GEOTECHNICAL ENGINEERING REPORT

for

CIHA AIRPORT HEIGHTS SENIOR HOUSING PROJECT (PHASE 1) ANCHORAGE, ALASKA

Prepared for:

Spark Design, LLC
5401 Cordova St Ste 301
Anchorage, AK 99518

Prepared by:

Northern Geotechnical Engineering, Inc. - Terra Firma Testing

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NOVEMBER 2025

NGE-TFT Project #10155-25

November 3, 2025 NGE-TFT Project #10155-25

Spark Design, LLC
5401 Cordova St Ste 301
Anchorage, AK 99518

Attn: Deanna Nafzger, AIA, LEED AP BD+C – Partner, Architect

RE: GEOTECHNICAL ENGINEERING REPORT FOR THE PROPOSED CIHA AIRPORT HEIGHTS SENIOR HOUSING PROJECT (PHASE 1) LOCATED IN ANCHORAGE, ALASKA

Deanna,

We (Northern Geotechnical Engineering, Inc. - Terra Firma Testing) have completed a geotechnical engineering assessment of the project site for the proposed CIHA Airport Heights Senior Housing Project (Phase 1) located in Anchorage, Alaska.

In the following report, we provide a summary of the subsurface conditions that we observed at the project site as well as our laboratory findings for the soil samples that we collected.

Subsurface conditions can vary across a project site. As such, we recommend that *The Observational Method* (described in more detail in Appendix A of this report) be followed throughout the construction process of the proposed improvements.

We greatly appreciate the opportunity to provide you with our professional service. Please contact us directly with any questions or comments you may have regarding the information that we present in this report, or if you have any other questions, comments, and/or requests.

Sincerely,
Northern Geotechnical Engineering, Inc. - Terra Firma Testing

Jacob Stephens
Project Engineer

Keith F. Mobley, P.E.
President

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Table of Contents

List of Figures

List of Tables

List of Appendices

1.0 INTRODUCTION

Project Site: Tract 1 of the Northway Business Park Seward Towers Subdivision, Anchorage, Alaska

Client: Spark Design, LLC

Service Fee Proposal: #25-048 dated February 28, 2025

Authorization of Services: Approval of Service Fee Proposal via email by Deanna Nafzger, AIA, LEED AP BD+C – Partner, Architect on August 1, 2025

Scope of Service:

- characterize the subsurface conditions across the project site;
- provide preliminary foundation design values;
- provide storm water infiltration rates for designing a stormwater drainage system;
- provide general pavement design recommendations;
- provide preliminary foundation design values for deep foundations; and
- provide general foundation and earthworks engineering and construction recommendations.

2.0 PROJECT OVERVIEW

Project Name: CIHA Airport Heights Senior Housing Project

Project Site Location: Northeast corner of the intersection between Debarr Road and Columbine Court in Anchorage, Alaska (Figure 1)

Legal Description of Project Site: Tract 1 of the Northway Business Park Seward Towers Subdivision, Anchorage, Alaska

Project Site Size: Approximately 4.3 acres

Past Site Activities:

- During exploration activities at the project site, loose fill soils were encountered throughout the exploration areas suggesting that cut and fill activities previously took place at the proposed project site.
- Satellite imagery, provided courtesy of the MOA, also suggests that cut and fill activities took place at the proposed project location during the development of the surrounding area.
  - See MOA Imagery App; and
  - MOA Imagery Compare App
- The exact dates and extent of the possible cut and fill activities are not certain.

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Current Site Conditions: (See Figure 2)

- Undeveloped lot with thick vegetation including shrubs and adult trees mostly around the south, west, and north perimeters; and
- varying elevations across the project site.

Proposed Improvements to Site: (See Figure 3)

- Phase 1 includes the construction of a residential structure (Building A,) which is proposed to be three-story, wood-framed building, w/ elevator and 24 residential units consisting of:
  - 3 efficiency units (+/- 465 sf)
  - 18 one-bedroom units (+/- 675 sf)
  - 3 two-bedroom units (+/- 850 sf);
- a proposed building footprint of approximately 12,000 square feet; and
- associated parking area/access roads and underground utilities.

3.0 SITE CHARACTERIZATION ACTIVITIES

Dates of Exploration: September 9, 2025 – September 11, 2025

Subsurface Exploration Contractor: Discovery Drilling, Inc. (DDI)

Number and Type of Soil Explorations: Ten (10) hollow-stem auger soil borings

Exploration Locations: Figure 2 of this report

Exploration Depths: Approximately 16.5 to 31.5 feet below the ground surface (bgs)

Sampling Method: Modified Penetration Test (MPT) split-spoon sampler

Drop-Hammer Type & Correction Factor (CF): 340-lb automatic drop-hammer, CF=1.1

Field Blow Count Correction: Figure 4 of this report

Graphical Borehole Logs: Appendix B of this report

For more details regarding field activities refer to Appendix A (Section 1.0) of this report.

3.1 Infiltration Testing

Location: Boreholes IT01 and IT02 (See Figure 2)

Procedures Followed:

- Falling head percolation test procedure outlined in Table 3.9 of the EPA On-site Water Treatment & Disposal Systems Manual
- EPA falling head test method as outlined in the Municipality of Anchorage Drainage Design Guidelines, Section 9.2.1.

Results: (See Full Data Sheets in Appendix C)

- IT01 - 136 minutes per inch

- IT02 - 200 minutes per inch

For more details regarding infiltration testing refer to Appendix A (Section 1.3) of this report.

4.0 LABORATORY TESTING

We tested select soil samples in general accordance with the respective ASTM standard test methods including:

- moisture content analysis (ASTM D-2216);
- determination of fines content (a.k.a. P200 – ASTM D-1140);
- Atterberg limits (ASTM D-4318); and
- grain size sieve and hydrometer analysis (ASTM D-6913 & D-7928) (*See Appendix A (Section 2.0) for an important note about these test methods*).

Laboratory Test Results: Appendices B (graphical exploration logs) and D (laboratory data sheets)

5.0 DESCRIPTION OF SUBSURFACE CONDITIONS

We compiled our field observations with the results from our laboratory analyses to produce graphical logs of each subsurface exploration (Appendix B). The graphical exploration logs depict the subsurface conditions that we identified at each exploration location and help us to interpret/extrapolate the subsurface conditions for areas adjacent to, and immediately surrounding, each exploration location across the project site.

5.1 General Subsurface Profile

The generalized subsurface conditions at the project site consist of:

Location for Building A (B01 to B04 and IT02)

0.0 to 0.2 ft bgs: Topsoil that is typically brown and moist and loose.

0.2 to 3.0/15.0 ft bgs: Fill composed of primarily very loose to medium dense silty sand with gravel (USCS classification of "SM"). Organics and wood debris encountered. Fill soils are typically brown, moist and assumed low to non-plastic. Assumed to have moderate frost susceptibility.

3.0/15.0 to 31.5 ft bgs: Native mineral soils composed of both poorly graded sand (SP) and poorly graded gravel (GP), as well as well graded sand (SW) and well graded gravel (GW). These mineral soils are typically medium dense to dense, brown, and moist to saturated. Frost susceptibility is assumed to be low, especially as depth increases and the soils are generally assumed to be non-plastic.

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Central Paved Parking Area (B06 to B08)

0.0 to 0.2 ft bgs:	Topsoil that is typically brown and moist and loose.
0.2 to 7.8/15.0 ft bgs:	Fill composed of primarily very loose to medium dense silty sand with gravel (USCS classification of "SM") and organics/wood debris. Fill soils are typically brown, moist, and assumed low to non-plastic. At depths less than 10 feet bgs, frost susceptibility ranges from moderately frost susceptible (F2) to highly frost susceptible (F3). At depths greater than 10 feet bgs, frost susceptibility ranges from non-frost susceptible (NFS) to low frost susceptibility (F1).
7.8/15.0 to 16.5 ft bgs:	Native mineral soils composed of both poorly graded sand (SP) and poorly graded gravel (GP), areas of well graded sand (SW) and silt with sand (ML) were also encountered. These mineral soils are typically loose to dense, brown, and moist. Frost susceptibility is low (NFS to F1).

North End of Paved Parking Area and Snow Storage (B05 and IT01)

0.0 to 0.2 ft bgs:	Topsoil that is typically brown and moist and loose.
0.2 to 5.5 ft bgs:	Fill composed of loose silty sand with gravel or silty gravel with sand (USCS classification of "SM" and "GM" respectively). Fill soils are brown, moist, and assumed non-plastic. Frost susceptibility is moderate (F2).
5.5 to 16.5 ft bgs:	Native mineral soils composed of both poorly graded gravel (GP) and poorly graded sand (SP). These mineral soils are typically medium dense to dense, brown, moist to saturated, and non-plastic. Frost susceptibility is assumed to be low (NFS).

It is important to note that the depths of these layers all vary across the project, in some cases up to 12 feet. Refer to Graphical Exploration Logs in Appendix B of this report for more details.

5.2 Groundwater

We observed indications of groundwater at depths of approximately 20 feet and 24 feet bgs at B01 to B04 during our exploration efforts. Indications of groundwater were also observed at 14 feet and 11 feet at B05 and IT01, respectively, on the north end of the project site.

Static groundwater was measured at IT01 at 11 feet bgs on October 3, 2025. No indications of groundwater were encountered at the location of IT02 both during exploration activities on September 9, 2025 to September 11, 2025 and during our groundwater monitoring efforts on October 3, 2025.

5.3 Frozen Soils

No indication of frozen soils was observed during our subsurface exploration activities, and we do not expect permafrost to occur at the project site.

6.0 ENGINEERING CONCLUSIONS

Based on the findings of our field, laboratory testing, and engineering analysis efforts, it is our conclusion that:

General:

1. The subgrade soils consisting of fill material are not suitable for supporting any shallow building foundations.
2. The subgrade soils below fill material, primarily native sand and gravel, are generally suitable to support the proposed improvements provided that our concerns and recommendations are addressed by the design and construction processes.

Earthworks:

3. Any organic rich material and fill should be excavated out to its horizontal and vertical extent within the footprint of the proposed improvements for all shallow foundations.
4. Coarse-grained material may be re-used on-site as structural fill assuming that the material is free of any organic material (or other deleterious debris) and that the material is compactible.
5. Excavations below the groundwater table will necessitate dewatering efforts for structural fill placement.

Foundations:

6. A conventional shallow foundation is suitable for the proposed site improvements, assuming that the foundation bears on either undisturbed native soils or properly placed structural fill above the undisturbed native soils.
7. A deep foundation system which transfers foundation loads through the unsuitable fill materials and into the underlying relatively dense mineral soils is also a suitable foundation system for the project site.
8. There is a low potential for soil liquefaction and earthquake-induced lateral spreading and pressure ridges are unlikely.
    a. Low liquefaction potential can be maintained by properly placing structural fill as discussed in Section 7.1 and 8.1 of this report.

Underground Utilities:

9. Underground utilities can be founded directly onto the undisturbed native soils or properly placed structural fill.

10. Existing subgrade soils consisting of fill material are not suitable to support underground utilities that can be damaged from moderate movement in the subgrade.

<u>Pavement:</u>

1. Pavement sections can be designed to “float” above the loose fill soils using a combination of geo-fabrics and prescribed amounts of structural fill.
2. The pavement section design also needs to consider the moderate to high frost susceptible (F1 to F3) Municipality of Anchorage (MOA) frost classification of the near surface subgrade soils (i.e., fill).

<u>Settlements:</u>

3. Total settlement for shallow concrete foundations placed on recommended bearing materials (defined in Section 7.1) is anticipated to be less than three-quarters (3/4) of an inch, with differential settlements comprising about one-half (1/2) of the total anticipated settlement.
    a. Settlement amounts could increase substantially if the structural fill material used to bring any foundation pads to grade is not properly compacted.
    b. Most of the settlements should occur as the building loads are applied, such that additional long-term settlements should be relatively small and within tolerable limits.
4. Settlements for deep foundations should be negligible.
5. Settlements under driveways and parking areas are expected to vary more than under any buildings, especially where utility trenches are located.
    a. The settlement potential can be reduced by performing all utility excavation and backfill efforts as early in the construction schedule as possible and placing any pavement as last in the construction schedule as possible.

7.0 DESIGN RECOMMENDATIONS

We have presented our design recommendations in the general order that the project site will most likely be developed. Our design recommendations can be used in parts (as needed) for the final design configuration.

7.1 Earthworks

Our general recommendations for earthworks are:

- Foundations should be placed on recommended bearing materials.
    - <u>Recommended bearing materials</u>: undisturbed native sand and gravel or properly compacted structural fill above the undisturbed native sand and gravel.
- Excavations into soils consisting of fill material that are backfilled with structural fill for any shallow foundations should be completed per Figure 5 of this report.

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- Structural fill materials should be compacted to a minimum of 95 percent of the modified Proctor density.
- To reuse excavated coarse-grained material as structural fill it:
    - should have less than approximately 15 percent passing the #200 sieve; and
    - must not contain any organic/deleterious material.

Slopes at the project site should:

- not exceed a 2:1 slope (if constructed);
- have properly keyed in fill; and
- have erosion control.

We recommend the following quality control inspections:

- bottom-of-hole inspections;
- fill gradation classification; and
- in-situ compaction testing.

A bottom-of-hole inspection should be conducted (by a qualified geotechnical engineer, geologist, or special inspector) before any foundation construction begins.

7.2 Seismic Design Parameters

Assumptions: ASCE/SEI 7-16 and Seismic Risk Category II

Seismic Site Classification: *D*

ASCE 7 Hazards Report: Appendix E

7.3 Shallow Foundations

For the purposes of this report, we consider a shallow foundation to be any foundation which is shallower than ten (10) feet bgs. We have provided our recommendations for warm (i.e., heated) shallow foundations into Sections 7.3.1 of this report. We do not recommend cold shallow foundations (i.e., unheated).

7.3.1 Warm Shallow Foundations

For the purposes of this report, we consider a warm shallow foundation to be any shallow foundation located within or along the direct perimeter of an enclosed, climate-controlled space that maintains an internal ambient air temperature above 40°F.

7.3.1.1 Soil Bearing Capacity

Concrete foundations placed on recommended bearing materials (defined in Section 7.1) and at the burial depths of a perimeter footing as described in Section 7.3.1.3 may be designed with a:

- 3000 pounds per square foot (psf) soil bearing capacity; and

- one-third (1/3) increase to accommodate short-term wind and/or seismic loads.

Larger footings (smallest dimension greater than two feet in plan dimension) may be designed for greater bearing capacities at a rate of 200 psf for every additional horizontal linear foot of footing up to a maximum value of 4000 psf.

7.3.1.2 Continuous Strip Footings and Spread Footings

The minimum horizontal dimensions for continuous strip footings and/or spread footings founded directly onto recommended bearing materials (defined in Section 7.1) are:

- 16 inches for continuous strip footings
- 24 inches for individual spread footings

7.3.1.3 Footing Burial Depths

For the project site, the minimum burial depth for any uninsulated shallow foundation footings should be as follows (measured from the bottom of the foundation footing):

1. 12 inches (D_1 in Figure 6) for interior footings located entirely within an enclosed, continuously heated space* (measured from the bottom of the footing to the top of the floor slab) and
2. 42 inches (D_2 in Figure 6) for foundation footings located along the perimeter of an enclosed, continuously heated space* (measured from the bottom of the footing to the exterior finished grade).

**The temperature of an enclosed, continuously heated space must be maintained above 40 °F and allow for adequate heat transfer to foundation soils in order for our recommendations to apply.*

We have provided our recommended insulation configurations Figure 7 of this report. We should be consulted if alternative foundation insulation configurations are to be utilized for this project so that we can evaluate their suitability as it pertains to the existing site conditions and proposed foundation design.

If foundation burial depths are reduced through the use of insulation, then the allowable bearing capacity of the foundation may also be reduced. As such, we should be consulted to re-evaluate our minimum allowable bearing capacities if foundation depths are to be shallower than those which we recommend above.

We provide more details about frost development and protection in Appendix A (Section 3.1) of this report.

7.3.1.4 Thickened Edge Slab Foundations and Floor Slabs

Thickened slab edges (i.e., perimeter slab footings) should extend a minimum of 16 inches below the finished exterior grade to achieve the recommended allowable soil bearing capacity and help resist any lateral forces. Warm thickened edge slab foundations and/or floor slabs can be founded directly onto the recommended bearing materials (defined in Section 7.1) with a pad that consists of:

- adequate amounts of insulation (Figure 7);
- relatively free draining sands and gravels with less than about 15% of the fill material passing through a #200 sieve for the upper structural fill material (at or above the footing grade); and
- free draining material with less than 3% passing the #200 sieve for the top four to six inches beneath the slabs.

Concrete slabs constructed directly on the recommended bearing materials (defined in Section 7.1, may be designed using a modulus of subgrade reaction of k_1=180 pci (k_1 is the value for a 1-ft × 1-ft rigid plate) and the equations presented in Appendix A (Section 3.2) for modulus of subgrade reaction for load footprints.

7.3.2 Cold Shallow Foundations

For the purposes of this report, we consider a cold shallow foundation to be any shallow foundation whose subgrade is subjected to freezing temperatures for any amount of time. We do not recommend the construction of a cold shallow foundations. However, in the event that cold shallow foundations cannot be avoided, we provide cold shallow foundations recommendations in the following Subsections of this report.

Deep foundation systems can serve as an alternative means of cold foundation support. We provide a more detailed description of cold deep foundation systems in Section 7.4 of this report. Cost and constructability will typically be the driving forces behind which type of cold foundation system is ultimately selected for a given project.

We provide more details about frost development and protection as well as deep foundation systems in Appendix A (Section 3.1) of this report.

7.3.2.1 Soil Bearing Capacity

The bearing capacity of cold shallow foundations will be a function of both the configuration (i.e., dimensions) and burial depth of the foundation. We can provide allowable bearing capacities for various footing burial depths once a foundation configuration has been determined.

7.3.2.2 Footing Burial Depths

For the project site, the minimum burial depth (measured from the bottom of the footing to the lowest elevation of either the interior or exterior finished grade – including any floor slabs) for any uninsulated cold shallow foundation footings should be 96 inches (D3 in Figure 6).

The minimum footing burial depth for any cold shallow foundation may be reduced, if the foundation is placed onto a granular structural pad constructed of NFS fill material where:

- the NFS material has less than 3% of the material finer than 0.02 mm in diameter;
- the NFS fill subgrade extends a minimum of 96 inches below the planned finished grade (interior or exterior - whichever is lower); and
- the minimum foundation burial for a cold shallow foundation bearing onto a structural NFS fill pad should is the same as our minimum recommended burial depth for a warm shallow foundation (D2 in Figure 6).

Artificial insulation may be used in lieu of some of the NFS backfill where:

- a minimum of 18 inches of NFS fill is present between the bottom of any shallow foundation footing and the top of any insulation; and
- one inch of rigid foam board insulation is considered equivalent to one foot of NFS fill (in terms of insulating properties).

We detail our recommended insulation configurations for cold shallow foundations in Figure 7 of this report. We should be consulted if alternative shallow foundation insulation configurations are to be utilized for this project so that we can evaluate their suitability.

We provide more details about frost development and protection in Appendix A (Section 3.1) of this report.

7.3.2.3 Grade-level Design Elements

Any cold shallow foundation design elements which are to exist at (or very close to) grade level (e.g., grade beams, connecting structural members, exterior siding, etc.) should be designed to accommodate a minimum of two inches of vertical ground movement

We can evaluate the frost heaving pressures that may develop (for use in the structural design) if the design cannot accommodate our recommended air gap. If planned grade-level design elements cannot withstand any vertical movements, then they should not be used with a cold shallow foundation system.

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7.3.3 Shallow Foundation Uplift Resistance

The uplift capacity of a foundation is a function of its weight, configuration, and depth and can be determined using:

- 80 percent of the weight of the foundation plus 80 percent of the weight of the effective soil mass (Figure 8) located above the footing;
- an effective unit weight of 130 pcf for granular structural backfill material; and
- no increase in uplift capacity for short-term loading, as the ultimate uplift load includes any short-term load factors.

Shallow foundation footings should extend laterally a minimum of one-eighth (1/8) of the footing width beyond any foundation walls to help resist any anticipated uplift/overturning forces (Figure 9).

We can calculate the uplift capacity for other foundation configurations upon request and once we have been provided with a general foundation design.

7.3.4 Lateral Loads for Foundation and Retaining Walls

Retaining walls (such as perimeter foundation stem walls for buildings with basements or crawl spaces) must be designed to resist lateral earth pressures. The magnitude of the pressure exerted on a retaining wall is dependent upon several factors, including:

1) whether the top of the wall is allowed to deflect after placement of backfill;
2) the type of backfill used;
3) compaction effort; and
4) wall drainage provisions.

Any foundation stem walls that are not designed to carry lateral loads should be backfilled on both sides simultaneously to prevent differential lateral loading of the foundation stem wall.

The lateral soil pressures can be represented by equivalent fluid pressures. The pressure distribution is a function of wall restraint, seismic loading, and drainage conditions. In Table 1 of this report, we provide the unit weights to be used with the pressure distribution diagrams for various loading conditions provided in Figure 9 of this report. We assumed that structural fill (containing less than ten percent fines) is used as backfill, and that the fill is compacted to at least 90 percent of the modified Proctor density.

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Table 1: Equivalent Fluid Specific Weight for Lateral Loading Design

LOADING CONDITION	DRAINED EQUIVALENT FLUID SPECIFIC WEIGHT		UN-DRAINED EQUIVALENT FLUID SPECIFIC WEIGHT	
	SPECIFIC WEIGHT (pcf)	**SYMBOL**	**SPECIFIC WEIGHT (pcf)**	**SYMBOL**
ACTIVE	35	t_1	21	t_2
AT-REST	55	t_3	33	t_4
PASSIVE	440	t_5	265	t_6
SEISMIC	16 **(UNRESTRAINED)**	t_7	10 **(RESTRAINED)***	t_8

*For wall heights less than 8 ft

Lateral forces may also be resisted by friction between the concrete foundations and the underlying soil. The frictional resistance may be calculated using a coefficient of friction of 0.4 between the concrete and soil.

We provide more details about lateral earth pressure in Appendix A (Section 3.3) of this report.

7.4 Deep Foundations

For the purposes of this report, a deep foundation can be considered any foundation which transfers foundation loads (both bearing and uplift) through the existing fill to the deeper, more competent relatively dense sand/gravel (with limited foundation excavation effort required).

7.4.1 Steel Pipe Piles

The most common type of deep foundation system in the Anchorage area consists of driven steel pipe piling. For this project, we recommend:

- open-ended piles with or without the use of re-enforced/hardened drive shoe;
- using the final driving rate to verify that the estimated allowable bearing capacity has been achieved; and
- having a qualified geotechnical engineer, geologist, and/or special inspector be on-site during pile installation activities to verify that piles are installed properly.

7.4.1.1 Pile Bearing Capacity

Allowable Bearing Capacity Chart: Figure 10 of this report

We can refine the allowable pile bearing capacities once the building loads are known and a preferred pile diameter/size has been selected.

- The allowable capacity may be increased by 1/3 for short term wind and seismic loading.

7.4.1.2 Pile Uplift Capacity

Our recommendations for uplift capacity are:

- The short-term uplift capacity of each pile may be taken as one-half (1/2) of the long-term bearing capacity (Figure 10).
    - This includes a typical one-third (1/3) increase for short-term wind and seismic loading.
- A minimum pile embedment of 18 feet below the finished grade is required for any cold pile foundations installed at the project site in order to resist frost jacking forces.

7.4.1.3 Lateral Pile Capacity

The ultimate and allowable lateral loads listed in Table 2 of this report were determined:

- using the computer program ALLpile7 (developed by CivilTech software);
- assuming a free-head condition for the piles (i.e., the pile head is allowed to rotate/deflect);
- assuming that the pile head is level with the ground surface (i.e., no pile stickup);
- using ½ of the ultimate lateral loads for the allowable lateral loads; and
- using subsurface soil conditions encountered during exploration at the proposed location of Building A, specifically B02 where fill existed down to approximately 15 feet bgs.
    - Minimum embedment depth of 20 feet includes 15 feet passing through the loose fill soils and 5 feet embedded into competent native soils.

We can recalculate the lateral loads once the pile head elevation and connection design has been defined. It should be noted that the lateral pile capacities significantly decrease as the pile stickup (above grade) increases.

Table 2: Free-Head Lateral Pile Capacity

PILE TYPE	MAX. DEFLECTION (in)	MIN. DEPTH (ft)	ULTIMATE CAPACITY (kips)*	ALLOWABLE CAPACITY (kips)*
6-in SCH. 80	1.0	30	8.7	4.3
8-in SCH. 80	1.0	30	12.6	6.3
10-in SCH. 80	1.0	30	16.4	8.2
12-in SCH. 80	1.0	30	20.1	10.0

*Lateral pile capacities calculated with pile head at grade (i.e., no pile stickup above grade)

7.4.1.4 Pile Foundations with Connecting Structural Members

For a continuously heated pile foundation system (where the soil surrounding individual piles and under any structural members remains in a continuously thawed state) with structural members:

- The design does not need to consider frost heaving uplift loads.

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- Uninsulated and insulated configurations are presented in Figure 11 of this report.

For a cold pile foundation system with structural members, we recommend:

- No grade-level structural members.
- Any below grade structural members be installed deeper than eight feet bgs or contain frost-protection if at shallower depths.
- Maintaining an air gap of 6 inches between the ground surface and any above grade structural members that connect to or span between cold pile foundations.

We should be consulted in the event that the structural design cannot accommodate a sub-structural member air gap so that we can evaluate any frost heaving pressures that may develop, so that they can be accounted for by the structural design.

We provide more details about frost development in Appendix A (Section 3.1) of this report.

7.5 Insulation

Any subgrade insulation used should:

- consist of extruded polystyrene such as DOW Styrofoam™ Highload or UC Industries Foamular;
- not absorb more than 2% water per ASTM Test Method C-272;
- not have a thermal conductivity (k) that exceeds 0.25 BTU-in/hr-ft2-°F when tested at 75°F;
- be installed with proper bedding material that provides a flat, smooth surface; and
- be closed cell, board stock with a minimum compressive strength of:
    - 60 psi (at 5% deflection) for use under structural slabs.
    - 25 psi (at 5% deflection) for use around the exterior of any foundations.

7.6 Underground Utilities

In general, the soils in which deep utility trenches (6-10 feet bgs) are to be constructed are composed of fill material or native sand and gravel. Any gravity-fed utility trenches extending into the fill material or native sand and gravel should be a minimum of three feet wide at the bottom with the utility piping located in the center of the trenches. Structural fill should be used to bring the gravity-fed utilities to the proper installation grade. Utilities that are not sensitive to settlement may be placed in the existing native sand and gravel.

The subgrade soils with existing fill material at the project site are not suitable to support underground utilities.

Underground utilities which are susceptible to damage from freezing:

- Need to be frost-protected by sufficient amounts of backfill, insulation, and/or active freeze protection systems (e.g., heat tape, thaw wire, etc.); or some combination of the above.

- Need to contain some level of additional frost-protection (e.g., insulation, active freeze protection systems, or a combination of both) if they are planned to be constructed less than eight feet below the planned finished grade.
- Should not be constructed within four feet of the planned finished grade (regardless of insulation measures or active freeze-protection systems).

Any insulation used should:

- conform to the specifications detailed in Section 7.5 of this report; and
- extend a minimum of two feet (and a maximum of four feet) perpendicular to either side of the proposed utility alignment.

The thickness of the insulation used will be a function of the burial depth. In general, one inch of insulation is equal to approximately 12 inches of compacted NFS backfill.

7.7 Pavement Sections

Design Considerations:

- The proposed pavement sections are underlaid by approximately 5.5 to 15 feet of fill material that will either need to be:
  - Removed and replaced with structural fill material; or
  - Reinforced using Geogrid material, such as Tensar TX-5 along with a synthetic geotextile conforming to MOA requirements.
- The near surface subgrade soils classify as F1 to F3 on the MOA frost classification scale.

We provide more details about frost development in pavement sections in Appendix A (Section 3.1) of this report.

We have detailed our recommended pavement section for construction above the F1/F3 in the following tables:

Table 3: Recommended Uninsulated Pavement Section for F1/F3 subgrade – Excavated Fill

SECTION THICKNESS	MATERIAL
2 INCHES MIN.	ASPHALT CONCRETE (AC) PAVEMENT
2 INCHES MAX.	NFS LEVELING COURSE (A.K.A. “D-1” or RAP)
12 INCHES	TYPE II-A
24 INCHES	TYPE II or II-A
N/A	SEPERATION GEOTEXTILE FABRIC (OPTIONAL)
N/A	COMPACTIBLE GRANULAR FILL OR TYPE II (F2 or Better)
N/A	NFS SUBGRADE (NATIVE)

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Table 4: Recommended Uninsulated Pavement Section for F/1F3 subgrade – Reinforced with Geogrid Material

SECTION THICKNESS	MATERIAL
2 INCHES MIN.	ASPHALT CONCRETE (AC) PAVEMENT
2 INCHES MAX.	NFS LEVELING COURSE (A.K.A. "D-1")
12 INCHES	TYPE II-A
24 INCHES	TYPE II
N/A	SEPERATION GEOTEXTILE FABRIC (WOVEN OR NONWOVEN)
N/A	GEOGRID MATERIAL (SUCH AS TENSAR TX-5)
N/A	F1 to F3 SUBGRADE (NATIVE OR FILL)

Rigid, closed-cell foam board insulation (as we specify in Section 7.5 of this report) can be used to reduce the amount of Type II material that we specify in our recommended F1 and F3 pavement section (Tables 5 and 6) at a rate of one inch of insulation for 12 inches of Type II/II-A fill. However, given the relatively thin overall section of our recommended pavement section it is likely that insulation will not be a cost-effective option for this project.

7.7.1 Confirmation Testing

NFS and F1 subgrades will only require a leveling course layer, as there is little to no potential for ice lens development in the subgrade soils at the project site. Confirmation frost classification testing of the subgrade soils located along the proposed street alignment should be conducted after the completion of all overburden removal and any utility installation activities at a frequency of:

- one test per 100 lineal feet along the exposed subgrade surface, and
- one test per 200 lineal feet at a depth of approximately 12 inches below the exposed subgrade surface.

The results of the confirmation frost classification testing can be used to ensure that the proper pavement section is used for the soil conditions exposed. If the confirmation testing indicates that the subgrade soils are NFS, then an alternative (thinner) pavement section can be used (as we discuss above). However, if the conformation testing indicates that the frost classification of the subgrade soils is higher than MOA F3, then alternative pavement section designs, including thicker structural sections and/or the use of artificial insulation may be required.

7.7.1 Material Specifications

A permeable geotextile fabric is optional, but not required for this project. Any geotextile fabric used should meet the specifications in the 2015 Municipality of Anchorage Standard Specifications (MASS), Section 20.25 For the project site, we recommend a Type A, Class 2 (i.e., separation) geotextile fabric. The geotextile fabric may be either: 1) woven, or 2) non-woven with

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perforations. We have provided the various strengths for both a woven and non-woven Type A, Class 2 geotextile fabric in Table 5 of this report.

Table 5: Type A, Class 2 Geotextile Fabric Strengths

FABRIC PROPERTY	ASTM STANDARD USED TO DETERMINE STRENGTH	WOVEN FABRIC STRENGTH	NON-WOVEN FABRIC STRENGTH
GRAB STRENGTH	D4632	250	160
SEWN SEAM STRENGTH	D4632	225	140
TEAR STRENGTH	D4533	90	56
PUNCTURE STRENGTH	D6241	495	310

Note: Units in lbs per foot.

The leveling course, Type II, and Type II-A materials used should conform to the specifications we provide in Figure 11 of this report and be placed in thin lifts compacted to a minimum of 95 % of the modified Proctor density.

One layer of geogrid material, such as Tensar TX-5 or similar, should be used and should have a minimum overlap of one foot.

Any leveling course used should be NFS; however, it is our experience that the “D-1” leveling course material currently available in Anchorage area may not be NFS following compaction, and as such we recommend:

- using two inches of recycled asphalt pavement (RAP) for the leveling course; or
- keeping the leveling course thickness to two inches or less.

We provide more details about pavement material specifications in Appendix A (Section 3.4) of this report.

7.8 Surface Drainage

After the property is brought to grade it should be relatively flat, such that storm water will tend to accumulate and flow off the site slowly.

Water accumulation will have a detrimental effect on foundations, retaining structures, and pavement sections and as such we recommend:

1) grading the ground surface around the proposed developments such that surface runoff is channel away from foundations/retaining structures/pavement sections;
2) tightly compacting the surface soils;
3) diverting roof, parking lot and driveway drainage away from foundation; and
4) making tight-line connections from roof drain collectors to storm sewer (if available).

8.0 CONSTRUCTION RECOMMENDATIONS

We have presented our construction recommendations in the general order that the project site will most likely be developed. Our construction recommendations are intended to aid the construction contractor(s) during the construction process.

8.1 Earthwork

Structural fill should be:

- compacted to a minimum of 95 percent of the modified Proctor density as determined by ASTM D-1557 (unless specifically stated otherwise in other sections of this report); and
- placed in individual lifts of less than one-foot in thickness (typical);
  - thickness will be determined based on the equipment used, the soil type, and existing soil moisture content.

All earthworks should be completed with quality control inspection.

Excavated coarse-grained material should:

- have less than approximately 10 to 15 percent passing the #200 sieve and not contain any organic/deleterious material to be used as structural fill; and
- be protected from additional moisture inputs (precipitation, etc.) through the use of plastic tarps, etc. if stockpiled on-site.

Soils with higher silt contents can be used within the foundation footprint. However, the effort required to achieve proper compaction of silt-rich soils may be more costly than purchasing better grade materials. The time of year, existing moisture content, rainfall, air temperature, and fill temperature can all have an impact on the effort required to adequately compact silt-rich material.

8.1.1 Winter Construction

To ensure proper placement and compaction of structural fill during winter months the following additional guidelines should be followed:

- ambient soil temperatures need to be above 37 °F;
- fill material needs to be completely thawed before placement; and
- subgrade soils (fill or native) need to be completely thawed prior to the placement and compaction of additional lifts of thawed fill material.

8.2 Shallow Foundations

Care should be taken during foundation excavation activities to limit the disturbance of the bottom of any foundation excavations. The bottom of any foundation excavation should be moisture conditioned and proof-rolled as necessary to return the exposed soils to their original in-situ density.

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In general, the soils in which the proposed foundation pads are to be constructed consist primarily of loose fill material consisting of gravel, sand, silt, and organics. As such, any surface water (*e.g.,* from precipitation, snowmelt, etc.) that enters into foundation excavations will tend to dissipate slowly. Excess water will have a negative impact on any backfill and compaction efforts. Therefore, if surface water does accumulate in any open foundation excavations it can be controlled by excavating a shallow drainage trench around the perimeter of the excavation. The drainage trench will collect surface water and direct it to a sump area, which should be located outside of the foundation footprint. The excess water can then be pumped from the sump area and be discharged at an appropriate location away from the excavation and any other existing foundations.

8.2.1 Warm Shallow Foundations

Warm shallow building foundation must remain thawed continuously through construction;

- if construction occurs during the winter months tenting (temporary enclosures) and heat should be applied to keep the foundation bearing material thawed
- consequences of freezing are described in Section 3.1 of Appendix A

8.2.2 Cold Shallow Foundations

We do not recommend the construction of any cold (unheated) shallow foundations without freeze protection, as they may experience ice lens development and/or thaw-weakening, which could result in damages to the proposed foundations. As we mention in Section 7.3.2.2 of this report, the minimum cold foundation burial depth (D_3) can be reduced, if the foundation is placed on a structural pad constructed of NFS fill. The NFS structural pad thickness may be reduced by using insulation at a rate of one inch of insulation to one foot of NFS material.

8.3 Deep Foundations

A drive shoe is not required if the steel pipe pile wall thickness used is sufficient to help reduce the potential for buckling. Any drive shoe used during pipe pile installation should have an outside diameter smaller than the outside diameter of the pile so that it does not oversize the pile annulus and reduce the skin friction on the pile. Once the pile size, pile loading, and pile hammer are chosen, we can perform a pile analysis to determine a final driving rate for the allowable load required.

Heated pile foundations that are allowed to freeze during the initial construction (before the building is enclosed and heated) may be compromised by frost heaving/jacking. Frost heaving could damage the pile connection, raising any structural member that spans between individual piles or frost jack the individual piles themselves. Piles may be allowed to freeze and/or be installed in frozen soils, if they are driven to a minimum depth of 5 feet into competent native soils for cold pile foundations (assuming no grade-level structural members connect adjoining pile foundations – See Section 7.4 of this report for more detail).

8.4 Underground Utilities

We expect that utility trench wall stability in the fill material or sand and gravel to be poor to moderate, especially where utility trenches extend below the groundwater table. The contractor should be responsible for trench safety and regulation compliance. If groundwater is encountered during utility trench excavation, then dewatering efforts may be required to facilitate proper utility installation and trench backfill.

All piping should be bedded per the manufacturer's recommendations, with the bedding material compacted to provide pipe support. Above the bedding materials, the backfill should be similar to, and compacted to the approximate density of, the surrounding soils.

8.5 Pavement

The following are our construction recommendations for pavement sections:

- Confirmation frost classification testing of the exposed subgrade should be completed.
- All of the earthwork within any areas to be paved should be completed as early in the construction schedule as possible, and the pavement placed as late in the construction schedule as possible.
    - Underground utility piping should be installed prior to construction of any pavement sections such that trenching is done through the subgrade soils only.
    - This will give the subgrade soils time to settle, compress, and stabilize prior to placement of the pavement.
- Any structural fill used should be placed in thin lifts (less than one foot in thickness) and each lift should be compacted to a minimum of 95 percent of the modified Proctor density.
- Prior to paving, any surface fill material should be re-leveled and re-compacted.
- All backfill and paving materials should be inspected and tested for material specification compliance and compaction.

The minimum thickness for any asphalt concrete (AC) pavement surfaces is two inches. The minimum thickness of any Portland cement concrete (PCC) pavement surfaces will be a function of the reinforcement required. All applicable ACI and IBC standards should be followed.

8.6 Insulation

The satisfactory performance of any subsurface insulation is in part controlled by the details of construction including: 1) the care taken to ensure that the board stock lies flat on a smooth, level surface; and 2) the adjoining ends of the insulation are closely butted together. Any vertical joints should be staggered where more than one layer of insulation is used.

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9.0 CLOSURE

We (Northern Geotechnical Engineering, Inc. - Terra Firma Testing) prepared this report exclusively for the use Spark Design, LLC and their consultants/contractors/etc. for use in the design and construction of the proposed improvements. We should be notified if significant changes are to occur in the nature, design, or location of the proposed improvements in order that we may review our conclusions and recommendations that we present in this report and, if necessary, modify them to satisfy the proposed changes.

This report should always be read and/or distributed in its entirety (including all figures, exploration logs, appendices, etc.) so that all of the pertinent information contained within is effectively disseminated. Otherwise, an incomplete or misinterpreted understanding of the site conditions and/or our engineering recommendations may occur. Our recommended best practice is to make this report accessible, in its entirety, to any design professional and/or contractor working on the project. Any part of this report (e.g., exploration logs, calculations, material values, etc.) which is presented in the design/construction plans and/or specifications for the project should have an adequate reference which clearly identifies where the report can be obtained for further review.

Due to the natural variability of earth materials, variations in the subsurface conditions across the project site may exist other than those we identified during the course of our geotechnical assessment. Therefore, a qualified geotechnical engineer, geologist, and/or special inspector be on-site during construction activities to provide corrective recommendations for any unexpected conditions revealed during construction (see our discussion of the Observational Method in Section 5.0 of Appendix A of this report for more detail). Furthermore, the construction budget should allow for any unanticipated conditions that may be encountered during construction activities.

We conducted this evaluation following the standard of care expected of professionals undertaking similar work in the State of Alaska under similar conditions. No warranty, expressed or implied, is made.

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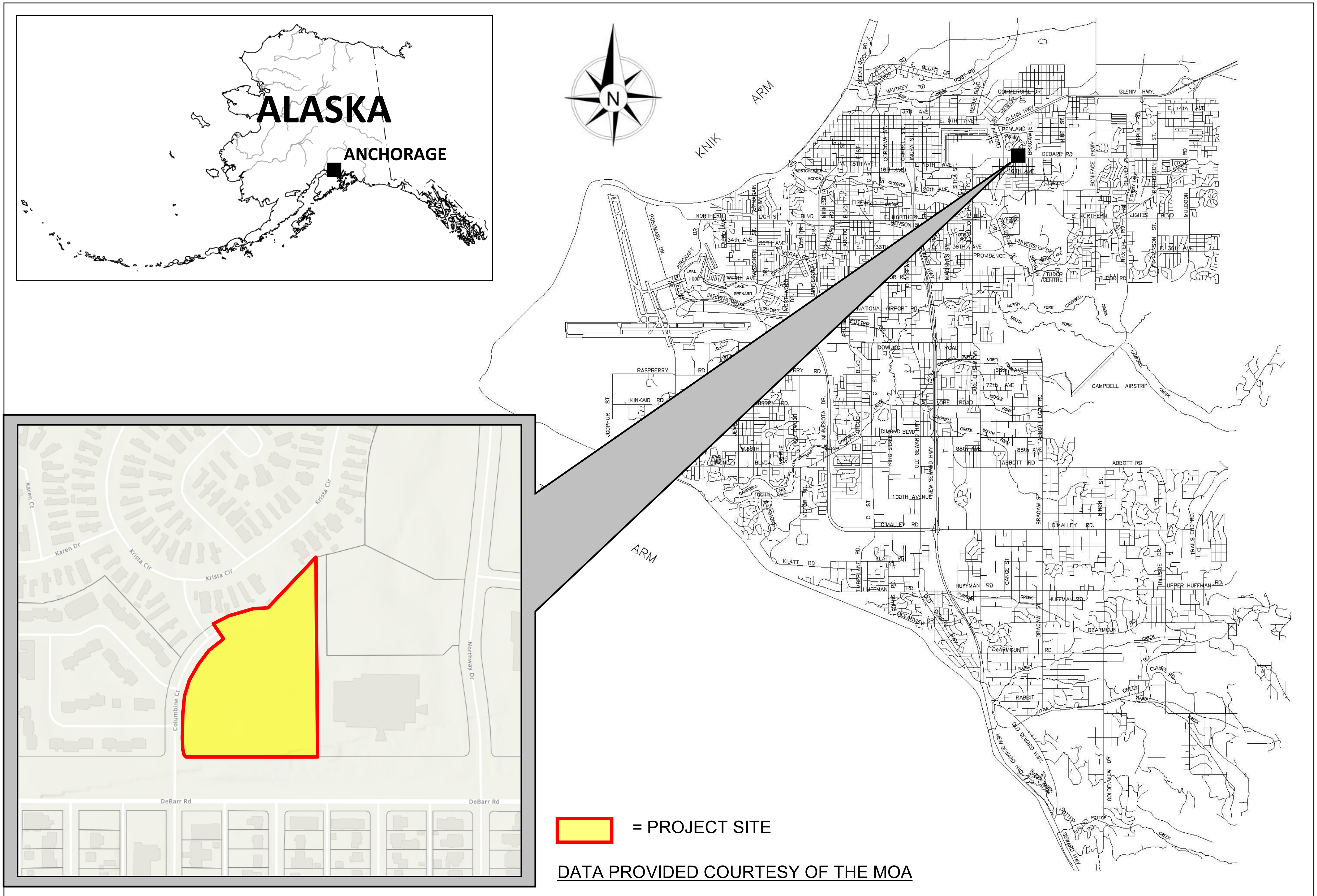
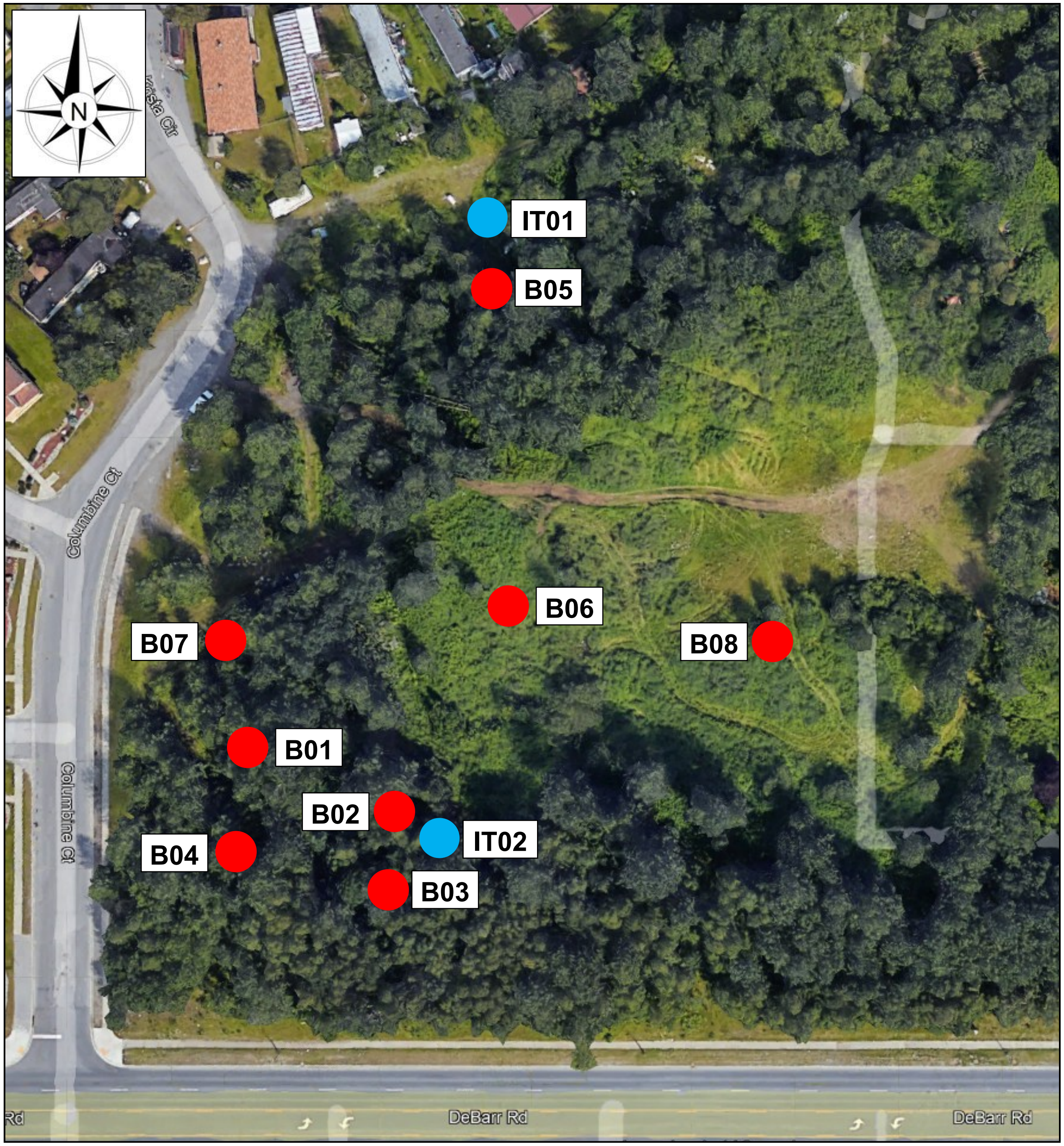
REPORT
FIGURES



NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: PROJECT SITE LOCATION MAP	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 1



Borehole	Coordinates (N / W)
B01	61.210325 / -149.817198
B02	61.210257 / -149.817509
B03	61.21015 / -149.81671
B04	61.210183 / -149.817201
B05	61.211066 / -149.816376
B06	61.210535 / -149.816382
B07	61.210503 / -149.817287
B08	61.210511 / -149.815509
IT01	61.211176 / -149.816451
IT02	61.210200 / -149.816729

- APPROXIMATE BOREHOLE LOCATIONS
- APPROXIMATE INFILTRATION WELL LOCATIONS

DATA PROVIDED COURTESY OF THE MOA

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

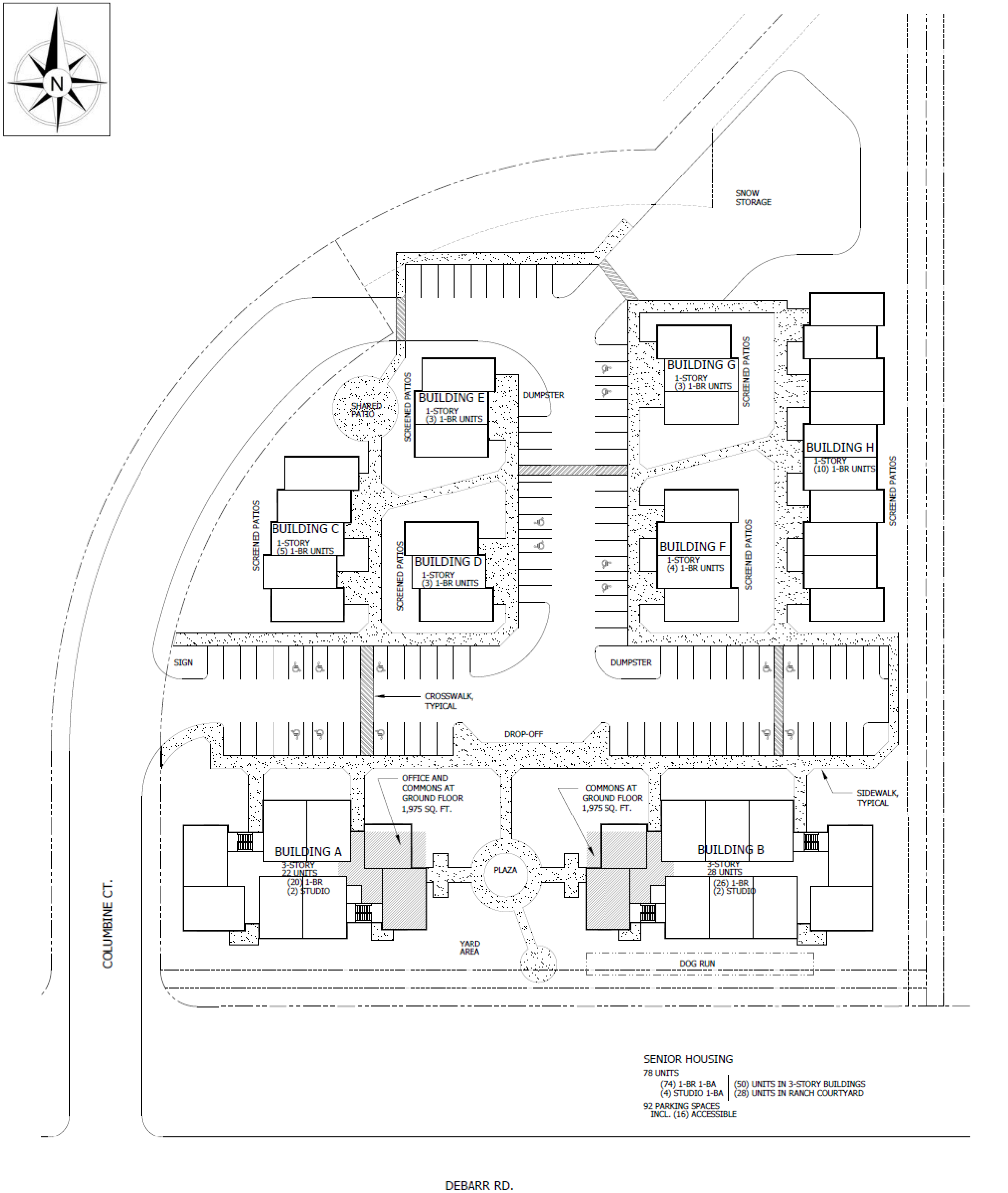
FIGURE TITLE:
CURRENT SITE LAYOUT AND APPROXIMATE EXPLORATION LOCATIONS

PROJECT NAME:
CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1

PROJECT ID:
10155

PROJECT LOCATION:
ANCHORAGE, ALASKA

FIGURE NUMBER:
2



DRAWING PROVIDED SPARK DESIGN

NORTHERN GEOTECHNICAL ENGINEERING, INC.
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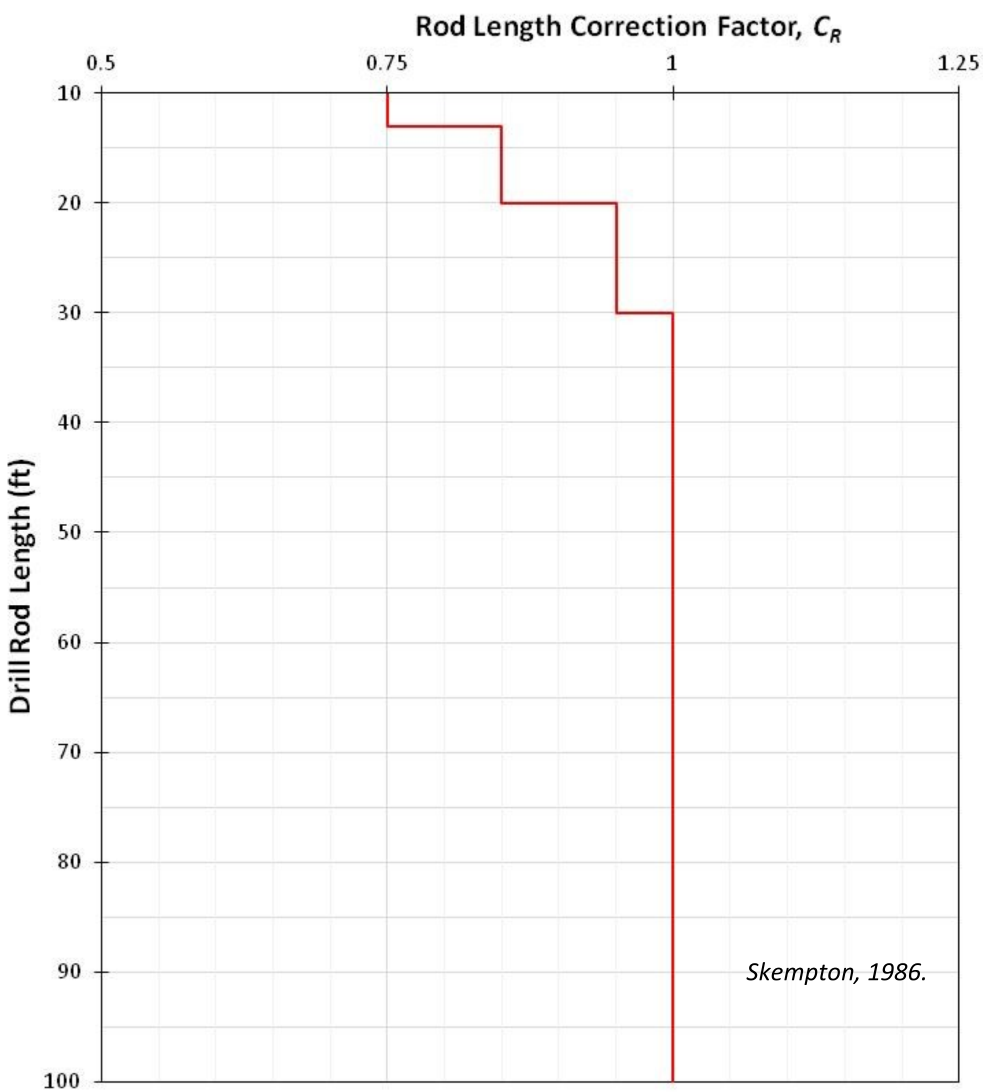
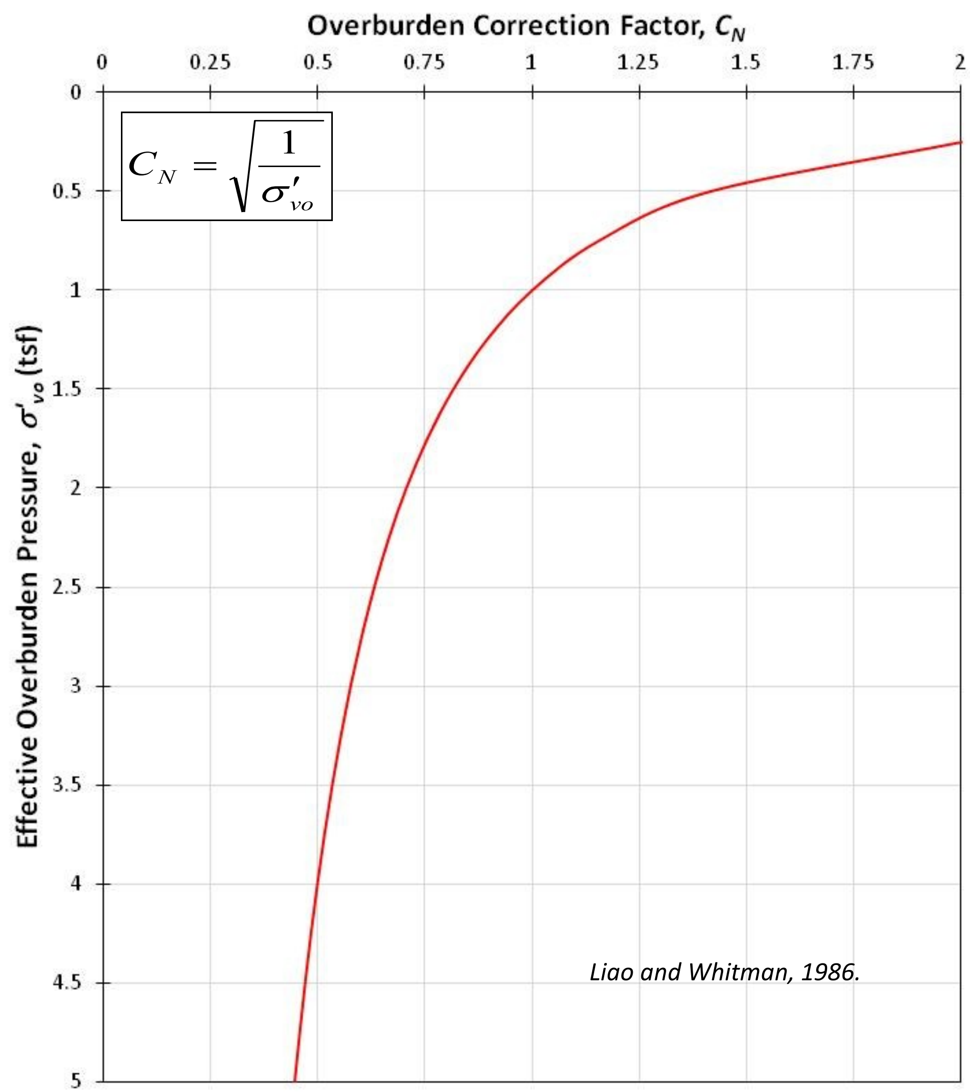
FIGURE TITLE: PROPOSED IMPROVEMENTS	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 3





NOTES:

- OVERBURDEN CORRECTION FACTOR IS USED ONLY FOR COHESIONLESS SOILS
- C_N IS THE RATIO OF THE MEASURED BLOW COUNT TO WHAT THE BLOW COUNT WOULD BE AT AN OVERBURDEN PRESSURE OF 1 TON/FT^2
- Σ'_{VO} IS THE EFFECTIVE OVERBURDEN PRESSURE AT THE POINT OF MEASUREMENT (TON/FT^2)

NORTHERN GEOTECHNICAL ENGINEERING, INC.
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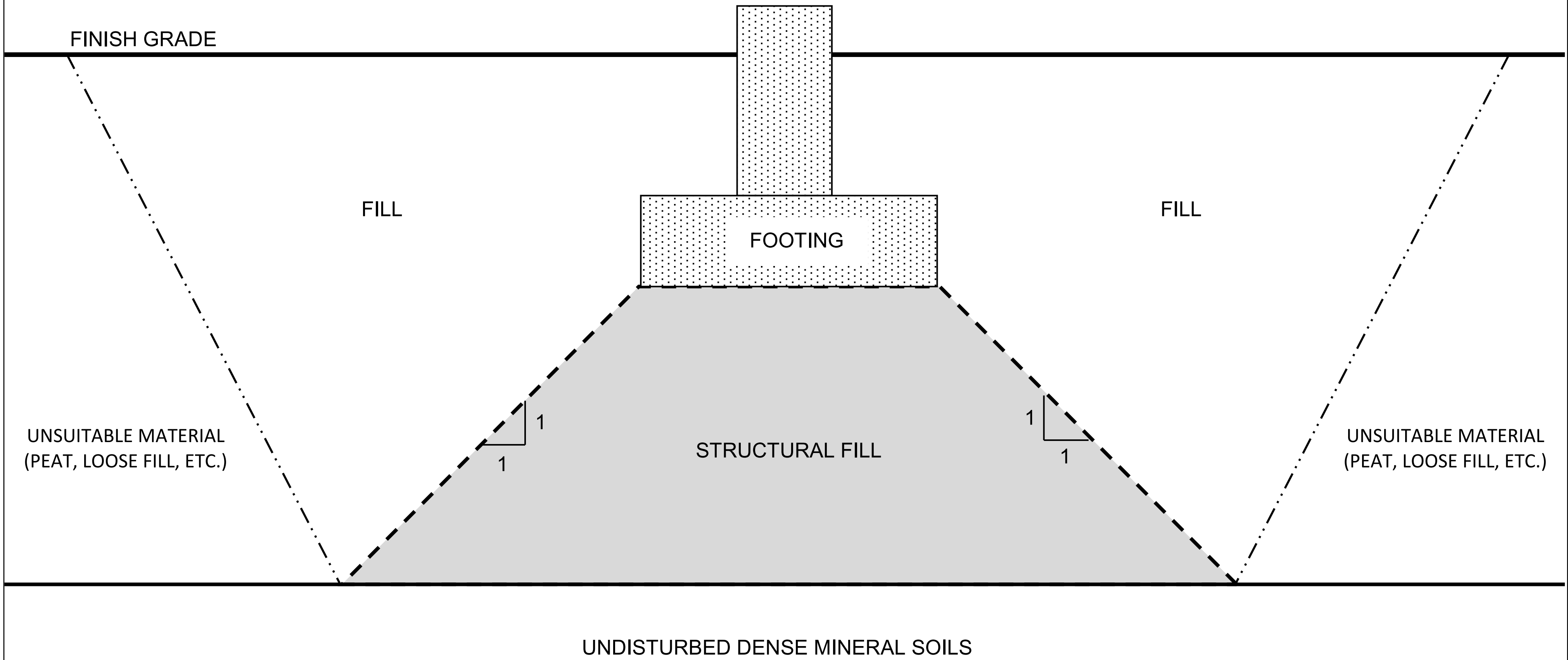
FIGURE TITLE: BLOW COUNT CORRECTIONS	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 4



= FOOTING / STEM WALL

NOTES:

1. ALL STRUCTURAL FILL SHOULD BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MODIFIED PROCTOR DENSITY.
2. CONTRACTOR SHOULD BE RESPONSIBLE FOR TRENCH SAFETY AND REGULATION COMPLIANCE DURING EXCAVATION.

DRAWING NOT TO SCALE

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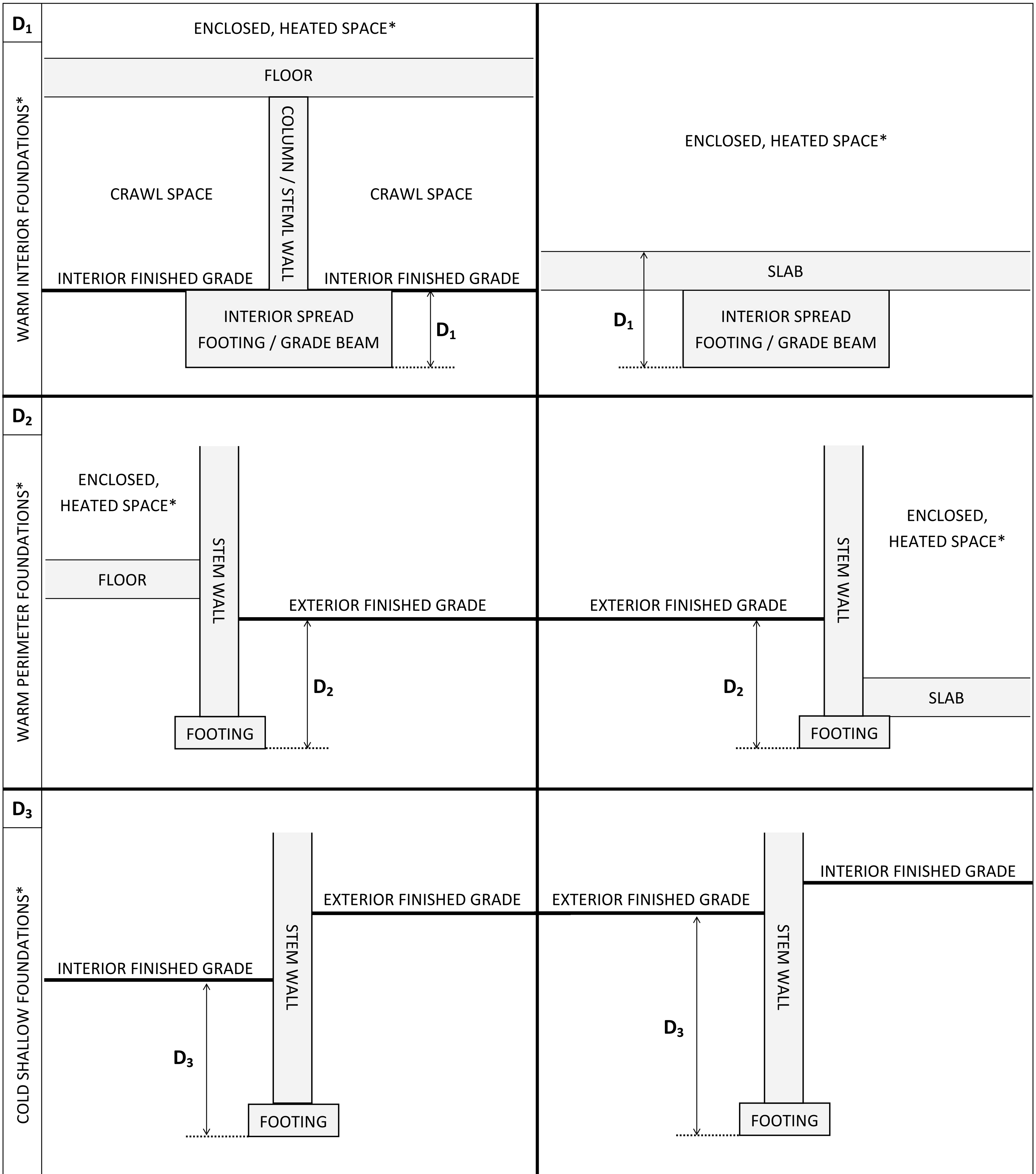
FIGURE TITLE: EXCAVATION DIAGRAM	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 5



NOTES:

DRAWINGS NOT TO SCALE

MINIMUM DEPTHS PROVIDED IN REPORT

* ENCLOSED HEATED SPACES MUST BE CONTINUOUSLY MAINTAINED AT/ABOVE 40°F

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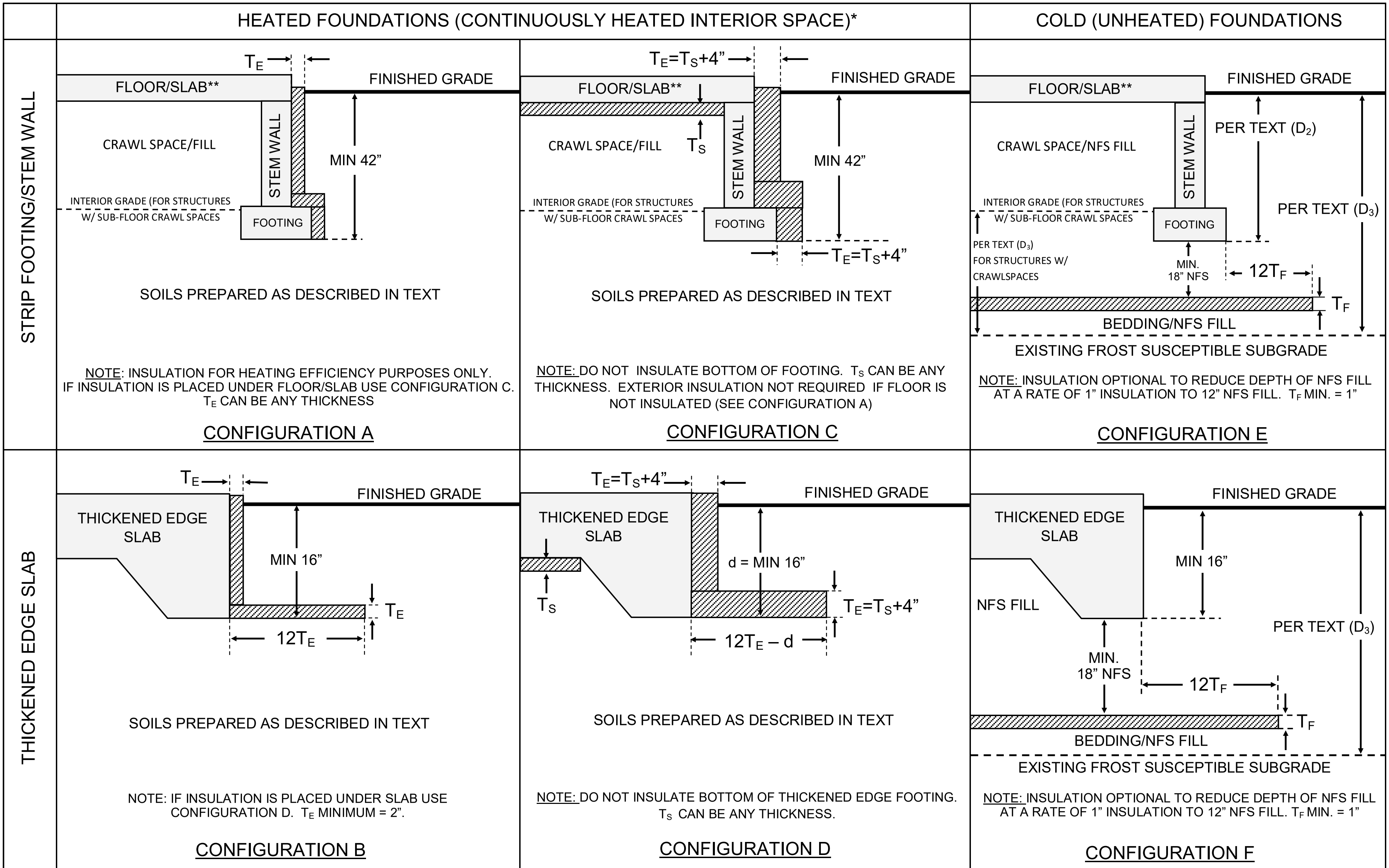
FIGURE TITLE: UNINSULATED SHALLOW FOUNDATION CONFIGURATIONS	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 6



T_F = INSULATION THICKNESS UNDER ENTIRE FOUNDATION (INCHES)
T_S = INSULATION THICKNESS UNDER FLOOR/SLAB ONLY (INCHES)
T_E = INSULATION ALONG EXTERIOR OF FOUNDATION (INCHES)

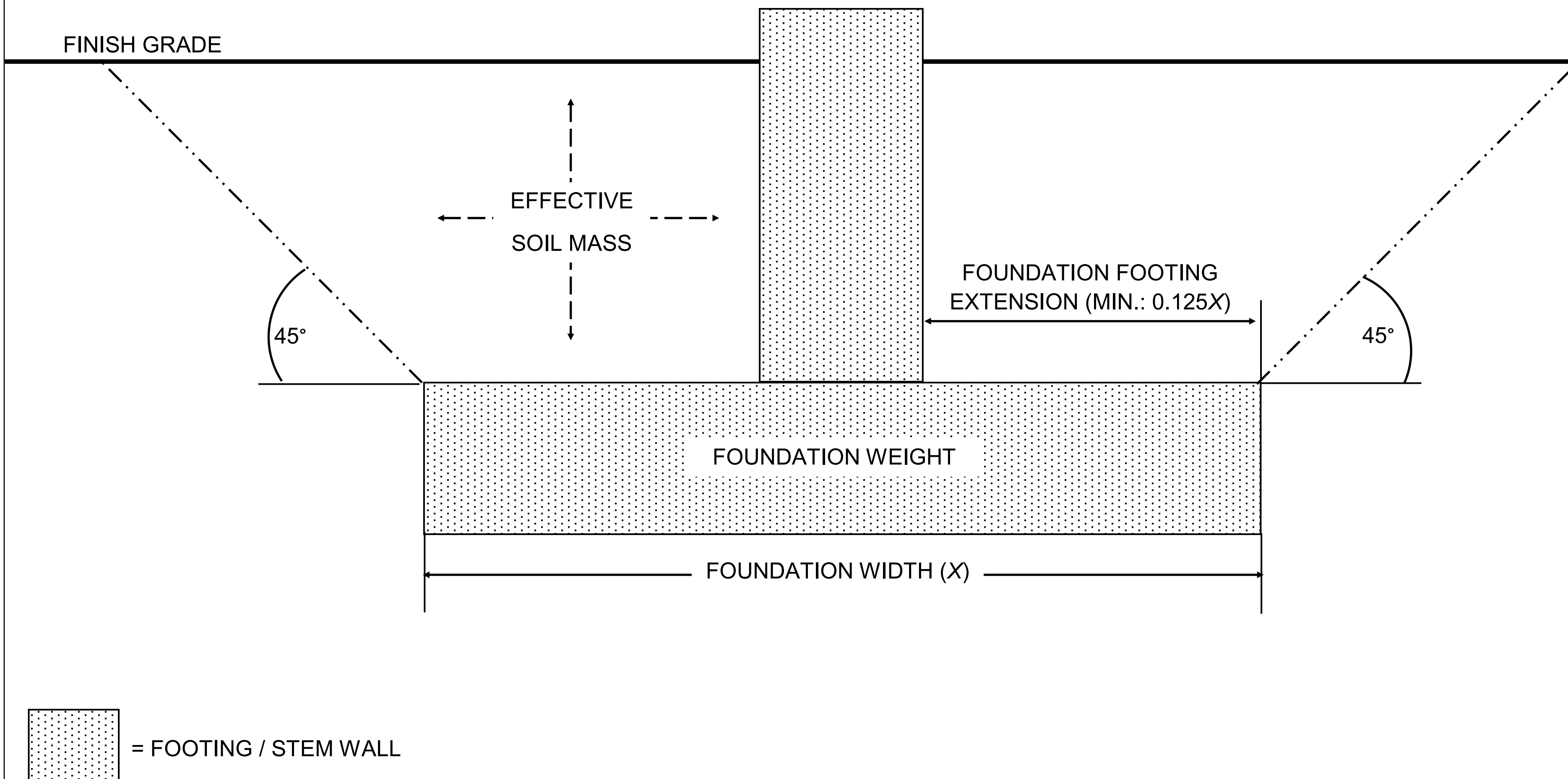
*HEATED FOUNDATION TEMPERATURE MUST BE CONTINUOUSLY MAINTAINED AT/ABOVE 40˚F
**FLOOR SYSTEM CAN BE STRUCTURAL (W/ CRAWLSPACE) OR SLAB-ON-GRADE
[hatched box] = RIGID BOARD INSULATION

DRAWING NOT TO SCALE

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: INSULATED SHALLOW FOUNDATION CONFIGURATIONS	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 7

UPLIFT CAPACITY = 0.8 × (EFFECTIVE SOIL WEIGHT + WEIGHT OF FOUNDATION)



DRAWING NOT TO SCALE

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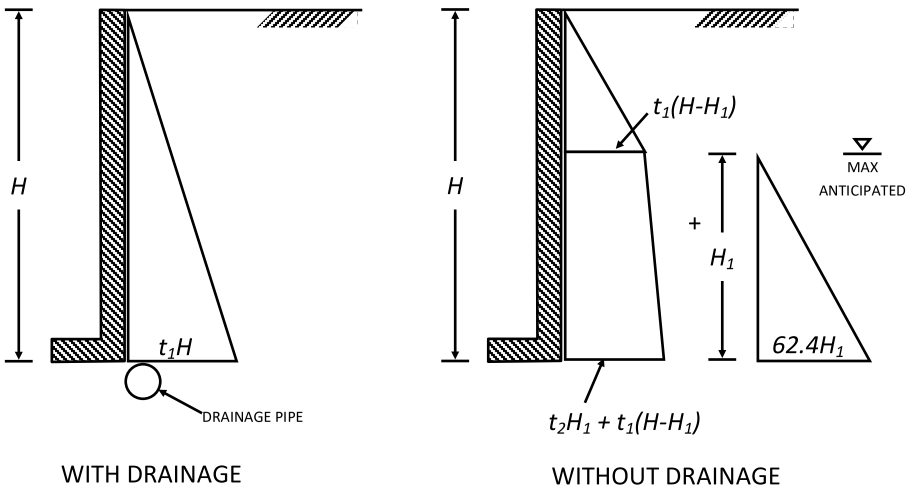
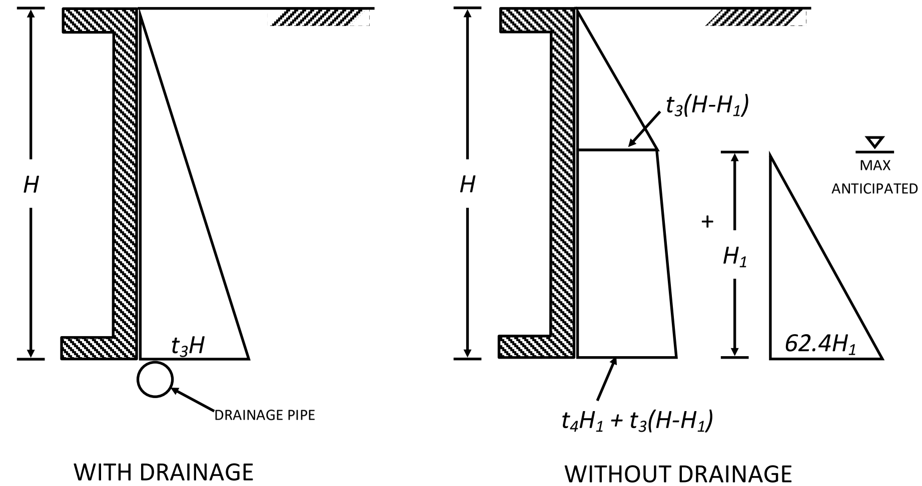
TERRA FIRMA TESTING

FIGURE TITLE: FOOTING UPLIFT CAPACITY DIAGRAM	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 8

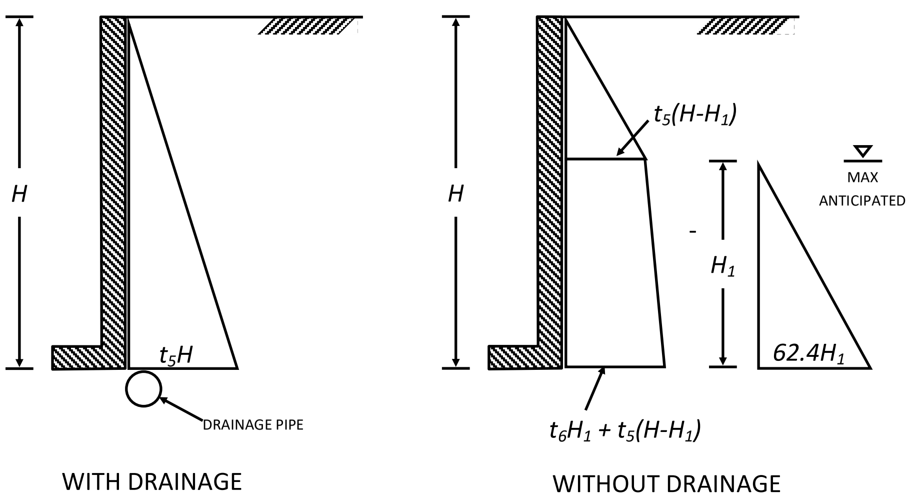
ACTIVE PRESSURE CONDITION



AT-REST PRESSURE CONDITION

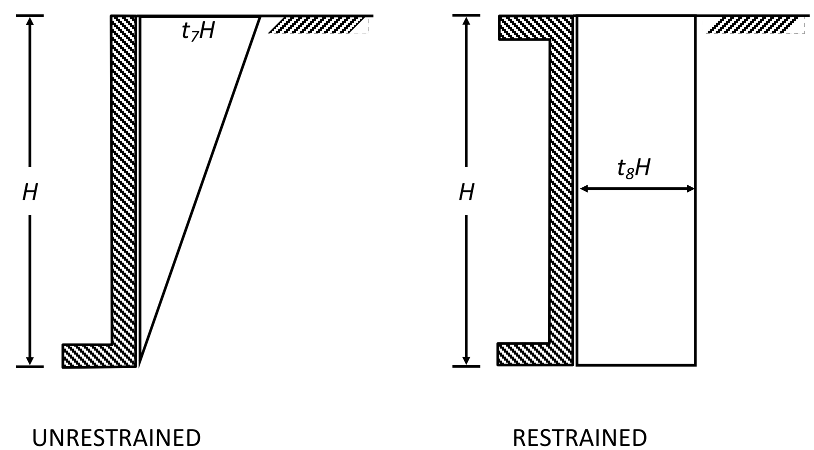


PASSIVE PRESSURE CONDITION



NOTE: WALLS CAN BE EITHER FREE OR RESTRAINED AT THE TOP FOR THE PASSIVE PRESSURE CONDITION. EQUATIONS ARE ONLY VALID FOR UNITS OF t_{1-8} (PCF) AND H-H_1(FT).

SEISMIC



NOTE: SEISMIC LOADS ARE VALID FOR WALLS RETAINING LESS THAN 8 FEET VERTICAL OF EARTH. THE SEISMIC LOAD IS ADDED TO ACTIVE OR AT-REST CONDITIONS AND IS SUBTRACTED FROM PASSIVE CONDITIONS.

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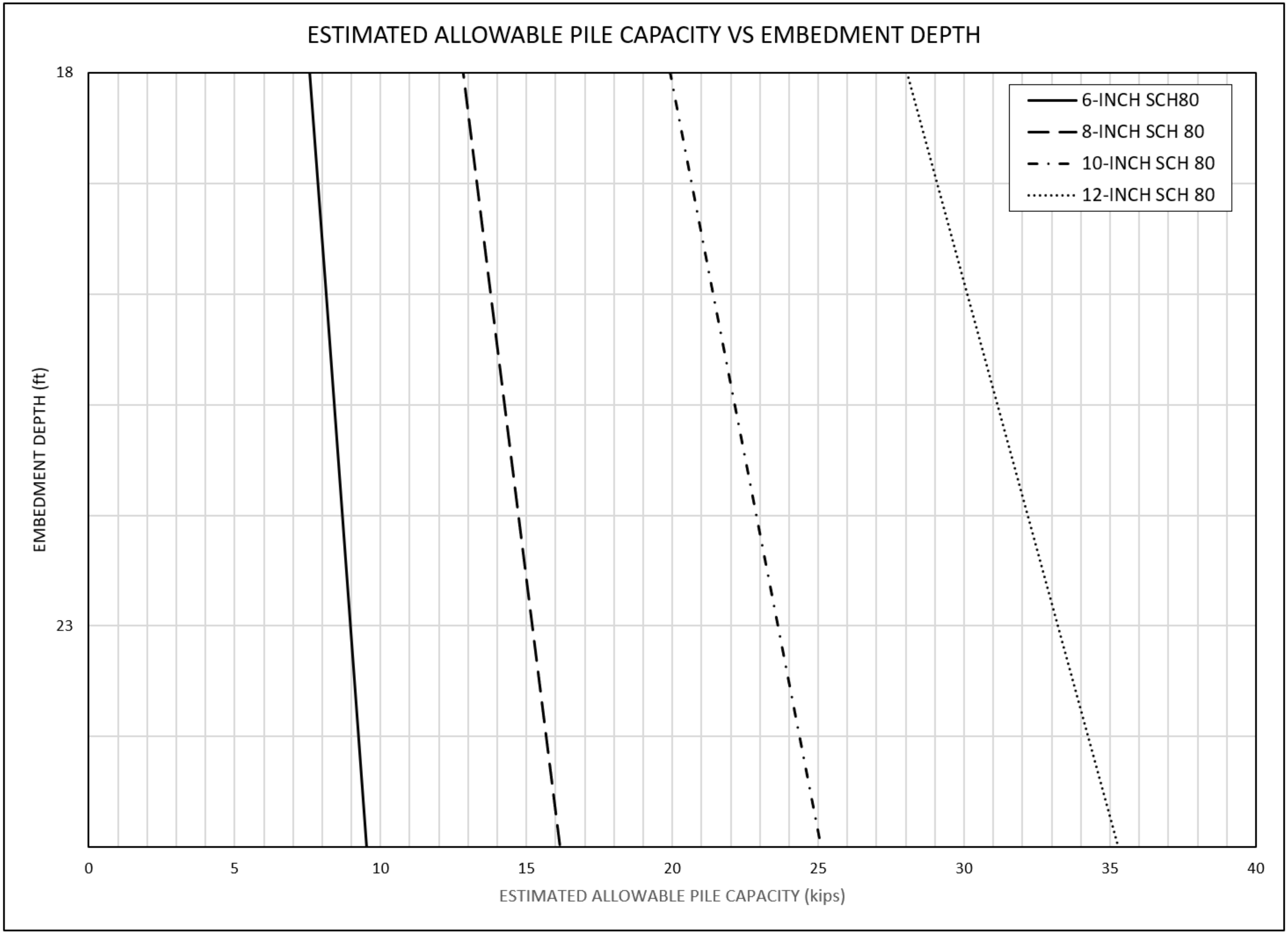
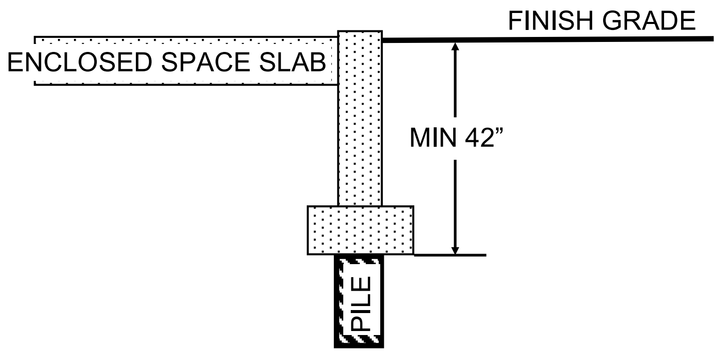
FIGURE TITLE: LATERAL RETAINING WALL PRESSURE SCHEMATICS	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 9



NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: ESTIMATED ALLOWABLE PILE CAPACITY VS EMBEDMENT DEPTH	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 10

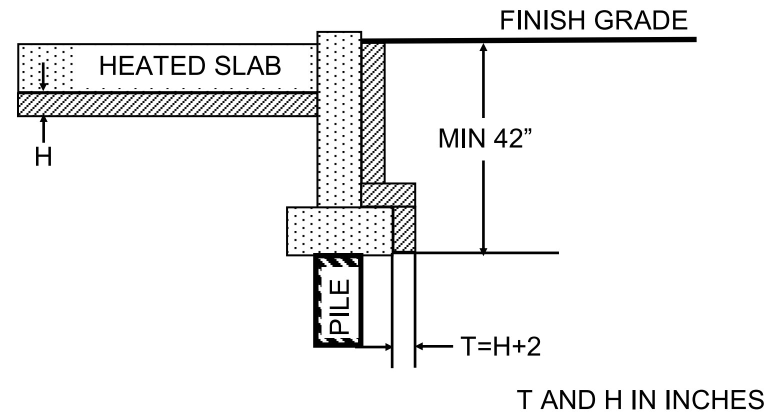
	ENCLOSED (HEATED) SPACE SLAB	HEATED (RADIANT) SLAB
STRIP FOOTING	SLABS MUST BE STRUCTURAL OR SEPERATED FROM GRADE BEAM	SLABS MUST BE STRUCTURAL OR SEPERATED FROM GRADE BEAM



NOTE: IF INSULATION IS PLACED UNDER SLAB USE

CONFIGURATION B

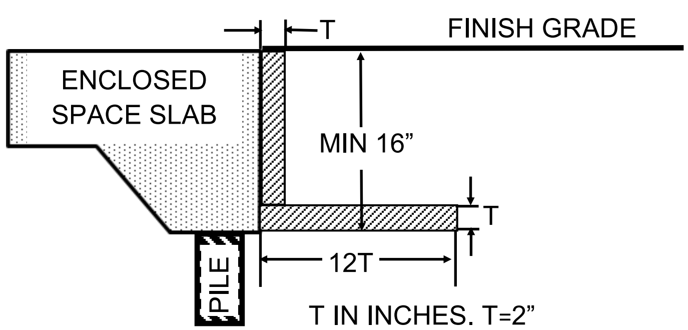
CONFIGURATION A



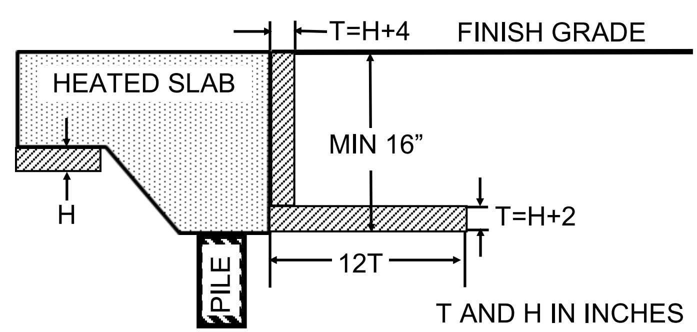
NOTE: DO NOT INSULATE FOOTING SURFACES BELOW SLAB
THE THICKNESS OF INSULATION “H” CAN BE CHANGED
TO OBTAIN DESIRED INSULATION BENEATH SLAB

CONFIGURATION B

SLAB ON GRADE



CONFIGURATION C



NOTE: DO NOT INSULATE FOOTING SURFACES BELOW SLAB
THE THICKNESS OF INSULATION “H” CAN BE CHANGED
TO OBTAIN DESIRED INSULATION BENEATH SLAB

CONFIGURATION D

NORTHERN GEOTECHNICAL ENGINEERING, INC.
TERRA FIRMA TESTING

FIGURE TITLE: HEATED PILE FOUNDATION INSULATION CONFIGURATION	
PROJECT NAME: CIHA AIRPORT HEIGHTS SENIOR HOUSING PHASE 1	PROJECT ID: 10155-25
PROJECT LOCATION: ANCHORAGE, ALASKA	FIGURE NUMBER: 11

LEVELING COURSE

SIEVE SIZE	% BY MASS PASSING
1”	100
3/4”	70-100
3/8”	50-80
#4	35-65
#8	20-50
#50	8-28
#200	2-6
0.02	0-3

TYPE II

SIEVE SIZE	% BY MASS PASSING
8”	100
3”	70-100
1-1/2”	55-100
3/4”	45-85
#4	20-60
#10	12-50
#40	4-30
#200	*2-6
0.02	0-3

*IN ADDITION TO THE GRADING LIMITS LISTED ABOVE, THE FRACTION OF MATERIAL PASSING THE #200 SIEVE SHALL NOT BE GREATER THAN FIFTEEN PERCENT (15 %) OF THAT FRACTION PASSING THE #4 SIEVE.

TYPE II - A

SIEVE SIZE	% BY MASS PASSING
3”	100
3/4”	50-100
#4	25-60
#10	15-50
#40	4-30
#200	*2-6
0.02	0-3

*IN ADDITION TO THE GRADING LIMITS LISTED ABOVE, THE FRACTION OF MATERIAL PASSING THE #200 SIEVE SHALL NOT BE GREATER THAN TWENTY PERCENT (20 %) OF THAT FRACTION PASSING THE #4 SIEVE.

APPENDIX A

ADDITIONAL REPORT DETAILS

APPENDIX A –

Additional Report Details & Considerations

1.0 SITE CHARACTERIZATION ACTIVITIES

1.1 Subsurface Exploration

We conceived, coordinated, and directed a subsurface exploration program at the project site in an effort to characterize the subsurface conditions of the project site as they currently exist. We subcontracted Discovery Drilling, Inc. (DDI) to provide the necessary geotechnical exploration services. A qualified representative from our office was present on-site during the entire exploration program to select the exploration locations, direct the exploration activities, log the geology of each exploration, and collect representative samples for further identification and laboratory analysis. Under our direction DDI advanced a total of ten (10) soil borings at the project site between September 9, 2025 and September 11, 2025 to depths ranging from approximately 16.5 to 31.5 feet below the existing ground surface (bgs) using conventional hollow-stem auger drilling and split-spoon sampling methods.

Under our direction, DDI performed a Modified Penetration Test (MPT) at regular intervals during the drilling of each borehole. A MPT can be used to assess the consistency of a soil interval and to collect representative soil samples. A MPT is performed by driving a 3.0-inch O.D. (2.4-inch I.D.) split-spoon sampler at least 18 inches past the bottom of the advancing augers with blows from a 340-lb drop-hammer, free-falling 30 inches onto an anvil attached to the top of the drill rod stem. Our field representative recorded the hammer blows required to drive the modified split-spoon sampler the entire length of each sample interval, or until sampler refusal was encountered. We have provided the field blow count data for each sample interval (in six-inch increments) on the graphical borehole logs contained in Appendix B of this report.

During the course of our subsurface exploration program, we encountered a physical phenomenon common to hollow-stem auger drilling known as "sand-heave" in the southwest area of the project site at boreholes B02, B03, and B04. The depths that sand-heave was encountered was between 25 and 31.5 feet bgs. Sand-heave typically occurs when sampling saturated sand deposits with hollow stem augers/split-spoon samplers, as the increased hydrostatic pressure outside of the hollow-stem augers forces a sand slurry up into the hollow auger flights when the drill stem is removed (to allow for split-spoon sampling). At times, sand-heave can be significant; filling the inside of the hollow-stem auger flights with several feet of densely-packed sand. As a result, sand-heaving forces disturb the in-situ density of the sand deposit at the tip of the advancing augers and can lead

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to the collection of unrepresentative blow count data (i.e., soil resistance measurements) and a disturbed split-spoon sample.

We corrected the field blow count data for all 10 boreholes for standard confining pressure, drill rod length, and drop-hammer operation procedure to estimate a standard $(N_1)_{60}$ value for each sample interval. $(N_1)_{60}$ values are a measure of the relative density (compactness) and consistency (stiffness) of cohesionless or cohesive soils, respectively. Our estimate of the $(N_1)_{60}$ values is based on the drop-hammer blows required to drive the spilt-spoon sampler the final 12-inches of an 18-inch MPT. We have provided our estimated $(N_1)_{60}$ values for each sample interval on the graphical borehole logs contained in Appendix B of this report. The automatic drop-hammer that DDI used for this project is not standard, so we applied a correction factor of 1.1 to the $(N_1)_{60}$ values to account for the efficiency of the automatic drop-hammer used. We have provided a graphical plot of the field blow count corrections that we used to correct for confining pressure and drill rod length in Figure 4 of this report.

We did not report the $(N1)_{60}$ values on the borehole logs where sand-heave occurred, as the $(N1)_{60}$ values obtained for those sample intervals are not representative of the in-situ material.

Our field representative sealed each sample that they collected during our subsurface exploration program inside of an air-tight bag and/or container, to help preserve the moisture content of each sample, and then submitted each sample to our laboratory for further identification and analysis.

Once the exploration activities were complete, we directed DDI to backfill the annulus of each exploration with its respective drill cuttings.

We directed DDI to install three-inch diameter, open-ended PVC pipe from the ground surface down to 5 and 7 feet bgs at locations near boreholes IT01 and IT02 respectively to provide conduits (i.e., test wells) for future infiltration testing. DDI then placed approximately two inches of washed, 3/8-inch gravel (a.k.a. pea gravel) at the bottom of each test well to protect the bottom from water scour during infiltration testing. We then directed the DDI to backfill the annulus of each test well borehole with drill cuttings.

We directed DDI to install one-inch diameter, open-ended PVC pipe from the ground surface down to the bottom of boreholes IT01 and IT02 to provide a conduit (i.e., monitoring wells) for future groundwater level monitoring. As per our instruction, DDI hand-slotted the bottom 10 feet of the monitoring well casings prior to installation and then backfilled the annulus of each monitoring well borehole with drill cuttings. Construction diagrams for each groundwater monitoring well are presented on the graphical borehole logs contained in Appendix B of this report.

1.2 Groundwater Level Monitoring

We conducted groundwater level monitoring efforts at the project site on October 3, 2025 to help determine what the static groundwater level is. We used an electronic water level meter (with 0.01-foot increments) to measure the relative depth of the groundwater surface (below the existing ground surface) at each monitoring well location. A summary of the groundwater level measurements that we collected at the project site are presented in the graphical borehole logs contained in Appendix B of this report.

1.3 Infiltration Testing

We conducted infiltration testing near boreholes IT01 to IT02 from on October 2, 2025 to October 3, 2025. We conducted our infiltration testing in general conformance with the falling head percolation test procedure outlined in Table 3.9 of the EPA On-site Water Treatment & Disposal Systems Manual (as specified in Paragraph 9 of Section 9.2.1 of the 2009 Municipality of Anchorage Drainage Design Guidelines). Complete infiltration test data for each test well is contained in Appendix C of this report.

2.0 LABORATORY TESTING

It is important to note that ASTM test method D-6913 requires that any soil sample specimen which is to be submitted for gradational analysis (by ASTM D-7928 or other methods) must satisfy a minimum mass requirement based on the maximum particle size of the sample specimen. Split-spoon sampling techniques (standard or modified), as well as other small-diameter soil sampling techniques (e.g., macro-core, etc.), typically recover anywhere from approximately 1 to 10 pounds of sample specimen. The amount of sample specimen recovered can be influenced by (amongst other variables) the soil gradation, soil density, sample interval, sampler tooling, and soil moisture content. As a result, samples of coarse-grained soils (with individual soil particles greater than approximately 0.75 inches in diameter) collected with small-diameter sampling methods (e.g., split-spoons, macro-core, etc.) may not meet the minimum mass requirement specified by Table 2 of ASTM D-6913. This may result in gradational and frost classification results which are not representative of the actual (i.e., in-situ) soil gradation and/or frost classification. The use of small-diameter sampling devices in coarse-grained soils (e.g., sand and gravel) can result in the collection of unrepresentative samples due to: the exclusion of oversized particles (larger than the opening of the sampler) from the sample; and the mechanical breakdown/degradation of coarse-grained particles by the sampling process (producing an unrepresentative increase in smaller-diameter particles in the sample). Both of these sampling biases can skew laboratory test results towards the fine-grained end of the gradational spectrum.

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3.0 DESIGN RECOMMENDATIONS

3.1 Frost Development and Protection

Frost Heave:

If the subgrade soils are allowed to freeze (for any amount of time), then soil ice can form in the subgrade and result in a phenomena known as "frost heaving". Frost heaving forces can generate significant uplift loads which can damage foundations or connecting members.

Burial Depths:

Perimeter and exterior shallow foundation footing burial depths will vary, based on whether or not the foundation subgrade will be allowed to freeze during winter months. Additionally, shallow foundations need to be buried sufficiently deep so as to resist any anticipated uplift/overturning forces (e.g. wind, seismic, frost jacking, etc.).

Frost heaving forces can damage shallow foundations. As such, footings need to be buried sufficiently deep and/or be adequately insulated so as to reduce the potential for freezing of the foundation subgrade and any associated frost heaving forces.

Insulation:

Artificial insulation can be used to decrease minimum burial depths for both heated and unheated foundations by helping to reduce the potential for freezing of foundation soils, as well as help increase heating efficiency.

Insulation may be placed beneath of interior floors/slabs. However, no insulation should be placed directly underneath of any perimeter footings, as this can promote freezing of the foundation soils by preventing adequate heat transfer from the interior of the structure to the foundation soils. Alternatively, insulation should be placed along the exterior of the footing/stem wall to prevent freezing (and associated frost heaving) of the foundation soils along the perimeter of the foundation.

In terms of insulating properties, one inch of rigid board insulation can be considered equivalent to one foot of NFS fill.

Cold Shallow Foundations

It is difficult to predict the depth of ground frost penetration and extent of ice lens formation at any given site. Therefore, we do not recommend the construction of cold shallow foundations. The formation of ice lenses in the foundation subgrade can damage overlying foundations due to differential movements in the foundation subgrade as a result of soil ice growth and/or subsequent thaw-related losses of soil bearing capacity (due to increased soil moisture contents).

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Cold Deep Foundations

Deep foundation systems such as driven piling, helical piers, under-reamed concrete piers, or other deep foundation systems can serve as an alternative means of cold foundation support, as they can provide the uplift resistance needed to counteract any frost heaving/jacking forces (assuming proper embedment depths, footing sizes, etc. are achieved).

Frost heaving forces can damage connecting members of pile foundations and/or result in failures at connections between pile foundations. As such, connecting members need to be above grade with a sufficient air gap or be buried sufficiently deep and/or be adequately insulated so as to reduce the potential for freezing of the foundation subgrade and any associated frost heaving forces.

3.2 Modulus of Subgrade Reaction Calculations

For this project, the following equations can be used (with standard English units) to calculate the appropriate modulus of subgrade reaction for load footprints bearing onto recommended bearing materials (defined in the report):

$$k_{(B\ x\ B)} = k_1 \left(\frac{B+1}{2B}\right)^2 \tag{1}$$

Where:

B = the load footprint width of a square load in feet
k_1 = the modulus of subgrade reaction for a 1-ft × 1-ft rigid plate in pci
$k_{(B\ x\ B)}$ = the modulus of subgrade reaction for a square load footprint of width B in pci

The following equation (2) can be used for a rectangular load having the dimensions $B \times L$ (in feet) with similar bearing soils as the square footprint loading equation above (1).

$$k_{(B\ x\ L)} = \frac{k_{(B\ x\ B)}\left(1+0.5\frac{B}{L}\right)}{1.5} \tag{2}$$

Where:

$k_{(B\ x\ B)}$ = the modulus of subgrade reaction for a $B \times B$ square load footprint
$k_{(B\ x\ L)}$ = the modulus of subgrade reaction for $B \times L$ rectangular load footprint
B = the least horizontal dimension of a rectangular load footprint
L = the larger horizontal dimension of a rectangular load footprint

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3.3 Lateral Earth Pressures

An active-earth pressure condition will prevail (under static loading) if a retaining wall is allowed to deflect or rotate a minimum of 0.001 times by the wall height. An at-rest pressure condition will prevail if a retaining wall is restrained at the top and cannot move at least 0.002 times the wall height. Lateral forces exerted by wind or seismic activity may be resisted by passive-earth pressures against the sides of the foundation footings, exterior walls (below grade), and grade beams. Therefore, interior footings should extend a minimum of 12 inches below the finished floor grade (assuming a continuously heated building is maintained during winter months) to help resist any lateral forces.

In order to prevent water accumulation against the outside of any foundation or retaining wall, the wall must have a perimeter drainage system connected to an outlet that will not freeze closed at any time of the year. The top of the drainage piping must be located below the top of the footing for the foundation and/or retaining wall. Backfill used against the wall (and extending a minimum of one foot beyond the wall) must be free-draining with less than three percent fines. The top one-foot of backfill against the outside of a foundation and/or retaining wall should consist of relatively impermeable (fine-grained) material and be tightly compacted such that surface water is directed away from the foundation and/or retaining wall. A permeable geotextile fabric may be useful to prevent mixing of the impermeable (fine-grained) overburden and underlying free-draining (coarse-grained) backfill. Furthermore, the finished surface should slope away from any foundation and/or retaining wall with a grade between 1 to 2 percent, such that surface water is directed away from the foundation and/or retaining wall.

Seismic loading on foundation and/or retaining walls generally increases the lateral pressures on the wall and decreases the passive resistance. For foundation systems where the building foundation is continuous, the differential lateral movement between the soil and foundation is very small, and as such, essentially no excess lateral loading on the foundation wall is experienced. Foundation walls with a differential in backfill heights of over six feet (basements, crawl spaces, etc.) will experience seismic lateral loading from the inertial effects of seismic waves passing through the foundation.

3.4 Pavement Sections

Construction of the pavement section for the proposed roads and parking areas will be guided (in part) by the amount of cut/fill needed to achieve the final grade. The composition, structure, and thickness of the pavement section will be further controlled by the frost susceptibility of, and overall potential for ice lens development within, the subgrade soils.

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There are three primary factors that influence the potential for ice lens formation at a given site:

1. soil gradation (i.e., ability to draw up moisture through capillary tension);
2. the presence of sufficient volumes of water (surface water, pore water, or groundwater) near the freeze front to foster ice lens development; and
3. the rate and duration of freeze-front advancement due to air temperature and wind variations.

All three factors need to occur simultaneously in order for ice lenses to develop in the subgrade.

Materials:

As we discuss in the report, it is our experience that the "D-1" leveling course material currently available in Anchorage area may not be NFS following compaction, because the compaction with a vibratory compactor further increases the frost susceptibility of the leveling course by increasing the percentage of fine-grained material (due to degradation of the soil particles from the impact of the compaction equipment).

RAP has a low frost susceptibility, making it a suitable alternative for D-1 as the leveling course material.

Type II-A materials can be used as a substitute for Type II materials, as Type II materials are becoming difficult to procure in the Anchorage area. However, no Type II materials should be placed within 12 inches of any pavement surfaces to help reduce the risk of pavement dimpling (from oversized particles contained within the Type II material).

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 Warm Shallow Foundations

It is imperative that shallow building foundations for heated structures remain in a thawed state for the entire construction period; even when dealing with soils that have little to no frost susceptibility. Foundation soils that are allowed to freeze during the initial construction (before the building is enclosed and heated) may be compromised by the development of ice lenses. Upon thawing, which may take several weeks or months, potential differential settlements could distort the structure resulting in damaged foundations, cracked sheetrock, skewed door frames, and broken windows.

If construction extends into the winter months, temporary enclosures should be constructed which completely enclose warm foundations and heat should be applied to the enclosure to prevent freezing of the soils located beneath any warm foundation and/or floor slab.

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5.0 THE OBSERVATIONAL METHOD

A comprehensive geoprofessional service (e.g., geotechnical, geological, civil, and/or environmental engineering, etc.) should consist of an interdependent, two-part process comprised of:

Part I - pre-construction site assessment, engineering, and design; and

Part II - continuous construction oversight and design support.

This process, commonly referred to in the geoprofessional industry as “The Observational Method”, was developed to reduce the costs required to complete a construction project, while simultaneously reducing the overall risk associated with the design and construction of the project.

In geotechnical engineering, Part I of the Observational Method (OM) begins with a geotechnical assessment of the site, which typically consists of some combination of literature research, site reconnaissance, subsurface exploration, laboratory testing, and geotechnical engineering. These efforts are usually documented in a formal report (e.g., such as this report) that summarizes the findings of the geotechnical assessment, and presents provisional geotechnical engineering recommendations for design and construction. Geotechnical assessment reports (and the findings and recommendations contained within) are considered provisional due to the fact that their contents are typically based primarily on limited subsurface information for a site. Most conventional geotechnical exploration programs only physically characterize a very small percentage of a given site, as it is typically cost prohibitive to conduct extensive (i.e. high density/frequency) exploration programs. As an alternative, geoprofessionals use the subsurface information available for a site to extrapolate subsurface conditions between exploration locations and develop appropriate provisional recommendations based on the inferred site conditions. As a result, the geoprofessional of record cannot be certain that the provisional recommendations will be wholly applicable to the site, as subsurface conditions other than those identified during the geotechnical assessment may exist at the site which could present obstacles and/or increased risk to the proposed design and construction.

Part II of the OM is employed by geoprofessionals to help reduce the risk associated with unidentified and/or unexpected subsurface conditions. Geoprofessionals accomplish Part II of the OM by providing construction oversight (e.g., construction observation, inspection, and testing). Part II of the OM is a valuable service, as the geoprofessional of record is available if unexpected conditions are encountered during the construction process (e.g., during excavation, fill placement, etc.) to make timely assessments of the unexpected conditions and modify their design and construction recommendations accordingly; thus reducing considerable cost resulting from potential construction delays and reducing the risk of future problems resulting from inappropriate design and construction practices.

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Oftentimes, a client may be persuaded to use an alternative geoprofessional firm to conduct Part II of the OM for a given project; as some geoprofessional firms offer the same services at discounted prices in order to help them obtain the overall construction materials engineering and testing (CoMET) commission. The geoprofessional industry as a whole recommends against this practice. An alternative geoprofessional firm cannot provide the same level of service as the geoprofessional of record. The geoprofessional of record has (amongst other things) a unique familiarity with the project including; an intimate understanding of the subsurface conditions, the proposed design, and the client's unique concerns and needs, as well as other factors that could impact the successful completion of a construction project. An alternative geoprofessional firm is not aware of the inferences made and the judgment applied by the geoprofessional of record in developing the provisional recommendations, and may overlook opportunities to provide extra value during Part II of the geoprofessional service.

Clients that prevent the geoprofessional of record from performing a complete service can be held solely liable for any complications stemming from engineering omissions as a result of unidentified conditions. The geoprofessional of record may not be liable for any resulting complications that occur, as the geoprofessional of record was not able to complete their services. Furthermore, the replacement geoprofessional firm may also be found to have no liability for the same reasons.

We are available at any time to discuss the OM in more detail, or to provide you with an estimate for any additional construction observation and testing services required.

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APPENDIX B

GRAPHICAL EXPLORATION LOGS

Soil BoringID: B01

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.210325, W -149.817195 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/09/2025 (9:45 AM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/09/2025 (1:30 PM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Overcast 55° F
▽ **GROUNDWATER (ATD)** Encountered @ 21.5' (9/9)
BACKFILL NOTES Backfilled with cuttings
▼ **GROUNDWATER MONITORING** N/A

DEPTH (ft)	GRAPHIC LOG	FROZEN	MATERIAL DESCRIPTION	SAMPLE TYPE	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE INT. COLLECTED	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
0			**TOPSOIL**, medium dense, dark brown, moist		B01-S01	16	2 3 5	13		25-1725-1	25-1725-1 MC = 9.0%	
			FILL, **SILTY SAND** (SM), medium dense, brown, moist, generally 1" minus gravel, subrounded to rounded, with trace organics		B01-S02	14	4 6 7	21		25-1725-2	25-1725-2 MC = 2.4% 32% gravel 66% sand 3% silt P200 = 3%	
5			**POORLY GRADED SAND WITH GRAVEL** (SP), medium dense to very dense, brown, moist, generally 1.5" minus gravel, subrounded to rounded, non plastic		B01-S03	14	4 6 7	17		25-1725-3	25-1725-3 MC = 7.5%	
					B01-S04	15	6 11 14	29		25-1725-4	25-1725-4 MC = 3.1%	
10					B01-S05	18	13 24 34	57		25-1725-5	25-1725-5 MC = 2.8%	
15			**POORLY GRADED SAND** (SP), medium dense, brown, moist, fine		B01-S06	16	8 10 12	21		25-1725-6	25-1725-6 MC = 5.2%	
20 (▽ 21.5)			**POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, very moist to saturated, generally 0.5" minus gravel		B01-S07	16	6 8 11	18		25-1725-7	25-1725-7 MC = 15.0%	
25			**WELL-GRADED SAND** (SW), dense, saturated, generally 1" minus gravel, subangular to rounded		B01-S08	18	25 15 16	26		25-1725-8	25-1725-8 MC = 10.8%	
30			**POORLY GRADED SAND** (SP), loose, brown, saturated, fine		B01-S09	18	3 3 7	8		25-1725-9	25-1725-9 MC = 22.9%	

Bottom of borehole at approx. 31.5 feet

REMARKS

Soil BoringID: B02

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.210257, W -149.817509 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/09/2025 (1:39 PM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/09/2025 (3:20 PM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Rainy 55° F
▽ **GROUNDWATER (ATD)** Encountered @ 20' (9/9)
BACKFILL NOTES Backfilled with cuttings
▼ **GROUNDWATER MONITORING** N/A

DEPTH (ft)	GRAPHIC LOG	FROZEN	MATERIAL DESCRIPTION	SAMPLE TYPE	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE INT. COLLECTED	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
			TOPSOIL, dark brown, moist *FILL*, **POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, brown, moist, generally 2" minus gravel, non plastic		B02-S01	17	7 4 7			25-1726-1	25-1726-1 MC = 7.4% 28% gravel 70% sand 2% silt P200 = 2%	Freshly fractured rock in sampler (S01)
5					B02-S02	14	4 4 4	13		25-1726-2	25-1726-2 MC = 9.5%	
			FILL, **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), very loose to loose, dark brown, moist, generally 1" minus gravel, subrounded to rounded, non plastic		B02-S03	16	1 2 2	5		25-1726-3	25-1726-3 MC = 34.1% 36% gravel 54% sand 10% silt P200 = 10%	
10					B02-S04	15	1 1 2	3		25-1726-4	25-1726-4 MC = 30.3%	
15					B02-S05	9	1 2 2	4		25-1726-5	25-1726-5 MC = 39.0%	
20 ▽			**POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, brown, moist, generally 2" minus gravel, non plastic		B02-S06	17	6 11 15	24		25-1726-6	25-1726-6 MC = 4.6% P200 = 1% P0.02 =0.9%	
25			**WELL-GRADED SAND WITH GRAVEL** (SW), medium dense, saturated, subangular to subrounded		B02-S07	16	1 10 13	22		25-1726-7	25-1726-7 MC = 10.6%	
30			**WELL-GRADED SAND** (SW), brown, saturated		B02-S08	18	10 7 9			25-1726-8	25-1726-8 MC = 14.5%	Sand heave (S08)
			POORLY GRADED SAND (SP), brown, saturated, fine		B02-S09	18	2 2 7			25-1726-9	25-1726-9 MC = 21.2%	Sand heave (S09)

Bottom of borehole at approx. 31.5 feet

REMARKS Blowcounts not representative when sand heave/fracture occured, no N160 value reported.

Soil BoringID: B03

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.21015, W -149.81671 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/10/2025 (11:22 AM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/10/2025 (1:50 PM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Overcast 55° F
GROUNDWATER (ATD) Encountered @ 21.5' (9/10)
BACKFILL NOTES Backfilled with cuttings
GROUNDWATER MONITORING N/A

DEPTH (ft)	MATERIAL DESCRIPTION	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
	TOPSOIL, medium dense, brown, moist, with wood root *FILL*, **SILTY SAND WITH GRAVEL** (SM), loose to medium dense, brown, moist, generally 2" minus gravel, subrounded to rounded, non plastic, with trace organics	B03-S01	14	3 4 6	17	25-1727-1	25-1727-1 MC = 11.3%	
		B03-S02	16	1 1 2	5	25-1727-2	25-1727-2 MC = 37.6% 32% gravel 54% sand 14% silt P200 = 14%	
5	*FILL*, **SILTY SAND WITH GRAVEL** (SM), loose, olive to grey, moist, generally 0.5" gravel, subrounded to rounded	B03-S03	18	1 2 3	7	25-1727-3	25-1727-3 MC = 20.0%	
		B03-S04	12	5 8 9		25-1727-4	25-1727-4 MC = 2.3%	Freshly fractured rock in sampler (S04)
10	**WELL-GRADED GRAVEL** (GW), brown, moist, subrounded to rounded **POORLY GRADED GRAVEL WITH SAND** (GP), medium dense to dense, brown, very moist to saturated, generally 1.5" minus gravel, subrounded to rounded, non plastic	B03-S05	17	12 21 22	41	25-1727-5	25-1727-5 MC = 2.6% 49% gravel 46% sand 4% silt P200 = 4%	
15		B03-S06	17	10 16 17	31	25-1727-6	25-1727-6 MC = 2.8%	
20		B03-S07	17	10 11 14	21	25-1727-7	25-1727-7 MC = 9.5%	
25	**POORLY GRADED SAND** (SP), brown, saturated, fine	B03-S08	18	12 15 18		25-1727-8	25-1727-8 MC = 17.6%	Sand heave (S08)
30		B03-S09	18	0 9 28		25-1727-9	25-1727-9 MC = 18.8%	Sand heave (S09)

Bottom of borehole at approx. 31.5 feet

REMARKS Blowcounts not representative when sand heave/fracture occured, no N160 value reported.

Soil BoringID: B04

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.210183, W -149.817201 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/10/2025 (2:02 PM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/10/2025 (4:10 PM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Overcast 55° F
▽ **GROUNDWATER (ATD)** Encountered @ 24' (9/10)
BACKFILL NOTES Backfilled with cuttings
▼ **GROUNDWATER MONITORING** N/A

DEPTH (ft)	MATERIAL DESCRIPTION	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
	TOPSOIL, medium dense, dark brown, moist	B04-S01	15	2 4 5	15	25-1746-1	25-1746-1 MC = 5.1%	
5	*FILL*, **SILTY SAND WITH GRAVEL** (SM), dense, brown, moist, generally 1" minus gravel, subrounded to rounded, non plastic	B04-S02	15	6 10 12	36	25-1746-2	25-1746-2 MC = 4.8% 28% gravel 51% sand 22% silt P200 = 22%	
	POORLY GRADED SAND WITH GRAVEL (SP), dense, brown, moist, generally 1.5" minus gravel, subrounded to rounded, non plastic	B04-S03	14	19 10 12	31	25-1746-3	25-1746-3 MC = 1.8%	
10		B04-S04	15	7 16 20	42	25-1746-4	25-1746-4 MC = 2.2% 48% gravel 49% sand 3% silt P200 = 3%	
15		B04-S05	16	10 24 32	55	25-1746-5	25-1746-5 MC = 2.1%	
	SILTY SAND (SM), medium dense, dark/blackish brown, moist	B04-S06	18	9 10 12	21	25-1746-6	25-1746-6 MC = 3.5%	
20	**POORLY GRADED SAND WITH GRAVEL** (SP), dense, brown, moist, generally 1" minus gravel, fine							
▽ 25	**WELL-GRADED SAND WITH GRAVEL** (SW), dense, brown, moist, generally 1" minus gravel, subrounded to rounded	B04-S07	16	9 14 14	26	25-1746-7	25-1746-7 MC = 3.9%	
30	**POORLY GRADED SAND** (SP), brown, saturated, fine	B04-S08	11	10 30 0		25-1746-8	25-1746-8 MC = 20.7%	Sand heave (S08)
		B04-S09	18	4 11 15		25-1746-9	25-1746-9 MC = 20.0%	Sand heave (S09)

Bottom of borehole at approx. 31.5 feet

REMARKS Blowcounts not representative when sand heave occured, no N160 value reported.

Soil BoringID: B05

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.211066, W -149.816376 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/11/2025 (1:50 PM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/11/2025 (2:40 PM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Overcast 55° F
GROUNDWATER (ATD) Encountered @ 14' (9/11)
BACKFILL NOTES Backfilled with cuttings
GROUNDWATER MONITORING N/A

DEPTH (ft)	GRAPHIC LOG	FROZEN	MATERIAL DESCRIPTION	SAMPLE TYPE	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE INT. COLLECTED	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
			TOPSOIL, loose, dark brown, moist									
			FILL, **SILTY SAND WITH GRAVEL** (SM), loose, brown, moist, generally 1.5" minus gravel, subrounded to rounded		B05-S01	12	1 1 2	5		25-1748-1	25-1748-1 MC = 19.9%	
			FILL, **SILTY GRAVEL WITH SAND** (GM), loose, brown, moist, generally 0.75" gravel, non plastic		B05-S02	10	1 2 2	7		25-1748-2	25-1748-2 MC = 12.4% 43% gravel 42% sand 15% silt P200 = 15% P0.02 =11.1% FC = F2	
5												
			POORLY GRADED GRAVEL WITH SAND (GP), medium dense to dense, brown, moist to saturated, generally 1.5" minus gravel, subrounded to rounded, non plastic		B05-S03	15	9 13 13	34		25-1748-3	25-1748-3 MC = 2.6% 53% gravel 44% sand 3% silt P200 = 3% P0.02 =2.5% FC = NFS	
					B05-S04	15	4 10 15	27		25-1748-4	25-1748-4 MC = 4.3%	
10												
					B05-S05	17	10 14 18	29		25-1748-5	25-1748-5 MC = 3.5%	
15												
					B05-S06	18	7 11 13	22		25-1748-6	25-1748-6 MC = 10.7%	

Bottom of borehole at approx. 16.5 feet

REMARKS

Soil BoringID: B06

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.210535, W -149.816382 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/11/2025 (10:20 AM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/11/2025 (11:10 AM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Light Rain 55° F
GROUNDWATER (ATD) None observed
BACKFILL NOTES Backfilled with cuttings
GROUNDWATER MONITORING N/A

DEPTH (ft)	MATERIAL DESCRIPTION	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
	TOPSOIL, loose, dark brown, moist							
	FILL, **SILTY GRAVEL WITH SAND** (GM), very loose to medium dense, brown to grey, moist, generally 1-2" minus gravel, subrounded to rounded, low plasticity Trace organics (S01)	B06-S01	15	1 1 1	3	25-1749-1	25-1749-1 MC = 27.0%	
		B06-S02	16	2 2 4	10	25-1749-2	25-1749-2 MC = 24.7%	
5		B06-S03	17	5 6 4	12	25-1749-3	25-1749-3 MC = 11.1% 41% gravel 39% sand 20% silt P200 = 20% P0.02 =12.1% LL = 30 PL = 25 PI = 5 FC = F2	
		B06-S04	6	4 5 4	10	25-1749-4	25-1749-4 MC = 17.6%	Assumed cobble or wood obstruction (S04)
10	Wood debris (S05)	B06-S05	18	2 4 5	8	25-1749-5	25-1749-5 MC = 19.6%	
15	**POORLY GRADED GRAVEL WITH SAND** (GP), medium dense, brown, moist, generally 1.5" minus gravel, non plastic	B06-S06	18	10 14 15	24	25-1749-6	25-1749-6 MC = 2.6% 56% gravel 42% sand 3% silt P200 = 3% P0.02 =2.3% FC = NFS	

Bottom of borehole at approx. 16.5 feet

REMARKS

Soil BoringID: B07

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.210503, W -149.817287 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/11/2025 (9:00 AM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/11/2025 (10:05 AM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Overcast/Light rain
GROUNDWATER (ATD) None observed
BACKFILL NOTES Backfilled with cuttings
GROUNDWATER MONITORING N/A

DEPTH (ft)	GRAPHIC LOG	FROZEN	MATERIAL DESCRIPTION	SAMPLE TYPE	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE INT. COLLECTED	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
0			**TOPSOIL**, brown to grey, moist *FILL*, **SILTY SAND WITH GRAVEL** (SM), loose to dense, brown to dark brown, moist, generally 1-2" minus gravel, subrounded to rounded, non plastic		B07-S01	18	4 8 8	26		25-1750-1	25-1750-1 MC = 9.5%	
					B07-S02	13	10 10 8			25-1750-2	25-1750-2 MC = 3.2%	Freshly fractured rock in sampler (S02)
5					B07-S03	17	2 3 3	8		25-1750-3	25-1750-3 MC = 18.0% 26% gravel 42% sand 31% silt P200 = 31% P0.02 =18.2% FC = F3	
			Wood debris (S04)		B07-S04	18	1 2 2	5		25-1750-4	25-1750-4 MC = 22.9%	
10			**POORLY GRADED SAND WITH GRAVEL** (SP), loose to dense, brown, moist, generally 1" minus gravel, subrounded, non plastic		B07-S05	14	3 4 5	9		25-1750-5	25-1750-5 MC = 5.6%	
15					B07-S06	17	13 21 20	38		25-1750-6	25-1750-6 MC = 3.0% 49% gravel 49% sand 1% silt P200 = 1% P0.02 =1% FC = NFS	
			Bottom of borehole at approx. 16.5 feet									

REMARKS: Blowcounts not representative when fracture occured, no N160 value reported.

Soil BoringID: B08

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.210511, W -149.815509 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/11/2025 (11:33 AM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/11/2025 (1:30 PM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Overcast/Light rain
GROUNDWATER (ATD) None observed
BACKFILL NOTES Backfilled with cuttings
GROUNDWATER MONITORING N/A

DEPTH (ft)	MATERIAL DESCRIPTION	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES
0	**TOPSOIL**, loose, dark brown, moist	B08-S01	16	1 1 2	5	25-1751-1	25-1751-1 MC = 12.6%	
	FILL, **POORLY GRADED SAND WITH SILT AND GRAVEL** (SP-SM), loose to medium dense, brown, moist, generally 1.5" minus gravel, subrounded to rounded, non plastic	B08-S02	12	2 2 3	8	25-1751-2	25-1751-2 MC = 13.1%	
5	Transitions from brown to grey	B08-S03	17	3 5 7	18	25-1751-3	25-1751-3 MC = 8.3% 41% gravel 53% sand 6% silt P200 = 6% P0.02 =4.5% FC = F2	
	SILT WITH SAND (ML), medium dense, light brown, moist	B08-S04	18	3 6 13	16	25-1751-4	25-1751-4 MC = 20.4%	
	WELL-GRADED SAND WITH GRAVEL (SW), dense to medium dense, brown, moist, generally 1" minus gravel							
10	**POORLY GRADED GRAVEL WITH SILT AND SAND** (GP-GM), brown, moist, generally 2-3" minus gravel, non plastic	B08-S05	16	6 12 17		25-1751-5	25-1751-5 MC = 3.5% 59% gravel 30% sand 11% silt P200 = 11% P0.02 =5.6% FC = F1	Freshly fractured rock in sampler (S05)
15		B08-S06	17	29 33 38		25-1751-6	25-1751-6 MC = 2.0%	Freshly fractured rock in sampler (S06)

Bottom of borehole at approx. 16.5 feet

REMARKS Blowcounts not representative when fracture occured, no N160 value reported.

Soil BoringID: IT01

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.211176, W -149.816451 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/11/2025 (3:00 PM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/11/2025 (3:40 PM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Light Rain 55° F
GROUNDWATER (ATD) Encountered @ 11' (9/11)
BACKFILL NOTES See remarks at end of log
GROUNDWATER MONITORING Encountered @ 11' (10/3)

DEPTH (ft)	GRAPHIC LOG	FROZEN	MATERIAL DESCRIPTION	SAMPLE TYPE	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE INT. COLLECTED	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES	WELL DIAGRAM
0			**TOPSOIL**, loose, dark brown, moist										
			FILL, **SILTY SAND** (SM), loose, brown, moist, generally 1.5"minus gravel, subrounded to rounded		IT02-S01	16	1 2 3	8		25-1753-1	25-1753-1 MC = 11.3%		
5			**POORLY GRADED GRAVEL WITH SAND** (GP), dense, brown, moist to saturated, generally 1.5"minus gravel, subrounded to rounded		IT02-S02	12	8 12 13	33		25-1753-2	25-1753-2 MC = 2.9% 49% gravel 47% sand 3% silt P200 = 3%		
10					IT02-S03	14	10 16 14	27		25-1753-3	25-1753-3 MC = 10.5%		
15			**POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, brown, saturated, generally 0.5" minus gravel		IT02-S04	16	3 5 10	14		25-1753-4	25-1753-4 MC = 14.9%		

Bottom of borehole at approx. 16.5 feet

REMARKS

Set 1 in. PVC to bottom of hole with section slotted from 6.5 to 16.5 ft bgs. Backfilled with cuttings.
Installed 3 in. PVC nearby.

Soil BoringID: IT02

PROJECT NAME CIHA Airport Heights Senior Housing Phase 1
PROJECT NUMBER 10155-25(G)
PROJECT LOCATION Anchorage, Alaska (See Report Figure 1)
HOLE LOCATION N 61.210200, W -149.816729 (Report Figure 2)
DRILLING CONTRACTOR Discovery Drilling, Inc.
DATE STARTED 09/10/2025 (9:30 AM)
EQUIPMENT USED Geoprobe 6712DT
DATE COMPLETED 09/10/2025 (11:15 AM)
DRILLING METHOD Hollow Stem Auger
SAMPLE METHOD MPT w/ 340-lb autohammer
LOGGED BY D.Light **WEATHER** Overcast 55° F
GROUNDWATER (ATD) None observed
BACKFILL NOTES See remarks at end of log
GROUNDWATER MONITORING None observed

DEPTH (ft)	GRAPHIC LOG	FROZEN	MATERIAL DESCRIPTION	SAMPLE TYPE	FIELD SAMPLE ID	RECOVERY (in)	BLOW COUNTS	$(N_1)_{60}$	SAMPLE INT. COLLECTED	SAMPLE SPECIMEN ID	LAB RESULTS	NOTES	WELL DIAGRAM
0			**TOPSOIL**, dark brown, moist *FILL*, **SILTY SAND WITH ORGANICS** (SM), loose, brown, moist		IT01-S01	9	1 1 2	5		25-1752-1	25-1752-1 MC = 16.1%		
5			*FILL*, **ORGANIC CLAY** (OL), soft, dark brown, moist *FILL*, **POORLY GRADED GRAVEL WITH SILT AND SAND** (GP-GM), very loose, grey, moist, generally 1" minus gravel, subrounded to rounded, non plastic		IT01-S02	16	1 1 1	3		25-1752-2	25-1752-2 MC = 27.3% 45% gravel 43% sand 12% silt P200 = 12%		
10			*FILL*, **SILTY SAND WITH GRAVEL** (SM), loose, brown, moist, generally 1.5" minus gravel, angular to subangular		IT01-S03	12	3 4 6	10		25-1752-3	25-1752-3 MC = 4.8%		
15			**POORLY GRADED SAND WITH GRAVEL** (SP), medium dense, brown, moist, generally 1" minus gravel, angular to subangular		IT01-S04	15	8 6 9	14		25-1752-4	25-1752-4 MC = 7.8%		

Bottom of borehole at approx. 16.5 feet

REMARKS
Set 1 in. PVC to bottom of hole with section slotted from 6.5 to 16.5 ft bgs. Backfilled with cuttings.
Installed 3 in. PVC nearby.

SOIL CLASSIFICATION CHART

PRIMARY DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTION
COARSE GRAINED SOILS more than 50% of material is larger than No. 200 sieve size	GRAVEL more than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL less than 5% fines		GW	well-graded GRAVEL
				GP	poorly-graded GRAVEL
		GRAVEL with DUAL CLASSIFICATIONS 5% to 12% fines		GW-GM	well-graded GRAVEL with silt
				GP-GM	poorly-graded GRAVEL with silt
				GW-GC	well-graded GRAVEL with clay
				GP-GC	poorly-graded GRAVEL with clay
		GRAVEL with FINES more than 12% fines		GM	silty GRAVEL
				GC	clayey GRAVEL
	SAND 50% or more of coarse fraction retained on No. 4 sieve	CLEAN SAND less than 5% fines		SW	well-graded SAND
				SP	poorly-graded SAND
		SAND with DUAL CLASSIFICATIONS 5% to 12% fines		SW-SM	well-graded SAND with silt
				SP-SM	poorly-graded SAND with silt
				SW-SC	well-graded SAND with clay
				SP-SC	poorly-graded SAND with CLAY
		SAND with FINES more than 12% fines		SM	silty SAND
				SC	clayey SAND
				SC-SM	silty, clayey SAND
FINE GRAINED SOILS more than 50% of material is snaller than No. 200 sieve size	SILT and CLAY liquid limit less than 50%	INORGANIC		CL	lean CLAY
				ML	SILT
				CL-ML	silty CLAY
		ORGANIC		OL	organic CLAY
	SILT and CLAY liquid limit 50% or more	INORGANIC		CH	fat CLAY
				MH	elastic SILT
		ORGANIC		OH	organic SILT
	HIGHLY ORGANIC SOILS			PT	Peat
				ICE	Mass Ice
				WOOD	Wood
				BEDROCK	Bedrock
				ASPHALT	Asphalt or as specified

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No. 4 (4.5 mm)
Coarse Gravel	3 in to 3/4 in
Fine Gravel	3/4 in to No. 4 (4.5 mm)
Sand	No. 4 (4.5 mm) to No. 199
Coarse Sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium Sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine Sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTIONS
Trace	1-5%
Few	5-10%
Little	10-20%
Some	20-35%
And	35-50%

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table

SAMPLER SYMBOLS

	SPT w/ 140# Hammer 30" Drop and 2.0" O.D. Sampler
	Modified SPT w/ 340# Hammer 30" Drop and 3.0 O.D. Sampler
	Grab Sample
	Shelby Tube Sample
	Rock Core Sample
	Direct Push Sample
	No Recovery

WELL SYMBOLS

	Slotted Pipe Backfilled with Cuttings
	PVC Pipe Backfilled with Cuttings
	PVC Pipe with Bentonite Seal

ABBREVIATIONS

LL	- LIQUID LIMIT (%)	TV	- TORVANE
PI	- PLASTIC INDEX (%)	PID	- PHOTOIONIZATION DETECTOR
MC	- MOISTURE CONTENT (%)	UC	- UNCONFINED COMPRESSION
DD	- DRY DENSITY (%)	ppm	- PARTS PER MILLION
NP	- NON PLASTIC	N/E	- NOT ENCOUNTERED
P200	- PERCENT PASSING NO. 200 SIEVE	N/R	- NOT REPRESENTATIVE
P0.02	- PERCENT PASSING 0.02mm SIEVE	N/A	- NOT APPLICABLE
PP	- POCKET PENTROMETER (tons/ft^2)	$I_{s(50)}$	- POINT LOAD INDEX
S/U	- CASING STICK-UP	S_c	- UNCONFINED COMPRESSIVE STRENGTH

▽ Water Level at Time of Drilling, or as Shown

▼ Water Level After 24 Hours, or as Shown

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
DENSITY	N (BLOWS/FT)	APPROX. RELATIVE DENSITY (%)	CONSISTENCY	N (BLOWS/FT)	APPROX. UNDRAINED SHEAR STRENGTH (PSF)
VERY LOOSE	0-4	0-15	VERY SOFT	0-1	< 250
LOOSE	5-10	15-35	SOFT	2-4	250-500
MEDIUM DENSE	11-25	35-65	MEDIUM STIFF	5-8	500-1000
DENSE	26-50	65-85	STIFF	9-15	1000-2000
VERY DENSE	> 50	85-100	VERY STIFF	16-30	2000-4000
			HARD	> 30	> 4000

FROST DESIGN SOIL CLASSIFICATION

FROST GROUP (USACOE)	FROST GROUP (M.O.A.)	SOIL TYPE	% FINER THAN 0.02mm BY MASS	TYPICAL SOIL TYPES UNDER UNIFIED SOIL CLASSIFICATION SYSTEM
NFS*	NFS*	(A) GRAVELS CRUSHED STONE CRUSHED ROCK (B) SANDS	0 - 1.5 0 - 3	GW, GP SW, SP
PFS*	NFS*	(A) GRAVELS CRUSHED STONE CRUSHED ROCK	1.5 - 3	GW, GP
	F2	(B) SANDS	3 - 10	SW, SP
S1	F1	GRAVELLY SOILS	3 - 6	GW, GP, GW-GM, GP-GM
S2	F2	SANDY SOILS	3 - 6	SW, SP, SW-SM, SP-SM
F1	F1	GRAVELLY SOILS	6 - 10	GM, GW-GM, GP-GM
F2	F2	(A) GRAVELLY SOILS (B) SANDS	10 - 20 6 - 15	GM, GW-GM, GP-GM SM, SW-SM, SP-SM
F3	F3	(A) GRAVELLY SOILS (B) SANDS, EXCEPT VERY FINE SILTY SANDS (C) CLAYS, PI>12	Over 20 Over 15 -----------	GM, GC SM, SC CL, CH
F4	F4	(A) ALL SILTS (B) VERY FINE SILTY SANDS (C) CLAYS, PI>12 (D) VARIED CLAYS AND OTHER FINE GRAINED, BANDED SEDIMENTS	------- Over 15 -------- --------	ML, MH SM CL, CL-ML CL & ML; CL, ML & SM; CL, CH, & ML; CL, CH, ML, & SM

*Non-frost susceptible
*Possibly frost susceptible, but requires lab testing to determine frost design soils classifications.

ICE CLASSIFICATION SYSTEM

GROUP	ICE VISIBILITY	DESCRIPTION		SYMBOL	
N	SEGREGATED ICE NOT VISIBLE BY EYE	POORLY BONDED OR FRIABLE		Nf	
		WELL BONDED	NO EXCESS ICE	Nb	Nbn
			EXCESS MICROSCOPIC ICE		Nbe
V	SEGREGATED ICE IS VISIBLE BY EYE AND IS ONE INCH OR LESS IN THICKNESS	INDIVIDUAL ICE CRYSTALS OR INCLUSIONS		Vx	
		ICE COATINGS ON PARTICLES		Vc	
		RANDOM OR IRREGULARLY ORIENTED ICE		Vr	
		STRATIFIED OR DISTINCTLY ORIENTED ICE		Vs	
		UNIFORMLY DISTRIBUTED ICE		Vu	
ICE	ICE IS GREATER THAN ONE INCH IN THICKNESS	ICE WITH SOILS INCLUSIONS		ICE + Soil Type	
		ICE WITHOUT SOILS INCLUSIONS		ICE	

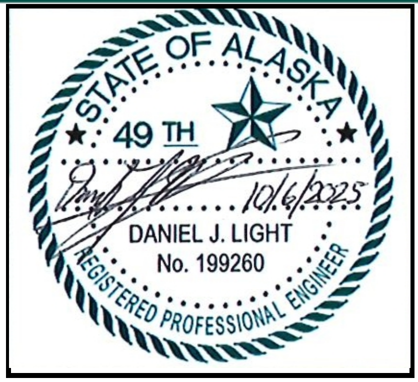
APPENDIX C

INFILTRATION TEST RESULTS

NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

Laboratory Testing · Geotechnical Engineering · Instrumentation · Construction Monitoring Services · Thermal Analysis

Infiltration/Percolation Test Form



Project Name/No.:	10155-25 - Airport Heights Sr Housing
Legal Description:	Northway Bus. Park Seward Twr Tract-1
Date Test Performed:	10/2/2025 - 10/3/2025
Test Performed For:	Infiltration Test
Date of Installation:	9/10/2025
Exploration I.D:	IT01

Depth (feet) (USCS)

1_ 2_ 3_ 4_ 5_ 6_ 7_ 8_ 9_ 10_ 11_ 12_ 13_ 14_ 15_ 16_ 17_ 18_ 19_ 20_ 21_ 22_ 23_ 24_ 25_

(SM)

(SW)

Site Plan

Was GW Observed ATD? No

If yes, at what depth? ...

GW Monitoring Depth N/E bgs

Date of Measurement 10/3/25

Reading No.	Date	Gross Time Start/Stop (HH:MM)	Net Time (Minutes)	Depth to Water Start/Stop (feet BTOC)		Net Drop (inches)
Soak	10/2/25	13:03 - 13:13	> 10	6.51	-	N/A
Soak	10/2 - 10/3	13:13 - 11:23	(~22 hrs)	6.51	-	N/A
1	10/3/25	11:25	30	7.01	7.18	0.17
2	10/3/25	11:58	30	7.01	7.19	0.18
3	10/3/25	12:31	30	7.01	7.23	0.22
4	10/3/25	13:02	30	7.01	7.23	0.22

Final Percolation Rate: 136 (minutes/inch) Casing Diam: 3"

Test Run between: 4.2 ft and 4.7 ft BGS Casing S/U: 2.9 ft

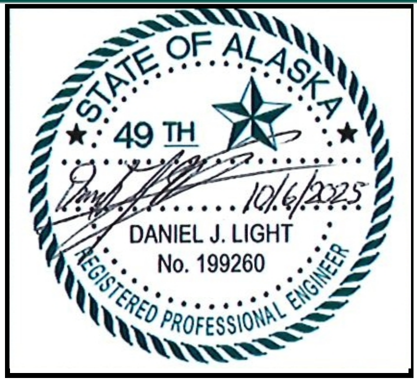
Comments:

Performed By Daniel J. Light I, Daniel J. Light certify that this test was performed in accordance with all state and municipal guidelines in effect on this date. Date: 10/6/2025

NORTHERN GEOTECHNICAL ENGINEERING, INC. / TERRA FIRMA TESTING

Laboratory Testing · Geotechnical Engineering · Instrumentation · Construction Monitoring Services · Thermal Analysis

Infiltration/Percolation Test Form



Project Name/No.:	**10155-25 - Airport Heights Sr Housing**
Legal Description:	**Northway Bus. Park Seward Twr Tract-1**
Date Test Performed:	**10/2/2025 - 10/3/2025**
Test Performed For:	**Infiltration Test**
Date of Installation:	**9/10/2025**
Exploration I.D:	**IT02**

Site Plan

Depth (feet) (USCS)

1_ 2_ 3_ 4_ 5_ 6_ 7_ (GM)

8_ BOH

9_ 10_ 11_ 12_ 13_ 14_ 15_ 16_ 17_ 18_ 19_ 20_ 21_ 22_ 23_ 24_ 25_

Was GW Observed ATD? Yes **GW Monitoring Depth** 10.98 ft **bgs**

If yes, at what depth? ~ 11 ft **bgs** **Date of Measurement** 10/3/25

Reading No.	Date	Gross Time Start/Stop (HH:MM)	Net Time (Minutes)	Depth to Water Start/Stop (feet BTOC)		Net Drop (inches)
Soak	10/2/25	13:35 - 13:45	> 10	9.30	-	N/A
Soak	10/2 - 10/3	13:45 - 14:05	(~24 hrs)	9.30	-	N/A
1	10/3/25	14:06	30	9.80	9.93	0.13
2	10/3/25	14:38	30	9.80	9.95	0.15
3	10/3/25	15:10	30	9.80	9.95	0.15

Final Percolation Rate: **200** **(minutes/inch)** **Casing Diam:** **3"**

Test Run between: **6.3 ft** **and** **6.8 ft** **BGS** **Casing S/U:** **3.5 ft**

Comments:

Performed By **Daniel J. Light** **I,** **Daniel J. Light** **certify that this test was performed in accordance with all state and municipal guidelines in effect on this date.** **Date:** **10/6/2025**

APPENDIX D

LABORATORY DATA SHEETS

Geotechnical Sample Summary

Listing of key results for geotechnical investigations
*****Non-Plastic or Liquid Limit results that are Not Obtainable are shown with a value of 0***
Search: Project = '10155-25'

Group: ProjectName = CIHA Airport Heights Senior Housing Phase 1.

Exploration ID	Sample ID	Depth [ft]	MC [%]	LL	PL	PI	Gravel [%]	Sand [%]	Silt/Clay	Pass. #200 [%]	Pass. 0.02 mm [%]	Frost Class.	Org. Cont. [%]	Group Code	Group Name
B01-S01	25-1725-1	0.0 - 1.5	9.0												
B01-S02	25-1725-2	2.5 - 4.0	2.4	0	0	0	32	66	3	2.7				SP	Poorly graded sand with gravel
B01-S03	25-1725-3	5.0 - 6.5	7.5												
B01-S04	25-1725-4	7.5 - 9.0	3.1												
B01-S05	25-1725-5	10.0 - 11.5	2.8												
B01-S06	25-1725-6	15.0 - 16.5	5.2												
B01-S07	25-1725-7	20.0 - 21.5	15.0												
B01-S08	25-1725-8	25.0 - 26.5	10.8												
B01-S09	25-1725-9	30.0 - 31.5	22.9												
B02-S01	25-1726-1	0.0 - 1.5	7.4	0	0	0	28	70	2	2.4				SP	Poorly graded sand with gravel
B02-S02	25-1726-2	2.5 - 4.0	9.5												
B02-S03	25-1726-3	5.0 - 6.5	34.1	0	0	0	36	54	10	9.8				SP-SM	Poorly graded sand with silt and gravel
B02-S04	25-1726-4	7.5 - 9.0	30.3												
B02-S05	25-1726-5	10.0 - 11.5	39.0												
B02-S06	25-1726-6	15.0 - 16.5	4.6	0	0	0			1	0.9					
B02-S07	25-1726-7	20.0 - 21.5	10.6												
B02-S08	25-1726-8	25.0 - 26.5	14.5												
B02-S09	25-1726-9	30.0 - 31.5	21.2												
B03-S01	25-1727-1	0.0 - 1.5	11.3												
B03-S02	25-1727-2	2.5 - 4.0	37.6	0	0	0	32	54	14	14.2				SM	Silty sand with gravel
B03-S03	25-1727-3	5.0 - 6.5	20.0												
B03-S04	25-1727-4	7.5 - 9.0	2.3												
B03-S05	25-1727-5	10.0 - 11.5	2.6	0	0	0	49	46	4	4.3				GP	Poorly graded gravel with sand
B03-S06	25-1727-6	15.0 - 16.5	2.8												
B03-S07	25-1727-7	20.0 - 21.5	9.5												
B03-S08	25-1727-8	25.0 - 26.5	17.6												
B03-S09	25-1727-9	30.0 - 31.5	18.8												
B04-S01	25-1746-1	0.0 - 1.5	5.1												
B04-S02	25-1746-2	2.5 - 4.0	4.8	0	0	0	28	51	22	21.6				SM	Silty sand with gravel
B04-S03	25-1746-3	5.0 - 6.5	1.8												
B04-S04	25-1746-4	7.5 - 9.0	2.2	0	0	0	48	49	3	2.6				SP	Poorly graded sand with gravel
B04-S05	25-1746-5	10.0 - 11.5	2.1												
B04-S06	25-1746-6	15.0 - 16.5	3.5												
B04-S07	25-1746-7	20.0 - 21.5	3.9												
B04-S08	25-1746-8	25.0 - 26.5	20.7												
B04-S09	25-1746-9	30.0 - 31.5	20.0												
B05-S01	25-1748-1	0.0 - 1.5	19.9												
B05-S02	25-1748-2	2.5 - 4.0	12.4	0	0	0	43	42	15	14.9	11.1	F2		GM	Silty gravel with sand
B05-S03	25-1748-3	5.0 - 6.5	2.6	0	0	0	53	44	3	3.3	2.5	NFS		GP	Poorly graded gravel with sand
B05-S04	25-1748-4	7.5 - 9.0	4.3												
B05-S05	25-1748-5	10.0 - 11.5	3.5												
B05-S06	25-1748-6	15.0 - 16.5	10.7												

Geotechnical Sample Summary

Listing of key results for geotechnical investigations
*****Non-Plastic or Liquid Limit results that are Not Obtainable are shown with a value of 0***
Search: Project = '10155-25'

Group: ProjectName = CIHA Airport Heights Senior Housing Phase 1.

Exploration ID	Sample ID	Depth [ft]	MC [%]	LL	PL	PI	Gravel [%]	Sand [%]	Silt/Clay	Pass. #200 [%]	Pass. 0.02 mm [%]	Frost Class.	Org. Cont. [%]	Group Code	Group Name
B06-S01	25-1749-1	0.0 - 1.5	27.0												
B06-S02	25-1749-2	2.5 - 4.0	24.7												
B06-S03	25-1749-3	5.0 - 6.5	11.1	30	25	5	41	39	20	20.0	12.1	F2		GM	Silty gravel with sand
B06-S04	25-1749-4	7.5 - 9.0	17.6												
B06-S05	25-1749-5	10.0 - 11.5	19.6												
B06-S06	25-1749-6	15.0 - 16.5	2.6	0	0	0	56	42	3	2.7	2.3	NFS		GP	Poorly graded gravel with sand
B07-S01	25-1750-1	0.0 - 1.5	9.5												
B07-S02	25-1750-2	2.5 - 4.0	3.2												
B07-S03	25-1750-3	5.0 - 6.5	18.0	0	0	0	26	42	31	31.3	18.2	F3		SM	Silty sand with gravel
B07-S04	25-1750-4	7.5 - 9.0	22.9												
B07-S05	25-1750-5	10.0 - 11.5	5.6												
B07-S06	25-1750-6	15.0 - 16.5	3.0	0	0	0	49	49	1	1.3	1.1	NFS		SP	Poorly graded sand with gravel
B08-S01	25-1751-1	0.0 - 1.5	12.6												
B08-S02	25-1751-2	2.5 - 4.0	13.1												
B08-S03	25-1751-3	5.0 - 6.5	8.3	0	0	0	41	53	6	5.6	4.5	F2		SP-SM	Poorly graded sand with silt and gravel
B08-S04	25-1751-4	7.5 - 9.0	20.4												
B08-S05	25-1751-5	10.0 - 11.5	3.5	0	0	0	59	30	11	11.0	5.6	F1		GP-GM	Poorly graded gravel with silt and sand
B08-S06	25-1751-6	15.0 - 16.5	2.0												
IT01-S01	25-1752-1	0.0 - 1.5	16.1												
IT01-S02	25-1752-2	5.0 - 6.5	27.3	0	0	0	45	43	12	11.9				GP-GM	Poorly graded gravel with silt and sand
IT01-S03	25-1752-3	10.0 - 11.5	4.8												
IT01-S04	25-1752-4	15.0 - 16.5	7.8												
IT02-S01	25-1753-1	0.0 - 1.5	11.3												
IT02-S02	25-1753-2	5.0 - 6.5	2.9	0	0	0	49	47	3	3.2				GP	Poorly graded gravel with sand
IT02-S03	25-1753-3	10.0 - 11.5	10.5												
IT02-S04	25-1753-4	15.0 - 16.5	14.9												

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Report No: MAT:25-1725-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1725-2
Field Sample ID	B01-S02
Date Sampled	9/9/2025
Material	B01-S02
Sampling Method	Modified split-spoon

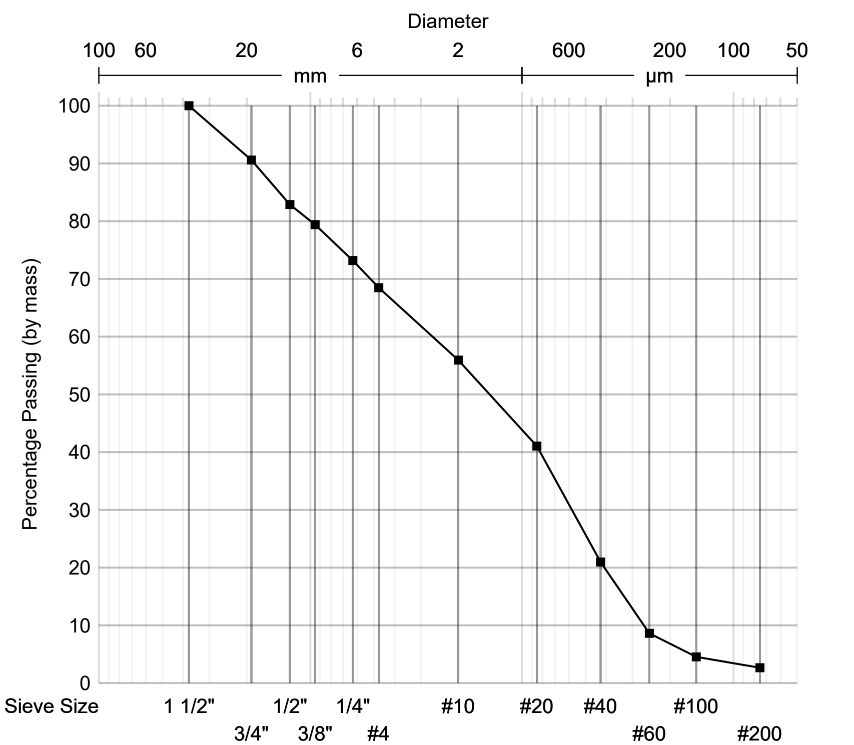
Sample Description:

Depth: 2.5 - 4.0 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (32%)		SAND (66%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	9.4%	22.1%	12.5%	35.0%	18.3%	3%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
1½in	100	
¾in	91	
½in	83	
3/8in	79	
¼in	73	
No.4	68	
No.10	56	
No.20	41	
No.40	21	
No.60	9	
No.100	5	
No.200	2.7	

D85: 14.0251 **D60:** 2.6463 **D50:** 1.4219
D30: 0.5806 **D15:** 0.3289 **D10:** 0.2653
Cu: 9.97 **Cc:** 0.48

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Report No: MAT:25-1725-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1725-2
Field Sample ID	B01-S02
Date Sampled	9/9/2025
Material	B01-S02
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487	9.97	
Cc		0.48	
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	2.4	
Date Tested		9/16/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	SP	
Group Name		Poorly graded sand with gravel	
Tested By		Nic Cropper	
Date Tested		9/24/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/17/2025	

Comments

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Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1726-1
Field Sample ID	B02-S01
Date Sampled	9/9/2025
Material	B02-S01
Sampling Method	Modified split-spoon

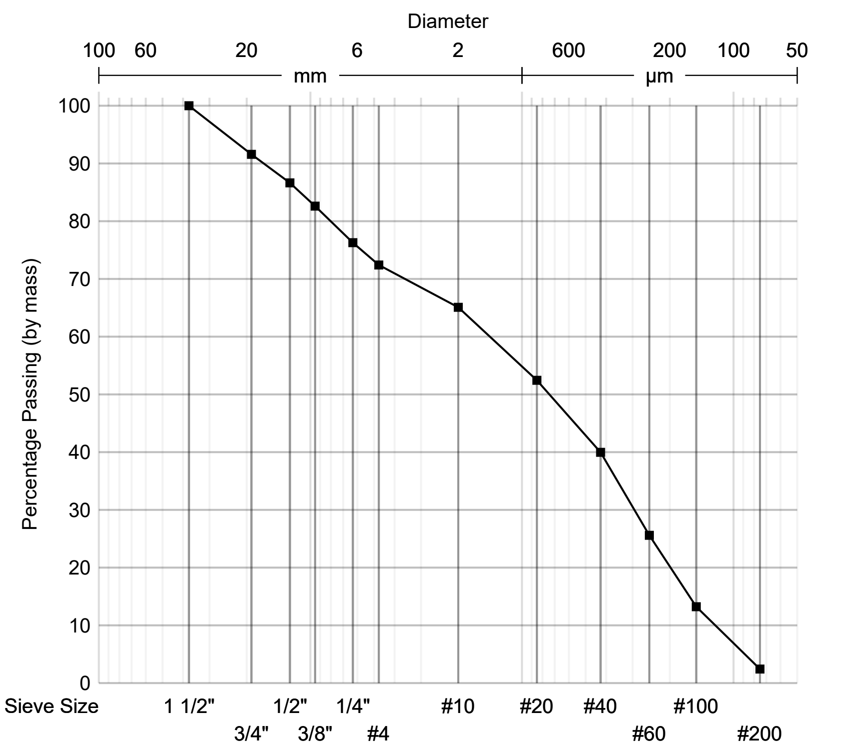
Sample Description:

Depth: 0.0 - 1.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (28%)		SAND (70%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	8.4%	19.2%	7.3%	25.1%	37.5%	2%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
1½in	100	
¾in	92	
½in	87	
3/8in	83	
¼in	76	
No.4	72	
No.10	65	
No.20	52	
No.40	40	
No.60	26	
No.100	13	
No.200	2.4	

D85: 11.1794 **D60:** 1.4177 **D50:** 0.7421
D30: 0.2942 **D15:** 0.1614 **D10:** 0.1219
Cu: 11.63 **Cc:** 0.50

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Report No: MAT:25-1726-1
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1726-1
Field Sample ID	B02-S01
Date Sampled	9/9/2025
Material	B02-S01
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487	11.63	
Cc		0.50	
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	7.4	
Date Tested		9/16/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	SP	
Group Name		Poorly graded sand with gravel	
Tested By		Nic Cropper	
Date Tested		9/24/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/24/2025	

Comments

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Report No: MAT:25-1726-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

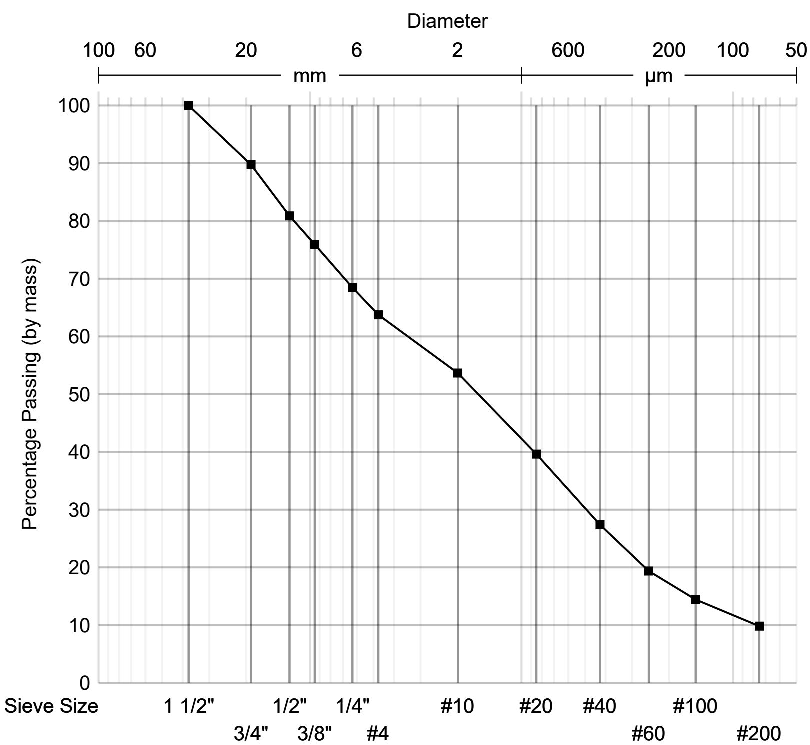
Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1726-3
Field Sample ID	B02-S03
Date Sampled	9/9/2025
Material	B02-S03
Sampling Method	Modified split-spoon

Particle Size Distribution



COBBLES	GRAVEL (36%)		SAND (54%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	10.3%	26.0%	10.1%	26.3%	17.6%	10%

Sample Description:

Depth: 5.0 - 6.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
1½in	100	
¾in	90	
½in	81	
3/8in	76	
¼in	68	
No.4	64	
No.10	54	
No.20	40	
No.40	27	
No.60	19	
No.100	14	
No.200	9.8	

D85: 15.1850 **D60:** 3.4444 **D50:** 1.6000
D30: 0.4929 **D15:** 0.1592 **D10:** 0.0770
Cu: 44.71 **Cc:** 0.92

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Report No: MAT:25-1726-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1726-3
Field Sample ID	B02-S03
Date Sampled	9/9/2025
Material	B02-S03
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487	44.71	
Cc		0.92	
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	34.1	
Date Tested		9/16/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	SP-SM	
Group Name		Poorly graded sand with silt and gravel	
Tested By		Nic Cropper	
Date Tested		9/24/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/19/2025	

Comments

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Report No: MAT:25-1726-6
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1726-6
Field Sample ID	B02-S06
Date Sampled	9/9/2025
Material	B02-S06
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Passing No. 200 (75 μm) (%)	ASTM D1140	1	
Procedure		A	
Soaking Period (min)		60	
Initial Dry Mass (g)		869.6	
Tested By		Nic Cropper	
Date Tested		9/19/2025	
Water Content (%)	ASTM D2216	4.6	
Date Tested		9/16/2025	
Tested By		Amir Mack	
	ASTM D4318		
Liquid Limit		Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/18/2025	

Particle Size Distribution

Chart

Comments

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Report No: MAT:25-1727-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1727-2
Field Sample ID	B03-S02
Date Sampled	9/10/2025
Material	B03-S02
Sampling Method	Modified split-spoon

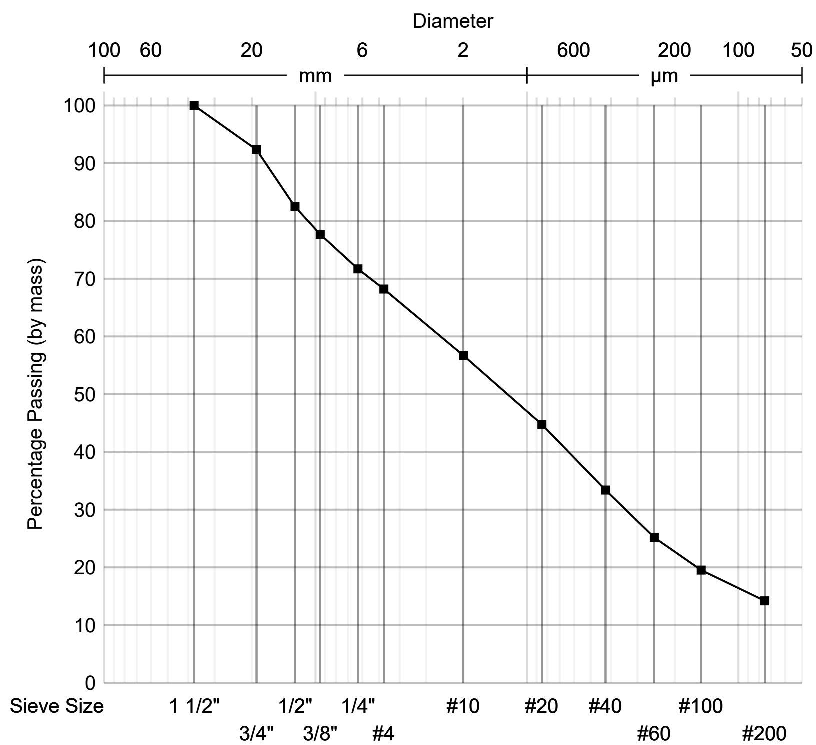
Sample Description:

Depth: 2.5 - 4.0 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (32%)		SAND (54%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	7.7%	24.1%	11.5%	23.3%	19.2%	14%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
1½in	100	
¾in	92	
½in	82	
3/8in	78	
¼in	72	
No.4	68	
No.10	57	
No.20	45	
No.40	33	
No.60	25	
No.100	20	
No.200	14	

D85: 13.9208 **D60:** 2.5607 **D50:** 1.2367
D30: 0.3413 **D15:** 0.0832 **D10:** N/A
Cu: N/A **Cc:** N/A

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Report No: MAT:25-1727-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1727-2
Field Sample ID	B03-S02
Date Sampled	9/10/2025
Material	B03-S02
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487		
Cc			
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	37.6	
Date Tested		9/16/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	SM	
Group Name		Silty sand with gravel	
Tested By		Nic Cropper	
Date Tested		9/19/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/19/2025	

Comments

Northern Geotechnical Engineering, Inc. - Terra Firma Testing
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Phone: (907) 344-5934 | www.nge-tft.com

Report No: MAT:25-1727-5
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1727-5
Field Sample ID	B03-S05
Date Sampled	9/10/2025
Material	B03-S05
Sampling Method	Modified split-spoon

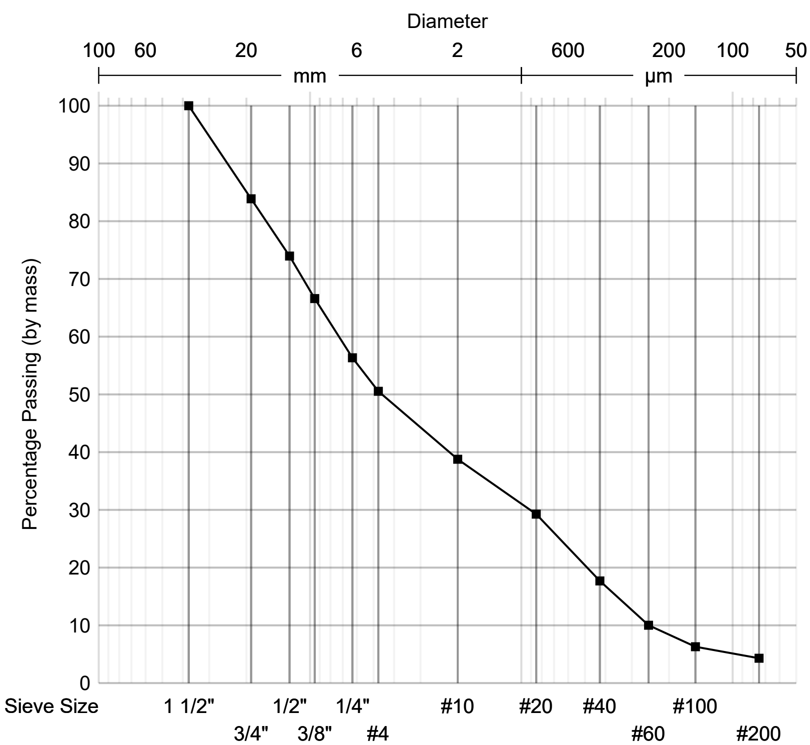
Sample Description:

Depth: 10.0 - 11.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (49%)		SAND (46%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	16.1%	33.3%	11.8%	21.1%	13.4%	4%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
1½in	100	
¾in	84	
½in	74	
3/8in	67	
¼in	56	
No.4	51	
No.10	39	
No.20	29	
No.40	18	
No.60	10	
No.100	6	
No.200	4.3	

D85: 19.9169 **D60:** 7.2935 **D50:** 4.5660
D30: 0.9087 **D15:** 0.3528 **D10:** 0.2494
Cu: 29.25 **Cc:** 0.45

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Report No: MAT:25-1727-5
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1727-5
Field Sample ID	B03-S05
Date Sampled	9/10/2025
Material	B03-S05
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487	29.25	
Cc		0.45	
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	2.6	
Date Tested		9/16/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	GP	
Group Name		Poorly graded gravel with sand	
Tested By		Nic Cropper	
Date Tested		9/24/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/17/2025	

Comments

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Report No: MAT:25-1746-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1746-2
Field Sample ID	B04-S02
Date Sampled	9/10/2025
Material	B04-S02
Sampling Method	Modified split-spoon

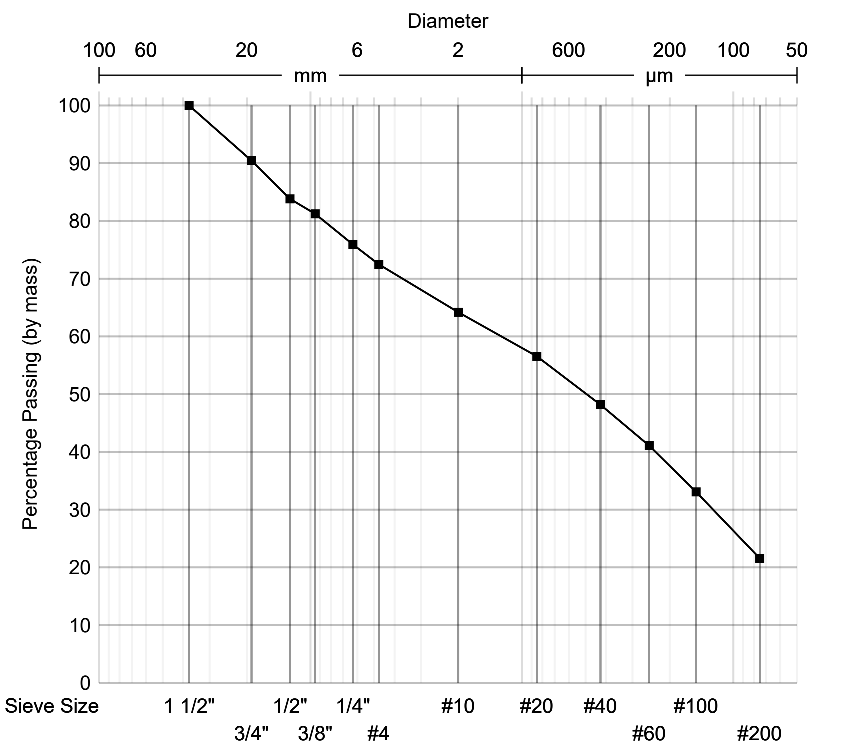
Sample Description:

Depth: 2.5 - 4.0 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (28%)		SAND (51%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	9.6%	18.0%	8.3%	16.0%	26.6%	22%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
1½in	100	
¾in	90	
½in	84	
3/8in	81	
¼in	76	
No.4	72	
No.10	64	
No.20	57	
No.40	48	
No.60	41	
No.100	33	
No.200	22	

D85: 13.4652 **D60:** 1.2505 **D50:** 0.4945
D30: 0.1247 **D15:** N/A **D10:** N/A
Cu: N/A **Cc:** N/A

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Report No: MAT:25-1746-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1746-2
Field Sample ID	B04-S02
Date Sampled	9/10/2025
Material	B04-S02
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487		
Cc			
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	4.8	
Date Tested		9/17/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	SM	
Group Name		Silty sand with gravel	
Tested By		Nic Cropper	
Date Tested		9/24/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/19/2025	

Comments

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Report No: MAT:25-1746-4
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1746-4
Field Sample ID	B04-S04
Date Sampled	9/10/2025
Material	B04-S04
Sampling Method	Modified split-spoon

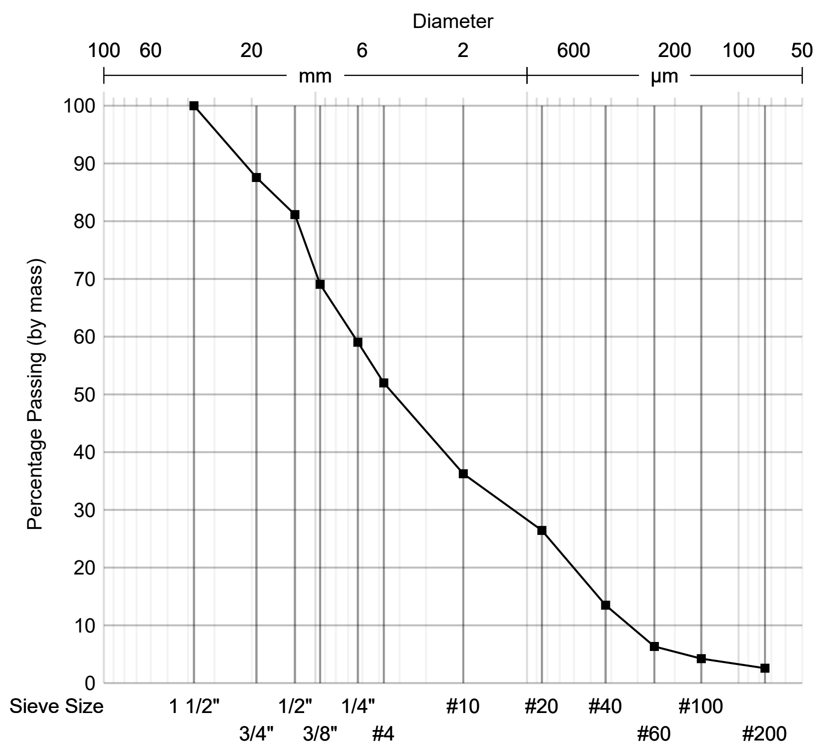
Sample Description:

Depth: 7.5 - 9.0 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (48%)		SAND (49%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	12.4%	35.6%	15.7%	22.8%	10.9%	3%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
1½in	100	
¾in	88	
½in	81	
3/8in	69	
¼in	59	
No.4	52	
No.10	36	
No.20	26	
No.40	13	
No.60	6	
No.100	4	
No.200	2.6	

D85: 16.0710 **D60:** 6.5534 **D50:** 4.2580
D30: 1.1592 **D15:** 0.4608 **D10:** 0.3280
Cu: 19.98 **Cc:** 0.63

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Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1746-4
Field Sample ID	B04-S04
Date Sampled	9/10/2025
Material	B04-S04
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487	19.98	
Cc		0.63	
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	2.2	
Date Tested		9/17/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	SP	
Group Name		Poorly graded sand with gravel	
Tested By		Nic Cropper	
Date Tested		9/24/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/18/2025	

Comments

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Report No: MAT:25-1748-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

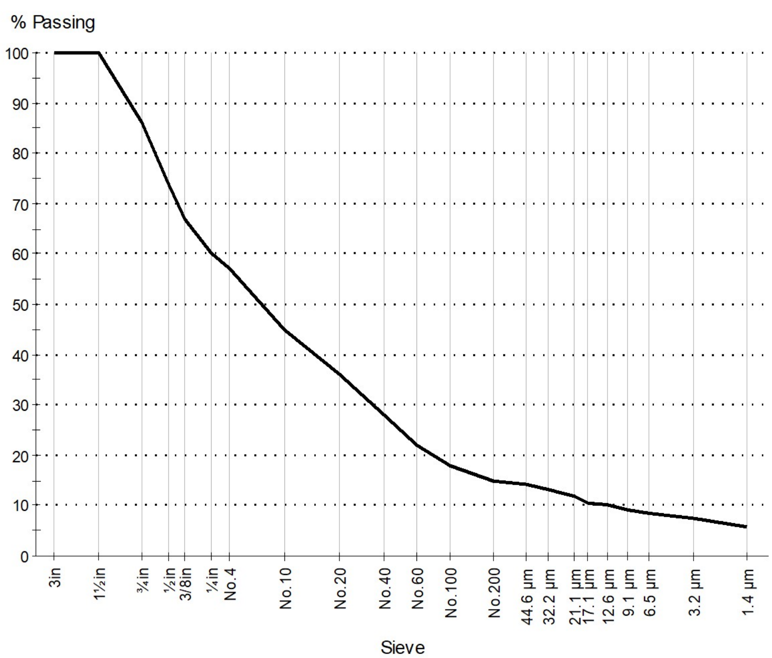
Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1748-2
Field Sample ID	B05-S02
Date Sampled	9/11/2025
Material	B05-S02
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(14.4%)	(29.0%)	(11.2%)	(16.9%)	(13.5%)	(6.7%)	(8.1%)

Sample Description:

Depth: 2.5 - 4.0 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/26/2025
Tested By: Jacob Marvin

Sieve Size	% Passing	Limits
3in	100	
1½in	100	
¾in	86	
½in	74	
3/8in	67	
¼in	60	
No.4	57	
No.10	45	
No.20	36	
No.40	28	
No.60	22	
No.100	18	
No.200	15	
44.6 µm	14.2	
32.2 µm	13.2	
21.1 µm	11.7	
17.1 µm	10.6	
12.6 µm	10.1	
9.1 µm	9.1	
6.5 µm	8.6	
3.2 µm	7.6	
1.4 µm	5.6	

D85: 18.3485 **D60:** 6.3000 **D50:** 2.8679
D30: 0.5054 **D15:** 0.0750 **D10:** 0.0122
Cu: 516.54 **Cc:** 3.32

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Report No: MAT:25-1748-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1748-2
Field Sample ID	B05-S02
Date Sampled	9/11/2025
Material	B05-S02
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		11.1	
Frost Group		F2	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		Rounded	
Hardness		Hard and durable	
Sand/gravel description		Sandy soil with organics	
Cu		516.54	
Cc		3.32	
Water Content (%)	ASTM D2216	12.4	
Date Tested		9/17/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	GM	
Group Name		Silty gravel with sand	
Gravel (%)		43	
Sand (%)		42	
Fines (%)		15	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/26/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	

Sample Details

Comments

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Report No: MAT:25-1748-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample ID	25-1748-2
Field Sample ID	B05-S02
Date Sampled	9/11/2025
Material	B05-S02
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Date Tested		9/25/2025	

Comments

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Report No: MAT:25-1748-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1748-3
Field Sample ID	B05-S03
Date Sampled	9/11/2025
Material	B05-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

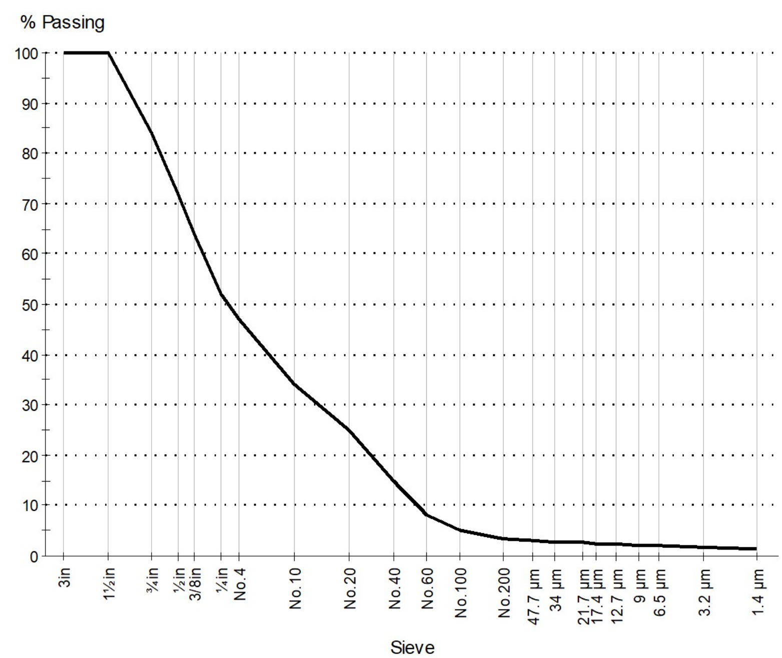
Sample Description:

Depth: 5.0 - 6.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(16.2%)	(36.9%)	(12.8%)	(19.5%)	(11.3%)	(1.5%)	(1.8%)

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/25/2025
Tested By: Jacob Marvin

Sieve Size	% Passing	Limits
3in	100	
1½in	100	
¾in	84	
½in	72	
3/8in	64	
¼in	52	
No.4	47	
No.10	34	
No.20	25	
No.40	15	
No.60	8	
No.100	5	
No.200	3.3	
47.7 µm	3.1	
34.0 µm	2.8	
21.7 µm	2.6	
17.4 µm	2.4	
12.7 µm	2.4	
9.0 µm	2.1	
6.5 µm	1.9	
3.2 µm	1.7	
1.4 µm	1.4	

D85: 19.8248 **D60:** 8.2844 **D50:** 5.6271
D30: 1.3673 **D15:** 0.4250 **D10:** 0.2909
Cu: 28.48 **Cc:** 0.78

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Report No: MAT:25-1748-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1748-3
Field Sample ID	B05-S03
Date Sampled	9/11/2025
Material	B05-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		2.5	
Frost Group		NFS	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		subrounded	
Hardness		hard and durable	
Cu		28.48	
Cc		0.78	
Water Content (%)	ASTM D2216	2.6	
Date Tested		9/17/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	GP	
Group Name		Poorly graded gravel with sand	
Gravel (%)		53	
Sand (%)		44	
Fines (%)		3	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/26/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/18/2025	

Comments

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Report No: MAT:25-1749-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1749-3
Field Sample ID	B06-S03
Date Sampled	9/11/2025
Material	B06-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

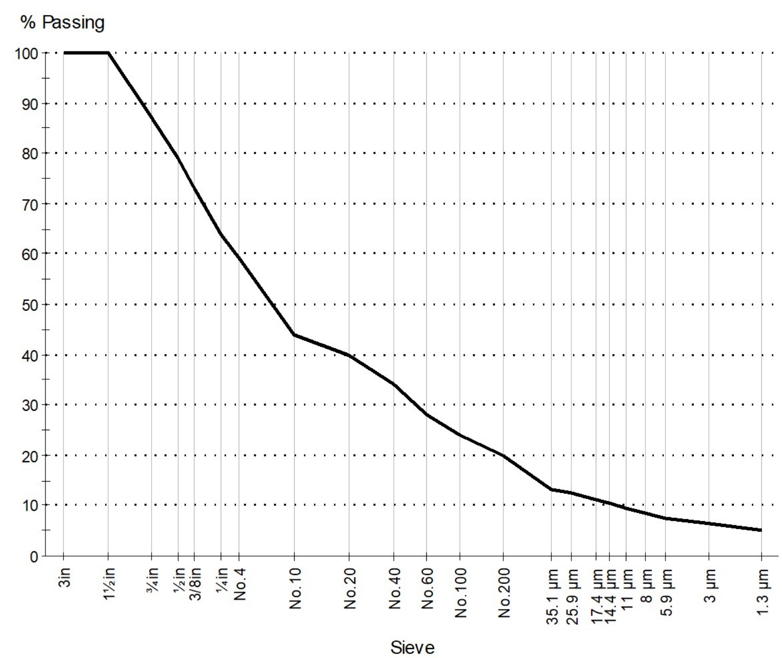
Sample Description:

Depth: 5.0 - 6.5 bgs

Atterberg Limit:

Liquid Limit: 30
Plastic Limit: 25
Plasticity Index: 5
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(12.5%)	(28.4%)	(15.0%)	(10.3%)	(13.8%)	(12.8%)	(7.2%)

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/26/2025
Tested By: Jacob Marvin

Sieve Size	% Passing	Limits
3in	100	
1½in	100	
¾in	87	
½in	79	
3/8in	73	
¼in	64	
No.4	59	
No.10	44	
No.20	40	
No.40	34	
No.60	28	
No.100	24	
No.200	20	
35.1 µm	13.1	
25.9 µm	12.5	
17.4 µm	11.3	
14.4 µm	10.4	
11.0 µm	9.5	
8.0 µm	8.6	
5.9 µm	7.6	
3.0 µm	6.4	
1.3 µm	5.2	

D85: 17.1117 **D60:** 5.0260 **D50:** 2.8268
D30: 0.2984 **D15:** 0.0433 **D10:** 0.0128
Cu: 393.41 **Cc:** 1.39

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Report No: MAT:25-1749-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1749-3
Field Sample ID	B06-S03
Date Sampled	9/11/2025
Material	B06-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		12.1	
Frost Group		F2	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		Subrounded	
Hardness		Hard and durable	
Cu		393.41	
Cc		1.39	
Water Content (%)	ASTM D2216	11.1	
Date Tested		9/17/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	GM	
Group Name		Silty gravel with sand	
Gravel (%)		41	
Sand (%)		39	
Fines (%)		20	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/26/2025	
Liquid Limit	ASTM D4318	30	
Plastic Limit		25	
Plasticity Index		5	
Tested By		Nic Cropper	
Date Tested		9/23/2025	

Comments

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Report No: MAT:25-1749-6
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1749-6
Field Sample ID	B06-S06
Date Sampled	9/11/2025
Material	B06-S06
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

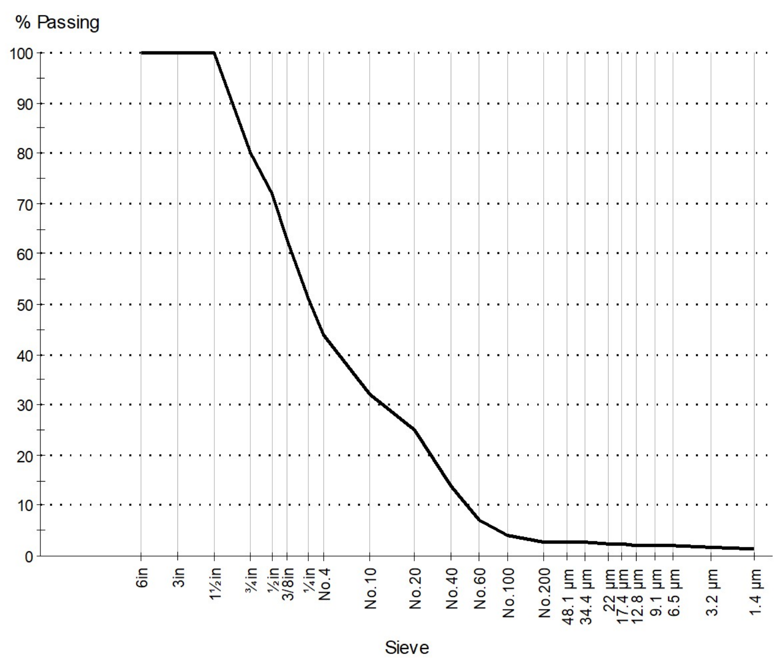
Sample Description:

Depth: 15.0 - 16.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(19.9%)	(35.8%)	(12.3%)	(17.9%)	(11.4%)	(0.9%)	(1.8%)

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/24/2025
Tested By: Jacob Marvin

Sieve Size	% Passing	Limits
6in	100	
3in	100	
1½in	100	
¾in	80	
½in	72	
3/8in	63	
¼in	51	
No.4	44	
No.10	32	
No.20	25	
No.40	14	
No.60	7	
No.100	4	
No.200	2.7	
48.1 µm	2.8	
34.4 µm	2.6	
22.0 µm	2.3	
17.4 µm	2.3	
12.8 µm	2.1	
9.1 µm	1.9	
6.5 µm	1.9	
3.2 µm	1.7	
1.4 µm	1.5	

D85: 22.5202 **D60:** 8.5729 **D50:** 6.0509
D30: 1.5662 **D15:** 0.4526 **D10:** 0.3138
Cu: 27.32 **Cc:** 0.91

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Report No: MAT:25-1749-6
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1749-6
Field Sample ID	B06-S06
Date Sampled	9/11/2025
Material	B06-S06
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		2.3	
Frost Group		NFS	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		subrounded	
Hardness		hard and durable	
Cu		27.32	
Cc		0.91	
Water Content (%)	ASTM D2216	2.6	
Date Tested		9/17/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	GP	
Group Name		Poorly graded gravel with sand	
Gravel (%)		56	
Sand (%)		41	
Fines (%)		3	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/25/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/18/2025	

Comments

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Report No: MAT:25-1750-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1750-3
Field Sample ID	B07-S03
Date Sampled	9/11/2025
Material	B07-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

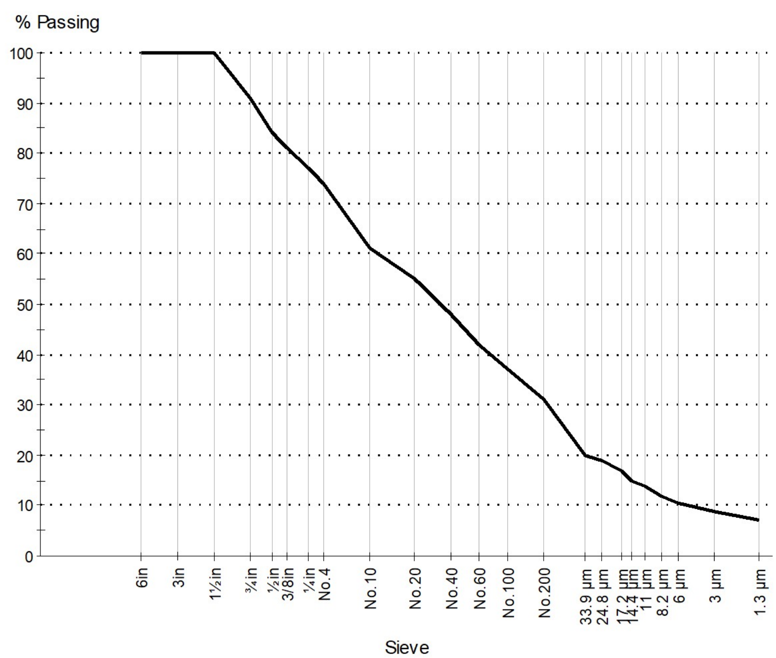
Sample Description:

Depth: 5.0 - 6.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(9.2%)	(17.1%)	(12.2%)	(13.5%)	(16.7%)	(21.3%)	(10.0%)

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/25/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
6in	100	
3in	100	
1½in	100	
¾in	91	
½in	84	
3/8in	81	
¼in	77	
No.4	74	
No.10	61	
No.20	55	
No.40	48	
No.60	42	
No.100	37	
No.200	31	
33.9 µm	19.9	
24.8 µm	19.0	
17.2 µm	16.8	
14.4 µm	15.0	
11.0 µm	13.7	
8.2 µm	11.9	
6.0 µm	10.6	
3.0 µm	8.8	
1.3 µm	7.1	

D85: 13.2705 **D60:** 1.7342 **D50:** 0.5181
D30: 0.0698 **D15:** 0.0144 **D10:** 0.0048
Cu: 364.16 **Cc:** 0.59

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Report No: MAT:25-1750-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1750-3
Field Sample ID	B07-S03
Date Sampled	9/11/2025
Material	B07-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		18.2	
Frost Group		F3	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		Subrounded	
Hardness		Hard and durable	
Cu		364.16	
Cc		0.59	
Water Content (%)	ASTM D2216	18	
Date Tested		9/17/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	SM	
Group Name		Silty sand with gravel	
Gravel (%)		26	
Sand (%)		43	
Fines (%)		31	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/25/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/19/2025	

Comments

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Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1750-6
Field Sample ID	B07-S06
Date Sampled	9/11/2025
Material	B07-S06
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

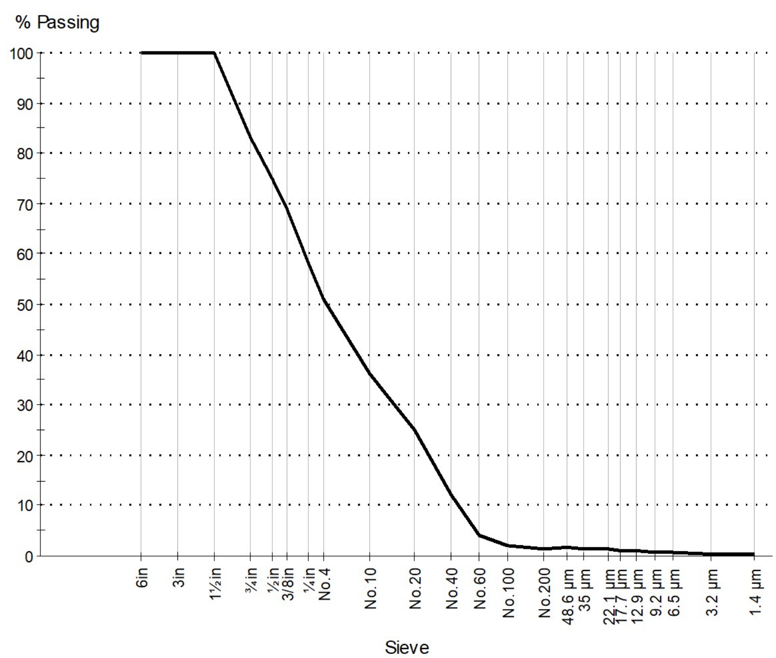
Sample Description:

Depth: 15.0 - 16.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(16.9%)	(32.4%)	(15.2%)	(23.7%)	(10.5%)	(0.7%)	(0.6%)

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/25/2025
Tested By: Jacob Marvin

Sieve Size	% Passing	Limits
6in	100	
3in	100	
1½in	100	
¾in	83	
½in	75	
3/8in	69	
¼in	58	
No.4	51	
No.10	36	
No.20	25	
No.40	12	
No.60	4	
No.100	2	
No.200	1.3	
48.6 µm	1.6	
35.0 µm	1.2	
22.1 µm	1.2	
17.7 µm	0.9	
12.9 µm	0.9	
9.2 µm	0.7	
6.5 µm	0.7	
3.2 µm	0.5	
1.4 µm	0.2	

D85: 20.5822 **D60:** 6.7885 **D50:** 4.4838
D30: 1.2541 **D15:** 0.4987 **D10:** 0.3722
Cu: 18.24 **Cc:** 0.62

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Report No: MAT:25-1750-6
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1750-6
Field Sample ID	B07-S06
Date Sampled	9/11/2025
Material	B07-S06
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		1.1	
Frost Group		NFS	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		Subrounded	
Hardness		Hard and durable	
Cu		18.24	
Cc		0.62	
Water Content (%)	ASTM D2216	3	
Date Tested		9/17/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	SP	
Group Name		Poorly graded sand with gravel	
Gravel (%)		49	
Sand (%)		50	
Fines (%)		1	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/25/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/19/2025	

Comments

Northern Geotechnical Engineering, Inc. -
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Report No: MAT:25-1751-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1751-3
Field Sample ID	B08-S03
Date Sampled	9/11/2025
Material	B08-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

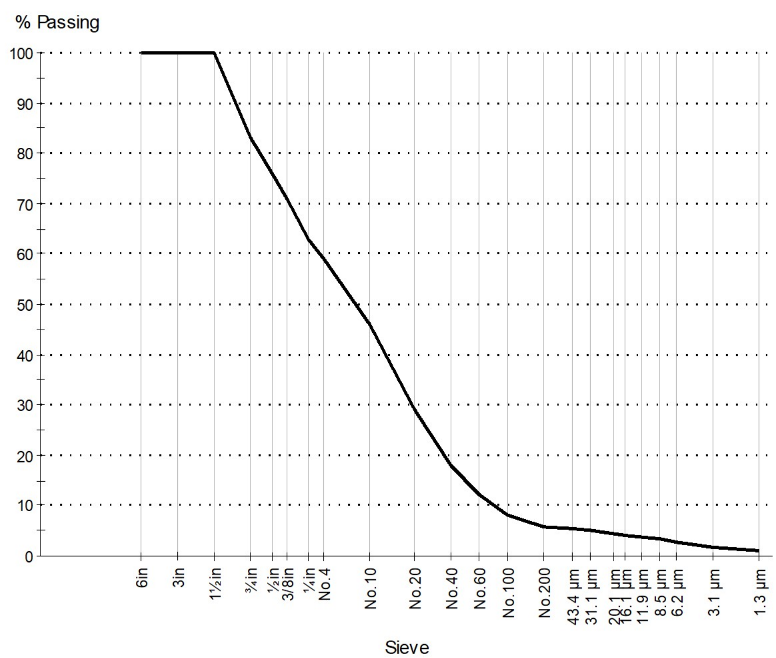
Sample Description:

Depth: 5.0 - 6.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	**Fine**	**Coarse**	**Medium**	**Fine**	**Silt**	**Clay**
(0.0%)	**(17.3%)**	**(23.8%)**	**(12.9%)**	**(27.7%)**	**(12.8%)**	**(3.3%)**	**(2.3%)**

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/25/2025
Tested By: Jacob Marvin

Sieve Size	% Passing	Limits
6in	100	
3in	100	
1½in	100	
¾in	83	
½in	76	
3/8in	71	
¼in	63	
No.4	59	
No.10	46	
No.20	29	
No.40	18	
No.60	12	
No.100	8	
No.200	5.6	
43.4 µm	5.5	
31.1 µm	5.1	
20.1 µm	4.5	
16.1 µm	4.1	
11.9 µm	3.8	
8.5 µm	3.4	
6.2 µm	2.7	
3.1 µm	1.7	
1.3 µm	1.0	

D85: 20.5822 **D60:** 5.0975 **D50:** 2.6099
D30: 0.8939 **D15:** 0.3260 **D10:** 0.1936
Cu: 26.32 **Cc:** 0.81

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Report No: MAT:25-1751-3
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1751-3
Field Sample ID	B08-S03
Date Sampled	9/11/2025
Material	B08-S03
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		4.5	
Frost Group		F2	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		Subrounded	
Hardness		Hard and durable	
Cu		26.32	
Cc		0.81	
Water Content (%)	ASTM D2216	8.3	
Date Tested		9/18/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	SP-SM	
Group Name		Poorly graded sand with silt and gravel	
Gravel (%)		41	
Sand (%)		53	
Fines (%)		6	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/25/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/22/2025	

Comments

Northern Geotechnical Engineering, Inc. - Terra Firma Testing
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Report No: MAT:25-1751-5
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1751-5
Field Sample ID	B08-S05
Date Sampled	9/11/2025
Material	B08-S05
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

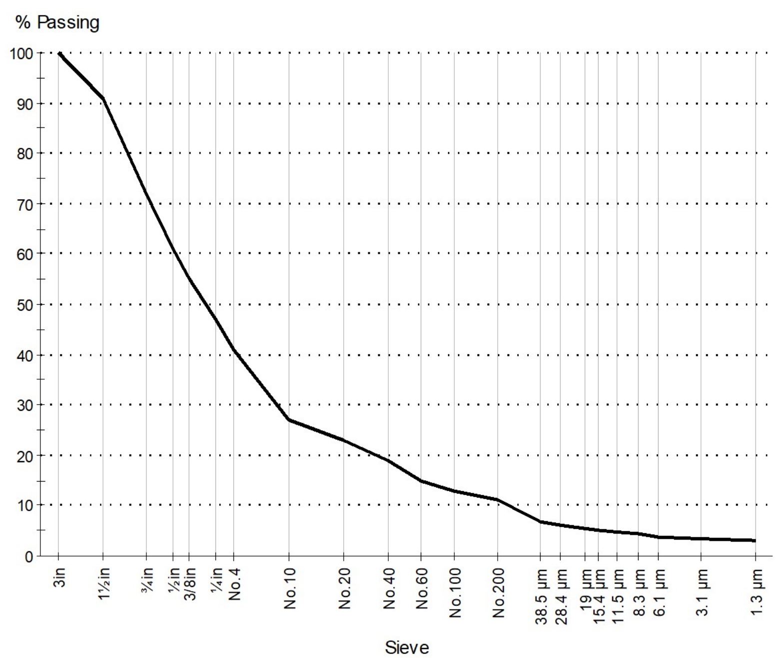
Sample Description:

Depth: 10.0 - 11.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(27.7%)	(31.7%)	(13.8%)	(8.1%)	(7.7%)	(7.4%)	(3.6%)

Grading: ASTM D 422

Drying By: Oven
Date Tested: 9/25/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
3in	100	
1½in	91	
¾in	72	
½in	61	
3/8in	55	
¼in	47	
No.4	41	
No.10	27	
No.20	23	
No.40	19	
No.60	15	
No.100	13	
No.200	11	
38.5 µm	6.8	
28.4 µm	6.2	
19.0 µm	5.5	
15.4 µm	5.1	
11.5 µm	4.8	
8.3 µm	4.4	
6.1 µm	3.8	
3.1 µm	3.3	
1.3 µm	2.9	

D85: 30.2542 **D60:** 11.9411 **D50:** 7.3491
D30: 2.4073 **D15:** 0.2500 **D10:** 0.0640
Cu: 186.61 **Cc:** 7.58

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Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1751-5
Field Sample ID	B08-S05
Date Sampled	9/11/2025
Material	B08-S05
Specification	D422 + Sieve
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Classificaiton Method		MOA	
Percentage Finer than 0.02 mm		5.6	
Frost Group		F1	
Tested By		Andrew Fortt	
Date Tested		10/4/2025	
Dispersion device	ASTM D 422	A	
Dispersion time (min)		1	
Shape		Subrounded	
Hardness		Hard and durable	
Cc		7.58	
CuS		4.57	
Water Content (%)	ASTM D2216	3.5	
Date Tested		9/18/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	GP-GM	
Group Name		Poorly graded gravel with silt and sand	
Gravel (%)		59	
Sand (%)		30	
Fines (%)		11	
Tested By	ASTM D2487	Nic Cropper	
Date Tested		9/25/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/22/2025	

Comments

Northern Geotechnical Engineering, Inc. - Terra Firma Testing
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Report No: MAT:25-1752-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1752-2
Field Sample ID	IT01-S02
Date Sampled	9/10/2025
Material	IT01-S01
Sampling Method	Modified split-spoon

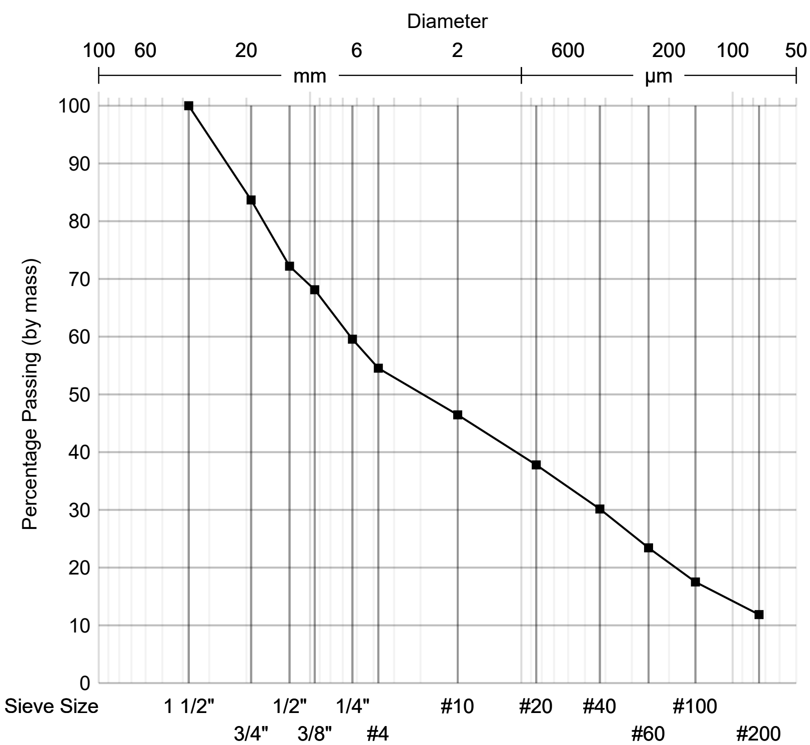
Sample Description:

Depth: 5.0 - 6.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (45%)		SAND (43%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	16.3%	29.1%	8.1%	16.3%	18.3%	12%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Wyatt Neilson

Sieve Size	% Passing	Limits
1½in	100	
¾in	84	
½in	72	
3/8in	68	
¼in	60	
No.4	55	
No.10	46	
No.20	38	
No.40	30	
No.60	23	
No.100	18	
No.200	12	

D85: 20.0742 **D60:** 6.4335 **D50:** 2.9220
D30: 0.4199 **D15:** 0.1102 **D10:** N/A
Cu: N/A **Cc:** N/A

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Report No: MAT:25-1752-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1752-2
Field Sample ID	IT01-S02
Date Sampled	9/10/2025
Material	IT01-S01
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487		
Cc			
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	27.3	
Date Tested		9/17/2025	
Tested By		Amir Mack	
Group Code	ASTM D2487	GP-GM	
Group Name		Poorly graded gravel with silt and sand	
Tested By		Nic Cropper	
Date Tested		9/25/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/19/2025	

Comments

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Report No: MAT:25-1753-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1753-2
Field Sample ID	IT02-S02
Date Sampled	9/11/2025
Material	IT02-S02
Sampling Method	Modified split-spoon

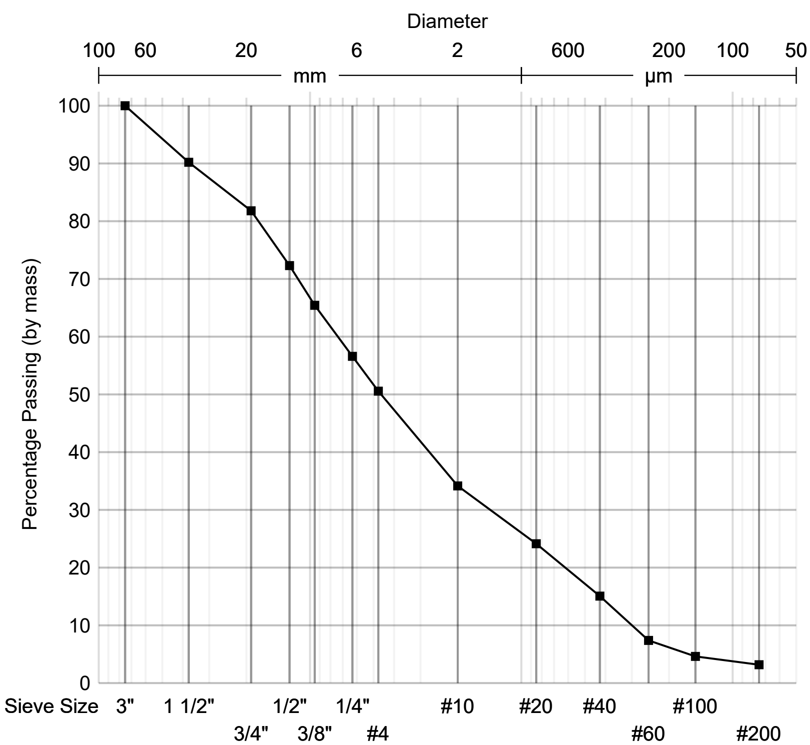
Sample Description:

Depth: 5.0 - 6.5 bgs

Atterberg Limit:

Liquid Limit: Not Obtainable
Plastic Limit: NP (Non-Plastic)
Plasticity Index: NP (Non-Plastic)
Linear Shrinkage (%):

Particle Size Distribution



COBBLES	GRAVEL (49%)		SAND (47%)			SILT/CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
0%	18.2%	31.2%	16.4%	19.1%	11.9%	3%

Grading: ASTM C136

Drying By: Oven
Date Tested: 9/19/2025
Tested By: Amir Mack

Sieve Size	% Passing	Limits
3in	100	
1½in	90	
¾in	82	
½in	72	
3/8in	65	
¼in	57	
No.4	51	
No.10	34	
No.20	24	
No.40	15	
No.60	7	
No.100	5	
No.200	3.2	

D85: 24.6081 **D60:** 7.3810 **D50:** 4.6115
D30: 1.4029 **D15:** 0.4231 **D10:** 0.2995
Cu: 24.65 **Cc:** 0.89

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Report No: MAT:25-1753-2
Issue No: 1

Material Test Report

Client: Spark Design LLC

Project: 10155-25
CIHA Airport Heights Senior Housing Phase 1

Reviewed By: Andrew Fortt, Engineer, P.E.
Date: 10/4/2025

Sample Details

Sample ID	25-1753-2
Field Sample ID	IT02-S02
Date Sampled	9/11/2025
Material	IT02-S02
Sampling Method	Modified split-spoon

Other Test Results

Description	Method	Result	Limits
Cu	ASTM D2487	24.65	
Cc		0.89	
Procedure	ASTM C117	A	
Water Content (%)	ASTM D2216	2.9	
Date Tested		9/17/2025	
Tested By		Gunner Bergstedt	
Group Code	ASTM D2487	GP	
Group Name		Poorly graded gravel with sand	
Tested By		Nic Cropper	
Date Tested		9/19/2025	
Liquid Limit	ASTM D4318	Not Obtainable	
Plastic Limit		NP (Non-Plastic)	
Plasticity Index		NP (Non-Plastic)	
Tested By		Nic Cropper	
Date Tested		9/18/2025	

Comments

APPENDIX E

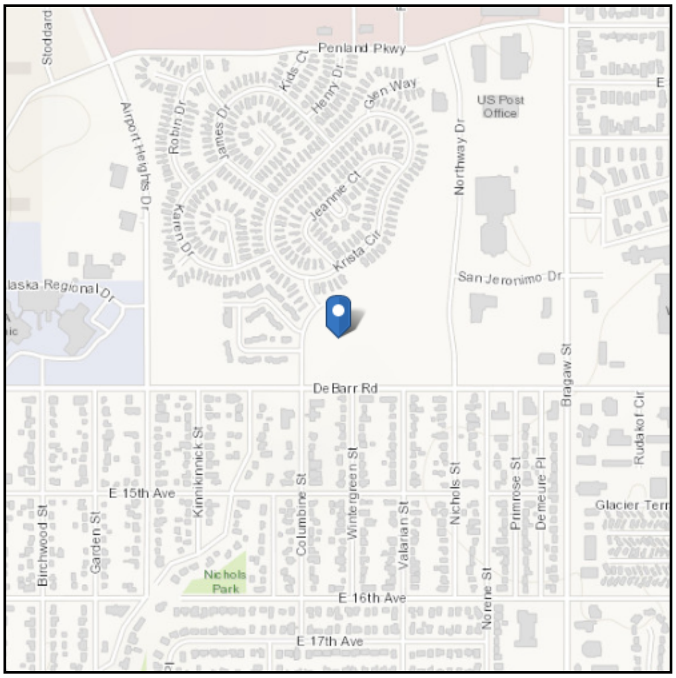
ASCE 7-16 SEISMIC HAZARD REPORT

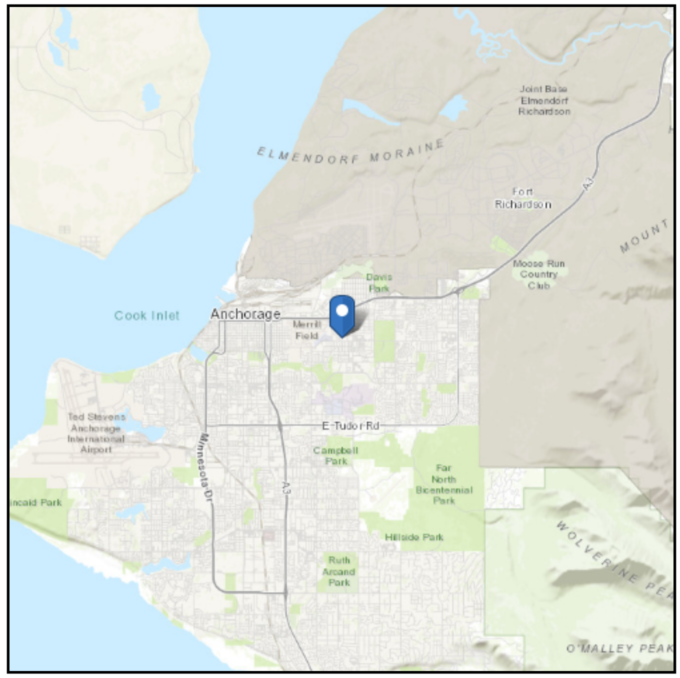
ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Latitude: 61.210564
Longitude: -149.816534
Elevation: 140.97768628950104 ft (NAVD 88)





Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.5	S_{D1} :	N/A
S_1 :	0.679	T_L :	16
F_a :	1	PGA :	0.5
F_v :	N/A	PGA_M :	0.55
S_{MS} :	1.5	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	1	C_v :	1.4

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Wed Oct 22 2025

Date Source: USGS Seismic Design Maps

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