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PRELIMINARY GEOTECHNICAL STUDY
JHY PARCEL
16186 U.S. HIGHWAY 6
EAGLE COUNTY, COLORADO

JOB NO. 115 296A

SEPTEMBER 30, 2015

PREPARED FOR:

FROST CREEK
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TABLE OF CONTENTS

PURPOSE AND SCOPE OF STUDY ..... - 1 -

PROPOSED DEVELOPMENT ..... - 1 -

SITE CONDITIONS ..... - 2 -

GEOLOGIC CONDITIONS ..... - 2 -

FIELD EXPLORATION ..... - 4 -

SUBSURFACE CONDITIONS ..... - 4 -

PRELIMINARY DESIGN RECOMMENDATIONS ..... - 5 -
- FOUNDATIONS ..... - 5 -
- FLOOR SLABS ..... - 6 -
- UNDERDRAIN SYSTEM ..... - 6 -
- SITE GRADING ..... - 7 -
- SURFACE DRAINAGE ..... - 8 -
- PAVEMENT SECTIONS ..... - 8 -

LIMITATIONS ..... - 9 -

FIGURE 1 - LOCATION OF EXPLORATORY BORINGS

FIGURE 2 and 3 - LOGS OF EXPLORATORY BORINGS

FIGURE 4 - LEGEND AND NOTES

FIGURE 5 through 8 - SWELL-CONSOLIDATION TEST RESULTS

FIGURE 9 - GRADATION TEST RESULTS

TABLE 1- SUMMARY OF LABORATORY TEST RESULTS

PURPOSE AND SCOPE OF STUDY

This report presents the results of a preliminary geotechnical study of the JHY Parcel (aka Montgomery Tract) located at 16186 U.S. Highway 6, west of Eagle, Eagle County, Colorado. The project site is shown on Figure 1. The purpose of the study was to evaluate the general geologic and subsurface conditions with respect to the proposed construction and their potential impacts on the project. The study was conducted in accordance with our proposal for to Frost Creek, dated June 23, 2015.

A field exploration program consisting of a cursory field reconnaissance and exploratory borings was conducted to obtain the information on site and subsurface conditions. Samples of the subsoils obtained during the field exploration were tested in the laboratory to determine their classification, compressibility or swell and other engineering characteristics. The results of the field exploration and laboratory testing were analyzed to develop recommendations considered suitable for project planning of the project and preliminary site grading, pavement section and foundation design. This report summarizes the data obtained and presents our conclusions and preliminary recommendations. The report includes a discussion of the general geologic conditions and major geologic hazards that could impact the site development.

PROPOSED DEVELOPMENT

The proposed development of the site is undetermined at this time but will probably consist of residential and/or commercial type subdivision. We understand the findings of our study will be considered in the purchase of the property.

We understand the site will probably be developed as mixed use including single family and multi-family residential as well as commercial buildings. We assume the buildings will be typical of the area and be one to three stories in height, some with basement levels. There will be access roadway(s) and subdivision streets. The development will be set back some for the hilly terrain to the south and west and considerable grading is

expected due to the terrain. The property is planned to be annexed into the Town of Eagle and be serviced by municipal water and sewer.

When preliminary development and grading plans have been determined, we should review the plans and perform additional analyses as needed.

SITE CONDITIONS

The property is vacant and consists of about 30 acres located in part of Tract 50, Section 6, Township 5, Range 84 and Tract 49, Section 5, Township 5, Range 84. The site is south of Highway 6 and west of Sylvan Lake Road, just west of the Town of Eagle, as shown on Figure 1. The terrain is primarily strongly sloping down to the north/northeast transitioning from steep hillsides along the south and west sides of the property to the flatter terrain. Hockett Gulch, a relatively large drainage basin, bisects the hilly terrain and outlets onto the site from the west, see Figure 1.

The ground surface appears mostly natural and is vegetated grass, weeds and moderately thick sage brush. There are several two track trails and a utility easement through the property. The elevation across the site is about 100 feet ranging from about 6,550 to 6,650 feet elevation. Slope grades across the site range from 4 to 8% in the lower and middle part of the site, and about 10 to 20% in the middle and upper part of the site. The steep hillside terrain that encroaches the southern and western portions of the property has grades on the order of 30 to 50%. The Hockett Gulch drainage is ephemeral and has a slightly defined and shallow broad channel through the site. The drainage was dry at the time of our field exploration.

GEOLOGIC CONDITIONS

The near surface soils are site are primarily alluvial fan and colluvium deposits underlain by dense coarse granular alluvium with depth. The alluvial fan deposits are from the outlet of Hockett Gulch from the west. The colluvium is from erosion of the hillsides to

the west and south. The underlying coarse granular soils are older alluvium deposits from the Eagle River and/or Brush Creek. The underlying bedrock is the Eagle Valley Evaporite and is exposed on the nearby hillsides.

Potential geologic hazards that could impact the site include debris flow and flooding from Hockett Gulch, hydro-compressive alluvial fan and colluvial deposit soils, and the potential for sinkhole development from possible voids in the underlying evaporite bedrock. The debris flow/flooding is from infrequent intense thunderstorms and/or snowmelt run-off. There could also be smaller debris flow/floods from the hillside terrain along the south and west sides of the site. The potential for flooding should be further evaluated by the civil engineer and may require additional study by us. The potential for hydro-compressive soils and mitigation is discussed in the "Preliminary Geotechnical Recommendations" section of this report. The sinkhole potential is discussed below.

Bedrock of the Pennsylvanian age Eagle Valley Evaporite underlies the site and nearby areas. These rocks are a sequence of gypsiferous shale, fine-grained sandstone and siltstone with some massive beds of gypsum and limestone. There is a possibility that massive gypsum deposits associated with the Eagle Valley Evaporite underlie portions of the lot. Dissolution of the gypsum under certain conditions can cause sinkholes to develop and can produce areas of localized subsidence. During previous work in the area, several sinkholes were observed scattered throughout the Eagle River and Brush Creek valley areas.

Sinkholes were not observed at the subject site. No evidence of cavities was encountered in the subsurface materials; however, the exploratory borings were relatively shallow, for preliminary design and general site evaluation only. Based on our present knowledge of the subsurface conditions at the site, it cannot be said for certain that sinkholes will not develop. The risk of future ground subsidence within the proposed development, in our opinion, is low and similar to other nearby developed areas. If further investigation of possible cavities in the bedrock below the site is desired, we should be contacted.

FIELD EXPLORATION

The field exploration for the project was conducted on July 21 and 22, 2015. Eight exploratory borings were drilled at the locations shown on Figure 1 1 to evaluate the general subsurface conditions. The borings were advanced with 4 inch diameter continuous flight auger powered by a truck-mounted CME-45B drill rig. The borings were logged by a representative of Hepworth-Pawlak Geotechnical, Inc.

Samples of the subsoils were taken with 1⅜ inch and 2 inch I.D. spoon samplers. The samplers were driven into the subsoils at various depths with blows from a 140 pound hammer falling 30 inches. This test is similar to the standard penetration test described by ASTM Method D-1586. The penetration resistance values are an indication of the relative density or consistency of the subsoils. Depths at which the samples were taken and the penetration resistance values are shown on the Logs of Exploratory Borings, Figures 2 and 3. The samples were returned to our laboratory for review by the project engineer and testing.

SUBSURFACE CONDITIONS

Graphic logs of the subsurface conditions encountered at the site are shown on Figure 2. The subsoils encountered, below about ½ foot of topsoil, consisted typically of from about 6 to 30 feet of stiff to very stiff, slightly sandy to sandy silt and clay to sandy silty clay overlying relatively dense, silty sandy gravel and cobbles with small boulders. At Boring 8, located in the northeast part of the site, medium dense silty sand was encountered below about ½ foot of topsoil and underlain at 3 feet by the relatively dense, silty sandy gravel and cobbles. Drilling in the dense coarse granular soils with auger equipment was difficult due to the cobbles and boulders and drilling refusal was encountered in the deposit in several of the borings after shallow penetration.

Laboratory testing performed on samples obtained from the borings included natural moisture content and density, gradation analyses, and Atterberg limits. Results of swell-

consolidation testing performed on relatively undisturbed drive samples of the silt and clay soils, presented on Figures 5 through 8, indicate moderate compressibility under conditions of loading with generally a low hydro-compression (settlement under a constant light surcharge when wetted) potential. Several samples showed a minor swell expansion potential when wetted. Results of a gradation analyses performed on a small diameter drive sample (minus 1½ inch fraction) of the natural coarse granular soils are shown on Figure 9. The laboratory testing is summarized in Table I.

No free water was encountered in the borings at the time of drilling and the subsoils were slightly moist.

PRELIMINARY DESIGN RECOMMENDATIONS

The site appears feasible for the assumed proposed development as generally planned. Several aspects of the project will require special consideration. These aspects includes geologic conditions, site grading and moisture sensitive soils.

The conclusions and recommendations presented below are based on the assumed development, subsurface conditions encountered in the exploratory borings, and our experience in the area. The recommendations are considered suitable for planning and preliminary design. We should review the preliminary development and grading plans and perform additional analyses as needed. We recommend site specific subsoil studies be conducted for individual subdivision, lot and/or building development.

FOUNDATIONS

Foundation bearing conditions will vary depending on the specific location of the buildings on the property. The soils at the site typically tend to settle when wetted. Expansion potential of the soils is considered minimal and can probably be neglected in the foundation design.

Based on the nature of the proposed construction spread footings should be suitable for most lightly loaded building such as for typical residential and smaller commercial

building. We expect the footings can be sized for an allowable bearing pressure in the range of 1,200 psf to 2,500 psf. Providing a depth of structural fill below the spread footings (typically 3 to 4 feet) may be needed to reduce the settlement (or heave) potential of the natural soils. Heavily reinforced mat foundations may also be feasible. Extending the foundation down to bear on the underlying dense coarse granular soils may be needed for more heavily loaded or more movement sensitive structures. Possible methods of deep foundations to bear on the underlying coarse granular soils include screw piles, helical piers or driven piles. Drilled piers end-bearing in the dense coarse granular soils should also be a feasible deep foundation system.

Foundation walls should be designed to span local anomalies and to resist lateral earth loadings when acting as retaining structures. Heavily reinforced foundation walls may be needed to better withstand the effects of some differential settlement. Below grade areas and retaining walls should be protected from wetting and hydrostatic loading by use of an underdrain system. The footings should have a minimum depth of 48 inches for frost protection.

FLOOR SLABS

Slab-on-grade construction should be feasible for bearing on the natural soils. There could be some post construction slab movement at sites with collapsible or expansive subgrade soils if the subgrade becomes wetted. Providing several feet of structural fill below the slabs may be needed to mitigate the settlement or heave potential. To reduce the effects of some differential movement, floor slabs should be separated from all bearing walls and columns with expansion joints. Floor slab control joints should be used to reduce damage due to shrinkage cracking to non-structural floor slabs. A minimum 4 inch thick layer of free-draining gravel should underlie basement level slabs to facilitate drainage.

UNDERDRAIN SYSTEM

Although free water was not encountered in the exploratory borings, it has been our experience in the area and where clayey soils are present that local perched groundwater

can develop during times of heavy precipitation, seasonal runoff, or frozen ground conditions. A perimeter/underdrain system be provided to protect below-grade construction, such as retaining walls, crawlspace and basement areas from wetting and hydrostatic pressure buildup. Perimeter foundation drains around shallow crawlspace areas (less than 4 feet deep) may not be not be needed with adequate compaction of foundation wall backfill and positive surface slope away from foundation walls. Impermeable PVC liners are typically recommended below perimeter foundation drains in hydro-compressive soil areas to reduce the potential for wetting of the bearing soils.

SITE GRADING

All fill for site grading should be properly placed and compacted to reduce settlement and distress to facilities constructed on the fill. It should be feasible to use the on-site soils for roadway/street and embankment fill as well as for limited overlot grading. Roadway and embankment fills should be compacted to at least 95% of the maximum standard Proctor density (SPD) at a moisture content within about 2% of optimum. We expect long term settlements of the on-site fill soils compacted to 95% SPD near optimum moisture content will be about 1 to possibly 1½% of the fill depth. To reduce settlements of deeper fills (greater than about 8 to 10 feet) we recommend the fill be compacted to at least 98% SPD. All overlot fill should be compacted to at least 98% SPD. Prior to fill placement, the subgrade should be carefully prepared by removing all vegetation and topsoil, the subgrade scarified to a depth of about 8 inches, moisture content adjusted to near optimum and then compacted to 95% SPD. The fill should be benched horizontally into the portions of the hillside areas exceeding 20% grade. Miscellaneous fill can be compacted to 90% SPD. The on-site soils excluding oversized rock and topsoil should be suitable for use in embankment fills or suitable granular import material, approved by the geotechnical, engineer can be used.

The risk of construction-induced slope instability at the site appears low provided the buildings are located in the northern and eastern portions of the property away from the steep hillside terrain and cut and fill depths are limited. Cut depths adjacent the steeper

hillside terrain should be limited to about 8 to10 feet. Permanent unretained cut and fill slopes should be graded at 2 horizontal to 1 vertical or flatter and protected against erosion by revegetation, rock riprap or other means. We should review site grading plans for the project prior to construction and perform additional analyses as needed.

SURFACE DRAINAGE

The grading plans for the subdivision should consider runoff through the project especially from the relatively large drainage to the west and from the adjacent steep uphill slopes. Positive surface drainage away from buildings and foundations at the individual building sites should also be provided. To limit infiltration into the bearing soils next to buildings, exterior backfill should be well compacted and have a positive slope away from the building for a distance of at least 10 feet. Water should not be allowed to pond which could impact slope stability such as adjacent embankment fills, and foundation and pavement areas.

PAVEMENT SECTIONS

Roadway alignment and traffic loadings for the development are unknown at this time. We assume most of the streets/roadways will be asphalt paved. The near surface soils at the site consist of fine grained slightly sandy to sandy silt and clay, to sandy silty clay with AASHTO classifications of A-4 with Group Indices of 5 and 6 on the samples tested. These soils are considered a relatively poor support for pavement sections and at least moderately susceptible to frost heave. We estimate a Hveem stabilometer 'R' value of about 7 or 8 for these soils. A granular import sub-base material such as CDOT Class 2 aggregate base course or other similar material below the pavement sections would increase the subgrade support and reduce the frost heave potential.

Based on our experience in the area with assumed similar developments, we expect pavement sections for the access/main roads with the fine grained soils as subgrade, will be about 4 to 5 inches of asphalt on 6 to 10 inches of base course. For subdivision type

street pavement sections, about 4 inches of asphalt on from 6 to 10 inches of base course will probably be needed. A 12 to 18 inch thick granular sub-base material would reduce the pavement section thicknesses some and reduce the risk of frost heave. For concrete pavement sections in residential/commercial developments, 6 to 7 inches of concrete on 4 to 6 inches of base course is typically adequate.

Required fill to establish design subgrade level can consist of the on-site soils, or suitable imported granular soils approved by the geotechnical engineer, compacted as recommended in the "Site Grading" section of this report. In soft or wet areas, the subgrade may require drying or stabilization prior to fill placement. A geogrid and/or subexcavation and replacement with aggregate base soils may be needed for the stabilization. The subgrade should be proofrolled. Areas that deflect excessively should be corrected before placing pavement materials. The subgrade improvements and placement and compaction of base and asphalt materials should be monitored on a regular basis by a representative of the geotechnical engineer.

Once traffic loadings are better known, we should review our preliminary pavement section recommendations and provide more details for the pavement section designs.

LIMITATIONS

This study has been conducted according to generally accepted geotechnical engineering principles and practices in this area at this time. We make no warranty either express or implied. The conclusions and recommendations submitted in this report are based upon the data obtained from the limited field reconnaissance, the exploratory borings located as shown on Figure 1, the assumed type of construction and development, and our experience in the area. Our findings include interpolation and extrapolation of the subsurface conditions identified at the exploratory borings and variations in the subsurface conditions may not become evident until excavation is performed.

This report has been prepared for the exclusive use by our client for planning and preliminary design purposes. We are not responsible for technical interpretations by others of our information. As the project evolves, we should provide continued consultation, conduct additional evaluations and review and monitor the implementation of our recommendations prior to and during construction. Significant proposed development changes may require additional analysis or modifications to the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata and testing of structural fill by a representative of the geotechnical engineer.

Respectfully Submitted,

HEPWORTH - PAWLAK GEOTECHNICAL, INC.

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Reviewed by:

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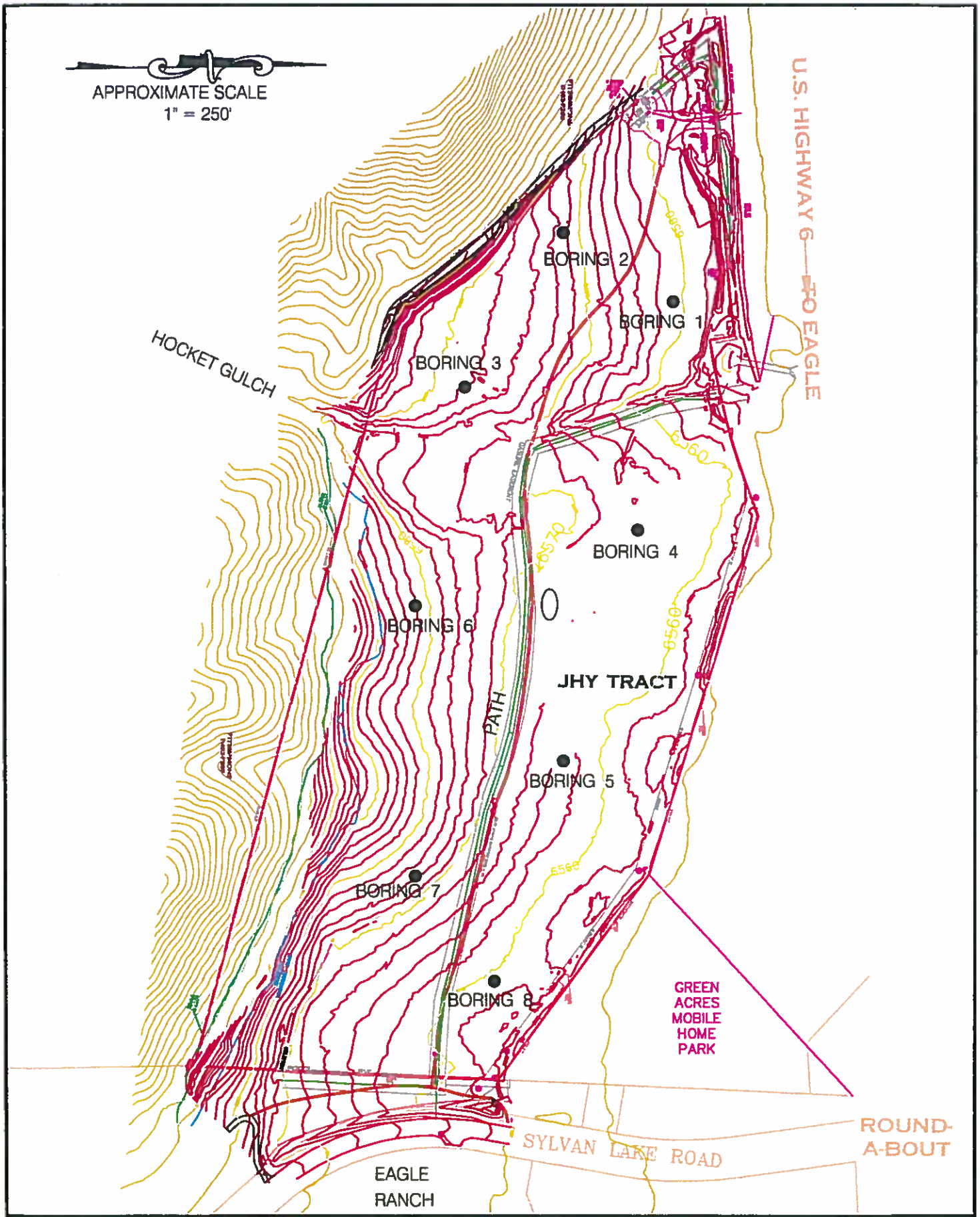
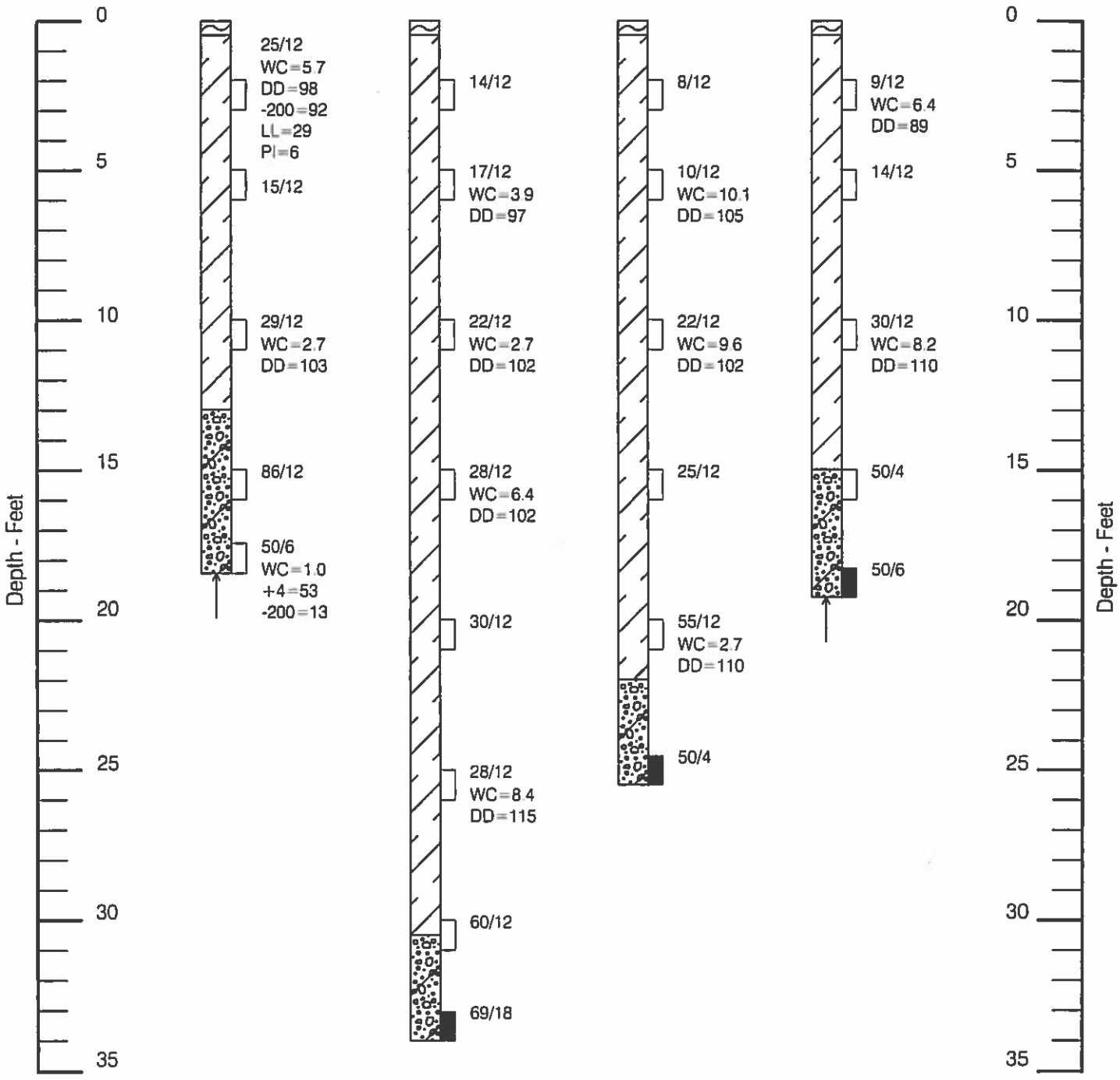
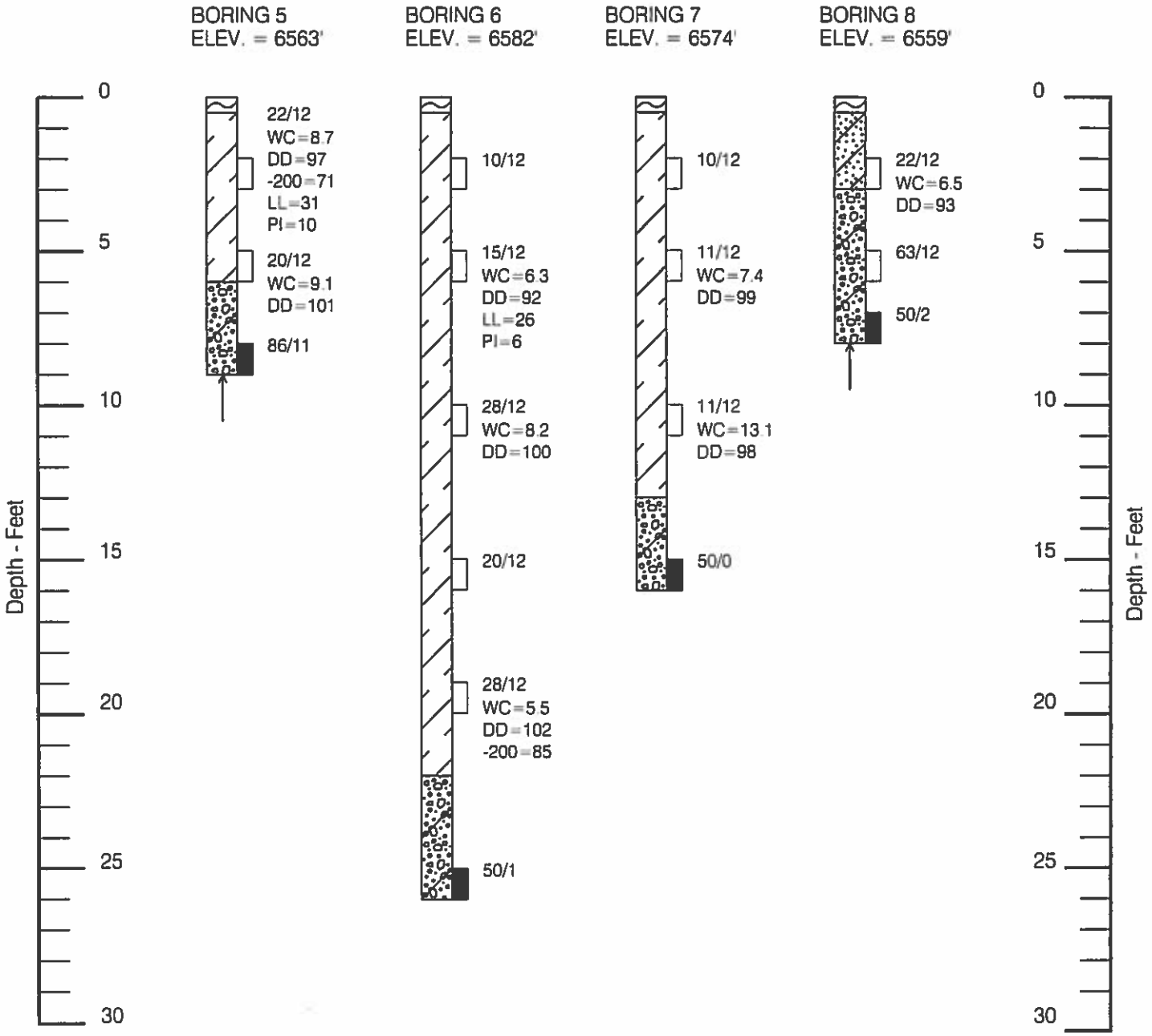


115 296A	HP Geotech Hepworth-Pawlak Geotechnical	LOCATION OF EXPLORATORY BORINGS	Figure 1



Note: Explanation of symbols is shown on Figure 4.

115 296A	HP Geotech Hepworth-Pawlak Geotechnical	LOGS OF EXPLORATORY BORINGS	Figure 2



Note: Explanation of symbols is shown on Figure 4.

LEGEND:

TOPSOIL; organic, clayey silt, dark brown, roots.

SILT AND CLAY (ML-CL), TO SILTY CLAY (CL); slightly sandy to sandy, stiff to very stiff, slightly moist, light brown, low plasticity, gypsiferous.

SAND (SM); silty, medium dense, slightly moist, red-brown, non-plastic fines.

GRAVEL AND COBBLES (GM); with small boulders, sandy, silty, dense, slightly moist, reddish brown, rocks are primarily rounded to subrounded. Coarse granular alluvium.

Relatively undisturbed drive sample; 2-inch I.D. California liner sample.

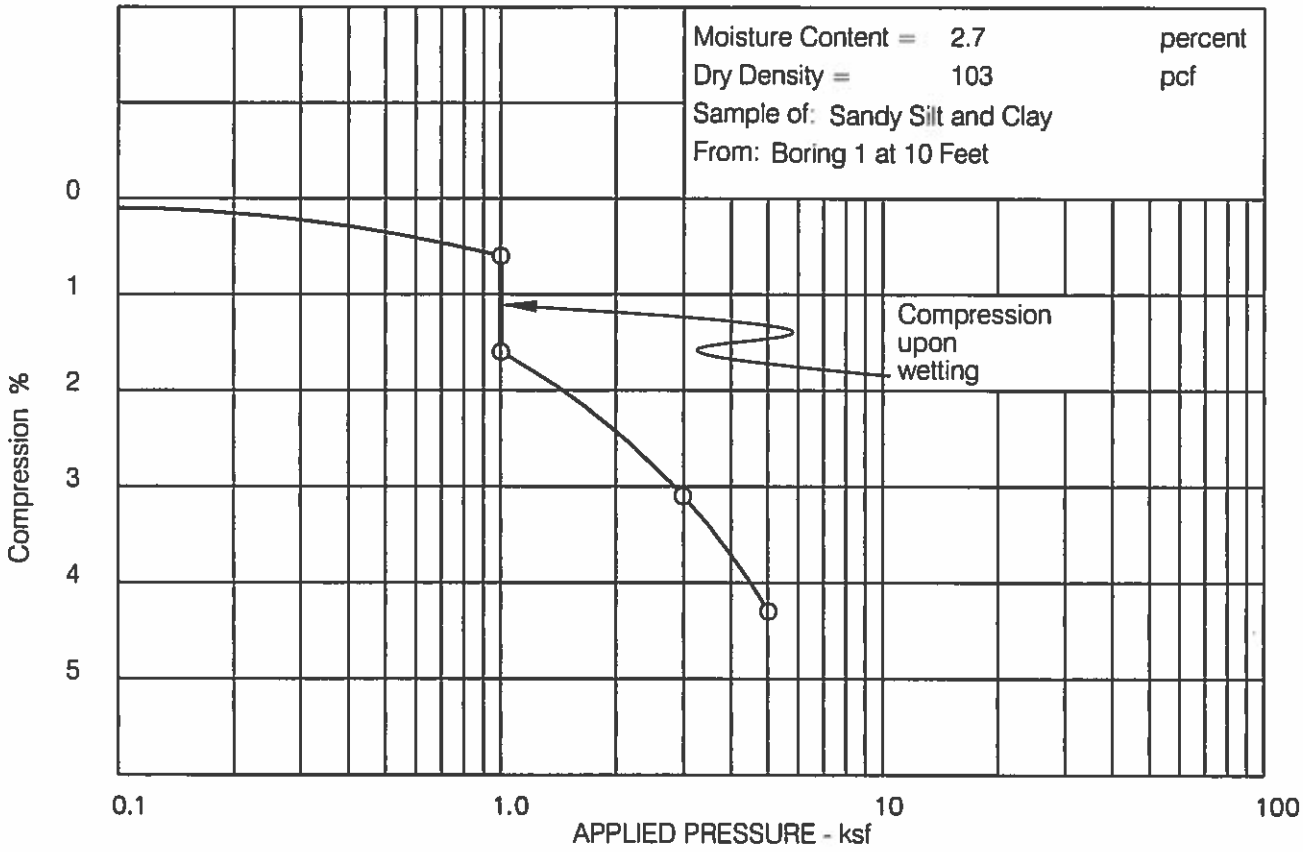
Drive sample; standard penetration test (SPT), 1 3/8 inch I.D. split spoon sample, ASTM D-1586.

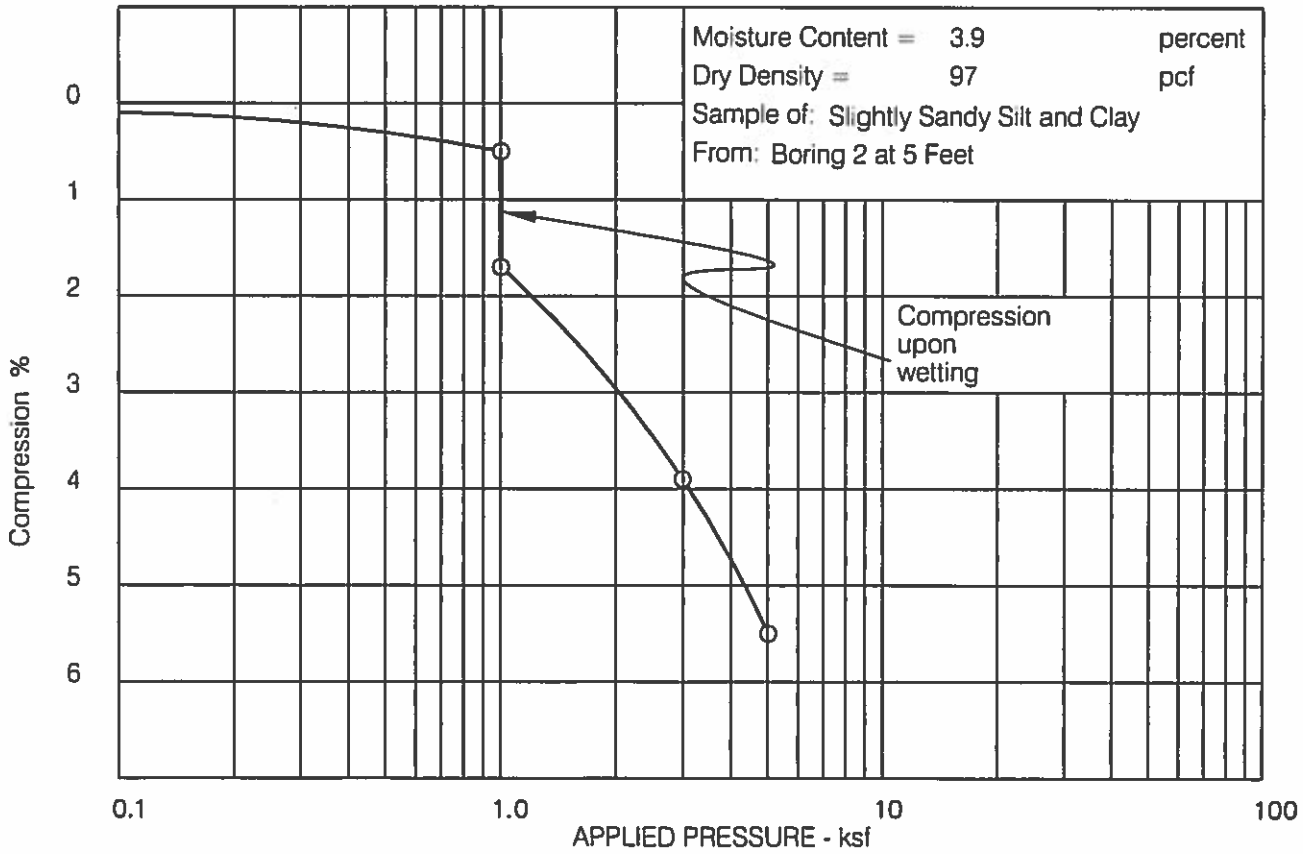
25/12 Drive sample blow count; indicates that 25 blows of a 140 pound hammer falling 30 inches were required to drive the California or SPT sampler 12 inches.

Practical auger drilling refusal

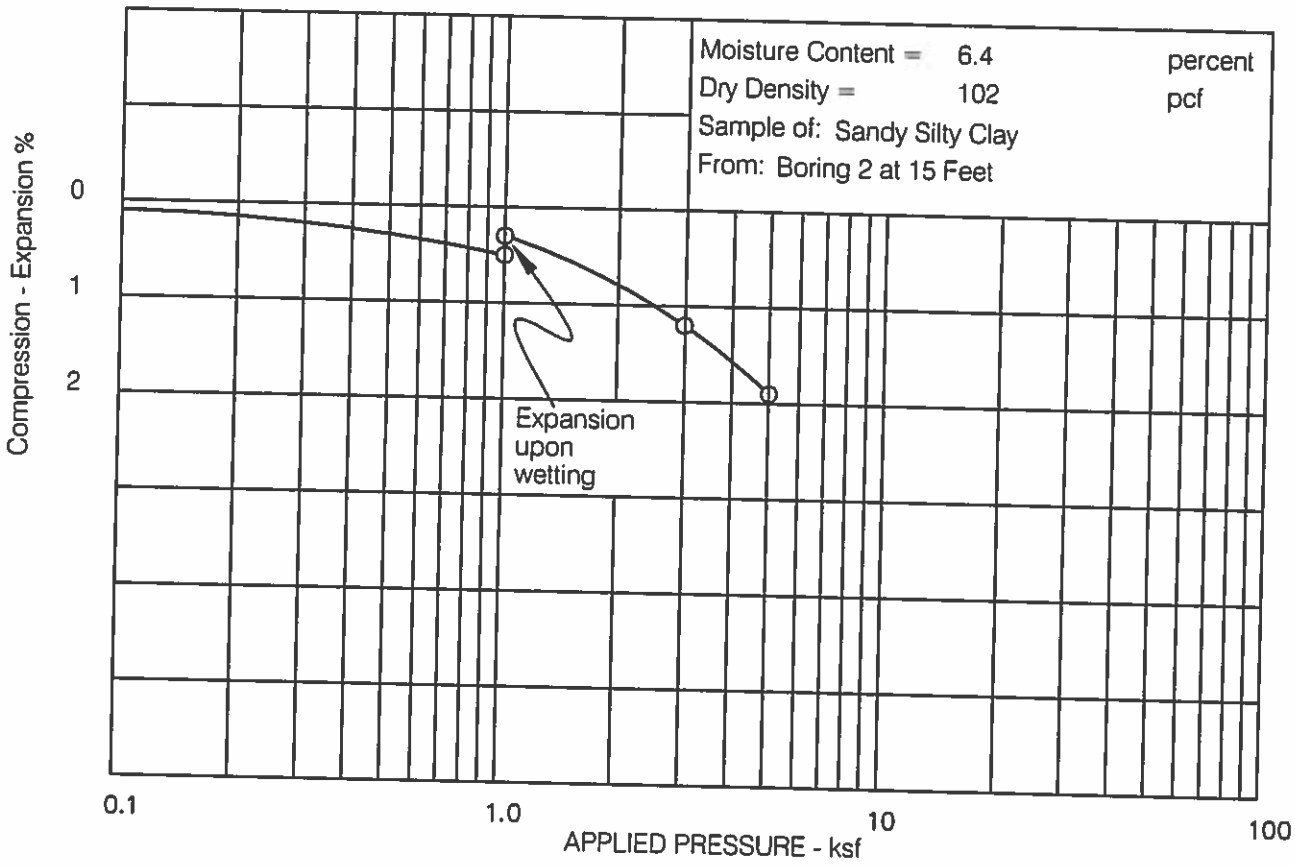
NOTES:

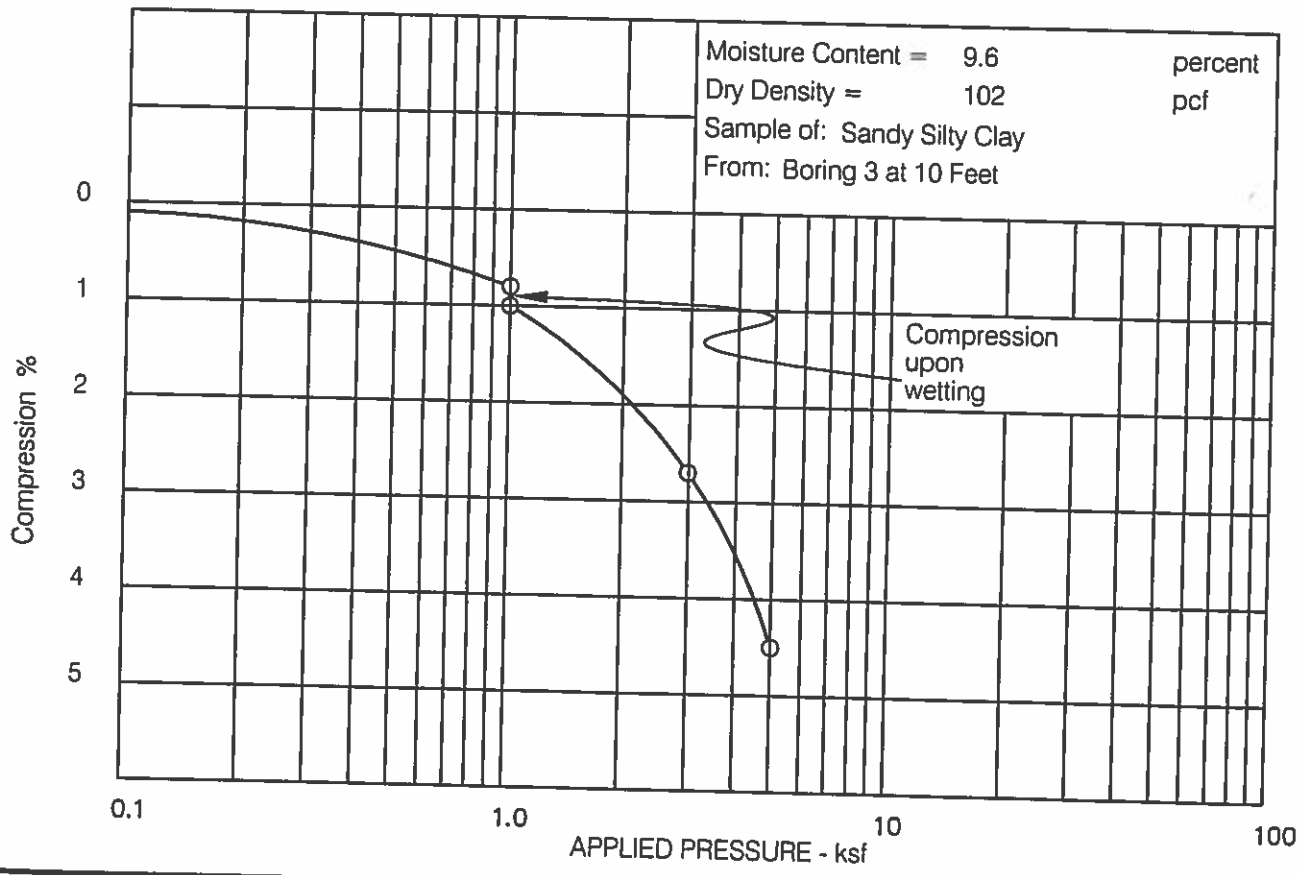
1. Exploratory borings were drilled on July 21 and 22, 2015 with 4-inch diameter continuous flight power auger.
2. Locations of exploratory borings were provided by Alpine Engineering with the exception of Borings 1 and 8 which were approximated by pacing from features shown on the site plan.
3. Elevations of exploratory borings were approximated by contours on the site plan provided. Boring logs are drawn to depth.
4. The exploratory boring locations and elevations should be considered accurate only to the degree implied by the method used.
5. The lines between materials shown on the exploratory boring logs represent the approximate boundaries between material types and transitions may be gradual.
6. No free water was encountered in the borings at the time of drilling. Fluctuation in water level may occur with time.
7. Laboratory Testing Results:
   WC = Water Content (%)
   DD = Dry Density (pcf)
   +4 = Percent retained on the No. 4 sieve
   -200 = Percent passing No. 200 sieve
   LL = Liquid Limit (%)
   PI = Plasticity Index (%)



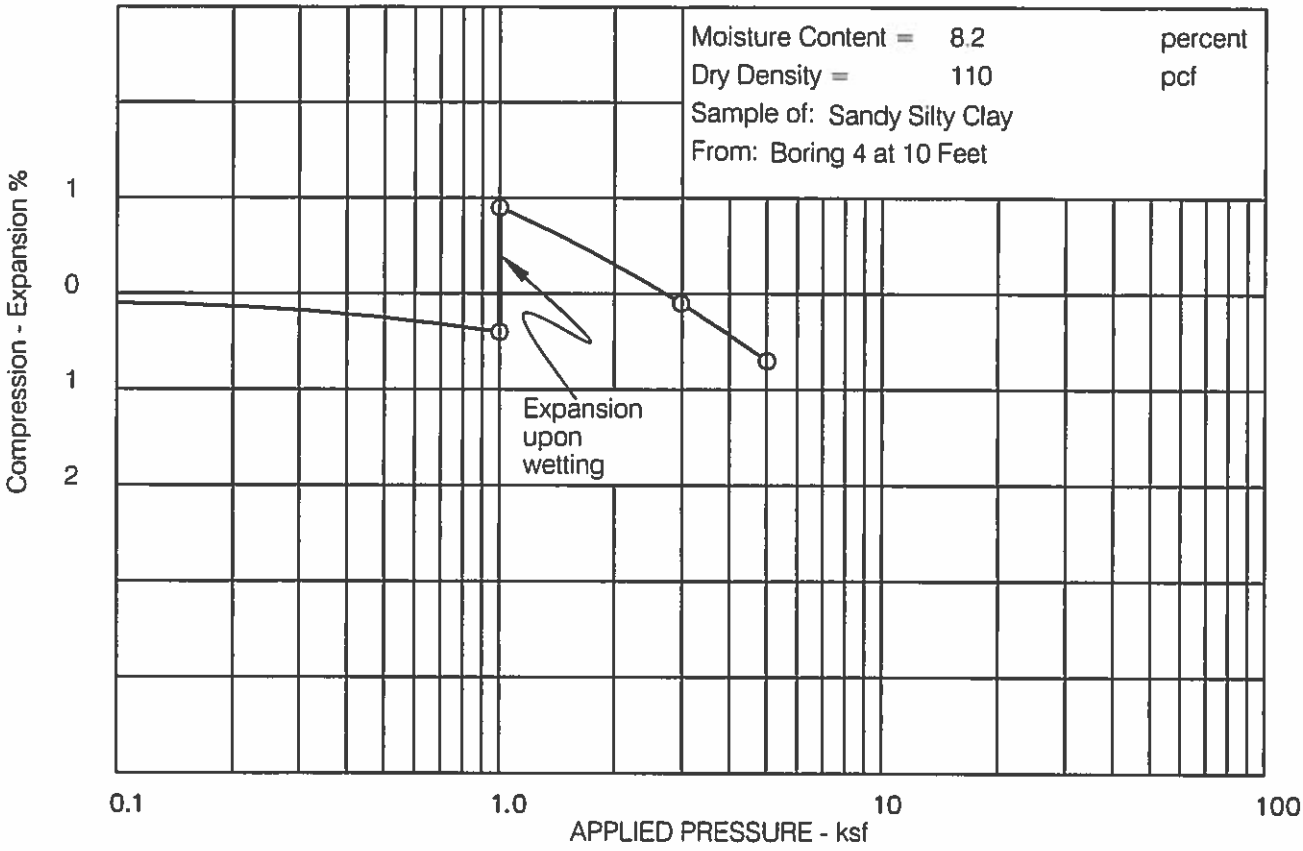


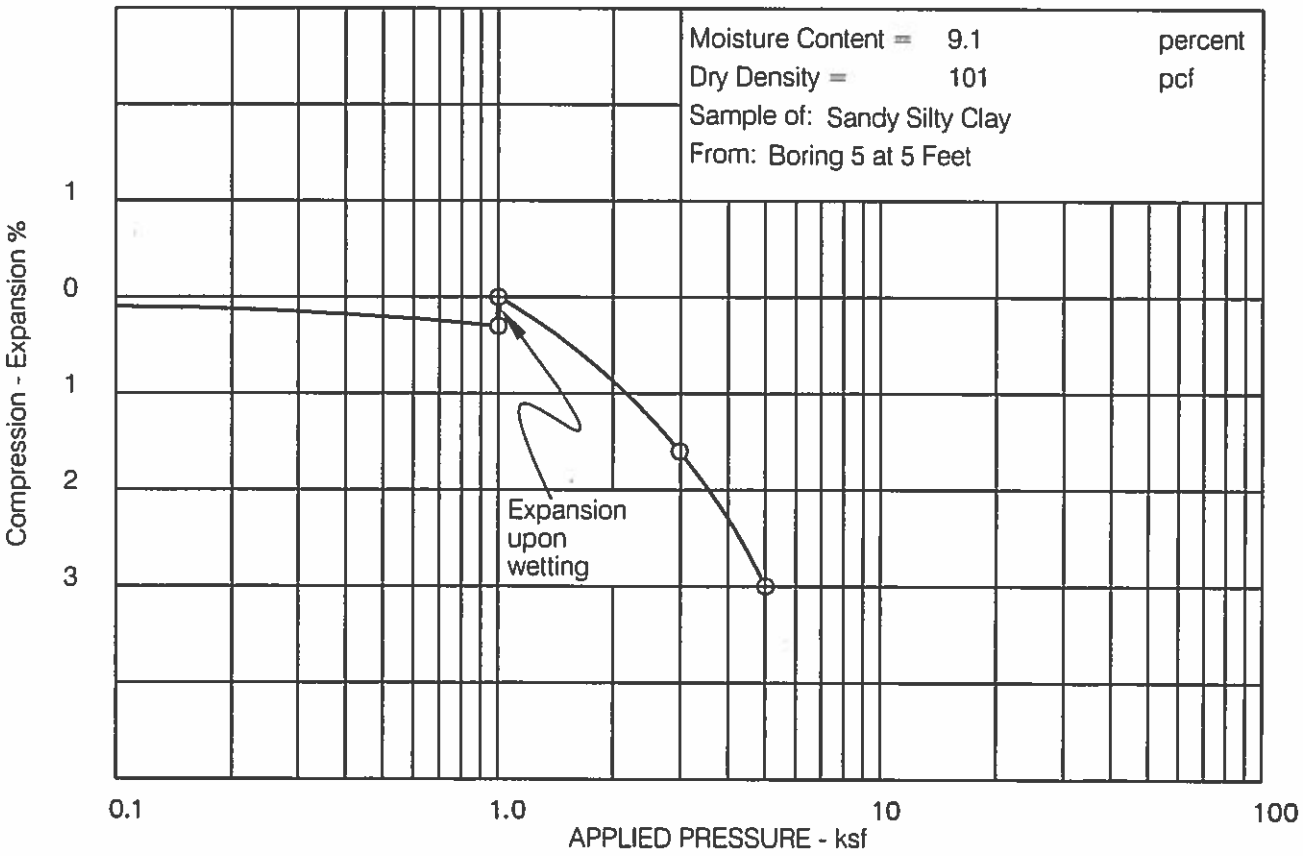
115 296A	HP Geotech Hepworth-Pawlak Geotechnical	SWELL-CONSOLIDATION TEST RESULTS	Figure 5



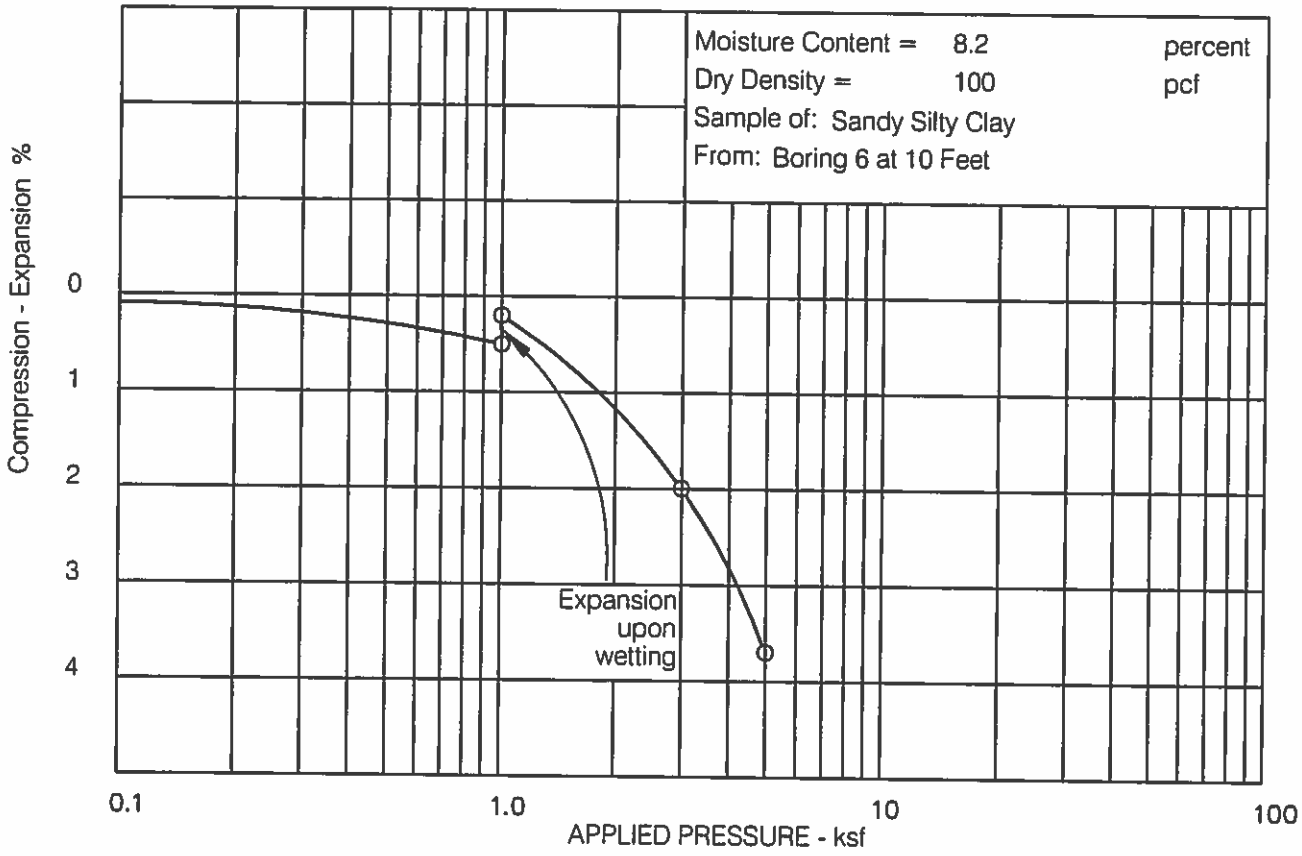


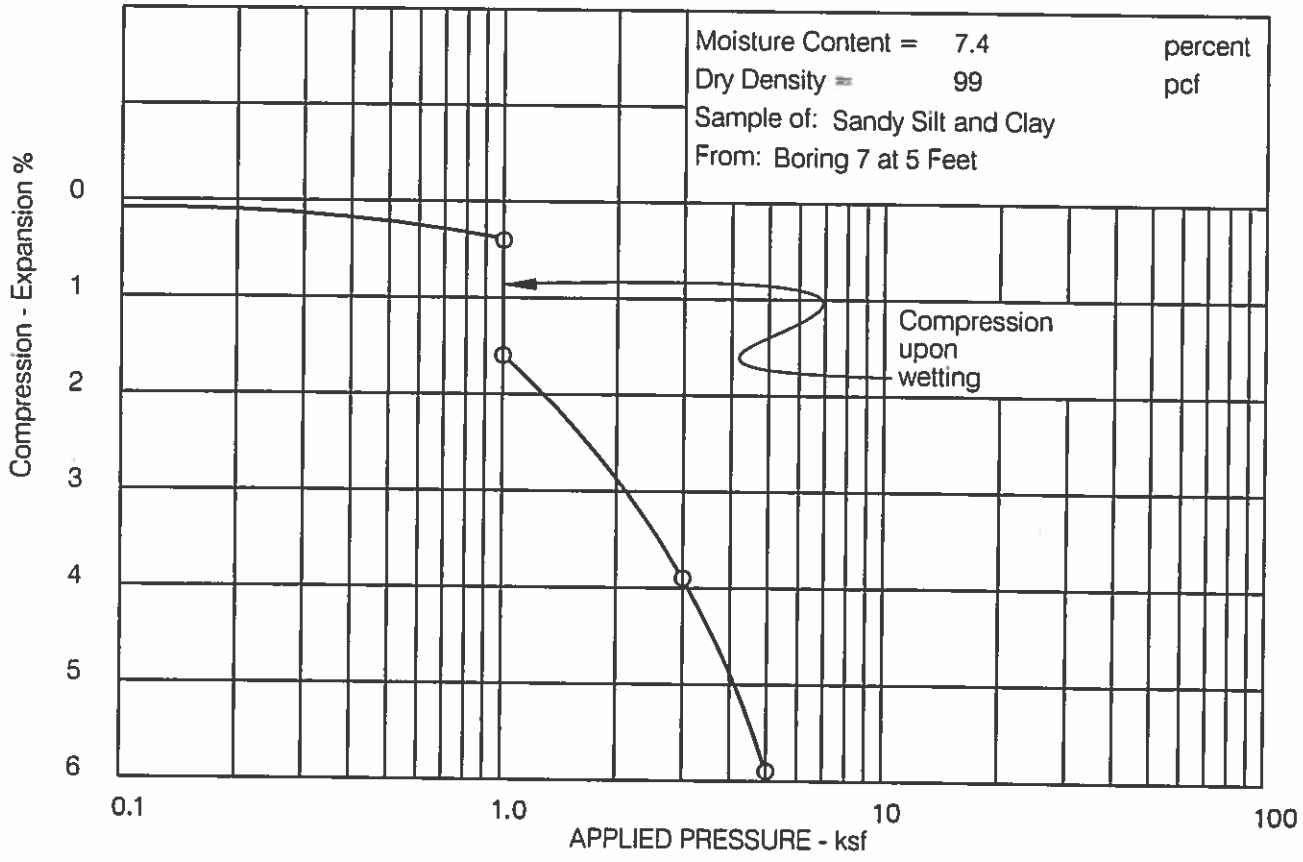
115 296A	HP Geotech Hepworth-Pawlak Geotechnical	SWELL-CONSOLIDATION TEST RESULTS	Figure 6



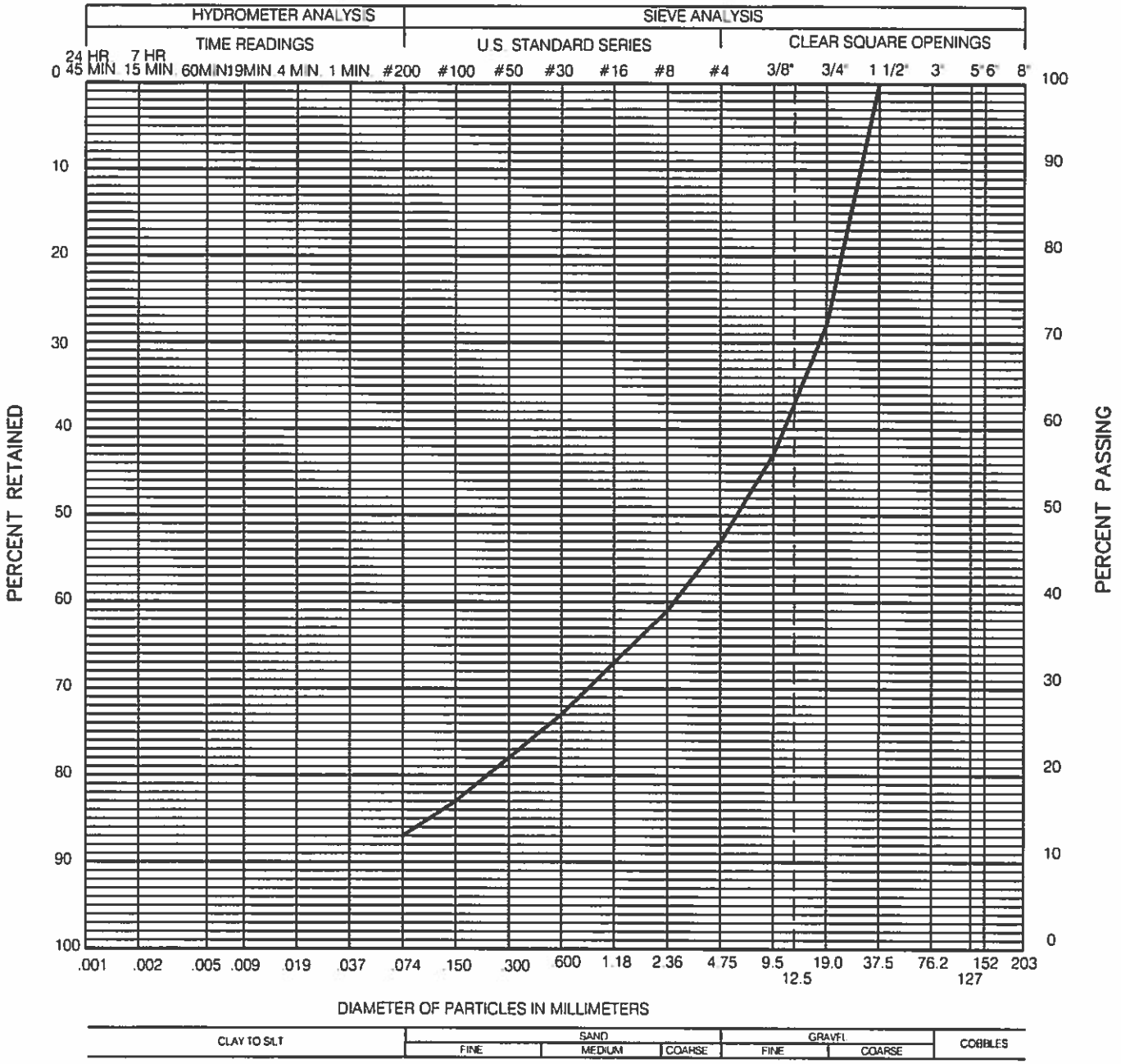


115 296A	HP Geotech Hepworth–Pawlak Geotechnical	SWELL-CONSOLIDATION TEST RESULTS	Figure 7





115 296A	HP Geotech Hepworth–Pawlak Geotechnical	SWELL-CONSOLIDATION TEST RESULTS	Figure 8



GRAVEL 53 % SAND 34 % SILT AND CLAY 13 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF: Silty Sandy Gravel FROM: Boring 1 at 17 1/2 Feet

115 296A	HP Geotech Hepworth–Pawlak Geotechnical	GRADATION TEST RESULTS	Figure 9

HEPWORTH-PAWLAK GEOTECHNICAL, INC.

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

Job No. 115 296A

SAMPLE LOCATION		NATURAL MOISTURE CONTENT	NATURAL DRY DENSITY	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		AASHTO CLASSIFICATION	SOIL OR BEDROCK TYPE
BORING	DEPTH (ft)	(%)	(pcf)	GRAVEL (%)	SAND (%)		LIQUID LIMIT (%)	PLASTIC INDEX (%)		
1	2	5.7	98			92	29	6	A-4 (5)	Slightly Sandy Silt and Clay
	10	2.7	103							Sandy Silt and Clay
	17½	1.0		53	34	13				Silty Sandy Gravel
2	5	3.9	97							Slightly Sandy Silt and Clay
	10	2.7	102							Sandy Silt and Clay
	15	6.4	102							Sandy Silty Clay
	25	8.4	115							Sandy Silt and Clay
3	5	10.1	105							Sandy Silt and Clay
	10	9.6	102							Sandy Silty and Clay
	20	2.7	110							Sandy Silt and Clay
4	2	6.4	89							Slightly Sandy Silt and Clay
	10	8.2	110							Sandy Silt and Clay
5	2	8.7	97			71	31	10	A-4 (6)	Sandy Silty Clay
	5	9.1	101							Sandy Silty Clay

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SAMPLE LOCATION		NATURAL MOISTURE CONTENT	NATURAL DRY DENSITY	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		AASHTO CLASSIFICATION	SOIL OR BEDROCK TYPE
BORING	DEPTH (ft)	(%)	(pcf)	GRAVEL (%)	SAND (%)		LIQUID LIMIT (%)	PLASTIC INDEX (%)		
6	5	6.3	92				26	6	A-4	Sandy Silt and Clay
	10	8.2	100							Sandy Silty Clay
	20	5.5	102			85				Sandy Silt and Clay
7	5	7.4	99							Sandy Silt and Clay
	10	13.1	98							Sandy Silt and Clay
8	2	6.5	93							Silty Sand