Case Research

History

Pre-Application Request

Purpose:

The purpose of the Pre-Application submittal, and meeting, is for the applicant and city staff to discuss a proposed Development Application, and the information and process that is necessary for city staff to process the proposal.

In accordance with the Zoning Ordinance, no development application shall be accepted before a Pre-Application has been submitted, and a Pre-Application meeting has been conducted with city staff, unless the Pre-Application meeting has been waived by the Zoning Administrator.

Submittal:

The completed Pre-Application Request form and all required materials and fees should be submitted in person to the One-Stop-Shop located at 7447 East Indian School Road; or, may they be submitted digitally at following website: https://eservices.scottsdaleaz.gov/eServices/PreApps/Default.aspx

All checks shall be payable to "City of Scottsdale."

Scheduling

After the Pre-Application submittal has been accepted at the One-Stop-Shop, a staff member will contact the Applicant within five (5) Staff Working Days to schedule a Pre-Application meeting with the assigned staff member(s). Generally, a Pre-Application meeting is scheduled within five (5) to fifteen (15) Staff Working Days from the date of the submittal.

Project Name: 2529 North Hayden

Property's Address: 2529 North Hayden Road **APN:** 131-02-110 B & N

Property's Zoning District Designation: R-5 Multiple-Family Residential

Property Details:

☐ **Single-Family Residential** ☒ **Multi-Family Residential** ☐ **Commercial** ☐ **Industrial** ☐ **Other**

Has a 'Notice of Compliance' been issued? ☐ **Yes** ☐ No If yes, provide a copy with this submittal

Owner: HAYDEN VIRGINIA LLC	**Applicant:** Kelly Lannan
Company: HAYDEN VIRGINIA LLC	**Company:** HAYDEN VIRGINIA LLC
Address: 7520 E. Angus Dr.	**Address:** 7520 E. Angus Dr.
Phone: 480-947-6200 **Fax:** 480.947.6222	**Phone:** 480-947-6200 **Fax:** 480.947.6222
E-mail: ktl@azdelpueblo.com	**E-mail:** ktl@azdelpueblo.com
Owner Signature	Applicant Signature

Official Use Only Submittal Date: 5/5/17 Application No.: 321 -PA- 2017

Project Coordinator: _____

Pre-Application Request

Development Application Type:
Please check the appropriate box of the Type(s) of Application(s) you are requesting

Zoning	Development Review	Signs
☐ Text Amendment (TA)	☑ Development Review (Major) (DR)	☐ Master Sign Program (MS)
☐ Rezoning (ZN)	☐ Development Review (Minor) (SA)	☐ Community Sign District (MS)
☐ In-fill Incentive (II)	☐ Wash Modification (WM)	**Other**
☐ Conditional Use Permit (UP)	☐ Historic Property (HP)	☐ General Plan Amendment (GP)
Exemptions to the Zoning Ordinance	**Land Divisions**	☐ In-Lieu Parking (IP)
☐ Hardship Exemption (HE)	☐ Subdivision (PP)	☐ Abandonment (AB)
☐ Special Exception (SX)	☐ Subdivision (Minor) (MD)	☐ Adult Care (AC)
☐ Variance (BA)		☐ Single-Family Residential
☐ Minor Amendment (MN)		☐ Other:

Submittal Requirements: (fees subject to change every July)

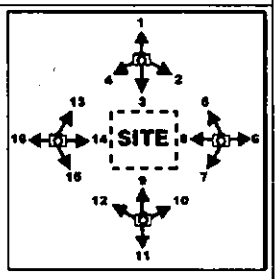
☒ Pre-Application Fee: $ 87
(No fees are changed for Historic Preservation (HP) properties.)

☐ Records Packet Fee: $_____
Processed by staff. The applicant need not visit the Records desk to obtain the packet.
(Only required when requested by Staff)

☒ Application Narrative:
The narrative shall describe the purpose of the request, and all pertinent information related to the request, such as, but not limited to, site circulation, parking and design, drainage, architecture, proposed land use, and lot design.

☐ Property Owner Authorization Letter
(Required for the SA and MS Pre-Applications)

☑ Site / Context Photographs



- Provide color photographs showing the site and the surrounding properties. Use the guidelines below for photos.
- Photos shall be taken looking in towards the project site and adjacent to the site.
- Photos should show adjacent improvements and existing on-site conditions.
- Each photograph shall include a number and direction.
- Sites greater than 500 ft. in length, also take the photo locations shown in the dashed lines.
- Photos shall be provided 8 ½ x 11 paper, max. two per page.

☐ Other

_____

_____

- ***The following list of Additional Submittal Information is not required for a Pre-Application meeting, unless indicated below by staff prior to the submittal of this request.***
- ***Applicants are advised to provide any additional information listed below. This will assist staff to provide the applicant with direction regarding an application.***

Additional Submittal Information

☑ Site Plan
☐ Subdivision plan
☑ Floor Plans
☑ Elevations
☐ Landscape plans
☐ H.O.A. Approval letter
☐ Sign Criteria Regulations & Language
☐ Material Samples – color chips, awning fabric, etc.
☐ Cross Sections – for all cuts and fills
☐ Conceptual Grading & Drainage Plan
☐ Exterior Lighting – provide cut sheets, details and photometrics for any proposed exterior lighting.
☐ Boundary Survey (required for minor land divisions)
☐ Areal of property that includes property lines and highlighted area abandonment request.
☐ One copy of the recorded document for the area that is requested to be abandoned. Such as: subdivision plat, map of dedication, GLO (General Land Office) federal patent roadway easement, or separate dedication document. A copy of most recorded documents to be abandoned may be purchased at the City of Scottsdale Records Dept. (480-312-2356), or the Maricopa County Recorder's Office (602-506-3535). A copy of the General Land Office (GLO) federal patent roadway easement may be purchased from the Bureau of Land Management (602-417-9200).

Affidavit of Authority to Act as the Property Owner

1. This affidavit concerns the following parcel of land:

   a. Street Address: 2529 N. Hayden Road, Scottsdale, AZ
   b. County Tax Assessor's Parcel Number: 131-02-110B & N
   c. General Location: SEC of Hayden Road & Virginia Avenue
   d. Parcel Size: 1.8 ACRES
   e. Legal Description: SEE ATTACHED EXHIBIT "A"

   (If the land is a platted lot, then write the lot number, subdivision name, and the plat's recording number and date. Otherwise, write "see attached legal description" and attach a legal description.)

2. I am the owner of the land or I am the duly and lawfully appointed agent of the owner of the land and have authority from the owner to sign this affidavit on the owner's behalf. If the land has more than one owner, then I am the agent for all of the owners, and the word "owner" in this affidavit refers to all of them.

3. I have authority from the owner to act for the owner before the City of Scottsdale with regard to any and all reviews, zoning map amendments, general plan amendments, development variances, abandonments, plats, lot splits, lot ties, use permits, building permits and other land use regulatory or related matters of every description involving the land, or involving adjacent or nearby lands in which the owner has (or may acquire) an interest, and all applications, dedications, payments, assurances, decisions, agreements, legal documents, commitments, waivers and other matters relating to any of them.

4. The City of Scottsdale is authorized to rely on my authority as described in this affidavit until three work days after the day the owner delivers to the Director of the Scottsdale Planning & Development Services Department a written statement revoking my authority.

5. I will immediately deliver to the Director of the City of Scottsdale Planning & Development Services Department written notice of any change in the ownership of the land or in my authority to act for the owner.

6. If more than one person signs this affidavit, each of them, acting alone, shall have the authority described in this affidavit, and each of them warrant to the City of Scottsdale the authority of the others.

7. Under penalty of perjury, I warrant and represent to the City of Scottsdale that this affidavit is true and complete. I understand that any error or incomplete information in this affidavit or any applications may invalidate approvals or other actions taken by the City of Scottsdale, may otherwise delay or prevent development of the land, and may expose me and the owner to other liability. I understand that people who have not signed this form may be prohibited from speaking for the owner at public meetings or in other city processes.

Name (printed)	Date	Signature
KELLY LANNAN	May 2nd, 2017	AA
	, 20__	
	, 20__	
	, 20__	

Planning and Development Services
7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-7000 • Fax: 480-312-7088

EXHIBIT "A"
LEGAL DESCRIPTION

PARCEL NO. 1
THAT PART OF THE NORTHWEST QUARTER OF SECTION 36, TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA, DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER OF SECTION 36, TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA;
THENCE SOUTH 00 DEGREES 24 MINUTES 00 SECONDS EAST, 1530.07 FEET ALONG THE WEST LINE OF SAID SECTION 36
TO THE POINT OF BEGINNING;

THENCE NORTH 89 DEGREES 36 MINUTES 00 SECONDS EAST, 265.00 FEET;

THENCE SOUTH 00 DEGREES 24 MINUTES 00 SECONDS EAST, 1129.28 FEET PARALLEL TO THE WEST LINE OF SAID SECTION 36 TO A POINT ON THE EAST-WEST MID-SECTION LINE OF SAID SECTION 36;

THENCE SOUTH 89 DEGREES 45 MINUTES 20 SECONDS WEST, 265.00 FEET TO THE WEST QUARTER CORNER OF SAID SECTION 36;

THENCE NORTH 00 DEGREES 24 MINUTES 00 SECONDS WEST, 1128.56 FEET ALONG THE WEST LINE OF SAID SECTION 36 TO THE POINT OF BEGINNING;

EXCEPT THE SOUTH 928 FEET THEREOF; AND

EXCEPT THE WEST 65 FEET FOR ROAD PURPOSES; AND

EXCEPT ALL MINERALS, ORES AND METALS OF EVERY KIND AND CHARACTER, AND ALL COAL, ASPHALTUM, OIL, GASES, FOSSILS AND OTHER LIKE SUBSTANCES RESERVED IN THE PATENT FROM THE STATE OF ARIZONA RECORDED IN BOOK 160 OF DEEDS, PAGE 355.

PARCEL NO. 2
THAT PART OF THE WEST HALF OF THE NORTHWEST QUARTER OF SECTION 36, TOWNSHIP 2 NORTH, RANGE 4 EAST OF THE GILA AND SALT RIVER BASE AND MERIDIAN, DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 36;

THENCE SOUTH 00 DEGREES 24 MINUTES 00 SECONDS EAST, 1392.07 FEET TO THE TRUE POINT OF BEGINNING;

THENCE NORTH 89 DEGREES 36 MINUTES 00 SECONDS EAST, 65 FEET;

THENCE ALONG A CURVE WHOSE CENTRAL ANGLE IS 90 DEGREES AND WHOSE RADIUS POINT LIES NORTH 89 DEGREES 36 MINUTES 00 SECONDS EAST, A DISTANCE OF 12.00 FEET;

THENCE NORTH 89 DEGREES 36 MINUTES 00 SECONDS EAST, 73.00 FEET;

THENCE ALONG A CURVE WHOSE CENTRAL ANGLE IS 09 DEGREES 04 MINUTES 10 SECONDS AND WHOSE RADIUS POINT LIES NORTH 00 DEGREES 24 SECONDS 00 MINUTES WEST, 200.00 FEET, A DISTANCE OF 31.66 FEET;

THENCE ALONG A CURVE WHOSE CENTRAL ANGLE IS 09 DEGREES 04 MINUTES 10 SECONDS AND WHOSE RADIUS POINT LIES SOUTH 09 DEGREES 28 MINUTES 10 SECONDS EAST, 200.00 FEET, A DISTANCE OF 31.66 FEET;

THENCE NORTH 89 DEGREES 36 MINUTES 00 SECONDS EAST, 51.95 FEET;

THENCE SOUTH 00 DEGREES 24 MINUTES 00 SECONDS EAST, 155 FEET;

THENCE SOUTH 89 DEGREES 36 MINUTES 00 SECONDS WEST, 265 FEET;

THENCE NORTH 00 DEGREES 24 MINUTES 00 SECONDS WEST, 138 FEET TO THE TRUE POINT OF BEGINNING;

EXCEPT THE WEST 33 FEET OF SAID WEST HALF OF THE NORTHWEST QUARTER AS SET FORTH IN THE PATENT FROM THE STATE OF ARIZONA RECORDED IN BOOK 160 OF DEEDS, PAGE 355; AND

EXCEPT THE EAST 7 FEET OF THE WEST 40 FEET OF THAT PORTION OF SAID WEST HALF OF THE NORTHWEST QUARTER CONVEYED TO MARICOPA COUNTY IN QUIT CLAIM DEED RECORDED IN DOCKET 2514, PAGE 557; AND

EXCEPT ALL MINERALS, ORES AND METALS OF EVERY KIND AND CHARACTER, AND ALL COAL, ASPHALTUM, OIL, GASES, FOSSILS AND OTHER LIKE SUBSTANCES RESERVED IN THE PATENT FROM THE STATE OF ARIZONA RECORDED IN BOOK 160 OF DEEDS, PAGE 355.

BSB
DESIGN

April 27, 2017

Planning & Development
Services Department
City of Scottsdale
7447 E. Indian School Rd
Suite 105
Scottsdale, AZ 85251

RE: Development Pre-application Narrative

Review Team:

Please accept this narrative and accompanying site plan, architectural elevations, and context plan for Preliminary Application review. Del Pueblo Communities is excited to submit this request for a new 31- unit townhome community fronting Hayden Road in south Scottsdale. This proposed community is planned for 1.8 acres of R-5 zoned land with a total gross density of 12.8 dwellings per acre.

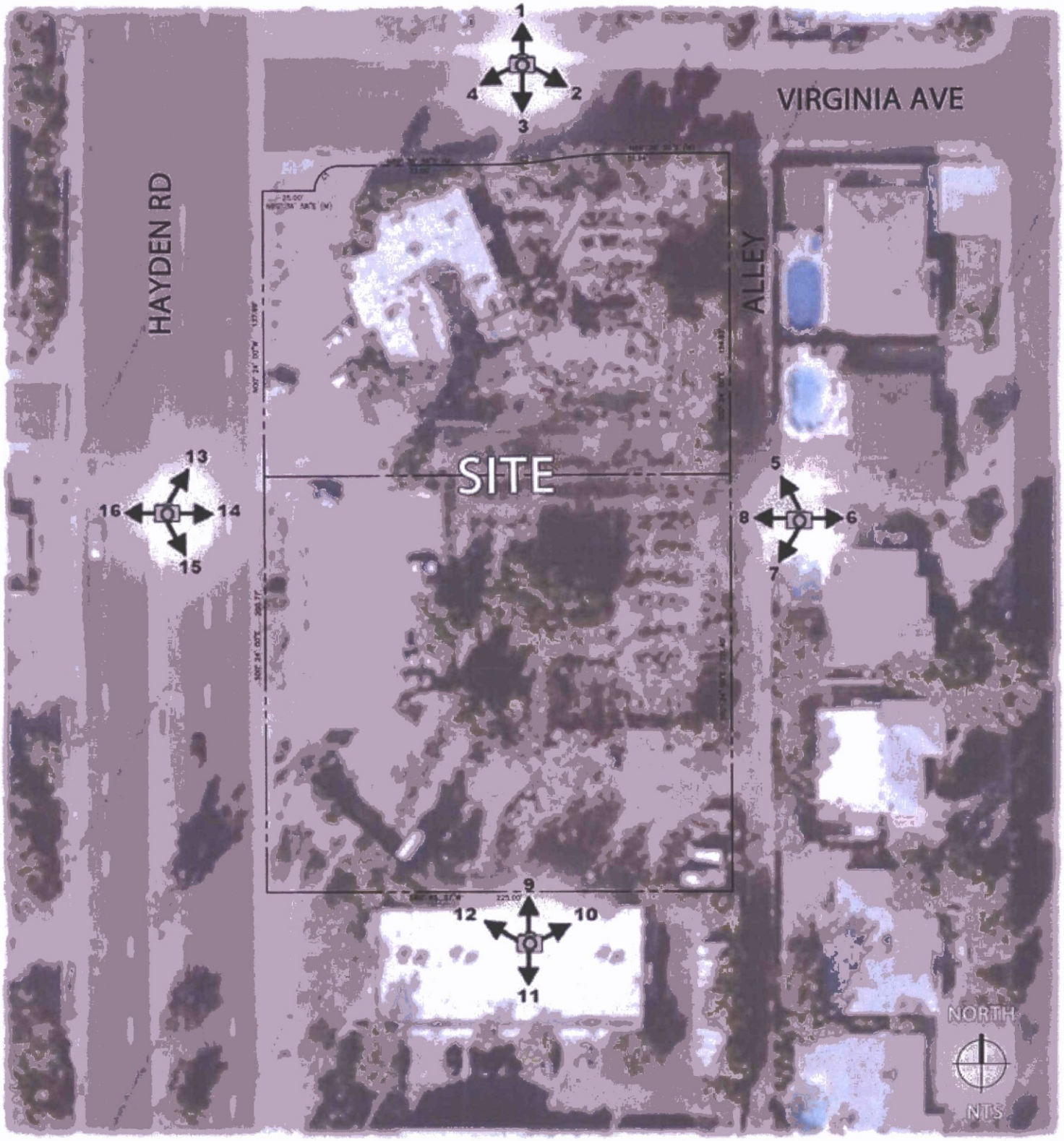
The development is designed for a broad demographic, appealing to empty nesters, young families, and millennials who seek a contemporary and secure turn-key community. Located near shopping, employment, and entertainment, this urban enclave has a pedestrian friendly design with front entries along landscaped paseos and exclusive two car garages accessed from private alleyways. The five buildings consist of three-story townhomes designed with a variety of private outdoor living spaces accessed from each floor of the homes and views of the open space amenities.

A central pool and recreation BBQ area provides a gathering area for residents and guests and is a focal point from the gated entrance on Virginia Avenue. A secondary egress location and emergency access point is located at the southern portion of the site, to Hayden Road. The design is sensitive to the existing single family homes located east of the abutting public alley. The proposed buildings are a minimum of 62' from the single-family property line and three of the five buildings provide an even greater setback. A landscape buffer of existing mature trees and new landscaping will create a lush buffer between the proposed townhomes and the abutting development.

We look forward to discussing this development proposal at your earliest convenience. Should you have any questions, I can be reached at the contact information below.

Best regards,

Dana Burkhardt, AICP
480.229.8177
dburkhardt@hubplan.com



SITE / CONTEXT PHOTOS

2529 N. Hayden Road
Scottsdale, AZ

Del Pueblo


1 - NORTH


2 - EAST


3 - SOUTH


4 - WEST


5 - NORTH


6 - EAST


7 - SOUTH


8 - WEST


9 - NORTH


10 - EAST

11 - SOUTH

12 - WEST

13 - NORTH

14 - EAST

15 - SOUTH

16 - WEST

VANN ENGINEERING INC

Geotechnical Investigation Report

PROPOSED TOWNHOME DEVELOPMENT
1.7 ACRES (AKA HARPERS NURSERY)
SEC, VIRGINIA AVENUE AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

Prepared for:

J. Patrick Lannan
Del Pueblo Communities
7520 East Angus Drive
Scottsdale, Arizona 85251

April 25, 2017

Project 25105

1980 – 2017
37
YEARS OF EXCELLENCE
Vann Engineering Inc.

GEOTECHNICAL ENGINEERING ▪ ENVIRONMENTAL CONSULTING
CONSTRUCTION TESTING & OBSERVATION

VANN ENGINEERING INC
GEOTECHNICAL ENGINEERING • ENVIRONMENTAL CONSULTING • CONSTRUCTION TESTING & OBSERVATION

April 25, 2017 Project 25105

J. Patrick Lannan
Del Pueblo Communities
7520 East Angus Drive
Scottsdale, Arizona 85251

RE: GEOTECHNICAL INVESTIGATION REPORT
PROPOSED TOWNHOME DEVELOPMENT
1.7 ACRES (AKA HARPERS NURSERY)
SEC, VIRGINIA AVENUE AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

Mr. Lannan:

Transmitted herewith is a copy of the final report of the geotechnical investigation on the above-mentioned project. The services performed provide an evaluation at selected locations of the subsurface soil conditions throughout the zone of significant foundation influence. As an additional service, this firm would be pleased to review the project plans and structural notes for conformance to the intent of this report. We trust that this report will assist you in the design and construction of the proposed project. Vann Engineering, Inc. appreciates the opportunity to provide our services on this project and looks forward to working with you during construction and on future projects. **This firm possesses the capability of performing testing and inspection services during construction. Such services include, but are not limited to, compaction testing as related to fill control, foundation inspections and concrete sampling. Please notify this firm if a proposal for these services is desired.** Should any questions arise concerning the content of this report, please feel free to contact this office as soon as possible.

Respectfully submitted,

VANN ENGINEERING, INC.

Registered Professional Engineer (Geological)
CERTIFICATE NO. 15206
JEFFRY D. VANN
Date Signed 4/25/17
ARIZONA, U. S. A.
Expires 09/30/19

Jeffry D. Vann, MS, PE, F. ASCE
Principal Engineer

Copies: Addressee (2), and via email jpl@azdelpueblo.com

TABLE OF CONTENTS

SECTION I

1.0 INTRODUCTION

Vann Engineering, Inc. understands that a townhome development is proposed for the subject site. This document presents the results of a geotechnical investigation conducted by Vann Engineering, Inc. for the:

PROPOSED TOWNHOME DEVELOPMENT
1.7 ACRES (AKA HARPERS NURSERY)
SEC, VIRGINIA AVENUE AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

Figure 1: Aerial view of proposed site and surroundings

The services performed provide an evaluation at selected locations of the subsurface soil conditions throughout the zone of significant foundation influence.

1.1 Purpose

The purpose of the investigation was two-fold: 1) to determine the physical characteristics of the soil underlying the undeveloped portions of the site, and 2) to provide recommendations for safe and economical foundation design and slab support. For purposes of foundation design, the maximum column and wall loads have been assumed to be as summarized below:

Foundation Type	Maximum Column Load (KIPS)	Maximum Wall Load (KLF)
Conventional, shallow, lightly to heavily loaded surface-level spread foundations bearing on native undisturbed soil or engineered fill with total and differential settlements limited to ½-inch and ¼-inch, respectively	150*	7.5*
Post Tension Slabs		

*Anticipated structural loads more than those stated above will need to be addressed in an addendum, i.e. they are not covered under the scope of work involved with this effort.

1.2 Scope of Services

The scope of services for this project includes the following:

- Description of the subject site
- Description of the major soil layers
- Site Plan indicating the locations of all points of exploration
- Explanation of applicable geologic hazards
- Recommendations for surface-level conventional spread foundations; allowable bearing capacity based on settlement analysis of ½ inch total settlement and ¼ inch differential settlement (Design data, allowable bearing pressure and depth, for shallow spread foundations)
- Recommendations for post-tensioned slabs
- General excavation conditions
- On-site pavement design recommendations
- Lateral stability analyses including active pressure, passive pressure and base friction
- Recommendations for site grading - necessary earthwork for conventional systems
- Recommendations for drainage and slab support
- Anticipated shrinkage of the surface soil
- 2012 IBC site classification
- 2012 IRC compliance pertaining to sulfates and chlorides

Note: This report does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of work of such studies with you. Recommendations for basement-level facilities have not been included in our scope of services.

1.3 Authorization

The obtaining of data from the site and the preparation of this geotechnical investigation report have been carried out according to this firm's proposal, authorized by **J. Patrick Lannan**, to proceed with the work.

1.4 Standard of Care

Since our investigation is based upon review of background data, observation of site materials, and engineering analysis, the conclusions and recommendations are professional opinions. Our professional services have been performed using that degree and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. These opinions have been derived in accordance with current standards of practice and no other warranty, express or implied, is made.

Limitations of this report and geotechnical issues that further explain the limitations of the information contained in this report are listed at 7.0.

2.0 PROJECT DESCRIPTION

2.1 Proposed Development

Vann Engineering, Inc. understands that a townhome development is proposed for the subject site.

2.2 Site Description

Please refer to the preceding aerial photograph for the general character of the site and vicinity. The west portion of the is currently covered with parking and driveway areas. The southern portion appears to be associated with soil processing and loading. The balance of the is actively used for storage and sales of trees (small to large), shrubs and flowers.

At the locations of the test borings, primarily the western and southern portions, approximately 2.5 inches of asphaltic concrete pavement was detected (Test Borings 2 through 4). Where the asphaltic concrete pavement was encountered, it is typically underlain by 3.5 inches of aggregate base course (ABC). At the locations of Test Borings 2 through 4, the pavement structure (AC and ABC) is underlain by nearly 11.0 to 12.0 inches of spread fill. At the location of the Test Boring 1 (southern area), roughly 16.0 inches of spread fill were detected. All spread fill and overlying asphaltic concrete and ABC must be removed at the initial stages of the grading process.

Please refer to the following photographs which depict the nature of the site and the immediate surroundings.

Figure 2: Existing site conditions

Figure 3: Existing site conditions

Figure 4: Existing site conditions

Figure 5: Existing site conditions

Figure 6: Existing site conditions

3.0 SUBSURFACE INVESTIGATION AND LABORATORY TESTING

3.1 Subsurface Investigation

The site's subsurface was explored through the utilization of four (4) exploratory test borings for examination of the subsurface profile at the site The locations of the exploratory test borings are shown on the Site Plan in Section II of this report, and are presented as TB-1 through TB-4.

A field log was prepared for each test boring. The field logs contain visual classifications of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples. Final logs, included in Section II, represent our interpretation of the field logs and may include modifications based on laboratory observation and tests of the field samples. The final logs describe the materials encountered, their thicknesses, and the sample locations. The sample locations are noted graphically on the final logs included in Section II of this report. The Unified Soil Classification System was used to classify soils. The soil classification symbols appear on the final logs and are briefly described in Section II.

The materials encountered on the site are believed to be representative of the total area; however, soil and rock materials do vary in character between points of investigation. The recommendations contained in this report assume that the soil conditions do not deviate appreciably from those disclosed by the investigation. Should unusual material or conditions be encountered during construction, the soil engineer must be notified so that supplemental recommendations may be considered if they are required.

3.2 Laboratory Testing

Laboratory analyses were performed on representative soil samples to aid in material classification and to estimate pertinent engineering properties of the on-site soils in preparation of this report. Testing was performed in general accordance with applicable test methods. Representative samples obtained during the field investigation were subjected to the following laboratory analyses:

Table 1: Laboratory Testing

Test	Sample(s)	Purpose
Response to Wetting	Undisturbed native soils (4)	Foundation bearing capacity and settlement analysis
Expansion	Remolded subgrade soils (2)	Potential for heave upon wetting
Sieve Analysis & Atterberg Limits and Moisture Content	Native subgrade soils (2)	Soil classification and pavement thickness design
Moisture Content & Dry Density	Undisturbed native soils (4)	Existing in-place soil conditions
Sulfates and Chlorides	Native subgrade soils (1)	Soil corrosion and sulfate attack potential

Refer to Section III of this report for the complete results of the laboratory testing. The samples will be stored for 30 days from the date of issue of this report, and then disposed of unless otherwise instructed in writing by the client.

4.0 SUBSURFACE CONDITIONS

4.1 Engineering Properties of the Site Soils

Expansive soils are soils that expand or swell and are typically known to have a shrink/swell potential. Cohesive soils, or clay soils, tend to shrink as they are dried, and swell as they become wetted. The clay content of the soil determines the extent of the shrink/swell potential. The surface soils encountered at the site are considered cohesive based on the laboratory testing (i.e. plasticity index values of 14 and 15). Based on the measured soil properties, this firm has determined that the potential for soil expansion in conjunction with conventional applications is low to moderate.

Collapsible soils are typically comprised of silt and sand size grains with lesser amounts of clay. The collapse potential of a soil depends on the in-situ density, depth of the deposit and the extent of a porous structure. When loading is applied to collapsible soils, originating from the weight of the structure, along with wetting, settlement occurs. Wetting sources are most commonly associated with landscape irrigation, inadequate surface drainage, utility line leakage, proximity of retention basins and water features to a structure, and long-term ponding next to the structure. Based on laboratory test data and standard penetration test data, the soils encountered at the site are considered to have a moderate potential for collapse and excessive differential soil movement (mitigated by the foundation recommendations contained herein).

4.2 Soil Sulfate Content

Laboratory test data revealed that the sulfate content in the site soil is 0.118 percent. This suggests a moderate potential for sulfate exposure according to Table 2 (Adapted from Reference 2-20 and ACI 318, Table 4.5.3). Therefore, this firm recommends the use of Type II cement in all concrete applications.

Table 2: Sulfate Content

Sulfate Exposure	Water-soluble sulfate (SO_4) in soil, percent by weight	Sulfate (SO_4) in water, ppm	Cement type
Negligible	0.00-0.10	0-150	Type II
Moderate*	**0.10-0.20**	**150-1500**	**II, IP(MS), IS(MS), P(MS),I(PM)(MS), I(SM)(MS)**
Severe	0.20-2.00	1500-10,000	V
Very Severe	Over 2.00	Over 10,000	V plus pozzolan**

*Seawater
**Pozzolan that has been determined by test or service record to improve sulfate resistance when used in concrete containing Type V cement

4.3 Soil Chloride Content

The laboratory test result for chloride concentration of the subgrade soil was determined to be 131 ppm. Because the chloride concentration is less than 500 ppm, post-tension cable encapsulation will not be required.

4.4 Groundwater

No groundwater was encountered during this firm's site investigation to a depth of 15.0 feet.

5.0 RECOMMENDATIONS

The recommendations contained herein are based upon the properties of the surface and subsurface soils and rocks as described by the field evaluation, the results of which are presented and discussed in this report. Alternate recommendations may be possible and will be considered upon request.

5.1 Excavating Conditions

Excavations into the site surface and subsurface soils extending to a depth of 15.0 feet should be possible with conventional excavating equipment.

The surface and subsurface soils may be susceptible to sloughing in the upper 5.0 feet if allowed to dry significantly or stand vertically. Appropriate precautions should be observed in the field to avoid problems associated with caving.

Excavations greater than 4.0 feet should be sloped or braced as required to provide personnel safety and satisfy local safety code regulations. Temporary construction slopes should be designed and excavated in strict compliance with the rules and regulations of the Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA), 29 CFR, Part 1926. This document was prepared to better insure the safety of workers entering trenches or excavations, and requires that all excavations conform to new OSHA guidelines. The contractor is solely responsible for protecting excavations by shoring, sloping, benching or other means as required to maintain stability of both the excavation sides and bottom. Vann Engineering, Inc. does not assume any responsibility for construction site safety or the activities of the contractor.

5.2 Site Preparation

The following recommendations are presented as a guide in the compilation of construction specifications. The recommendations are not comprehensive contract documents and should not be utilized as such.

Underground facilities such as septic tanks, cesspools, basements, and dry wells were not encountered at the locations of TB-1 through TB-4. Any such features discovered during construction should be demolished or abandoned in accordance with the recommendations of the geotechnical engineer. Such measures may include backfill with 2-sack ABC/cement slurry.

It is recommended that the following items be removed within the proposed building and pavement areas prior to site work. This shall include all vegetation, nursery storage, asphaltic concrete pavement, ABC, fencing, remains of CMU walls, and remnants associated with the demolition of existing structures (inclusive of concrete slabs, foundations, and abandoned utilities) and all other deleterious material. An inspection of the site should be performed during the grubbing process to ensure that all applicable materials have been removed.

Any tree removal efforts made to accommodate the new structure must include removal of the root systems, followed by backfilling of the volume occupied by the root ball. Typically, to remove all significant roots such that the maximum diameter of any root is no greater than ½ inch, it is required to excavate to a depth of 4.0 feet to capture all applicable roots. Further, the lateral extent of each tree root excavation is generally 8.0 feet (twice the depth).

All existing spread fill soils must be removed in the proposed development areas. According to the field investigation, this will include the removal of 11.0 to 16.0 inches of spread fill at the locations of the test borings. Greater amounts of fill may be encountered at locations not drilled by this firm. The presence of native soils at the base and sides of the spread fill removal excavation must be verified by the project geotechnical engineer.

Following the removal of the above listed items, at a minimum, the uppermost 8.0 inches of the native soils must be reworked to establish a stable condition. All final compaction shall be as specified herein at Table 3. The scarification and compaction requirement applies to cut situations as well as fill situations. Site cut materials may be reused as structural supporting fill in limited areas, as described herein, if it is free of all trash, vegetation and construction debris, the maximum particle size is 3.0 inches and a suitable percentage of fines will be generated to ensure a stable mixture.

Special Note: Post Tension Systems

Subgrade preparation in post tensioned slab areas must consist of at least 12.0 inches of processed soil underlying the footings for an allowable soil bearing capacity of 1250 psf.

Special Note: Conventional Surface Level Systems

It will be necessary to subexcavate to the limits dictated by the selected bearing condition presented in Table 8 of this report. If engineered fill is utilized to achieve the selected bearing conditions, it should have a lateral extent beyond the footing edges of at least twice the depth of subexcavation below the footing. The base of the zone of subexcavation (subexcavation cut surface below foundations) shall not require moisture processing and compaction.

Complete removal and cleaning of any undesirable materials and proper backfilling of depressions will be necessary to develop support for the proposed facilities.

Widen all depressions as necessary to accommodate compaction equipment and provide a level base for placing any fill. All fills shall be properly moistened and compacted as specified in the section on compaction and moisture recommendations. All subbase fill required to bring the structure areas up to subgrade elevation should be placed in horizontal lifts not exceeding 6.0 inches compacted thickness or in horizontal lifts with thicknesses compatible with the compaction equipment utilized.

Fill placement in wash areas, trench areas, or sloped topography should involve horizontal layers placed in 6-inch lifts; such that each successive lift is benched into the native site soils a minimum lateral distance of 5.0 feet.

It is the understanding of this firm that various utility trenches may traverse the completed pads. The backfill of all utility trenches, if not in conformance with this report, may adversely impact the integrity of the completed pads. This firm recommends that all utility trench backfill crossing the pads be inspected and tested to ensure full conformance with this report. Untested utility trench backfill will nullify any as-built grading report regarding the existence of engineered fill beneath the proposed building foundations and place the owner at greater risk in terms of potential unwanted foundation and floor slab movement.

Compaction of backfill, subgrade soil, subbase fill, and base course materials should be accomplished to the following density and moisture criteria prior to concrete placement:

Table 3: Compaction Requirements

Material	Building Area	Percent Compaction (ASTM D698)	Compaction Moisture Content Range (%)
On-site Soils with PI ≥ 15	Below Foundation Level	95 min	optimum to optimum +4
	Above Foundation Level[1]	89 - 94	optimum to optimum +4
	Below Asphaltic Pavements	95 min	optimum -3 to optimum +1
On-site soils with 12 ≤ PI < 15	Below Foundation Level	95 min	optimum -1 to optimum +3
	Above Foundation Level[1]	92 - 97	optimum to optimum +4

Material	Building Area	Percent Compaction (ASTM D698)	Compaction Moisture Content Range (%)
	Below Asphaltic Pavements	95 min	optimum -3 to optimum +1
On-site soils with PI < 12	Below Foundation Level	95 min	optimum -2 to optimum +2
	Above Foundation Level[1]	95 min	optimum -2 to optimum +2
	Below Asphaltic Pavements	95 min	optimum -3 to optimum +1
Imported fill material	Below Foundation Level	95 min	optimum -2 to optimum +2
	Above Foundation Level[1]	90 min	optimum -2 to optimum +2
	Below Asphaltic Pavements	95 min	optimum -3 to optimum +1
Base course	Below Interior Concrete Slabs	95 min	-
	Below Asphaltic Pavements	100 min	-

[1]Also applies to the subgrade in exterior slab, sidewalk, curb, and gutter areas

All imported (engineered) fill material to be used as structural supporting fill should be free of vegetation, debris and other deleterious material and meet the following requirements:

Table 4: Imported Fill Soil Parameters

Soil Parameter	Requirement
Plasticity Index:	14 (Maximum)
Particle Size:	3 inches (Maximum)
Passing #200 Sieve:	60 percent (Maximum)
Expansion Potential*:	1.5 % (Maximum)
Sulfates:	0.19 % (Maximum)

*Performed on a sample remolded to 95 percent of the maximum ASTM D698 density at 2 percent below the optimum moisture content, under a 100 PSF Surcharge.

Water settling and/or slurry shall not, in any case, be used to compact or settle surface soils, fill material, or trench backfill within 10.0 feet of a structure area or within an area, which is to be paved. When trench backfill consists of permeable materials that would allow percolation of water into a structure or pavement area, water settling shall not be used to settle such materials in any part of the trench.

5.3 Fill Slope Stability

Maximum fill slopes may conform to a 2:1 (horizontal: vertical) ratio if fill is placed in accordance with the recommendations contained herein.

5.4 Shrinkage

For balancing grading plans, the estimated shrink of on-site soils has been provided below. The calculated shrink assumes oversized material will be processed and used on the project (i.e. oversized material is crushed and used in engineered fill). Assuming the average degree of compaction will approximate 97 percent of the standard maximum density, the approximate shrinkage of the reworked on-site soils are as follows:

Table 5: Shrinkage

Material	Estimated Shrinkage (Based on ASTM D698A)
On-site soils	17% ± 3

The above value does not consider losses due to erosion, waste, variance of on-site soils, over-excavation, re-compaction of zones disturbed by demolition, previous site usage or the screening of oversized particles and/or debris. In other words, additional factors can and will create situations where seemingly balanced grading and drainage plans do not balance during construction.

5.5 Site Classification

This project is not located over any known active faults or fault associated disturbed zones. The following 2012 IBC Site Classification may be utilized in the earthquake design of the proposed structure.

2012 IBC Site Classification	D

5.6 Post-Tension Slabs

The following applicable soil parameters are to be utilized in the design of post-tensioned slabs. The analyses are based on VOLFLO 1.5 as related to the PTI 3rd Edition. The following summarizes the results from the analyses:

Table 6: VOLFLO Results -2012 IBC

Parameter	Swell (Edge)	Shrink (Center)
y_m	0.41 inches	0.17 inches
e_m	4.8 feet	9.0 feet

Uniform Thickness Post-Tension Slabs

The minimum recommended perimeter foundation thickness is 12.0 inches in conjunction with 12.0 inches of subgrade preparation beneath the perimeter footings for a 1250 psf bearing. **The uniform thickness slab shall be designed by the project structural engineer.** Embedment depth for uniform thickness post-tensioned slab systems is referenced from finish floor for both interior and perimeter footings.

Table 7: Post-Tension Slab Bearing

Allowable Soil Bearing Capacity	Thickness of Prepared Subgrade Beneath the Perimeter Foundation
1250 psf	12 inches
1500 psf	18 inches
1750 psf	24 inches

Aggregate base course shall not be required beneath post-tensioned slabs unless desired as a leveling course.

The use of vapor retarders may be considered for any slab-on-grade where the floor will be covered by moisture sensitive floor coverings.

The following additional parameters can be used by the Project Structural Engineer in the design of an economical post-tension slab design:

Subgrade Friction Coefficient	1.0
Soil Modulus of Elasticity	1000 psi
Modulus of Subgrade Reaction	156 psi/inch

5.7 Conventional Surface-Level Spread Foundations

It is recommended that all perimeter foundations and isolated exterior foundations (which also includes site walls) bearing on native undisturbed soil be embedded a minimum of 2.5 feet below the lowest adjacent finish pad grade within 5.0 feet of proposed exterior walls. Interior footings bearing on native undisturbed should be founded a minimum of 2.5 feet below finish floor level.

Embedment depths may be decreased to a minimum of 1.5 feet if 1.0 foot of engineered fill is utilized as the bearing stratum beneath the footings. For all construction, 2.0 feet and 1.33 feet are recommended as the minimum width of spread and continuous footings, respectively. The following tabulations may be used in the design of shallow spread (column) and continuous (wall) foundations for the proposed structures.

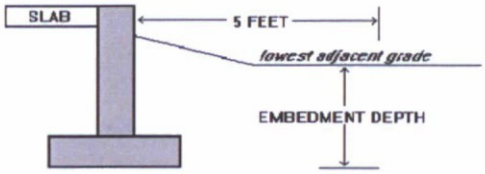
Table 8: Conventional Surface Level Foundations

Foundation Embedment Depth[1]	Bearing Stratum[2]	Allowable Soil Bearing Capacity[3]
2.5 Feet	Native Undisturbed Soil[4]	1500 PSF
3.0 Feet	Native Undisturbed Soil[4]	1750 PSF
3.5 Feet	Native Undisturbed Soil[4]	2000 PSF
4.0 Feet	Native Undisturbed Soil[4]	2250 PSF
4.5 Feet	Native Undisturbed Soil[4]	2500 PSF
1.5 Feet	1.0 Feet of Engineered Fill[5]	1500 PSF
2.0 Feet	1.0 Feet of Engineered Fill[5]	1750 PSF
2.5 Feet	1.0 Feet of Engineered Fill[5]	2000 PSF
3.0 Feet	1.0 Feet of Engineered Fill[5]	2250 PSF
3.5 Feet	1.0 Feet of Engineered Fill[5]	2500 PSF

[1]Conditions for foundation embedment depth:

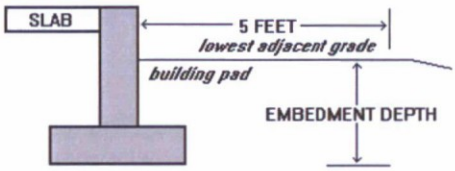
a) The depth below the lowest adjacent exterior pad grade within 5.0 feet of proposed exterior walls;

Condition A



b) The depth below finish compacted pad grade provided that a sufficient pad blow-up (the lateral extent to which the building pad is constructed beyond the limits of the exterior walls or other structural elements, inclusive of exterior column foundations) has been incorporated into the grading and drainage design (5.0 feet or greater);

Condition B



[2]Refers to the soil layer that the footing pad rests on, and does not mean to imply that the foundation be fully embedded into that particular stratum

[3]**The allowable soil bearing capacity value and associated allowable loads are based on a total settlement of ½-inch and a differential settlement of ¼ inch.** The maximum estimated footing settlements (in situ) should be within tolerable limits if constructed in accordance with the recommendations contained in this report and a reasonable effort is made to balance loads on the footings

[4]A mixture of 2-sack ABC/cement slurry may be utilized in the lower portions of the foundation excavations for footings bearing on native undisturbed soil. For example, if ABC/cement slurry is used, 1.0 foot of the mixture should underlie a conventional foundation depth of 1.5 feet for an allowable soil bearing capacity of 1500 psf. The preceding table shall govern the thickness of 2-sack ABC/cement slurry depending on the allowable soil bearing capacity selected

[5]The engineered fill should have a lateral extent beyond the edges of all footings of at least twice the depth of subexcavation below the footing. If there is less than the tabulated depth of engineered fill beneath the footings, consider the bearing condition to be unacceptable. The base of the zone of subexcavation (subexcavation cut surface below foundations) shall not require moisture processing and compaction

The weight of the foundation below grade may be neglected in dead load computations. The above recommended bearing capacities should be considered allowable maximums for dead plus design live loads.

The maximum allowable foundation bearing pressure for foundation toe pressures may be increased by ⅓ for resistance to short-term/temporary wind loads and or eccentric or lateral loading.

Retaining wall or building foundations to be constructed in close proximity to retention basins (*within 5.0 feet*) should be embedded 1.0 feet deeper than the stated depths in the preceding bearing capacity tables.

We recommend that continuous footings and stem walls are reinforced and bearing walls be constructed with frequent joints to better distribute stresses in the event of localized settlements. Similarly, all masonry walls should be provided with both vertical and horizontal reinforcement.

It is recommended that the footing excavations be inspected by the Vann Engineering Inc. project geotechnical engineer or their representative to ensure that they are free of loose soil which may have blown or sloughed into the excavations. It will also be necessary for the geotechnical engineer to verify that the footing embedment depths and bearing stratum adhere to the recommendations presented in Table 8 above.

A minimum code compliant concrete with **Type II cement** should be used for footings, stem walls and floor slabs. A maximum 4-inch slump should be used for footings and stem walls and a maximum 6-inch slump should be used for floor slabs.

5.8 Lateral Stability Analyses

All on-site retaining walls must be designed to resist the anticipated lateral earth pressures. Unrestrained (free-end) retaining walls should be designed for active earth pressures (K_a) and are assumed to allow small movement of the wall. Restrained (fixed-end) retaining walls should be designed for at-rest earth pressures (K_o) with no assumed wall movement. Soil or rock present in front of the toe of the retaining wall will provide resistance to movement and should be modeled as passive earth pressure (K_p). The following presents recommendations for lateral stability analyses for native undisturbed soil and engineered fill:

Table 9: Lateral Stability

Parameter	Wall Type	Engineered Fill	Native Undisturbed Soils
Active (K_a) Pressure	Free-end	34 psf/ft	39 psf/ft
At-Rest (K_o) Pressure	Fixed-end[b]	52 psf/ft	57 psf/ft
Passive (K_p) Resistance	Free-end/Fixed-end independent of base friction	358 psf/ft	279 psf/ft
	Fixed-end in conjunction with base friction	240 psf/ft	187 psf/ft
Coefficient of Base Friction (μ)	Free-end/Fixed-end independent of passive resistance	0.62	0.53
	Free or Fixed-end in conjunction with passive resistance	0.42	0.36

[a]Equivalent fluid pressures for vertical walls and horizontal backfill surfaces (*maximum 12.0 feet in height*). Pressures do not include temporary forces during compaction of the backfill, expansion pressures developed by over-compacted clayey backfill, hydrostatic pressures from inundation of backfill, or surcharge loads. Walls should be suitably braced during backfilling to prevent damage and excessive deflection.

[b]The backfill pressure can be reduced to the unrestrained lateral pressure if the backfill zone between the wall and cut slope is a narrow wedge (*width less than ½ the height*)

The equivalent fluid pressures presented herein do not include the lateral pressures arising from the presence of:

- Hydrostatic conditions, submergence or partial submergence
- Sloping backfill, positively or negatively
- Surcharge loading, permanent or temporary
- Seismic or dynamic conditions

Fill against footings, stem walls, and any retaining walls should be compacted to the densities specified in Site Preparation. High plasticity clay soils should not be used as backfill against retaining walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Overcompaction may cause excessive lateral earth pressures that could result in wall movements. Unstable cut-slopes (those in non-conformance with cut-slope stability ratios included herein) may result in significantly higher lateral active and at-rest pressures.

We recommend a free-draining soil layer or manufactured geosynthetic material, be constructed adjacent to the back of any retaining walls serving as basement walls. A filter fabric may be required between the soil backfill and drainage layer. The drainage zone should help prevent development of hydrostatic pressure on the wall. This vertical drainage zone should be tied into a gravity drainage system at the base of the wall.

5.9 Conventional Slab Support

Site grading within the building areas should be accomplished as recommended herein. Four inches of aggregate base course (ABC) floor fill should immediately underlie interior grade floor slabs with a typical thickness of 4.0 inches. The aggregate base material should conform to the requirements of local practice. The use of vapor retarders may be considered for any slab-on-grade where the floor will be covered by products using water based adhesives, wood, vinyl backed carpet, impermeable floor coatings (urethane, epoxy, or acrylic terrazzo). When used, the design and installation should be in accordance with the recommendation given in ACI 302.1R-96.

Building pads for conventional systems may be constructed with sufficient lateral pad "blow-up" to accommodate the entire perimeter slab width. To further reduce the potential for slab related damage in conjunction with conventional systems, we recommend the following:

1. Placement of effective control joints on relatively close centers.
2. Proper moisture and density control during placement of subgrade fills.
3. Provision for adequate drainage in areas adjoining the slabs.
4. Use of designs that allow for the differential vertical movement described herein between the slabs and adjoining structural elements, **i.e. ½ inch**.
5. 2-sack ABC/cement slurry should be utilized as backfill at the intersection of utility trenches with the building perimeter.

Code compliant concrete with **Type II cement** with air entrainment should be used for footings, stem walls and floor slabs. A maximum 4 inch slump should be used for footings and stem walls and a maximum 6 inch slump should be used for floor slabs.

5.10 On-Site Pavement Thickness Recommendations

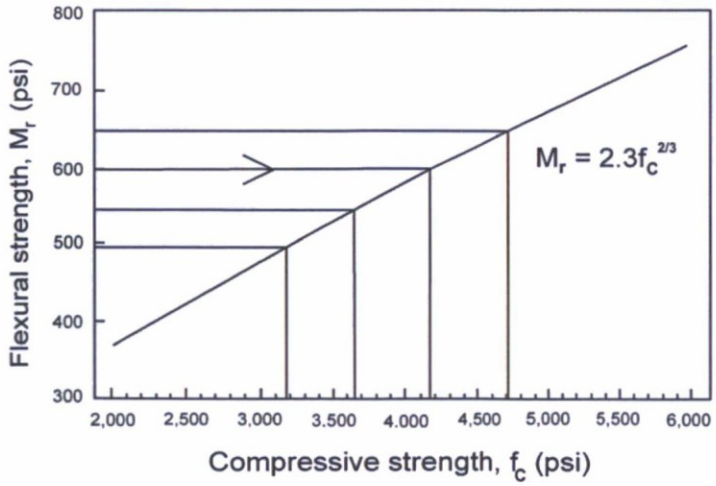
Site grading within pavement areas should provide requisite subgrade support for flexible pavements. A compacted subgrade of on-site soils or soils with comparable properties is assumed. Pavement materials and placement requirements should be in accordance with the Maricopa Association of Government Standard Specifications, or equivalent. Asphaltic concrete surfacing should be MAG type 19 mm (C-3/4 inch) placed in a single lift.

The stability of compacted pavement subgrade soils is reduced under conditions of increased soil moisture. Therefore, base course or pavement materials should not be placed when the surface is in a wet condition. Adequate surface drainage should be provided away from the edge of paved areas to minimize lateral moisture transmission into the subgrade. The following presents minimum recommended pavement sections for anticipated traffic conditions.

Table 9: On-Site Pavement Design Criteria

Traffic Loads	Alternate	Prepared Subgrade (Inches)	ABC (Inches)	Asphaltic Concrete (Inches)	Concrete Pavement (Inches)
Light Vehicles or Low Volume Traffic Areas **(0 to 45 psi tire pressures)**	A[a]	8.0	5.0	2.0	
	B[a]	8.0		4.0	
	C[b]	8.0			5.0[c]
Heavy Vehicle Areas **(45 to 90 psi tire pressures)**	A[a]	8.0	5.0	3.0	
	B[a]	8.0		5.0	
	C[b]	8.0			6.0[c]
Very Heavy Vehicle Areas **(90 to 135 psi tire pressures)**	A[a]	8.0	5.0	4.0	
	B[a]	8.0		6.0	
	C[b]	8.0			8.0[c]

[a] 10 to 15 year design life, with typical maintenance
[b] 20-year design life, with typical maintenance
[c] **Based on a modulus of rupture of 600 PSI. The recommended concrete thicknesses should be increased in increments of 0.5 inch for every 50 PSI decrease in the modulus of rupture. The following chart relates rupture modulus to compressive strength**



Compaction of subbase fill and base course materials should be accomplished to the density and moisture criteria listed at 5.2. Compaction of asphalt should be accomplished to the following density criteria:

Table 10: Asphalt Compaction

Material	Percent Compaction 75-blow method
Asphalt Surfacing	95 minimum

5.11 Stone Pavers

Site grading within pavement areas should provide requisite subgrade support for pavers and the associated loads. A compacted subgrade of on-site soils or soils with comparable properties is assumed. Materials and paver placement requirements should be in accordance with local government standards and specifications.

The stability of compacted paver subgrade soils is reduced under conditions of increased soil moisture. Therefore, base course or pavement materials should not be placed when the surface is in a wet condition. Adequate surface drainage should be provided away from the edge of paved areas to minimize lateral moisture transmission into the subgrade.

The following presents minimum recommended paver sections for 80 mm stone pavers. The recommendations are designed to withstand very heavy vehicle loads (90 to 135 psi tire pressures).

Table 11: Pavers Design Criteria

Stone Paver Size	Alternate	Prepared Subgrade (Inches)	Lean Concrete 3-Sack Min. (Inches)	ABC (Inches)	Sand Bedding (inches)
80 mm	A	8.0	-	9.0	1.0
80 mm	B	8.0	6.0	-	1.0

The aggregate base material should conform to the requirements of local practice. Preparation and compaction of the subgrade shall be compacted to a minimum of 95 percent, of the ASTM D698 maximum density. Preparation and compaction of the ABC and/or Decomposed Granite shall be compacted to a minimum of 100 percent of the ASTM D698 maximum density.

5.12 Drainage

The major cause of soil problems in this locality is moisture increase in soils below structures. Therefore, it is extremely important that positive drainage be provided during construction and maintained throughout the life of any proposed development. **In no case should long-term ponding be allowed near structures.** Infiltration of water into utility or foundation excavations must be prevented during construction.

Planters or other surface features that could retain water adjacent to buildings should not be constructed. In areas where sidewalks or paving do not immediately adjoin structures, protective slopes should be provided with an outfall of about 4 percent for at least 10 feet

from perimeter walls. This is necessary due to the moderate expansion potential of the on-site soils.

Backfill against footings, exterior walls, retaining walls, and in utility or sprinkler line trenches should be well compacted and free of all construction debris to minimize the possibility of moisture infiltration through loose soil. Roof drainage systems, such as gutters or rain dispenser devices, are recommended all around the roof-line.

Rain runoff from roofs should be discharged at least 10.0 feet from any perimeter wall or column footing. If a roof drainage system is not installed, rain-water will drip over the eaves and fall next to the foundations resulting in sub-grade soil erosion, creating depressions in the soil mass, which may allow water to seep directly under the foundations and slabs.

5.13 Landscaping Considerations

The potential for unwanted foundation and slab movements can often times be reduced or minimized by following certain landscape practices. The main goal for proper landscape design should be to minimize fluctuations in the moisture content of the soils surrounding the structure. In addition to maintaining positive drainage away from the structure, appropriate plant/tree selections and sprinkler/irrigation practices are extremely important to the long-term performance of the foundations and slabs. The conventional practice of planting near foundations is not recommended.

In the case of conventional surface level systems, do not plant flowers and shrubs within 5.0 feet of any perimeter wall or column foundation. If a post tensioned system is utilized, flowers and shrubs should not be planted within 3.0 feet of any perimeter wall. Ground cover plants with low water requirements may be acceptable for landscaping near foundations. Ground cover vegetation helps to reduce fluctuations in the soil moisture content. Limit the watering to the minimum needed to maintain the ground cover vegetation near foundations. For greater moisture control, water these areas by hand.

For planters and general landscaping, we recommend the following:

- Planters should be sealed.
- Grades should slope away from the structures.
- Only shallow rooted landscaping material should be used.
- Watering should be kept to a minimum.

Trees should be planted a minimum distance of 10.0 feet away from the foundation of the structure. Some trees may have extensive shallow root system that may grow under and displace shallow foundations.

In addition, tree roots draw moisture from the surrounding soils, which may exacerbate shrink/swell cycles of the surface soils. The amount of moisture drawn out of the soil will depend on the tree species, size, and location. If trees are planted well away from foundations in irrigated areas, the chances of foundation damage is greatly reduced.

If irrigation/sprinkler systems are to be used, we recommended installing the system all around the structure to provide uniform moisture throughout the year. The irrigation/sprinkler systems should spray no closer than 5.0 feet from the foundation. The sprinkler system should be checked for leakages once per month. Significant foundation movements can occur if the soils under the foundations are exposed to a source of free water.

5.14 Foundations and Risks

The factors that aid in the design and construction of lightly loaded foundations include economics, risk, soil type, foundation shape and structural loading. Most of the time, foundation systems are selected by the owner/builder, which as a result of economic considerations, accept higher risks in foundation design. It should be noted that some levels of risk are associated with all foundation systems and there is no such thing as a "zero-risk" foundation. It also should be noted that the previous foundation recommendations are not designed to resist soil movements as a result of sewer/plumbing leaks, excessive irrigation, poor drainage, and water ponding near the foundation system. It is recommended that the owner implement a foundation maintenance program to help reduce potential future unwanted foundation/slab movements throughout the useful life of the structure. The owner should conduct yearly observation of foundations and slabs and perform any maintenance necessary to improve drainage and minimize infiltrations of water from precipitation and/or irrigation. Irrigation/sprinkler systems should be periodically monitored for leaks and malfunctioning sprinkler heads, which should be repaired immediately. Post-construction landscaping should be carefully designed to preserve initial site grading.

6.0 ADDITIONAL SERVICES

As an additional service, this firm would be pleased to review the project plans and structural notes for conformance to the intent of this report. Vann Engineering, Inc. should be retained to provide documentation that the recommendations set forth are met. These include but are not limited to documentation of site clearing activities, verification of fill suitability and compaction, and inspection of footing excavations. Relative to field density testing, a minimum of 1 field density test should be taken for every 2500 square feet of building area, per 6.0-inch layer of compacted fill. This firm possesses the capability of performing testing and inspection services during the course of construction. Such services include, but are not limited to, compaction testing as related to fill control, foundation inspections and concrete sampling. Please notify this firm if a proposal for these services is desired.

The recommendations contained in this report are contingent on Vann Engineering, Inc. observing and/or monitoring:

A. Proof rolling and fill subgrade conditions
B. Suitability of borrow materials
C. Fill control for building pads (verification of overexcavation depths and lateral extents, compaction testing, and the general monitoring of fill placement)
D. Foundation observations (compliance with the General Structural Notes, depths, bearing strata, etc.)
E. Basement, structural or retaining wall backfill testing
F. Backfilling and compaction of excavations (e.g. Utility trench backfill)
G. Special inspections as dictated by the local municipality
H. Concrete sampling and testing for footings, stem walls and floor slabs

I. Subgrade testing for proposed pavement areas
J. ABC testing for proposed pavement areas
K. Asphaltic concrete testing for proposed pavement areas
L. Subgrade preparation for on-site sidewalk areas
M. Grout sampling and testing, where applicable
N. Mortar sampling and testing, where applicable
O. Compliance with the geotechnical recommendations

7.0 LIMITATIONS

This report is not intended as a bidding document, and any contractor reviewing this report must draw their own conclusions regarding specific construction techniques to be used on this project. The scope of services carried out by this firm does not include an evaluation pertaining to environmental issues. If these services are required by the lender, we would be most pleased to discuss the varying degrees of environmental site assessments.

This report is issued with the understanding that it is the responsibility of the owner to see that its provisions are carried out or brought to the attention of those concerned. In the event that any changes of the proposed project are planned, the conclusions and recommendations contained in this report shall be reviewed and the report shall be modified or supplemented as necessary.

Prior to construction, we recommend the following:

1. Consultation with the design team in all areas that concern soils and rocks to ensure a clear understanding of all key elements contained within this report.
2. Review of the General Structural Notes to confirm compliance to this report and determination of which allowable soil bearing capacity has been selected by the project structural engineer (this directly affects the extent of earthwork and foundation preparation at the site).
3. This firm be notified of all specific areas to be treated as special inspection items (designated by the architect, structural engineer or governmental agency).

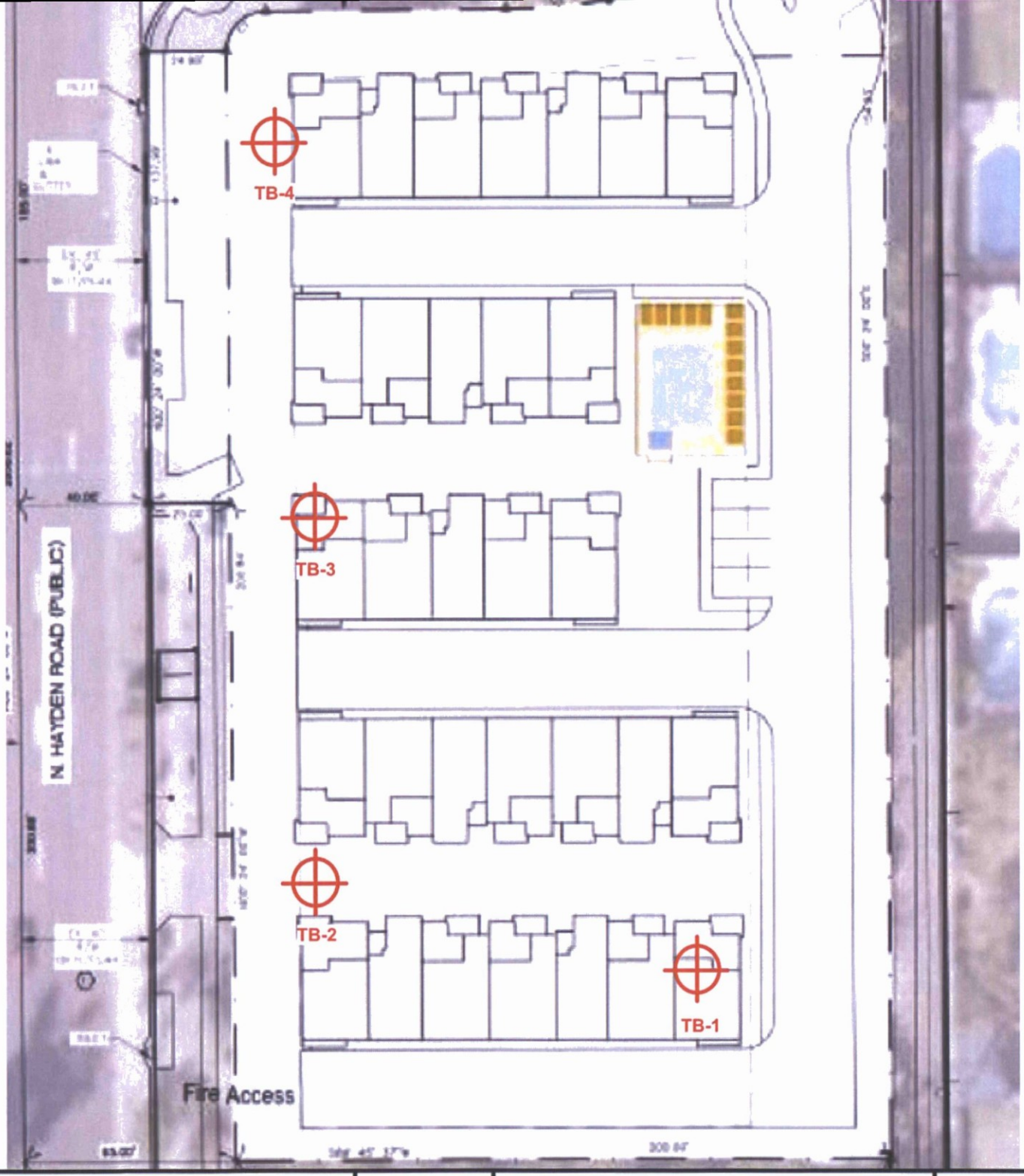
Relative to this firm's involvement with the project during the course of construction, we offer the following recommendations:

1. The site or development owner should be directly responsible for the selection of the geotechnical consultant to provide testing and observation services during the course of construction.
2. This firm should be contracted by the owner to provide the course of construction testing and observation services for this project, as we are most familiar with the interpretation of the methodology followed herein.
3. All parties concerned should understand that there exists a priority surrounding the testing and observation services completed at the site.

DEFINITION OF TERMINOLOGY

Allowable Soil Bearing Capacity Allowable Foundation Pressure	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
Aggregate Base Course (ABC)	A sand and gravel mixture of specified gradation, used for slab and pavement support.
Backfill	A specified material placed and compacted in a confined area.
Base Course	A layer of specified material placed on a subgrade or subbase.
Base Course Grade	Top of base course.
Bench	A horizontal surface in a sloped deposit.
Caisson	A concrete foundation element cased in a circular excavation, which may have an enlarged base. Sometimes referred to as a cast-in-place pier.
Concrete Slabs-on-Grade	A concrete surface layer cast directly upon a base, subbase, or subgrade.
Controlled Compacted Fill	Engineered Fill. Specific material placed and compacted to specified density and/or moisture conditions under observation of a representative of a soil engineer.
Differential Settlement	Unequal settlement between or within foundation elements of a structure.
Existing Fill	Materials deposited through the action of man prior to exploration of the site.
Expansive Potential	The potential of a soil to increase in volume due to the absorption of moisture.
Fill	Materials deposited by the action of man.
Finish Grade	The final grade created as a part of the project.
Heave	Upward movement due to expansion or frost action.
Native Grade	The naturally occurring ground surface.
Native Soil	Naturally occurring on-site soil.
Overexcavate	Lateral extent of subexcavation.
Rock	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting, or other methods of extraordinary force for excavation.
Scarify	To mechanically loosen soil or break down the existing soil structure.
Settlement	Downward movement of the soil mass and structure due to vertical loading.
Soil	Any unconsolidated material composed of disintegrated vegetable or mineral matter, which can be separated by gentle mechanical means, such as agitation in water.
Strip	To remove from present location.
Subbase	A layer of specified material between the subgrade and base course.
Subexcavate	Vertical zone of soil removal and recompaction required for adequate foundation or slab support
Subgrade	Prepared native soil surface.

SECTION II



LEGEND:

TEST BORING LOCATIONS

SCALE: N.T.S.	**SITE PLAN**	PREPARED BY: ES
DATE: 04/20/17		

PROPOSED TOWNHOME DEVELOPMENT
1.7 ACRES (AKA HARPERS NURSERY)
SEC, VIRGINIA AVENUE AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

N

PROJECT 25105

VANN ENGINEERING INC

TB-1

Operator M. Mewhinney
Boring Date: 4/17/17
Boring Location: See Site Plan
Drilling Method: CME-55

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0	Grab sample obtained at 1.5 to 3.0 feet			3/4		GWT not encountered	FL	SPREAD FILL (16") damp, 25% gravel, 45% sand, 30% fines, poorly graded, subangular to subrounded coarse-grained particles, stiff, PI of 8 to 10, no cementation
							SC	SILTY CLAYEY SAND, some gravel, brown to light-brown, damp to moist, 10% gravel, 55% sand, 35% fines, poorly graded, subangular to subrounded coarse-grained particles, loose, PI of 14, weak cementation
5								Whitish-brown, PI of 14 to 16 below 3.0 feet
								With gravel, tan, medium dense, PI of 16, medium cementation below 5.0 feet
10								Gravelly, whitish-tan, damp, dense, PI of 14 to 16, medium to strong cementation below 10.0 feet
15								TEST BORING DISCONTINUED AT 15.0 FEET
20								
25								
30								
35								

LOG OF BORING

VANN ENGINEERING, INC.	**Harper's Nursery** **Project No. 25105**	**Plate 1**

TB-2

Operator M. Mewhinney
Boring Date: 4/17/17
Boring Location: See Site Plan
Drilling Method: CME-55

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0				2/ 4		GWT not encountered	FL	Asphalt (2.5")
								ABC (3.5")
							CL	SPREAD FILL (12") slightly damp to damp, 25% gravel, 35% sand, 40% fines, poorly graded, subangular to subrounded coarse-grained particles, stiff, PI of 8 to 10, no cementation
5								SILTY SANDY CLAY, medium brown, damp, 10% gravel, 35% sand, 55% fines, poorly graded, subangular to subrounded coarse-grained particles, stiff, PI of 10+, weak cementation
								With gravel, whitish-brown, slightly damp to damp, very stiff, PI of 12 to 14, medium to strong cementation below 5.0 feet
10								Gravelly, brown-tan, PI of 14 to 16, medium cementation below 10.0 feet
15								TEST BORING DISCONTINUED AT 15.0 FEET
20								
25								
30								
35								

LOG OF BORING

VANN ENGINEERING, INC.	**Harper's Nursery** **Project No. 25105**	**Plate 2**

TB-3

Operator M. Mewhinney
Boring Date: 4/17/17
Boring Location: See Site Plan
Drilling Method: CME-55

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0	Grab sample obtained at 1.5 to 3.0 feet			2/ 4		GWT not encountered	FL	Asphalt (2.5")
								ABC (3.5")
							CL	SPREAD FILL (11") damp to moist, 20% gravel, 30% sand, 50% fines, poorly graded, subangular to subrounded coarse-grained particles, firm, PI of 10 to 12, no cementation
5								SILTY SANDY CLAY, trace gravel, medium brown, damp to moist, 5% gravel, 35% sand, 60% fines, poorly graded, subangular to subrounded coarse-grained particles, firm, PI of 15, weak cementation
								With gravel, whitish-brown, damp, stiff, weak to medium cementation below 5.0 feet
10								Gravelly, very stiff, medium cementation below 10.0 feet
15								TEST BORING DISCONTINUED AT 15.0 FEET
20								
25								
30								
35								

LOG OF BORING

VANN ENGINEERING, INC.	**Harper's Nursery** **Project No. 25105**	**Plate 3**

Operator M. Mewhinney
Boring Date: 4/17/17
Boring Location: See Site Plan
Drilling Method: CME-55

Depth	Remarks	Moisture (%)	Dry Density	Blow Counts	Sample Type	Water Table		
0				3/ 5		GWT not encountered	FL	Asphalt (2.5")
								ABC (3.5")
							CL	SPREAD FILL (12") damp, 25% gravel, 30% sand, 45% fines, poorly graded, subangular to subrounded coarse-grained particles, firm, PI of 10 to 12, no cementation
5								SILTY SANDY CLAY, medium brown, damp to moist, 10% gravel, 35% sand, 55% fines, poorly graded, subangular to subrounded coarse-grained particles, firm to stiff, PI of 12 to 14, weak cementation
								Whitish-brown, stiff, PI of 14+, weak to medium cementation below 5.0 feet
10								Gravelly, slightly damp to damp, PI of 16, medium cementation below 10.0 feet
15								TEST BORING DISCONTINUED AT 15.0 FEET
20								
25								
30								
35								

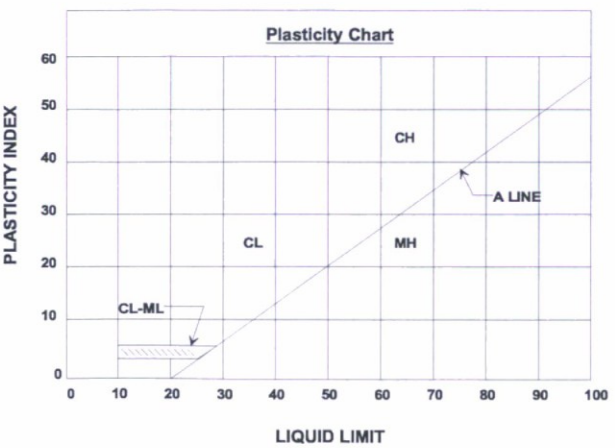
LOG OF BORING

VANN ENGINEERING, INC.	**Harper's Nursery**	**Plate 4**

LEGEND

Major Divisions				Group Symbol	Typical Names
Coarse-Grained Soils (Less than 50% passes No. 200 sieve)	Gravels (50% or less or coarse fraction passes No. 4 sieve)	Clean Gravels (Less than 5% passes No. 200 sieve)		GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
				GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		Gravels with Fines (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on Plasticity Chart.	GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plots above "A" line & hatched zone on Plasticity Chart.	GC	Clayey gravels, gravel-sand-clay mixtures.
	Sands (More than 50% of coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% passes No. 200 sieve)		SW	Well graded sands, gravelly sands.
				SP	Poorly graded sands, gravelly sands.
		Sands with Fines (More than 12% passes No. 200 sieve)	Limits plots below "A" line & hatched zone on Plasticity Chart.	SM	Silty sands, sand-silt mixtures.
			Limits plots above "A" line & hatched zone on Plasticity Chart.	SC	Clayey sands, sand-clay mixtures.
Fine-Grained Soils (50% or more passes No. 200 sieve)	Silts-Plot below "A" line & hatched zone on Plasticity Chart	Silts of Low Plasticity (Liquid Limit Less Than 50)		ML	Inorganic silts, clayey silts with slight plasticity.
		Silts of High Plasticity (Liquid Limit More Than 50)		MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	Clays-Plot above "A" line & hatched zone on Plasticity Chart	Clays of Low Plasticity (Liquid Limit Less Than 50)		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Clays of High Plasticity (Liquid Limit More Than 50)		CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

Note: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the Plasticity Chart to have double symbol.



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment

VANN ENGINEERING INC uses a CME-55 drill-rig capable of auger drilling to depths of 150 feet in southwestern soils. The drill is truck-mounted for rapid, low cost mobilization to the jobsite and on the jobsite. The CME-55 owned by this firm is powered by a 300 cubic inch, 6-cylinder Ford industrial engine that produces 124 horsepower. This energy is transmitted through a rugged mechanical drive that provides 7,000 foot-lbs of torque on the drillstring. Two 72-inch hydraulic cylinders develop 16,000 lbs of downward thrust and 24,000 lbs of retractive force. Two hydraulic cable hoists and a mechanical cathead allow downhole sampling and testing at any depth to be accomplished with great speed and accuracy. For drilling operations, the truck is stabilized with platform mounted vertical hydraulic jacks with a 48-inch stroke. Drilling through soil or softer rock is performed with 6¾ inch O.D. hollow-stem, or 4½-inch continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils that require blasting or very heavy equipment for excavation. The operation of well-maintained equipment by an experienced crew allows VANN ENGINEERING INC to complete any type of drilling job with minimum downtime and maximum efficiency.

Sampling Procedures

Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedure. In many cases, 2 inch O.D., $1^3/_8$-inch I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3-inch O.D. samplers lined with 2.42 inch I.D. brass rings. The driving energy is generally recorded as a number of blows of a 140-pound hammer, utilizing a 30-inch free fall drop, per foot of penetration. However, in stratified soils, driving resistance is sometimes recorded in 2 or 3-inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. Undisturbed sampling of softer soils is sometimes performed with thin-walled Shelby tubes (ASTM D1587). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing from auger cuttings.

Continuous Penetration Tests

Continuous penetration tests are performed by driving a 2-inch O.D. blunt nosed penetrometer adjacent to or in the bottom of test borings. The penetrometer is attached to $1^5/_8$-inch O.D. drill rods to provide clearance and thus minimize side friction so that penetration values are as nearly as possible a measure of end resistance. Penetration values are recorded as the number of blows of a 140 pound hammer, utilizing a 30-inch drop required to advance the penetrometer in one foot increments or less.

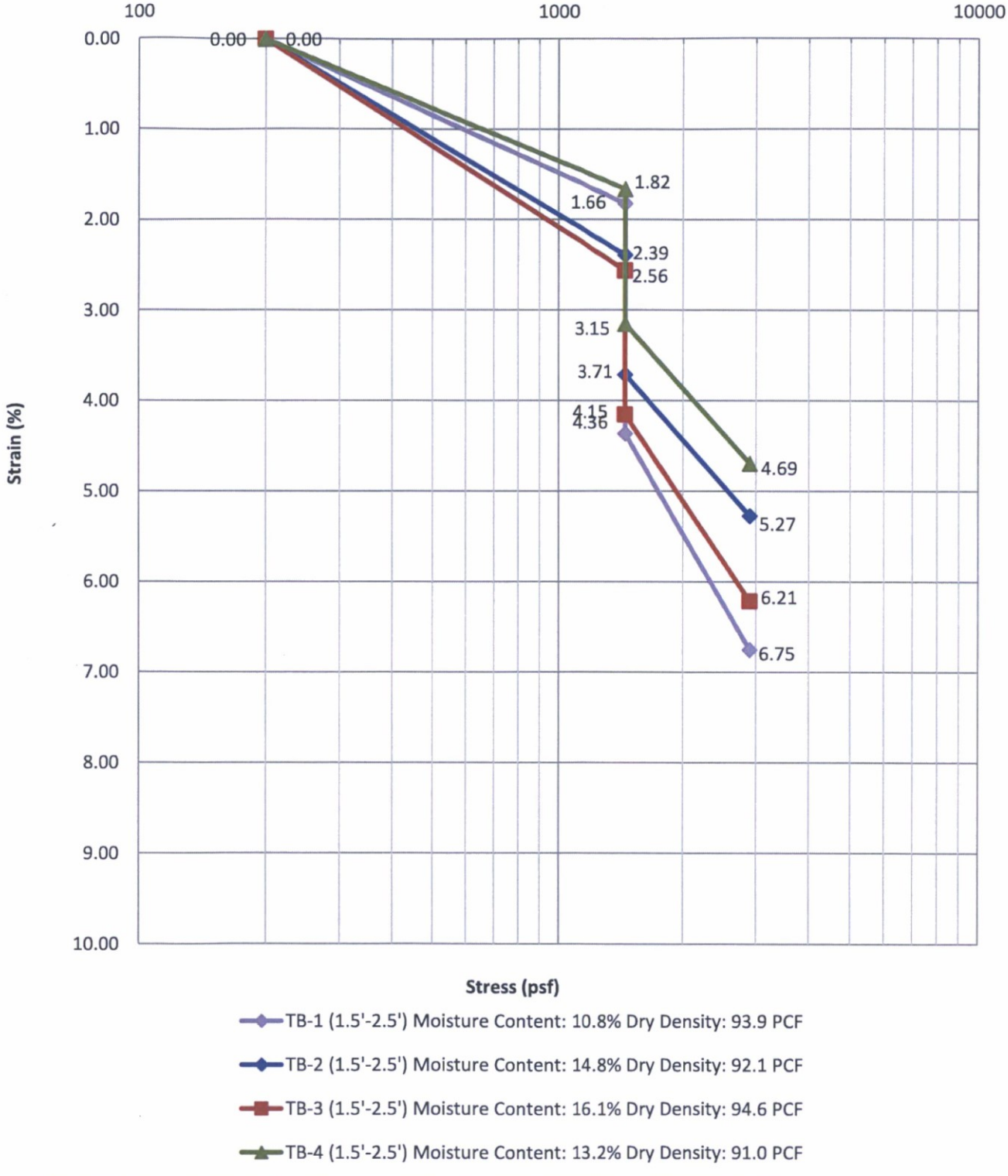
As an alternate, Cone Penetration Testing may be utilized in an effort to determine the point capacity of the cone tip, and skin friction measured on the cone sleeve.

Boring Records

Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

SECTION III

Response to Wetting Test Data
Project 25105



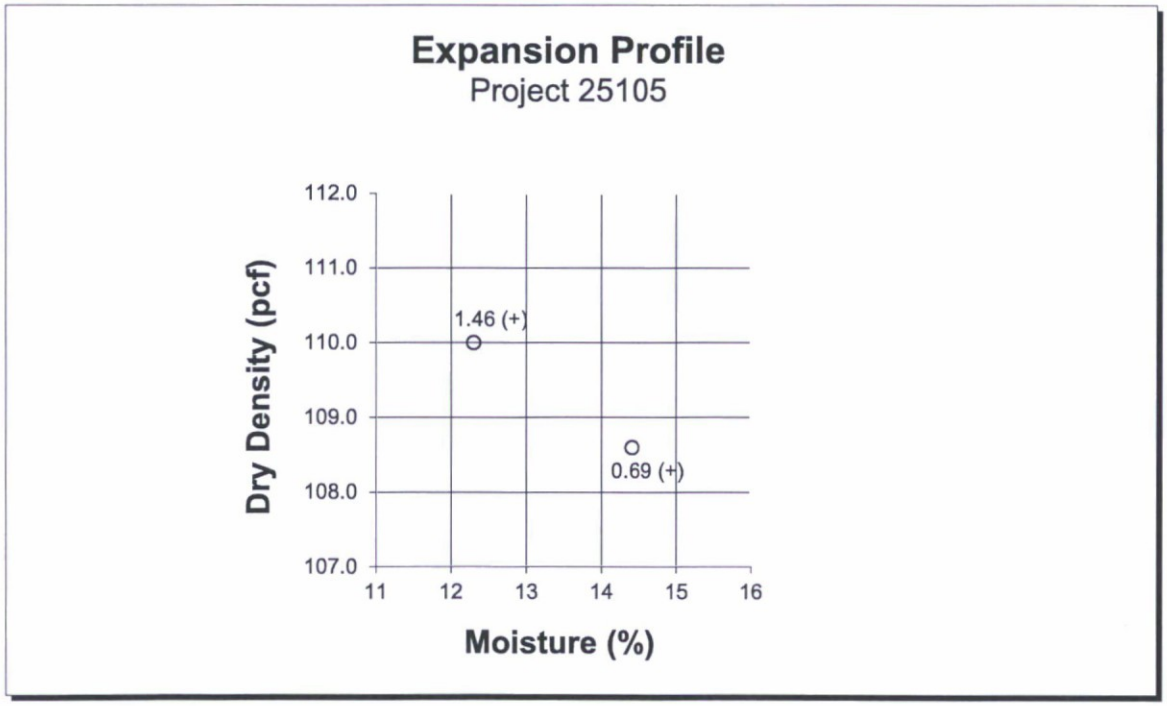
EXPANSION TEST DATA

PROPOSED TOWNHOME DEVELOPMENT
1.7 ACRES
SEC, VIRGINIA AVENUE AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

Sample Location	*Remolded Moisture Content (%)*	*Dry Density (PCF)*	*Volume Change After Saturation (%)*	*Adjusted Volume Change After Saturation (%)*
TB-3 (1.5'-3.0')	14.4	108.6	0.74 (+)	0.69 (+)
TB-3 (1.5'-3.0')	12.3	110.0	1.57 (+)	1.46 (+)

(+) denotes expansion

(-) denotes compression



CLASSIFICATION TEST DATA

PROPOSED TOWNHOME DEVELOPMENT
1.7 ACRES
SEC, VIRGINIA AVENUE AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

Sample Location	*Sieve Analysis (% Passing Sieve Size)*								*Atterberg Limits*		*USCS*	*Moisture Content %*
	3"	*2"*	*1"*	*#4*	*#10*	*#40*	*#100*	*#200*	*LL*	*PI*		
TB-3 (1.3'-3.0')	-	-	100	93	90	92	-	60	33	15	CL	12.9

SULFATES AND CHLORIDES TEST RESULTS

PROPOSED TOWNHOME DEVELOPMENT
1.7 ACRES
SEC, VIRGINIA AVENUE AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

Sample Location	*Test Interval (feet)*	*Sulfate (%)*	*Chloride (ppm)*
TB-1	1.5'-3.0'	0.118	131

Project 25105
Vann Engineering Inc - Phoenix, Arizona

SECTION IV

VOLFLO 1.5

Geostructural Tool Kit, Inc.

Registered To : Vann Engineering, Inc.

Serial Number : 200-100-061

Project Title : Proposed Townhome Development
Project Engineer : JV

Project Number : 25105
Project Date : April 25, 2017

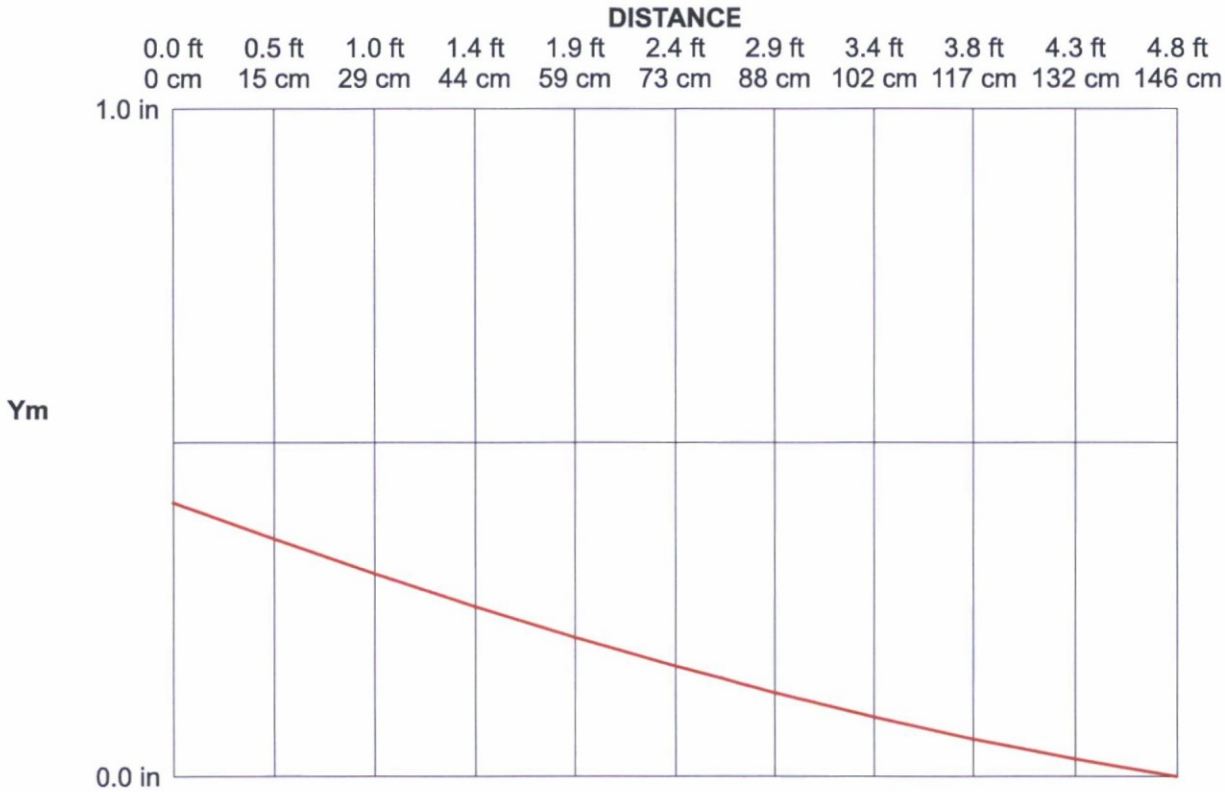
Geotechnical Report :

Report Date :
Report Number :

SWELL CALCULATION

Ym Edge (Swell) = 0.41 inches (1.04 centimeters)

Em Edge = 4.80 feet (146.30 centimeters)



	Swell at Slab Edge	Swell at distance X from edge of slab									Swell at Em
	0.0 ft 0 cm	0.5 ft 15 cm	1.0 ft 29 cm	1.4 ft 44 cm	1.9 ft 59 cm	2.4 ft 73 cm	2.9 ft 88 cm	3.4 ft 102 cm	3.8 ft 117 cm	4.3 ft 132 cm	4.8 ft 146 cm
inches	0.41	0.36	0.30	0.25	0.21	0.17	0.13	0.09	0.06	0.03	0.00
cm	1.04	0.90	0.77	0.65	0.53	0.42	0.32	0.23	0.14	0.07	0.00

VOLFLO 1.5

Geostructural Tool Kit, Inc.

Registered To : Vann Engineering, Inc.

Serial Number : 200-100-061

Project Title : Proposed Townhome Development
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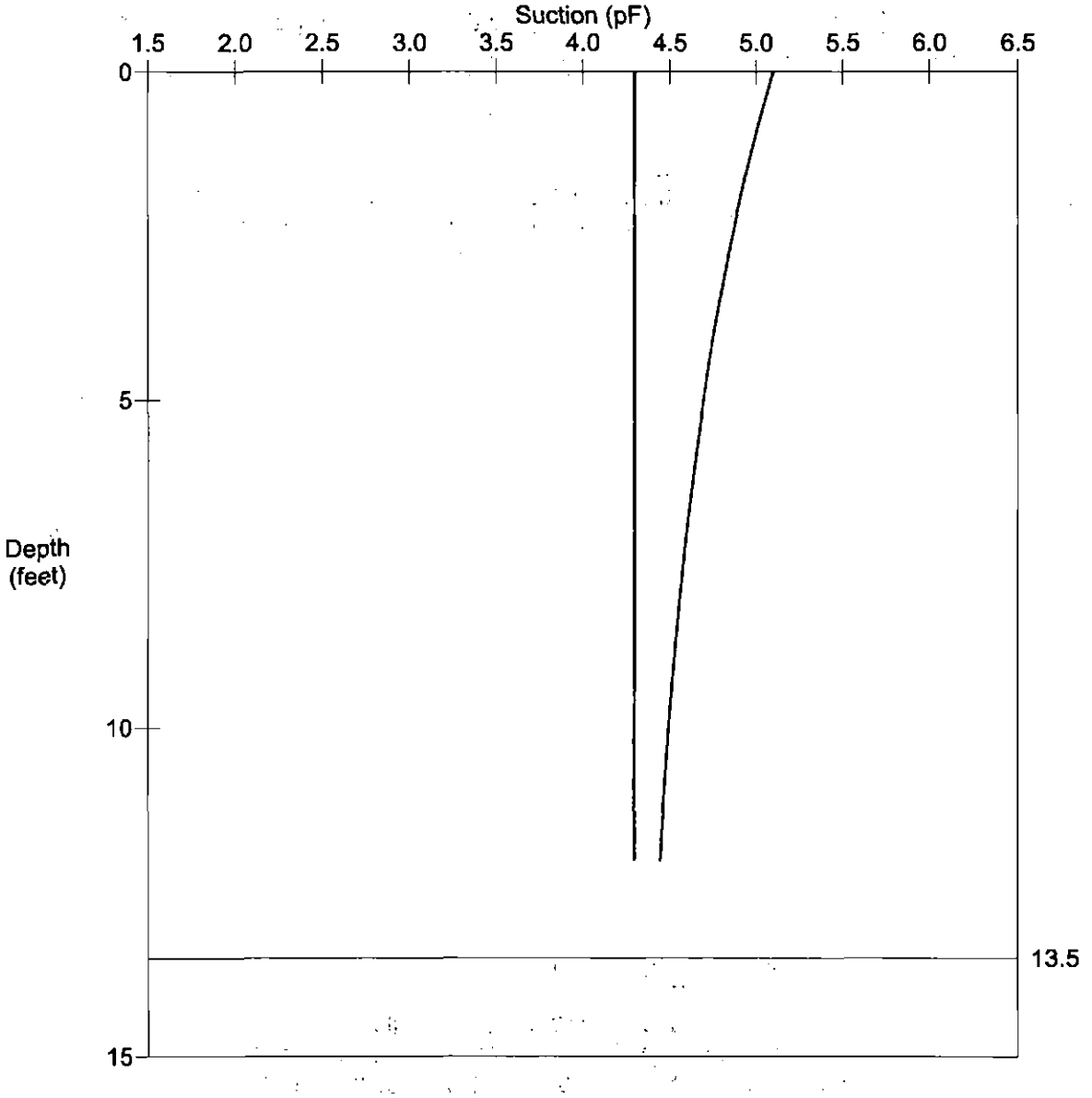
SUCTION PROFILES



Initial suction at edge of slab

Final suction at edge of slab

Constant Suction

VANN ENGINEERING INC

Geotechnical Engineering □ Enviromental Consulting □ Construction Testing & Inspection

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