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MEMORANDUM

3 February 2006
File No. 31807-001

TO: Timothy Prince
Mercy Health System of Maine

C: KLMK Group, LLC; Attn.: Patrick Duke
DeLuca-Hoffman Associates, Inc.; Attn.: Steve Bushey
Gilbane Building Company; Attn.: Doug Butler
SMRT, Inc.; Attn.: Janusz Wszola, P.E.

FROM: Haley & Aldrich, Inc.
Andrew R. Blaisdell, P.E., Wayne A. Chadbourne, P.E.

SUBJECT: Geotechnical Design Memorandum No. 2
Additional Design Parameters and Construction Considerations
Phase I Hospital – Mercy at the Fore Development
Portland, Maine

This memorandum presents supplemental geotechnical design recommendations and construction considerations for the proposed Phase I Hospital Building (hospital) and Phase I site development (exclusive of the Medical Office Building; MOB) to be constructed as part of the proposed Mercy at the Fore development in Portland, Maine. We previously presented foundation and seismic design recommendations for the hospital in our Geotechnical Design Memorandum No. 1, dated 12 January 2006. A geotechnical data report summarizing the subsurface conditions encountered in the design-phase exploration program was issued on 18 January 2006.

Proposed Development and Design Parameters

Phase I Hospital

It is our understanding that the hospital will be a five-story structure with plan footprint area equal to 30,000 square feet (sf), resulting in a gross building plan area of approximately 150,000 sf. The level of the first floor slab is proposed to be constructed at El. 32 (ft, NGVD 29), which is the approximate finished grade of the main entrance to the hospital on the west side of the building.

The hospital will be constructed with a full level of below grade space (ground floor) to house laboratory, storage and office areas as well as the loading dock/receiving area. The level of the ground floor slab is proposed to be constructed at El. 17.5, approximately 12 to 15 ft

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below existing site grades. Based on the proposed site grading plan provided by DeLuca-Hoffman (D-H), finished grades on the north, south and east sides of the hospital will be within several feet of the ground floor slab (i.e., between El. 13 and El. 19). As stated above, finished grade on the west side of the hospital is proposed at El. 32, approximately 15 ft above the level of the ground floor slab.

The southeast quadrant of the ground floor will be used to house mechanical equipment (electrical, chiller and boiler rooms). The level of the floor slab in this area is proposed to be constructed at El. 11.5, approximately 6 ft below the level of the rest of the round floor slab.

SMRT has provided design column loads (axial compression) and a plan showing column layout for the hospital. We understand that the hospital will have columns spaced uniformly throughout the structure at 32.5 ft on-center in both the north-south and east-west directions. Typical column loads (dead plus live and snow) will range from approximately 780 to 830 kips for interior columns, 440 to 570 kips for exterior columns, and 130 to 260 kips for corner columns. The design loading information and lower level slab elevations are the basis for the foundation recommendations presented below. Design loading information for lateral and uplift foundation loads was not available at the time of this report.

Retaining Structures

Based on our review of the current grading plan (prepared by D-H, received on 5 January 2006), we anticipate retaining structures will be required to facilitate grade changes in three locations at the site: 1) at the southeast corner of Parking Area A, north of the proposed hospital (retaining wall No. 1); 2) east of the entrance roadway/rotary for the proposed MOB, west of the open marsh area (retaining wall No. 2); and 3.) west of the proposed perimeter access roadway, east of the open marsh area (retaining wall No. 3).

For retaining wall No. 1, proposed finished grades at the top of the wall vary between El. 15 and El. 28, and proposed grades at the toe of the wall vary between El. 17 and El. 20. Based on the proposed grading, we estimate that the height of the retaining wall will vary from 2 ft up to approximately 14 ft.

For retaining wall No. 2, the proposed pavement grades above the wall vary between El. 19 and El. 20, and the existing grades at the toe of the wall (in the adjacent marsh area) vary between El. 9 and El. 16. Therefore, we estimate that the height of the retaining wall will vary from approximately 4 to 10 ft.

For retaining wall No. 3, the proposed pavement grades above the wall are at El. 19, and the existing grades at the toe of the wall (in the adjacent marsh area) are at El. 10. Therefore, we estimate that the maximum height of the retaining wall will be 9 ft.

Underground Utilities

Based on our discussion with Mr. Steve Bushey (D-H) and the schematic utility location plan (prepared by D-H, dated 11 January 06; Rev. 3), it is our understanding that there are three major utility corridors planned to support the Phase I site development. The first corridor is proposed to run adjacent to the alignment of the proposed perimeter access roadway at the eastern edge of the site. This stretch of utilities will extend from the northern end of the hospital loading dock access road to the proposed outparcel site located at the far southern end of the site (south of the I-295 connector). The second corridor is located adjacent to the loading dock access roadway for the hospital. These utilities will service the proposed hospital. The third corridor is located along the southeast edge of the open marsh area, north of proposed Parking Areas D and E. These utilities will provide service to the Phase I MOB and a future outparcel building located adjacent to the I-295 connector.

Water lines to service fire hydrants as well as a storm drain system are also proposed. The location/alignment of these supplemental utilities are not known at this time. It is our understanding that invert of the site utilities will generally be located within 10 ft of finished ground surface.

It is our understanding that all other proposed improvements, including grading requirements for the parking areas and access roads, are generally unchanged from the descriptions provided in our 18 January 2006 data report.

GEOTECHNICAL RECOMMENDATIONS

Resistance of Lateral Design Building Loads

Lateral loads can be resisted by a combination of friction along the base of the footings and passive pressure on the vertical faces of footings and below grade foundation walls. Frictional resistance should be computed using an ultimate base friction coefficient (tan δ) equal to 0.30 between the footing concrete and the in-situ glaciomarine clay soils and 0.45 between the footing concrete and the in-situ glaciofluvial sand and gravel or structural fill. The higher friction value should be applied in Foundation Design Zone A, and the lower value should be applied in Foundation Design Zones B, C and D, as designated in our 12 January 2006 memorandum.

The net passive resistance (passive minus active) provided by the fill adjacent to footings and below grade portions of foundation walls can be calculated using an equivalent fluid weight (triangular distribution) of 300 and 160 pounds per cubic foot (pcf) for soils above and below El. 10 (estimated high groundwater level), respectively. These resistance values assume a free-draining granular backfill is placed within 6 ft of the footings and below grade portions of foundation walls (with moist unit weight equal to 120 pcf) and that a perimeter foundation drain system is installed as recommended herein (i.e., no unbalanced hydrostatic pressures exist; "drained condition"), as recommended in our 12 January 2006 memorandum.

The soil within 1 ft of ground surface should be ignored unless it is confined by a slab or bituminous concrete. If the horizontal distance between adjacent footings or walls is less than twice the height of the subject structural element (measured from bottom of element to bottom of slab/ground surface), the passive pressure must be discounted proportionately to the distance (full pressure at twice the height away) to accommodate for interaction of the elements.

The frictional and passive resistance values may be used in combination without reduction. If a combination of these two resistance forces is not enough to provide adequate lateral resistance, we will consider the problem in more detail. A minimum factor of safety for sliding equal to 2.0 should be achieved for resistance of permanent lateral loads.

Resistance of Axial Uplift Design Building Loads

Axial uplift design loads can be resisted using the dead weight of the foundation concrete. If additional uplift resistance is required, we will consider the problem in more detail.

Earth Retaining Structures

As discussed previously, we anticipate three earth retaining wall structures with maximum heights of 9 to 14 ft will be required to meet grade change requirements in the areas north of the hospital, southeast of the Phase I MOB, and west of the proposed perimeter access roadway, east of the open marsh area. Considering that all three walls will be constructed in areas of raise in grade, we believe mechanically stabilized earth (MSE) walls would be the most appropriate and cost-effective retaining wall structures.

We anticipate up to 1 to 3 ft of organics-containing topsoil, fill, and/or glaciomarine deposits may be present over the glaciofluvial sand and gravel at the proposed wall locations. We recommend all topsoil, fill, and glaciomarine deposits (i.e., clay) be removed from within the zone of influence (ZOI) of wall foundations and beneath the area to be filled prior to construction of the retaining wall. The ZOI is defined as the area below the footing(s) and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a one horizontal to one vertical (1H:1V) slope to the top of the undisturbed glaciofluvial deposit.

MSE wall facing units should bear on a minimum 10-in. thick "leveling pad" of crushed stone or unreinforced concrete placed on compacted granular fill or undisturbed glaciofluvial deposits. The MSE wall foundation system should be designed using a maximum allowable bearing pressure of 4 kips per square foot (ksf). The MSE wall foundation system should be constructed a minimum of 18 in. below the lowest ground surfaces exposed to freezing.

Typically, MSE walls are vendor-designed systems. The specifications should require the contractor to submit a complete design package for the MSE wall system, including assumed naturally-deposited soil and backfill physical and strength properties as well as local stability calculations, for review by the geotechnical engineer. The design calculations should be stamped and signed by a professional engineer registered in the State of Maine.

Settlement in Areas of Raises in Grade

There are three general areas in which existing grades will be raised by at least 5 ft to achieve the proposed grades, including:

1) The Phase I MOB entrance roadway/rotary, with a maximum raise in grade of about 6 ft.
2) The eastern portion of Parking Area A and the loading dock access roadway, with a maximum raise in grade of about 20 ft.

3) The former railroad bed beneath Parking Areas A and B, with a maximum raise in grade of about 10 ft.

These areas are underlain by varying amounts of glaciomarine and marine clays, and some minor consolidation settlement will occur under the new fill and pavement loads. Based on the available subsurface data, we estimate total settlement will be 1 in. or less in the Phase I MOB entry area and beneath the southern portion of Parking Area A based on current development plans. We estimate total settlement will be 1.5 in. or less in the former railroad bed area. We anticipate at least 25 to 50 percent of the estimated settlement will occur as the fill is placed at all three locations. Therefore, post-construction ground surface settlement is anticipated to be on the order of ¾ to 1 in. or less.

Pavement Section

Recommendations for bituminous pavement sections for auto/truck traffic are provided below based upon the Maine Department of Transportation (MaineDOT) Standard Specification, Highways and Bridges (December 2002):

Standard-Duty Flexible Pavement (parking areas):

- 3 in. bituminous concrete, placed in two 1½ in. thick layers.
- 4 in. screened or crushed gravel base course.
- 12 in. sand or gravel subbase course.

Heavy-Duty Flexible Pavement (loading dock areas):

- 4 in. bituminous concrete, place in two 2 in. thick layers.
- 5 in. screened or crushed gravel base course
- 15 in. sand or gravel subbase course.

Base and subbase course materials should conform to the following gradations:

Screened or Crushed Gravel - MaineDOT Standard Specification, Highways and Bridges; Section 703.06a, Type A.

Sand or Gravel Subbase - MaineDOT Standard Specification, Highways and Bridges; Section 703.06b, Type D. Type D aggregate should be modified to a maximum 4 in. size. Compacted granular fill may be substituted for subbase course material, but the maximum particle size should be reduced to 4 in.

Subbase course material should be placed and compacted in separate 8 in. (maximum) thick loose lifts and compacted at approximately optimum moisture content to a minimum dry density of at least 95 percent of the maximum dry density as determined by ASTM D1557. Base course material should be placed in one loose lift and compacted with a minimum of two passes with self-propelled vibratory compaction equipment.

Prior to placement of pavement base and subbase course materials, all topsoil, organic matter and fill materials containing debris should be removed from within the limits of the proposed roadway/parking area. The pavement recommendations are based on the assumption that a stable, firm subgrade is prepared beneath the base and subbase courses, as discussed in the Construction Considerations section of this report.

Sidewalks

Concrete sidewalks should be supported on a minimum of 2 ft of compacted granular fill (CGF) or subbase gravel. The purpose of placing free-draining granular soil below the sidewalks is to help control the potential for post-construction differential heaving and cracking. Prior to placement of CGF or subbase gravel, all topsoil, organic matter and fill materials containing debris should be removed from within the limits of the proposed roadway/parking area.

CONSTRUCTION CONSIDERATIONS

General

The primary purpose of this section of the report is to comment on items related to excavation, earthwork and other related geotechnical concerns regarding the proposed construction. This will aid individuals responsible for preparation of plans and specifications, as well as personnel appointed to monitor construction activities. The contractor must evaluate construction problems on the basis of knowledge and experience in the Portland area as well as their experience on similar projects in other localities, taking into account proposed construction procedures, methods, equipment, and personnel. The contractor should also be familiar with the Voluntary Remedial Action Plan (VRAP) prepared for the development to ensure all construction practices meet the applicable regulatory guidelines.

Excavation

Excavation will be required for general site grading, and for construction of the building foundations, the elevator and utility pits, and underground utilities. We anticipate that excavations for building foundations and elevator pits will extend to depths up of 20 to 28 ft below existing site grades and up to 5 to 7 ft below the proposed building floor slab subgrade elevation. Excavation in pavement areas will extend to depths up to 22 ft in the vicinity of the proposed loading dock, and up to 8 to 12 ft in Parking Areas A and B. Underground utilities are proposed to extend to depths up to 10 ft below proposed grades. All topsoil, debris and organic matter encountered within the limits of the proposed building, site access roads and parking areas should be stripped and removed from the site prior to placing site fills.

We expect that excavation of the in-situ soils can be accomplished using normal earth-moving equipment. Site excavations will be performed primarily in naturally-deposited glaciomarine clays and glaciofluvial sands and gravels. Test pits excavated at the site have exposed some cobbles and boulders in the glaciofluvial deposits. We recommend that the contract documents require the contractor to include provisions for boulder removal in their earthwork bid.

Temporary cut earth slopes should, typically, be stable if constructed no steeper than about 1.5H:1V. Some sloughing and raveling should be anticipated in temporary earth slopes, especially during and after rainfall. All temporary excavations should be made in accordance with all OSHA and other applicable regulatory agency requirements. The contractor should be responsible for the design, stability and safety of all temporary and permanent excavations.

Construction Dewatering

Groundwater has generally been measured at elevations ranging from El. 8 to El. 13 at the site. We anticipate groundwater will be encountered in excavations that extend below these elevations. We anticipate some groundwater will be encountered during excavation for the building foundations. Groundwater will likely be encountered during excavation of deeper utility trenches. We expect that dewatering in these areas may be accomplished by pumping from open sumps and temporary ditches located at the base of the excavations. Sumps should be provided with filters suitable to prevent pumping of fine grained soil particles. It is possible, depending on the site/groundwater conditions at the time of construction, that dewatering using sumps may not be effective to construct the MSE wall footings for retaining walls No. 2 and 3. A well point dewatering system or one or more gravel-pack wells may be required to effectively dewater these areas. The contractor should be responsible for the design, installation and removal of an appropriate excavation dewatering system.

The contractor should also be responsible for controlling all surface runoff, infiltration and water from other sources at all times during excavation. Rainwater or snowmelt should be directed away from exposed soil bearing surfaces. Dewatering should be performed as required to maintain the undisturbed nature of the soil bearing surfaces and enable all final excavation, foundation construction and backfilling to be completed "in-the-dry."

Dewatering and discharge of dewatering effluent should be performed in accordance with all local, state and federal regulations. Dewatering discharge should be recharged on site if possible. Dewatering should be conducted in a manner that avoids disturbance to prepared foundation subgrades, and that limits pumping of fines.

Subgrade Preparation

Soil subgrade surfaces for foundations, slabs, and pavements are generally anticipated to be located in existing in-situ fill soils, glaciomarine deposits, or glaciofluvial deposits. The following table summarizes the anticipated generalized subgrade conditions expected for different elements and areas of the project.

Location	**Anticipated Subgrade Soil**
Hospital Foundations and Slabs	Med. Stiff to Stiff Glaciomarine Clay and Dense to Very Dense Glaciofluvial Sand
Parking Area A	Stiff to Very Stiff Glaciomarine Clay and Med. Dense Glaciofluvial Sand
Parking Area B	Soft to Stiff Glaciomarine Clay
Parking Areas D and E	Med. Dense In-situ Fill and Glaciofluvial Sand
Loading Dock Access Road and Retaining Walls No. 1 and 3	Med. Dense to Dense Glaciofluvial Sand
Site Access Road, North of Loading Dock Access Road	Soft to Stiff Glaciomarine Clay
Access Road, South of Loading Dock Access Road	Med. Dense In-situ Fill and Glaciofluvial Sand
MOB Entrance Roadway/Rotary and Earth Retaining Structure	Med. Dense In-situ Fill, Med. Dense Glaciofluvial Deposits and Stiff Glaciomarine Clay

The following guidelines are recommended to protect subgrade soils beneath footings, slabs, and parking areas:

- Make final excavations into natural bearing soils by hand or using smooth-bladed equipment to limit disturbance (particularly important in the glaciomarine clay soils).
- Prevent water from accumulating on soil surfaces to reduce the possibility of soil disturbance. All filling and concreting of slabs and footings should be performed in-the-dry. Subgrades that become disturbed due to water infiltration should be re-excavated and stabilized. Subgrade stabilization methods could include placement of crushed stone and filter fabric with approval of a geotechnical engineer.
- Exposed subgrades should be examined in the field by a geotechnical engineer to verify strength and bearing capacity. Excavation may be necessary to remove weak, disturbed or otherwise unacceptable soils.
- Disturbance due to water and adverse weather could be reduced by maintaining footing excavations at least 12 in. above the final bearing level until immediately before placing footing reinforcement and concrete. Alternatively, it may be desirable to protect the exposed soil subgrade areas, as soon as possible after acceptance by a geotechnical engineer, by placing a 2 to 3-in. thick lean concrete mud-mat.
- Limit equipment traffic across the exposed soil bearing surfaces.
- Do not permit temporary drainage trenches or other dewatering facilities to extend below the bearing level near footings.

Footings

We recommend that the excavation work be conducted in a manner that minimizes disturbance to the natural soils when excavating for footing bearing surfaces. After final excavation to the natural bearing soils, the exposed subgrade should be observed in the field by a geotechnical engineer to confirm the assumed foundation bearing conditions. It may be necessary to over-excavate and replace locally weak, disturbed or otherwise unacceptable foundation bearing soils. Following excavation to the bearing stratum, the exposed glaciofluvial sand and gravel soil surfaces should be proofrolled with a minimum of two passes of a self-propelled vibratory roller or heavy hand-guided vibratory compactor, until firm. To minimize disturbance, we recommend that glaciomarine clay soils exposed at subgrade level not be proofrolled.

Soil bearing surfaces below completed foundations and slabs must be protected against freezing, before and after foundation construction. If construction is performed during freezing weather, footings should be backfilled to a sufficient depth (up to 4.5 ft) as soon as possible after they are constructed. Alternatively, insulating blankets or other means may be used for protection against freezing.

Slabs

All topsoil, existing in-situ fill material, debris and organic matter should be removed from beneath the ground floor slabs and should be replaced with CGF. We recommend that fill subgrade surfaces be inspected by a geotechnical engineer prior to placement of fill. Again, we do not recommend that glaciomarine soils present at subgrade level be proofrolled.

Pavement Areas

All topsoil, debris and organic matter should be removed within the limits of access roads and parking areas. If glaciofluvial soils or existing man-placed fill is present at subgrade level, we recommend that these surfaces be proofrolled with a minimum of four passes of a self-propelled vibratory roller or heavy hand-guided vibratory compactor, until firm. We do not recommend that glaciomarine soils present at subgrade level be proofrolled. Any soft areas revealed by proofrolling should be removed and replaced by CGF or base course material.

Special Considerations for Weak, Saturated Clay

We anticipate soft to medium stiff, saturated glaciomarine clay will be encountered within the proposed hospital footprint, in Parking Area A and the nearby access road, and in some utility trenches. This material is very easily disturbed by construction activities and we anticipate overexcavation and replacement of several feet of disturbed material could be necessary if typical rubber-tired earth-moving equipment such as articulated trucks, graders, and scrapers are used within a few feet of design subgrade elevations.

Based on these considerations, we recommend use of lightweight tracked grading equipment, such as low ground-pressure bulldozers, within 2 ft of subgrade elevation in areas underlain by soft to medium stiff clay to the extent possible. It may also be appropriate (or necessary) to overexcavate several feet of excess soft clay below subgrade elevation in these areas and place woven geotextile tensile fabric (Mirafi 600X or equivalent) overlain by granular fill material to provide suitable haul roads for heavy equipment.

Filling and Backfilling

Engineered fills up to 15 and 10 ft in thickness will be necessary to raise grades beneath Parking Areas A and B. Fills on the order of 3 ft thick or less will be required to raise grades beneath Parking Areas D and E, and up to 20 ft of engineered fill will be required in the area between Parking Area A and the loading dock access road. Up to 10 ft of engineered fill will be required beneath the loading dock access road.

We recommend that compacted granular fill (CGF) be used to raise site grades below the slabs and beneath the site roadway and parking areas. All topsoil, debris and organic matter should be removed as previously stated prior to placement of CGF. Requirements for CGF are defined below.

Placement of compacted fills should not be conducted when air temperatures are low enough (approximately 30 degrees F., or below) to cause freezing of the moisture in the fill during or before placement. Fill materials should not be placed on snow, ice or uncompacted frozen soil. Compacted fill should not be placed on frozen soil. No fill should be allowed to freeze prior to compaction. At the end of each day's operations, the last lift of fill, after compaction, should be rolled by a smooth-wheeled roller to eliminate ridges of uncompacted soil.

Compacted Granular Fill

Compacted granular fill (CGF) placed within the ZOI of footings, beneath building slabs, adjacent to foundation walls and beneath site roadways should consist of mineral, bank-run sand and gravel, free of organic material, snow, ice, or other unsuitable materials and should be well-graded within the following limits:

Sieve Size	Percent Finer by Weight
6 in. (1)	100
No. 4	30 – 80
No. 40	10 – 50
No. 200	0 – 8

(1) Cobbles or boulders having a size exceeding 2/3 of the loose lift thickness should be removed prior to compaction.

CGF should be placed in lifts not exceeding 12 in. in loose measure and compacted using self-propelled vibratory equipment. In confined areas, maximum particle size should be reduced to 3 in., maximum loose layer reduced to 9 in., and compaction performed by hand-guided equipment. A minimum of four systematic passes of the compaction equipment should be used to compact each lift. Cobbles or boulders having a size exceeding 2/3 of the loose lift thickness should be removed prior to compaction.

CGF placed on the exterior of the perimeter below-grade foundation walls should extend laterally a minimum of 6 ft beyond the outside edge of the walls. Backfill beyond this limit could consist of common fill. The top 12 in. of fill around the exterior of the building should consist of low permeability material used to minimize water infiltration adjacent to the structure. Grading should be designed to promote drainage of surface water away from the structure.

Common Fill

Common fill should consist of mineral sandy soil, free from organic matter, plastic, metal, wood, ice, snow or other deleterious material and should have the characteristic that it can be readily placed and compacted. Common fill imported to the site should have a maximum of 80 percent passing the No. 40 sieve and a maximum of 30 percent finer than the No. 200 sieve. The largest particle size for common fill should not exceed 2/3 of the loose lift thickness. Silty common fill soils may require moisture control during placement and compaction. Common fill should be placed in maximum 12 in. thick loose lifts using compaction equipment as described above for CGF.

Compaction Requirements

A summary of recommended compaction requirements is as follows:

Location	Minimum Compaction Requirements
Beneath footings and building slabs	95 percent
Parking, roadways and sidewalks	92 percent up to 3 ft below finished grade 95 percent in the upper 3 ft
Landscaped areas	90 percent nominal compaction

Minimum compaction requirements refer to percentages of the maximum dry density determined in accordance with ASTM D1557.

Reuse of Excavated On-Site Soils for Backfill

Existing Fill Soils

Existing in-situ fill soils encountered at the site generally consist of one of the following material types: reworked glaciomarine deposits, reworked glaciofluvial deposits, black silty sand, or railroad base material. The physical properties of the reworked glaciomarine and glaciofluvial deposits are generally similar to those of the undisturbed deposits. Therefore, the comments presented below for the undisturbed glaciomarine and glaciofluvial deposits are also applicable for the reworked glaciomarine and glaciofluvial fill.

Approximately 2 ft thick layer of black silty sand fill material was encountered in several explorations performed within approximately 200 ft of the Fore River shoreline (i.e., in borings HA05-6 and HA05-7 between 0 and 6 ft BGS). Coal, wood, organics, and glass were encountered in the fill layer across the site. In general, this fill material is not anticipated to be encountered in areas where general site excavation is required. If this material is encountered, it should not be reused as CGF within the ZOI beneath footings, within the footprint of the new building expansion, as foundation or retaining wall backfill, or as base/subbase material beneath roadways or sidewalks.

Former railroad base material was encountered and sampled at the location of test boring HA05-2. Considering this material is below a proposed fill area, we do not anticipate this material will be excavated and reused at the site.

Glaciomarine Soils

Based on the silty and/or clayey nature of the glaciomarine soils, these soils are not acceptable for use as CGF within the ZOI beneath footings, within the footprint of the new building expansion, as foundation or retaining wall backfill, or as base/subbase material within new paved areas.

We anticipate that the marine deposits will be suitable for reuse as common fill. These soils could potentially be used as fill to raise the grade within the limits of the old railroad grade in Parking Areas A and B. Please note, however, that prospective contractors should be aware that these soils may be difficult to place and compact when wet, and that the material may have to be spread out and dried prior to placement. Based on our experience, poorly graded soils with such a high percentage of fines (like these soils) will be easily disturbed and will be difficult to properly place and compact. It should be noted that the use of these types of soils as compacted fill is normally successful only when used in favorable weather conditions (e.g., between June and September).

If the contractor decides to attempt to use these soils as fill to raise the grade within the limits of the old railroad grade in Parking Areas A and B, we recommend that a sheepsfoot roller be used to compact each lift. Each lift should be placed within 2 percent of the optimum moisture content and compacted to a minimum of 90 percent maximum dry density and should not exceed 12 in. in loose measure. These soils should not be used as fill within 3 ft of the finished pavement level. Reuse of these soils in this area should be undertaken at the sole risk of the contractor.

Glaciofluvial Soils

Based on the results of our laboratory testing (presented in our 18 January 2006 data report), we conclude these soils are acceptable for reuse as CGF at all appropriate locations within the site. Reworked glaciofluvial in-situ fill soils were encountered at several locations in the area of proposed Parking Areas D and E. This in-situ fill material appears similar in grain size distribution to the naturally deposited materials and appears generally free of organics and debris, and therefore is also acceptable for reuse as CGF. Placement of glaciofluvial soils should be performed in accordance with the recommendations presented above for CGF.

Construction Monitoring

The recommendations contained herein and in the previous Geotechnical Design Memorandum No. 1 are based on the predictable behavior of a properly engineered and constructed foundation. Monitoring of the foundation installation is required to enable the geotechnical engineer to verify that the procedures and techniques used during construction are in accordance with the recommendations contained herein and the contract documents. Therefore, it is recommended that a geotechnical engineer or experienced technician be present during construction to:

- Observe preparation of footing excavations to confirm appropriate bearing material is exposed for the design bearing capacities.

- Observe and approve footing and slab bearing surfaces, particularly in the glaciomarine clay deposit.
- Observe installation of elevator/utility pits, dampproofing, perimeter/underslab drain system and foundation elements for the building.
- Observe and test placement and compaction of CGF and other compacted fills, especially if glaciomarine clay soils are attempted to be reused within the limits of Parking Areas A and B.
- Confirm that soils used as fill and backfill are in accordance with the project plans and specifications, and make judgments on the suitability of excavated soils for reuse as fill.

Closure

We trust this provides sufficient geotechnical design information to proceed with design development and estimation of project costs for geotechnical-related items. Please do not hesitate to contact us if you require additional information.

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