Report of Geotechnical Evaluation

August 12, 2021

Proposed Dealership Expansion

DCH Brunswick Toyota
1504 US Route 1
Block 143.05, Lots 18.02 & 19.01
Township of North Brunswick, Middlesex County, New Jersey

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1.0 Introduction

This report presents the results of the geotechnical exploration undertaken to provide geotechnical design criteria and foundation support recommendations for the proposed DCH Auto service building addition, located in the Township of North Brunswick, Middlesex County, New Jersey (Block 143.05, Lots 18.02 & 19.01), as shown on the attached Site Location Map (Figure No. 1). Colliers Engineering & Design understands that the proposed development consists of an approximately 38,521 square-feet (SF) addition to the existing service building and the removal of the former Saturn building. Additional development also includes various appurtenant site improvements.

The subsurface exploration was conducted in accordance with our proposal 19003878P (dated June 29, 2020), and your subsequent written authorization. The purposes of this exploration are to evaluate the existing subsurface conditions at the project site, and to provide geotechnical related design and construction recommendations for the proposed service building addition and supporting site improvements.

Our scope of services for this exploration included the completion of five test borings performed throughout the proposed building addition footprint area, subsequent laboratory testing of representative soil samples, engineering analyses of the subsurface data obtained from this field exploration, and the preparation of this report.

2.0 Site Description

The subject project site is located to the rear (southeast) of the existing DCH Brunswick Toyota facility located at 1504 US Route 1 in the Township of North Brunswick, Middlesex County, New Jersey and is referred to as Block 143.05, Lots 18.02 & 19.01 on the local Tax Maps. The site currently contains two single-story dealership buildings and asphalt paved vehicle storage/parking areas.

The existing facility is bordered to the north by US Route 1 followed by developed commercial properties containing single story buildings, to the south and east by an apartment complex containing 2-story buildings and associated paved parking and drive lanes, and to the west by paved access roads and retention pond followed by developed commercial properties containing single and 2-story buildings.

According to the undated Dimension Plan prepared by Colliers Engineering & Design, the existing site grades in the footprint of the proposed building addition are generally level and range from approximately Elevation 119 to 121 feet, NAVD88. Site grades within the area gently slope upward to the south/southeast across the site (from US Route 1 to the lot). An additional Dimension Plan dated July 30, 2021, prepared by Colliers Engineering & Design was provided after the subsurface exploration was performed. This updated plan shows the new alignment of the proposed building addition and the removal of the former Brunswick Automotive Professionals building.

3.0 Proposed Development

The proposed development includes the demolition and removal of the former Saturn dealership building and construction of an approximately 38,521 SF single-story addition to the Toyota dealership building with appurtenant site improvements. Proposed grading plans depicting finished floor elevations were not provided.

We have assumed that the proposed building addition will match the construction of the adjoining building and will consist of masonry construction with steel or wood framing and concrete slab-on-grade. Building loading information was not available during the preparation of this report, but we assume that maximum column and wall loads will be typical to those of similar sized structures.

4.0 Scope of Services

The purposes for this subsurface exploration are to evaluate the subsurface conditions for the construction of a new building addition and to provide geotechnical recommendations for proposed site development, foundation construction, earthwork, and utility construction. We were authorized to perform the following scope of services:

a) Retain a drilling contractor to perform test borings to explore the subsurface soil and groundwater conditions;

b) Provide full-time technical observation of the work of the drilling contractor;

c) Obtain representative soil samples encountered within the test borings;

d) Evaluate and prepare test boring logs showing the types of soils, as well as depth to encountered groundwater;

e) Perform laboratory analyses of representative soil samples; and

f) Prepare this *Report of Geotechnical Evaluation*, presenting the results of our subsurface explorations, engineering evaluation, and subsequent recommendations for foundation support options and site earthwork considerations.

5.0 Subsurface Exploration and Laboratory Testing

The subsurface conditions at the site were explored on June 1, 2021 through the advancement of a total of five test borings, identified herein as TB-1 through TB-5. The test borings were field-located by Colliers Engineering & Design using existing site features and were generally performed throughout the footprint area of the proposed building addition. The layout of the test boring locations is based on the undated Dimension Plan prepared by Colliers Engineering & Design. The approximate test boring locations are shown on the Exploration Location Plan, Figure No. 2.

The test borings were advanced to termination depths ranging from 15 to 20 feet below ground surface (bgs) by Soil Borings Drilling of Haddon Township, NJ, using standard hollow-stem auger drilling techniques. Split spoon sampling was performed in accordance with ASTM D1586 (Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils). The number of blows required to drive the split spoon every 6 inches into the soil was recorded and is shown on the test boring log. The sum of blows for the interval from 6 inches to 18 inches is the N-value. The N-value indicates the soil resistance encountered within each sampling interval. Each of the test borings, as part of this exploration, were advanced in the asphalt paved parking area and were backfilled and patched upon completion.

The test borings were performed under the full-time technical observation of Colliers Engineering & Design. Representative soil samples were collected and visually identified in accordance with the Burmister Soil Classification System. Details pertaining to the subsurface conditions encountered are presented on the Test Boring Logs in Appendix A.

The laboratory testing was programmed to determine the physical properties of the subsoils, as well as to augment the field exploration. The stratigraphic continuity and physical characteristics of the subsoils were evaluated by the determinations of water content, grain size distribution by both mechanical sieve and Atterberg limits, and organic content. Laboratory Testing Results are presented in Appendix B.

Soil samples obtained during this exploration will be retained by Colliers Engineering & Design for three months from issuance of this report. At the end of this time, they will be discarded unless we receive other instructions from DCH Auto Group.

6.0 Subsurface Conditions

6.1 Regional Geology

The site is located within the Piedmont Physiographic Province of New Jersey. Based on the *Surficial Geology of the New Brunswick Quadrangle, Middlesex and Somerset Counties, New Jersey* (Stanford, S.D., Monteverde, D.H., et al., 1998), the surficial soils are composed of loamy marine and alluvial deposits from the Pensauken Formation (Tp). The Pensauken Formation is characterized by loamy sand stratified with pebble gravel and minor cobble gravel that is a reddish yellow to yellow color. The sand is predominantly quartz with some glauconite, mica and red shale while the gravel is predominantly quartz, quartzite and ironstone.

According to the *Bedrock Geology of the New Brunswick Quadrangle, Middlesex and Somerset Counties, New Jersey*, the surficial soils are underlain by the Passaic Formation (JTrp), which is mapped to consist of interbedded siltstone, mudstone and shale. The formation tends to be reddish-brown to brownish purple and grayish-red.

6.2 Subsurface Description

Based on the results of the test borings, the generalized subsurface conditions at the site may be described below, in order of depth:

- **Surface Cover:** Asphalt and granular subbase was encountered at the ground surface of the test borings. The asphalt and subbase thickness at these locations was measured to be up to approximately ±6 inches.

- **Apparent Fill Material (Stratum F):** Underlying the surficial cover materials are materials that were generally brown and black medium to fine gravel, coarse to fine sand, and silt and clay occurring in intermixed layers. This layer ranged in depth from approximately 2 feet bgs, to as deep as 4 feet bgs in TB-3 and 8 feet bgs in TB-4. The N-values for this stratum varied from 0 to 22 blows per foot (bpf), averaging 8 bpf, and this material was generally noted to have a very loose to medium dense state of relative density. The layer appears to consist of fill material.

- **Natural Granular & Fine-Grained Soil (Stratum 1):** Underlying the apparent fill material are natural materials consisting of brown, gray, orange and red coarse to fine sand with varying amounts (some to and) of clay and silt interbedded with layers of clay and silt with little fine sand. This layer was encountered to the termination depths of the test boring; extending to approximately 11 to 19 feet bgs. The N-values for this stratum varied from 8 to greater than 50 blows per foot (bpf), averaging 28 bpf, and this material was generally noted to have a medium dense to very dense state of relative density. Split spoon and auger advancement refusal were encountered within this Stratum.

The subsurface material encountered is generally consistent with the regional geology described above.

6.3 Groundwater Conditions

Groundwater was not encountered in the test borings extending to the maximum exploration levels ranging from approximately 11 to 19 feet bgs. It should be noted that fluctuation in groundwater levels can occur due to several factors, including variations in precipitation, seasonal changes, and site development activities, which can alter surface water drainage paths.

7.0 Summary of Conclusions and Recommendations

The test borings indicate that the site is favorable for use of shallow foundation and slab-on-grade construction following the implementation of a limited stabilization program to densify existing near surface soils. Based on our geotechnical explorations, we have identified the following issues to be addressed during the design and construction of the proposed development:

- The construction of the proposed building will require the demolition and removal of existing Saturn dealership building and associated structural elements, pavements, and utility conduits, resulting in the probable loosening or softening of the exposed subgrade.

Therefore, we recommend that any disturbed areas within the limits of new construction be evaluated and, if necessary, over-excavated and replaced with load bearing fill. In portions of the proposed addition footprint with loose soils greater than 3 feet in thickness, soils should be over-excavated followed by the densification and stabilization of exposed subgrade materials using a high energy proof-rolling prior to the placement of load-bearing fill to reach proposed final grades. The following sections summarize our recommendations with respect to site and subgrade preparation, as well as the construction of foundations, floor slabs and site utilities.

7.1 Site Preparation

The purpose of these site preparation procedures is to provide stable and uniform bearing conditions for the proposed building foundations and slab-on-grade. This includes the compaction of the loose soils encountered in the upper 4 to 8 feet of the project site. The following procedures should be performed under the technical supervision of the Geotechnical Engineer.

- Install soil erosion and sedimentation control devices, as well as temporary stormwater management facilities, as specified by Site/Civil Engineer.
- Maintain positive drainage conditions throughout construction, avoiding unnecessary ponding of stormwater in excavations or low areas of the site. Seal-roll exposed soil or subgrade surfaces prior to rain or snow events, and promptly remove any standing water immediately afterwards.
- Any existing underground or above-ground utility locations should be verified in the field and relocated or abandoned as necessary, prior to construction. If the option to abandon utilities in-place is chosen, we recommend that a lean cement grout (250 psi) be used to fill the utility lines.
- Demolish the existing structure elements including all foundations, slabs, sidewalks, pavements, and possible conduits that will interfere with the new development. Below-grade elements shall be removed to a depth of at least 3 feet below proposed subgrade elevations. Those deeper than 3 feet below the new construction may remain in place provided they do not interfere with new construction (utility lines, for example). Hoe rams or specialized demolition equipment may be required to dislodge and remove such buried obstructions.
- Demolition debris shall be disposed of off-site in accordance with local, state, and federal regulations. If desired, some of this material may be crushed to a NJDOT DGA gradation and stockpiled for future use on site.
- Remove and dispose of vegetation and topsoil at an appropriate off-site facility.
- Following demolition of the existing structural elements not to remain, stripping of pavements and prior to the placement of load-bearing fills, complete a surficial stabilization program within structural areas of the site, plus a 5-foot perimeter (where possible), by compacting the exposed subgrade with a 10-ton smooth drum roller with a minimum of 6 passes applied in a crisscrossing pattern. Padded drum (sheepsfoot) rollers should be considered within predominantly fine-grained (silt/clay) subgrades. The vibratory or static modes shall be used as directed by the on-site Geotechnical Engineer.

Specific attention should be made to areas of previous development and the deep fill observed in test boring TB-4.

- Afterwards, the subgrade shall be proof-rolled with a loaded tri-axle dump truck. Any remaining unstable zones detected by this procedure shall be stabilized via moisture conditioning and recompacting efforts, removal and replacement, or other means necessary, as determined by the onsite Geotechnical Engineer. Excavate and replace any loose disturbed soils from within and a minimum distance of 5 feet beyond the proposed building footprint. **Specific attention should be made to areas of previous development and the deep fill observed in test boring TB-4.**
- Following the satisfactory subgrade preparation, place and compact load-bearing fill, as needed, in thin, controlled, compacted lifts to achieve the final subgrade elevations in accordance with the recommendations presented in the Load Bearing Fill section of this report.
- In accordance with the Occupational Safety and Health Administration (OSHA) requirements, all excavations shall be properly sloped or otherwise structurally retained to provide stable and safe working conditions.

7.2 High Energy Proof Rolling

Following the demolition of the existing structural elements, stripping of vegetation and topsoil, and prior to the placement of load-bearing fills, the exposed subgrade soils of the apparent fill and natural deposits should be improved by utilizing high energy (10-ton minimum static weight) vibratory rollers with a minimum of 6 passes applied in a crisscrossing pattern. **Specific attention should be made to areas of previous development and the deep fill observed in test boring TB-4.** A smooth drum roller should be utilized on predominantly granular soil and a padded drum or sheepsfoot roller should be utilized on predominantly fine-grained (silt/clay) soil. Caution is advised when compacting near to the existing development. The compactor should not be used in vibratory mode within 5 feet of the existing dealership building.

The resulting energy will improve densities ranging from 3 to 4 feet below existing site grades depending upon the nature of the soils and groundwater levels at the time. The use of high energy proof-rolling equipment will also prepare roadway/parking areas and is recommended for all paved areas. Areas that do not respond favorably to high energy proof-rolling may require the use of over-excavation and replacement methods.

7.3 Load Bearing Fill and Backfill

All fill/backfill proposed to support building and site features that would be adversely affected by settlement is considered load-bearing fill. Materials used as load-bearing fill should consist of inorganic, readily compactable, predominantly well-graded granular soils with no more than 15 percent fines (material passing the No. 200 sieve). We recommend that fragments having a maximum dimension greater than 3 inches be excluded from the fill. The moisture content of the fill materials should be controlled to within tolerable limits of the optimum moisture content by conditioning (e.g. wetting, aeration, or soil blending) to facilitate compaction. The field moisture-density relationship of materials shall be determined in accordance with the modified Proctor (ASTM D1557). Fill placement and compaction activities shall be monitored by the onsite Geotechnical Engineer.

The excavated site soils can be reused as compacted structural fill, provided they are screened of deleterious matter, if encountered. Portions of the site soils contain elevated percentages of silt and/or clay and will be subject to moisture-related compaction problems. As such, and depending on the prevailing weather conditions at the time earthwork is performed, moisture conditioning of the excavated soils may be required prior to their reuse as fill or backfill. Where possible, these materials should be stockpiled separately for re-use in landscaped and non-structural areas. If air-drying of the soil is not possible due to precipitation and/or colder temperatures, or if the project schedule cannot accommodate the time required for air-drying of the soil, unsuitable excavated soils may need to be exported from the site and replaced with suitable imported granular fill materials.

Imported granular fill material, if required, shall be well-graded and should conform to the following material gradation requirements. Alternate imported fill materials such as dense graded aggregate and recycled concrete aggregates may also be considered:

Table No. 1 – Recommended Gradation Envelope (Imported Granular Fill)

U.S. Standard Sieve Size	Percent Finer by Weight
2″	100
1″	80 – 100
3/8″	70 – 100
No. 10	50 – 100
No. 30	30 – 85
No. 60	15 – 65
No. 200	5 – 15

Subgrades to receive fill should be subject to high energy compaction, per Section 7.2, and evaluated for stability by the Geotechnical Engineer. Load-bearing fill should be placed in horizontal lifts with a maximum loose-lift thickness of 12 inches. It is recommended that load bearing fill within the construction area be compacted to the requirements outlined in Table No. 2. Compactive effort for each lift of fill should be verified by in-place density testing prior to placement of subsequent lifts. Adjustments to the lift thickness and/or compaction equipment may be required, as directed by the onsite Geotechnical Engineer, based on prevailing weather conditions at the time of fill placement and performance of the compacted soils. In addition, it is recommended that fills be visually stable under construction traffic, as determined by an onsite representative of the Geotechnical Engineer. Quality control testing of in-place fill densities should be conducted throughout the earthwork, load-bearing fill, and subgrade preparation activities.

Table No. 2 – Recommended Compaction

Type of Support	Granular Load-Bearing Fill
Structural fill below foundations, floor slabs and pavements	95% Modified Proctor
Backfill for retaining walls, below-grade walls and utility trenches	92% Modified Proctor
General fill for landscaped and other non-structural areas	90% Modified Proctor

Note 1: Increase the compaction percentages by 3% when utilizing Standard Proctor values (ASTM D698); only permitted in tight areas where access is limited to small hand operated compaction equipment.

7.4 Foundation Recommendations

The test borings indicate that the proposed building addition can be adequately supported using a conventional shallow foundation system, provided that the site-specific stabilization and load-bearing fill procedures outlined above are implemented. Conventional spread and strip footings may be designed and proportioned assuming a maximum allowable soil bearing pressure of 3,000 pounds per square foot (psf). The bearing capacity may be increased by 30% for transient loadings. Footings may be supported on compacted Apparent Fill, Natural Deposits (Stratum 1) or on newly placed compacted structural fill, provided the subgrades have been adequately compacted and stabilized. Loose or soft soil is not considered suitable for foundation support and, if encountered, should be excavated and replaced with load-bearing fill compacted in-place.

Footing subgrades should be compacted using a "jumping jack" or other suitable trench compaction equipment upon completion of footing excavation and prior to reinforcing steel installation. Afterwards, the foundation bearing surface should be observed by the onsite Geotechnical Engineer prior to foundation construction (i.e. reinforcing steel installation and concrete placement) for consistency with the recommended design allowable soil bearing pressure.

The length of time that the exposed subgrade remains exposed to weather conditions should be kept to a minimum so as to not generate more unsuitable material removal. On-site fill and soils exposed to weather conditions may soften, requiring removal and replacement prior to fill placement and foundation installation, due to their sensitivity to moisture. Water that accumulates in the bottom of the excavation should be removed promptly. Due to the excessive amounts of fine-grained soil within the in-situ subgrade anticipated at the prepared foundation bearing level, any foundation excavations that will be open for more than one day, a 2 inch lean concrete mud slab is recommended to protect the exposed subgrade.

The minimum width of all wall footings should be 24 inches, and the minimum horizontal dimension of all spread footings should be 36 inches, regardless of the bearing pressure developed. All exterior footings subject to frost action should be based at least 36 inches below the adjacent exterior grade for frost protection and bearing considerations. Interior footings should be based at least 24 inches below the finished floor elevation. In addition, we recommend that the shallow foundations bear below a zone bounded by a plane that extends outward and upward on a 1:1 slope from any underground utility excavation, or other underground features.

Shallow foundations constructed adjacent to the existing dealership building should bear at an elevation **at or lower than the existing building spread footing level** and satisfy the frost heave protection criteria as specified above. The proposed building addition shallow foundations may be stepped down or up extending outward from the existing building foundation to accommodate changes in the final exterior grades provided that the minimum depth requirements for frost heave protection are satisfied. It is not anticipated that underpinning of the existing dealership building foundations will be required for construction of the proposed building addition, but if the proposed shallow foundations are more than 2 feet deeper than the existing foundations, underpinning will be needed. A licensed professional engineer should design the underpinning system.

It is estimated that maximum post-construction footing settlement of the proposed building addition will be less than 1-inch and the differential settlement between adjacent columns will be less than ½ inch. These values are generally within tolerable limits for this type of structure.

7.5 Floor Slab

Assuming the proposed building addition subgrade is stabilized, compacted, and proof-rolled under the observation of a Geotechnical Engineer as described in the Site Preparation Section 7.1, the floor slab for the proposed facility may be supported on-grade in accordance with the following criteria.

The subgrade should be compacted with a large vibratory roller just prior to installation of the aggregate base to re-compact any materials disturbed by previous construction activities or adverse weather conditions. Any unstable zones detected that cannot be stabilized by additional compaction should be removed, and the excavated area backfilled with load-bearing fill.

An aggregate base course of a dense-graded aggregate (DGA) consisting of crushed stone or recycled concrete (NJDOT 901.10) is recommended below the slab to promote uniform support and curing conditions. If placed immediately prior to slab construction, the minimum compacted thickness shall be 4 inches. Alternatively, if placed earlier as the final lift of structural fill and used as a working surface during construction, the minimum compacted thickness shall be 6 inches. This second approach is acceptable provided the aggregate base is repaired, re-graded, and re-compacted as needed prior to concrete placement. All structural fill supporting the floor slab, including the DGA base course, should be compacted to a minimum of 95 percent of the maximum dry density, as determined by the modified Proctor test (ASTM D1557).

It is anticipated that, following proper site preparation outlined herein, the subgrade soils can achieve a Modulus of Subgrade Reaction on the order of 125 pounds per cubic inch (pci). Based on the type of soil at the site, a coefficient of sliding friction of 0.30 may be used for design of a floor slab without a vapor retarder. However, a minimum 10-mil vapor retarder shall be placed over the subgrade in areas of the building to receive a floor covering (tile, carpeting, epoxy coating, etc.), such as an office area. Where vapor retarders are used, a reduced coefficient of sliding friction of 0.20 should be used for design.

Reinforced concrete floor slabs should be simply supported at wall and column junctures to allow unrestricted rotation of the slab edges. Alternatively, the slabs should be free to undergo vertical deflections at the edges.

7.6 Seismic Considerations

In accordance with the provisions of the 2018 International Building Code (New Jersey Edition), the site generally has a Site Class Definition of "D" for the existing subsurface soil and groundwater conditions. This classification was determined by utilizing the Standard Penetration Test (SPT) blow count data through the upper 19 feet of the subsurface profile. Medium compact conditions were assumed throughout the remainder of the soil profile to a depth of 100 feet. The following design parameters are provided utilizing tables in the IBC Code and United States Geological Survey (USGS) design tools:

From the USGS and using ASCE 7-16 information (See Appendix C):

Short Period Spectral Acceleration (S_S)	0.253g
Spectral Acceleration at 1 Second (S_1)	0.055g
Peak Ground Acceleration (PGA)	0.152g

7.7 Surface Water and Groundwater Control

Groundwater was not encountered during these explorations extending to a maximum depth of approximately 19 feet bgs. However, perched water conditions may be encountered in the near surface subgrade due to the presence of silts and clays, especially if construction starts during or after rainy seasons. Any perched water and ponding stormwater can be managed using standard sump pit and pump techniques. If needed, sump pits should be installed outboard of the proposed building addition footprint area, filled with minimum ¾-inch clean stone and lined with geotextile filter fabric to prevent excessive particle migration, particularly if heavy pumping is required. The fine-grained soils are anticipated to reduce dewatering pump efficiency. Pumped water should be discharged away from the building pad, structural areas and open excavations, and filtered as per soil erosion / sediment control requirements and any applicable environmental regulations.

Surface grading should be maintained on a continual basis during construction to direct surface water runoff away from open excavations and prevent water from pooling on subgrade soils. The contract documents should require the contractor to provide whatever means and methods are necessary to maintain stable, relatively dry excavations and subgrade conditions at all times during construction. It is recommended that the finished grades surrounding the proposed building addition slope away from the building perimeter and that any water from discharge points (i.e. roof gutter, etc.) be channeled away from the building perimeter. This is required due to the fine-grained soils, their sensitivity to water and possible reduction in stability and strength.

7.8 Below Grade Utilities

The proposed underground utility installation is not anticipated to be impacted by groundwater concerns, provided they are installed at typical depths of 4 to 6 feet or less below existing site grades. Utility excavations may also encounter perched water conditions in the near surface due to the presence of silts and clays, especially if construction starts during or after rainy seasons.

The majority of site soils will be suitable for support of subsurface utilities. We offer the following recommendations specific to utility construction:

- Any excavated utility trenches beneath the proposed finished floor, or pavement subgrades should have the subgrade soils compacted evaluated by the onsite Geotechnical Engineer or technician, then backfilled with compacted load-bearing fill in accordance with the recommendations outlined in Section 7.3 of this report. If loose or otherwise unstable material is present, this material should be removed and replaced with load-bearing fill.

- Prior to installation, the bearing surface for utility structures (manholes, vaults, etc.) should be evaluated by the onsite Geotechnical Engineer or technician. Should debris or unsuitable soils be encountered at the utility invert levels, the subgrade should be over-excavated a minimum depth of 6 inches and backfilled with load-bearing fill material to provide uniform support.

- The utility structures should receive a bedding of at least 4 inches of dense-graded aggregate (DGA), as defined by current NJDOT construction standards.

7.9 Existing Utilities

Any existing underground utilities should be located, and those utilities which are not reused should be removed and capped. The utility trenches that are in the influence zone of new construction are recommended to be backfilled with compacted structural fill or grout, as needed. Underground utilities, which are to be reused, should be evaluated by the Structural Engineer and utility backfill should be evaluated by the onsite Geotechnical Engineer to determine their suitability for support of the planned construction. If any existing utilities are to be preserved, grading operations must be carefully performed so as to not disturb or damage the existing utility.

7.10 Preliminary New Pavement Recommendations

New pavements can be constructed on stable in-place soils or newly placed and compacted load-bearing fill. Immediately prior to pavement construction, the exposed pavement subgrade should be compacted with a minimum 10-ton smooth-drum roller and be proof-rolled with a loaded tri-axle dump truck under the observation of the onsite Geotechnical Engineer to evaluate stability. Subgrade areas that are observed to be unstable should be selectively over-excavated to more stable material and replaced with load-bearing fill or granular subbase material.

Depending on the timing between pavement subgrade preparation and pavement section construction, the contractor should anticipate some remedial effort to achieve a stable subgrade prior to paving, even if the subgrade soils had previously been compacted to the required densities. Prudent scheduling of pavement construction and control of construction equipment traffic will reduce the need for potential remedial work.

Provided the pavement subgrade is prepared in accordance with the recommendations contained herein, we recommend the minimum light-duty (passenger vehicles only, no truck traffic) flexible pavement sections, summarized in Table No. 3 below, be designed assuming a California Bearing Ratio (CBR) of 5 for the subgrade soils. These recommended pavement sections may be subject to local official approval.

Table No. 3 – Recommended Minimum Flexible Asphalt Pavement Sections (Automobile Traffic Only)

Asphalt Pavement Element	Thickness (inches)
9.5M64 HMA Wearing Course	2.0
19.5M64 HMA Base Course	3.5
Aggregate Subbase (1)	6.0
Improved Subgrade (2)	-

(1) Aggregate base course to be dense-graded aggregate (DGA) or recycled concrete aggregate (RCA) conforming to NJDOT 901.10, with less than 10 percent finer than the No. 200 sieve and all fines to be non-plastic (PI=0). Aggregate base course to be compacted to a minimum of 95 percent of the maximum dry density, as determined by the Modified Proctor test, ASTM D1557.

(2) Subgrade shall consist of load-bearing fill and/or existing materials capable of achieving a minimum CBR value of 5. The moisture content of the material should also be maintained within ±2 percent of the optimum moisture content.

Supplemental Explorations

The subsurface explorations were conducted only within the footprint area of the proposed building as access to explore future new pavement areas was restricted due to the presence of existing buildings at those locations. Due to the future demolition of the existing buildings, and variable fill encountered in the test borings, it is anticipated that fill soils will be encountered within the new pavement areas. The amount and condition (i.e. composition and consistency) of the anticipated fill soils is currently unknown.

Following the demolition of the existing buildings within the proposed new pavement areas and prior to new pavement construction, a supplemental exploration shall be performed to confirm the pavement recommendations provided above. A conservative approach is provided above due to the unknown subgrade conditions within the new pavement areas. Performing a supplemental exploration to evaluate the pavement subgrade conditions may allow for a reduction in the recommended minimum pavement sections above.

Additionally, should recommendations be requested to address conditions of existing pavement for potential reuse (i.e. mill and overlay or seal coat), explorations to evaluate pavement, subbase and subgrade conditions can be performed.

7.11 Over-Excavation/Stabilization

Construction during extended wet weather periods could create the need to over-excavate exposed soils if they become disturbed and cannot be recompacted due to elevated moisture content and/or weather conditions. The need for over-excavation should be confirmed through continuous observation and testing by the onsite Geotechnical Engineer. Selective drying and recompaction of unsuitable subgrades may be accomplished by scarifying or windrowing surficial material during extended periods of dry and warm weather. Otherwise, use of imported material or chemical subgrade stabilization methods, such as cement or fly ash, could become necessary at additional cost. The need for subgrade over excavation and/or stabilization will be dependent, in part, on the subgrade protection effort exercised by the contractor. Similar subgrade stability problems may develop after completion of subgrade preparation due to weather and construction traffic effects, requiring stabilization prior to floor slab-on-grade and pavement construction.

8.0 Construction Observation

Regardless of the thoroughness of a geotechnical engineering exploration, there is always a possibility that conditions between the borings and below the depths explored may be different from those encountered in the borings, that conditions are not as anticipated by the designers, or that the construction process has altered the subsurface conditions. Therefore, geotechnical engineering construction observation should be performed under the supervision of a Geotechnical Engineer from Colliers Engineering & Design who is familiar with the intent of the recommendations presented herein. This observation is recommended to evaluate whether the conditions anticipated in the design actually exist or whether the recommendations presented herein should be modified where necessary. Colliers Engineering & Design should also provide observation and testing of compacted structural fill and backfill. Colliers Engineering & Design recommends that a representative from Colliers Engineering & Design be on-site on a full-time basis during the earthwork construction and subgrade preparation.

9.0 Closing

The conclusions and recommendations presented in this report are based, in part, on the explorations accomplished for this evaluation. The number, location, and depth of the explorations were completed within the constraints of budget and site access so as to yield the information to formulate the recommendations. We recommend that we be provided the opportunity for general review of the project plans and specifications when they become available, to confirm that the recommendations and design considerations presented in this report have been properly interpreted and implemented into the project design package.

We recommend that the test boring logs be a part of the specifications for the project along with a reference to the plan sheets that contain the test boring locations for informational purposes. Should the data not be adequate for the Contractor's purposes, the Contractor may make, prior to bidding, his own explorations, tests, and analyses.

10.0 Clarification

Conclusions and recommendations presented in this report are based solely on the on the findings of our geotechnical exploration. The number, location, and depth of the explorations were completed within the constraints of the exploration’s budget.

We emphasize that this report should be made available to prospective bidders for informational purposes. We would recommend that the project specifications contain the following statement:

> *"A geotechnical engineering report has been prepared for this project by Colliers Engineering & Design. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Engineer and represent their interpretation of the subsurface conditions, field and laboratory testing, and the results of analyses which they have conducted. Should the data contained in this report not be adequate for the Contractor's purposes, the Contractor may make, prior to bidding, his own investigation, tests, and analyses."*

11.0 Limitations

This report has been prepared in accordance with generally accepted geotechnical design practice for the exclusive use of DCH Auto and their agents for specific application to this project. This report has not been prepared to serve as the plans and specifications for actual construction without the appropriate interpretation by the project Architect, Structural Engineer, and/or Civil Engineer. This report has been based on assumed conditions and characteristics of the proposed development where specific information was not available. The conclusions, projections, and recommendations presented in this report cannot be applied to other building configurations or loads.

We recommend that the Architect, Civil Engineer, and Structural Engineer, along with any other design professionals involved in this project, carefully review the assumptions noted in this report regarding the proposed development so that they are consistent with the actual planned development. When discrepancies exist, they should be brought to our attention so that they do not affect the conclusions and recommendations provided in the report. The project plans and specifications should be submitted to us for review so that the geotechnical-related conclusions and recommendations provided herein have been correctly interpreted and are incorporated into the design.

The conclusions and recommendations contained in this report are based upon the subsurface data obtained during this investigation and on details stated in this report. The validity of the projections, conclusions, and recommendations contained in this report is necessarily limited by the scope of field program and by the number of explorations that were made. It is understood that the number of explorations made are consistent with good engineering practice but, given the nature of subsurface conditions, there is a possibility that actual conditions encountered may differ from those projected in this report. Should conditions arise which differ from those described in this report, Colliers Engineering & Design should be notified immediately and provided with all information, when available, regarding subsurface conditions.

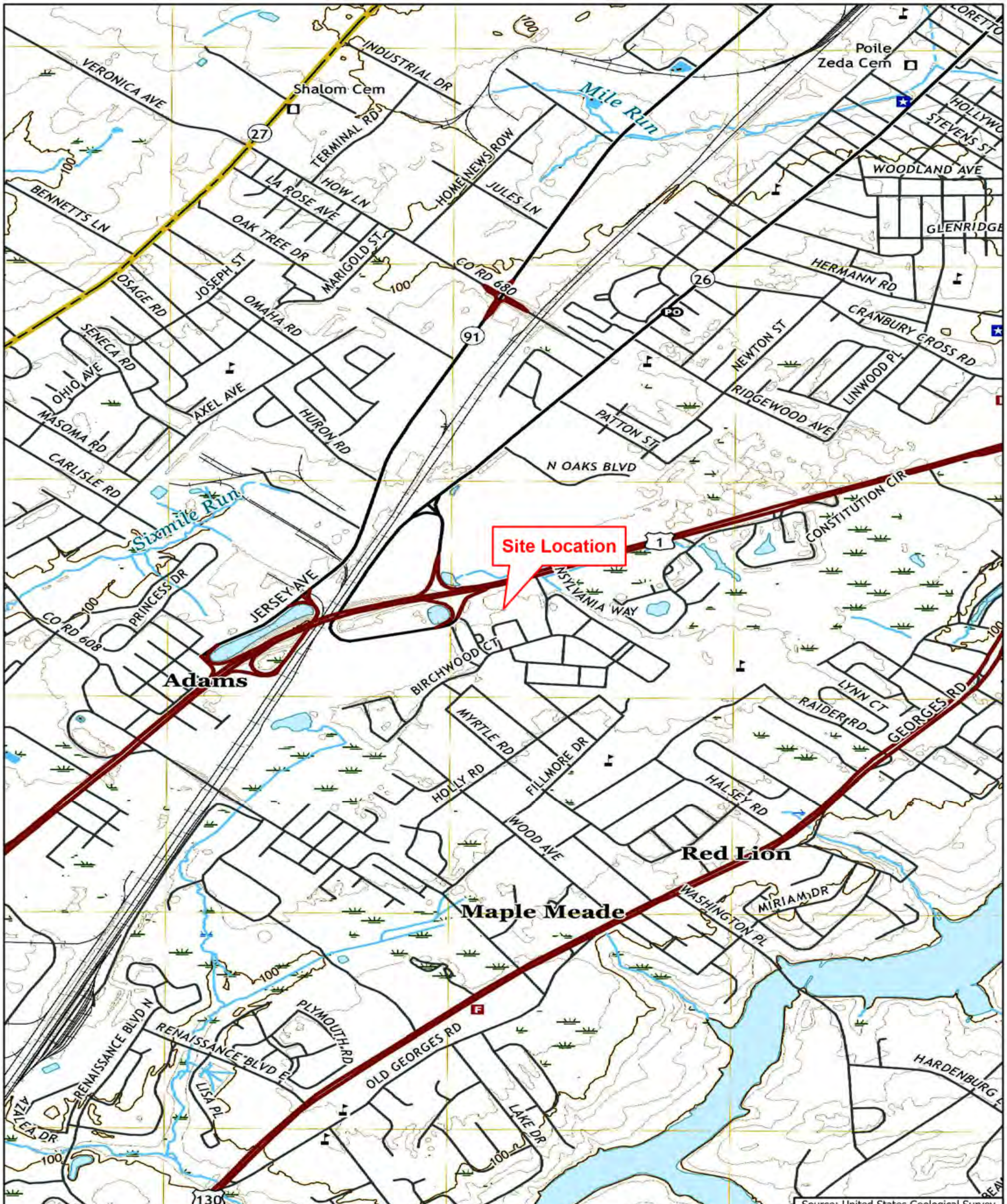
Our recommendations are based upon the assumption that the services of a qualified Geotechnical Engineer will be retained for the observation of excavation operations, proof-rolling, load-bearing fill placement, foundation installation, and all critical earthwork operations. Colliers Engineering & Design has the capability of providing these services and has provided a proposal to perform the on-site quality assurance observation and materials testing.

The scope of this evaluation was limited to the evaluation of the load-carrying capabilities and load stability of the soils. Oil, hazardous waste, radioactivity, irritants, pollutants, radon or other dangerous substances and conditions were not the subject of this exploration.

R:\RedBank\Projects\2019\19003878A\Reports\Geotechnical\01-Exploration\GeoRpt-FND\Report Docs\210812_RP_GeoRpt - DCH Brunswick Toyota.docx

Colliers Engineering & Design

Figures



Prepared For:

DCH AUTO GROUP

Delivering Customer Happiness

Prepared By:

Red Bank Office
331 Newman Springs Rd #203
Red Bank, NJ 07701
T: 877.627.3772
www.colliersengineering.com

Colliers Engineering & Design

SITE LOCATION MAP

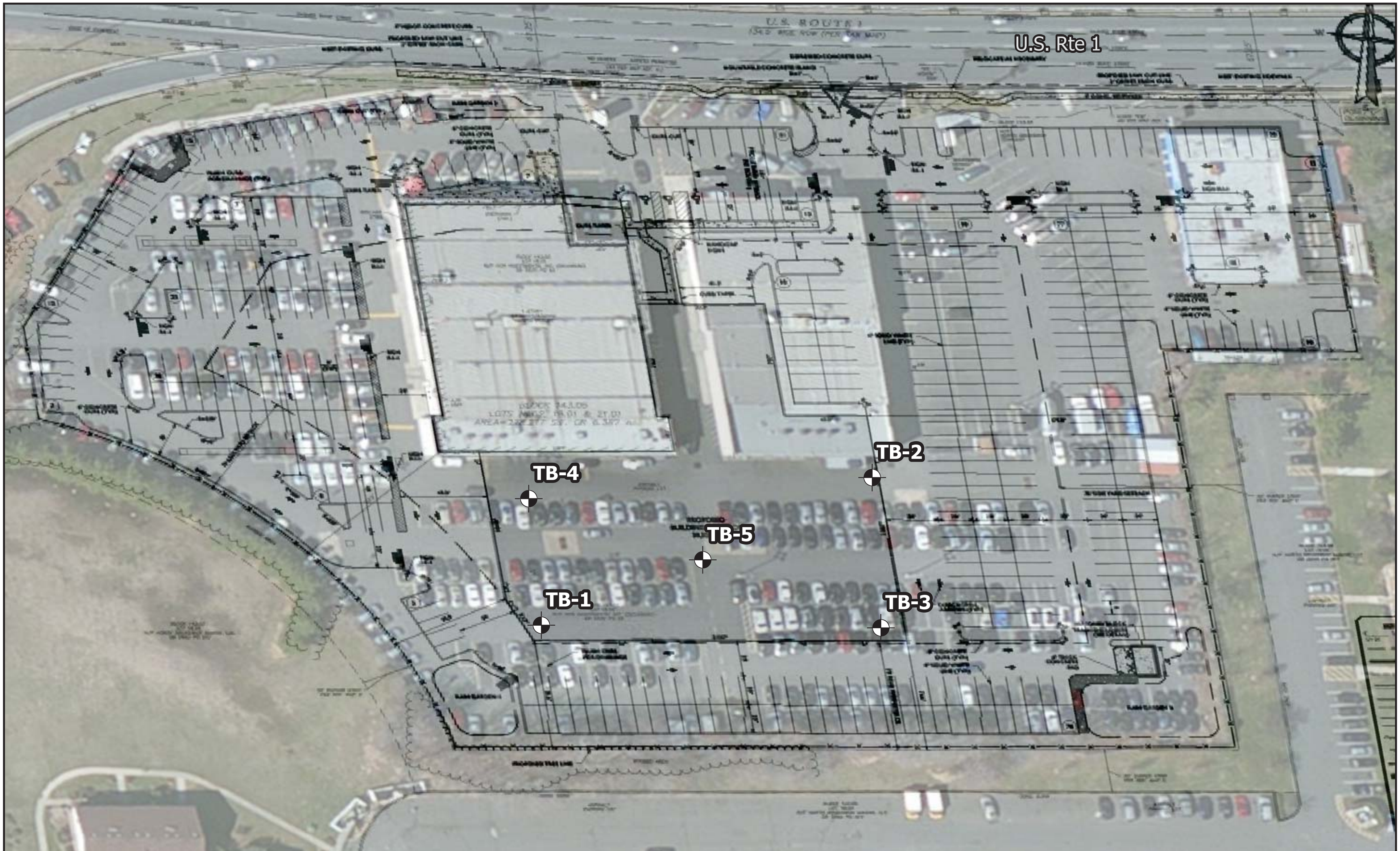
Proposed Dealership Expansion
Brunswick Toyota

NORTH BRUNSWICK TOWNSHIP
MIDDLESEX COUNTY, NJ 08902

Drawn By: MAM	Checked By: RP	Proj. No.: 19003878A
Scale: 1 IN = 2,000 FT	Date: 06/02/2021	Figure No.: 1

N W E S

0 1,000 2,000 4,000 Feet



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; Site plan "Dimension Plan" dated 7/30/21 by Colliers Engineering & Design.

LEGEND

INDICATES THE NUMBERS AND APPROXIMATE LOCATIONS OF TEST BORINGS PERFORMED FOR THIS EXPLORATION PROGRAM.

0 50 100 200 Feet

N

Prepared For:

DCH AUTO GROUP

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TITLE:

EXPLORATION LOCATION PLAN

PROJECT:

Proposed Dealership Expansion Brunswick Toyota

NORTH BRUNSWICK TOWNSHIP
MIDDLESEX COUNTY, NJ 08902

Drawn By: RTR	Checked By: RP	Project No.: 19003878A
Scale: 1 IN = 100 FT	Date: 8/2/2021	Figure No.: 2

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Appendix A

Test Boring Logs

Burmister Soil Classification System

I - Soil and Fraction/Plasticity Definitions

Material	Symbol	Fraction	Sieve Size	Definition
Boulders	Bldr	-----	9" +	Material retained on 9" sieve.
Cobbles	Cbl	-----	3" to 9"	Material passing 9" sieve and retained on the 3" sieve.
Gravel	G	Coarse (c) Medium (m) Fine (f)	1" to 3" 3/8" to 1" No. 10 to 3/8"	Material passing the 3" sieve and retained on the No. 10 sieve.
Sand	S	Coarse (c) Medium (m) Fine (f)	No. 30 to No. 10 No. 60 to No. 30 No. 200 to No. 60	Material passing No. 10 sieve and retained on the No. 200 sieve.
Material	**Symbol**	**Plasticity**	**Plasticity Index**	**Definition**
Silt	$	Non-Plastic	Passing No. 200 (0.075 mm) PI<1	Material passing the No. 200 sieve that is non-plastic in character and exhibits little or no strength when air-dried.
Clayey Silt	cy$	Slight (SL)	1 to 5	Clay – Soil. Material passing the No. 200 sieve which can be made to exhibit plasticity and clay qualities within a certain range of moisture content, and which exhibits considerable strength when air-dried.
Silt & Clay	$ & C	Low (L)	5 to 10	
Clay & Silt	C & $	Medium (M)	10 to 20	
Silty Clay	$C	High (H)	20 to 40	
Clay	C	Very High (VH)	40 Plus	
Organic Silt	(O$)	-----	-----	Material passing the No. 200 sieve which exhibits plastic properties within a certain range of moisture content and exhibits fine granular and organic characteristics.

II - Proportion Definitions

Component	Written	Proportions	Symbol	Percentage Range by Weight*
Principal	CAPITALS	---	---	50 or more
Minor	Lower Case	And	a.	35 to 50
		Some	s.	20 to 35
		Little	l.	10 to 20
		Trace	t.	0 to 10

* Minus sign (-) lower limit, plus sign (+) upper limit, no sign middle range.

III – Terminology for Stratified Soils

Terminology	Definition
Parting	0 to 1/16" thickness
Seam	1/16" to ½" thickness
Layer	½" to 12" thickness
Occasional	One or less per foot of thickness
Frequent	More than one per foot of thickness
Alternating	Stratification descriptor (non-varved)

Colliers Engineering & Design

331 Newman Springs Road, Suite 203, Red Bank, NJ 07701

PROJECT: Dealership Expansion - DCH Toyota - North Brunswick

LOCATION: Southwest corner of proposed building (See plan).

PROJECT NO. 19003878A

TEST BORING: TB-1

PAGE 1 OF 1

GROUND ELEVATION (ft): 120.0
ELEV. FROM: Interpolated

GROUNDWATER ELEV. (ft):

CONTRACTOR: Soil Borings Drilling, LLC
DRILLER: Anthony Scafidi
DRILLING EQUIPMENT: Mobile Drill B-57
METHOD: HSA X Mud Rotary ___ Other ___
HAMMER: CH ___ Safety ___ Automatic X
RODS: AW X NW ___ Other ___

GROUNDWATER:	DEPTH (ft)	DATE
FIRST ENCOUNTERED	NE	6/1/21
END OF DRILLING (0 hrs.)		

ASTM D-1586

DATE STARTED 6/1/21
DATE FINISHED 6/1/21
FIELD OBSERVER: R. Recchia
CHECKED BY: R. Pedrick

DEPTH BELOW SURFACE (ft.)	SAMPLE NUMBER / DEPTH (ft.)	0-6"	6-12"	12-18"	18-24"	RECOVERY (in)	POCKET PENETROM. (tsf)	MOISTURE (%)	WATER SYMBOL	PROFILE DEPTH / ELEV.	PROFILE	IDENTIFICATION OF SOILS / REMARKS
	S-1	-	8	7	5	12						S-1: Augered Top 6": Asphalt & Subbase
	0.0'-2.0'									2.0 / 118.0	Stratum F	Black, Brown mf GRAVEL, little mf Sand, trace(+) Silt & Clay. (Moist). [FILL]
	S-2	6	4	7	8	14						S-2: Brown CLAY & SILT, little(-) f Sand. (Moist).
	2.0'-4.0'											
5	S-3	5	3	5	7	20						S-3: Brown mf SAND, and Clay & Silt. (Moist).
	4.0'-6.0'											
	S-4	6	5	5	7	24						S-4: TOP (0"-12"): Same as S-3.
	6.0'-8.0'											BOT (12"-24"): Dk Brown, Red mf SAND, and Silty Clay. (Moist).
	S-5	6	7	16	20	24						S-5: Dk Brown, Red mf SAND, and Silty Clay. (Moist).
10	8.0'-10.0'											
	S-6	23	44	50/5"	-	24					Stratum 1	S-6: Same as S-5.
	10.0'-11.4'											
	S-7	17	24	32	42	NR						S-7: No recovery. Auger cuttings same as S-5.
15	13.0'-15.0'											
	S-8	35	50/4"	-	-	24				18.8		S-8: Same as S-5.
20	18.0'-18.8'									101.2		END OF TEST BORING AT 18.8 FEET
25												
30												
35												
40												

NOTES:

TEST BORING: TB-1
PAGE 1 OF 1

Colliers Engineering & Design

331 Newman Springs Road, Suite 203, Red Bank, NJ 07701

PROJECT: Dealership Expansion - DCH Toyota - North Brunswick

LOCATION: Northeast corner of proposed building (See plan).

PROJECT NO. 19003878A

TEST BORING: TB-2

PAGE 1 OF 1

GROUND ELEVATION (ft): 120.0
ELEV. FROM: Interpolated

GROUNDWATER ELEV. (ft):

CONTRACTOR: Soil Borings Drilling, LLC
DRILLER: Anthony Scafidi
DRILLING EQUIPMENT: Mobile Drill B-57
METHOD: HSA X Mud Rotary ____ Other ____
HAMMER: CH ____ Safety ____ Automatic X
RODS: AW X NW ____ Other ____

GROUNDWATER:	DEPTH (ft)	DATE
FIRST ENCOUNTERED	NE	6/1/21
END OF DRILLING (0 hrs.)		

ASTM D-1586

DATE STARTED 6/1/21
DATE FINISHED 6/1/21
FIELD OBSERVER: R. Recchia
CHECKED BY: R. Pedrick

DEPTH BELOW SURFACE (ft.)	SAMPLE NUMBER / DEPTH (ft.)	BLOWS PER 6 INCHES 0-6"	6-12"	12-18"	18-24"	RECOVERY (in)	POCKET PENETROM. (tsf)	MOISTURE (%)	WATER SYMBOL	PROFILE DEPTH / ELEV.	IDENTIFICATION OF SOILS / REMARKS
	S-1	-	4	6	5	12				Stratum F	S-1: Augered Top 6": Asphalt & Subbase
	0.0'-2.0'									2.0	Brown mf SAND, some(+) Silt & Clay, little mf Gravel. (Moist). [FILL].
	S-2	3	4	4	3	22	4.5			118.0	S-2: Brown, Orange CLAY & SILT, little(-) f Sand. (Moist).
	2.0'-4.0'										
5	S-3	3	8	6	9	20					S-3: Gray, Orange CLAY & SILT, little(-) f Sand. (Moist).
	4.0'-6.0'										
	S-4	7	9	11	12	20	4.5				S-4: Gray, Brown CLAY & SILT, little(-) f Sand. (Moist).
	6.0'-8.0'										
	S-5	4	4	7	6	12				Stratum 1	S-5: Red, Brown mf SAND, and Silty Clay. (Moist).
10	8.0'-10.0'										
	S-6	6	10	11	16	22					S-6: Same as S-5. [with Tan, Black mf SAND layer].
	10.0'-12.0'										
	S-7	13	20	42	50/4"	24					S-7: Red, Brown mf SAND, and Silty Clay. (Moist).
15	13.0'-14.7'									14.7	
										105.3	END OF TEST BORING AT 14.7 FEET
20											
25											
30											
35											
40											

NOTES: Auger refusal at 16' while advancing to S-8.

TEST BORING: TB-2
PAGE 1 OF 1

Colliers Engineering & Design

331 Newman Springs Road, Suite 203, Red Bank, NJ 07701

PROJECT: Dealership Expansion - DCH Toyota - North Brunswick

LOCATION: Southeast corner of proposed building (See plan).

PROJECT NO. 19003878A

TEST BORING: TB-3

GROUND ELEVATION (ft): 120.0
ELEV. FROM: Interpolated

GROUNDWATER ELEV. (ft):

CONTRACTOR: Soil Borings Drilling, LLC
DRILLER: Anthony Scafidi
DRILLING EQUIPMENT: Mobile Drill B-57
METHOD: HSA X Mud Rotary ____ Other ____
HAMMER: CH ____ Safety ____ Automatic X
RODS: AW X NW ____ Other ____

GROUNDWATER:	DEPTH (ft)	DATE
FIRST ENCOUNTERED	NE	6/1/21
END OF DRILLING (0 hrs.)		

ASTM D-1586

DATE STARTED 6/1/21
DATE FINISHED 6/1/21
FIELD OBSERVER: R. Recchia
CHECKED BY: R. Pedrick

DEPTH BELOW SURFACE (ft.)	SAMPLE NUMBER / DEPTH (ft.)	BLOWS PER 6 INCHES 0-6"	6-12"	12-18"	18-24"	RECOVERY (in)	POCKET PENETROM. (tsf)	MOISTURE (%)	WATER SYMBOL	PROFILE DEPTH / ELEV.	IDENTIFICATION OF SOILS / REMARKS
	S-1	-	12	10	7	16				Stratum F	S-1: Augered Top 6": Asphalt & Subbase. Black, Dk Brown mf SAND, some Silt & Clay, little(+) mf Gravel. (Moist). [FILL].
	0.0'-2.0'										
	S-2	3	3	3	4	20	4.5				S-2: Brown CLAY & SILT, some mf Gravel, little cmf sand. (Moist). (Trace organics). [FILL].
	2.0'-4.0'									4.0 / 116.0	
5	S-3	5	6	7	8	22				Stratum 1	S-3: Gray, Orange CLAY & SILT, little f Sand. (Moist).
	4.0'-6.0'										
	S-4	11	10	10	10	18					S-4: Dk Brown, Orange mf SAND, some Clay & Silt, little mf Gravel. (Moist).
	6.0'-8.0'										
	S-5	4	6	9	11	24					S-5: Red, Brown mf SAND, and Silty Clay. (Moist).
10	8.0'-10.0'										
	S-6	11	11	20	26	22					S-6: Same as S-5.
	10.0'-12.0'										
	S-7	8	16	47	50/3"	24					S-7: Same as S-5.
15	13.0'-14.8'									14.8 / 105.2	END OF TEST BORING AT 14.8 FEET
20											
25											
30											
35											
40											

NOTES:

TEST BORING: TB-3

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331 Newman Springs Road, Suite 203, Red Bank, NJ 07701

PROJECT: Dealership Expansion - DCH Toyota - North Brunswick

LOCATION: Northwest corner of proposed building (See plan).

PROJECT NO. 19003878A

TEST BORING: TB-4

PAGE 1 OF 1

GROUND ELEVATION (ft): 120.0
ELEV. FROM: Interpolated

GROUNDWATER ELEV. (ft):

CONTRACTOR: Soil Borings Drilling, LLC
DRILLER: Anthony Scafidi
DRILLING EQUIPMENT: Mobile Drill B-57
METHOD: HSA X   Mud Rotary ____   Other ____
HAMMER: CH ____   Safety ____   Automatic X
RODS: AW X   NW ____   Other ____

GROUNDWATER:	DEPTH (ft)	DATE
FIRST ENCOUNTERED	NE	6/1/21
END OF DRILLING (0 hrs.)		

DATE STARTED 6/1/21
DATE FINISHED 6/1/21
FIELD OBSERVER: R. Recchia
CHECKED BY: R. Pedrick

ASTM D-1586

DEPTH BELOW SURFACE (ft.)	SAMPLE NUMBER / DEPTH (ft.)	BLOWS PER 6 INCHES 0-6"	6-12"	12-18"	18-24"	RECOVERY (in)	POCKET PENETROM. (tsf)	MOISTURE (%)	WATER SYMBOL	PROFILE DEPTH / ELEV.	IDENTIFICATION OF SOILS / REMARKS
	S-1	-	4	5	3	2					S-1: Augered Top 6": Asphalt & Subbase Brown cmf SAND, and mf Gravel, some Silt & Clay. (Moist). [FILL].
	0.0'-2.0'										
	S-2	3	2	1	5	4					S-2: Brown mf GRAVEL, and cmf Sand, some Clay & Silt. [FILL].
	2.0'-4.0'										
5	S-3	3	2	1	1	4				Stratum F	S-3: Brown mf GRAVEL, some Clay & Silt, some cmf Sand. [FILL].
	4.0'-6.0'										
	S-4	WOH	WOH	WOH	WOH	2					S-4: Brown cmf SAND, and mf Gravel, some Clay & Silt. [FILL].
	6.0'-8.0'									8.0 / 112.0	
	S-5	4	7	9	14	24					S-5: Red, Brown mf SAND, and Silty Clay. (Moist).
10	8.0'-10.0'										
	S-6	7	11	14	16	24					S-6: Same as S-5.
	10.0'-12.0'									Stratum 1	
	S-7	7	13	48	50/3"	24					S-7: Same as S-5.
15	13.0'-14.8'									14.8 / 105.2	END OF TEST BORING AT 14.8 FEET
20											
25											
30											
35											
40											

NOTES: Encountered obstruction at 2', offset 2' southwest.
Location adjacent to parking lot storm drain inlet.

TEST BORING: TB-4
PAGE 1 OF 1

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331 Newman Springs Road, Suite 203, Red Bank, NJ 07701

PROJECT: Dealership Expansion - DCH Toyota - North Brunswick

LOCATION: Center of proposed building (See plan).

PROJECT NO. 19003878A

TEST BORING: TB-5

GROUND ELEVATION (ft): 120.0
ELEV. FROM: Interpolated

GROUNDWATER ELEV. (ft):

CONTRACTOR: Soil Borings Drilling, LLC
DRILLER: Anthony Scafidi
DRILLING EQUIPMENT: Mobile Drill B-57
METHOD: HSA X Mud Rotary ____ Other ____
HAMMER: CH ____ Safety ____ Automatic X
RODS: AW X NW ____ Other ____

GROUNDWATER:	DEPTH (ft)	DATE
FIRST ENCOUNTERED	NE	6/1/21
END OF DRILLING (0 hrs.)		

ASTM D-1586

DATE STARTED 6/1/21
DATE FINISHED 6/1/21
FIELD OBSERVER: R. Recchia
CHECKED BY: R. Pedrick

DEPTH BELOW SURFACE (ft.)	SAMPLE NUMBER / DEPTH (ft.)	BLOWS PER 6 INCHES 0-6"	6-12"	12-18"	18-24"	RECOVERY (in)	POCKET PENETROM. (tsf)	MOISTURE (%)	WATER SYMBOL	PROFILE DEPTH / ELEV.	IDENTIFICATION OF SOILS / REMARKS
	S-1	-	4	2	3	6				Stratum F	S-1: Augered Top 6": Asphalt & Subbase Dk Brown, Black mf SAND, some mf Gravel, little Silt & Clay. (Moist). (Trace organics). [FILL].
	0.0'-2.0'									2.0 / 118.0	
	S-2	2	4	5	5	22	3.2				S-2: Gray, Orange CLAY & SILT, little f Sand. (Moist).
	2.0'-4.0'										
5	S-3	6	5	7	6	14					S-3: Brown, Orange, Gray mf SAND, some Clay & Silt. (Moist).
	4.0'-6.0'										
	S-4	5	6	7	9	18				Stratum 1	S-4: Red, Brown cmf SAND, and Silty Clay, trace f Gravel. (Moist).
	6.0'-8.0'										
	S-5	6	13	24	36	16					S-5: Same as S-4.
10	8.0'-10.0'										
	S-6	44	50/5"	-	-	14				10.9	S-6: Same as S-4.
	10.0'-10.9'									109.1	END OF TEST BORING AT 10.9 FEET
15											
20											
25											
30											
35											
40											

NOTES:

TEST BORING: TB-5

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Appendix B

Laboratory Testing Results

5439 Harding Highway
Mays Landing, New Jersey 08330
Main: 877 627 3772
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AASHTO ACCREDITED

Colliers Engineering & Design

US Army Corps of Engineers
VALIDATED LABORATORY

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: DCH Auto Group
440 Franklin Turnpike
Mahwah, NJ 07430

ATTN: Ms. Maureen Porter

PROJECT: Proposed Dealership Expansion
Brunswick Toyota

Project # 19003878A **DATE:** June 11, 2021

PAGE: 1 of 1

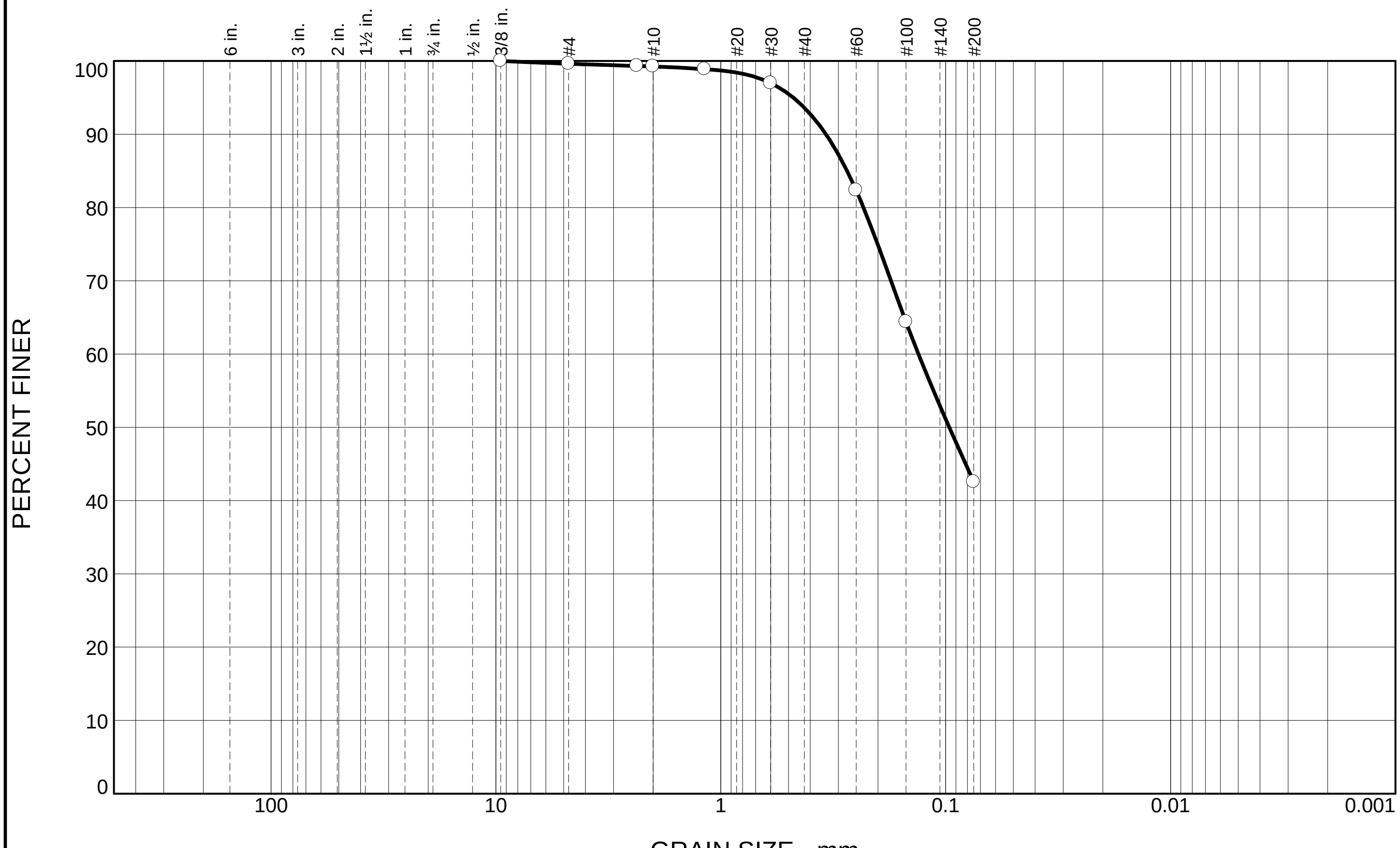
CHECKED BY: Eduardo M. Freire, P.E.
TITLE: Laboratory Manager

SAMPLES RECEIVED: June 4, 2021 **SAMPLES TESTED:** 6/4/21 - 6/10/21 **LAB TECHNICIAN(S):** J. Veach & K. Perry

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D422)	%Passing #200 Sieve (ASTM D1140)	Organic Content (%) (ASTM D2974)	Sulfate (ppm (mg/kg)) (ASTM D516)	Chloride (ppm (mg/kg)) (ASTM D512B)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial* (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)										A	B				
TB-1	S-3	4-6	23.2	Non-Plastic			PSA-1														
TB-3	S-2	2-4	20.1	39	24	15	PSA-2		2.8												
TB-4	S-3	4-6					PSA-3														
TB-5	S-1	0.5-2							1.3												
	S-4	6-8	34.0	65	38	27	PSA-4														
Testing Total:			**0**		**3**		**4**		**2**												

Comments/Remarks: * See attached Plate(s)

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.7	2.3	14.6	39.9	42.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.6		
#8	99.3		
#10	99.3		
#16	98.9		
#30	97.0		
#60	82.4		
#100	64.4		
#200	42.5		

* (no specification provided)

Material Description

Brown medium to fine SAND, and Silt

Atterberg Limits

PL= NP   LL= NV   PI= NP

Coefficients

D_{90}= 0.3408 D_{85}= 0.2744 D_{60}= 0.1321
D_{50}= 0.0964 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM   AASHTO= A-4(0)

Remarks

Water Content (WC): 23.2%
NV: No-Value
NP: Non-Plastic

Source of Sample: TB-1   **Depth:** 4'-6'
Sample Number: S-3

Date: 7/27/21

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

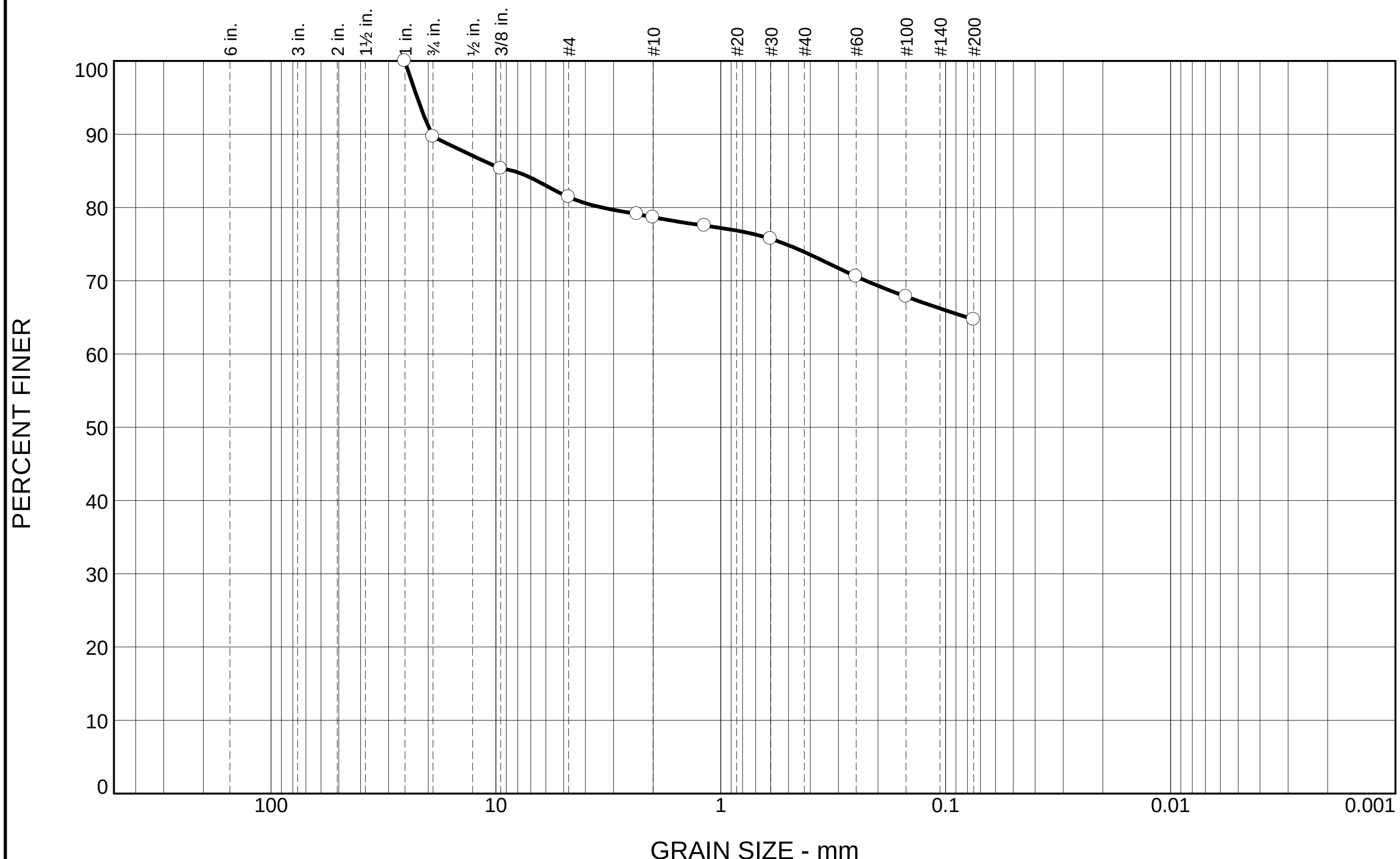
Geotechnical Laboratory

Colliers Engineering & Design

Client: DCH Auto Group
Project: Proposed Dealership Expansion
Brunswick Toyota

Project No: 19003878A   **Plate** PSA-1

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	14.7	6.6	3.0	5.1	5.9	64.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	89.7		
.375	85.3		
#4	81.4		
#8	79.1		
#10	78.7		
#16	77.5		
#30	75.7		
#60	70.6		
#100	67.8		
#200	64.7		

* (no specification provided)

Material Description

Brown CLAY & SILT, some medium to fine Gravel, little coarse to fine Sand

Atterberg Limits

PL= 24 LL= 39 PI= 15

Coefficients

D_{90}= 19.2745 D_{85}= 8.3608 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(8)

Remarks

WC: 20.1%
Organic Content (OC): 2.8%

Source of Sample: TB-3 **Depth:** 2'-4'
Sample Number: S-2

Date: 7/27/21

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

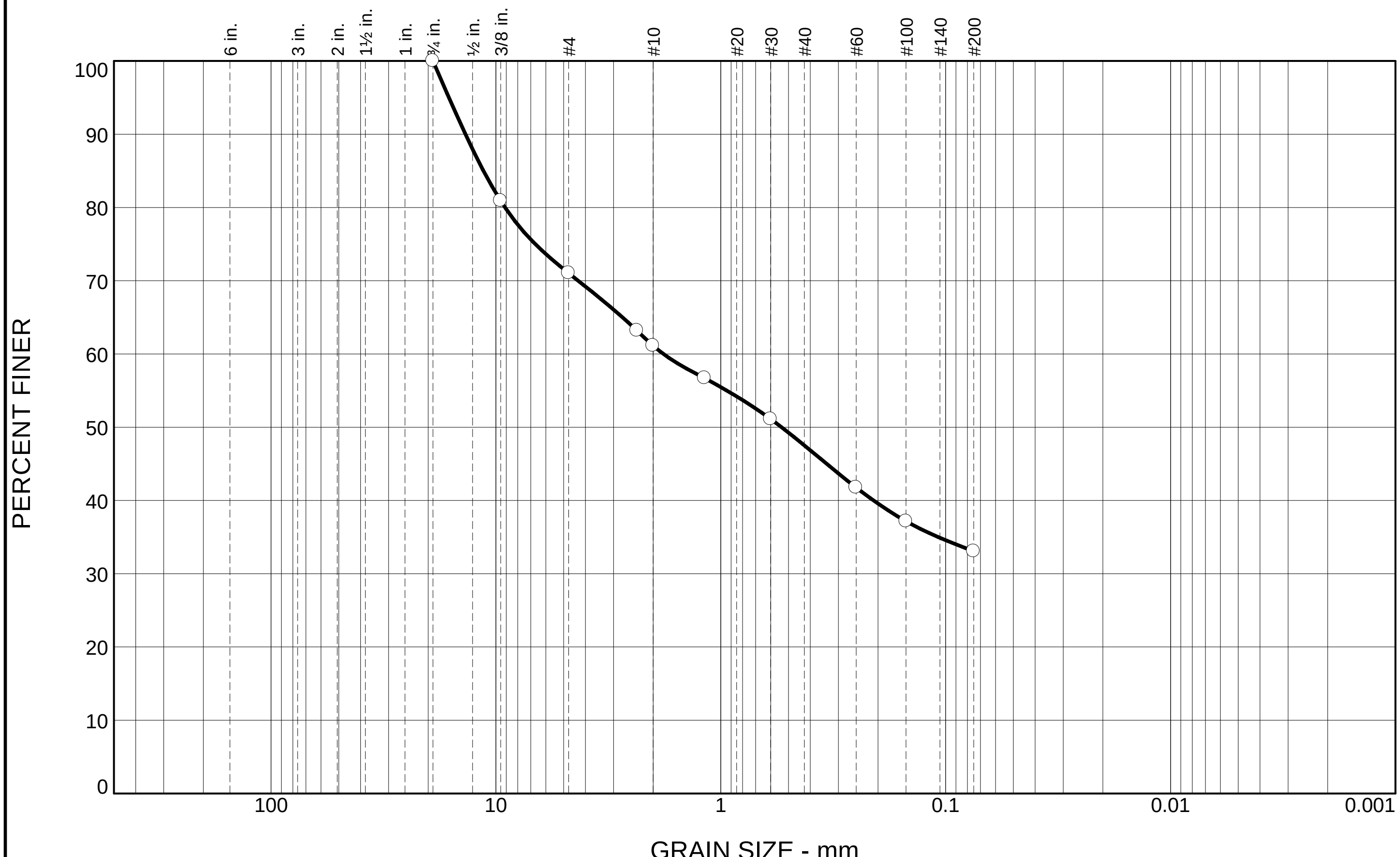
Geotechnical Laboratory

Colliers Engineering & Design

Client: DCH Auto Group
Project: Proposed Dealership Expansion
Brunswick Toyota

Project No: 19003878A **Plate** PSA-2

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	19.1	19.8	10.0	9.3	8.7	33.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	80.9		
#4	71.0		
#8	63.2		
#10	61.1		
#16	56.7		
#30	51.1		
#60	41.8		
#100	37.2		
#200	33.1		

* (no specification provided)

Material Description

Brown medium to fine Gravel, some [Fines: (Silt/Clay)], some coarse to fine Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.6644 D_{85}= 11.3599 D_{60}= 1.7993
D_{50}= 0.5365 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM\SC AASHTO=

Remarks

Source of Sample: TB-4 **Depth:** 4'-6'
Sample Number: S-3

Date: 7/27/21

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Colliers Engineering & Design

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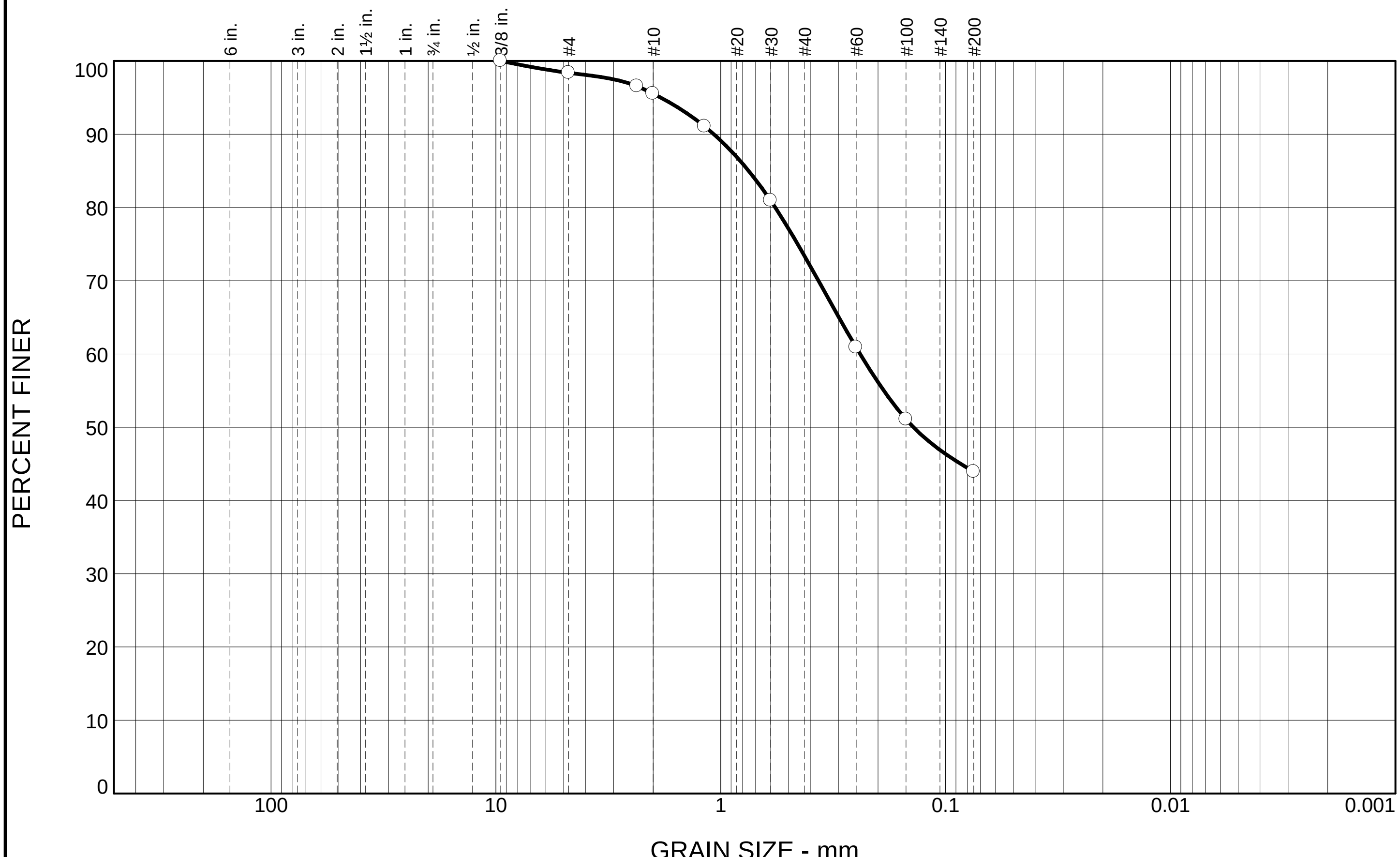
Project: Proposed Dealership Expansion
Brunswick Toyota

Project No: 19003878A **Plate** PSA-3

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	4.5	14.6	20.0	17.0	43.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.4		
#8	96.6		
#10	95.5		
#16	91.1		
#30	80.9		
#60	60.9		
#100	51.1		
#200	43.9		

* (no specification provided)

Material Description

Brown, tan coarse to fine SAND, and Silty Clay, trace fine Gravel

Atterberg Limits

PL= 38 LL= 65 PI= 27

Coefficients

D_{90}= 1.0735 D_{85}= 0.7519 D_{60}= 0.2400
D_{50}= 0.1390 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-7-5(8)

Remarks

WC: 34.0%

Source of Sample: TB-5 **Depth:** 6'-8'
Sample Number: S-4

Date: 7/27/21

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Brunswick Toyota
Project No: 19003878A **Plate** PSA-4

Appendix C

Seismic Information

1504 US-1, North Brunswick Township, NJ 08902, USA

Latitude, Longitude: 40.455492, -74.4794005

Date	7/28/2021, 8:57:05 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.253	MCE_R ground motion. (for 0.2 second period)
S_1	0.055	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.404	Site-modified spectral acceleration value
S_{M1}	0.133	Site-modified spectral acceleration value
S_{DS}	0.269	Numeric seismic design value at 0.2 second SA
S_{D1}	0.089	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.598	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.152	MCE_G peak ground acceleration
F_{PGA}	1.497	Site amplification factor at PGA
PGA_M	0.227	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	0.253	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.268	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.055	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.059	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.942	Mapped value of the risk coefficient at short periods
C_{R1}	0.944	Mapped value of the risk coefficient at a period of 1 s

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