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PRELIMINARY GEOTECHNICAL INVESTIGATION

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
SOUTHEAST OF RIDGEGATE PARKWAY AND LYRIC STREET
LONE TREE, COLORADO

Prepared for:

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Project No. DN51,551-115-R1

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Cheyenne, Wyoming and Bozeman, Montana

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SCOPE

This report presents the results of our Preliminary Geotechnical Investigation for the proposed 20 townhome and 19 condo buildings within Lyric at Ridgegate located in Lone Tree, Colorado (Fig. 1). The purpose of our investigation was to evaluate the site geology and subsurface conditions to assist in planning and development of the property. The report includes descriptions of soil and bedrock conditions found in our exploratory borings, and discussion of site development and construction as influenced by geotechnical considerations. The scope was described in a Service Agreement (DN 22-0148) dated April 6, 2022.

This report is based on subsurface conditions found in our exploratory borings, results of field and laboratory tests, engineering analysis of field and laboratory data, previous investigation and our experience. The report contains discussions of geotechnical conditions and geologic hazards, site development, ground improvement, potential foundation, floor, and pavement support alternatives, surface, and subsurface drainage. The preliminary discussions of foundation and floor system alternatives are intended for planning purposes only. Lot specific investigations will be necessary to design residences. A brief summary of our conclusions and recommendations follows, with more detailed discussion in the report.

SUMMARY

1. Strata encountered in our exploratory borings consisted of nil to 17 feet of existing fill and nil to 16 feet of native clay over weathered to comparatively unweathered claystone and sandstone bedrock. Claystone was predominant and relatively shallow in nine borings (less than 10 feet). The native clay, claystone, and existing fill have high swell potential.

2. Groundwater was not encountered during or after drilling. Groundwater should not affect construction. Groundwater may develop and rise after construction in response to development, precipitation, landscaping irrigation, and changes in land use.

3. Our investigation indicates expansive soil and bedrock are present at depths likely to influence the performance of shallow foundations, flatwork and pavements. The presence of expansive soils and bedrock constitutes a geologic hazard. There is risk that slabs-on-grade and foundations will heave or settle and be damaged. We believe the recommendations presented in this report will help to reduce risk of damage; they will not eliminate that risk. Slabs-on-grade and, in some instances, foundations may be damaged.

4. Without proposed grading plans and building FFEs, a conservative approach to mitigating the expansive soil and bedrock at the site is warranted. We recommend at least 13 feet of separation between lowest foundation elements and existing expansive material (Fig. 3). This can be achieved either through sub-excavation, overlot site grading, or a combination of both. If we are provided with 1st floor FFEs, along with proposed site grading plans, we can potentially reduce the amount of sub-excavation and/or site grading fill required below proposed construction. Pavements will likely require mitigation of expansive subgrade to depths of 3 to 5 feet.

5. Control of surface drainage will be critical to the performance of foundations. Overall surface drainage should be designed to provide rapid run-off of surface water away from the proposed structures and off pavements and flatwork. Water should not be allowed to pond near the crests of slopes, near structures, or on pavements and flatwork.

SITE CONDITIONS

The 39 proposed residential buildings are planned southeast of Ridgegate Parkway and Lyric Street in Lone Tree, Colorado (Fig. 1 and Photo 1). The parcel is currently vacant, and the ground surface is barren due to recent site grading. Based on review of historical aerial images, the site has remained vacant dating back to at least 1937 and has remained unchanged until development began sometime between 2020 and 2021. Overhead powerlines run along the eastern edge of the site and were constructed between 1999 and 2002. The site is bordered by vacant land planned for development to the east, west, and south, and Ridgegate Parkway to the north. The topography generally slopes to the north with total vertical relief of about 30 feet. The southeast portion of the site is located over the since buried Arapahoe Canal.

Photo 1: Aerial Image, Google Earth©, June 2021.

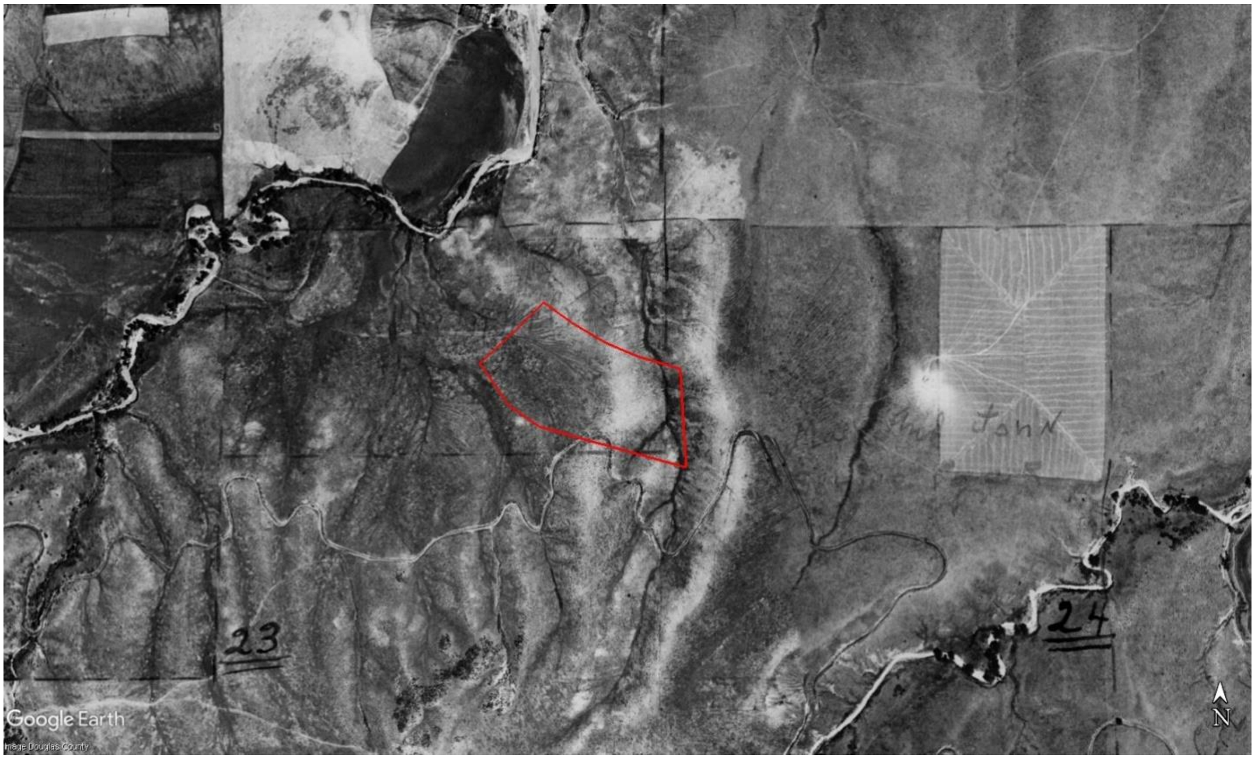


Photo 2: Aerial Image, Google Earth©, 1937.

PROPOSED DEVELOPMENT

Plans prepared by PCS Group (dated January 19, 2022) indicate the property is being considered for residential development of 20 townhome and 19 condo buildings. The buildings will be served by paved access drives, buried utilities, and associated infrastructure. Nine detached garages are planned throughout the development. Retaining walls will be located around the perimeter of the property. We anticipate the buildings will be three-story, wood-framed structures with no below grade areas. We understand PT Slab-on-Grade foundations are desired.

PREVIOUS INVESTIGATIONS

We previously performed a Preliminary Geotechnical Investigation within the site boundaries under our Project No. DN49,935-115 (report dated April 24, 2019) and subsequently performed a Supplemental Preliminary Geotechnical Investigation (letter dated January 21, 2021). A Eight borings from these investigations were drilled within the subject site. Groundwater was encountered at approximate elevations of 5997 and 6007. We encountered highly expansive clay and claystone in our borings and judged the parcel to be at high risk of potential damage due to expansive soils. We preliminarily recommended sub-excavation to a depth of 10 feet below lowest foundation elements.

INVESTIGATION

Subsurface conditions were investigated May 13, 2022, by drilling and sampling 16 exploratory borings at the approximate locations shown on Fig. 1. Prior to drilling, we contacted the Utility Notification Center of Colorado and local sewer and water districts to clear boring locations for conflicts with buried utilities. Approximate boring location coordinates and surface elevations were staked and surveyed by a representative of our firm.

The borings were drilled to depths of 25 to 30 feet using 4-inch diameter, continuous-flight auger powered by a truck-mounted CME-55 and BK-51 drill rigs. We obtained samples at approximate 5-foot intervals using 2.5-inch diameter (O.D.) a modified California barrel samplers driven by blows of a 140-pound hammer falling 30 inches. Our field representatives observed drilling, logged the strata encountered in the borings, and obtained samples. We returned to the site several days after drilling to measure the depth to groundwater in each boring. Graphical logs of the borings, including results of field penetration resistance tests and some laboratory test data, are presented in Appendix A.

Samples obtained during drilling were returned to our laboratory where they were examined and assigned testing. Laboratory testing included moisture content and dry density, swell/consolidation, total suction, Atterberg limits, percent silt and clay-sized particles (passing No. 200 sieve), and water-soluble sulfate concentrations. Swell tests were performed by wetting samples under approximate overburden pressures (i.e., the pressure exerted by the overlying soil and bedrock). Load-back analysis was performed on select samples to help estimate swell pressures. Results of the laboratory tests are summarized in Appendix B.

SUBSURFACE CONDITIONS

Strata encountered in our exploratory borings consisted of nil to 17 feet of existing fill and nil to 16 feet of native clay over weathered to comparatively unweathered claystone and sandstone bedrock. Claystone was predominant and relatively shallow in nine borings (less than 10 feet). The native clay and claystone have high swell potential. Pertinent engineering characteristics of the soil and bedrock are presented in the following paragraphs.

Existing Fill

We encountered 4 to 17 feet of existing fill related to recent site grading in six borings. The fill consisted of slightly sandy to very sandy clay with some clayey sand and was very stiff based on results of field penetration resistance tests. The fill was difficult to discern from the natural soils at times, and more or less fill may be present than our borings imply. Five fill samples swelled between 0.3 and 2.1 percent and one sample swelled 11.1 percent when wetted. One clayey sand fill sample contained 49 percent fines (passing No. 200 sieve) and exhibited high plasticity. We judge this fill unsuitable to support proposed construction. All existing fill should be removed and reworked to the criteria outlined in <u>Site Grading.</u>

Native Clay

The native clay encountered was slightly sandy to sandy and very stiff to hard. One clay sample compressed, and seven samples swelled 3.3 to 10.3 percent when wetted. The average swell of clay samples was 5.8 percent. One sample had a total suction value of 4.27 pF and developed a load-back swell pressure of about 8,400 psf. Another sample contained 75 percent fines and exhibited high plasticity. Testing indicates the clay is moderately to highly expansive.

Bedrock

Claystone and sandstone bedrock were encountered in 15 borings at depths ranging from 1 to 24 feet (approximate elevations 5994½ to 6038½) as shown on Fig. 2. Bedrock was relatively shallow (less than 10 feet) in nine borings. Weathered claystone zones were identified in two borings, about 3½ to 6 feet thick. The claystone was silty to very silty and medium hard to very hard. The sandstone was very clayey and hard to very hard. One claystone sample compressed slightly, 26 samples swelled 3.3 percent or less, and five swelled 4.7 to 8.5 percent when wetted. The average swell was 1.8 percent. Thirteen claystone samples had total suction values of 3.33 to 4.61 pF, with 11 developing load-back swell pressures of approximately 2,100 to 21,900 psf. Three claystone samples contained 62 to 82 percent fines, two of which displayed high plasticity. Four samples of sandstone swelled 1.2 percent or less when wetted. Three samples had total suction values of 3.43 to 4.22 pF and two had load-back swell pressures of about 1,900 and 2,000 psf. One sandstone sample contained 32 percent fines. Testing indicates the claystone is variably expansive and the sandstone is non-expansive to low swelling.

Groundwater

Groundwater was not encountered during or after drilling. Groundwater is not expected to influence construction. Groundwater levels may fluctuate seasonally and raise in response to development, precipitation, landscape irrigation and changes in land-use.

GEOLOGY

To evaluate the geology of the parcel, we used previous work performed by CTL|Thompson, supplemented by borings drilled for this investigation, and review of the Geologic Map of the Parker Quadrangle, Arapahoe and Douglas Counties, Colorado by U.S. Geological Survey (Miscellaneous Geologic Investigations Map I-770-A by Maberry, J.O., and Lindvall, R.M., dated 1972). An excerpt from the 1972 geologic map is reproduced below, Photo 3.

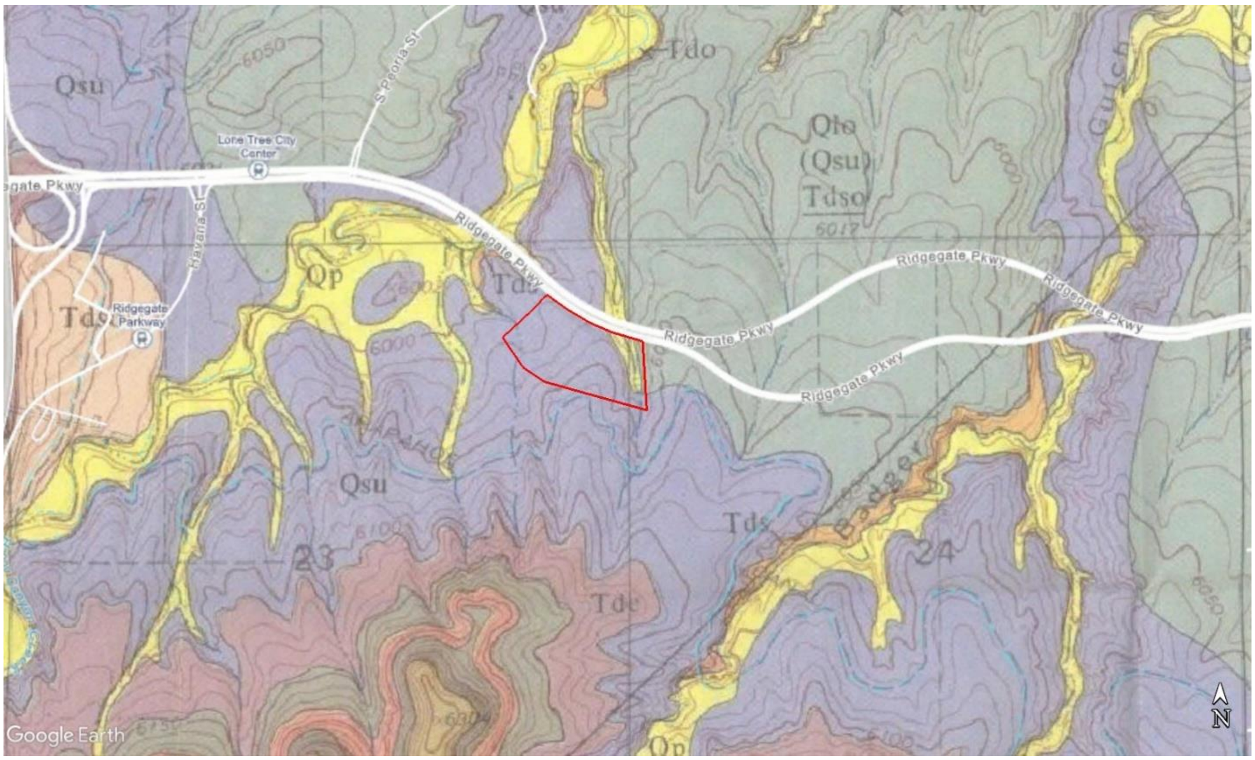


Photo 3: Geologic Map of Parker Quadrangle, Arapahoe and Douglas Counties, Colorado by USGS, 1972

As shown on the geologic map, and supported by material encountered in our exploratory borings, Lyric at Ridgegate is covered by surficial soils of the Slocum alluvium (map symbol Qsu) of early Pleistocene age and Piney Creek alluvium (map symbol Qp) of early-middle Holocene age. The underling bedrock is claystone and sandstone of the Dawson formation. The sandstone is arkosic, and although not encountered, can be cemented in areas. The claystone is silty and plastic when wet.

GEOLOGIC HAZARDS

Geologic hazards and geotechnical concerns can affect development risks and costs. Geologic hazards at this site include expansive soil and bedrock and the regional geologic hazards of seismicity and naturally occurring radioactive materials. No geologic hazards that would preclude the proposed development were noted. We believe potential hazards can be mitigated with proper engineering, design, and construction practices as discussed in this report.

Expansive Clay and Claystone

The presence of expansive soil and bedrock implies risk that ground heave will damage foundation, slab-on-grade floors, and pavements. Covering the ground with structures, streets, driveways, patios, etc., coupled with lawn irrigation and changing drainage patterns, leads to an increase in subsurface moisture conditions. Thus, some soil movement due to heave or settlement is inevitable. Expansive soils and bedrock are present at this site, which constitutes a geologic hazard. It is critical that precautions are taken to increase the chances that proposed improvements will perform satisfactorily. Engineered design of grading, pavements, foundations, slabs-on-grade, and surface drainage can mitigate, but not eliminate, the effects of expansive soil and bedrock. Sub-excavation, as recommended in this report, is an alternative to reduce potential heave and allow use of shallow foundations.

Estimated Potential Heave

We conducted swell/consolidation tests to provide a basis to calculate potential heave of the on-site materials. The analysis involves dividing the soil profile into layers and modeling the heave of each layer from representative swell tests. A depth of wetting of 24 feet below the ground surface was used for the heave evaluation. Research by Walsh, Colby, Houston and Houston[1] indicates there is a 90 percent probability that the wetting depth will not exceed 24 feet for this region, suggesting the risk of ground heave exceeding the estimated values is low. This depth of wetting is typically used for irrigated residential sites with basements. Considering the buildings will not have basements the depth of wetting may be less.

[1] "Method for Evaluation of Depth of Wetting in Residential Areas" by Walsh, Colby, Houston and Houston, Journal of Geotechnical and Geoenvironmental Engineering, ASCE February 2009.

We chose two methods to evaluate potential ground heave, the Thompson Method and partial-wetting technique by Houston et al.[2] The latter study theorizes that the highest degree of wetting occurs near-surface with a gradually decreasing degree of wetting with depth. The Thompson method does not account for partial wetting and assigns a constant 30 percent reduced wetting factor to each layer. This typically results in higher heave estimates at greater depths. Houston, Stauffer, West, Bradford, and Houston's 2017 publication indicates that about 80 to 90 percent of the laboratory measured swell actually occurs in the field in the upper 30 to 40 percent of the depth of wetting, decreasing parabolically from that point to the maximum depth of wetting, i.e., about 50 percent of the laboratory measured swell occurs in the field at 70 percent of the depth of wetting and 10 percent occurs at 90 percent of the depth of wetting. We estimated potential heave by averaging the Thompson method and partial-wetting technique, along with using engineering judgement, to tabulate Table I.

TABLE I

ESTIMATED POTENTIAL GROUND SURFACE HEAVE – 24-FEET DEPTH OF WETTING

Boring	Estimated Potential Heave at Existing Ground Surface (inches)
B-1	5
B-2	3½
B-3	13
B-4	7
B-5	11½
B-6	5
B-7	4½
B-8	3½
B-9	6
B-10	7½
B-11	4
B-12	4½
B-13	3½
B-14	3
B-15	1½
B-16	5

[2] "Use of the Net Partial Wetting Factor (NPWF) Method of Computation of Remaining Heave: A Forensic Study" by Houston, Stauffer, West, Bradford, and Houston, 2017.

Radioactivity

It is normal in the Front Range of Colorado and nearby eastern plains area to measure radon gas in poorly ventilated spaces (e.g., full-depth residential basements) in contact with soil or bedrock. Radon 222 gas is considered a health hazard and is just one of several radioactive products in the chain of the natural decay of uranium into lead. Radioactive nuclides are common in the soil and bedrock underlying the subject site. Because these sources exist or will exist on most sites in the area, there is a potential for radon gas accumulation in poorly ventilated spaces. The concentration of radon is a function of many factors, including the radionuclide activity of the soil and bedrock, construction methods and materials, soil gas pathways, and accumulation areas. The only reliable method to determine if a hazard exists is to perform radon testing of completed residential structures. Typical mitigation methods consist of sealing soil gas entry areas, ventilation of below-grade spaces, and venting from foundation drain systems. Radon rarely accumulates to significant levels in above-grade living spaces. We recommend provision for ventilation of foundation drain systems if a radon problem is discovered.

Other Considerations

We did not identify significant economically recoverable, high quality aggregate in our borings.

SITE DEVELOPMENT

The primary geotechnical concerns that we believe will influence development is the presence of expansive clay and claystone. This concern can be mitigated, but not eliminated, with proper planning, engineering, design and construction. We believe there are no geologic or geotechnical constraints that would preclude development. The following sections provide site development recommendations.

Excavation

We believe the soils penetrated by our exploratory borings can be excavated with typical heavy-duty equipment. We recommend the owner and contractor become familiar with applicable local, state and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Based on our investigation and OSHA standards, we anticipate the clay and claystone may classify as Type B soil, the sandstone as Type C, and the fill as Type B or C. Based on OSHA regulations, Type B soils require maximum slope inclinations of 1:1 (horizontal: vertical) and 1½:1 for Type C soils for temporary excavations in dry conditions. Seepage and saturated soils will necessitate flatter conditions. The contractor's "competent person" is required to identify the soils encountered in the excavations and refer to OSHA standards to determine appropriate slopes. Stockpiles of soils and equipment should not be placed within a horizontal distance equal to one-half the excavation depth from the edge of the excavation. A professional engineer should design excavations deeper than 20 feet.

Site Grading

Prior to fill placement, the ground surface should be stripped of vegetation, scarified, and moisture conditioned to between 1 and 4 percent above optimum moisture content for clay and within 2 percent of optimum for sand, and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698).

The properties of fill will affect the performance of foundations, slabs-on-grade, utilities, pavements, flatwork and other improvements. The on-site soils are suitable for use as site grading fill provided they are substantially free of debris, organics and other deleterious materials. Rock particles and boulders larger than 6 inches and soil clods larger than 3 inches should be removed from the fill or be broken-down. Fill should be placed in thin loose lifts, moisture conditioned and compacted prior to placement of the next lift using the criteria presented in the previous paragraph. The placement and compaction of site grading fill should be observed and density tested by our representative during construction. Guideline grading specifications are presented in Appendix C. If imported soil is necessary it should ideally consist of soil having a maximum particle size of 3 inches, between 25 and 50 percent passing the No. 200 sieve, a liquid limit less than 30, and a plasticity index less than 15. Potential import fill materials should be submitted to our office for approval prior to importing to the site.

Our experience indicates fill will settle under its own weight. We estimate potential settlement of about 1 to 2 percent of the fill thickness even if the fill is compacted to the specified criteria. Most of this settlement usually occurs during and soon after construction; for clayey fill, it may continue for longer. Heave or additional settlement may occur after development in response to wetting.

There may be some areas where proposed grading will create non-uniform depths of fill below residence sites. Where the depth varies more than about 5 feet, sub-excavation or benching of existing slopes should be considered to create more uniform fill depth. We recommend additional review of these conditions as grading and sub-excavation plans are formalized.

Sub-Excavation

Deep foundations and structurally supported floor systems are commonly used on sites where moderate to high swell clay or claystone bedrock are found at depths likely to influence performance. Many local builder-developers choose to perform sub-excavation to reduce potential heave and provide a relatively uniform fill layer that is likely suitable for shallow foundations and slab-on-grade floors. Sub-excavation has been employed in the Denver area with satisfactory performance for the large majority of the sites where this ground modification method has been completed. We have seen isolated instances where differential settlement of sub-excavation fill has led to damage to buildings supported on footings. In most cases, the settlement was caused by wetting associated with poor surface drainage or seepage, and/or poorly compacted fill placed at the horizontal limits of excavation. Wetting of the fill may cause softening and settlement.

Without planned 1st floor FFEs for the townhome and condominium buildings, a more conservative approach to mitigating the expansive soil and bedrock at the site is warranted. We recommend creating at least 13 feet of separation between lowest foundation elements and existing expansive material (Fig. 3). This can be achieved either through sub-excavation, overlot site grading, or a combination of both (depending on proposed FFEs). If we are provided with 1st

floor FFEs, along with proposed site grading plans, we can potentially reduce the amount of sub-excavation and/or site grading fill required below proposed building footprints.

The bottom of sub-excavation areas should extend laterally at least 5 feet outside the largest possible foundation footprint to ensure foundations are constructed over moisture-conditioned fill. The sub-excavation areas should be checked by a surveyor. An “as-built” sub-excavation plan should be prepared and provided to construction and sales staff to ensure foundations and decks are located within the sub-excavated area. A conceptual sub-excavation profile is shown on Fig. 4.

The excavation contractor should be chosen carefully to assure they have experience with fill placement at over-optimum moisture and have the necessary compaction equipment. In order for the sub-excavation procedure to be performed properly, close control of fill placement to specifications is required. Special precautions should be taken for compaction of fill at corners, access ramps, and edges of the sub-excavation trenches due to equipment access constraints. The contractor should have the appropriate equipment to reach and compact these areas. Fill should be moisture treated between 1 and 4 percent above optimum moisture content and be compacted to at least 95 percent of maximum standard proctor dry density (ASTM D 698). Guideline specifications are provided in Appendix D. Our representative should observe and test compaction of the fill. The fill should be tested after the fill placement.

If the fill dries excessively prior to construction, it may be necessary to rework the upper drier materials prior to constructing foundations. We judge the fill should retain adequate moisture for about two years. Moisture conditions can be assessed in excavations as construction progresses.

Utility Construction

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill can have a significant effect on the life and serviceability of pavements. Based on Douglas County specifications, utility trench backfill should be moistened between optimum and 4 percent above optimum and compacted to at least 95 percent of standard Proctor maximum dry density for clay and moistened within 2 percent of optimum and compacted to 100 percent of standard Proctor for sand. Trench backfill should be placed in thin (8 inches or less) loose lifts. The placement and compaction of utility trench backfill should be observed and tested by a representative of our firm during construction.

Utility trench backfill compaction by a sheepsfoot wheel attachment on a backhoe or trackhoe has been found to be generally less successful than using self-propelled roller compactors. Special attention should be paid to backfill placed adjacent to manholes as we have seen instances where settlement in excess of 2 percent has occurred. Any improvements placed over backfill should be designed to accommodate movement.

Slopes

We recommend permanent cut and fill slopes be designed with a maximum slope of 3:1 (horizontal to vertical); use of 4:1 would be better to control erosion. If site constraints (property boundaries and streets) do not permit construction with recommended slopes, we should be contacted to evaluate the subsurface soils and steeper slopes. Slopes higher than 20 feet should be evaluated by our office on a case-by-case basis. Concentrated surface drainage should not be allowed to sheet flow across slopes or pond near the crest of slopes. All slopes should be re-vegetated soon after grading to reduce erosion.

Retaining Walls

Retaining walls are currently planned around the perimeter of the site. Retaining walls should be designed to resist lateral earth pressures. Mechanically Stabilized Earth (MSE) are commonly used in residential developments. Residence foundations should not be constructed on retaining wall backfill.

MSE Walls

MSE walls include geosynthetic-reinforced structural fill. Internal and global stability should be analyzed as part of the design process. Surcharge pressures from slopes, backfill and vehicular loads should also be considered.

Some movement of MSE walls must occur to mobilize the shear strength of the soil and reinforcement. We assume retained soil and backfill behind the reinforced zone will be native soil or fill derived from similar materials. The on-site soil should not be used in the reinforced zone. We recommend the reinforced zone be constructed with imported sand and gravel meeting CDOT Class 5 or 6 Aggregate Road Base or Class I Structural fill specifications (or better). Angular gravel meeting AASHTO No. 57 or 67 may also be used for the reinforced soil and is recommended for the leveling pad and drainage material. Most MSE block retaining wall design programs require input of soil parameters for foundation soil, leveling pad, reinforced soil and retained soil. We anticipate the parameters in Table II.

TABLE II

PRELIMINARY MSE SOIL INPUT PARAMETERS

Material Use	Material Description & Classification	Cohesion (psf)	Internal Friction Angle (degrees)	Unit Weight (pcf)
Foundation Soil	Clay (CH)	100	21	110
Leveling Pad	Gravel (imported) AASHTO #57 or 67 Coarse Concrete Aggregate	0	40	135
Reinforced Soil (import recommended)	Sand, Gravelly, Silty, CDOT Class 6 Road Base (or better)	0	34	125
Retained Soil	Clay (CH)	100	21	110

Free-draining granular backfill should be used behind the block face to relieve hydrostatic pressure and provide drainage. We recommend a material with less than 5 percent fines (passing No. 200 sieve) within at least 1 foot behind the walls. The free-draining gravel layer should be placed in thin, loose lifts, and compacted to at least 70 percent of maximum relative dry density (ASTM D 4253 and ASTM D 4254). Fill should be placed and compacted to the criteria provided in Site Grading. Special precautions should be taken to avoid over-stressing the walls during compaction. We recommend use of small, hand-operated compactors.

We recommend weep holes and/or installation of a drain pipe at the base of the free-draining backfill zone. If a pipe is installed, it should consist of 4-inch perforated, rigid PVC encased in free-draining gravel. The drain should slope at least 1 percent to a positive gravity outlet at either or both ends of the walls or be connected to outfall more than 5 feet in front of the wall. Any pipe installed beneath a wall should be strong enough to withstand the applied pressure and should be solid extending at least 5 feet beyond the toe of the wall or to discharge within a concrete pan.

Pavements

Pavement subgrade soils are variable and may consist of clay, bedrock, or fill of similar composition. The City of Lone Tree has adopted Douglas County pavement design standards. Douglas County minimum pavement section alternatives are presented in Table III. For planning purposes, we estimate a 4-inch thick asphaltic concrete and 8-inch base course section for local residential streets. Douglas County requires swell mitigation consisting of 12 inches of aggregate base course when pavement subgrade samples swell more than 2 percent under an applied pressure of 100-150 psf. This base course is in addition to any base course that is part of the pavement section. Additionally, sub-excavation (3 to 5 feet) may also be merited. Subgrade investigation and pavement designs should be performed after grading is complete.

Douglas County requires edge drains and cleanouts on both sides of the street for all collectors that have curb and gutter (Standard Details SP-23a through SP-26). The edge or trench drain consists of a filter fabric wrapped gravel section with a pipe at least 30 inches below grade. The edge drains typically outfall into storm structures. Edge drains work well with pavements that have at least some aggregate road base.

TABLE III

DOUGLAS COUNTY MINIMUM PAVEMENT SECTIONS*

Roadway Classification	Full-Depth Hot Mix Asphalt (HMA)	Hot Mix Asphalt + Aggregate Base Course (HMA + ABC)	Portland Cement Concrete (PCC)
Local Residential	N/A	5” HMA + 8” ABC	6” PCC
Local Commercial	N/A	5” HMA + 8” ABC	7” PCC
Minor Collector Residential	N/A	6” HMA + 8” ABC	8” PCC
Minor Collector Commercial	8” HMA	6” HMA + 10” ABC	9” PCC

*Placement on 12 inches of additional base course may be necessary

BUILDING CONSTRUCTION CONSIDERATIONS

The following discussions are preliminary and are not intended for design or construction. After grading is completed, design-level investigations should be performed on a lot-specific basis.

Foundations

Our investigation indicates expansive clay and claystone are present at depths likely to influence the performance of shallow foundations and slabs-on-grade. Footing or post-tension slab-on-grade foundation can likely be used after sub-excavation of the expansive material is performed. Alternatively, a deep foundation system such as drilled piers can be considered.

Slab-On-Grade Construction

The performance of garage floors, driveways, sidewalks, and other surface flatwork will likely be poor where high swell materials are shallow, unless sub-excavation is performed. The following precautions will be required to reduce the potential for damage due to movement of slabs-on-grade for this site.

1. Isolation of the slabs from foundation walls, columns and other slab penetrations;
2. Voiding of interior partition walls to allow for slab movement without transferring the movement to the structure;
3. Flexible water and gas connections to allow for slab movement. A flexible plenum above furnaces will be required; and
4. Proper surface grading and foundation drain installation to reduce water availability to sub-slab and foundation soils.

Surface and Subsurface Drainage

The performance of improvements will be influenced by surface drainage. When developing an overall drainage scheme, consideration should be given to drainage around each building. The ground surface around the buildings should be sloped to provide positive drainage away from the foundations. We recommend a slope of at least 5 percent for the first 10 feet surrounding buildings without basements, where practical. If the distance between buildings is less than 20 feet, the slope in this area should be 5 percent to the swale between them. Where possible, drainage swales should slope at least 2 percent. Variation from these criteria is acceptable in some areas. Roof downspouts and other water collection systems should discharge beyond the limits of backfill around structures.

Proper control of surface runoff is also important to control the erosion of surface soils. Sheet flow should not be directed over unprotected slopes. Water should not be allowed to pond at the crest of slopes. Permanent slopes should be prepared in such a way to reduce erosion.

Water from irrigation frequently flows through relatively permeable backfill placed adjacent to buildings and collects on the surface of less permeable soils occurring at the bottom of excavations. This process can cause wet or moist below-grade conditions after construction. There are no below-grade areas planned at this time. Our experience indicates moist conditions can develop in crawl spaces (if constructed), resulting in isolated instances of damp soils, musty smells, and, in rare cases, standing water. Crawl spaces should be well ventilated, depending on the use of a vapor retarder/barrier and the floor material selected.

Concrete

Concrete in contact with soil can be subject to sulfate attack. We measured water-soluble sulfate concentrations of less than 0.01 to 0.1 percent. For this negligible level of sulfate concentration (RS0), ACI 332-20 *Code Requirements for Residential Concrete* indicates there are no special requirements for sulfate resistance.

Superficial damage may occur to the above-grade exposed surfaces of concrete walls and grade beams in contact with soils, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high-water tables. Concrete should have a total air content of 6 percent ± 1.5 percent. We advocate all foundation walls and grade beams in contact with the subsoils (including the inside and outside faces of garage and crawl space grade beams) be damp-proofed.

RECOMMENDED FUTURE INVESTIGATIONS

We recommend the following investigations and services:

1. Construction testing and observation during site development and grading;
2. Subgrade investigation and pavement design(s) after grading;
3. Design-level Soils and Foundation Investigation(s) for residences after grading; and
4. Foundation installation observations.

CONSTRUCTION OBSERVATIONS

We recommend that CTL|Thompson, Inc. provide construction observation services to allow us the opportunity to verify whether soil conditions are consistent with those found during this investigation. If others perform these observations, they must accept responsibility to judge whether the recommendations in this report remain appropriate.

GEOTECHNICAL RISK

The concept of risk is an important aspect with any geotechnical evaluation primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free. Our recommendations represent our judgment of those measures that are necessary to increase the chances that the structures will perform satisfactorily. It is critical that all recommendations in this report are followed during construction.

LIMITATIONS

This report has been prepared for the exclusive use of Lokal Homes and your design team for planning for the proposed project. The information, conclusions, and recommendations presented herein are based upon consideration of many factors including, but not limited to, the type of structures proposed, the geologic setting, and the subsurface conditions encountered. The conclusions and recommendations contained in the report are not valid for use by others. Standards of practice evolve in geotechnical engineering. The recommendations provided are appropriate for about three years. If the site is not developed within about three years, we should be contacted to determine if we should update this report.

Our borings were spaced to provide a general picture of subsurface conditions for preliminary planning of development and residential construction. Variations from our borings should be anticipated. We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or analysis of the influence of subsurface conditions on the project, please call.

CTL | THOMPSON, INC.

Robert J. Brown
Staff Geologist

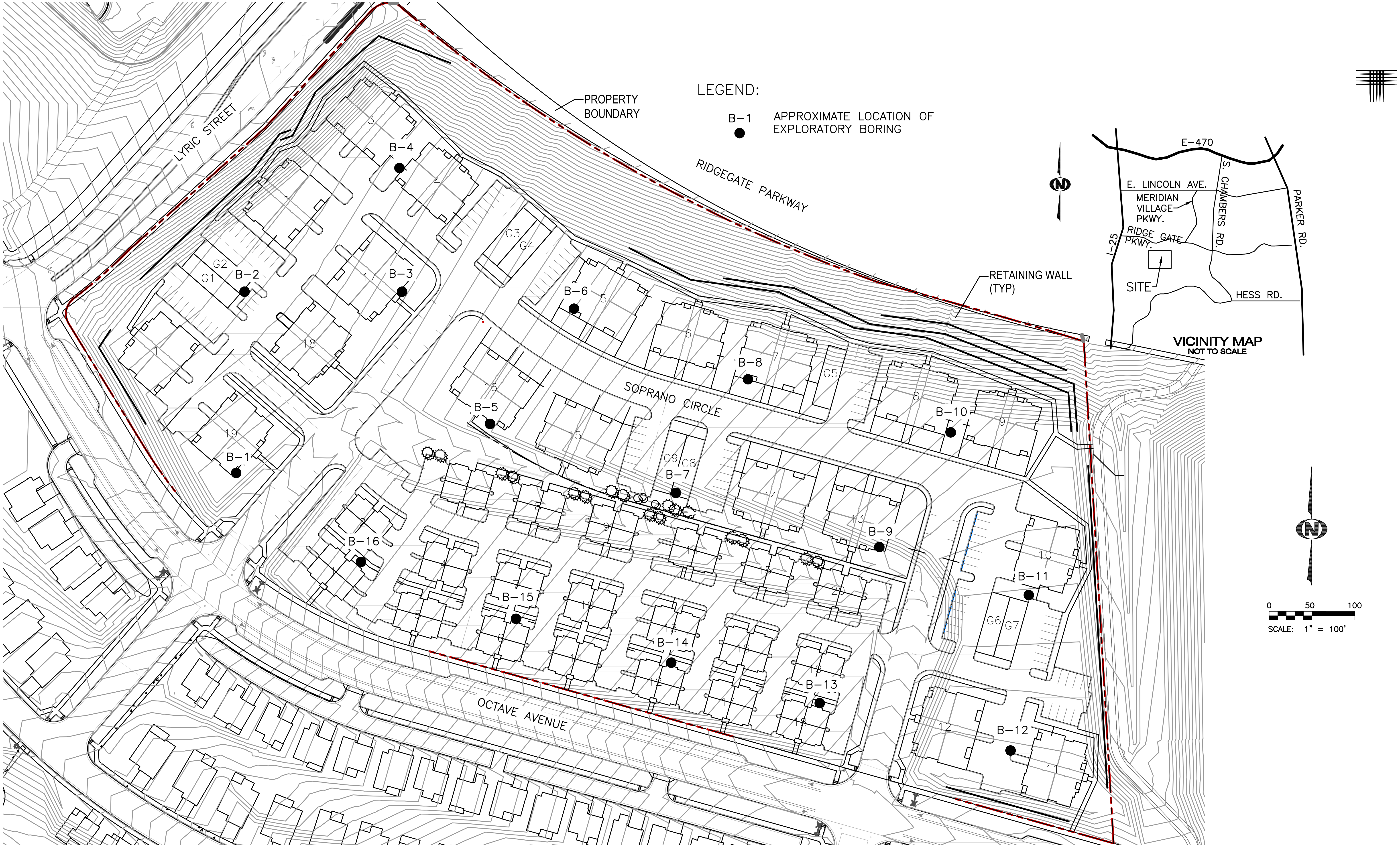
Reviewed by:

COLORADO LICENSED ALAN J. LISOWY 32516 PROFESSIONAL ENGINEER

Alan J. Lisowy, P.E.
Principal

Alan J. Lisowy
Jul 1 2022

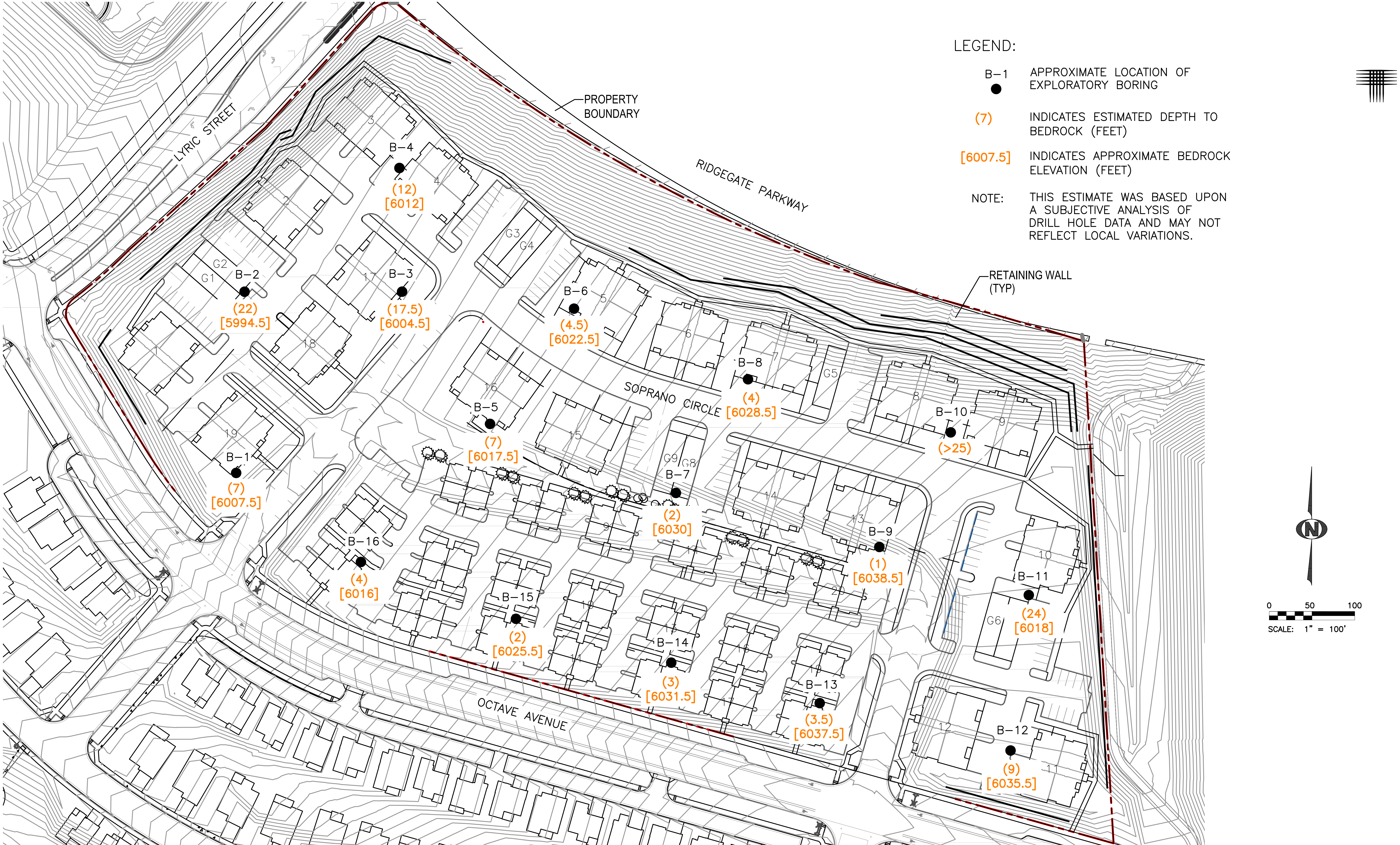
Via e-mail: rteater@lokalhomes.com



LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T Project No. DN51,551-115-R1

Locations of Exploratory Borings

Fig. 1



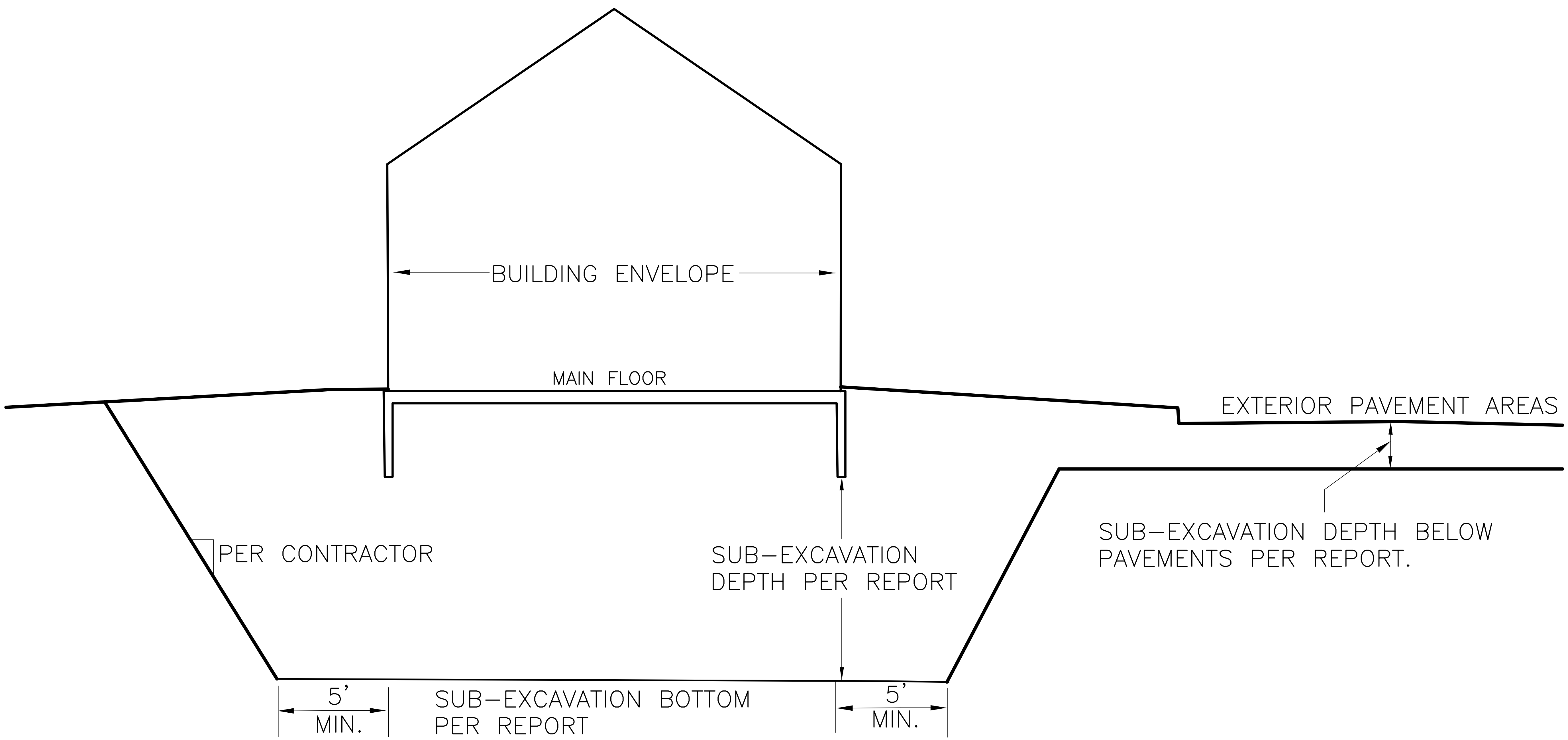
LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T Project No. DN51,551-115-R1

Depth and Elevation of Bedrock Fig. 2

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T Project No. DN51,551-115-R1

Preliminary Sub-Excavation Considerations

Fig. 3



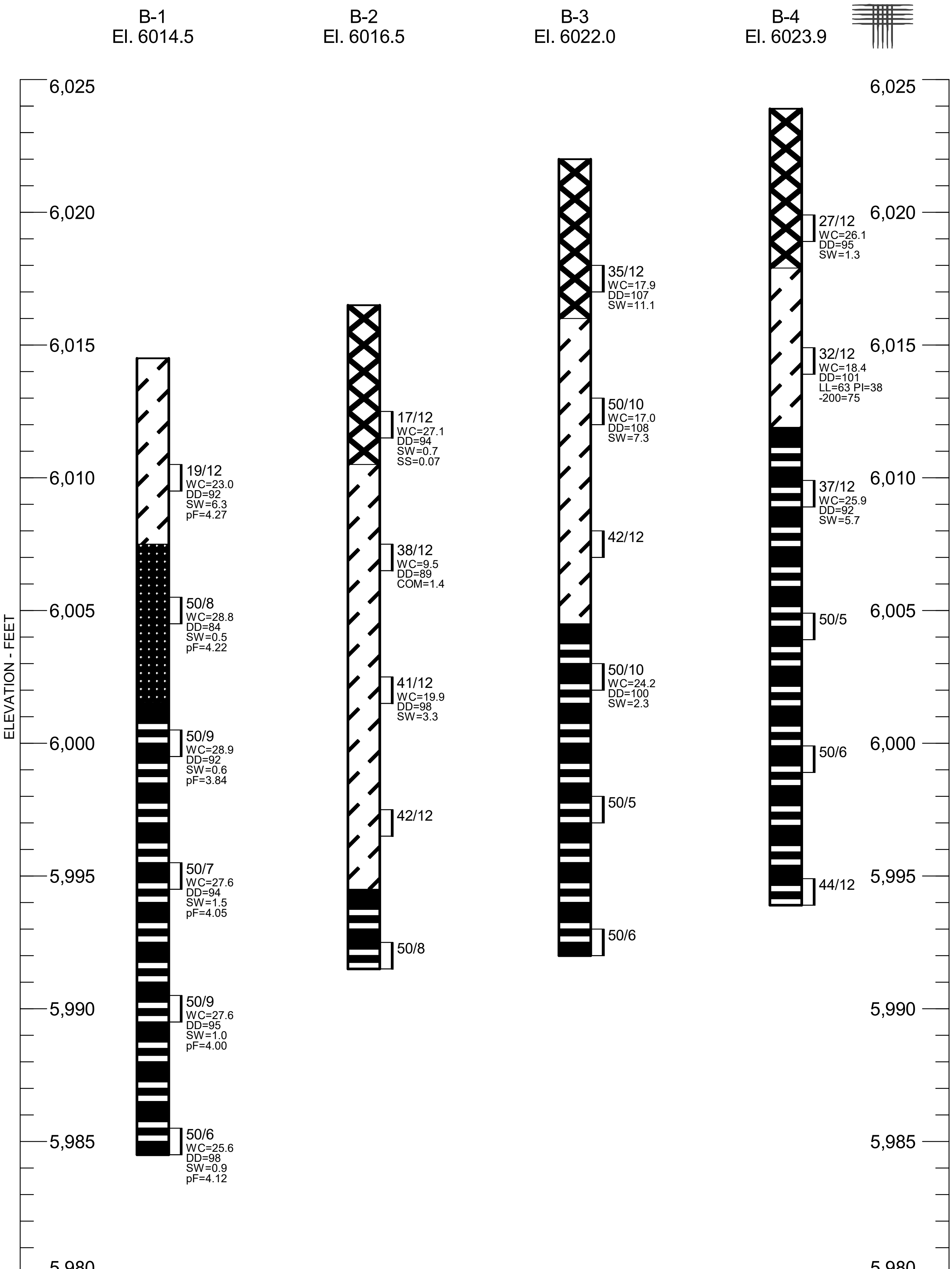
LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T Project No. DN51,551-115-R1

Conceptual Sub-Excavation Profile

Fig. 4

APPENDIX A

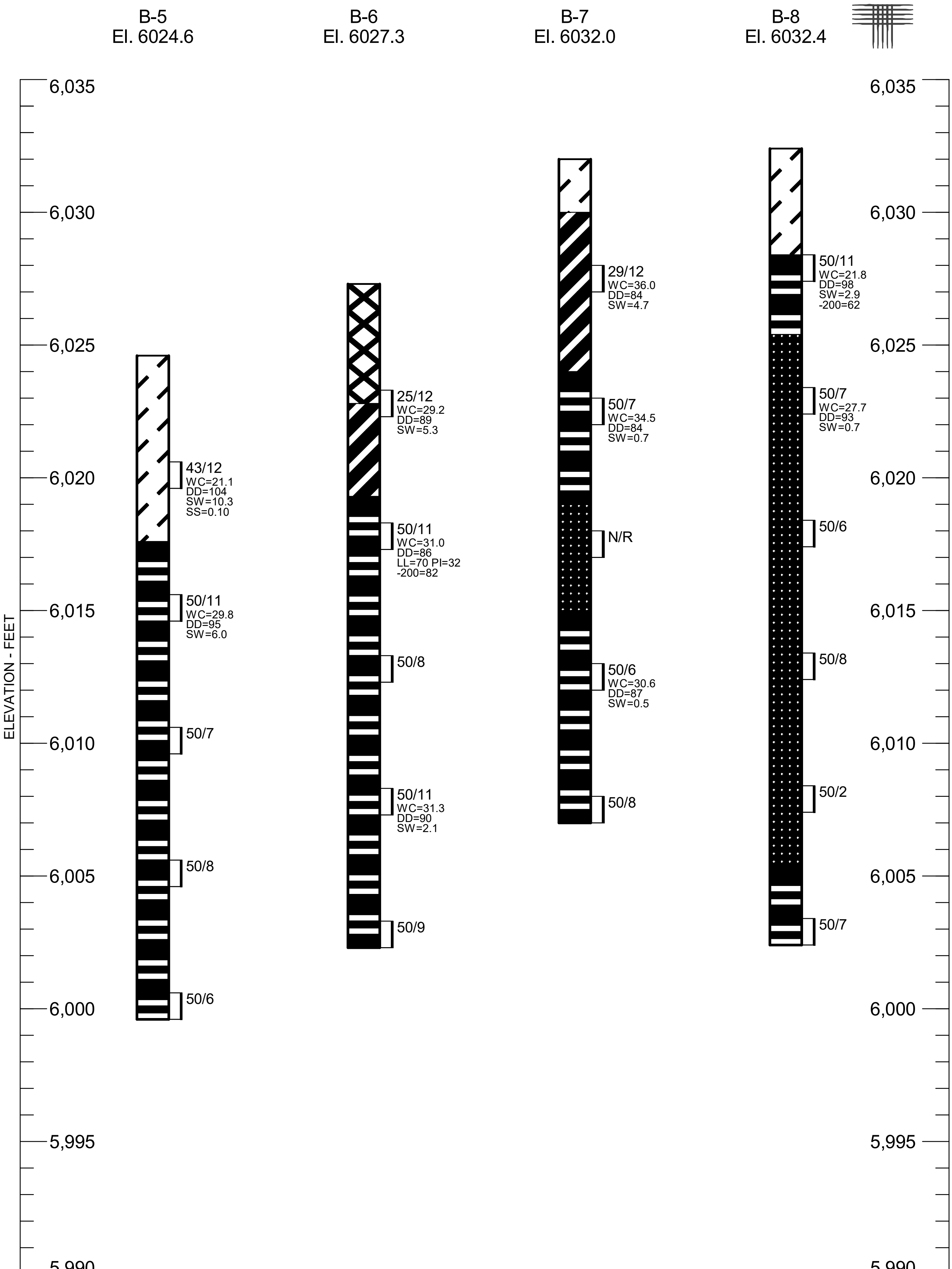
SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

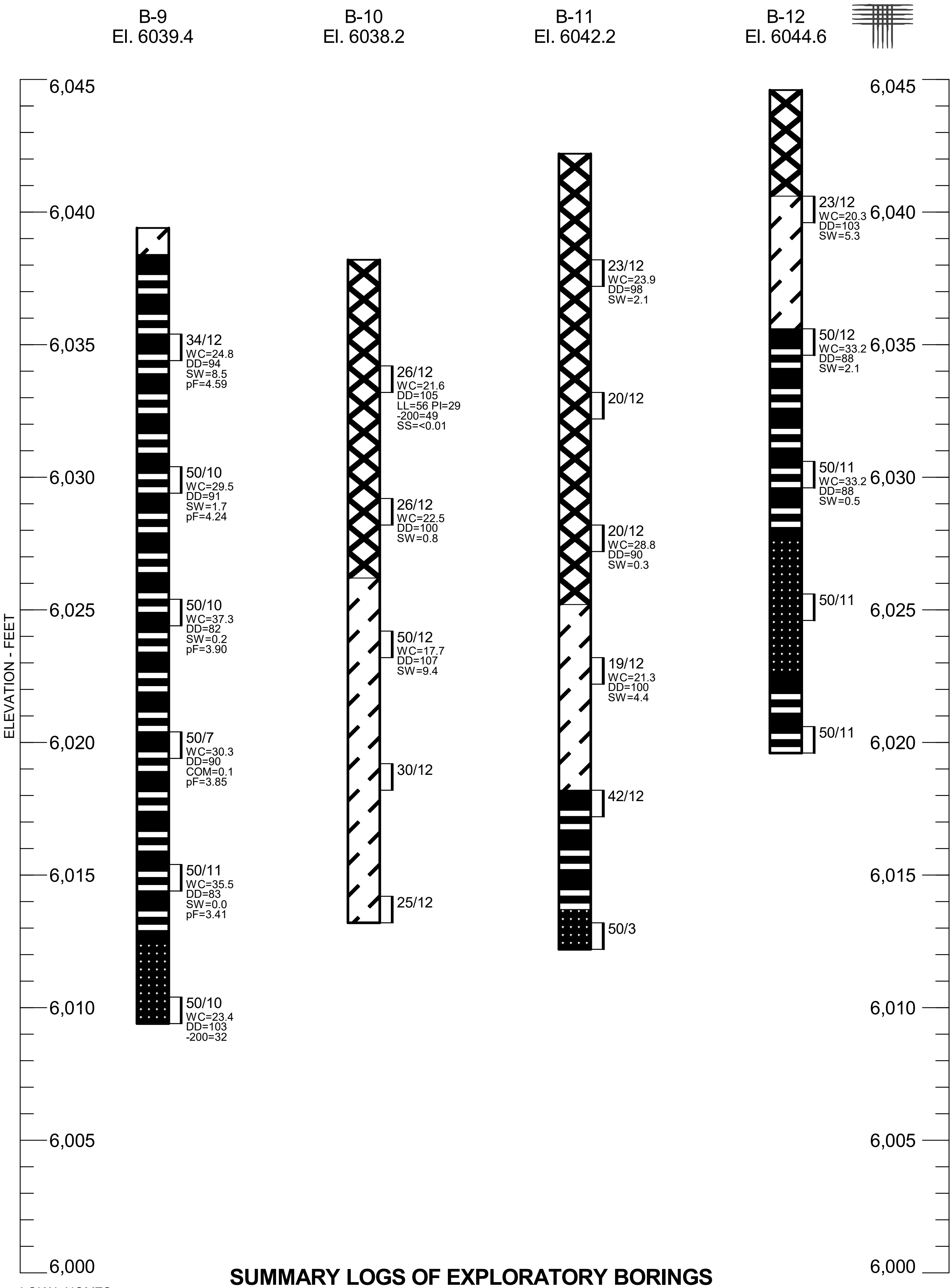
FIG. A- 1



SUMMARY LOGS OF EXPLORATORY BORINGS

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

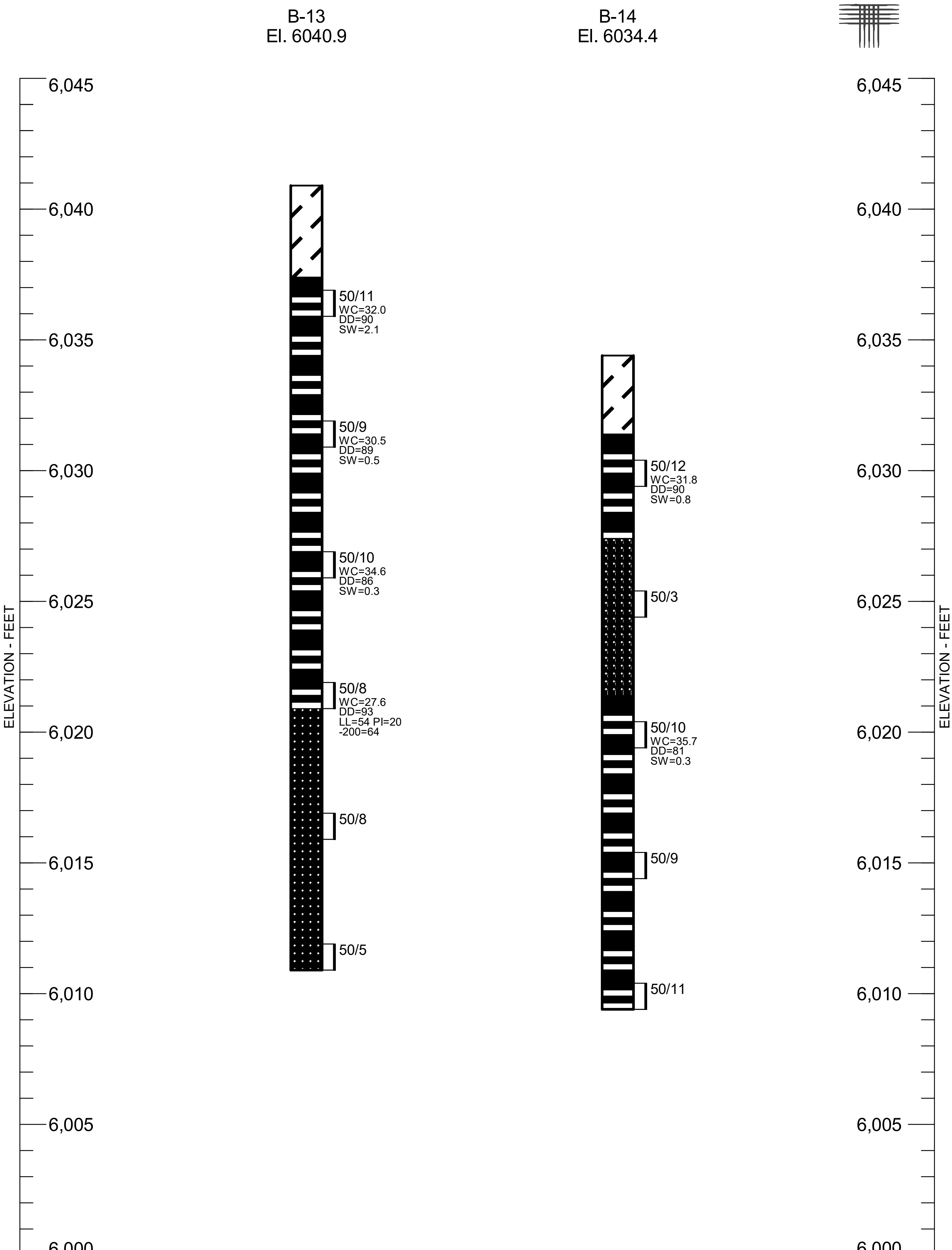
FIG. A- 2



SUMMARY LOGS OF EXPLORATORY BORINGS

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

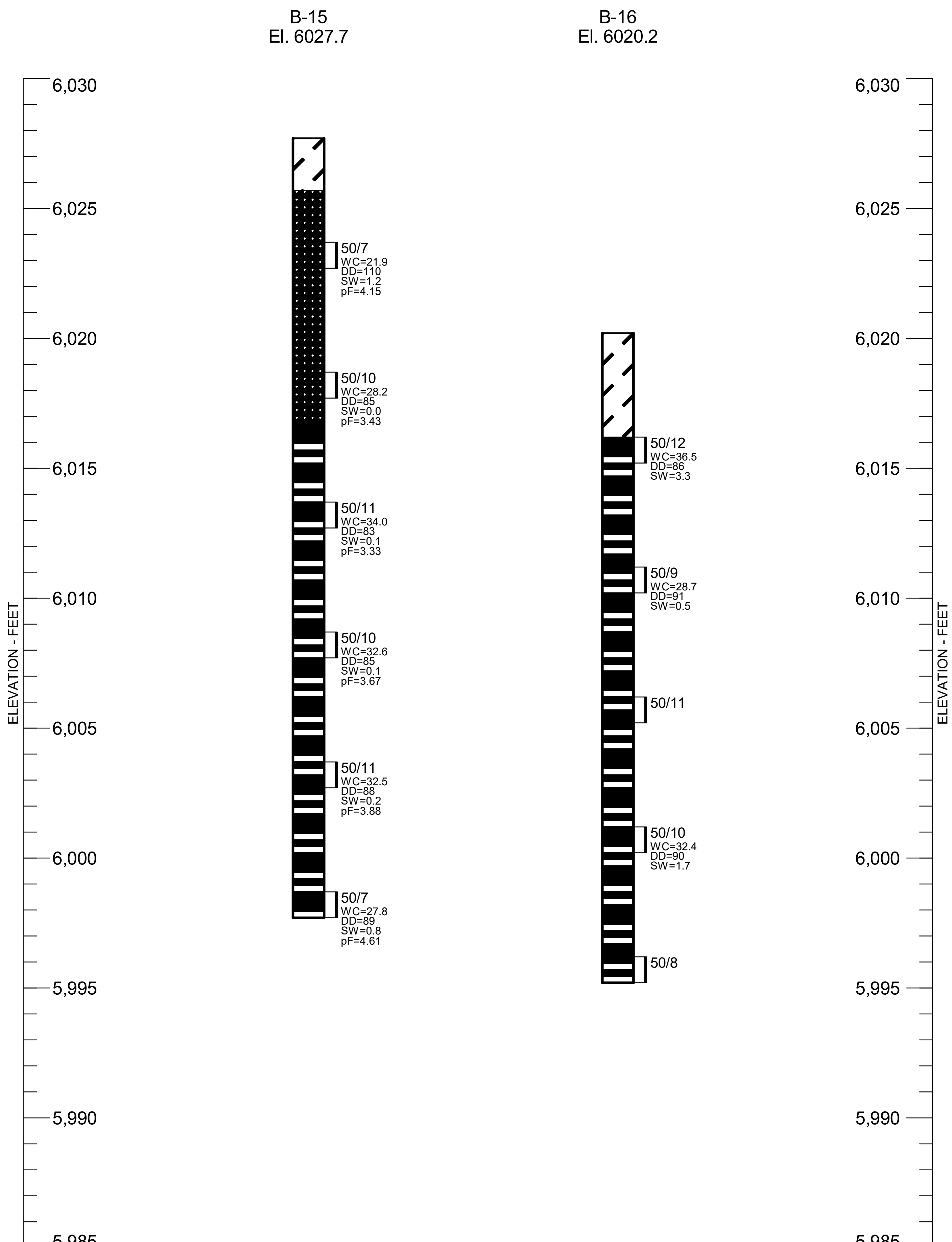
FIG. A- 3



SUMMARY LOGS OF EXPLORATORY BORINGS

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

FIG. A- 4



SUMMARY LOGS OF EXPLORATORY BORINGS

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

LEGEND:

FILL, CLAY, SLIGHTLY SANDY TO VERY SANDY, SOME CLAYEY SAND, VERY STIFF, SLIGHTLY MOIST TO MOIST, BROWN, RUST, GRAY, TAN.

CLAY, SLIGHTLY SANDY TO SANDY, VERY STIFF TO HARD, SLIGHTLY MOIST TO MOIST, BROWN, BLACK, GRAY, RUST (CL/CH, CH).

WEATHERED CLAYSTONE, SILTY TO VERY SILTY, SLIGHTLY MOIST TO MOIST, BROWN, BLACK, RUST (MH/CH, MH).

BEDROCK, CLAYSTONE, SILTY TO VERY SILTY, MEDIUM HARD TO VERY HARD, SLIGHTLY MOIST TO MOIST, BROWN, BLACK, OLIVE, RUST, GRAY (MH/CH, MH).

BEDROCK, SANDSTONE, VERY CLAYEY, HARD TO VERY HARD, SLIGHTLY MOIST TO MOIST, RUST, BROWN, GRAY (SC/SM).

DRIVE SAMPLE. THE SYMBOL 19/12 INDICATES 19 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

N/R NO SAMPLE RECOVERY.

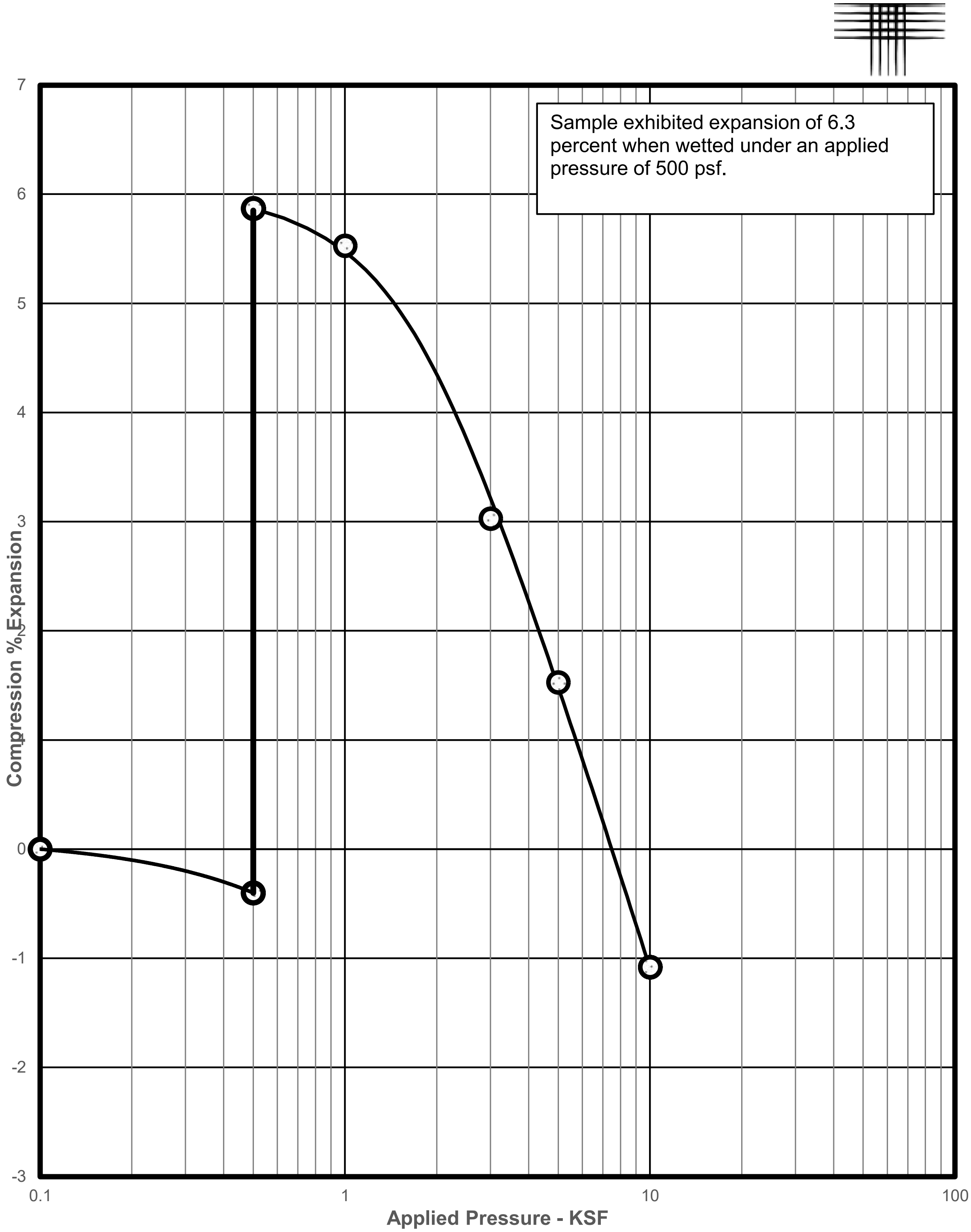
NOTES:

1. THE BORINGS WERE DRILLED ON MAY 13, 2022 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND TRUCK-MOUNTED DRILL RIGS.
2. BORING LOCATIONS AND ELEVATIONS ARE APPROXIMATE AND WERE DETERMINED BY A REPRESENTATIVE OF OUR FIRM USING A LEICA GS18 GPS UNIT REFERENCING THE NORTH AMERICAN DATUM OF 1983 (NAD 83).
3. NO GROUNDWATER ENCOUNTERED DURING THIS INVESTIGATION.
4. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
   COM - INDICATES COMPRESSION WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
   pF - INDICATES SOIL SUCTION VALUE (pF).
5. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

APPENDIX B

LABORATORY TEST RESULTS

TABLE B-I – SUMMARY OF LABORATORY TESTING



SAMPLE OF CLAY, SANDY (CL/CH) DRY UNIT WEIGHT: 92 pcf

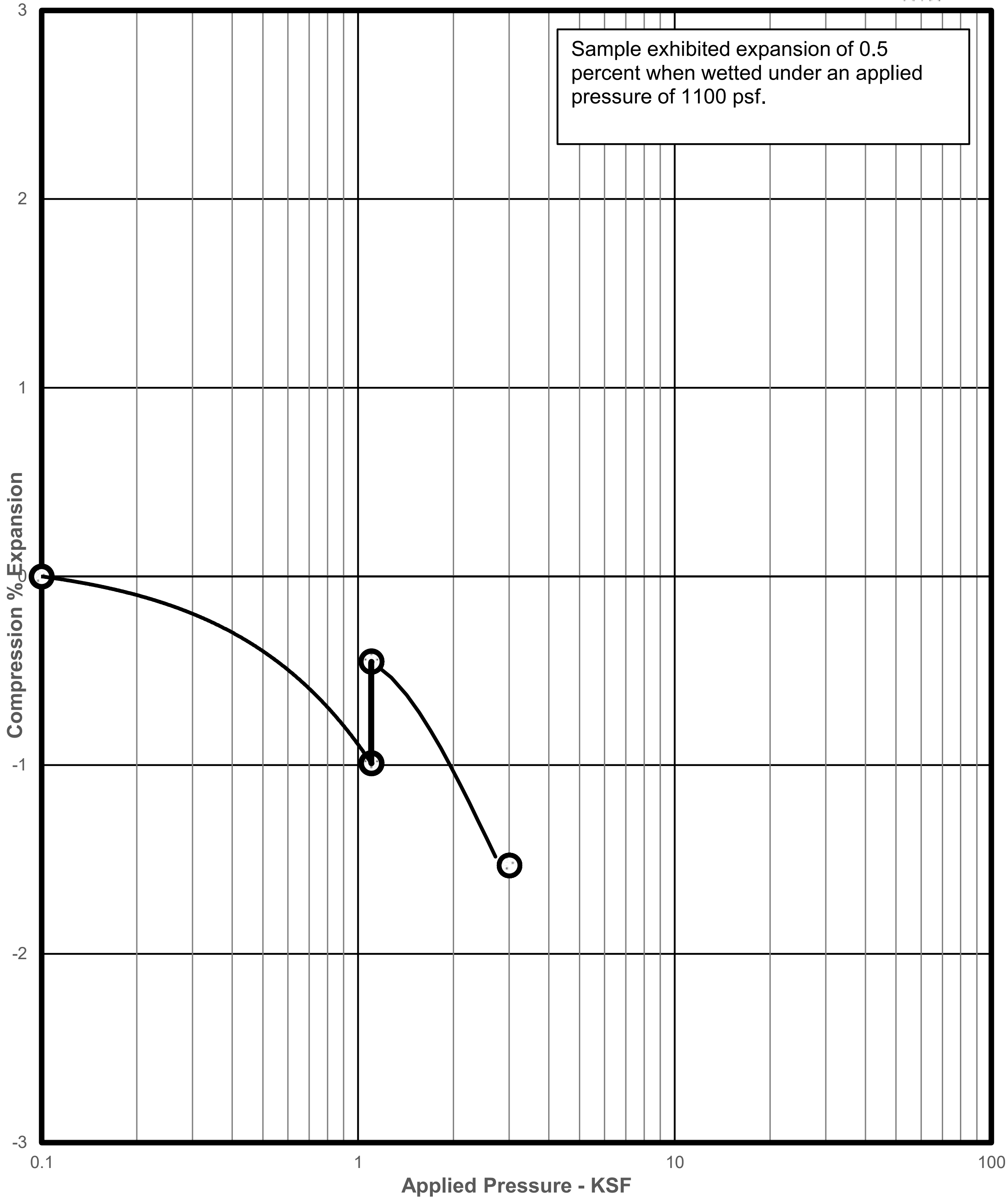
FROM: B-1 AT 4 FEET MOISTURE CONTENT: 23.0 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 1

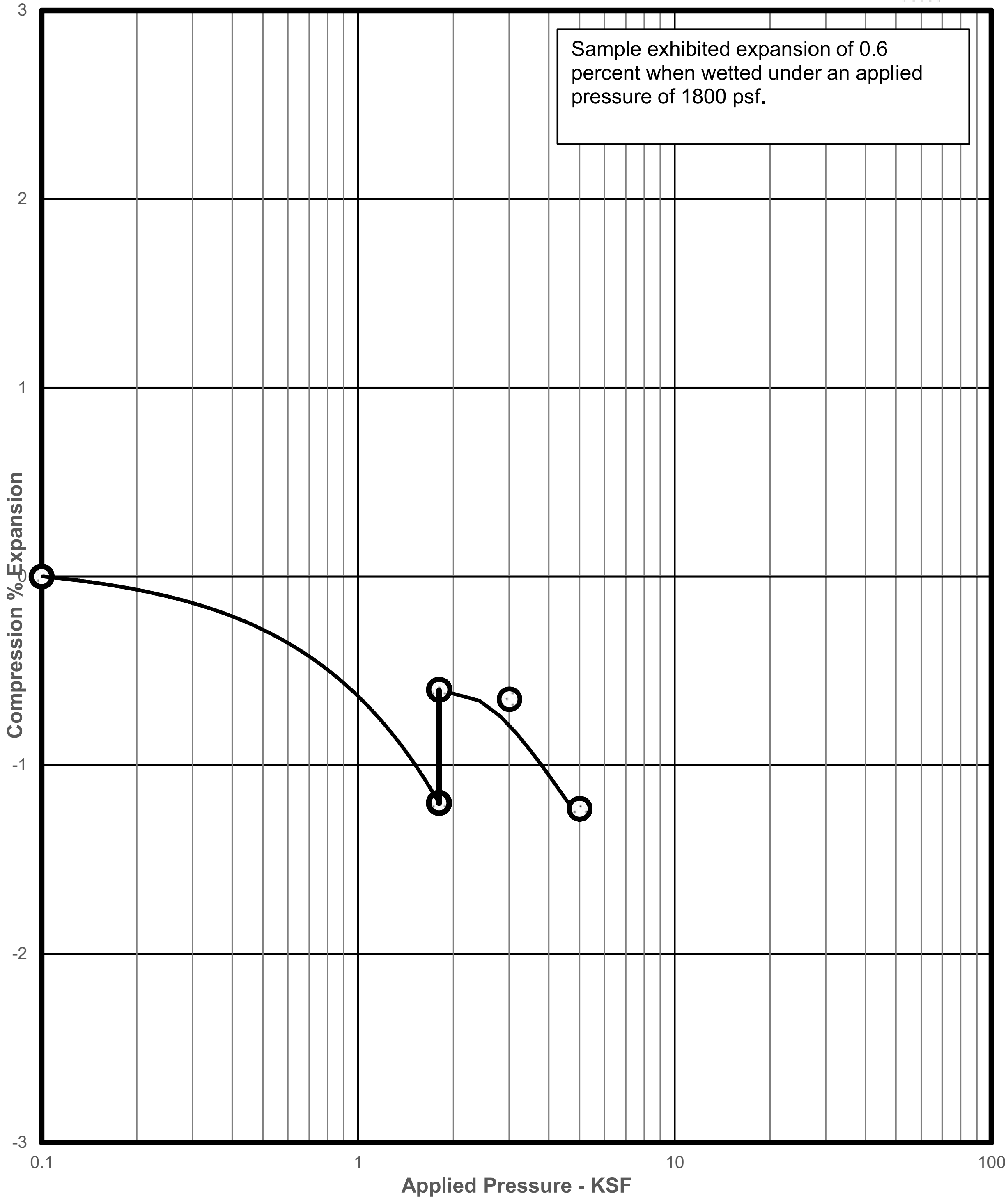


SAMPLE OF SANDSTONE (SC/SM)
FROM: B-1 AT 9 FEET

DRY UNIT WEIGHT: 84 pcf
MOISTURE CONTENT: 28.8 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 2



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 92 pcf

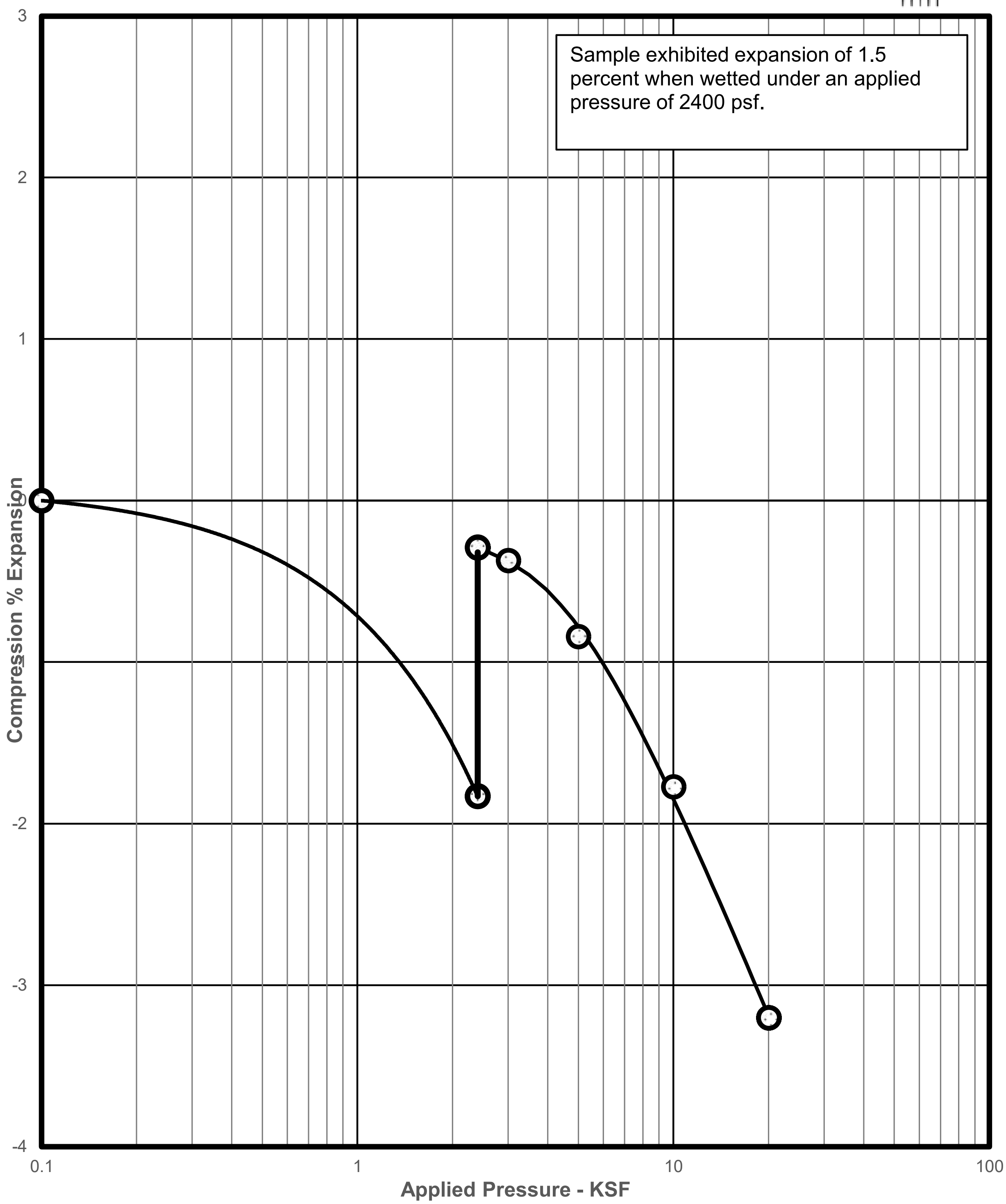
FROM: B-1 AT 14 FEET MOISTURE CONTENT: 28.9 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

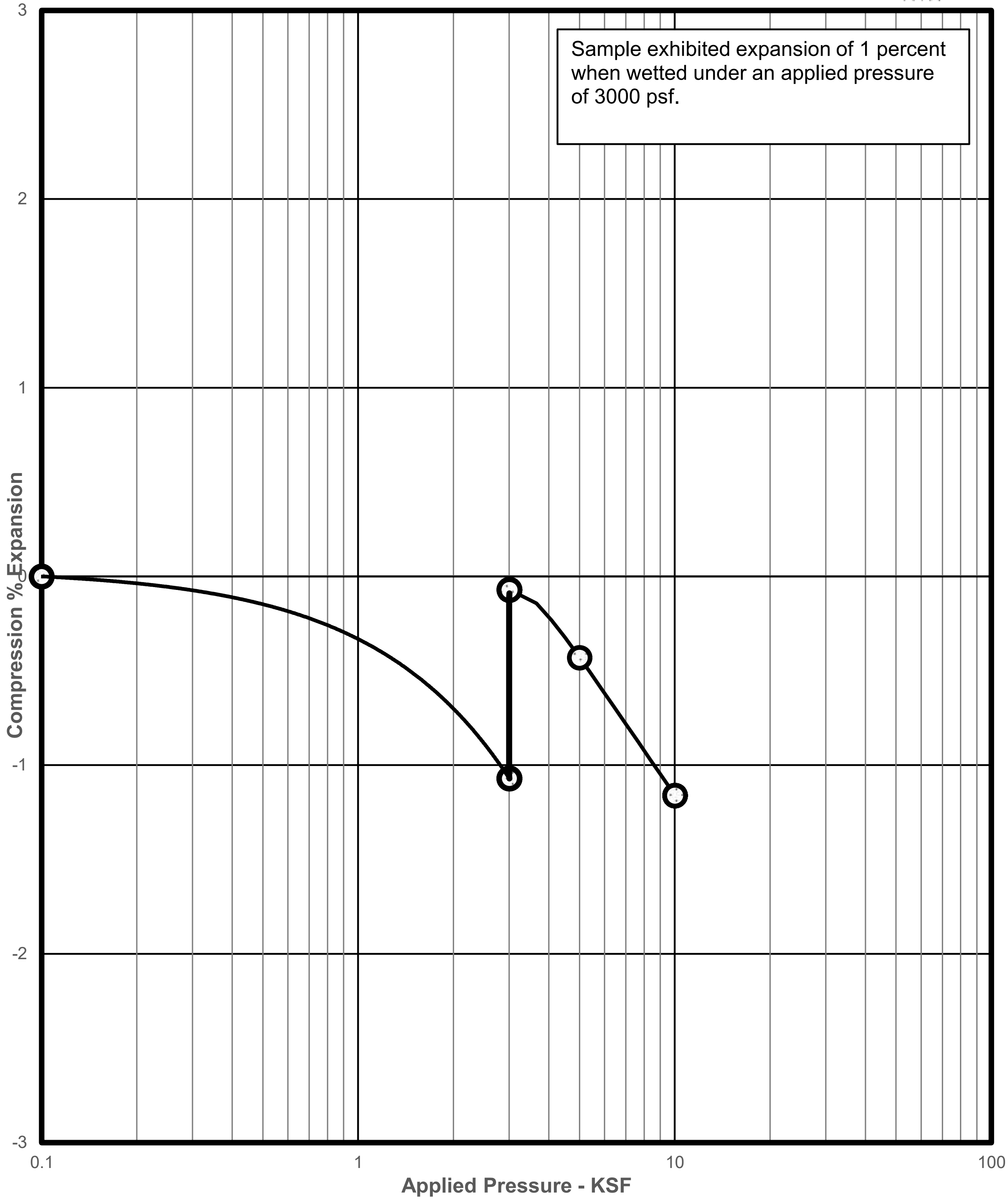
Swell Consolidation Test Results FIG. B- 3



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 94 pcf
FROM: B-1 AT 19 FEET MOISTURE CONTENT: 27.6 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 4



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 95 pcf

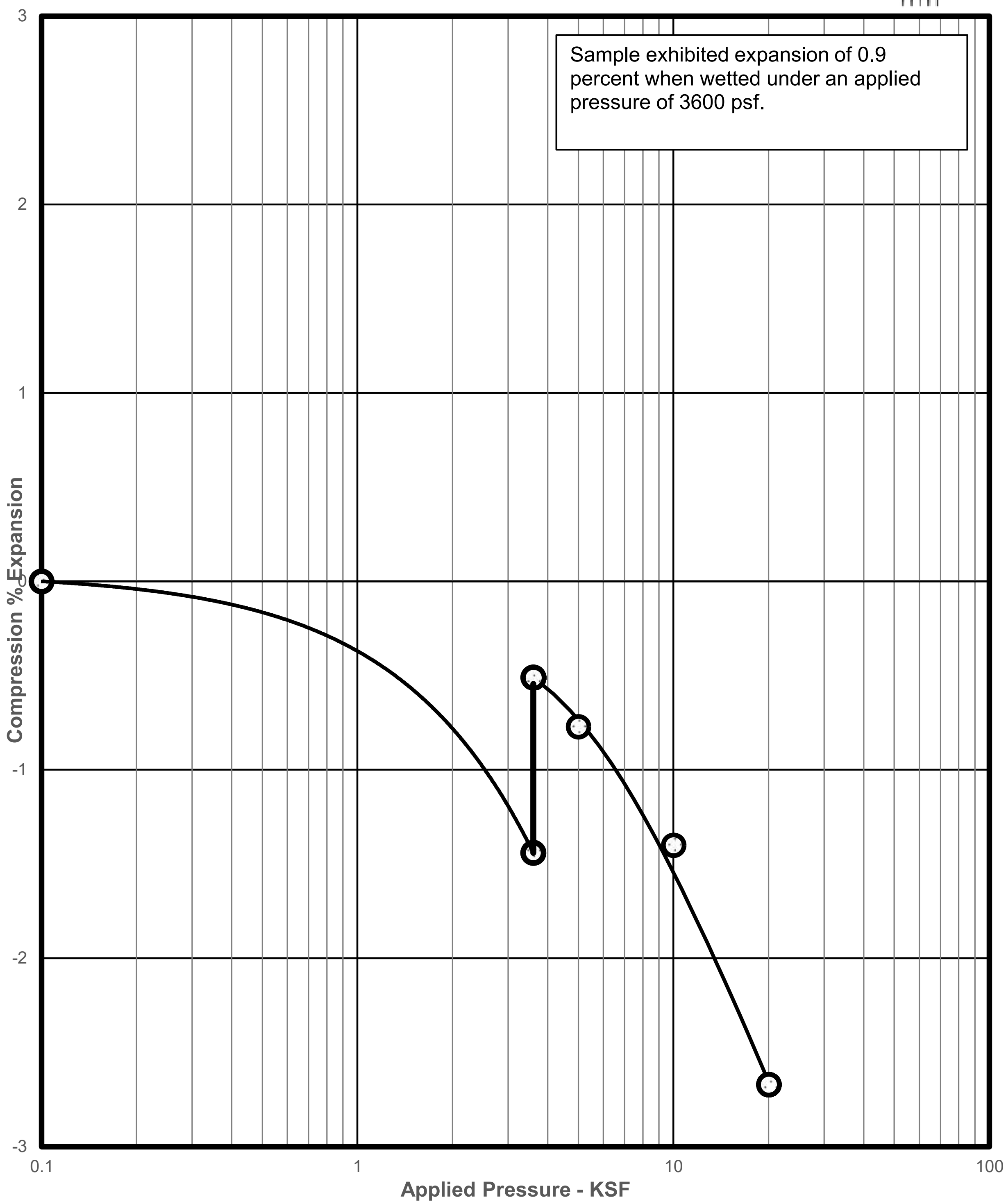
FROM: B-1 AT 24 FEET MOISTURE CONTENT: 27.6 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 5

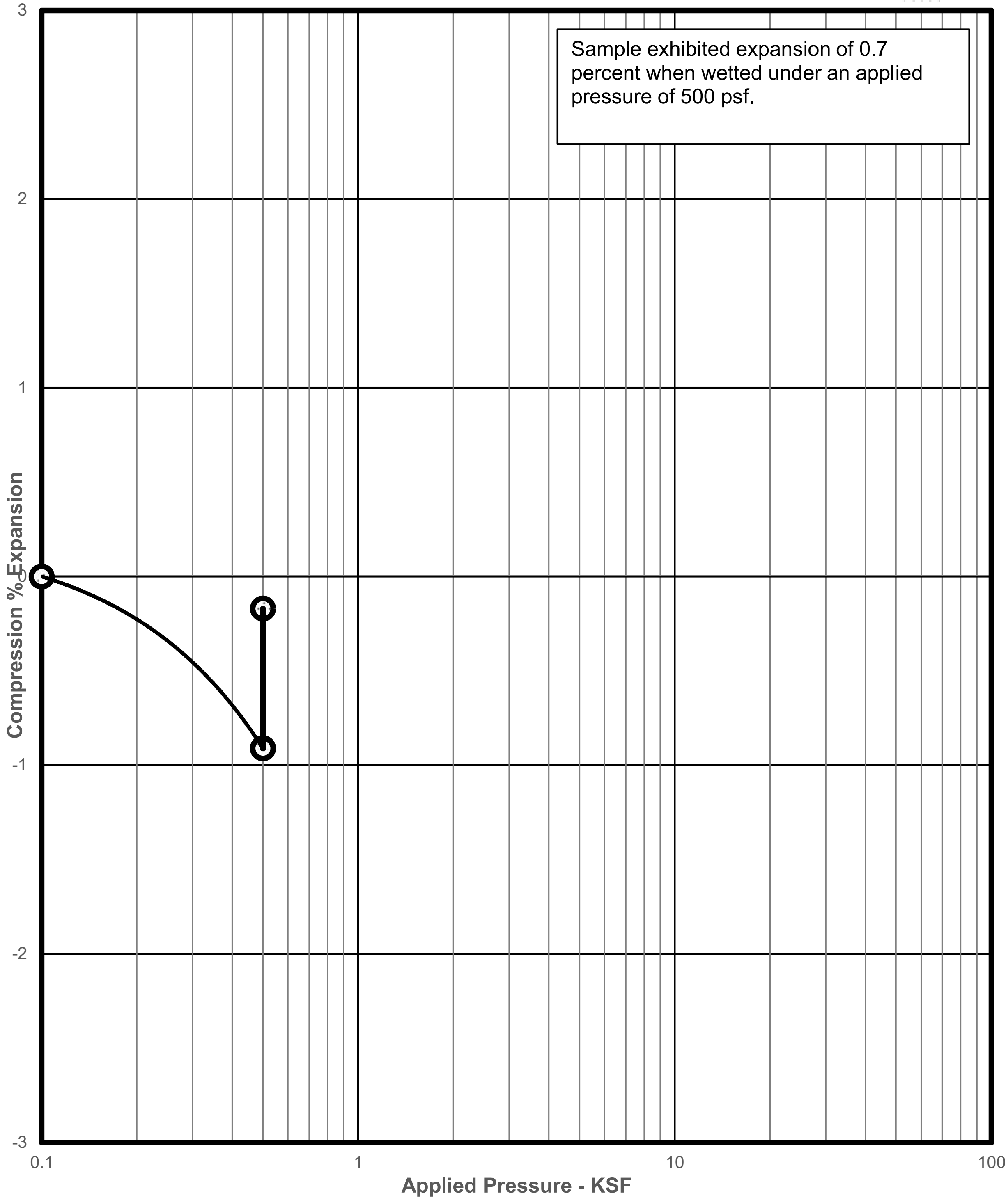


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-1 AT 29 FEET

DRY UNIT WEIGHT: 98 pcf
MOISTURE CONTENT: 25.6 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 6



SAMPLE OF FILL, CLAY, SANDY

FROM: B-2 AT 4 FEET

DRY UNIT WEIGHT: 94 pcf

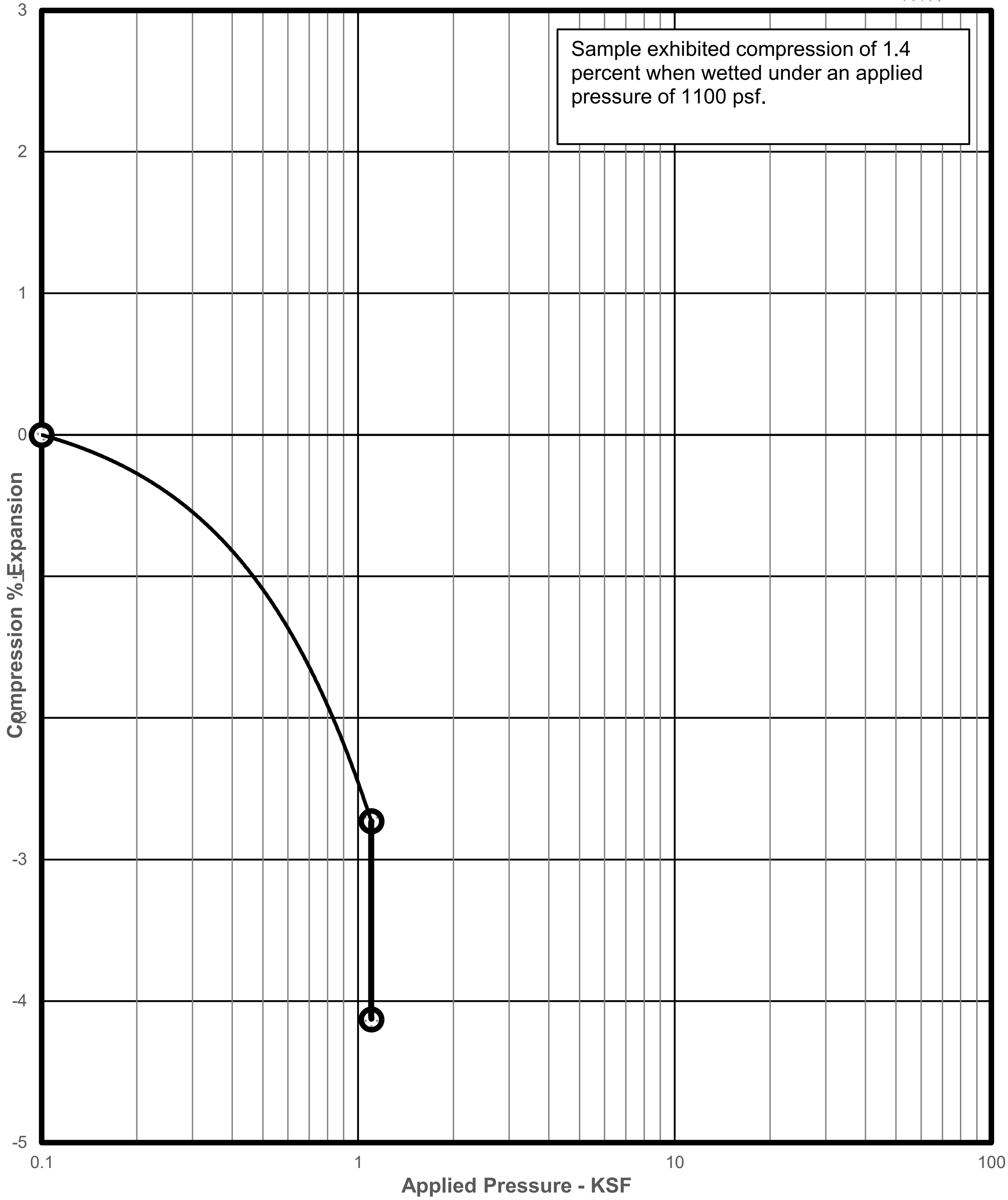
MOISTURE CONTENT: 27.1 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

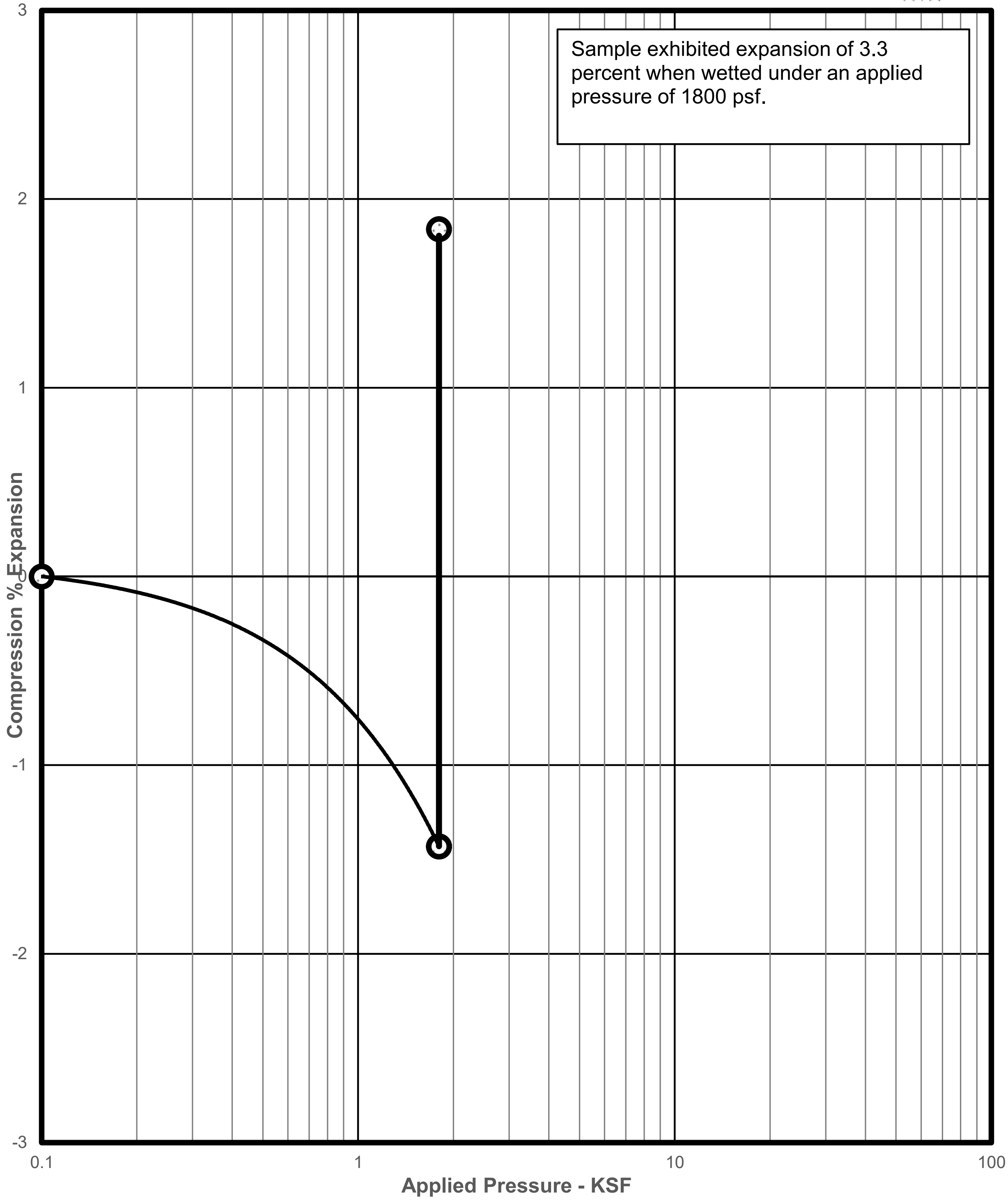
Swell Consolidation Test Results FIG. B- 7



SAMPLE OF CLAY, SANDY (CL/CH) DRY UNIT WEIGHT: 89 pcf
FROM: B-2 AT 9 FEET MOISTURE CONTENT: 9.5 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 8



SAMPLE OF CLAY, SANDY (CL/CH) DRY UNIT WEIGHT: 98 pcf

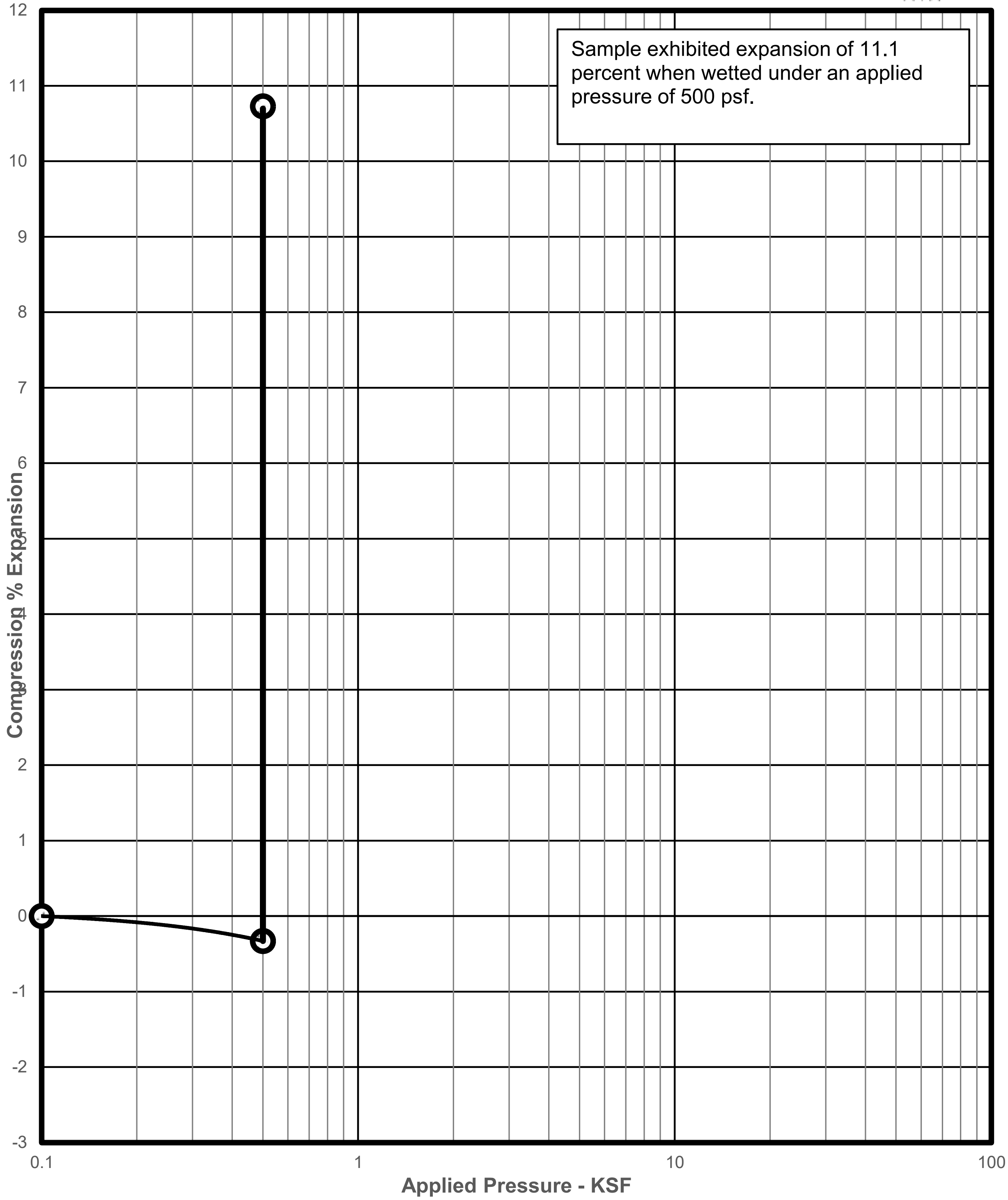
FROM: B-2 AT 14 FEET MOISTURE CONTENT: 19.9 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 9



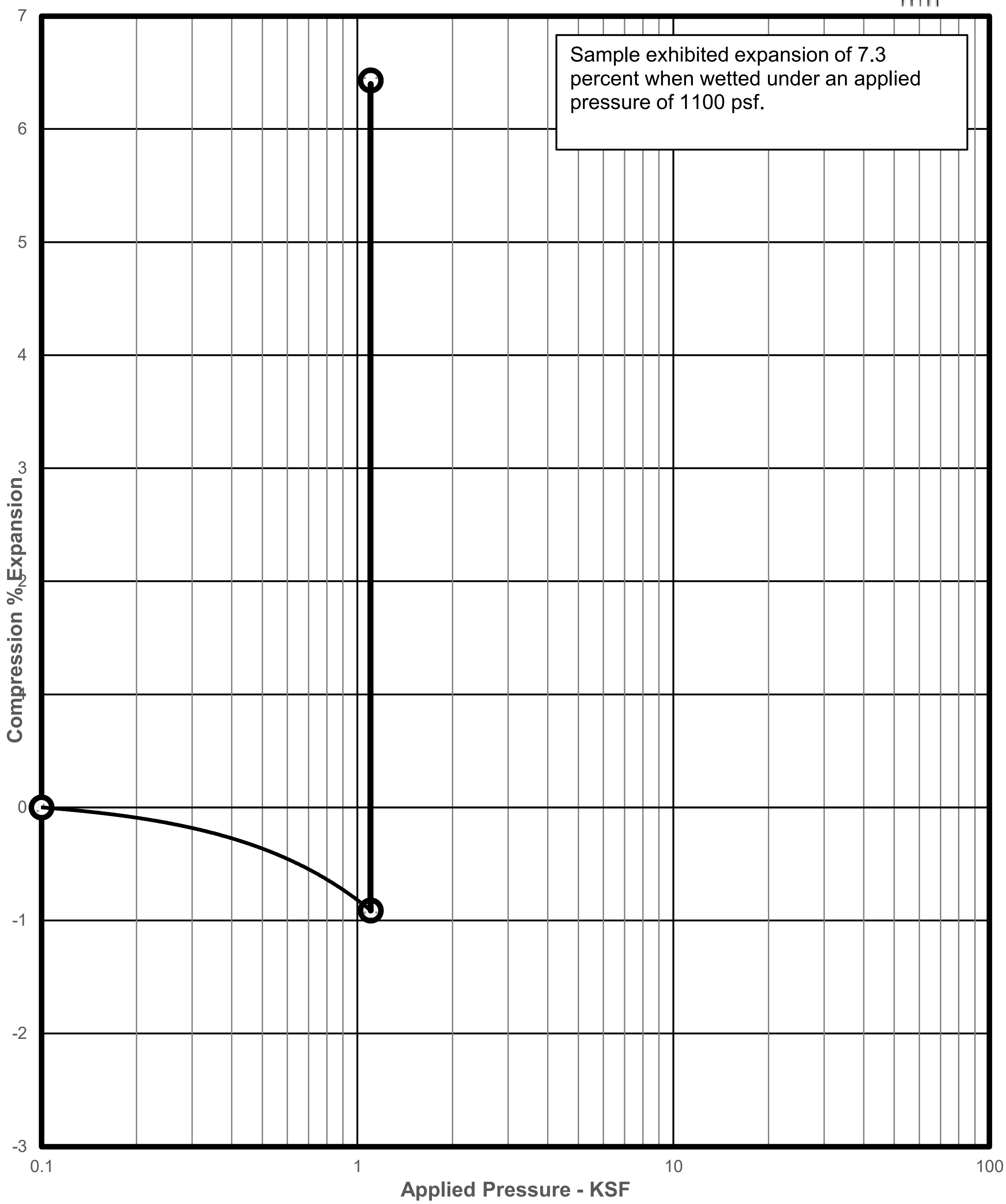
SAMPLE OF	FILL, CLAY, SANDY	DRY UNIT WEIGHT:	107	pcf
FROM:	B-3 AT 4 FEET	MOISTURE CONTENT:	17.9	%

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 10



SAMPLE OF CLAY, SANDY (CL/CH) DRY UNIT WEIGHT: 108 pcf

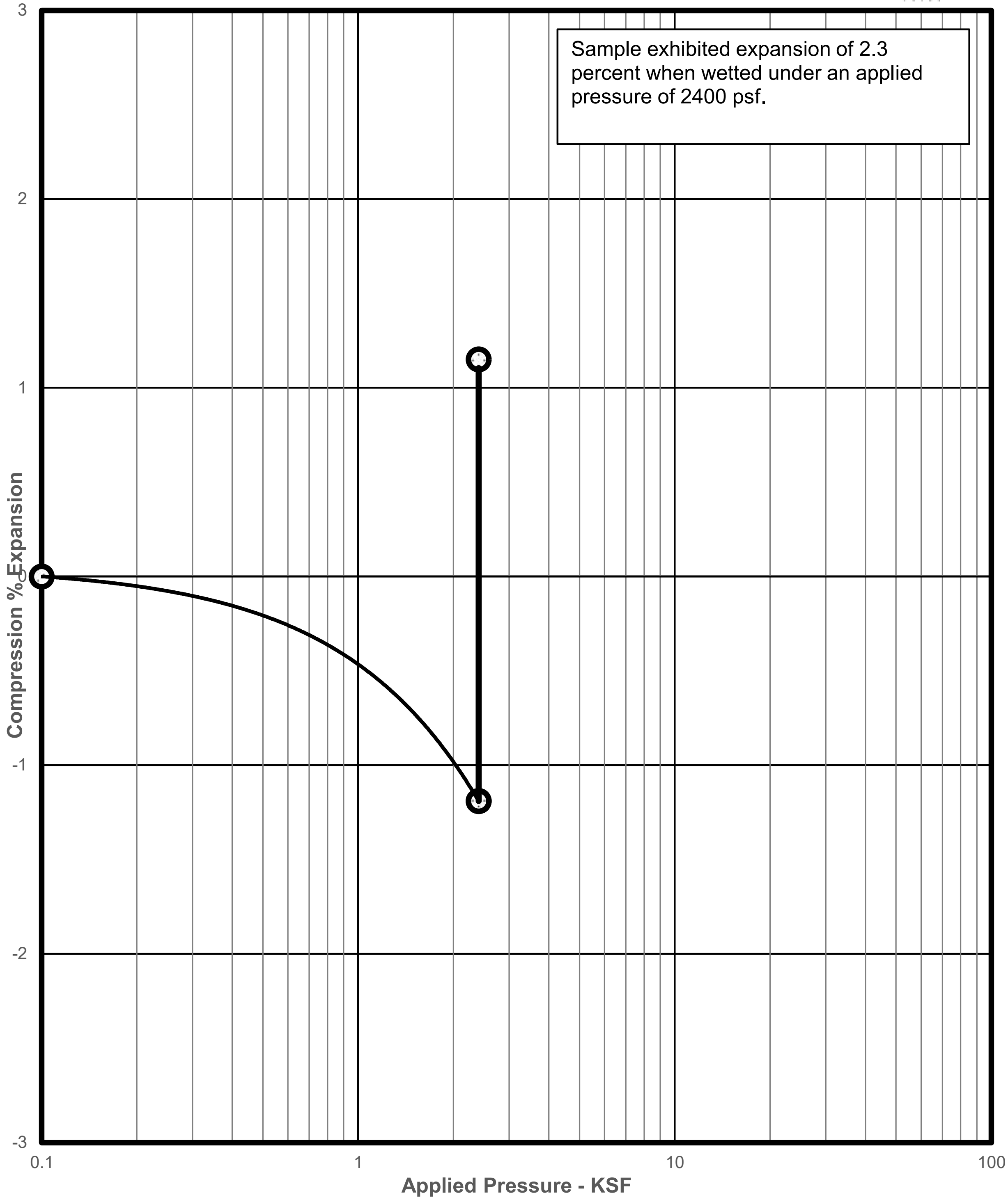
FROM: B-3 AT 9 FEET MOISTURE CONTENT: 17.0 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 11



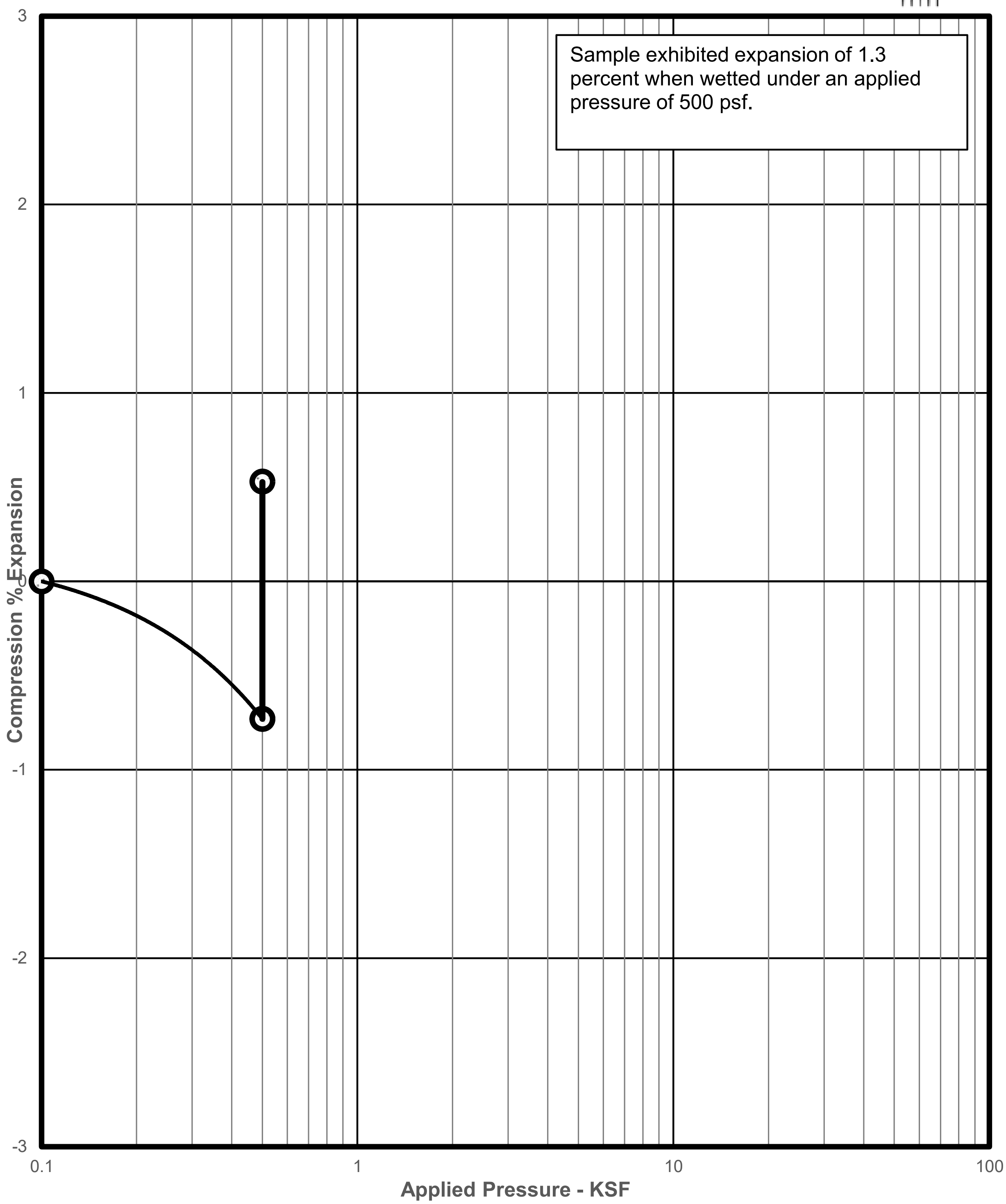
SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-3 AT 19 FEET

DRY UNIT WEIGHT: 100 pcf
MOISTURE CONTENT: 24.2 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results

FIG. B- 12



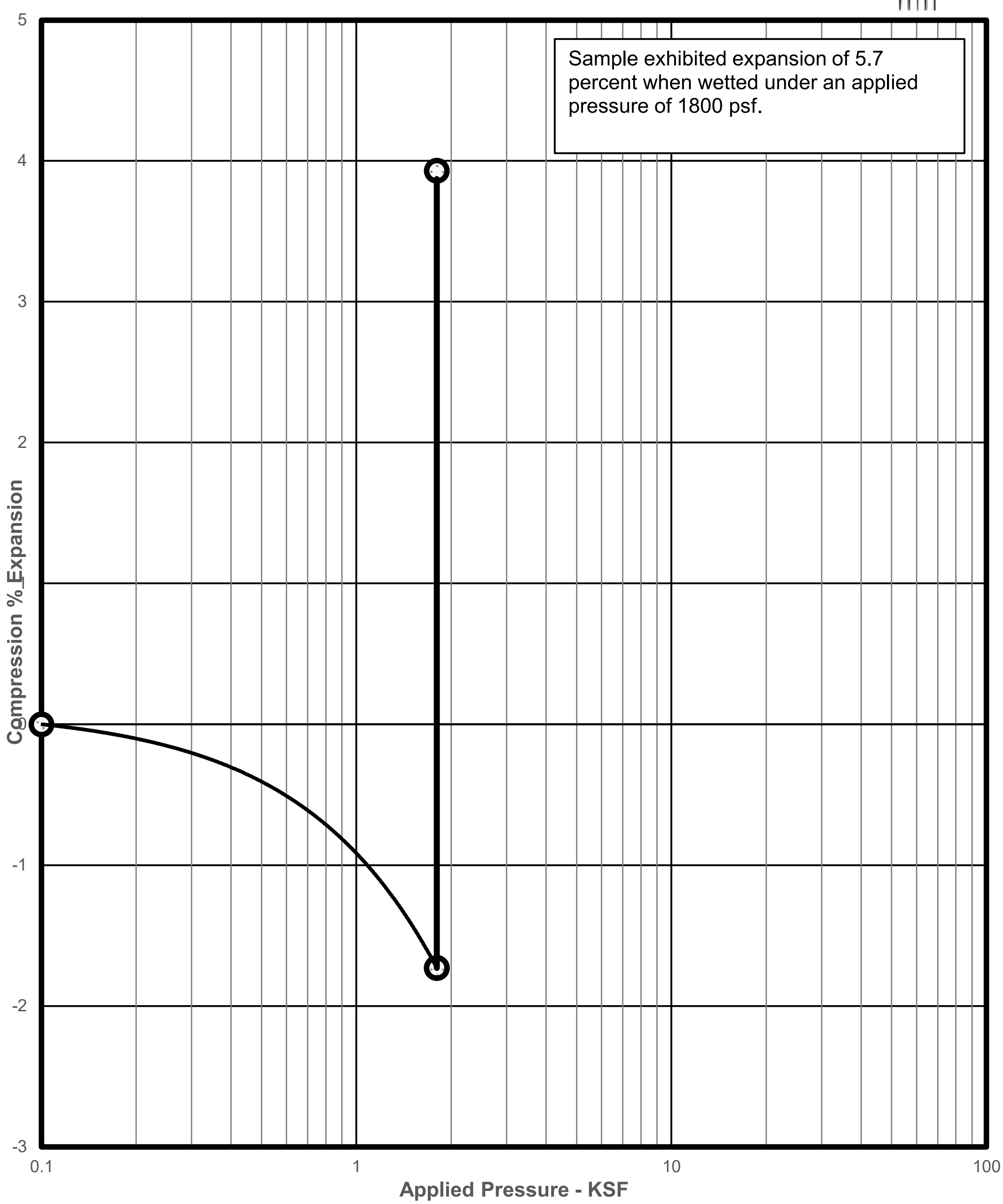
SAMPLE OF FILL, CLAY, SANDY
FROM: B-4 AT 4 FEET

DRY UNIT WEIGHT: 95 pcf
MOISTURE CONTENT: 26.1 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results

FIG. B- 13

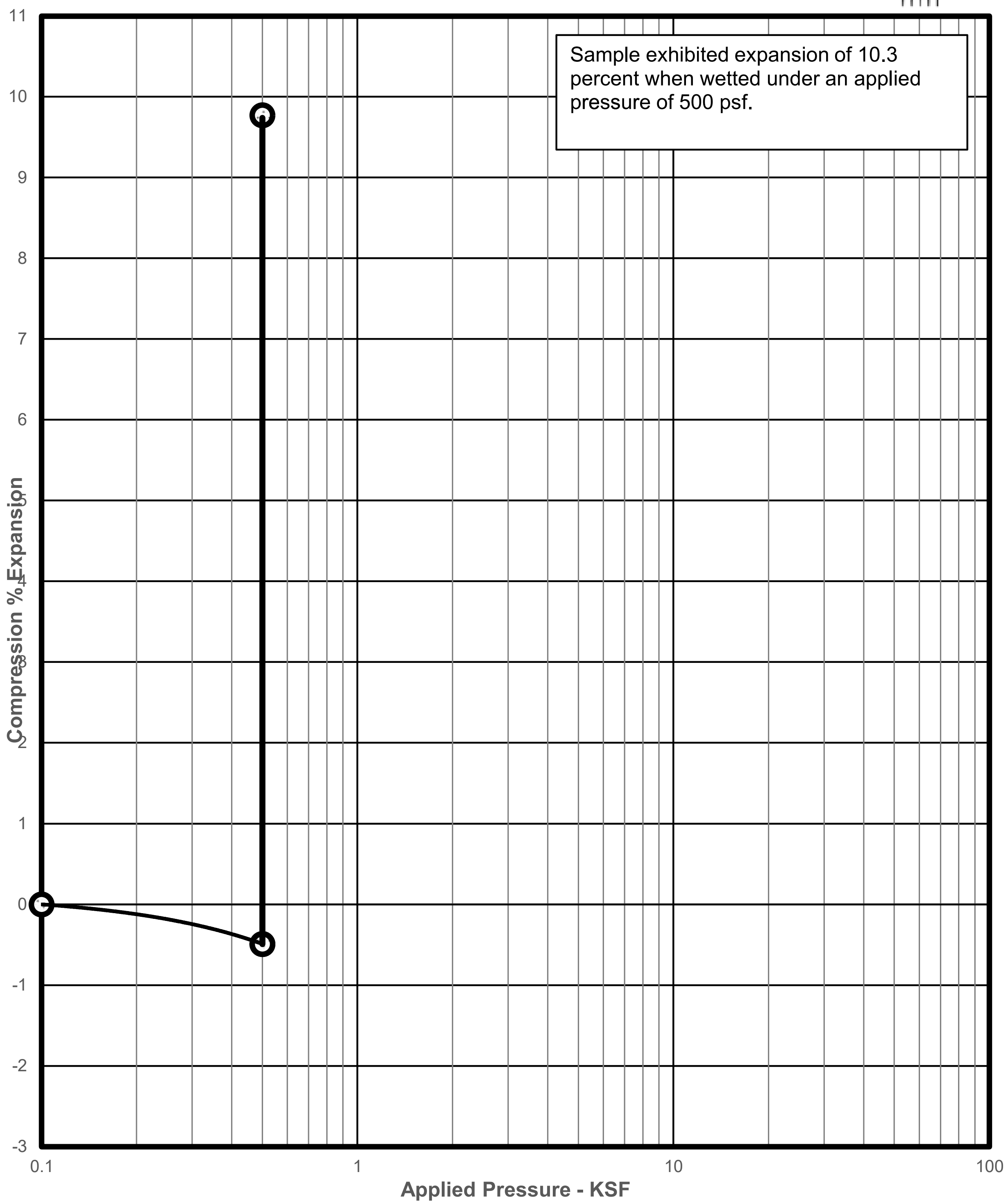


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-4 AT 14 FEET

DRY UNIT WEIGHT: 92 pcf
MOISTURE CONTENT: 25.9 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

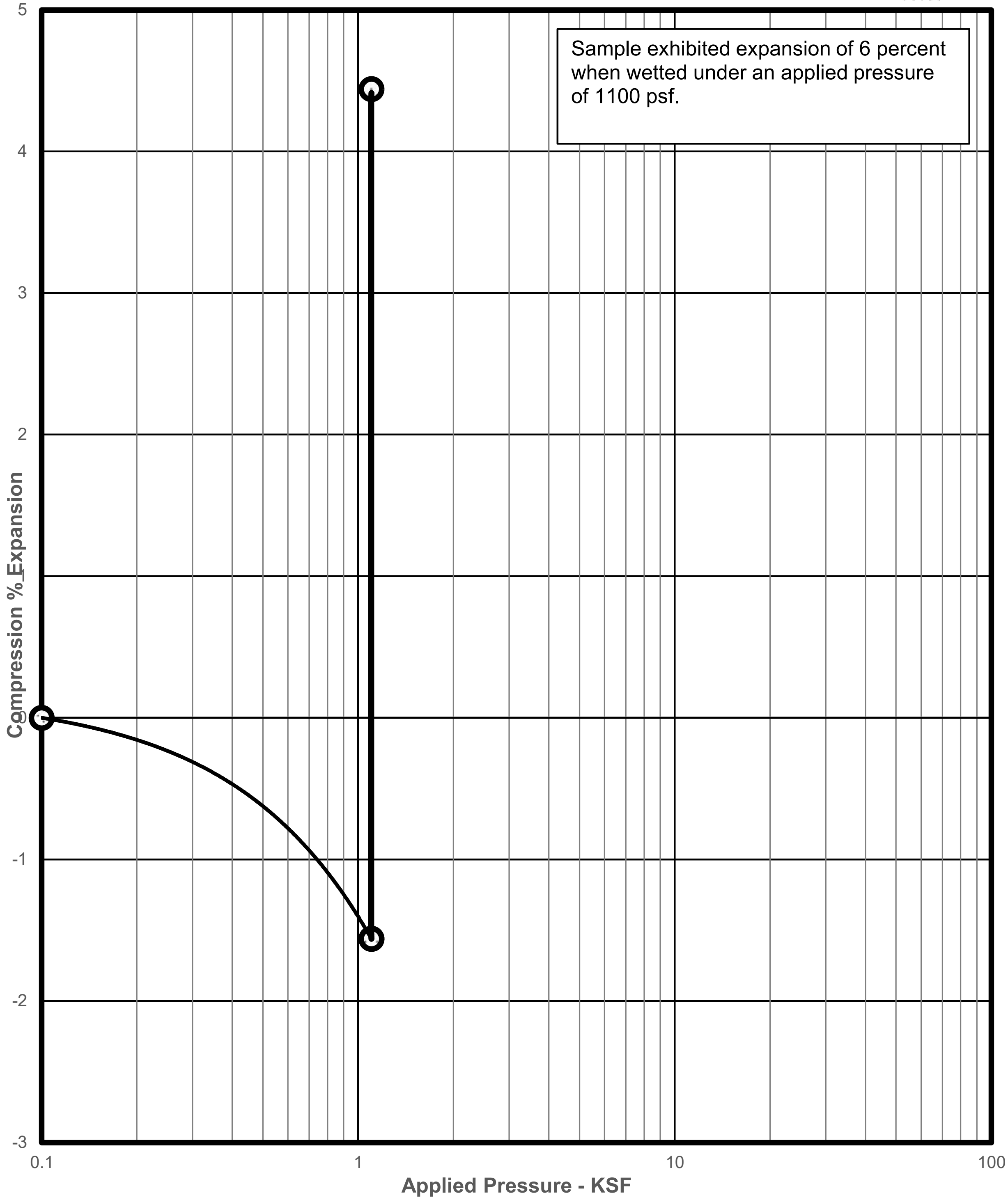
Swell Consolidation Test Results FIG. B- 14



SAMPLE OF CLAY, SANDY (CL/CH) DRY UNIT WEIGHT: 104 pcf
FROM: B-5 AT 4 FEET MOISTURE CONTENT: 21.1 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 15

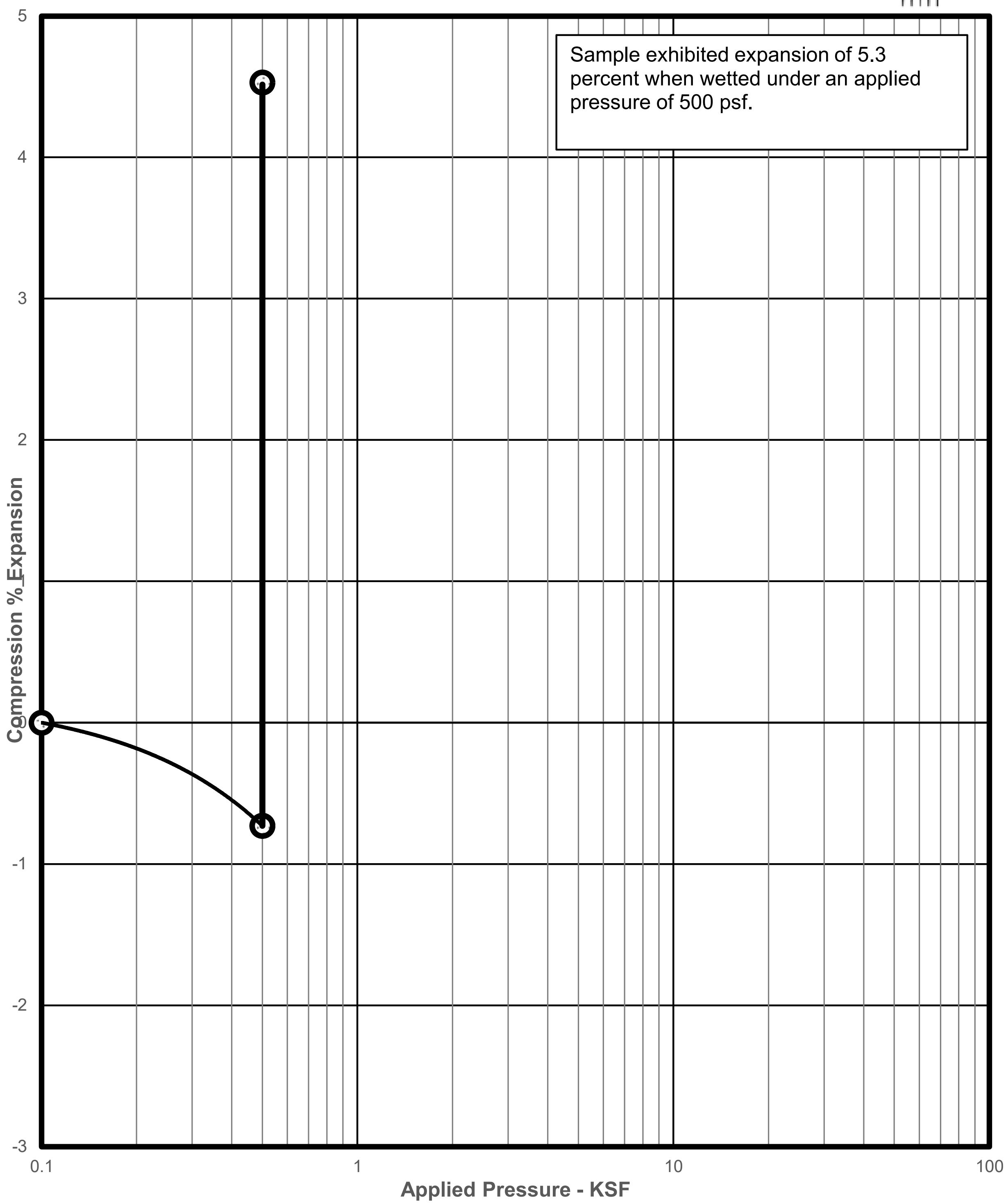


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-5 AT 9 FEET

DRY UNIT WEIGHT: 95 pcf
MOISTURE CONTENT: 29.8 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 16



SAMPLE OF WEATHERED CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 89 pcf

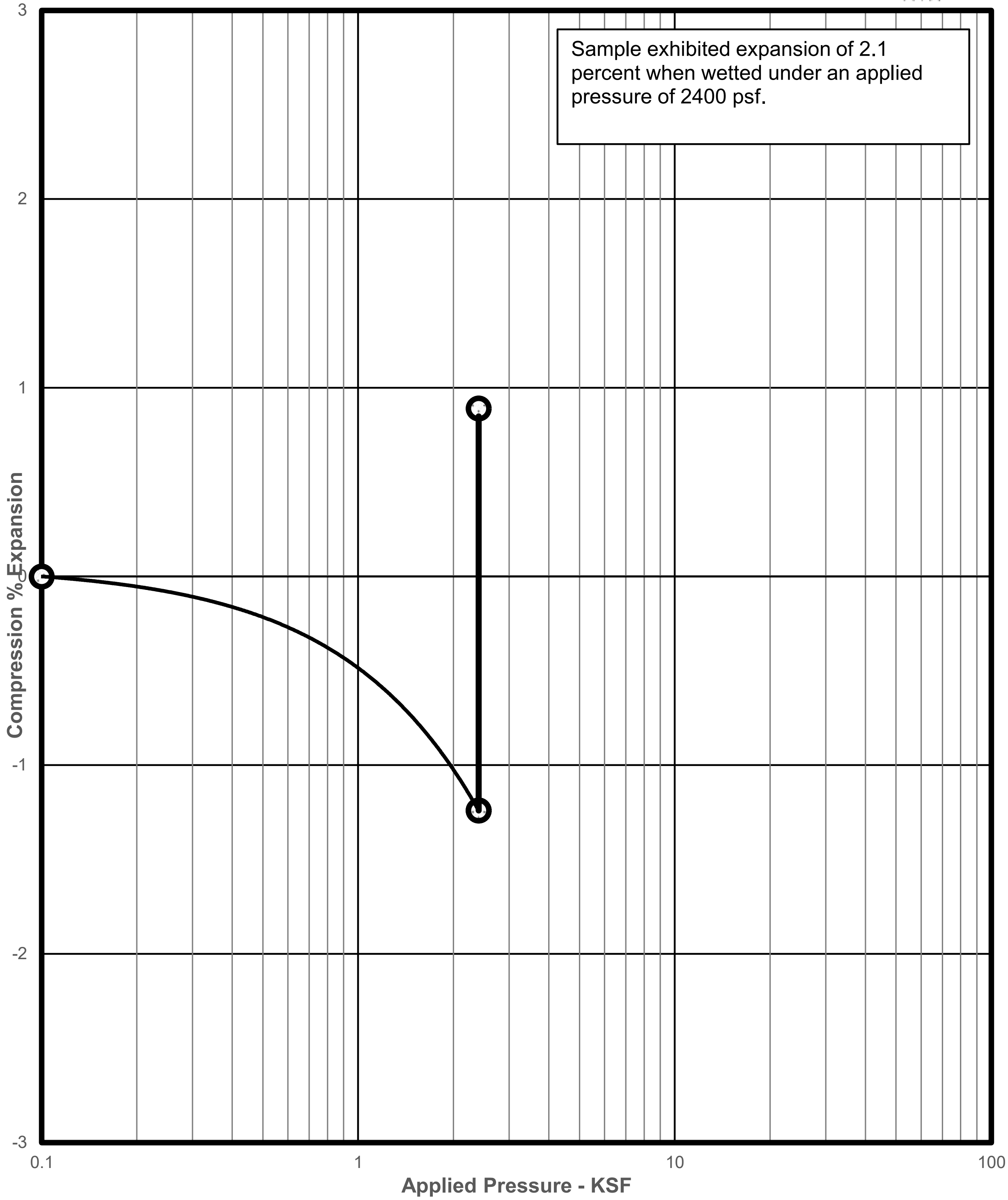
FROM: B-6 AT 4 FEET MOISTURE CONTENT: 29.2 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 17



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 90 pcf

FROM: B-6 AT 19 FEET MOISTURE CONTENT: 31.3 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

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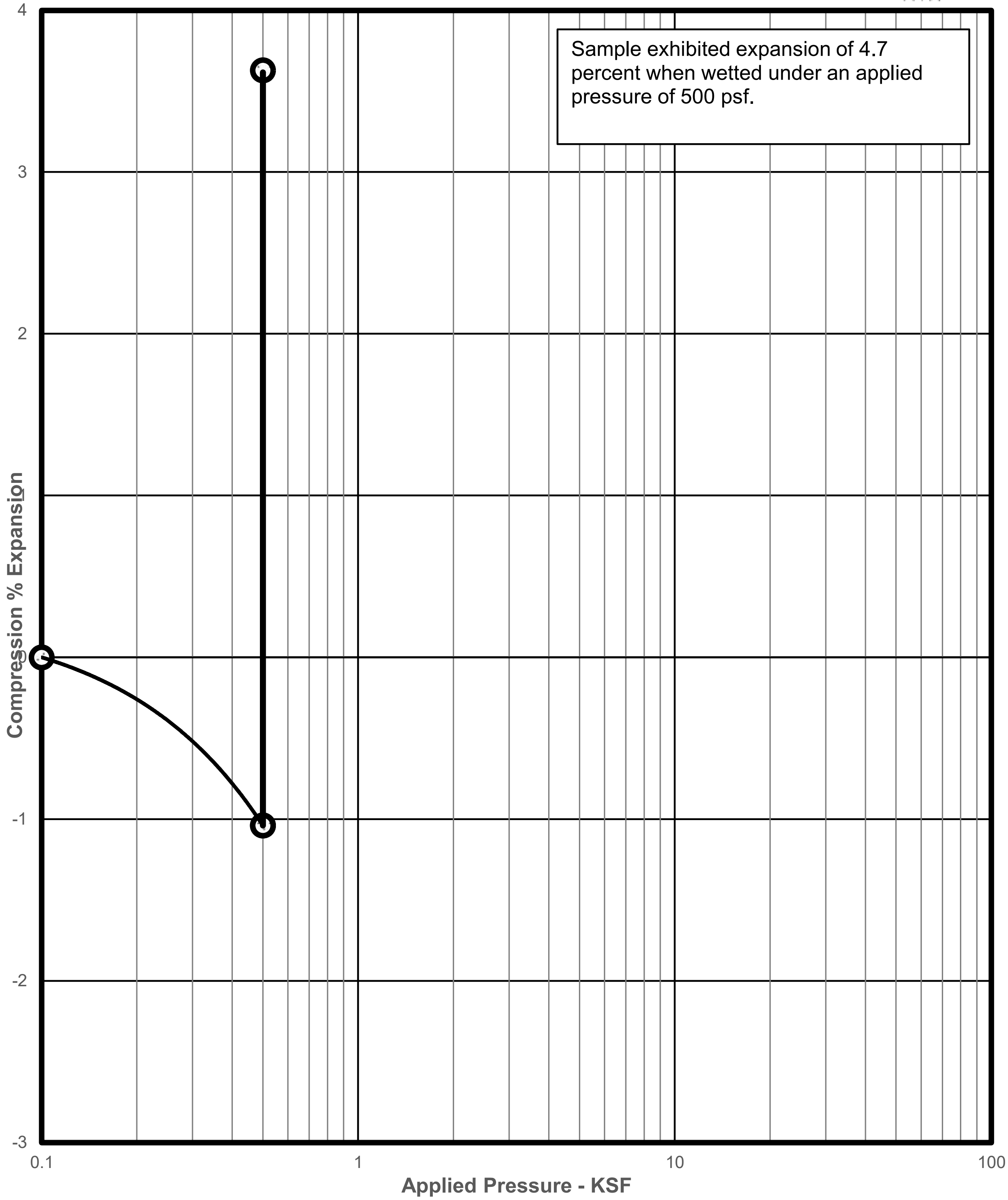
Swell Consolidation Test Results FIG. B- 18



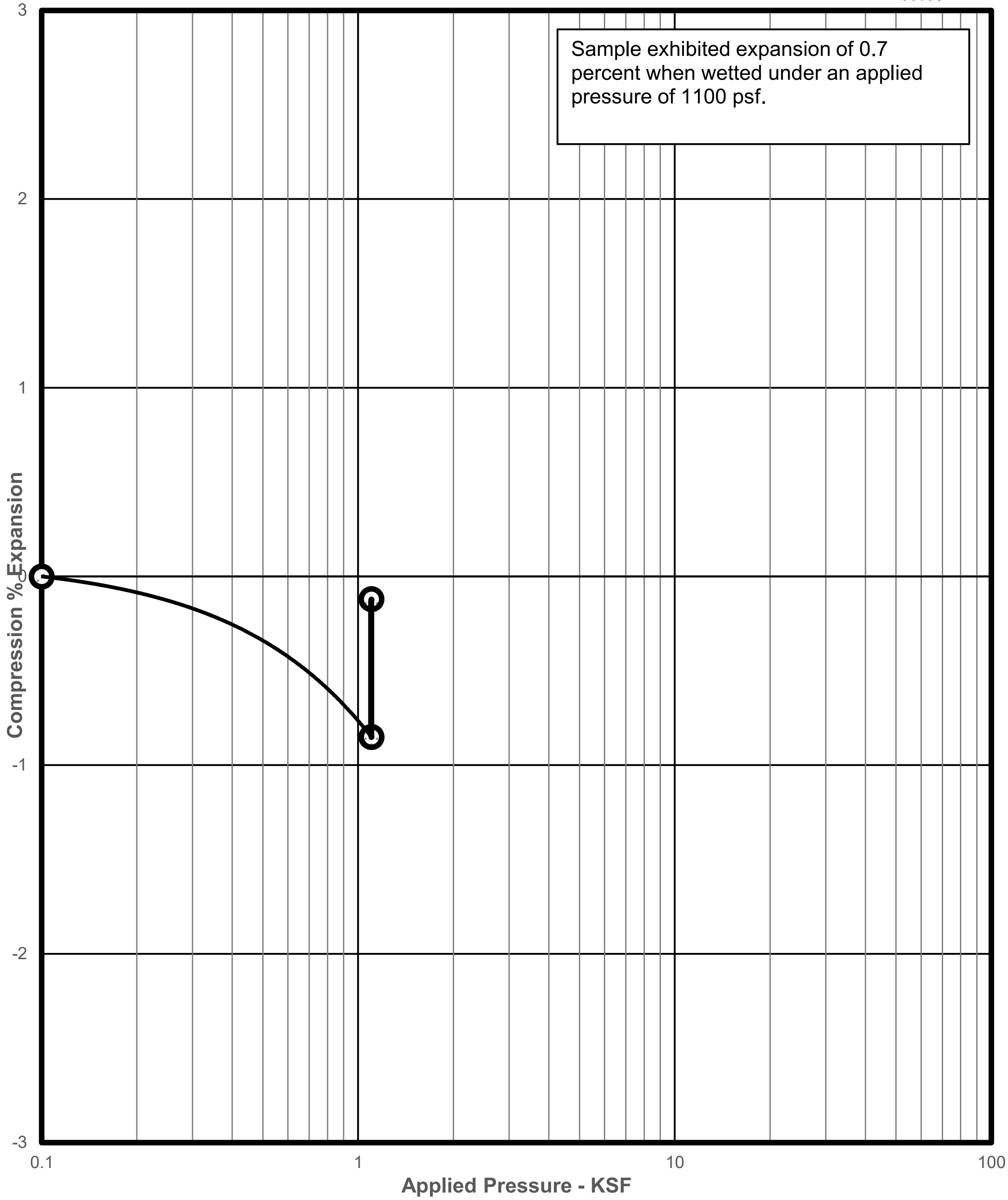
SAMPLE OF WEATHERED CLAYSTONE (MH/CH)
FROM: B-7 AT 4 FEET

DRY UNIT WEIGHT: 84 pcf
MOISTURE CONTENT: 36.0 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results

FIG. B- 19



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 84 pcf

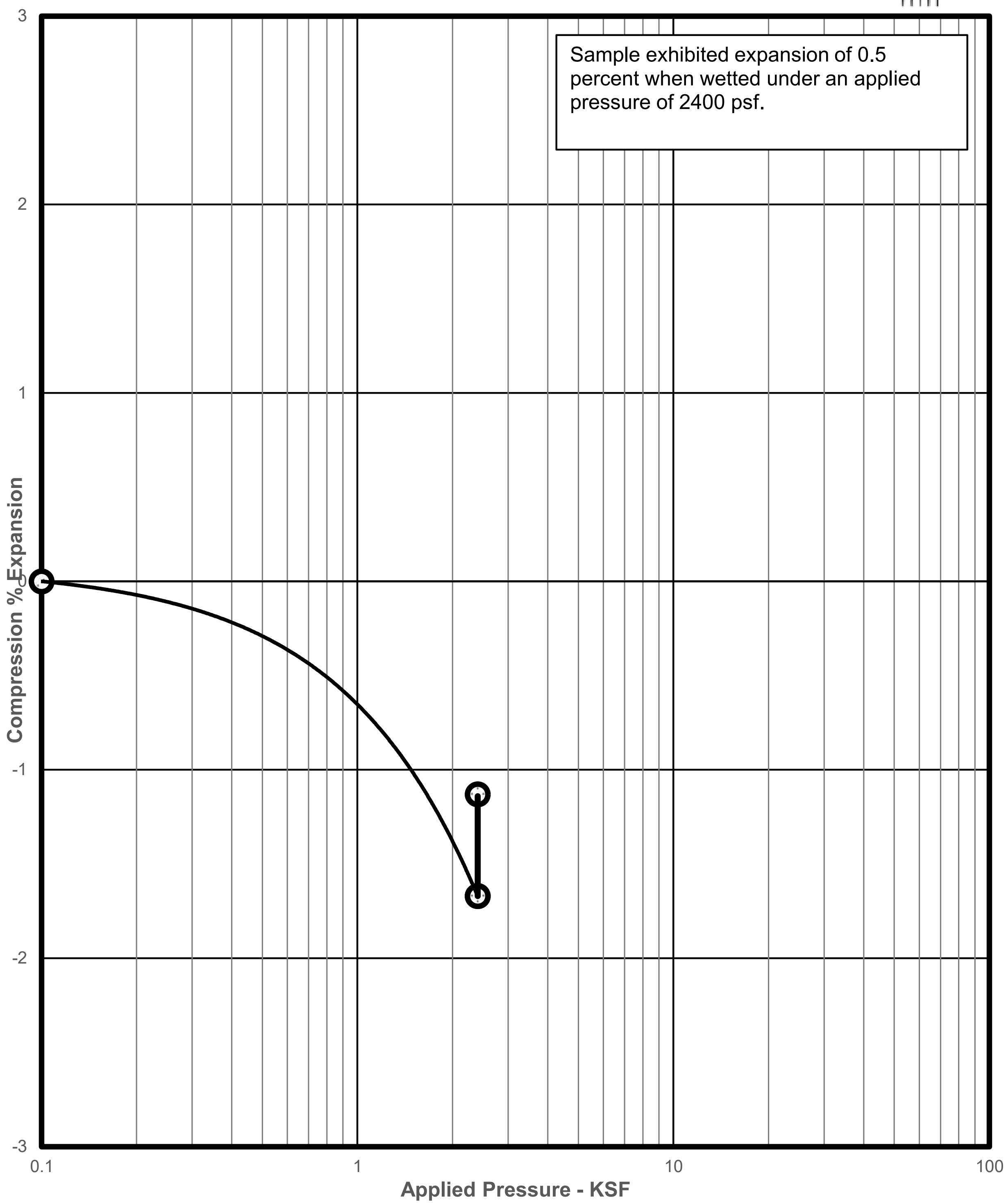
FROM: B-7 AT 9 FEET MOISTURE CONTENT: 34.5 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 20



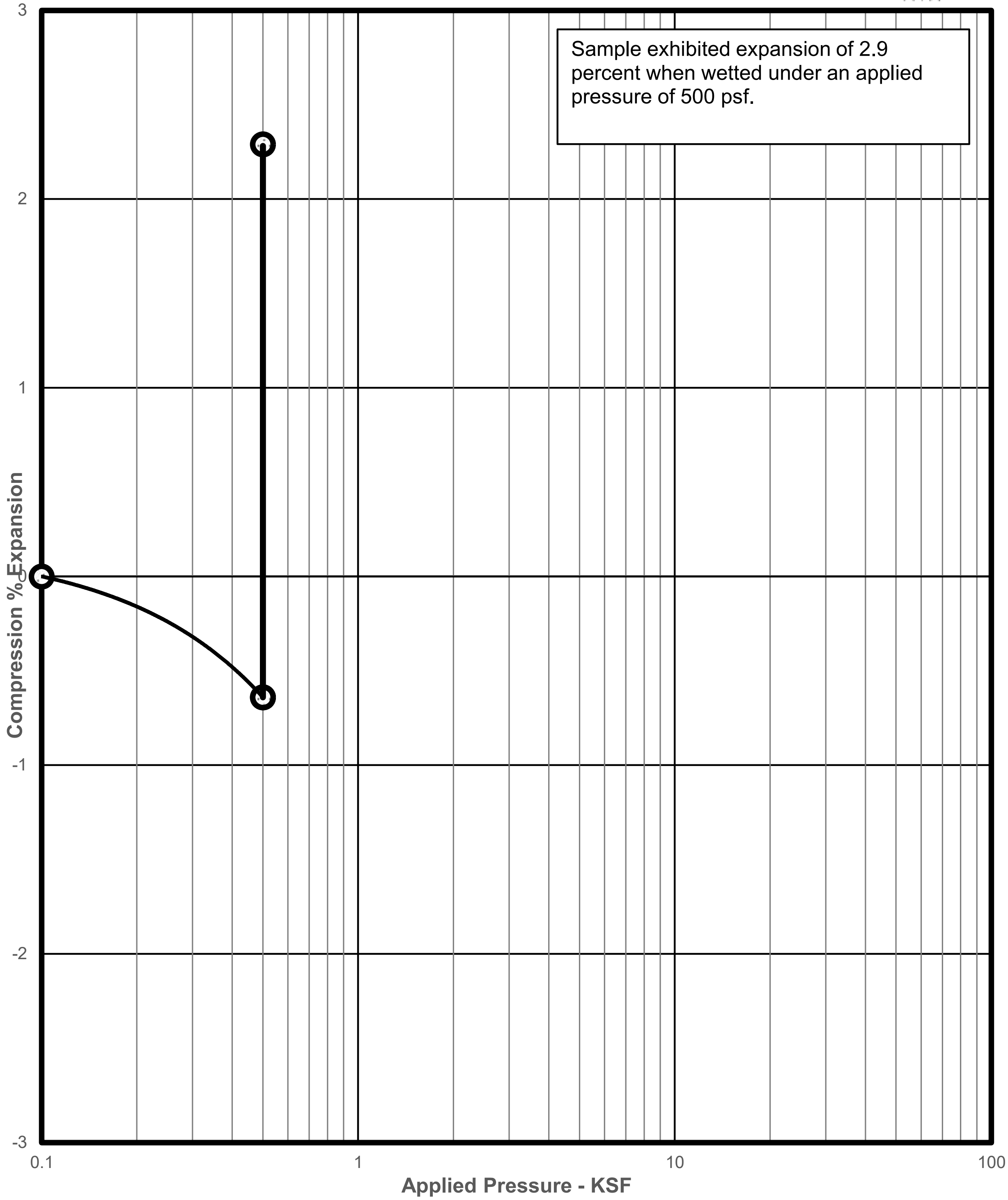
SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-7 AT 19 FEET

DRY UNIT WEIGHT: 87 pcf
MOISTURE CONTENT: 30.6 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results

FIG. B- 21

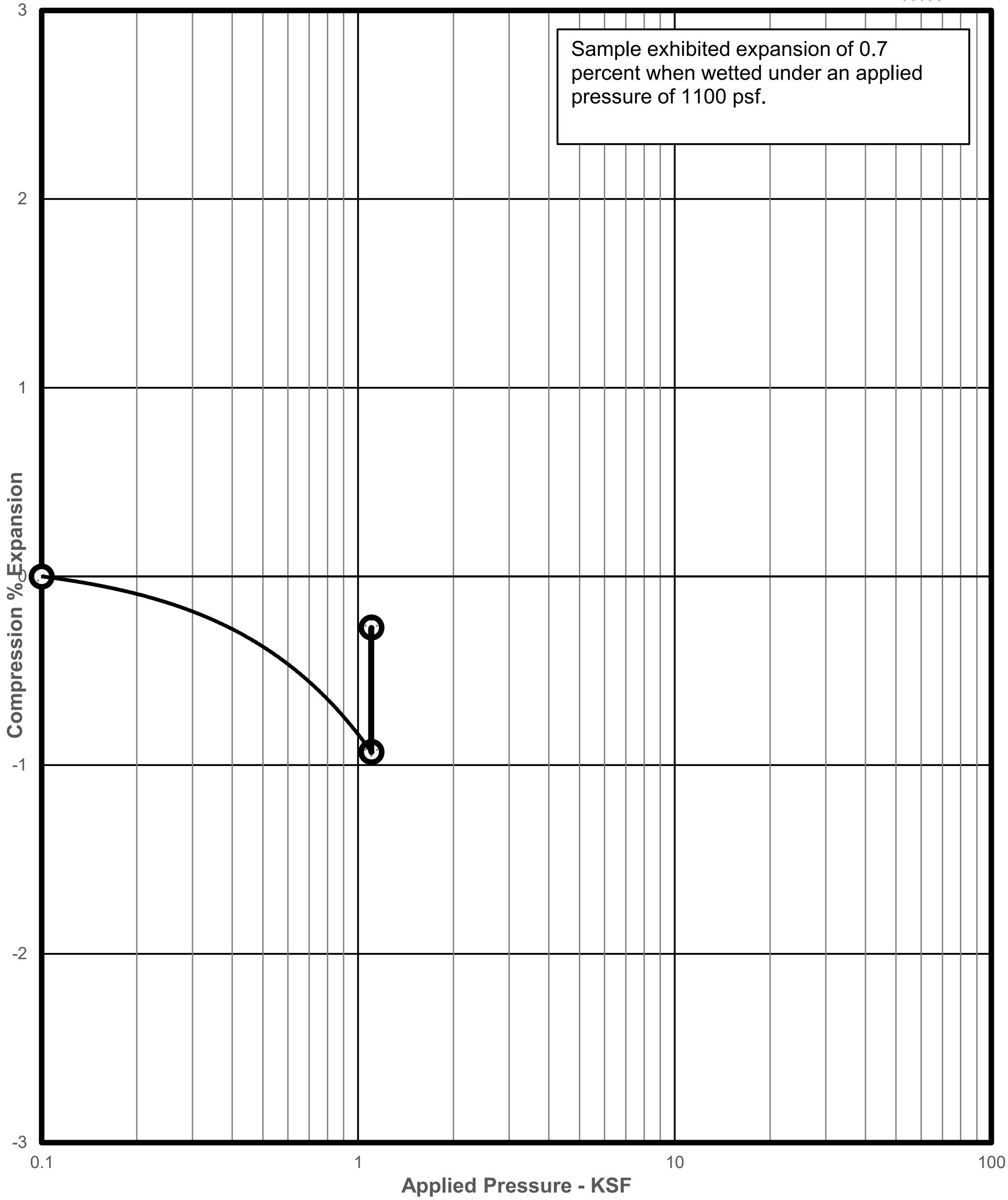


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-8 AT 4 FEET

DRY UNIT WEIGHT: 98 pcf
MOISTURE CONTENT: 21.8 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 22



SAMPLE OF SANDSTONE (SC/SM) DRY UNIT WEIGHT: 93 pcf

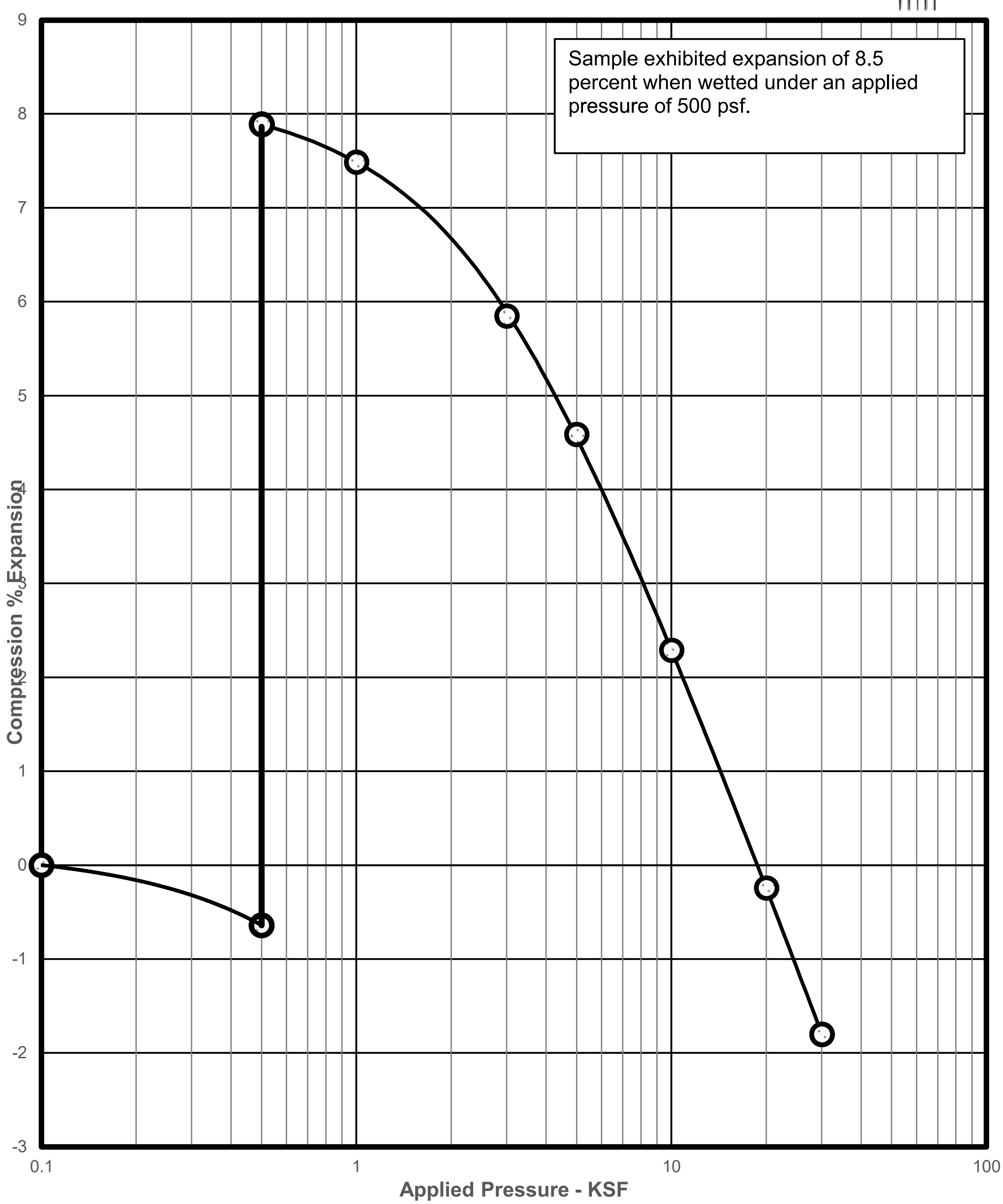
FROM: B-8 AT 9 FEET MOISTURE CONTENT: 27.7 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 23



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 94 pcf

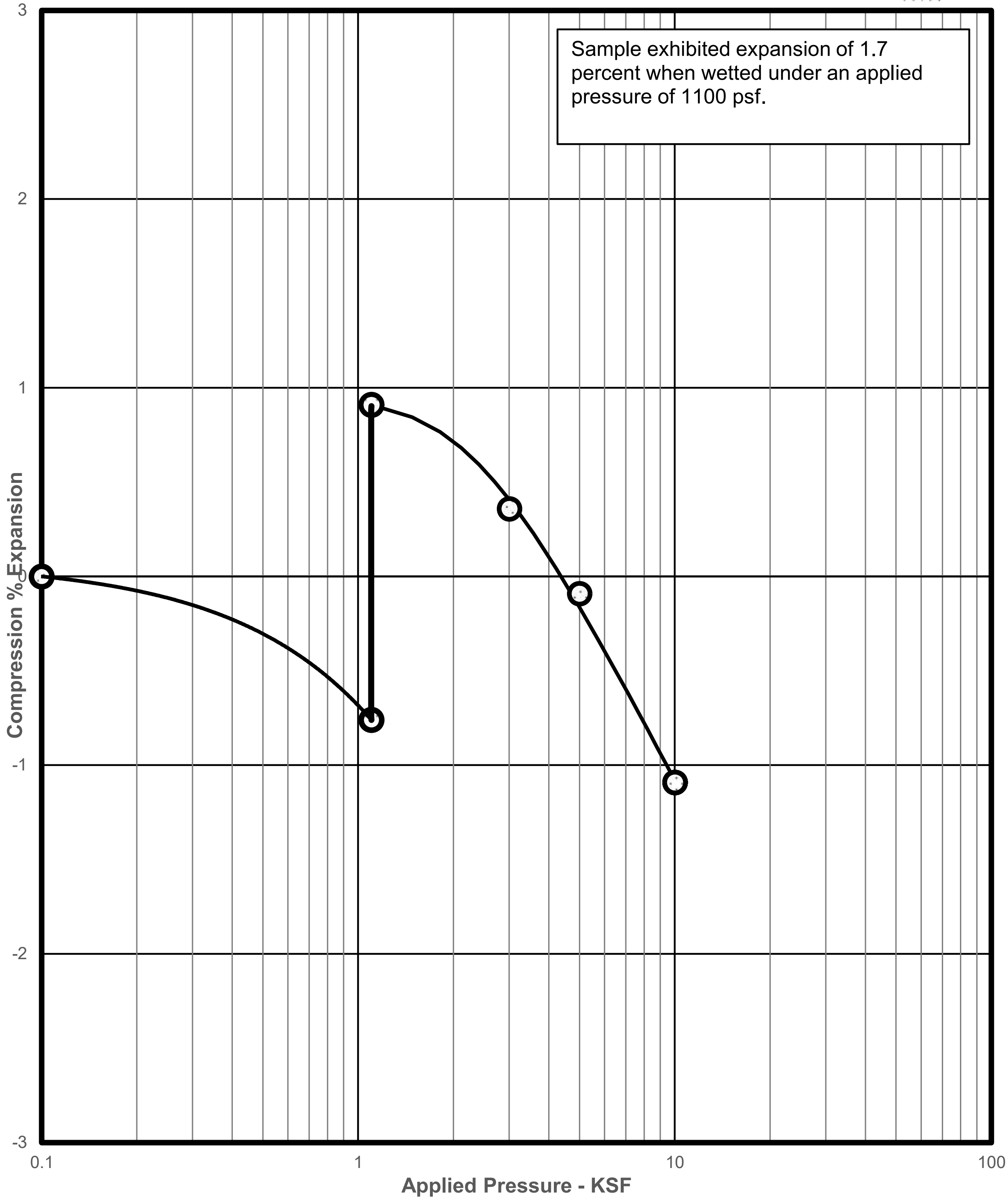
FROM: B-9 AT 4 FEET MOISTURE CONTENT: 24.8 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 24

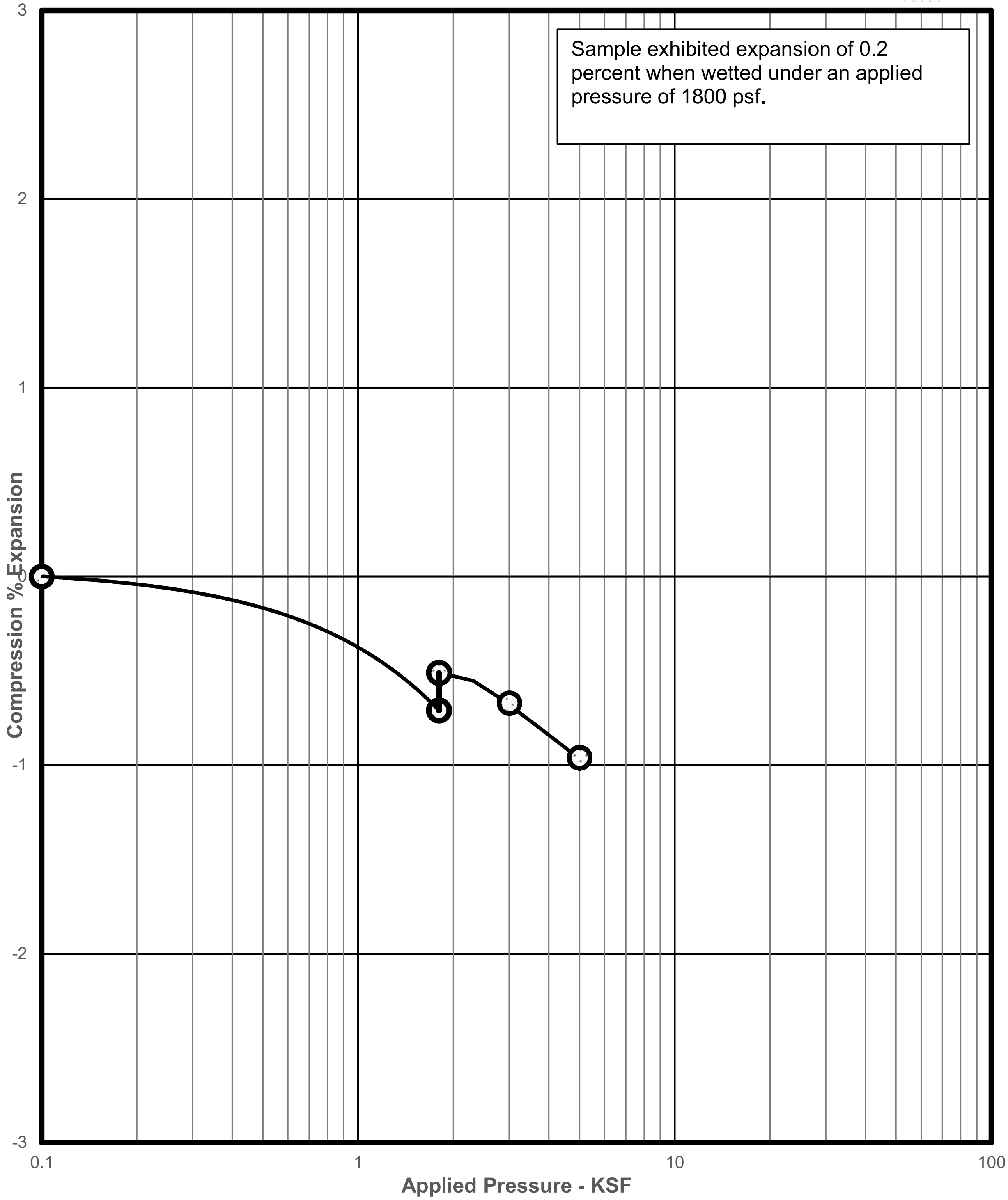


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-9 AT 9 FEET

DRY UNIT WEIGHT: 91 pcf
MOISTURE CONTENT: 29.5 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

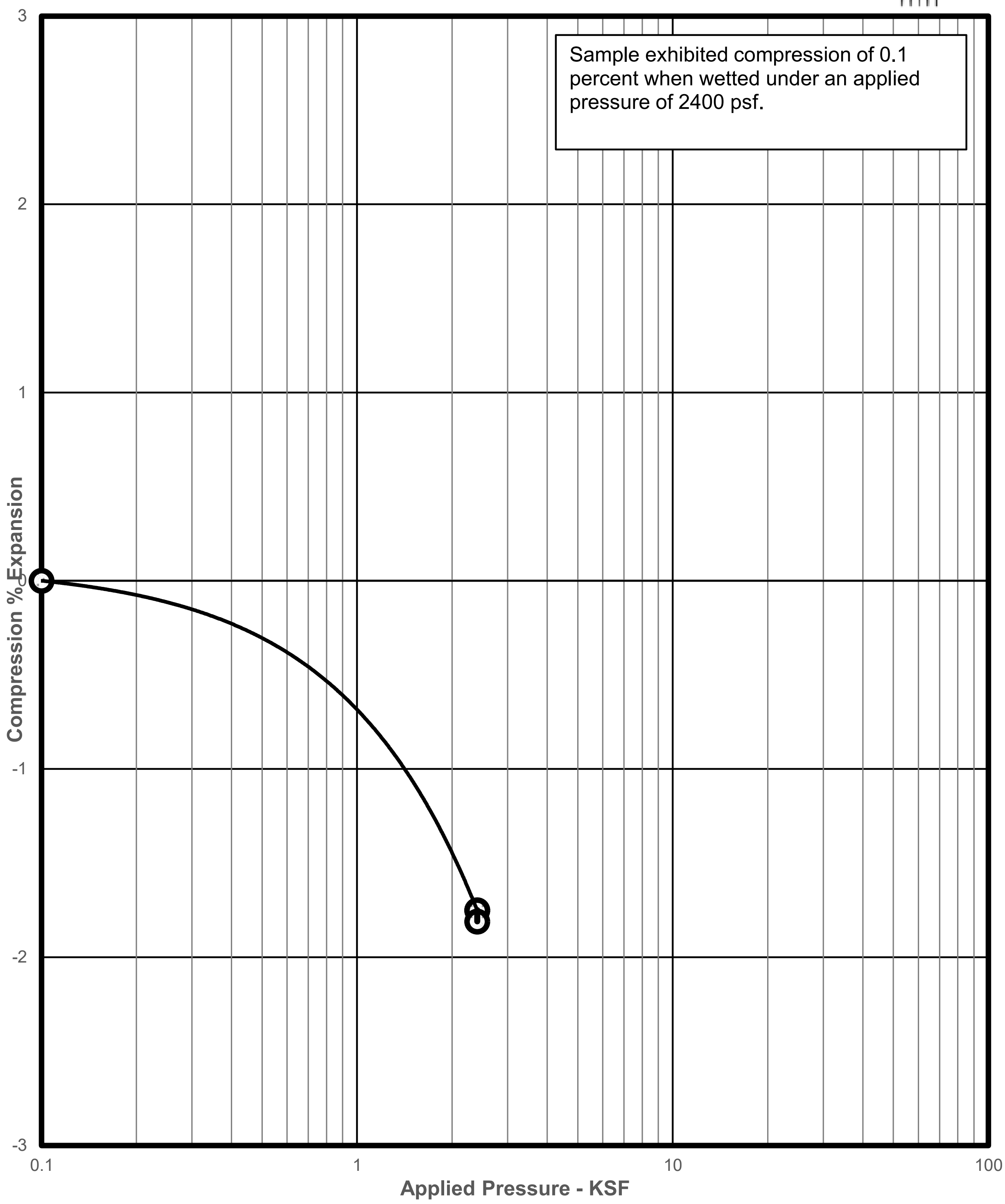
Swell Consolidation Test Results FIG. B- 25



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 82 pcf
FROM: B-9 AT 14 FEET MOISTURE CONTENT: 37.3 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 26

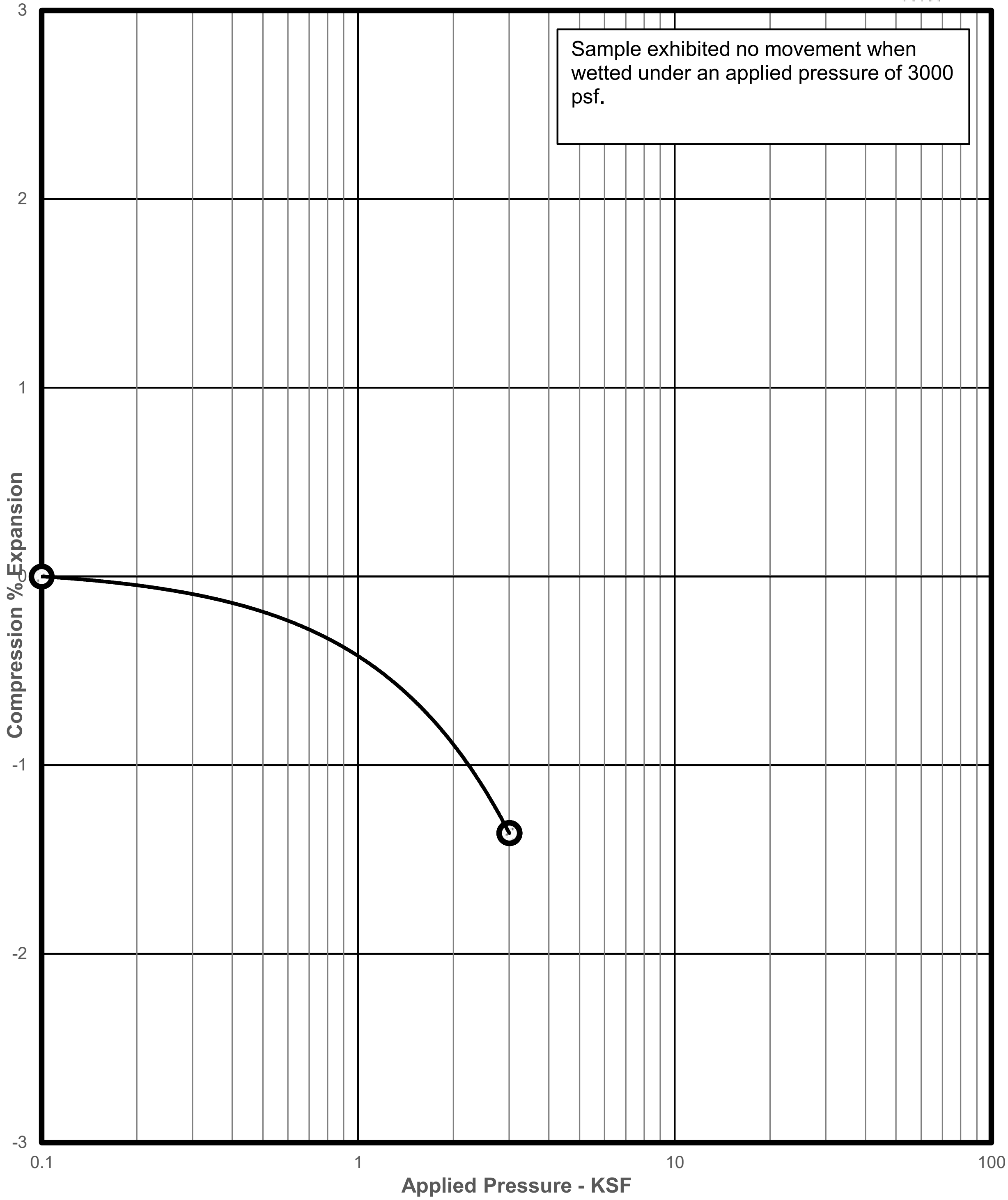


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-9 AT 19 FEET

DRY UNIT WEIGHT: 90 pcf
MOISTURE CONTENT: 30.3 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

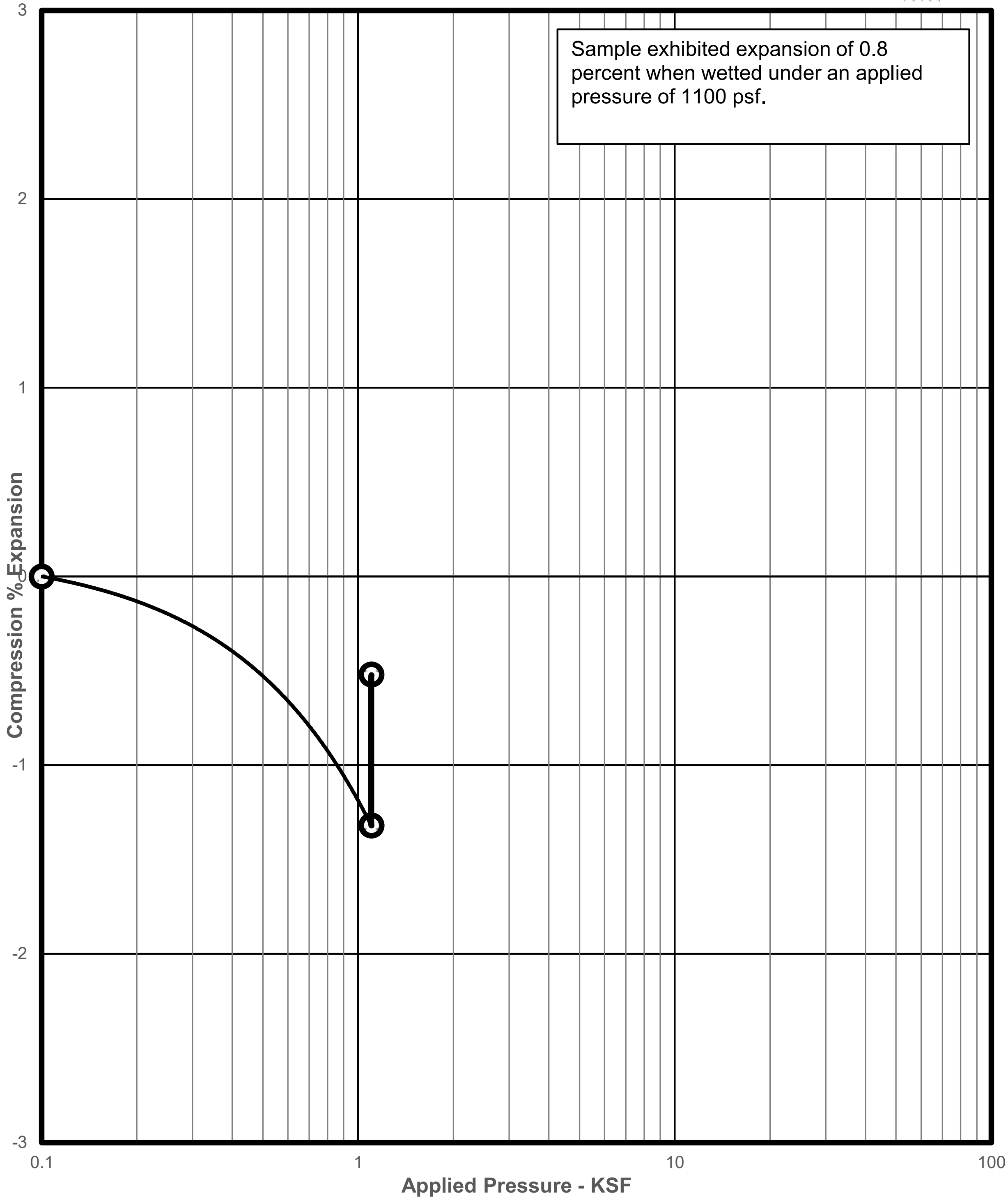
Swell Consolidation Test Results FIG. B- 27



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 83 pcf
FROM: B-9 AT 24 FEET MOISTURE CONTENT: 35.5 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 28



SAMPLE OF FILL, CLAY, SANDY | DRY UNIT WEIGHT: 100 pcf

FROM: B-10 AT 9 FEET | MOISTURE CONTENT: 22.5 %

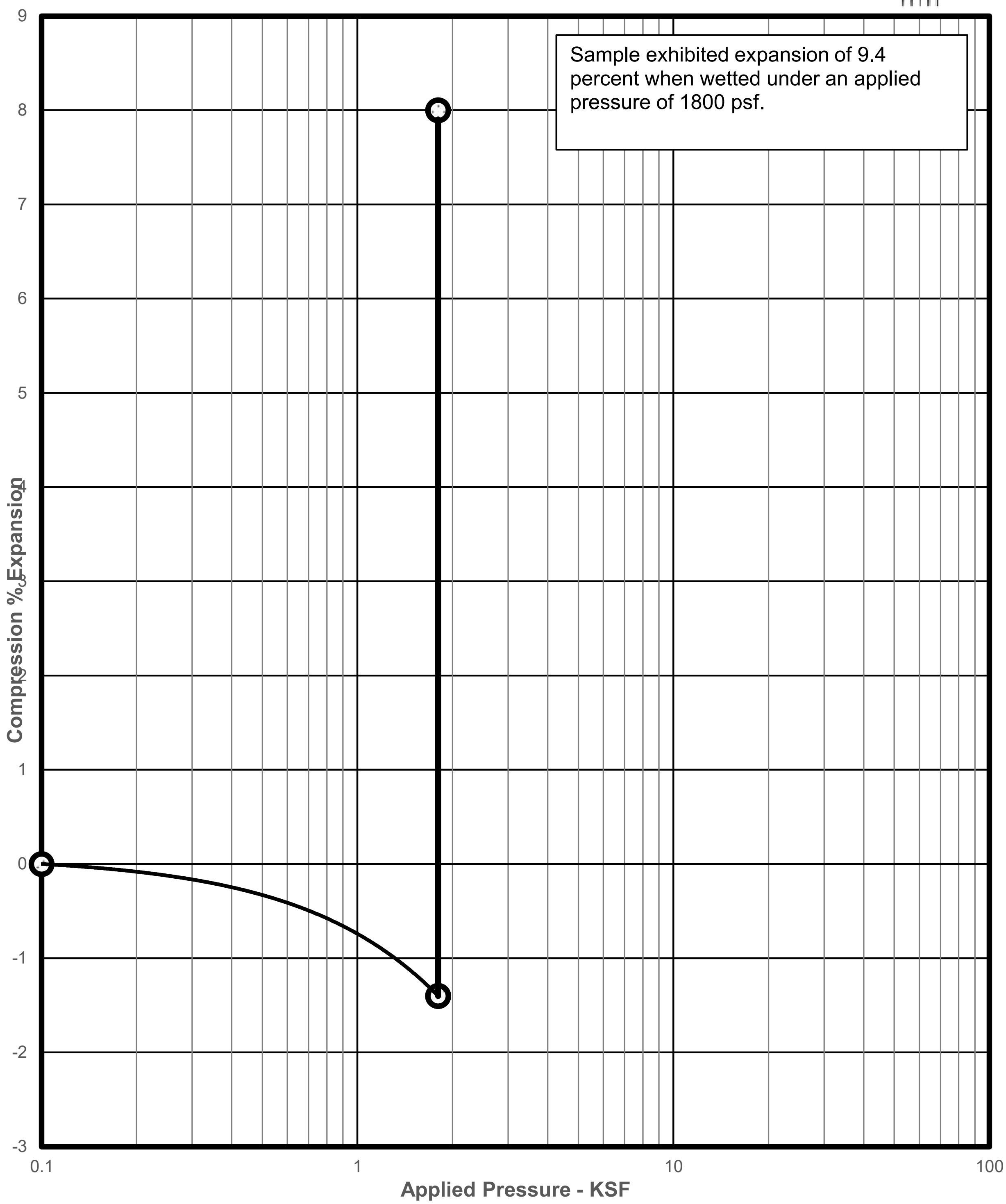
LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results

FIG. B- 29



SAMPLE OF CLAY, SANDY (CL/CH) DRY UNIT WEIGHT: 107 pcf

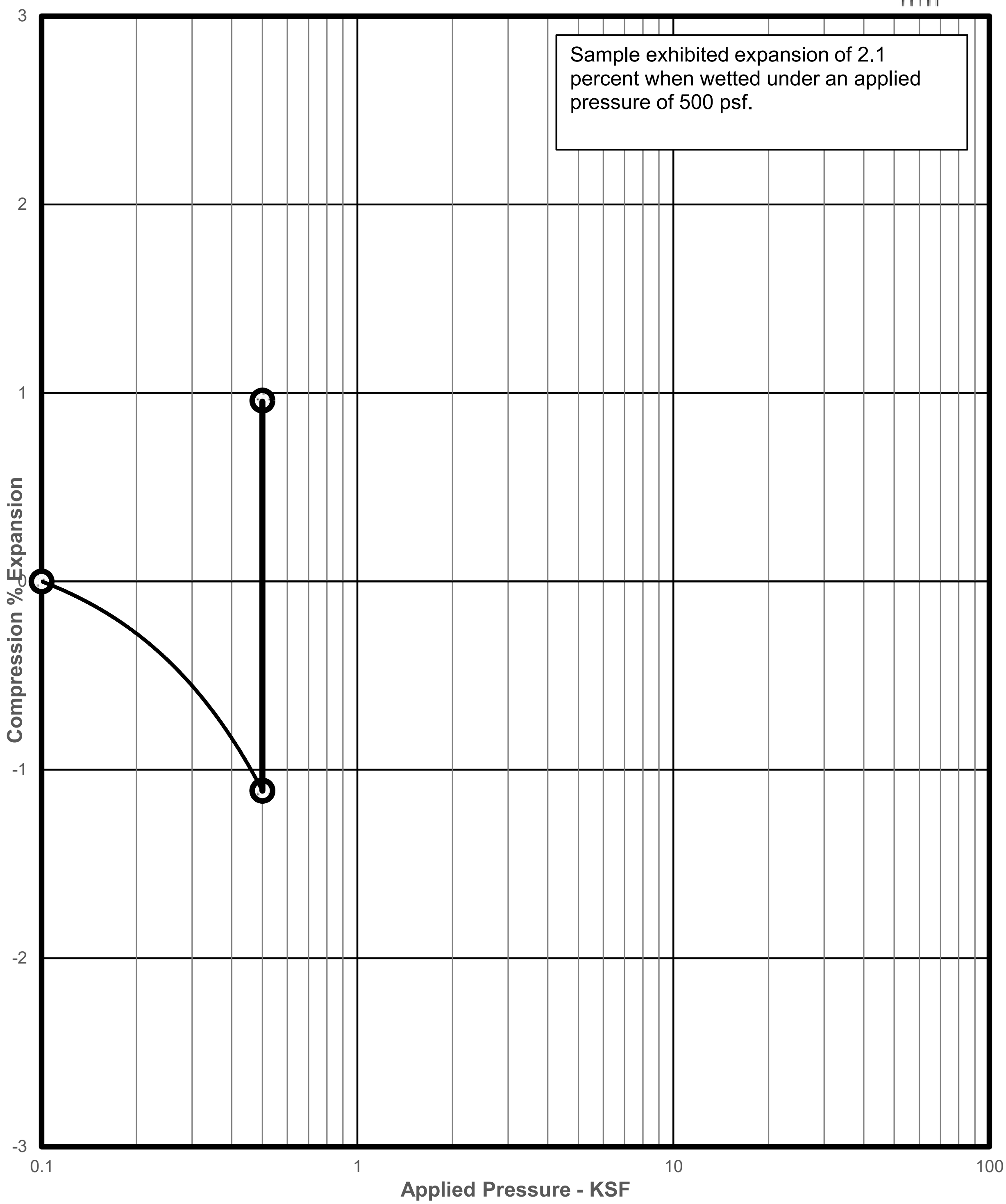
FROM: B-10 AT 14 FEET MOISTURE CONTENT: 17.7 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 30

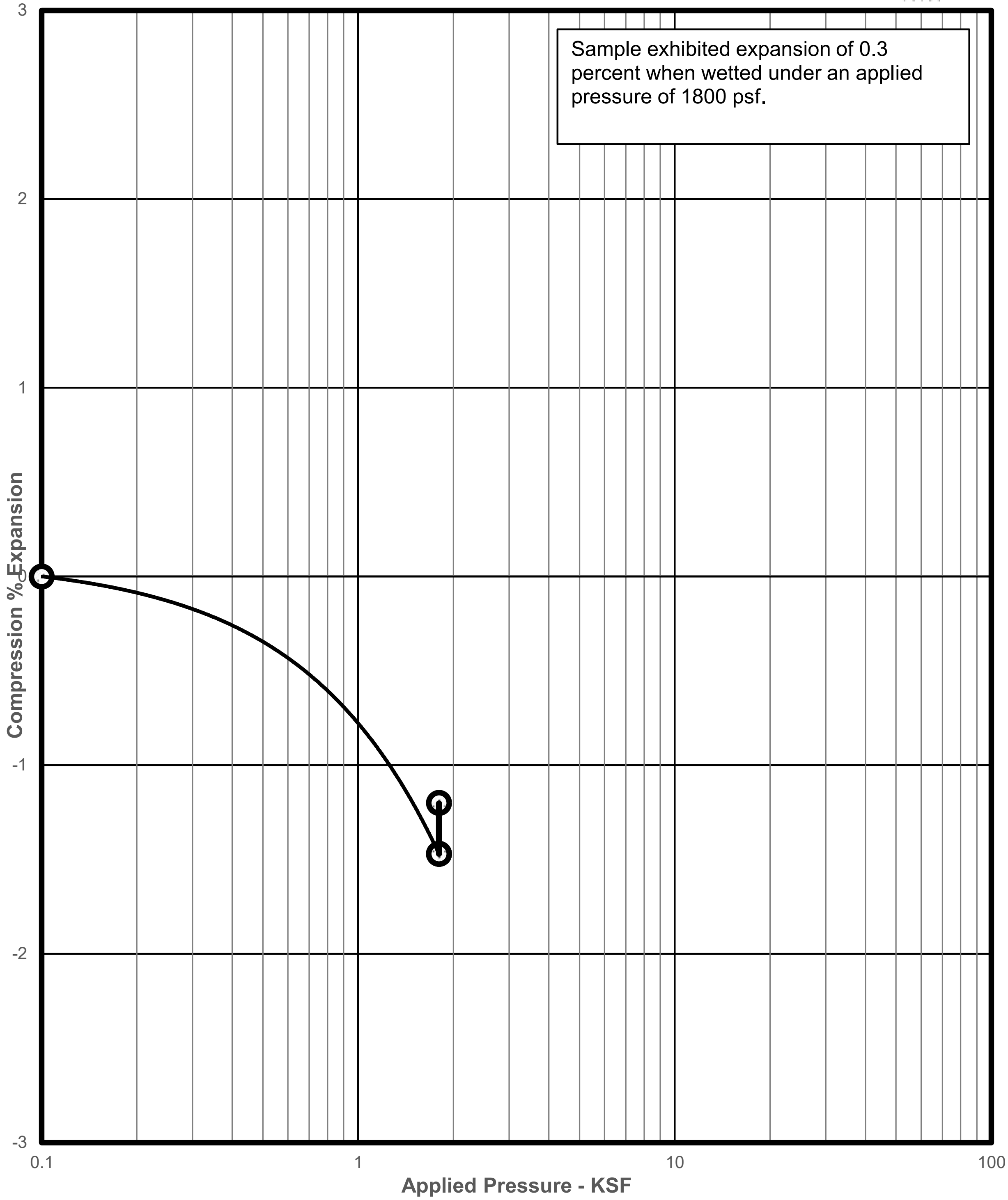


SAMPLE OF FILL, CLAY, SANDY
FROM: B-11 AT 4 FEET

DRY UNIT WEIGHT: 98 pcf
MOISTURE CONTENT: 23.9 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 31



SAMPLE OF FILL, CLAY, SANDY

FROM: B-11 AT 14 FEET

DRY UNIT WEIGHT: 90 pcf

MOISTURE CONTENT: 28.8 %

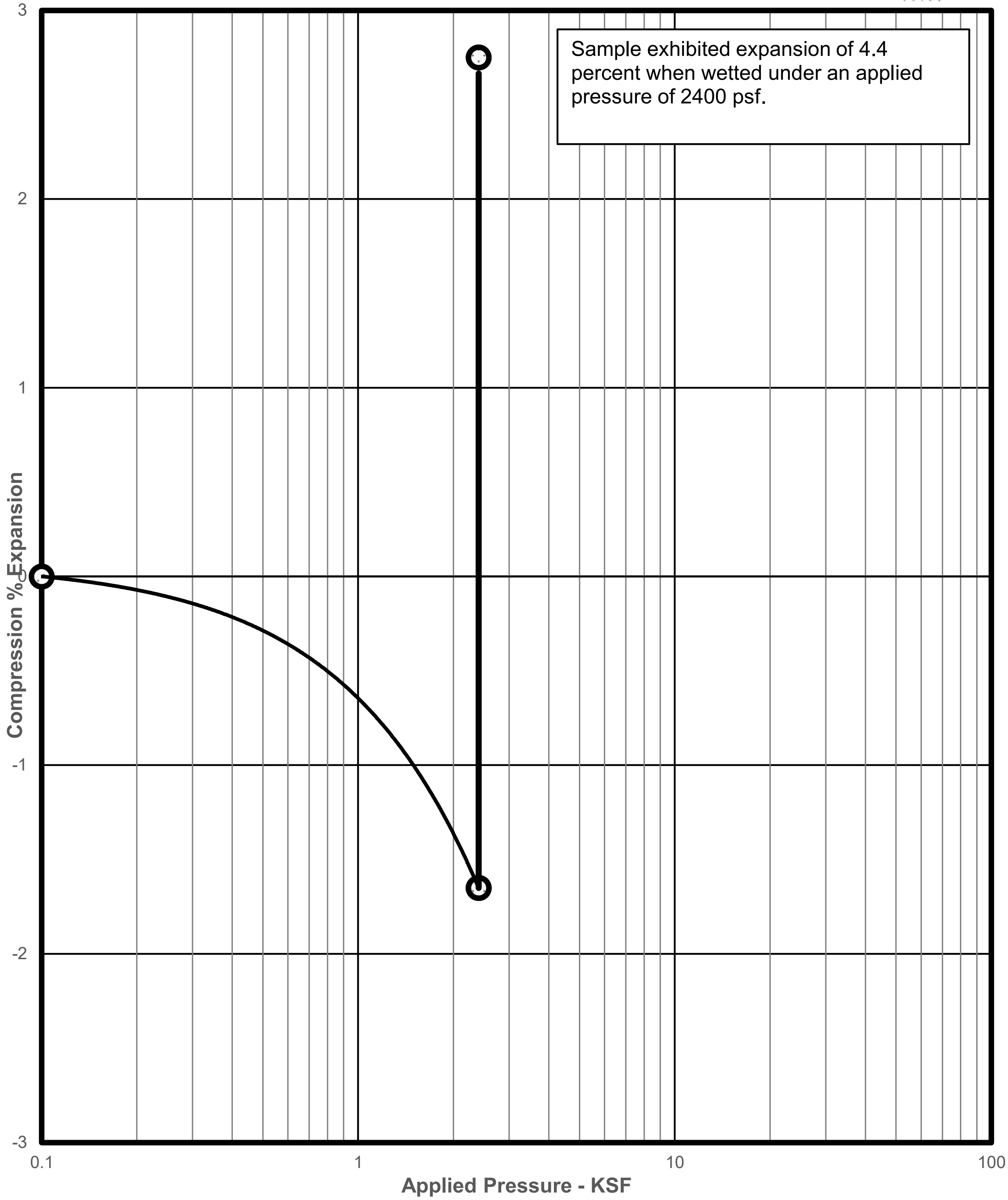
LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results

FIG. B- 32

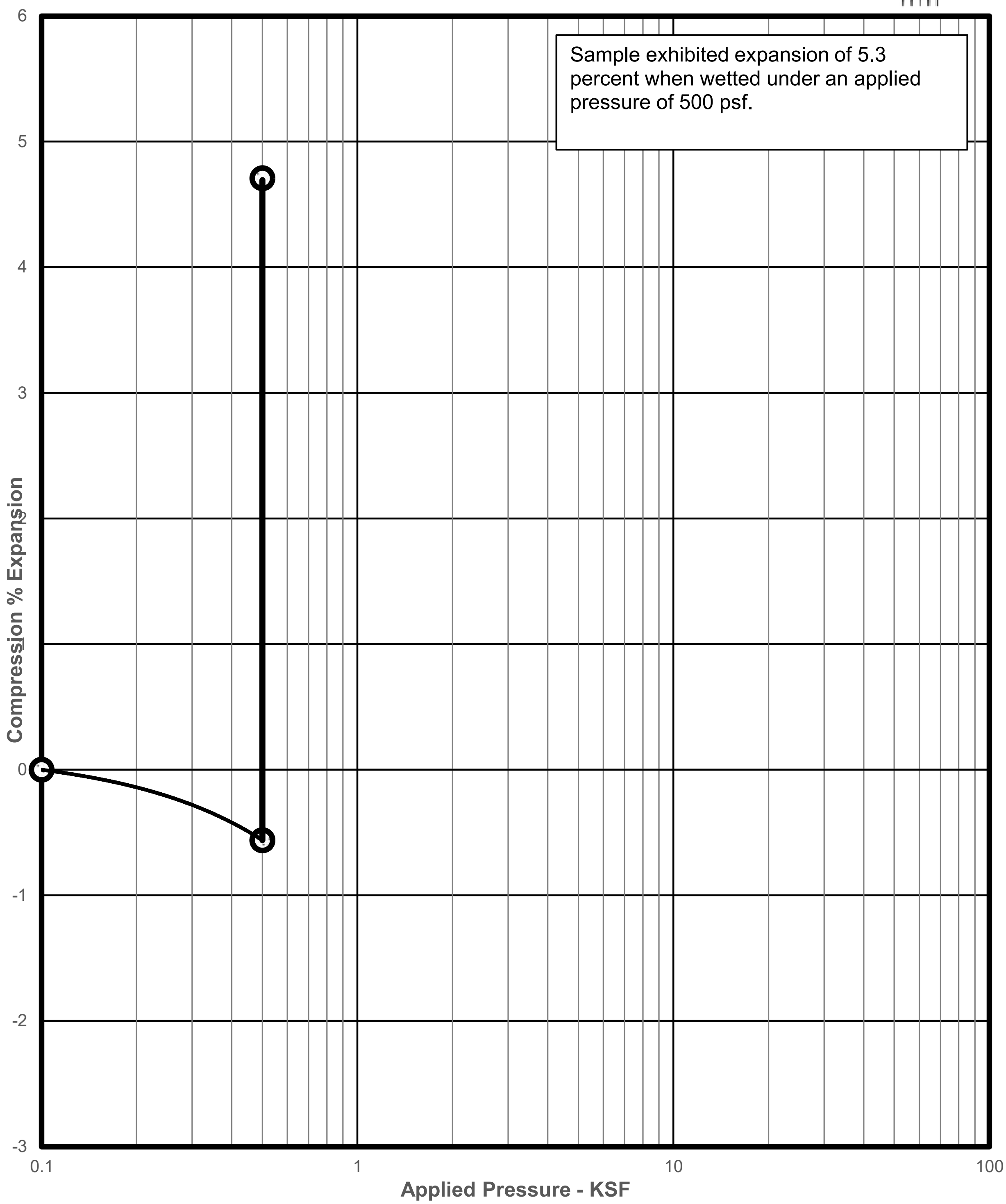


SAMPLE OF CLAY, SANDY (CL/CH)
FROM: B-11 AT 19 FEET

DRY UNIT WEIGHT: 100 pcf
MOISTURE CONTENT: 21.3 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 33

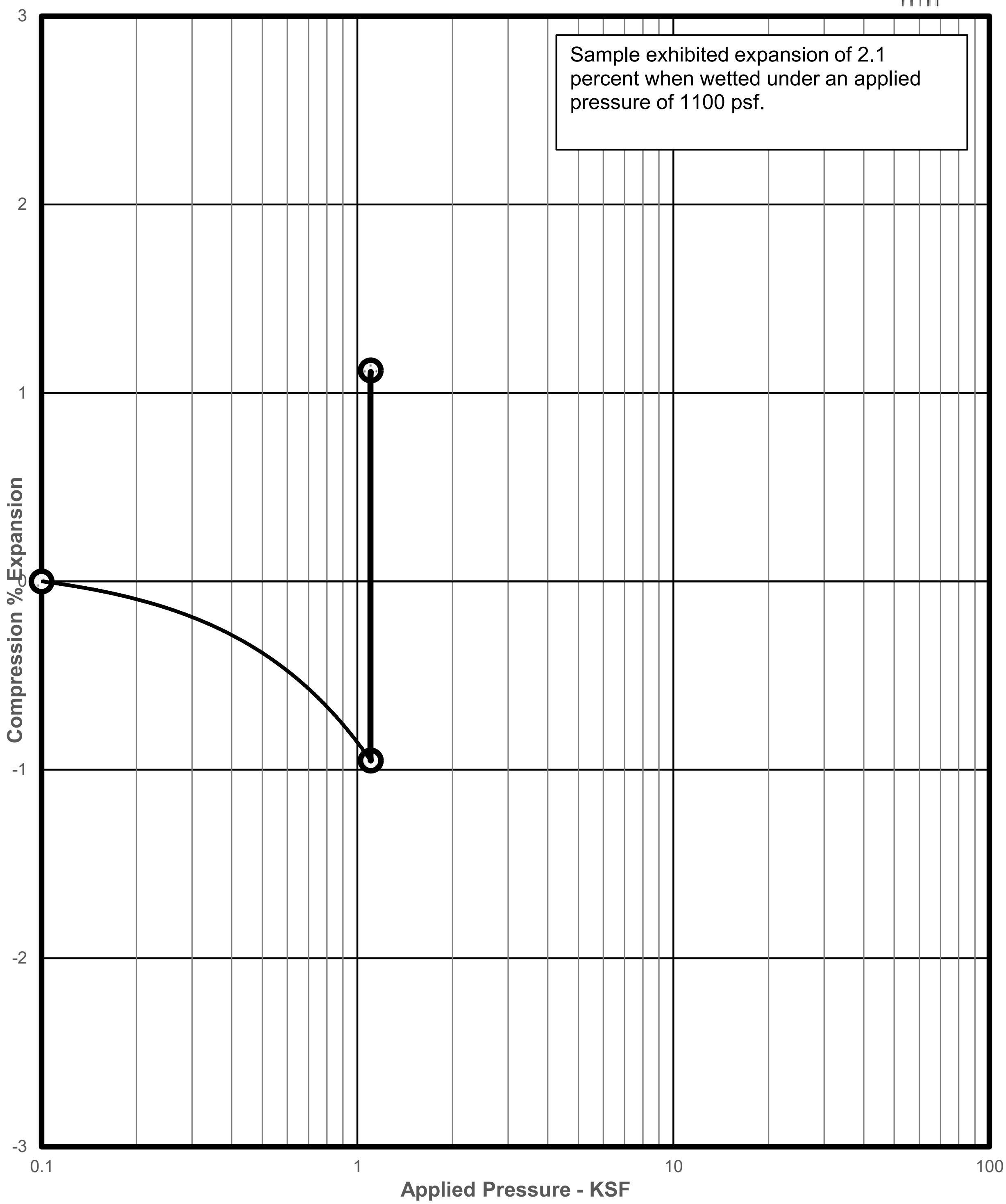


SAMPLE OF CLAY, SANDY (CL/CH)
FROM: B-12 AT 4 FEET

DRY UNIT WEIGHT: 103 pcf
MOISTURE CONTENT: 20.3 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 34



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 88 pcf

FROM: B-12 AT 9 FEET MOISTURE CONTENT: 33.2 %

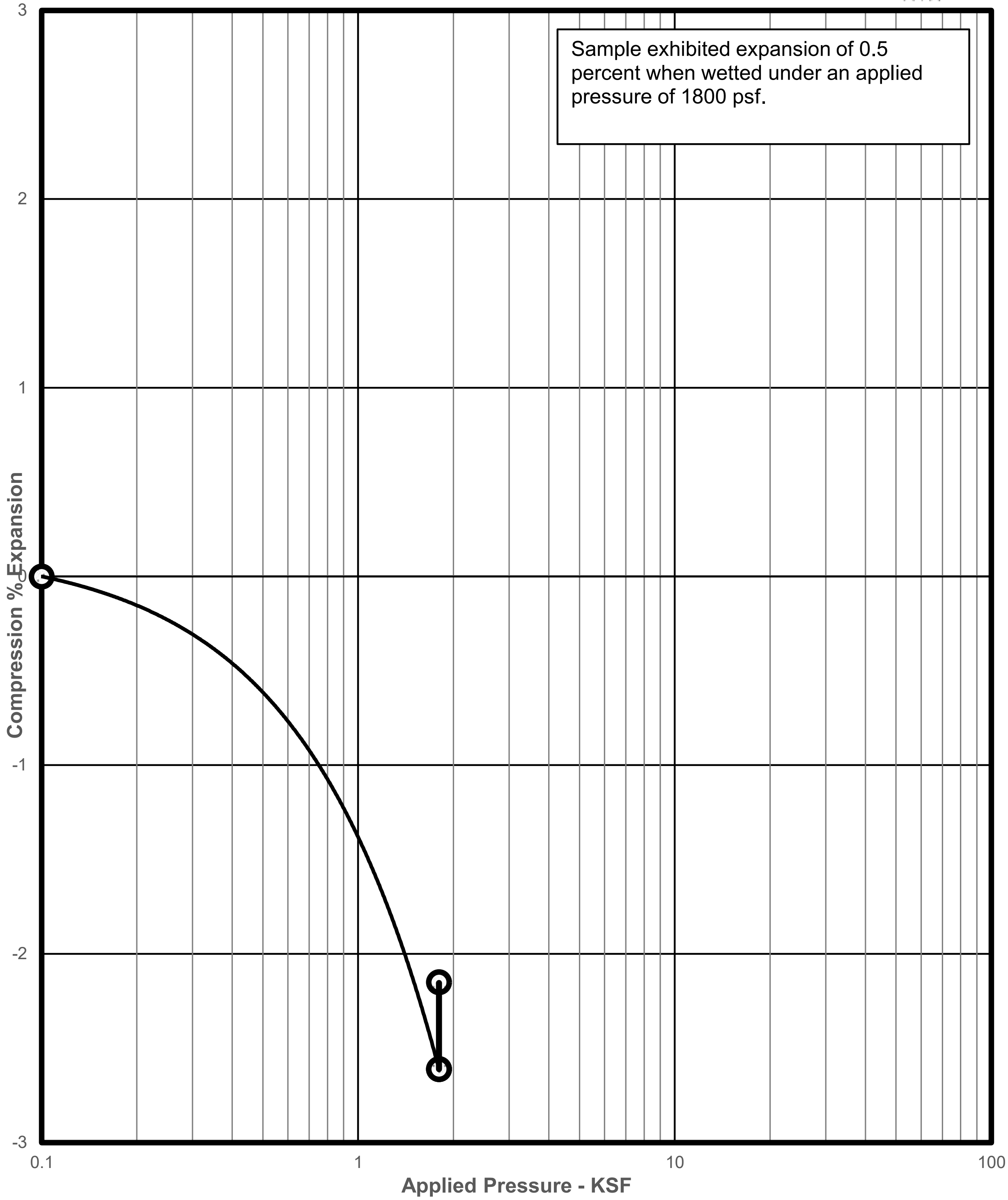
LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results

FIG. B- 35



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 88 pcf

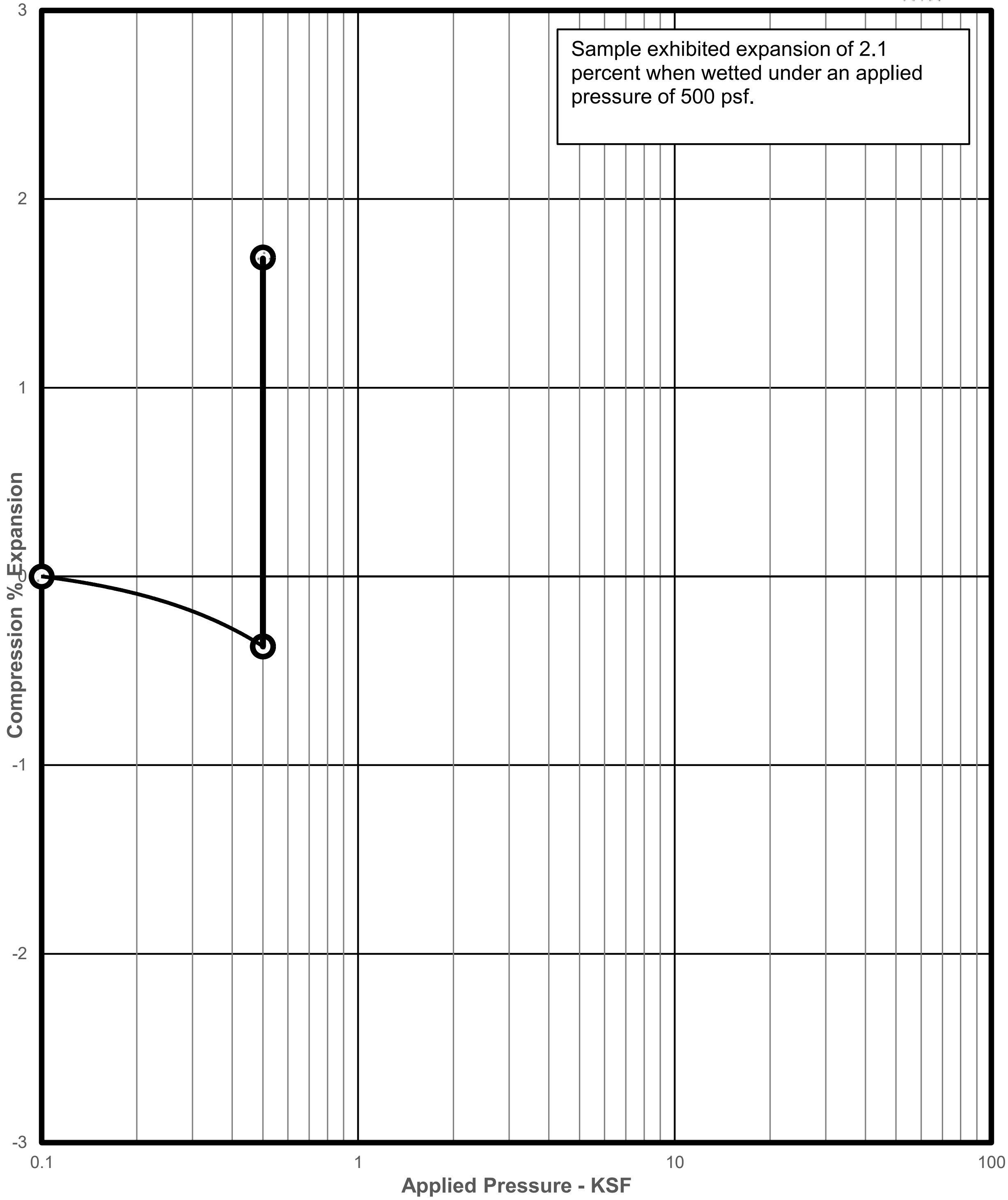
FROM: B-12 AT 14 FEET MOISTURE CONTENT: 33.2 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 36

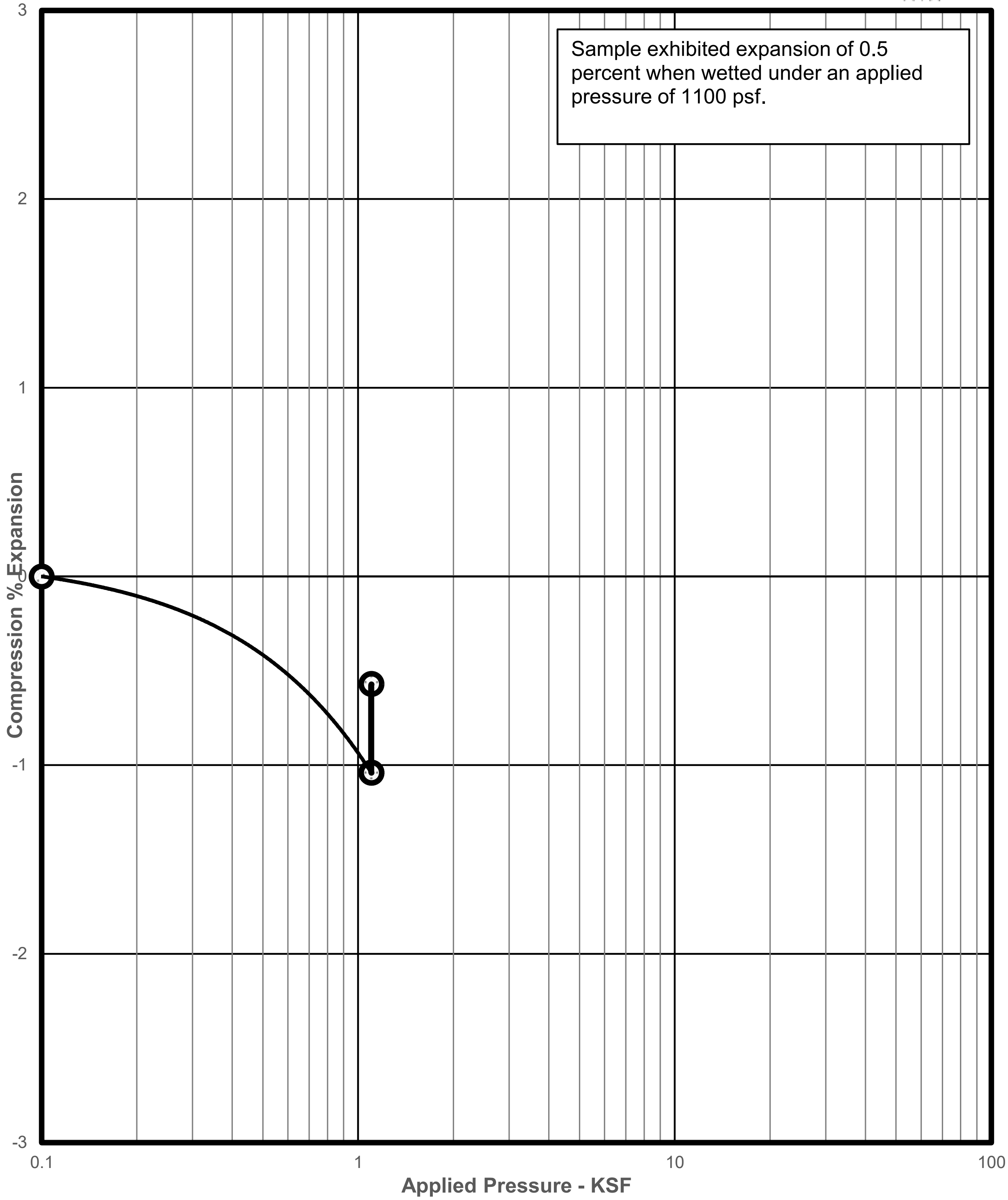


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-13 AT 4 FEET

DRY UNIT WEIGHT: 90 pcf
MOISTURE CONTENT: 32.0 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 37



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 89 pcf

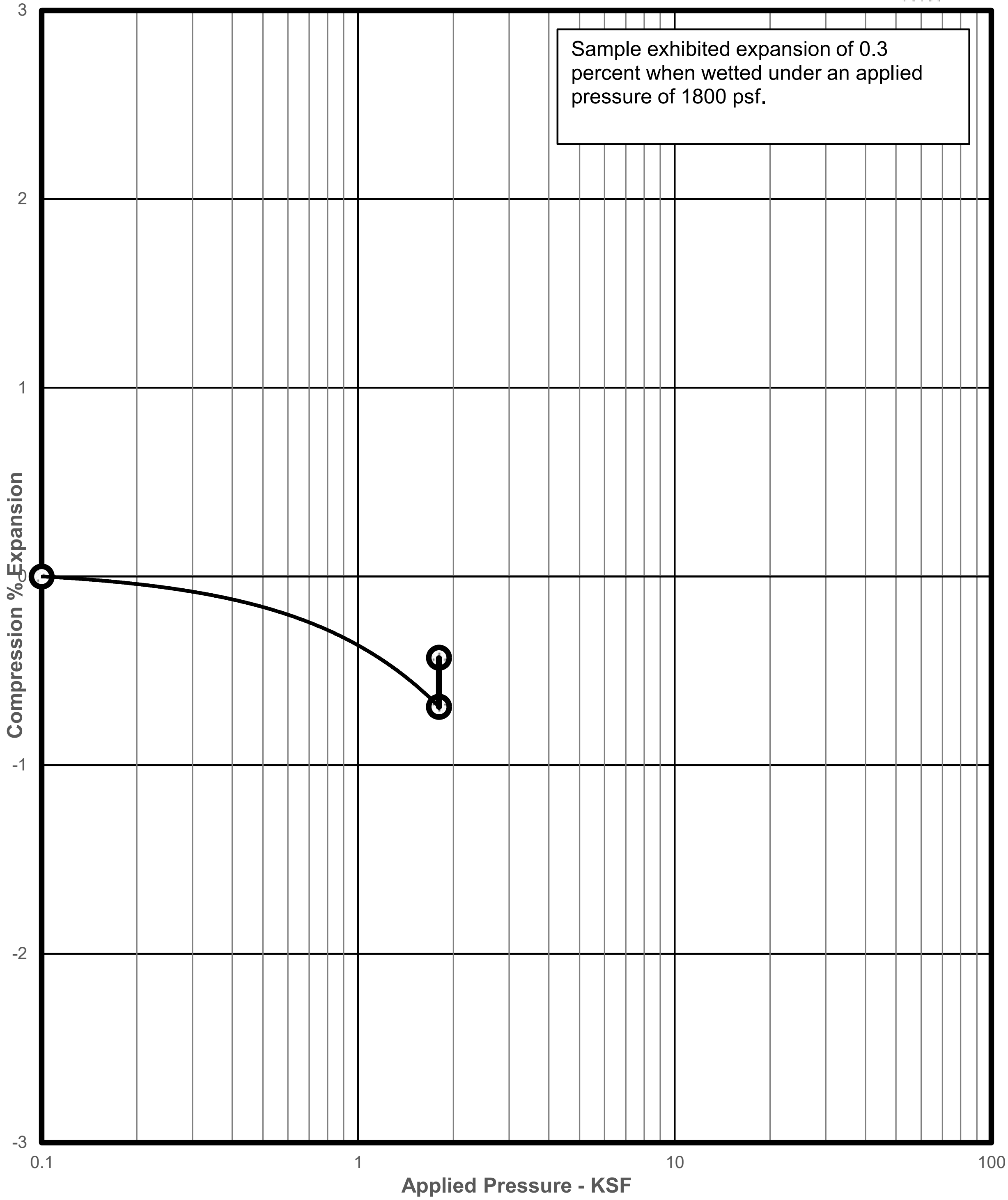
FROM: B-13 AT 9 FEET MOISTURE CONTENT: 30.5 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 38



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 86 pcf

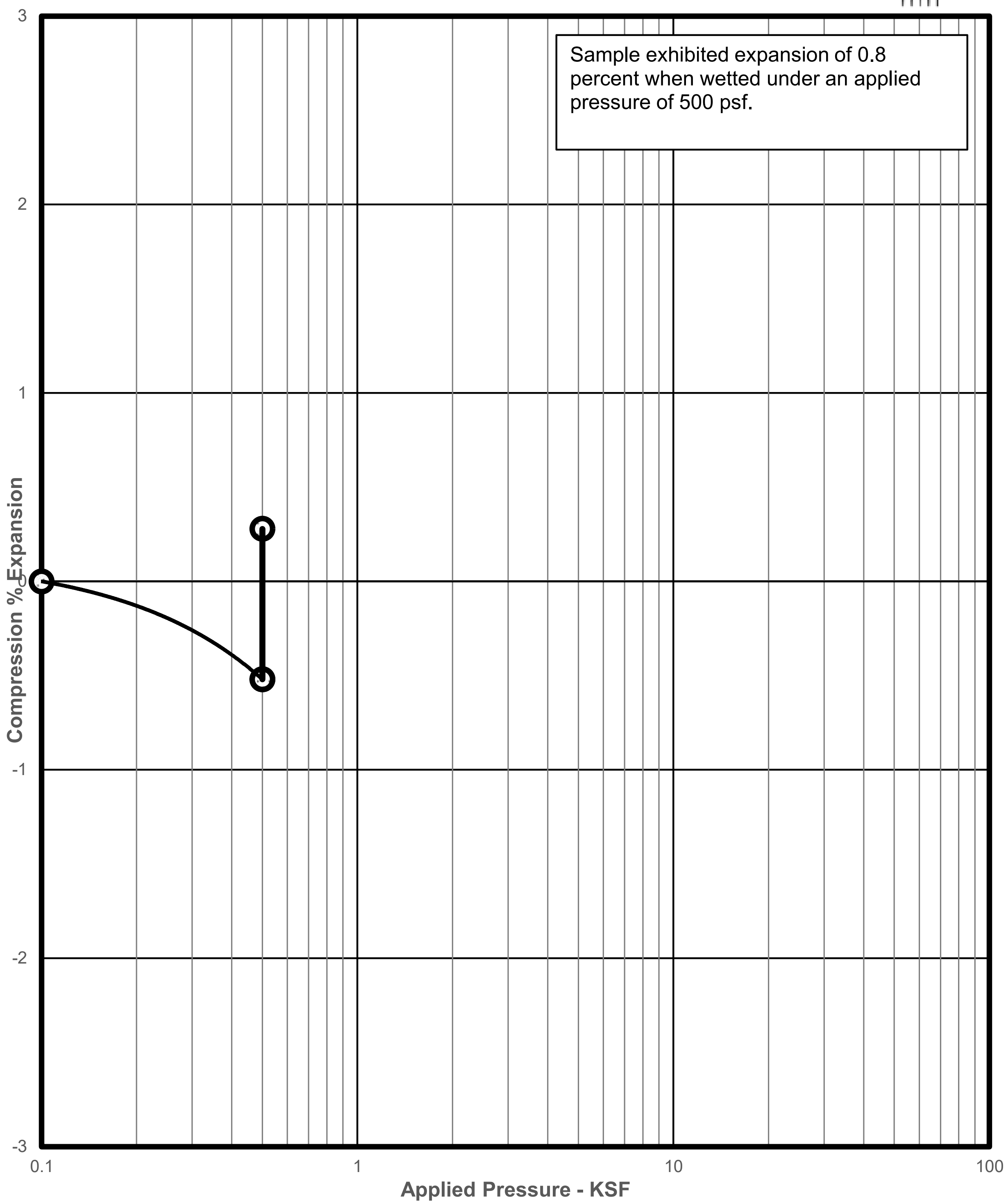
FROM: B-13 AT 14 FEET MOISTURE CONTENT: 34.6 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 39

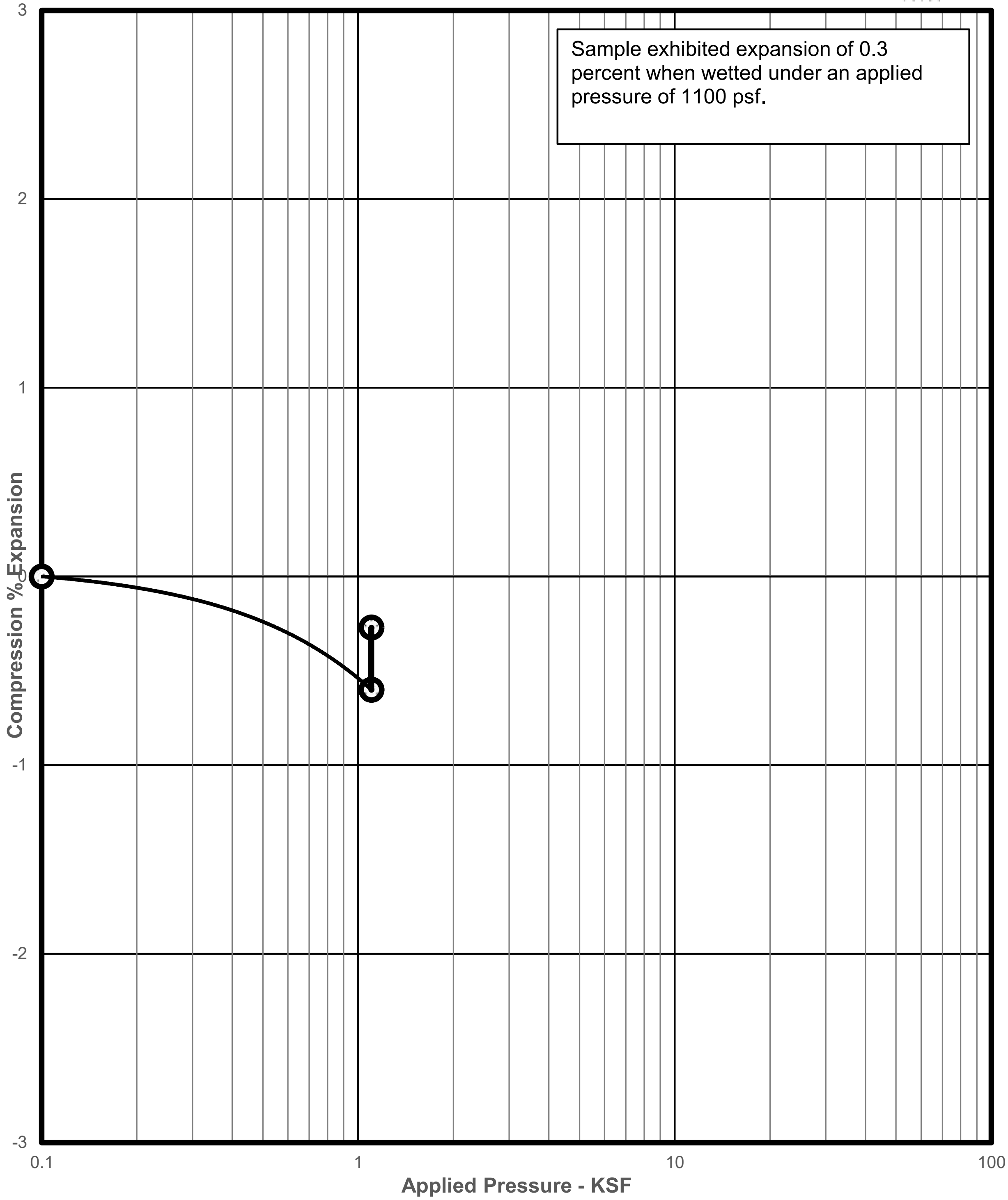


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-14 AT 4 FEET

DRY UNIT WEIGHT: 90 pcf
MOISTURE CONTENT: 31.8 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 40



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 81 pcf

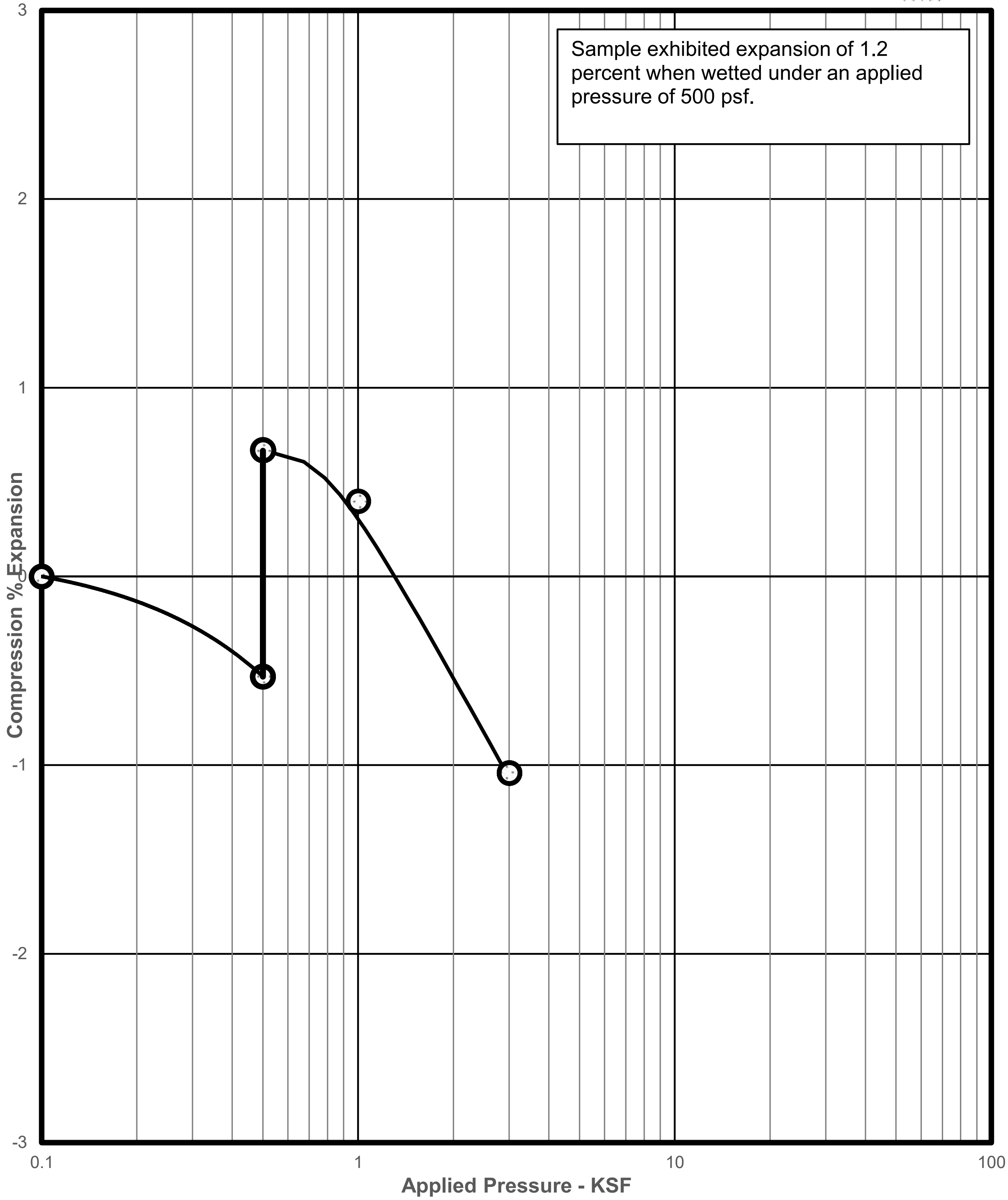
FROM: B-14 AT 14 FEET MOISTURE CONTENT: 35.7 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 41

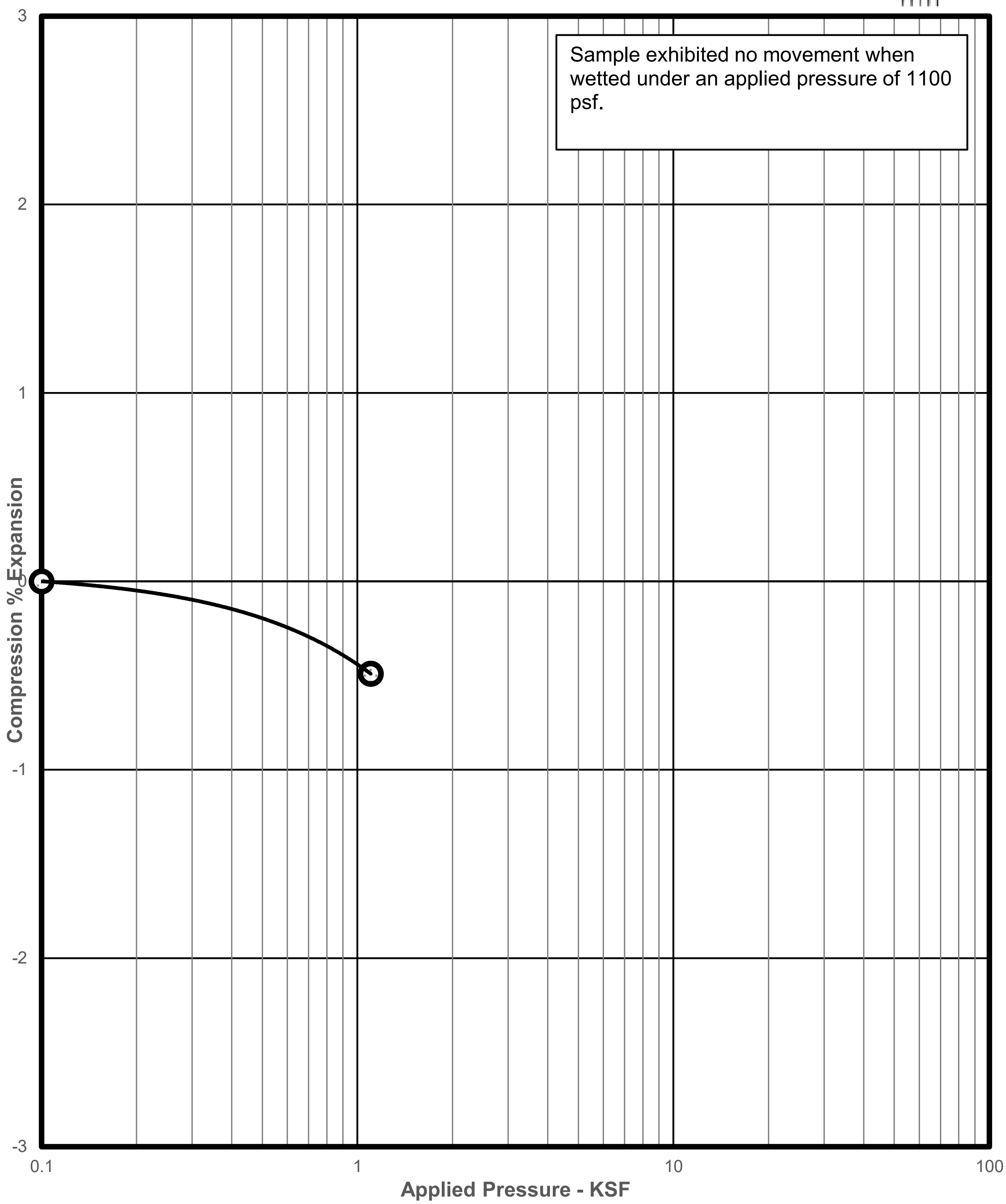


SAMPLE OF SANDSTONE (SC/SM)
FROM: B-15 AT 4 FEET

DRY UNIT WEIGHT: 110 pcf
MOISTURE CONTENT: 21.9 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 42

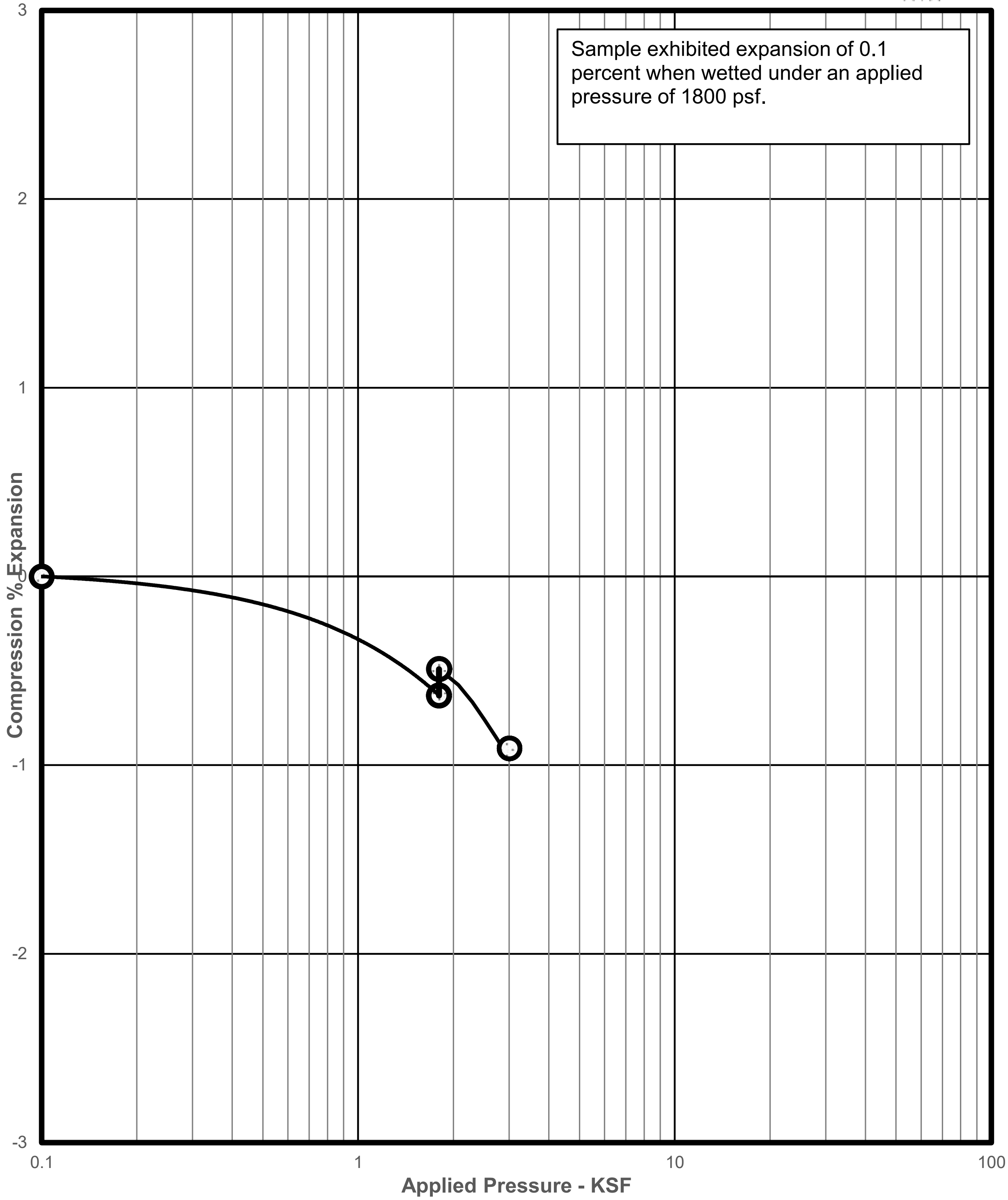


SAMPLE OF SANDSTONE (SC/SM)
FROM: B-15 AT 9 FEET

DRY UNIT WEIGHT: 85 pcf
MOISTURE CONTENT: 28.2 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 43



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 83 pcf

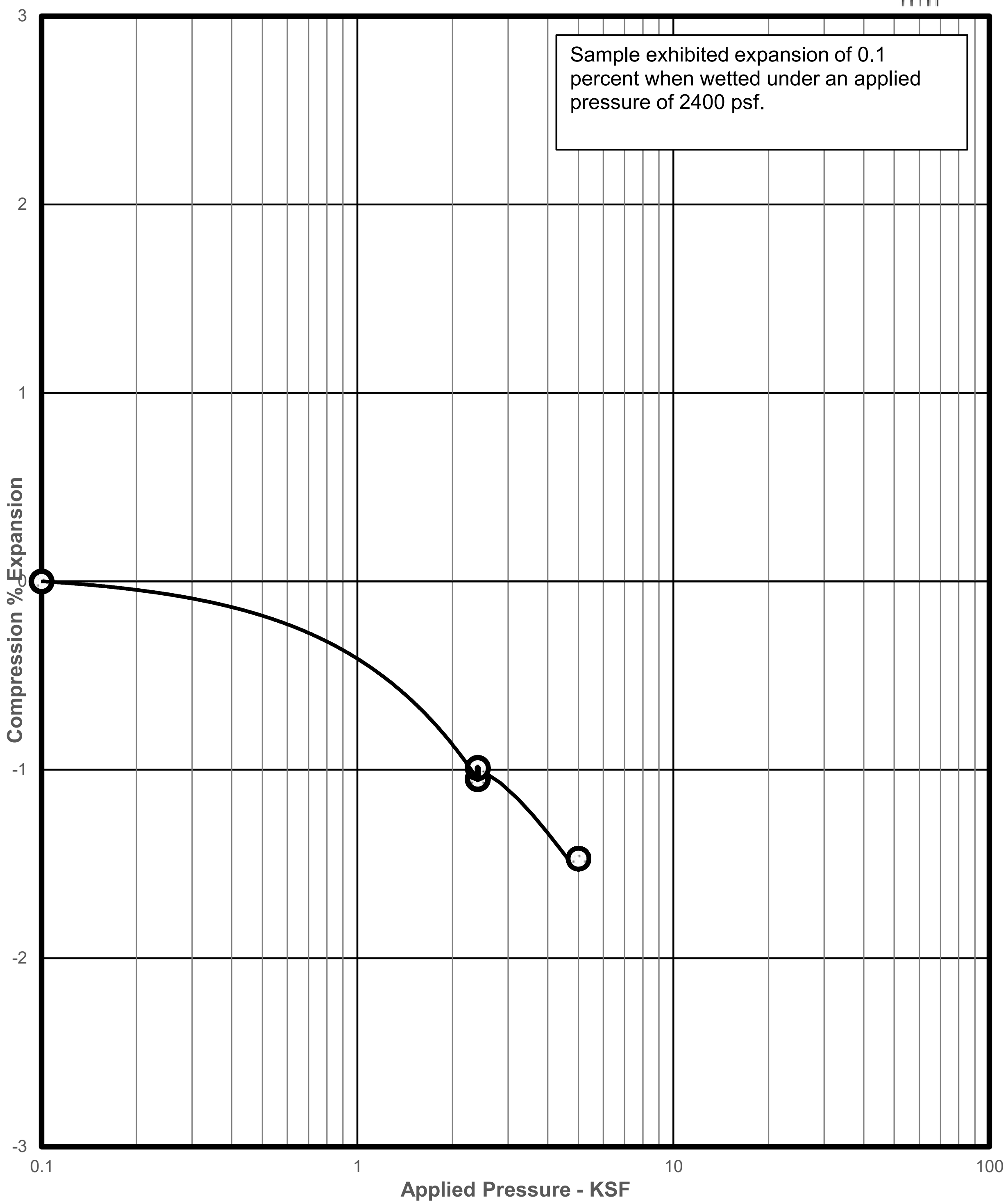
FROM: B-15 AT 14 FEET MOISTURE CONTENT: 34.0 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 44



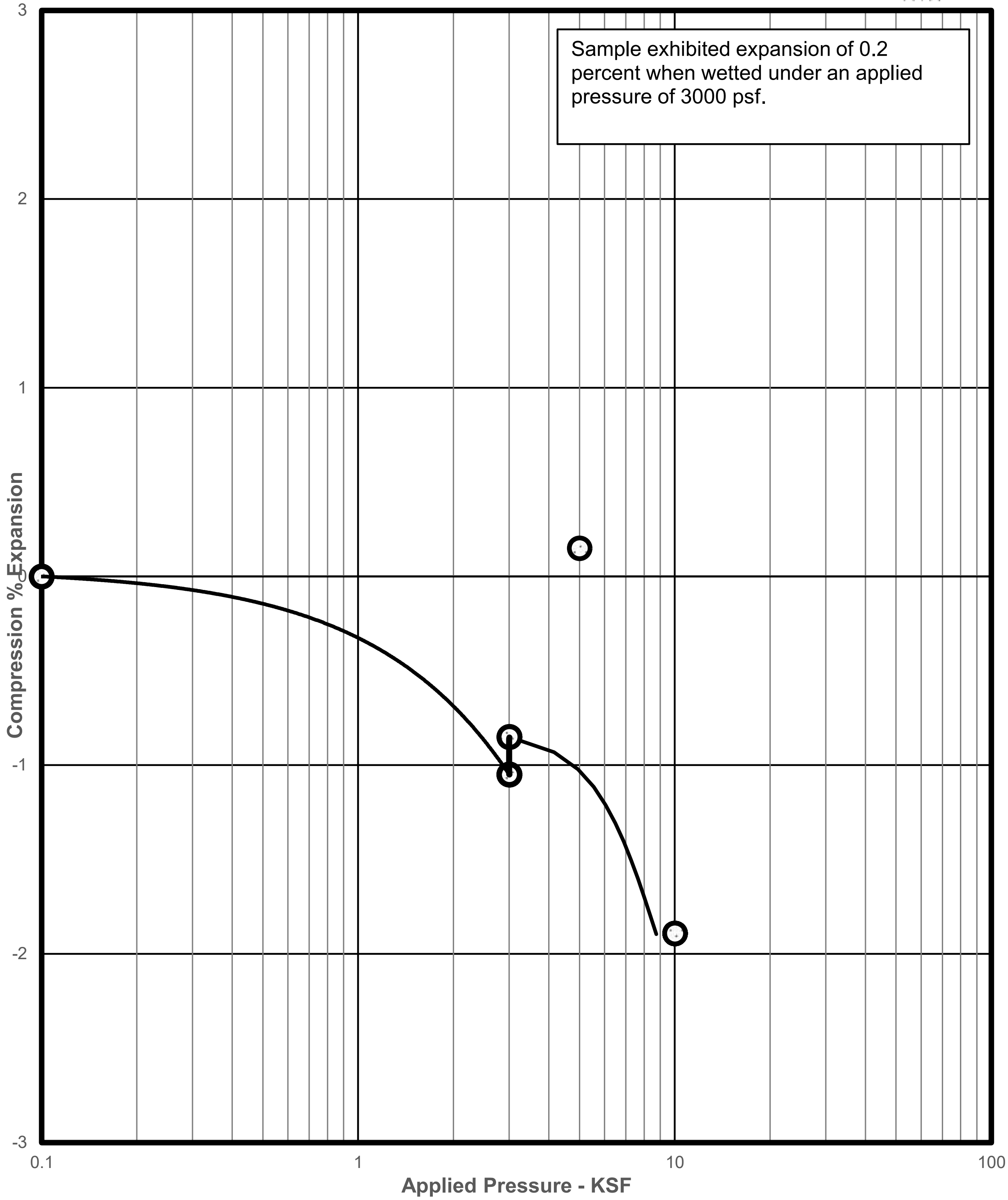
SAMPLE OF	CLAYSTONE (MH/CH)	DRY UNIT WEIGHT:	85	pcf
FROM:	B-15 AT 19 FEET	MOISTURE CONTENT:	32.6	%

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 45

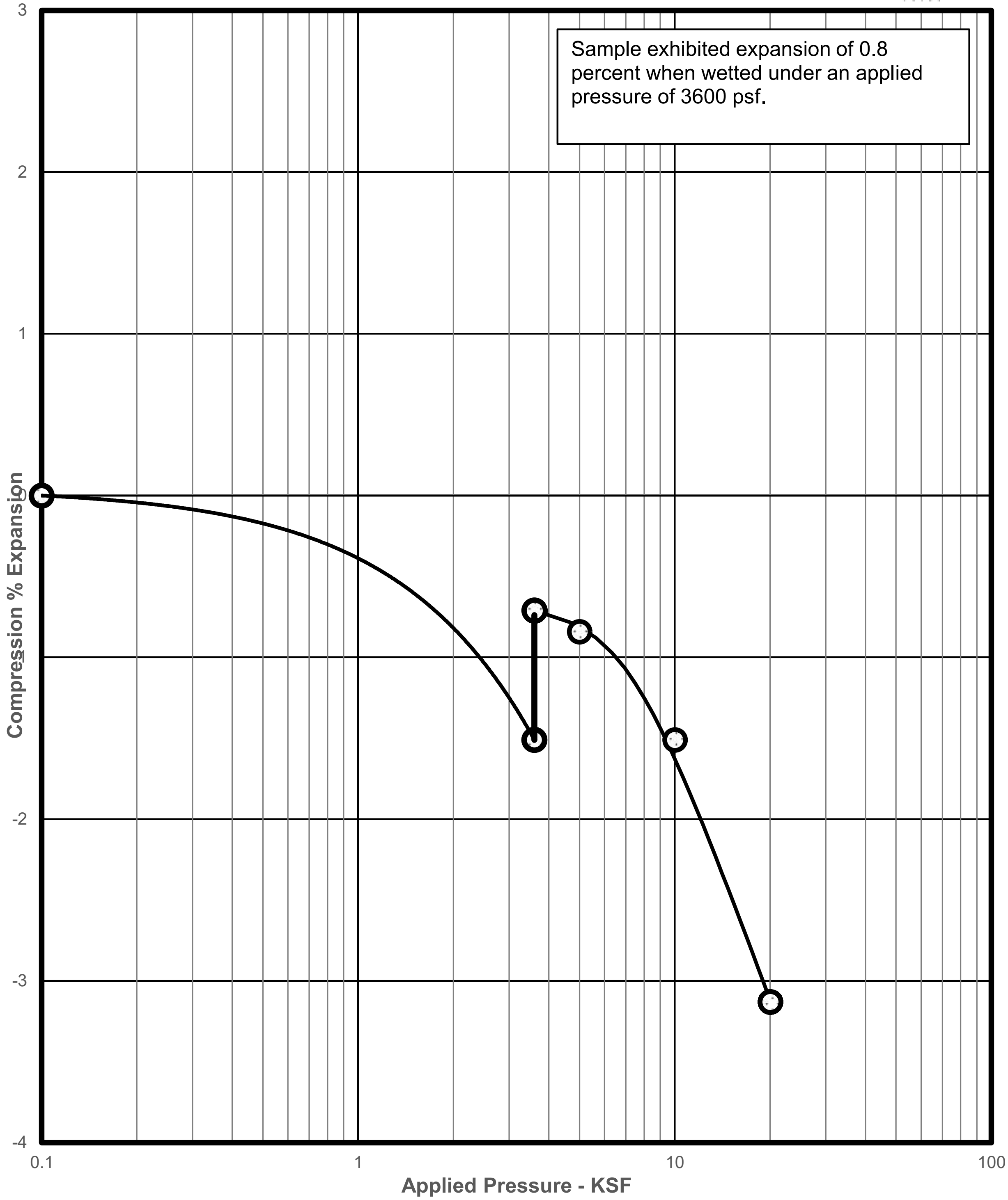


SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-15 AT 24 FEET

DRY UNIT WEIGHT: 88 pcf
MOISTURE CONTENT: 32.5 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 46



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 89 pcf

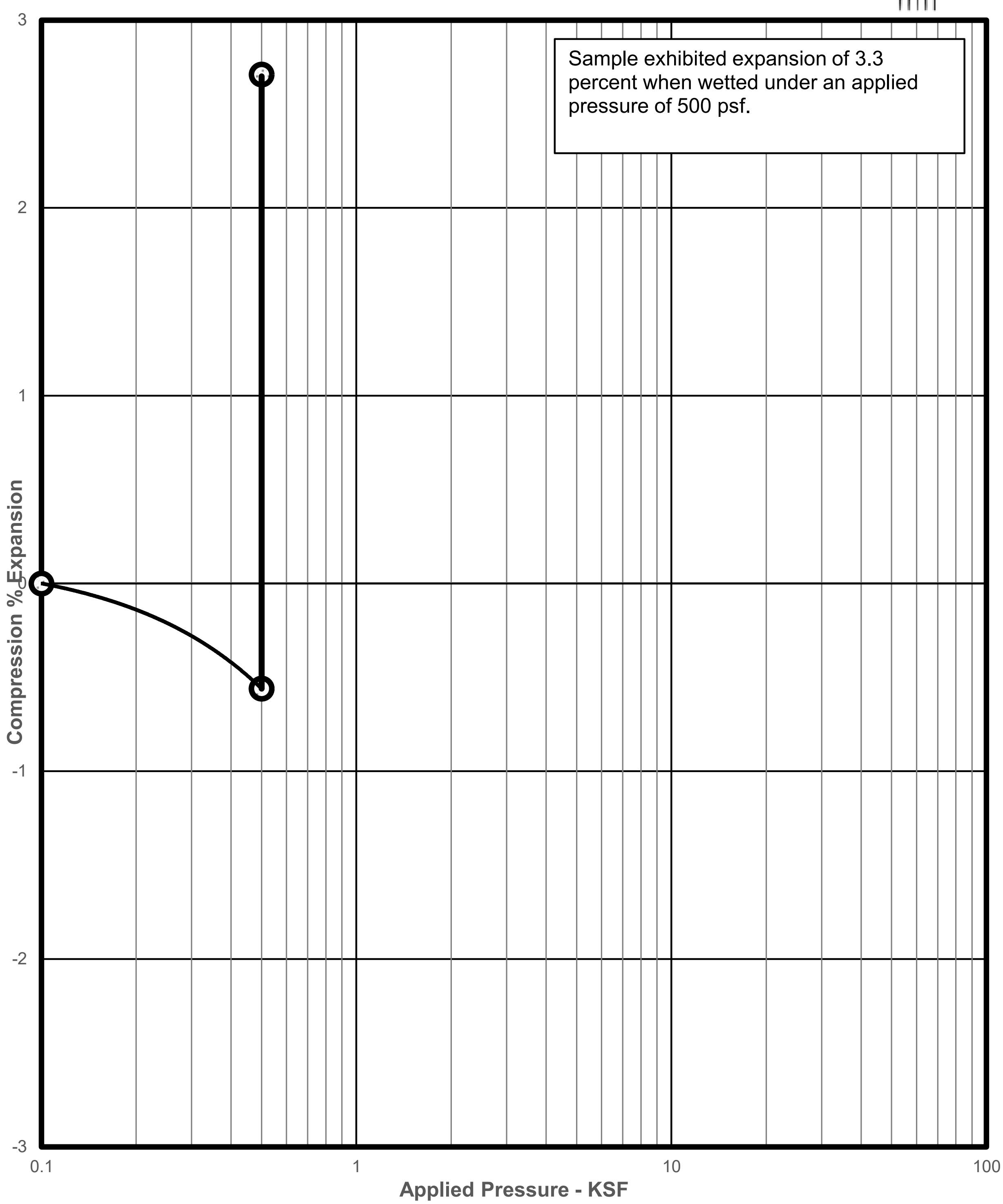
FROM: B-15 AT 29 FEET MOISTURE CONTENT: 27.8 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

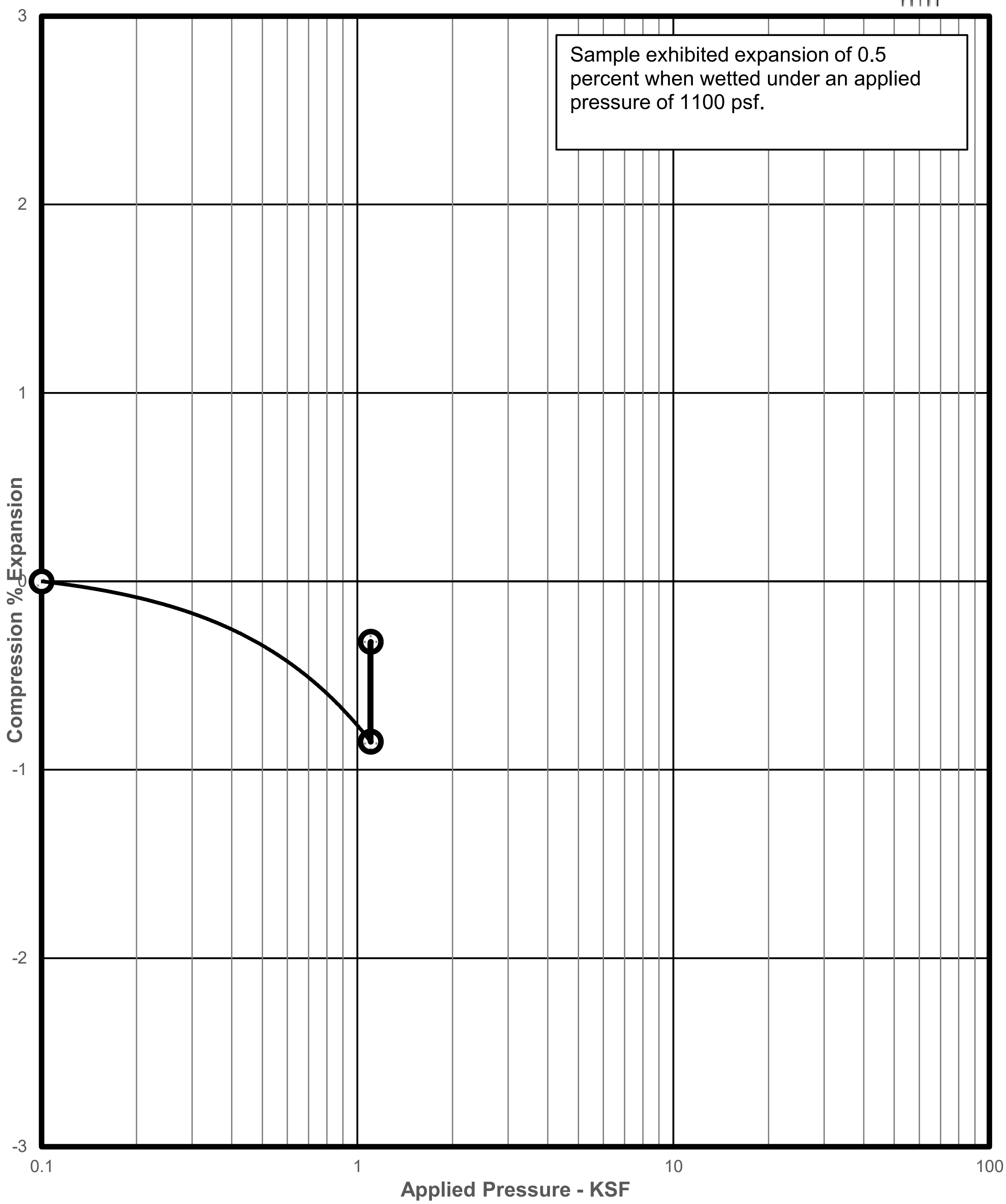
Swell Consolidation Test Results FIG. B- 47



SAMPLE OF CLAYSTONE (MH/CH) DRY UNIT WEIGHT: 86 pcf
FROM: B-16 AT 4 FEET MOISTURE CONTENT: 36.5 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 48



SAMPLE OF CLAYSTONE (MH/CH)

FROM: B-16 AT 9 FEET

DRY UNIT WEIGHT: 91 pcf

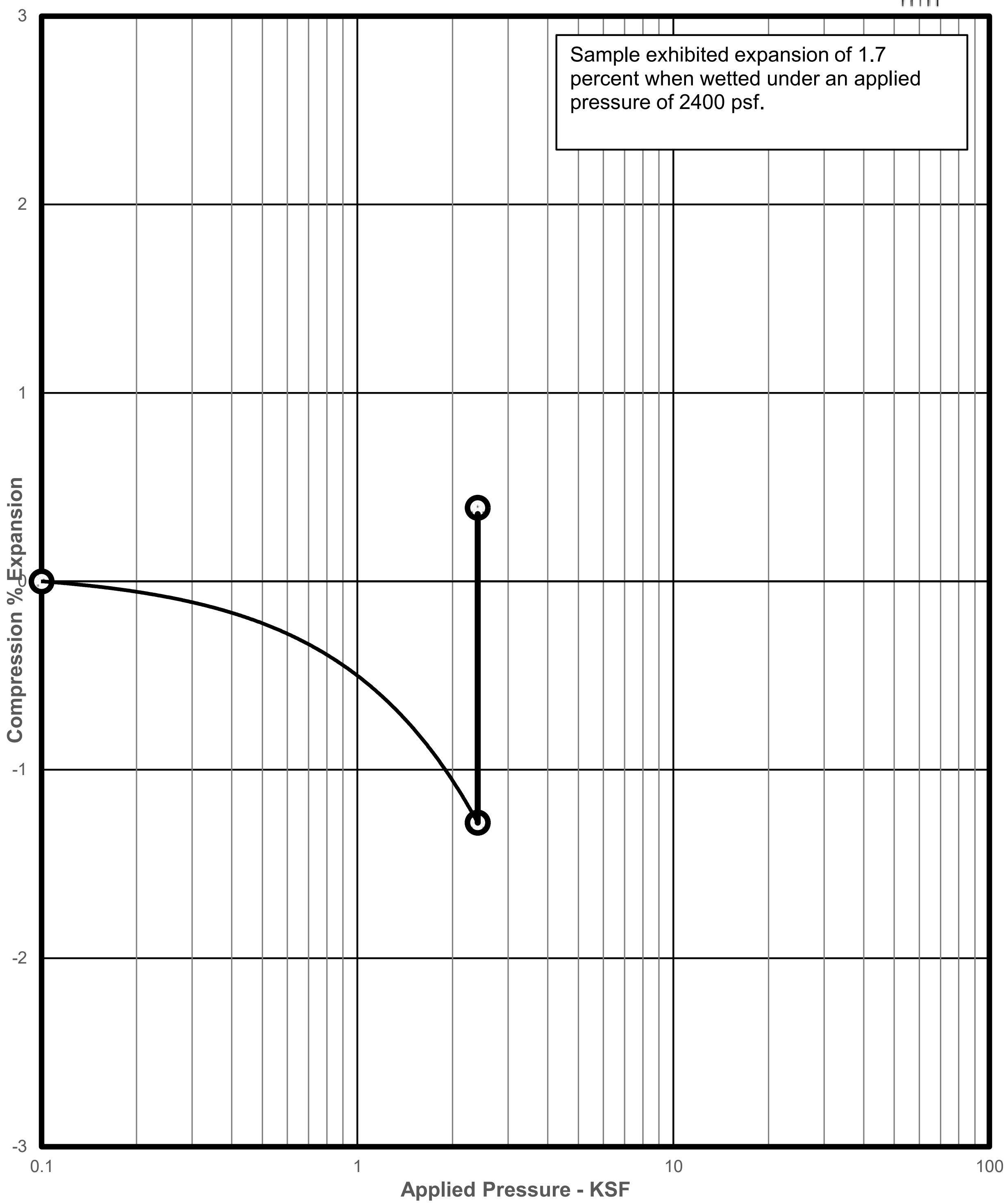
MOISTURE CONTENT: 28.7 %

LOKAL HOMES

LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS

CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 49



SAMPLE OF CLAYSTONE (MH/CH)
FROM: B-16 AT 19 FEET

DRY UNIT WEIGHT: 90 pcf
MOISTURE CONTENT: 32.4 %

LOKAL HOMES
LYRIC AT RIDGEGATE, 20 TOWNHOME AND 19 CONDO BUILDINGS
CTL|T PROJECT NO. DN51,551-115-R1

Swell Consolidation Test Results FIG. B- 50

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH	MOISTURE	DRY	SWELL TEST DATA				SOIL	ATTERBERG LIMITS		SOLUBLE	PASSING	SOIL TYPE
		CONTENT	DENSITY	SWELL	COMPRESSION	APPLIED PRESSURE	SWELL PRESSURE	SUCTION VALUE	LIQUID LIMIT	PLASTICITY INDEX	SULFATE CONTENT	NO. 200 SIEVE	
	(ft)	(%)	(pcf)	(%)	(%)	(psf)	(psf)	(pF)			(%)	(%)	
B-1	4	23.0	92	6.3		500	8,400	4.27					CLAY, SANDY (CL/CH)
B-1	9	28.8	84	0.5		1,100	2,000	4.22					SANDSTONE (SC/SM)
B-1	14	28.9	92	0.6		1,800	4,600	3.84					CLAYSTONE (MH/CH)
B-1	19	27.6	94	1.5		2,400	9,700	4.05					CLAYSTONE (MH/CH)
B-1	24	27.6	95	1.0		3,000	9,100	4.00					CLAYSTONE (MH/CH)
B-1	29	25.6	98	0.9		3,600	9,300	4.12					CLAYSTONE (MH/CH)
B-2	4	27.1	94	0.7		500					0.07		FILL, CLAY, SANDY
B-2	9	9.5	89		1.4	1,100							CLAY, SANDY (CL/CH)
B-2	14	19.9	98	3.3		1,800							CLAY, SANDY (CL/CH)
B-3	4	17.9	107	11.1		500							FILL, CLAY, SANDY
B-3	9	17.0	108	7.3		1,100							CLAY, SANDY (CL/CH)
B-3	19	24.2	100	2.3		2,400							CLAYSTONE (MH/CH)
B-4	4	26.1	95	1.3		500							FILL, CLAY, SANDY
B-4	9	18.4	101						63	38		75	CLAY, SLIGHTLY SANDY (CH)
B-4	14	25.9	92	5.7		1,800							CLAYSTONE (MH/CH)
B-5	4	21.1	104	10.3		500					0.10		CLAY, SANDY (CL/CH)
B-5	9	29.8	95	6.0		1,100							CLAYSTONE (MH/CH)
B-6	4	29.2	89	5.3		500							WEATHERED CLAYSTONE (MH/CH)
B-6	9	31.0	86						70	32		82	CLAYSTONE (MH)
B-6	19	31.3	90	2.1		2,400							CLAYSTONE (MH/CH)
B-7	4	36.0	84	4.7		500							WEATHERED CLAYSTONE (MH/CH)
B-7	9	34.5	84	0.7		1,100							CLAYSTONE (MH/CH)
B-7	19	30.6	87	0.5		2,400							CLAYSTONE (MH/CH)
B-8	4	21.8	98	2.9		500						62	CLAYSTONE (MH/CH)
B-8	9	27.7	93	0.7		1,100							SANDSTONE (SC/SM)
B-9	4	24.8	94	8.5		500	21,900	4.59					CLAYSTONE (MH/CH)
B-9	9	29.5	91	1.7		1,100	8,200	4.24					CLAYSTONE (MH/CH)
B-9	14	37.3	82	0.2		1,800	3,100	3.90					CLAYSTONE (MH/CH)
B-9	19	30.3	90		0.1	2,400		3.85					CLAYSTONE (MH/CH)
B-9	24	35.5	83	0.0		3,000		3.41					CLAYSTONE (MH/CH)
B-9	29	23.4	103									32	SANDSTONE (SC/SM)
B-10	4	21.6	105						56	29	<0.01	49	FILL, SAND, CLAYEY
B-10	9	22.5	100	0.8		1,100							FILL, CLAY, SANDY
B-10	14	17.7	107	9.4		1,800							CLAY, SANDY (CL/CH)
B-11	4	23.9	98	2.1		500							FILL, CLAY, SANDY
B-11	14	28.8	90	0.3		1,800							FILL, CLAY, SANDY
B-11	19	21.3	100	4.4		2,400							CLAY, SANDY (CL/CH)
B-12	4	20.3	103	5.3		500							CLAY, SANDY (CL/CH)
B-12	9	33.2	88	2.1		1,100							CLAYSTONE (MH/CH)
B-12	14	33.2	88	0.5		1,800							CLAYSTONE (MH/CH)
B-13	4	32.0	90	2.1		500							CLAYSTONE (MH/CH)
B-13	9	30.5	89	0.5		1,100							CLAYSTONE (MH/CH)
B-13	14	34.6	86	0.3		1,800							CLAYSTONE (MH/CH)
B-13	19	27.6	93						54	20		64	CLAYSTONE (MH)
B-14	4	31.8	90	0.8		500							CLAYSTONE (MH/CH)
B-14	14	35.7	81	0.3		1,100							CLAYSTONE (MH/CH)
B-15	4	21.9	110	1.2		500	1,900	4.15					SANDSTONE (SC/SM)
B-15	9	28.2	85	0.0		1,100		3.43					SANDSTONE (SC/SM)
B-15	14	34.0	83	0.1		1,800	2,100	3.33					CLAYSTONE (MH/CH)
B-15	19	32.6	85	0.1		2,400	2,800	3.67					CLAYSTONE (MH/CH)

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA: SWELL (%)	SWELL TEST DATA: COMPRESSION (%)	SWELL TEST DATA: APPLIED PRESSURE (psf)	SWELL TEST DATA: SWELL PRESSURE (psf)	SOIL SUCTION VALUE (pF)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
B-15	24	32.5	88	0.2		3,000	5,500	3.88					CLAYSTONE (MH/CH)
B-15	29	27.8	89	0.8		3,600	9,100	4.61					CLAYSTONE (MH/CH)
B-16	4	36.5	86	3.3		500							CLAYSTONE (MH/CH)
B-16	9	28.7	91	0.5		1,100							CLAYSTONE (MH/CH)
B-16	19	32.4	90	1.7		2,400							CLAYSTONE (MH/CH)

APPENDIX C

GUIDELINE SITE GRADING SPECIFICATIONS

Canyons South, Phase 2, Filing 2
Douglas County, Colorado

GUIDELINE SITE GRADING SPECIFICATIONS
Canyons South, Phase 2, Filing 2
Douglas County, Colorado

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of excess cut materials that may be placed outside of the subdivision and/or filing boundaries.

2. GENERAL

The Soils Representative shall be the Owner's representative. The Soils Representative shall approve fill materials, method of placement, moisture contents and percent compaction, and shall give written approval of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all vegetation, trees, brush and rubbish before excavation or fill placement begins. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures of any kind.

4. SCARIFYING AREA TO BE FILLED

Topsoil and vegetable matter shall be substantially removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified to a depth of 8 inches, moisture treated to above optimum moisture content, and compacted until the surface is free from ruts, hummocks or other uneven features, which would prevent uniform compaction by the equipment to be used.

5. DIFFERENTIAL FILL DEPTHS BENEATH PROPOSED FOUNDATIONS

Depth of fill below a building footprint shall not differ more than 5 feet below bottom of foundations. Where walkout basements are planned, the difference should be determined by comparing the bottom of the frost wall footings to the upper-level footings. If fill depths are to vary greater than 5 feet below proposed foundations two methods can be used to lower the risk of differential settlement:

- Bearing the foundations below fill on non-expansive soils and bedrock;
- Sub-excavating the existing ground surface to the lowest existing ground surface beneath the proposed residence footprint.

6. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods to a depth of 8 to 12 inches, brought to the proper moisture content (between optimum and 3 percent above optimum for clay and within 2 percent of optimum for sand) and compacted to not less than 95 percent of maximum density as determined in accordance with ASTM D 698. The foundation materials shall be worked, stabilized, or removed and replaced if necessary in accordance with the soils representative's recommendations in preparation for fill.

7. FILL MATERIALS

Fill soils shall be substantially free from vegetable matter or other deleterious substances, and shall not contain rocks having a diameter greater than six (6) inches and claystone pieces larger than three (3) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.

On-site materials classifying as CL, CH, SC, SM, SW, SP, GP, GC and GM are acceptable. Concrete, asphalt, organic matter and other deleterious materials or debris shall not be used as fill.

8. MOISTURE CONTENT

For fill material classifying as CH, CL or SC, the fill shall be moisture treated to between 1 percent and 4 percent above optimum moisture content. Soils classifying as SM, SW, SP, GP, GC and GM shall be moisture treated to within 2 percent of optimum moisture content as determined from Proctor compaction tests. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Representative, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor may be required to rake or disc the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Representative, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

9. COMPACTION OF FILL AREAS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill shall be compacted to at least 95 percent of the maximum density as determined in accordance with ASTM D 698. If fill is placed at depths greater than 20 feet below proposed grade, fill shall be compacted to at least 100 percent of the maximum density as determined in accordance with ASTM D 698. At the option of the Soils Representative, soils classifying as SW, GP, GC, or GM may be compacted to 95 percent of maximum density as determined in accordance with ASTM D 1557 or 70 percent relative density for cohesionless sand soils. Fill materials shall be placed such that the thickness of loose materials does not exceed 8 inches and the compacted lift thickness does not exceed 6 inches.

Compaction as specified above shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved for soils classifying as CL, CH, or SC. Granular fill shall be compacted using vibratory equipment or other approved equipment. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient passes to ensure that the required density is obtained.

10. COMPACTION OF SLOPES

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is not an appreciable amount of loose soils on the slopes. Compaction of slopes may be done progressively in increments of three to five feet (3' to 5') in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

11. PLACEMENT OF FILL ON NATURAL SLOPES

Where natural slopes are steeper than 20 percent in grade and the placement of fill is required, cut benches shall be provided at the rate of one bench for each 5 feet in height (minimum of two benches). Benches shall be at least 10 feet in width. Larger bench widths may be required by the Engineer. Fill shall be placed on completed benches as outlined within this specification.

12. DENSITY TESTS

Field density tests shall be made by the Soils Representative at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate that the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

13. SEASONAL LIMITS

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Representative indicates that the moisture content and density of previously placed materials are as specified.

14. NOTICE REGARDING START OF GRADING

The Contractor shall submit notification to the Soils Representative and Owner advising them of the start of grading operations at least three (3) days in advance of the starting date. Notification shall also be submitted at least 3 days in advance of any resumption dates when grading operations have been stopped for any reason other than adverse weather conditions.

15. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Representative, as specified under "Density Tests" above, shall be submitted progressively to the Owner. Dry density, moisture content, and percentage compaction shall be reported for each test taken.

16. DECLARATION REGARDING COMPLETED FILL

The Soils Engineer shall provide a written declaration stating that the site was filled with acceptable materials, and was placed in general accordance with the specification.

APPENDIX D

GUIDELINE SUB-EXCAVATION SPECIFICATIONS

Canyons South, Phase 2, Filing 2
Douglas County, Colorado

GUIDELINE SUB-EXCAVATION SPECIFICATIONS
Canyons South, Phase 2, Filing 2
Douglas County, Colorado

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of materials that may be placed outside of the development boundaries.

2. GENERAL

The Soils Engineer shall be the Owner's representative. The Soils Engineer shall observe fill materials, method of placement, moisture content and percent compaction, and shall provide written opinions of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all vegetation and debris before excavation or fill placement is begun. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill where the material will support structures of any kind.

4. SCARIFYING AREA TO BE FILLED

All topsoil and vegetable matter shall be removed from the ground surface where fill is to be placed. The surface shall then be plowed or scarified until the surface is free from ruts, hummocks or other uneven features that would prevent uniform compaction.

5. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, brought to the proper moisture content, (1 percent to 4 percent above optimum) and compacted to not less than 95 percent of maximum density as determined in accordance with ASTM D 698.

6. FILL MATERIALS

Fill soils shall be free from vegetable matter or other deleterious substances, and shall not contain clay and claystone having a diameter greater than three (3) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.

On-site materials classifying as CL, CH, SC, SM, SP, GP, GC and GM are acceptable. Concrete, asphalt, and other deleterious materials or debris shall not be used as fill.

7. MOISTURE CONTENT

Fill materials shall be moisture-conditioned to within limits of optimum moisture content specified in "Moisture Content and Density Criteria". Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Engineer, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor will be required to rake or disc the fill to provide uniform moisture content throughout the fill.

The application of water to embankment materials shall be made with any type of watering equipment that will give the desire results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

8. COMPACTION OF FILL MATERIALS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density given in “Moisture Content and Density Criteria”. Fill materials shall be placed such that the thickness of loose material does not exceed 8 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of suitable equipment. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient trips to ensure that the required density is obtained.

9. MOISTURE CONTENT AND DENSITY CRITERIA

Fill material shall be substantially compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698, AASHTO T 99) dry density at 1 percent to 4 percent above optimum moisture content. Additional criteria for acceptance are presented in DENSITY TESTS.

10. DENSITY TESTS

Field density tests shall be made by the Soils Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof not within specifications, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

Allowable ranges of moisture content and density given in MOISTURE CONTENT AND DENSITY CRITERIA are based on design considerations. The moisture shall be controlled by the Contractor so that moisture content of the compacted earth fill, as determined by tests performed by the Soils Engineer, shall be within the limits given. The

Soils Engineer will inform the Contractor when the placement moisture is less than or exceeds the limits specified and the Contractor shall immediately make adjustments in procedures as necessary to maintain placement moisture content within the specified limits, to satisfy the following requirements.

A. Moisture

1. The average moisture content of material tested each day shall not be less than 1.5 percent over optimum moisture content.

2. Material represented by samples tested having moisture lower than 1 percent over optimum will be rejected. Such rejected materials shall be reworked until moisture equal to or greater than 1 percent above optimum is achieved.

B. Density

1. The average dry density of material tested each day shall not be less than 95 percent of standard Proctor maximum dry density (ASTM D 698).

2. No more than 10 percent of the material represented by the samples tested shall be at dry densities less than 95 percent of standard Proctor maximum dry density (ASTM D 698).

3. Material represented by samples tested having dry density less than 93 percent of standard Proctor maximum dry density (ASTM D 698) will be rejected. Such rejected materials shall be reworked until a dry density equal to or greater than 95 percent of standard Proctor maximum dry density (ASTM D 698) is obtained.

11. OBSERVATION AND TESTING OF FILL

Observation by the Soils Engineer shall be sufficient during the placement of fill and compaction operations so that they can declare the fill was placed in general conformance with specifications. All observations necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

12. SEASONAL LIMITS

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Engineer indicates the moisture content and density of previously placed materials are as specified.

13. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Engineer, as specified under “Density Tests” above, shall be submitted progressively to the Owner. Dry density, moisture content and percentage compaction shall be reported for each test taken.