VIVID Engineering Group, Inc.

1053 Elkton Drive, Colorado Springs, CO 80907

November 17, 2017

Michael Bishop, Development Manager
908 US Highway 50 Holdings, LLC
c/o: Index Development Management, LLC
4300 South US Highway One, Suite 203-350
Jupiter, Florida 33477
mbishop@indexrealestate.com

Subject: Geotechnical Investigation and Report
Project: Proposed Addition, 908 US Hwy 50, Pueblo, Colorado
Proposal No: D17-2-075

Dear Mr. Bishop:

Vivid Engineering Group, Inc. (VIVID) has completed a geotechnical evaluation to provide design and construction recommendations for the proposed building addition at the above referenced project address. The investigation consisted of obtaining subgrade samples, performing laboratory testing, and evaluating geotechnical design parameters for the proposed building foundations and floor slabs. This letter transmits our test results and presents our geotechnical recommendations.

PROPOSED CONSTRUCTION

We understand the project includes construction of a new addition to the current facility. The addition will expand the existing building approximately 15 feet to the east to increase the building size to a 2,500 SF total footprint. The addition will include structural steel columns and beams with metal stud exterior wall construction. It is understood that the existing structure is on drilled pier and grade beam foundations. We anticipate no below grade (basement) construction will be included.

FIELD INVESTIGATION

The existing subgrade conditions were investigated by performing two borings at the site, at the approximate locations shown on Figure 2, attached to this report. Subgrade samples were collected from each boring for laboratory analysis.

SUBGRADE CONDITIONS

Based on our investigation we encountered the following subsurface conditions:

Existing Pavement: Existing pavement consisted of approximately 2 inches of asphalt. Approximately 7-inches of granular base was encountered beneath the asphalt at boring B-1, while no granular base was encountered at boring B-2.

Native Clay: The upper four feet of soil consisted of Lean Clay (CL). The material was reddish-brown, moist, and stiff to very stiff. Moisture contents were below the soil's plastic limit indicating the clay will be generally stable under loading.

Claystone (Weathered Shale): Below the upper native clay soils, Claystone was encountered to depths of approximately 9 to 15 feet below the existing ground surface in borings B-1 and B-2, respectively. This material is weathered (typically somewhat softer and has higher moisture content) than the underlying Shale. The Claystone encountered was reddish brown, moist, and firm to hard, and contained calcareous deposits.

Shale: Below the Claystone material, Shale was encountered to the final boring depths of approximately 24 feet below the existing ground surface. The Shale was gray, dry to slightly moist, hard to very hard, and contained calcareous deposits.

Samples of the Claystone and Shale were subject to laboratory swell testing. The results ranged from approximately 0.3 to 3.3 percent swell when the samples were subject to wetting under a surcharge pressure of 1,000 pounds per square foot (psf). Local qualitative description puts this material in the low to moderate category in regard to expansion potential and respective potential damage to structures. Based on this, mitigation will be required to help protect the structure against damage as a result to expansion of the underlying soil/bedrock materials.

Groundwater was encountered in boring B-1 only, within the Shale formation, at an approximate depth of 22 feet below the existing ground surface. It is not uncommon to find water within seams and fractures of the Shale formation at random depths and locations. Based on our understanding of the proposed construction we don't believe groundwater will be a significant factor. However, it is possible water within the Shale seams could be encountered during drilled pier construction.

Logs of the borings are included in Attachment A.

LABORATORY TESTING

Laboratory testing was conducted on the samples and included determination of soil moisture, density, plasticity and swell potential. Results of the laboratory testing are presented in Attachment B and shown on the logs in Attachment A.

GEOTECHNICAL RECOMMENDATIONS

As anticipated, our investigation encountered expansive soil and bedrock at our boring locations. Samples of the Claystone and Shale were subject to laboratory swell testing. The results ranged from approximately 0.3 to 3.3 percent swell when the samples were subject to wetting under a surcharge pressure of 1,000 pounds per square foot (psf). Local qualitative description puts this material in the low to moderate category in regard to expansion potential and respective potential damage to structures. Based on this, mitigation will be required to help protect the structure against damage as a result to expansion of the underlying soil/bedrock materials. The expansive nature of the soils and bedrock on this site increase the risk of poor performance of foundations and floor systems that are constructed on this site. As such the following sections present our foundation and floor system recommendations to help mitigate this risk.

Building Foundations

Due to the presence of expansive bedrock on this site at the proposed foundation elevations, it is recommended that the proposed building structure be supported on a deep foundation system consisting of straight-shaft drilled piers bottomed within the underlying BEDROCK consisting of hard Claystone or Shale bedrock. For the purposes of this report and foundation design, **BEDROCK is defined as the material below 10 feet below the existing ground surface.** This depth is considered appropriate for "socketing" the piers to achieve the end bearing and skin friction criteria presented below, as well as providing proper "anchorage" of the lower portion of the pier against uplift forces due to expansive soil/bedrock.

Piers Design Criteria:

- Compression load capacity of piers should be designed based on a maximum allowable end bearing pressure of 40,000 pounds per square foot (psf) and an average skin friction value of 3,500 psf for the portion of pier in the BEDROCK (as defined above).
- To resist uplift due to the expansive bedrock, piers should have a minimum "drilled" length of at least 20-feet and should penetrate a minimum of 8-feet into the BEDROCK. Final "design" drilled length will be developed by the project structural engineer based on the actual structure loads for individual piers and the geotechnical parameters provided. Final "constructed" pier depths should be determined by the geotechnical engineer in the field at the time of construction based on the actual conditions encountered.
- Calculations for uplift resistance should be based upon an uplift skin friction value of two-thirds of the compressive side friction for the portion of pier within the BEDROCK strata, which equates to 2,300 psf.
- Piers should be designed by a qualified structural engineer. Piers should be reinforced their full length. As a minimum, we recommend the cross-sectional area of reinforcement be equal to at least 0.5 percent of the gross cross-sectional area of the pier. Grade 60 steel should be used. Reinforcement should extent into grade beams or foundation walls.
- Provide at least a 6-inch continuous void beneath grade beams or foundation walls (between piers) to concentrate building deadloads and isolate the superstructure from underlying expansive soils and bedrock.
- Piers should have a center-to-center spacing of at least three pier diameters when designing for vertical loading conditions, or they should be designed as a group. Piers aligned in the direction of lateral forces should have a center-to-center spacing of at least 6 pier diameters. Grouped pier reduction factors can be provided if required.
- Engineering properties of the subsurface materials that will aid in the analysis of laterally loaded piers for analytical programs such as L-PILE are provided in the table below. Lateral resistance within the upper 5-feet of the pier shaft should be ignored.

LPILE Soil Parameters

Depth (ft)	P-Y Curve Model	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Friction Angle (deg)	Strain Factor, ε_{50}	Soil Modulus, k (pci)
5 to 20	Stiff Clay w/o Free Water *(Claystone/Sandstone/Siltstone)*	125	2,000	n/a	0.005	500

Pier Construction Recommendations:

We recommend the pier drilling contractor be familiar and experienced with pier drilling operations in this area. The construction criteria presented below should be observed for a straight-shaft drilled pier foundation system. The construction details should be considered when preparing project documents.

- The sides and base of the drilled shaft excavation should expose undisturbed soil or bedrock cleaned of remolded and loose material prior to placement of concrete. Piers should be filled with concrete immediately after they are drilled, cleaned and observed. Open pier holes should not be left overnight.
- It is very important to avoid "mushrooming" or widening of the top of the pier hole as this provides additional surface area on which heaving/swelling soils can exert uplift forces. Where required, we recommend the use of "sonotube" or other equivalent product to preserve the diameter of this section of the pier. The sonotube should be placed prior to pouring the upper portion of the pier.
- Concrete used in the drilled piers should be a fluid mix with a slump in the range of 5 to 7-inches to properly consolidate in pier holes. The higher end should be targeted where temporary casing is utilized.
- Drilled pier holes should be properly cleaned prior to placement of concrete. Concrete should be placed in drilled piers immediately after drilling to reduce the risk of contamination from groundwater or other sources.
- Drilled pier foundations should only be attempted by a caisson drilling company that has proven experience with these subsurface conditions. Drilling companies must review the geotechnical report and evaluate subsurface conditions prior to supplying bids. Groundwater was encountered in our borings during drilling operations. While not anticipated based on our field investigations, if water is encountered during drilled pier installation and cannot be controlled (no more than 3-inches of groundwater in the hole at time of pour), then the concrete should be pumped from the bottom of the hole to the top in order to displace the water. Piers should be filled with concrete immediately after they are drilled, cleaned and inspected. Open pier holes should not be left overnight.
- The pier drilling contractor should mobilize equipment of sufficient size to achieve required penetration into the hard bedrock strata and have available equipment necessary for groundwater control.
- It is important that the installation of drilled piers be observed by a VIVID representative to identify the proper bearing strata, observe construction techniques, and confirm subsurface conditions are as anticipated from our exploratory borings.

Floor Systems

Option 1:

From a geotechnical standpoint, a structural floor system is the more reliable floor system and would mitigate the risk of damage resulting from heave of expansive soils and bedrock. If a structural floor system (crawl-space construction) is utilized, various items should be considered in the design and construction that are beyond the scope of this report. These include design considerations associated with clearance, ventilation, insulation, as appropriate, and other issues addressed through standard construction practice and local building codes. There is the potential for moisture to develop in crawl spaces through transpiration of the moisture within native soils underlying the structure, water intrusion from snowmelt and precipitation, and surface runoff or infiltration of water through irrigation of lawns and landscaping and along utility trenches/bedding materials.

Option 2:

Slab-on-grade floor systems are a viable option, but due to the increased risk of movement and associated damage due to heave from expansive soils and bedrock, over-excavation of 4-feet of the expansive clayey soils beneath the floor slab and replacement with imported structural fill (CDOT Class 1 Structure Backfill with no less than 20% fines (percent particles passing the No. 200 Sieve screen) would be required in order to reduce the risk of slab movement and damage. Over-excavation and replacement with an imported structural fill below slabs would create a more uniform bearing surface for the slab construction. <u>However, it should be noted that this approach would reduce, but not eliminate, the potential for slab movement and damage.</u>

The criteria presented below should be observed for design and construction of floor slabs on this site. The construction details should be considered when preparing the project documents.

- For concrete slab-on-grade design purposes, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) can be used for slabs bearing on imported structural fill. Additional reinforcement can also be used to help resist damage due to differential movement of slabs.
- Floor slabs should be separated from all bearing walls and columns with expansion joints that allow unrestrained vertical movement. At door thresholds only, both interior and exterior slabs can be dowelled into the foundation stem wall to resist movement that can create a trip hazard or impede proper door operation. Interior wall construction should include a 2-inch slip joint at the bottom of the wall to allow for vertical floor slab movement without impacting the framing or drywall that would otherwise buckle/crack if impacted by floor heave due to expansive soils. Plumbing that penetrates the floor should also include a slip joint such that slab movement would not damage the pluming.
- Floor slab control joints should be used to reduce damage due to shrinkage cracking. Control joint spacing is a function of slab thickness, aggregate size, slump and curing conditions. The requirements for concrete slab thickness, joint spacing and reinforcement should be established by the designer based on experience, recognized design guidelines and the intended slab use. Placement and curing conditions will have a strong impact on the final concrete slab integrity.

Perimeter Exterior Drain System:

If below-grade areas with a crawl space will be constructed, we recommend installation of an exterior foundation perimeter drain connected to a gravity outlet or sump.

If the slab-on-grade on structural fill option is utilized a perimeter drain is not required, however the surface soils placed adjacent the new structure **should include a 12-inch layer of compacted clay** soil to hinder water from readily penetrating the structural fill and pooling at the base of the over-excavated area beneath the floor slab as this will exacerbate the expansive soil problem.

Soil Compaction Requirements

Fill materials should be placed in horizontal lifts compatible with the type of compaction equipment being used, moisture conditioned, and compacted in accordance with the following criteria:

Compaction Specifications

FILL LOCATION	MATERIAL TYPE	PERCENT COMPACTION (ASTM D 698)	MOISTURE CONTENT
Structural Fill placed beneath slabs-on-grade (floor slab option 2)	Granular Import	95 minimum	± 2 % of optimum
Exterior Wall Backfill	On-site Soils	95 minimum	-1 to +3 % of optimum

Chemical Sulfate Susceptibility and Concrete Type

The degradation of concrete or cement grout can be caused by chemical agents in the soil or groundwater that react with concrete to either dissolve the cement paste or precipitate larger compounds within the concrete, causing cracking and flaking. The concentration of water-soluble sulfates in the soils is a good indicator of the potential for chemical attack of concrete or cement grout. The American Concrete Institute (ACI) in their publication Guide to Durable Concrete (ACI 201.2R-08) provides guidelines for this assessment.

The concentration of water-soluble sulfates measured on subsurface materials submitted for testing represents a Class 2 exposure of sulfate attack on concrete exposed to the soils per CDOT Standard Specifications for Road and Bridge Construction, 2011, Section 601.04. Utilize CDOT recommendations in Section 601.04 for concrete mix designs to address this level of sulfate exposure. Sulfate test results are presented in Attachment C.

CLOSING

We appreciate this opportunity to serve you, and we look forward to working with you again. Should you have any questions concerning this report, please contact Bill Barreire at 719.491.2292 or wbarreire@vivideg.com.

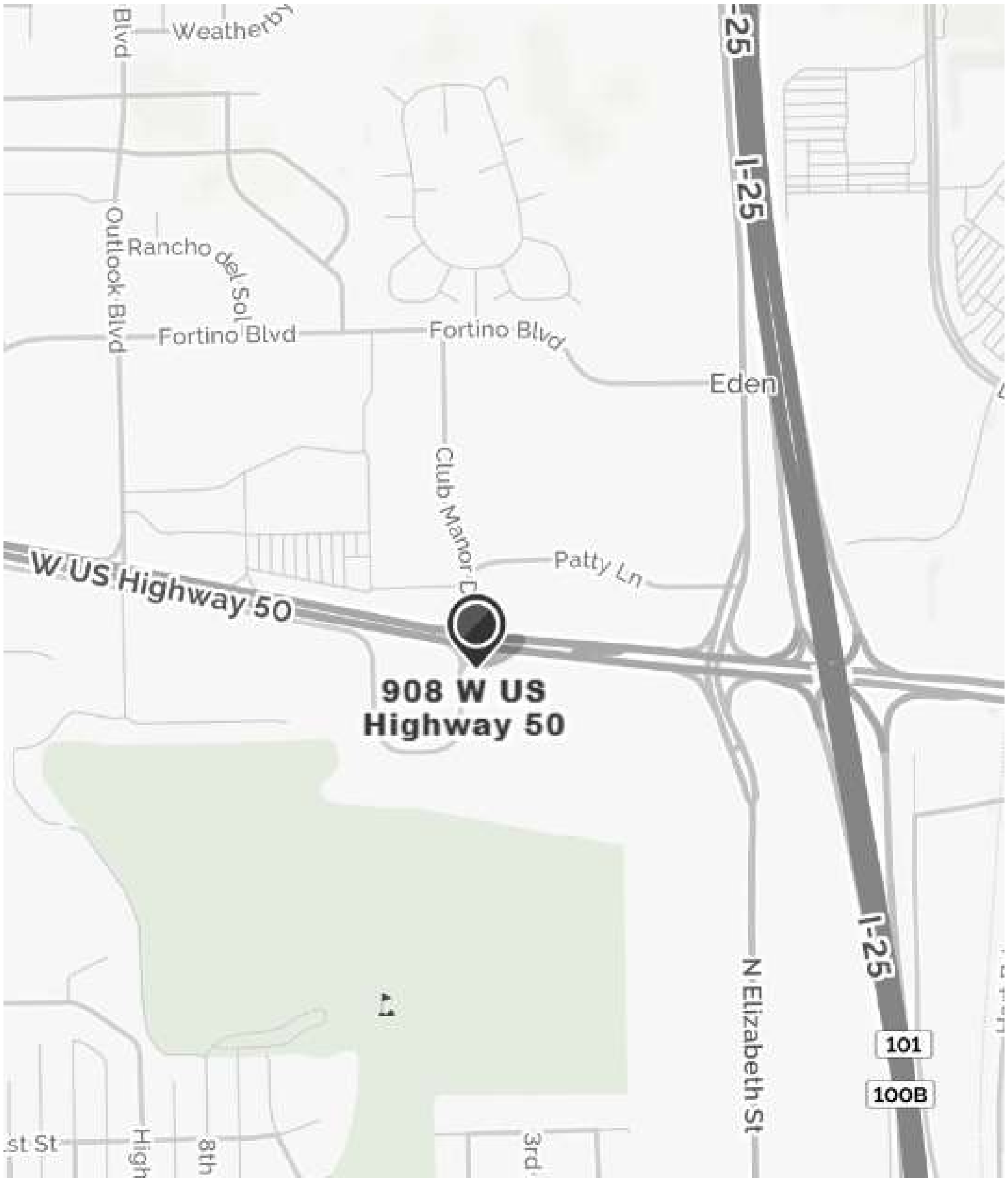
Sincerely,

11-17-17

William (Bill) J. Barreire, PE
Vice President / Operations Manager

Brysen T. Mustain, PG
Project Geologist

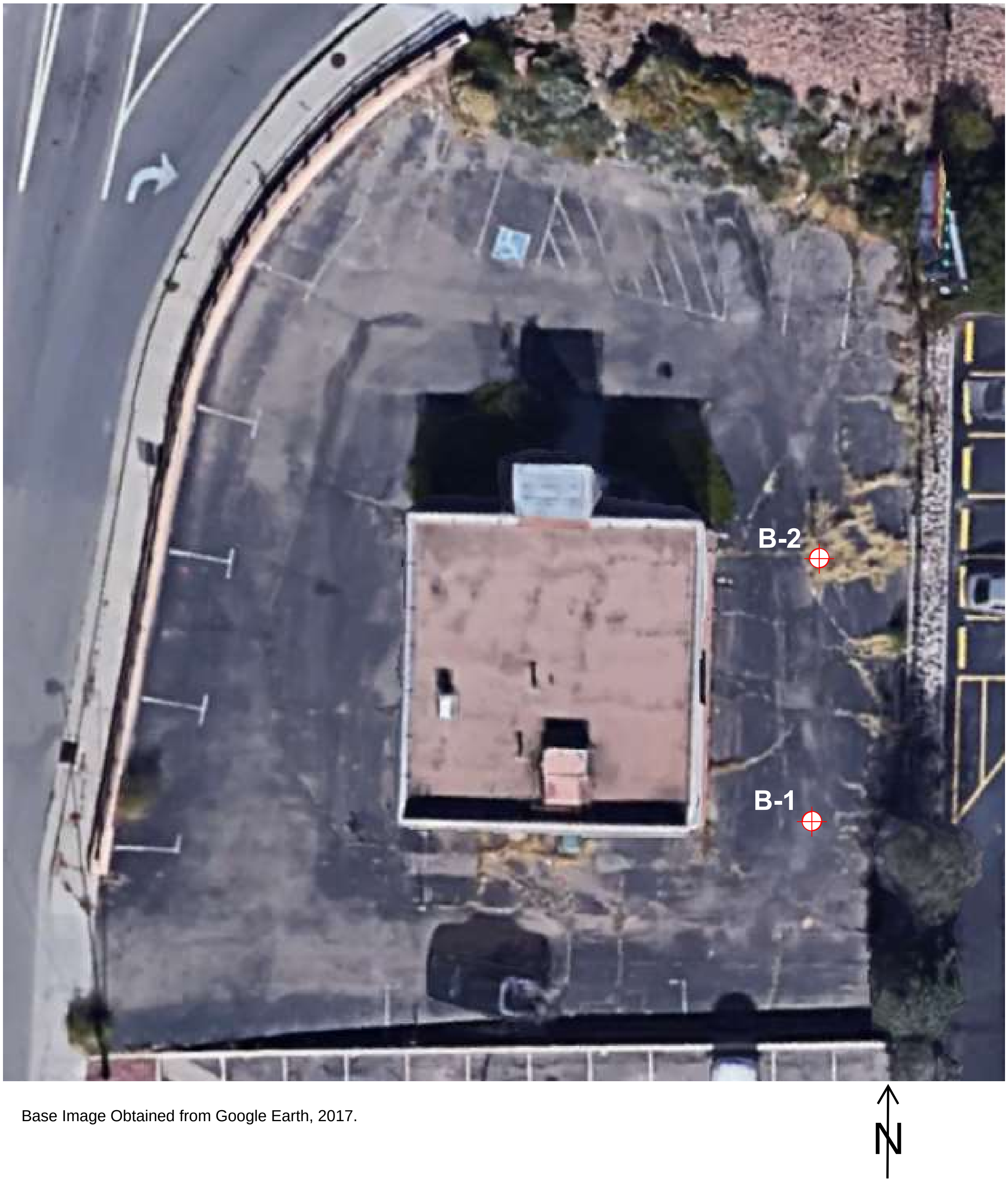
Figures



Base Drawing Obtained from www.mapquest.com, 2017.

N

VIVID Engineering Group	Project No: D17-2-075	**Vicinity Map**	Figure
	Date: Nov. 13, 2017		1
	Drawn by: WJB	Proposed Building Addition 908 W. US Hwy 50 Pueblo, Colorado	
	Reviewed by: BTM		



Base Image Obtained from Google Earth, 2017.

VIVID Engineering Group	Project No: D17-2-075	**Boring Location Plan**	Figure
	Date: Nov. 13, 2017		2
	Drawn by: WJB	Proposed Building Addition 908 W. US Hwy 50 Pueblo, Colorado	
	Reviewed by: BTM		

Attachment A

Boring Logs

Vivid Engineering Group, Inc.
1053 Elkton Drive
Colorado Springs, CO 80907
Telephone: 719-896-4356
Fax: 719-896-4357

BORING NUMBER B-1

CLIENT 908 Highway 50 Holdings, LLC
PROJECT NAME 908 US Hwy 50 West, Pueblo, CO
PROJECT NUMBER D17-2-075
PROJECT LOCATION 908 US Hwy 50 West, Pueblo, CO
DATE STARTED 10/31/17 **COMPLETED** 10/31/17
GROUND ELEVATION **HOLE SIZE** 4 inches
DRILLING CONTRACTOR Custom Auger Drilling
GROUND WATER LEVELS:
DRILLING METHOD 4" SSA
AT TIME OF DRILLING 22.00 ft
LOGGED BY S. Noonan **CHECKED BY** W. Barreire
AT END OF DRILLING ---
NOTES South end of lot
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0				0.2	**Asphalt - 2-inches**
				0.6	**Aggregate Base Course - 7-inches**
	GB		MC = 15.8% LL = 40 PL = 22	4.0	CLAY, reddish brown, moist, stiff to very stiff
5	MC	20-24	Sulfates = 1.283%	9.0	CLAYSTONE, reddish brown, moist, moderately hard to hard, calcareous deposits
10	MC	30-50/5"	MC = 12.1% DD = 121.5 pcf Swell = 2.5% when wetted under 1ksf load		SHALE, gray, dry to slightly moist, hard to very hard, calcareous deposits
15	MC	50/5"			
20	MC	50/2"			
				∇	
	SPT	50/1"		24.0	Bottom of borehole at 24.0 feet.

Vivid Engineering Group, Inc.
1053 Elkton Drive
Colorado Springs, CO 80907
Telephone: 719-896-4356
Fax: 719-896-4357

BORING NUMBER B-2

CLIENT 908 Highway 50 Holdings, LLC
PROJECT NAME 908 US Hwy 50 West, Pueblo, CO
PROJECT NUMBER D17-2-075
PROJECT LOCATION 908 US Hwy 50 West, Pueblo, CO
DATE STARTED 10/31/17 **COMPLETED** 10/31/17
GROUND ELEVATION **HOLE SIZE** 4 inches
DRILLING CONTRACTOR Custom Auger Drilling
GROUND WATER LEVELS:
DRILLING METHOD 4" SSA
AT TIME OF DRILLING --- None
LOGGED BY S. Noonan **CHECKED BY** W. Barreire
AT END OF DRILLING ---
NOTES North end of lot
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS AND REMARKS	GRAPHIC LOG	MATERIAL DESCRIPTION
0					0.2 **Asphalt - 2-inches**
	GB		MC = 16.2% LL = 37 PL = 19		CLAY, reddish brown, moist, stiff to very stiff
5	MC	9-17	MC = 16.1% DD = 114.7 pcf Swell = 0.3% when wetted under 1ksf load		4.0 CLAYSTONE, reddish brown, moist, firm to hard
10	MC	20-44			
15	MC	32-50/5"	MC = 13.4% DD = 120.9 pcf Swell = 2.9% when wetted under 1ksf load		15.0 SHALE, gray, dry to slightly moist, hard to very hard, calcareous deposits
20	MC	50/4"	MC = 11.4% DD = 114.7 pcf Swell = 3.3% when wetted under 1ksf load		
	SPT	50/2"			24.2

Bottom of borehole at 24.2 feet.

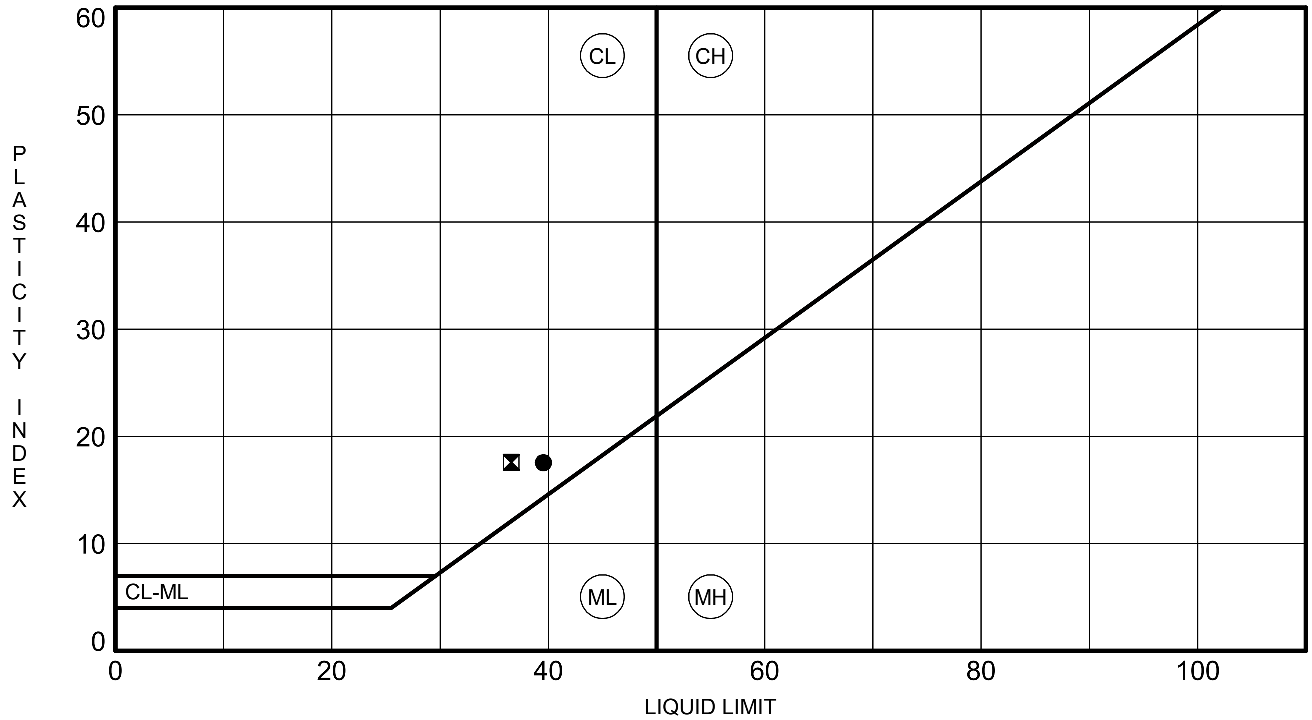
Attachment B

Geotechnical Laboratory Test Results

Vivid Engineering Group, Inc.
1053 Elkton Drive
Colorado Springs, CO 80907
Telephone: 719-896-4356
Fax: 719-896-4357

ATTERBERG LIMITS' RESULTS

CLIENT 908 Highway 50 Holdings, LLC
PROJECT NAME 908 US Hwy 50 West, Pueblo, CO
PROJECT NUMBER D17-2-075
PROJECT LOCATION 908 US Hwy 50 West, Pueblo, CO



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B-1**	**1.0**	**40**	**22**	**18**		
⊠	**B-2**	**1.0**	**37**	**19**	**18**		

Vivid Engineering Group, Inc.
1053 Elkton Drive
Colorado Springs, CO 80907
Telephone: 719-896-4356
Fax: 719-896-4357

SUMMARY OF LABORATORY RESULTS

CLIENT 908 Highway 50 Holdings, LLC

PROJECT NAME 908 US Hwy 50 West, Pueblo, CO

PROJECT NUMBER D17-2-075

PROJECT LOCATION 908 US Hwy 50 West, Pueblo, CO

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-1	1.0	40	22	18				15.8			
B-1	9.0							12.1	121.5		
B-2	1.0	37	19	18				16.2			
B-2	4.0							16.1	114.7		
B-2	14.0							13.4	120.9		
B-2	19.0							11.4	114.7		

Attachment C

Analytical Laboratory Testing (Sulfates)

Colorado Analytical LABORATORIES, INC.

Analytical Results

TASK NO: 171102071

Report To: Bill Barreire
Company: Vivid Engineering Group, Inc.
1053 Elkton Drive
Colorado Springs CO 80907

Bill To: Bill Barreire
Company: Vivid Engineering Group, Inc.
1053 Elkton Drive
Colorado Springs CO 80907

Task No.: 171102071
Client PO: D17-2-075

Date Received: 11/2/17
Date Reported: 11/9/17
Matrix: Soil - Geotech

Customer Sample ID B-1 @ 4 Ft
Lab Number: 171102071-01

Test	Result	Method
Sulfate - Water Soluble	**1.283 %**	AASHTO T290-91/ ASTM D4327

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.
ASTM - American Society for Testing and Materials.
ASA - American Society of Agronomy.
DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.

DATA APPROVED FOR RELEASE BY

240 South Main Street / Brighton, CO 80601-0507 / 303-659-2313
Mailing Address: P.O. Box 507 / Brighton, CO 80601-0507 / Fax: 303-659-2315

Attachment D

Important Information About This Geotechnical Engineering Report

Important Information about This

Geotechnical-Engineering Report

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

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

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

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

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

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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