October 2, 2014

Black Dog Holding, LLC
c/o Rob Hawkins Architects
P.O. Box 771743
Steamboat Springs, CO 80477

Attn: Mr. Robert Hawkins

Re: Geotechnical Subsurface Exploration Report
Proposed Ostragnai Residence
Lot 4, Murphy-Larsen Ranch
Routt County, Colorado
Soilogic Project # 14-4004

Dear Rob,

Soilogic, Inc. (Soilogic) has completed the geotechnical subsurface exploration you requested for the proposed Ostragnai residence to be constructed within Lot 4 of the Murphy-Larsen Ranch in Routt County, Colorado. The results of our subsurface exploration and pertinent geotechnical engineering recommendations are included with this report.

PURPOSE AND SCOPE OF WORK

The purpose of this exploration and associated reporting is to provide geotechnical design and construction recommendations for the proposed residence and other site improvements. Soilogic's scope of work included field exploration, laboratory testing and the preparation of this report summarizing the data obtained and outlining our recommendations for foundation design and construction. The conclusions and recommendations outlined in this report are based on the results of field and laboratory explorations and Soilogic's experience with subsurface conditions and similar construction in this area.

PROPOSED CONSTRUCTION

Based on our discussions with the project architect, Soilogic understands the proposed residence will generally consist of a one to two-story wood framed structure over a partial full depth walkout basement and attached garage. Residence structure foundations are anticipated to bear at depths ranging from 3 to 10 feet below existing grades. Site grading is unknown at this time, however, based on site topography, Soilogic assumes unretained cuts and fills on the order of 3 to 5 feet will be required to develop finish site grades.

Foundation loads are expected to be relatively light, with continuous wall loads less than 3 kips per lineal foot and individual column loads less than 50 kips. If the assumed construction and loading conditions vary substantially from those assumed, Soilogic should be contacted to reevaluate the recommendations in this report.

SITE DESCRIPTION

The project site is Lot 4 of the Murphy-Larsen Ranch Subdivision consisting of approximately 50 acres of land off Hannah's Way and County Road 62 in Routt County, Colorado. At the time of Soilogic's site exploration, the proposed building site was vacant and undisturbed and a gravel surfaced driveway had been developed to access the building envelope. Site vegetation consisted of native grasses, weeds, deciduous brush and scattered aspen trees.

Site topography appeared fairly consistent and generally sloped moderately down to the northeast at approximately 8 percent. A maximum elevation difference of approximately 5 feet appears to exist across the building site.

FIELD EXPLORATION AND SUBSURFACE CONDITIONS

A field exploration program consisting of the drilling of two (2) exploratory test holes were advanced at the project site to provide subsurface information at the proposed building site and On-site Wastewater Treatment System (OWTS) absorption field location. The approximate test hole locations are shown on Figure 1.

The subsurface conditions encountered in the test holes were variable and generally consisted of a layer of topsoil and vegetation overlying natural sandy lean clay/clayey sand and claystone bedrock to the maximum depth explored, 30 feet. Graphic logs of the exploratory test holes are shown on Figure 2.

The topsoil and vegetation layer was approximately 24 inches in thickness at the building site and 30 inches at the proposed OWTS site. Sandy lean clay/clayey sand was encountered beneath the topsoil and organics and was low to moderately plastic, very stiff, to hard and dense to very dense, fine to medium grained, moist to wet and reddish brown to gray in color. Samples of the lean clay/clayey sand classified as SC-CL and CL soils in accordance with the Unified Soil Classification System (USCS). Swell-consolidation tests conducted on samples of the …

Claystone bedrock was encountered beneath the clay at a depth of approximately 27 feet. The bedrock was highly plastic, medium hard to hard, moist and mottled light to dark gray in color.

Groundwater was encountered at a depth of 19 feet in the test hole at the time of drilling and was measured at a depth of 13 feet when checked one day after drilling.

Groundwater levels will vary seasonally and over time based on weather conditions, site development, irrigation practices and other hydrologic conditions. Perched and/or trapped groundwater conditions may also be encountered at times throughout the year. Perched water is commonly encountered in soils overlying less permeable soil layers and/or bedrock.

ANALYSIS AND RECOMMENDATIONS

Geologic Hazards

Geologic hazards associated with this site include expansive soils and slope stability. Based on the proposed construction, subsurface conditions encountered in the test holes

and laboratory test results, Soilogic believes the sandy lean clay will provide adequate support for lightly loaded residential foundations. Swell-consolidation testing indicates the clay soils will display a low swell potential under loading and saturation conditions; however, total and differential foundation movements should be within tolerable limits provided the design, construction and maintenance recommendations contained herein are observed.

Based on Soilogic personnel's previous experience at Murphy–Larsen Ranch, we believe the site lies within a suspected slope failure complex that extends well beyond the subject property boundaries. A slope failure complex can be described an individual or multiple coalesced slope failures that cannot be distinguished individually and display morphology common to landslides. Although mostly obscured by erosion, remnant hummocky topography that is representative of historic slope movement is common to the Murphy-Larsen subdivision. Relative age of past movement is unknown and could range from several hundred to thousands of years. Evidence of recent slope movement were not observed at the subject or other nearby properties within the subdivision.

An assessment of long-term slope stability is beyond the scope of this report. However, based on Soilogic's experience and site observations, we believe slope stability should not affect foundations, site development or performance of existing or proposed slopes. Soilogic believes structural performance related to expansive soil conditions should be acceptable provided our recommendations are followed and proper drainage is provided and maintained throughout the life of the project.

Foundations

Based on Soilogic's understanding of the proposed construction, potential foundation bearing depths will vary from approximately 3 to 8 feet beneath existing grades. Based on the results of the field exploration, it appears that sandy, lean clay/clayey sand will be encountered at proposed foundation grades.

Based on Soilogic's experience, Soilogic recommends the proposed residence be supported by continuous spread footing and isolated pad foundations bearing on natural, undisturbed sandy lean clay/ clayey sand and designed and constructed as outlined below:

1. Soilogic recommends foundation footings be placed on undisturbed sandy lean clay/clayey sand and designed using a maximum net allowable soil bearing pressure of 3,500 psf. As a precaution and to resist uplift forces from expansive soils, we recommend all footings be designed to maintain a minimum dead load pressure of 1,000 psf.
2. Footings exposed to freezing or frost conditions should be designed with adequate soil cover to prevent freezing. A cover depth of 48 inches is recognized by the local building authority as the minimum value for frost protection.
3. Soilogic recommends continuous footings have a minimum width of 12 inches and isolated pad foundations have a minimum width of 24 inches in order to facilitate construction and reduce the potential for development of eccentrically loaded conditions.
4. Foundation walls and grade beams should be designed to span an unsupported distance of 10 feet or the distance between pads.
5. Foundation resistance to lateral loads can be developed by passive pressure against footings and walls and sliding resistance between footings and floor slabs and the underlying soils and bedrock. Soilogic recommends passive pressures be computed using an equivalent fluid pressure value of 250 pcf and friction resistance be calculated using a coefficient of friction of 0.35 times structural dead loads. The recommended passive equivalent fluid pressure value and coefficient of friction do not include a factor of safety.
6. Soilogic should be retained to observe foundation excavations to verify the subsurface conditions are consistent with those assumed.

Soilogic estimates total and differential settlement of foundations designed and constructed as outlined above and resulting from the assumed structural loads will be less than 1 inch.

Interior Building Floor Slabs

Soilogic understands slab-on-grade construction is preferred for the residence lower level and garage. Based on the results of the subsurface and laboratory exploration, Soilogic believes slab-on-grade construction can be used for finished living areas and the garage, provided the risk of differential slab movement is recognized and the design and construction precautions outlined below are observed.

1. Floor slabs should designed and constructed as floating slabs, separated from foundation walls, columns and plumbing intrusions by the use of cellotex or another approved material.
2. Interior partition walls should not bear on floor slabs, but should be hung from interior framing and constructed with a slip joint at the wall-to-slab connection. The slip joint should provide for a minimum of 1½ inches of vertical movement.
3. Underslab subgrade (natural soils or fill) areas should be graded to drain to the building perimeter to prevent the accumulation of water.
4. If fill is required to bring underslab areas to grade, underslab fill materials should consist of either approved Low Volume Change (LVC) soils or imported nonexpansive materials and compacted to at least 95% of the maximum standard Proctor density within -1% to +3% of optimum moisture content (ASTM D698). The on-site lean clay/clayey sand should be suitable for use beneath floor slabs but will likely require moisture conditioning and processing prior to use.
5. Floor slabs should be underlain by a minimum 6-inch layer of free draining gravel. The gravel layer will help provide uniform support and aid in underslab drainage.

The implementation of the above recommendations will not eliminate floor slab movement in the event that the underslab soils undergo significant moisture changes. Soilogic estimates floor slab movement of up to 1 inch and associated distress is possible. If this value is not acceptable, Soilogic recommends the use of structural floors supported above a crawl space.

Perimeter Drainage Systems

Soilogic recommends a perimeter drainage system be installed at the building perimeter to enhance site drainage, help reduce the potential for development of hydrostatic pressures behind the below-grade walls and reduce the potential for water infiltration beneath footings and into underslab or crawl space areas.

A perimeter drainage system should generally consist of a 4-inch perforated PVC drain pipe covered by a minimum of twelve (12) inches of free-draining gravel and covered with filter fabric (Mirafi 140N or equivalent) to prevent intrusion of fines. The high point of the drain pipe should be placed at approximate footing grade around the exterior of the lower level perimeter foundation walls, constructed with a minimum 1% slope and discharge to a daylighted outfall. Minimum burial depths of 24 inches are acceptable for at-grade floor slab areas. Soilogic can provide perimeter drainage system design and details upon request and after building plans are available.

Lateral Earth Pressures and Foundation Backfill

Lateral Earth Pressures: Foundations should be designed to resist lateral pressures associated with foundation backfill materials and existing site soils. Materials affecting lateral pressures are located within the area extending from the base of the foundation wall upward at a 1(H) to 1(V) angle. Recommended lateral earth pressure design values to be used in foundation wall design are provided in Table A shown below. All values presented assume drained conditions (no hydrostatic loads) and sufficient wall rotation is achieved for activation of active earth pressure conditions.

Table A

Design Pressure Condition	Equivalent Fluid Pressure (pcf)
Active	40
At-Rest	60
Passive	250

Variables that affect active lateral earth pressures include but are not limited to the classification and swell potential of the backfill soils, backfill compaction and geometry, wetting of the backfill soils, surcharge loads and point loads developed in the backfill materials. The recommended equivalent fluid pressure values do not include a factor of safety or an allowance for hydrostatic loading. Use of expansive soil backfill, excessive compaction of the wall backfill or surcharge loads placed adjacent to the foundation walls can add to the lateral earth pressures causing the equivalent fluid pressure values used in design to be exceeded.

Foundation Backfill: Backfill placed adjacent to below-grade walls should consist of LVC potential and relatively impervious soils free from organic matter, debris and other objectionable materials. The existing fill and natural site lean clay/clayey sand should be suitable for reuse as foundation backfill, but will likely require moisture conditioning prior to placement and compaction. Soilogic recommends foundation backfill soils be uniformly placed in maximum 9-inch loose lifts, moisture conditioned to within ±2% of optimum moisture content and compacted to at least 95% of the maximum standard Proctor dry density (ASTM D698).

Foundation wall backfill operations should be conducted only after proper bracing and support is provided. Structural engineer approval is recommended. Excessive lateral stresses resulting in distress and damage to foundation walls can occur when a lack of bracing is in place or heavy mechanical compaction equipment is used. Soilogic recommends compaction of unbalanced foundation wall backfill soils be completed using light mechanical or hand compaction equipment.

Exterior Flatwork

Exterior flatwork can be supported on natural site lean clay/clayey sand, on-site fill materials or imported granular materials uniformly placed and compacted in 9-inch loose lifts to at least 95% of the maximum standard Proctor density within 2% of optimum moisture content (ASTM D698). All materials should be approved by Soilogic prior to use.

Subgrade soils expected to receive flatwork concrete should be evaluated closely immediately prior to concrete placement. If areas of disturbed, wet and softened, or dry subgrade soils are encountered at that time, reworking of those materials or removal/ replacement procedures may be required.

Drainage

Positive drainage is imperative for satisfactory long-term performance of the proposed residence foundation and associated site improvements. Soilogic recommends positive drainage be developed away from the structure during construction and maintained throughout the life of the site improvements. Twelve (12) inches of fall in the first 10 feet away from the building is recommended. Shallower slopes could be considered in hardscape areas. In the event that some settlement of the backfill soils occurs adjacent to the residence, the original grade and associated positive drainage outlined above should be immediately restored.

Care should be taken in the planning of landscaping to avoid features which could result in the fluctuation of the moisture content of the foundation bearing and/or flatwork subgrade soils. We recommend watering systems be placed a minimum of 5 feet away from the perimeter of the site structure and be designed to discharge away from all site improvements. Gutter systems should be considered to help reduce the potential for water ponding adjacent to the residence, with the gutter downspouts, roof drains or scuppers extended to discharge a minimum of 5 feet away from structural, flatwork and pavement elements. Water which is allowed to pond adjacent to the site improvements can result in unsatisfactory performance of those improvements over time.

Site Grading

Soilogic understands unretained cuts and fills of up to 10 feet in height will be constructed for driveway and general site development. Based on the proposed construction, Soilogic recommends the following:

1. Unretained cuts and fills should be constructed to a 2(H) to 1(V) or flatter slope configuration. Shallower slopes are often desirable to help facilitate revegetation efforts.
2. Fills materials may consist of on-site lean clay/clayey sand and should be uniformly placed and compacted in 9-inch loose lifts to at least 95% of the maximum standard Proctor density within 2% of optimum moisture content (ASTM D698). All fills should be benched or keyed into hillsides exceeding 25 percent grade using minimum 4-foot benches.
3. Proper drainage should be provided and maintained around all cuts, fills, buildings and driveway surfaces.
4. All disturbed areas should be protected from erosion by revegetation or other appropriate means. Areas of concentrated drainage should be protected from erosion by use of rip rap or other appropriate methods.

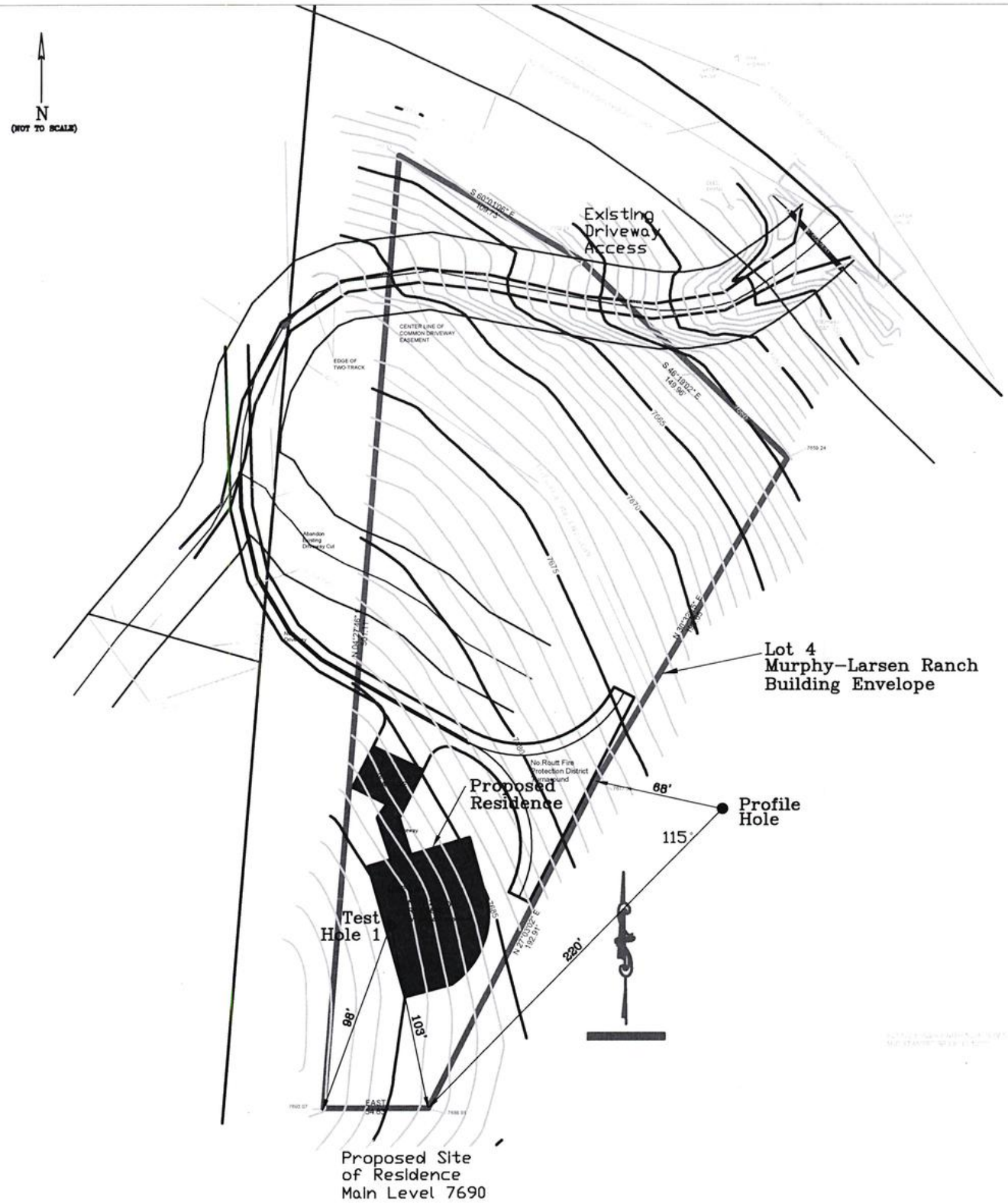
GENERAL COMMENTS

This report was prepared based upon the data obtained from the completed site exploration, engineering analysis and Soilogic's experience with similar construction in this area. The subsurface conditions encountered during this investigation provides an indication of subsurface conditions at the excavation location only. Variations in subsurface conditions can occur in relatively short distances away. This report does not reflect any variations which may occur across the site or away from the excavation. If variations in the subsurface conditions anticipated become evident, the geotechnical engineer should be notified immediately so that further evaluation can be completed and when warranted, alternative recommendations provided.

The scope of services for this project does not include either specifically or by implication any biological or environmental assessment of the site or identification or prevention of pollutants or hazardous materials or conditions. Other studies should be completed if concerns over the potential of such contamination or pollution exist.

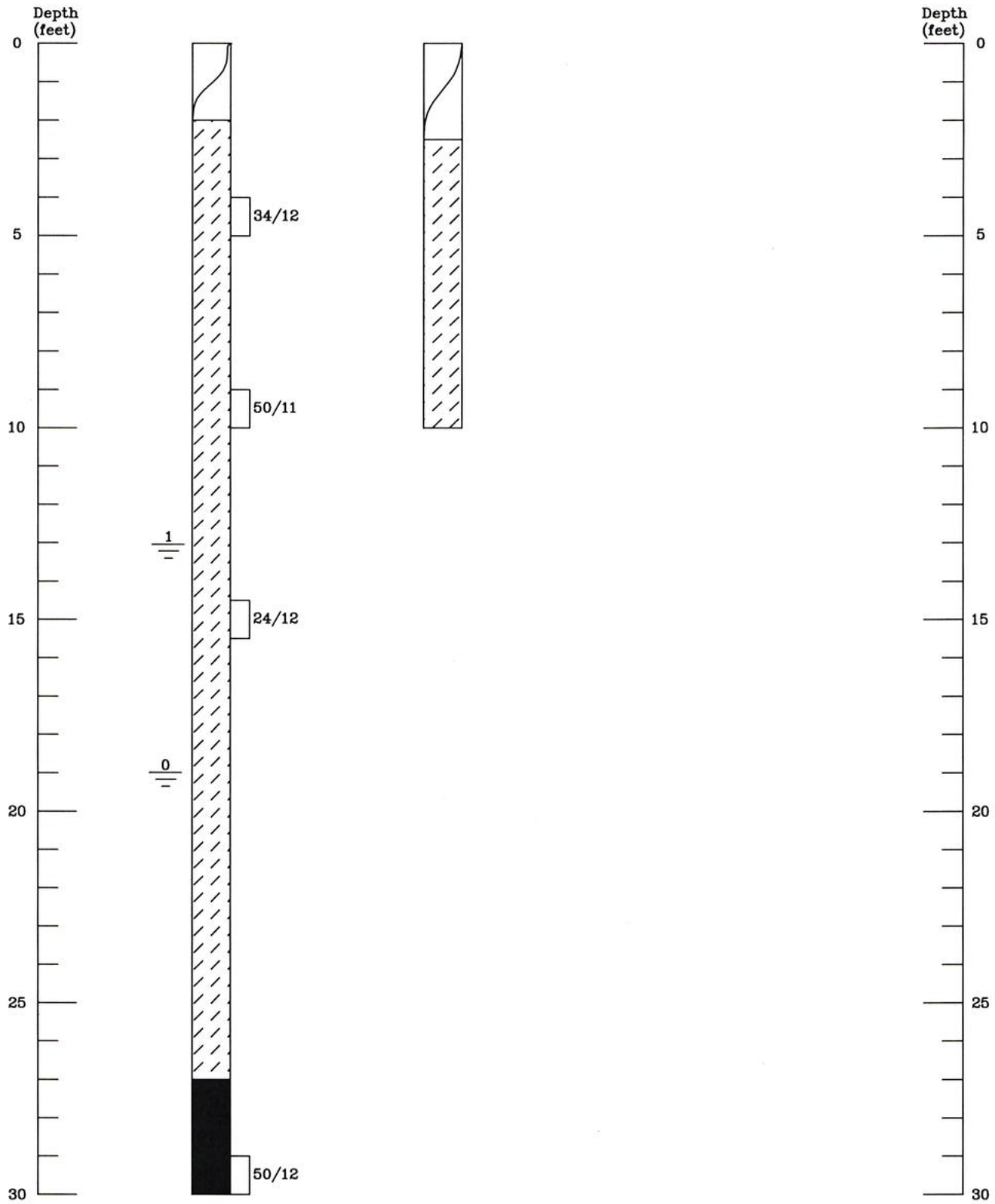
Soilogic should be retained to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. Soilogic should also be retained to provide testing and observation services during construction to help evaluate compliance with project plans and specifications.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with the generally accepted standard of care for the profession. No warranties express or implied, are made. The conclusions and recommendations contained in this report should not be considered valid in the event that any changes in the nature, design or location of the project as outlined in this report are planned, unless those changes are reviewed and the conclusions of this report modified and verified in writing by the geotechnical engineer.



Site Plan/Location of Test Holes

Project Name: Ostragnai Residence	SOILOGIC Steamboat Springs Hayden•Greeley	
Location: Lot 4, Murphy-Larsen Ranch, Routt County	Project No.: 14-4004	Drawn/Checked:HS/HS
	Date: 9/29/14	Figure No.: 1



Logs of Test Holes

Project Name: Ostragnai Residence	SOILOGIC Steamboat Springs Hayden • Greeley	
Location: Lot 4, Murphy–Larsen Ranch, Routt County	Project No.: 14–4004	Drawn/Checked:HS/HS
	Date: 9/29/14	Figure No. 2

Legend

TOPSOIL & ORGANICS.

LEAN CLAY/CLAYEY SAND: low to moderately plastic, very stiff to hard, moist to wet and reddish brown to gray.

CLAYSTONE: Hard to very hard, moist and mottled light to dark gray.

California barrel sample.

25/12 Drive sample blow count. Indicates 25 blows from a 140–pound hammer falling 30–inches was required to drive the sampler 12 inches.

Indicates depth groundwater was encountered and number of days after drilling measurement was taken.

Notes

1) Test holes were drilled on 9/15/14 with a track mounted CME 45 drill rig using 4–inch diameter continuous flight augers.

2) Test hole locations were determined by taping from staked building envelope corners and features shown on the site plan provided.

3) Test hole elevations were determined by interpolation between contours shown on the site plan provided.

4) Lines between materials types indicated on the test hole logs are approximate and transitions may be gradual.

Legend and Notes

Project Name: Ostragnai Residence	SOILOGIC Steamboat Springs Hayden·Greeley	
Location: Lot 4, Murphy–Larsen Ranch, Routt County	Project No.: 14–4004	Drawn/Checked:HS/HS
	Date: 9/29/14	Figure No. 3

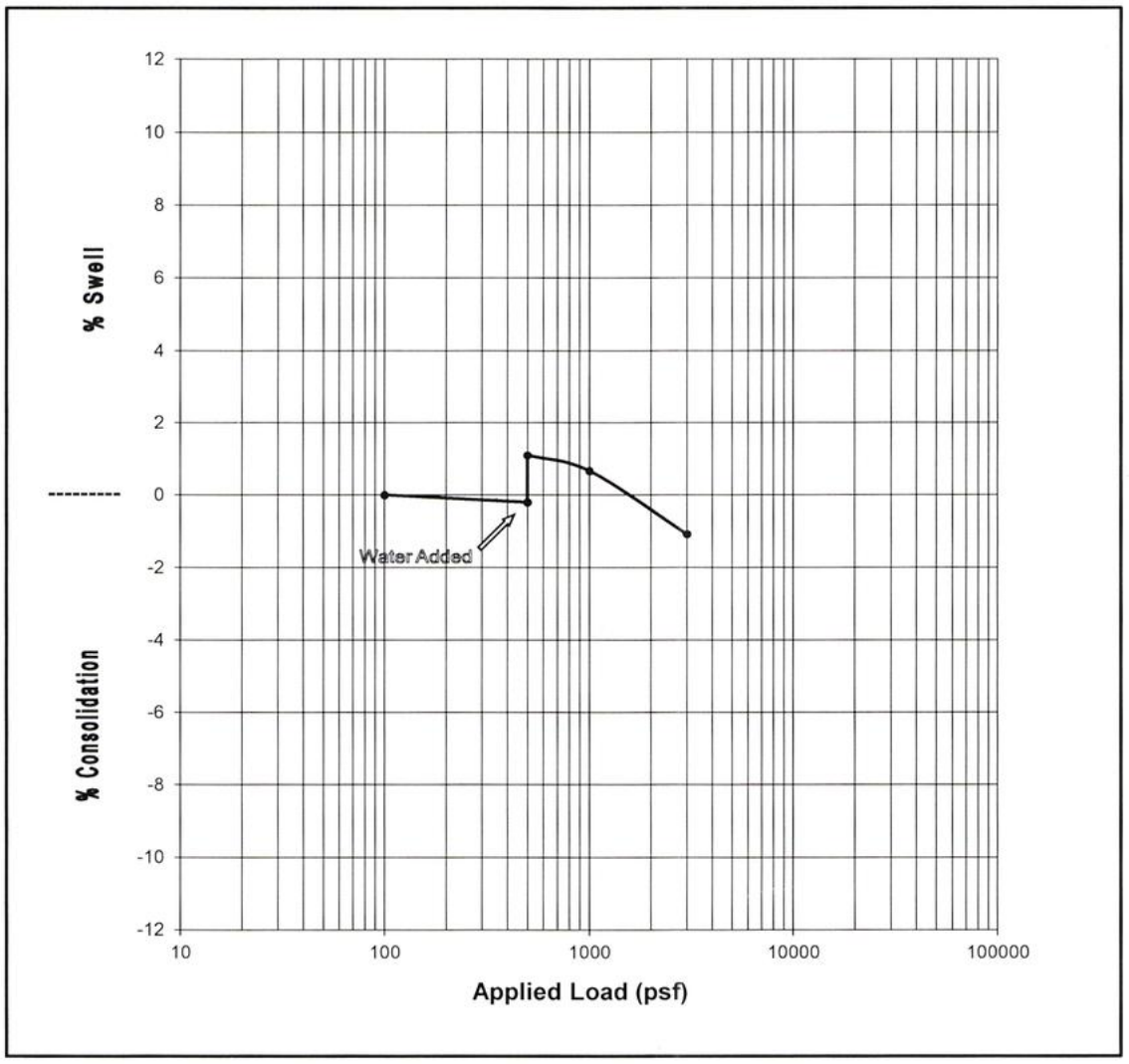
OSTRAGNAI RESIDENCE

LOT 4, MURPHY-LARSON RANCH, ROUTT COUNTY, CO

Project # 14-4004

September 2014

SWELL/CONSOLIDATION TEST SUMMARY



Sample ID: TH-1 at 4'

Sample Description: Sandy Lean Clay/Clayey Sand (CL-SC)

Initial Moisture	14.5%	Liquid Limit	32
Final Moisture	20.5%	Plasticity Index	9
% Swell @ 500 psf	1.3%	% Passing #200	49.0%
Swell Pressure	1,100 psf	Dry Density	111.8 pcf

SOILOGIC

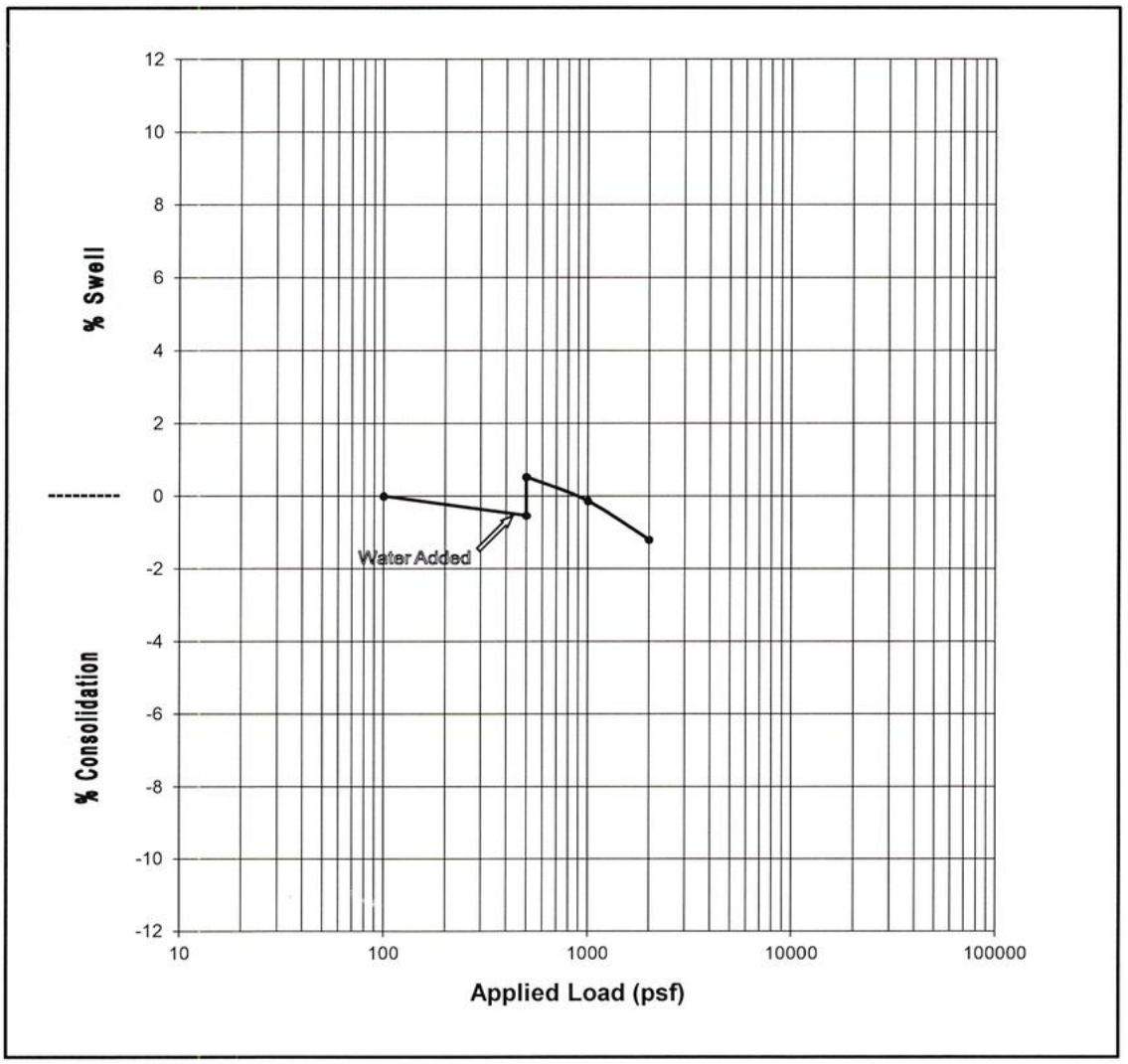
OSTRAGNAI RESIDENCE

LOT 4, MURPHY-LARSON RANCH, ROUTT COUNTY, CO

Project # 14-4004

September 2014

SWELL/CONSOLIDATION TEST SUMMARY



Sample ID: TH-1 @ 9'

Sample Description: Sandy Lean Clay

Initial Moisture	17.6%	Liquid Limit	43
Final Moisture	22.1%	Plasticity Index	25
% Swell @ 500 psf	1.1%	% Passing #200	87.0%
Swell Pressure	800 psf	Dry Density	110.0 pcf

SOILOGIC

Soilogic appreciates the opportunity to be of service to you on this project. If you have any questions concerning the enclosed information or if we can be of further service to you in any way, please do not hesitate to contact us.

Very Truly Yours,
Soilogic, Inc.

Harold Schlicht, P.E.
Senior Project Engineer

Reviewed by:

Wolf von Carlowitz, P.E.
Principal Engineer