



301 North Howes • P.O. Box 503  
Fort Collins, Colorado 80521-0503  
(970) 484-0359 Fax: (970) 484-0454

November 24, 2003

The Genesee Company  
9990 Park Meadows Drive  
Lone Tree, Colorado 80124

Attn: Mr. Bob Van Dop

Re: **Geotechnical Engineering Report**  
**Waterfront First Subdivision – Phase 1**  
**Lot 23, Block 1**  
**Loveland, Colorado**  
**Terracon Project No. 20025125**

Terracon has completed a geotechnical engineering exploration for a proposed single family residence to be located on the above referenced lot within the Waterfront First Subdivision – Phase 1, in Loveland, Colorado. The purpose of these services is to provide geotechnical-engineering recommendations for design of foundations, slab on grade, and perimeter drainage systems. For further information and additional geotechnical engineering recommendations please refer to our "Geotechnical Engineering Report" for the Waterfront First Subdivision – Phase 1, dated February 18, 2003.

The site exploration included one test boring drilled near the center of the lot as requested. A swell-consolidation test was performed on a relatively undisturbed sample obtained at an approximate depth of 7-feet below existing lot grade. The Log of Boring describing the soil, bedrock and groundwater conditions along with the laboratory test results are attached with this report.

The subsurface soils encountered on this lot consisted of approximately 7-1/2 feet of sandy lean clay overlot grading fill material underlain by native sandy lean clay which extended to the bedrock below. Claystone/siltstone bedrock was encountered at an approximate depth of 14-feet and extended to the depth explored, approximately 25-feet. The native soils exhibited moderate bearing capability and moderate swell potential characteristics.

It is our understanding the proposed residence will be constructed having full depth basement construction. Therefore, based on the properties of the soils present on this lot, Terracon recommends the proposed structure be supported by conventional type spread footings bearing on a minimum 3-foot layer of over-excavated and replaced controlled fill material. Slab-on-grade construction is feasible provided the recommendations set forth in this report are followed.

## **FOUNDATION RECOMMENDATIONS**

### **Conventional Spread Footing Foundation Systems**

The proposed residence may be supported by a conventional-type spread footing foundation system bearing upon over-excavated and replaced on-site soils, or other approved fill material. Due to the moderate expansive potential of the on-site soils, Terracon recommends the footings be placed on a minimum 3-foot depth of over-excavated and replaced on-site soils, or other approved fill material, compacted to at least 95 percent of Standard Proctor Density ASTM D698. Footings bearing upon the over-excavated and replaced fill material may be designed for a net allowable bearing pressure of 2,000 psf. In addition, the footings should be sized to maintain a minimum dead load pressure of 500 psf. The approved fill material should be placed in uniform lifts and moisture conditioned at or near optimum moisture content.

### **Lower Level Construction**

Groundwater was not encountered on the lot during initial drilling operations or when checked on December 6, 2002. Therefore, full-depth basement construction is considered acceptable. To reduce the potential for groundwater and/or surface water infiltration to enter the basement of the residence, installation of a dewatering system is recommended. The drainage system should be constructed around the exterior perimeter of the basement foundation, and sloped at a minimum 1/8 inch per foot to a suitable outlet, such as a sump and pump system.

The drainage system should consist of a 4-inch diameter perforated pipe, embedded in free-draining gravel, placed in a trench at least 12-inches in width. Gravel should extend a minimum of 3-inches beneath the bottom of the pipe, and at least 1-foot above the bottom of the foundation wall. The gravel should be covered with drainage fabric prior to placement of foundation backfill.

Backfill placed around the outside perimeter of the structure should be placed in uniform lifts; moisture conditioned to optimum moisture content and mechanically compacted to 95% of Standard Proctor Density ASTM 698, after the walls have been laterally braced.

### **Floor Slab Design and Construction**

If conventional-type slab on grade construction is utilized on this lot, differential slab movement on the order of 1 to 3 inches or more is possible. If slab movement cannot be tolerated for any proposed slab, a structural floor system is recommended. If basements are to be finished during the initial construction phases, we strongly recommend the use of a structural floor system.

An alternative to the structural floor system is a conventional-type slab on grade bearing upon a minimum of 4-feet of non-expansive moisture controlled over-excavated and replaced material. This procedure will not fully eliminate the possibilities of slab heave; but movements should be reduced and tend to be more uniform.

### Surface Drainage

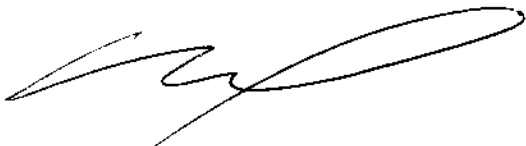
Positive drainage should be provided during construction and maintained throughout the life of the proposed residence. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 10 percent for at least 10-feet from perimeter walls. Backfill against foundations, exterior walls and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration. Downspouts, roof drains or scuppers should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems should not be installed within 5-feet of foundation walls.

### General Comments

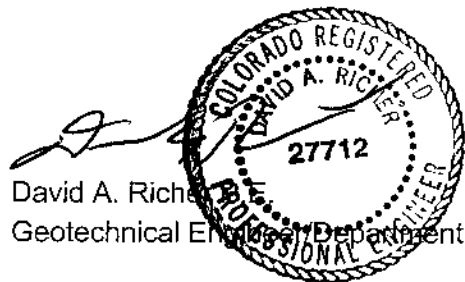
It is recommended that the homeowner reads [A Guide to Swelling Soils for Colorado Homebuyers and Homeowners](#) – Colorado Geological Survey – Special Publication 43 to attain more knowledge about owning a residence constructed in a region of potentially expansive soils.

We appreciate the opportunity to be of service to you on this phase of your project. If you have any questions, or if we may be of further service to you, please do not hesitate to contact us.

Sincerely,  
**TERRACON**



Daniel R. Lambert, P.E.  
Geotechnical Engineer



David A. Richter  
Geotechnical Engineer / Department Manager

Copies to: Addressee (5)

Enclosures (2): Log of Boring (1)  
Swell-Consolidation Curve (1)

# LOG OF BORING NO. L23-B1

CLIENT <p style="text-align: center;">The Genessee Company</p>	ARCHITECT/ENGINEER
SITE <p style="text-align: center;">Loveland, Colorado</p>	PROJECT <p style="text-align: center;">Waterfront 1st Subdivision</p>

GRAPHIC LOG	DESCRIPTION	DEPTH, ft	USCS SYMBOL	SAMPLES			TESTS	
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %
0	<b>FILL MATERIAL</b> Sandy Lean Clay Brown, moist, very stiff to stiff  * Claystone Bedrock Fragments Encountered	5						
7.5	<b>SANDY LEAN CLAY</b> Brown, tan, moist, calcareous, very stiff	7.5						
14	<b>WEATHERED CLAYSTONE/SANDSTONE/SILTSTONE</b> Gray, black, olive, rust, moist, moderately hard  <b>CLAYSTONE/SANDSTONE/SILTSTONE</b> Gray, black, olive, rust, moist, hard to very hard	14						
14.5	<b>WEATHERED CLAYSTONE/SANDSTONE/SILTSTONE</b> Gray, black, olive, rust, moist, moderately hard  <b>CLAYSTONE/SANDSTONE/SILTSTONE</b> Gray, black, olive, rust, moist, hard to very hard	14.5						
20	<b>BOTTOM OF BORING</b>	20						
20	<b>BOTTOM OF BORING</b>	20						

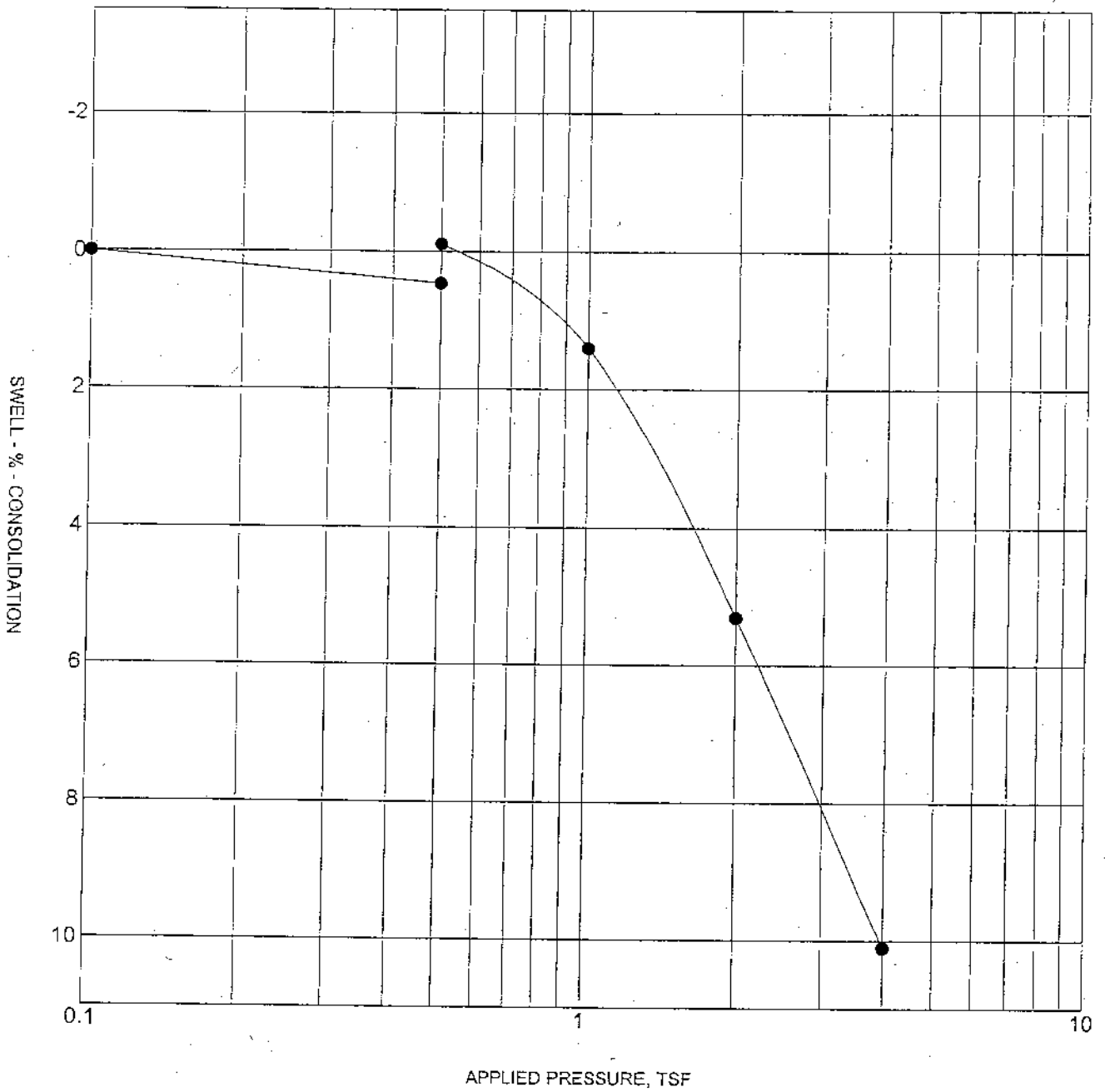
The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ DRY	WD	▽ DRY AB
WL	▽	▽	
WL Water Level Checked on 12/6/2002			



BORING STARTED	12-5-02
BORING COMPLETED	12-5-02
RIG	CME-55
FOREMAN	DL
APPROVED	DAR
JOB #	20025125

BOREHOLE 99 20025125.LOTS.GPJ TERRACON.GDT 12/1/02



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● L23-B1      7.0ft	FILL: SANDY LEAN CLAY	104	10

Notes:

**Terracon**

**CONSOLIDATION TEST**

Project: Waterfront 1st Subdivision  
 Site: Loveland, Colorado  
 Job #: 20025125  
 Date: 12-18-02