June 13, 2022

Feathered Elk Ranch, LLC
c/o Marc Fraoli
AHL
PO Box 770133
Steamboat Springs, Colorado 80477

Re: Geotechnical Subsurface Exploration
Proposed Feathered Elk Ranch Residence
26105 County Road 35B
Routt County, Colorado
Western Slope Geotech Project No. 22-1036

Dear Marc,

Western Slope Geotech, Inc. (WSG) has completed the geotechnical subsurface exploration you requested for the proposed residence to be constructed within the Feathered Elk Ranch property located at 26105 County Road 35B, Routt County, Colorado. The results of our subsurface exploration, laboratory testing 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 residential structure and other associated site improvements. In addition, a site and soil evaluations was conducted for the purposes of site characterization for a potential On-site Wastewater Treatment System (OWTS). WSG'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 and support of floor slabs and exterior flatwork. The conclusions and recommendations outlined in this report are based on the results of field exploration, laboratory testing and WSG's experience with subsurface conditions and similar construction in this area. The results of the OWTS site and soil evaluation and design will be provided in a separate report.

PROPOSED CONSTRUCTION

Based on discussions with the client, WSG understands the proposed residence will generally consist of a two-story wood and timber framed structure with no basement and over a crawl space. We anticipate lower floor elevation slightly above existing site grades. A site plan showing an approximate building footprint and other existing and proposed site features is presented on Figure 1.

WSG also assumes that site grading would be generally minor could include unretained fill slopes up to three feet in height for site development.

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 30 kips. If the assumed construction and loading conditions vary substantially from those assumed, WSG should be contacted to reevaluate the recommendations in this report.

SITE DESCRIPTION

The project site is situated approximately 2,100 feet west-southwest of the existing main ranch residence located at 26105 County Road 35B, Routt County, Colorado. The site is accessed by an existing two-track dirt roadway between the existing ranch residence and proposed building site.

The proposed building site consists of vacant and undisturbed rural land used primarily for agricultural purposes. Site vegetation consisted of grasses, weeds, sagebrush and scattered deciduous brush.

The proposed building site occupies the crest of a low topographic knoll. Site topography was variable and generally sloped away from the site in all directions at approximately 2 percent. Based on site observations, it appeared that a maximum elevation difference of approximately one to two feet is likely across the building site.

FIELD EXPLORATION AND SUBSURFACE CONDITIONS

WSG's field exploration program consisted of the excavation and observation of four (4) exploratory test and profile pits. The test/profile pits were advanced to obtain information of the subsurface profile, groundwater conditions and obtain material samples for laboratory testing. Approximate test pit locations are shown on Figure 1.

The subsurface conditions encountered in the test pits were variable and generally consisted of a layer of natural topsoil and organics overlying natural gravel, cobbles and boulders to the maximum depth explored, 6 feet below existing ground surface. Graphic logs of the exploratory test/profile pits and associated legend and notes are shown on Figure 2.

A layer of topsoil and organics was encountered at the ground surface in all test pits and was estimated at approximately 12 to 18 inches in thickness.

Natural gravel, cobbles and boulders were encountered beneath the topsoil all test pits. The gravel, cobbles and boulders were sandy, slightly silty, non-plastic, medium dense, moist and brown. Samples of the sandy gravel matrix material classified as GW and GW-GM soils in accordance with the Unified Soil Classification System. Laboratory test results are summarized on Table 1.

Groundwater seepage was not observed in the test/profile pits at the time of excavation. Groundwater levels will vary seasonally and over time based on seasonal runoff conditions, 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

General

Based on WSG's understanding of proposed construction and subsurface conditions encountered in the test pits, we anticipate that natural gravel, cobbles and boulders will be encountered at proposed foundation grades. These materials should provide adequate bearing for spread footing foundations and floor slabs.

Irregular excavations are likely due to coarse grained materials with cobbles and boulders. Minor subexcavation and structural backfill of foundation and slab areas should be anticipated to produce uniform grades suitable for concrete placement.

Foundations

Based on our understanding of proposed construction, subsurface conditions encountered during the field exploration, laboratory test results and WSG's experience, we recommend the proposed residence be supported by continuous spread footing and isolated pad foundations bearing on natural gravel, cobbles and boulders or on structural fill placed over natural, undisturbed gravel, cobbles and boulders and designed and constructed as outlined below:

1. WSG recommends foundation footings be placed on undisturbed gravel, cobbles and boulders or structural fill placed over natural, undisturbed gravel and designed using a maximum net allowable soil bearing pressure of 2,500 psf.
2. Where footing areas are over-excavated due to removal of cobbles and boulders, resulting voids are expected to be minor (18-inches or less) and should be filled with approved, non-expansive structural fill materials. WSG recommends 1½-inch screened rock be placed and compacted in 6 to 12-inch loose lifts and uniformly compacted to at least 80% of the maximum relative density (ASTM D4253/4254). On-site gravel materials could also be used for structural fill but will require processing/removal of 3-inch plus sized material prior to use.
3. Loose disturbed soils exposed at footing grades should either be removed, or moisture conditioned to near optimum moisture content and compacted to at least 98% of the maximum standard Proctor density as determined by ASTM D698. All foundation areas should be compacted with a mechanical compactor prior to forming for footings.
4. 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.
5. WSG 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.
6. Foundation walls and grade beams should be designed to span an unsupported distance of 10 feet or the distance between pads.

7. 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. WSG 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 0.30 times structural dead loads. The recommended passive equivalent fluid pressure value and coefficient of friction do not include a factor of safety.
8. WSG should be retained to observe foundation excavations to verify the subsurface conditions are consistent with those assumed.

WSG estimates settlement of footing foundations designed and constructed as outlined above and resulting from the assumed structural loads would be on the order of 1 inch or less. Differential settlement could approach the amount of total settlement estimated above.

Interior Building Floor Slabs

WSG believes slab-on-grade construction could be used for finished living areas and garages, provided the design and construction precautions outlined below are observed.

1. Cobbles and boulders greater than 6-inches in diameter should be removed within 6 inches of slab grade to reduce the potential for point-loading of the slab, which could lead to distress and cracking.
2. Underslab (structural) 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 2% of optimum moisture content (ASTM D698).
3. 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.
4. Floor slabs should be constructed with control joints located a maximum of 12 feet on center to control natural, unavoidable cracking associated with concrete shrinkage that commonly occurs during curing. Control joint locations should be carefully selected to intersect slab intrusions and other locations where shrinkage cracking is common.

Perimeter and Interior Drainage Systems

WSG 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. In addition, WSG also typically recommends an interior drainage system be constructed within crawl space areas as a precaution to provide for collection and discharge of any water accumulation within crawl space areas.

Perimeter drainage systems should generally consist of a 4-inch perforated PVC drainpipe 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 drainpipe 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 protected from backflow and small animal intrusion. Minimum burial depths of 24 inches would be acceptable for at-grade floor slab areas. Interior crawl space drainage systems should generally consist of 4-inch diameter perforated PVC drainpipe placed at the interior side of the perimeter foundations. Lateral drainpipes connected to the perimeter piping at approximate 10-foot centers should be connected to a sloping central drainpipe leading to a sump and pump system or daylighted outfall if possible.

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 an approximate 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	50
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 on-site gravel, cobbles and boulder materials could be suitable for reuse as foundation backfill but will likely require processing of larger material and moisture conditioning prior to placement and compaction. Cobbles and boulders greater than 3 inches in any dimension should be removed from proposed foundation wall backfill in order to reduce the potential for damage to waterproofing and development of point loads on walls. WSG 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. WSG recommends compaction of unbalanced foundation wall backfill soils be completed using light mechanical or hand compaction equipment.

Exterior Flatwork

Topsoil and organic materials are not considered suitable for support of exterior flatwork. WSG recommends complete removal of these materials to improve slab performance and control settlement.

Fill materials used to bring slab areas to grade 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 materials should be approved by WSG 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. Cobbles and boulders larger than 6-inches in diameter are not recommended within 6-inches of slab elevation to minimize the potential for point loading.

Drainage

Positive surface drainage is imperative for satisfactory long-term performance of the proposed residence foundations and associated site improvements. WSG recommends positive drainage be developed away from the building structure and site retaining walls 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. Flatter 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 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

Based on site topography, WSG assumes unretained cuts and fills of up to three feet in height could be constructed for general site development. Based on our understanding and assumptions regarding proposed construction, WSG recommends the following:

1. Unretained cuts and fills should be constructed to a 2(H) to 1(V) or flatter slope configuration. Flatter slopes are often desirable to help facilitate revegetation efforts.

2. Fills materials supporting driveways, exterior slabs or other settlement-sensitive landscaping features should consist of either the on-site existing fill materials (6-inch minus) or approved imported materials. All fills 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).

3. Proper drainage should be provided and maintained around all cuts, fills, buildings, and driveway surfaces. Special attention should be given to channeling or routing drainage around and away from site fills and retaining structures. Excessive or uncontrolled surface and subsurface drainage could lead to erosion and poor site fill performance and/or slope failure.

4. All disturbed areas should be protected from erosion by revegetation or other appropriate methods. Areas of concentrated drainage should be protected by use of rip rap or other appropriate methods.

5. Construction safety is the sole responsibility of the contractor. The contractor is responsible for determining the appropriate OSHA slope criteria for the soils conditions encountered and implementing it during construction. The contractor shall be responsible for all means, methods, techniques, sequencing, and operations during construction. All excavation activities should meet minimum OSHA, state or local trenching and excavation safety standards.

GENERAL COMMENTS

This report was prepared based upon the data obtained from the completed site exploration, engineering analysis and WSG's experience with similar construction in this area. The subsurface conditions assumed for this exploration provide an indication of subsurface conditions at the test pit locations 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 test pits. 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.

This report was prepared based upon the data obtained from the completed site exploration, engineering analysis and WSG's experience with similar construction in this area. The subsurface conditions assumed for this exploration provide an indication of subsurface conditions at the test pit locations 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 test pit locations. 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.

WSG should be retained to observe foundation excavations and confirm the recommendations in this report and 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. WSG should also be retained to provide testing and observation services during construction to help evaluate compliance with project plans and specifications.

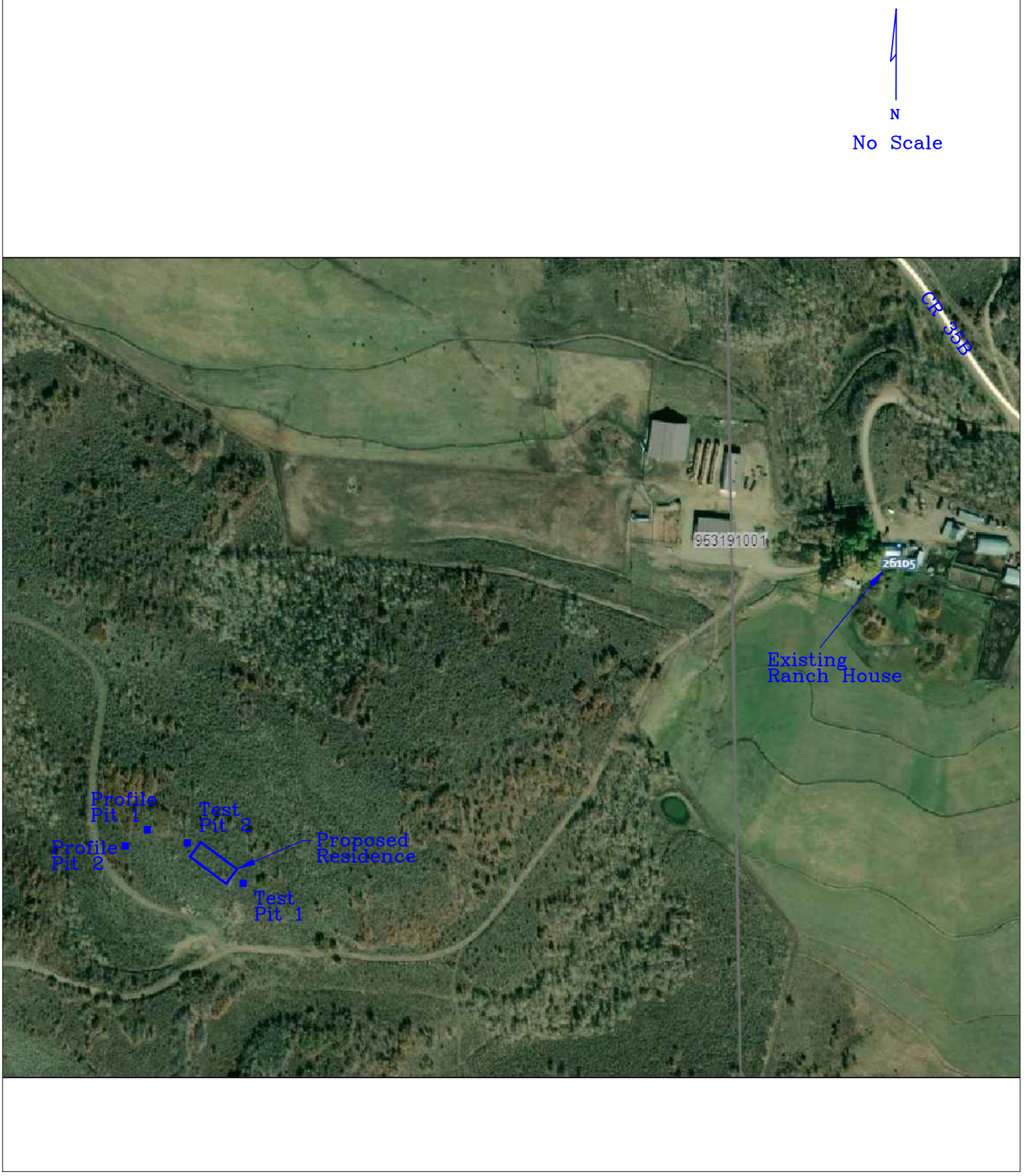
This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with the generally accepted

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.

Western Slope Geotech 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,
Western Slope Geotech, Inc.

Harold Schlicht, P.E.
Principal Engineer



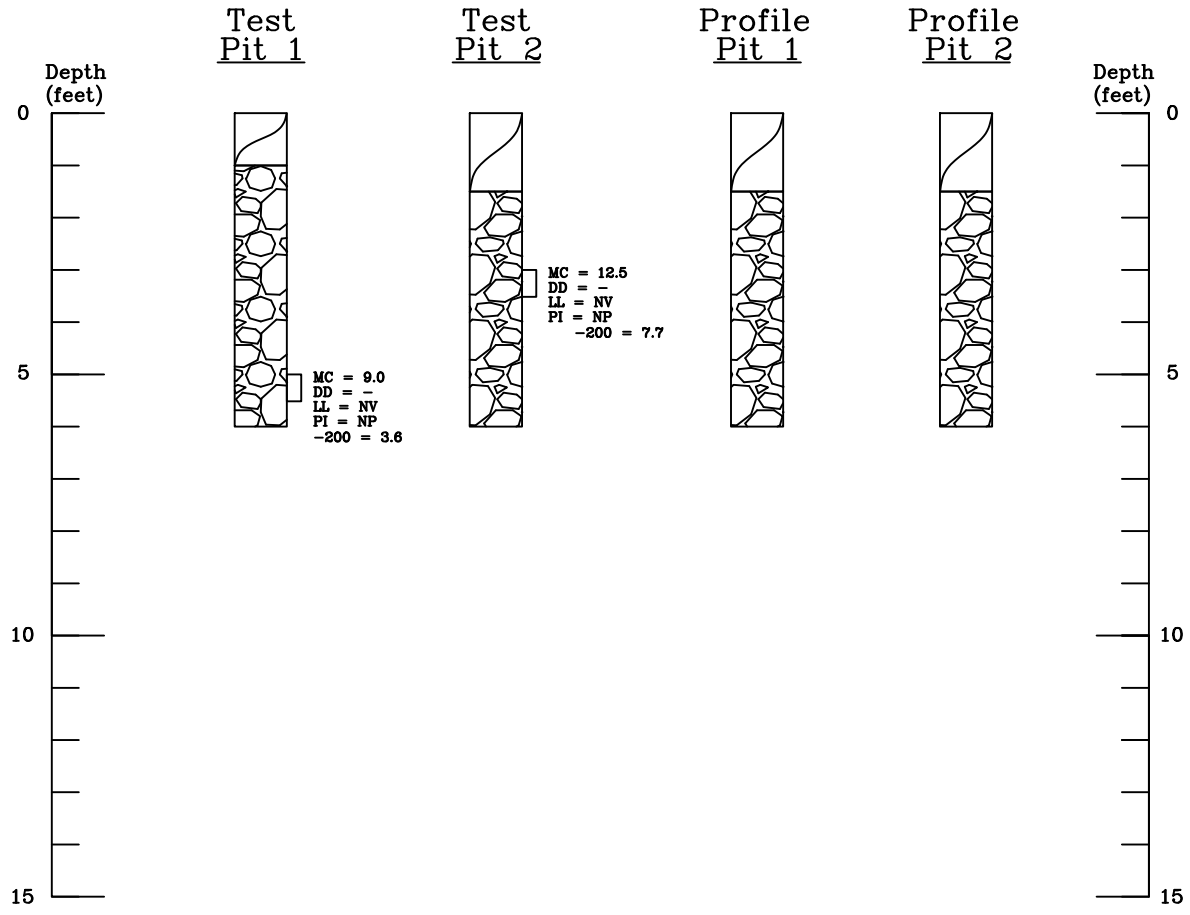
SITE PLAN/LOCATION OF TEST PITS

Project Name: Feathered Elk Ranch Residence

Location: County Road 35B, Routt County, CO

WESTERN SLOPE GEOTECH STEAMBOAT SPRINGS COLORADO

Project No.: 22-1036	Drawn/Checked:HS
Date: 6/10/22	Figure No.: 1



Legend:

TOPSOIL/ORGANICS.

GRAVEL: Cobbles and boulders, sandy, slightly silty, non–plastic, medium dense, moist and brown.

Small disturbed bag sample.

MC = Natural Moisture Content (%)
DD = Natural Dry Density (pcf)
LL = Liquid Limit
PI = Plasticity Index
-200 = Percent Passing No. 200 Sieve
Swell = Percent Swell Under 500 or 1,000 psf surcharge

Notes:

1) Test pits were excavated on 5/17/22 with a JCB 214 backhoe.
2) Locations of test pits were determined by pacing from existing features in the field.
3) Test pit elevations were not determined and logs are drawn to the depths explored.
4) Lines between materials types are approximate and transitions may be gradual.
5) Groundwater measurements were made at the time of excavation and levels may vary.

LOGS, LEGEND & NOTES

Project Name: Feathered Elk Ranch Residence

Location: County Road 35B, Routt County, CO

WESTERN SLOPE GEOTECH STEAMBOAT SPRINGS COLORADO

Project No.: 22–1036	Drawn/Checked:HS/HS
Date: 6/10/22	Figure No. 2

Table 1
Summary of Laboratory Test Results

WESTERN SLOPE GEOTECH — STEAMBOAT SPRINGS COLORADO

Project No.: 22-1036

Test Hole/ Pit	Depth (ft)	Natural Moisture Content (%)	Dry Density (pcf)	Grain Size Analysis			Atterberg Limits		Swell Test Data		Soil or Bedrock Type	USCS Classification	AASHTO Classification
				Gravel (%)	Sand (%)	Silt/ Clay (%)	LL (%)	PI (%)	Swell(+) Consol.(-)	Swell Pressure (psf)			
TP-1	5-6	9.0	-	73	23	4	NV	NP			Sandy Gravel	GW	
TP-2	3-4	12.5	-	75	17	12	NV	NP			Slightly Silty, Sandy Gravel	GW-GM	