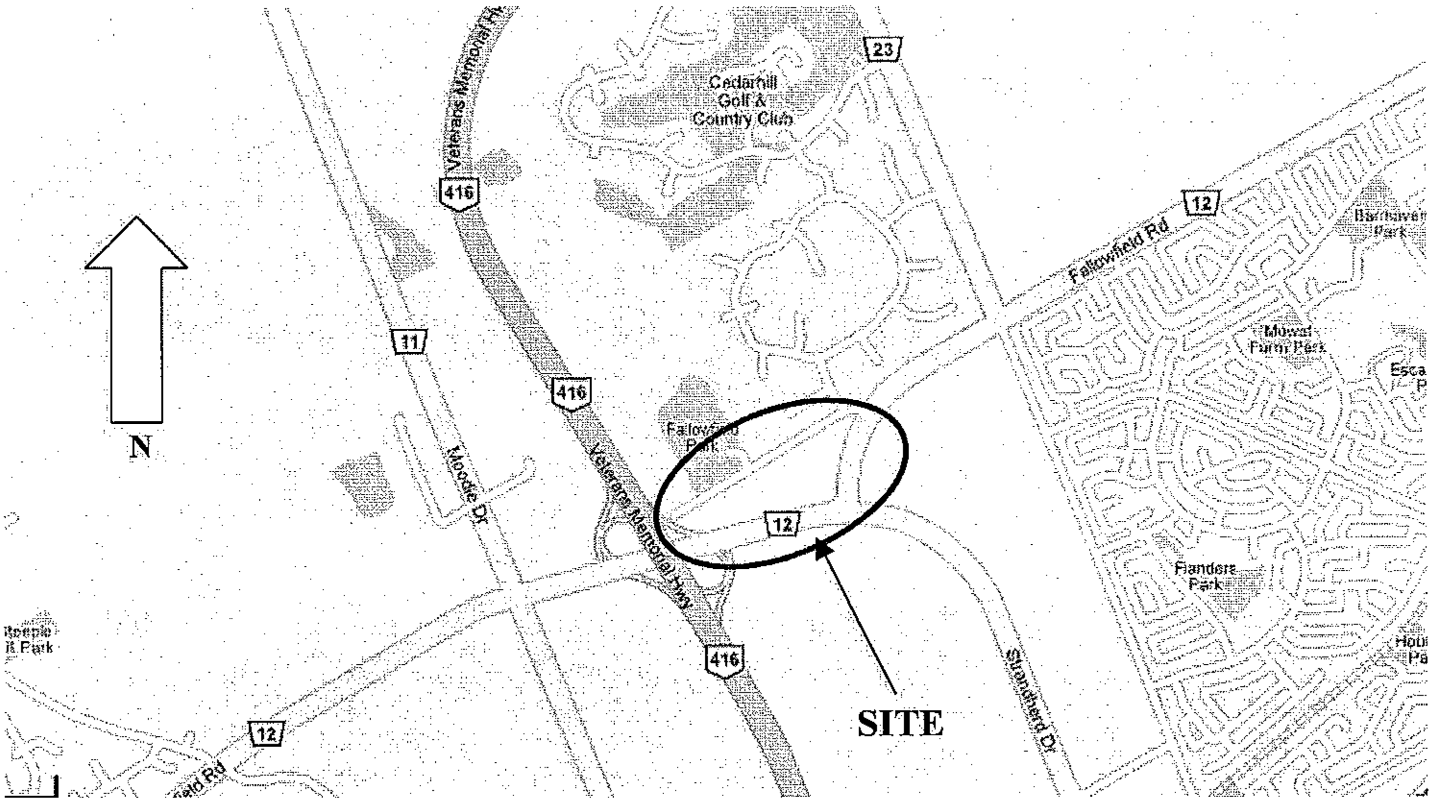
Larch

Evergreen Conifers

Spruce
Fir
Pine

KEY PLAN

FIGURE 1



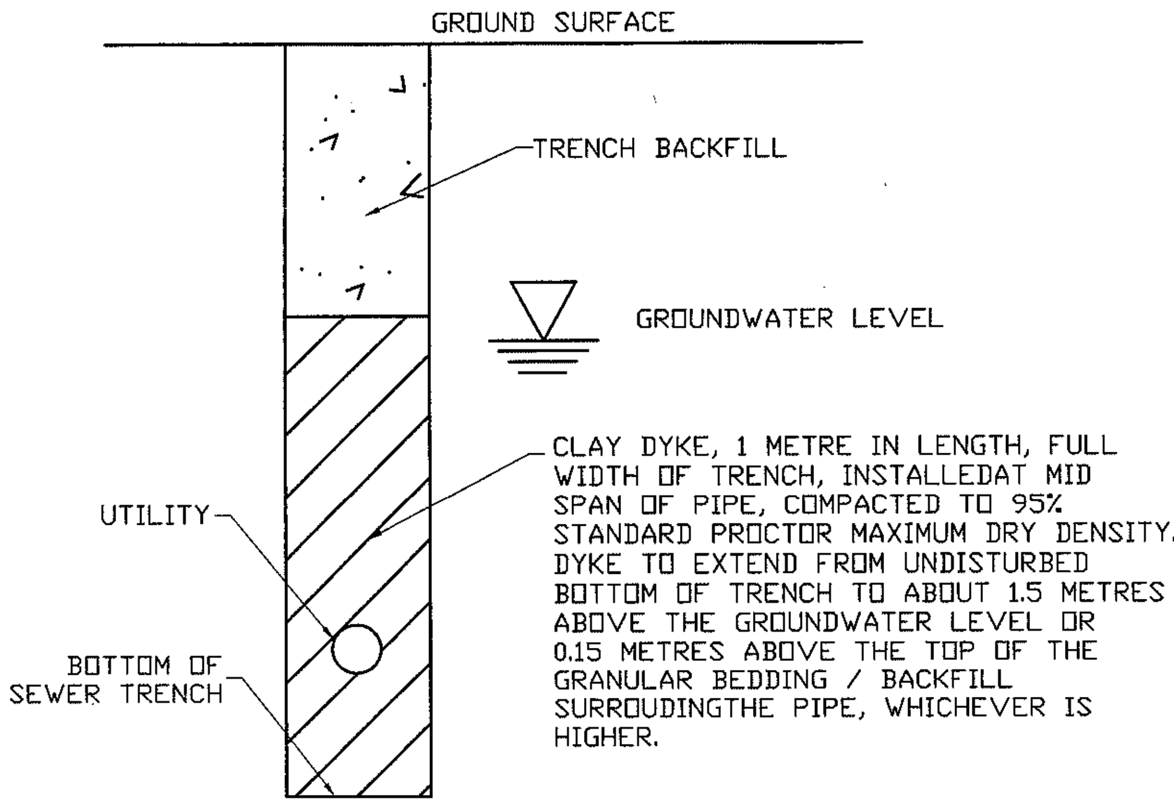
NOT TO SCALE

Kollaard Associates
Engineers

Project No. 060445

Date August 2006

FIGURE 3



REV.	NAME	DATE	DESCRIPTION

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CLIENT: PHOENIX HOMES

PROJECT: GEOTECHNICAL INVESTIGATION

LOCATION: O'KEEFE COURT AND FALLOWFIELD ROAD OTTAWA, ONTARIO

DESIGNED BY: DM	DATE: AUGUST 2006
DRAWN BY: DM	SCALE: NTS
KOLLAARD FILE NUMBER: 060445	