SOIL FEATURES
Pembina County, North Dakota

The following table gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A restrictive layer is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. Depth to top is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as low, moderate, or high, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as low, moderate, or high. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

SOIL FEATURES--Continued
Pembina County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
Ar:							
Arveson---------	---	---	---	---	High	High	Low
Av:							
Arveson---------	---	---	---	---	High	High	Low
Aw:							
Arveson---------	---	---	---	---	High	High	Low
BaD:							
Barnes----------	---	---	---	---	Moderate	Moderate	Low
BnA:							
Bearden---------	---	---	---	---	High	High	Low
BnB:							
Bearden---------	---	---	---	---	High	High	Low
BrA:							
Bearden, SALINE-	---	---	---	---	High	High	Moderate
Bs:							
Bearden---------	---	---	---	---	High	High	Low
Colvin----------	---	---	---	---	High	High	Low
BvA:							
Bearden---------	---	---	---	---	High	High	Low
Glyndon---------	---	---	---	---	High	High	Low
BwA:							
Binford---------	---	---	---	---	Low	Low	Low
BwB:							
Binford---------	---	---	---	---	Low	Low	Low
Bx:							
Borup----------	---	---	---	---	High	High	Low
ByA:							
Brantford-------	---	---	---	---	Low	Low	Low
ByB:							
Brantford-------	---	---	---	---	Low	Low	Low
ByC:							
Brantford-------	---	---	---	---	Low	Low	Low
ByD:							
Brantford-------	---	---	---	---	Low	Low	Low
Ca:							
Cashel----------	---	---	---	---	Moderate	High	Low
CaA:							
Cashel----------	---	---	---	---	Moderate	High	Low
CaB:							
Cashel----------	---	---	---	---	Moderate	High	Low
CbB:							
Claire----------	---	---	---	---	Low	Moderate	Low
Cd:							
Clayey Breaks---	---	---	---	---	Moderate	High	Moderate
Cf:							
Colvin----------	---	---	---	---	High	High	Low
Cg:							
Colvin, SALINE--	---	---	---	---	High	High	Moderate
Ch:							
Colvin----------	---	---	---	---	High	High	Low
CoA:							
Cormant---------	---	---	---	---	Moderate	High	Low
DdA:							
Divide----------	---	---	---	---	Moderate	High	Low
Do:							
Dovray----------	---	---	---	---	Moderate	High	Low
EgA:							
Egeland---------	---	---	---	---	Moderate	Low	Low
EgB:							
Egeland---------	---	---	---	---	Moderate	Low	Low
EmA:							
Embden----------	---	---	---	---	Moderate	Moderate	Low
EmB:							
Embden----------	---	---	---	---	Moderate	Moderate	Low
FaA:							
Fairdale--------	---	---	---	---	Moderate	Moderate	Low
FaB:							
Fairdale--------	---	---	---	---	Moderate	Moderate	Low
Ff:							
Fargo----------	---	---	---	---	High	High	Low

SOIL FEATURES--Continued
Pembina County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
GaA:							
Gardena---------	---	---	---	---	High	Moderate	Low
GbA:							
Gilby----------	---	---	---	---	High	High	Low
GdA:							
Glyndon---------	---	---	---	---	Moderate	Low	Low
GfA:							
Glyndon---------	---	---	---	---	High	High	Low
Gm:							
Glyndon, SALINE-	---	---	---	---	High	High	Moderate
Gr:							
Grano----------	---	---	---	---	High	High	Low
Gs:							
Grano, SALINE---	---	---	---	---	High	High	Low
Ha:							
Hamar----------	---	---	---	---	Moderate	High	Low
Hb:							
Hamar----------	---	---	---	---	Moderate	High	Low
HdA:							
Hecla----------	---	---	---	---	Moderate	Low	Low
HdB:							
Hecla----------	---	---	---	---	Moderate	Low	Low
HfA:							
Hecla----------	---	---	---	---	Moderate	Moderate	Low
HfB:							
Hecla----------	---	---	---	---	Moderate	Moderate	Low
HgE:							
Hecla----------	---	---	---	---	Moderate	Low	Low
Maddock---------	---	---	---	---	Low	Low	Low
Hh:							
Hegne, SALINE---	---	---	---	---	High	High	Low
HmA:							
Hegne----------	---	---	---	---	High	High	Low
Fargo----------	---	---	---	---	High	High	Low
HmB:							
Hegne----------	---	---	---	---	High	High	Low
Fargo----------	---	---	---	---	High	High	Low
La:							
Lamoure---------	---	---	---	---	High	High	Moderate
LbA:							
Lankin----------	---	---	---	---	Moderate	High	Low
LgA:							
Gilby----------	---	---	---	---	High	High	Low
Lankin----------	---	---	---	---	Moderate	High	Low
LpA:							
La Prairie------	---	---	---	---	Moderate	Moderate	Low
LrA:							
La Prairie------	---	---	---	---	Moderate	Moderate	Low
LrB:							
La Prairie------	---	---	---	---	Moderate	Moderate	Low
LvD:							
La Prairie------	---	---	---	---	Moderate	Moderate	Low
Fairdale--------	---	---	---	---	Moderate	Moderate	Low
M-W:							
Miscellaneous Water----------	---	---	---	---	---	---	---
MaA:							
Maddock---------	---	---	---	---	Low	Low	Low
MaB:							
Maddock---------	---	---	---	---	Low	Low	Low
MbA:							
Maddock---------	---	---	---	---	Low	Moderate	Low
MbB:							
Maddock---------	---	---	---	---	Low	Moderate	Low
McB:							
Maddock, VARIANT	---	---	---	---	Low	Moderate	Low
Mf:							
Mcdonaldsville--	---	---	---	---	Moderate	High	Low
Na:							
Nahon----------	---	---	---	---	Moderate	High	Moderate

SOIL FEATURES--Continued
Pembina County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
Ng:							
Neche	---	---	---	---	High	High	Low
Nh:							
Neche	---	---	---	---	High	High	Low
Oa:							
Ojata	---	---	---	---	High	High	Moderate
OgB:							
Olga	---	---	---	---	Moderate	High	Moderate
OgE:							
Olga	---	---	---	---	Moderate	High	Moderate
OvA:							
Overly	---	---	---	---	High	High	Low
Pa:							
Peat	---	---	---	---	High	High	Low
Pg:							
Pits	---	---	---	---	None	Low	Low
Pu:							
Perella	---	---	---	---	High	High	Low
PyA:							
Poppleton	---	---	---	---	Moderate	Low	Low
Ra:							
Rauville	---	---	---	---	High	High	Moderate
RbA:							
Renshaw	---	---	---	---	Low	Moderate	Low
RfB:							
Renshaw	---	---	---	---	Low	Moderate	Low
RoA:							
Rolette	---	---	---	---	Moderate	High	Low
Rp:							
Rough Broken Land	---	---	---	---	Moderate	High	Moderate
Rr:							
Ryan	---	---	---	---	Moderate	High	Moderate
Fargo	---	---	---	---	High	High	Low
SnD:							
Serden	---	---	---	---	Low	Moderate	Low
SwA:							
Swenoda	---	---	---	---	Moderate	High	Low
Tf:							
Tiffany	---	---	---	---	High	High	Low
VaA:							
Vang	---	---	---	---	Moderate	High	Low
VbA:							
Vang	---	---	---	---	Moderate	High	Low
VwA:							
Vang	---	---	---	---	Moderate	High	Low
Walsh	---	---	---	---	Moderate	High	Low
VwB:							
Vang	---	---	---	---	Moderate	High	Low
Walsh	---	---	---	---	Moderate	High	Low
Vy:							
Vang, VARIANT	---	---	---	---	Moderate	High	Low
W:							
Water	---	---	---	---	---	---	---
WaA:							
Wahpeton	---	---	---	---	High	High	Low
WaB:							
Wahpeton	---	---	---	---	High	High	Low
WaC:							
Wahpeton	---	---	---	---	High	High	Low
WhC:							
Walsh	---	---	---	---	Moderate	High	Low
WhD:							
Walsh	---	---	---	---	Moderate	High	Low
WnA:							
Walsh	---	---	---	---	Moderate	High	Low
WoA:							
Waukon	---	---	---	---	Moderate	Low	Low
WoB:							
Waukon	---	---	---	---	Moderate	Low	Low

SOIL FEATURES--Continued
Pembina County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
WoC:							
Waukon	---	---	---	---	Moderate	Low	Low
WoD:							
Waukon	---	---	---	---	Moderate	Low	Low
Wv:							
Wheatville	---	---	---	---	High	High	Low
ZgC:							
Zell	---	---	---	---	High	Low	Low
Gardena	---	---	---	---	High	Moderate	Low
ZgD:							
Zell	---	---	---	---	High	Low	Low
Gardena	---	---	---	---	High	Moderate	Low