Pavement Design Report

Date: July 19, 2016

To: Ryan McKane, P.E.
NW Region Local Program Management Consultant

From: Aaron Palmer, P.E.
Westbrook Associated Engineers, Inc.

WISCONSIN
AARON B. PALMER E-35695 RICHLAND CENTER, WI
PROFESSIONAL ENGINEER
7/9/16

Subject: **Pavement Design Report** (PDR)
I.D. 8357-01-72
T Russell, Little Sand Bay Road
Old CTH K – Termini
Local Street
Bayfield County

Executive Summary:

Recondition Little Sand Bay Road from Sta. 100+16.08 to Sta. 155+33.29 with:

2.5" of 4 LT 58-34 S HMA Pavement, over
2.0" of Base Aggregate Dense 1 ¼-Inch, over
10.0" of Pulverized and Relayed Surface, over
Remaining existing material.

Approved: Ryan B McKane
Date: 10/27/16

Widen Shoulders from Sta. 155+33.29 to Sta. 238+94.47 with:

2.5" of 4 LT 58-34 S HMA Pavement, over
10.0" of Base Aggregate Dense 1 ¼-Inch.

Ryan McKane, PE
NW Region LPMC
Project Manager

- Use 36,000 ESALs on cover sheet.

Location:

The project is located in Section 04, T51N, R04W and Section 32 and 33, T52N, Town of Russell, Bayfield County. The project limits extend from Station 100+16.08 which is approximately 16.08' north of the intersection of Little Sand Bay Road and Old CTH K to Station 238+94.47 at the Termini of Little Sand Bay Road. The project is approximately 2.618 miles in length. Little Sand Bay Road is classified as a minor collector. See Exhibit A for the Project Location Map.

Proposed Improvement:

The proposed improvement will rehabilitate Little Sand Bay Road from the intersection of Old CTH K, Sta. 100+16.08, to the intersection of Ridge Road, Sta. 155+33.29, and widen the shoulders from the intersection of Ridge Road to Termini, Sta. 238+94.47.

From Old CTH K to Ridge Road, Little Sand Bay Road's existing pavement structure will be pulverized to its full depth. A 2-inch layer of base aggregate will be placed on top of the pulverized material, followed by a 2 1/2-inch asphaltic surface layer. The proposed typical section will consist of 11-foot driving lanes, 3-foot paved shoulders and 0.5-foot gravel shoulders. From Ridge Road to Termini, the existing asphaltic driving surface will remain and the shoulders will be widened. The shoulders will consist of a 3-foot paved shoulder and 0.5-foot gravel shoulder.

Construction is scheduled for 2017.

Soils:

No subsurface investigation was performed for this project and no soils reports were provided. In order to determine an appropriate Soil Support Value (SSV) and Design Group Index (DGI) the United States Department of Agriculture (USDA) Web Soil Survey tool was utilized. The results of the Web Soil Survey were compared to past bridge projects soils reports located in Bayfield County and the soil summary provided in the Wetland Delineation Report. From these three sources the soil type was determined to be a sandy clay mixture with the following pavement design parameters:

Soil Support Value.....4.5
Design Group Index.....10
K Modulus.....150 PCI

Exhibits:

A – Project Location Map
B – WisPAVE Pavement Design Worksheets
C – Web Soil Survey Results

EXHIBIT A

PROJECT LOCATION MAP

Little Sand Bay Road,
Town of Russell,
Bayfield County

BAYFIELD COUNTY

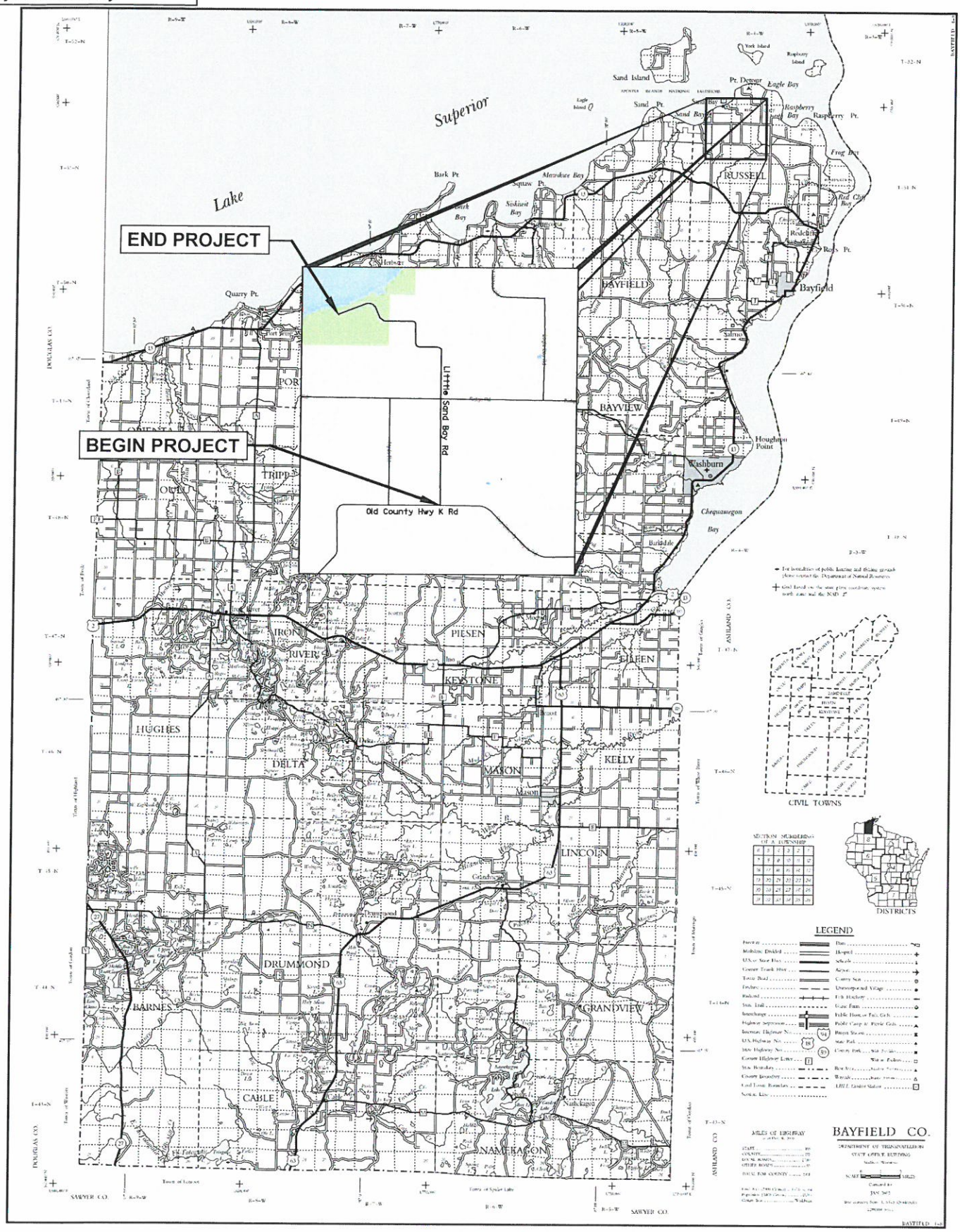

EXHIBIT B

WisPAVE Pavement Design Worksheets

Edit Pavement Design General Information

* Project ID:	8357-01-72	* Designer's Name:	Erik Meyer
* Design Name:	Rehabilitation	* Design Date:	07/08/2016
* Roadway Name:	T Russell, Little Sand Bay Road	* Type:	Local
* Project Termini:	Old CTH K - Termini	* Status:	Draft
* Highway Name:	Town Road	* Design Source:	WisPave
* Region:	NW		
* County:	Bayfield / Select		
Comments:			

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Last Updated date and Time: 07/19/2016 11:14:39 AM

Pavement Design Details

Project ID:	8357-01-72	Design Name:	Rehabilitation	Design Date:	07/08/2016
Highway:	Town Road	Project Termini:	Old CTH K - Termini	County:	Bayfield
		Designer:	Erik Meyer		

Soil Parameters

*Design Group Index (DGI):	10
*Subgrade Improvement:	Yes / No
*Soil Support Value(SSV):	4.5
*Modulus of Subgrade Reaction(k):	200

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Pavement Design Details

Project ID:	8357-01-72	Design Name:	Rehabilitation	Design Date:	07/08/2016
Highway:	Town Road	Project Termini:	Old CTH K - Termini	County:	Bayfield
		Designer:	Erik Meyer		

Traffic Parameters

*Construction Year:	2017	*Design Year:	2037
*Construction Year AADT:	360	*Design Year AADT:	360
*Directional Factor(DF):	0.5	*Lane Distribution Factor(LDF):	1.0

Truck Classification	% of AADT
2D	5.7
3SU	0.0
2S-1,-2	0.0
3S-2	0.0
2-S1-2	0.0
Total % Truck Traffic	5.7

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Pavement Design Details

Project ID:	8357-01-72	**Design Name:**	Rehabilitation	**Design Date:**	07/08/2016
Highway:	Town Road	**Project Termini:**	Old CTH K - Termini	**County:**	Bayfield
		Designer:	Erik Meyer		

HMA Pavement Design

Truck Type	% of AADT	DLT	# of Trucks	ESAL Load Factor	ESALs
2D	8.7	185	16	0.3	5
3SU	0.0	185	0	0.8	0
2S-1.-2	0.0	185	0	0.5	0
3S-2	0.0	185	0	0.9	0
2-S1-2	0.0	185	0	2.0	0

Design Lane Daily ESALs: 5
Design Lane Total Life ESALs: 36,500 **Rounded to:** 37,000

Soil Parameters

DGI : 10
Subgrade Improvement Flag selected: No
SSV : 4.5

Design Calculation

Calculated Required SN: 2.22

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Pavement Design Details

Project ID:	8357-01-72	**Design Name:**	Rehabilitation	**Design Date:**	07/08/2016
Highway:	Town Road	**Project Termini:**	Old CTH K - Termini	**County:**	Bayfield
		Designer:	Erik Meyer		

HMA ALT#1 Layer Thickness Design

Title: Rehabilitation

Add Layer Delete Layer

Layers	Existing Pavement	Uppermost Base Agg.	Other	Material Type	Unit Type	Layer Coefficient	Thickness in.	Structural Number
1	☐	☐	☐	HMA Pavement Type E-0.3	------	0.44	2.5	1.1
2	☐	☐	☐	Base Aggregate Dense 1 1/4-inch	------	0.1	2.0	0.2
3	☑	☐	☐	Pulverize and Relay	------	0.1	10.0	1.0

Note: You can add only 10 layers (including 'Other' layers)

No.of Layers: 3 No.of Other Layers: 0 Total SN: 2.3
Required SN: 2.22

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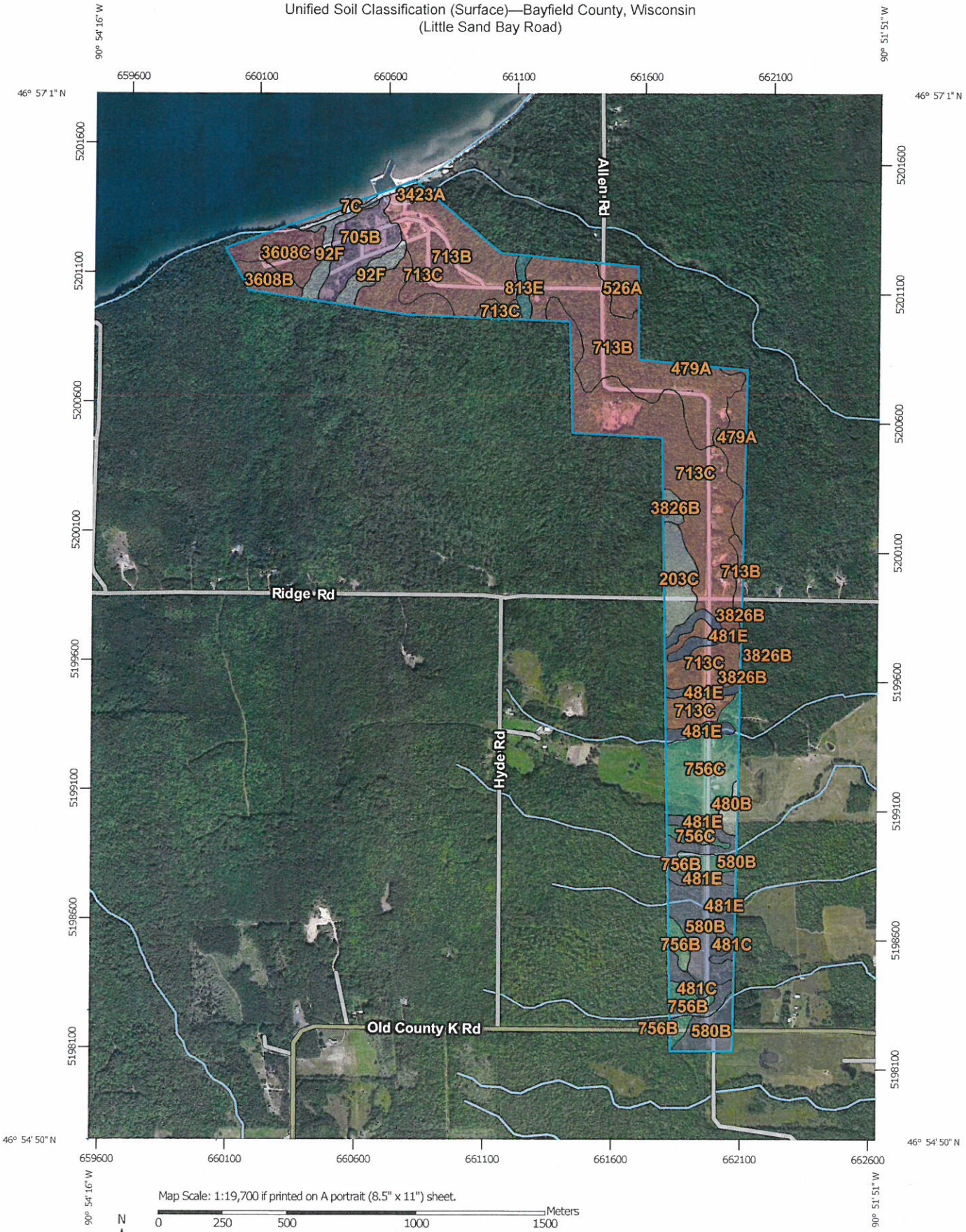
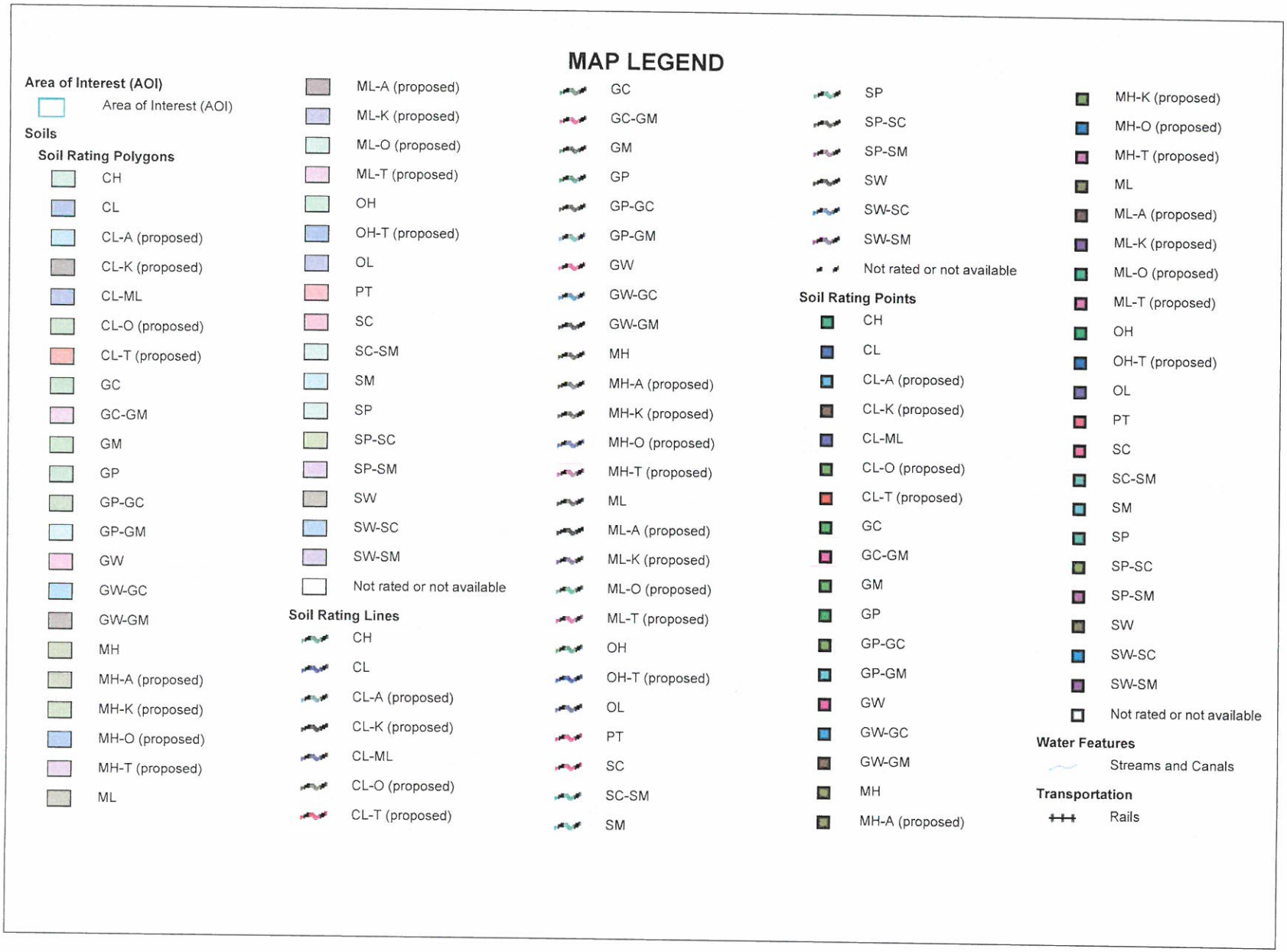
Note 1. If the structural design includes a granular subbase, then the layer can only contribute a maximum of 10% of the required SN (see FDM 14-10-5.8), regardless of the material's strength coefficient or the thickness of the layer.

EXHIBIT C

Web Soil Survey Results

Unified Soil Classification (Surface)—Bayfield County, Wisconsin
(Little Sand Bay Road)




MAP LEGEND
Area of Interest (AOI)
Area of Interest (AOI)
Soils
Soil Rating Polygons
CH
CL
CL-A (proposed)
CL-K (proposed)
CL-ML
CL-O (proposed)
CL-T (proposed)
GC
GC-GM
GM
GP
GP-GC
GP-GM
GW
GW-GC
GW-GM
MH
MH-A (proposed)
MH-K (proposed)
MH-O (proposed)
MH-T (proposed)
ML
ML-A (proposed)
ML-K (proposed)
ML-O (proposed)
ML-T (proposed)
OH
OH-T (proposed)
OL
PT
SC
SC-SM
SM
SP
SP-SC
SP-SM
SW
SW-SC
SW-SM
Not rated or not available
Soil Rating Lines
CH
CL
CL-A (proposed)
CL-K (proposed)
CL-ML
CL-O (proposed)
CL-T (proposed)
GC
GC-GM
GM
GP
GP-GC
GP-GM
GW
GW-GC
GW-GM
MH
MH-A (proposed)
MH-K (proposed)
MH-O (proposed)
MH-T (proposed)
ML
ML-A (proposed)
ML-K (proposed)
ML-O (proposed)
ML-T (proposed)
OH
OH-T (proposed)
OL
PT
SC
SC-SM
SM
SP
SP-SC
SP-SM
SW
SW-SC
SW-SM
Not rated or not available
Soil Rating Points
CH
CL
CL-A (proposed)
CL-K (proposed)
CL-ML
CL-O (proposed)
CL-T (proposed)
GC
GC-GM
GM
GP
GP-GC
GP-GM
GW
GW-GC
GW-GM
MH
MH-A (proposed)
MH-K (proposed)
MH-O (proposed)
MH-T (proposed)
ML
ML-A (proposed)
ML-K (proposed)
ML-O (proposed)
ML-T (proposed)
OH
OH-T (proposed)
OL
PT
SC
SC-SM
SM
SP
SP-SC
SP-SM
SW
SW-SC
SW-SM
Not rated or not available
Water Features
Streams and Canals
Transportation
Rails

MAP INFORMATION

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bayfield County, Wisconsin
Survey Area Data: Version 17, Sep 17, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 8, 2011—Sep 9, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Unified Soil Classification (Surface)

Unified Soil Classification (Surface)— Summary by Map Unit — Bayfield County, Wisconsin (WI007)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
7C	Beaches, 2 to 12 percent slopes		2.1	0.6%
92F	Udorthents, ravines and escarpments, 25 to 60 percent slopes		10.0	2.9%
203C	Wakefield fine sandy loam, 6 to 18 percent slopes, stony		10.6	3.0%
479A	Lerch-Herbster complex, 0 to 3 percent slopes	PT	10.5	3.0%
480B	Portwing-Herbster complex, 0 to 6 percent slopes		2.4	0.7%
481C	Cornucopia silt loam, 6 to 15 percent slopes	CL-ML	7.6	2.2%
481E	Cornucopia silt loam, 15 to 45 percent slopes	CL-ML	20.8	6.0%
526A	Flink sand, 0 to 3 percent slopes	PT	6.3	1.8%
580B	Sanborg-Badriver complex, 0 to 6 percent slopes	CL	24.6	7.1%
705B	Cublake-Croswell-Ashwabay complex, 0 to 6 percent slopes	SP-SM	14.8	4.2%
713B	Kellogg-Allendale-Ashwabay complex, 2 to 6 percent slopes	PT	87.8	25.2%
713C	Kellogg-Allendale-Ashwabay complex, 6 to 15 percent slopes	PT	88.4	25.4%
756B	Superior-Sedgwick complex, 0 to 6 percent slopes	SC-SM	11.5	3.3%
756C	Superior-Sedgwick complex, 6 to 15 percent slopes	SC-SM	25.0	7.2%
813E	Manistee-Kellogg-Ashwabay complex, 15 to 45 percent slopes	SM	2.8	0.8%
3423A	Rifle peat, 0 to 1 percent slopes		0.5	0.1%

Unified Soil Classification (Surface)— Summary by Map Unit — Bayfield County, Wisconsin (WI007)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3608B	Deerton-Brownstone complex, 0 to 6 percent slopes, very stony	PT	5.6	1.6%
3608C	Deerton-Brownstone complex, 6 to 15 percent slopes, very stony	PT	12.4	3.6%
3826B	Allendale-Wakeley-Kinross complex, 0 to 6 percent slopes		2.7	0.8%
Subtotals for Soil Survey Area			**346.5**	**99.6%**
Totals for Area of Interest			**348.0**	**100.0%**

Description

The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)