NELSON-COUVRETTE & ASSOCIATES, INC.
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February 24, 1997

Ms. Linda Byrnes
Mr. Gale Hogan
Arlington School District
600 East First Street
Arlington, Washington 98223

Preliminary Geotechnical Engineering Report
Arlington School District Property Purchase
Arlington, Washington
NCA File No. 192796

Dear Ms. Byrnes and Mr. Hogan:

We are pleased to submit ten copies of our report titled "Preliminary Geotechnical Engineering Report Arlington School District Property Purchase, Arlington, Washington". The scope of our services is outlined in our proposal to you dated December 19, 1996 and supplemental services agreement to you dated January 30, 1997.

We found the site to have sensitive near-surface native soils, derived from an ancient mudflow, within a majority of the property. Based on our study of these soils, we consider that the site is suited for the planned development providing that foundation improvements for structures and paved areas are used. The improvements are outlined in our report.

It has been a pleasure to be of service to you on this project. If you have any questions regarding the contents of this report or if we can be of further service, please call.

Sincerely,
NELSON-COUVRETTE & ASSOCIATES, INC.

David L. Nelson, PG
Principal

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Dear Ms. Byrnes and Mr. Hogan:

INTRODUCTION

This report presents the results of our preliminary geotechnical engineering investigation for a portion of your proposed school district property. The subject property is situated in Snohomish County, just north of the city of Arlington. The site consists of approximately 180 acres, located just east of State Route 530 (SR-530) and north of Arlington Heights Road. The site location is shown on the Vicinity Map in Figure 1. You have requested preliminary geologic and geotechnical surface, and subsurface information for general site development planning. For our use in preparing this study, we were provided with a general site plan and conceptual siting drawings, undated, prepared by McGranahan Partnership, and an excerpt of the Dykeman Site Assessment report prepared for the Arlington School District.

The property is proposed to be the site of the Arlington High School Complex, with future considerations for a middle and/or elementary school complex. Presently, the property is the site of an existing farm, with structures located within the northwestern portion and pasture throughout most of the rest. The southern area consists of a regraded portion of the old Concrete Nor'West gravel mining operation. The high school is planned to be located within the northerly portion of the property, with future expansion of other schools within the central to southern portion. The high school complex is expected to consist of both large structures, and attached and detached buildings, access and parking pavements, and playfields. Plans may also include a sports stadium. We met with you on site during our field explorations and discussed general locations of the proposed improvements. Precise locations of these features were not specifically known at the time of this report. Similar types of projects sometimes require mass grading, depending on final design and site topography. Given the site topography, significant grading may not be required, however, that has not been determined as of yet. The site grades seem to be such that a minimal grading design might be feasible.

Access to the high school portion of the site is planned off the north side, off of 249th Street NE, or from the west from SR-530, toward the planned high school location in the north to northeastern section. Parking areas would be around the high school and playfield area. Playfield locations are proposed to the south and/or west of the high school site. Siting information is presently not available for expansions for the additional schools or a stadium.

We encountered a mudflow deposit during the test pit phase of our investigation. Although this deposit appeared to be reasonably compact, mudflows can be poor soil conditions to build on, particularly for a school. Following discussions with school representatives, it was decided to sample and test the on-site soils for strength and consolidation (settlement) characteristics. Our scope was then expanded to drill shallow borings at the site, and complete testing of the mudflow.

SCOPE

The purpose of this preliminary geotechnical study is to explore the subsurface soil conditions and to provide information for school area development planning, including ground and surface water conditions found. Specifically, our scope of services includes the following:

1. Research site conditions through review of published geologic and soils maps, and known previous subsurface soils studies around the area.
2. Evaluate the site for interpretation of subsurface conditions, based on visual field work, geologic mapping and performing backhoe excavated test pits sporadically around the accessible portions of the property.
3. Perform three exploratory borings within the potential high school site to obtain soil samples of near-surface soils for laboratory analyses, and install three temporary water level pipes (piezometers).

4. Identify and delineate the soils, geologic and surface/subsurface hydrologic conditions, and their relationship to potential site development.

5. Perform limited laboratory analyses on selected samples, including sieve analyses, hydrometer analyses, direct shear, and consolidation testing.

6. Provide opinions regarding site development, earthwork parameters, cuts and fills, preliminary foundation recommendations, and building and pavement siting.

7. Prepare a preliminary written report to document our findings and recommendations.

SITE CONDITIONS

Surface

The total subject property consists of approximately 180 acres, and is located on a terrace with a general downslope gradient to the south. Most of the property is existing pasture land that is relatively flatlying, with a somewhat higher area toward the east and a gently sloping area at the west. A drainage ditch separates the flat portion of the pasture from the higher area to the east. A graded portion of the old Concrete Nor'West gravel mining operation exists within the southern portion of the property. Graded slopes down into the old mining pit exist in this area. The specific evaluated portion of the property consists of the accessible portions of the pasture land. The area of the gravel pit, the developed farm buildings and the pasture area in the northwest corner of the site were not explored.

The site is vegetated with field grass and a few deciduous trees along the drainage ditch. The pasture is fenced and cross fenced, and is being used for cattle raising.

Geology

Most of the Puget Sound region was affected by past intrusion of continental glaciation. The last period of glaciation, the Vashon Stade, ended approximately 10,000 to 11,000 years ago. Many of the geographic features seen today are a result of scouring and overriding by glacial ice, and subsequent fluvial erosion and deposition of outwash deposits. During the Vashon Stade, the Puget Sound region was overridden by over 3,000 feet of ice. Soil layers overridden by the ice sheet were compacted to a much greater extent than those that were not. A typical glacial sequence includes recessional outwash sand and gravels overlying till or drift.

The geologic units mapped for this area are shown on the Geologic Map of the Arlington East Quadrangle, Snohomish County, Washington, by James P. Minard (U.S.G.S., 1985). The entire site is mapped as Recessional Outwash, Arlington Gravel Member (Qvra). As discussed in the description of map units, these deposits are in and around Arlington, and form terraces at the next level above the Arlington Sand Member of the outwash sequence. They consist of well-drained and stratified outwash sand and gravel, deposited by meltwater from the stagnating and receding Vashon glacier. These deposits typically vary from about 6 to 75 feet thick, and are mostly underlain by glacial till. Although not mapped at this location, but in an area nearby, a unique deposit of oxidized, dacitic silt, sand and pebbles lies on the Arlington Gravel Member. The deposit (designated for this report as $Qvra_1$) exhibits well-rounded sand and pebbles of low specific gravity. The material probably was ejected as pumice during an eruption of Glacier Peak, and was carried down the mountain and streams as lahars (mudflows) and alluvium. Similar deposits just west of Arlington were tentatively dated at 11,700 years ago (J.E. Beget 1979, 1982).

Subsurface Conditions

Subsurface conditions were explored at the site by excavating 32 test pits using a rubber-tired backhoe, and three borings using a track-mounted rotary drill. The test pits were located randomly to obtain general subsurface conditions across the site. The borings were located within the northeasterly portion of the site to obtain soil samples for analyses and install temporary piezometers. Samples in the borings were obtained using a "California" ringed sampler, driven beyond the bottom of the auger to obtain relatively undisturbed samples. The test pits and borings were located in the field by a geologist with this firm, who classified the soils encountered and maintained logs of the explorations. The test pit and boring locations are shown on Figure 2. A detailed explanation of the field exploration program and the exploration logs are presented in Appendix A.

Our explorations encountered a range of about 0.5 to 1.8 feet of topsoil, with most areas indicating an average of about 1 foot. The topsoil consisted of brown to dark brown, loose silty fine sand with roots. The variability of the topsoil thickness is attributed to past farming and grading activities on the property.

Underlying the topsoil, the explorations located within the majority of the relatively flatlying north to central portion encountered the mudflow $Qvra_1$. These materials generally consisted of rust-mottled gray, medium dense, silty fine to coarse sand. Distinguishing characteristics of these deposits were apparent grains and pebbles of pumice and volcanic ash. Our laboratory analysis shows the silt content as much as 50 percent, with on the order of 10 to 15 percent clay. We found this deposit to range in depth from about 3 to 8 feet below grade. Underlying the $Qvra_1$ materials in this area are the granular

Qvra deposits. These materials consist of brown to gray, medium dense to dense, fine to coarse sand, gravel and cobbles.

Underlying the topsoil in the eastern higher elevation portion of the site, we did not encounter the mudflow $Qvra_1$ deposits. Instead, we encountered about 1.0 to 1.5 feet of weathered Qvra, consisting of rust-brown, medium dense, fine to coarse sand with silt and gravel. The weathered strata overlies the Qvra sands and gravels discussed above.

We have developed a site surface Geology Map, as shown in Figure 3, based on our exploration data. This map shows the relative location of the near-surface mudflow $Qvra_1$ deposits, and the area of the near-surface Qvra deposits. In addition, we have developed two schematic cross sections, Cross-Section A-A', as shown in Figure 4 and Cross-Section B-B', as shown in Figure 5, which are intended to show the expected stratigraphic relationship of the deposits through the site.

Laboratory Analysis

We performed laboratory analyses on selected samples obtained from the test pits and borings. A more detailed description of the testing is presented in Appendix B. The testing was completed on the mudflow to evaluate its engineering properties and expected performance during construction. The grain size analysis, both sieve and hydrometer, indicate that the mudflow has a high silt content. One test had material finer than the 200 sieve (silt and clay size) almost at 50 percent. There were also clay sized particles on the order of 10 to 15 percent in the samples tested. The direct shear tests were plotted on a shear versus normal pressure graph, with a resulting shear strength angle of 27 degrees. This angle indicates that the material will behave more like a silt than a granular material. The consolidation test on what would be considered the "softest" sample indicated an engineering compression index of 0.03. This is considered low, and more in line with a loose sand.

Hydrologic Conditions

Ground water was observed within all of the lower test pits and in the borings. We found two ground water levels within the areas underlain by the $Qvra_1$ deposits. The two levels existed near-surface above and within the $Qvra_1$ deposits, and below the $Qvra_1$ materials within the granular Qvra sands and gravels. The shallow ground water encountered is considered perched within the more permeable upper portions of the $Qvra_1$ deposits overlying a less permeable portion. Perched ground water conditions, such as these, tend to be somewhat seasonal. This type of seepage condition tends to decline during the drier summer months. Drainage, including interceptor or curtain drains, is commonly used for minimizing the impact of perched water conditions during and after construction. We would expect the amount of water to decrease during drier times of the year and increase during wetter periods.

The ground water level was found to vary at elevations where the Qvra was encountered below $Qvra_1$. This may represent a regional confined water table/aquifer above low permeability deposits, such as the glacial till expected to occur at depth. The test pits were observed to cave below the water table. Ground water should be expected at approximately these elevations, and possibly higher, during the normally wetter periods of the year, due to seasonal runoff, snow melt and subsurface water flow.

SENSITIVE AREA EVALUATION

Seismic Hazard

The Puget Sound Region is classified as a Zone 3 by the Uniform Building Code. Seismic considerations for this type of site includes liquefaction potential and attenuation of ground motions by soft soil deposits. The liquefaction potential is highest for loose sand and silty sand with a high ground water table. We do not consider siesmically sensitive conditions to exist on this site.

CONCLUSIONS AND RECOMMENDATIONS

General

The conclusions and recommendations presented here should be considered preliminary in nature and intended to aid in your feasibility study of this site. The outwash Qvra soils found at the site are considered competent and are capable of supporting the new high school facility. The mudflow $Qvra_1$ deposits can be successfully built on but are considered more marginal, due to their engineering properties and geologic formation. Design factors such as bearing capacity and settlement should not be considered a problem for the Qvra deposits. The $Qvra_1$ material will support the structures, but with lower bearing pressures and higher settlements. However, it is our opinion that the settlements will most likely be within tolerances for the type of structures planned.

In our opinion, the most critical aspect of development at this site will be that the on-site $Qvra_1$ soils are very moisture sensitive. That is, they are very difficult, if not impossible to work with when wet. Even during the dry summer months this material may have too high of a moisture content for compaction without drying. If possible, site planning should include completing the earthwork during the normal dry summer months. Even at that, some additional effort may be required to obtain the proper moisture content for compaction. We do not consider this material to be suitable for direct equipment support, especially if winter time construction occurs. Minimum thicknesses of granular material will be required to cover the $Qvra_1$ material for construction access. Once subgrade is established, it may be prudent to protect the prepared subgrade (after placing the granular material) by asphalt paving or asphalt treated base (ATB). The design thicknesses of these coverings will be dependent on the performance of the subgrade, weather and construction traffic loads.

With the expected difficulty of working with the $Qvra_1$ material, an option to be considered would be to raise the entire site 2 to 4 feet with a suitable granular fill. This would be costly and not preferred, unless the entire site elevation needed to be raised. However, a significant amount of covering will be necessary in all building and pavement areas. One option to consider is to use the high area to the east as a borrow pit. The material found in that area appears to be suitable for a pit run borrow source, which could reduce the cost of covering the site. We have not completed yardage take-offs to evaluate the amount of material that is available.

Erosion Control

The on-site $Qvra_1$ soils have a moderate to high erosion potential when disturbed, depending on how the site is graded and water is allowed to concentrate. Areas disturbed during construction should be protected from erosion. Measures taken may include diverting surface water away from the stripped areas, and covering them with straw, in addition to using silt fences and straw bales. Disturbed areas should be revegetated at the end of construction. The vegetation should be maintained until established. Where the existing grass cover is not disturbed, erosion potential should not be significant.

For a site this large, we would expect that a temporary drainage system, including a sedimentation pond system, will be needed. The near-surface $Qvra_1$ soils have a fairly low permeability and should be suited for construction of the pond embankments. Some selection of specific soils may be needed when constructing the pond.

Site Preparation and Grading

Normal grading operations include stripping of the site of topsoil, thoroughly compacting the exposed subgrade and then placing new fill to grade. This technique is not expected to work on the $Qvra_1$ material on this site unless it is during the dry summer months, and then there is still a chance that the subgrade soils will be too wet for compaction. Although this technique may be attempted, we recommend that it be planned to use the alternative method described below for site preparation and grading.

The method expected to be needed on this site is to strip the vegetation and topsoil using a large excavator hoe with a smooth-bucket. Construction traffic should not be allowed on the exposed subgrade if it is observed to degrade when compacted. Following stripping, granular fill should be placed to bring the area up to subgrade elevation. The depth of fill should be in part determined based on performance observed in the field, and the material type used. In roadway areas, we recommend that a separator be used between the subgrade and any pit run type of material. The separator could be a suitable geotextile and/or rock spalls. For budgeting purposes, we recommend that a minimum of 1 foot of rock spalls be planned in addition to a geotextile and 6 inches of pit run to create a subgrade surface. In building areas where minimal traffic is expected, the rock spalls may not be necessary.

As the topsoil is stripped, the exposed surface should be evaluated to determine if soft areas exist. Soft areas should be overexcavated as determined in the field, and an additional thickness of pit run or spalls placed. If pit run is used, it will be easily contaminated by the on-site soils. It may be prudent to place a layer of ATB on the exposed subgrade to minimize this contamination. We recommend that the following thicknesses of granular cover be included in the budget:

Areas	Covering Types
Roads	18 inches (12 inches of 2- to 4-inch rock spalls and 6 inches of pit run) and 3 inches of ATB
Parking	12 inches pit run & ATB
Slabs	1 foot of pit run and capillary break
Foundations	1 to 2 feet of pit run

Typical cross sections of the road, parking, foundations, and slabs are shown on Figures 6 and 7.

Structural Fill

General: Fill to be placed beneath buildings, pavements or other settlement sensitive features should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be prepared as outlined in the **Site Preparation and Grading** sub-section of this report.

Materials: Imported structural fill should consist of a good quality, free draining granular soil, free of organic and other deleterious material, and be well graded to a maximum size of about 3 inches. Imported all weather fill should contain no more than about 5 percent fines (soil finer than a U.S. No. 200 sieve) based on that fraction passing the U.S. No. 4 sieve. The on-site surface and $Qvra_1$ soils are highly moisture sensitive, and are not expected to be usable for fill. These soils should only be considered if earthwork is attempted during the dry season, and even then, it may be difficult. This can be evaluated at the time of construction.

We recommend that the feasibility study assume that imported structural fill will be required in all trenches within the $Qvra_1$ areas.

Fill Placement: Following subgrade preparation, placement of the structural fill may proceed. The lift thickness should be based on the ability of the compaction equipment to achieve the required density specified, and the need to not disturb the underlying subgrade. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas, and within 2 feet of pavement subgrade, should be compacted to at least of 95 percent of its maximum dry density. Maximum dry density in this report refers to that density as determined by the ASTM D 1557 compaction test procedure. Fills more than 2 feet beneath sidewalks and pavement subgrades should be compacted to at least 90 percent of their maximum dry density. The moisture content of the soils to be compacted should be within about 2 percent of optimum, so that a readily compactable condition exists. It may be necessary to overexcavate and remove wet soils in cases where drying to a compactable condition is not feasible.

Care should be taken during compaction. If the underlying soils appear to be disturbing under compaction equipment, then a larger first lift may be appropriate. We recommend that a first lift thickness of 18 inches be used to start. This should be adjusted based on observations made during construction.

Excavations

It is expected that some excavations will occur on site for development and construction within this area for roadways, buildings, ballfields, a stadium, and possibly parking. The depths and extent of these excavations is not known at this time. Utility installation depths are also not known. Based on the preliminary explorations, and our findings of soils and ground water conditions, we are of the opinion that stability of excavations may be of concern where cuts extend below the water table within the granular Qvra deposits. In general, precautions should include control of ground water, seepage and surface flow, and maintaining any cut slopes. In addition, dewatering of any excavations or trenches within the Qvra water table should be anticipated. Excavation below the water table should be expected to require dewatering wells.

For planning purposes, we recommend that temporary cuts in the surface soils and weathered zone be no steeper than 2 Horizontal to 1 Vertical (2H:1V). Within the $Qvra_1$ deposits, temporary cut slopes should not be steeper than 1.5H:1.0V. Temporary cut slopes in the granular Qvra deposits above the water table should not exceed 2H:1V, and flatter where the water table is encountered. These slope angles should be considered as guidelines only. The contractor would be continuously at the site and could monitor the performance of excavations on a daily basis.

Playfields

The playfields will most likely require mass grading activities. We expect that portions of the playfields will consist of cuts and fills. We strongly recommend that the playfields be designed with a proper underdrain system. The on-site $Qvra_1$ soils do not readily infiltrate water, therefore, the fields would not be expected to be of use throughout much of the school year without the underdrain system. The underdrain system typically consists of shallow drainage galleries and a sand blanket underlying the sod. Specific designs are beyond the scope of this report. Playfields constructed in areas directly underlain by the unsaturated granular Qvra deposits may not require as extensive an underdrain system. This could be determined once the area of the proposed playfield areas are located.

Playfields, in general, can tolerate some settlements and still be functional. Therefore, compaction standards may be slightly lower that structural fill under pavements and buildings. This possibly could allow the use of some of the excavated $Qvra_1$ material as fill. However, the use of this material in the playfields should be based on allowable settlement tolerances and what type of density can be achieved in the field. We recommend that compaction be kept, at least, close to 90 percent.

Foundations

Our preliminary recommendations are that the buildings can be founded on conventional spread or continuous footings. This can be accomplished without significant difficulty within areas directly underlain by the granular Qvra deposits. We recommend that some overexcavation and replacement with good granular fill be planned in the areas of the mudflow $Qvra_1$ deposits. The actual amount of overexcavation will be based on building loads and allowable settlement. We do not expect excessive settlements from the mudflow unless high foundation loads are used, and then they are still not expected to be more than allowable tolerance. In the event that settlements need to be limited, some additional overexcavation may be needed. Estimates of settlements can be made when foundation loads are provided.

At a minimum, the $Qvra_1$ soils should be covered with 6 inches of pit run to protect them from disturbance while the foundation forms are set. Footings should be embedded a minimum of 18 inches for frost protection. It may be more appropriate to use a coarser material, such as railroad ballast or crushed rock, to cover the foundation subgrade. These types of soils take less compactive effort.

Specific review and/or analysis should be performed for the final location of the structures. For preliminary design, we recommend and allowable bearing pressures of 1,500 pounds per square foot (psf) for the mudflow, $Qvra_1$ material. Allowable bearing values on the order of 2,500 to 3,500 psf may be used for the outwash, Qvra. Bearing capacity is effected by the depth and width of the foundation, and the allowable settlement. Therefore, higher values may be appropriate for larger or deeper foundations. A one-third increase in the above allowable bearing pressure may be used when considering short-term transitory wind or seismic loads. The bearing pressures and expected settlements for the planned buildings should be evaluated after the loads and location of the buildings are known.

Retaining Walls

The lateral pressure acting on retaining walls is dependent on the nature and density of the soil behind the wall, the amount of lateral wall movement which can occur as backfill is placed, and the inclination of the backfill. For walls that are free to yield at the top at least one-thousandth of the height of the wall, soil pressures will be less than if movement is restricted by floor slabs. For planning purposes, we recommend that walls be designed using an active pressure equivalent to a fluid weighing 35 pounds per cubic foot (pcf) for yielding walls and 50 pcf for non-yielding walls. These are for walls with level, finished ground. The effects of surcharges, such as traffic or foundation loads should be 30 to 50 percent of the surcharge for yielding and non-yielding walls, respectively. For walls with sloped finish ground or with surcharge load, we would be available to provide design recommendations when the specific information is obtained.

The above wall pressures assume proper drainage and compaction of the wall backfill. Wall backfill should consist of free draining granular fill. All backfill for subgrade walls should be compacted to between 90 and 92 percent of the maximum dry density determined in accordance with ASTM D 1557. Care should be taken to prevent the buildup of excess lateral soil pressures due to overcompaction of the backfill behind the wall. This can be accomplished by placing the backfill located within 18 to 24 inches of the wall in lifts not exceeding 8 inches in loose thickness, and compacting this zone with hand-operated vibrating plate compactors.

Lateral loads can be resisted by friction between the foundation and subgrade or the passive earth pressure acting on the below-grade foundation. For the latter, the foundation must be placed "neat" against the undisturbed soil, or backfilled with a clean, free draining, compacted structural fill. We recommend that a lateral soil pressure of 250 pcf equivalent fluid weight be used. An allowable coefficient of friction between footings and the subgrade of 0.35 may be used. These values include a factor of safety of 1.5.

Perched water conditions are expected in the subsurface conditions. A drainage system should be planned behind all of the subgrade walls to avoid build-up of hydrostatic pressures. For standard cantilever wall construction, an 18-inch-wide blanket of free draining sand or pea gravel placed behind the wall is recommended. A perforated pipe should be placed along the base of the wall within the free draining materials. The elevation of the pipe should be a minimum of 12 inches below the interior slab or pavement elevation. The pipe should be routed to an appropriate discharge point or the storm drainage system.

Slabs-On-Grade

Depending on final slab elevations, slabs-on-grade can be supported on structural fill pads over the $Qvra_1$ soils or native subgrade of the Qvra prepared as outlined. As described above, the $Qvra_1$ soils will disturb easily. It is important to properly remove all loose or soft near-surface material from the subgrade. A protective blanket of rock or pit run will be needed under the slab to protect the subgrade. We expect that keeping the slab area clear of loose, wet material will be very difficult during wetter months. Therefore, the pit run covering, as discussed in the **Site Preparation and Grading** sub-section, will be important to install immediately following stripping. A capillary break could be used as the protective blanket, as long as it does not "silt up" from earthwork activities.

Where moisture control is important, we recommend that at least 6 inches of free draining material be placed under slabs-on-grade to act as a capillary break. We recommend using a pea gravel type material for the capillary break. The capillary break material should be separated from slabs by a vapor barrier, such as plastic sheeting. A 2-inch-thick sand blanket may be used to cover the vapor barrier. The sand blanket on top of the vapor barrier is to aid in concrete curing and will help provide a protective cover during construction.

Drainage and Detention System

We recommend that any surface water encountered at the time of construction be diverted around the areas to be developed. This may require the use of a grass lined swale up gradient of the areas of the planned development. A grass lined swale may be used to divert any remaining surface water around areas to be developed. However, even with a diversion of the surface water, significant surface or subsurface perched water flows could still develop.

The finished ground surface should be graded such that storm water is collected and directed off site. Final site grades should allow for drainage away from the buildings. We suggest that the finished ground be sloped at a gradient of 3 percent minimum, for a distance of at least 10 feet away from the building. Surface water should be collected by permanent catch basins and drain lines, and be discharged into a storm drain system. Roof drains should be routed away from the vicinity of the foundations, and be discharged in a permanent discharge system.

The on-site $Qvra_1$ soils are well suited for the construction of a detention pond, due to their low permeability. Providing they are properly compacted, we would not expect seepage or stability problems. Within the granular Qvra deposits, permeability is expected to be much more significant. If infiltration is not desired, lining of the pond would be necessary. Specific pond design recommendations can be developed after the pond site has been located.

USE OF THIS REPORT

We have prepared this report for the Arlington School District and their agents, for use in preliminary planning and design of this project. The data and report should be provided to your design team and contractors for their estimating purposes. However, this report, conclusions and interpretations should not be construed as a warranty of subsurface conditions. Provisions for unanticipated conditions should be included in your schedule and budget. Plans were not available at the time this report was written. We recommend that we provide additional site specific recommendations when plans are available. The need for additional explorations should be evaluated at that time.

The scope of our work does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. There are possible variations in subsurface conditions. We recommend that project planning include contingencies in budget and schedule, should areas be found with conditions that vary from those described in this report.

Within the limitations of scope, schedule and budget for our services, we have strived to take care that our work has been completed in accordance with generally accepted practices followed in this area at the time this report was prepared. No other conditions, expressed or implied, should be understood.

It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,
NELSON-COUVRETTE & ASSOCIATES, INC.

CHARLES P. COUVRETTE
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20285
REGISTERED
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2.24.97
EXPIRES 6.17.98

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Ten Copies Submitted
Seven Figures
Appendix A
Appendix B