

GEOTECHNICAL ENGINEERING REPORT
PROPOSED RESIDENTIAL DEVELOPMENT
MORGAN COUNTY ROADS 4 AND P
WIGGINS, COLORADO

NORTHERN COLORADO GEOTECH
PROJECT NO. 307-15
JANUARY 29, 2016

Prepared for:

Town of Wiggins
304 Central Avenue
Wiggins, Colorado 80654
Attn: Paul Larino





2956 29th Street, Unit 21
Greeley, Colorado 80631
Phone: (970) 506-9244
Fax: (970) 506-9242

January 29, 2016

Town of Wiggins
304 Central Avenue
Wiggins, Colorado 80654

Attn: Paul Larino

**Re: Geotechnical Engineering Report
Wiggins Residential Development
Morgan County Roads 4 and P
Northern Colorado Geotech Project No. 307-15**

Northern Colorado Geotech has completed a geotechnical engineering exploration for the proposed development to be located southwest of the intersection of Morgan County Roads P and 4 in Wiggins, Colorado. This study was performed in general accordance with our proposal number P15025 (Revision 1) dated November 10, 2015.

The subsurface soils at the site consisted of varying layers of silty sand, silty clayey sand, clayey sand, sandy lean clay and fat clay to depths of 25 feet. The results of our field exploration and laboratory testing indicate that the granular soils have non to low expansive potential and low load bearing capabilities.

Based on the anticipated construction and the results of our engineering exploration, it is our opinion that proposed residential structures may generally be supported on spread footing foundations. Isolated units of fat clay soil may require removal from proposed construction areas.

If you have any questions concerning this report or any of our consulting services, please do not hesitate to contact us.

Sincerely,
NORTHERN COLORADO GEOTECH

Prepared by:

Doug Leafgren, P.G.
President

Reviewed by:

Gary G. Weeks, P.E.
Vice President

Copies to: Addressee (3)
Baessler Homes (Kevin Archer – 1 email)

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GEOTECHNICAL ENGINEERING REPORT
PROPOSED RESIDENTIAL DEVELOPMENT
MORGAN COUNTY ROADS 4 AND P
WIGGINS, COLORADO
NORTHERN COLORADO GEOTECH
PROJECT NO. 307-15
JANUARY 29, 2016

SCOPE

This report contains the results of our geotechnical engineering exploration for the proposed development to be located southwest of the intersection of Morgan County Roads P and 4 in Wiggins, Colorado. The site is located in Section 22, Township 3 North, Range 60 West of the 6th Principal Meridian.

This report includes descriptions of, and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- foundation design and construction
- basement construction
- drainage
- lateral earth pressures
- floor slab design and construction
- pavement design and construction
- earthwork

The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, structures and our understanding of the proposed project.

SITE CONDITIONS

The site is currently agricultural and/or pasture ground that is vegetated with grasses and weeds. The property is poor surface drainage to the northeast. The property is bordered to the north and east by Morgan County Roads P and 4, respectively. Agricultural ground is located to the south and east.

PROPOSED CONSTRUCTION

As we understand it, the project will consist of developing a parcel of ground for primarily residential construction. The Town of Wiggins may also build a new town hall and/or community center and pool near the northeast corner of the property.

SITE EXPLORATION

A total of 15 test borings were drilled on December 3, 2015. The borings were drilled to approximate depths of 15 to 25 feet at the locations shown on the Site Plan, Figure 1. All borings were advanced with a truck-mounted drilling rig, utilizing 4-inch diameter solid stem augers.

The borings were located in the field by pacing from property lines and/or existing site features. Relative surface elevations at the boring locations were obtained by interpolating from a topographic map provided by the client. The accuracy of boring locations and elevations should only be assumed to the level implied by the methods used to determine each.

Lithologic logs of each boring were recorded by a representative of Northern Colorado Geotech during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon and/or ring samplers. Standard penetration measurements were recorded while driving a split-spoon and/or ring sampler into the subsurface materials. The standard penetration test is a useful index in estimating the density of the materials encountered.

Groundwater conditions were evaluated in each boring at the time of subsurface exploration, and one day after the drilling.

Laboratory Testing

The samples retrieved during the subsurface exploration were returned to our laboratory for observation by the project manager. The soils were classified in general accordance with the Unified Soil Classification System. At that time, the field descriptions were confirmed or modified and an applicable laboratory testing program was formulated. Boring logs were prepared and are attached with this report.

Laboratory tests were conducted on selected samples and are presented on the boring logs and attached laboratory test sheets. The test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations.

Selected samples were tested for the following engineering properties:

- Water Content
- Dry Density
- Consolidation
- Compressive Strength
- Grain size
- Atterberg Limits
- Percent Fines
- Expansion

SUBSURFACE CONDITIONS

Geology

The proposed area is located within the Great Plains physiographic province. The Colorado Piedmont is located near the western border of the Great Plains province and was formed during Late Tertiary and Early Quaternary time (approximately 2,000,000 years ago). The Colorado Piedmont is a broad, erosional trench which separates the Southern Rocky Mountains from the High Plains. Structurally, the site lies along the eastern flank of the Denver Basin. During the mountain building of the Laramide Orogeny (approximately 70,000,000 years ago), intense tectonic activity occurred, causing the uplifting of the Front Range and associated downwarping of the Denver Basin to the east. Due to the erosional action of wind and streams, relatively flat uplands and broad valleys characterize the present-day topography of the Colorado Piedmont in this region.

Due to the relatively flat nature of the site, geologic hazards at the site are anticipated to be low. Seismic activity in the area is anticipated to be low; and from a structural standpoint, the property should be relatively stable. With proper site grading around proposed structures, erosional problems at the site should be minimal.

Soil Conditions

Soils at the site generally consisted of varying layers of silty sand, silty clayey sand, clayey sand, sandy lean clay and fat clay to depths of 25 feet. Summary boring logs are attached with this report.

Groundwater Conditions

Groundwater was not observed in any test boring at the time of field exploration, nor when checked one day after the drilling. These observations represent groundwater conditions at the time of the field exploration, and may not be indicative of other times, or at other locations. Groundwater conditions can be expected to fluctuate with varying seasonal and weather conditions, and other factors.

Field Test Results

Field test results indicate that the sand soils loose to medium dense in relative density. The clay soils vary from medium to stiff in consistency.

Laboratory Test Results

Laboratory test results indicate that the granular soils have non to low expansive potential and low load bearing capabilities. The clay soils have low expansive potential and low load bearing capabilities.

DESIGN RECOMMENDATIONS

Foundation Design

Based on the results of our subsurface exploration and the results of the laboratory testing, it is our opinion that spread footing foundations may be used for support of normally loaded structures. The footings should be placed on undisturbed soils and/or engineered fill material. Due to the isolated presence of fat clay soils at the site, we recommend removal of these units beneath foundations and/or concrete slabs.

Design and construction recommendations for foundation systems and other earth connected phases of the project are outlined below.

Footing Foundations

Based on the results of our subsurface exploration and laboratory testing, it is our opinion that spread footing foundations bearing upon undisturbed soil and/or engineered fill may be used for support of normally loaded structures. The footings may be designed for a maximum bearing pressure of 1,500 psf. In addition, the footings should be sized to maintain a minimum dead-load pressure of 500 psf. The design bearing pressure applies to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions.

Exterior footings should be placed a minimum of 30 inches below finished grade for frost protection and to provide confinement for the bearing soils. Finished grade is the lowest adjacent grade for perimeter footings.

Footings should be proportioned to reduce differential foundation movement. Proportioning on the basis of equal total movement is recommended; however, proportioning to relative constant dead-load pressure will also reduce differential movement between adjacent footings. Total movement resulting

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Morgan CR 4 and P Development
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from the assumed structural loads is estimated to be on the order of 3/4 inch or less. Differential movement should be on the order of 1/2 to 3/4 of the estimated total movement. Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage should be provided in the final design and during construction.

Areas of soft soils may be encountered at foundation bearing depth. Soft soils should be removed to a minimum depth of 12 inches and a minimum of 12 inches horizontally beyond the edge of footings. Soft soils should be replaced with ¾ to 1½ inch washed aggregate.

Foundations and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by Northern Colorado Geotech. The isolated units of fat clay encountered during the drilling should be removed beneath foundations or concrete slabs. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations may be required.

Below Grade Construction

Groundwater was not encountered on the site to the maximum depth of exploration, 25 feet. Therefore, full-depth basement construction is considered acceptable on the site.

To reduce the potential for groundwater to impact foundation bearing soils and enter the basement of the structure, installation of a perimeter drainage system is recommended. The drainage system should be constructed around the exterior perimeter of the basement foundation, and sloped at a minimum 1/8 inch per foot to a suitable outlet, such as a sump and pump system.

The drainage system should consist of a properly sized perforated pipe, embedded in free-draining gravel, placed in a trench at least 12 inches in width. The flow-line of the pipe should be placed no higher than the bottom of the footings and be sloped at 1/8" per foot minimum to the sump pit or suitable outlet. A minimum slope of 1:1 should be maintained between the bottom of the footing or grade beam and the drainage pipe trench. Gravel should extend a minimum of 3 inches beneath the bottom of the pipe, and above the bottom of the foundation wall. The gravel should be covered with drainage fabric prior to placement of foundation backfill.

Surface Drainage

Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Infiltration of water into utility or foundation excavations must be prevented during

construction. Planters and other surface features which could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 10 percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Downspouts, roof drains or scuppers should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems should not be installed within 5 feet of foundation walls. Landscaped irrigation adjacent to the foundation system should be minimized or eliminated.

Lateral Earth Pressures

For soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are:

- Active:
On-site soil backfill 40 psf/ft

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- At rest:
On-site soil backfill 55 psf/ft

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if submerged conditions are to be included in the design.

Floor Slab Design and Construction

Some differential movement of slab-on-grade floor systems is possible should the subgrade soils become elevated in moisture content. To reduce potential slab movements, the subgrade soils should be prepared as outlined in the earthwork section of this report.

Additional floor slab design and construction recommendations are as follows:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.

- Control joints should be provided in slabs to control the location and extent of cracking.
- A minimum 2-inch void space should be constructed above, or below non-bearing partition walls placed on the floor slab. Special framing details should be provided at door jambs and frames within partition walls to avoid potential distortion. Partition walls should be isolated from suspended ceilings.
- Interior trench backfill placed beneath slabs should be compacted in accordance with recommended specifications outlined below.
- In areas subjected to normal loading, a minimum 4-inch layer of sand, clean-graded gravel or aggregate base course should be placed beneath interior slabs.
- A minimum 4-inch layer of free-draining gravel should be placed beneath basement floor slabs in conjunction with the underslab drainage system.
- Floor slabs should not be constructed on frozen subgrade.
- Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

Exterior slabs-on-grade, exterior architectural features, and utilities founded on, or in backfill may experience some movement due to the volume change of the backfill. Potential movement could be reduced by:

- minimizing moisture increases in the backfill
- controlling moisture-density during placement of backfill
- using designs which allow vertical movement between the exterior features and adjoining structural elements
- placing effective control joints on relatively close centers

Preliminary Pavement Design and Construction

The required total thickness for the pavement structure is dependent primarily upon the foundation soil or subgrade and upon traffic conditions. In accordance with current industry standards, final pavement

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design reports should be performed after the wet utilities have been installed within the street right of ways on the property.

Based on the soil conditions encountered at the site, the anticipated type and volume of traffic, we estimate that the following minimum pavement thicknesses will be needed:

Traffic Area	Alternative	Recommended Pavement Thicknesses (Inches)				
		Asphalt Concrete Surface	Aggregate Base Course	Plant-Mixed Bituminous Base	Portland Cement Concrete	Total
Residential Streets	A	3½	6			9½
	B	2		4		6
Collector Streets	A	5	6			11
	B	3		5		8

Each alternative should be investigated with respect to current material availability and economic conditions.

Aggregate base course (if used on the site) should consist of a blend of sand and gravel which meets strict specifications for quality and gradation. Use of materials meeting Colorado Department of Transportation (CDOT) Class 5 or 6 specifications is recommended for base course.

Aggregate base course should be placed in lifts not exceeding six inches and should be compacted to a minimum of 95% Standard Proctor Density (ASTM D698).

Asphalt concrete and/or plant-mixed bituminous base course should be composed of a mixture of aggregate, filler and additives, if required, and approved bituminous material. The bituminous base and/or asphalt concrete should conform to approved mix designs stating the Superpave properties, optimum asphalt content, job mix formula and recommended mixing and placing temperatures. Aggregate used in plant-mixed bituminous base course and/or asphalt concrete should meet particular gradations. Material meeting Colorado Department of Transportation Grading S or SX specification is recommended for asphalt concrete. Aggregate meeting Colorado Department of Transportation Grading G specifications is recommended for plant-mixed bituminous base course. Mix designs should be submitted prior to construction to verify their adequacy. Asphalt material should be placed in maximum 3-inch lifts and should be compacted to a minimum of 92% maximum theoretical specific gravity.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively stable. However, the presence of isolated

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pockets of fat clay soils may affect the stability of the street subgrade. We recommend that the fat clay soils NOT be placed and/or removed from the upper three feet of street subgrade to improve the subgrade stability.

The stability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. When unstable conditions develop, workability may be improved by scarifying and drying. Overexcavation of wet zones and replacement with granular materials may be necessary. Use of lime, fly ash, kiln dust, cement or geotextiles could also be considered as a stabilization technique. Laboratory evaluation is recommended to determine the effect of chemical stabilization on subgrade soils prior to construction. Lightweight excavation equipment may be required to reduce subgrade pumping.

General Earthwork

All earthwork on the project should be observed and evaluated by Northern Colorado Geotech. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Site Preparation

Strip and remove existing vegetation, debris, and other deleterious materials from proposed building and pavement areas. All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

Stripped materials consisting of vegetation and organic materials should be wasted from the site, or used to revegetate landscaped areas or exposed slopes after completion of grading operations.

If unexpected fills or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

Fill Materials and Placement

All exposed areas which will receive fill should be scarified to a minimum depth of eight inches, conditioned to near optimum moisture content, and compacted.

The placement of soils on the site should be observed by Northern Colorado Geotech. The fill should be assessed for suitability of use in the proposed fill and tested for placement including compaction percentage and moisture content.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Recommended compaction criteria for engineered fill materials are as follows:

Clean on-site soils or approved imported materials may be used as fill material. Fat clay soils that were encountered in isolated units should not be used as fill under concrete slabs or as foundation backfill.

Imported soils (if required) should conform to the following:

<u>Gradation</u>	<u>Percent fines by weight (ASTM C136)</u>
6"	100
3"	70-100
No. 4 Sieve.....	50-100
No. 200 Sieve.....	60 (max)
• Liquid Limit	30 (max)
• Plasticity Index.....	15 (max)
<u>Material</u>	<u>Minimum Percent (ASTM D698)</u>
Scarified subgrade soils	95
On-site and imported fill soils:	
Beneath foundations.....	95
Beneath slabs	95
Beneath pavements.....	95

On-site or imported clay soils should be compacted within a moisture content range of 2 percent below, to 2 percent above optimum. Granular soils should be compacted within a moisture range of 3 percent below to 3 percent above optimum unless modified by the project geotechnical engineer.

Shrinkage

For balancing grading plans, estimated shrink or swell of soils and bedrock when used as compacted fill following recommendations in this report are as follows:

<u>Material</u>	<u>Estimated Shrink(-) Swell (+)</u>
On-site soils:	
Silty clays and silty sands	-5 to -15%

GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon data obtained from borings performed to obtain representative subsurface conditions at the site. Variations in the soil between borings will occur. Northern Colorado Geotech should be present during construction to observe the excavation and construction procedures and confirm or modify our recommendations.

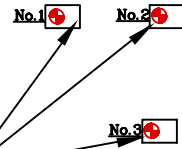
The scope of services for this project does not include either specifically or by implication any environmental assessment of the site.

This report is intended exclusively for the use by the client. Any use or reuse of the findings and/or recommendations of this report by parties other than the client without the written consent of Northern Colorado Geotech is undertaken at said parties' sole risk.

This report has been prepared in accordance with generally accepted geotechnical engineering practices in this area at this time. No warranties, either express or implied, are intended or made.

MORGAN COUNTY ROAD P

MORGAN COUNTY ROAD 4



APPROXIMATE LOCATION OF
PROPOSED TOWN STRUCTURES

No. 4

No. 5

No. 6

No. 7

No. 8

No. 9

No. 10

No. 11

No. 12

No. 13

No. 14

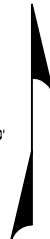
No. 15

PROPERTY BOUNDARY

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES



N



BORING LOCATION PLAN PROPOSED DEVELOPMENT

COUNTY ROAD 4 & P
WIGGINS, COLORADO
FOR BAESSLER HOMES



2956 29th Street, Unit 21
Greeley, Colorado 80631
Phone: (970) 506-9244
Fax: (970) 506-9242

Project No.	307-15
Scale:	1" = 400'
Date:	12-21-15
Project Mgr:	DML
Figure No.	1

LOG OF BORING No. 1

Sheet 1 of 1

CLIENT Town of Wiggins				ARCHITECT/ENGINEER Baessler Homes			
SITE Morgan County Roads 4 and P Wiggins, Colorado				PROJECT Wiggins Residential Development			
				SAMPLES			TESTS
				BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED
							MOISTURE, %
							DRY DENSITY PCF
							HAND PENE- TROMETER psf
							LIQUID LIMIT PLASTIC INDEX PERCENT FINES
Approx. Surface Elev.: 4551.0 ft.							
0.5 6" TOPSOIL				15	1	SS	18
4550.5							16
<u>SILTY SAND</u> Tan to brown, moist, loose to medium dense							
				2	2	SS	12
							9
				5			
				7	3	RS	12
							10
				10			
							106
							5500
							0% Swell
15.0				10	4	SS	12
4536.0							9
BOTTOM OF BORING				15			

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED 12/3/15		FINISHED 12/3/15	
WL	None	W.D.		DRILL CO. Drilling Eng		DRILL RIG CME-75	
WL	None	A.B.		LOGGED BY TK		APPROVED DML	
When Checked 1 Day A.B.				NCG PROJECT NO.		307-15	

307-15.GPJ

Sheet 1 of 1

307-15.GPJ








WATER LEVEL OBSERVATIONS			 <p> Northern Colorado Geotech 2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242 </p>	STARTED	12/3/15	FINISHED	12/3/15
WL	None	W.D.		DRILL CO.	Drilling Eng	DRILL RIG	CME-75
WL	None	A.B.		LOGGED BY	TK	APPROVED	DML
When Checked 1 Day A.B.				NCG PROJECT NO.	307-15		

Sheet 1 of 1

307-15.GPJ

LOG OF BORING No. 4

Sheet 1 of 1



CLIENT			ARCHITECT/ENGINEER										
Town of Wiggins			Baessler Homes										
SITE			PROJECT										
Morgan County Roads 4 and P Wiggins, Colorado			Wiggins Residential Development										
			GRAPHIC LOG	DEPTH (FT.)	SAMPLES				TESTS				
					BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED	MOISTURE, %	DRY DENSITY PCF	HAND PENE-TROMETER psf	LIQUID LIMIT PLASTIC INDEX PERCENT FINES	
Approx. Surface Elev.: 4554.0 ft.													
0.5	6" TOPSOIL FAT CLAY Brown, moist, medium	4553.5			4	1	SS	18	27				72/39/96
3.5	SANDY LEAN CLAY Tan, moist, medium to stiff	4550.5			7	2	SS	12	35				
9.0	SILTY SAND Tan, moist, loose	4545.0			7	3	RS	12	16	105	7000	0.5% Swell	
15.0	BOTTOM OF BORING	4539.0			8	4	SS	12	9				

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED 12/3/15		FINISHED 12/3/15	
WL	None	W.D.		DRILL CO. Drilling Eng		DRILL RIG CME-75	
WL	None	A.B.		LOGGED BY TK		APPROVED DML	
When Checked 1 Day A.B.				NCG PROJECT NO. 307-15			

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LOG OF BORING No. 5

Sheet 1 of 1

CLIENT			ARCHITECT/ENGINEER										
Town of Wiggins			Baessler Homes										
SITE			PROJECT										
Morgan County Roads 4 and P Wiggins, Colorado			Wiggins Residential Development										
			GRAPHIC LOG	DEPTH (FT.)	SAMPLES				TESTS				
					BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED	MOISTURE, %	DRY DENSITY PCF	HAND PENE-TROMETER psf	LIQUID LIMIT PLASTIC INDEX PERCENT FINES	
Approx. Surface Elev.: 4554.5 ft.													
0.5 6" TOPSOIL			4554.0		8	1	SS	18	21				
<u>SILTY SAND</u> Tan, moist, loose					5	2	RS	12	11	113	6000	0% Swell	

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED 12/3/15		FINISHED 12/3/15	
WL	None	W.D.		DRILL CO. Drilling Eng		DRILL RIG CME-75	
WL	None	A.B.		LOGGED BY TK		APPROVED DML	
When Checked 1 Day A.B.				NCG PROJECT NO.		307-15	

307-15.GPJ

LOG OF BORING No. 6

Sheet 1 of 1

CLIENT Town of Wiggins				ARCHITECT/ENGINEER Baessler Homes			
SITE Morgan County Roads 4 and P Wiggins, Colorado				PROJECT Wiggins Residential Development			
				SAMPLES			TESTS
				BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED
							MOISTURE, %
							DRY DENSITY PCF
							HAND PENE- TROMETER psf
							LIQUID LIMIT PLASTIC INDEX PERCENT FINES
Approx. Surface Elev.: 4554.5 ft.							
0.5 6" TOPSOIL				5	1	SS	18
SILTY SAND Tan, moist, loose				7	2	RS	12
				5	3	SS	12
				7	4	SS	12
15.0							
BOTTOM OF BORING							

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED 12/3/15		FINISHED 12/3/15	
WL	None	W.D.		DRILL CO. Drilling Eng		DRILL RIG CME-75	
WL	None	A.B.		LOGGED BY TK		APPROVED DML	
When Checked 1 Day A.B.				NCG PROJECT NO. 307-15			

307-15.GPJ

LOG OF BORING No. 7

Sheet 1 of 1

CLIENT			ARCHITECT/ENGINEER											
Town of Wiggins			Baessler Homes											
SITE			PROJECT											
Morgan County Roads 4 and P Wiggins, Colorado			Wiggins Residential Development											
		GRAPHIC LOG	DEPTH (FT.)	SAMPLES				TESTS						
				BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED	MOISTURE, %	DRY DENSITY PCF	HAND PENE-TROMETER psf	LIQUID LIMIT PLASTIC INDEX PERCENT FINES			
Approx. Surface Elev.: 4553.5 ft.														
0.5	6" TOPSOIL SILTY SAND Tan, moist, loose to medium dense	4553.0			35	1	SS	18	14					
4.0		4549.5			11	2	SS	12	10					
	SANDY LEAN CLAY Tan, moist, medium to stiff			5										
					20	3	RS	12	19	104	6000	0.7%Swell		
10.0		4543.5		10										
	SILTY SAND Tan, moist, loose													
15.0		4538.5		15	6	4	SS	12	3					
BOTTOM OF BORING														

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED	12/3/15	FINISHED	12/3/15
WL	None	W.D.		DRILL CO.	Drilling Eng	DRILL RIG	CME-75
WL	None	A.B.		LOGGED BY	TK	APPROVED	DML
When Checked 1 Day A.B.				NCG PROJECT NO. 307-15			





307-15.GPJ

Sheet 1 of 1

307-15.GPJ

LOG OF BORING No. 9

Sheet 1 of 1

CLIENT			ARCHITECT/ENGINEER								
Town of Wiggins			Baessler Homes								
SITE			PROJECT								
Morgan County Roads 4 and P Wiggins, Colorado			Wiggins Residential Development								
		GRAPHIC LOG	DEPTH (FT.)	SAMPLES				TESTS			
				BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED	MOISTURE, %	DRY DENSITY PCF	HAND PENE-TROMETER psf	LIQUID LIMIT PLASTIC INDEX PERCENT FINES
Approx. Surface Elev.: 4555.5 ft.											
0.5	6" TOPSOIL SILTY SAND Tan, moist, loose	4555.0		4	1	SS	18	22			0% Swell
3.0	CLAYEY SAND Brown, moist, loose	4552.5		8	2	SS	12	18			
8.0	SILTY SAND Tan, moist, loose	4547.5		8	3	RS	12	9	102	7000	
15.0	BOTTOM OF BORING	4540.5		8	4	SS	12	6			


WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED	12/3/15	FINISHED	12/3/15
WL	None	W.D.		DRILL CO.	Drilling Eng	DRILL RIG	CME-75
WL	None	A.B.		LOGGED BY	TK	APPROVED	DML
When Checked 1 Day A.B.				NCG PROJECT NO. 307-15			

307-15.GPJ

LOG OF BORING No. 10

Sheet 1 of 1

CLIENT Town of Wiggins				ARCHITECT/ENGINEER Baessler Homes			
SITE Morgan County Roads 4 and P Wiggins, Colorado				PROJECT Wiggins Residential Development			
				SAMPLES			TESTS
				BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED
							MOISTURE, %
							DRY DENSITY PCF
							HAND PENE- TROMETER psf
							LIQUID LIMIT PLASTIC INDEX PERCENT FINES
Approx. Surface Elev.: 4554.0 ft.							
0.5 6" TOPSOIL				5	1	SS	18
SILTY SAND							
Brown, moist, loose							
				5	2	SS	12
				9	3	RS	12
				8	4	SS	12
15.0							
BOTTOM OF BORING							

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED	12/3/15	FINISHED	12/3/15
WL	None	W.D.		DRILL CO.	Drilling Eng	DRILL RIG	CME-75
WL	None	A.B.		LOGGED BY	TK	APPROVED	DML
When Checked 1 Day A.B.				NCG PROJECT NO.		307-15	

307-15.GPJ


Sheet 1 of 1


307-15.GPJ

WATER LEVEL OBSERVATIONS			 <p> Northern Colorado Geotech 2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242 </p>	STARTED	12/3/15	FINISHED	12/3/15
WL	None	W.D.		DRILL CO.	Drilling Eng	DRILL RIG	CME-75
WL	None	A.B.		LOGGED BY	TK	APPROVED	DML
When Checked 1 Day A.B.				NCG PROJECT NO.	307-15		

LOG OF BORING No. 12

Sheet 1 of 1

CLIENT			ARCHITECT/ENGINEER								
Town of Wiggins			Baessler Homes								
SITE			PROJECT								
Morgan County Roads 4 and P Wiggins, Colorado			Wiggins Residential Development								
			SAMPLES				TESTS				
			DEPTH (FT.)	BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED	MOISTURE, %	DRY DENSITY PCF	HAND PENE- TROMETER psf	LIQUID LIMIT PLASTIC INDEX PERCENT FINES
Approx. Surface Elev.: 4556.0 ft.											
0.5 6" TOPSOIL				24	1	SS	18	14			
SILTY SAND Tan, moist, loose				11	2	RS	12	12	113	7500	0% Swell
				2	3	SS	12	9			
				5	4	SS	12	9			
15.0				5							
BOTTOM OF BORING											

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED	12/3/15	FINISHED	12/3/15
WL	None	W.D.		DRILL CO.	Drilling Eng	DRILL RIG	CME-75
WL	None	A.B.		LOGGED BY	TK	APPROVED	DML
When Checked 1 Day A.B.				NCG PROJECT NO.		307-15	

307-15.GPJ

Sheet 1 of 1

307-15.GPJ

LOG OF BORING No. 14

Sheet 1 of 1

CLIENT		ARCHITECT/ENGINEER									
Town of Wiggins		Baessler Homes									
SITE		PROJECT									
Morgan County Roads 4 and P Wiggins, Colorado		Wiggins Residential Development									
		GRAPHIC LOG	DEPTH (FT.)	SAMPLES				TESTS			
				BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED	MOISTURE, %	DRY DENSITY PCF	HAND PENE- TROMETER psf	LIQUID LIMIT PLASTIC INDEX PERCENT FINES
Approx. Surface Elev.: 4562.0 ft.											
0.5 6" TOPSOIL		4561.5									
SILTY SAND											
Tan, moist, loose											

WATER LEVEL OBSERVATIONS			STARTED 12/3/15		FINISHED 12/3/15	
WL	None	W.D.	DRILL CO. Drilling Eng		DRILL RIG CME-75	
WL	None	A.B.	LOGGED BY TK		APPROVED DML	
When Checked 1 Day A.B.			NCG PROJECT NO.		307-15	

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307-15.GPJ

LOG OF BORING No. 15

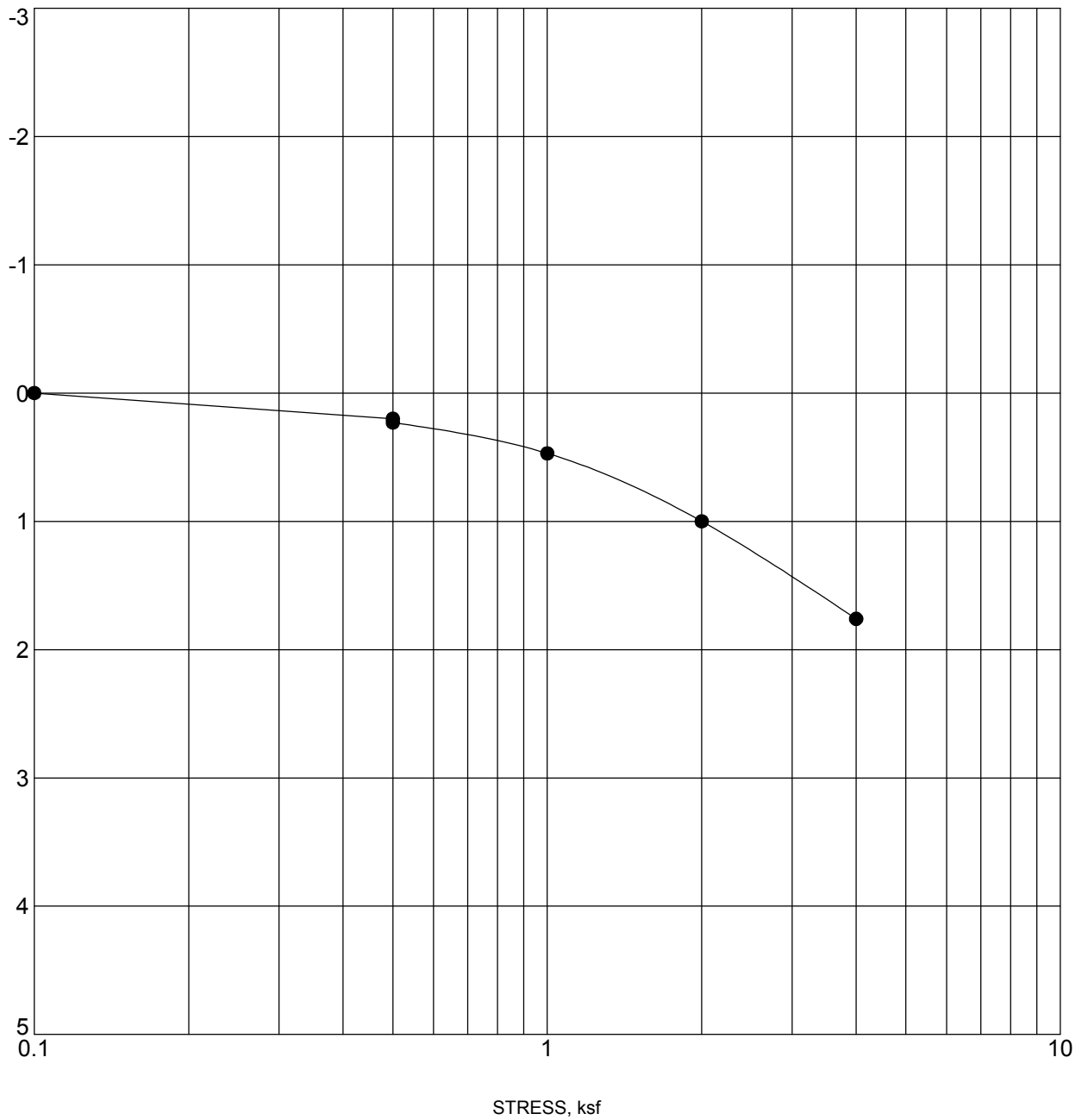
Sheet 1 of 1

CLIENT		ARCHITECT/ENGINEER									
Town of Wiggins		Baessler Homes									
SITE		PROJECT									
Morgan County Roads 4 and P Wiggins, Colorado		Wiggins Residential Development									
		GRAPHIC LOG	DEPTH (FT.)	SAMPLES				TESTS			
				BLOWS/12" N-VALUE	NUMBER	TYPE	IN. DRIVEN IN. RECOVERED	MOISTURE, %	DRY DENSITY PCF	HAND PENE- TROMETER psf	LIQUID LIMIT PLASTIC INDEX PERCENT FINES
Approx. Surface Elev.: 4561.0 ft.											
0.5	6" TOPSOIL <u>SILTY CLAYEY SAND</u> Brown, moist, loose	4560.5		7	1	SS	18	10			
				5	2	SS	12	18			
5.0	<u>SILTY SAND</u> Tan, moist, loose	4556.0	5								
				1	3	RS	12	7	102	4000	0% Swell
			10								
				4	4	SS	12	12			
15.0		4546.0	15								
BOTTOM OF BORING											

WATER LEVEL OBSERVATIONS			<div><p>Northern Colorado Geotech</p><p>2956 29th Street, Unit 21 Greeley, Colorado 80631 Phone: 970-506-9244 Fax: 970-506-9242</p></div>	STARTED	12/3/15	FINISHED	12/3/15
WL	None	W.D.		DRILL CO.	Drilling Eng	DRILL RIG	CME-75
WL	None	A.B.		LOGGED BY	TK	APPROVED	DML
When Checked 1 Day A.B.				NCG PROJECT NO.	307-15		

307-15.GPJ

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 1	8.0	Silty Sand	106	10



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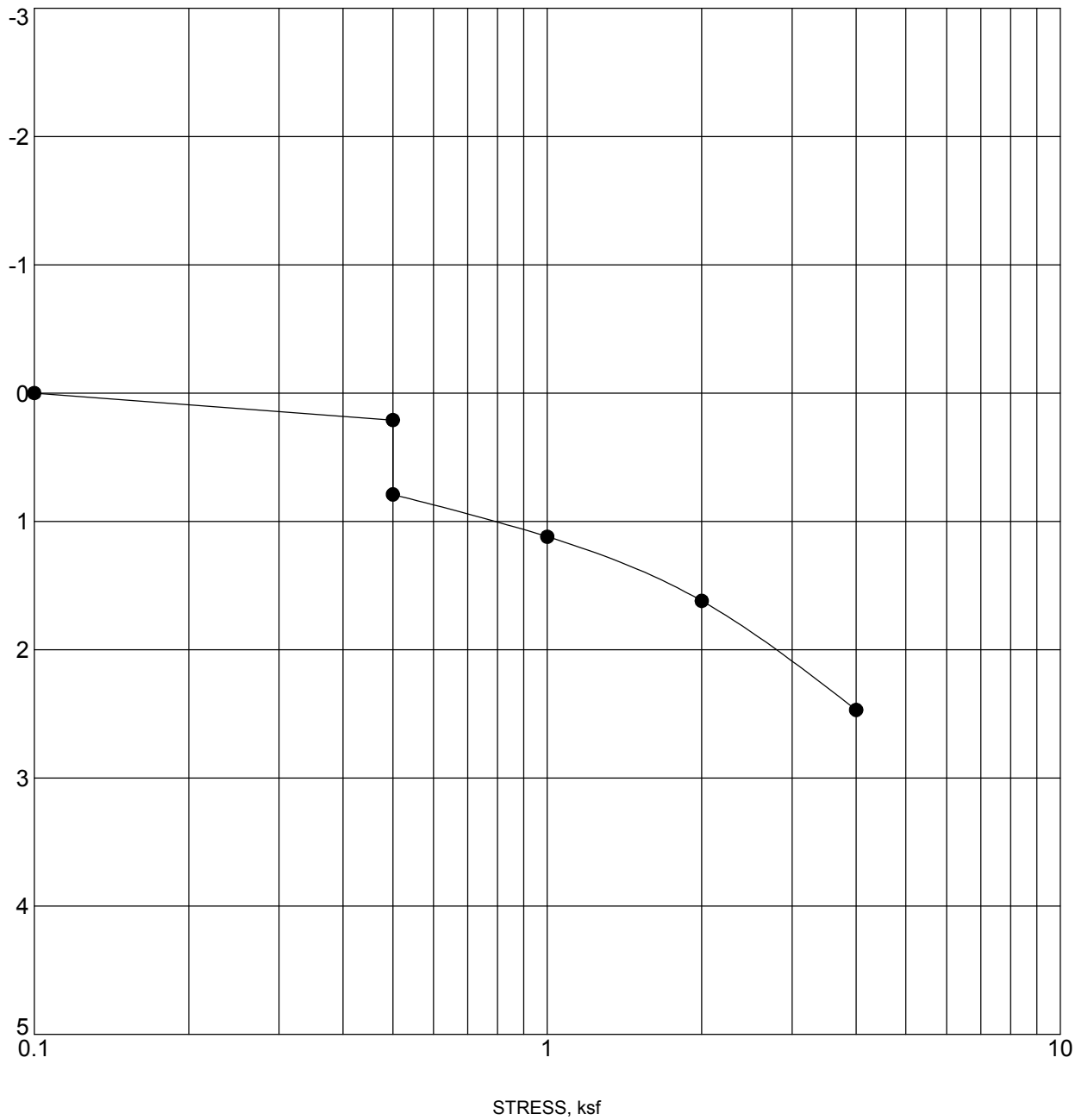
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 2	3.0	Silty Sand	5	105



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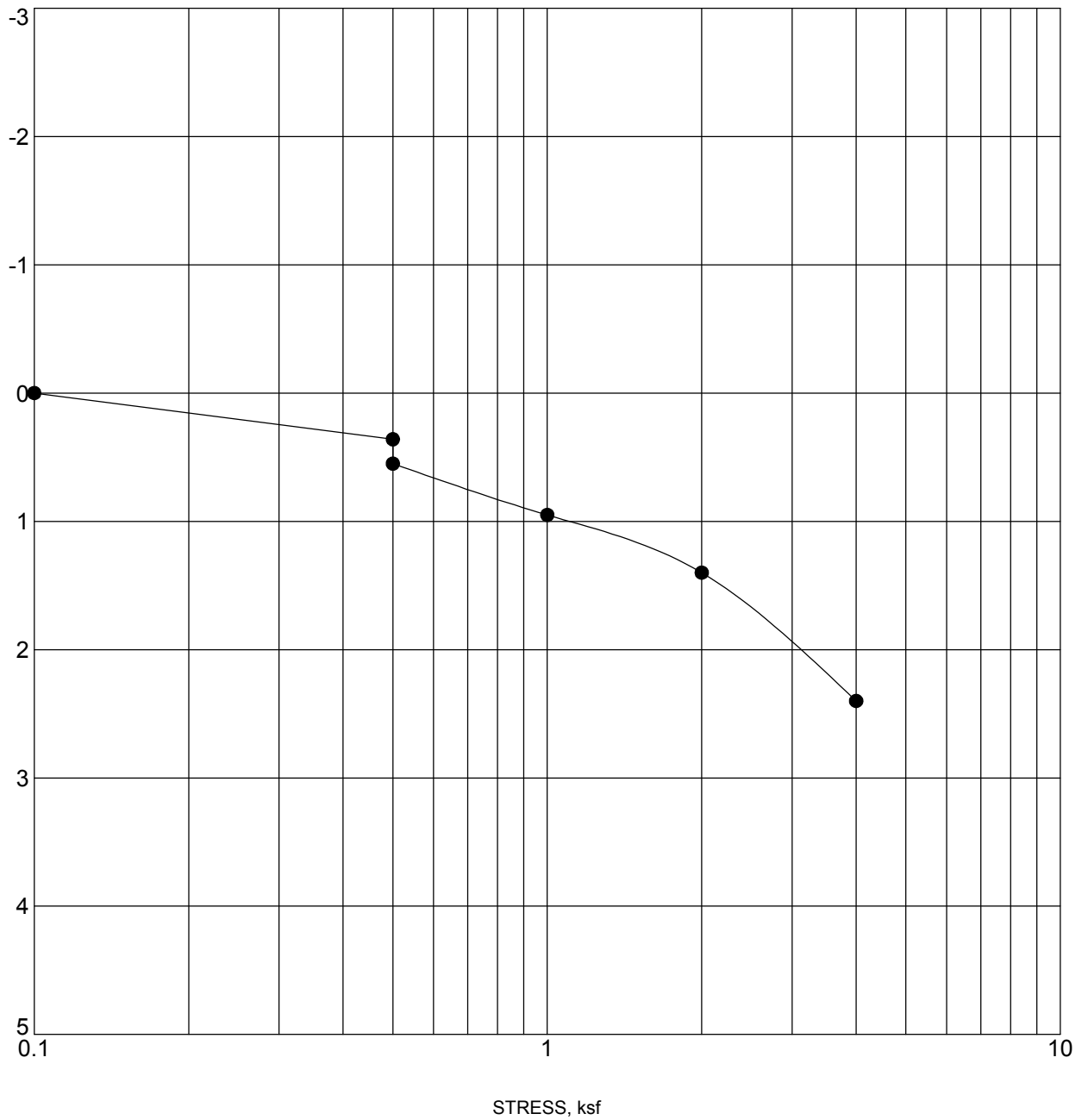
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 3	3.0	Silty Sand	99	4



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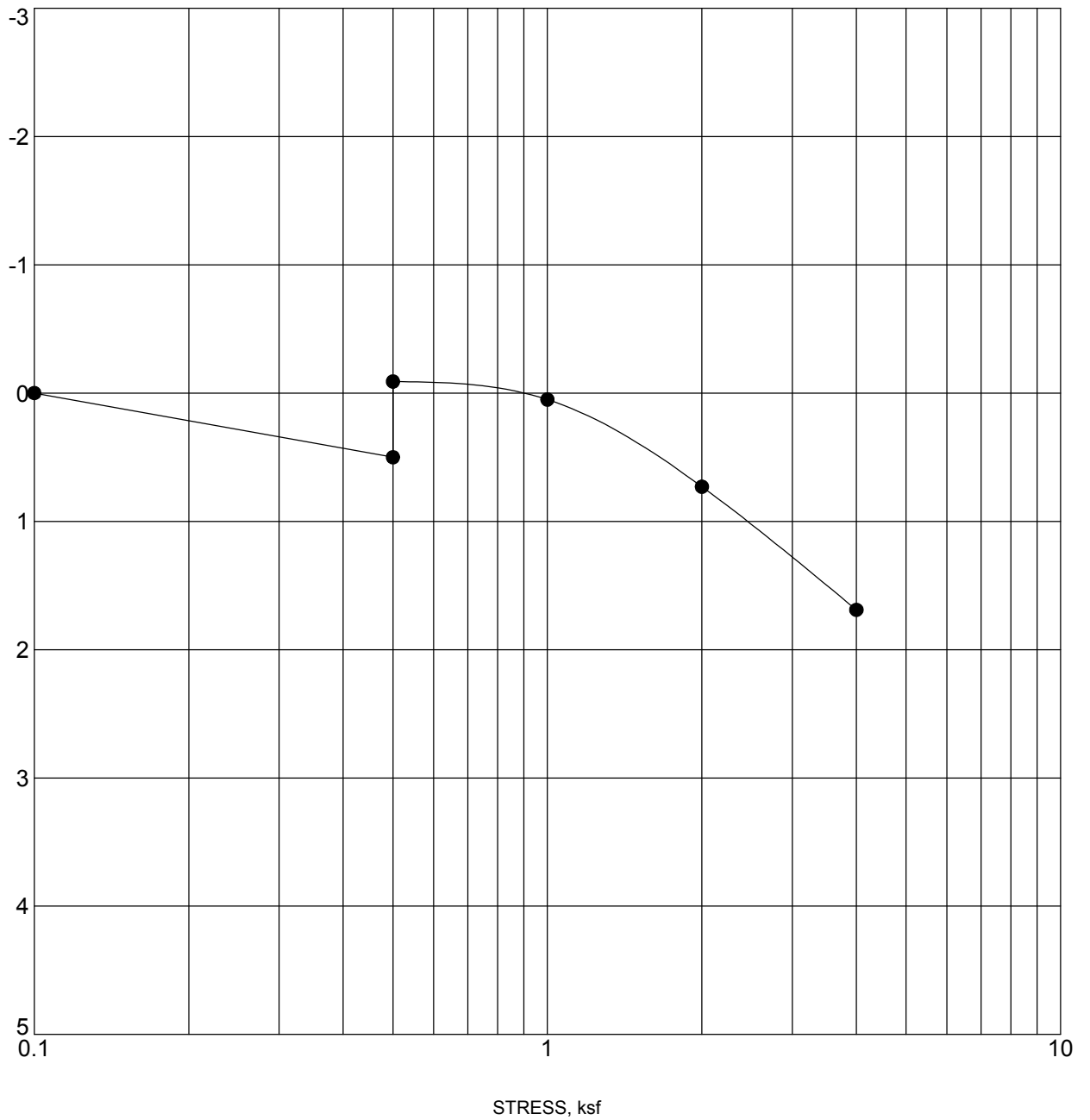
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%	
●	4	8.0	Sandy Lean Clay	105	16



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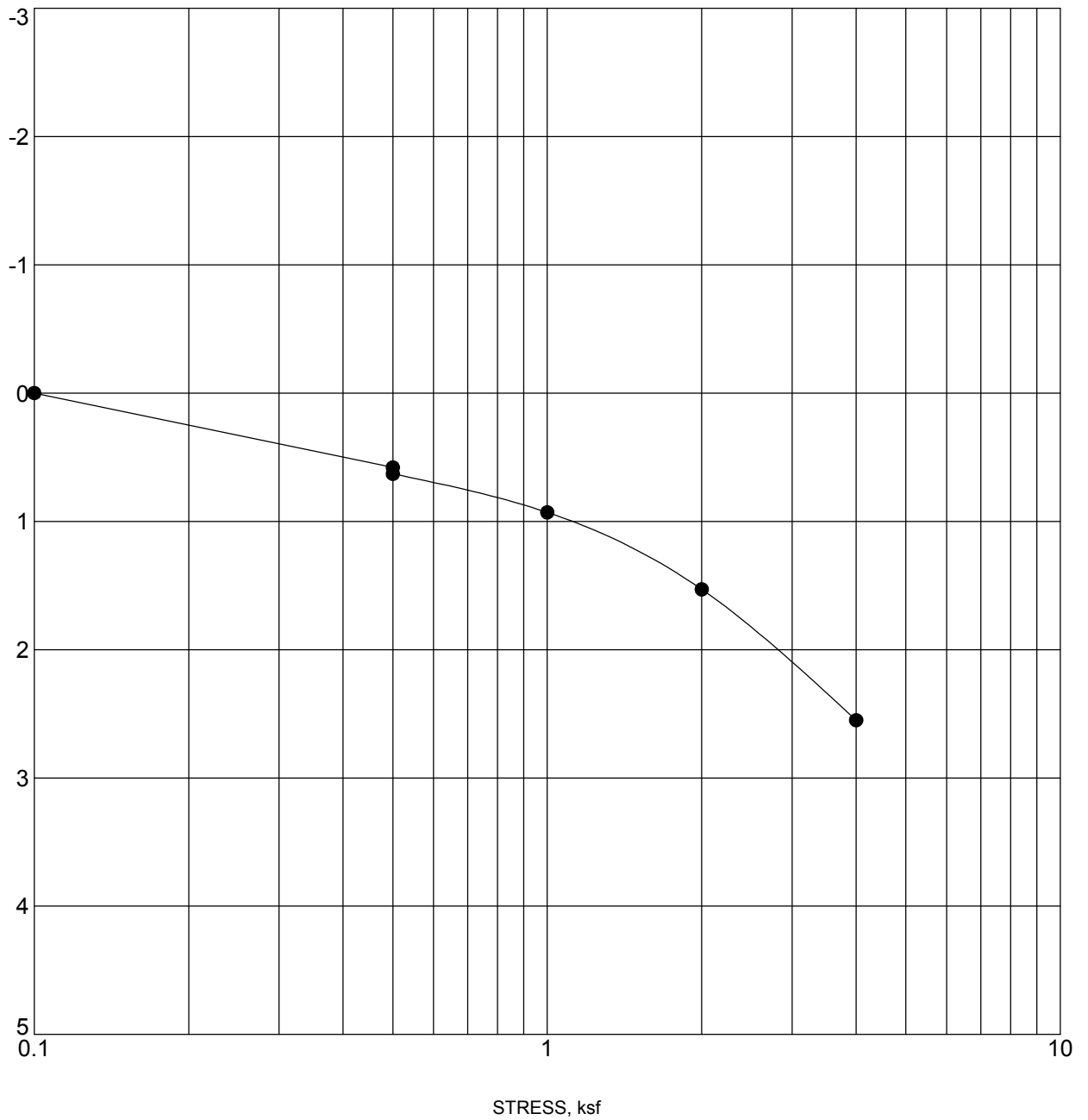
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 5	3.0	Silty Sand	113	11



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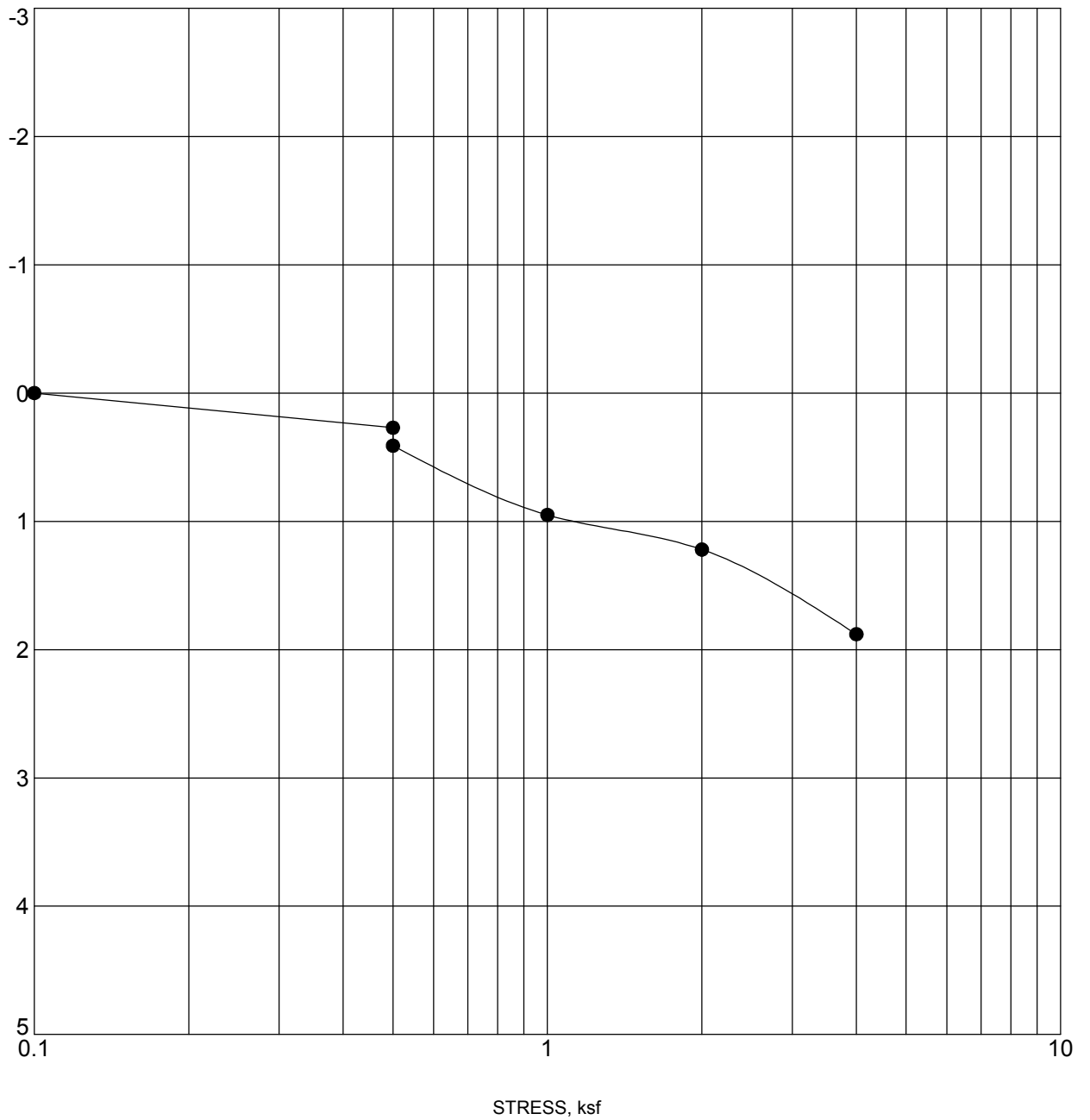
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification			Classification	γ_d	MC%
●	6	3.0	Silty Sand	111	9



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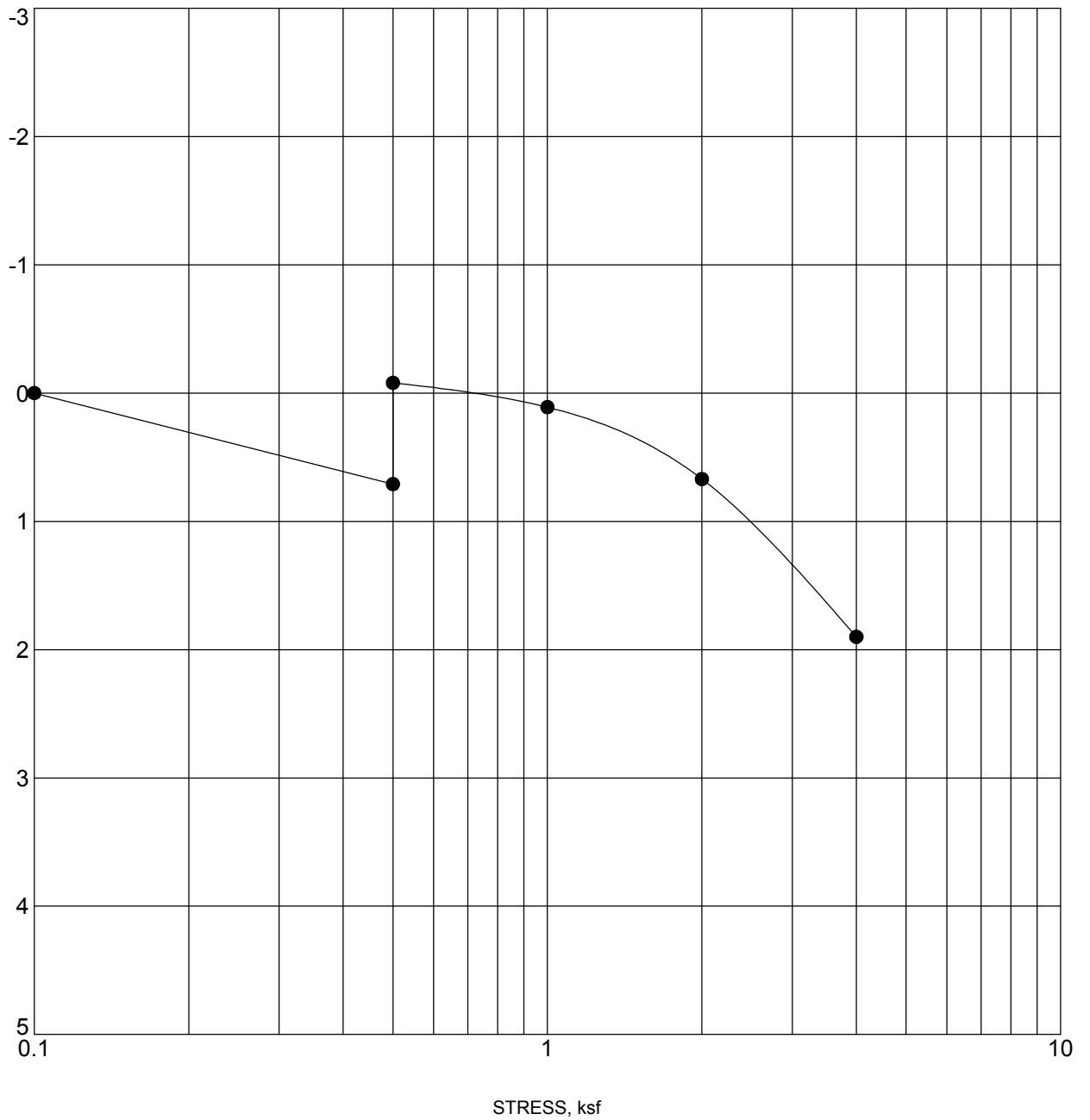
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
●	78.0	Sandy Lean Clay	104	19



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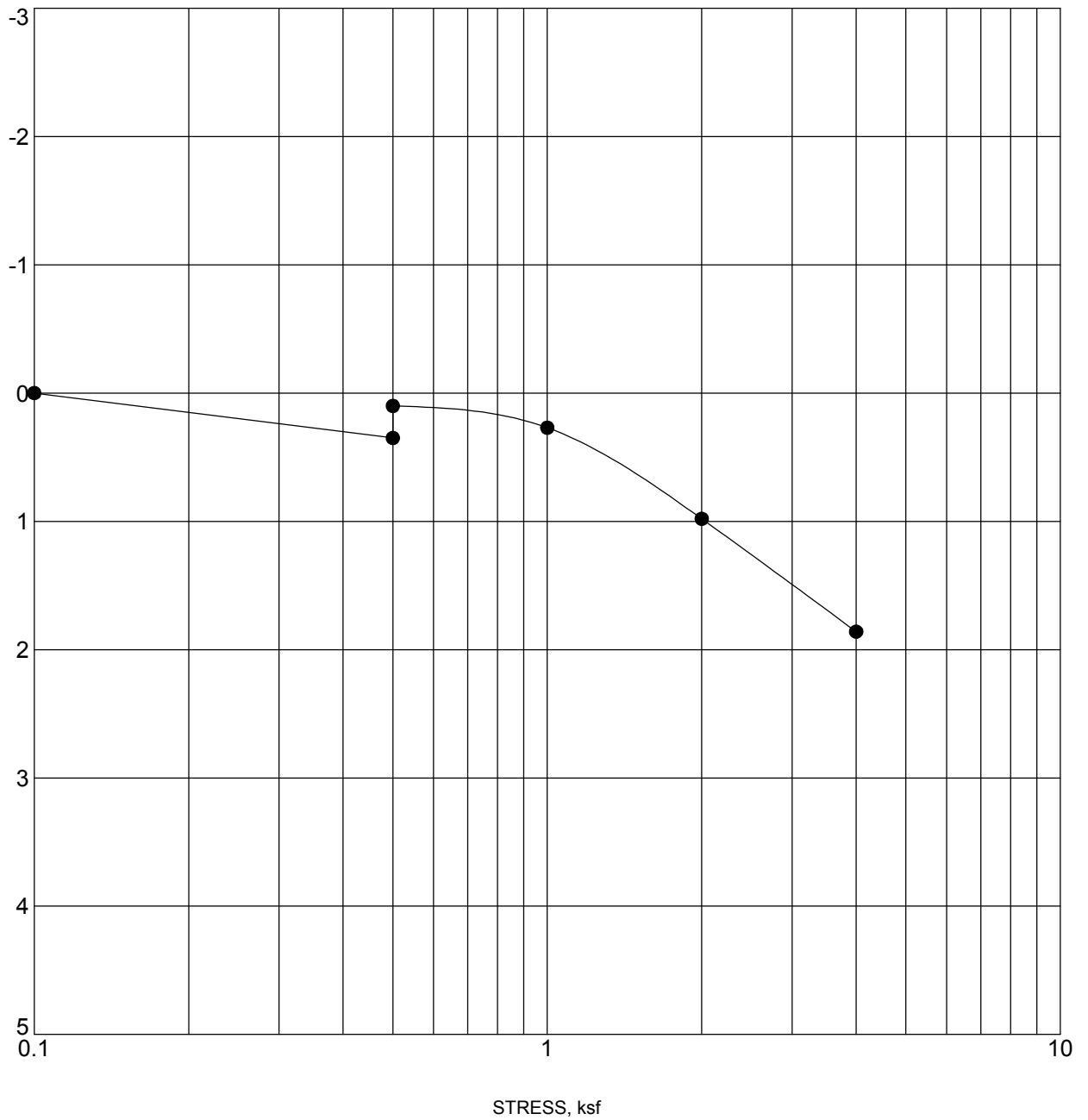
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 8	3.0	Silty Clayey Sand	109	11



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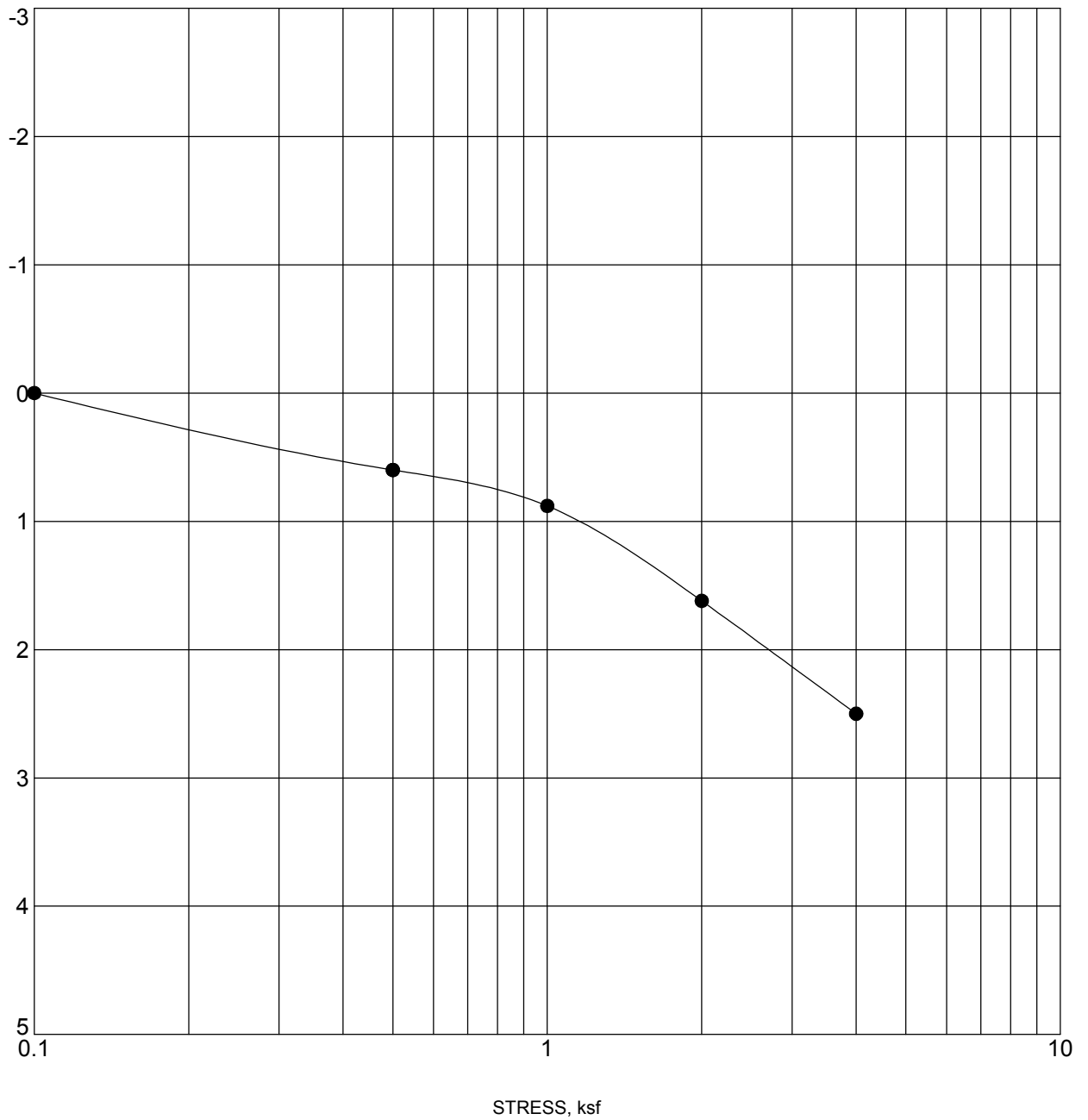
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%	
●	9	8.0	Silty Sand	102	9



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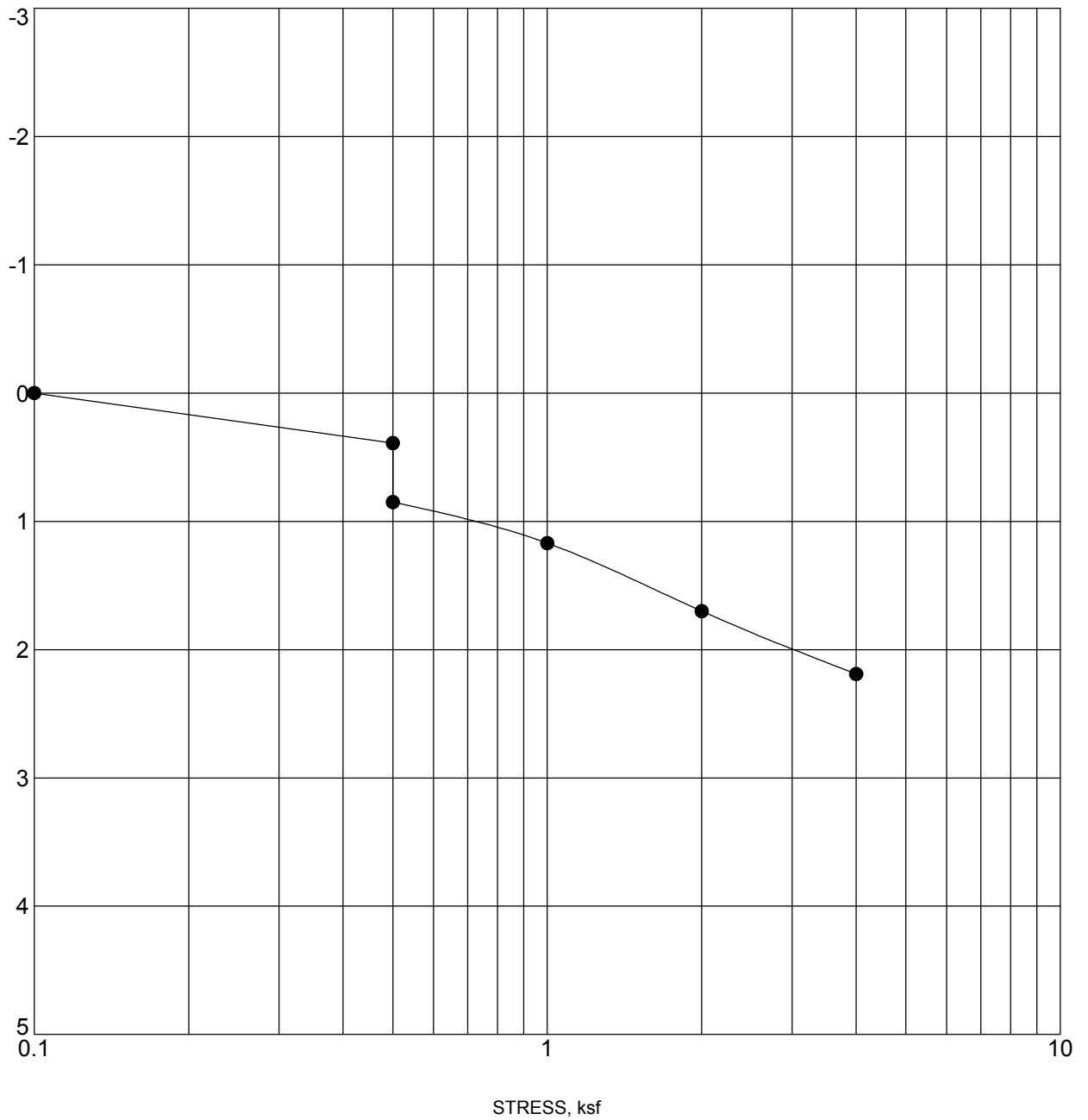
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 10	8.0	Silty Sand	103	7



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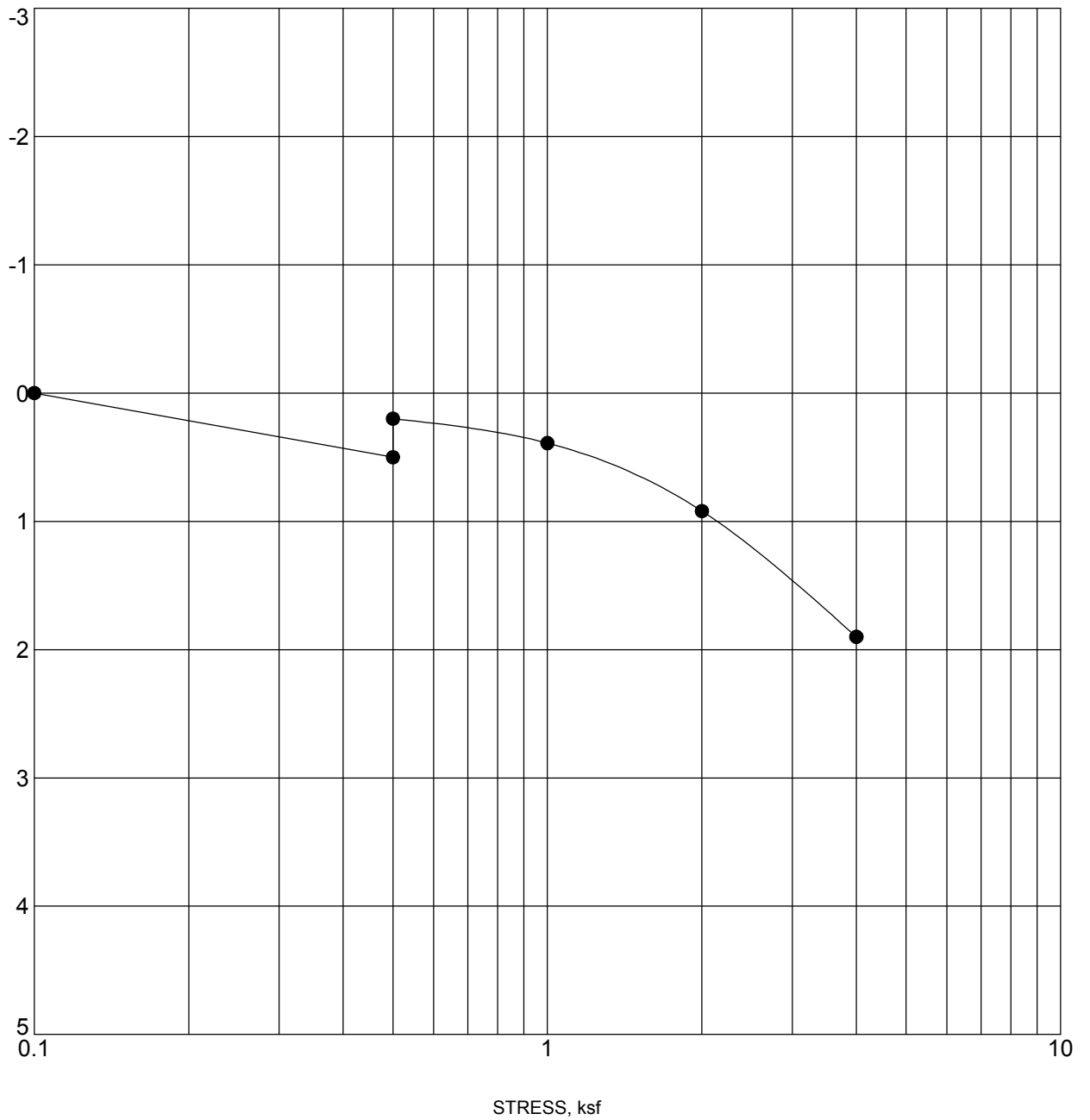
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 11	8.0	Sandy Lean Clay	98	21



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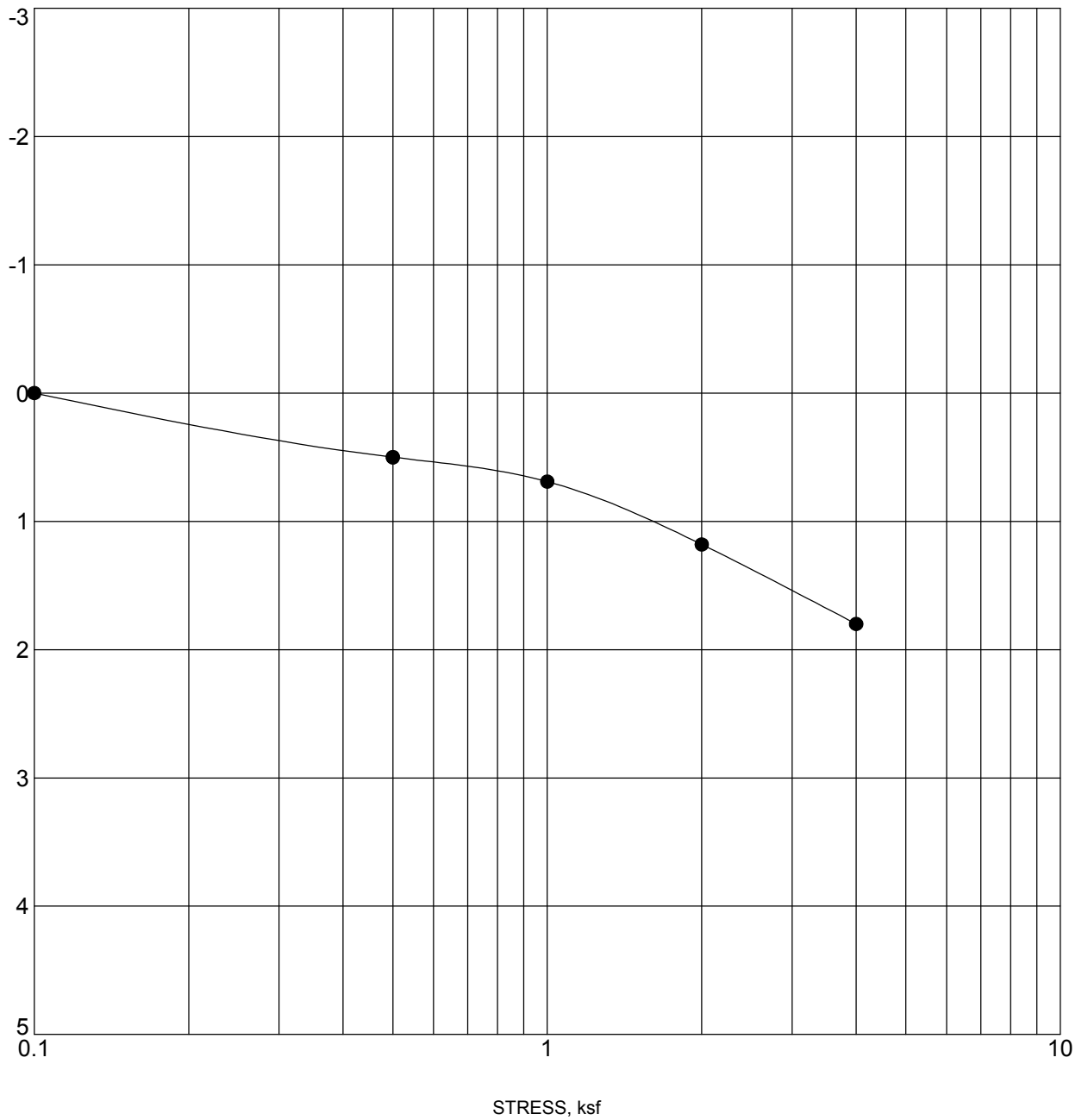
CONSOLIDATION TEST

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Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 12	3.0	Silty Clayey Sand	113	12



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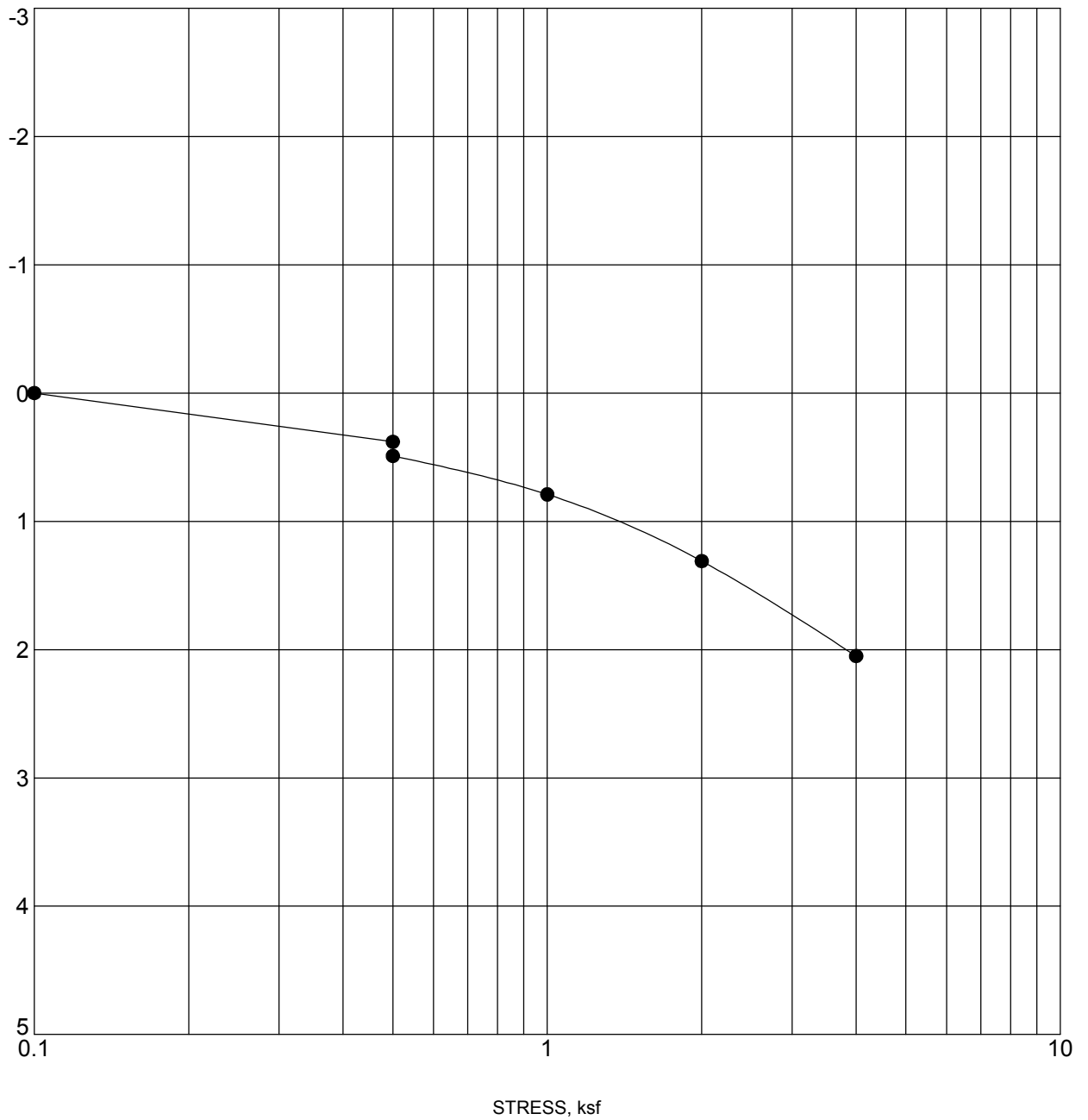
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 13	3.0	Silty Sand	109	9



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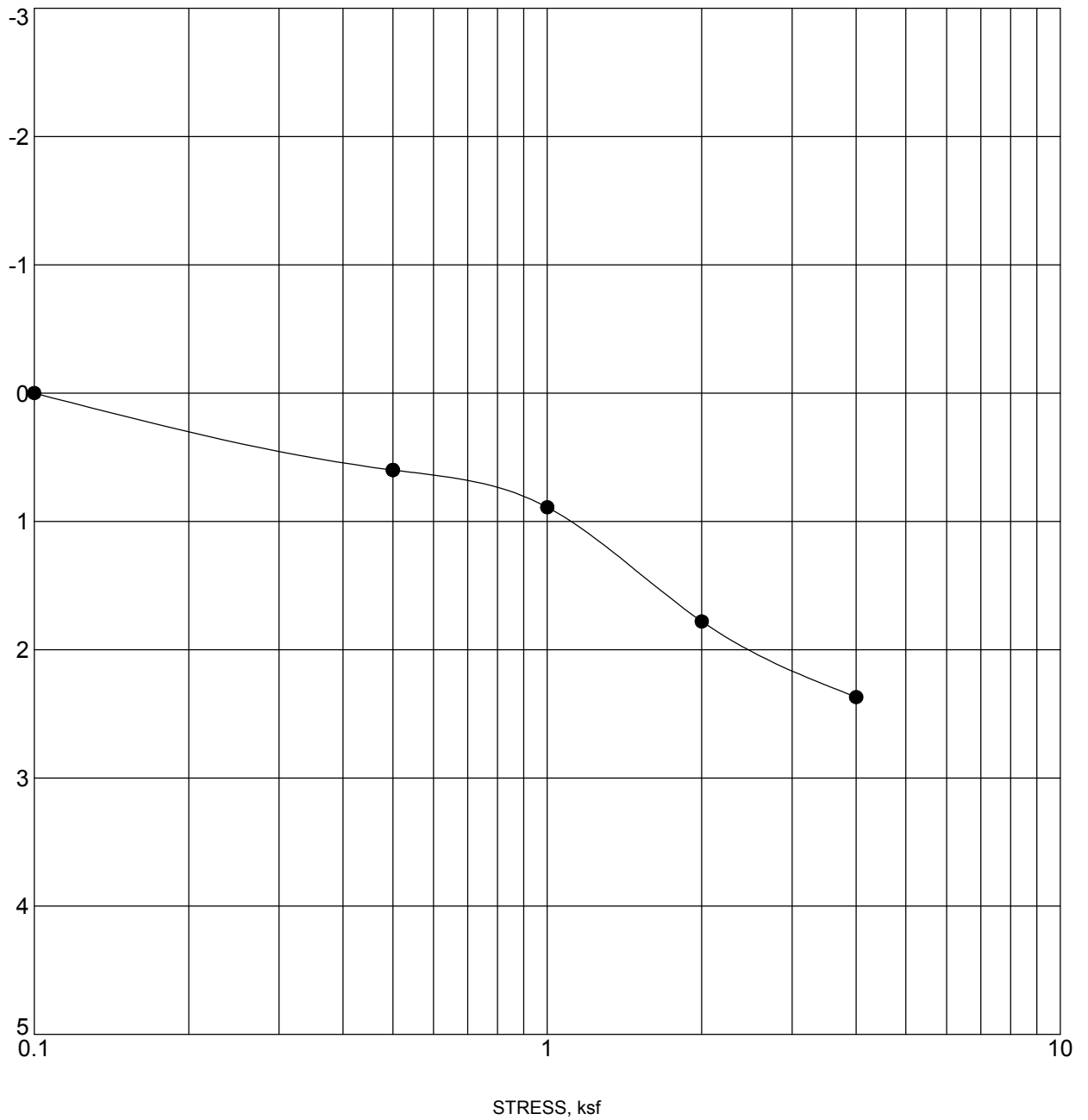
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
● 14	3.0	Silty Sand	106	7



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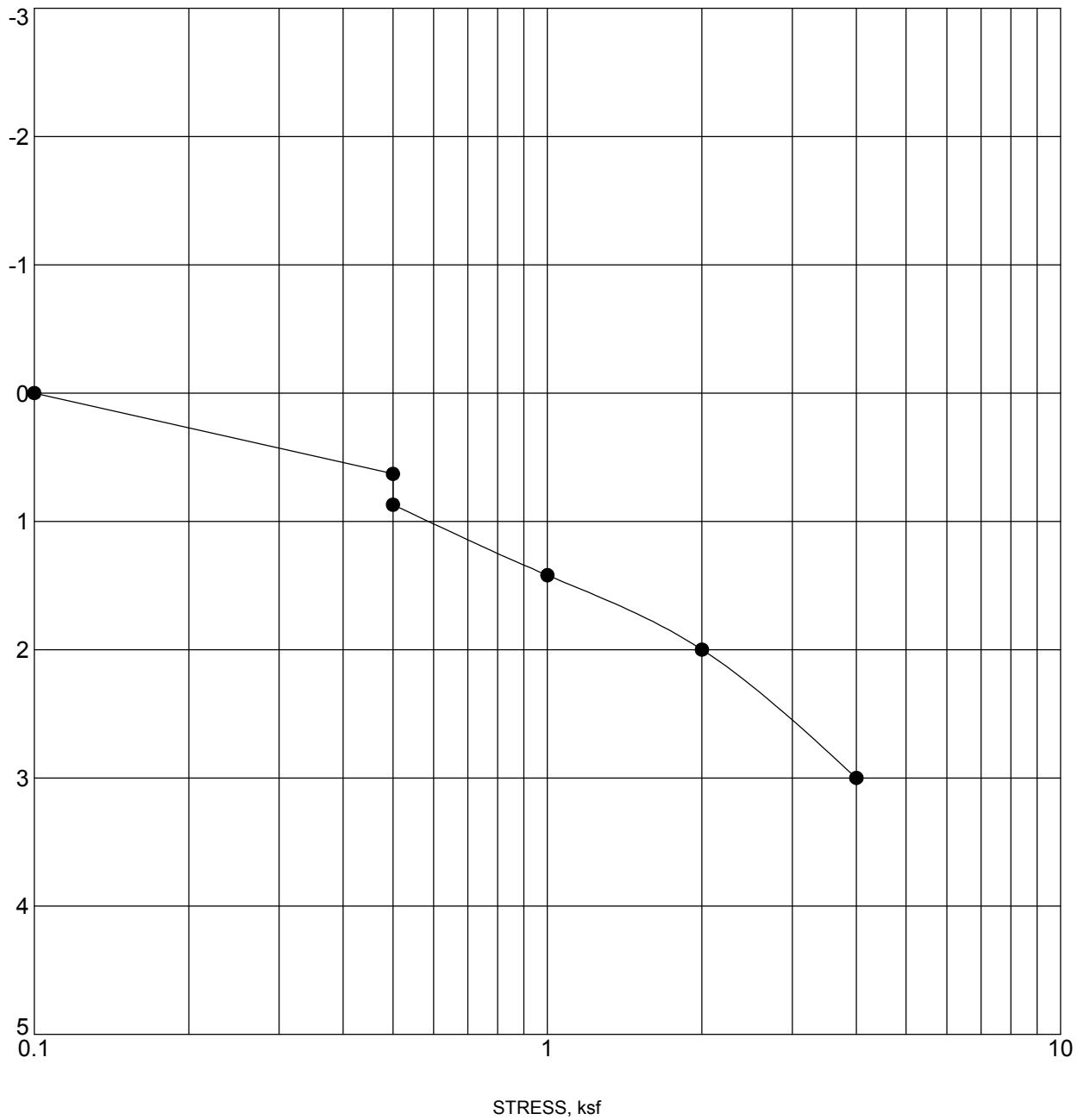
CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P

STRAIN, %



Specimen Identification		Classification	γ_d	MC%
●	15 8.0	Silty Sand	102	7



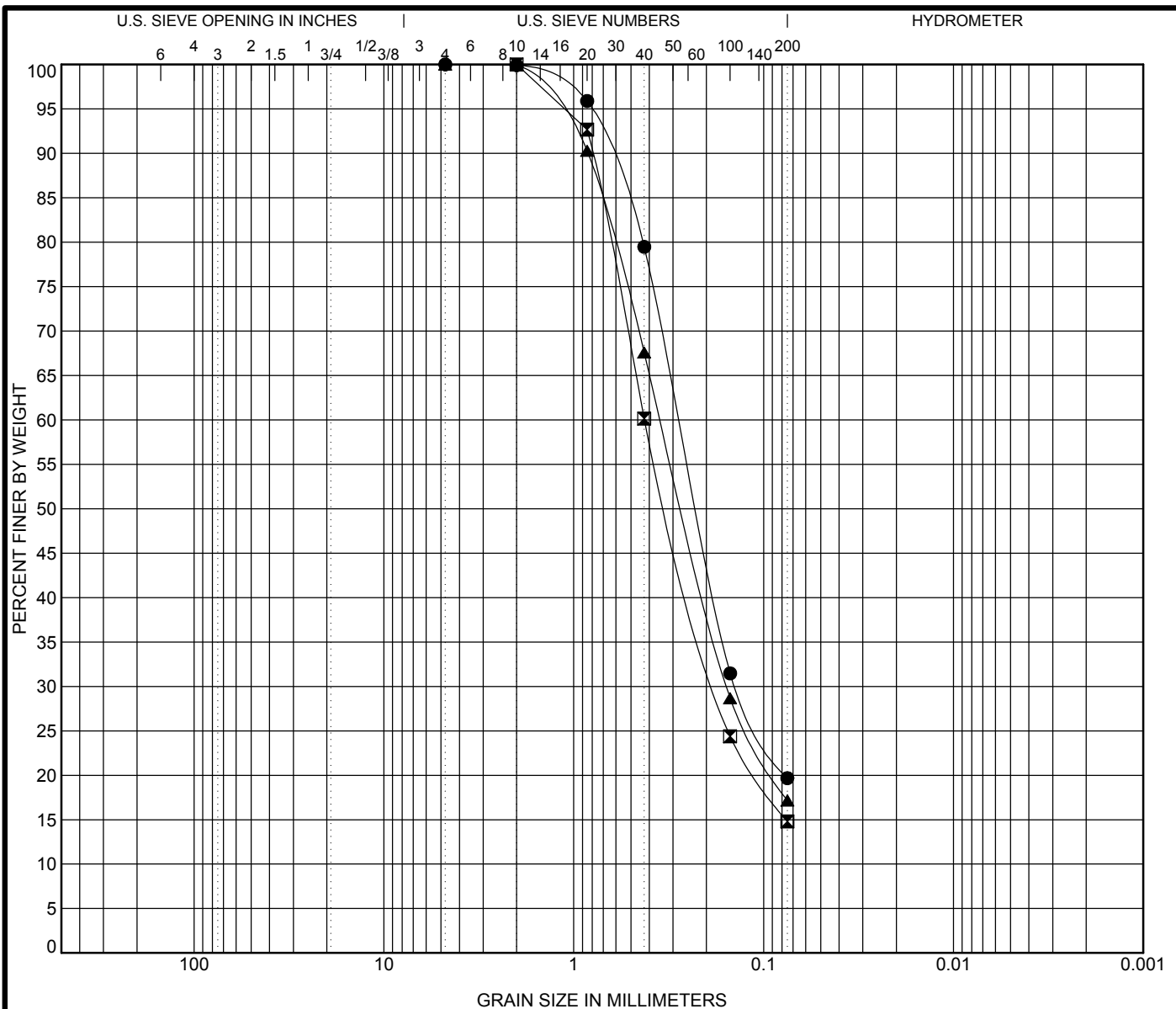
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CONSOLIDATION TEST

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	3	8.0	Silty Sand							
☒	7	14.0	Silty Sand							
▲	10	3.0	Silty Sand							
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	3	8.0	4.75	0.279	0.138		0.0	80.3	19.7	
☒	7	14.0	2	0.423	0.177		0.0	85.2	14.8	
▲	10	3.0	4.75	0.347	0.155		0.0	82.8	17.2	



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GRAIN SIZE DISTRIBUTION

Client: Town of Wiggins Number: 307-15

Project: Wiggins Residential Development

Location: Morgan County Roads 4 and P