JOHN D. HYNES & ASSOCIATES, INC.

Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing

June 5, 2013

Indian River School District
c/o Mr. Jon Lipka, AIA
Becker Morgan Group
Port Exchange
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Re: Report of Subsurface Exploration and Geotechnical Engineering Recommendations
Indian River School District Classroom Annex Buildings
Sussex County, Delaware
Project No.: JDH-10/13/225

Dear Mr. Lipka:

John D. Hynes & Associates, Inc. has completed the authorized subsurface exploration and geotechnical engineering evaluations for the Indian River School District Classroom Annex Buildings in Sussex County, Delaware. Our services were performed in accordance with our contract proposal dated April 25, 2013.

This report describes the exploration methods employed, exhibits the data obtained and presents our evaluations and recommendations. In summary, we recommend that the four buildings be supported by footing foundations bearing on firm, natural soils or controlled, structural fill. If the recommendations of this report regarding subgrade preparation and construction are followed, then 2,000 psf bearing should be used to proportion the spread footing foundations for East Millsboro Elementary, North Georgetown Elementary, and Philip C. Showell Elementary Annex Buildings. If the recommendations of this report are followed, then 3,000 psf bearing should be used to proportion spread footing foundations for the Long Neck Elementary Annex Building.

We appreciate the opportunity to be of service to you. If you have any questions regarding the contents of this report or if we may be of further assistance, please contact our office.

Respectfully,

JOHN D. HYNES & ASSOCIATES, INC.

Justin J. Redding
Staff Engineer

John D. Hynes, P.E.
President

JOHN D. HYNES
REGISTERED
No. 7591
DELAWARE
PROFESSIONAL ENGINEER

JJR: JDH/jsl

cc: Jim Baker, Macintosh Engineering, jbaker@macintosheng.com

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdhynes@aol.com

REPORT OF
SUBSURFACE EXPLORATION
AND
GEOTECHNICAL ENGINEERING RECOMMENDATIONS

INDIAN RIVER SCHOOL DISTRICT CLASSROM ANNEX BUILDINGS
SUSSEX COUNTY, DELAWARE

PREPARED FOR
INDIAN RIVER SCHOOL DISTRICT

JUNE 5, 2013
PROJECT NO.: JDH-10/13/225

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Email: jdhynes@aol.com

HYNES

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Email: jdhynes@aol.com

PURPOSE AND SCOPE

The subsurface exploration study was performed to evaluate the subsurface conditions with respect to the following:

1. General site and subgrade preparation;
2. Fill and backfill construction;
3. Foundation recommendations, including allowable bearing capacity and estimated embedment depths of spread footings;
4. Foundation construction and inspection procedures;
5. Floor slab support;
6. Location of groundwater and applicable construction dewatering control procedures; and
7. Other aspects of the design and construction for the proposed structures indicated by the exploration.

An evaluation of the site, with respect to potential construction problems and recommendations dealing with earthwork and inspection during construction, is included. The inspection is considered necessary both to confirm the subsurface conditions and to verify that the soils related construction phases are performed properly.

EXISTING SITE CONDITIONS

As shown on our Project Location Maps (Drawing No.: JDH-10/13/225-A-1 to 4) in the Appendix, Annex Buildings are proposed at the following four schools:

- Long Neck Elementary in Long Neck (Millsboro), Delaware
- East Millsboro Elementary in Millsboro, Delaware
- North Georgetown Elementary in Georgetown, Delaware
- Phillip C. Showell Elementary in Selbyville, Delaware

All project sites are clear of the main school buildings prior to the date of the test borings. Each project site is located on the rear side of the school. The sites are on predominately grassy areas, with a section of concrete sidewalk to be removed.

FIELD EXPLORATION AND STUDY

In order to determine the nature of the subsurface conditions at the sites, Hynes & Associates drilled 8 test borings, 2 at each site, at the locations indicated on the "Boring Location Plans" (Drawing JDH-10/13/225-B-1 to 4) in the Appendix on April 26, 2013. We advanced borings A-1, B-1, C-1, and D-1 to depths of 20.5 feet and borings A-2, B-2, C-2, and D-2 to depths of 10 feet. The test borings were drilled with Mobile B-47 HD trailer mounted drill rigs.

Soil sampling and testing were carried out in general accordance with ASTM Specification D-1586. A brief description of our field procedures is included in the Appendix. The results of all boring and sampling operations are shown on the boring logs.

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Samples of the subsurface soils were examined by our engineering staff and were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM Specification D-2488. The estimated USCS symbols appear on the boring logs and a key to the system nomenclature is provided in the Appendix of this report. Also included are reference sheets which define the terms and symbols used on the boring logs and explain the Standard Penetration Test procedures.

We note that the test boring records represent our interpretation of the field data based on visual examination and selected soil classification tests. Indicated interfaces between materials may be gradual.

The field exploration data was supplemented with laboratory testing data. The laboratory at John D. Hynes & Associates, Inc. performed 2 Sieve Analysis tests. The test results are noted on the boring logs in the Appendix.

SUBSURFACE CONDITIONS

At the time of our field services, we encountered a layer of organic bearing surficial soils at all boring locations. The organic bearing soil layer varied in thickness between 7 and 72 inches at the boring locations. Other thickness of organic bearing soils may be located at other areas of the site. The North Georgetown building area has been filled with 5 to 6 feet of organic bearing soil. We, also, encountered 4 feet of mixed fill with "topsoil" in boring D-2 at the Showell Elementary School.

Below the soil horizon, we encountered interbedded layers of Clayey SAND (SC), Poorly Graded SAND (SP) and Silty SAND (SM). Most soils were SM materials.

The granular soils were characterized by Standard Penetration Test (SPT) values (N-values) of 3 to 50 blows per foot. This range of penetration resistance indicates in place relative densities of very loose to dense.

Groundwater was encountered at depths of 4 to 15 feet below grade in the test borings. Groundwater depths will vary during the year depending upon the amount of precipitation received locally. Refer to the boring logs for the groundwater depths at each boring location.

PROJECT CHARACTERISTICS

Proposed for development on the sites are annex buildings at the rear of each school. The proposed buildings are of similar layouts and are approximately 3,600 square feet. All of the buildings are to be wood framed, pole barn type structures. The floor will be a turned down concrete slab-on-grade with a finish floor grade slightly above current grades. The exterior and corner column loads will be 15 kips and 8 kips, respectively. The continuous wall loading will be 0.5 klf. All loadings were obtained through Mr. James Baker at MacIntosh Engineering through email communication dated May 6, 2013.

RECOMMENDATIONS

The following recommendations and considerations are based on our understanding of the proposed construction, the data obtained from the exploration, and our previous experience with similar subsurface conditions and projects. If there are any significant changes to the project characteristics, such as revised structural loadings differing significantly from those noted above, building geometry, building location, elevations, etc., we request that this office be advised so the recommendations of this report can be re-evaluated.

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A. Site Preparation

Prior to the construction of foundations, ground slabs or pavements, or the placement of fill in any structural areas, all frozen or wet, excessively soft or loose soils, old foundations, demolition debris, and other deleterious materials should be removed and wasted. The existing organic bearing soil should be stripped and can be stockpiled for reuse in landscape areas. At the North Georgetown Elementary site, 5 to 6 feet of "organic bearing soils" (old topsoil fill) needs to be removed from the building pad and a distance of at least 5 feet outside the building footprint. At the Showell Elementary site, we encountered 4 feet of mixed fill with "topsoil". This material shall, also, be overexcavated where encountered at the building pad and to a distance of 5 feet outside the building footprint. Following the removal of any deleterious materials, the excavations should be prepared and filled in accordance with the recommendations of this report. If perched surface water is encountered during any grading or excavation process, Hynes & Associates should be consulted for additional recommendations regarding the stabilization of the bases of the excavations and backfilling.

After the stripping operations have been completed, the exposed subgrade soils should be inspected by the Geotechnical Engineer or his approved representative. The inspector should require the exposed subgrade materials be proofrolled utilizing a heavily-loaded dump truck or other pneumatic tired vehicle of similar size and weight. The purpose of proofrolling would be to provide surficial densification and to locate any isolated areas of soft or loose soils requiring undercutting. Proofrolling is not advised in wet areas which may deteriorate under repeated vehicular loading. Wet areas should be drained and allowed to dry prior to proofrolling. The voids from the removal of old foundations, rubble, or other deleterious material removal should be backfilled with compacted structural fill. If the holes contain water, contact our office for additional recommendations. Precipitation may result in standing water (perched water) at low areas. If the water is allowed to pond, the natural soils may deteriorate and overexcavation or subgrade improvement may be necessary at those areas. The Geotechnical Engineer should be consulted to evaluate poor subgrade conditions during construction.

Care should be exercised during the grading operations at the sites. Shallow SM materials were identified at the boring locations. These materials are moderately sensitive to changes in moisture conditions and should therefore be protected. If earthwork is conducted in the presence of moisture, the traffic of heavy equipment, including heavy compaction equipment, may create pumping and a general deterioration of the subgrade soils. Construction traffic should be minimized at structural subgrade areas. If subgrade problems arise, the Geotechnical Engineer should be consulted for an evaluation of the conditions. Overexcavated areas resulting from the removal of soft or loose soils, organic soils, or otherwise unsuitable materials should be backfilled with properly compacted materials in accordance with the procedures discussed in the following section.

B. Fill Selection, Placement and Compaction

It is recommended that all materials to be used as structural fill be inspected, tested and approved by the Geotechnical Engineer prior to use. The native SM soils that do not contain organics may be re-used for structural fill. Acceptable borrow material should include GW, GP, GM, SM, SW and SP classified in accordance with the USCS. Furthermore, the material to be utilized as structural fill should have a Plasticity Index (PI) less than 20.

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The importation of high quality, granular material should be allowed, and acceptable unit rates for importation and placement should be established. Sand, gravel or sand/gravel mixtures would be appropriate for wet weather placement. Otherwise, the materials noted above will be acceptable for use as structural fill. Native or imported SM soils will be sensitive to alteration in moisture content and will become unworkable during and following periods of precipitation. For this reason, if earthwork is attempted in late autumn, winter or early spring, the above mentioned high quality imported granular material should be limited to well draining sands and gravels. SM materials become unworkable at moisture contents greater than 3 percentage points above optimum. The contractor would have to dry these materials or set them aside for use in landscaping areas.

Structural fill should be placed in lifts which are eight inches or less in loose thickness and should be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). Adjustments to the natural moisture content of the soils may be required in order to obtain specified compaction levels. Should utility construction be performed after earthwork, the Contractor should be responsible for achieving 95 percent compaction in all trench backfill. These guidelines should be set for all structural fill at the site including, but not limited to building, and ground slab fills.

For the proofrolling and fill compaction operations, fill limits should be extended at least 5 feet beyond the building exterior walls, exterior columns, and slab on grade boundaries. A sufficient number of in-place density tests should be performed by an engineering technician to verify that the proper degree of compaction is being obtained in all fill soils.

C. Structure Foundations

Considering current and proposed grade levels, the in-situ soil conditions and the proposed structural loadings, we recommend that the new annex school buildings be supported on spread footing foundations bearing on firm, natural soils or controlled, structural fill. Foundation footings at frost depth or greater depths may be proportioned based on a maximum allowable soil bearing pressures listed below:

Allowable Soil Bearing Pressure	psf
Long Neck Elementary	3,000
East Millsboro Elementary	2,000
North Georgetown Elementary	2,000
Phillip C. Showell Elementary	2,000

Some locations may be encountered where less than the required bearing is available. At those locations, compaction in the footing trenches may be necessary or minor overexcavation may yield greater soil support. For this reason, the inspection of the footing excavations by the Geotechnical Engineer is advised.

Minimum dimensions of 24 inches for square footings and 18 inches for wall footings should be used in foundation design to minimize the possibility of a local shear failure. Turned down slabs may be as narrow as 12 inches. All foundation excavations should be inspected by the Geotechnical Engineer or his approved representative prior to the placement of concrete. The purpose of the inspection would be to verify that the exposed bearing materials are suitable for the design soil bearing pressure and that loose, wet, frozen, compressible or organic soils are not present.

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Exterior footings and footings in unheated areas should be located at a depth of at least 2 feet to bottom of footing below the outside final grade to provide adequate frost cover protection. However, if deeper footings are specified in the contract drawings, these should govern. If the building is to be constructed during the winter months or if the building will be subjected to freezing temperatures after footing construction, then all footings should be adequately protected during freezing periods.

Soils exposed at the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition, such as disturbance from rain or frost. Surface runoff should be drained away from the excavations and not be allowed to pond. Foundation excavations should be adequately protected from rainfall or freezing conditions.

If our recommendations are followed, we estimate a total settlement of 1 inch or less. We estimate differential settlements of ½ inch.

D. Floor Slab Support

Ground supported slabs at the building areas may be supported on firm, natural soils or on a layer of controlled, structural fill. The subgrade should be prepared in accordance with the procedures described in Sections A and B of this report. We recommend that a 4 to 6 inch clean, granular, leveling and load-distributing material such as washed gravel, or screened crushed stone, be used beneath the building floor slabs. These materials will require acquisition from off-site sources. Prior to placing the leveling and load distributing material, the building slab subgrade should be free of standing water or mud. A suitable moisture barrier should also be provided for the building slab. These procedures will help to prevent capillary rise and damp floor slab conditions. For native soil or fill material placed and compacted according to the procedures outlined in this report, we recommend using a value of modulus of subgrade reaction of 150 pounds per cubic inch.

E. Groundwater and Drainage

As noted under "SUBSURFACE CONDITIONS" above and the boring logs, groundwater was encountered at depths of 4 to 15 feet below grade during drilling operations. Relative to building foundations, the Contractor should only experience construction problems relating to the groundwater at the building locations. The Contractor should be prepared to dewater the lowest excavations in the event of the infiltration of precipitation. If so, the contractor shall dewater as necessary to construct the foundations. Dewatering should be by well point systems, dewatering wells, sumping and pumping, etc.

Efforts should be made to keep exposed subgrade areas dry during construction, primarily because the soils will be susceptible to deterioration and loss of strength in the presence of moisture. Adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation subgrade soils. The grades should be sloped away from the buildings to prevent ponding of water around them. The final site drainage should also be designed such that run-off onto adjacent properties is controlled properly.

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Email: jdhynes@aol.com

ADDITIONAL SERVICES RECOMMENDED

Additional engineering, testing and consulting services recommended for this project are summarized below.

A. Site Preparation and Proofrolling

The Geotechnical Engineer or experienced soils inspector should inspect the site after it has been final graded and excavated. The inspector should determine if any undercutting or in-place densification is necessary to prepare a subgrade for fill placement, or slab support.

B. Fill Placement and Compaction

The Geotechnical Engineer or experienced soils inspector should witness all fill operations and take sufficient in-place density tests to verify that the specified degree of fill compaction is achieved. The inspector should observe and approve borrow materials used and should determine if their existing moisture contents are acceptable.

C. Foundation Excavation Inspections

The Geotechnical Engineer should inspect all foundation excavations for the structures. He should verify that the design bearing pressures are available and that no loose or soft areas exist beneath the bearing surfaces of the foundation excavations.

REMARKS

This report has been prepared solely and exclusively for the Indian River School District to provide guidance to design professionals in developing facilities plans for the Indian River School District Classroom Building Annex projects in Sussex County, Delaware. It has not been developed to meet the needs of others, and application of this report for other than its intended purpose could result in substantial difficulties. The Consulting Engineer cannot be held accountable for any problems which occur due to the application of this report to other than its intended purpose. This report in its entirety should be attached to the project specifications.

These analyses and recommendations are, of necessity, based on the concepts made available to us at the time of the writing of this report, and on-site conditions, surface and subsurface that existed at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings, in relation both to the areal extent of the site and to depth, are representative of conditions across the site. It is also recommended that we be given the opportunity to review all plans for the project in order to comment on the interaction of soil conditions as described herein and the design requirements.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices.

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Email: jdhynes@aol.com

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APPENDIX

1. Investigative Procedures
2. Project Location Map
3. Boring Location Plan
4. Boring Logs
5. Unified Soil Classification Sheet
6. Field Classification Sheet
7. Information Sheet

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INVESTIGATIVE PROCEDURES

SOIL TEST BORINGS

Soil drilling and sampling operations were conducted in accordance with ASTM Specification D-1586. The borings were advanced by mechanically turning continuous hollow stem auger flights into the ground. At regular intervals, samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D. splitspoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil's strength, density and behavior under applied loads. The soil descriptions and penetration resistances for each boring are presented on the Test Boring Records in the Appendix.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our investigation, jar samples obtained during drilling operations are examined in our laboratory and visually classified by the geotechnical engineer in accordance with ASTM Specification D-2488. The soils are classified according to the AASHTO or Unified Classification System (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior.

SIEVE ANALYSIS

Gradational analysis tests were performed to determine the particle size and distribution of the samples tested. The grain size distribution of soils coarser than a No. 200 sieve is determined by passing the sample through a standard set of nested sieves. The percentage of materials passing the No. 200 sieve is determined by washing the material over a No. 200 sieve. These tests are in accordance with ASTM D-421, D-422 and D-1140. The results are presented in the Appendix to our report.

NATURAL MOISTURE

Portions from representative soil samples obtained during drilling operations were selected for Natural Moisture Content tests. The Natural Moisture Content Test determines the water content of soils by drying into an oven with a standard drying temperature of 110 °C. The lost of mass drying the sample, determines the water content into the soil. The water content of the sample is calculated in percentage. The water content of soils (natural moisture) is determined in accordance with ASTM Specification D-2216.

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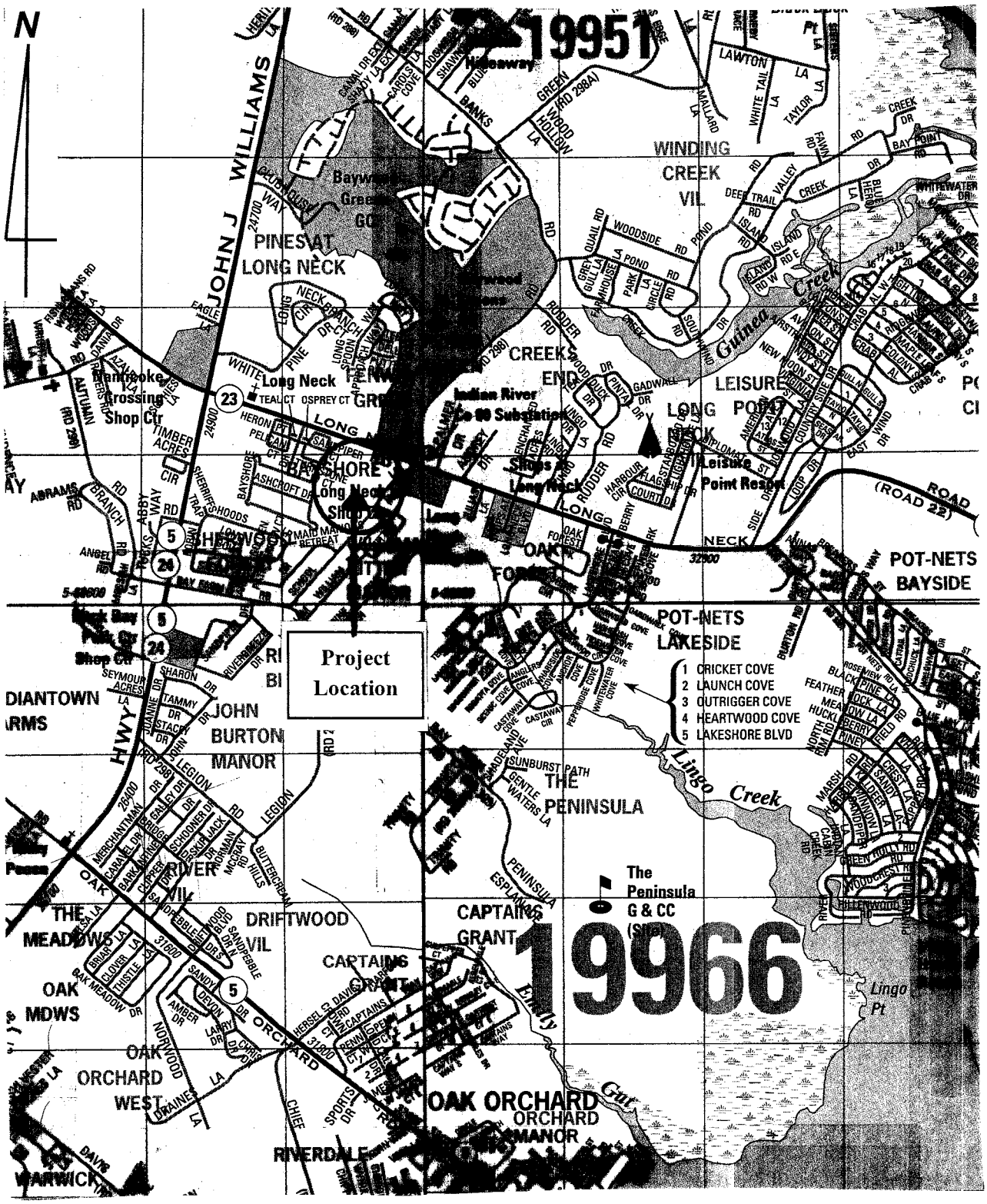

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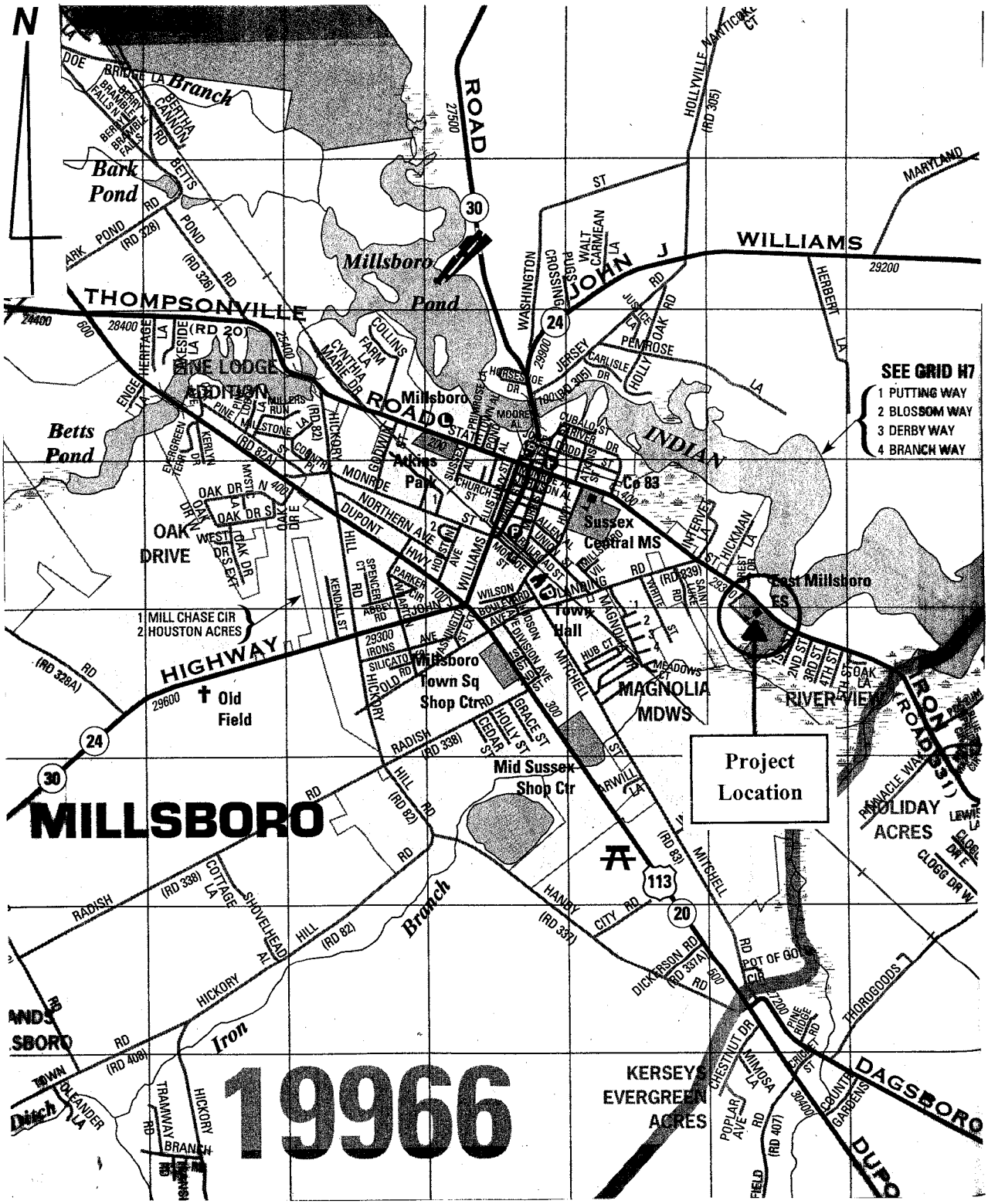
410-546-6462 / Fax: 410-548-5346

Date: May 2, 2013	
Scale: 1"= 2000'	
Drawn: ADC Map	
Project Location Map Indian River School District – Long Neck Elementary Long Neck, Delaware	DWG. No. JDH-10/13/225-A-1



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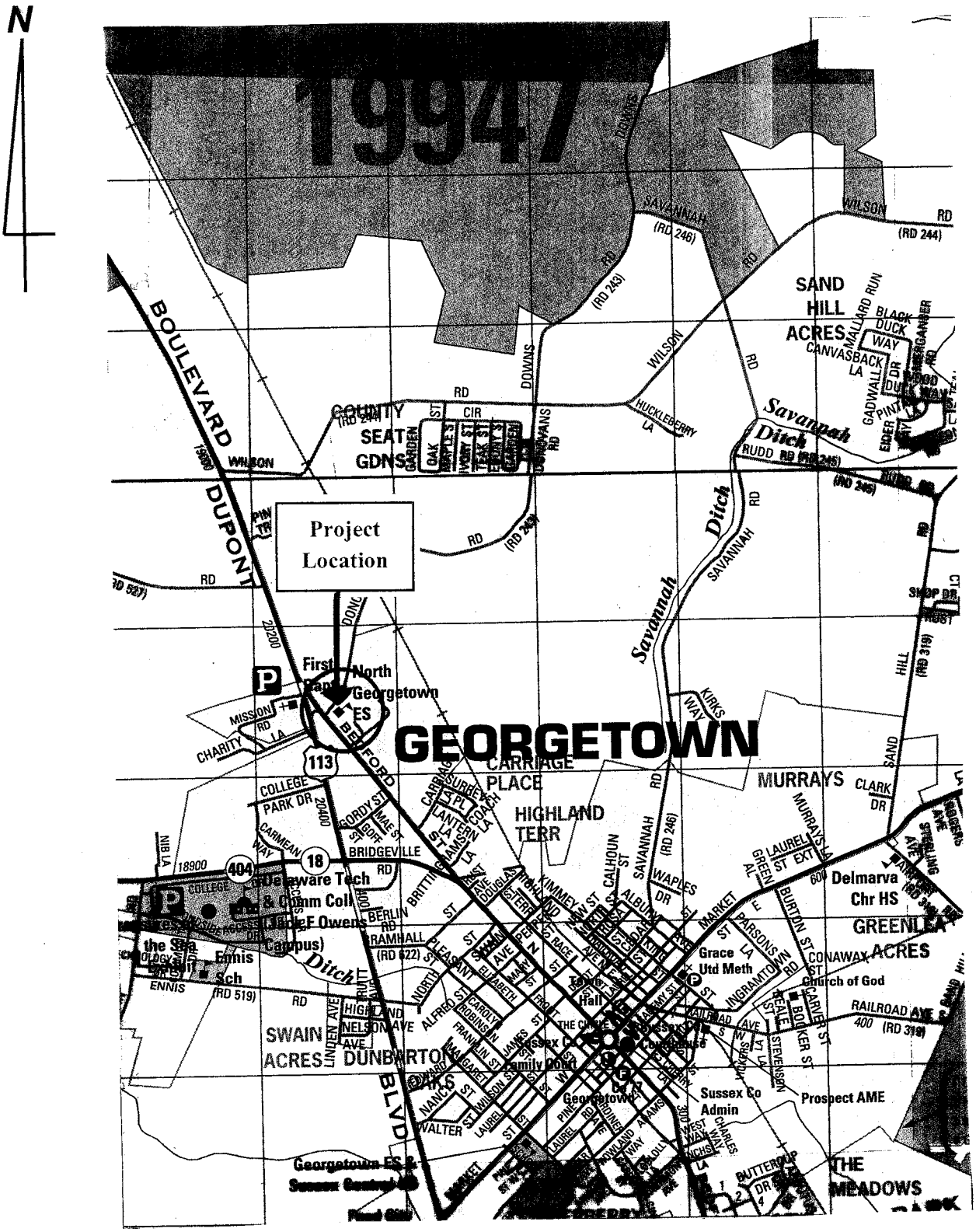
Date: May 2, 2013
Scale: 1"= 2000'
Drawn: ADC Map

Project Location Map
Indian River School District – East Millsboro Elementary
Millsboro, Delaware

DWG. No.
JDH-10/13/225-A-2



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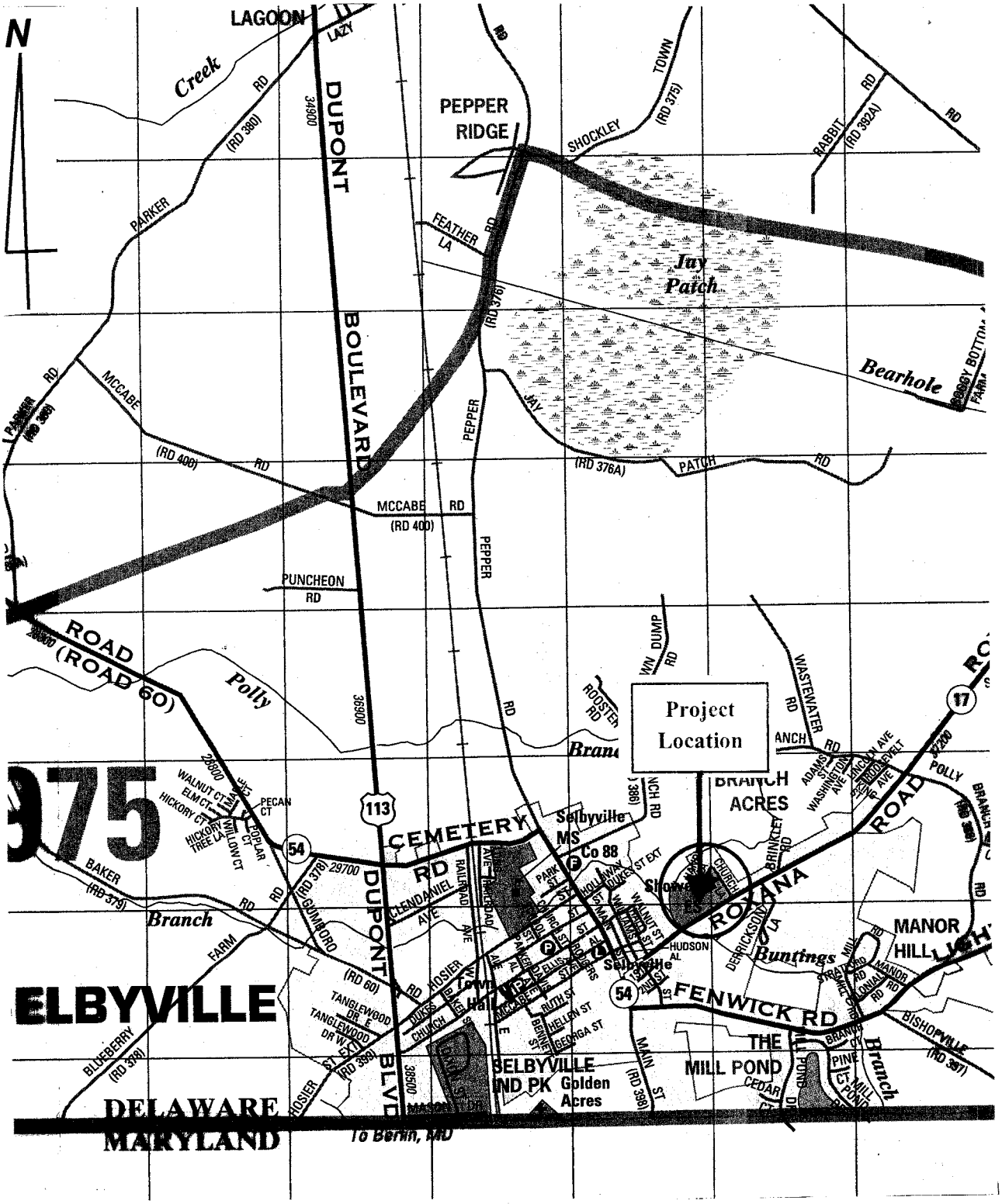
Date: May 2, 2013	
Scale: 1"= 2000'	
Drawn: ADC Map	
Project Location Map Indian River School District – North Georgetown Elementary Georgetown, Delaware	DWG. No. JDH-10/13/225-A-3



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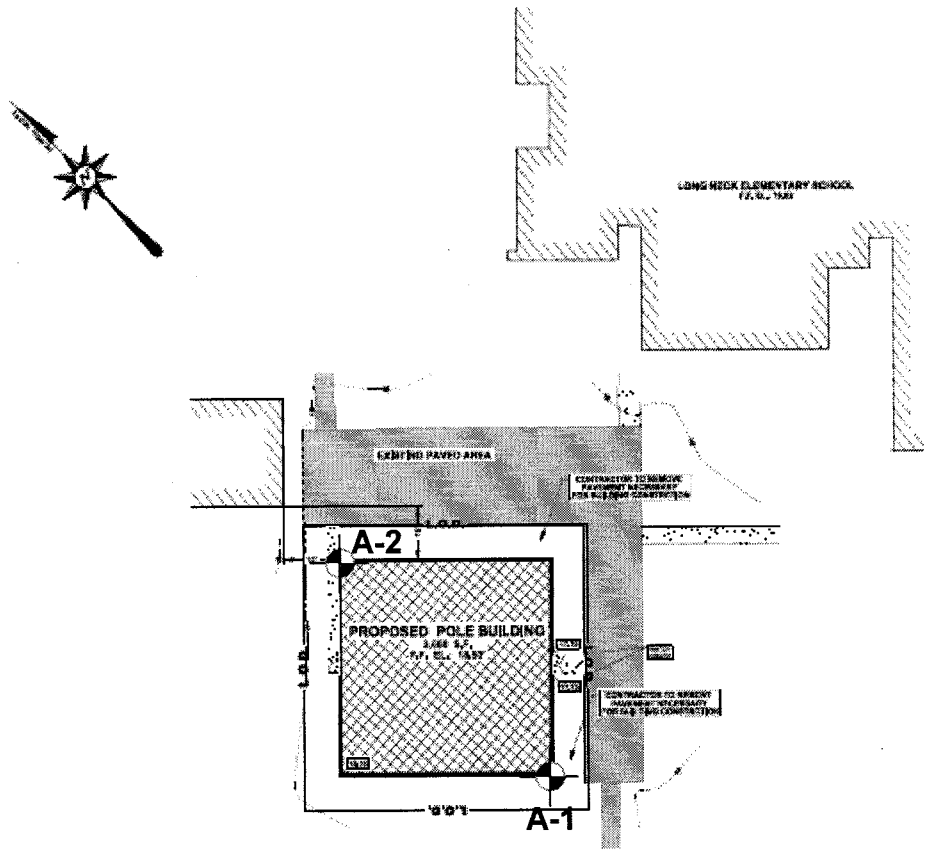
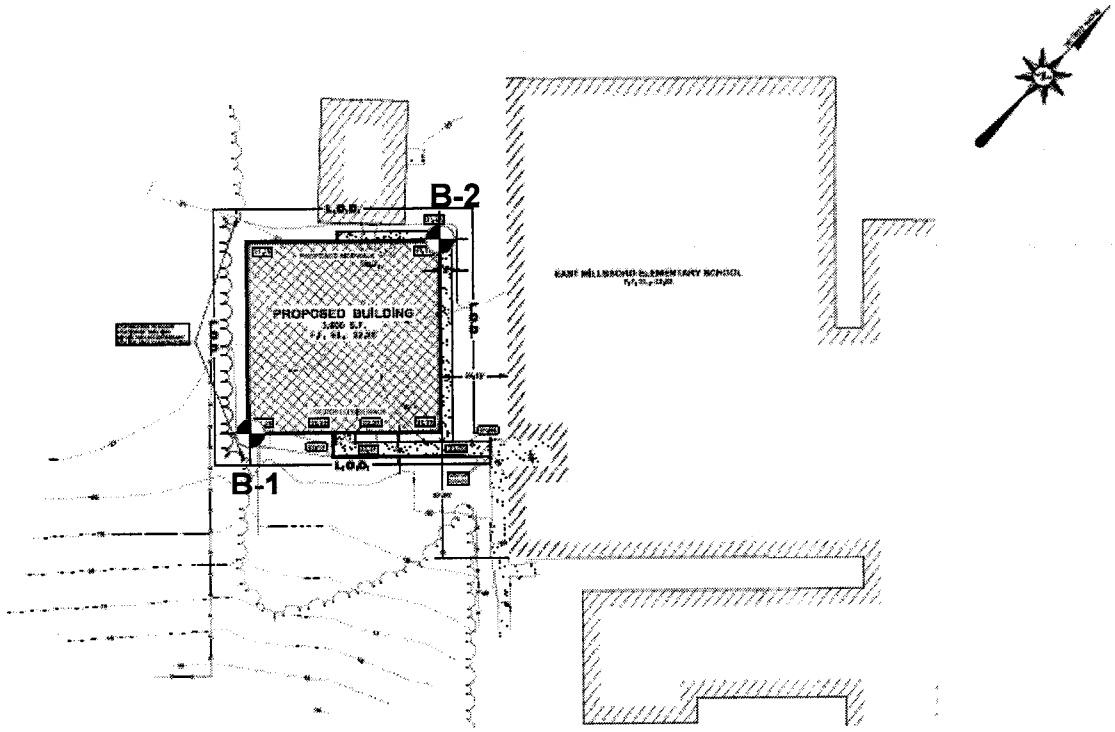
	Date: May 2, 2013
	Scale: 1"= 2000'
	Drawn: ADC Map
Project Location Map Indian River School District – Showell Elementary Selbyville, Delaware	DWG. No. JDH-10/13/225-A-4



: Boring Location

JOHN D. HYNES & ASSOCIATES, INC. 32185 Beaver Run Drive • Salisbury, Maryland 21804 410-546-6462 / Fax: 410-548-5346	**Date: May 2, 2013** **Scale: 1" = 15.5'** **Drawn: Becker Morgan**
Boring Location Plan Indian River School District – Long Neck Elementary Long Neck, Delaware	**DWG. No.** **JDH-10/13/225-B-1**



: Boring Location

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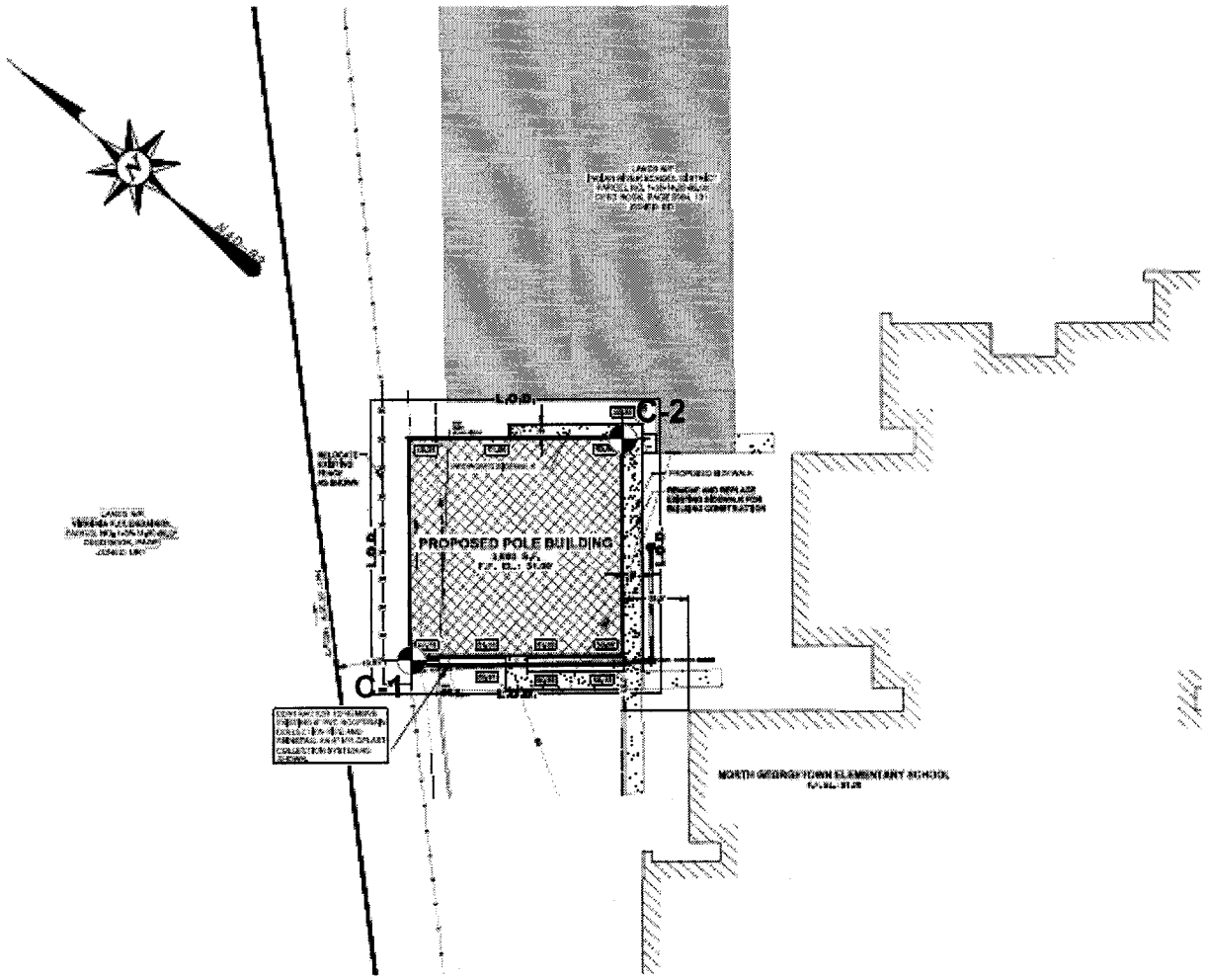
Boring Location Plan Indian River School District – East Millsboro Elementary Millsboro, Delaware	Date: May 2, 2013 Scale: 1" = 17.5' Drawn: Becker Morgan DWG. No. JDH-10/13/225-B-2



: Boring Location

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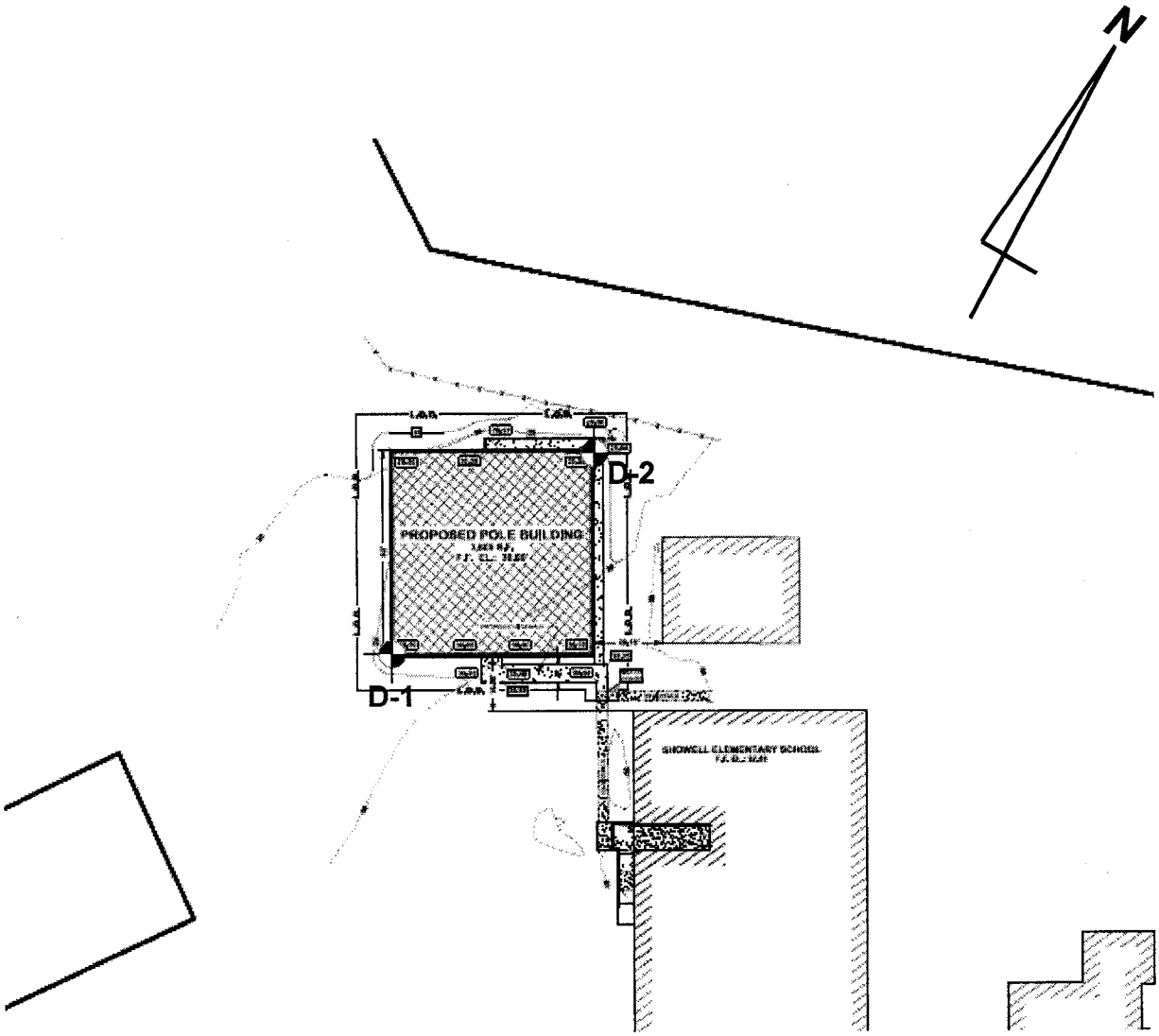
Date: May 2, 2013
Scale: 1" = 15.5'
Drawn: Becker Morgan

Boring Location Plan
Indian River School District – North Georgetown Elementary
Georgetown, Delaware

DWG. No.
JDH-10/13/225-B-3



: Boring Location

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Boring Location Plan Indian River School District – Showell Elementary Selbyville, Delaware	Date: May 2, 2013 Scale: 1" = 15.5' Drawn: Becker Morgan DWG. No. JDH-10/13/225-B-4

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LOG OF BORING A-1

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Building

Long Neck Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : M. Hynes
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 17.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	17	Brown, wet, dense, fine to medium SAND, with some silt		SM	1	5-25-25	Scale 1" ~ 4.5 feet
		Dark gray, wet, dense, RAP (Recycled Asphalt Pavement) (millings)		SW			
2	15	Brown, saturated, medium dense, fine to medium SAND, wtih little to some silt		SM	2	10-11-11-11	Approximately 7 inches of organic bearing soil was encountered at the ground surface.
4	13	Brown to orange-brown, saturated, medium dense, fine to medium SAND, with little to some clay, little silt (mottled)		SC	3	13-5-5-7	Groundwater was encountered at 7 feet during drilling operations.
6	11	Orange-brown, saturated, medium dense, fine to coarse SAND, with some silt		SM	4	15-8-7-5	At completion groundwater was at 2 feet; boring caved in at 8 feet.
8	9	Light brown, saturated, loose, fine to medium SAND, with some silt		SM	5	14-3-2-4	
10	7						
12	5	Gray-white, saturated, loose, fine to coarse SAND, with some silt		SM			
14	3				6	4-3-6	
16	1						
18	-1						
20	-3				7	3-4-6	
		Boring terminated at 20.5 feet.					
22	-5						
24	-7						
26	-9						
28	-11						
30							

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LOG OF BORING A-2

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Building

Long Neck Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : M. Hynes
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 18.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	18	Brown, wet, medium dense, fine to medium SAND, with some silt, trace to fine gravel		SM	1	3-7-11-11	Scale 1" ~ 4.5 feet
2	16	Light brown, wet, medium dense, fine to medium SAND, with little clay, little silt		SC	2	6-7-6-7	Approximately 8 inches of organic bearing soil was encountered at the ground surface.
4	14	Orange-brown and gray, wet, medium dense, fine to medium SAND and clayey SILT (mottled)		SM	3	5-6-7-10	Groundwater was encountered at 8 feet during drilling operations.
6	12	Light brown, wet, medium dense, fine to medium SAND, with little to some silt		SM	4	7-7-8-8	At completion groundwater was at 8 feet.
8	10	Orange-brown, saturated, medium dense, fine to coarse SAND, with some silt		SM	5	12-5-6-5	Laboratory Test Results Sample No. 3 From 4 to 6 feet
10	8	Boring terminated at 10 feet.					Sieve Analysis
12	6						Sieve Size / Passing % No. 4 100 No. 10 99.5 No. 20 96.9 No. 40 90.5 No. 60 80.7 No. 100 52.7 No. 200 32.4
14	4						
16	2						Natural Moisture = 18.5%
18	0						
20	-2						
22	-4						
24	-6						
26	-8						
28	-10						
30							

HYNES & ASSOCIATES

LOG OF BORING B-1

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Building

East Millsboro Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 20.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	20	Orange-brown, wet, very loose, fine to medium SAND, with trace to little silt		SM	1	2-2-1-2	Scale 1" ~ 4.5 feet Approximately 12 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 14 feet during drilling operations. At completion groundwater was at 14 feet; boring caved in at 13 feet.
2	18	Light brown and brown, wet, loose to medium dense, fine to medium SAND, with trace to little silt (mottled)		SM	2	3-4-5	
4	16						
6	14				3	4-3-6	
8	12						
10	10				4	6-6-8	
12	8	Light brown and orange-brown, saturated, medium dense, fine to coarse SAND, with trace silt (mottled)		SP			
14	6				5	8-9-10	
16	4						
18	2						
20	0				6	7-8-9	
22	-2	Boring terminated at 20.5 feet.					
24	-4						
26	-6						
28	-8						
30							

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HYNES & ASSOCIATES

LOG OF BORING B-2

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Building
East Millsboro Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10.5 feet

Depth in Feet	Surf. Elev. 21.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	21	Dark brown and brown, wet, loose, fine to medium SAND, with trace to little silt		SM	1	2-3-3-4	Scale 1" ~ 4.5 feet Approximately 18 inches of organic bearing soil was encountered at the ground surface. Groundwater was not encountered during drilling operations.
2	19	Orange-brown and light brown, wet, loose, fine to medium SAND, with little silt (mottled)		SM	2	3-3-4	
4	17						
6	15				3	4-4-6	
8	13						
10	11	Light brown and gray, wet, medium dense, fine to medium SAND, with trace silt (mottled)		SP	4	6-6-7	
		Boring terminated at 10.5 feet.					
12	9						
14	7						
16	5						
18	3						
20	1						
22	-1						
24	-3						
26	-5						
28	-7						
30							

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HYNES & ASSOCIATES

LOG OF BORING C-1

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Building
North Georgetown Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : M. Hynes
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 48.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	48	Dark brown, wet, dense to medium dense, fine to medium silty SAND, with trace to little organic silt (fill)		SM	1	3-11-17-20	Scale 1" ~ 4.5 feet
2	46				2	11-11-8-7	Approximately 5 feet of organic bearing soil and fill mix were encountered at the ground surface.
4	44				3	3-3-5-7	Groundwater was encountered at 7 feet during drilling operations.
6	42	Gray, wet, medium dense, fine to medium SAND, with some silt		SM			At completion water was at 7.5 feet; boring caved in at 9 feet.
		Gray-white, wet to saturated, loose to medium dense, fine to medium SAND, with some silt, trace clay			4	9-6-5-8	
8	40				5	5-4-4-10	
10	38						
12	36			SM			
14	34				6	3-3-5	
16	32						
18	30						
20	28				7	4-5-8	
		Boring terminated at 20.5 feet.					
22	26						
24	24						
26	22						
28	20						
30							

HYNES & ASSOCIATES

LOG OF BORING C-2

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Buildings

North Georgetown Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : M. Hynes
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 50.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	50	Dark brown to gray and brown, wet, medium dense, fine to medium SAND and some silt, trace clay (mottled) (fill material)		SM	1	5-8-10-12	Scale 1" ~ 4.5 feet
2	48	Dark brown, wet, medium dense, fine to medium SAND, with some silt (fill)		SM	2	7-4-7-7	Approximately 6 inches of organic bearing soil was encountered at the ground surface.
4	46	Dark brown, wet, medium dense, fine to medium, silty SAND, with little organic silt, trace clay		SM	3	5-6-6-7	Groundwater was encountered at 10 feet during drilling operations.
6	44	Gray, wet to saturated, medium dense, fine to medium SAND, with little to some silt		SM	4	5-11-13-16	
8	42				5	5-9-13-11	
10	40	Boring terminated at 10 feet.					
12	38						
14	36						
16	34						
18	32						
20	30						
22	28						
24	26						
26	24						
28	22						
30							

HYNES & ASSOCIATES

LOG OF BORING D-1

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Buildings

Showell Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 28.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	28	Dark brown to brown, wet, loose, fine to medium SAND, some silt		SM	1	2-3-3-6	Scale 1" ~ 4.5 feet
2	26				2	3-3-2-6	Approximately 4 feet of organic bearing soil was encountered at the ground surface.
		Black to gray and orange to brown, wet, medium stiff, silty CLAY, with trace organics		CL			
4	24	Brown, saturated, loose, fine SAND, with some silt		SM	3	4-3-4-6	Groundwater was encountered at 4 feet during drilling operations.
6	22	Gray, saturated, medium dense, fine to medium SAND, with some silt		SM	4	8-12-15-14	At completion water was at 10.5 feet; boring caved in at 10.5 feet.
8	20	Orange to brown, saturated, dense, fine to medium SAND, with some silt		SM	5	8-12-15-16	Laboratory Test Results Sample No. 6 From 14 to 15.5 feet
10	18						Sieve Analysis
12	16	Gray, saturated, loose, fine, clayey SAND		SC	6	3-4-4	Sieve Size / Passing % No. 10 100 No. 20 99.8 No. 40 98.8 No. 60 96.8 No. 100 90.6 No. 200 42.0 Natural Moisture = 21.0%
14	14						
16	12						
18	10	Gray, saturated, medium dense, fine to medium SAND, with little clay, little silt		SC	7	6-7-7	
20	8						
		Boring terminated at 20.5 feet.					
22	6						
24	4						
26	2						
28	0						
30							

HYNES & ASSOCIATES

LOG OF BORING D-2

Becker Morgan Group
312 West Main Street, Suite 300
Salisbury, Maryland 21801

Indian River School Classroom Annex Buildings

Showell Project No.: JDH-10/13/225

Date Completed: : April 26, 2013
Logged By: : D. Hynes
Drilled By: : B. Anderson
Drilling Method: : HSA (Mobile B-47 HD)
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 29.0	DESCRIPTION	GRAPHIC	USCS	Sample	Blows per 6 inches	Remarks
0	29	Light brown and brown, wet, loose, fine to medium SAND, with trace to little silt (mottled)		SM	1	2-3-4-6	Scale 1" ~ 4.5 feet
2	27	Brown, wet to saturated, medium dense, fine to medium SAND, wtih some silt		SM	2	6-7-7-8	Groundwater was encountered at 4 feet during drilling operations.
4	25	Gray, saturated, medium dense, fine to medium SAND, wtih trace silt		SP	3	6-9-10-11	At completion water was at 4 feet; boring caved in at 5 feet.
6	23				4	6-6-7-8	
8	21				5	7-6-8-11	
10	19	Boring terminated at 10 feet.					
12	17						
14	15						
16	13						
18	11						
20	9						
22	7						
24	5						
26	3						
28	1						
30							

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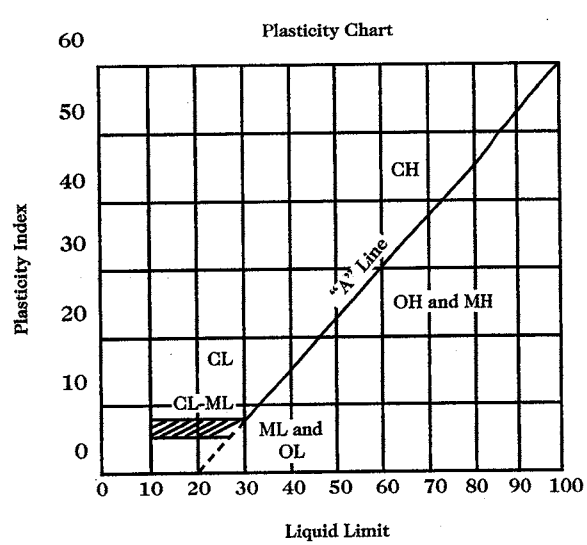
JOHN D. HYNES & ASSOCIATES, INC.

Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			*Group Symbols*	*Typical Names*	*Laboratory Classification Criteria*		
Coarse-grained soils (More than half of material is larger than No 200 sieve size)	Gravels (More than half of coarse fraction is larger than No 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No 200 sieve size), coarse grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent *Borderline cases requiring dual symbols*[a]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel sand mixtures, little or no fines		Not meeting all graduation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a] d u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands,		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all graduation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a] d u	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soils			



32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
E-mail - jdhynes@aol.com

HYNES

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON-COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

DENSITY

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

RELATIVE PROPORTIONS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

PARTICLE SIZE IDENTIFICATION

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- Coarse - 1 to 3 inch
	- Medium - 1/2 to 1 inch
	- Fine - 4.75 mm to 1/2 inch
Sand	- Coarse - 2.0 mm to 4.75 mm
	- Medium - 0.425 mm to 2.0 mm
	- Fine - 0.075 mm to 0.425 mm
Silt	- 0.075 mm to 0.002 mm

COHESIVE SOILS
(Clay, Silt and Combinations)

CONSISTENCY

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft.
Hard	- 31 blows/ft. or more

PLASTICITY

Degree of Plasticity	Plasticity Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	over 22

Classification on logs are made by visual inspection of samples unless a sample has been subjected to laboratory classification testing.

Standard Penetration Test - Driving a 2.0" O.D., 1-3/8" I.D., splitspoon sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test value (N - value) can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.). (ASTM D-1586)

Strata Changes - In the column "Soil Descriptions," on the drill log, the horizontal lines represent strata changes. A solid line (—) represents an actually observed change, a dashed line (----) represents an estimated change.

Groundwater - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.

32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 • Fax 410-548-5346

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you*—should apply the report for any purpose or project except the one originally contemplated.

Read the full report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE

8811 Colesville Road Suite G106 Silver Spring, MD 20910
Telephone: 301-565-2733 Facsimile: 301-589-2017
email: info@asfe.org www.asfe.org

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