SUBSOIL AND FOUNDATION INVESTIGATION
SUNLIGHT SUBDIVISION - PHASE 2 RESIDENCES
STEAMBOAT SPRINGS, COLORADO

Prepared by

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NWCC Project NO. 18-11252

October 2, 2018

TABLE OF CONTENTS

List of Figures, Tables and Appendices

1.0 CONCLUSIONS

Based on results of the field and laboratory investigations, NWCC, Inc. (NWCC) recommends the proposed single-family residences and garages to be constructed within Phase 2 of the Sunlight Subdivision be founded on deep foundation systems consisting of straight-shaft skin friction/end bearing piers or helical screw piles advanced into the natural clays.

2.0 PURPOSE AND SCOPE OF WORK

This report presents the results of the Subsoil and Foundation Investigation completed for Phase 2 of the Sunlight Subdivision to be constructed within a parcel of land in Section 6 of Township 6 North, Range 84 West of the 6th P.M. in Steamboat Springs, Colorado. The approximate location of the project site is shown in Figure #1. Phase 2 consists of Lots 49 and 54 through 77 in the Sunlight Subdivision.

The scope of our work included obtaining data from a visual inspection of the site; the excavation of ten (10) test pits and the drilling of two (2) test holes; sampling of the overburden soils and the laboratory testing of the samples obtained. This report summarizes the results of the field investigation and the laboratory test results, as well as our recommendations for foundation design, floor slabs, foundation walls, perimeter drainage and site grading based on the proposed construction and the subsurface conditions encountered.

3.0 PROPOSED CONSTRUCTION

NWCC understands this phase of the subdivision will consist of twenty five (25) single-family or duplex residential structures. NWCC has assumed the residences will consist of 1 to 2 story wood framed structures with attached garages. NWCC has assumed the lower levels of the residences and garages will be constructed with concrete slab-on-grade floor systems. Walkout and full depth basement levels may be constructed within a number of the lots.

We have assumed the loads generated by the proposed building structures will be variable and range from light to moderate, typical of this type of residential construction.

Overlot site grading and construction of the roadways and utilities has been completed. NWCC has assumed the remaining permanent cut and fill slopes constructed within each of the individual lots will be on the order of 5 feet or less to bring the sites to the finish grades.

4.0 SITE CONDITIONS

The project site is located north of the Steamboat Springs Cemetery and east of US Highway 40 in Steamboat Springs, Colorado. The site is bordered on the north and east by undeveloped rural land and on the west by existing commercial properties. Within the past two years, construction of

Roads "A" and "B" have been completed and the majority of the underground utilities have been installed. The site consists generally of vacant, undisturbed land that appears vegetated with native grasses, weeds and sage brush. Lots 54 through 62 were not vegetated at the time of the investigation and had a layer of mulch over the ground surface.

The topography of the project site is variable and consists of manmade and natural terrain. Lots 54 through 62, situated to the west and east of Road A, have terrain that slopes moderately to steeply down to the southeast on the order of 15 to 25 percent. Lots 54 through 58 have been filled, and portions of Lots 59 through 62 appear to have cuts from road construction. Lots 65 through 69 appear to have fill overlying a historic drainage channel. Lots 71 through 77 have topography that slopes moderately to steeply down to the south. A maximum elevation difference of approximately 70 feet appears to exist across this phase of the subdivision.

5.0 FIELD INVESTIGATION

The field investigation for this project was conducted on April 25, 2018, September 6, 2018, and September 11, 2018. Ten (10) foundation test pits and two (2) test holes were advanced at the approximate locations shown in Figure #2. Test Pit A was excavated on April 25, 2018 with a Yanmar Vio 45 trackhoe provided by NWCC. Test Holes 1 and 2 were advanced on September 6, 2018 with a track-mounted drill rig using 4-inch diameter continuous flight augers provided by Ager Enterprises. Test Pits 1 through 9 were excavated with a Komatsu PC 400 LC trackhoe provided by Native Excavating on September 11, 2018. The test pits and holes were logged and samples were obtained at the time of excavation and/or drilling by an engineer from NWCC. Graphic logs of the exploratory test holes are shown in Figure #3 and the graphic logs of the exploratory test pits are shown in Figure #4. Associated Legend and Notes are shown in Figure #5.

6.0 LABORATORY INVESTIGATION

Samples obtained from the test pits and test holes were examined and classified in the laboratory by the project engineer. Laboratory testing included standard index property tests including natural densities and moisture contents, dry unit weights, strength testing, grain size analyses and liquid and plastic limits. Swell-consolidation testing was also conducted on relatively undisturbed samples of the clay fill materials and natural clays. Swell-consolidation test results are shown in Figures #6 to #22, and the results are discussed in the following sections. The results of the laboratory testing are summarized in the Table #1 that follows the figures. Laboratory testing was conducted in general accordance with applicable ASTM specifications.

7.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered in the test pits and test holes advanced across the site were highly variable and generally consisted of a layer of natural topsoil and organic materials or fill

materials overlying natural clays to the maximum depth investigated, 25 feet beneath existing ground surface (bgs).

Topsoil fill was encountered at the ground surface in Test Pits 1, 2, 4, and 5. The topsoil fill was generally moist and dark brown. Test pits 1 and 2 also had mulch at the surface at the time of the investigation.

Natural topsoil and organic materials were encountered at the ground surface in Test Pits 3, 7, 8, and 9. The layers of topsoil and organic materials were approximately 1 to 5 ½ feet thickness. Lots 71 through 77 appear to have the greatest topsoil thickness. The natural topsoil and organic materials were moist and dark brown in color with roots.

Clay fill materials were encountered in both test holes and in Test Pits 4, 5, 6, and A, extending either from the ground surface or from beneath the topsoil fill to depths ranging from 1 foot to 7 ½ feet bgs. The fill generally consisted of sandy to very sand clays that were fine-grained with occasional gravels and cobble-sized bedrock fragments, low to highly plastic, stiff, moist and light brown to brown in color. Samples of the fill materials classified as CL to CH soils in accordance with the Unified Soil Classification System (USCS).

Natural organic clays were encountered beneath the fill materials in Test Pits 4 and 5, and extended to depths ranging from 1 to 6 ½ feet bgs, respectively. The organic clays were nil to slightly sandy with rootlets, low plastic, soft to medium stiff, brown to dark gray in color, and had a slight organic odor. A sample of the natural clays with organics classified as an OL soil in accordance with the USCS.

Natural clays were encountered below the natural topsoil and organic materials, clays with organics, and fill materials in all the test holes and pits and extended to the maximum depths investigated. The clays were nil to very sandy, fine-grained with occasional gravel sized bedrock fragments, low to highly plastic, stiff to hard, moist to very moist, and light brown to dark brown to gray in color. Samples of the natural clays classified as CL, CH, and CL-CH soils in accordance with the USCS.

Gravelly sandy clays were encountered from 7 ½ to 13 feet bgs in Test Hole 1. The gravelly sandy clays were fine to coarse grained, low to highly plastic, stiff to very stiff, moist and brown to reddish brown in color. A sample of the gravelly sandy clays classified as a CH soil in accordance with the USCS.

Swell-consolidation testing conducted on relatively undisturbed samples of the clay fill materials and natural clays indicate the materials tested will exhibit a low to very high swell potential when wetted under a constant load. A swell-consolidation test conducted on a sample of the organic clays indicates that the material tested will exhibit slight consolidation when wetted under a constant load. The swell-consolidation test results are summarized in Table A below. The swell-consolidation test results are shown in Figures #6 through #22, and all of the other test results are summarized in the associated Table 1.

TABLE A
SUMMARY OF SWELL TEST RESULTS

Soil Type	Consolidation	Range of Swell (%)			
	<0	Low 0 to <2	Moderate 2 to <4	High 4 to <6	Very High >6
	Number of Samples and Percent				
Natural Clays	0	2	2	9	1
Clay Fill	0	0	1	1	0
Organic Clays	1	0	0	0	0
Percent	6%	12%	18%	60%	6%

Groundwater seepage was not encountered in any of the test pits at the time of excavation and no signs of a seasonal high groundwater table were observed. Groundwater seepage was not encountered in the test holes at the time of drilling or when measured five days after drilling was completed. It should be noted that the groundwater conditions at this site can be expected to fluctuate with precipitation and seasonal runoff.

Based on the subsurface conditions encountered at the site, the laboratory test results and our review of the available literature, NWCC recommends that a Site Class C be used for the foundation designs in accordance with Table 20.3-1 in Chapter 20 of ASCE 7-10.

8.0 FOUNDATION RECOMMENDATIONS

Based on the subsurface conditions encountered in the test pits, the results of the field and laboratory investigations and our understanding of the proposed construction, NWCC believes an economically feasible and safe type of foundation system is straight-shaft skin friction/end bearing piers drilled into the underlying natural clays. Foundation movement should be within tolerable limits if the following design and construction precautions are observed.

1) A minimum pier diameter of 12 inches and a minimum pier length of 20 feet are recommended.

2) Piers should be designed using an allowable skin friction value of 900 psf for the portion of the pier drilled into the undisturbed natural clays. The upper 5 feet of pier penetration should be neglected in skin-friction calculations. A drill rig of sufficient size, type and

operating condition should be used so bottom of the piers can be cleaned out properly and a minimum length requirement can be met. If bottom of piers are properly cleaned and approved by an engineer from this office, then an allowable end bearing pressure of 3,500 psf can be used in the design for the natural clays.

3) Piers should be reinforced their full length with at least one #5 reinforcing rod for each 16 inches of pier perimeter.

4) Piers should be properly cleaned and dewatered prior to steel and concrete placement. A maximum of 3 inches of water in the bottom of the piers will be acceptable. If water depth is greater than 3 inches, tremie methods must be used to place the concrete.

5) A 4-inch void should be provided beneath grade beams to prevent the swelling soils from exerting uplift forces on the grade beams and to concentrate pier loadings. A void should also be provided beneath necessary pier caps.

6) We strongly recommend that at least one test hole or pier be drilled at each of the building sites prior to starting the pier drilling operations so that the deeper subsurface and drilling conditions can be determined and the recommendations given above can be verified.

7) The presence of cobbles and small boulders in the clays could complicate the pier drilling operations. The drilling subcontractor should be made aware of the subsurface conditions and mobilize drilling equipment with sufficient size and operating condition to achieve the required depths. The use of core buckets/bits may be required to remove and/or penetrate through the larger cobbles and boulders.

8) A representative of this office should observe the pier drilling operations on a full-time basis.

9.0 ALTERNATE FOUNDATION RECOMMENDATIONS

NWCC believes an alternate deep foundation consisting of helical screw piles advanced into the underlying clays may be a feasible alternative to the drilled piers

Utilizing this type of foundation, each column is supported on a single or group of screw piles and the structures are founded on grade beams or pier caps that are supported by a series of piles. Load applied to the piles is transmitted to the natural soils through the end bearing pressure at the helices of the screw pile. Foundation movement should be less than ½-inch if the following design and construction conditions are observed.

The helical screw pile foundation system should be designed by a qualified engineer, using industry standards and be installed by a licensed/certified installer. If pile groups are required, we recommend a minimum pile spacing of 3 times the largest helix to achieve the maximum capacity of each individual

pile. Lateral loads should be resisted by the use of battered piles or tiebacks or through passive soil pressures against foundation walls or grade beams.

NWCC also recommends the following:

- Minimum 8-inch diameter helix;
- Minimum installation torque of 4,000 ft-lbs;
- Minimum penetration depth of 8 feet for upper most helix;
- Full-time installation observation by a qualified special inspector;
- Review of the Contractor's quality control plan regarding instrumentation calibration and testing, materials QC, and pile installation procedures;
- Additional test piles should be advanced across the site to confirm torque versus depth relationships.

10.0 FLOOR SLAB RECOMMENDATIONS

NWCC has assumed the proposed residences and garages will be constructed with concrete slab-on-grade floor systems placed at varying depths across the site. The on-site soils, with the exception of the existing topsoil and topsoil fill materials, are capable of supporting slab-on-grade construction. However, floor slabs present a very difficult problem where swelling materials are present near floor slab elevation because sufficient dead load cannot be imposed on them to resist the uplift pressure generated when the materials are wetted and expand. Based on the moisture-volume change characteristics of the clays encountered at this site, we recommend that structural floor systems over well-ventilated crawlspaces or void form be used in the proposed residences and garages.

If the client elects to construct concrete slab-on-grade floor systems, we recommend the following special design and construction precautions be followed so that the amount of movement in the floor slabs can be reduced, if the clays become wetted.

1) Floor slabs should be separated from all bearing walls, columns and their foundation supports with a positive slip joint. We recommend the use of ½-inch thick cellotex or impregnated felt.

2) Interior non-bearing partition walls resting on the floor slabs should be provided with a slip joint, preferably at the bottom, so that in the event the floor slab moves, this movement is not transmitted to the upper structure. This detail is also important for wallboard and doorframes and is shown in Figure #23.

3) A minimum 6-inch gravel layer should be provided beneath all floor slabs to act as a capillary break and to help distribute pressures. Prior to placing the gravel, the excavation should be shaped so that if water does get under the slab, it will flow to the low point of the excavation.

In addition, all of the topsoil and organic materials should be removed prior to placement of the underslab gravels or new structural fill materials.

4) Floor slabs should be provided with control joints placed a maximum of 12 feet on center in each direction to help control shrinkage cracking. The location of the joints should be carefully checked to assure that the natural, unavoidable cracking will be controlled. The depth of the control joints should be a minimum of ¼ the thickness of the slab.

5) Underslab soils should be kept as close as possible to their in-situ moisture content. Excessive wetting or drying of these soils prior to placement of the floor slab could result in differential movement after the slabs are constructed.

6) It has been our experience that the risk of floor slab movement can be reduced by removing at least 3 feet of the expansive materials and replacing them with a well compacted, non-expansive fill. If this is done, or if fills are required to bring the underslab soils to the desired grade, the fill should consist of non-expansive, granular materials. The fill should be uniformly placed and compacted in 6 to 8 inch lifts to at least 95% of the maximum standard Proctor density at or above the optimum moisture content, as determined by ASTM D-698/AASHTO T-99.

The above precautions and recommendations will not prevent floor slab movement in the event the clays beneath the floor slabs undergo moisture changes. However, they should reduce the amount of damage if such movement occurs. The only way to eliminate the risk of all floor slab movement is to construct a structural floor over a well-vented crawl space or void form materials.

11.0 PERIMETER DRAINAGE SYSTEM RECOMMENDATIONS

Any floor levels or crawl space areas constructed below the existing or finished ground surfaces and the foundations should be protected by underdrain systems to help reduce the problems associated with surface and subsurface drainage during high runoff periods.

Localized perched water or runoff can infiltrate the lower levels of the structures at the foundation levels. This water can be one of the primary causes of differential foundation and slab movement, especially where expansive soils are encountered. Excessive moisture in crawl space areas or lower levels can also lead to rotting and mildewing of wooden structural members and the formation of mold and mold spores. Formation of mold and mold spores could have detrimental effects on the air quality in these areas, which in turn can lead to potential adverse health effects.

Drains should be located around entire perimeter of the lower levels and be placed and at least 12 inches below any floor slab or crawl space levels and at least 6 inches below the foundation voids and bottom of the foundation walls. NWCC recommends the use of perforated PVC pipe for the drainpipe, which meets or exceeds ASTM D-3034/SDR 35 requirements, to minimize potential for pipe crushing during backfill operations. Holes in the drainpipe should be oriented down between 4

o'clock and 8 o'clock to promote rapid runoff of water. Drainpipe should be surrounded with at least 12 inches of free draining gravel and should be protected from contamination by a filter covering of Mirafi 140N subsurface drainage fabric or an equivalent product. Drains should have a minimum slope of 1/8 inch per foot and be daylighted at positive outfalls protected from freezing, or be led to sumps from which water can be pumped. The use of interior laterals, multiple daylights or sumps may be required for the proposed structure. Caution should be taken when backfilling so as not to damage or disturb the installed underdrains. NWCC recommends the drainage systems include a cleanout every 100 feet, be protected against intrusion by animals at outfalls and be tested prior to backfilling. NWCC also recommends the client retain our firm to observe the underdrain systems during construction to verify that they are being installed in accordance with recommendations provided in this report and observe a flow test prior to backfilling the system.

In addition, NWCC recommends an impervious barrier be constructed to keep water from infiltrating through the voided areas and/or under the foundation walls. Barrier should be constructed of an impervious material, which is approved by this office and placed below the perimeter drain and up against the sides of the foundation walls. A typical perimeter/underdrain detail is shown in Figure #24.

Placement of and impervious membrane and/or properly compacted clays in crawl space areas to the top of the footings or at least 12 inches above the top of the foundation voids or bottom of the foundation walls should help reduce the moisture problems in these areas.

12.0 FOUNDATIONS WALLS AND RETAINING STRUCTURE RECOMMENDATIONS

Foundation walls and retaining structures, which are laterally supported and can be expected to undergo only a moderate amount of deflection (at rest), may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 45 pcf for imported, free draining granular backfill and 60 pcf for the on-site soils.

Cantilevered retaining structures on the site can be expected to deflect sufficiently to mobilize the full active earth pressure condition. Therefore, cantilevered structures may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 35 pcf for imported, free draining granular backfill and 50 pcf for the on-site soils.

Foundation walls and retaining structures should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic and construction materials. An upward sloping backfill and/or natural slope will also increase the earth pressures on foundation walls and retaining structures.

NWCC recommends imported granular soils for backfilling foundation walls and retaining structures because their use results in lower lateral earth pressures. The imported granular materials should be placed to within 2 to 3 feet of the ground surface. Imported granular soils should be free draining and have less than 7 percent passing the No. 200 sieve. The granular soils behind foundation and retaining walls should be sloped from the base of the wall at an angle of at least 45 degrees from the

vertical. The upper 2 to 3 feet of fill should be a relatively impervious soil or pavement structure to prevent surface water infiltration into the backfill.

Wall backfill should be carefully placed in uniform lifts and compacted to at least 95 % of the maximum standard Proctor density and within 2% of the optimum moisture content. Care should be taken not to overcompact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfill materials will occur even if the material is placed correctly.

13.0 SITE DRAINAGE RECOMMENDATIONS

Proper surface drainage at these lots is of paramount importance for minimizing the infiltration of surface drainage into the wall backfill and bearing soils, which could result in increased wall pressures, differential foundation and slab movement. The following drainage precautions should be observed during construction and at all times after the structures have been completed:

1) Ground surface surrounding the structures should be sloped (minimum of 1.0 inch per foot) to drain away from the structure in all directions to a minimum of 10 feet. Ponding must be avoided. If necessary, raising the top of foundation walls to achieve a better surface grade is advisable.

2) Non-structural backfill placed around the structures should be compacted to at least 95% of the maximum standard Proctor density at or above the optimum moisture content in order to minimize future settlement of the fill. Backfill should be placed immediately after the braced foundation walls are able to structurally support the fill. Puddling or sluicing must be avoided.

3) Top 2 to 3 feet of soil placed within 10 feet of the foundations should be impervious in nature to minimize infiltration of surface water into the wall backfill.

4) Roof downspouts and drains should discharge well beyond the limits of all backfill. Roof overhangs, which project two to three feet beyond the foundations, should be considered if gutters are not used.

5) Landscaping, which requires excessive watering and lawn sprinkler heads, should be located a minimum of 10 feet from the foundation walls of the structures.

6) Plastic membranes should not be used to cover the ground surface adjacent to foundation walls.

14.0 SITE GRADING RECOMMENDATIONS

All fill materials placed beneath the interior floor slabs, exterior flat work, pavement areas or underground utilities should be compacted to at least 95 percent of the maximum standard Proctor density and within 2 percent of the optimum moisture content as determined in accordance with ASTM D698/AASHTO T99. The fills placed in these areas should not contain boulders, topsoil, organics or

other deleterious substances. The fill materials placed in the landscaped areas should be compacted to at least 90 percent of the maximum standard Proctor density. The materials not suitable for use under the building and pavement areas should be placed in the bottom of the fills in landscaped areas, where some settlement can be tolerated.

Site grading should be carefully planned to provide positive surface drainage away from all of the buildings and pavement areas. The buildings and pavement areas should be placed as high as possible on the sites so that positive drainage away from these structures can be provided. Surface diversion features should be provided around the paved areas to prevent surface runoff from flowing across the paved surfaces.

Although site grading plans for each of the lots were not available at the time of this report, we have assumed that cuts and fills of up to 5 feet in depth will be required to develop the individual lots. We recommend that the final fill slopes not exceed 2 (H) to 1 (V) configuration if they are properly compacted and drained. Positive surface drainage should be provided around all permanent cut and fill slopes to direct surface drainage away from the slope faces. All cut and fill slopes and other stripped areas should be protected against erosion by revegetation or other methods.

15.0 LIMITATIONS

The recommendations provided in this report are based on the subsurface conditions encountered in the test pits and test holes advanced across the project site, our assumptions regarding the proposed construction and the behavior of structures at neighboring, similar sites. We believe that this information gives a high degree of reliability for anticipating the behavior of the proposed structures; however, our recommendations are professional opinions and cannot control nature, nor can they assure the soils profiles beneath those or adjacent to those observed. No warranties expressed or implied are given on the content of this report.

Swelling soils were encountered within this phase of the subdivision. These soils are stable at their natural moisture content but can shrink or swell with changes in moisture. The behavior of swelling soils is not fully understood. The swell potential of any particular site can change erratically both in lateral and vertical extent. Moisture changes also occur erratically, resulting in conditions, which cannot always be predicted. The recommendations presented in this report are based on the current state of the art for foundations and floor slabs on swelling soils. The owner should be aware that there is a risk in construction on these types of soil. Performance of the structures will depend on following the recommendations and in proper maintenance after construction is complete. As water is the main cause for volume change in these soils, it is necessary that the changes in moisture content be kept to a minimum. This requires judicious irrigation and providing positive surface drainage away from the structures. Any distress noted in the structures should be brought to the attention of this office.

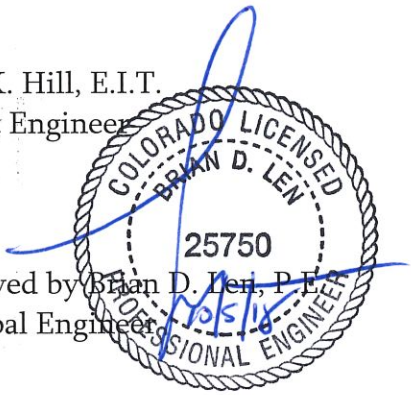
This report is based on the investigation at the described site and on the specific anticipated construction as stated herein. If either of these conditions is changed, the results would also most likely change. Therefore, we strongly recommend that our firm be contacted prior to finalizing the construction plans

so that we can verify that our recommendations are being properly incorporated into the construction plans. Man-made or natural changes in the conditions of a property can also occur over a period of time. In addition, changes in requirements due to state of the art knowledge and/or legislation do from time to time occur. As a result, the findings of this report may become invalid due to these changes. Therefore, this report is subject to review and not considered valid after a period of 3 years or if conditions as stated above are altered. It is the responsibility of the owner or his representative to ensure that the information in this report is incorporated into the plans and/or specifications and construction of the project. It is advisable that a contractor familiar with construction details typically used to dealing with the local subsoils and climatic conditions be retained to build the structures.

If you have any questions regarding this report or if we may be of further service, please do not hesitate to contact us.

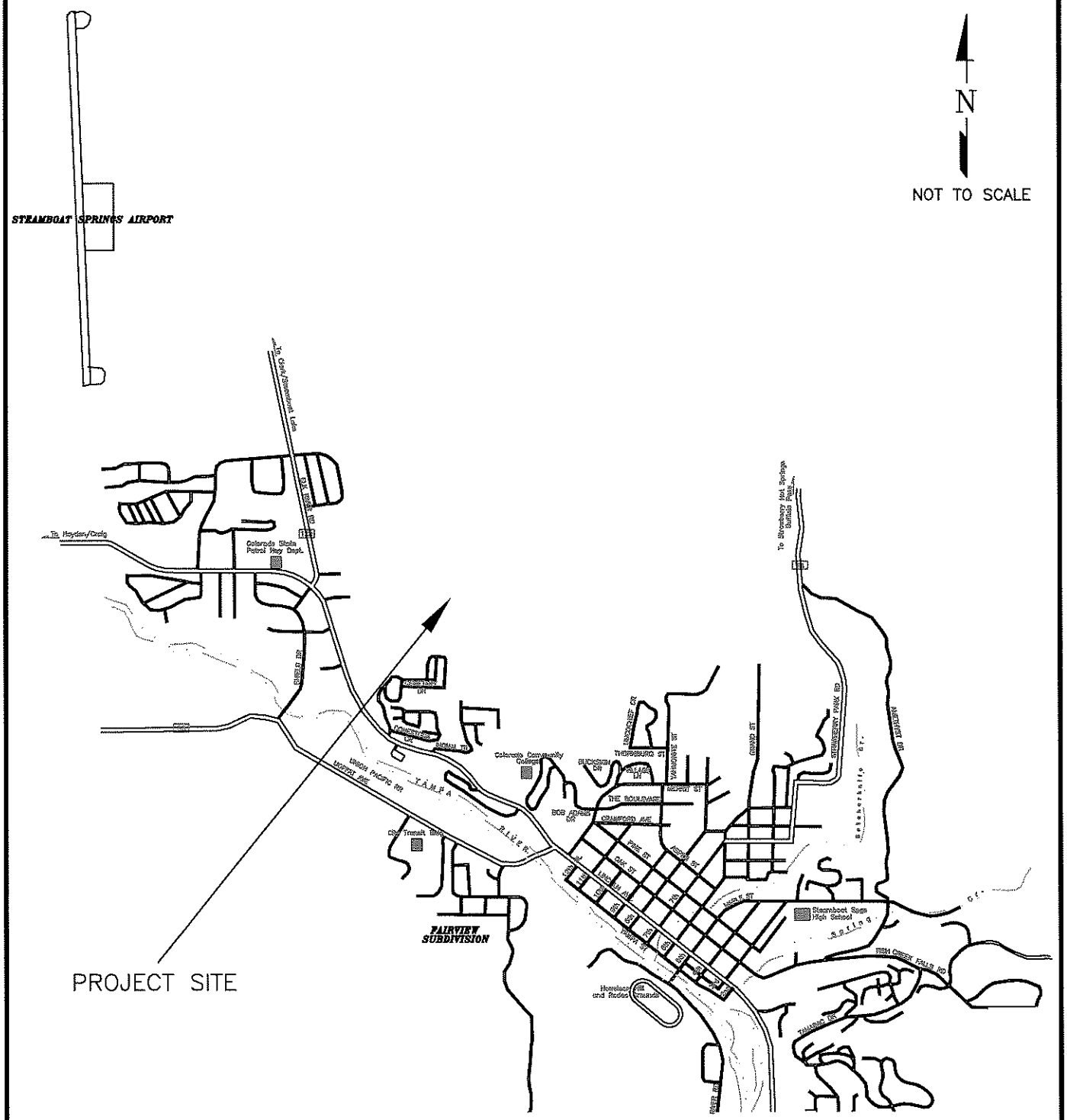
Sincerely,
NWCC, INC.

Erika K. Hill, E.I.T.
Project Engineer

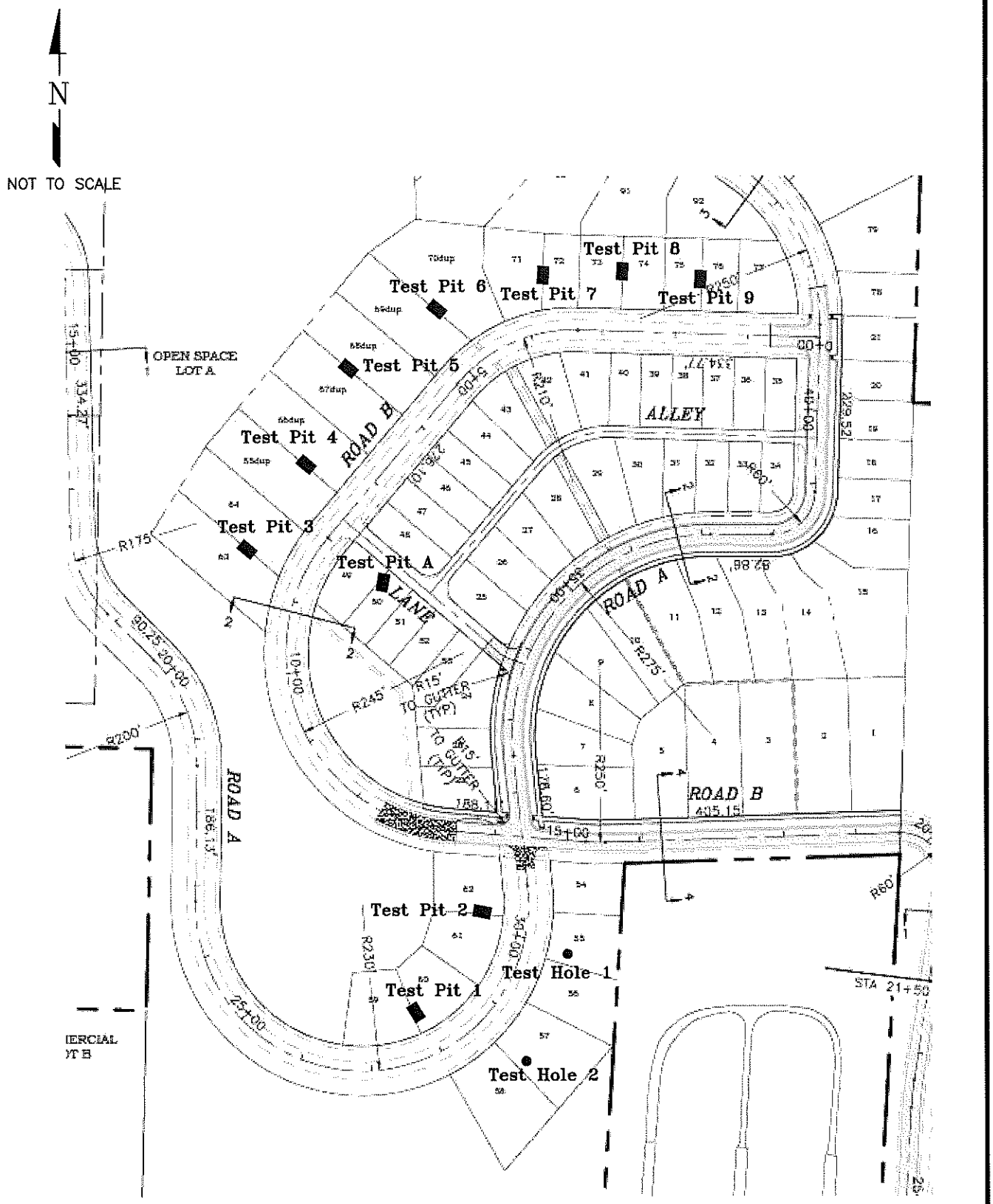


Reviewed by Brian D. Len, P.E.
Principal Engineer

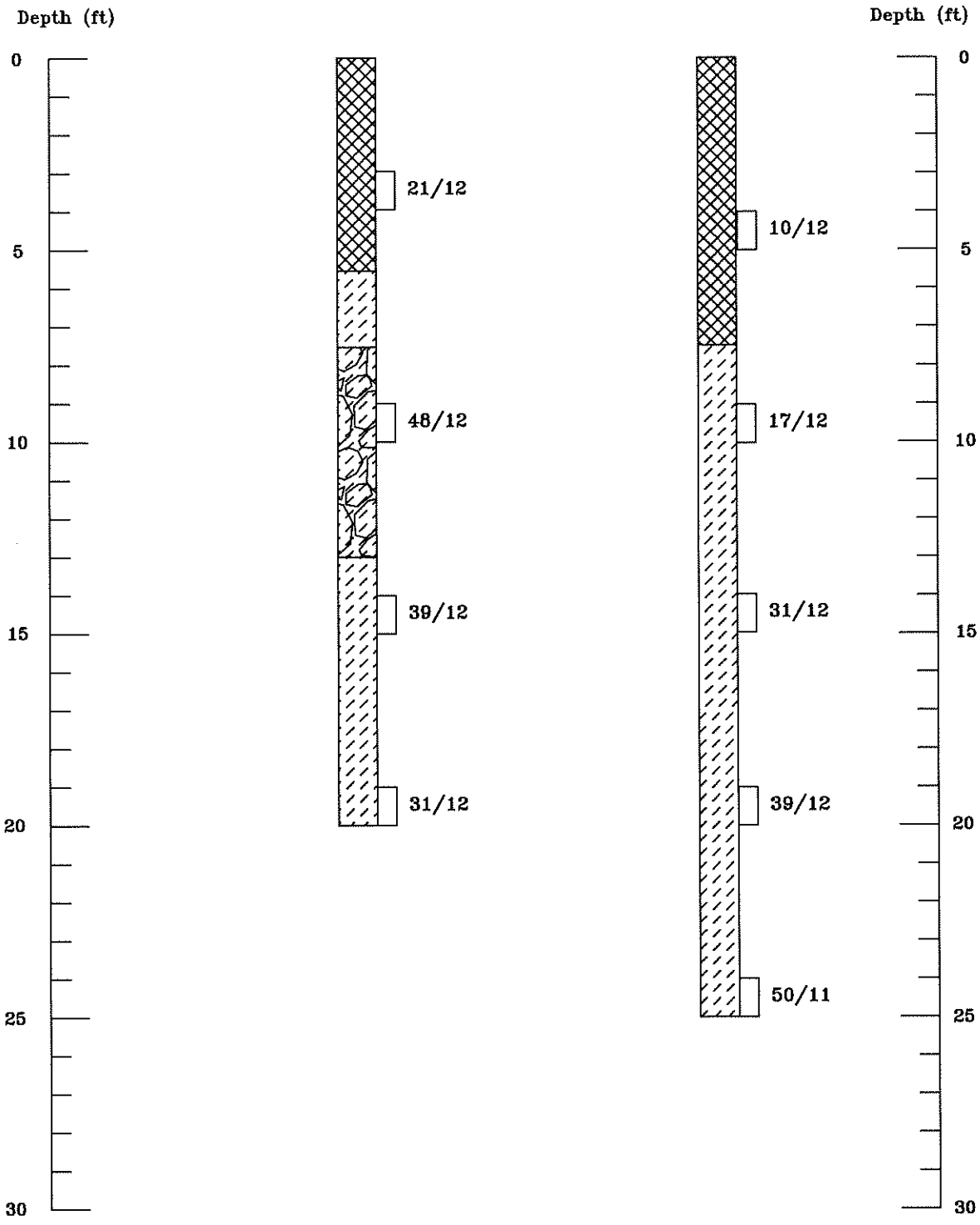
cc: Nick Metzler



Title: VICINITY MAP	**Date:** 9/27/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Sunlight Phase 2 Residences	**Job No.** 18-11252	(970)879-7889 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: Steamboat Springs, Colorado	**Figure** #1	



Title: SITE PLAN – TEST PIT AND TEST HOLE LOCATIONS		**Date:** 9/27/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Sunlight Phase 2 Residences		**Job No.** 18-11252	(970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: Steamboat Springs, Colorado		**Figure** #2	



Title: LOGS OF EXPLORATORY TEST HOLES		Date: 9/27/18
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252
Location: Steamboat Springs, CO		Figure #3

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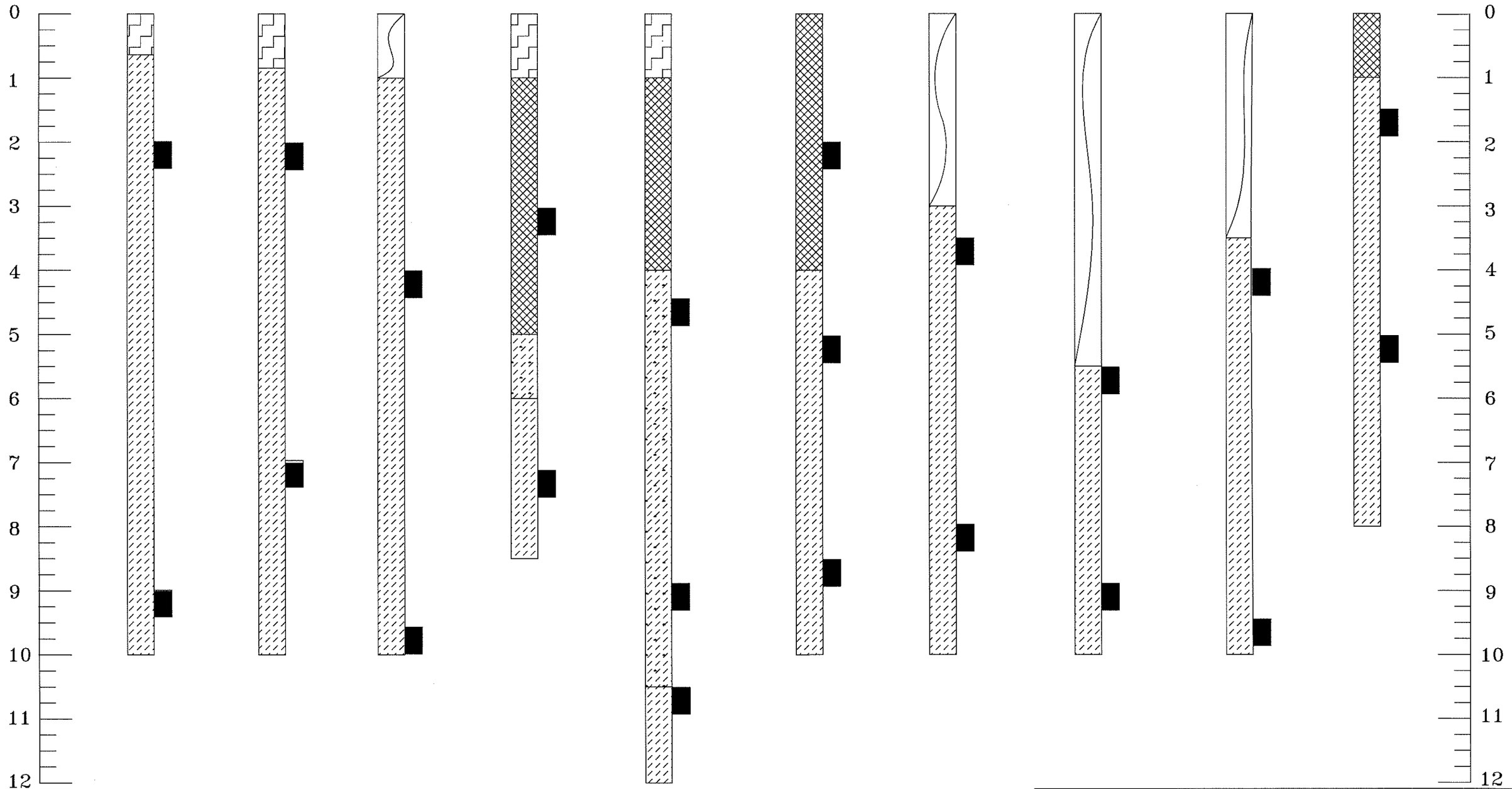

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Title: Logs of Exploratory Test Pits

Job Name: Sunlight Phase 2 Residences

Location: Steamboat Springs, Colorado

Job No.: 18-11252 | Date: 9/28/18 | Fig. #4

LEGEND:

TOPSOIL FILL: Moist and dark brown with mulch.

NATURAL TOPSOIL AND ORGANICS: Moist and dark brown with roots.

FILL: Clays: Sandy to very sandy, fine grained with occasional gravels and cobble-sized bedrock fragments, low to highly plastic, stiff, moist and light brown to brown.

CLAY: Nil to very sandy, fine grained with occasional gravel-sized bedrock fragments, low to highly plastic, stiff to hard, moist to very moist and light brown to dark brown to gray.

GRAVELLY SANDY CLAY: Fine to coarse grained, low to highly plastic, stiff to very stiff, moist and brown to reddish brown.

ORGANIC CLAY: Nil to slightly sandy with rootlets, low plastic, soft to medium stiff, moist, brown to dark gray in color, with slight organic odor.

31/12 Drive Sample Blow Count, indicates 31 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 12 inches.

California Liner Hand Drive Sample.

Drive Sample, 2-inch California Liner Sampler

NOTES:

1) Test Holes 1 and 2 were drilled on September 6, 2018 with a track-mounted drill rig using 4-inch diameter continuous flight augers.

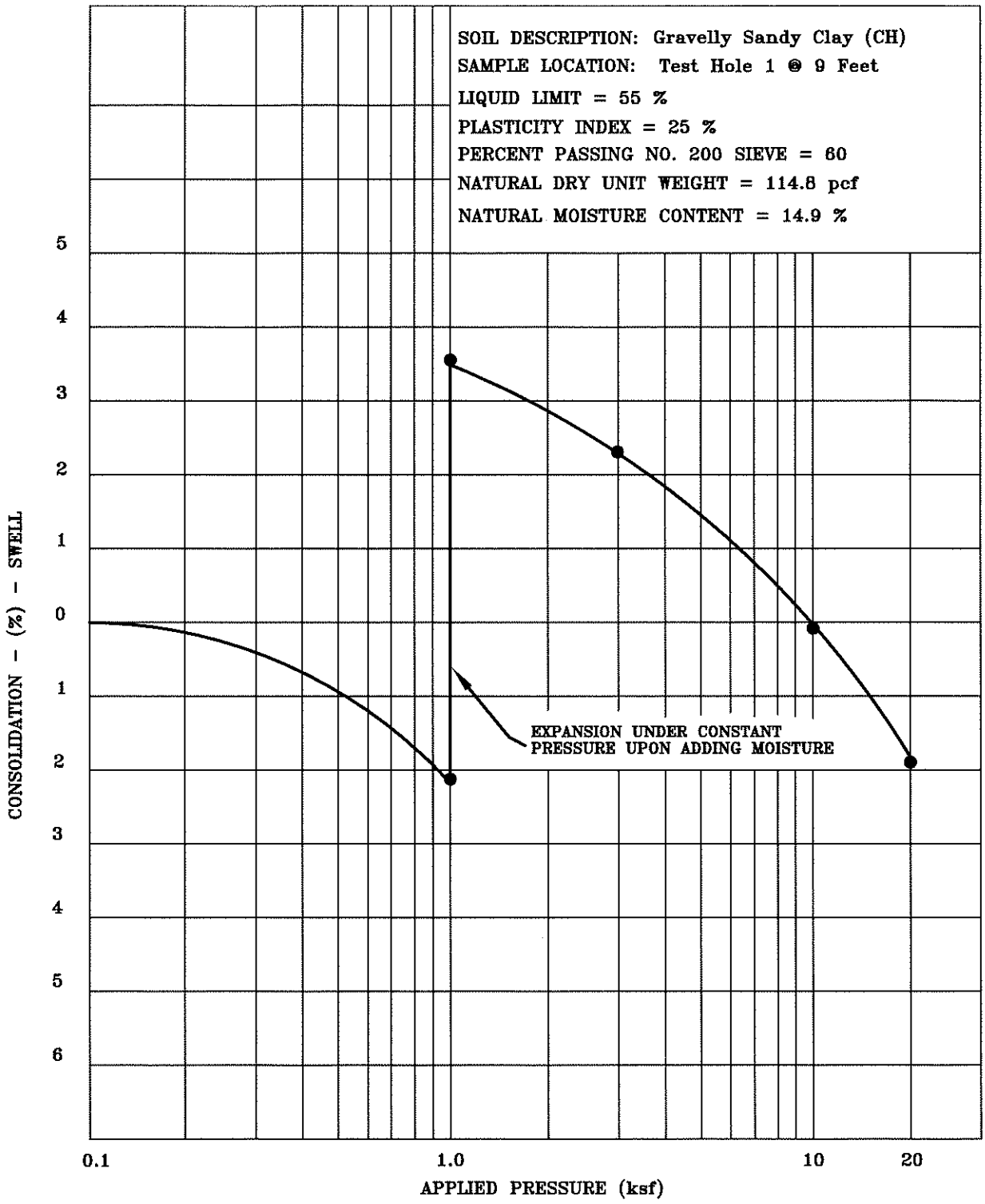
2) Test Pits 1 through 9 were excavated on September 11, 2018 with a Komatsu PC 400 LC trackhoe, and Test Pit A was excavated on April 25, 2018 with a Yanmar Vio 45 trackhoe.

3) Locations of the test holes and test pits were determined in the field by pacing from existing lot number signs and existing topographic features.

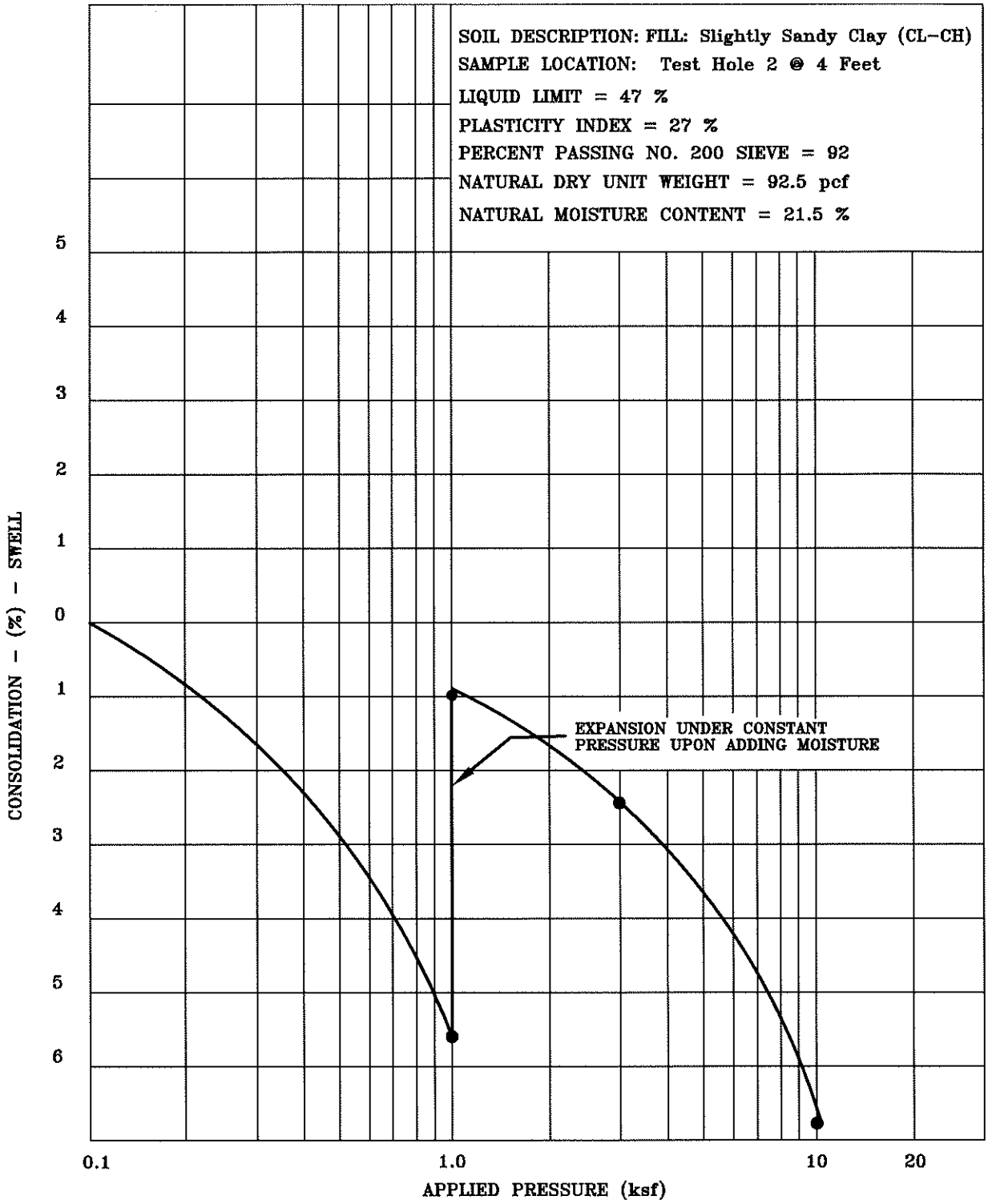
4) Elevations of the test holes were not measured and logs are drawn to the depths investigated.

5) The lines between materials shown on the logs represent the approximate boundaries between material types and transitions may be gradual.

Title: LEGEND AND NOTES	Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Sunlight Phase 2 Residences	Job No. 18-11252	(970)879-7888 Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80477
Location: Steamboat Springs, Colorado	Figure #5	



Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC Northwest Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #6	



Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18	
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #7	

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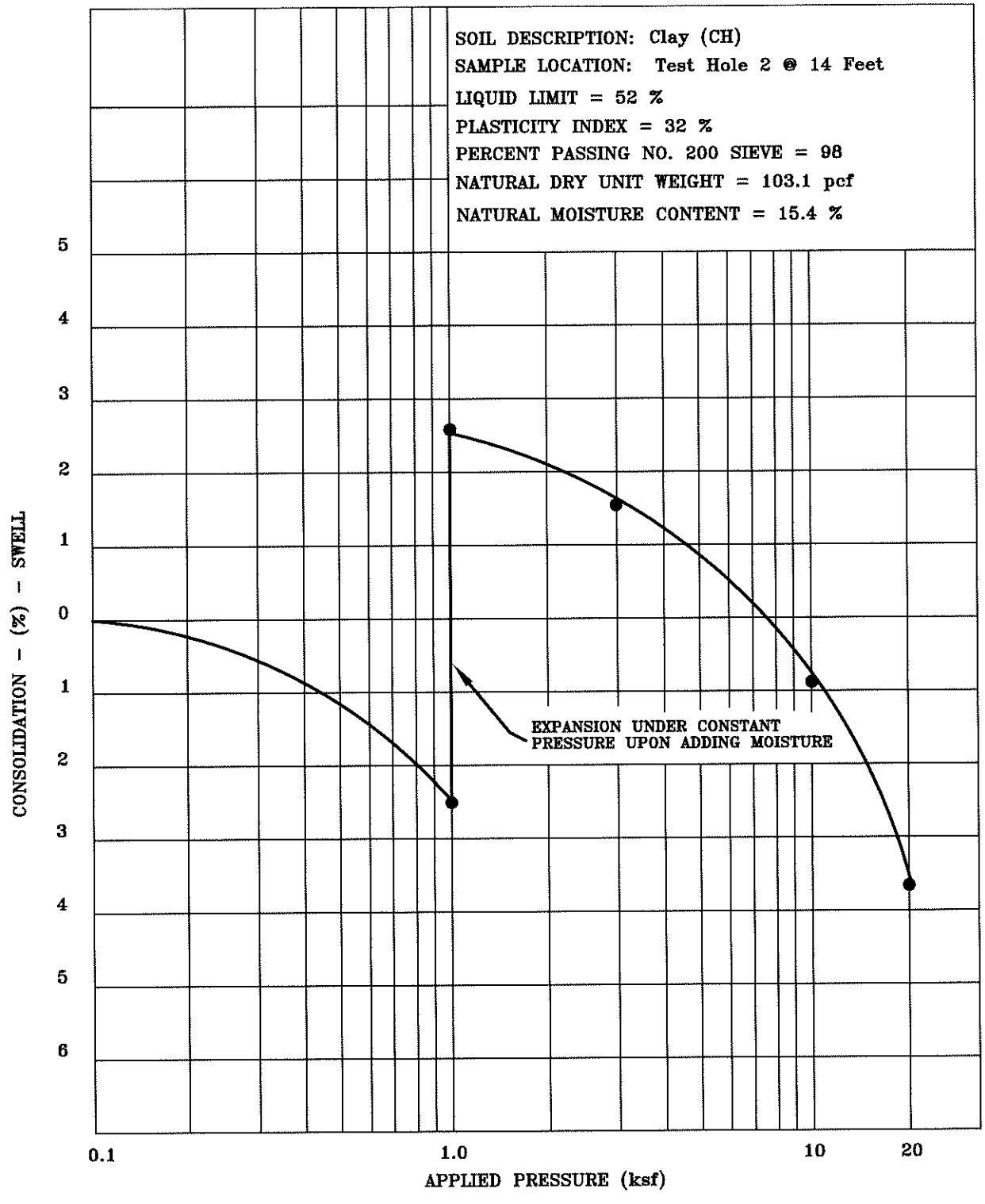

Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18	
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #8	

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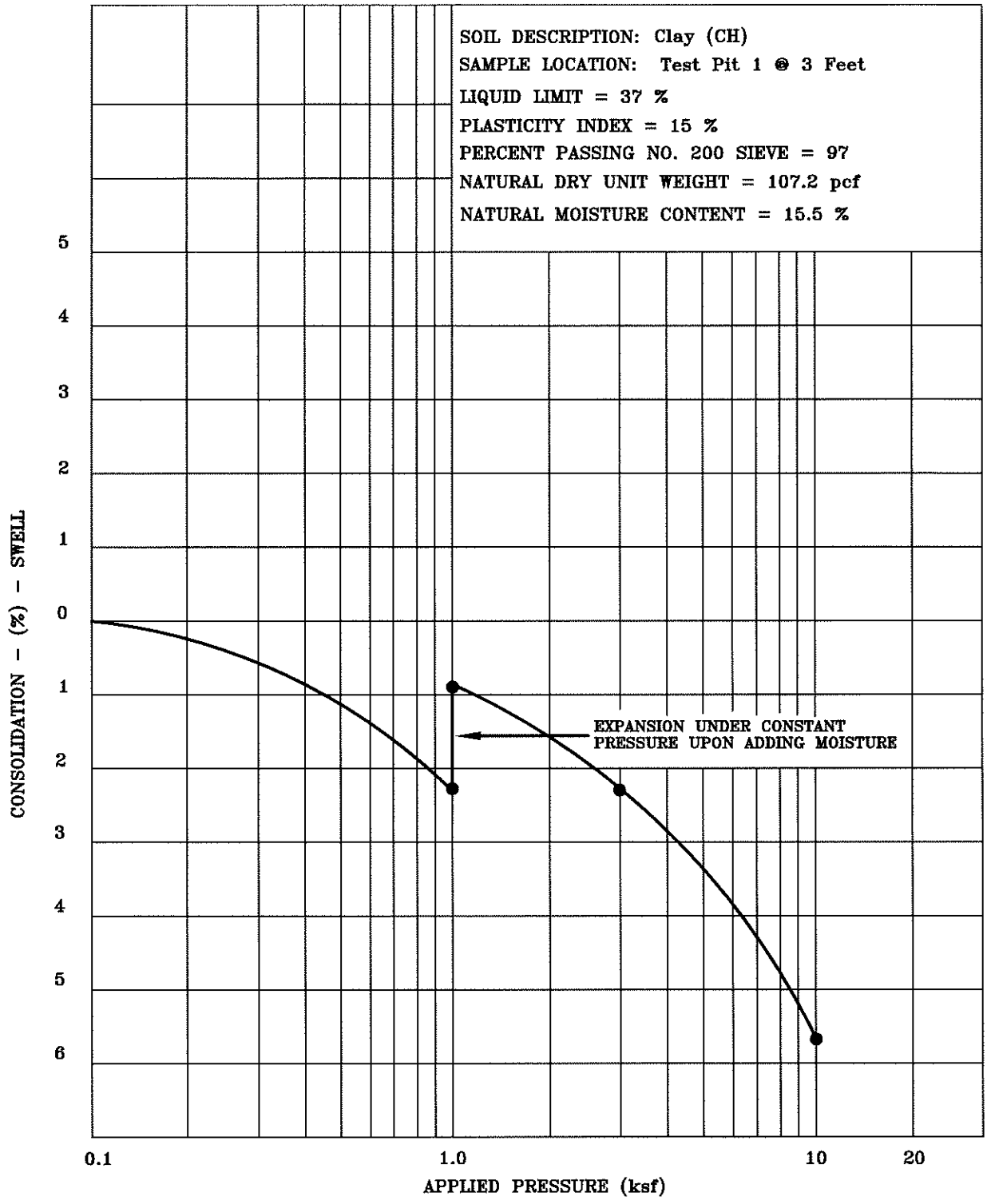
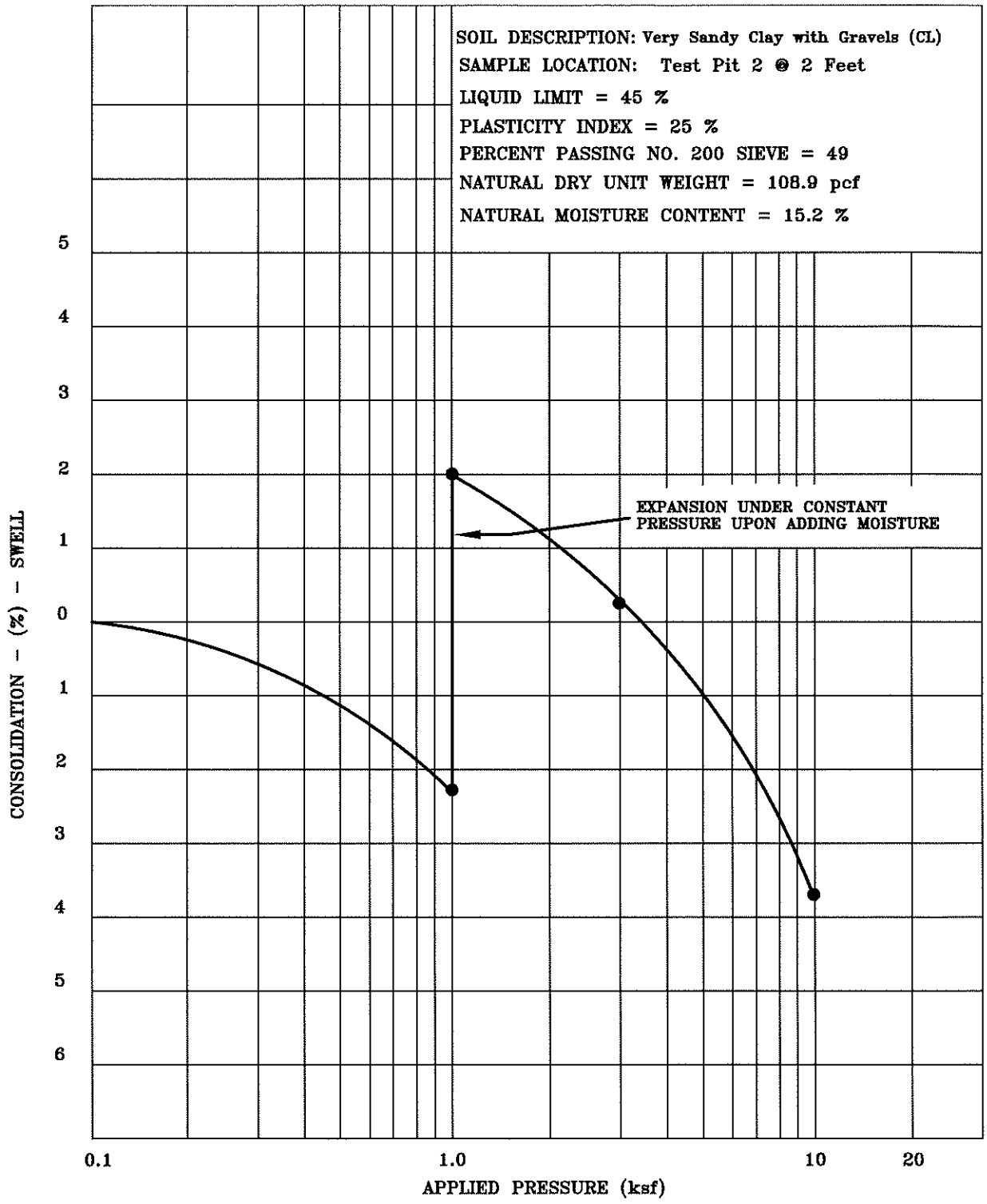
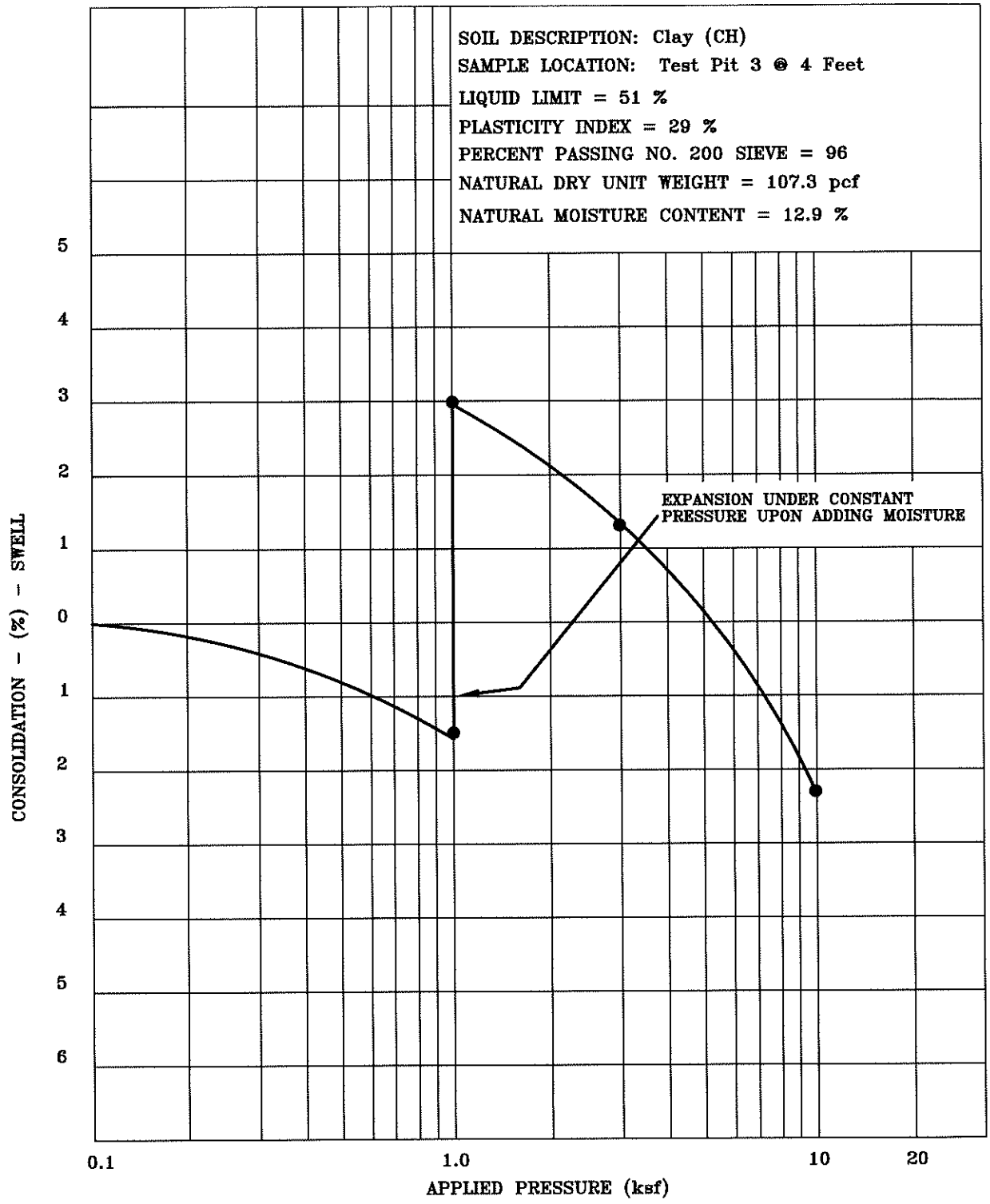


Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 · Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18–11252	
Location: Steamboat Springs, Colorado		Figure #9	



Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	(970)879-7888 · Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: Steamboat Springs, Colorado		Figure #10	



Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18	
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #11	

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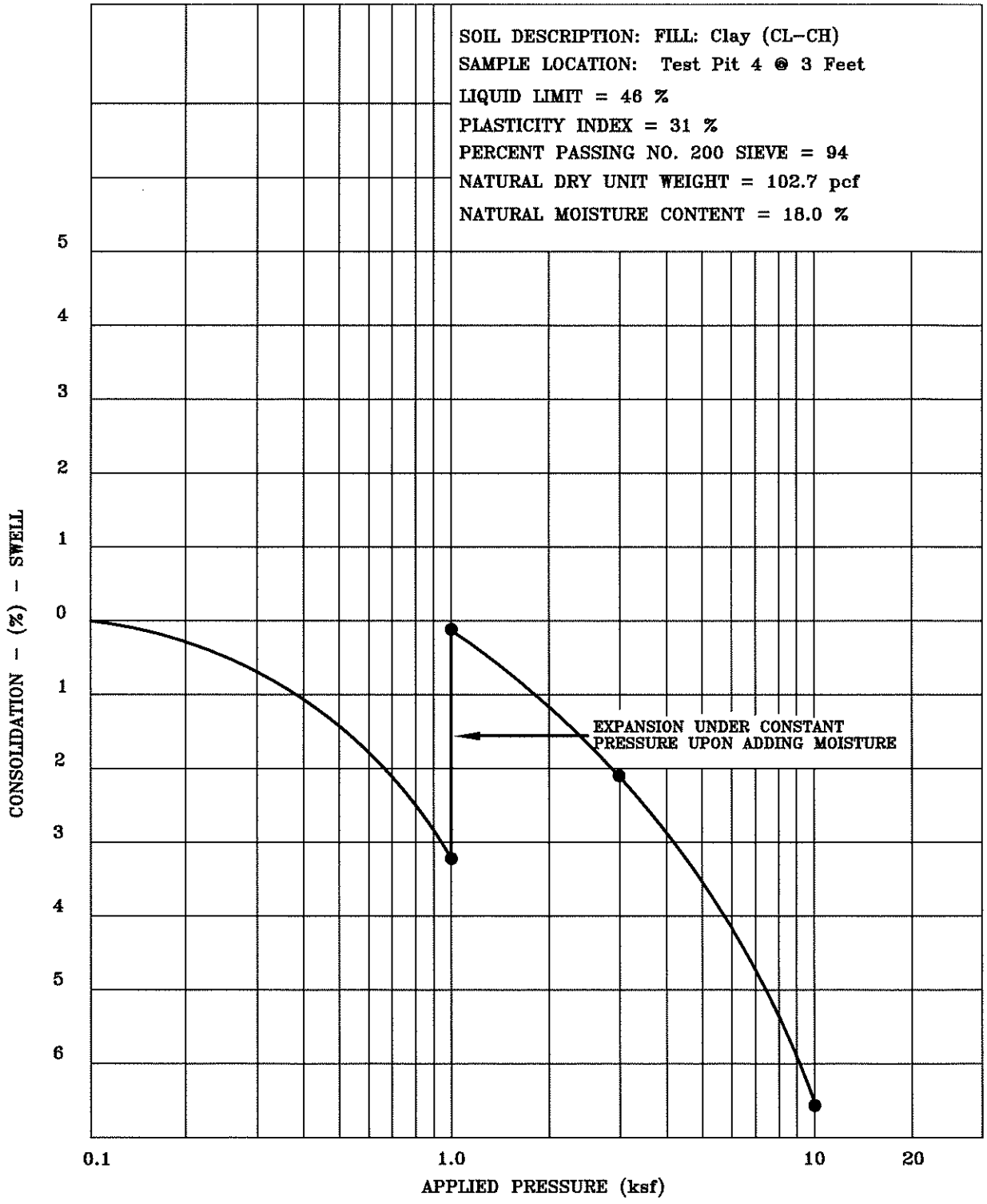
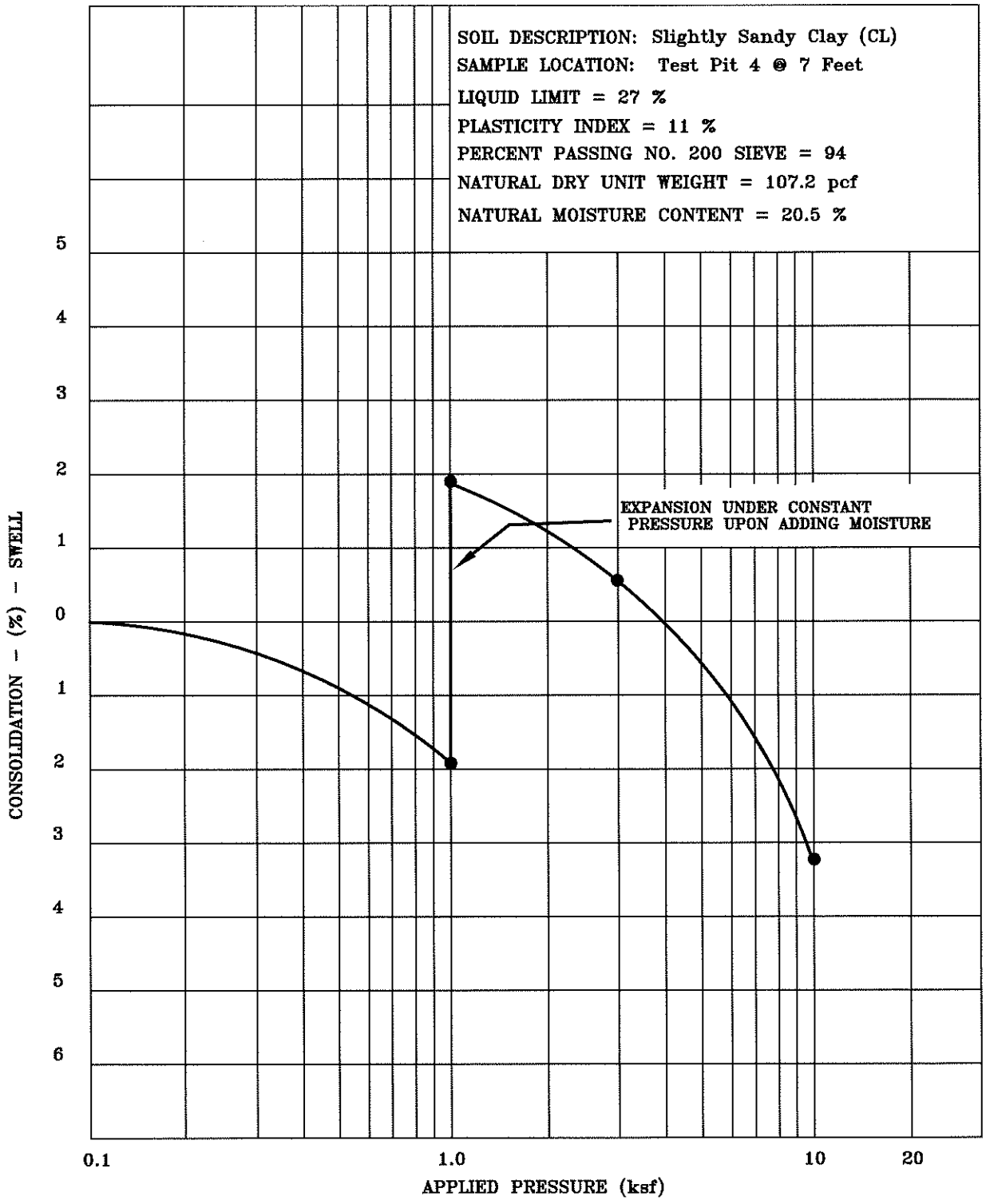
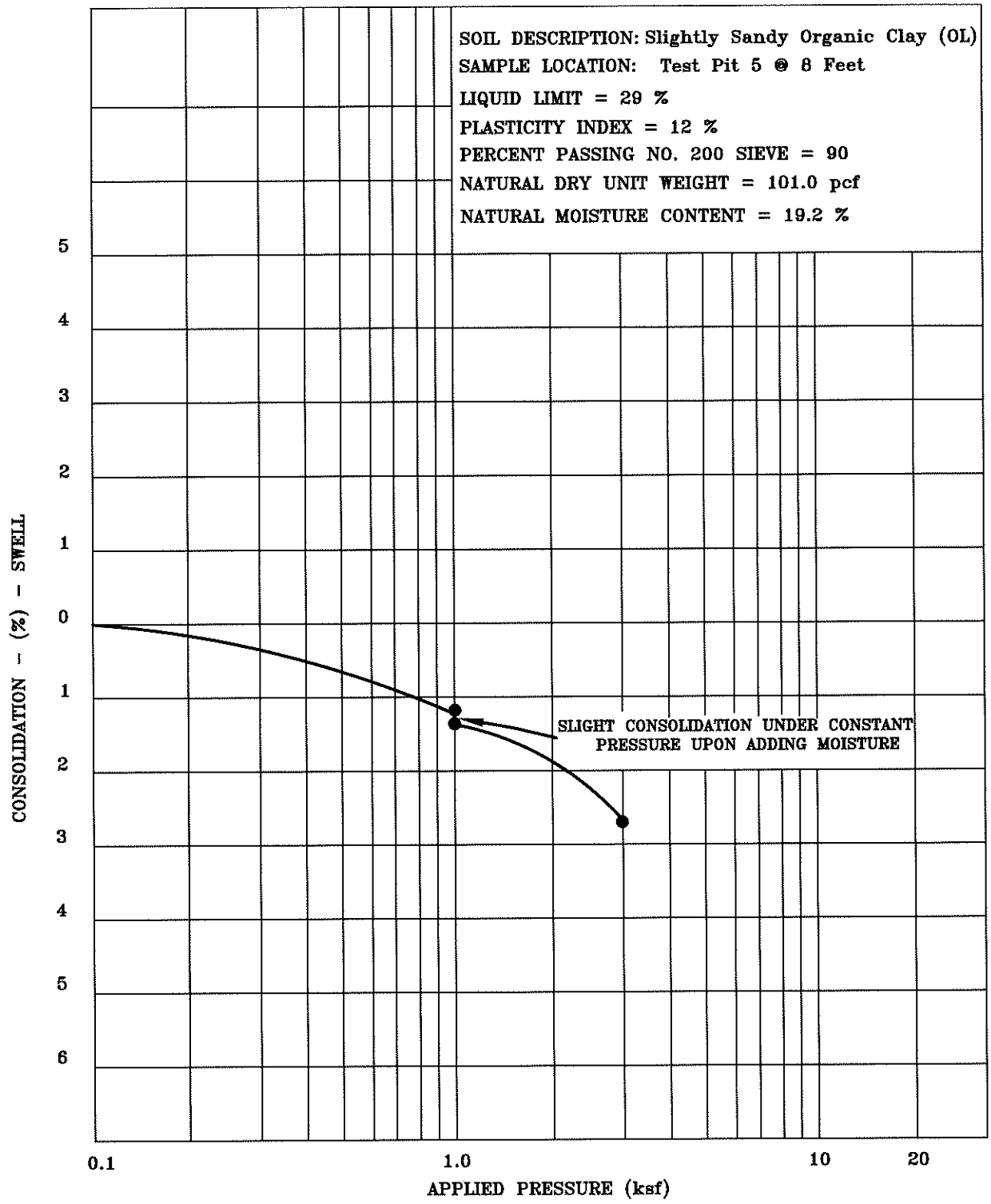


Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #12	



Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC Northwest Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18–11252	
Location: Steamboat Springs, Colorado		Figure #13	

SOIL DESCRIPTION: Slightly Sandy Organic Clay (OL)
SAMPLE LOCATION: Test Pit 5 @ 8 Feet
LIQUID LIMIT = 29 %
PLASTICITY INDEX = 12 %
PERCENT PASSING NO. 200 SIEVE = 90
NATURAL DRY UNIT WEIGHT = 101.0 pcf
NATURAL MOISTURE CONTENT = 19.2 %



Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252
Location: Steamboat Springs, Colorado		Figure #14

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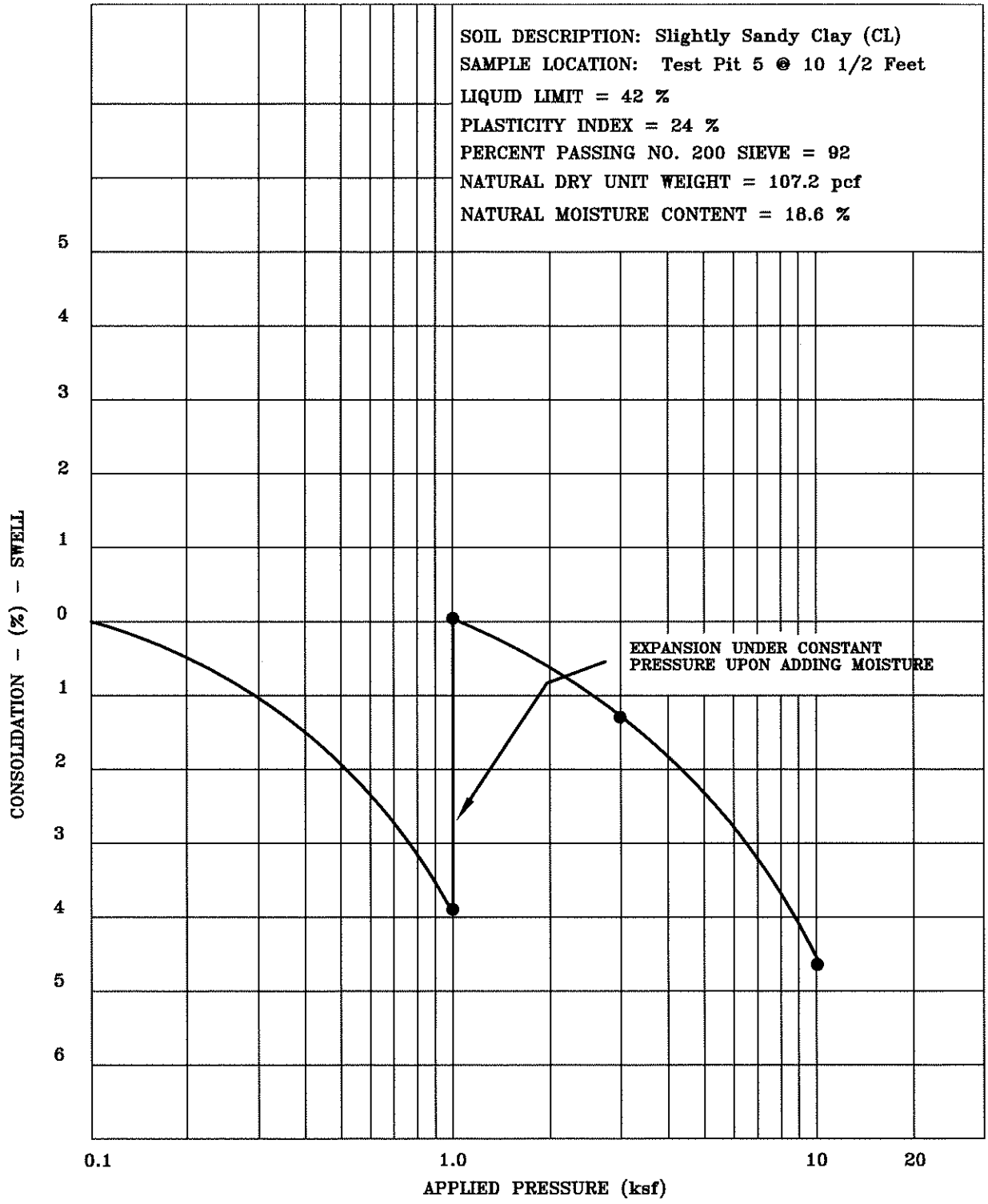
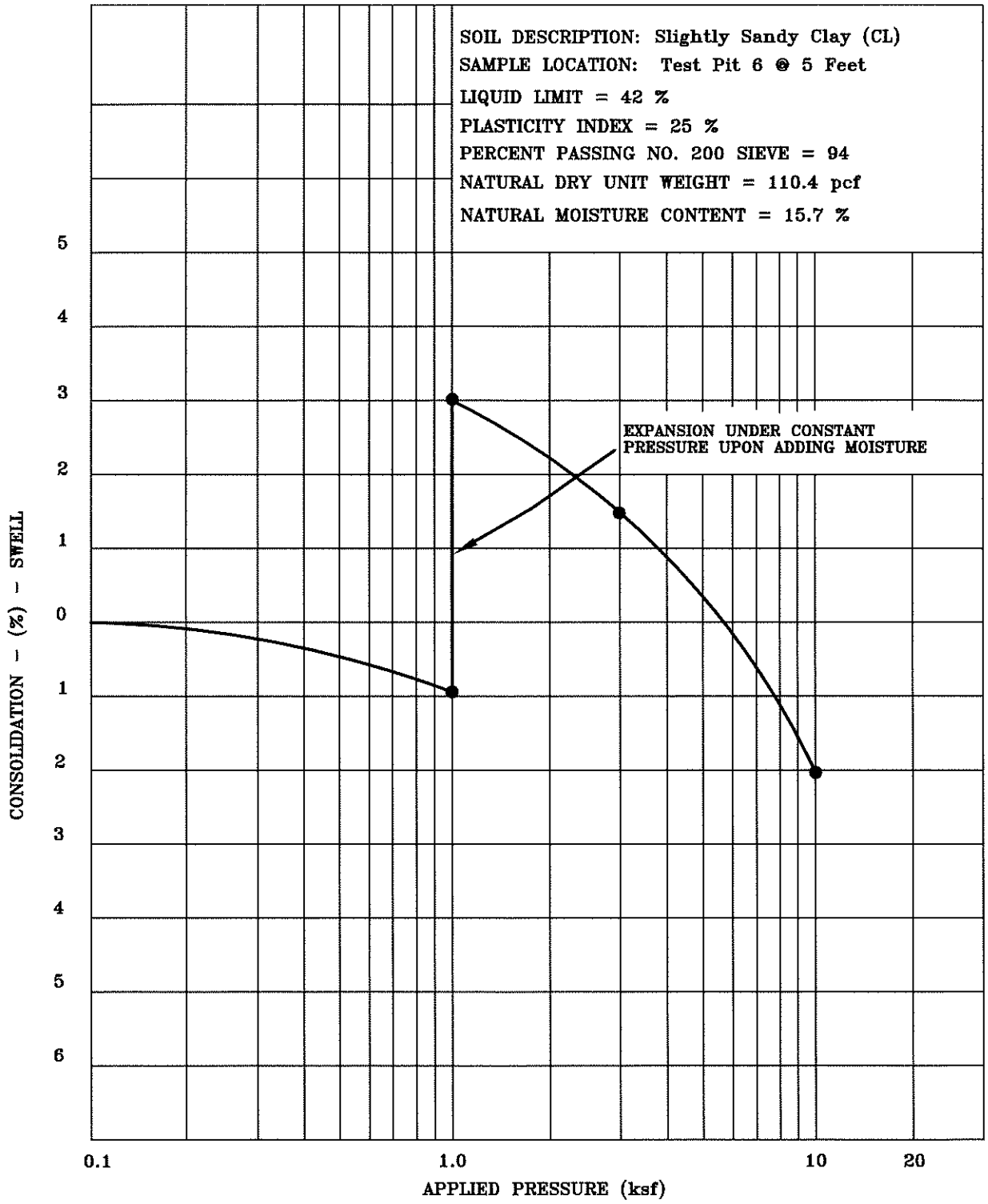


Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7688 · Fax (970)879-7691 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18–11252	
Location: Steamboat Springs, Colorado		Figure #15	



Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252
Location: Steamboat Springs, Colorado		Figure #16

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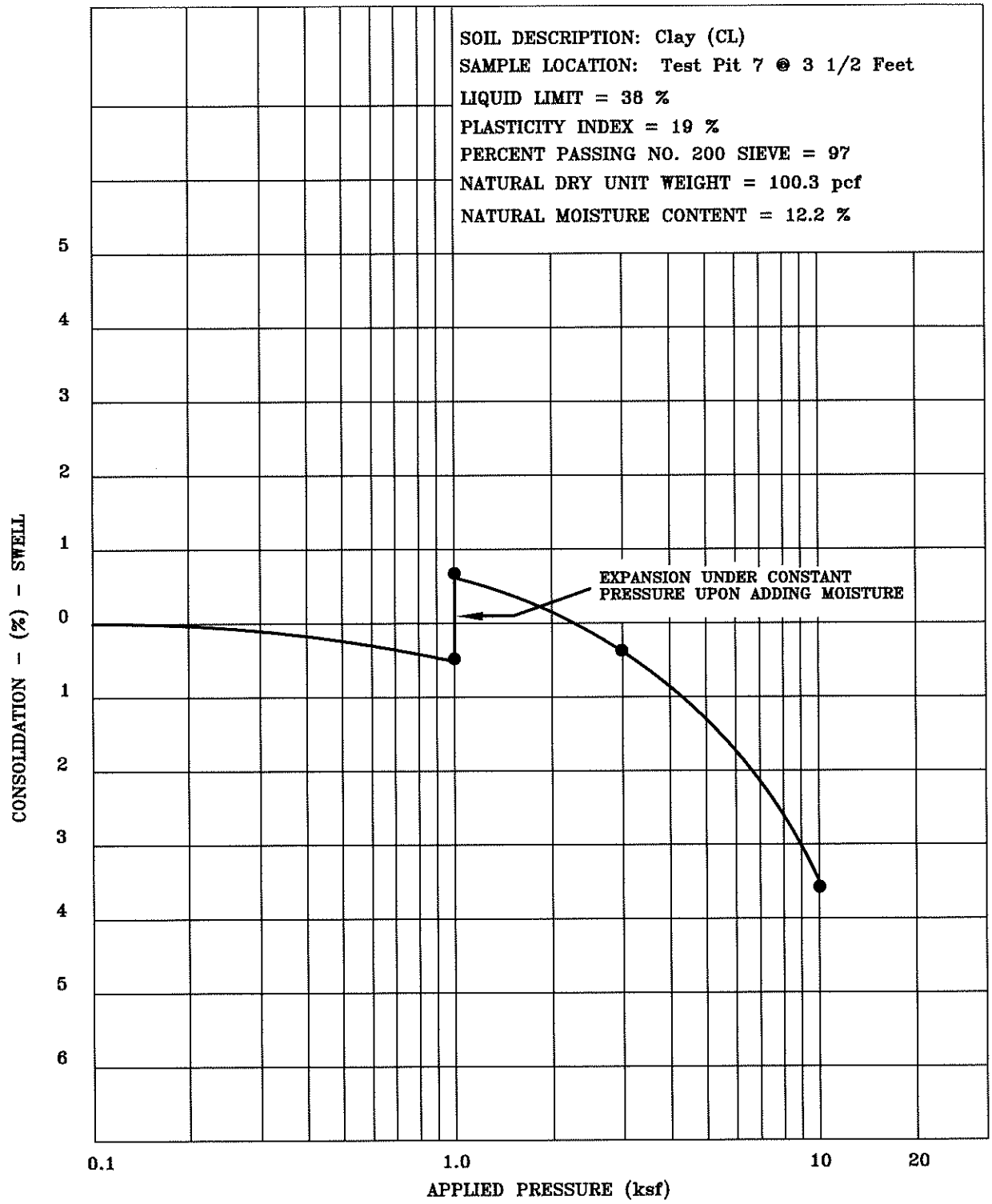

Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252
Location: Steamboat Springs, Colorado		Figure #17

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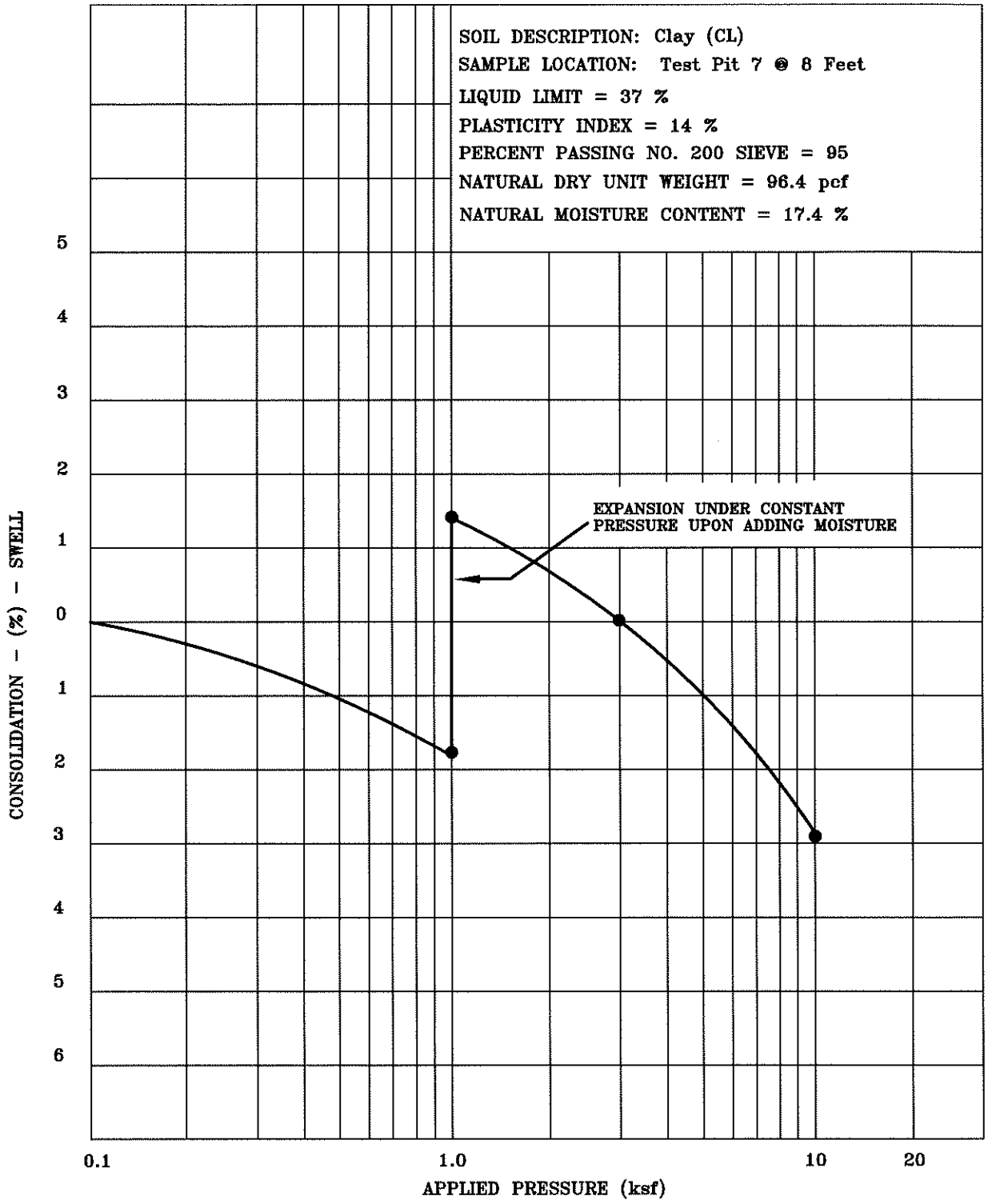
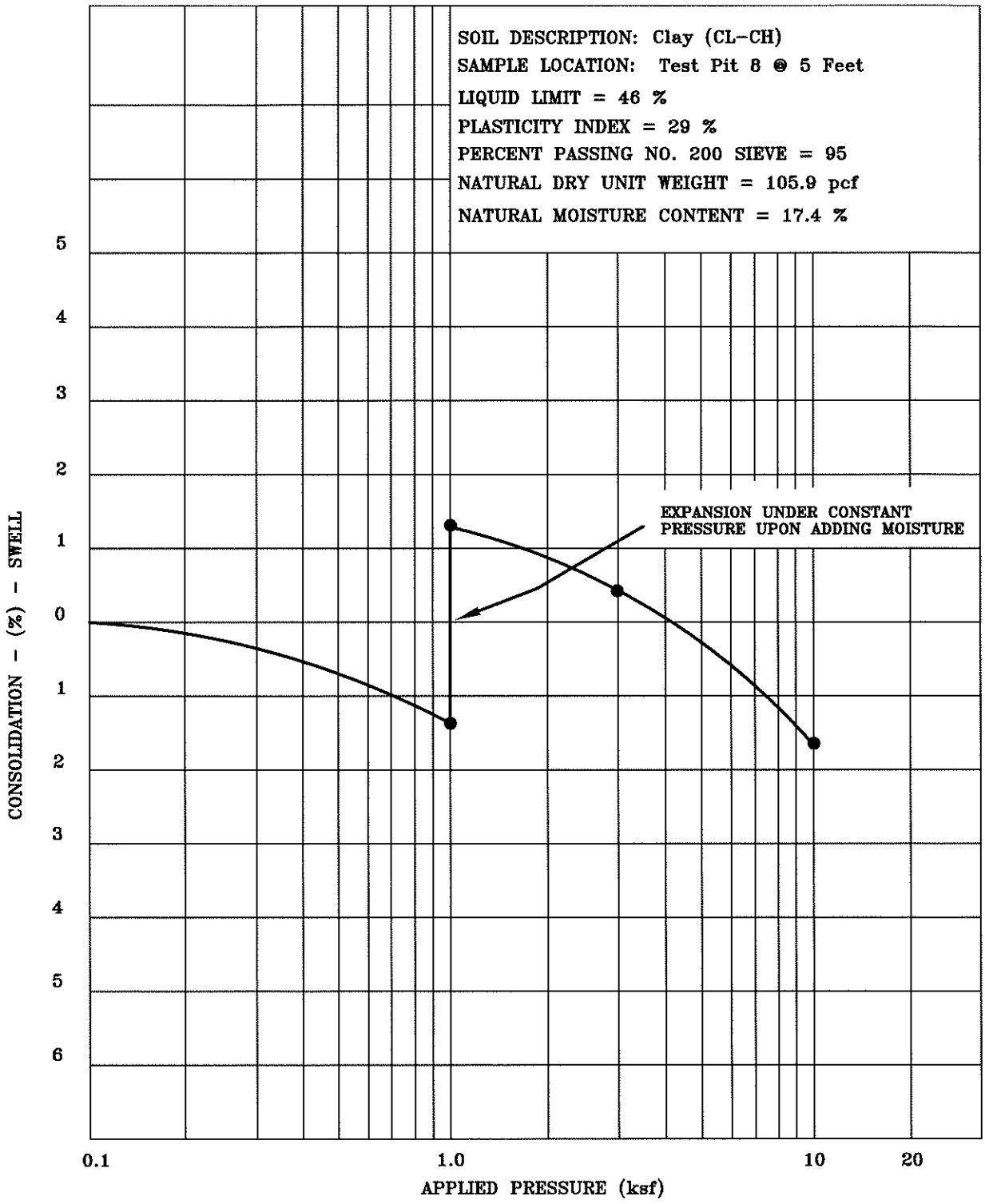
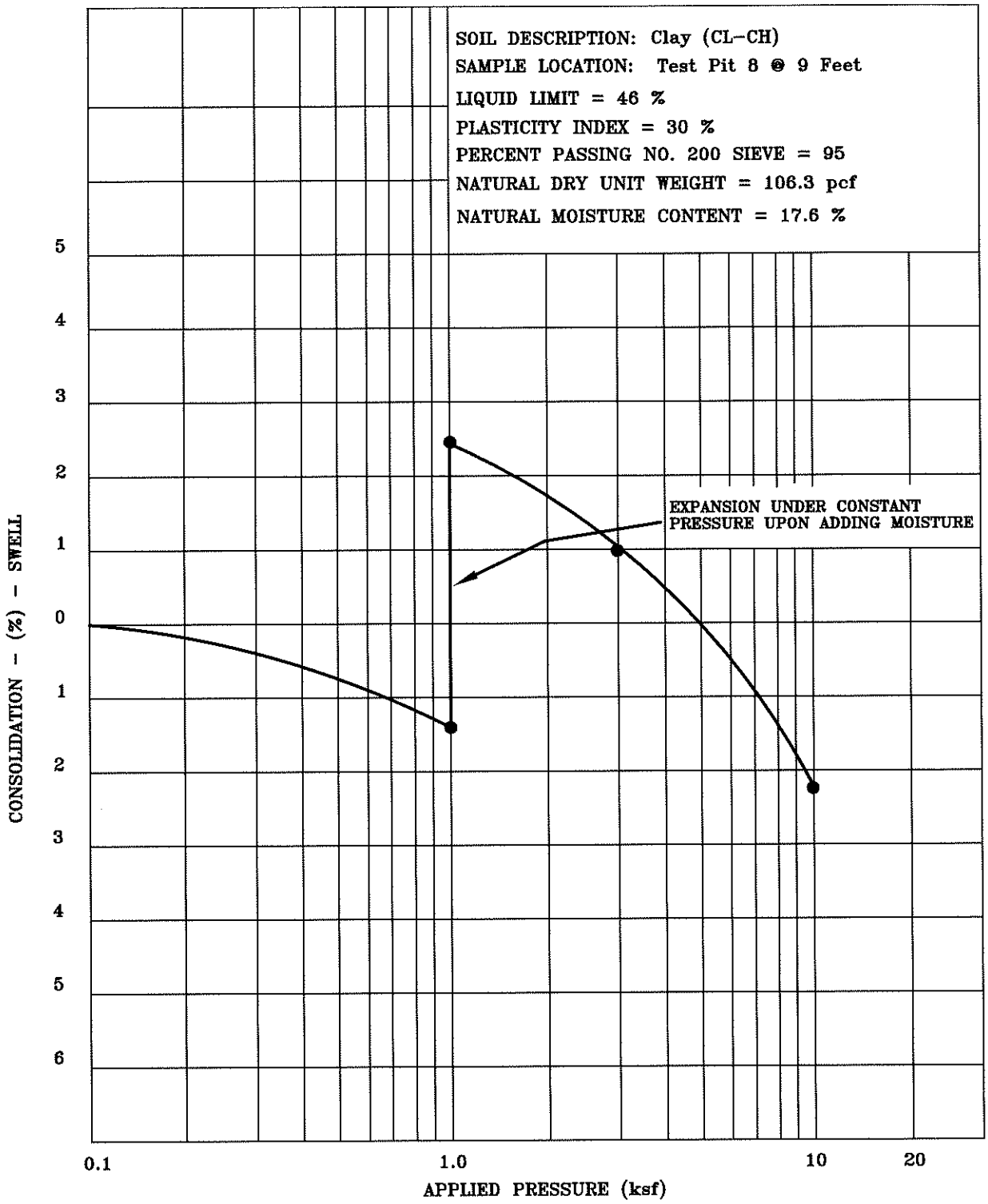


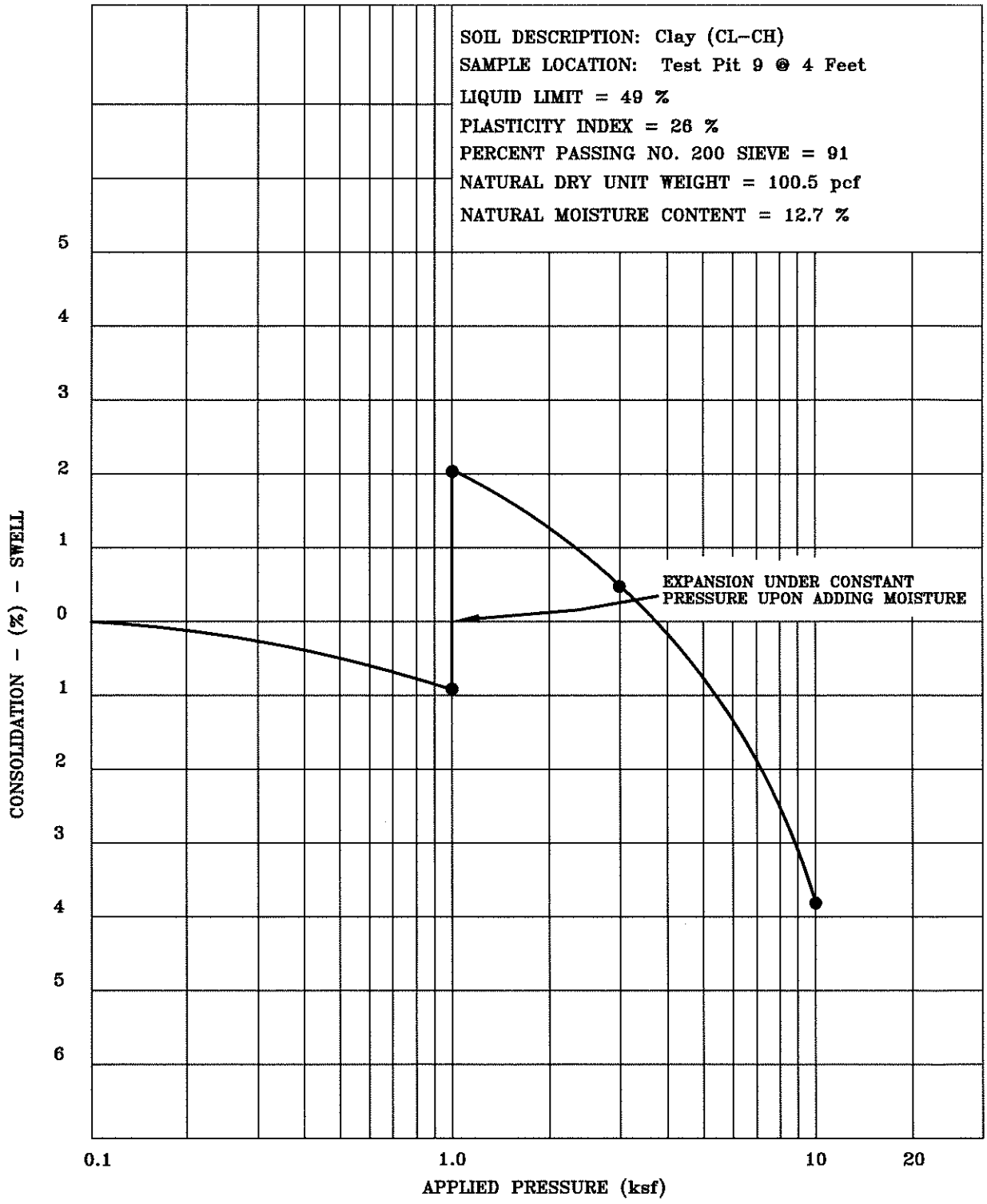
Title: SWELL–CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7868 Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #18	



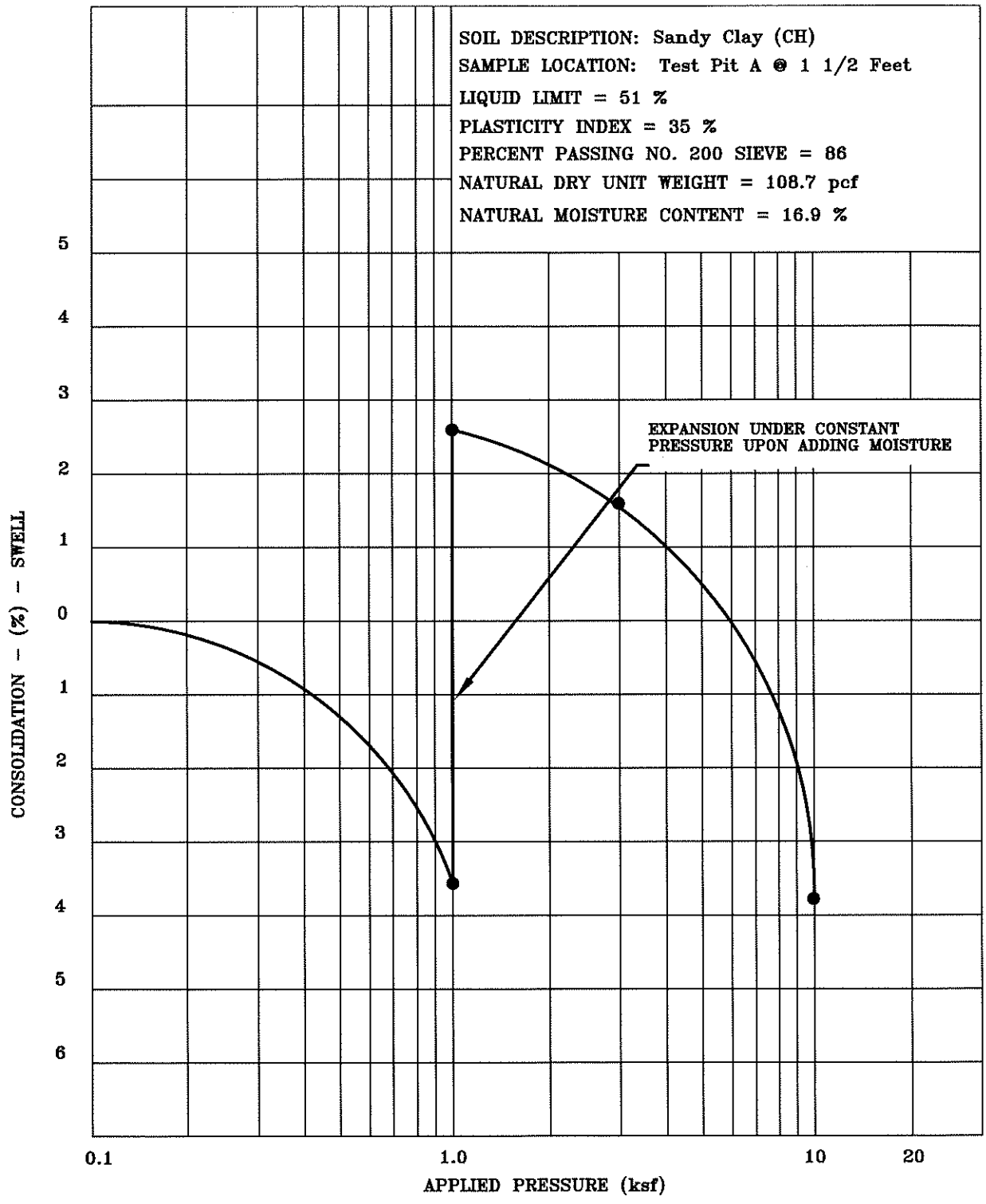
Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC Northwest Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7886 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #19	



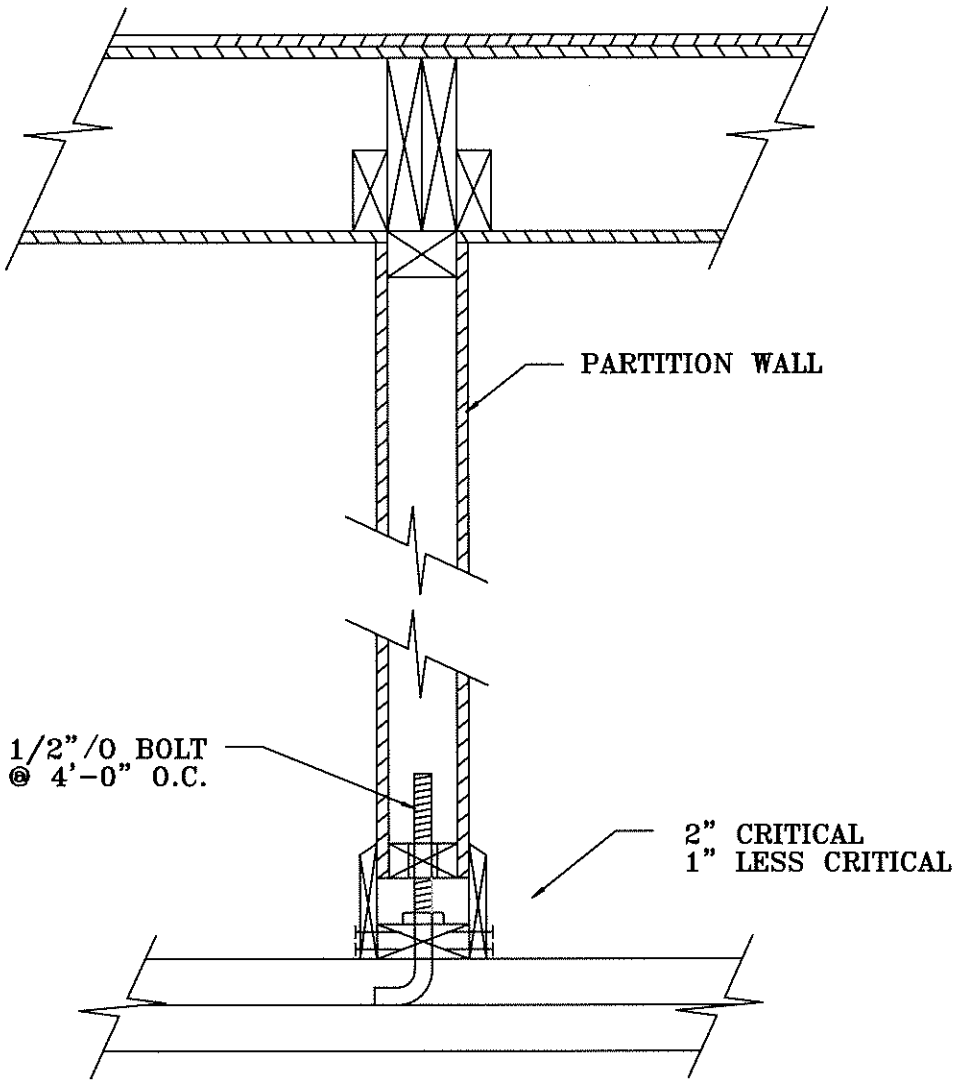
Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	(970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: Steamboat Springs, Colorado		Figure #20	



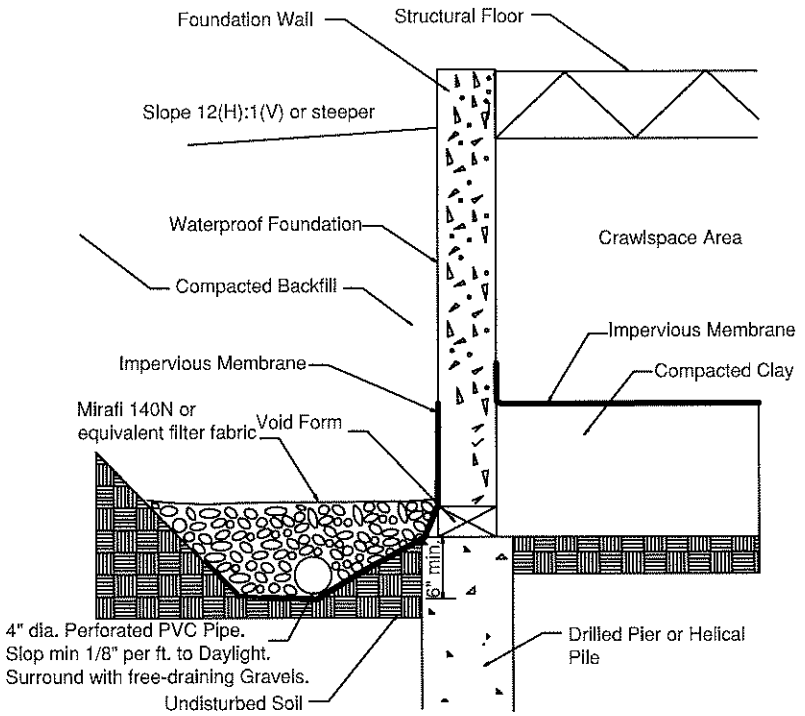
Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/28/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #21	



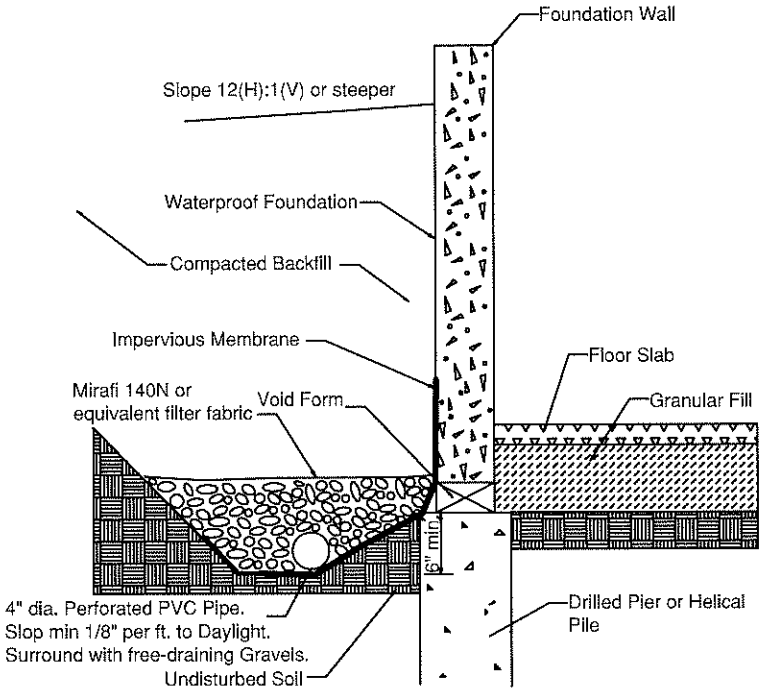
Title: SWELL-CONSOLIDATION TEST RESULTS		Date: 9/29/18	NWCC Northwest Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing (970)879-7888 - Fax (970)879-7891 2560 Copper Ridge Drive Steamboat Springs, Colorado 80487
Job Name: Sunlight Phase 2 Residences		Job No. 18-11252	
Location: Steamboat Springs, Colorado		Figure #22	



Title: HUNG PARTITION WALL DETAIL	Date: 9/29/18	NWCC North West Colorado Consultants, Inc. Geotechnical / Environmental Engineering - Materials Testing
Job Name: Sunlight Phase 2 Residences	Job No. 18-11252	(970)879-7688- Fax (970)879-7891 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487
Location: Steamboat Springs, Colorado	Figure #23	



Crawlspace Area



Lower Level with
Floor Slab

Title: PERIMETER/UNDERDRAIN DETAIL	**Date:** 9/29/18	NWCC North West Colorado Consultants, Inc.
Job Name: Sunlight Phase 2 Residences	**Job No.** 18-11252	Geotechnical / Environmental Engineering - Materials Testing
Location: Steamboat Springs, Colorado	**Figure** #24	(970)879-7686 - Fax (970)879-7691 2580 Copper Ridge Drive Steamboat Springs, Colorado 80487

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TABLE 1, PAGE 1

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	ATTERBERG LIMITS		GRADATION		PERCENT PASSING No. 200 SIEVE	UNCONFINED COMPRESSIVE STRENGTH (pcf)	SOIL or BEDROCK DESCRIPTION	UNIFIED SOIL CLASS.
TEST PIT/HOLE	DEPTH (feet)			LIQUID LIMIT (%)	PLASTICITY INDEX (%)	GRAVEL (%)	SAND (%)				
TH-1	9	14.9	114.8	55	35	13	27	60		Sandy Clay with Gravels	CH
TH-1	14	15.4	115.1	47	28	6	26	68	20,000	Sandy Clay with Gravels	CL-CH
TH-2	4	21.5	92.5	47	27	1	7	92		FILL: Slightly Sandy Clay	CH
TH-2	14	16.1	103.1	52	32	0	2	98		Clay	CH
TP-1	3	15.5	107.2	37	15	0	3	97		Clay	CL
TP-1	9	13.0	111.0	39	17	2	56	42		Very Clayey Sand	SC
TP-2	2	15.2	108.9	45	25	6	45	49		Sandy Clay with Gravels	CL
TP-3	4	12.9	107.3	51	29	0	4	96		Clay	CH

JOB NUMBER: 18-11252

NWCC, Inc

TABLE 1, PAGE 2

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	ATTERBERG LIMITS		GRADATION		PERCENT PASSING No. 200 SIEVE	UNCONFINED COMPRESSIVE STRENGTH (pcf)	SOIL or BEDROCK DESCRIPTION	UNIFIED SOIL CLASS.
TEST PIT	DEPTH (feet)			LIQUID LIMIT (%)	PLASTICITY INDEX (%)	GRAVEL (%)	SAND (%)				
TP-4	3	18.0	102.7	46	31	3	3	94		FILL: Clay	CL-CH
TP-4	7	20.5	107.2	27	11	0	6	94		Slightly Sandy Clay	CL
TP-5	8	19.2	101.0	29	12	0	10	90		Slightly Sandy Organic Clay	CH
TP-5	10 1/2	18.6	101.5	42	24	0	8	92		Slightly Sandy Clay	CL
TP-6	5	15.7	110.4	42	25	0	6	94		Slightly Sandy Clay	CL
TP-7	3 1/2	12.2	100.3	38	19	0	3	97		Clay	CL
TP-7	8	15.1	96.4	37	14	0	5	95		Clay	CL
TP-8	5	17.4	105.9	46	29	0	5	95		Clay	CL-CH

JOB NUMBER: 18-11252

NWCC, Inc

TABLE 1, PAGE 3

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	ATTERBERG LIMITS		GRADATION		PERCENT PASSING No. 200 SIEVE	UNCONFINED COMPRESSIVE STRENGTH (pcf)	SOIL or BEDROCK DESCRIPTION	UNIFIED SOIL CLASS.
TEST PIT	DEPTH (feet)			LIQUID LIMIT (%)	PLASTICITY INDEX (%)	GRAVEL (%)	SAND (%)				
TP-8	9	17.6	106.3	46	30	0	5	95		Clay	CL-CH
TP-9	4	12.7	100.5	49	26	0	9	91		Slightly Sandy Clay	CL-CH
TP-A	1 1/2	16.9	108.7	51	35	0	14	86		Sandy Clay	CH
TP-A	5	24.8	99.1	43	22	0	2	98		Clay	CL

JOB NUMBER: 18-11252