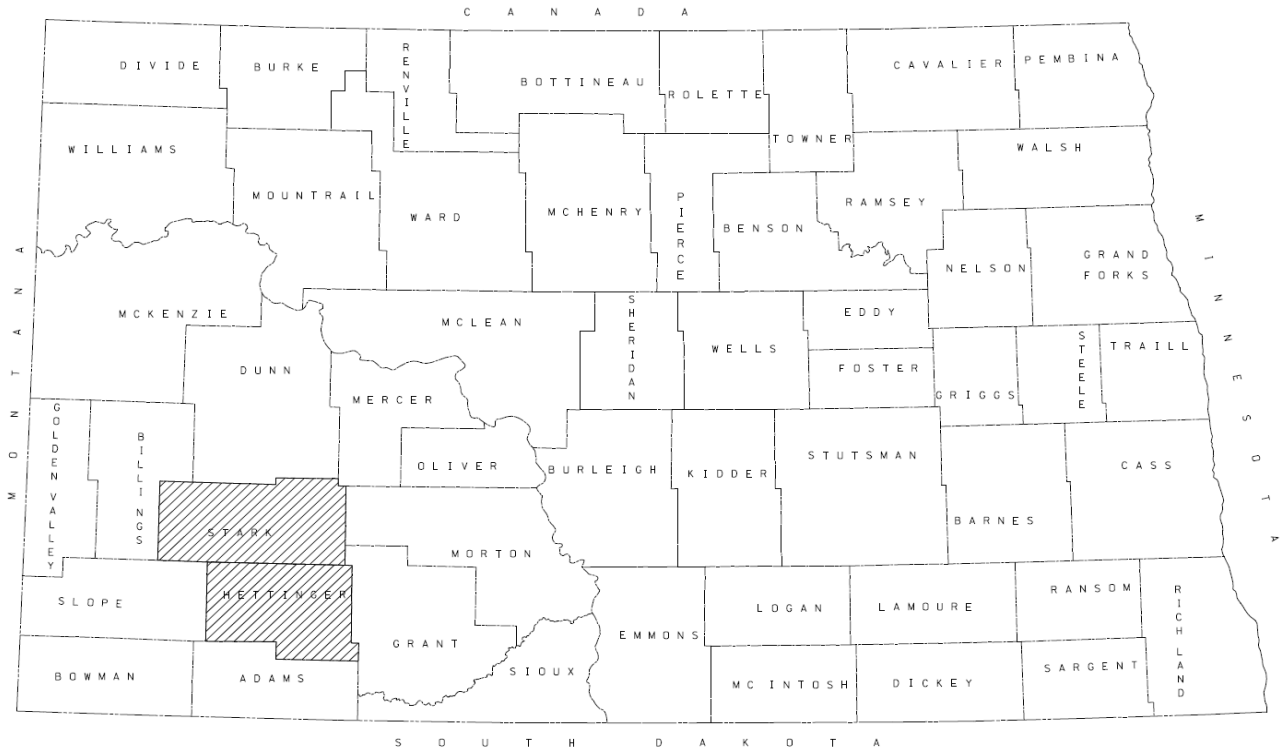
LINEAR SOILS SURVEY AND RECOMMENDATIONS

PROJECT NO. SS-5-022(132)047

PCN: 22621

COUNTY: HETTINGER-STARK

RP 47.5720 to 68.6600



PREPARED BY: Naveed Haider

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

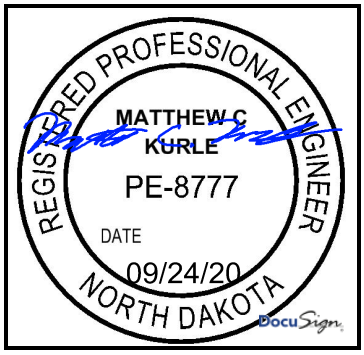
September 2020

SS-5-022(132)047

Location: N New England N to 8th St-Dickinson

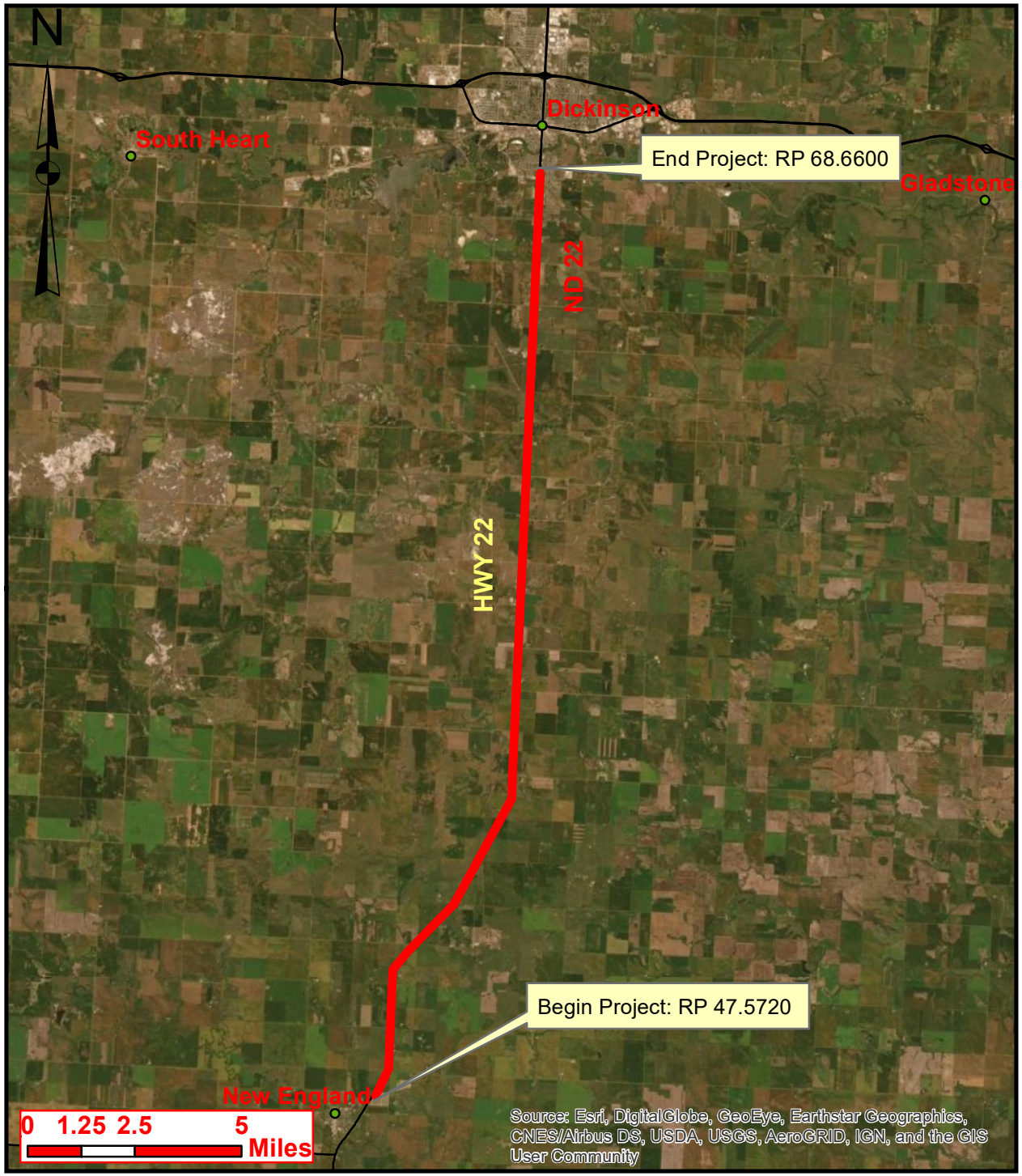
CERTIFICATION

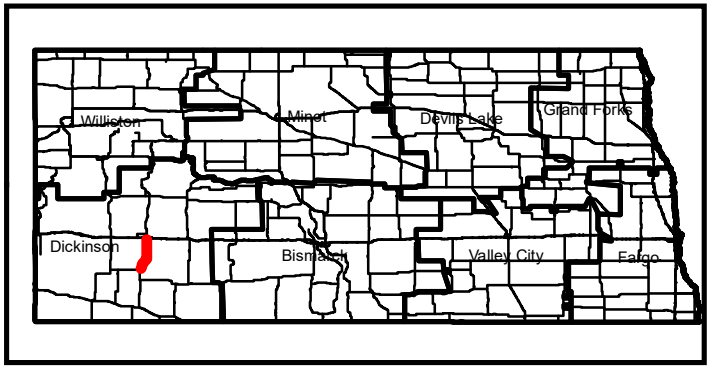
I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of North Dakota. This document was originally issued and sealed by Matthew C. Kurle, Registration number PE-8777 on 09/24/2020 and the original document is stored at the North Dakota Department of Transportation.



Project Location Map
Soil Investigation

Project: SS-5-022(132)047
PCN: 22621
Scope: Minor Rehabilitation
Location: N New England N to 8th St-Dickinson





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Introduction

PCN No: 22621
Highway: 022.047
Location: N New England N to 8th St-Dickinson
Reference Points: RP 47.5720 to 68.6600
Project Length: 21.1059 Miles
Proposed Project Scope: Minor Rehabilitation
Investigation Scope: Identified Maintenance Areas

Maintenance Review

Date of Maintenance Review: 5/19/2020
Materials and Research Person Conducting the Review: Jamie Naumann
Maintenance Person Conducting Review: Don Howie – District Transportation Service Supervisor

Table 1 – Identified Maintenance Areas

Location RP + Feet	Distress Identified	Description & Maintenance Comments	Drilling Required
47+3020 to 68+3484	Longitudinal Cracking	Depressed Cracks, LC - NWP - Last Crack seal was 2019	No
52+1700 to 52+2237	Longitudinal Cracking	Transverse cracks depressed due to pumping - Mastic Patch done in 2020 to control pumping, which has occurred in last 10 years.	Yes
53+1185	Culvert	Frost/Heave occur in every winter. - Both lanes are affected, due to winter heave.	Yes
54+0800 to 54+2100	Longitudinal Cracking	Longitudinal cracks started in wheel path. - Pavement getting weak.	Yes
56+0460 to 56+3000	Longitudinal Cracking	Non wheel path and center line problem. - Patched for last 3 years.	Yes
57+0100 to 57+0400	Longitudinal Cracking	Isolated Longitudinal cracks.	Yes
57+3300 to 57+3700	Longitudinal Cracking	Starting rut and longitudinal cracks. - Southbound right wheel path started to rut.	Yes
58+0200 to 59+0000	Longitudinal Cracking	Centerline crack distressing. Some longitudinal cracking in the wheel path. - Not constant distress in the stretch.	Yes
59+4270 to 60+2170	Bituminous Patch	Patching done on both lanes, outside of wheel path. Whole stretch has longitudinal cracking underneath (3 patch areas). - Maintenance patches were done in May 2020.	Yes
66+1255 to 67+2256	Longitudinal Cracking	Right wheel path started rutting this year. - Patched this year. Problem started this year and patched this year.	Yes
69+2800 to 69+2900 (Frontage road)	Alligator Cracking	Frontage road east of HWY 22.- Blade patched in scotch patched lot of cracking and looked like a water issue	Yes

Summary of Soil Investigation

The soil investigation was completed on 7/16/2020. The investigation consisted of 37 borings.

Table 2 – Boring Locations Summary

Boring Location	Pavement Distress	Justification for Boring	Boring Depth	Location
52+1700 to 52+2237	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 1 boring in distressed area and one boring outside the distressed area on each side, approximately 100 feet away. A total number of 3 borings.
53+1185	Frost Heave at Culvert	Minor Rehabilitation	20 feet	Conduct 1 boring in distressed area and one boring approximately 50 feet away from destressed area. A total number of 2 borings.
54+0800 to 54+2100	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
56+0460 to 56+3000	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
57+0100 to 57+0400	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
57+3300 to 57+3700	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
58+0200 to 59+0000	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 boring in distressed area and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
59+4270 to 60+2170	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
66+1255 to 67+2256	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
69+2400 to 69+3000 on east frontage road	Alligator Cracking	Minor Rehabilitation	10 feet	Conduct 4 boring equally spaced, including one within the distressed area. A total number of 4 borings.

Maps of the boring locations are shown in Appendix C. Soil analysis and lab results are included in Appendix D & E.

Summary of Soil Analysis

52+1700 to 52+2237: Three borings have been carried out at this location to a depth of 10 ft. One boring was done in the distressed area and the others were approximately 100 ft away at each end.

The soils within the distressed area are lean clay with sand (CL). This soil has a maximum dry density of approximately 125 pcf and an optimum water content of 11%. The in-place moisture content of the soil is approximate 4% over optimum.

The soils beyond the distressed area are lean clay with sand (CL). These soils have average maximum dry density of approximately 121 pcf and an average optimum water content of approximately 12.8%. The average in-place moistures of the soils are approximately 5% over optimum.

53+1185: Two borings have been carried out at this location to a depth of 20 ft. One boring was done in the distressed area and the other was 100 ft away.

The soil within the distressed area is fat clay (CH). This soil has a maximum dry density of 118 pcf and an optimum water content of 14%. The in-place moisture content of the soil is approximately 14% over optimum.

The soil beyond the distressed area is sandy lean clay (CL). This soil has maximum dry density of 121 pcf and an optimum water content of approximately 12.8%. The average in-place moistures of the soils are approximately 12% over optimum.

54+0800 to 54+2100: Four borings have been carried out at this location to a depth of 10 ft. Two borings were done in the distressed area and the others were approximately 100 ft away at each end.

The soils within the distressed area are lean clay with sand. These soils have a maximum dry density of approximately 123 pcf and an average optimum water content of 11%. The in-place moisture content of the soil is approximately 7% over optimum.

The soils beyond the distressed area are lean clay with sand (CL) and silt with sand (ML). These soils have average maximum dry density of approximately 118 pcf and an average optimum water content of approximately 14%. The average in-place moistures of the soils are approximately 6% over optimum.

56+0460 to 56+3000: Four borings have been carried out at this location to a depth of 10 ft. Two borings were done in the distressed area and the others were approximately 100 ft away at each end.

The soils within the distressed area are lean clay with sand (CL). These soils have a maximum dry density of approximately 125 pcf and an average optimum water content of 11.5%. The in-place moisture contents of the soils are approximately 5% over optimum.

The soils beyond the distressed area are lean clay with sand (CL). These soils have average maximum dry density of approximately 122 pcf and an average optimum water content of approximately 12%. The average in-place moistures of the soils are approximately 2% to 12% over optimum.

57+0100 to 57+0400: Four borings have been carried out at this location to a depth of 10 ft. Two borings were done in the distressed area and the others were approximately 100 ft away at each end.

The soils within the distressed area are lean clay with sand (CL) and fat clay. These soils have a maximum dry density of approximately 117.5 pcf and an optimum water content of 13.5%. The in-place moisture content of the soils is approximately 10% over optimum.

The soils beyond the distressed area are fat clay (CH) and lean clay (CL). These soils have average maximum dry density of approximately 115.5 pcf and an optimum water content of approximately 14%. The average in-place moistures of the soil are approximately 7% over optimum.

57+3300 to 57+3700: Four borings have been carried out at this location to a depth of 10 ft. Two borings were done in the distressed area and the others were approximately 100 ft away at each end.

The soils within the distressed area are lean clay with sand (CL). These soils have a maximum dry density of approximately 125 pcf and an average optimum water content of 10%. The in-place moisture contents of the soils are approximately 7% over optimum.

The soils beyond the distressed area are lean clay (CL) and clayey sand (SC). These soils have average maximum dry density of approximately 125 pcf and an average optimum water content of approximately 10.5%. The average in-place moistures of the soil are approximately 5% over optimum.

58+0200 to 59+0000: Four borings have been carried out at this location to a depth of 10 ft. Two borings were done in the distressed area and the others were approximately 100 ft away at each end.

The soils within the distressed area are lean clay with sand (CL) and clayey sand (SC). These soils have a maximum dry density of approximately 126 pcf and an average optimum water content of 10.6%. The in-place moisture contents of the soils are approximately 4% to 10% over optimum.

The soils beyond the distressed area are lean clay (CL) and clayey sand (SC). These soils have average maximum dry density of approximately 128 pcf and an average optimum water content of approximately 10%. The average in-place moistures of the soil are approximately 1% to 7%% over optimum.

59+4270 to 60+2170: Four borings have been carried out at this location to a depth of 10 ft. Two borings were done in the distressed area and the others were approximately 100 ft away at each end.

The soils within the distressed area are lean clay with sand (CL). These soils have a maximum dry density of approximately 125 pcf and an average optimum water content of 11.5%. The in-place moisture contents of the soils are approximately 4% to 12%over optimum.

The soils beyond the distressed area are fat clay (CH) and lean clay with sand (CL). These soils have average maximum dry density of approximately 125 pcf and an average optimum water content of approximately 11%. The average in-place moistures of the soil are approximately 17% to10% over optimum.

66+1255 to 67+2256: Three borings have been carried out at this location to a depth of 10 ft. Two boring were done in the distressed area and the other was approximately 100 ft away.

The soils within the distressed area are lean clay with sand (CL) and fat clay (CH). These soils have a maximum dry density of approximately 125 pcf and an optimum water content of 10.5%. The in-place moisture contents of the soil are approximately 3% to 7% over optimum.

The soil beyond the distressed area is lean clay with sand (CL). This soil has maximum dry density of 125 pcf and an optimum water content of 11%. The average in-place moistures of the soils are approximately 9% over optimum.

69+2400 to 69+3000 (on east frontage road): Four borings have been carried out at this location to a depth of 10 ft. Three borings were done in the distressed area and one was approximately 100 ft away at each end.

The soils within the distressed area are sand with silt and gravel (SW-SM) and clayey sand (SC). These soils have a maximum dry density of approximately 127 pcf and an average optimum water content of 10.5%. The in-place moisture contents of the soils are approximately 2% to 11%% over optimum.

The soil beyond the distressed area is silty, clayey sand (SC-SM). This soil has maximum dry density of approximately 126 pcf and an optimum water content of approximately 9.2%. The average in-place moistures of the soil are approximately 8% over optimum.

Free water has been encountered in the bore holes at the approx. depth of three feet.

Soil Sample Distribution

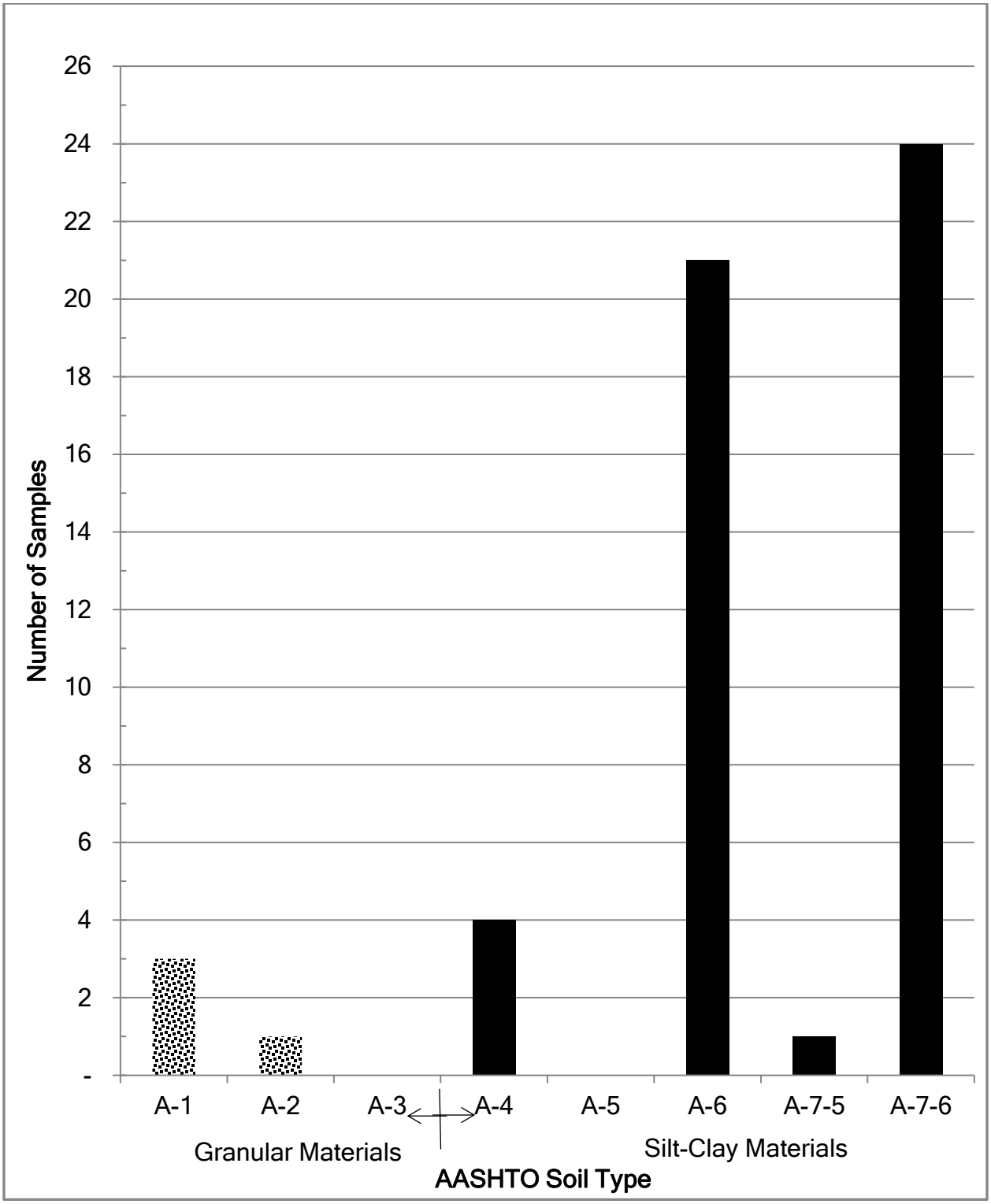


Figure 1 - Soil Sample Distribution

Design Recommendations

52+1700 to 52+2237: The soils encountered within the distress area and outside of the distress area are similar. The distress at this location is not indicative of a subgrade related distress, so the distress is not related to seasonal movement. Subgrade work is not recommended at this location.

53+1185: The soils encountered within the distress area and outside of the distress area are similar. The seasonal movement that is occurring at this location could be remedied by replacing the culvert with an alternative backfill design. Pipe replacement is not currently within the scope of this project.

54+0800 to 54+2100: The soils encountered within the distress area and outside of the distress area are similar. The distress at this location is not indicative of a subgrade related distress.

56+0460 to 56+3000: The soils encountered within the distress area and outside of the distress area are similar. The distress at this location is not indicative of a subgrade related distress, so the distress is not related to seasonal movement. Subgrade work is not recommended at this location.

57+0100 to 57+0400: The soils encountered within the distress area and outside of the distress area are similar. The distress at this location is not indicative of a subgrade related distress. Subgrade work is not recommended at this location.

57+3300 to 57+3700: The soils encountered within the distress area and outside of the distress area are similar. The distress at this location is not indicative of a subgrade related distress. Subgrade work is not recommended at this location.

58+0200 to 59+0000: The soils encountered within the distress area and outside of the distress area are similar. The distress at this location is not indicative of a subgrade related distress. Subgrade work is not recommended at this location.

59+4270 to 60+2170: The soils encountered within the distress area and outside of the distress area are similar. The distress at this location is not indicative of a subgrade related distress. Subgrade work is not recommended at this location.

66+1255 to 67+2256: The soils encountered within the distress area and outside of the distress area are not indicative of a subgrade related distress. The distress at this location is not indicative of a subgrade related distress. Subgrade work is not recommended at this location.

69+2400 to 69+3000 (on east frontage road): During investigation, free water was found to be flowing into the bore holes at approx. depth of 3 feet. The water in the subgrade is a probable cause of pavement distress in this area. Scoping document states, not to perform work in this area. Therefore, we do not recommend any subgrade work.

Design Information

Pipe Replacement: Pipe replacements on this project may require a non-standard pipe backfill detail. Contact the Materials and Research Geotechnical Section prior to the PS&E if any pipes are being installed or replaced on this project. Please include any pertinent information such as location, size, depth to inlet, etc.

Compaction Method: T-180

Subgrade Prep: None

Subcut Recommendations: None

Drainage: None

Plan Notes: None

The recommendations in this report are based on the scope specified in the Introduction. If the scope of work, vertical profile or horizontal alignment is changed, in either the conceptual phase or the design phase, the Geotechnical Engineer must be notified as soon as possible to ensure that there is adequate geotechnical information addressing these areas.

APPENDIX A

SOIL CLASSIFICATION

AASHTO Classification System

Table 5.1. AASHTO Classification System

General Classification	*Granular materials (35% or less passing No. 200 Sieve (0.075 mm)*							*Silt-clay Materials More than 35% passing No. 200 Sieve (0.075 mm)*			
Group Classification	*A—1*		*A—3*	*A—2*				*A—4*	*A—5*	*A—6*	*A—7*
	A—1—a	*A—1—b*		*A—2—4*	*A—2—5*	*A—2—6*	*A—2—7*				*A—7—5 A—7—6*
(*a*) Sieve Analysis: Percent Passing											
(*i*) 2.00 mm (No. 10)	50 max										
(*ii*) 0.425 mm (No. 40)	30 max	50 max	51 min								
(*iii*) 0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
(*b*) Characteristics of fraction passing 0.425 mm (No. 40)											
(*i*) Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
(*ii*) Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min*
(*c*) Usual types of significant Constituent materials	Stone Fragments Gravel and sand		Fine Sand	Silty or Clayey Gravel Sand				Silty Soils		Clayey Soils	
(*d*) General rating as subgrade.	Excellent to Good							Fair to Poor			

* If plasticity index is equal to or less than (liquid Limit—30), the soil is A—7—5 (*i.e.* PL > 30%)
If plasticity index is greater than (Liquid Limit—30), the soil is A—7—6 (*i.e.* PL < 30%)

Unified Soil Classification System, USCS

Table 5.2 Unified Soil Classification System (Based on Material Passing 76.2-mm Sieve)

Criteria for assigning group symbols				Group symbol
Coarse-grained soils More than 50% of retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[a]	$C_u \geq 4$ and $1 \leq C_c \leq 3$[c]	GW
			$C_u < 4$ and/or $1 > C_c > 3$[c]	GP
		Gravels with Fines More than 12% fines[a,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	GM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	GC
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[b]	$C_u \geq 6$ and $1 \leq C_c \leq 3$[c]	SW
			$C_u < 6$ and/or $1 > C_c > 3$[c]	SP
		Sands with Fines More than 12% fines[b,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	SM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	SC
Fine-grained soils 50% or more passes No. 200 sieve	Silts and clays Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line (Figure 5.3)[e]	CL
			$PI < 4$ or plots below "A" line (Figure 5.3)[e]	ML
		Organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$; see Figure 5.3; OL zone	OL
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line (Figure 5.3)	CH
			PI plots below "A" line (Figure 5.3)	MH
		Organic	$\frac{\text{Liquid limit — oven dried}}{\text{Liquid limit — not dried}} < 0.75$; see Figure 5.3; OH zone	OH
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor			Pt

[a] Gravels with 5 to 12% fine require dual symbols: GW-GM, GW-GC, GP-GM, GP-GC.

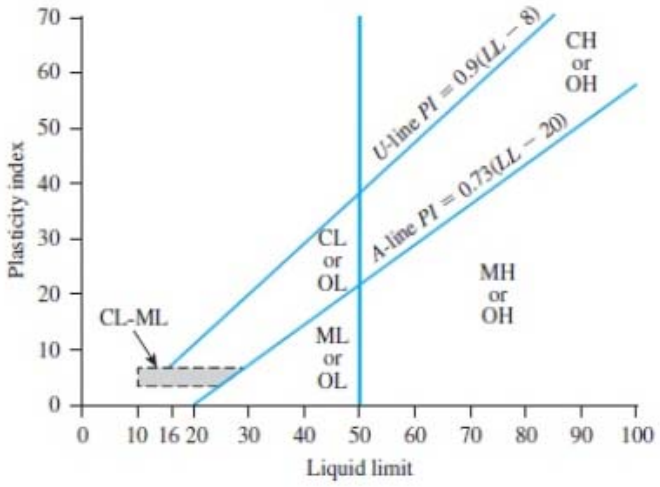
[b] Sands with 5 to 12% fines require dual symbols: SW-SM, SW-SC, SP-SM, SP-SC.

[c] $C_u = \frac{D_{60}}{D_{10}}$; $C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}}$

[d] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol GC-GM or SC-SM.

[e] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol CL-ML.

Plasticity Chart :



APPENDIX B

MAINTENANCE REVIEW AND SUBSURFACE INVESTIGATION SCOPE

LINEAR SOILS SURVEY FIELD INVESTIGATION SCOPE

TO:	**File**
FROM:	**Naveed Haider – Materials and Research (Geotechnical)**
DATE:	**06/15/2020**
HIGHWAY:	**022.047**
PROJECT NUMBER:	**SS-SU-5-022(132)047**
PCN:	**22621**
LOCATION:	**N New England N to 8th St-Dickinson**
IMPROVEMENT SCOPE:	**Minor Rehabilitation**
SUBJECT:	**Linear Soils Survey Subsurface Investigation Scope**

We have completed the Maintenance Review of the roadway (attached to this memo). The linear soils survey field investigation scope is based on the improvement strategy for the roadway as per Chapter 7 of the NDDOT Design Manual.

Improvement Strategy: Minor Rehabilitation
Investigation Scope: Identified Areas

The following table shows the proposed subsurface investigation scope.

Boring Location	Pavement Distress	Justification for Boring	Boring Depth	Location
52+1700 to 52+2237	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 1 boring in distressed area and one boring outside the distressed area on each side, approximately 100 feet away. A total number of 3 borings.
53+1185	Frost Heave at Culvert	Minor Rehabilitation	20 feet	Conduct 1 boring in distressed area and one boring approximately 50 feet away from destressed area. A total number of 2 borings.
54+0800 to 54+2100	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
56+0460 to 56+3000	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
57+0100 to 57+0400	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
57+3300 to 57+3700	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
58+0200 to 59+0000	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 boring in distressed area and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
59+4270 to 60+2170	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.
66+1255 to 67+2256	Longitudinal Cracks	Minor Rehabilitation	10 feet	Conduct 2 borings in the destressed area (equally spaced) and 1 boring outside the distressed area on each side, approximately 100 feet away. A total number of 4 borings.

69+2400 to 69+3000 on east frontage road	Alligator Cracking	Minor Rehabilitation	10 feet	Conduct 4 boring equally spaced, including one within the distressed area. A total number of 4 borings.

The following are the associated tasks and dates for the completion of the Linear Soils Survey and Recommendations for this project.

Task	Completion (***Anticipated***) Date
Maintenance Review with District Maintenance Forces	5/19/2020
Linear Soils Survey Field Work Complete	*6/15/2020*
Linear Soils Survey Lab Work	*7/15/2020*
Linear Soils Survey Report	*09/1/2020**
*Milestone Task	

PAVEMENT EVALUATION LOG FOR LINEAR SOIL SURVEY

North Dakota Department of Transportation, Materials & Research

SFN 60472 (6-2017)

Project Number	PCN	Date of Survey
SS-SU-5-022(132)047	22621	05/19/2020

Section Maintenance Contact	Completed By
Don Howie	Jamie Naumann

Highway Reference Points	Surface Types
47+3020 to 68+3484	Asphalt

Location	Pavement Distress	Description	Maintenance Comment	Picture Number	Drilling Required
47+3020 to 68+3484	Longitude Cracks	Depressed Cracks, LC - NWP	Last Crack seal was 2019		No
52+1700 to 52+2237	Longitude Cracks	Transverse cracks depresed due to pumping	Mastic Patch done in 2020 to control pumping, which has ocuring in last 10 years.	1,2	Yes
53+1185	Culvert	Frost/Heave occur in every winter.	Both lanes are effected, due to winter heave.	N/A	Yes
54+0800 to 54+2100	Longitude Cracks	Longitudinal cracks started in wheel path.	Pavement getting weak.	3,4,5	Yes
56+0460 to 56+3000	Longitude Cracks	Non wheel path and center line problem.	Patched for last 3 years.	6-9	Yes
57+0100 to 57+0400	Longitude Cracks	Longitudinal cracks	Isolated traverse cracks	10,11	Yes
57+3300 to 57+3700	Longitude Cracks	Starting rut and longitudinal cracks.	Southbound right wheel path started to rut.	12,13	Yes
58+0200 to 59+0000	Longitude Cracks	Centerline crack distressing . Some longitudinal cracking in the wheel path.	Not constant distress in the stretch.	14-16	Yes
59+4270 to 60+2170	Bituminous Patch	Patching done on both lane, outside of wheel path. Whole stretch has longitudinal cracking underneath. 3 patch areas.	Maintenance patches were done in May 2020.		Yes

Comments

Longitudinal crack has been seen across the stretch. Transverse crack may have occurred due to underneath cracks.

PAVEMENT EVALUATION LOG FOR LINEAR SOIL SURVEY

North Dakota Department of Transportation, Materials & Research

SFN 60472 (6-2017)

Sheet 2 of 2

Project Number	PCN	Date of Survey
SS-SU-5-022(132)047	22621	05/19/2020

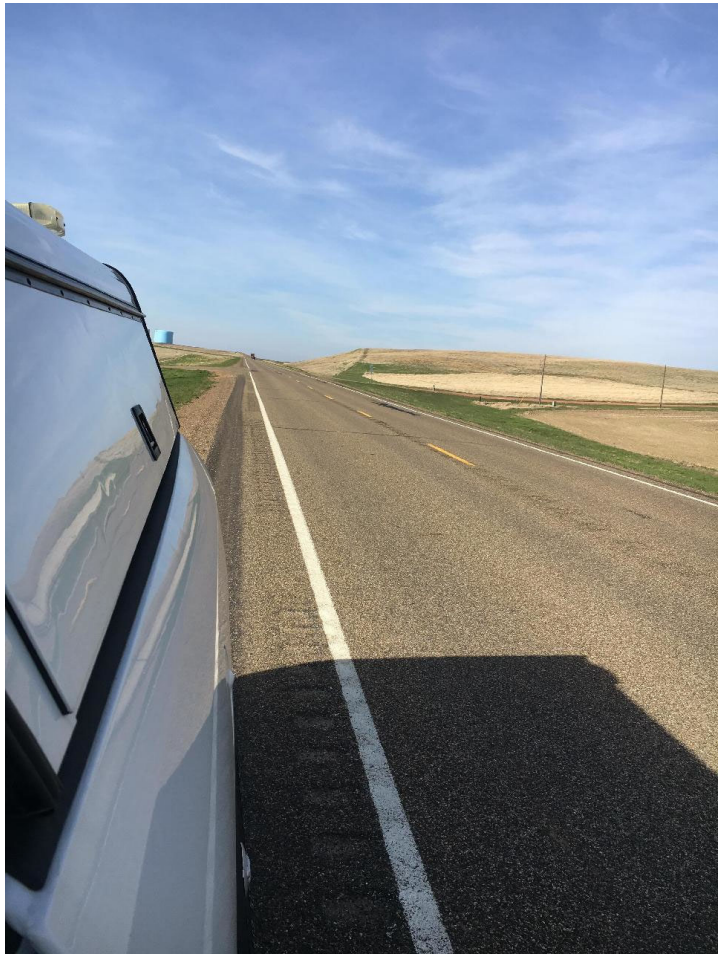
Section Maintenance Contact	Completed By
Don Howie	Jamie Naumann

Highway Reference Points	Surface Types
47+3020 to 68+3484	Asphalt

Location	Pavement Distress	Description	Maintenance Comment	Picture Number	Drilling Required
66+1255 to 67+2256	Longitude Cracks	Right wheel path started rutting this year.	Patched this year	17-19	Yes
69+2800 to 69+2900 (Frontage road)	Alligator Cracking	Frontage road east of HWY 22.	Blade patched in scotch patched lot of cracking and looked like a water issues	20	Yes

Comments

1
52+1700 to 52+2237

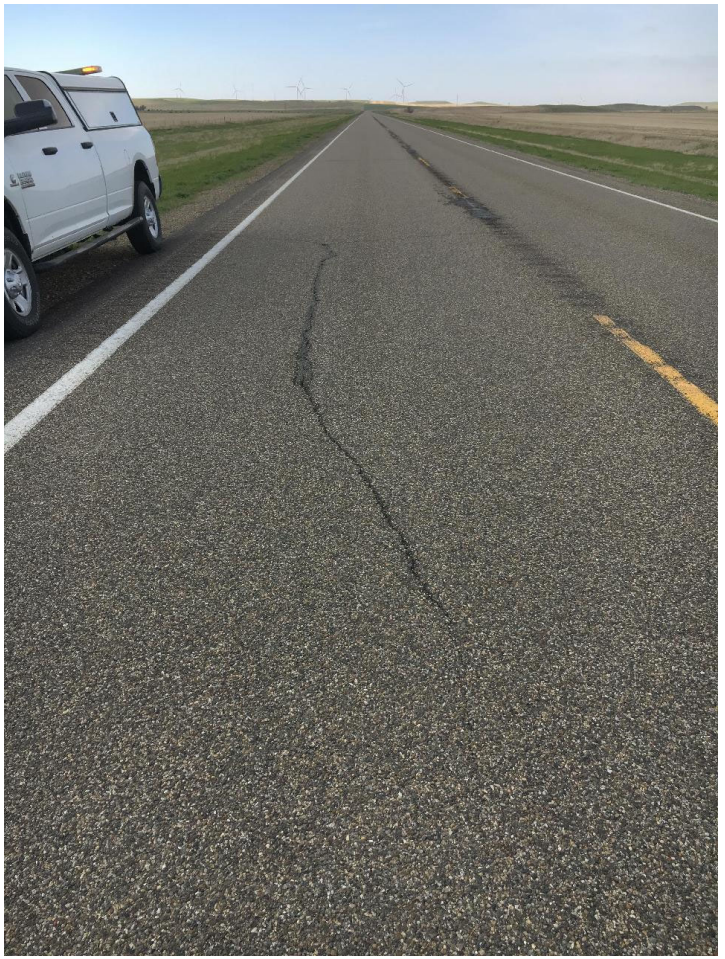


2
52+1700 to 52+2237

3
54+0800 to 54+2100

4
54+0800 to 54+2100

5
54+0800 to 54+2100



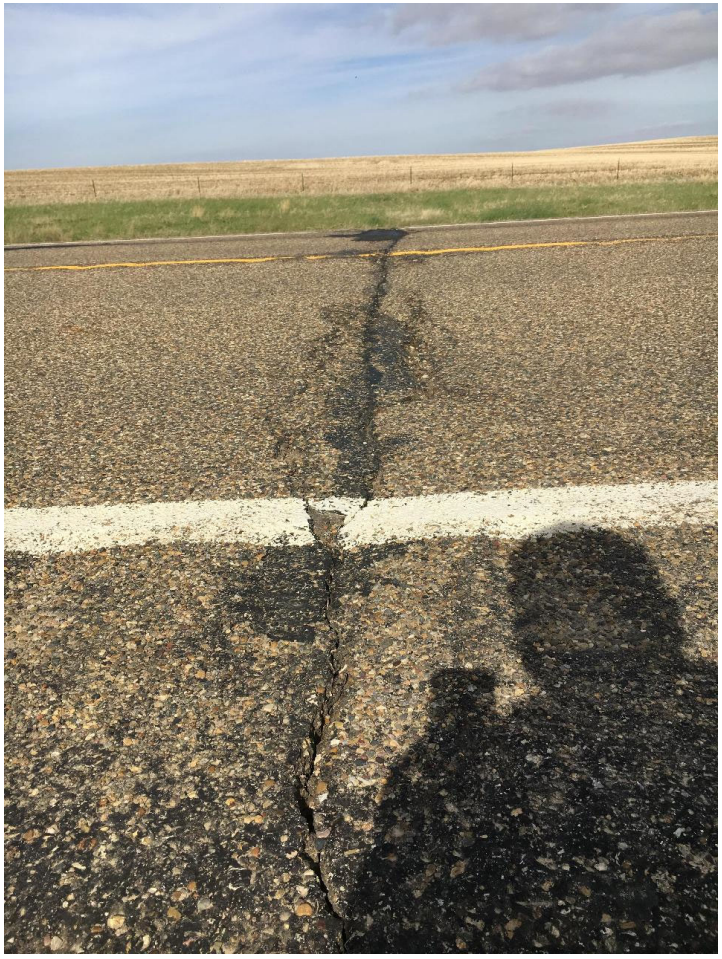
6
56+0460 to 56+3000

7
56+0460 to 56+3000

8
56+0460 to 56+3000

9
56+0460 to 3000

10
57+0100 to 57+0400



11
57+0100 to 57+0400

12
57+3300 to 57+3700

13
57+3300 to 57+3700

14
58+0200 to 59+000

15
58+0200 to 59+000

16
58+0200 to 59+000

17
66+1255 to 67+2256

18
66+1255 to 67+2256

19
66+1255 to 67+2256

20
69+2800 to 69+2900

APPENDIX C

BORING LOCATIONS

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

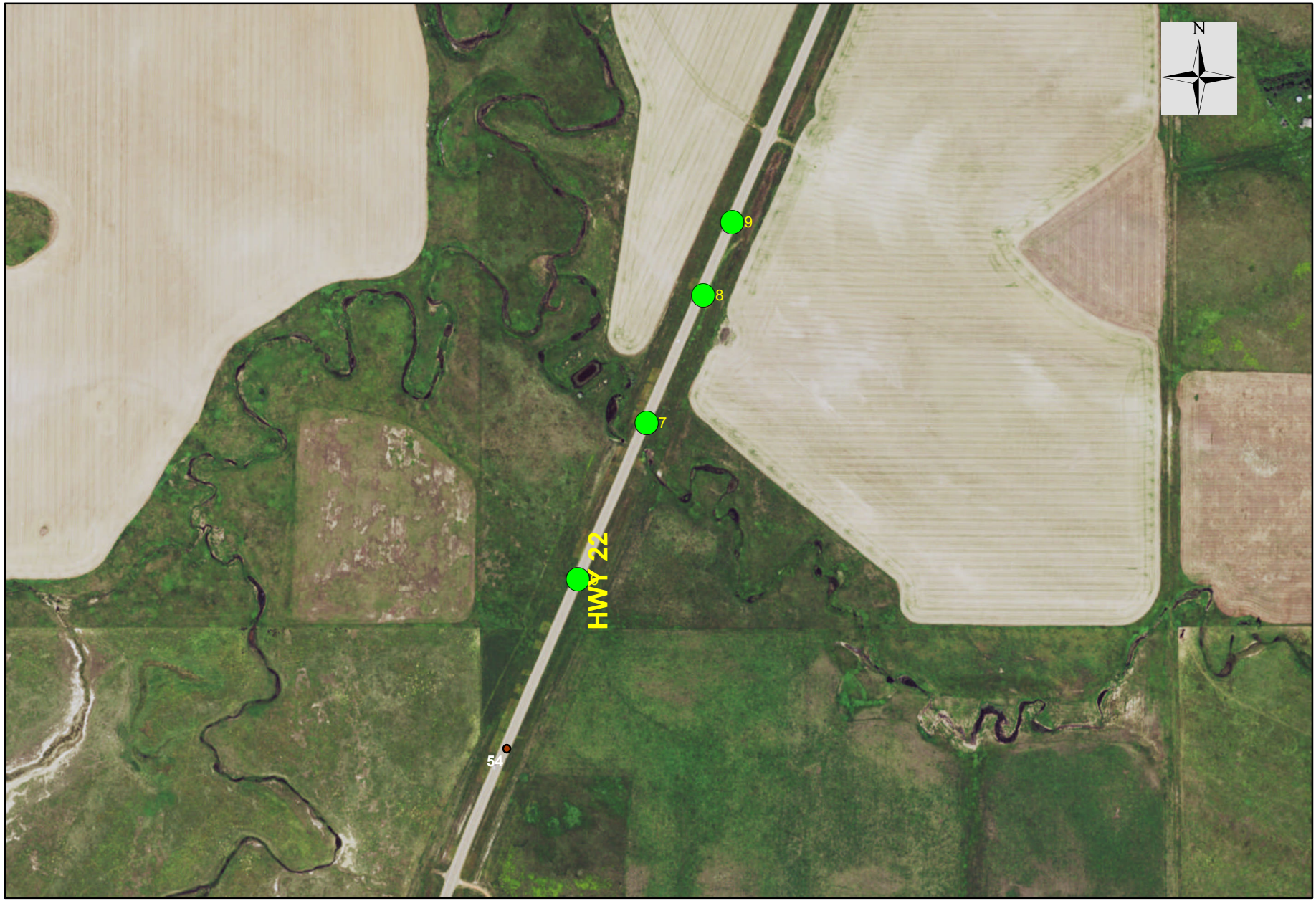
Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047



Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800
Feet

Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

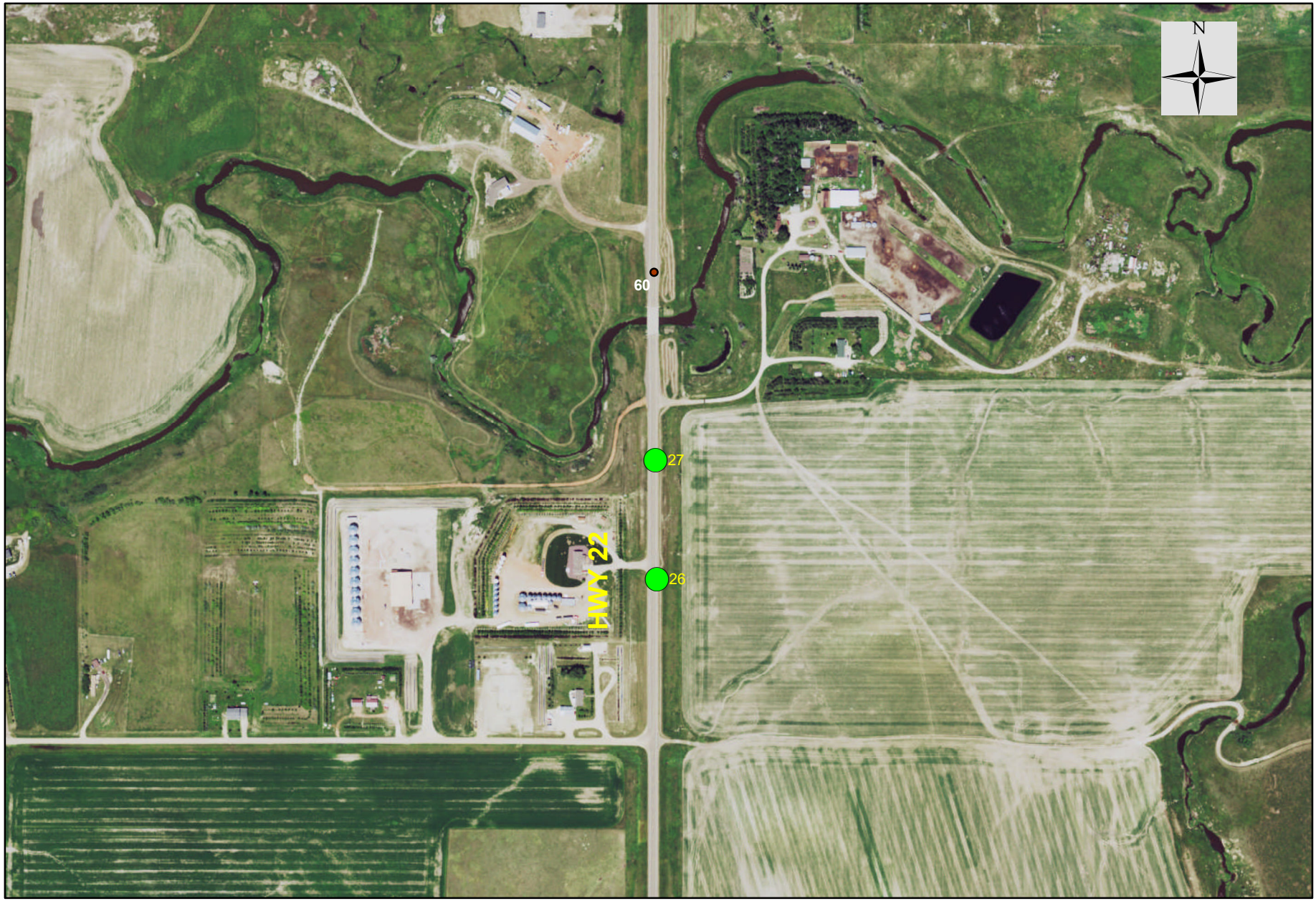
Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047

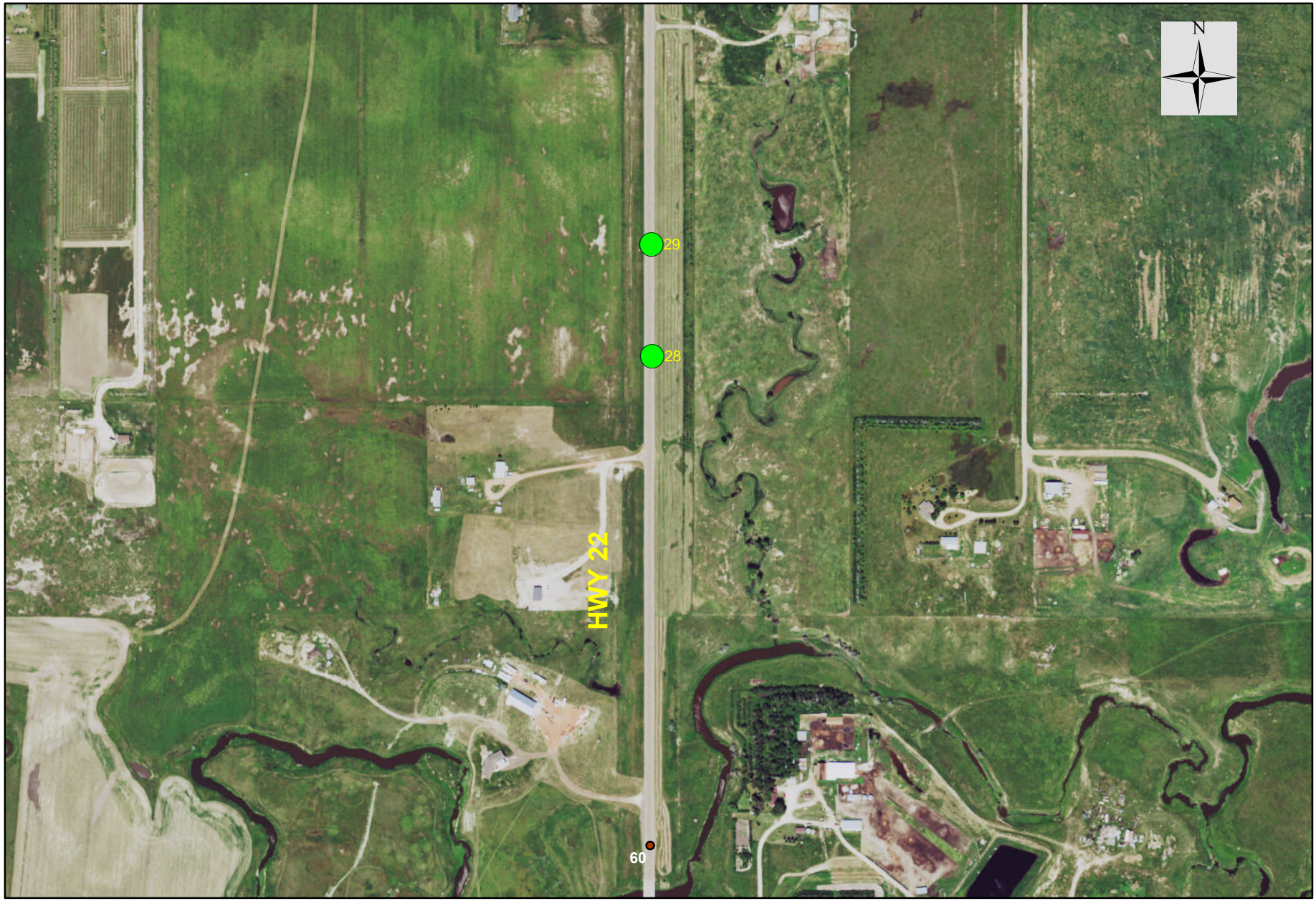


Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047



Legend

- Reference Point
- Boring Locations

0 900 1,800
Feet

Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

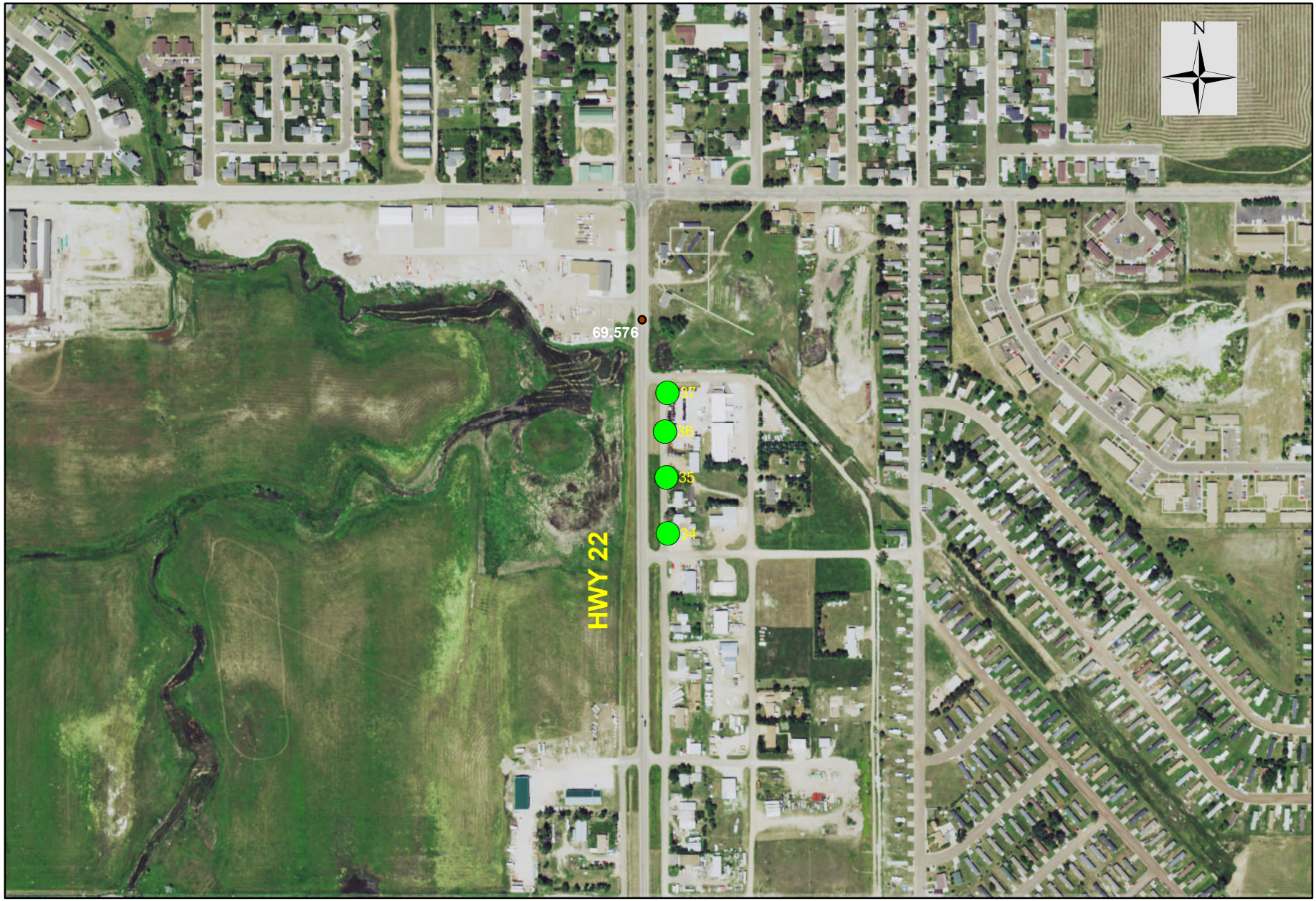
Project Number: SS-5-022(132)047

Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047



Legend

- Reference Point
- Boring Locations

0 900 1,800 Feet

Project Number: SS-5-022(132)047

APPENDIX D

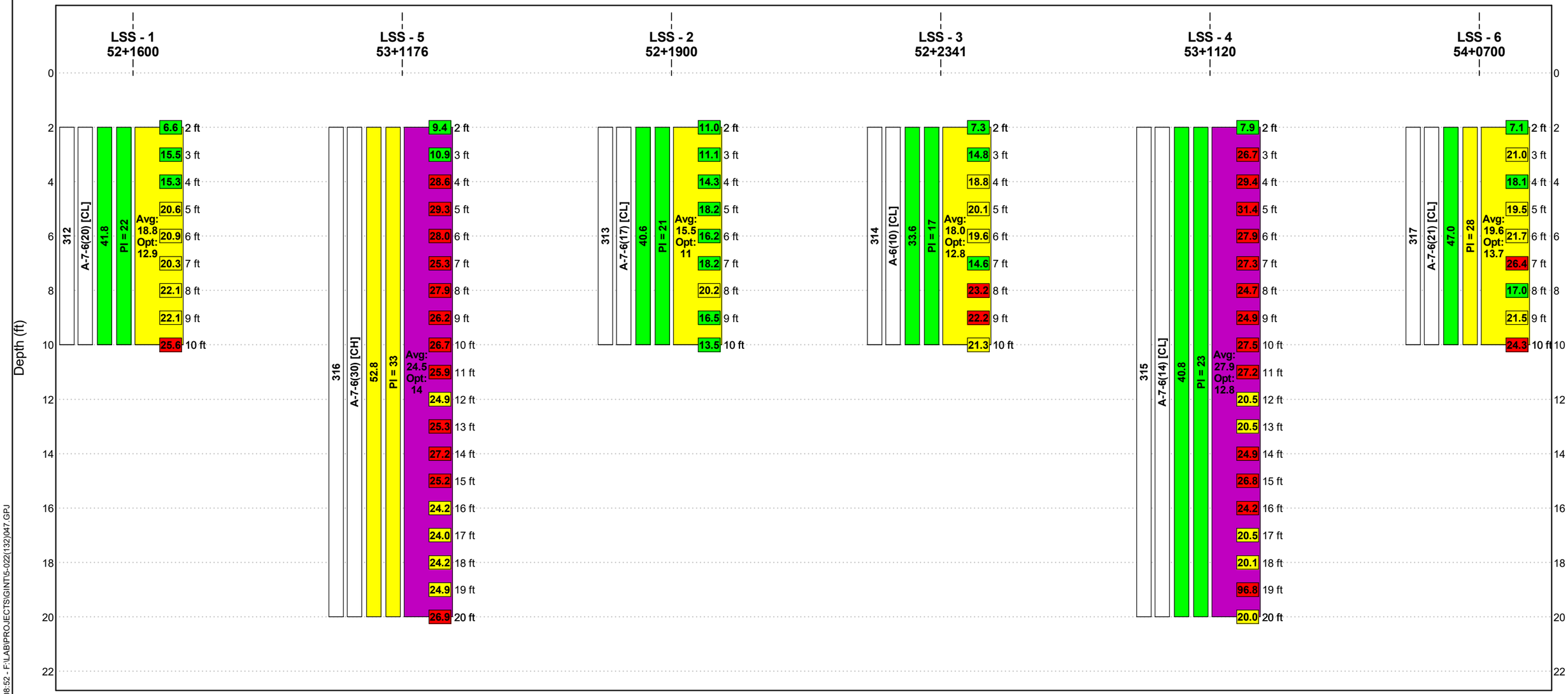
SUMMARY OF SOILS ANALYSIS

NDDOT
North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

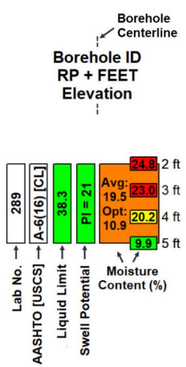
PROJECT NUMBER SS-5-022(132)047 **PCN** 22621

LOCATION Stark County

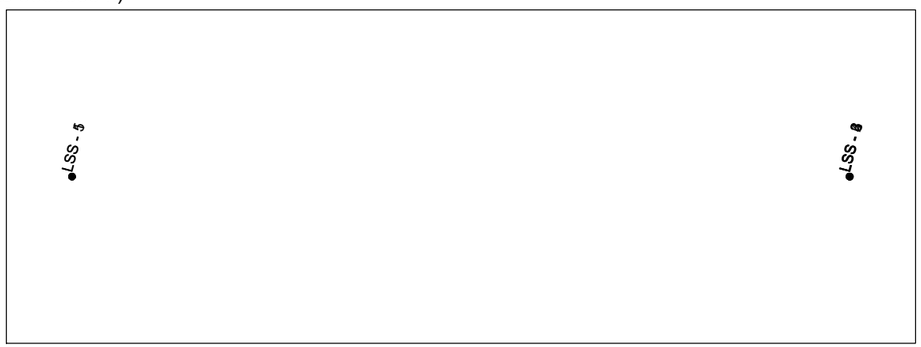


Boreholes Equally Spaced (0 to 5500000 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60		
Swell Potential	Low	Marginal	High		
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic	
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

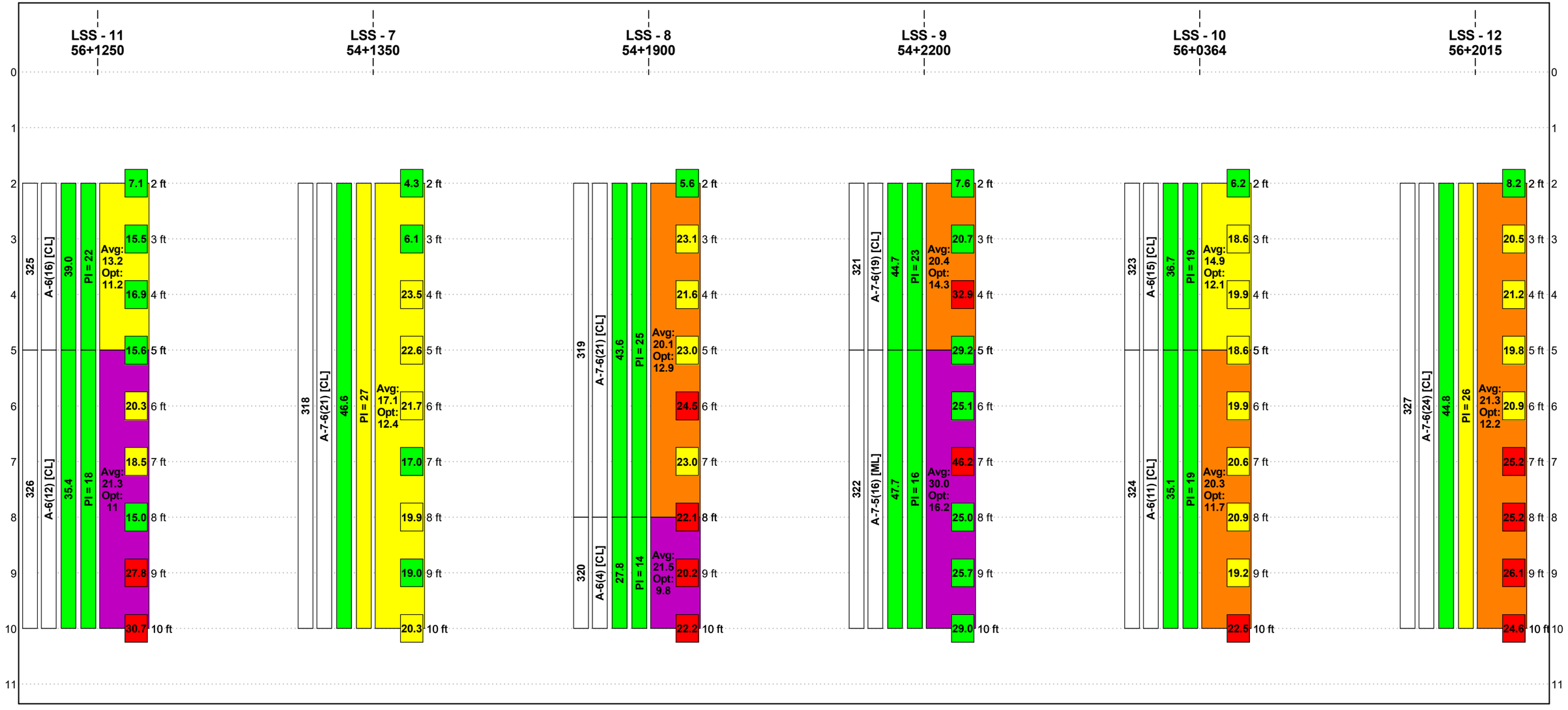


NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 9/22/20 08:52 - F:\LAB\PROJECTS\GINT\5-022(132)047.GPJ

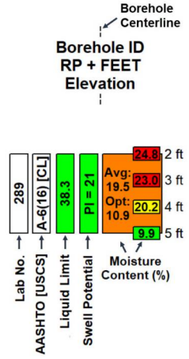
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **PCN** 22621

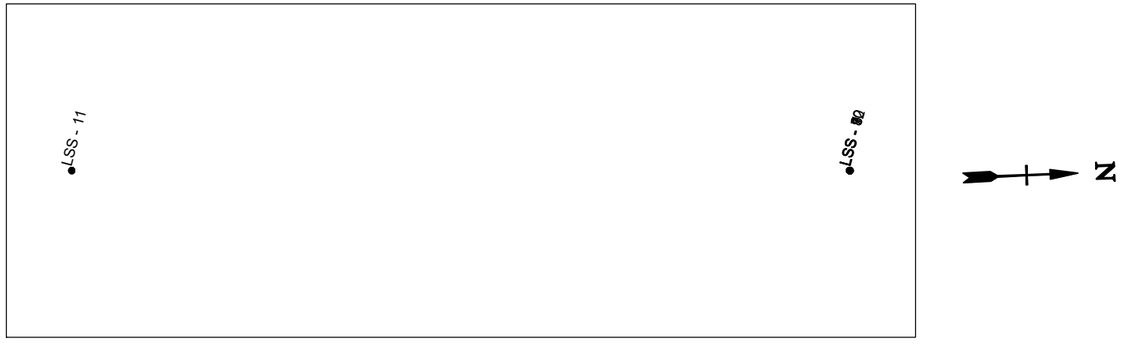
LOCATION Stark County



LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



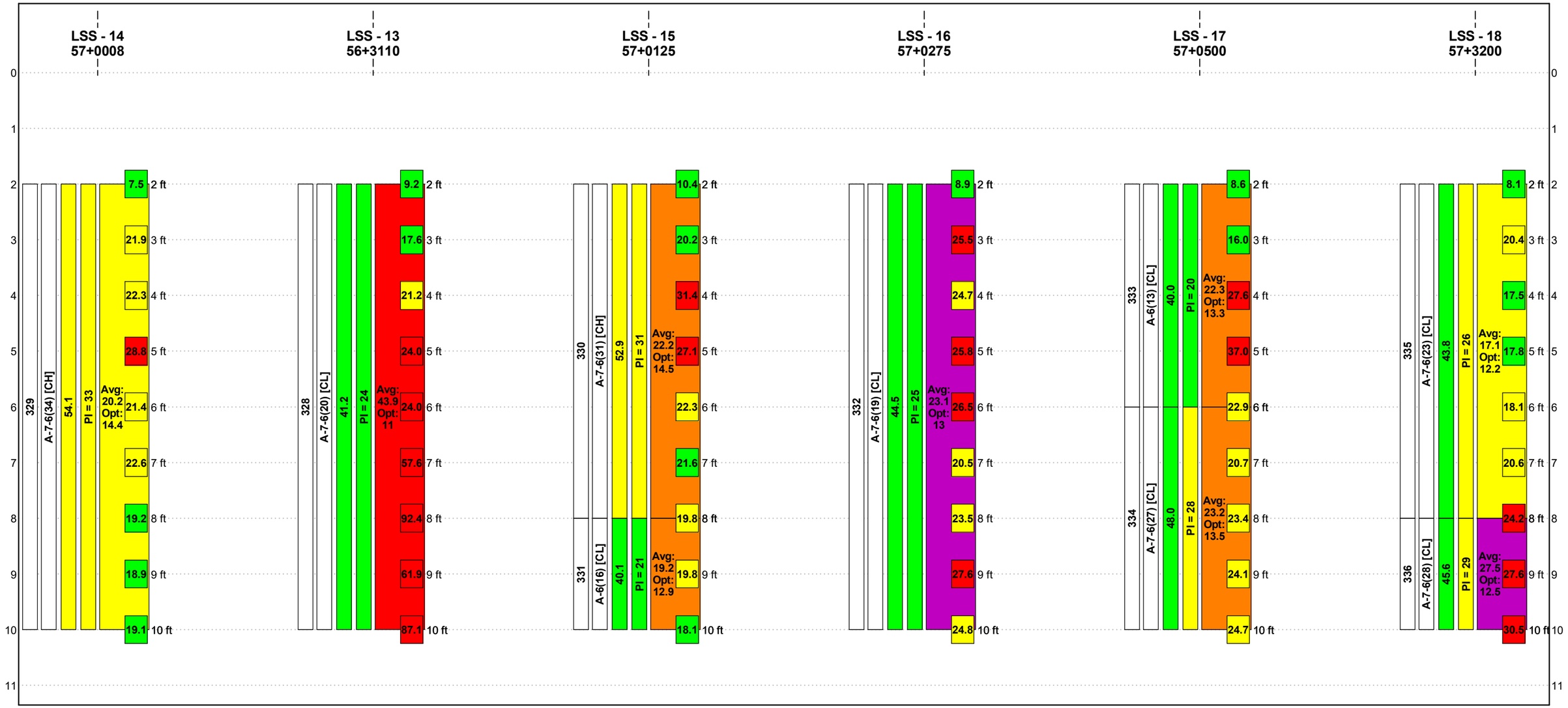
NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 9/22/20 08:53 - F:\LAB\PROJECTS\GINT\S-022(132)047.GPJ

NDDOT
North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

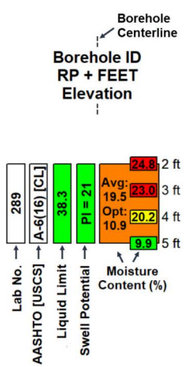
PROJECT NUMBER SS-5-022(132)047 **PCN** 22621

LOCATION Stark County



Boreholes Equally Spaced (0 to 5500000 ft)

LEGEND



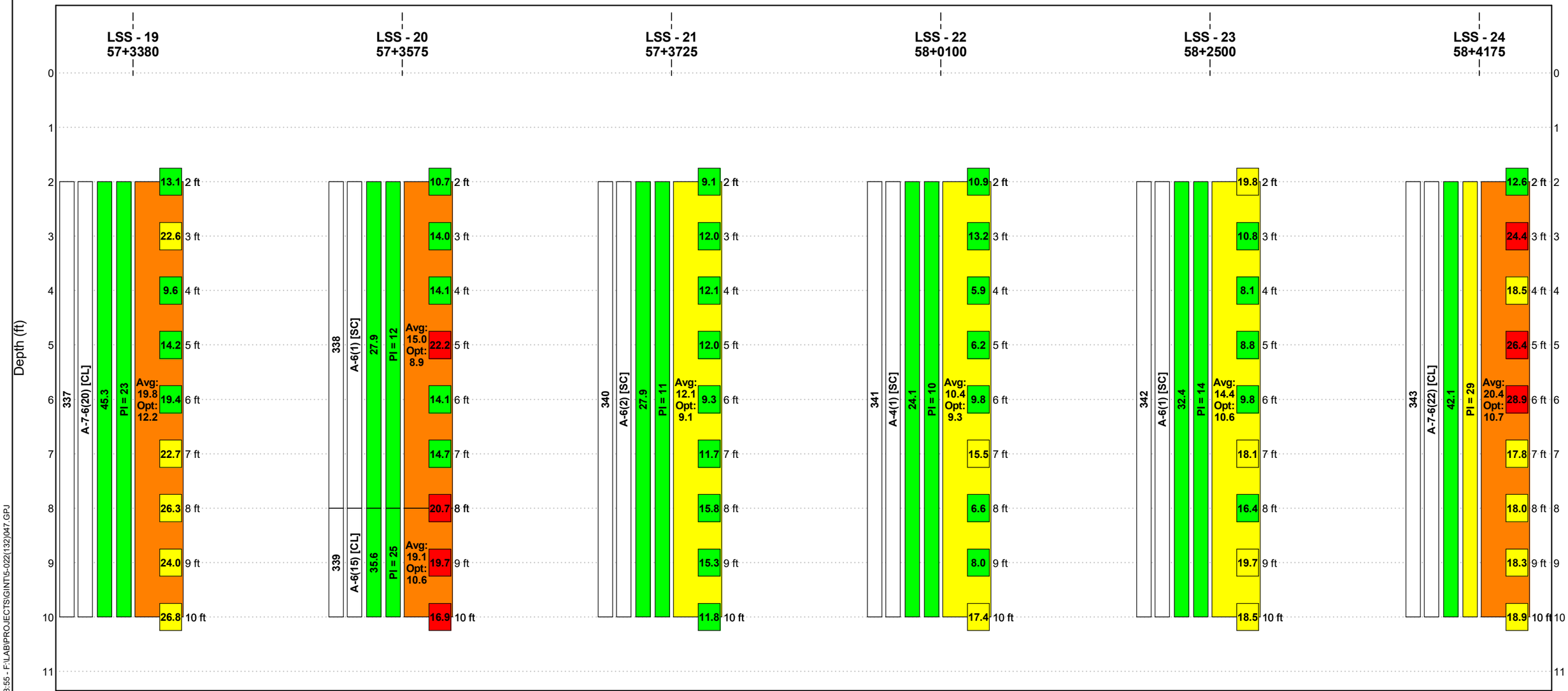
Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 9/22/20 08:54 - F:\LAB\PROJECTS\GINT\5-022(132)047.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
300 AIRPORT ROAD
BISMARCK, ND 58504

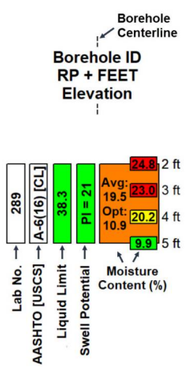
PROJECT NUMBER SS-5-022(132)047 **PCN** 22621

LOCATION Stark County

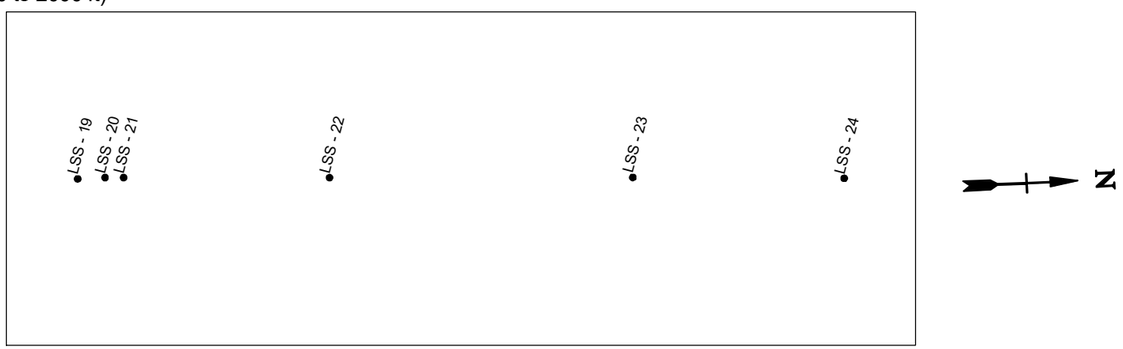


Boreholes Equally Spaced (0 to 2000 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

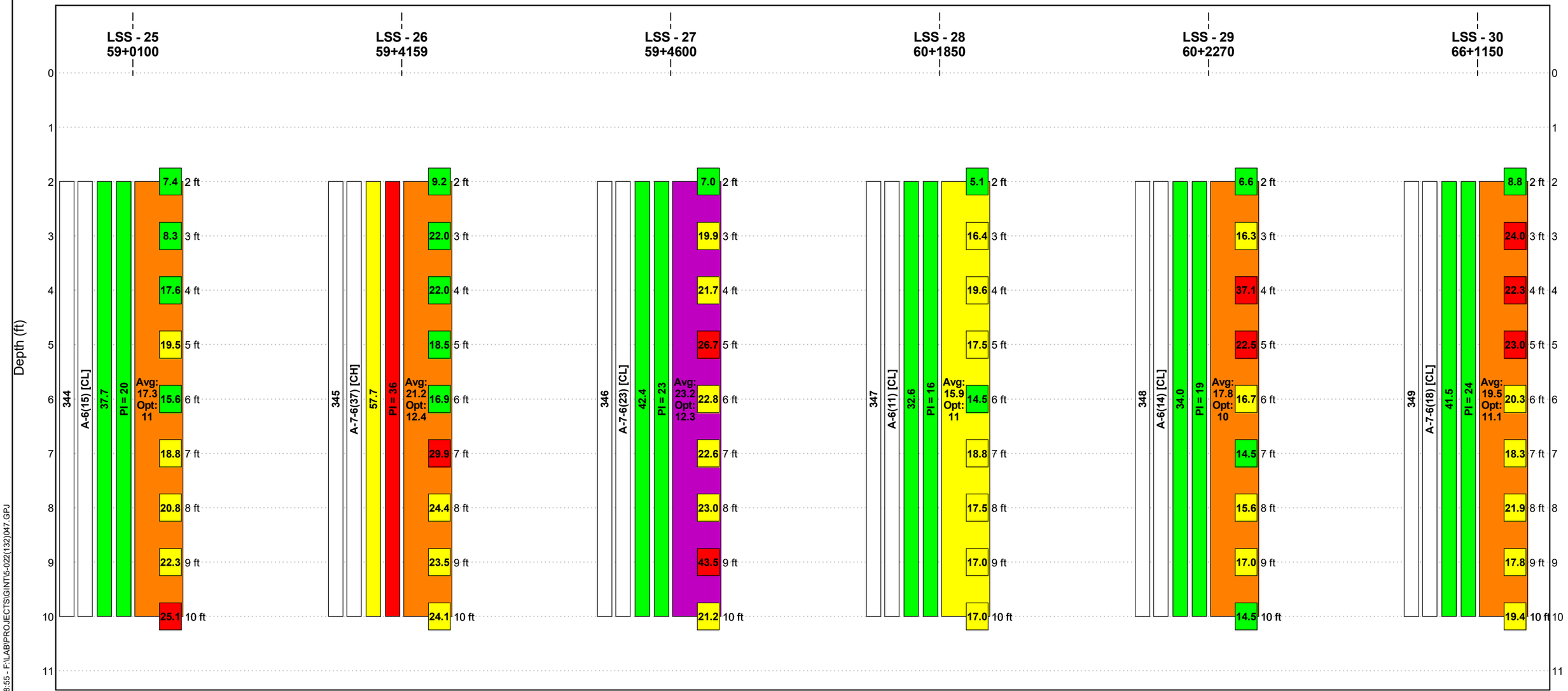


NDDOT North Dakota Department of Transportation

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **PCN** 22621

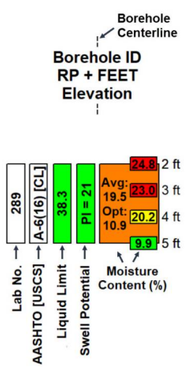
LOCATION Stark County



NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 9/22/20 08:55 - F:\LAB\PROJECTS\GINT\S5-022(132)047.GPJ

Boreholes Equally Spaced (0 to 12000 ft)

LEGEND

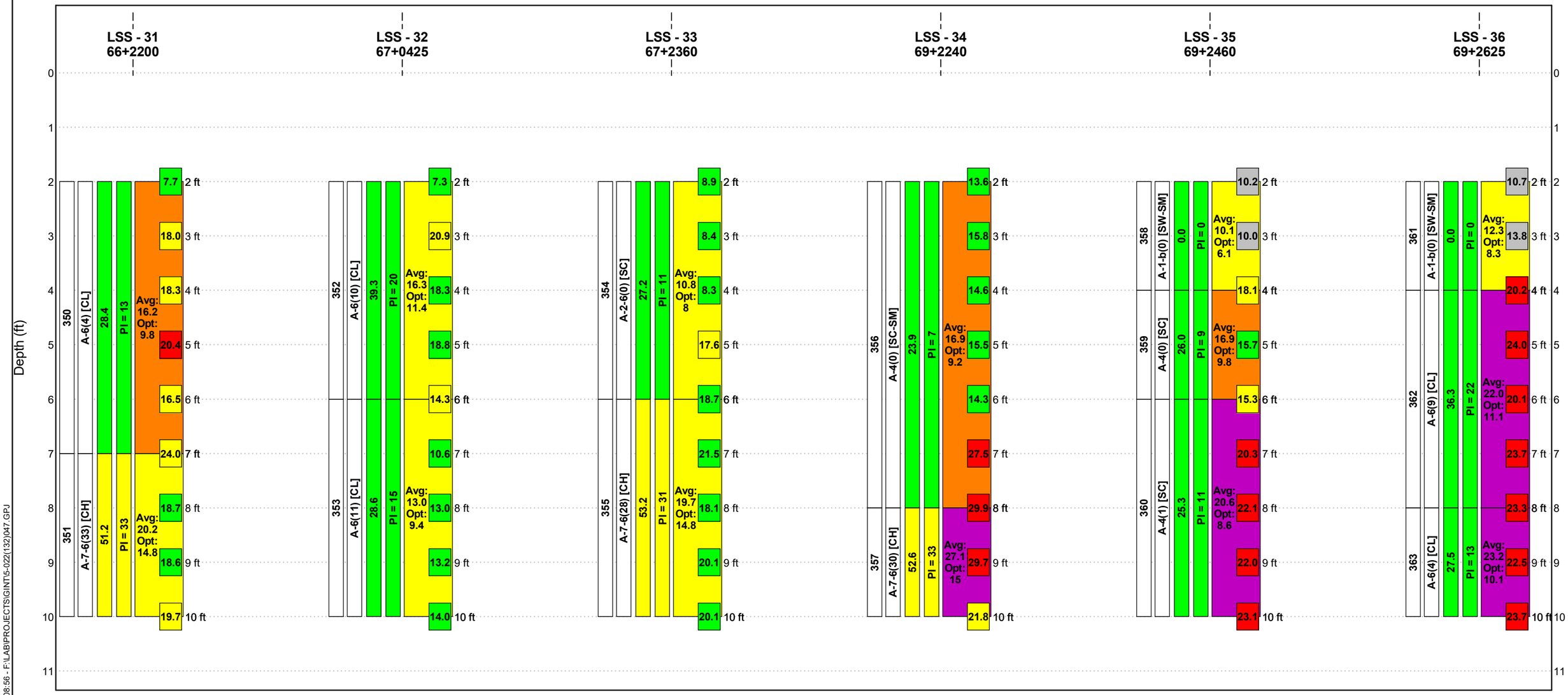


Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

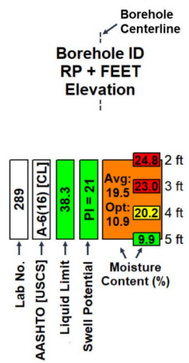
PROJECT NUMBER SS-5-022(132)047 **PCN** 22621

LOCATION Stark County



Boreholes Equally Spaced (0 to 5000 ft)

LEGEND



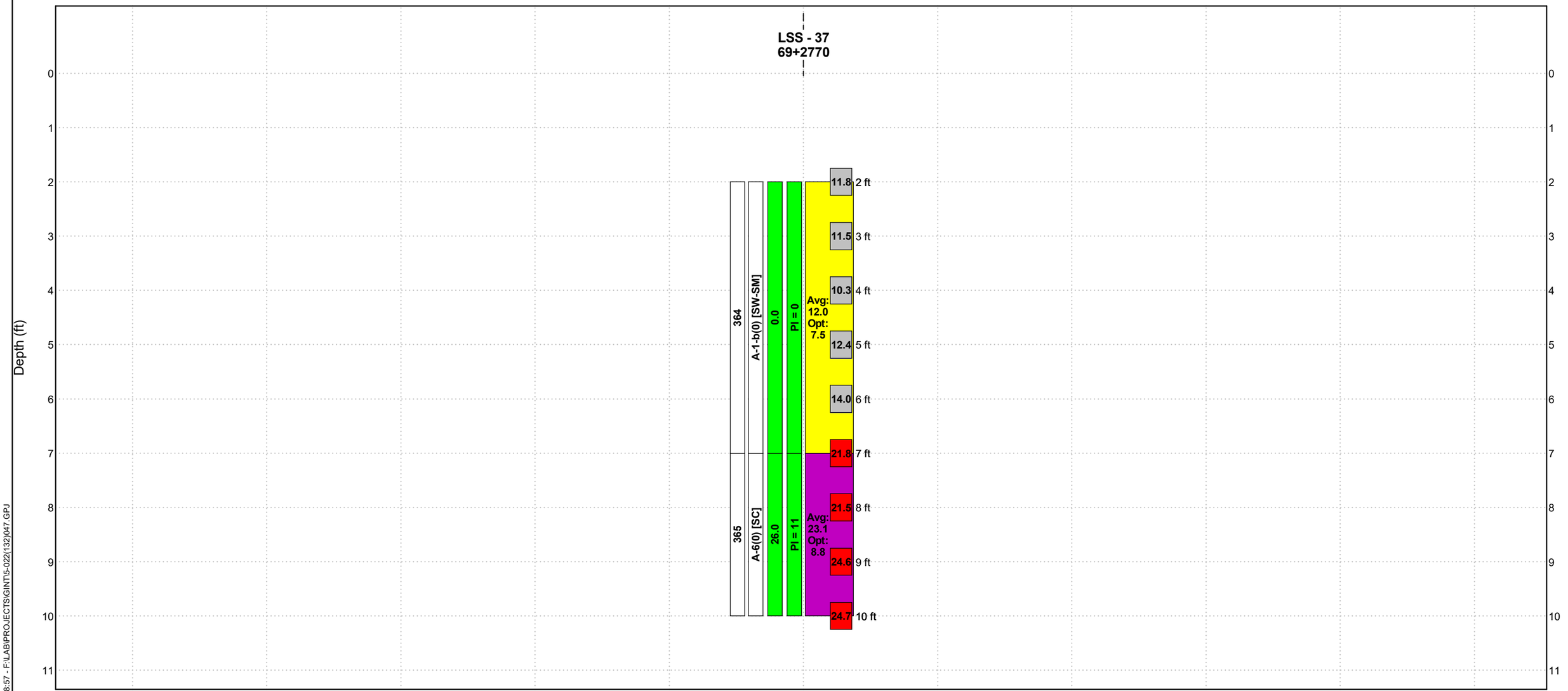
Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt

NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 9/22/20 08:56 - F:\LAB\PROJECTS\GINT\S-022(132)047.GPJ

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
300 AIRPORT ROAD
BISMARCK, ND 58504

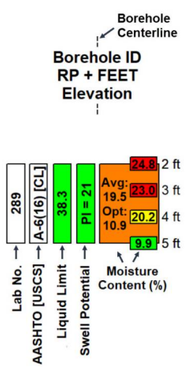
PROJECT NUMBER SS-5-022(132)047 **PCN** 22621

LOCATION Stark County

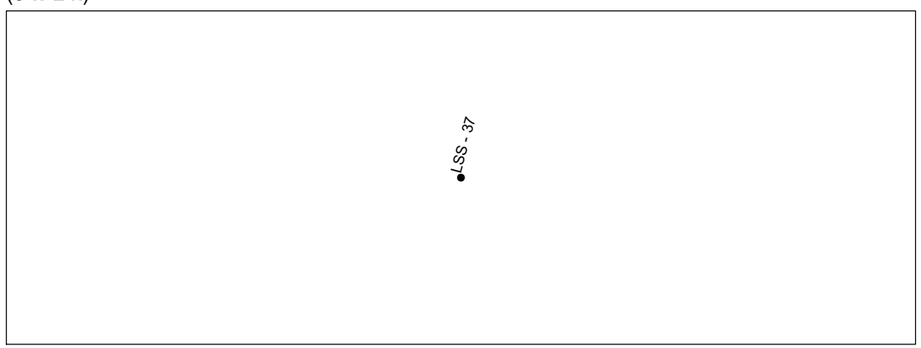


Boreholes Equally Spaced (0 to 2 ft)

LEGEND



Liquid Limit	LL<50	50<=LL<60	LL>=60	
Swell Potential	Low	Marginal	High	
Moisture Content	Below PL	0-5% Over PL	>5% Over PL	Non-Plastic
Avg. In-Place Moisture Content	MC < Opt	0<=MC<6% Over Opt	6<=MC<10% Over Opt	10<=MC<16% Over Opt	MC>16% Over Opt



NDDOT_LINEARCOLORFENCE_DEPTH - 20171219.GDT - 9/22/20 08:57 - F:\LAB\PROJECTS\GINT\S-022(132)047.GPJ

APPENDIX E

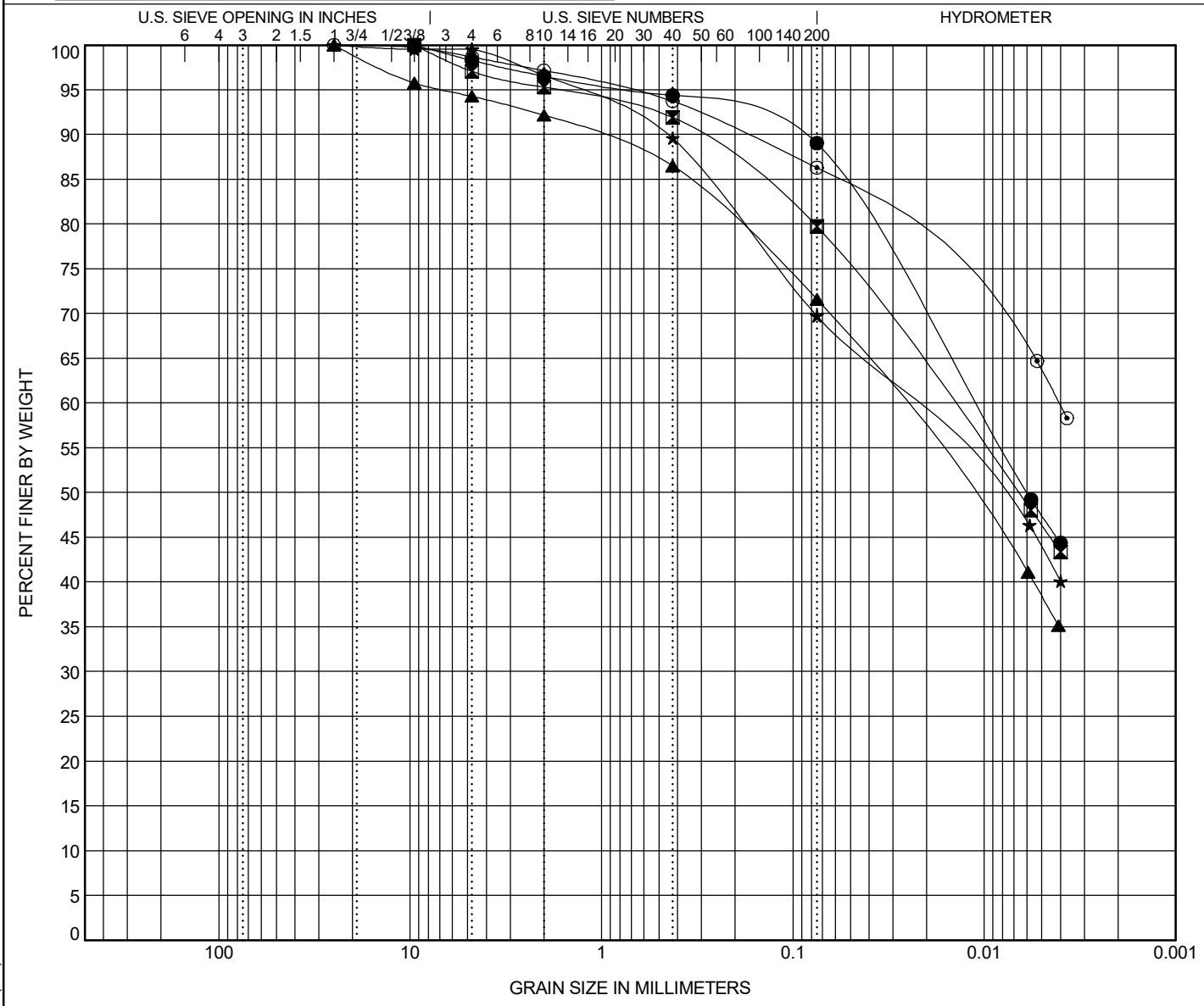
LAB RESULTS

GRAIN SIZE DISTRIBUTION

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● LSS - 1	2.0	A-7-6 (20)	CL	42	20	22		
⊠ LSS - 2	2.0	A-7-6 (17)	CL	41	19	22		
▲ LSS - 3	2.0	A-6 (10)	CL	34	17	17		
★ LSS - 4	2.0	A-7-6 (14)	CL	41	18	23		
⊙ LSS - 5	2.0	A-7-6 (30)	CH	53	20	33		

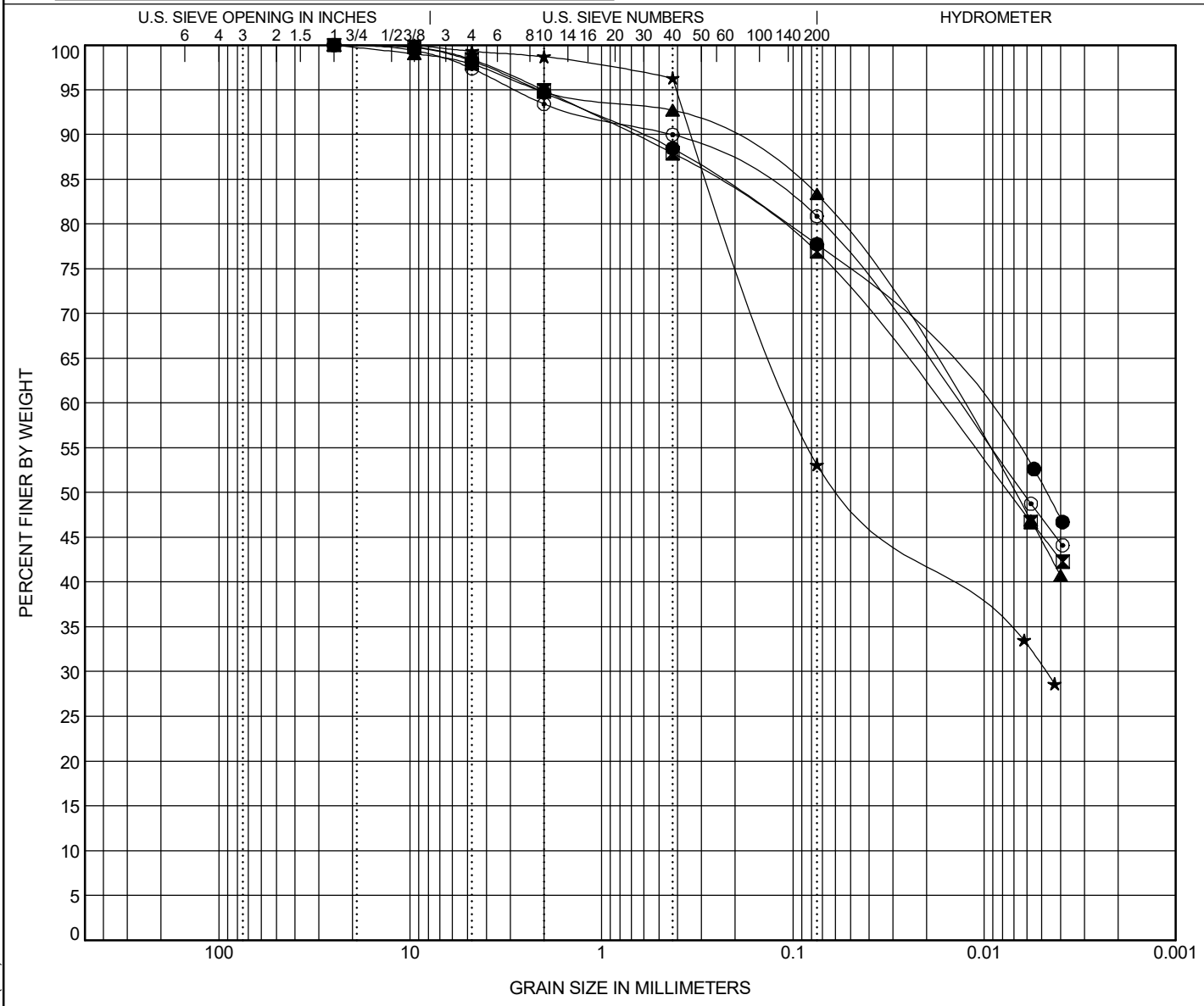
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● LSS - 1	2.0	9.5	0.011			1.7	9.2	89.0	
⊠ LSS - 2	2.0	9.5	0.015			2.9	17.3	79.7	
▲ LSS - 3	2.0	25	0.029			5.7	22.7	71.6	
★ LSS - 4	2.0	25	0.026			0.5	29.8	69.7	
⊙ LSS - 5	2.0	25	0.004			1.3	12.4	86.3	

GRAIN SIZE DISTRIBUTION

NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● LSS - 6	2.0	A-7-6 (21)	CL	47	19	28		
⊠ LSS - 7	2.0	A-7-6 (21)	CL	47	19	28		
▲ LSS - 8	2.0	A-7-6 (21)	CL	44	19	25		
★ LSS - 8	8.0	A-6 (4)	CL	28	14	14		
⊙ LSS - 9	2.0	A-7-6 (19)	CL	45	22	23		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● LSS - 6	2.0	25	0.012			1.8	20.5	77.7	
⊠ LSS - 7	2.0	25	0.018			1.6	21.4	76.9	
▲ LSS - 8	2.0	25	0.014			2.1	14.5	83.4	
★ LSS - 8	8.0	9.5	0.099	0.005		0.7	46.2	53.1	
⊙ LSS - 9	2.0	25	0.014			2.6	16.5	80.9	

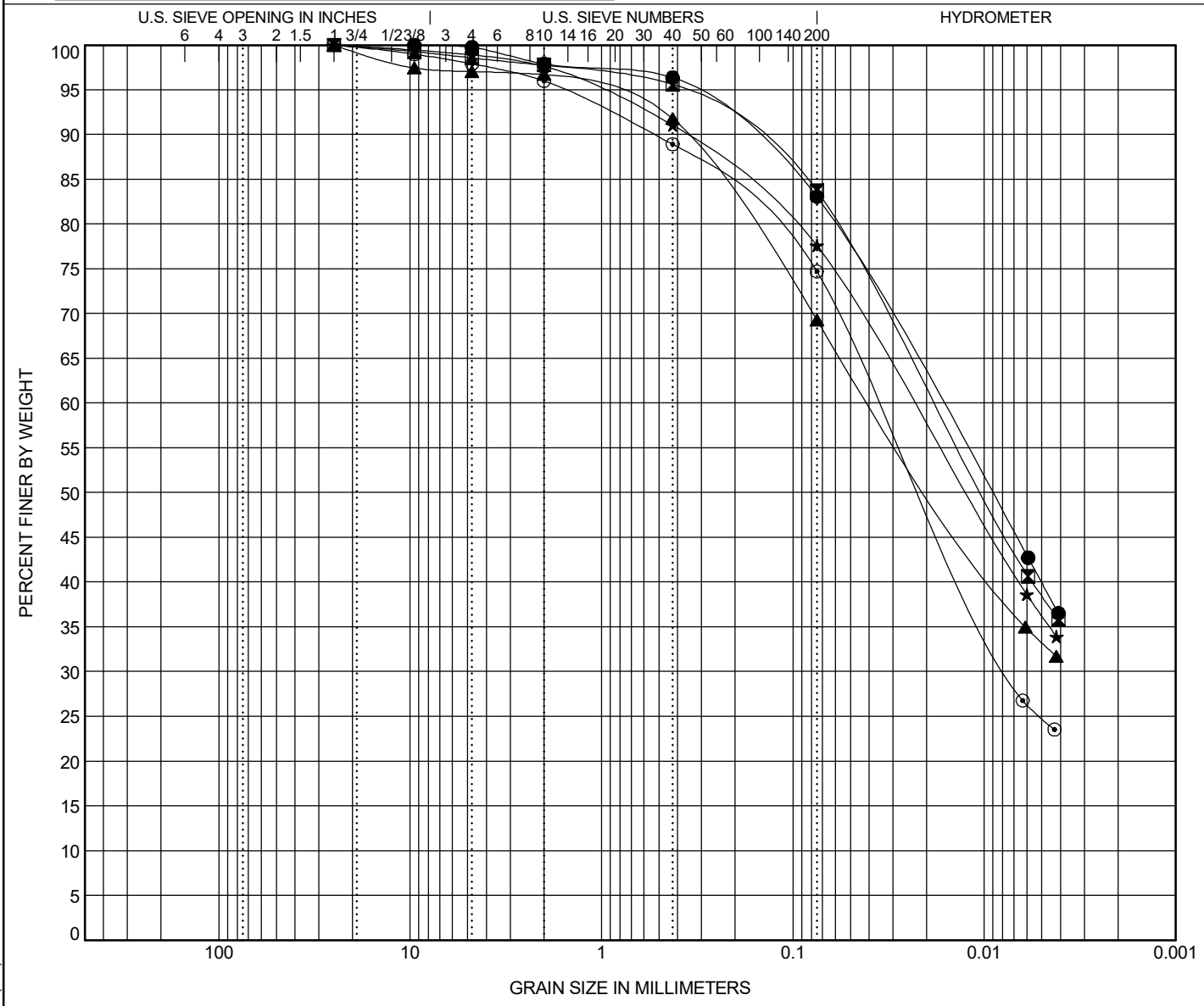
GRAIN SIZE - 20171219.GDT - 9/10/20 09:08 - F:\LAB\PROJECTS\GINT\5-022(132)047.GPJ

GRAIN SIZE DISTRIBUTION

NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	LSS - 9	5.0	A-7-5 (16)	ML	48	31	17		
⊠	LSS - 10	2.0	A-6 (15)	CL	37	18	19		
▲	LSS - 10	5.0	A-6 (11)	CL	35	16	19		
★	LSS - 11	2.0	A-6 (16)	CL	39	17	22		
⊙	LSS - 11	5.0	A-6 (12)	CL	35	17	18		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	LSS - 9	5.0	9.5	0.018			0.2	16.7	83.1	
⊠	LSS - 10	2.0	25	0.018			1.4	14.8	83.7	
▲	LSS - 10	5.0	25	0.038			3.0	27.8	69.3	
★	LSS - 11	2.0	25	0.024			1.1	21.3	77.6	
⊙	LSS - 11	5.0	25	0.035	0.007		2.1	23.2	74.7	

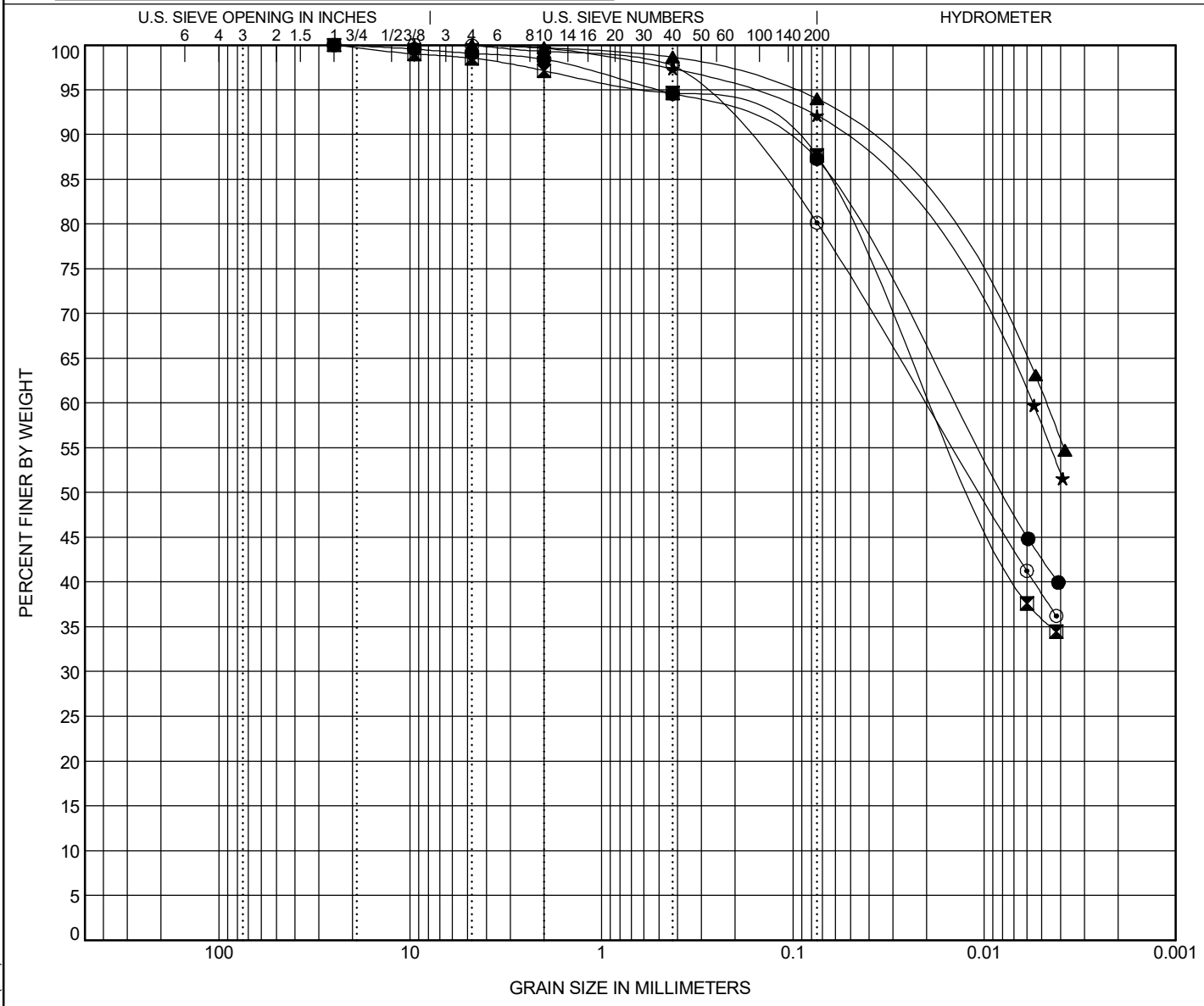
GRAIN SIZE - 20171219.GDT - 9/10/20 09:08 - F:\LAB\PROJECTS\GINT\5-022(132)047.GPJ

GRAIN SIZE DISTRIBUTION

NDDOT North Dakota Department of Transportation
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	LSS - 12	2.0	A-7-6 (24)	CL	45	18	27		
⊠	LSS - 13	2.0	A-7-6 (20)	CL	41	18	23		
▲	LSS - 14	2.0	A-7-6 (34)	CH	54	21	33		
★	LSS - 15	2.0	A-7-6 (31)	CH	53	22	31		
⊙	LSS - 15	8.0	A-6 (16)	CL	40	19	21		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	LSS - 12	2.0	25	0.015			0.9	11.8	87.3	
⊠	LSS - 13	2.0	25	0.019			1.5	10.8	87.7	
▲	LSS - 14	2.0	4.75	0.005			0.0	6.0	94.0	
★	LSS - 15	2.0	9.5	0.006			0.0	7.9	92.1	
⊙	LSS - 15	8.0	9.5	0.02			0.1	19.8	80.1	

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PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

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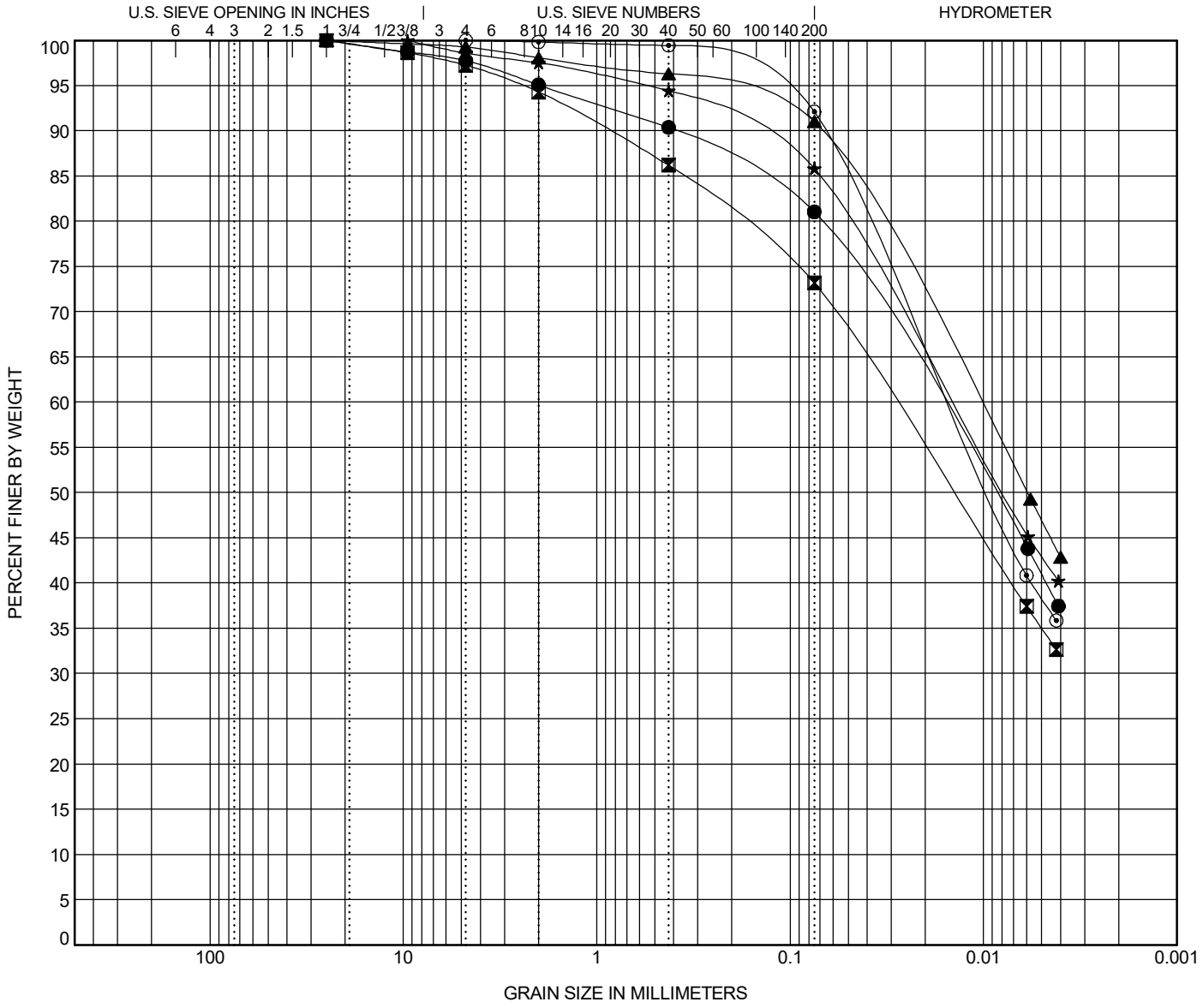

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE		DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	LSS - 16	2.0	A-7-6 (19)	CL	44	20	24		
⊠	LSS - 17	2.0	A-6 (13)	CL	40	20	20		
▲	LSS - 17	6.0	A-7-6 (27)	CL	48	20	28		
★	LSS - 18	2.0	A-7-6 (23)	CL	44	18	26		
⊙	LSS - 18	8.0	A-7-6 (28)	CL	46	17	29		

BOREHOLE		DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	LSS - 16	2.0	25	0.018			2.3	16.7	81.0	
⊠	LSS - 17	2.0	25	0.03			2.7	24.1	73.2	
▲	LSS - 17	6.0	25	0.011			0.7	8.2	91.0	
★	LSS - 18	2.0	9.5	0.015			1.4	12.7	85.8	
⊙	LSS - 18	8.0	4.75	0.015			0.0	7.9	92.1	

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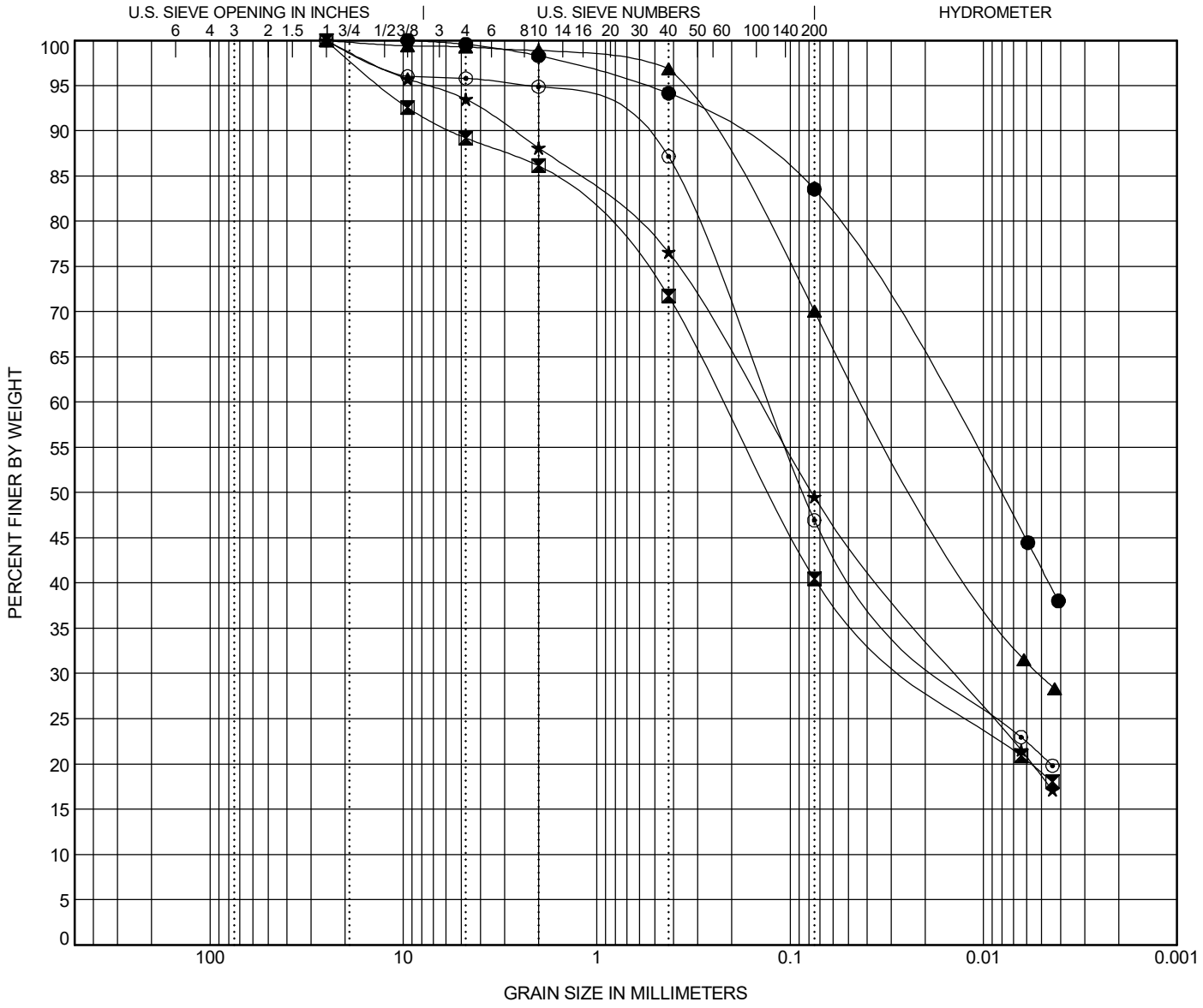

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	LSS - 19	2.0	A-7-6 (20)	CL	45	22	23		
⊠	LSS - 20	2.0	A-6 (1)	SC	28	16	12		
▲	LSS - 20	8.0	A-6 (15)	CL	36	11	25		
★	LSS - 21	2.0	A-6 (2)	SC	28	17	11		
⊙	LSS - 22	2.0	A-4 (1)	SC	24	15	9		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	LSS - 19	2.0	9.5	0.016			0.4	16.0	83.6	
⊠	LSS - 20	2.0	25	0.222	0.02		10.8	48.8	40.4	
▲	LSS - 20	8.0	25	0.039	0.005		0.7	29.2	70.0	
★	LSS - 21	2.0	25	0.147	0.013		6.5	44.0	49.5	
⊙	LSS - 22	2.0	25	0.132	0.013		4.2	48.9	46.9	

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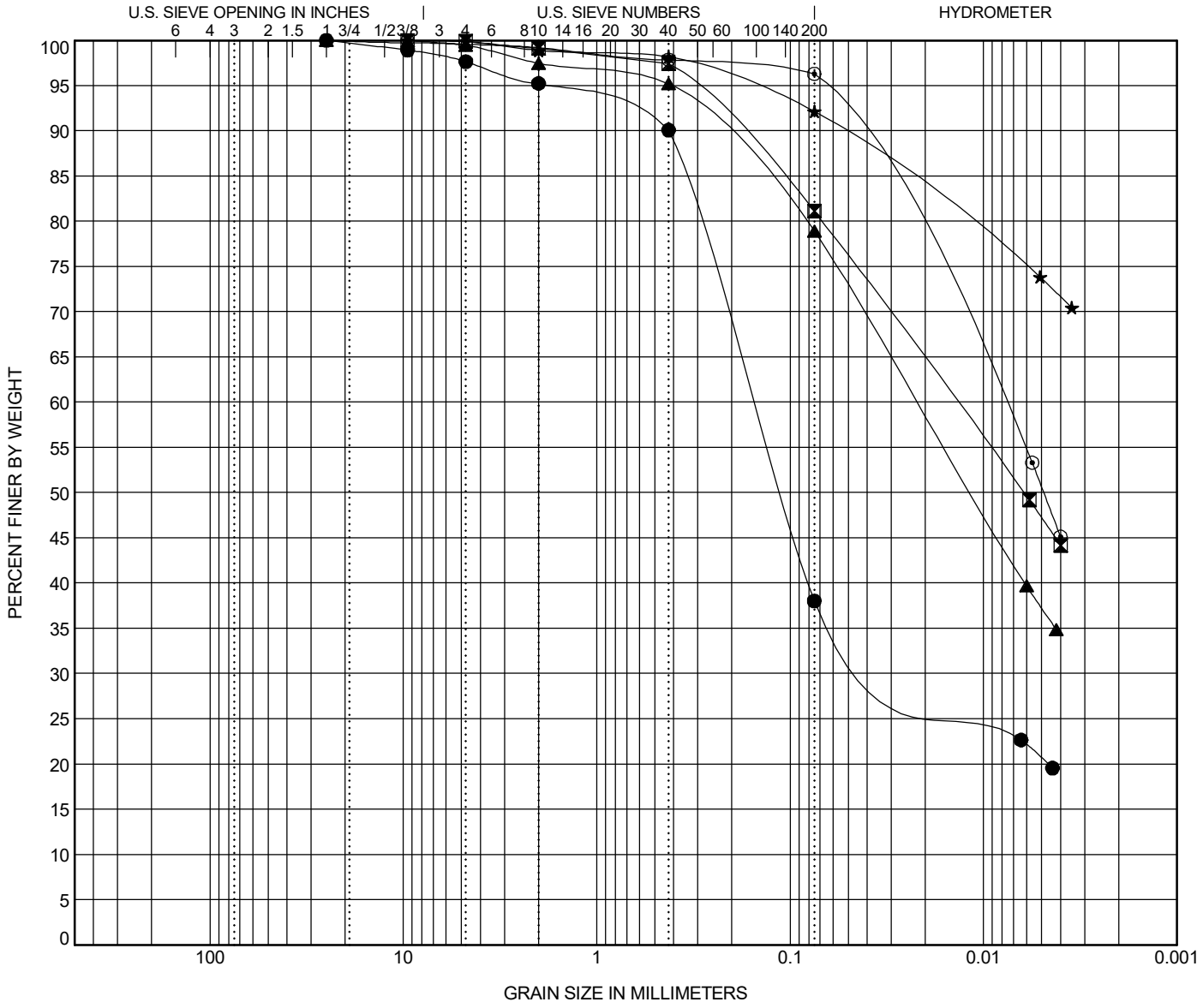

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 23**	**2.0**	**A-6 (1)**	**SC**	**32**	**18**	**14**		
⊠	**LSS - 24**	**2.0**	**A-7-6 (22)**	**CL**	**42**	**14**	**28**		
▲	**LSS - 25**	**2.0**	**A-6 (15)**	**CL**	**38**	**18**	**20**		
★	**LSS - 26**	**2.0**	**A-7-6 (37)**	**CH**	**58**	**22**	**36**		
⊙	**LSS - 27**	**2.0**	**A-7-6 (23)**	**CL**	**42**	**19**	**23**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 23**	**2.0**	**25**	**0.156**	**0.021**		**2.4**	**59.6**	**38.0**	
⊠	**LSS - 24**	**2.0**	**9.5**	**0.014**			**0.1**	**18.8**	**81.1**	
▲	**LSS - 25**	**2.0**	**25**	**0.022**			**0.5**	**20.5**	**78.9**	
★	**LSS - 26**	**2.0**	**9.5**				**0.1**	**7.7**	**92.1**	
⊙	**LSS - 27**	**2.0**	**9.5**	**0.008**			**0.4**	**3.3**	**96.3**	

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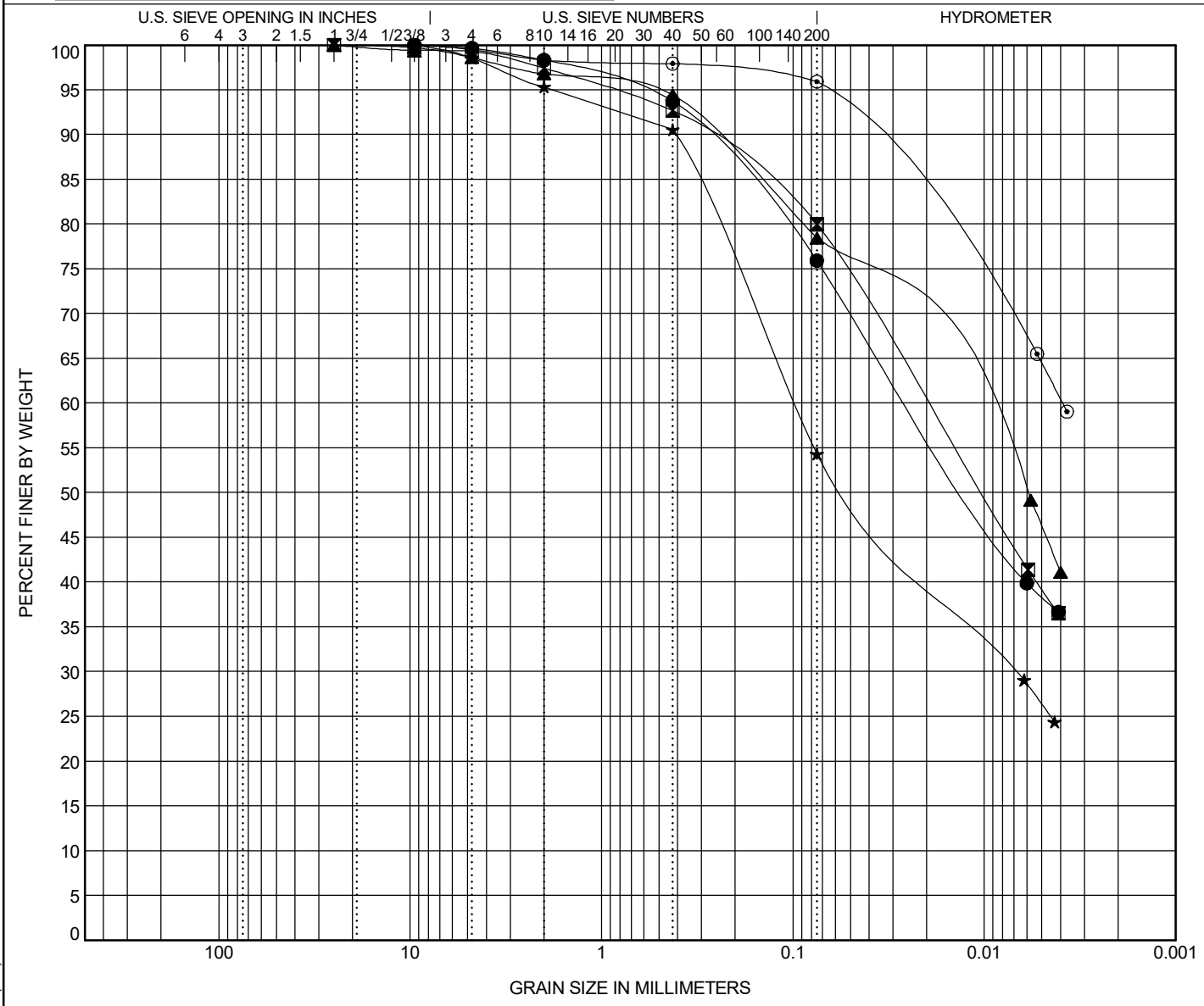

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 28**	**2.0**	**A-6 (11)**	**CL**	**33**	**16**	**17**		
⊠	**LSS - 29**	**2.0**	**A-6 (14)**	**CL**	**34**	**15**	**19**		
▲	**LSS - 30**	**2.0**	**A-7-6 (18)**	**CL**	**42**	**17**	**25**		
★	**LSS - 31**	**2.0**	**A-6 (4)**	**CL**	**28**	**15**	**13**		
⊙	**LSS - 31**	**7.0**	**A-7-6 (33)**	**CH**	**51**	**19**	**32**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 28**	**2.0**	**9.5**	**0.025**			**0.3**	**23.8**	**75.9**	
⊠	**LSS - 29**	**2.0**	**25**	**0.02**			**0.7**	**19.3**	**80.0**	
▲	**LSS - 30**	**2.0**	**25**	**0.015**			**1.4**	**20.2**	**78.4**	
★	**LSS - 31**	**2.0**	**9.5**	**0.098**	**0.007**		**1.4**	**44.3**	**54.3**	
⊙	**LSS - 31**	**7.0**	**9.5**	**0.004**			**0.5**	**3.6**	**95.9**	

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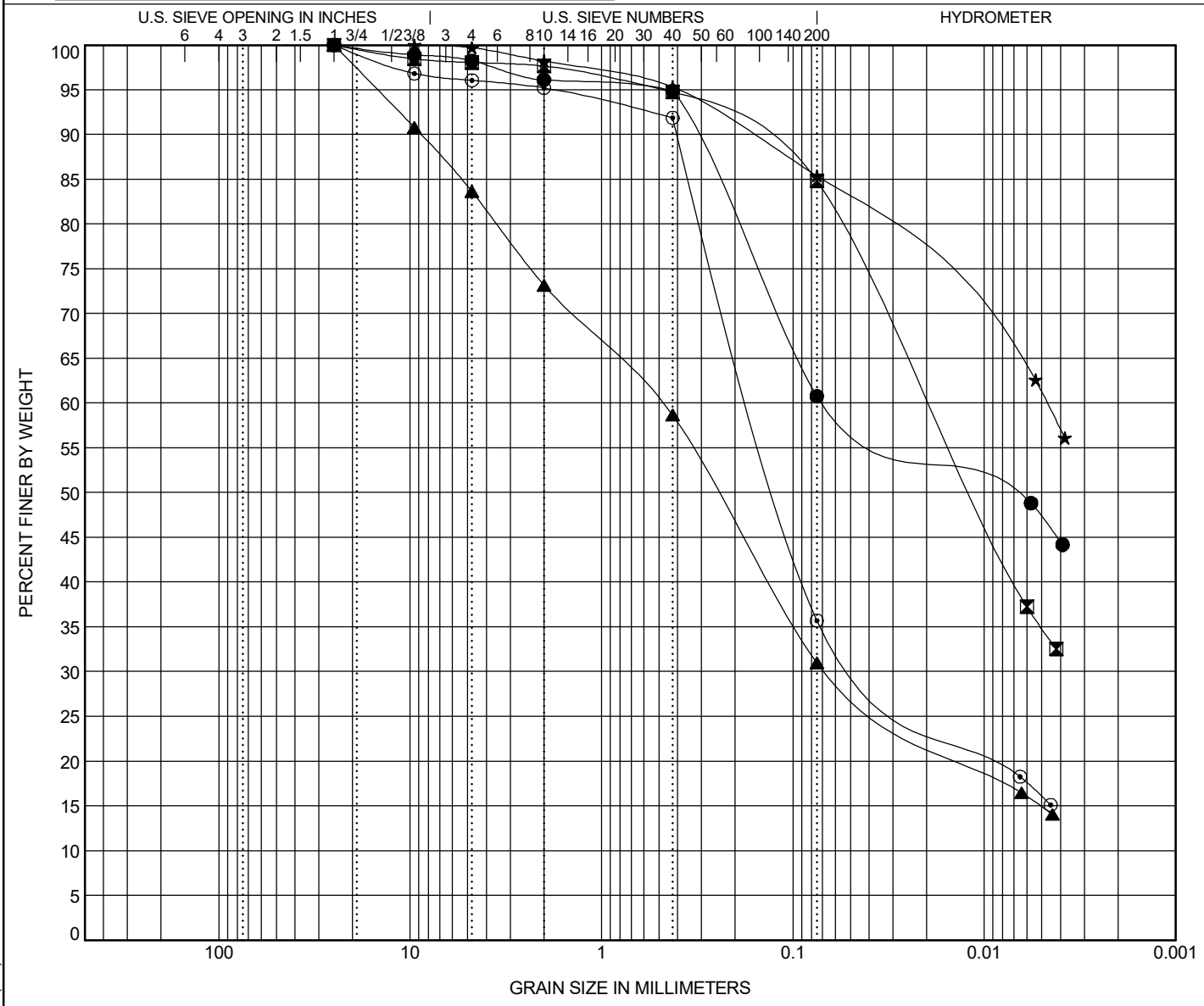

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 32**	**2.0**	**A-6 (10)**	**CL**	**39**	**19**	**20**		
⊠	**LSS - 32**	**6.0**	**A-6 (11)**	**CL**	**29**	**14**	**15**		
▲	**LSS - 33**	**2.0**	**A-2-6 (0)**	**SC**	**27**	**16**	**11**		
★	**LSS - 33**	**6.0**	**A-7-6 (28)**	**CH**	**53**	**22**	**31**		
⊙	**LSS - 34**	**2.0**	**A-4 (0)**	**SC-SM**	**24**	**17**	**7**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 32**	**2.0**	**25**	**0.064**			**1.8**	**37.5**	**60.8**	
⊠	**LSS - 32**	**6.0**	**25**	**0.02**			**2.0**	**13.2**	**84.8**	
▲	**LSS - 33**	**2.0**	**25**	**0.49**	**0.064**		**16.4**	**52.7**	**30.9**	
★	**LSS - 33**	**6.0**	**9.5**	**0.005**			**0.3**	**14.3**	**85.4**	
⊙	**LSS - 34**	**2.0**	**25**	**0.159**	**0.034**		**3.9**	**60.4**	**35.7**	

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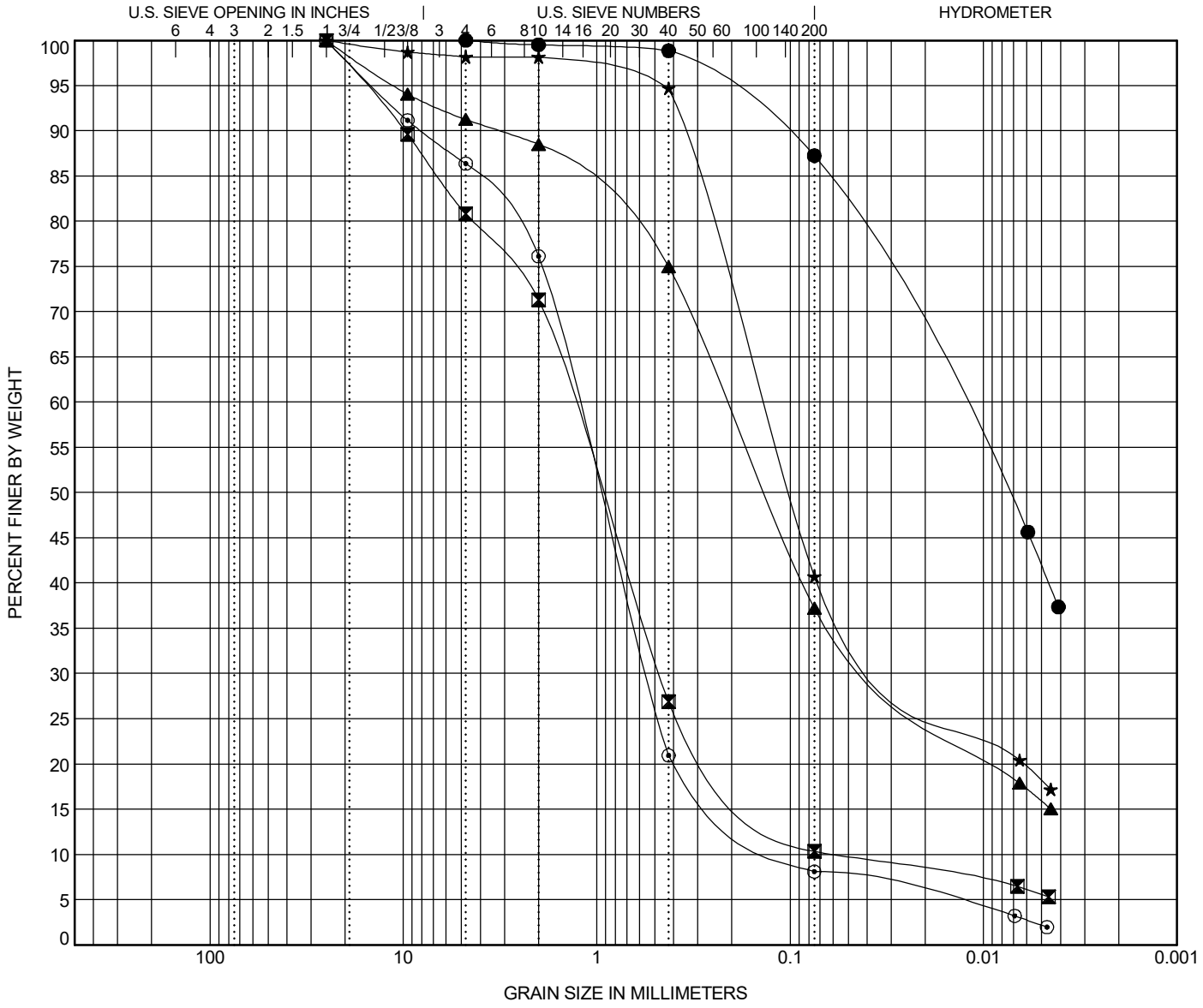

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 34**	**8.0**	**A-7-6 (30)**	**CH**	**53**	**20**	**33**		
⊠	**LSS - 35**	**2.0**	**A-1-b (0)**	**SW-SM**	**NP**	**NP**	**NP**	**2.71**	**21.89**
▲	**LSS - 35**	**4.0**	**A-4 (0)**	**SC**	**26**	**17**	**9**		
★	**LSS - 35**	**6.0**	**A-4 (1)**	**SC**	**25**	**15**	**10**		
⊙	**LSS - 36**	**2.0**	**A-1-b (0)**	**SW-SM**	**NP**	**NP**	**NP**	**2.43**	**13.09**

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 34**	**8.0**	**4.75**	**0.014**			**0.0**	**12.7**	**87.3**	
⊠	**LSS - 35**	**2.0**	**25**	**1.348**	**0.474**	**0.062**	**19.2**	**70.5**	**10.3**	
▲	**LSS - 35**	**4.0**	**25**	**0.214**	**0.03**		**8.7**	**54.1**	**37.2**	
★	**LSS - 35**	**6.0**	**25**	**0.139**	**0.021**		**1.8**	**57.5**	**40.7**	
⊙	**LSS - 36**	**2.0**	**25**	**1.272**	**0.548**	**0.097**	**13.6**	**78.3**	**8.1**	

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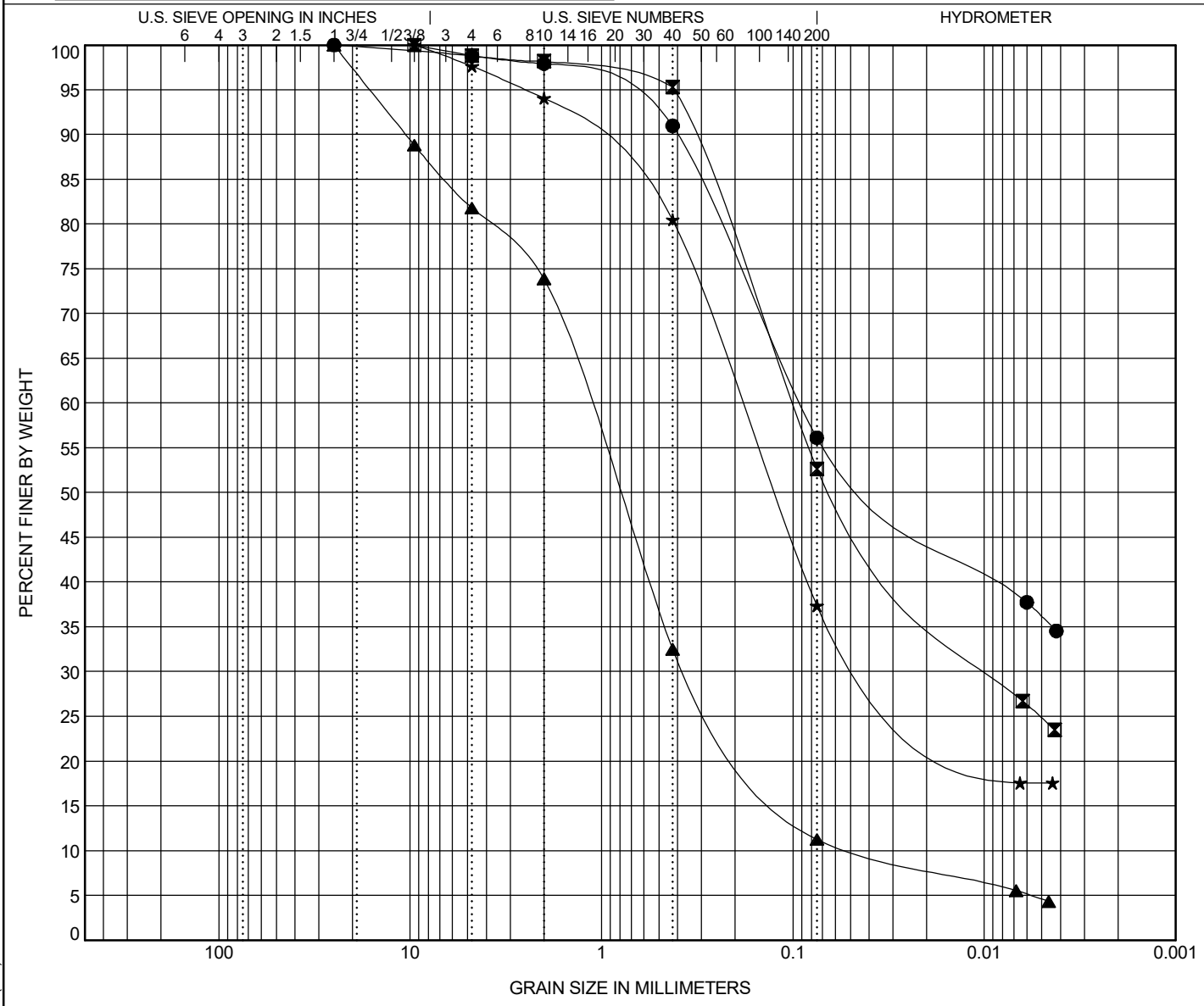

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
● LSS - 36	4.0	A-6 (9)	CL	36	14	22		
⊠ LSS - 36	8.0	A-6 (4)	CL	28	15	13		
▲ LSS - 37	2.0	A-1-b (0)	SW-SM	NP	NP	NP	2.26	26.71
★ LSS - 37	7.0	A-6 (0)	SC	26	15	11		

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● LSS - 36	4.0	25	0.091			1.2	42.6	56.1	
⊠ LSS - 36	8.0	9.5	0.101	0.009		1.2	46.2	52.6	
▲ LSS - 37	2.0	25	1.19	0.346	0.045	18.2	70.5	11.2	
★ LSS - 37	7.0	9.5	0.186	0.03		2.4	60.3	37.4	

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MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

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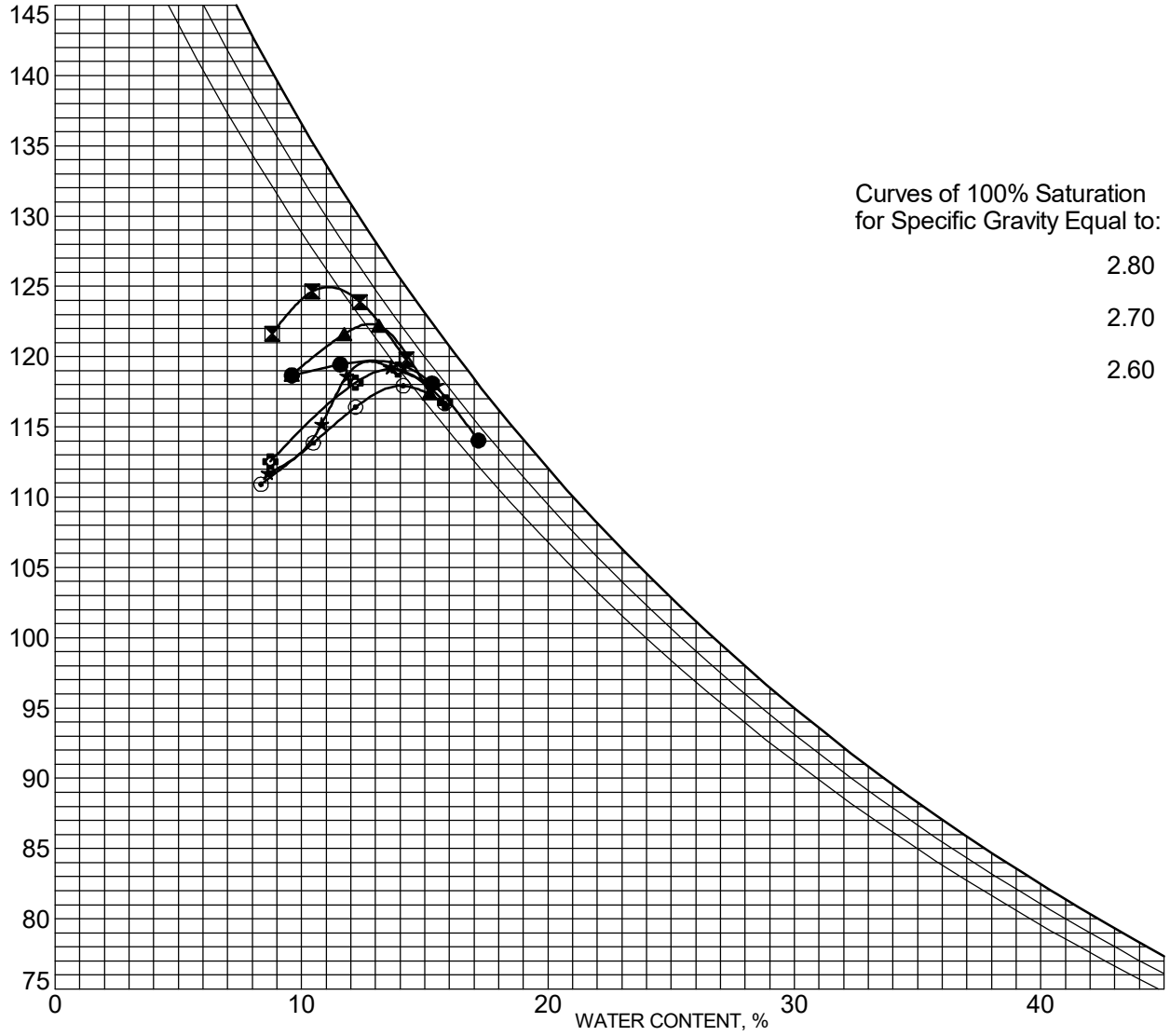

BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	**LSS - 1**	**2.0**	**A-7-6 (20)**	**LEAN CLAY(CL)**
⊠	**LSS - 2**	**2.0**	**A-7-6 (17)**	**LEAN CLAY with SAND(CL)**
▲	**LSS - 3**	**2.0**	**A-6 (10)**	**LEAN CLAY with SAND(CL)**
★	**LSS - 4**	**2.0**	**A-7-6 (14)**	**SANDY LEAN CLAY(CL)**
⊙	**LSS - 5**	**2.0**	**A-7-6 (30)**	**FAT CLAY(CH)**
✪	**LSS - 6**	**2.0**	**A-7-6 (21)**	**LEAN CLAY with SAND(CL)**

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 1**	**2.0**	**AASHTO T-180 Method A**	**42**	**20**	**22**	**119.7 PCF**	**12.9 %**
⊠	**LSS - 2**	**2.0**	**AASHTO T-180 Method A**	**41**	**19**	**22**	**124.9 PCF**	**11.0 %**
▲	**LSS - 3**	**2.0**	**AASHTO T-180 Method A**	**34**	**17**	**17**	**122.3 PCF**	**12.8 %**
★	**LSS - 4**	**2.0**	**AASHTO T-180 Method A**	**41**	**18**	**23**	**119.7 PCF**	**12.8 %**
⊙	**LSS - 5**	**2.0**	**AASHTO T-180 Method A**	**53**	**20**	**33**	**117.9 PCF**	**14.0 %**
✪	**LSS - 6**	**2.0**	**AASHTO T-180 Method A**	**47**	**19**	**28**	**119.1 PCF**	**13.7 %**

MOISTURE-DENSITY RELATIONSHIP

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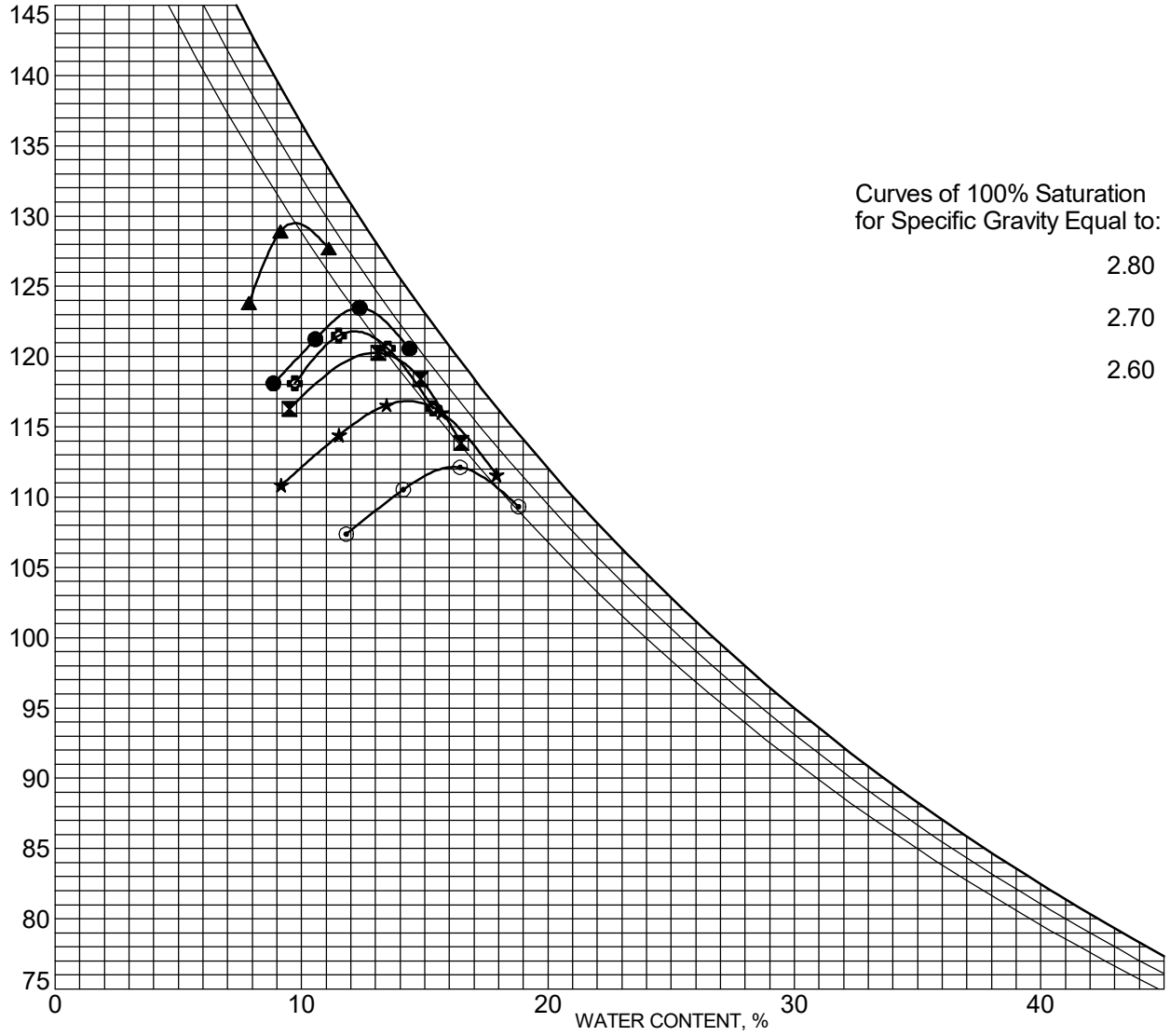

BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	**LSS - 7**	**2.0**	**A-7-6 (21)**	**LEAN CLAY with SAND(CL)**
⊠	**LSS - 8**	**2.0**	**A-7-6 (21)**	**LEAN CLAY with SAND(CL)**
▲	**LSS - 8**	**8.0**	**A-6 (4)**	**SANDY LEAN CLAY(CL)**
★	**LSS - 9**	**2.0**	**A-7-6 (19)**	**LEAN CLAY with SAND(CL)**
⊙	**LSS - 9**	**5.0**	**A-7-5 (16)**	**SILT with SAND(ML)**
✿	**LSS - 10**	**2.0**	**A-6 (15)**	**LEAN CLAY with SAND(CL)**

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 7**	**2.0**	**AASHTO T-180 Method A**	**47**	**19**	**28**	**123.5 PCF**	**12.4 %**
⊠	**LSS - 8**	**2.0**	**AASHTO T-180 Method A**	**44**	**19**	**25**	**120.3 PCF**	**12.9 %**
▲	**LSS - 8**	**8.0**	**AASHTO T-180 Method A**	**28**	**14**	**14**	**129.5 PCF**	**9.8 %**
★	**LSS - 9**	**2.0**	**AASHTO T-180 Method A**	**45**	**22**	**23**	**116.8 PCF**	**14.3 %**
⊙	**LSS - 9**	**5.0**	**AASHTO T-180 Method A**	**48**	**31**	**17**	**112.1 PCF**	**16.2 %**
✿	**LSS - 10**	**2.0**	**AASHTO T-180 Method A**	**37**	**18**	**19**	**121.8 PCF**	**12.1 %**

MOISTURE-DENSITY RELATIONSHIP

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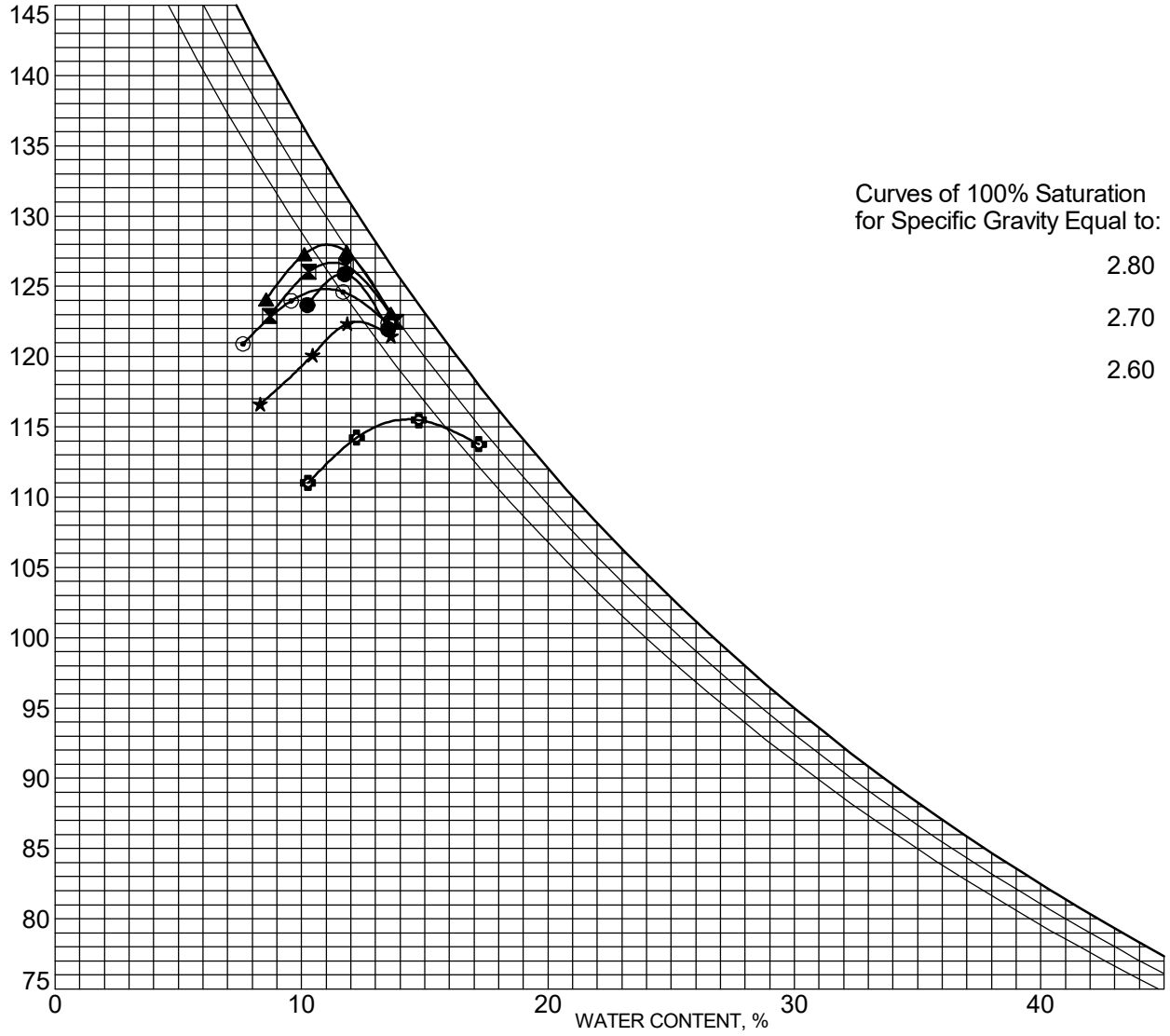

BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	LSS - 10	5.0	A-6 (11)	SANDY LEAN CLAY(CL)
⊠	LSS - 11	2.0	A-6 (16)	LEAN CLAY with SAND(CL)
▲	LSS - 11	5.0	A-6 (12)	LEAN CLAY with SAND(CL)
★	LSS - 12	2.0	A-7-6 (24)	LEAN CLAY(CL)
⊙	LSS - 13	2.0	A-7-6 (20)	LEAN CLAY(CL)
✿	LSS - 14	2.0	A-7-6 (34)	FAT CLAY(CH)

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	LSS - 10	5.0	AASHTO T-180 Method A	35	16	19	125.9 PCF	11.7 %
⊠	LSS - 11	2.0	AASHTO T-180 Method A	39	17	22	126.7 PCF	11.2 %
▲	LSS - 11	5.0	AASHTO T-180 Method A	35	17	18	128.0 PCF	11.0 %
★	LSS - 12	2.0	AASHTO T-180 Method A	45	18	27	122.5 PCF	12.2 %
⊙	LSS - 13	2.0	AASHTO T-180 Method A	41	18	23	124.8 PCF	11.0 %
✿	LSS - 14	2.0	AASHTO T-180 Method A	54	21	33	115.5 PCF	14.4 %

MOISTURE-DENSITY RELATIONSHIP

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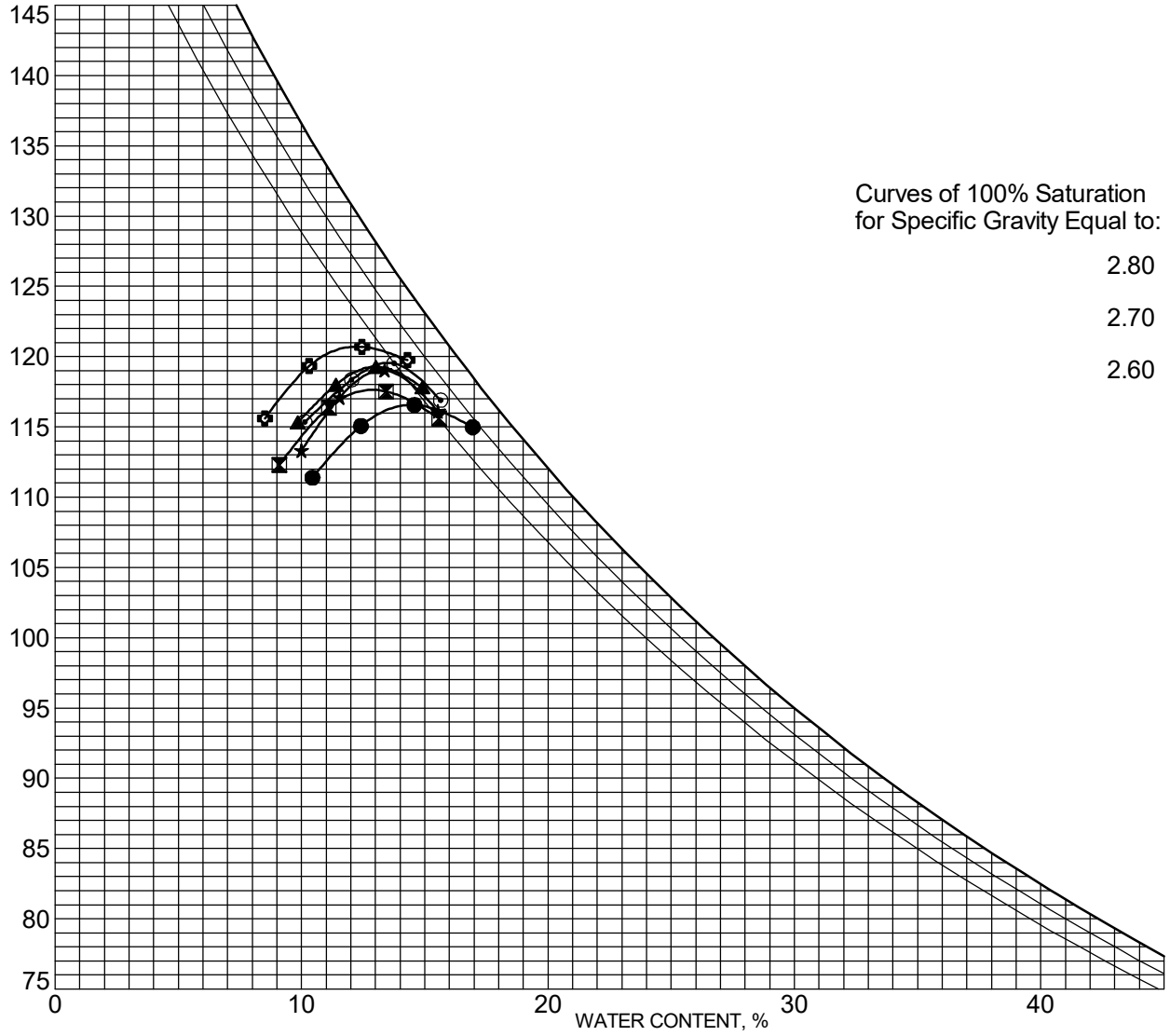


	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	**LSS - 15**	**2.0**	**A-7-6 (31)**	**FAT CLAY(CH)**
⊠	**LSS - 15**	**8.0**	**A-6 (16)**	**LEAN CLAY with SAND(CL)**
▲	**LSS - 16**	**2.0**	**A-7-6 (19)**	**LEAN CLAY with SAND(CL)**
★	**LSS - 17**	**2.0**	**A-6 (13)**	**LEAN CLAY with SAND(CL)**
⊙	**LSS - 17**	**6.0**	**A-7-6 (27)**	**LEAN CLAY(CL)**
✿	**LSS - 18**	**2.0**	**A-7-6 (23)**	**LEAN CLAY(CL)**

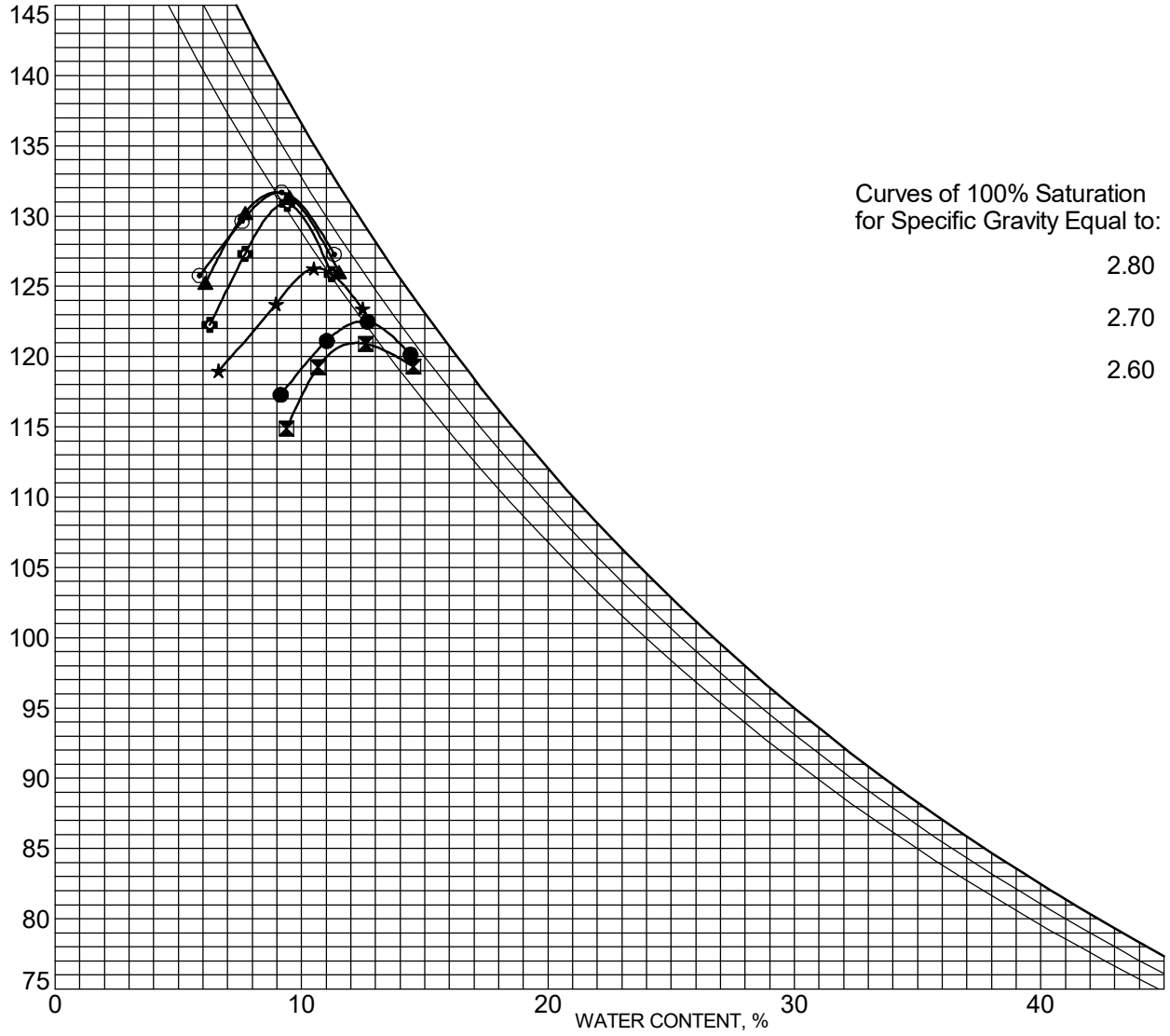
	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 15**	**2.0**	**AASHTO T-180 Method A**	**53**	**22**	**31**	**116.6 PCF**	**14.5 %**
⊠	**LSS - 15**	**8.0**	**AASHTO T-180 Method A**	**40**	**19**	**21**	**117.6 PCF**	**12.9 %**
▲	**LSS - 16**	**2.0**	**AASHTO T-180 Method A**	**44**	**20**	**24**	**119.3 PCF**	**13.0 %**
★	**LSS - 17**	**2.0**	**AASHTO T-180 Method A**	**40**	**20**	**20**	**119.0 PCF**	**13.3 %**
⊙	**LSS - 17**	**6.0**	**AASHTO T-180 Method A**	**48**	**20**	**28**	**119.6 PCF**	**13.5 %**
✿	**LSS - 18**	**2.0**	**AASHTO T-180 Method A**	**44**	**18**	**26**	**120.7 PCF**	**12.2 %**

MOISTURE-DENSITY RELATIONSHIP

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621



BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	**LSS - 18**	**8.0**	**A-7-6 (28)**	**LEAN CLAY(CL)**
⊠	**LSS - 19**	**2.0**	**A-7-6 (20)**	**LEAN CLAY with SAND(CL)**
▲	**LSS - 20**	**2.0**	**A-6 (1)**	**CLAYEY SAND(SC)**
★	**LSS - 20**	**8.0**	**A-6 (15)**	**LEAN CLAY with SAND(CL)**
⊙	**LSS - 21**	**2.0**	**A-6 (2)**	**CLAYEY SAND(SC)**
✿	**LSS - 22**	**2.0**	**A-4 (1)**	**CLAYEY SAND(SC)**

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 18**	**8.0**	**AASHTO T-180 Method A**	**46**	**17**	**29**	**122.5 PCF**	**12.5 %**
⊠	**LSS - 19**	**2.0**	**AASHTO T-180 Method A**	**45**	**22**	**23**	**121.0 PCF**	**12.2 %**
▲	**LSS - 20**	**2.0**	**AASHTO T-180 Method A**	**28**	**16**	**12**	**131.7 PCF**	**8.9 %**
★	**LSS - 20**	**8.0**	**AASHTO T-180 Method A**	**36**	**11**	**25**	**126.3 PCF**	**10.6 %**
⊙	**LSS - 21**	**2.0**	**AASHTO T-180 Method A**	**28**	**17**	**11**	**131.7 PCF**	**9.1 %**
✿	**LSS - 22**	**2.0**	**AASHTO T-180 Method A**	**24**	**15**	**9**	**130.9 PCF**	**9.3 %**

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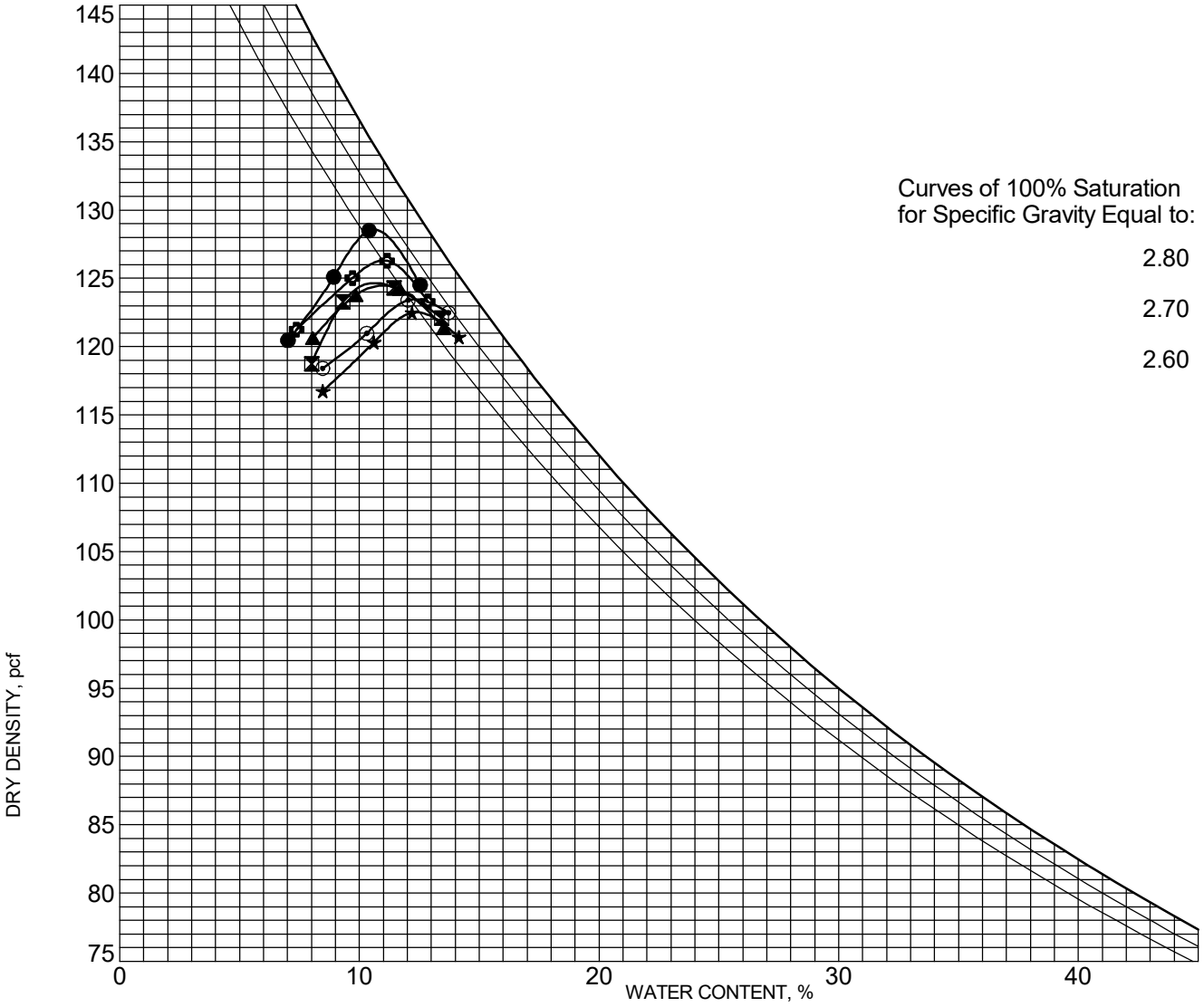

	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	**LSS - 23**	**2.0**	**A-6 (1)**	**CLAYEY SAND(SC)**
⊠	**LSS - 24**	**2.0**	**A-7-6 (22)**	**LEAN CLAY with SAND(CL)**
▲	**LSS - 25**	**2.0**	**A-6 (15)**	**LEAN CLAY with SAND(CL)**
★	**LSS - 26**	**2.0**	**A-7-6 (37)**	**FAT CLAY(CH)**
⊙	**LSS - 27**	**2.0**	**A-7-6 (23)**	**LEAN CLAY(CL)**
✿	**LSS - 28**	**2.0**	**A-6 (11)**	**LEAN CLAY with SAND(CL)**

	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 23**	**2.0**	**AASHTO T-180 Method A**	**32**	**18**	**14**	**128.6 PCF**	**10.6 %**
⊠	**LSS - 24**	**2.0**	**AASHTO T-180 Method A**	**42**	**14**	**28**	**124.7 PCF**	**10.7 %**
▲	**LSS - 25**	**2.0**	**AASHTO T-180 Method A**	**38**	**18**	**20**	**124.5 PCF**	**11.0 %**
★	**LSS - 26**	**2.0**	**AASHTO T-180 Method A**	**58**	**22**	**36**	**122.5 PCF**	**12.4 %**
⊙	**LSS - 27**	**2.0**	**AASHTO T-180 Method A**	**42**	**19**	**23**	**123.5 PCF**	**12.3 %**
✿	**LSS - 28**	**2.0**	**AASHTO T-180 Method A**	**33**	**16**	**17**	**126.3 PCF**	**11.0 %**

MOISTURE-DENSITY RELATIONSHIP

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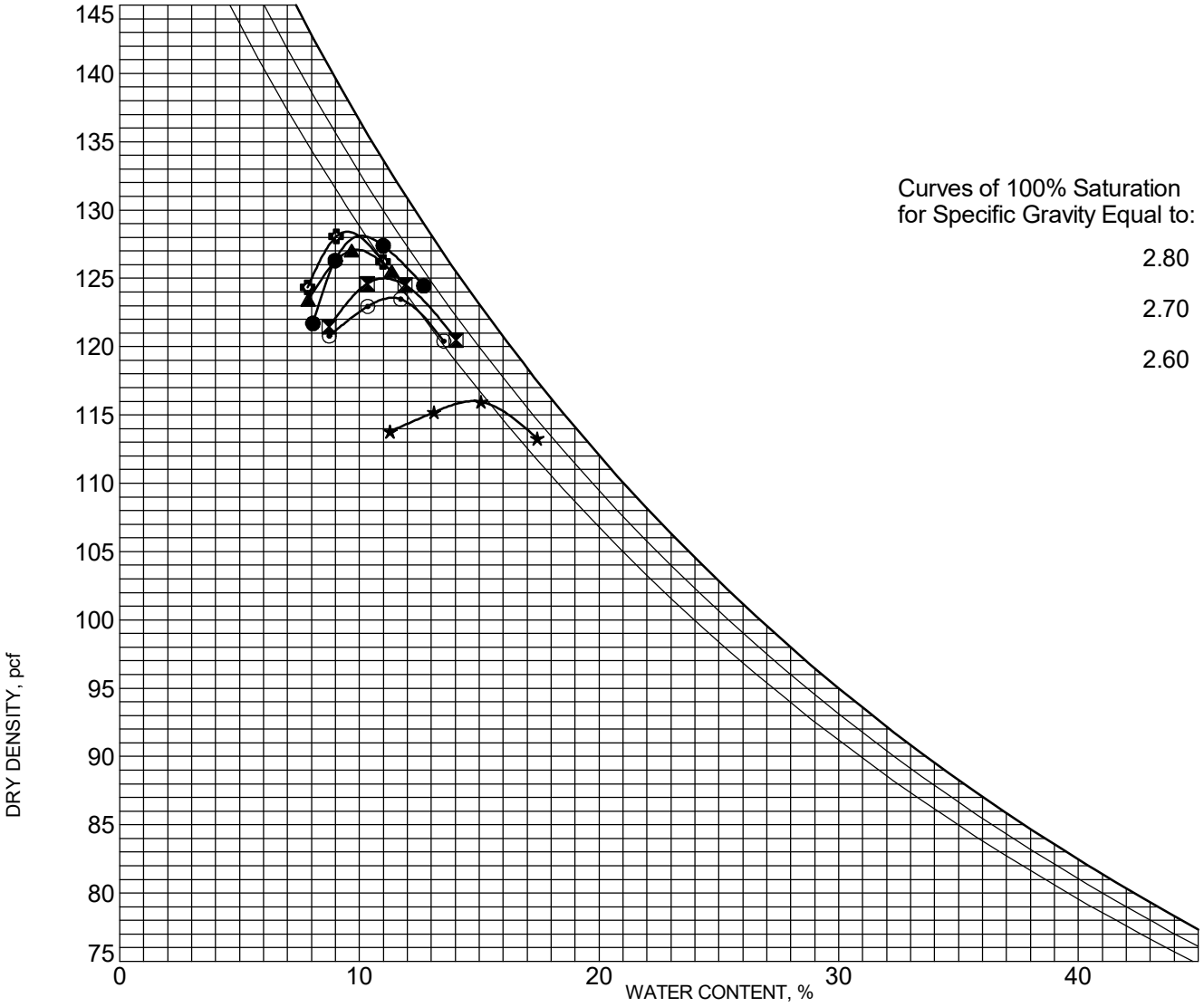

	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	LSS - 29	2.0	A-6 (14)	LEAN CLAY with SAND(CL)
⊠	LSS - 30	2.0	A-7-6 (18)	LEAN CLAY with SAND(CL)
▲	LSS - 31	2.0	A-6 (4)	SANDY LEAN CLAY(CL)
★	LSS - 31	7.0	A-7-6 (33)	FAT CLAY(CH)
⊙	LSS - 32	2.0	A-6 (10)	SANDY LEAN CLAY(CL)
✪	LSS - 32	6.0	A-6 (11)	LEAN CLAY with SAND(CL)

	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	LSS - 29	2.0	AASHTO T-180 Method A	34	15	19	128.1 PCF	10.0 %
⊠	LSS - 30	2.0	AASHTO T-180 Method A	42	17	25	125.0 PCF	11.1 %
▲	LSS - 31	2.0	AASHTO T-180 Method A	28	15	13	127.1 PCF	9.8 %
★	LSS - 31	7.0	AASHTO T-180 Method A	51	19	32	116.0 PCF	14.8 %
⊙	LSS - 32	2.0	AASHTO T-180 Method A	39	19	20	123.6 PCF	11.4 %
✪	LSS - 32	6.0	AASHTO T-180 Method A	29	14	15	128.4 PCF	9.4 %

MOISTURE-DENSITY RELATIONSHIP

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BISMARCK, ND 58504

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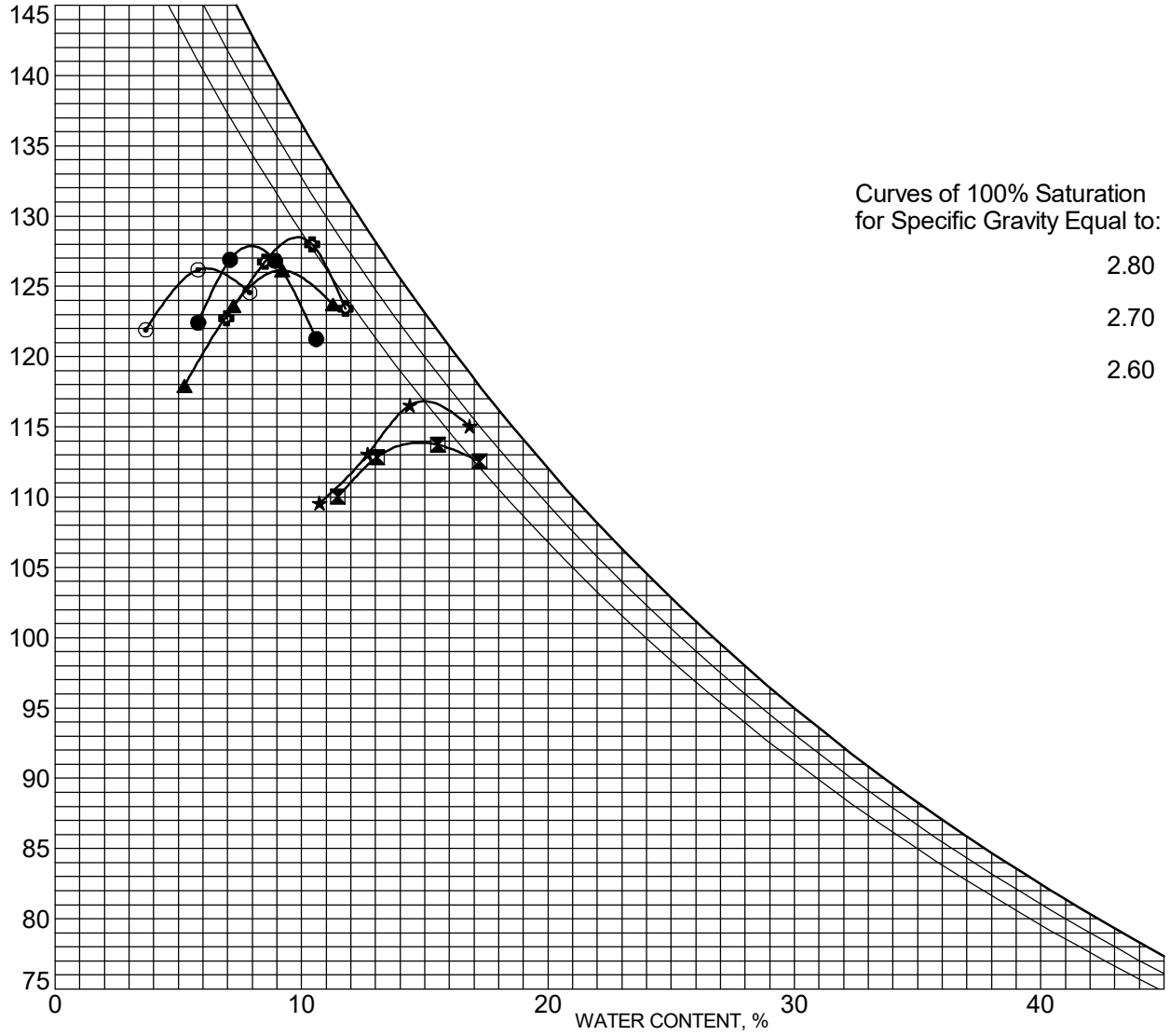

BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	LSS - 33	2.0	A-2-6 (0)	CLAYEY SAND with GRAVEL(SC)
⊠	LSS - 33	6.0	A-7-6 (28)	FAT CLAY(CH)
▲	LSS - 34	2.0	A-4 (0)	SILTY, CLAYEY SAND(SC-SM)
★	LSS - 34	8.0	A-7-6 (30)	FAT CLAY(CH)
⊙	LSS - 35	2.0	A-1-b (0)	WELL-GRADED SAND with SILT and GRAVEL(SW-SM)
✿	LSS - 35	4.0	A-4 (0)	CLAYEY SAND(SC)

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	LSS - 33	2.0	AASHTO T-180 Method A	27	16	11	127.9 PCF	8.0 %
⊠	LSS - 33	6.0	AASHTO T-180 Method A	53	22	31	113.9 PCF	14.8 %
▲	LSS - 34	2.0	AASHTO T-180 Method A	24	17	7	126.1 PCF	9.2 %
★	LSS - 34	8.0	AASHTO T-180 Method A	53	20	33	116.8 PCF	15.0 %
⊙	LSS - 35	2.0	AASHTO T-180 Method A	NP	NP	NP	126.3 PCF	6.1 %
✿	LSS - 35	4.0	AASHTO T-180 Method A	26	17	9	128.5 PCF	9.8 %

MOISTURE-DENSITY RELATIONSHIP

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300 AIRPORT ROAD
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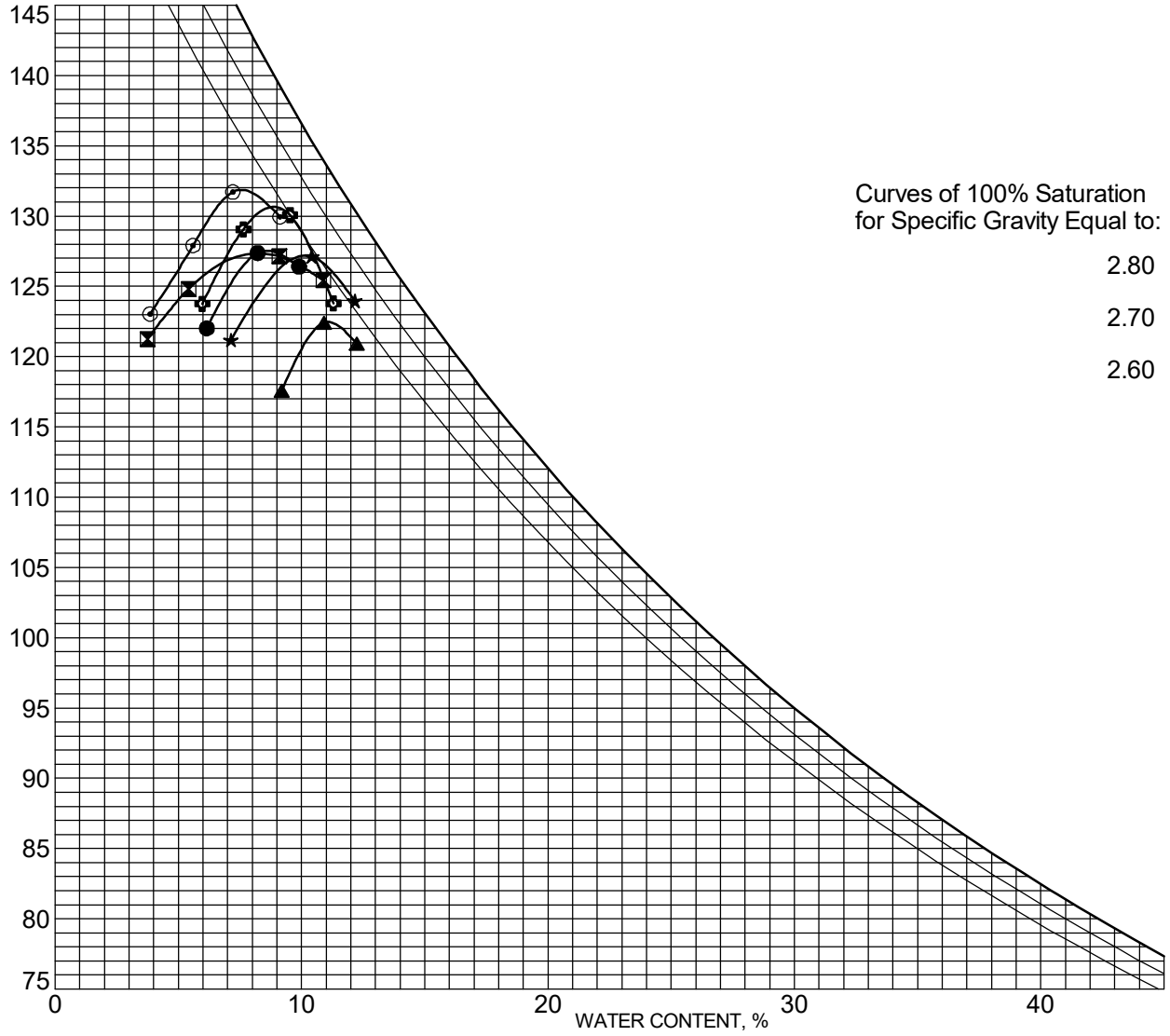

BOREHOLE		DEPTH	AASHTO Classification	USCS Description
●	LSS - 35	6.0	A-4 (1)	CLAYEY SAND(SC)
⊠	LSS - 36	2.0	A-1-b (0)	WELL-GRADED SAND with SILT(SW-SM)
▲	LSS - 36	4.0	A-6 (9)	SANDY LEAN CLAY(CL)
★	LSS - 36	8.0	A-6 (4)	SANDY LEAN CLAY(CL)
⊙	LSS - 37	2.0	A-1-b (0)	WELL-GRADED SAND with SILT and GRAVEL(SW-SM)
✿	LSS - 37	7.0	A-6 (0)	CLAYEY SAND(SC)

BOREHOLE		DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	LSS - 35	6.0	AASHTO T-180 Method A	25	15	10	127.5 PCF	8.6 %
⊠	LSS - 36	2.0	AASHTO T-180 Method A	NP	NP	NP	127.3 PCF	8.3 %
▲	LSS - 36	4.0	AASHTO T-180 Method A	36	14	22	122.5 PCF	11.1 %
★	LSS - 36	8.0	AASHTO T-180 Method A	28	15	13	127.2 PCF	10.1 %
⊙	LSS - 37	2.0	AASHTO T-180 Method A	NP	NP	NP	131.9 PCF	7.5 %
✿	LSS - 37	7.0	AASHTO T-180 Method A	26	15	11	130.7 PCF	8.8 %

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 1	2.0	42	20	22	9.5	89	A-7-6 (20)	CL	6.6	18.8			
LSS - 1	3.0								15.5	18.8			
LSS - 1	4.0								15.3	18.8			
LSS - 1	5.0								20.6	18.8			
LSS - 1	6.0								20.9	18.8			
LSS - 1	7.0								20.3	18.8			
LSS - 1	8.0								22.1	18.8			
LSS - 1	9.0								22.1	18.8			
LSS - 1	10.0								25.6	18.8			
LSS - 2	2.0	41	19	22	9.5	80	A-7-6 (17)	CL	11.0	15.5			
LSS - 2	3.0								11.1	15.5			
LSS - 2	4.0								14.3	15.5			
LSS - 2	5.0								18.2	15.5			
LSS - 2	6.0								16.2	15.5			
LSS - 2	7.0								18.2	15.5			
LSS - 2	8.0								20.2	15.5			
LSS - 2	9.0								16.5	15.5			
LSS - 2	10.0								13.5	15.5			
LSS - 3	2.0	34	17	17	25	72	A-6 (10)	CL	7.3	18.0			
LSS - 3	3.0								14.8	18.0			
LSS - 3	4.0								18.8	18.0			
LSS - 3	5.0								20.1	18.0			
LSS - 3	6.0								19.6	18.0			
LSS - 3	7.0								14.6	18.0			
LSS - 3	8.0								23.2	18.0			
LSS - 3	9.0								22.2	18.0			
LSS - 3	10.0								21.3	18.0			
LSS - 4	2.0	41	18	23	25	70	A-7-6 (14)	CL	7.9	27.9			
LSS - 4	3.0								26.7	27.9			
LSS - 4	4.0								29.4	27.9			
LSS - 4	5.0								31.4	27.9			
LSS - 4	6.0								27.9	27.9			
LSS - 4	7.0								27.3	27.9			
LSS - 4	8.0								24.7	27.9			
LSS - 4	9.0								24.9	27.9			
LSS - 4	10.0								27.5	27.9			
LSS - 4	11.0								27.2	27.9			
LSS - 4	12.0								20.5	27.9			
LSS - 4	13.0								20.5	27.9			
LSS - 4	14.0								24.9	27.9			
LSS - 4	15.0								26.8	27.9			
LSS - 4	16.0								24.2	27.9			
LSS - 4	17.0								20.5	27.9			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 4	18.0								20.1	27.9			
LSS - 4	19.0								96.8	27.9			
LSS - 4	20.0								20.0	27.9			
LSS - 5	2.0	53	20	33	25	86	A-7-6 (30)	CH	9.4	24.5			
LSS - 5	3.0								10.9	24.5			
LSS - 5	4.0								28.6	24.5			
LSS - 5	5.0								29.3	24.5			
LSS - 5	6.0								28.0	24.5			
LSS - 5	7.0								25.3	24.5			
LSS - 5	8.0								27.9	24.5			
LSS - 5	9.0								26.2	24.5			
LSS - 5	10.0								26.7	24.5			
LSS - 5	11.0								25.9	24.5			
LSS - 5	12.0								24.9	24.5			
LSS - 5	13.0								25.3	24.5			
LSS - 5	14.0								27.2	24.5			
LSS - 5	15.0								25.2	24.5			
LSS - 5	16.0								24.2	24.5			
LSS - 5	17.0								24.0	24.5			
LSS - 5	18.0								24.2	24.5			
LSS - 5	19.0								24.9	24.5			
LSS - 5	20.0								26.9	24.5			
LSS - 6	2.0	47	19	28	25	78	A-7-6 (21)	CL	7.1	19.6			
LSS - 6	3.0								21.0	19.6			
LSS - 6	4.0								18.1	19.6			
LSS - 6	5.0								19.5	19.6			
LSS - 6	6.0								21.7	19.6			
LSS - 6	7.0								26.4	19.6			
LSS - 6	8.0								17.0	19.6			
LSS - 6	9.0								21.5	19.6			
LSS - 6	10.0								24.3	19.6			
LSS - 7	2.0	47	19	28	25	77	A-7-6 (21)	CL	4.3	17.1			
LSS - 7	3.0								6.1	17.1			
LSS - 7	4.0								23.5	17.1			
LSS - 7	5.0								22.6	17.1			
LSS - 7	6.0								21.7	17.1			
LSS - 7	7.0								17.0	17.1			
LSS - 7	8.0								19.9	17.1			
LSS - 7	9.0								19.0	17.1			
LSS - 7	10.0								20.3	17.1			
LSS - 8	2.0	44	19	25	25	83	A-7-6 (21)	CL	5.6	20.1			
LSS - 8	3.0								23.1	20.1			
LSS - 8	4.0								21.6	20.1			

SUMMARY OF LABORATORY RESULTS

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BISMARCK, ND 58504

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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 8	5.0								23.0	20.1			
LSS - 8	6.0								24.5	20.1			
LSS - 8	7.0								23.0	20.1			
LSS - 8	8.0	28	14	14	9.5	53	A-6 (4)	CL	22.1	21.5			
LSS - 8	9.0								20.2	21.5			
LSS - 8	10.0								22.2	21.5			
LSS - 9	2.0	45	22	23	25	81	A-7-6 (19)	CL	7.6	20.4			
LSS - 9	3.0								20.7	20.4			
LSS - 9	4.0								32.9	20.4			
LSS - 9	5.0	48	31	17	9.5	83	A-7-5 (16)	ML	29.2	30.0			
LSS - 9	6.0								25.1	30.0			
LSS - 9	7.0								46.2	30.0			
LSS - 9	8.0								25.0	30.0			
LSS - 9	9.0								25.7	30.0			
LSS - 9	10.0								29.0	30.0			
LSS - 10	2.0	37	18	19	25	84	A-6 (15)	CL	6.2	14.9			
LSS - 10	3.0								18.6	14.9			
LSS - 10	4.0								19.9	14.9			
LSS - 10	5.0	35	16	19	25	69	A-6 (11)	CL	18.6	20.3			
LSS - 10	6.0								19.9	20.3			
LSS - 10	7.0								20.6	20.3			
LSS - 10	8.0								20.9	20.3			
LSS - 10	9.0								19.2	20.3			
LSS - 10	10.0								22.5	20.3			
LSS - 11	2.0	39	17	22	25	78	A-6 (16)	CL	7.1	13.2			
LSS - 11	3.0								15.5	13.2			
LSS - 11	4.0								16.9	13.2			
LSS - 11	5.0	35	17	18	25	75	A-6 (12)	CL	15.6	21.3			
LSS - 11	6.0								20.3	21.3			
LSS - 11	7.0								18.5	21.3			
LSS - 11	8.0								15.0	21.3			
LSS - 11	9.0								27.8	21.3			
LSS - 11	10.0								30.7	21.3			
LSS - 12	2.0	45	18	27	25	87	A-7-6 (24)	CL	8.2	21.3			
LSS - 12	3.0								20.5	21.3			
LSS - 12	4.0								21.2	21.3			
LSS - 12	5.0								19.8	21.3			
LSS - 12	6.0								20.9	21.3			
LSS - 12	7.0								25.2	21.3			
LSS - 12	8.0								25.2	21.3			
LSS - 12	9.0								26.1	21.3			
LSS - 12	10.0								24.6	21.3			
LSS - 13	2.0	41	18	23	25	88	A-7-6 (20)	CL	9.2	43.9			

SUMMARY OF LABORATORY RESULTS

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BISMARCK, ND 58504

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Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 13	3.0								17.6	43.9			
LSS - 13	4.0								21.2	43.9			
LSS - 13	5.0								24.0	43.9			
LSS - 13	6.0								24.0	43.9			
LSS - 13	7.0								57.6	43.9			
LSS - 13	8.0								92.4	43.9			
LSS - 13	9.0								61.9	43.9			
LSS - 13	10.0								87.1	43.9			
LSS - 14	2.0	54	21	33	4.75	94	A-7-6 (34)	CH	7.5	20.2			
LSS - 14	3.0								21.9	20.2			
LSS - 14	4.0								22.3	20.2			
LSS - 14	5.0								28.8	20.2			
LSS - 14	6.0								21.4	20.2			
LSS - 14	7.0								22.6	20.2			
LSS - 14	8.0								19.2	20.2			
LSS - 14	9.0								18.9	20.2			
LSS - 14	10.0								19.1	20.2			
LSS - 15	2.0	53	22	31	9.5	92	A-7-6 (31)	CH	10.4	22.2			
LSS - 15	3.0								20.2	22.2			
LSS - 15	4.0								31.4	22.2			
LSS - 15	5.0								27.1	22.2			
LSS - 15	6.0								22.3	22.2			
LSS - 15	7.0								21.6	22.2			
LSS - 15	8.0	40	19	21	9.5	80	A-6 (16)	CL	19.8	19.2			
LSS - 15	9.0								19.8	19.2			
LSS - 15	10.0								18.1	19.2			
LSS - 16	2.0	44	20	24	25	81	A-7-6 (19)	CL	8.9	23.1			
LSS - 16	3.0								25.5	23.1			
LSS - 16	4.0								24.7	23.1			
LSS - 16	5.0								25.8	23.1			
LSS - 16	6.0								26.5	23.1			
LSS - 16	7.0								20.5	23.1			
LSS - 16	8.0								23.5	23.1			
LSS - 16	9.0								27.6	23.1			
LSS - 16	10.0								24.8	23.1			
LSS - 17	2.0	40	20	20	25	73	A-6 (13)	CL	8.6	22.3			
LSS - 17	3.0								16.0	22.3			
LSS - 17	4.0								27.6	22.3			
LSS - 17	5.0								37.0	22.3			
LSS - 17	6.0	48	20	28	25	91	A-7-6 (27)	CL	22.9	23.2			
LSS - 17	7.0								20.7	23.2			
LSS - 17	8.0								23.4	23.2			
LSS - 17	9.0								24.1	23.2			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 17	10.0								24.7	23.2			
LSS - 18	2.0	44	18	26	9.5	86	A-7-6 (23)	CL	8.1	17.1			
LSS - 18	3.0								20.4	17.1			
LSS - 18	4.0								17.5	17.1			
LSS - 18	5.0								17.8	17.1			
LSS - 18	6.0								18.1	17.1			
LSS - 18	7.0								20.6	17.1			
LSS - 18	8.0	46	17	29	4.75	92	A-7-6 (28)	CL	24.2	27.5			
LSS - 18	9.0								27.6	27.5			
LSS - 18	10.0								30.5	27.5			
LSS - 19	2.0	45	22	23	9.5	84	A-7-6 (20)	CL	13.1	19.8			
LSS - 19	3.0								22.6	19.8			
LSS - 19	4.0								9.6	19.8			
LSS - 19	5.0								14.2	19.8			
LSS - 19	6.0								19.4	19.8			
LSS - 19	7.0								22.7	19.8			
LSS - 19	8.0								26.3	19.8			
LSS - 19	9.0								24.0	19.8			
LSS - 19	10.0								26.8	19.8			
LSS - 20	2.0	28	16	12	25	40	A-6 (1)	SC	10.7	15.0			
LSS - 20	3.0								14.0	15.0			
LSS - 20	4.0								14.1	15.0			
LSS - 20	5.0								22.2	15.0			
LSS - 20	6.0								14.1	15.0			
LSS - 20	7.0								14.7	15.0			
LSS - 20	8.0	36	11	25	25	70	A-6 (15)	CL	20.7	19.1			
LSS - 20	9.0								19.7	19.1			
LSS - 20	10.0								16.9	19.1			
LSS - 21	2.0	28	17	11	25	50	A-6 (2)	SC	9.1	12.1			
LSS - 21	3.0								12.0	12.1			
LSS - 21	4.0								12.1	12.1			
LSS - 21	5.0								12.0	12.1			
LSS - 21	6.0								9.3	12.1			
LSS - 21	7.0								11.7	12.1			
LSS - 21	8.0								15.8	12.1			
LSS - 21	9.0								15.3	12.1			
LSS - 21	10.0								11.8	12.1			
LSS - 22	2.0	24	15	9	25	47	A-4 (1)	SC	10.9	10.4			
LSS - 22	3.0								13.2	10.4			
LSS - 22	4.0								5.9	10.4			
LSS - 22	5.0								6.2	10.4			
LSS - 22	6.0								9.8	10.4			
LSS - 22	7.0								15.5	10.4			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 22	8.0								6.6	10.4			
LSS - 22	9.0								8.0	10.4			
LSS - 22	10.0								17.4	10.4			
LSS - 23	2.0	32	18	14	25	38	A-6 (1)	SC	19.8	14.4			
LSS - 23	3.0								10.8	14.4			
LSS - 23	4.0								8.1	14.4			
LSS - 23	5.0								8.8	14.4			
LSS - 23	6.0								9.8	14.4			
LSS - 23	7.0								18.1	14.4			
LSS - 23	8.0								16.4	14.4			
LSS - 23	9.0								19.7	14.4			
LSS - 23	10.0								18.5	14.4			
LSS - 24	2.0	42	14	28	9.5	81	A-7-6 (22)	CL	12.6	20.4			
LSS - 24	3.0								24.4	20.4			
LSS - 24	4.0								18.5	20.4			
LSS - 24	5.0								26.4	20.4			
LSS - 24	6.0								28.9	20.4			
LSS - 24	7.0								17.8	20.4			
LSS - 24	8.0								18.0	20.4			
LSS - 24	9.0								18.3	20.4			
LSS - 24	10.0								18.9	20.4			
LSS - 25	2.0	38	18	20	25	79	A-6 (15)	CL	7.4	17.3			
LSS - 25	3.0								8.3	17.3			
LSS - 25	4.0								17.6	17.3			
LSS - 25	5.0								19.5	17.3			
LSS - 25	6.0								15.6	17.3			
LSS - 25	7.0								18.8	17.3			
LSS - 25	8.0								20.8	17.3			
LSS - 25	9.0								22.3	17.3			
LSS - 25	10.0								25.1	17.3			
LSS - 26	2.0	58	22	36	9.5	92	A-7-6 (37)	CH	9.2	21.2			
LSS - 26	3.0								22.0	21.2			
LSS - 26	4.0								22.0	21.2			
LSS - 26	5.0								18.5	21.2			
LSS - 26	6.0								16.9	21.2			
LSS - 26	7.0								29.9	21.2			
LSS - 26	8.0								24.4	21.2			
LSS - 26	9.0								23.5	21.2			
LSS - 26	10.0								24.1	21.2			
LSS - 27	2.0	42	19	23	9.5	96	A-7-6 (23)	CL	7.0	23.2			
LSS - 27	3.0								19.9	23.2			
LSS - 27	4.0								21.7	23.2			
LSS - 27	5.0								26.7	23.2			

SUMMARY OF LABORATORY RESULTS

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 27	6.0								22.8	23.2			
LSS - 27	7.0								22.6	23.2			
LSS - 27	8.0								23.0	23.2			
LSS - 27	9.0								43.5	23.2			
LSS - 27	10.0								21.2	23.2			
LSS - 28	2.0	33	16	17	9.5	76	A-6 (11)	CL	5.1	15.9			
LSS - 28	3.0								16.4	15.9			
LSS - 28	4.0								19.6	15.9			
LSS - 28	5.0								17.5	15.9			
LSS - 28	6.0								14.5	15.9			
LSS - 28	7.0								18.8	15.9			
LSS - 28	8.0								17.5	15.9			
LSS - 28	9.0								17.0	15.9			
LSS - 28	10.0								17.0	15.9			
LSS - 29	2.0	34	15	19	25	80	A-6 (14)	CL	6.6	17.8			
LSS - 29	3.0								16.3	17.8			
LSS - 29	4.0								37.1	17.8			
LSS - 29	5.0								22.5	17.8			
LSS - 29	6.0								16.7	17.8			
LSS - 29	7.0								14.5	17.8			
LSS - 29	8.0								15.6	17.8			
LSS - 29	9.0								17.0	17.8			
LSS - 29	10.0								14.5	17.8			
LSS - 30	2.0	42	17	25	25	78	A-7-6 (18)	CL	8.8	19.5			
LSS - 30	3.0								24.0	19.5			
LSS - 30	4.0								22.3	19.5			
LSS - 30	5.0								23.0	19.5			
LSS - 30	6.0								20.3	19.5			
LSS - 30	7.0								18.3	19.5			
LSS - 30	8.0								21.9	19.5			
LSS - 30	9.0								17.8	19.5			
LSS - 30	10.0								19.4	19.5			
LSS - 31	2.0	28	15	13	9.5	54	A-6 (4)	CL	7.7	16.2			
LSS - 31	3.0								18.0	16.2			
LSS - 31	4.0								18.3	16.2			
LSS - 31	5.0								20.4	16.2			
LSS - 31	6.0								16.5	16.2			
LSS - 31	7.0	51	19	32	9.5	96	A-7-6 (33)	CH	24.0	20.2			
LSS - 31	8.0								18.7	20.2			
LSS - 31	9.0								18.6	20.2			
LSS - 31	10.0								19.7	20.2			
LSS - 32	2.0	39	19	20	25	61	A-6 (10)	CL	7.3	16.3			
LSS - 32	3.0								20.9	16.3			

SUMMARY OF LABORATORY RESULTS

NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

PROJECT NUMBER SS-5-022(132)047 **LOCATION** Stark County

PCN 22621

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 32	4.0								18.3	16.3			
LSS - 32	5.0								18.8	16.3			
LSS - 32	6.0	29	14	15	25	85	A-6 (11)	CL	14.3	13.0			
LSS - 32	7.0								10.6	13.0			
LSS - 32	8.0								13.0	13.0			
LSS - 32	9.0								13.2	13.0			
LSS - 32	10.0								14.0	13.0			
LSS - 33	2.0	27	16	11	25	31	A-2-6 (0)	SC	8.9	10.8			
LSS - 33	3.0								8.4	10.8			
LSS - 33	4.0								8.3	10.8			
LSS - 33	5.0								17.6	10.8			
LSS - 33	6.0	53	22	31	9.5	85	A-7-6 (28)	CH	18.7	19.7			
LSS - 33	7.0								21.5	19.7			
LSS - 33	8.0								18.1	19.7			
LSS - 33	9.0								20.1	19.7			
LSS - 33	10.0								20.1	19.7			
LSS - 34	2.0	24	17	7	25	36	A-4 (0)	SC-SM	13.6	16.9			
LSS - 34	3.0								15.8	16.9			
LSS - 34	4.0								14.6	16.9			
LSS - 34	5.0								15.5	16.9			
LSS - 34	6.0								14.3	16.9			
LSS - 34	7.0								27.5	16.9			
LSS - 34	8.0	53	20	33	4.75	87	A-7-6 (30)	CH	29.9	27.1			
LSS - 34	9.0								29.7	27.1			
LSS - 34	10.0								21.8	27.1			
LSS - 35	2.0	NP	NP	NP	25	10	A-1-b (0)	SW-SM	10.2	10.1			
LSS - 35	3.0								10.0	10.1			
LSS - 35	4.0	26	17	9	25	37	A-4 (0)	SC	18.1	16.9			
LSS - 35	5.0								15.7	16.9			
LSS - 35	6.0	25	15	10	25	41	A-4 (1)	SC	15.3	20.6			
LSS - 35	7.0								20.3	20.6			
LSS - 35	8.0								22.1	20.6			
LSS - 35	9.0								22.0	20.6			
LSS - 35	10.0								23.1	20.6			
LSS - 36	2.0	NP	NP	NP	25	8	A-1-b (0)	SW-SM	10.7	12.3			
LSS - 36	3.0								13.8	12.3			
LSS - 36	4.0	36	14	22	25	56	A-6 (9)	CL	20.2	22.0			
LSS - 36	5.0								24.0	22.0			
LSS - 36	6.0								20.1	22.0			
LSS - 36	7.0								23.7	22.0			
LSS - 36	8.0	28	15	13	9.5	53	A-6 (4)	CL	23.3	23.2			
LSS - 36	9.0								22.5	23.2			
LSS - 36	10.0								23.7	23.2			

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SUMMARY OF LABORATORY RESULTS

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PCN 22621

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	AASHTO Classification	USCS Class-ification	Water Content (%)	Avg. Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
LSS - 37	2.0	NP	NP	NP	25	11	A-1-b (0)	SW-SM	11.8	12.0			
LSS - 37	3.0								11.5	12.0			
LSS - 37	4.0								10.3	12.0			
LSS - 37	5.0								12.4	12.0			
LSS - 37	6.0								14.0	12.0			
LSS - 37	7.0	26	15	11	9.5	37	A-6 (0)	SC	21.8	23.1			
LSS - 37	8.0								21.5	23.1			
LSS - 37	9.0								24.6	23.1			
LSS - 37	10.0								24.7	23.1			