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REPORT ON
PROPOSED FOOD STORE
RIVERSIDE STREET
PORTLAND, MAINE

by

Haley & Aldrich, Inc.
South Portland, Maine

for

Hannaford Bros. Co.
Portland, Maine

File No. 29761-001
March 2003

HALEY & ALDRICH

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28 March 2003
File No. 29761-001

Hannaford Bros. Co.
PO Box 1000
Portland, Maine 04104

Attention: Mr. William McKenney

Subject: Proposed Food Store
Riverside Street
Portland, Maine

Ladies and Gentlemen:

This report presents the results of subsurface explorations and geotechnical engineering evaluations conducted for the proposed retail development project near the intersection of Forest Avenue and Riverside Street in Portland, Maine. This work was undertaken at your request in accordance with our proposal dated 3 February 2003.

INTRODUCTION

The proposed retail development will be located near the intersection of Forest Avenue and Riverside Drive within an approximately 14 acre lot which was formerly a sand and gravel pit. The site is bounded by Riverside Street to the west, businesses on Industrial Drive to the north, the Maine Turnpike to the east and businesses along Forest Avenue to the south (See Figure 1).

The site is characterized as a deep pit with steep side slopes. The elevation of the bottom of the pit generally ranges from approximately El. 45 at the eastern end adjacent to the Maine Turnpike to approximately El. 60 near the western portion. The ground surface in the vicinity of the western end of the site generally ranges from El. 75 to 80. The limits of the pit extend to a point about 300 ft. east of Riverside Street. The cut slopes that form the boundary of the pit are steep (generally ranges from 1 horizontal to 2 vertical (1H:2V) to 1H:1.2V) with no vegetation covering the soil. There is an access road into the pit at the western end of the site. The site is currently receiving miscellaneous fill (elevations in bottom of pit will vary from those indicated on Figure 2) and is also used for snow storage.

The proposed retail development consists of a new food store with a plan area of approximately 35,600 sq. ft., a parking area, access roads around the building and to

Riverside Street and Forest Avenue and a storm water detention pond. The building development will occur in the western portion of the project site. The currently envisioned site development plan is shown on Figure 2, Site and Exploration Location Plan.

Proposed site grading (see Figure 2) ranges from El. 80 near Riverside Street and Forest Avenue to El. 65 on the Forest Avenue access road; the proposed finish floor grade in the store is El. 75. As indicated on Figure 2 a significant portion of the food store will be located within the pit limits where the ground surface generally ranges from about El. 50 to El. 60. Therefore, fill material will be required to raise the grade within the general limits of the building and for the access road behind the building. A new access road extending from the eastern end of the food store through the gravel pit to Forest Avenue is proposed. The access road alignment will be built over and parallel to steep cut slopes for most of its length.

General site grading will require cuts and significant fills in the parking areas and access roads. Cuts up to 8 ft. deep are anticipated in the parking area in front of the store and on the north side of the store. Fills of up to 19 ft. are anticipated for portions of the parking areas in front of the food store (western side). Cuts of up to 15 ft. and fills of up to 30 ft. are anticipated for the Forest Avenue access road. A detention pond is proposed behind the store. The lowest elevation of the detention pond is about El. 52.

The proposed building will require fill over most of its proposed plan area. Fill thicknesses will range from 1 to 30 ft. A small cut area (about 35 ft. by 85 ft. in plan area) will be needed on the north side/northwestern corner of the building, where the maximum anticipated depth of cut will be about 5 ft.

Elevations in this report are in feet and are referenced to NGVD.

SUBSURFACE EXPLORATIONS

Subsurface explorations for this geotechnical investigation consisted of seventeen test borings (B101 through B116, and B105A) and seven test pits (TP101 through TP107) to evaluate general soil and groundwater conditions at the site. In addition, monitoring wells were installed in B101, B110, B111 and B117 during the exploration program.

Test borings were drilled by Maine Test Borings, Inc., of Brewer, Maine during the period 18 through 27 February and 4 March 2003. A Haley & Aldrich geologist was present to monitor the test borings and prepare boring logs. The boring logs are included in Appendix A.

The borings were drilled using a track-mounted drill rig and 2.5-in. or 4.25-in. I.D. hollow stem augers. Soil samples were typically obtained at 5-ft. intervals by driving a 1 3/8-in. I.D. split-spoon sampler with a 140-lb. weight dropped 30 in. Samples were taken continuously through fill materials so that the thickness of the fill could be determined. The borings were

drilled to depths below ground surface ranging from 10.1 ft. to 53.0 ft. and were terminated in naturally deposited soils. The boreholes were backfilled with drill spoil at the completion of the exploration program.

Test pits were excavated by RJ Grondin & Sons of Gorham, Maine on 19 March 2003. Haley & Aldrich personnel were present to monitor the test pits and prepare test pit logs. Test pit logs are included in Appendix B. Test pits were excavated to depths ranging from 4.5 to 11.0 ft. below ground surface. The test pit excavations were refilled with the excavated soil after the conditions were observed.

The locations and ground surface elevations of the test borings and test pits were determined by Titcomb Associates using survey techniques, and are shown on Figure 2.

LABORATORY TESTING

A limited laboratory testing program was undertaken to assist in soil classification.

Laboratory testing consisted of four grain-size analyses with water content determination.

Three samples of granular soil recovered from boring B117 (eastern end of pit) and one sample recovered from B115 (northern edge of site) were tested. The test results indicate the soils are poorly graded sand with silt (primarily a medium to fine sand with 5 to 10 percent silt sized fines. The water content of the samples ranged from about 4 to 18 percent.

Results of laboratory testing are included in Appendix C.

SUBSURFACE CONDITIONS

The explorations encountered three principal soil units beneath a surficial layer of topsoil (where present); Fill, Marine Deposits and Glacial Stream Deposits. The soil units are generally described as follows:

Topsoil - Topsoil was described as a gray to dark brown, sandy SILT to SILT (ML) with roots and leaf debris. The encountered thickness of the topsoil generally ranged from 0.1 to 2.0 ft.

Fill – Fill encountered at the site was highly variable and a combination of reworked/replaced natural soils and construction debris. Some fill consisted entirely of reworked natural soil, while some consisted of a mixture of natural soil and construction debris. Fill was encountered in each of the explorations except B108, B110(OW), B115, B116 and TP103. Natural soil components ranged from gray to brown to yellow-brown, lean CLAY with sand (CL) to well-graded GRAVEL with silt and sand (GW-GM). Construction debris was

encountered in several of the borings and included: asphalt, insulation, concrete blocks (up to 5ft x 4ft x 8in), bricks, wood, metal springs, cobblestones and ash. Encountered thickness ranged from 2.0 to 28.5 ft.

Marine Deposits – Marine deposits consisted of two subunits, silt/clay and sand/silt.

Silt/Clay – the silt/clay subunit consisted of brown to gray lean CLAY (CL), sometimes with fine sand partings to olive-brown elastic SILT (MH). Undrained shear strength as measure by field vane shear tests in boring B110(OW) ranged from 290 to 850 psf. Encountered thickness ranged from 0.8 to 52.5 ft.

Sand/Silt – the sand/silt subunit consisted of gray to red-brown poorly graded SAND (SP) to poorly-graded SAND with SILT (SP-SM) to silty SAND (SM) to SILT with sand (ML). Encountered thickness ranged from 0.8 to 25.0 ft.

Glacial Stream Deposits – Glacial stream deposits consisted of brown to yellow-brown poorly-graded SAND (SP) to well-graded SAND with gravel (SW), with occasional clay pockets. The encountered thickness varied from 2.5 to 17.5 ft.

Bedrock and refusal surfaces were not encountered in the borings and test pits.

Water levels in the borings and observation wells were measured during and after the completion of the field program. The water levels noted on the boring and test pit logs are not considered to be representative of the stabilized groundwater at the site. Groundwater was measured in the following monitoring wells on 19 March 2003: B101-OW - 43.3 ft. below ground surface (El. 33.7), B110-OW – 40.2 ft. below ground surface (El. 38.6), B111-OW – 9.5 ft. below ground surface (EL. 33.7) and B117-OW – 8.5 ft. below ground surface (El. 38.5). Groundwater levels are expected to vary seasonally as a result of precipitation, runoff and other factors.

Subsequent to subsurface explorations, additional fill was end-dumped within the limits of the proposed building. We estimate that the thickness of additional fill dumped is on the order of 15 to 20 ft. in portions of the northern half of the proposed building.

In summary, the subsurface explorations indicate that the proposed parking areas in front of the building and northern and northwestern portions of the building are underlain by a variable thickness of topsoil (1 to 2 ft.), fill (up to 28 ft), marine silt and clay (up to 45 ft.) and glacial stream deposits. The remaining building footprint and eastern and southern access roads are underlain by up to 28 ft. of fill over glacial stream deposits. Refer to the exploration locations indicated on Figure 2 and the summary of subsurface conditions in Table I for a more information on subsurface conditions beneath the proposed site development features.

GEOTECHNICAL ENGINEERING RECOMMENDATIONS

General

Specific loading data for the proposed structures were not available at the time this report was written. For purposes of this geotechnical engineering evaluation, we have assumed the building to be a one-story, steel-framed structure with masonry block walls. Based on conversations with Hannaford Bros., and other projects involving similar structures, the following loading data have been assumed:

Typical Maximum Column Loads

Interior	250 kips
Exterior	150 kips
Corner	75 kips
Column Spacing	Approximately 30 ft. to 65 ft. on center
Masonry Bearing Walls	7.5 kips per lin. ft.
Floor Load	150 lbs. per sq. ft.

The finished floor grade in the building is El. 75.0.

Site Filling Options

Much of the proposed supermarket building will require filling to raise the grade to finish floor elevation. Most of the building site is also underlain by 5 to 10 ft. of fill, with a greater thickness of fill in limited areas. The existing fill within the building limits consists primarily of silts and clays, with varying amounts of sand, gravel and construction debris, and limited amounts of sand and gravel fill. We do not believe that the fill materials, in their present condition, are suitable for support of the proposed food store. We believe that there are a number of options that can be assessed relative to reusing the fill material that is present at the site.

The options that we evaluated include:

- Option 1: Remove the fill within the building limits and segregate the material (granular, cohesive, construction debris, organic) in onsite stockpiles. Reuse suitable material within the building limits; placed in lifts and compacted. Place and compact suitable fill to design roadway, floor subgrade levels. Use unsuitable material in non-critical site fill areas.

- Option 2: Excavate the fill within the building to El. 45 (approximately 0 ft. cut to 15 ft. cut) and segregate the material as in Option 1. Excavation within the building limits should proceed to El. 45 or until naturally-deposited soils are encountered. Then perform intensive surface compaction on the fill subgrade using a large self-propelled vibratory pad-footed roller. The purpose of the intensive surface compaction effort is to densify fill material that is left in place. Additional suitable fill may then be placed and compacted in accordance with Option 1.

Based on the conditions encountered in the field explorations and the fact that additional fill has been placed without engineering controls, we believe that Option 2 is a reasonable and practicable option. The intensive surface compaction effort and the subsequent earthwork operations needed to raise the grade to the finish floor subgrade level should adequately consolidate/densify fill materials that are left in place.

It is noted that most of the fill at the site consists primarily of silt and clay soils. It has been our experience that these fine-grained soils are difficult to properly place and compact if they are wet or saturated. If this material is used beneath the food store, it will be very important that it is placed and compacted in accordance with the recommendations that follow, and that there is full-time field monitoring and testing services provided during construction to document that the work was conducted properly.

Obviously there is some risk involved if all the fill material is not removed within the building limits. The risk is that unsuitable material (organic matter, trash, debris with large voids, tree stumps, etc.) could be present in the fill that was not encountered in the field explorations. We believe that Option 2 reduces the risks substantially because a portion of the fill will be removed and the intensive surface compaction would likely disclose the presence of significant unsuitable materials.

Recommended Subgrade Preparation and Foundation System

The proposed developed areas should be prepared prior to construction. Topsoil, organic materials, and other unsuitable materials should be removed where present within the limits of the proposed buildings, the access road and parking areas. Compacted fill should be placed to design subgrade levels.

We recommend that the proposed buildings be supported on spread and continuous wall footing foundations which bear on a minimum of 2 ft. of compacted structural fill.

Footings bearing on compacted structural fill should be designed for a maximum allowable bearing pressure expressed in kips per sq. ft. equal to 1.3 multiplied by the least lateral

dimension of the footing expressed in feet, up to a maximum value of 4 kips per sq. ft. We recommend that continuous wall footings be at least 2-ft. wide.

Floor Slab

We recommend that the floor slab be designed as an earth-supported slab-on-grade. The floor slab should bear on a minimum of 8 in. of compacted structural fill.

The soils beneath the floor slab are expected to be moist. Therefore, normal damproofing of the floor slab is recommended.

Sidewalks

Concrete sidewalks provided around the exterior of the buildings should be supported on a minimum of 4 ft. of compacted structural fill to prevent differential frost heaving and settlement relative to the building foundation.

Frost Protection

Bottoms of exterior footings should be founded a minimum of 4.5 ft. below the lowest adjacent ground surface exposed to freezing. Bottoms of interior footings in heated areas should be founded a minimum of 18 in. below the top of the adjacent floor slab. However, if exposure to freezing is anticipated either during or following construction, these footings should be lowered in accordance with the recommendations for exterior footings, or the subgrades and foundations should be insulated to prevent freezing.

Foundation and Floor Slab Drains

An underslab drainage system is not considered necessary beneath the ground floor slabs.

Seismic Design Considerations

We recommend that the building be designed in accordance with the seismic requirements of the latest edition of the BOCA National Building Code. The site coefficient, S, is 1.0; the effective peak velocity-related acceleration coefficient, Av, is 0.10 and the effective peak acceleration coefficient, As, is 0.10.

The soils at the site are not considered to be liquefaction susceptible.

Lateral Earth Pressures on Foundation Walls

It is recommended that foundation walls associated with truck loading docks or other walls with unbalanced earth loads be designed to resist combined lateral forces resulting from soil pressures and surcharges.
Foundation walls which are restrained at the top, are backfilled on one side with compacted granular fill, and have a perimeter foundation drainage system should be designed for an equivalent fluid unit weight of 65 lbs. per cu ft. (pcf).

Foundation walls subjected to surcharge loads from adjacent floor slabs or foundations should be designed for an additional uniform lateral pressure, over the entire height of the backfilled wall, equal to 0.5 times the surcharge pressure.

Below-grade walls which are not restrained (top free to rotate) and are not subjected to unbalanced hydrostatic pressures (have foundation drains or are located above the groundwater level), should be designed for an equivalent fluid unit weight of 40 pcf. Portions of walls not protected by a foundation drainage system and are located below the groundwater level should be designed for an equivalent fluid unit weight of 80 pcf.

Compacted Fill

Compacted Structural Fill used for the layer below the foundations, floor slab and the sidewalks, and adjacent to foundation walls should consist of a sandy gravel or gravelly sand, free of organic material, loam, trash, snow, ice, frozen soil, or other objectionable material, and should be well-graded within the following limits:

Sieve Size	Percent Finer By Weight
6 in.	100
No. 4	30 to 90
No. 40	10 to 50
No. 200	0 to 8

In open areas, compacted structural fill should be placed in layers not exceeding 8 in. in loose measure and compacted with self-propelled compaction equipment at approximately optimum moisture content to a dry density of at least 95 percent of the maximum dry density as determined by ASTM D1557. In confined areas, the loose layer thickness should be reduced to 6 in. and compaction performed by hand-guided compaction equipment.

Reused or Imported Compacted Fill should be used for constructing the detention pond embankments and for raises-in-grade beneath the building, parking areas and access roads to subgrade elevations. Fill that is reused from the site or imported to the site should conform to the requirements of MDOT Standard Specifications for Highways and Bridges, Section 703.19, Material for Embankment Construction.

Compacted fill placed within the building limits should consist of inorganic mineral soil that can be readily placed in layers not exceeding 8 in. in loose measure and compacted to a minimum of 95 percent of ASTM D1557. Compacted fill placed outside the building limits should be placed in layers not exceeding 10 in. in loose measure and compacted to a minimum of 92 percent of ASTM D1557.

We anticipate that portions of the onsite fill may meet the requirements for the above noted compacted fill. In addition, glacial stream sands and gravels in the low-lying area on the eastern end of the site will be suitable for use as compacted fill. Appendix C contains typical gradation data for the glacial stream deposits. The material typically contains less than 10 percent fines (silt and clay size particles).

As previously noted most of the fill material that is present on the site consists of silt and clay soils. If properly moisture conditioned, placed and compacted, these materials would be suitable for use as compacted fill. However, if the soils are wet of optimum (ASTM D1557) in their present condition or they become wet during construction, they will be very difficult to properly place and compact. It will be very important to make sure the contractor is aware of the project expectations if the silt and clay soils are reused on the project.

Common Fill outside the limits of the proposed retail store and paved roadways and parking areas should consist of inorganic mineral soil that can be readily placed in layers not exceeding 10 in. in loose measure and compacted to 90 percent of ASTM D1557. We anticipate that the marine sand, silt and clay deposits may be suitable for reuse as common fill. However, prospective contractors should be aware that the these deposits may be difficult to place and compact when wet, and that the material may have to be spread out and dried prior to placement.

SITE DEVELOPMENT CONSIDERATIONS

Pavement Section

The following pavement sections are recommended:

Parking Areas In Front of the Retail Stores

3-in. bituminous concrete, placed in two 1-1/2 in. thick layers
5-in. screened or crushed gravel
12-in. sand or gravel subbase course

Roads and Loading Dock Areas

4-in. bituminous concrete, placed in two layers (1-1/2 in. surface and 3 in. binder)
5-in. screened or crushed gravel
12-in. sand or gravel subbase course

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

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

Sand or Gravel Subbase -Maine DOT, Section 703.06b, Type D.

Type D aggregate should be modified to a maximum 4-in. size. Compacted structural fill may be substituted for the subbase course material, but the maximum particle size should be reduced to 4 in.

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

In areas where the pavement subgrade consists of existing fill, unsuitable materials (topsoil and organics) should be removed and replaced with granular fill or structural fill. Subgrades should be proof-rolled with a large vibratory roller. Any soft spots should be excavated and replaced with granular fill or structural fill.

It should be noted that this pavement section will not prevent freezing of marine deposit silt and clay, existing fill or granular borrow subgrade soils, which are considered to be susceptible to frost action. As a result, pavement roughness due to non-uniform frost heaving may result. However, to eliminate such non-uniform frost heaving would require that an approximately 4-ft. thickness of granular subbase be used. It is common practice to tolerate seasonal movement to avoid the cost of the added thickness of subbase.

Earth Slopes

Proposed earth slopes are shown on Figure 2. Design slopes are at 2 horizontal to 1 vertical (2:1). The maximum fill heights behind the store are on the order of 15 to 20 ft. An alternative to standard 2:1 slopes is to build the slopes at 1:1 or steeper using geotextile-reinforced earth slopes. This would reduce the amount of fill required for slope construction. We can provide additional design details for the reinforced soil slopes if needed.

The Forest Avenue access road shown on Figure 2 indicates that a portion of the alignment will be located adjacent to the steep earth slopes of the former pit. At these locations, the existing slope is as steep as approximately 1.3:1. We recommend that these slopes be flattened to a nominal 2:1.

The earth slopes should be provided with vegetation to control erosion losses from wind and surface water runoff.

Storm Water Detention Pond

A detention pond is located to the east of the building in a low area of the pit. Existing grades in the area vary from approximately El. 50 to El. 60. Detention pond grading varies from El. 52 to El. 60. Therefore, site grading for the detention pond will involve cuts of 6 ft. to fills of 3 ft.

The bottom of existing fill in the detention pond area is likely near El. 30 to El. 40. Therefore, the detention pond will be constructed over existing fill with varying composition. Subgrades should be proofrolled and any soft areas replaced with compacted granular fill. Embankments should be constructed with compacted fill or common borrow as previously described.

CONSTRUCTION CONSIDERATIONS

General

The purpose of this section of the report is to comment on items related to excavation, earthwork, and related aspects of the proposed construction. It is written primarily for the engineer having responsibility for the preparation of plans and specifications. Since it identifies potential construction problems related to foundations and earthwork, it will also aid personnel who monitor the construction activity. Prospective contractors for this project should evaluate construction problems on the basis of their own knowledge and experience in the area, taking into consideration their proposed construction methods and procedures.

Excavation

Excavation will be required for general site grading, new foundations, the storm water detention system, and new underground utilities. We anticipate that excavations will be through existing fill, granular fill and marine sand, silt and clay soils. Excavations may be made using sloped open cut techniques. We recommend that the contractor be responsible for the design, stability, and safety of all excavations.

It is likely that the existing fill will contain cobbles, boulders and construction debris. Some of the construction debris could range in size up to a 4 ft. or more in any dimension.

Subgrade Preparation

The subgrade soils at the site are considered susceptible to disturbance due to construction traffic and water. Therefore, equipment and personnel should not be permitted to travel across exposed existing fill or marine deposit subgrades. Final excavation to the marine deposit subgrade should be made using smooth-bladed backhoe equipment. Foundation subgrades should be protected against freezing if exposed to freezing temperatures during construction. Any soft or disturbed subgrade areas should be excavated and replaced with compacted structural fill.

Existing fill, granular fill and marine sand, silt and clay subgrades in paved areas should be protected against freeze/thaw action and from disturbance from water and construction traffic. The pavement base and subbase courses should be placed and compacted as soon as is practicable to protect the silty soils from disturbance.

Spreading and compaction of the structural fill within the building areas should be accomplished using lightweight equipment. Trucks and other heavy rubber tired equipment hauling fill or construction materials should be restricted to areas where there is at least 3 ft. of cover over the foundation, roadway and parking lot subgrades.

Reuse of Onsite Soils

Existing Fill Reused as Compacted Fill

The existing fill soils likely contain a significant quantity of fines (material passing the No. 200 sieve). Even materials that are segregated and meet the Compacted Fill gradation requirements may be difficult to properly place and compact when they become wet. The contractor should be made aware that granular borrow may require moisture conditioning to achieve specified compaction requirements.

The construction time frame may include extended periods of rain fall, and freezing and thawing conditions. Furthermore, it is possible that the natural moisture content of the soil when it is excavated will be near or above the optimum moisture content for compaction. We recommend that the contractor be advised of these conditions and that the earthwork specifications require that the sand, silt and clay used as fill within the building limits, below paved areas and for the detention ponds be placed and compacted at water contents no greater than 2 percent above or below the optimum value as determined by ASTM D1557. This may mean that the excavated soil will need to be dried or mixed with dry soil before it is placed and compacted.

The glacial stream deposit soils encountered in boring B117 appear to be granular and contain less than about 10 percent fines. These soils will meet the gradation requirements for compacted fill as previously described.

Construction Monitoring

The foundation recommendations contained in this report are based on the predictable behavior of a properly engineered and constructed foundation. Monitoring of the earthwork and foundation construction is required to enable the geotechnical engineer to keep in contact with procedures and techniques used during construction. Therefore, it is recommended that a person qualified by training and experience be present to provide full-time monitoring at the site during the final preparation of bearing surfaces and placement of compacted fill.

Haley & Aldrich is available to perform these services.

LIMITATIONS OF RECOMMENDATIONS

This report has been prepared for specific application to the subject project in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. The recommendations presented herein are based, in part, on the information on subsurface conditions and proposed construction details described in this report. We request that Haley & Aldrich be provided the opportunity for a general review of the final design and specifications, in order to determine that our earthwork and foundation recommendations have been interpreted as they were intended. In particular, if any changes in the nature, design, or location of the proposed structures are made, we should review the applicability of our recommendations.

We appreciate the opportunity to provide engineering services on this project. Please do not hesitate to call if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

Brian K. Lawrence, P.E.
Staff Engineer

Stephen J. Kelley, C.G. (#GE210)
Senior Environmental Geologist

James W. Weaver, P.E.
Vice President

Enclosures:

Table 1	- Summary of Subsurface Conditions
Figure 1	- Project Locus
Figure 2	- Site and Exploration Location Plan
Appendix A	- Logs of Test Borings
Appendix B	- Logs of Test Pits
Appendix C	- Results of Laboratory Testing

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