HOLE NO. 2

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site — SHEET 1 OF 1
2. LOCATION (Coordinates or Station): 100' N 350 W [redacted] centerline
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.):
5. NAME OF DRILLER: Cooper

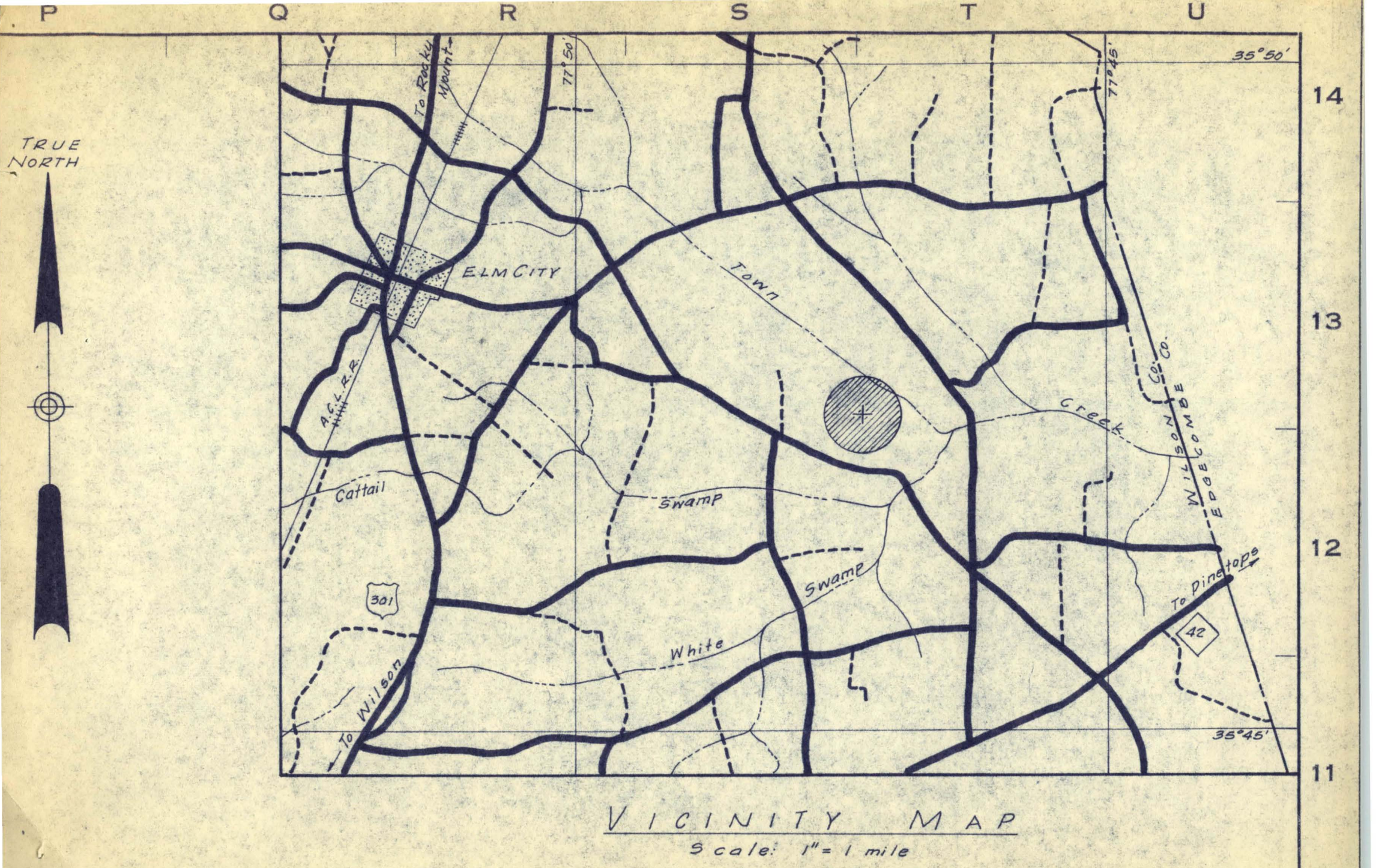
6. DIRECTION OF HOLE			7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
☒ VERTICAL	☐ INCLINED	DEGREES WITH VERTICAL	76'+	0	76.5'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS	(MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO JARS	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
22	0	22		11/9/59	11/10/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%)	19. SIGNATURE OF INSPECTOR
103±		

ELEVATION	DEPTH	LEGEND	BLOWS	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	JAR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0.0		2	Gray silty sand (SM). 25% fines.		1	Disturbed samples taken with 1½" I.D. SS sampler. Hole was cleaned out to sampling depth w/7" FT bit. Drilling mud used to keep hole open. Samples taken on 5' centers from 0.0 to depth 40' and from depth 55' to depth 76.5' and blows are shown for each sampling drive. Continuous SS sampling performed from 11/10/59 depth 40' to depth 55' and blows are shown for alternate sampling drives only. Depths at which stratum changes occur are estimated only. Soil types and symbols shown are based on visual classification using Unified Soil Classification System.
			19	Reddish tan clayey sand (SC). 25% fines.		2	
	10		11			3	
				Reddish clay (CH).			
			7	Reddish tan clayey sand (SC). 40% fines.		4	
	20		20	Tan coarse sand (SP).		5	
			4	Blue gray clay (CH).		6	
	30	CL-SP	2	Blue gray clay (CL) mixed w/poorly graded sand (SP).		7	
			9	Blue gray silty sand (SM). 30% fines.		8	
	40		7			9	Legend and Symbols: SS = Splitspoon; FT = Fishtail; Blows = No. of blows from 140 Lb. hammer falling 30" required to drive SS one foot after penetrating one-half foot into undisturbed soil; 40/0.2 = 40 blows for 0.2' penetration.
			7	Blue gray clay w/shell (CL).		10	
			10			11	
	50		10			12	
			11			13	
			17	Blue gray clayey sand (SC) w/shell. 45% fines.		14	
						15	
	60		40/0.2			16	
				Gray sand (SP) w/shell and gravel.		17	
			74/0.9			18	
						19	
	70		40/0.4			20	
				White silt (ML).		21	
			40/0.4			22	Boring terminated.
	80						



VICINITY MAP

Scale: 1" = 1 mile

Elm City Site

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site	SHEET 1 OF 12
2. LOCATION (Coordinates or Station): [redacted]	
3. DRILLING AGENCY: Mobile District (No. 29)	
4. HOLE NO. (As shown on drawing title and file No.)	5. NAME OF DRILLER: Cooper
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL	7. THICKNESS OF OVERBURDEN: 95.1'* / 8. DEPTH DRILLED INTO ROCK: 130.1' / 9. TOTAL DEPTH OF HOLE: 225.2'
10. SIZE AND TYPE OF BIT: SS; NX Diamond	11. DATUM FOR ELEVATION SHOWN: ~~XXXXX~~ MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: 314 Failing 1500	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20 / UNDISTURBED 4	14. TOTAL NO. CORE BOXES: 8 / 15. ELEV. GROUND WATER: 90.1' / 16. DATE HOLE: STARTED 11/2/59, COMPLETED 11/8/59
17. ELEV. TOP OF HOLE: 106.1'	18. TOTAL CORE RECOVERY FOR BORING (%) (Rock): 84.6 / 19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	BLOWS	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0.0						* Thickness of overburden shown as 95.1' although additional soil samples were taken at lower depths. These soil samples were taken in decomposed rock & appear on the log at the depth at which they occur.
			7			Jar 1	
U	2			Tan silty sand (SM). 15% fines.			
	4						Disturbed samples taken with 1½" I.D. SS sampler. Hole was cleaned out to sampling depth w/7" Fishtail bit. Drilling mud used to keep hole open. From depth 0.0 to depth 95.1' samples were taken on approx. 5' centers and blows are shown for each sampling drive. Depths at which stratum changes are shown are estimated only. Augered separate hole to determine ground water surface. Free water surface encountered at depth 16' on 11/2/59 and it remained at depth 16' through 11/8/59. Soil types and symbols shown are based on visual classification using Unified Soil Classification System.
	6	SC-SM	18	Tan coarse silty clayey sand (SC-SM) w/gravel. 15% fines.		2	
	8						
	10						
			11	Reddish tan clayey sand (SC) w/gravel. 45% fines.		3	
	12						
	14						Legend and Symbols: SS = Splitspoon; U = Undisturbed sample (taken w/5" or 3" piston type Shelby tube w/ inner rods); Blows = No. of blows from 140 Lb. hammer falling 30" required to drive SS one foot after penetration one-half foot into undisturbed soil; 40/0.2 = 40 blows for 0.2' penetration.
	16		12	Tan clay (CL).		4	
	18			Tan coarse clayey sand (SC) w/gravel. 25% fines.			Note: Ripping or light blasting will be required from depth 62'± to 128'±. Systematic blasting will be required below 128'±.
	20						

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site — SHEET 2 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.):
5. NAME OF DRILLER: Cooper
6. DIRECTION OF HOLE: [XX] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN: 95.1'
8. DEPTH DRILLED INTO ROCK: 130.1'
9. TOTAL DEPTH OF HOLE: 225.2'
10. SIZE AND TYPE OF BIT: SS; NX Diamond
11. DATUM FOR ELEVATION SHOWN: ~~MSL~~
12. MANUFACTURER'S DESIGNATION OF DRILL: 314 Failing 1500
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 4
14. TOTAL NO. CORE BOXES: 8
15. ELEV. GROUND WATER: 90.1'
16. DATE HOLE: STARTED 11/2/59; COMPLETED 11/3/59
17. ELEV. TOP OF HOLE: 106.1'
18. TOTAL CORE RECOVERY FOR BORING (%): (Rock) 84.6
19. SIGNATURE OF INSPECTOR:

ELEVATION	DEPTH	LEGEND	BLOWS	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	20						
				Tan clay (CH).			
			14			Jar 5	
				Tan coarse sand (SP).			
	22						
	24			Brown clay (CH).			
	26		9			6	
	28						
U		SC-H		Gray blue clayey sand (SC) w/high liquid limit. 40% fines.			
	30		4			7	
	32						
	34			Gray blue silty sand (SM). 25% fines.			
	36		9			8	
	38						
	40						

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site — SHEET 3 OF 12
2. LOCATION (Coordinates or Station): [redacted] site
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.)
5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE		7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
XX VERTICAL	INCLINED — DEGREES WITH VERTICAL	95.1'	130.1'	225.2'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS; NX Diamond	XXXXX MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
20	4	8	90.1'	11/2/59	11/8/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%)	19. SIGNATURE OF INSPECTOR
106.1'	(Rock) 84.6	

ELEVATION	DEPTH	LEGEND	BLOWS	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	40						
			8			Jar 9	
	42						
	44						
	46		9			10	
	48						
U				Gray blue clay (CH) w/shell.			
	50						
			10			11	
	52						
	54						11/3/59
	56		11			12	
	58						
	60						

ENG FORM 1836 (TRANSLUCENT) PREVIOUS EDITIONS ARE OBSOLETE PROJECT Elm City HOLE NO. 1

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site
SHEET 4 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.):
5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE		7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
XX VERTICAL	INCLINED; DEGREES WITH VERTICAL	95.1'	130.1'	225.2'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS; NX Diamond	XXXXXX MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
20	4	8	90.1'	11/2/59	11/8/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%)	19. SIGNATURE OF INSPECTOR
106.1'	(Rock) 84.6	

ELEVATION	DEPTH	LEGEND	BLOWS	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	60						
	62		60/0.7	Blue gray clayey sand (SC) w/gravel and shell. 15% fines.		Jar 13	
	64			Gray calcareous sandstone.		Box 1 Sample 14	NX Diamond bit.
	66						
	68		69/0.9	Gray silty sand (SM) w/ shell and gravel. 15% fines.		Jar 15	
	70						
	72						
	74						
U	76		69	Light gray poorly graded sand (SP).		16	
	78						
	80						

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site	SHEET 5 OF 12
2. LOCATION (Coordinates or Station): [redacted]	
3. DRILLING AGENCY: Mobile District (No. 29)	
4. HOLE NO. (As shown on drawing title and file No.)	5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE	7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
XX VERTICAL ☐ INCLINED; DEGREES WITH VERTICAL	95.1'	130.1'	225.2'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS; NX Diamond	XXXXXX MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
20	4	8	90.1'	11/2/59	11/8/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%)	19. SIGNATURE OF INSPECTOR
106.1'	(Rock) 84.6	

ELEVATION	DEPTH	LEGEND	BLOWS	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	80						
			68/0.9	Lt. gray clay (CH) w/quartz gravel.		Jar 17	
	82						
	84						
	86		74/0.9			18	
							11/4/59
	88			Gray inorganic silt (ML) w/gravel. (Decomposed sericite schist)			
	90						
			40/0.4			19	
	92						
	94						
95.1			40/0.1			20	Top of rock.
	96			Sericite schist. Crushed, broken, and decomposed to 108.2'.	41		Legend and Symbols: 40M (% Core Rec. Col.) = drill time per run in minutes. Degree of rock weathering: ||| = fresh, ||▓ = slightly weathered, |▓| = moderately weathered, ▓|| = highly weathered; / = joint or fracture; xx = highly fractured.
	98						
	100						

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site — SHEET 6 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.):
5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE			7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
[X] VERTICAL	[ ] INCLINED	DEGREES WITH VERTICAL	95.1'	130.1'	225.2'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS; NX Diamond	XXXXXXX (MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
20	4	8	90.1'	11/2/59	11/8/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%)	19. SIGNATURE OF INSPECTOR
106.1'	(Rock) 84.6	

ELEVATION	DEPTH	LEGEND	BLOWS/6"	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	100					Box 1	
	102				2		
	104				30M		
			69/0.9	Brown silt (ML) w/gravel. (Decomposed schist).		Jar 23	
	106					Box 1	
					100		
	108				35M		
				Gneiss. Continued crushed, broken, & decomposed to 124.9'.			
	110				67		
	112						
	114				0		
					25M		
	116		73/0.7	Tan silty(ML) w/gravel. (Decomposed gneiss).		Jar 27	
						Box 1	
	118				100		
	120						

ENG FORM 1836 (TRANSLUCENT) PREVIOUS EDITIONS ARE OBSOLETE PROJECT Elm City HOLE NO. 1

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site — SHEET 7 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.):
5. NAME OF DRILLER: Cooper
6. DIRECTION OF HOLE: [XX] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN: 95.1'
8. DEPTH DRILLED INTO ROCK: 130.1'
9. TOTAL DEPTH OF HOLE: 225.2'
10. SIZE AND TYPE OF BIT: SS; NX Diamond
11. DATUM FOR ELEVATION SHOWN: ~~XXXXXX~~ MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: 314 Failing 1500
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 4
14. TOTAL NO. CORE BOXES: 8
15. ELEV. GROUND WATER: 90.1'
16. DATE HOLE: STARTED 11/2/59; COMPLETED 11/8/59
17. ELEV. TOP OF HOLE: 106.1'
18. TOTAL CORE RECOVERY FOR BORING (%): (Rock) 84.6
19. SIGNATURE OF INSPECTOR:

ELEVATION	DEPTH	LEGEND	BLOWS	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	120						11/5/59
					69		
	122						
					25M		
						Box 2	
					0		
	124						
					30M		
				Gray, silty sand (SM), w/ 70% 0.6 quartz gravel. 40% fines.		Jar 30	
	126						
						Box 2	
				Chlorite schist. Crushed, broken, & decomposed to 129.1'. Contains pyrite.			
					55		
	128						
					40M		
				Biotite gneiss. Highly weathered and fractured to 133.2', but no longer decomposed.			
	130						
					90		
	132						
					45M		
				Chlorite schist.			
	134			Biotite gneiss.			Horizontal fracture @ 133.8'. Contact between chloritic & gneissic material.
				Chlorite schist.	94		
	136			Biotite gneiss.			
					75M		
				Chlorite schist.			
				Chlorite - sericite gneiss.			
	138						
				5°± joints.			
	140						

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site
SHEET 8 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.)
5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE			7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
XX VERTICAL	INCLINED	DEGREES WITH VERTICAL	95.1'	130.1'	225.2'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS; NX Diamond	~~XXXXXX~~ MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
20	4	8	90.1'	11/2/59	11/8/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%)	19. SIGNATURE OF INSPECTOR
106.1'	(Rock) 84.6	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	140		5°± joints.			
			CHLORITE - SERICITE GNEISS			
				89		
	142				Box 3	
			5°± joints.			
	144			55M		
			Horizontal fracture. Contact between chloritic & gneissic material.			
	146			96		
			5°± joint.			All fractures from 147' to 186' are moderately weathered unless noted otherwise.
	148		5°± joints.			
			30°. Contact between chloritic & gneissic.			11/6/59
	150		30° joint, w/pyrite.			
				95		
	152					
			80°			
	154		Fracture along quartz vein. Vein continues to 155.2' - highly weathered.			
			Contact between chloritic & gneissic material.	55M		
	156				Box 4	
	158					
			Contact between chloritic & gneissic material.			
	160					

ENG FORM 1928 (TRANSLUCENT) PREVIOUS EDITIONS ARE OBSOLETE PROJECT Elm City HOLE NO. 1

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site — SHEET 9 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.):
5. NAME OF DRILLER: Cooper
6. DIRECTION OF HOLE: [XX] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL:
7. THICKNESS OF OVERBURDEN: 95.1'
8. DEPTH DRILLED INTO ROCK: 130.1'
9. TOTAL DEPTH OF HOLE: 225.2'
10. SIZE AND TYPE OF BIT: SS; NX Diamond
11. DATUM FOR ELEVATION SHOWN: XXXXX MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: 314 Failing 1500
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 4
14. TOTAL NO. CORE BOXES: 8
15. ELEV. GROUND WATER: 90.1'
16. DATE HOLE: STARTED 11/2/59; COMPLETED 11/8/59
17. ELEV. TOP OF HOLE: 106.1'
18. TOTAL CORE RECOVERY FOR BORING (%): (Rock) 84.6
19. SIGNATURE OF INSPECTOR:

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	160		80° fracture. 10° joint. Highly weathered. SERICITE GNEISS			
	162		15° joint. Highly weathered.	100		
	164		5°± joints.	100M		
	166		15° joint.			
			Possibly metaconglomerate. Has feldspar metacrysts.			
			15° joint, highly weathered.	96		
	168		30° joint, highly weathered. SERICITE GNEISS			
	170		Quartz stringer @ 171.1'.			
	172		Fresh.		Box 5	
				100		
	174		15° fresh.			
	176			105M		
			Chlorite schist.			
			Fresh Fresh Biotite gneiss.			
	178		Chlorite Schist. 30° joints. 45° joints.	105		
	180					

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site — SHEET 10 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.):
5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE			7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
XX VERTICAL	INCLINED	DEGREES WITH VERTICAL	95.1'	130.1'	225.2'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS; NX Diamond	XXXXX MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
20	4	8	90.1'	11/2/59	11/8/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (%)	19. SIGNATURE OF INSPECTOR
106.1'	(Rock) 84.6	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	180		CHLORITE SCHIST			
				30M		
			30° joint. Covered w/pyrite & calcitic material.			Majority of fractures below 181' have calcitic material on fracture surfaces.
	182					
			Gneiss.			
			Chloritic schist.			
			Gneiss.	97		
	184		30° Chlorite schist.			
	186		30° Vertical. Fracture surface fresh, but completely covered with pyrite.		Box 6	
				85M		11/7/59
	188		75°.			All fractures below 187' are lightly weathered unless noted otherwise.
			GNEISS			
	190					
				99		
			Horiz. joint, w/two vertical fractures.			
	192		30°			
	194		15°			
			30°. Moderately weathered.	110M		11/8/59
	196					
			5°.	100		
	198		5°.			
			10° joint, mod. weath.			
				65M		
	200		75°			

ENG FORM 1836 (TRANSLUCENT) PREVIOUS EDITIONS ARE OBSOLETE PROJECT Elm City HOLE NO. 1

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site
SHEET 11 OF 12

2. LOCATION (Coordinates or Station): [redacted] Center of Site

3. DRILLING AGENCY: Mobile District (No. 29)

4. HOLE NO. (As shown on drawing title and file No.)

5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE: [XX] VERTICAL [ ] INCLINED; DEGREES WITH VERTICAL

7. THICKNESS OF OVERBURDEN: 95.1'

8. DEPTH DRILLED INTO ROCK: 130.1'

9. TOTAL DEPTH OF HOLE: 225.2'

10. SIZE AND TYPE OF BIT: SS; NX Diamond

11. DATUM FOR ELEVATION SHOWN: (XXXXXX MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL: 314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 4

14. TOTAL NO. CORE BOXES: 8

15. ELEV. GROUND WATER: 90.1'

16. DATE HOLE: STARTED 11/2/59; COMPLETED 11/8/59

17. ELEV. TOP OF HOLE: 106.1'

18. TOTAL CORE RECOVERY FOR BORING (%): (Rock) 84.6

19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	200		10° joint.			
			Chlorite gneiss			
			Gneiss		Box 7	
	202					
			10° joint.			
	204		Vertical fracture. Stained & lightly weathered.	100		
	206		45°.			
			10° with calcite filling.			
	208		Metaconglomerate			
			Gneiss.			
			Metaconglomerate	115M		
	210		Interstratified gneiss and metaconglomerate.			
			15°			
	212					
			10° some calcite filling.			
	214			100		
			GNEISS			
	216				Box 8	
			30° Metaconglomerate			
			Gneiss, with increased chlorite below 218.4'.			
	218		30°			
				145M		
	220					

ENG FORM 1836 (TRANSLUCENT) PREVIOUS EDITIONS ARE OBSOLETE PROJECT Elm City HOLE NO. 1

HOLE NO. 1

DEPARTMENT OF THE ARMY
DIVISION CORPS OF ENGINEERS
INSTALLATION WILMINGTON DISTRICT

DRILLING LOG

1. PROJECT: Elm City Site
SHEET 12 OF 12
2. LOCATION (Coordinates or Station): [redacted]
3. DRILLING AGENCY: Mobile District (No. 29)
4. HOLE NO. (As shown on drawing title and file No.)
5. NAME OF DRILLER: Cooper

6. DIRECTION OF HOLE			7. THICKNESS OF OVERBURDEN	8. DEPTH DRILLED INTO ROCK	9. TOTAL DEPTH OF HOLE
[XX] VERTICAL	[ ] INCLINED	DEGREES WITH VERTICAL	95.1'	130.1'	225.2'

10. SIZE AND TYPE OF BIT	11. DATUM FOR ELEVATION SHOWN	12. MANUFACTURER'S DESIGNATION OF DRILL
SS; NX Diamond	~~XXXXX~~ MSL)	314 Failing 1500

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	15. ELEV. GROUND WATER	16. DATE HOLE	
DISTURBED	UNDISTURBED			STARTED	COMPLETED
20	4	8	90.1'	11/2/59	11/8/59

17. ELEV. TOP OF HOLE	18. TOTAL CORE RECOVERY FOR BORING (% (Rock)	19. SIGNATURE OF INSPECTOR
106.1'	84.6	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	220					All fractures below 220' look fresh, as if done by drill action.
	222		Chlorite - Biotite gneiss.	100		
	224					
	225.2			80M		Boring terminated.

PETROGRAPHIC RE .T		CORPS OF .NGINEERS, U.S. ARMY SOUTH ATLANTIC DIVISION LABORATORY MARIETTA, GEORGIA	
Lab. No. 72/2566-70 72/2790-91	Date 4 December 1959		
Source Elm City, N.C.	Type NX Cores		
Project Wilmington	District Wilmington	Date Received 11/9/59 and 11/17/59	Sampled by Wilm. District Pers.

SUMMARY

Petrographic examination has been made of seven NX cores from Elm City, N.C. which are representative of lithologic changes in rock composition. The rock specimens were also examined megascopically for types of break under compressive strength tests.

The specimen from 63.1 to 63.7 feet depth is a calcareous sandstone of Miocene age. It probably grades into a coarser grained conglomerate at the unconformable contact between older Pre-Cambrian rock types located somewhere between 64 and 110 feet depth.

Underlying the more recent Miocene sedimentary rocks are older, metamorphosed, Pre-Cambrian rock types consisting of interlayered metavolcanics and metasediments. Weathering and jointing occurs near the proximity of the old erosion surface as indicated by the rock specimens from 110 to 134 feet depth. Lower strength characteristics prevail in these samples ranging in composition from fine-grained metasediment, metavolcanic, and claystone. From 134 to 208 feet depth, the rock specimens are fresh and dense metasediment and metavolcanic varieties with some exhibiting characteristics of both and are indeed probably a result of intermingling of volcanic and sediment material in Pre-Cambrian time. The rocks also increase in specific gravity, compressive strength, and basisity with depth below the 150 foot depth. The densest rock type is a greenish amphibolite occurring at 180.8 to 181.7 feet depth and probably represents a metamorphosed basalt.

Compressive strength values of the Pre-Cambrian rock specimens appear related to (a) degree of former chemical weathering and jointing, (b) angle of inclination of bedding or flow structure, and (c) degree of foliation imparted by micaceous material. In the former weathering zone, compressive strength values range from less than 890 psi to 1,300 psi. Below this zone, in fresh and dense rock, compressive strength values range 5,550 psi to 13,960 psi with greatest strength occurring in the amphibolite (180.7 to 181.7 feet).

The rock types are treated in detail in the other portion of this report and photographs and photomicrographs included as figures for graphic interpretation.

Reported by: ☐ phone ☐ wire date	Tested by: JN	Checked by: CJC

DETAILED PETROGRAPHY

1. Depth 63.1 to 63.7 feet - Calcareous Sandstone

Grey, dense, massive, calcaeous sandstone comprised of 55% detrital sand and 45% carbonate material occurs from 63.1 to 63.7 feet depth. Sand particles range in size from very fine sand to coarse sand with a mean average size of about 0.25 mm. The sand is bonded firmly by an extremely fine grained ground mass comprised of sub-microscopic carbonate and clay material. Constituent particle composition approximates the following percent distribution:

a. 55% Detrital Material - Fractional components approximate 93% quartz, 3% feldspar, 2% glauconite, and 2% heavy minerals. The heavy mineral fraction consists of 54% ilmenite, 15% staurolite, 10% pink garnet, 4% tourmaline, 4% kyanite, 4% hornblende, 4% zircon, 2% epidote, 2% magnetite, and trace amounts of xenotyme, monazite, corundum, rutile, leucoxene pyroxene, and sphene.

b. 45% Carbonate and Clay Material - Fractional components consists of 92% cryptocrystalline to microcrystalline carbonate minerals and 8% clay material.

Compressive strength value of this well indurated rock is 4,650 psi and a cone-shear rupture occurs under compressive forces. This rock type is younger in age (Miocene) than underlying pre-cambrian metavolcanics and metasediments.

2. Depth - 110.0 - 111.5 feet - Weathered Metasediment (argillaceous sandstone)

Mottled tan to greenish grey, fine grained, weathered, foliated, metasediment occurs from 110.0 to 111.5 feet depth. The rock is comprised essentially of thin quartzose and sericite-clay laminations dipping at an angle of about 45 degrees. Percentage mineral composition approximates 40% fine grained quartz, 50% sericite, 10% clay minerals, and trace amounts of volcanic glass and limonite. The limonite imparts the tan coloration to the rock and the greenish grey color is attributed to patches of montmorillonite clay. Fine grained sericite is foliated parallel to bedding; quartz grains exhibit stress as mortar structure and undulatatory extinction with lines of stress parallel to bedding. Rupture under compressive force generally parallels the bedding along a shear plane. A low compressive strength value of 890 psi is indicated.

This rock type exhibits weathering as a result of being in the weathering zone on the pre-cambrian erosion surface. The sediment comprising the rock was probably eroded from near source volcanics as evident by trace amounts of volcanic glass and montmorillonite clay. Source rock was probably rich in alkaline feldspar from which the montmorillonite was derived. Subsequent regional metamorphism of this weathered sediment resulted in the present structural character of this metasedimentary rock type.

3. Depth 129.4 to 130.0 feet - Weathered Felsite Porphyry

Mottled grey and white, jointed, flow structured, fine grained, weathered, felsite porphyry occurs from 129.4 to 130.0 feet depth. Phenocrysts of anhedral to rounded quartz and moderate to highly weathered plagioclase feldspar comprise about 10% of the rock enclosed in a matrix of fine grained crystalline groundmass composed of essentially quartz, feldspar, and minor biotite. Some of the groundmass in vicinity of joints is highly weathered. Flow structure and banding dip at about a 2 degree angle.

Joints are open slightly and dip at steep angles (60 to 80 degrees). Rupture of the rock is along a cone-shear plane and compressive strength value is 1,300 psi with the greatest weakness imparted by the joints and to a lesser degree by flow structure.

The random orientation of phenocrysts indicates that these crystals formed at depth and solidified in place in the extruded lava. Jointing permitted chemical weathering of the felsite porphyry whereby feldspars were converted to clay. During regional metamorphism pyrite (1% of rock) porphyblasts developed and groundmass minerals strained in compliance with earth forces.

4. Depth 133.2 to 133.6 feet - Claystone (Altered Volcanic Material)

Light greyish green, extremely fine grained and soft, dull lustered, rather poorly indurated claystone occurs between 133.2 to 133.6 feet depth. Constituent particles are submicroscopic but aggregate index is about 1.565 and clay staining employing benzedine suggests clay minerals of the montmorillonite group and possibly hydromica group. Upon immersion in water, minor swelling and crumbling occurs indicating an absorbent nature typical of montmorillonite clay types. X-ray examination and differential thermal analysis would be the only satisfactory means of establishing the identification of this submicroscopic material. Since the material disintegrated after soaking in water, no compressive strength values were obtained on this specimen.

This poorly indurated claystone may have originated as a hydrothermal alteration product of an aphanitic volcanic or as subsequent regional metamorphism of volcanic ash or tuff. Dark and lighter zones occur in this rock type with apparent lineation essentially horizontal.

5. Depth 153.0 to 153.6 feet - Phacoidal Metasediment

Cataclastically deformed, dark to light banded, fresh to partially altered, metasediment exhibiting phacoidal texture as ellipsoidal or lensoid units in a finer grained matrix occurs from 153.0 to 153.6 feet depth. The ellipsoidal minerals and aggregates comprise about 20% of the rock and consist of (a) fresh to highly altered plagioclase feldspar, (b) brecciated pods of fine grained volcanics, and (c) aggregates of quartzose material. Fine grained matrix material comprising the remaining 80% of the rock consists essentially of biotite-chlorite, quartz, and clay minerals. Color of the groundmass varies in relation to biotite-chlorite and quartz ratios. Lines of foliation in the micaceous material parallels banding which has a dip angle of about 30 degrees. Rupture partially parallels banding except where alteration or clay is highly concentrated. A compressive strength value of 5,550 psi is indicated for this rock specimen.

This rock type has both the characteristics of a metasediment and metavolcanic and may be a result of volcanic extrusives invading sediment. Weathered or altered feldspar may be a consequence of the sediment since the volcanic element is less altered. Subsequent metamorphism and possibly a nearby fault zone resulted in the cataclastically developed phacoidal texture.

6. Depth 180.8 to 181.7 - Amphibolite (meta-basalt)

Dark green, massive fresh and dense, fine grained amphibolite occurs from 180.8 to 181.7 feet. Locally this rock is cut by veins of quartz and small veinlets of calcite.

Army - CE - Mobile, Ala. District

Mineral composition approximates 65% green hornblende, 10% chlorite, 10% quartz, 9% feldspar, 4% epidote, 2% pyrite metacrysts, and trace amounts of calcite and minor others. The hornblende is lineated but rarely foliated with greatest lineation in zones where chlorite is developed. Rupture under compressive force is along cone-shear planes and strength value recorded is 12,400 psi. Rupture apparently follows rock cleavage.

This rock specimen probably resulted from regional metamorphism of a basalt or diabase whereby pyroxene was altered to amphibolite, plagioclase feldspar to epidote, calcite, and albite, and other ferromagnesian minerals to pyrite and chlorite. Quartz veins represent a hydrothermal injection from below into this rock.

7. Depth 208.4 to 209.5 feet - Phacoidal Metasediment

This rock type is similar in composition to the specimen occurring at 153.0 to 153.6 foot depth with the following exception or differences:

a. Except for minor alteration of feldspar phenocrysts this rock is fresh and dense.

b. Biotite ranges up to 40% mineral composition imparting a darker coloration.

c. A higher compressive strength of 13,960 psi is recorded as a result of the fresh and dense nature of the rock.

d. Higher specific gravity of 2.77 rather than 2.45 id due to lack of weathering of minerals.

The rock is highly lineated but not foliated and therefore of high strength characteristics. It has more structural features characteristic of a metavolcanic than a metasediment but probably is transitional in character. Figure 5 shows the well interlocked, fine, crystalline texture of the rock as well as strongly developed lineation.

8. Summary of Rock Specimens:

Because of the complex nature of the rock specimens involved it is necessary to consider the origin to account for rock name, texture, and to relate strength values. In general, it would appear that the pre-cambrian rocks are represented by interlayering and mixing of sediment and volcanic extrusives which have been subsequently metamorphosed and locally brecciated. That chemical weathering and jointing took place on the ancient erosion surface is indicated in previous discussion. As a result, low compressive strength values occur in this ancient zone of weathering. Local hydrothermal intrusion of quartz occurs at depth in the fresh and dense metavolcanics of increased basisity and higher specific gravity. Greater strength values of the metasediment and metasediment and metavolcanics occur with increasing depth and below the ancient zone of weathering. Above the pre-cambrian rocks a calcareous sandstone occurs which near the unconformable contact zone is probably a conglomerate. This material, laid down in Miocene time is sedimentary in nature and free from effects of regional metamorphism which occurred at an earlier age.

The compressive strength values of the pre-cambrian rocks appear related to the

degree of chemical weathering and jointing, angle of inclination of bedding or flow structure and degree of foliation imparted by micaceous minerals. Lowest compressive strength values occur in the claystone, weathered metasediment, and weathered metavolcanic between 110 and 150 feet depth. From 153 feet to 209.5 feet the strength values increase because the rock types become fresh and dense and appear to suffer less cataclastic effects.

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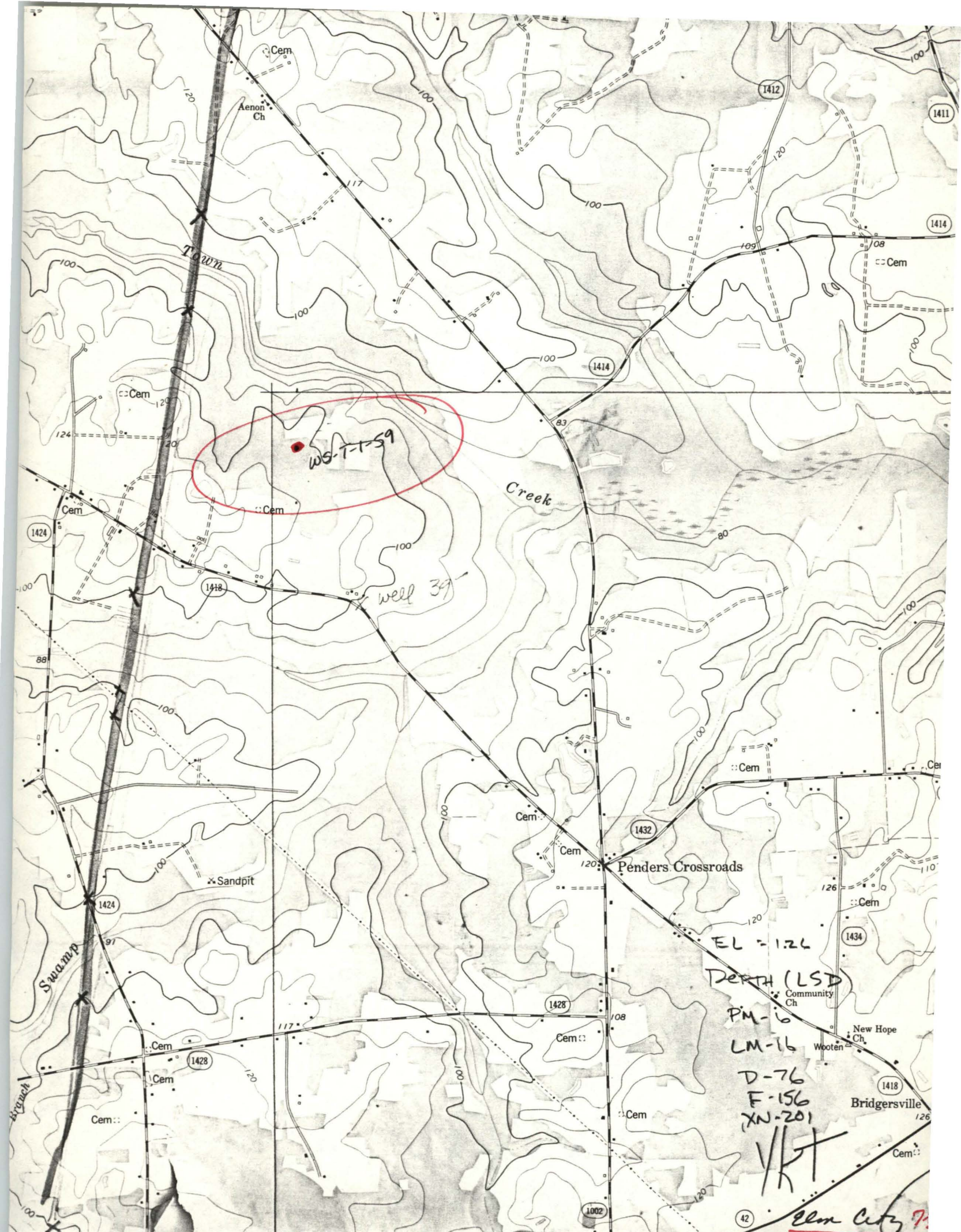
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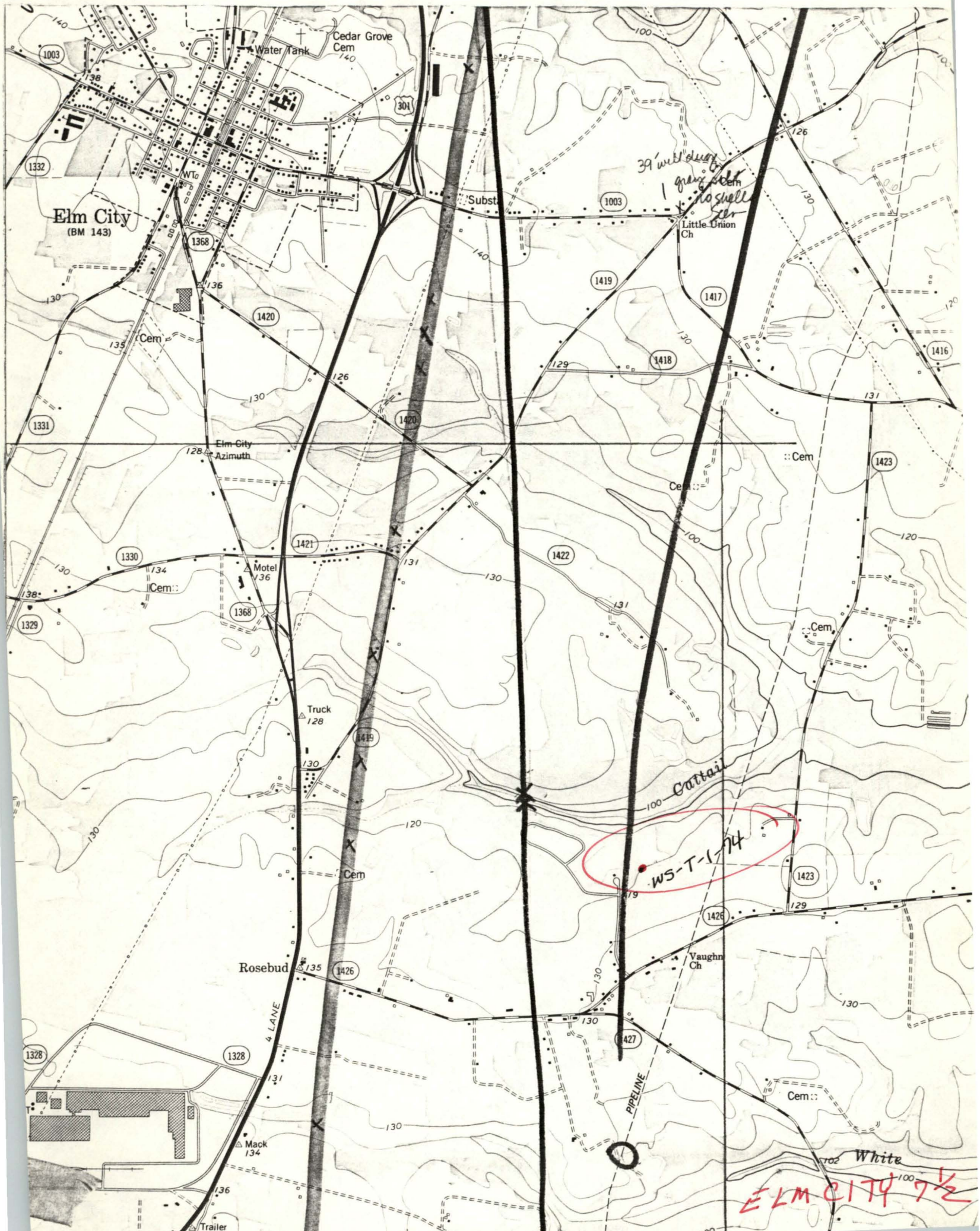
Cem
1412
1411
1414
Town
Creek
WS-T-1-59
well 37
1424
1418
Sandpit
Penders Crossroads
1432
1434
EL = 126
DEPTH (LSD)
Community Ch
PM-6
LM-16
D-76
F-156
XN-201
New Hope Ch
Wooten
Bridgersville
1428
Swamp
Branch
1002
42
Elm City


Elm City
(BM 143)
Water Tank
Cedar Grove Cem
WTo
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Little Union Ch
Cem
Elm City Azimuth
Motel
136
Truck
128
Rosebud
Vaughn Ch
4 LANE
PIPELINE
Mack
134
Trailer
White
Cattail
WS-T-1-74
39' well dug
grey clay
no shell
1003
1332
1368
1420
1419
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ELM CITY 7½