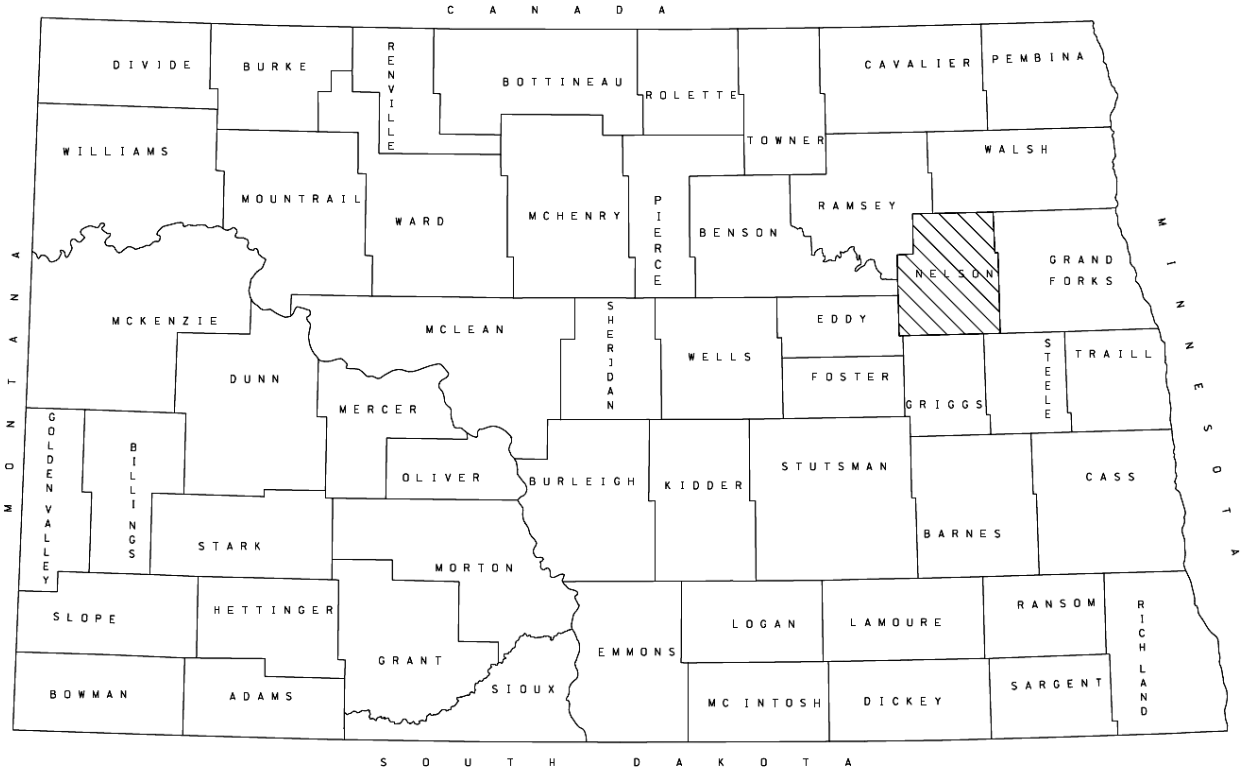
LINEAR SOILS SURVEY AND RECOMMENDATIONS

PROJECT NO. BND-NH-6-002(134)313

PCN 22278

COUNTY Nelson

US 2, RP 312.581 to RP 314.276



PREPARED BY: Jared Loegering, PE

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
MATERIALS AND RESEARCH DIVISION

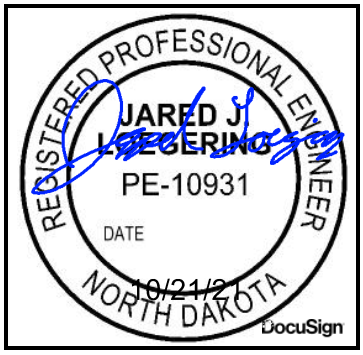
October 2021

BND-NH-6-002(134)313

US 2, 1 East of ND 32 South

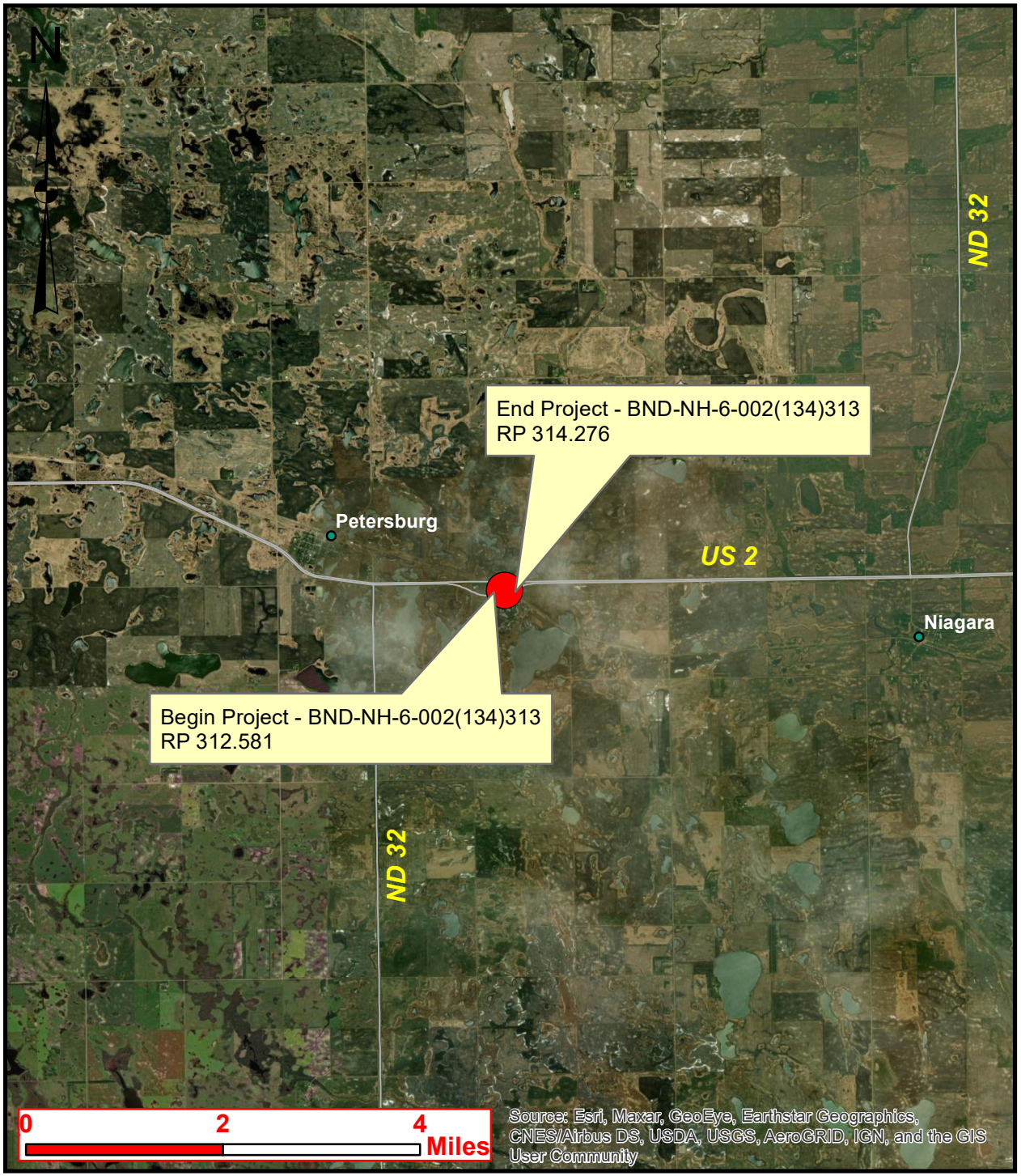
CERTIFICATION

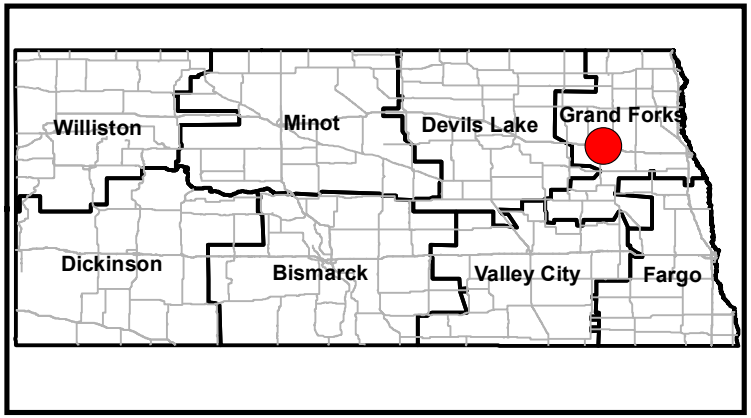
I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of North Dakota. This document was originally issued and sealed by Jared J. Loegering, Registration number PE-10931 on 10/21/2021 and the original document is stored at the North Dakota Department of Transportation.



Project Location

Project: BND-NH-6-002(134)313
PCN: 22278
Scope: New Structure
Location: 1 East of ND 32 South





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Appendix C – Summary of Soils Analysis
Appendix D – Lab Results

Introduction

Location: US 2, 1 East of ND 32 South
Reference Points: 312.581 to 314.276
Project Length: 1.695 Miles
Proposed Project Scope: New Roadway/Bridge Construction
Investigation Scope: 250' Intervals and Identified Maintenance Areas

Maintenance Review

This project is a new roadway alignment and structure on US 2. Therefore, a maintenance review was not completed.

Summary of Soil Investigation

The soil investigation was completed on 9/3/2019. The investigation consisted of 17 borings.

Table 1 – Boring Locations Summary

Boring Location	Justification for Boring	Boring Depth	Justification
312+4327 to 313+3734	New Construction	10 Feet	Conducted borings every 250' along the proposed roadway alignment. A total of 17 borings.

Maps of the boring locations are shown in Appendix B. The lab results are included in Appendix D.

Summary of Soil Analysis

Project Limits – 312+4327 to 313+3734: The majority of the soils within the project limits are sandy lean clays with an AASHTO classification of A-6 and A-7-6. These soils have on average a maximum dry density of approximately 119.5 lb/ft^3 and an optimum water content of approximately 13%. The in-place moistures of the soils are on average 0% to 16% over optimum.

Soil Sample Distribution

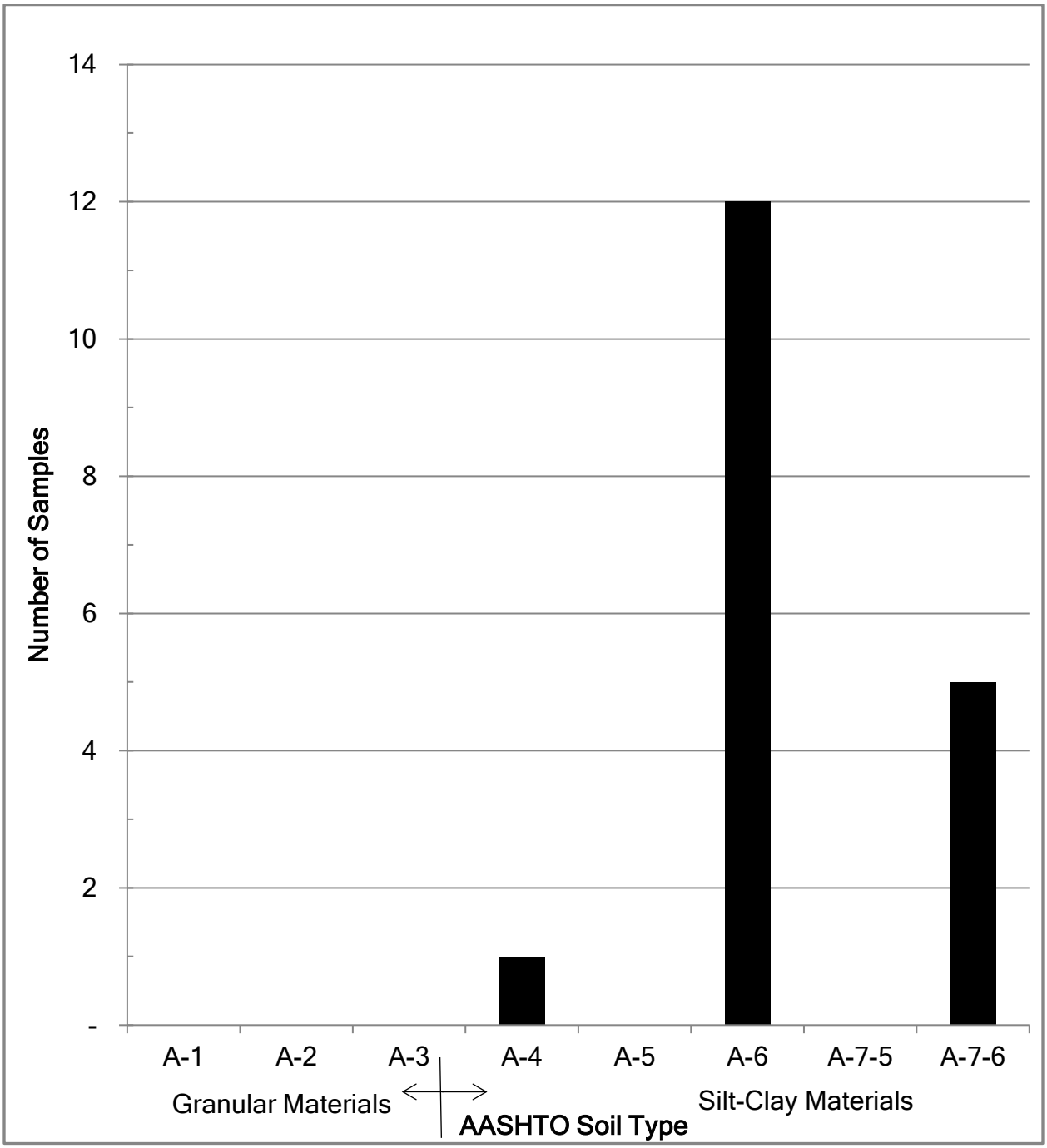


Figure 1 - Soil Sample Distribution

Design Recommendations

Project Limits – 312+3068 to 314+1457: In order to provide a sufficient working platform, compete subgrade prep along the project limits on all cut and fill areas of less than 18”.

Design Information

Pipe Replacement: None

Compaction Method: T-180

Subgrade Prep:

Location RP + Feet	Recommendation	Justification
312+3068 to 314+1457	12" Subgrade Prep Type - C on all cut and fill areas of less than 18"	The subgrade needs to provide a sufficient working platform to allow for the compaction of the base material.

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.

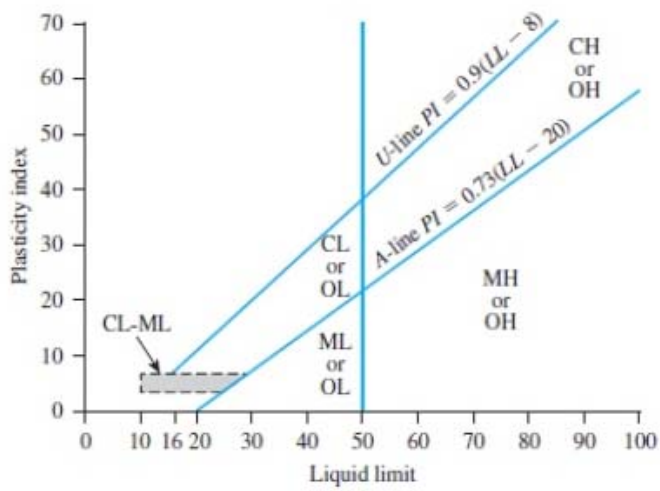
[b] Sands with 5 to 12% fines require dual symbols: SW-SM, SW-SC, SP-SM, SP-SC.

[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.

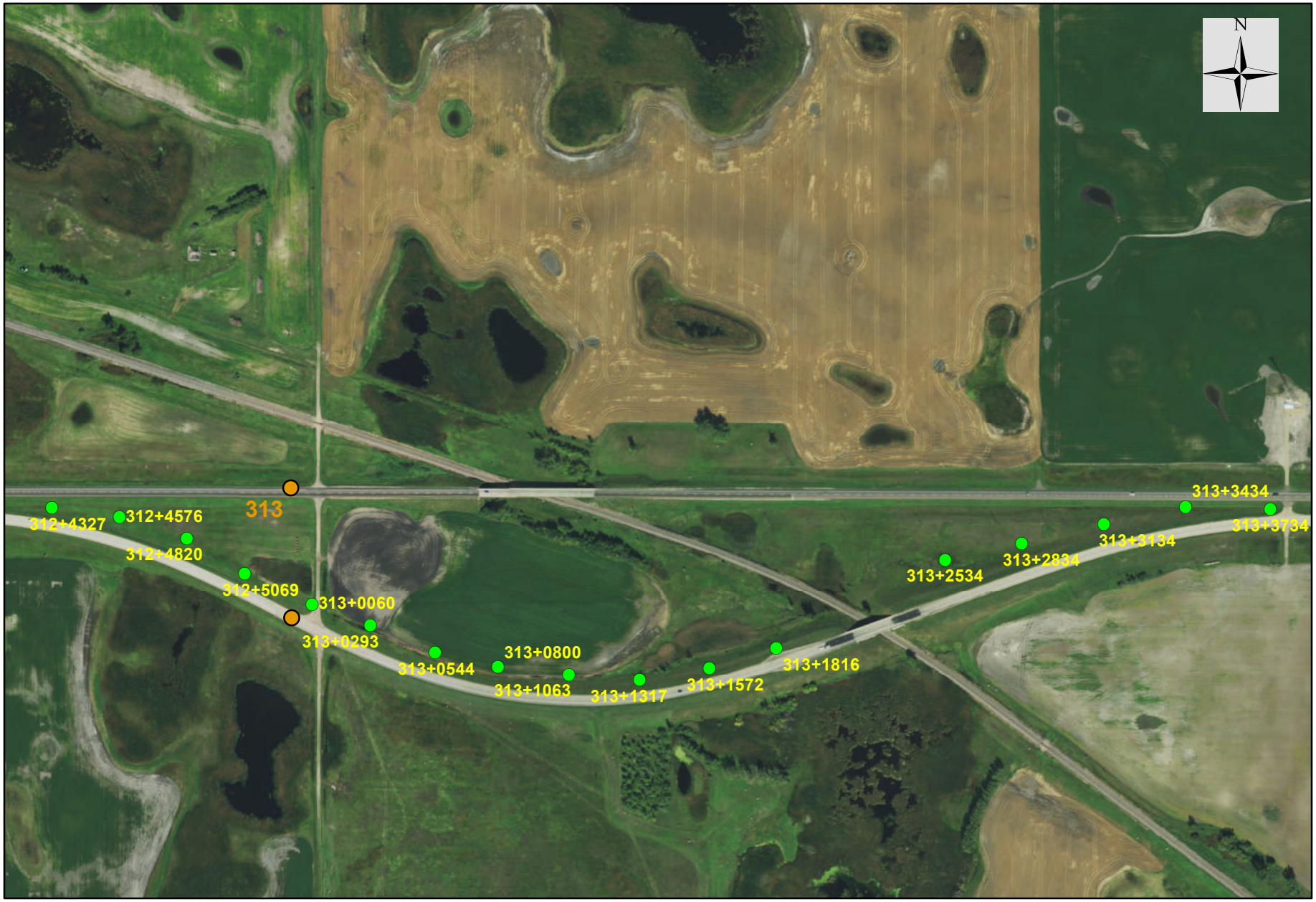
[e] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol CL-ML.

Plasticity Chart :



APPENDIX B

BORING LOCATIONS



0 1,000 2,000 Feet

Legend

- Reference Point
- Boring Locations

Project Number: NH-6-002(134)313

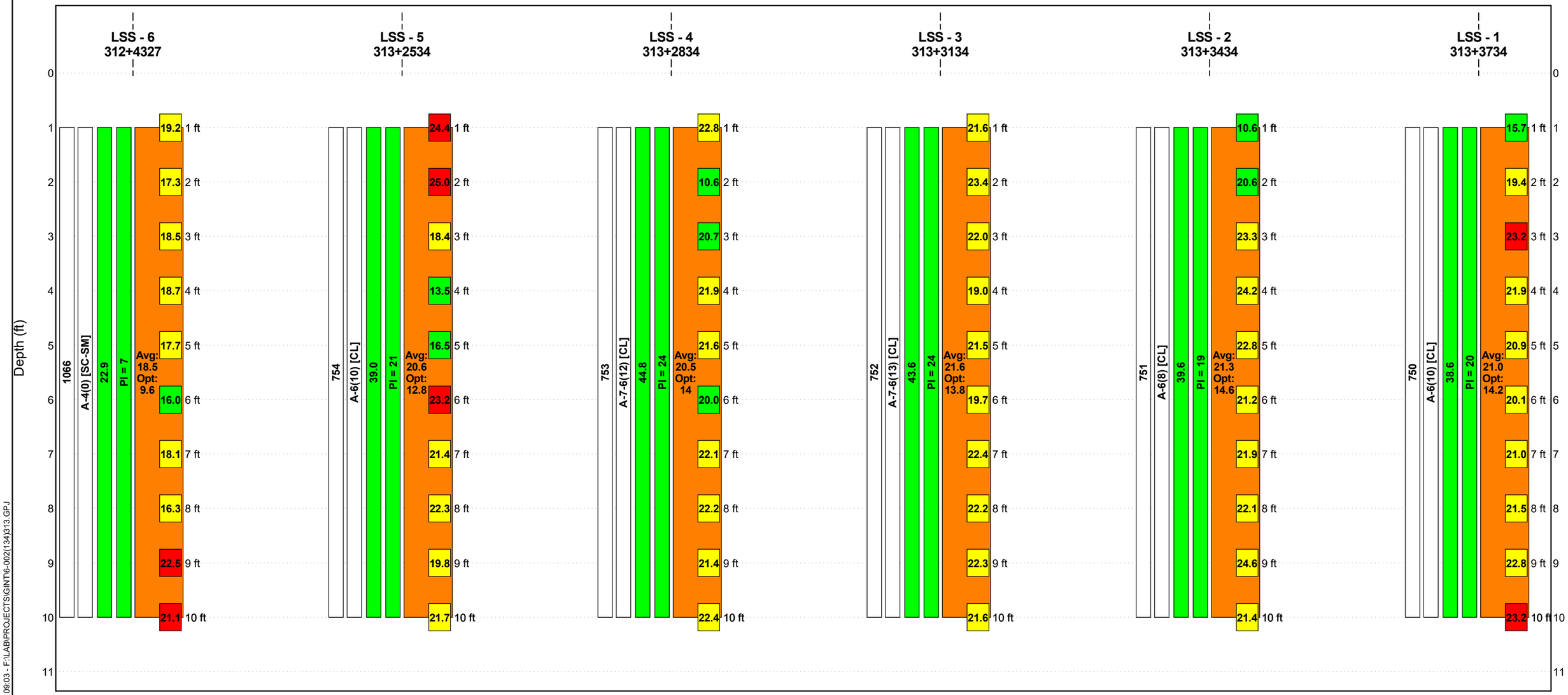
APPENDIX C

SUMMARY OF SOILS ANALYSIS

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

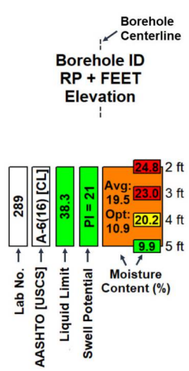
PROJECT NUMBER BND-NH-6-002(134)313 **PCN** 22278

LOCATION Nelson County

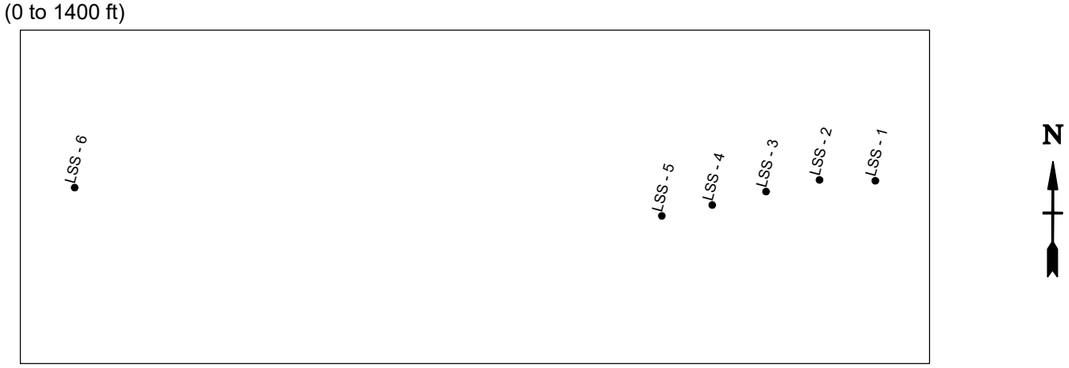


Boreholes Equally Spaced (0 to 1400 ft)

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



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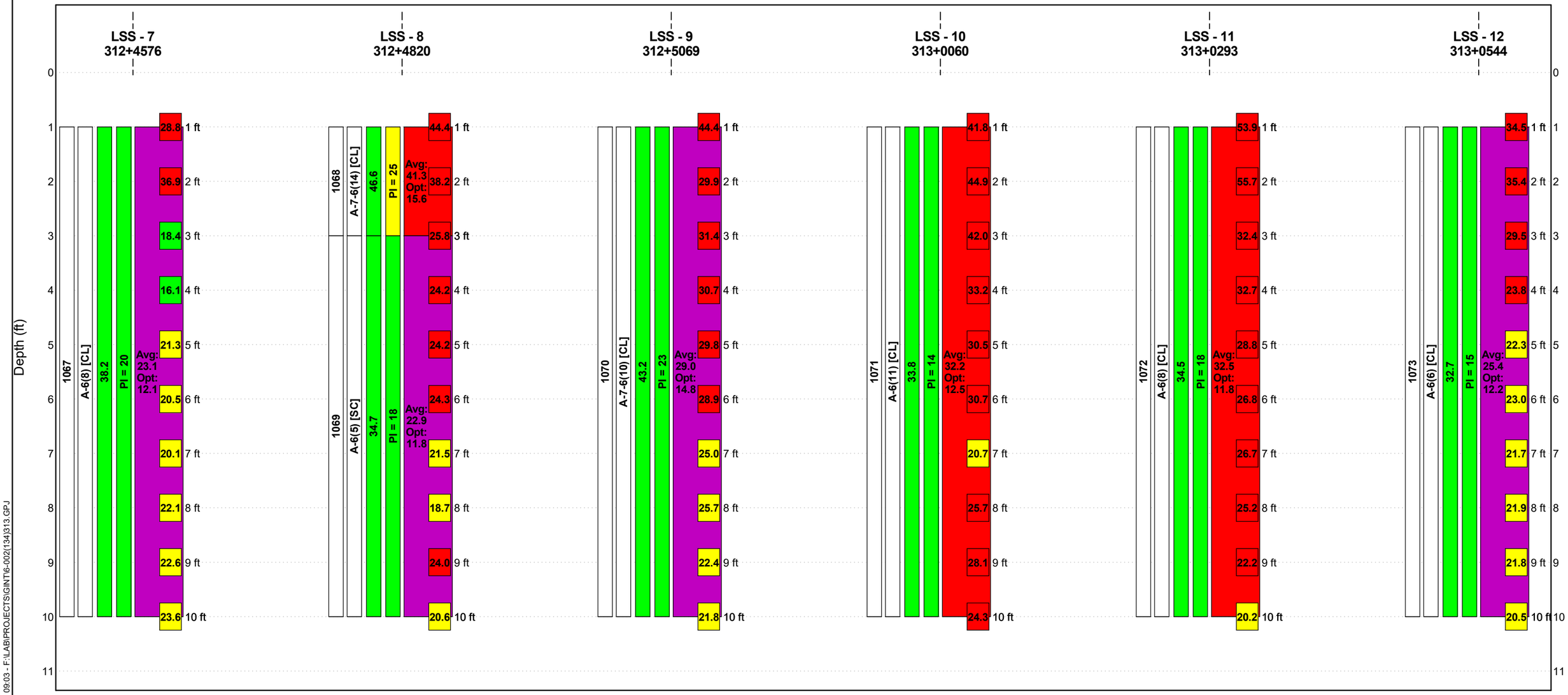
NORTH DAKOTA DEPARTMENT OF TRANSPORATION
300 AIRPORT ROAD
BISMARCK, ND 58504

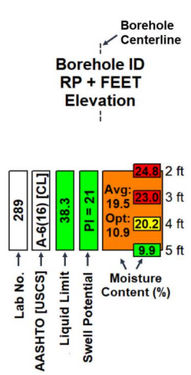
PROJECT NUMBER BND-NH-6-002(134)313 **PCN** 22278

LOCATION Nelson County

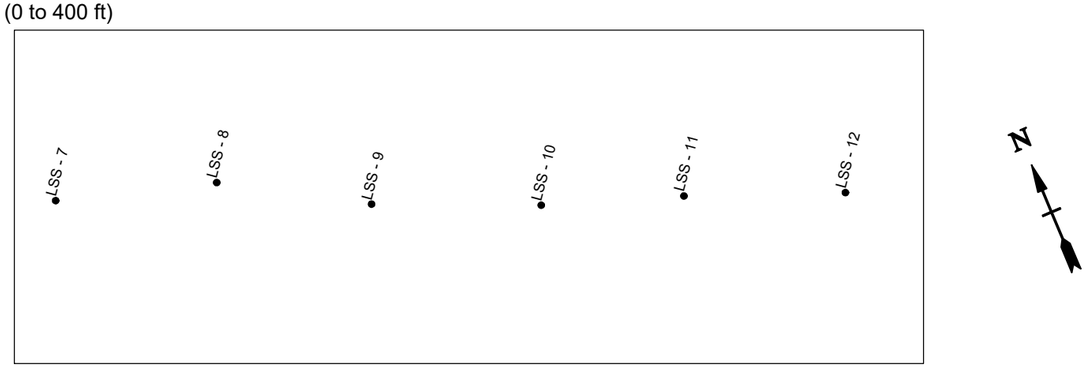


Boreholes Equally Spaced (0 to 400 ft)

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



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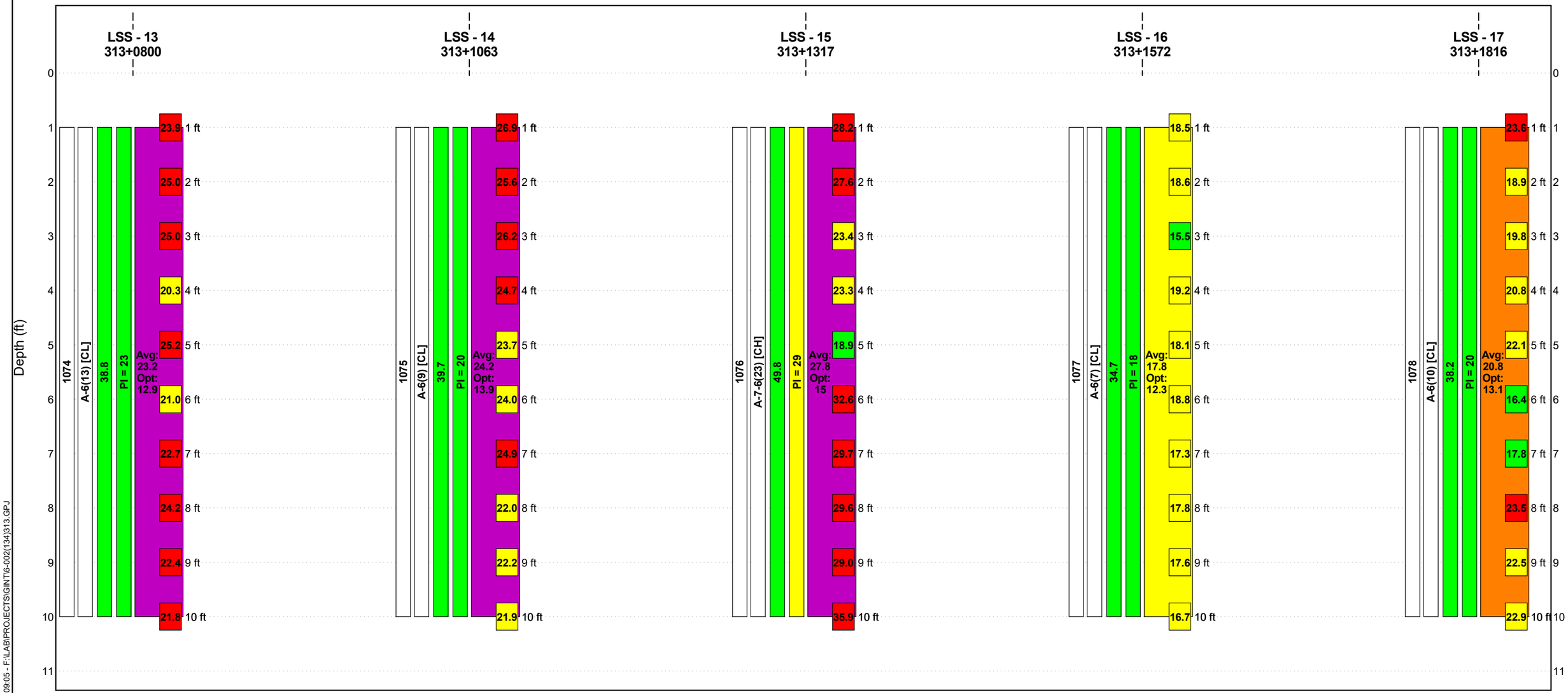
300 AIRPORT ROAD
BISMARCK, ND 58504

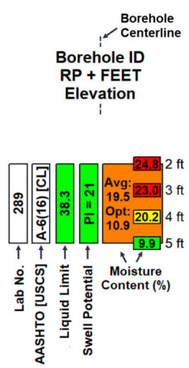
PROJECT NUMBER BND-NH-6-002(134)313 **PCN** 22278

LOCATION Nelson County

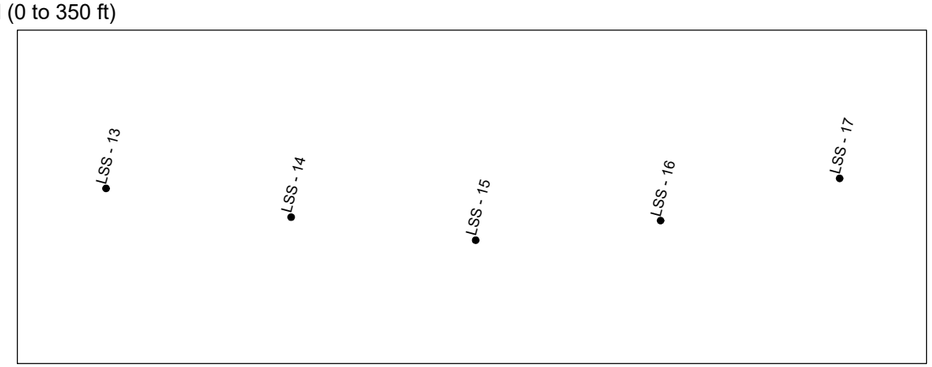


Boreholes Equally Spaced (0 to 350 ft)

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



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APPENDIX D

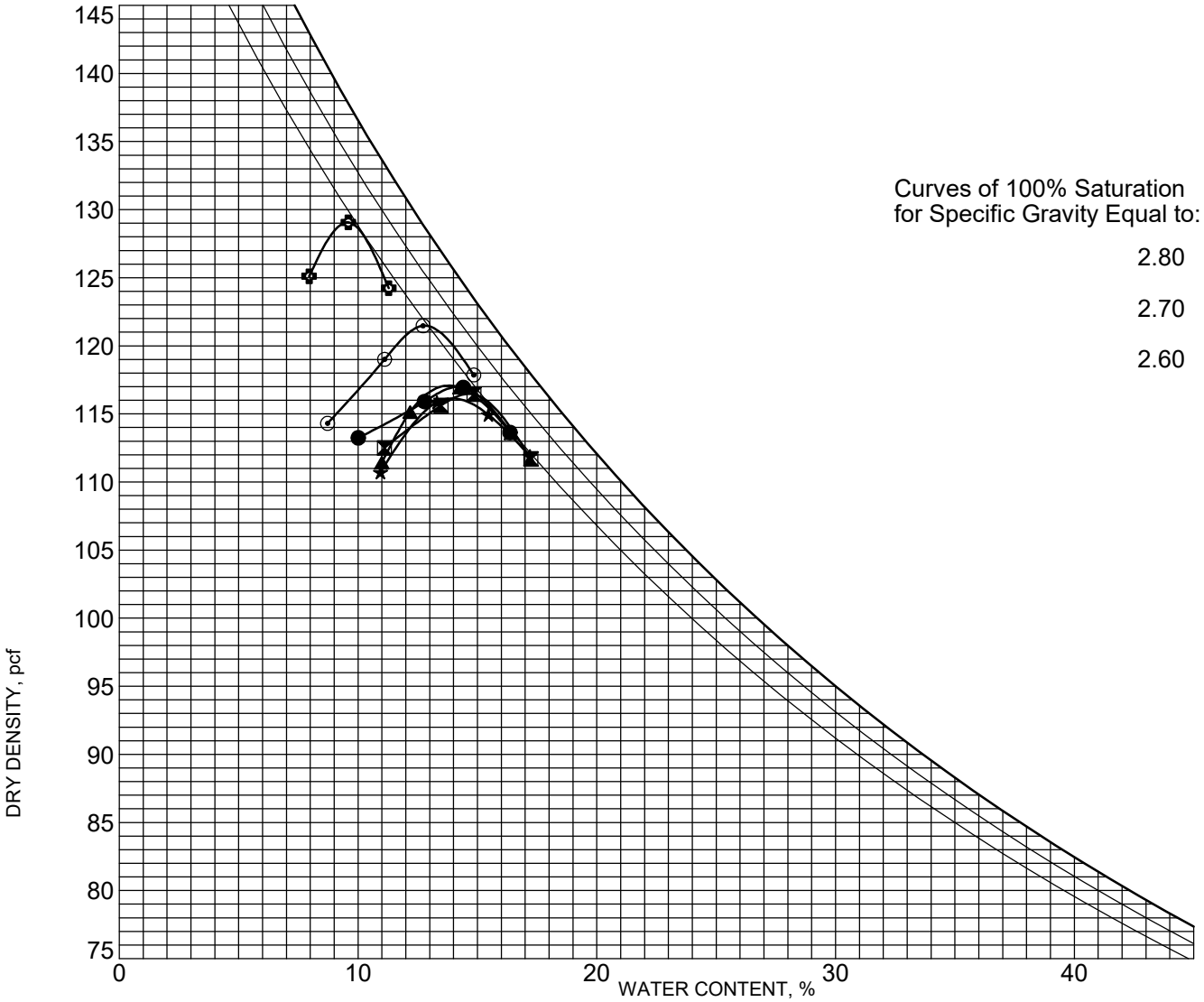
LAB RESULTS

MOISTURE-DENSITY RELATIONSHIP

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278



	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	**LSS - 1**	**1.0**	**A-6 (10)**	**SANDY LEAN CLAY(CL)**
⊠	**LSS - 2**	**1.0**	**A-6 (8)**	**SANDY LEAN CLAY(CL)**
▲	**LSS - 3**	**1.0**	**A-7-6 (13)**	**SANDY LEAN CLAY(CL)**
★	**LSS - 4**	**1.0**	**A-7-6 (12)**	**SANDY LEAN CLAY(CL)**
⊙	**LSS - 5**	**1.0**	**A-6 (10)**	**SANDY LEAN CLAY(CL)**
✿	**LSS - 6**	**1.0**	**A-4 (0)**	**SILTY, CLAYEY SAND(SC-SM)**

	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 1**	**1.0**	**AASHTO T-180 Method A**	**39**	**18**	**21**	**117.0 PCF**	**14.2 %**
⊠	**LSS - 2**	**1.0**	**AASHTO T-180 Method A**	**40**	**21**	**19**	**116.5 PCF**	**14.6 %**
▲	**LSS - 3**	**1.0**	**AASHTO T-180 Method A**	**44**	**19**	**25**	**117.1 PCF**	**13.8 %**
★	**LSS - 4**	**1.0**	**AASHTO T-180 Method A**	**45**	**21**	**24**	**116.1 PCF**	**14.0 %**
⊙	**LSS - 5**	**1.0**	**AASHTO T-180 Method A**	**39**	**18**	**21**	**121.5 PCF**	**12.8 %**
✿	**LSS - 6**	**1.0**	**AASHTO T-180 Method A**	**23**	**16**	**7**	**129.1 PCF**	**9.6 %**

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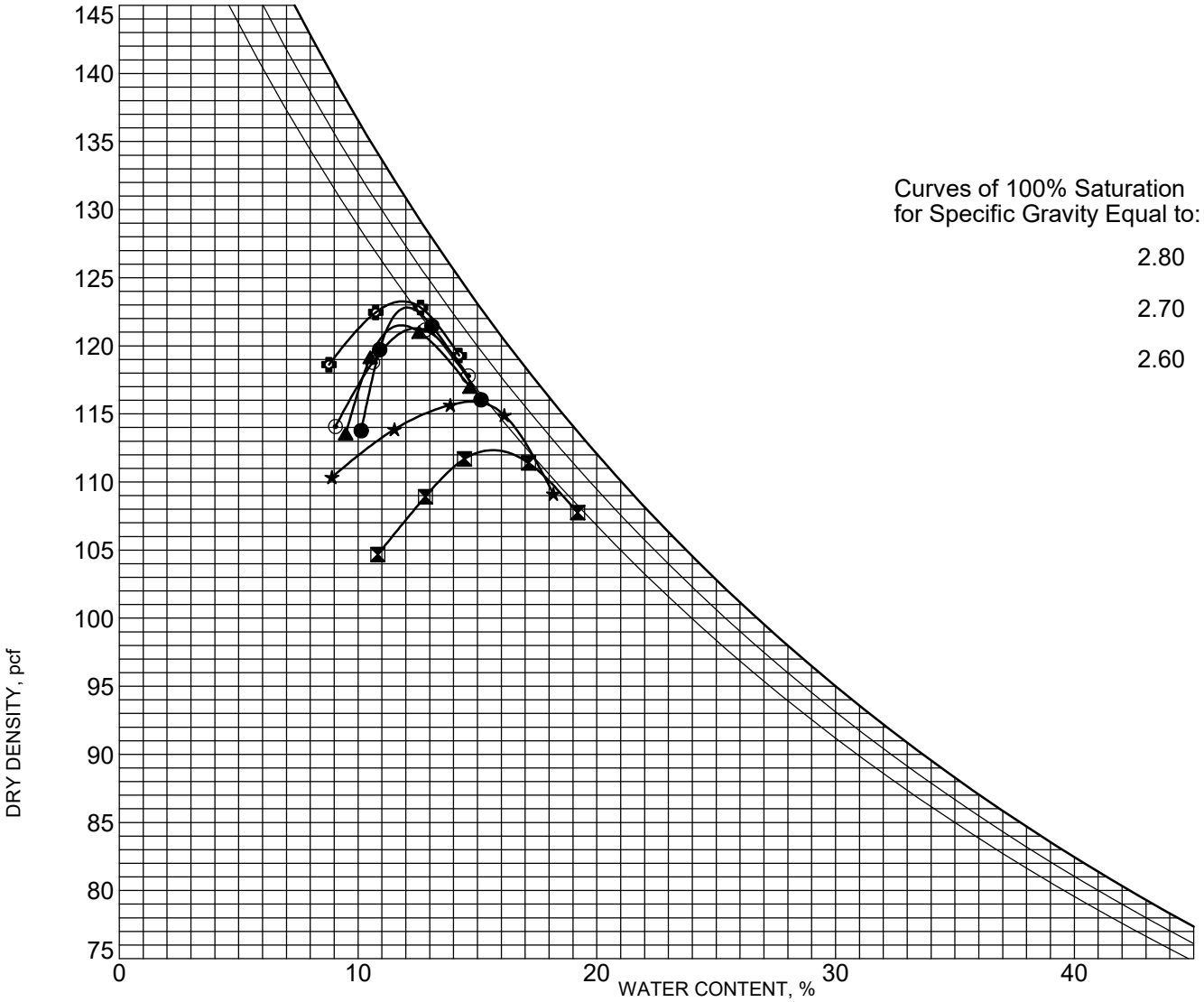
MOISTURE-DENSITY RELATIONSHIP

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278



	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	**LSS - 7**	**1.0**	**A-6 (8)**	**SANDY LEAN CLAY(CL)**
⊠	**LSS - 8**	**1.0**	**A-7-6 (14)**	**SANDY LEAN CLAY(CL)**
▲	**LSS - 8**	**3.0**	**A-6 (5)**	**CLAYEY SAND(SC)**
★	**LSS - 9**	**1.0**	**A-7-6 (10)**	**SANDY LEAN CLAY(CL)**
⊙	**LSS - 10**	**1.0**	**A-6 (11)**	**LEAN CLAY with SAND(CL)**
✿	**LSS - 11**	**1.0**	**A-6 (8)**	**SANDY LEAN CLAY(CL)**

	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 7**	**1.0**	**AASHTO T-180 Method A**	**38**	**19**	**19**	**122.8 PCF**	**12.1 %**
⊠	**LSS - 8**	**1.0**	**AASHTO T-180 Method A**	**47**	**21**	**26**	**112.3 PCF**	**15.6 %**
▲	**LSS - 8**	**3.0**	**AASHTO T-180 Method A**	**35**	**17**	**18**	**121.5 PCF**	**11.8 %**
★	**LSS - 9**	**1.0**	**AASHTO T-180 Method A**	**43**	**21**	**22**	**115.9 PCF**	**14.8 %**
⊙	**LSS - 10**	**1.0**	**AASHTO T-180 Method A**	**34**	**19**	**15**	**121.3 PCF**	**12.5 %**
✿	**LSS - 11**	**1.0**	**AASHTO T-180 Method A**	**35**	**17**	**18**	**123.3 PCF**	**11.8 %**

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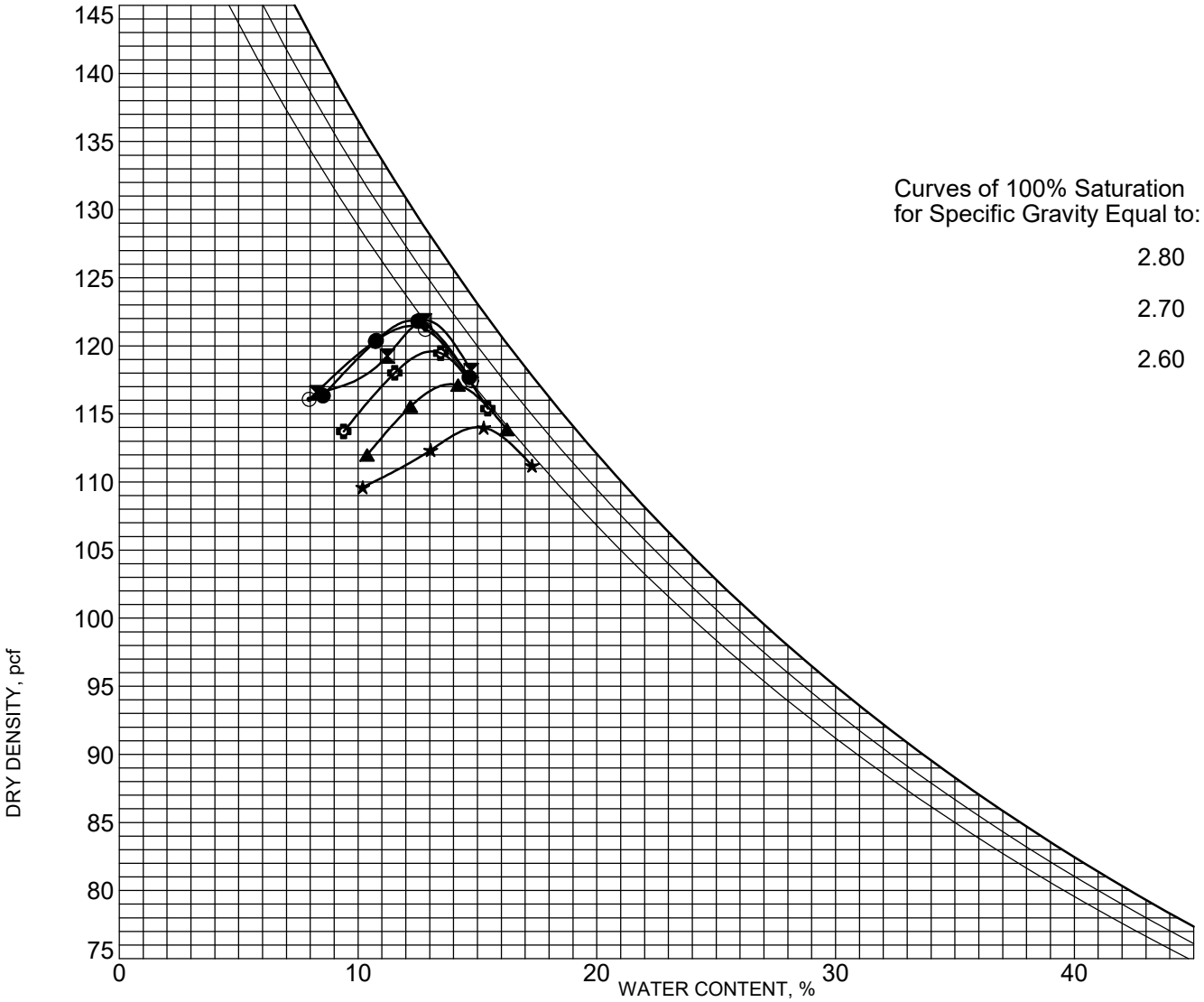
MOISTURE-DENSITY RELATIONSHIP

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278



	BOREHOLE	DEPTH	AASHTO Classification	USCS Description
●	**LSS - 12**	**1.0**	**A-6 (6)**	**SANDY LEAN CLAY(CL)**
⊠	**LSS - 13**	**1.0**	**A-6 (13)**	**SANDY LEAN CLAY(CL)**
▲	**LSS - 14**	**1.0**	**A-6 (9)**	**SANDY LEAN CLAY(CL)**
★	**LSS - 15**	**1.0**	**A-7-6 (23)**	**FAT CLAY with SAND(CH)**
⊙	**LSS - 16**	**1.0**	**A-6 (7)**	**SANDY LEAN CLAY(CL)**
✿	**LSS - 17**	**1.0**	**A-6 (10)**	**SANDY LEAN CLAY(CL)**

	BOREHOLE	DEPTH	Test Method	LL	PL	PI	Max DD	Optimum WC
●	**LSS - 12**	**1.0**	**AASHTO T-180 Method A**	**33**	**18**	**15**	**121.9 PCF**	**12.2 %**
⊠	**LSS - 13**	**1.0**	**AASHTO T-180 Method A**	**39**	**16**	**23**	**121.9 PCF**	**12.9 %**
▲	**LSS - 14**	**1.0**	**AASHTO T-180 Method A**	**40**	**19**	**21**	**117.2 PCF**	**13.9 %**
★	**LSS - 15**	**1.0**	**AASHTO T-180 Method A**	**50**	**21**	**29**	**114.0 PCF**	**15.0 %**
⊙	**LSS - 16**	**1.0**	**AASHTO T-180 Method A**	**35**	**16**	**19**	**121.5 PCF**	**12.3 %**
✿	**LSS - 17**	**1.0**	**AASHTO T-180 Method A**	**38**	**18**	**20**	**119.6 PCF**	**13.1 %**

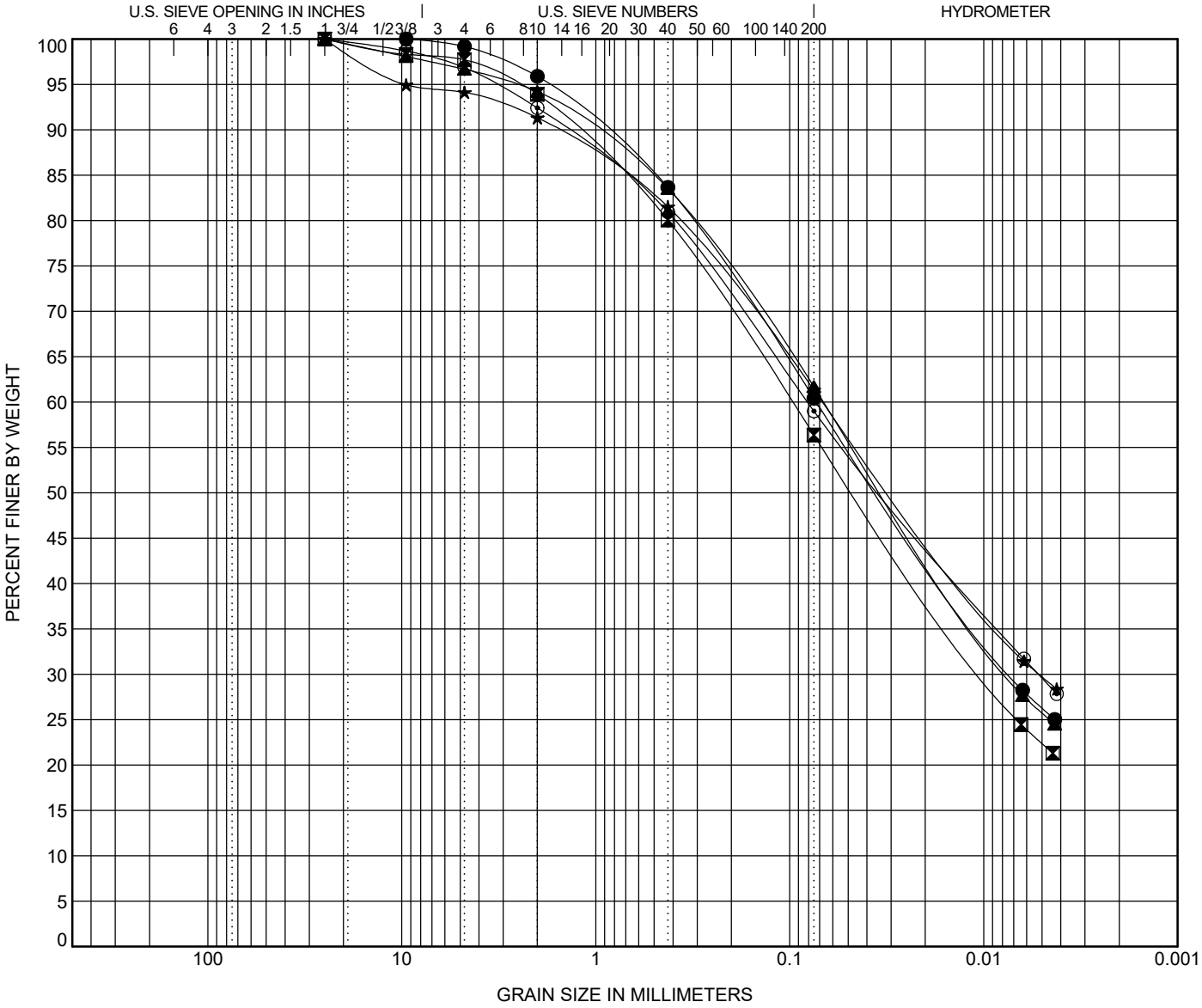
COMPACTION (MULTIPLE CURVES) - 20171219.GDT - 10/20/21 09:05 - F:\LAB\PROJECTS\GINT\6-002(134)313.GPJ

GRAIN SIZE DISTRIBUTION

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 1**	**1.0**	**A-6 (10)**	**CL**	**39**	**18**	**21**		
⊠	**LSS - 2**	**1.0**	**A-6 (8)**	**CL**	**40**	**21**	**19**		
▲	**LSS - 3**	**1.0**	**A-7-6 (13)**	**CL**	**44**	**19**	**25**		
★	**LSS - 4**	**1.0**	**A-7-6 (12)**	**CL**	**45**	**21**	**24**		
⊙	**LSS - 5**	**1.0**	**A-6 (10)**	**CL**	**39**	**18**	**21**		

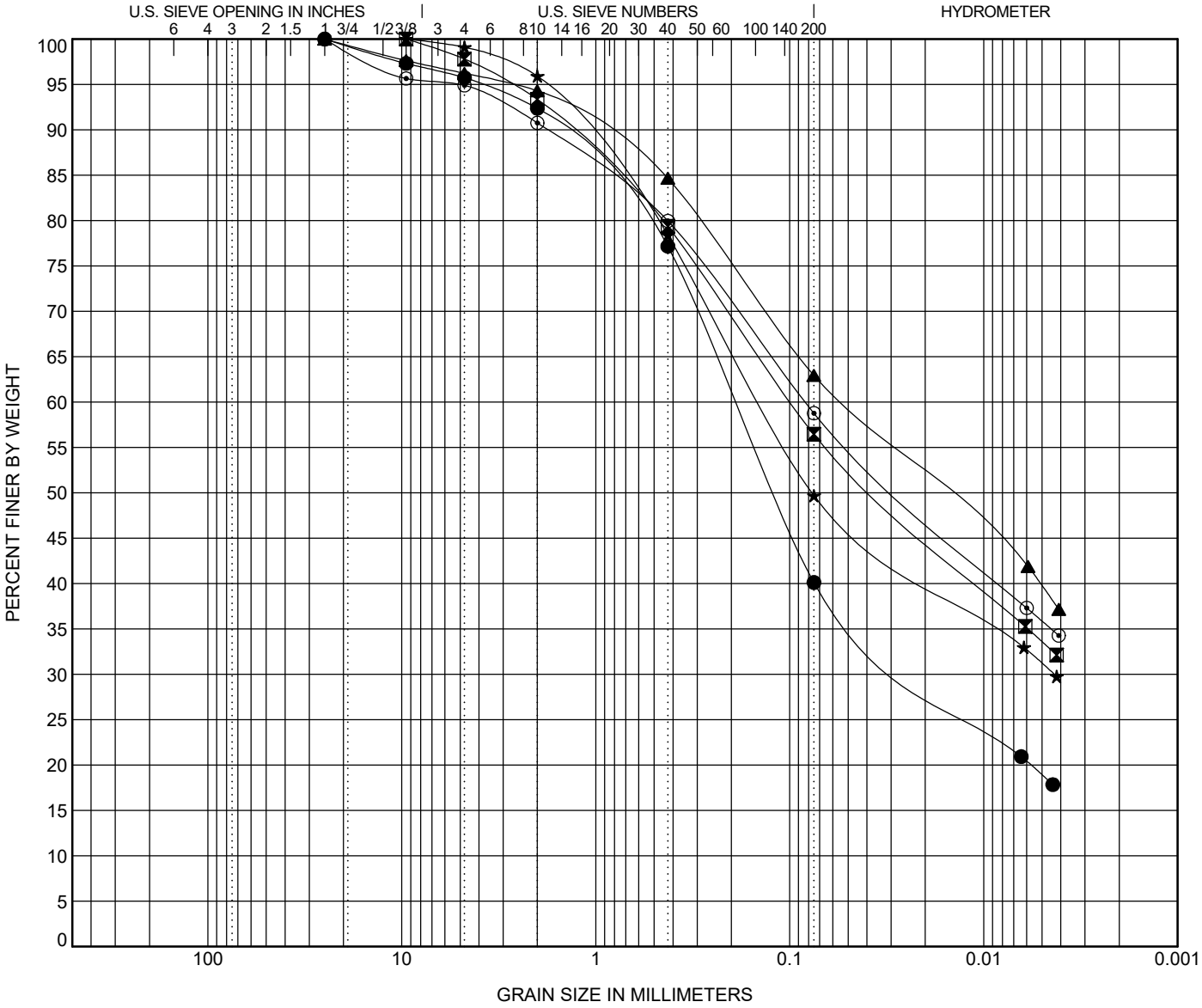
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 1**	**1.0**	**9.5**	**0.073**	**0.007**		**0.8**	**38.7**	**60.4**	
⊠	**LSS - 2**	**1.0**	**25**	**0.098**	**0.01**		**2.3**	**41.4**	**56.4**	
▲	**LSS - 3**	**1.0**	**25**	**0.066**	**0.007**		**3.3**	**35.0**	**61.7**	
★	**LSS - 4**	**1.0**	**25**	**0.067**	**0.005**		**5.9**	**32.8**	**61.3**	
⊙	**LSS - 5**	**1.0**	**25**	**0.081**	**0.005**		**3.1**	**37.8**	**59.0**	

GRAIN SIZE DISTRIBUTION

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 6**	**1.0**	**A-4 (0)**	**SC-SM**	**23**	**16**	**7**		
⊠	**LSS - 7**	**1.0**	**A-6 (8)**	**CL**	**38**	**19**	**19**		
▲	**LSS - 8**	**1.0**	**A-7-6 (14)**	**CL**	**47**	**21**	**26**		
★	**LSS - 8**	**3.0**	**A-6 (5)**	**SC**	**35**	**17**	**18**		
⊙	**LSS - 9**	**1.0**	**A-7-6 (10)**	**CL**	**43**	**21**	**22**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 6**	**1.0**	**25**	**0.19**	**0.02**		**4.3**	**55.6**	**40.1**	
⊠	**LSS - 7**	**1.0**	**9.5**	**0.098**			**2.2**	**41.4**	**56.4**	
▲	**LSS - 8**	**1.0**	**25**	**0.053**			**3.8**	**33.3**	**62.9**	
★	**LSS - 8**	**3.0**	**9.5**	**0.14**	**0.004**		**0.9**	**49.4**	**49.7**	
⊙	**LSS - 9**	**1.0**	**25**	**0.083**			**5.1**	**36.1**	**58.8**	

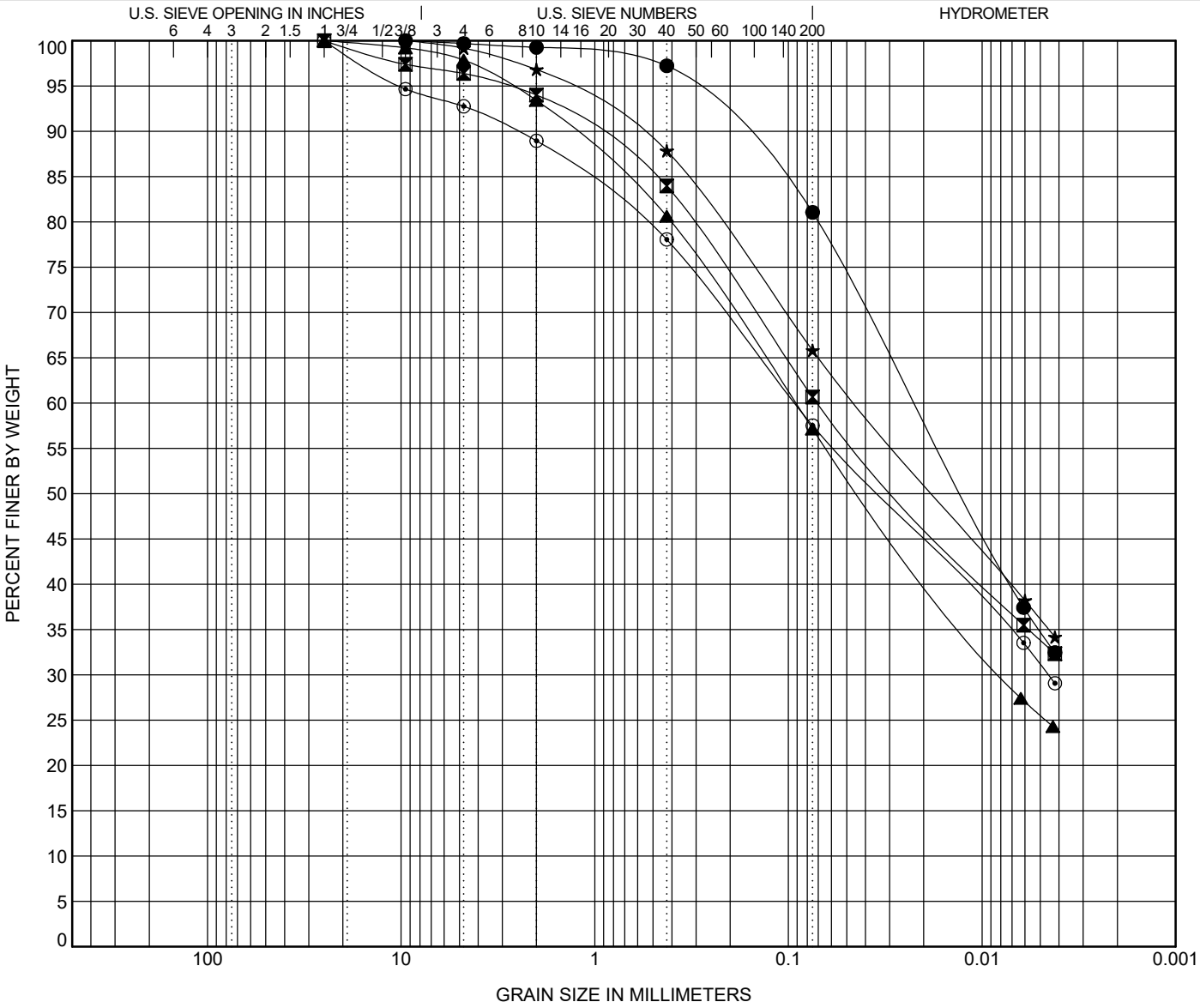
GRAIN SIZE - 20171219.GDT - 10/20/21 09:06 - F:\LAB\PROJECTS\GINT\6-002(134)313.GPJ

GRAIN SIZE DISTRIBUTION

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 10**	**1.0**	**A-6 (11)**	**CL**	**34**	**19**	**15**		
⊠	**LSS - 11**	**1.0**	**A-6 (8)**	**CL**	**35**	**17**	**18**		
▲	**LSS - 12**	**1.0**	**A-6 (6)**	**CL**	**33**	**18**	**15**		
★	**LSS - 13**	**1.0**	**A-6 (13)**	**CL**	**39**	**16**	**23**		
⊙	**LSS - 14**	**1.0**	**A-6 (9)**	**CL**	**40**	**19**	**21**		

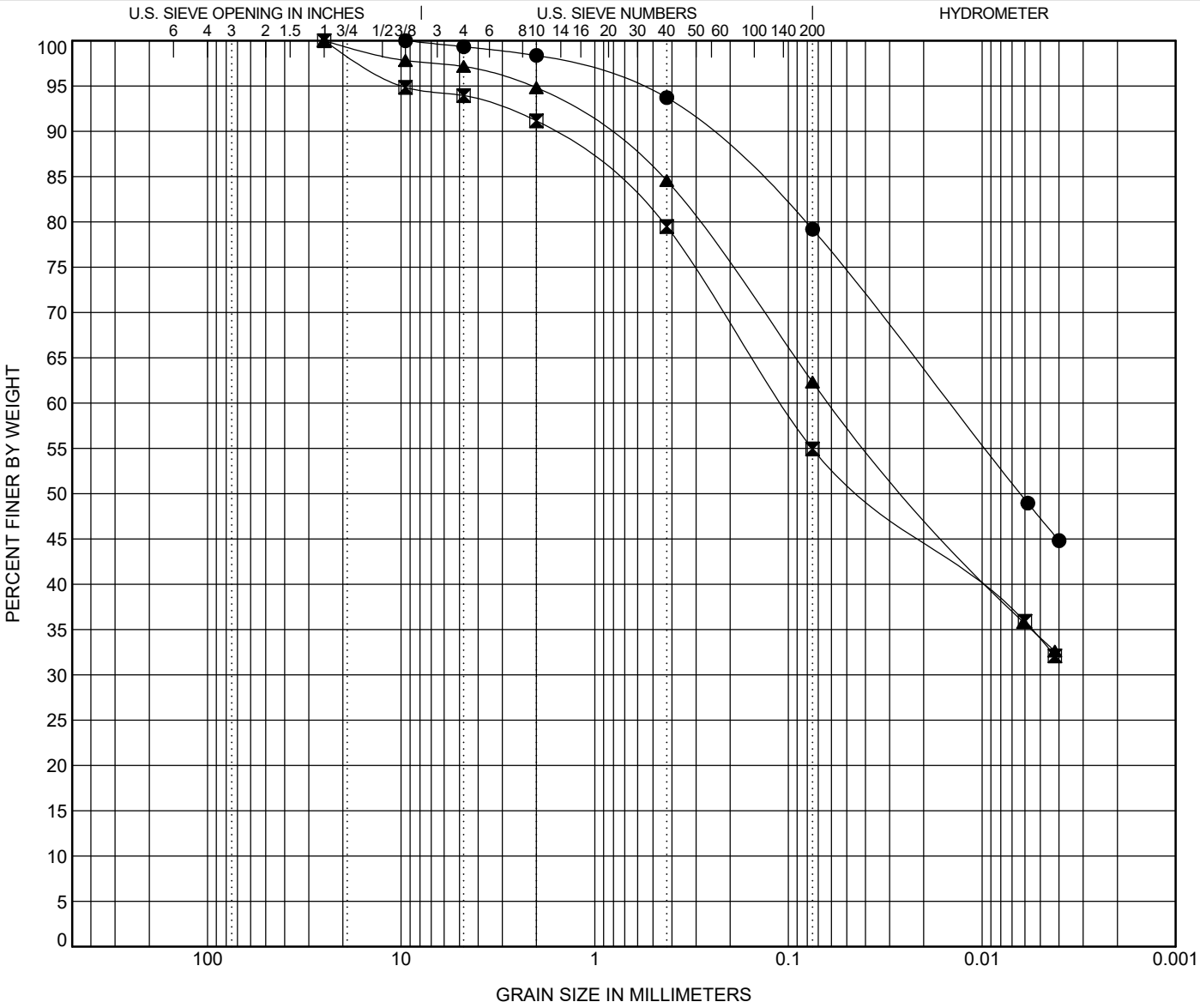
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 10**	**1.0**	**9.5**	**0.022**			**0.3**	**18.6**	**81.1**	
⊠	**LSS - 11**	**1.0**	**25**	**0.07**			**3.6**	**35.7**	**60.7**	
▲	**LSS - 12**	**1.0**	**25**	**0.093**	**0.008**		**2.1**	**40.7**	**57.2**	
★	**LSS - 13**	**1.0**	**9.5**	**0.044**			**0.8**	**33.4**	**65.8**	
⊙	**LSS - 14**	**1.0**	**25**	**0.092**	**0.005**		**7.2**	**35.2**	**57.5**	

GRAIN SIZE DISTRIBUTION

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	AASHTO Classification	USCS Classification	LL	PL	PI	Cc	Cu
●	**LSS - 15**	**1.0**	**A-7-6 (23)**	**CH**	**50**	**21**	**29**		
⊠	**LSS - 16**	**1.0**	**A-6 (7)**	**CL**	**35**	**16**	**19**		
▲	**LSS - 17**	**1.0**	**A-6 (10)**	**CL**	**38**	**18**	**20**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**LSS - 15**	**1.0**	**9.5**	**0.015**			**0.7**	**20.1**	**79.2**	
⊠	**LSS - 16**	**1.0**	**25**	**0.107**			**6.1**	**39.0**	**54.9**	
▲	**LSS - 17**	**1.0**	**25**	**0.06**			**2.8**	**34.8**	**62.3**	

GRAIN SIZE - 20171219.GDT - 10/20/21 09:06 - F:\LAB\PROJECTS\GINT\6-002(134)313.GPJ

SUMMARY OF LABORATORY RESULTS

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278

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	1.0	39	18	21	9.5	60	A-6 (10)	CL	15.7	21.0			
LSS - 1	2.0								19.4	21.0			
LSS - 1	3.0								23.2	21.0			
LSS - 1	4.0								21.9	21.0			
LSS - 1	5.0								20.9	21.0			
LSS - 1	6.0								20.1	21.0			
LSS - 1	7.0								21.0	21.0			
LSS - 1	8.0								21.5	21.0			
LSS - 1	9.0								22.8	21.0			
LSS - 1	10.0								23.2	21.0			
LSS - 2	1.0	40	21	19	25	56	A-6 (8)	CL	10.6	21.3			
LSS - 2	2.0								20.6	21.3			
LSS - 2	3.0								23.3	21.3			
LSS - 2	4.0								24.2	21.3			
LSS - 2	5.0								22.8	21.3			
LSS - 2	6.0								21.2	21.3			
LSS - 2	7.0								21.9	21.3			
LSS - 2	8.0								22.1	21.3			
LSS - 2	9.0								24.6	21.3			
LSS - 2	10.0								21.4	21.3			
LSS - 3	1.0	44	19	25	25	62	A-7-6 (13)	CL	21.6	21.6			
LSS - 3	2.0								23.4	21.6			
LSS - 3	3.0								22.0	21.6			
LSS - 3	4.0								19.0	21.6			
LSS - 3	5.0								21.5	21.6			
LSS - 3	6.0								19.7	21.6			
LSS - 3	7.0								22.4	21.6			
LSS - 3	8.0								22.2	21.6			
LSS - 3	9.0								22.3	21.6			
LSS - 3	10.0								21.6	21.6			
LSS - 4	1.0	45	21	24	25	61	A-7-6 (12)	CL	22.8	20.5			
LSS - 4	2.0								10.6	20.5			
LSS - 4	3.0								20.7	20.5			
LSS - 4	4.0								21.9	20.5			
LSS - 4	5.0								21.6	20.5			
LSS - 4	6.0								20.0	20.5			
LSS - 4	7.0								22.1	20.5			
LSS - 4	8.0								22.2	20.5			
LSS - 4	9.0								21.4	20.5			
LSS - 4	10.0								22.4	20.5			
LSS - 5	1.0	39	18	21	25	59	A-6 (10)	CL	24.4	20.6			
LSS - 5	2.0								25.0	20.6			
LSS - 5	3.0								18.4	20.6			

SUMMARY OF LABORATORY RESULTS

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278

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 - 5	4.0								13.5	20.6			
LSS - 5	5.0								16.5	20.6			
LSS - 5	6.0								23.2	20.6			
LSS - 5	7.0								21.4	20.6			
LSS - 5	8.0								22.3	20.6			
LSS - 5	9.0								19.8	20.6			
LSS - 5	10.0								21.7	20.6			
LSS - 6	1.0	23	16	7	25	40	A-4 (0)	SC-SM	19.2	18.5			
LSS - 6	2.0								17.3	18.5			
LSS - 6	3.0								18.5	18.5			
LSS - 6	4.0								18.7	18.5			
LSS - 6	5.0								17.7	18.5			
LSS - 6	6.0								16.0	18.5			
LSS - 6	7.0								18.1	18.5			
LSS - 6	8.0								16.3	18.5			
LSS - 6	9.0								22.5	18.5			
LSS - 6	10.0								21.1	18.5			
LSS - 7	1.0	38	19	19	9.5	56	A-6 (8)	CL	28.8	23.1			
LSS - 7	2.0								36.9	23.1			
LSS - 7	3.0								18.4	23.1			
LSS - 7	4.0								16.1	23.1			
LSS - 7	5.0								21.3	23.1			
LSS - 7	6.0								20.5	23.1			
LSS - 7	7.0								20.1	23.1			
LSS - 7	8.0								22.1	23.1			
LSS - 7	9.0								22.6	23.1			
LSS - 7	10.0								23.6	23.1			
LSS - 8	1.0	47	21	26	25	63	A-7-6 (14)	CL	44.4	41.3			
LSS - 8	2.0								38.2	41.3			
LSS - 8	3.0	35	17	18	9.5	50	A-6 (5)	SC	25.8	22.9			
LSS - 8	4.0								24.2	22.9			
LSS - 8	5.0								24.2	22.9			
LSS - 8	6.0								24.3	22.9			
LSS - 8	7.0								21.5	22.9			
LSS - 8	8.0								18.7	22.9			
LSS - 8	9.0								24.0	22.9			
LSS - 8	10.0								20.6	22.9			
LSS - 9	1.0	43	21	22	25	59	A-7-6 (10)	CL	44.4	29.0			
LSS - 9	2.0								29.9	29.0			
LSS - 9	3.0								31.4	29.0			
LSS - 9	4.0								30.7	29.0			
LSS - 9	5.0								29.8	29.0			
LSS - 9	6.0								28.9	29.0			

SUMMARY OF LABORATORY RESULTS

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278

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 - 9	7.0								25.0	29.0			
LSS - 9	8.0								25.7	29.0			
LSS - 9	9.0								22.4	29.0			
LSS - 9	10.0								21.8	29.0			
LSS - 10	1.0	34	19	15	9.5	81	A-6 (11)	CL	41.8	32.2			
LSS - 10	2.0								44.9	32.2			
LSS - 10	3.0								42.0	32.2			
LSS - 10	4.0								33.2	32.2			
LSS - 10	5.0								30.5	32.2			
LSS - 10	6.0								30.7	32.2			
LSS - 10	7.0								20.7	32.2			
LSS - 10	8.0								25.7	32.2			
LSS - 10	9.0								28.1	32.2			
LSS - 10	10.0								24.3	32.2			
LSS - 11	1.0	35	17	18	25	61	A-6 (8)	CL	53.9	32.5			
LSS - 11	2.0								55.7	32.5			
LSS - 11	3.0								32.4	32.5			
LSS - 11	4.0								32.7	32.5			
LSS - 11	5.0								28.8	32.5			
LSS - 11	6.0								26.8	32.5			
LSS - 11	7.0								26.7	32.5			
LSS - 11	8.0								25.2	32.5			
LSS - 11	9.0								22.2	32.5			
LSS - 11	10.0								20.2	32.5			
LSS - 12	1.0	33	18	15	25	57	A-6 (6)	CL	34.5	25.4			
LSS - 12	2.0								35.4	25.4			
LSS - 12	3.0								29.5	25.4			
LSS - 12	4.0								23.8	25.4			
LSS - 12	5.0								22.3	25.4			
LSS - 12	6.0								23.0	25.4			
LSS - 12	7.0								21.7	25.4			
LSS - 12	8.0								21.9	25.4			
LSS - 12	9.0								21.8	25.4			
LSS - 12	10.0								20.5	25.4			
LSS - 13	1.0	39	16	23	9.5	66	A-6 (13)	CL	23.9	23.2			
LSS - 13	2.0								25.0	23.2			
LSS - 13	3.0								25.0	23.2			
LSS - 13	4.0								20.3	23.2			
LSS - 13	5.0								25.2	23.2			
LSS - 13	6.0								21.0	23.2			
LSS - 13	7.0								22.7	23.2			
LSS - 13	8.0								24.2	23.2			
LSS - 13	9.0								22.4	23.2			

SUMMARY OF LABORATORY RESULTS

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

PROJECT NUMBER BND-NH-6-002(134)313 **LOCATION** Nelson County

PCN 22278

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	10.0								21.8	23.2			
LSS - 14	1.0	40	19	21	25	58	A-6 (9)	CL	26.9	24.2			
LSS - 14	2.0								25.6	24.2			
LSS - 14	3.0								26.2	24.2			
LSS - 14	4.0								24.7	24.2			
LSS - 14	5.0								23.7	24.2			
LSS - 14	6.0								24.0	24.2			
LSS - 14	7.0								24.9	24.2			
LSS - 14	8.0								22.0	24.2			
LSS - 14	9.0								22.2	24.2			
LSS - 14	10.0								21.9	24.2			
LSS - 15	1.0	50	21	29	9.5	79	A-7-6 (23)	CH	28.2	27.8			
LSS - 15	2.0								27.6	27.8			
LSS - 15	3.0								23.4	27.8			
LSS - 15	4.0								23.3	27.8			
LSS - 15	5.0								18.9	27.8			
LSS - 15	6.0								32.6	27.8			
LSS - 15	7.0								29.7	27.8			
LSS - 15	8.0								29.6	27.8			
LSS - 15	9.0								29.0	27.8			
LSS - 15	10.0								35.9	27.8			
LSS - 16	1.0	35	16	19	25	55	A-6 (7)	CL	18.5	17.8			
LSS - 16	2.0								18.6	17.8			
LSS - 16	3.0								15.5	17.8			
LSS - 16	4.0								19.2	17.8			
LSS - 16	5.0								18.1	17.8			
LSS - 16	6.0								18.8	17.8			
LSS - 16	7.0								17.3	17.8			
LSS - 16	8.0								17.8	17.8			
LSS - 16	9.0								17.6	17.8			
LSS - 16	10.0								16.7	17.8			
LSS - 17	1.0	38	18	20	25	62	A-6 (10)	CL	23.6	20.8			
LSS - 17	2.0								18.9	20.8			
LSS - 17	3.0								19.8	20.8			
LSS - 17	4.0								20.8	20.8			
LSS - 17	5.0								22.1	20.8			
LSS - 17	6.0								16.4	20.8			
LSS - 17	7.0								17.8	20.8			
LSS - 17	8.0								23.5	20.8			
LSS - 17	9.0								22.5	20.8			
LSS - 17	10.0								22.9	20.8			