

**PRELIMINARY GEOTECHNICAL STUDY**

**DRAFT REPORT ON  
PRELIMINARY GEOTECHNICAL STUDIES  
PROPOSED BEVERLY HIGH SCHOOL BUILDING ADDITION  
BERVERLY, MASSACHUSETTS**

by

**Haley & Aldrich, Inc.  
Boston, Massachusetts**

for

**Symmes Maini & McKee Associates  
Cambridge, Massachusetts**

**File No. 28022-001  
June 2002**

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6 June 2002  
File No. 28022-001

Symmes Maini & McKee Associates  
1000 Massachusetts Avenue  
Cambridge, Massachusetts 02138

Attention: Mr. Peter Glick

Subject: Draft Report on Preliminary Geotechnical Studies  
Proposed Beverly High School Building Addition  
Beverly, Massachusetts

Ladies and Gentlemen:

We are pleased to submit herewith our Draft Report on Preliminary Geotechnical Studies for the subject project. This report presents the results of initial subsurface investigations, and provides preliminary geotechnical design recommendations for the proposed Beverly High School building addition at the subject site in Beverly, Massachusetts. The general project site location is shown on Figure 1, Project Locus. This work was performed by Haley & Aldrich, Inc. (Haley & Aldrich) in accordance with our proposal dated 13 March 2002 (Revised 25 March 2002).

The purpose of our study was to obtain and evaluate data on subsurface soil, bedrock and groundwater conditions at the site, and to provide preliminary foundation design recommendations. We have also researched readily available data pertaining to the foundations for the existing High School, and the results of a Phase II Environmental Site Assessment conducted by others adjacent to the project site.

#### PREVIOUS STUDIES

Haley & Aldrich has conducted a previous Geotechnical Study in the vicinity of the existing High School, to investigate the cause of groundwater leakage into the building, and to analyze the available subsurface information relative to geotechnical aspects of building rehabilitation. The results of this study are contained in our report entitled "Preliminary Results of Geotechnical Investigation, Beverly High School, Beverly, Massachusetts", dated 27 August 2001.

#### PROPOSED CONSTRUCTION

It is our understanding that the proposed High School building addition will be located on the

#### OFFICES

Cleveland  
Ohio

Dayton  
Ohio

Denver  
Colorado

Detroit  
Michigan

Hartford  
Connecticut

Los Angeles  
California

Manchester  
New Hampshire

Newark  
New Jersey

Portland  
Maine

Rochester  
New York

San Diego  
California

Tucson  
Arizona

Washington  
District of Columbia

east side of the existing High School, and will consist of a two to three story building having a footprint of approximately 70,000 square feet. The general layout of the proposed addition is shown on Figure 2, Site and Exploration Location Plan. According to Mr. Peter Glick of Symmes Maini & McKee Associates (SM&M), the current design does not include a basement, or any below-grade space. Although the proposed building loads were not available at the time of this report, we have assumed that they will be typical for a building of this size and type. We have also assumed that the finished floor elevations of the proposed addition will be similar to those of the adjacent High School.

### **ELEVATION DATUM AND VERTICAL CONTROL**

Elevations in this report are in feet and refer to the project datum, as shown on a set of foundation plans prepared for the existing High School by Korslund, LeNormand & Quann, dated 5 March 1963. All depths are reported in feet relative to the existing ground surface.

### **EXISTING SITE CONDITIONS**

The site of the proposed building addition is located on the east side of the existing High School (Figure 2). Based on information available at the time of this report, the northern portion of the proposed addition is located within the upper paved parking area, adjacent to the existing High School administration building. The surface grade in this area is estimated to vary from approximately El. 44 to El. 48, and slopes downward gently to the south. The southern portion of the proposed addition is located within the lower paved parking area and grass-covered ball field adjacent to the existing High School auditorium. The surface grade over this portion of the site is estimated to vary from approximately El. 29 to El. 34, and slopes downward gently toward the southwest.

The northern and southern portions of the site are separated by a grass covered, south-facing slope. We estimate that this slope is about 12 feet in height, with a surface grade of approximately 25 percent.

### **ENVIRONMENTAL CONSIDERATIONS**

At your request, we have investigated the source of a groundwater observation well observed near the perimeter of the High School property. Although the exact location and designation of this well are not known, we believe it is related to the environmental investigations surrounding the former Varian Facility, located at 150 Sohler Road, about 2,500 feet to the northeast of the existing High School.

From 1959 to 1995, the Varian Facility was a manufacturer of electronic equipment (i.e. electron tubes) for various radar applications. According to a Phase II Comprehensive Site Assessment completed by IT Corporation for the Varian facility (September 2000), these activities resulted in the release of various degreasing compounds, including trichloroethene

(TCE), tetrachloroethene (PCE), and 1,1,1-trichloroethane (TCA), which in turn have produced five degradation products, including cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), and vinyl chloride (VC). The Phase II report indicates that these degradation products, which are considered "chemicals of concern" under the Massachusetts Contingency Plan, have been detected in surface water and groundwater in the immediate vicinity of the Varian facility.

Cursory review of the Phase II report completed by IT Corporation suggests that the location of the proposed High School addition (and existing High School) is not within or immediately adjacent to any of the surface water or groundwater contaminant plumes detected in shallow (soil), intermediate (soil), or deep (bedrock) wells. The closest monitoring well associated with this study is BR-8, a deep bedrock well located on Russell Street, approximately 850 feet to the west (and down-gradient) of the project site. Further, based on available topographic information, the site of the proposed addition appears to be up-gradient from the path of any potential contaminant migration.

According to Ms. Karen Brody of IT Corporation (Personal Communication, 13 May 2002) it is unlikely that any groundwater contamination related to the Varian facility is present in the immediate project vicinity. She also notes that any contamination in this area would be located within the deep bedrock aquifer, over 100 feet below the existing ground surface, and beyond the limits of the proposed construction. --

## **SUBSURFACE EXPLORATIONS**

Two test borings, designated BHB-1 and BHB-2(OW), were drilled within the footprint of the southern portion of the proposed High School addition between 22 May 2002 and 23 May 2002, to depths of 45.0 and 40.3 feet below existing ground surface, respectively. Each of the borings was monitored by a Haley & Aldrich representative, who observed the drilling procedures and described the subsurface conditions encountered. The approximate test boring locations are shown on Figure 2, and the boring logs are included in Appendix A of this report. The locations of the borings were determined by taping to existing surface structures.

A groundwater observation well was installed to a depth of 13.3 feet in boring BHB-2(OW). An observation well installation report is included in Appendix B.

Nine (9) test pits were previously excavated in the vicinity of the existing High School by Haley & Aldrich, between 3 August 2001 and 6 August 2001. The purpose of these test pits, designated TP-1 to TP-9, was to determine the subsurface soil and groundwater conditions adjacent to the existing foundations, and to investigate the cause of water leakage into the building. The results of these explorations were discussed in our August 2001 report. The approximate locations of these test pits are shown on Figure 2, and copies of the test pit logs are included in Appendix C of this report.

## **SUBSURFACE CONDITIONS**

Based on the subsurface conditions observed in the borings and test pits conducted to-date, the vicinity of the proposed High School addition is underlain by the following geologic units, listed in order of occurrence below existing ground surface:

Topsoil – Encountered in unpaved, landscaped areas, this material ranges in thickness from about 0.3 to 0.5 feet, and consists of dark brown SILT (USCS Classification = ML) with sand and roots.

Fill: The Fill encountered in the vicinity of most of the proposed High School addition ranges from 1 to at least 3.5 feet in thickness, and consists of medium dense brown silty SAND (SM). In test pits TP-1 and TP-2, which were excavated immediately adjacent to the existing High School, adjacent to the project site (Figure 2), the Fill consists of brown sandy SILT with gravel (ML), and sandy lean CLAY (CL).

Portions of the south-facing slope located in the middle of the site may consist of Fill placed during grading activities related to the construction of the existing High School. In this area, we anticipate that Fill could range in thickness from about 3 to 12 feet.

Marine Deposits: A layer of Marine Deposits is anticipated below the Fill throughout most of the site. The Marine Deposits encountered in borings BHB-1 and BHB-2(OW) consisted of medium dense to dense poorly graded brown SAND with silt (SP-SM) and silty SAND (SM), with frequent to occasional laminar to thick beds of medium stiff to very stiff lean CLAY (CL). Similar materials were encountered in the test pits excavated adjacent to the existing High School.

The thickness of the Marine Deposits ranges from 37 to at least 45 feet in the southern portion of the site, and is expected to decrease toward the north as the surface grade rises. In the northern portion of the site, in the vicinity of the upper parking lot, the Marine Deposits may vary in thickness from about 0 feet, up to about 15 to 20 feet.

Glacial Till: Glacial Till soils consisting of very dense well-graded SAND with silt and gravel (SW-SM) were encountered below the Marine Deposits in boring BHB-2(OW), at a depth of about 37.0 feet. Glacial Till was not encountered by Boring BHB-1, which was terminated in the Marine Deposits. We anticipate that a discontinuous layer of Glacial Till ranging in thickness from about 0 to 5 feet is present throughout most of the site.

Bedrock: Bedrock consisting of Cape Ann Granite was encountered at depths of 3.1 and 3.5 feet in test pits TP-3 and TP-6, which were excavated on the north side of the existing High School (Figure 2). In addition, a granite outcrop is exposed to the immediate north of the High School. Bedrock was not encountered by either of the borings conducted for this study.

In general, the bedrock surface is expected to rise gradually toward the north across the footprint of the proposed addition, from a depth of at least 50 feet in the southern portion of the site, to a depth of about 3 to 5 feet in the northern portion of the site. In the northernmost portion of the site, we anticipate that the Marine Deposits and Glacial Till may be absent, and that the Fill may directly overlie bedrock.

Groundwater was measured at a depth of 3.9 feet below ground surface in the observation well installed in boring BHB-2(OW) on 5 June 2002. It should be noted that groundwater may collect on the relatively impermeable clay layers in the Fill and Marine Deposits, resulting in periodic shallow, "perched" groundwater conditions. Groundwater levels at this site may also vary significantly due to seasonal changes, temperature, and precipitation. The groundwater flow in this area is probably controlled by the local topography, and likely flows toward the southwest.

#### **EXISTING HIGH SCHOOL FOUNDATIONS**

Based on our review of the original foundation plans for the existing High School (Korslund, LeNormand & Quann, 5 March 1963), it appears that these buildings are supported on shallow spread footings bearing on the Marine Deposits. The allowable capacity assigned to the footing bearing surfaces was 1 ton per square foot (tsf) for most of the High School, except the northernmost portion of the building, where the allowable bearing capacity was 2 tsf. This increase in bearing capacity may reflect the presence of shallow bedrock in this area. It should be noted that during our walk-through of the existing High School in July 2001 (as part of our previous study), we did not observe any signs of structural distress due to differential settlement of the existing building foundations.

It appears that the existing High School building slabs were designed as soil-supported, slabs-on-grade.

#### **PRELIMINARY RECOMMENDATIONS AND LIMITATIONS**

Based on the results of the recent test borings, and our observations of the performance of the existing building footings, it is our opinion the proposed Beverly High School building addition can likely be supported on shallow spread footings, similar to those which support the existing High School. As such, we envision that most of these footings would be supported on undisturbed Marine Deposits, with a maximum allowable soil bearing pressure of approximately 1 tsf (2,000 psf). In addition, we believe that the ground floor slabs for the proposed building addition can be designed and constructed as soil-supported slabs-on-grade.

Excavation for the northernmost portion of the proposed building addition may encounter shallow bedrock. In this area the footings can probably be constructed on a thin layer of structural fill placed over the bedrock surface, with a maximum allowable bearing pressure of

approximately 2 tsf (4,000 psf)

It should be noted that these conclusions have been made for the purpose of preliminary design, and should be verified and expanded prior to final design and construction. To this end, we recommend that prior to final design of the proposed High School addition, a Final Design Phase Geotechnical Study be completed, the scope of which should include the following components:

A subsurface exploration program consisting of three to five additional test borings and three to five test probes located within the footprint of the proposed building addition. Two of the borings should be drilled in the lower parking area, on the south side of the proposed addition. The remaining borings and the test probes should be conducted in the upper parking area, in the vicinity of the northern portion of the proposed addition. The purpose of the additional subsurface explorations should be to:

- a) Further define the extent, depth, in-situ density, and character of the Marine Deposits across the proposed building addition footprint, so as to evaluate potential areas of differential settlement, and to confirm that these materials will provide suitable bearing for the proposed foundation elements.
  - b) Investigate the nature of the materials comprising the existing slope in the center of the site.
  - c) Investigate the nature of the subsurface materials and depth to bedrock in the northern portion of the site, in the vicinity of the upper parking lot, and to determine if drill and blast rock excavation will be required for the proposed construction in this area.
- Perform laboratory testing of soil samples recovered from test borings to aid in classification, and for determination of engineering properties required in foundation design and site development studies.
  - Completion of a Final Geotechnical Report, including final recommendations for design and construction of foundations and slabs-on-grade, and comments on geotechnical aspects of construction, including excavation dewatering, subgrade preparation, controlled blasting, site and foundation drainage, erosion control, and preparation and protection of site slopes.

It should be noted that the review of the Varian Facility Phase II Comprehensive site assessment completed for this study does not constitute an assessment of the presence of oil or hazardous materials at the site, the characterization of excavated soil or groundwater that might be generated as a result of the proposed construction, or an assessment of the impact

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6 June 2002  
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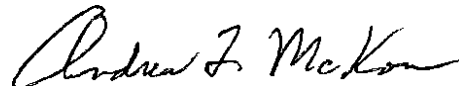
that contamination could have on the proposed construction.

We appreciate the opportunity to provide preliminary engineering services for this project, and we look forward to our continued association with the design team. Please do not hesitate to call if you have any questions or comments.

Sincerely yours,  
HALEY & ALDRICH, INC.



Nicholas H. Strater, P.G.  
Staff Geologist



Andrew F. McKown, P.E.  
Vice President

Enclosures:

- Figure 1 - Project Locus
- Figure 2 - Site and Exploration Location Plan
- Appendix A - Test Boring Logs
- Appendix B - Observation Well Installation Report
- Appendix C - Test Pit Logs

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## REFERENCES

1. Haley & Aldrich, Inc., Report entitled "Preliminary Report on the Geotechnical Investigation of Beverly High School, Beverly, Massachusetts", dated August 2001
2. IT Corporation, Report entitled "Phase II Comprehensive Site Assessment, Former Varian Facility, 150 Sohier Road, Beverly, Massachusetts, MADEP # 3-0485", dated September 19, 2000. Obtained at [www.beverlycleanup.varian.com](http://www.beverlycleanup.varian.com).
3. Karen Brody, Personal Communication, 13 May 2002
4. Beverly High School Foundation Plans, prepared by Korslund, LeNormand & Quann, dated 5 March 1963.

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