A COMPENDIUM OF SOIL SURVEY
INTERPRETIVE GUIDES
USED IN THE
ATLANTIC PROVINCES

Agriculture
Forestry
Recreation
Source Materials
Urban Development

Atlantic Advisory Committee
on Soil Survey 1987

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CONTENTS

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PREFACE

This is a compilation of interpretive guidelines, mainly in tabular format, that have been used in the Atlantic Provinces to rate soils and soil map units for selected land uses. The ratings are based on soil and land conditions specific to the map areas for which they were developed and are not necesarily applicable to the entire region. The guidelines establish relative rankings of soils from good or well suited to very poor or unsuited. Land uses range from the general to the specific. These include agricultural crops, forestry applications, urban development, recreation, and source material for various purposes.

The objective of this compilation is to provide a reference for pedologists who wish to interpret their data for similar land uses. It also provides a documentation of the approach used and should prove useful to land use planners, agrologists, engineers and other users of soil survey information.

We have also included a section dealing with some of the disadvantages of the interpretation table approach. Some improvements are suggested. This publication will be updated as interpretive procedures are enhanced by new technologies or as interpretive guidelines are developed for new land uses not previously considered.

This report may be cited as:

Atlantic Advisory Committee on Soil Survey. 1988. A Compendium of Soil Survey Interpretive Guides Used in the Atlantic Provinces. Edited by G.T. Patterson and H.W. Rees.

INTRODUCTION[1]

The purpose of soil survey is to organize and present information about soil properties and predictions of soil behaviour. Soil survey interpretations are predictions of soil behaviour for specified land uses and specified management practices. They are based on the soil properties that directly influence the specified use of the soil. Soil survey interpretations allow users of soil surveys to plan reasonable alternatives for the use and effective management of soils. They are developed for kinds of land use, for individual practices, and for resource management systems. They are used to plan both broad categories of land use such as cropland, pastureland, woodland, or urban development, as well as specific elements of those land uses, for example, irrigation of cropland, use of forestry equipment, or septic tank absorption fields.

Soil survey interpretations are developed for both soil taxonomic units and for soil map units. Generally, soil survey interpretations are developed for phases of soil taxonomic units which are used to name soil map units. In most interpretive schemes, ratings of soil limitations or suitability are given for the specified phase of the taxonomic unit.

The basic kinds of soil interpretations include relative ratings of production for crops; degree and kind of limitations for specified land uses or suitability of soils for specified land uses; and soil potential for source materials. For specific soil survey areas there is a wide latitude in the selection of land uses for which soil interpretations might be addressed. Criteria for specific soil interpretations are developed using the team approach. All specialists concerned with a given land use (i.e. agronomists, engineers, soil scientists, etc.) work together in developing the criteria for interpreting the soils for the given use. Soil interpretations can be presented in map form or in tabular form on a per map unit basis.

Soil interpretations are periodically updated as more is learned about a soil or its behavior under specified uses and new technologies. Existing soil interpretation guidelines are the best approximation which can be made with existing knowledge. Soil maps remain useful long after the soil interpretations originally published with them have become outdated. New technologies may change crop yields and may change the relative suitability of soils for various uses. Also, with time, new land uses or elements for which soil interpretations have not been prepared may become important in the area.

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[1] Extracted from Application of Soil Information, Part 603, National Soils Handbook. USDA Soil Conservation Service.

USE OF INTERPRETIVE TABLES

The ratings derived from these interpretive tables are based only on soil and landscape criteria. The soil rating indicates the severity of the limitation or lack of suitability of the soil if it is used without corrective or precautionary measures. The interpretation does not take into account socioeconomic factors such as nearness to municipal areas, markets, accessibility, size of the area, etc., that make some lands desirable for development regardless of soil conditions and related development costs.

The degree of limitation or soil suitability is determined by the most restrictive (least suitable) rating assigned to any of the listed soil properties. The cumulative effect of individual soil properties may act to further downgrade a soil. This is left to the discretion of the interpreter. Class limits of individual soil/landscape properties are set to compensate for the fact that all soil properties are not of equal importance for a given use.

Degrees of Soil Suitability for Agriculture for Organic Soils

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth of deposit (cm)			
if underlain by till or bedrock	>160	120-160	80-120
if underlain by sand, clay or marl	>120	80-120	40-80
Origin of peat material	slightly decomposed sphagnum, reed grass, sedges	reed grass, sedges,alder	decomposed sphagnum, cottongrass
Degree of decomposition (40-120 cm)	fibric for sphagnum; mesic for reed grass, sedges	mesic for sphagnum; fibric for reed grass, sedges	humic

A fourth degree of suitability for agriculture on organic soils is defined as unsuitable: Depth of peat <80 cm when underlain by till or bedrock or less than 40 cm when underlain by sand, clay or marl.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Suitability for Growing Alfalfa for Forage[1]

Soil Factors	Ratings			
	Good	Fair	Poor	Very Poor
Slope[2] (%)	0-9	10-15	16-30	>30[3]
Drainage[4]	W	MW, R	I	P, VP
Depth (cm) of friable soil[5]	>100	50-100	20-50	<20
Texture[6] (weighted average of friable soil. common groups only)	GSCL SCL Sil,GSiL L, GL SL, GSL	CL GCL VGSiL VGL VGSL	SiC SiCL LS, S GLS VGLS VGS, GS	gravel C
Stoniness[2]	1	2	3	4, 5
Rockiness[2]	--	--	1, 2	3-5
Flooding duration (consecutive days during growing season)[7]	--	1-3	3-5	>5

Source: Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[1]Ratings are based on the assumption that proper management which includes fertilization, liming, and weed control is carried out. These ratings apply to the Maritime Provinces only.

[2]United States Department of Agriculture and the University of Maine. 1967. Soil suitability guide for land use planning in Maine. Maine Agric. Exp. Stn. Misc. Publ. 667. Rev.

[3] 0 -2% slopes of CL, SiC, and SiCL soils are downgraded because of ice sheets and frost heaving.

[4]Smith, D. 1964. Winter injury and the survival of forage plants. Herbage Abstracts 34(4):203-209.

Russel, W.E., F.J. Olsen, J.H.Jones. 1979. Frost heaving in alfalfa establishment on soils with different drainage characteristics. Agron. J. 70:869-872.

Prince, F.A. 1956. Grassland farming in the humid northeast. Van Nostrand Princeton, N.J. 441 pp.

Heath, M.E.,D.S. Metcalf, and R.F. Barnes 1973. Forages: the science of grassland agriculture. Iowa State University Press, Ames, Iowa, 755 pp.

[5]Bolton, J.L. 1962. Alfalfa. Leonard Hill Ltd., London.

[6]Points considered in the texture ratings were water and nutrient holding capacity and winter survival of alfalfa in relation to texture only.

[7]Bolton, J.L. ibid.

Heinrichs, D.E. 1970. Flooding tolerance of legumes. Can. J. Plant Sci. 50:435-438.

[6]Points considered in the texture ratings were water and nutrient holding capacity and winter survival of alfalfa in relation to texture only.

Soil Limitations for Growing Alfalfa

Soil Factors	Degree of Limitation			
	Slight	Moderate	Severe	Unsuitable
Slope (%)	0-5	5-9	9-15	>15
Texture				
topsoil	SL L-FSL	S L	GSL	CL-C GR
subsoil	GSL-SiL	SI L-SiCL		
Stoniness(1)	1	2	3	4
pH range	6.0-7.0	5.5-6.0	5.0-5.5	<5.0
Drainage class	W	MW	I	R P
Available H20 (cm)	>12	9-12	6-9	0-6
Water table depth (cm)	>80	40-80	20-40	<20
Bulk Density (gm/cm^3)				
topsoil	1.0-1.2	1.2-1.4	1.4-1.5	>1.5
subsoil	<1.2	1.2-1.4	1.4-1.5	>1.5
Rooting depth (cm)	>80	40-80	20-40	<20

Source: MacMillan, J.K. unpublished mimeo. N.B. Dept. of Agriculture.

Soil Limitations for Alfalfa[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth of friable soil[2] (cm)	>100	50-100	<50
Flooding[3] (consecutive days during growing season)	none	1-3	3-5
crop damage	none	some	severe
Stoniness[4]	0-1	2	3
Rockiness[4]	0	---	1-2
Slope[4] (%)	<9	9-15	15-30
Drainage[5,6]	W	MW,R	I
Texture (average of friable soil)	L,SL,SiL SCL,GSCL GL,GSiL	CL,GCL,VGSiL VGL,VGSL	SiC,SiCL,LS GLS,VGLS,VGS S,GS

A fourth degree of soil limitation (unsuitable) is also defined:

- flooding for 5 days in growing season
- <30 cm friable soil
- drainage P,VP
- gravel or clay textures
- stoniness 4-5
- >30% slope
- rockiness 3-5

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Ratings are based on the assumption that proper management which includes fertilization, liming and weed control is carried out.

[2]Bolton, J.L. 1962. Alfalfa. Leonard Hill Ltd., London.

[3]Heinrichs, D.E. 1970. Flooding tolerance of legumes. Can. J. Plant Sci. 50:435-438.

Bolton, J.L. 1962. ibid.

[4]Spedding, C.R.W. and E.C. DieKmahns. (ed) 1972. Grasses and legumes in British agriculture. Common. W. Bur. Pastures Field Crops. Bull. 49:1-511.

Russel, W.E., F.J. Olsen, and J.H.Jones. 1979. Frost heaving in alfalfa establishment on soils with different drainage characteristics. Agron. J. 70:869-872.

Heath, M.E., D.S. Metcalf, and R.F. Barnes 1973. Forages: the science of grassland agriculture. Iowa State University Press, Ames, Iowa, 755 pp.

[6]Improve by one drainage class where tile drainage is feasible. Drainage is feasible for all soil conditions except the following: <2% slope; organic soils; <100 cm to bedrock; rockiness classes 2-5; stoniness classes 4-5; and where frequent flooding by rivers, lakes and streams occurs.

Soil Suitability for Alfalfa[1,2]

Soil Factors	Degree of Suitability			
	Good	Fair	Poor	Unsuitable
Depth of friable soil (cm)	>50	---	20-50	<20
Particle size of friable soil	2,3	0,1 4,7	5	6,8,9
Flooding	N	---	O	F,VF
Stoniness	0-1	2	3	4-5
Rockiness	0	1	---	2-5
Slope (%)	2-9	<2[3],9-15	15-30	>30
Drainage[3]	W	MW,R	I	P,VP

Sources:

Holmstrom, D.A. (in press). Soils of the Annapolis Valley area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 22. LRRC, Truro, NS.

Webb, K.T. (in press). Soils of the Cobequid Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 23. LRRC, Truro, NS.

Patterson, G.T. (in press). Soils of the Northumberland Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 24. LRRC, Truro, NS.

[1]Ratings are based on the assumption that proper management, which includes liming, fertilization, weed control, and disease control is carried out.

[2]Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[3]Slopes of <2% are conducive to the formation of ice sheets.

[4]Improve moderately well, imperfectly and poorly drained soils by one drainage class where tile drainage is feasible. Tile drainage is assumed to be feasible for soils that have the following characteristics: slope >2%, bedrock >80 cm from surface of mineral soils, rockiness classes 0 or 1, stoniness classes 0-3, and no flooding.

Soil Suitability for Apple Orchards

Soil Criteria	Ratings			
	well suited	suited	marginal	unsuited
Depth of soil above bedrock (cm)	>90	60-90	30-60	<30
Depth of soil above compacted or cemented layer (cm) (>1.6 gm/cm3)	>90	40-90	30-40	<30
Mottling	none	weak >50 cm	weak <50 cm	strong <50 cm
(drainage)	W	MW	I	P
Soil texture				
topsoil	SL,L,SiL	SL,L,SiL	LS,CL	GLS,S SiCL
subsoil	SL,L,SiL	SL,L,SiL CL	LS,CL	GLS,S SiCL
Slope (%)	<10	10-15	15-30	>30

Source: Michalica, K. unpublished mimeo. N.B. Dept. of Agriculture

Soil Suitability for Apples[1,2]

Soil Factors	Degree of Suitability			
	Good	Fair	Poor	Unsuitable
Depth of friable soil (cm)	>80	50-80	20-50	<20
Particle size of friable soil	2,3,4	5,7	0,1	9,6,8
Flooding	N	---	---	O,F,VF
Stoniness	0-2	3	---	4-5
Rockiness	0	1	---	2-5
Slope (%)	<9	9-15	15-30	>30
Drainage[3] (w)	W	MW,R	I	P,VP

Source: Holmstrom, D.A. (in press). Soils of the Annapolis Valley area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 22. LRRC, Truro, NS.

[1]Ratings are based on the assumption that proper management, which includes liming, fertilization, weed control, and disease control is carried out.

[2]Michalica, K. c1983. Soil Suitability for Apple Orchards. N.B. Dept. Agr. Unpublished mimeo.

Webster, D. Kentville Research Station, N.S. personal comm.

[3]Improve moderately well, imperfectly and poorly drained soils by one drainage class where tile drainage is feasible. Tile drainage is assumed to be feasible for soils that have the following characteristics: slope >2%, bedrock >80 cm from surface of mineral soils, rockiness classes 0 or 1, stoniness classes 0-3, and no flooding.

Soil Limitations for Growing Barley

Soil Factors	Degree of Limitation			
	Slight	Moderate	Severe	Unsuitable
Slope (%)	0-5	5-9	9-15	>15
Texture				
Surface	Si,L-FSL	S,L	GSL	CL-C,GR
Sub Sur.	GSL-SiL	Si L-SiCL	CL	C
Stoniness[1]	1	2	3	4
pH range	6.5-7.5	6.0-6.5	5.5-6.0	<5.5
Drainage	W	MW	I	R
Available H2O (cm)	>12	9-12	6-9	<6
Water table depth (cm)	>80	40-80	20-40	<20
Bulk density (g/cm3)				
topsoil	1.0-1.2	1.2-1.4	1.4-1.5	>1.5
subsoil	<1.2	1.2-1.4	1.4-1.5	>1.5
Rooting depth (cm)	20-25	15-20	10-15	<10

Source: MacMillan, J.K. unpublished mimeo. N.B. Dept. of Agriculture.

Soil Limitations for Carrots
(using irrigation)

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Surface coarse fragments			
gravel (%)	<5	5-25	25-50
cobbles (%)	<3	3-15	15-50
stoniness	0,1	2,3	4
boulders	0	1	2
Surface texture	SL	LS	S
Slope (%)	<5	5-9	9-15
Depth to cemented layer (cm)	50	20-50	<20
Degree of cementation	Weak	Moderate	Strong
Drainage	R,W,MW	I	P

Source: Hender, F. 1986. Soils of the Terra Nova Agricultural Development Area, Newfoundland. Report 13. Newfoundland Soil Survey. LRRC Publ. No. 84-62.

Degrees of Soil Suitability for Carrots and Parsnips

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth to compact or cemented layer (cm)	>50	30-50	<30
Transmissibility (cm/h)	>0.5	0.1-0.5	<0.1
Solum texure			
carrots	LS,SL	L,S	other
parsnips	SL,L	LS,S	other
Droughtiness	not affected	occurs some years	occurs almost every year
Drainage	W,MW	R,I	P
Surface rock fragments			
cobbles (%)	<3	3-15	15-30
stoniness	0,1	2	3
Gravel content of upper 30 cm (% by volume)	<20	20-50	>50
Depth to bedrock (cm)	>100	50-100	20-50
Slope (%)	<5	5-9	9-15

A fourth degree of soil suitability for carrots and parsnips is defined as unsuitable: Bedrock <20 cm, slope >15%, stoniness class 5, or very poor drainage.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Suitability for Growing Spring Cereals[1]

Soil Factors	Ratings			
	Good	Fair	Poor	Very Poor
Texture[2] (weighted average of friable soil. common groups only)	L SiL SCL SL	SiCL CL	LS S C SC SiC	gravel all VG
Drainage	W MW	I R	P	VP
Depth to pore discontinuity (cm)	>50	20-50	---	<20
Slope (%)[3]	0-5	6-9	10-15	>15
Stoniness (stones >25 cm)	0,1	2	3	4,5
Rockiness	0	0	1	>1
Flooding[4] duration (consecutive days)	0	0-2	3-7	>7

Source: Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[1]Ratings are based on the assumption that proper land management which includes fertilization, weed control, and crop rotation is carried out. These ratings apply to the Maritime Provinces only.

[2]Soils with gravelly textures (20-50% gravel by volume) rate as fair with the exception of gravelly loam and gravelly silt loam which remain good and gravelly sand and gravelly loamy sand which are rated as poor. Very gravelly soil textures (50 - 90%) are rated as poor.

[3]United States Department of Agriculture and the University of Maine. 1967. Soil suitability guide for land use planning in Maine. Maine Agric. Exp. Stn. Misc. Publ. 667. Rev.

[4]White, R.P. 1976. Cropping problems and programs on wet soils. Proceedings of a joint session of Canadian Society of Agronomy, Canadian Society of Soil Science, and Canadian Society of Agricultural Engineering. Agricultural Institute of Canada, Halifax, N.S.

Andrew, C.J. and M.K. Pomeroy. 1981. The effect of flooding pretreatment on cold hardiness and survival of winter cereals in ice encasement. Can. J. Plant Sci. 61:507-513

Soil Limitations for Spring Cereals[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth of friable soil(cm)	>50	30-50	---
Flooding[2] (consecutive days during the growing season)	0	1-2	3-7
Stoniness	0-1	2	3
Rockiness	0	--	1
Slope[3] (%)	<5	5-9	9-15
Drainage[4]	W,MW	R,I	P
Texture (average of friable soil)	L,SL,SiL SCL,GSCL GL,GSiL	CL,SiCL GSCL,GCL GSiCL	LS,SC,SiC S,GS,GLS,VGL VGSiL,VGSL

A fourth degree of soil limitation (unsuitable) is also defined:

- <30 cm friable soil
- stoniness 4-5
- >15% slope
- textures gravel,C
- flooding throughout growing season
- rockiness 2-5
- very poor (VP) drainage

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Ratings are based on the assumption that proper land management which includes fertilization, weed control, and crop rotation is carried out.

[2]White, R.P. 1976. Cropping problems and programs on wet soils. Proceedings of a joint session of Canadian Society of Agronomy, Canadian Society of Soil Science, and Canadian Society of Agricultural Engineering. Agricultural Institute of Canada, Halifax, N.S.

Andrew, C.J. and M.K. Pomeroy. 1981. The effect of flooding pretreatment on cold hardiness and survival of winter cereals in ice encasement. Can. J. Plant Sci. 61:507-513

[3]United States Department of Agriculture and the University of Maine. 1967. Soil suitability guide for land use planning in Maine. Maine Agric. Exp. Stn. Misc. Publ. 667. Rev.

[4]Improve by one drainage class where tile drainage is feasible. Drainage is feasible for all soil conditions except the following: <2% slope; organic soils; <100 cm to bedrock; rockiness classes 2-5; stoniness classes 4-5; and where frequent flooding by rivers, lakes and streams occurs.

Soil Suitability for Spring Cereals[1,2]

Soil Factors	Degree of Suitability			
	Good	Fair	Poor	Unsuitable
Depth of friable soil (cm)	>50	20-50	---	<20
Particle size of friable soil	2,3,4	(0,1)[3] 5	6,7	8,9
Flooding	N	O	F	VF
Stoniness	0-1	2	3	4-5
Rockiness	0	1	---	2-5
Slope (%)	<5	5-9	9-15	>15
Drainage[4]	W,MW	I,R	P	VP

Sources: Holmstrom, D.A. (in press). Soils of the Annapolis Valley area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 22. LRRC, Truro, NS.

Webb, K.T. (in press). Soils of the Cobequid Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 23. LRRC, Truro, NS.

Patterson, G.T. (in press). Soils of the Northumberland Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 24. LRRC, Truro, NS.

[1]Ratings are based on the assumption that proper management, which includes liming, fertilization, weed control, and disease control is carried out.

[2]Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[3]Downgrade to poor if soil has imperfect drainage.

[4]Improve imperfectly and poorly drained soils by one drainage class where tile drainage is feasible. Tile drainage is assumed to be feasible for soils that have the following characteristics: slope >2%, bedrock >80 cm from surface of mineral soils, rockiness classes 0 or 1, stoniness classes 0-3, and no flooding.

Soil Limitations for Cole Crops
(using irrigation)

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Surface coarse fragments			
cobbles (%)	<15	15-50	>50
stoniness	0,1	2,3	4
boulders	0	1	2
Surface texture	SL	LS	S
Slope (%)	<5	5-9	9-15
Depth to cemented layer (cm)	50	20-50	<20
Degree of cementation	Weak	Moderate	Strong
Drainage	R,W,MW	I	P

Source: Hender, F. 1986. Soils of the Terra Nova Agricultural Development Area, Newfoundland. Report 13. Newfoundland Soil Survey. LRRC Publ. No. 84-62.

Degrees of Soil Suitability for Cole Crops

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth to compact or cemented layer (cm)	>50	20-50	<20
Transmissibility (cm/h)	>0.5	0.1-0.5	<0.1
Droughtiness	not affected	occurs some years	occurs almost every year
Drainage	W,MW	R,I	P
Surface rock fragments			
cobbles (%)	<15	15-50	>50
stoniness	0,1	2,3	4
Depth to bedrock (cm)	>100	50-100	20-50
Slope (%)	<5	5-9	9-15

A fourth degree of soil suitability for cole crops is defined as unsuitable: Bedrock <20 cm, slope >15%, stoniness class 5, or very poor drainage.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Suitability for Corn[1,2]

Soil Factors	Degree of Suitability			
	Good	Fair	Poor	Unsuitable
Depth of friable soil (cm)	>50	20-50	---	<20
Particle size of friable soil	2,3	(0,1)[4] 4	5,6,7	8,9
Flooding	N	O	F	VF
Stoniness	0-1	2	3	4-5
Rockiness	0	1	---	2-5
Slope (%)	<2	2-5	5-9	>9
Drainage[3]	W,MW	I,R	P	VP

Sources:
Holmstrom, D.A. (in press). Soils of the Annapolis Valley area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 22. LRRC, Truro, NS.

Webb, K.T. (in press). Soils of the Cobequid Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 23. LRRC, Truro, NS.

Patterson, G.T. (in press). Soils of the Northumberland Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 24. LRRC, Truro, NS.

[1]Ratings are based on the assumption that proper management, which includes liming, fertilization, weed control, and disease control is carried out.

[2]Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[3]Improve imperfectly and poorly drained soils by one drainage class where tile drainage is feasible. Tile drainage is assumed to be feasible for soils that have the following characteristics: slope >2%, bedrock >80 cm from surface of mineral soils, rockiness classes 0 or 1, stoniness classes 0-3, and no flooding.

[4]Downgrade class if drainage is rated as imperfect.

Degrees of Development Difficulty of Organic Soils

Soil Factors	Degree of Development Difficulty		
	Minor	Moderate (reclamation warranted)	Major (reclamation seldom warranted)
Vegetative cover	light: grasses sedges reeds	moderate: brush small trees	heavy: large trees heavy shrub
Excess water	no seepage no runon	seepage runon	
Inundation hazard	none	slight	severe
Surface roughness	none	hummocks, mounds	holes,mounds
		30-60 cm microrelief	60 cm microrelief
Open water (%)	<10	10-30	>30
Wood fragments (%)	<1	1-5	>5
Depth of deposit (cm)			
if underlain by till or bedrock	>160	120-160	<120
if underlain by sand, clay or marl	<120	80-120	<80

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Field Crops[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to compact layer (cm)	>75	75-40	<40
Permeability at 50 cm (cm/h)	>0.5	0.1-0.5	<0.1
Actual erosion	moderate	moderately severe	severe
Fertility	highly responsive to fertilizer	moderately responsive to fertilizer	cannot be improved with feasible management
Flooding	occasional, no damage	frequent, some damage	frequent, severe damage
Available[2] moisture (cm)	>9	9-5	<5
Stoniness	0,1,2	3	4
Depth to bedrock (cm)	>100	100-50	50-20
Slope (%)	<5	5-9	9-15
Drainage	R,W,MW	I	P

A fourth degree of soil limitation is also defined for Field Crops:

Unsuitable: flooding throughout most of growing season
stoniness class 5
less than 20 cm to bedrock
slope >15%
CLI Capability classes 6 and 7 and part of 5
soils with very poor (VP) drainage

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville - Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

The degree of limitation for field crops is based on the CLI report Soil Capability Classification for Agriculture. The limitation ratings are as follows:

Slight-- Capability Class 2
Moderate--Capability Class 3
Severe-- Capability Class 4

Owing to climatic limitations in the Maritime region, no soils are classified as having an agricultural capability of Class 1: the best agricultural land is Class 2. Mineral soils in Classes 2, 3 and 4 are considered capable of sustained use for cultivated field crops.

The Soil properties used in the ratings are based on the limitations recognized at the capability subclass level. Range limits are set accordingly. This results in a very general scheme in which a soil is rated for the average field crop.

These interpretive soil limitation classes are not applied to organic soils because, in general, there is insufficient information on these organic soil areas to make such an interpretive judgement.

Crops that create conditions favorable to soil erosion (eg row crops like corn) should be rated according to the Soil Limitations for Vegetable Crop Classes.

[1]Canada Land Inventory. 1965. Soil Capability Classification for Agriculture. Report 2. Catalogue No. FO63-2/1972. 16 pp.

Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

[2]Class limits are based on the amount of moisture in the surface 50 cm of soil. The class storage capacities are related to rainfall, evapotranspiration rates and plant requirements.

>9 cm	no droughtiness
5-9 cm	moderate droughtiness
<5 cm	moderately severe to severe droughtiness

Soil Limitations for Field Crops[1,2]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to compact layer (cm)	>75	40-75	<40
Permeability at 50 cm (cm/h)	>0.5	0.1-0.5	<0.1
Flooding	occasional, no damage	frequent, some damage	frequent, severe damage
Available[3] moisture (cm)	>9	9-5	<5
Surface coarse fragments are seldom of signigicance in PEI			
Depth to bedrock (cm)	>100	100-50	50-20
Slope (%)	<5	5-9	9-15
Drainage	R,W,MW	I	P

A fourth degree of soil limitation (unsuitable) is also defined:

flooding throughout most of growing season
less than 20 cm to bedrock
slope >15%
soils with very poor (VP) drainage

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Canada Land Inventory. 1965. Soil Capability Classification for Agriculture. Report 2. Catalogue No. FO63-2/1972. 16 pp.

Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

[2]Crops that create conditions favorable to soil erosion (row crops such as corn) should be rated according to Soil Limitations for Vegetables.

[3]Class limits are based on the amount of moisture in the surface 50 cm of soil. The class storage capacities are related to rainfall, evapotranspiration rates and plant requirements.

Soil Limitations for Field Crops[1]

Soil Factors	Degree of Limitation: Slight	Moderate	Severe
Depth of friable soil(cm)	>50	30-50	<30
Permeability of subsoil (cm/h)	>0.5	0.15-0.5	<.15
Flooding crop damage	occasional none	frequent some	frequent severe
Stoniness	0-2	3	4
Depth to bedrock (cm)	>100	50-100	20-50
Slope (%)	<5	5-9	9-15
Drainage[2]	R,W,MW	I	P
Texture (average of friable soil)	L,SL,SiL SCL,GL,GSL GSiL,GSCL,GCL	VGL,VGSiL VGSL,CL SiCL	SiC,LS,GLS S,GS,C gravel

A fourth degree of soil limitation (unsuitable) is also defined:

- flooding throughout growing season
- <20 cm to bedrock
- very poor (VP) drainage
- stoniness 5
- >15% slope

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Department of the Environment. 1972. The Canada Land Inventory. Soil capability classification for agriculture. Rep. No. 2. 16 pp.

Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

Rate row crops using Soil Limitations for Vegetables

[2]Improve by one drainage class where tile drainage is feasible. Drainage is feasible for all soil conditions except the following: <2% slope; organic soils; <100 cm to bedrock; rockiness classes 2-5; stoniness classes 4-5; and where frequent flooding by rivers, lakes and streams occurs.

Degrees of Soil Suitability for Forage Crops

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth to compact or cemented layer (cm)	>50	20-50	<20
Transmissibility (cm/h)	>0.5	0.1-0.5	<0.1
Droughtiness	not affected	occurs some years	occurs almost every year
Drainage	W,MW	I	P
Surface rock fragments			
stoniness	0,1,2	3	4
Depth to bedrock (cm)	>100	50-100	20-50
Slope (%)	<9	9-15	>15

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Suitability for Forage[1,2]

Soil Factors	Degree of Suitability			
	Good	Fair	Poor	Unsuitable
Depth of friable soil (cm)	>20	---	---	---
Particle size of friable soil	2,3,4	0,1 7,5	6,8	9
Flooding	N	O	F	VF
Stoniness	0-1	2	3	4-5
Rockiness	0	1	---	2-5
Slope (%)	<9	9-15	15-30	>30
Drainage[3]	W,MW	I,R	P	VP

Sources: Holmstrom, D.A. (in press). Soils of the Annapolis Valley area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 22. LRRC, Truro, NS.

Webb, K.T. (in press). Soils of the Cobequid Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 23. LRRC, Truro, NS.

Patterson, G.T. (in press). Soils of the Northumberland Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 24. LRRC, Truro, NS.

[1]Includes timothy, clover and similar forage crops for hay production. Does not include specialty forage crops such as alfalfa. Ratings are based on the assumption that proper management, which includes liming, fertilization, weed control, and disease control is carried out.

[2]MacMillan, J.K. c1983. Soil limitations for growing timothy. Unpublished. New Bruns. Dept. Agr.

[3]Improve imperfectly and poorly drained soils by one drainage class where tile drainage is feasible. Tile drainage is assumed to be feasible for soils that have the following characteristics: slope >2%, bedrock >80 cm from surface of mineral soils, rockiness classes 0 or 1, stoniness classes 0-3, and no flooding.

Tentative Classification of Soil Suitability for Potatoes

Soil Factors	Degree of Limitation			
	Slight	Moderate	Severe	Unsuitable
Texture	SL-SiL L	LS,CL	FS,VFS SiCL	CS,MS all gravelly >SiCL
Soil depth to bedrock (cm)	>100	80-100	50-80	<50
Slope (%)	<5	5-9	9-12	>12
Drainage	W	W	MW	<MW
Stoniness (% by volume)	<20	20-30	30-50	>50

Source: Michalica, K. unpublished mimeo. N.B. Dept. of Agriculture

Degrees of Soil Suitability for Potatoes

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth to compact or cemented layer (cm)	>50	30-50	<30
Transmissibility (cm/h)	>0.5	0.1-0.5	<0.1
Solum texture	L,SL	LS,S	other
Droughtiness	not affected	occurs some years	occurs almost every year
Drainage	W,MW	I	P
Surface rock fragments			
cobbles (%)	<3	3-15	>15
stoniness	0,1,2	3	4
Depth to bedrock (cm)	>100	50-100	20-50
Slope (%)	<5	5-9	9-15

A fourth degree of soil suitability for potatoes is defined as unsuitable: Bedrock <20 cm, slope >15%, stoniness class 4, or very poor drainage.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Potatoes
(using irrigation)

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Surface coarse fragments			
cobbles (%)	<3	3-15	15-50
stoniness	0,1	2,3	4
boulders	0	1	2
Surface texture	SL	LS	S
Slope (%)	<5	5-9	9-15
Depth to cemented layer (cm)	50	20-50	<20
Degree of cementation	Weak	Moderate	Strong
Drainage	MW	I	P

Source: Hender, F. 1986. Soils of the Terra Nova Agricultural Development Area, Newfoundland. Report 13. Newfoundland Soil Survey. LRRC Publ. No. 84-62.

Soil Limitations for Sprinkler Irrigation

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Texture	SL	LS	S
Slope (%)	<5	5-9	9-15
Stoniness	0,1	2,3	4
Depth to cemented layer (cm)	50	20-50	10-20
Drainage	R,W,I	MW	P

Source: Hender, F. 1986. Soils of the Terra Nova Agricultural Development Area, Newfoundland. Report 13. Newfoundland Soil Survey. LRRC Publ. No. 84-62.

Soil Limitations for Growing Timothy

Soil Factors	Degree of Limitation			
	Slight	Moderate	Severe	Unsuitable
Slope (%)	0-5	5-9	9-15	>15
Texture				
topsoil	Si,L-FSL	SL, Si	GSL	CL-C, GR
subsoil	GSL-SiL	L-SiCL	CL	C
Stoniness	1	2	3	4
pH range	6.5-7.0	6.0-6.5	5.5-6.0	<5.5
Drainage	W	MW	I	R, P
Available H2O (cm)	>12	9-12	6-9	<6
Water table depth (cm)	>60	40-60	20-40	<20
Bulk Density (g/cm^3)				
topsoil	1.0-1.2	1.2-1.4	1.4-1.5	>1.5
subsoil	<1.2	1.2-1.4	1.4-1.5	>1.5
Rooting depth (cm)	20-25	15-20	10-15	<10

Source: MacMillan, J.K. unpublished mimeo. N.B. Dept. of Agriculture.

Degrees of Soil Suitability for Turnips and Rutabagas

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth to compact or cemented layer (cm)	>50	30-50	<30
Transmissibility (cm/h)	>0.5	0.1-0.5	<0.1
Solum texure	L,CL	SL,LS	other
Droughtiness	not affected	occurs some years	occurs almost every year
Drainage	W,MW	R,I	P
Surface rock fragments			
cobbles (%)	<3	3-15	15-30
stoniness	0,1	2	3
Depth to bedrock (cm)	>100	50-100	20-50
Slope (%)	<5	5-9	9-15

A fourth degree of soil suitability for turnips and rutabagas is defined as unsuitable: Bedrock <20 cm, slope >15%, stoniness class 4, or very poor drainage.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Vegetable Crops[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to compact layer (cm)	>100	100-50	50-30
Permeability subsoil (cm/h)	>0.5	0.5-0.1	<0.1
Actual erosion	moderate	moderately severe	severe
Fertility	highly responsive to fertilizer	moderately responsive to fertilizer	cannot be improved with feasible management
Flooding	occasional, no damage	frequent, some damage	frequent, severe damage
Available[2] moisture (cm)	>10	10-6	<6
Surface coarse fragments			
gravel(%)	<5	5-35	35-50
cobbles(%)	<2	2-15	15-30
stoniness	0,1	2	3
Depth to bedrock (cm)	>100	100-50	50-30
Slope (%)	<2	2-5	5-12
Excess water (drainage)	W MW	I R	P
Surface Texture	L,SIL SL	LS	SiC,C,CL SiCL,SCL,S

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

A fourth degree of soil limitation is also defined for Vegetable Crops:

Unsuitable:
- <30 cm to compact layer
- flood risk throughout much of growing season
- >50% gravel in surface layer
- >30% cobbles in surface layer
- stoniness class 4 and 5
- <20 cm to bedrock
- slope >9%
- very poor (VP) drainage
- severe droughtiness

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[1]Canada Land Inventory. 1965. Soil Capability Classification for Agriculture. Report 2. Catalogue No. FO63-2/1972. 16 pp.

Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

[2]Class Limits are based on the amount of moisture in the surface 50 cm of soil. The class storage capacities are related to rainfall, evapotranspiration rates and plant requirements.

>10 cm	no irrigation required
6-10 cm	may require irrigation
<6 cm	requires irrigation

Soil Limitations for Vegetable Crops[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to compact layer(cm)	>100	50-100	30-50
Permeability of subsoil (cm/h)	>0.5	0.1-0.5	<.1
Flooding	occasional	frequent	frequent
crop damage	none	some	severe
Available moisture[2] (cm)	>10	6-10	<6
Surface coarse fragments			
gravel(%)	<5	5-35	35-50
cobbles(%)	<2	2-15	15-30
stoniness	not a factor in PEI		
Depth to bedrock (cm)	>100	50-100	30-50
Slope (%)	<2	2-5	5-12
Drainage	W,MW	R,I	P
Surface texture	L,SiL,SL	LS	SiC,C,CL SiCL,SCL,S

A fourth degree of soil limitation (unsuitable) is also defined:

flooding throughout growing season	severe droughtiness
<30 cm to bedrock	>12% slope
<30 cm to compact layer	>50% surface gravel
very poor (VP) drainage	>30% surface cobbles

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Department of the Environment. 1972. The Canada Land Inventory. Soil capability classification for agriculture. Rep. No. 2. 16 pp.

Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

[2]Class limits are based on the amount of moisture in the surface 50 cm of soil. The class storage capacities are related to rainfall and evapotranspiration rates and plant requirements.

Organic Soil Limitations for Vegetable Production

The biggest consideration in selecting an organic soil for vegetable production is the drainability of the area and the amount of the area having flashets. The degree of decomposition is a minor factor since the fibric material will decompose with cultivation. It is assumed that regionally adapted vegetables are to be grown.

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Degree of decomposition	H 3-5	H 1,2,6	H 7-10
Depth of deposit (m)	>2	0.5-2	<0.5
Area of flashets (%)	<2	2-5	>5
Drainability	Good	Fair	Poor
Underlying material	S	GR, bedrock stones, silt clay, water	Humic

Source: Hender, F. 1986. Soils of the Terra Nova Agricultural Development Area, Newfoundland. Report 13. Newfoundland Soil Survey. LRRC Publ. No. 84-62.

Soil Limitations for Vegetable Crops[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth of friable soil(cm)	>60	40-60	<40
Permeability of subsoil (cm/h)	>0.5	0.1-0.5	<.1
Flooding crop damage	occasional none	frequent some	frequent severe
Stoniness	0-1	2	3
Depth to bedrock (cm)	>100	50-100	30-50
Slope (%)	<2	2-5	5-9
Drainage[2]	W,MW	R,I	P
Texture (average of friable soil)	L,SL,SiL GL,GSL GSiL,GSCL	LS,SCL,VGL VGSL,VGSiL VGCL	CL,SiCL,SiC C,S,GS,GLS

A fourth degree of soil limitation (unsuitable) is also defined:

- flooding throughout growing season
- stoniness 4-5
- <30 cm to bedrock
- >9% slope
- very poor (VP) drainage

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Department of the Environment. 1972. The Canada Land Inventory. Soil capability classification for agriculture. Rep. No. 2. 16 pp.

Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

[2]Improve by one drainage class where tile drainage is feasible. Drainage is feasible for all soil conditions except the following: <2% slope; organic soils; <100 cm to bedrock; rockiness classes 2-5; stoniness classes 4-5; and where frequent flooding by rivers, lakes and streams occurs.

Soil Suitability for Vegetables[1,2]

Soil Factors	Degree of Suitability			
	Good	Fair	Poor	Unsuitable
Depth of friable soil (cm)	>50	20-50	---	<20
Particle size of friable soil	2,4,5	(0,1)[4] 3	6,7	8,9
Flooding	N	O	F	VF
Stoniness	0-1	2	3	4-5
Rockiness	0	1	---	2-5
Slope (%)	<2	2-5	5-9	>9
Drainage[3]	R,W,MW	I	P	VP

Holmstrom, D.A. (in press). Soils of the Annapolis Valley area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 22. LRRC, Truro, NS.

Webb, K.T. (in press). Soils of the Cobequid Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 23. LRRC, Truro, NS.

Patterson, G.T. (in press). Soils of the Northumberland Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 24. LRRC, Truro, NS.

[1]Ratings are based on the assumption that proper management, which includes liming, fertilization, weed control, and disease control is carried out. It is also assumed that irrigation is available.

[2]Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[3]Improve imperfectly and poorly drained soils by one drainage class where tile drainage is feasible. Tile drainage is assumed to be feasible for soils that have the following characteristics: slope >2%, bedrock >80 cm from surface of mineral soils, rockiness classes 0 or 1, stoniness classes 0-3, and no flooding.

[4]Downgrade one class if drainage is rated as imperfect.

Soil Suitability for Growing Winter Wheat[1]

Soil Factors	Rating			
	Good	Fair	Poor	Very Poor
Texture[2,4] (weighted average of friable soil. common groups only)	L SiL SL SCL	SiCL CL LS	C SiC S	all G all VG
Drainage	W MW	I R	P	VP
Depth[3] to pore discontinuity (cm)	>50	---	20-50	<20
Slope (%)[5]	2-5	0-2 6-9	10-15	>15
Stoniness	0-1	2	3	>3
Rockiness	0	---	1	>1
Flooding duration[6] (after cold hardening of plant, days)	0	0-2	3-14	>14
Flooding duration[3] (conscecutive days during growing season)	0	0-2	3-7	>7

Source: Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[1]Ratings are based on the assumption that proper management which includes fertilization, liming, and weed control is carried out. These ratings apply to the Maritime Provinces only. Because climate determines, to a large degree, whether winter wheat can be grown, and because this guideline does not attempt to rate cimate, a climatic factor must be considered when determining whether or not to grow winter wheat.

[2]0-2% slope of CL, SiC, C,and SiCL soils are downgraded because of ice sheets and frost heaving. Imperfectly drained CL and SiCL soils are downgraded because of frost heaving.

[3]Depth of soil overlying a fragipan, dense subsoil, bedrock or contrasting material that would offer resistance to root or moisture movement.

[4]Soils with gravelly textures (20-50% gravel by volume) rate as fair, with the exception of gravelly loam and gravelly silt loam which remain good, and gravelly sand and gravelly loamy sand which are rated as poor. Very gravelly soil textures (50-90% gravel by volume) are rated as poor.

[5]United States Department of Agriculture and the University of Maine. 1967. Soil suitability guide for land use planning in Maine. Maine Agric. Exp. Stn. Misc. Publ. 667. Rev.

Sharipov, M.G., A.Sh. Ishem'Yarov, and S.N. Taychinov. 1978. Relief in the System of Land Capability Evaluation. pp 439-445 in Soviet Soil Science. Translated from Pochvovedenive No. 7:42-48.

[6]White, R.P. 1976. Cropping problems and programs on wet soils. Proceedings of a joint session of Canadian Society of Agronomy, Canadian Society of Soil Science, and Canadian Society of Agricultural Engineering. Agricultural Institute of Canada, Halifax, N.S.

Andrew, C.J. and M.K. Pomeroy. 1981. The effect of flooding pretreatment on cold hardiness and survival of winter wheat in ice encasement. Can. J. Plant Sci. 61:507-513.

Soil Limitations for Winter Wheat[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth of friable soil(cm)	>50	---	30-50
Flooding[2] (consecutive days during the growing season)	0	1-2	3-14
Stoniness	0-1	2	3
Rockiness	0	--	1
Slope[3] (%)	2-5	<2,5-9	9-15
Drainage[4]	W,MW	R,I	P
Texture (average of friable soil)	L,SiL,SL GL,GSL GSiL	SCL,LS GSCL,GCL GSiCL	CL,SiCL SiC,VGL VGSiL,GLS

A fourth degree of soil limitation (unsuitable) is also defined:

- <30 cm friable soil
- stoniness 4-5
- >15% slope
- textures gravel,C
- flooding >14 consecutive days
- rockiness 2-5
- very poor (VP) drainage

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Ratings are based on the assumption that proper land management which includes fertilization, weed control, and crop rotation is carried out.

[2]White, R.P. 1976. Cropping problems and programs on wet soils. Proceedings of a joint session of Canadian Society of Agronomy, Canadian Society of Soil Science, and Canadian Society of Agricultural Engineering. Agricultural Institute of Canada, Halifax, N.S.

Andrew, C.J. and M.K. Pomeroy. 1981. The effect of flooding pretreatment on cold hardiness and survival of winter cereals in ice encasement. Can. J. Plant Sci. 61:507-513

[3]United States Department of Agriculture and the University of Maine. 1967. Soil suitability guide for land use planning in Maine. Maine Agric. Exp. Stn. Misc. Publ. 667. Rev.

[4]Improve by one drainage class where tile drainage is feasible. Drainage is feasible for all soil conditions except the following: <2% slope; organic soils; <100 cm to bedrock; rockiness classes 2-5; stoniness classes 4-5; and where frequent flooding by rivers, lakes and streams occurs.

Soil Suitability for Winter Cereals[1,2]

Soil Factors	Degree of Suitability			
	Good	Fair	Poor	Unsuitable
Depth of friable soil (cm)	>50	---	20-50	<20
Particle size of friable soil	2,3,4	5	0,1 6,7	8,9
Flooding	N	O	F	VF
Stoniness	0-1	2	3	4-5
Rockiness	0	1	---	2-5
Slope (%)	2-5	5-9,<2[3]	10-15	>15
Drainage[4] (w)	R,W,MW	I	P	VP

Sources: Holmstrom, D.A. (in press). Soils of the Annapolis Valley area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 22. LRRC, Truro, NS.

Webb, K.T. (in press). Soils of the Cobequid Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 23. LRRC, Truro, NS.

Patterson, G.T. (in press). Soils of the Northumberland Shore area, Nova Scotia. Volume 3: Soil interpretations for Agriculture. Nova Scotia Soil Survey. Report 24. LRRC, Truro, NS.

[1]Ratings are based on the assumption that proper management, which includes liming, fertilization, weed control, and disease control is carried out.

[2]Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[3]Slopes of <2% are conducive to the formation of ice sheets.

[4]Improve imperfectly and poorly drained soils by one drainage class where tile drainage is feasible. Tile drainage is assumed to be feasible for soils that have the following characteristics: slope >2%, bedrock >80 cm from surface of mineral soils, rockiness classes 0 or 1, stoniness classes 0-3, and no flooding.

Soil Limitations for Equipment Use

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Drainage			
<35% silt and clay	R,W MW,I	P	VP
35-70% silt and clay	W,MW	I,P[1]	VP
>70% silt and clay	MW	I[2]	P,VP
Slope (%)	<9	9-30	>30
Stoniness	1-3	4	5

Note: These ratings do not apply to organic soils.

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Downgrade one class if operations carried out during eary spring.

[2]Downgrade one class if operations carried out in early spring or late fall.

Soil Limitations for Equipment Use

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Drainage			
<35% silt and clay	R,W MW,I	P	VP
35-70% silt and clay	W,MW	I,P[1]	VP
>70% silt and clay	MW	I[2]	P,VP
Slope (%)	<9	9-30	>30
Stoniness	not a factor in PEI soils		

Note: These ratings do not apply to organic soils.

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Downgrade one class if operations carried out during eary spring.

[2]Downgrade one class if operations carried out in early spring or late fall.

Degrees of Soil Suitability for Equipment Use

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Material according to Unified Classification System			
	GW,GP,GM,GC SW,SP,SM,SC	CL(PI<15)	CL(PI>15) ML,CH,MH
Drainage	W,MW	I,P	VP
Slope (%)	<9	9-15	>15
Stoniness	0,1,2,3	4	5

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Off-Road Use of Harvesting Equipment[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Drainage	R,W,MW	I	P,VP
Unified Classification	GW,GP,SW,SP (GM,GC,SM)[2]	SC,ML,CL	MH,CH,OL OH,Pt
Slope (%)	<9%	10-30	>30
Rockiness	0,1	2,3	4,5
Stoniness	0-3	4	5

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Vold, T. 1981. Discussion paper: Soil interpretations for forestry. Terrestrial Studies Branch, British Columbia Min. Environ. Victoria, B.C.

Wang, C. and H.W. Rees. 1983. Soils of the Rogersville - Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[2]Downgrade to moderate if >35% passes the #200 sieve and if equipment is used in the spring.

Soil Susceptibility to Erosion

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Slope (%)			
permeability at 100 cm <0.5 cm/hr	<5 5-9[1]	9-15[3] 15-25[1]	>25
permeability at 100 cm >0.5 cm/hr	<5	5-9 9-15[2]	>15

Note: These ratings do not apply to organic soils.

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Downgrade one class if appreciable amount of fine sand or silt or both.

[2]Downgrade one class if texture is silty clay (SiC) or silty clay loam (SiCL)

[3]Upgrade one class if gravel.

Soil Susceptibility to Gully Erosion

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Slope (%)			
permeability at 100 cm >0.5 cm/hr	<5 5-9[1]	9-15[3] 15-25[1]	>25
permeability at 100 cm <0.5 cm/hr	<5	5-9 9-15[2]	>15

Note: These ratings do not apply to organic soils.

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1] Downgrade one class if applicable amount of fine sand or silt or both.

[2] Downgrade one class if texture is silty clay (SiC) or silty clay loam (SiCL)

[3] Upgrade one class if gravel.

Soil Limitations for Construction of Access Roads[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Drainage	R,W,MW	I[5]	P[5],VP
Material suitability[2]	GW,GP,SW SP,(GM,GC SM,SC)[3]	CL (PI[4]<15)	CL (PI>15) ML,CH,MH
Slope (%)	<5	5-15	>15
Stoniness	1,2,3	4	5

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Access roads are designed for low speeds and are usually constructed of on-site materials with little or no hauling of fill. Main haul roads can be interpreted under soil limitations for local roads and streets. Note: Organic soils encountered during construction of access roads will most likely be shallow (terric or lithic) and rate severe.

[2]Material suitability is based on the Unified Classification System.

[3]Downgrade to moderate if more than 35% passes the NO. 200 sieve and road construction and use are intended for early spring.

[4]PI means plasticity index.

[5]Upgrade one class if coarse loamy ablational till or outwash gravel.

Soil Limitations for Access Road Construction[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Drainage	R,W,MW	I[5]	P[5],VP
Material suitability[2]	GW,GP,SW SP,(GM,GC SM,SC)[3]	CL (PI[4]<15)	CL (PI>15) ML,CH,MH
Slope (%)	<5	5-15	>15
Stoniness	not a factor in PEI		

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Access roads are designed for low speeds and are usually constructed of on-site materials with little or no hauling of fill. Main haul roads can be interpreted under soil limitations for local roads and streets. Note: Organic soils are rated as severe or unsuitable on an individual basis.

[2]Material suitability is based on the Unified Classification System.

[3]Downgrade to moderate if more than 35% passes the NO. 200 sieve and road construction and use are intended for early spring.

[4]PI means plasticity index.

[5]Upgrade one class if coarse loamy ablational till or outwash gravel.

Degrees of Soil Suitability for Constuction of Access Roads

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Material according to Unified Classification System			
	GW,GP,GM,GC SW,SP,SM,SC	CL(PI<15)	CL(PI>15) ML,CH,MH
Drainage	R,W,MW	I	P,VP
Slope (%)	<5	5-15	>15
Stoniness	0,1,2,3	4	5

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Forestry Road Construction[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Flooding	once in 5 years	once in 3 years	yearly
Stoniness	0-3	4	5
Slope (%)	<9	10-30	>30
Rockiness	0,1	2,3	4,5
Subgrade AASHO class	A-1,A-2,A-3	A-4,A-5	A-6,A-7
Unified class	GW,GP,SW SP,(GM,GC SM,SC)[2]	ML CL(PI<15)	MH,OL,CH OH,Pt CL(PI>15)
Drainage	R,W,MW	I[3]	P,VP

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Vold, T. 1981. Discussion Paper: Soil Interpretations for Forestry. Terrestrial Studies Branch, British Columbia Ministry of Environment, Victoria, British Columbia.

[2]Downgrade to moderate if >35% passes No. 200 sieve and if road construction and use are in the spring.

[3]Upgrade one class in very gravelly or gravel.

Soil Susceptibility to Windthrow

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth of restricting layer (cm)	>50[1]	20-50	<20
Drainage	R,W MW I[2]	P	VP
Stoniness	0-3	4	5

Note: These ratings do not apply to organic soils.

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]If the texture of the rooting zone is predominantly sand or silty clay to clay, lower the rating to moderate. These textures tend to inhibit proper root growth or support or both.

[2]Downgrade one class for fine loamy and clayey textured soils.

Soil Susceptibility to Windthrow

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth of restricting layer (cm)	>50[1]	20-50	<20
Drainage	R,W MW I[2]	P	VP
Stoniness	not a factor in PEI		

Note: These ratings do not apply to organic soils.

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]If the texture of the rooting zone is predominantly sand or silty clay to clay, lower the rating to moderate. These textures tend to inhibit proper root growth or support or both.

[2]Downgrade one class for fine loamy and clayey textured soils.

Degrees of Soil Susceptibility to Windthrow

Soil Factors	Degree of Susceptibility		
	Low	Moderate	High
Depth to bedrock (cm)	>50	20-50	<20
Depth to restricting layer (cm)	>50	20-50	<20
Drainage	R,W,MW,I	P	VP
Stoniness	0,1,2,3	4	5

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Windthrow Hazard[1]

Soil Factors	Degree of Limitation[2]		
	Slight	Moderate	Severe
Drainage	R,W,MW	I	P,VP
Rooting Depth (cm)	>50	20-50	<20

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Vold, T. 1981. Discussion Paper: Soil Interpretations for Forestry. Terrestrial Studies Branch, British Columbia Ministry of Environment, Victoria, British Columbia.

[2]Downgrade one class for fine loamy and clayey particle sizes in the rooting zone.

Soil Limitations for Outdoor Living[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to water table during period of use (cm) (drainage)			
tent & trailer	>75 (R,W,MW)	75-50 (I)	<50 (P)
picnic areas	>40 (R,W,MW)	>40 (I)	<40 (P)
Flooding during season of use			
tent & trailer	<1 in 10 yr	<1 in 5 yr	>1 in 5 yr
picnic areas	<1 in 5 yr	1 in 3-5 yr	>1 in 3 yr
Permeability[2] of upper 30 cm (cm/h)	>1.0	<1.0	-----
Slope (%)			
tent & trailer	<5	5-9	9-15
picnic areas	<9	9-15	15-30
Depth to bedrock (cm)	>50	<50	-----
Available moisture[3] (cm)	>9	5-9	<5
Surface texture[4]	SL,L SiL	CL,SCL SiCL,LS S (stable)	SC,SIC C S (loose)
Surface coarse fragments			
gravel & cobbles (%)	<20	20-50	>50
stoniness	0-2	3	4

A fourth degree of soil limitation is also defined for Outdoor Living:

Unsuitable:	slope >30% for picnicking and tenting slope >15% for trailer parks floods yearly organic soils permanently wet soils stoniness class 5

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This reflects the soils ability to dry out in the spring and after rainstorms. It is based on constant head hydraulic condutivity tests run on core samples.

[3]This item attempts to evaluate the adequacy of moisture for vegetative growth. Class limits are based on the available moisture in the top 50 cm of soil.

>9 cm	Slight or no moisture deficit
5-9 cm	Moderate moisture deficit
<5 cm	Severe moisture deficit

[4]Surface texture is related to surface wetness after rainfalls, dustiness, and trafficability.

Soil Limitations for Outdoor Living[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to water table during period of use (cm) (drainage)			
tent & trailer	>75 (R,W,MW)	75-50 (I)	<50 (P)
picnic areas	>40 (R,W,MW)	>40 (I)	<40 (P)
Flooding during season of use			
tent & trailer	<1 in 10 yr	<1 in 5 yr	>1 in 5 yr
picnic areas	<1 in 5 yr	<1 in 3-5 yr	>1 in 3 yr
Permeability[2] of upper 30 cm (cm/h)	>1.0	<1.0	-----
Slope (%)			
tent & trailer	<5	5-9	9-15
picnic areas	<9	9-15	15-30
paths & trails	<15	15-30	>30
Depth to bedrock (cm)	>50	<50	-----
Available moisture[3] (cm)	>9	5-9	<5
Surface texture[4]	SL,L SiL	CL,SCL SiCL,LS S (stable)	SC,SIC C S (loose)
Surface coarse fragments			
gravel & cobbles (%)	<20	20-50	>50
stoniness	not a factor in PEI		

A fourth degree of soil limitation is also defined for Outdoor Living:

Unsuitable:	slope >30% for picnicking and paths
	slope >15% for trailer parks and tenting
	floods yearly
	organic soils
	permanently wet soils

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This reflects the soils ability to dry out in the spring and after rainstorms. It is based on constant head hydraulic condutivity tests run on core samples.

[3]This item attempts to evaluate the adequacy of moisture for vegetative growth. Class limits are based on the available moisture in the top 50 cm of soil.

>9 cm	Slight or no moisture deficit
5-9 cm	Moderate moisture deficit
<5 cm	Severe moisture deficit

[4]Surface texture is related to surface wetness after rainfalls, dustiness, and trafficability.

Degrees of Soil Suitability for Outdoor Living

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Drainage (depth to water table during use [cm])			
	R,W,MW	I	P
	>75	50-75	<50
Transmissibility (cm/h)			
	>1	0.1-1	<0.1
Slope (%)			
tent, trailer	<5	5-9	9-15
picnic	<9	9-15	15-30
Depth to bedrock or cemented layer (cm)			
	>50	20-50	<20
Droughtiness	not affected	occurs in some years	occurs almost every year
Surface texure	SL,L,SiL	CL,SCL,LS stable S	SC,SiC,C loose S
Surface rock fragments			
gravel/cobbles (%)	<20	20-50	>50
stoniness	0-2	3	4

A fourth degree of soil suitability for outdoor living is defined as unsuitable: pemanently wet areas, slope >15% for tent and trailer parks or >30% for picnic areas, stoniness class 5.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Outdoor Living[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Permeability[2] of upper 30 cm (cm/h)	>1.0	<1.0	-----
Flooding during season of use			
tent & trailer	<1 in 10 yr	<1 in 5 yr	>1 in 5 yr
picnic areas	<1 in 5 yr	<1 in 3-5 yr	>1 in 3 yr
Surface coarse fragments			
gravel & cobbles	<20%	20-50%	>50%
stoniness class	0-2	3	4
Depth to bedrock (cm)	>50	<50	-----
Slope (%)			
tent & trailer	<5	5-9	9-15
picnic areas	<9	9-15	15-30
Drainage	R,W,MW	I	P
Surface texture[3]	SL,L SiL	CL,SCL SiCL,LS S (stable)	SC,SIC C S (loose)

A fourth degree of soil limitation (unsuitable) is also defined:

- floods yearly
- stoniness class 5
- slope >15% for trailer parks
- slope >30% for picnicking and tenting
- very poor (VP) drainage
- organic soils

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This reflects the soils ability to dry out in the spring and after rainstorms. It is based on constant head hydraulic condutivity tests run on core samples.

[3]Surface texture is related to surface wetness after rainfalls, dustiness, and trafficability.

Soil Limitations for Paths and Trails[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Flooding during season of use	1/yr (or less)	2-3/yr	4/yr (or more)
Stoniness	0-1	2	3-5
Rockiness	0-1	2	3
Slope[2] (%)	<15	15-30	30-60
Drainage	R,W,MW	I	P,VP
Surface texture	SL,L,SiL	CL,SCL SiCL,LS	SC,SiC S, organic
Coarse fragments on surface (%)	<20	20-50	>50

A fourth degree of soil limitation (unsuitable) is also defined:
- flooding >4 times/year
- rockiness 4-5
- >60% slope

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]Slope in this context refers to the slope of the ground surface, not the slope of the trail.

Soil Suitability as a Source for Gravel

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth of Material:	Within the survey area, most gravel deposits tend to be relatively thick (greater than one meter and usually several meters or more thick). Depths of the magnitude are beyond the scope of this report.		
Subsoil texture	VGS gravel	GS VGLS,GLS	GS,GLS GSL
Coarse Fragments (% by volume)			
gravel	>60	40-60	20-40
cobbles[1]	<5	5-15	15-40
Stoniness Class[2]	0-3	3-5	
Slope[3]	Slope is usually not a limiting factor in the survey area. Most slopes are <9% and the majority are 0-5%.		
Drainage	R,W,MW,W,I	-----	P,VP
Depth to mean water table (cm)	>20	>20	<20
Gravel hardness	hard[4]	s o f t[5]	

A fourth degree of soil suitability is also defined for use as a source for gravel:

Unsuitable: subsoil textures heavier than those mentioned
<20% gravel
>40% cobbles

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]When the percentage of cobbles is over 15%, screening is necessary to remove them and so the suitability of the source becomes poor.

[2]Surface stoniness is not much of a problem for the following reasons: surface stones are usually not associated with the types of soils that are gravel sources; if any stones are present, they are usually small, site preparation calls for tree and other vegetation removal and so stone removal can be done at the same time and excavations are usually in the form of pits (little surface area).

[3]Features such as kames and eskers tend to have steep slopes, but because of their size and shape they are easily excavated.

[4]Within the survey area, those deposits specified as being of hard gravel consist mainly of; granites, gneisses, schists and quartzite.

[5]Within the survey area, those deposits specified as being of soft gravel consist mainly of soft sandstone.

Organic Soil Limitations for Fuel Peat

A good fuel peat must be highly decomposed and of low ash content. The deposit should be at least 2m deep. Other factors which affect the development of the peat are number of flashets and the drainability. The presence of tree cover and roots and woody material in the peat do not present a problem in the surveyed area. Socioeconomic factors are not considered.

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Degree of decomposition	H-6,7,8	H-4,5&9	H-1,2,3&10
Depth of deposit (m)	>2	1-2	<1
Area of flashets (%)	<2	2-5	>5
Drainability	Good	Fair	Poor

Source: Hender, F. 1986. Soils of the Terra Nova Agricultural Development Area, Newfoundland. Report 13. Newfoundland Soil Survey. LRRC Publ. No. 84-62.

Degrees of Soil Suitability for Fuel Peat for Organic Soils

Soil Factors	Degree of Suitability		
	Good	Fair	Unsuitable
Depth of deposit (cm)			
if underlain by till or bedrock	>120	80-120	<80
if underlain by sand, clay or marl	>120	80-120	<80
Origin of peat material	decomposed sphagnum, reed grass, sedge grass (if poor in ash and friable)	slightly decomposed sphagnum	cottongrass
Degree of decomposition (entire depth)	mesic,humic H6	mesic (H5) fibric (H4)	fibric (H1-3)

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Suitability as a Source for Fuel Peat

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Thickness of all moderately and well decomposed (H4-3)[1] peats(cm)	>150	150-100	100-50
Thickness of all weakly decomposed (H1-3) peats(cm)	---	---	>100

A fourth degree of soil suitability is also defined for use as a source for fuel peat:

Unsuitable: H5-10 materials of less than 50 cm thickness
H1-3 materials of less than 10 cm thickness

Source: Rees, H.W., K.K. Langmaid, J.G. Losier, C. Veer, C. Wang, R.E. Wells, and S.H. Fahmy. (in press). Soils of the Chipman-Minto-Harcourt Region of New Brunswick. Eleventh Report of New Brunswick Soil Survey.

[1]von Post scale of decomposition

Organic Soil Limitations for Horticultural Peat

The major soil properties affecting the limitations of organic soils for horticultural peat are the degree of decomposition and the depth of the deposit. The optimum degree of decomposition is H-3 on the Von Post Scale and the depth should be greater than 2m. Other factors to be considered are the number of flashets and the drainability of the peat. The presence of tree cover and roots and woody material in the peat did not present a problem in the surveyed area. Socioeconomic factors were not considered.

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Degree of decomposition[1]	H1-4	H5-6	H7-10
Depth of deposit (cm)	>200	100-200	<100
Area of flashets (%)	<2	2-5	>5
Drainability	Good	Fair	Poor

Source: Hender, F. 1986. Soils of the Terra Nova Agricultural Development Area, Newfoundland. Report 13. Newfoundland Soil Survey. LRRC Publ. No. 84-62.

[1]von Post scale of decomposition

Degrees of Soil Suitability for Horticulture (peat moss) for Organic Soils

Soil Factors	Degree of Suitability		
	Good	Fair	Unsuitable
Depth of deposit (cm)			
if underlain by till or bedrock	>120	80-120	<80
if underlain by sand, clay or marl	>120	80-120	<80
Origin of peat material	slightly decomposed sphagnum, cottongrass	slightly decomposed reed grass, sedge grass	decomposed sphagnum, reed grass alder
Degree of decomposition (entire depth)	fibric (H2-3)	fibric (H4)	mesic,humic

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Suitability as a Source for Horticultural Peat

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Thickness of weakly decomposed (H1-4)[1] sphagnum peat (cm)	>150	150-100	100-50
Thickness of other peat materials excluding above listed (cm)	---	---	>50

A fourth degree of soil suitability is also defined for use as a source for peat moss:

Unsuitable: all organic materials of less than 50 cm thickness

Source: Rees, H.W., K.K. Langmaid, J.G. Losier, C. Veer, C. Wang, R.E. Wells, and S.H. Fahmy. (in press). Soils of the Chipman-Minto-Harcourt Region of New Brunswick. Eleventh Report of New Brunswick Soil Survey.

[1]von Post scale of decomposition

Soil Suitability as a Source for Roadfill[1]

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Engineering classes:			
Unified class	GW,GP,SW,SP (GM,GC SM,SC)[2]	CL(PI<15%)[3]	CL(PI>15%) ML,OL,MH CH,OH
ASSHO Class	A-1,A-2,A-3	A-4,A-5	A-6,A-7
Shrink-swell[4]	Except for Fundy and Mount Hope soils which are fair, all soils rank good.		
Susceptibility to frost action[5]	low	moderate	high
well drained roadbeds	GW,GP,SW,SP	GM,GC,SM SC,CL	ML,MH
poorly drained roadbeds	GW,GP	SW,SP,GC,CL	GM,SM,SC ML,MH
Slope (%)[6]	<15	15-30	30-45
Stoniness class	0-3	4	5
Drainage	R,W,MW	I	P,VP
Depth to mean water table (cm)	>100	20-100	<20
Depth to bedrock:	Depth to bedrock has no effect on soil suitability. The bedrock is a soft, rippable Pennsylvanian sandstone which can be easily excavated and used as a source of fill itself.		

A fourth degree of soil suitability is also defined for use as a source for roadfill:

Unsuitable: slope greater than 45%
organic soils

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils memorandum SCS-45.

[2]The suitability rating is downgraded to fair if the content of fine soil (material passing No. 200 sieve) is more than 30%.

[3]PI means plasticity index.

[4]Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[5]United States Department of Agriculture. ibid.

Soil ratings are based on the assumption that excavated material, regardless of original drainage, will be well drained in its new location. Should this not be the case, the ratings will have to be modified according to the susceptibility to frost action listed under poorly drained roadbeds.

[6]The slope ratings can be ignored under some circumstances. Features such as kames and eskers tend to have steeper slopes but because of their size and shape they are easily excavated.

Soil Suitability as a Source for Sand

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth of Material (cm)	>100	---	50-100
Subsoil texture (%sand)	S >85	S >85	LS 70-85
Coarse Fragments[1] (by volume)			
gravel	<3	3-15	>15
cobbles	0	<3	>3
Stoniness Class[3]	0-3	4	5
Slope[3]	Slope is usually not a limiting factor in the survey area. Most slopes are <9% and the majority are 2-5%		
Drainage	better than poor		P,VP
Depth to mean water table (cm)	>20	>20	<20

A fourth degree of soil suitability is also defined:

Unsuitable:
- <50 cm of material
- <70% sand in subsoil
- >40% coarse fragments (gravel & cobbles)

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]When the sand source contains >15% gravel or >3% cobbles, it becomes necessary to screen it. This results in its suitability being classed as poor.

[2]Surface stoniness is not much of a problem for the following reasons: surface stones are not usually associated with the types of soils that are sand sources; if any stones are present, they are usually small; site preparation calls for tree and other vegetation removal and so stone removal can be done at the same time; and excavations are usually in the form of pits (little surface area).

[3]Features such as kames and eskers tend to have steep slopes, but because of their size and shape they are easily excavated.

Soil Suitability as a Source for Topsoil[1]

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Moist consistence	very friable, friable	loose, firm	very firm
Texture	L,SiL,SL	CL,SiCL	S,LS
Thickness of material (cm)	>40	40-20	20-10
Coarse fragments (% by volume)	<3	3-15	15-40
Stoniness class	0	1	2,3
Slope (%)	<5	5-9	9-15
Drainage	>P	>VP	VP
Depth to seasonal water table (cm)	>20	>10	<10

A fourth degree of soil suitability is also defined for use as a source for topsoil:

Unsuitable:
- less than 10 cm of material
- >40% coarse fragments
- stoniness class 4-5
- slope >15%
- organic soils

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45.

Soil Limitations for Athletic Fields[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to water table during period of use (cm)	>75	75-50	<50
(drainage)	R,W,MW	I	P
Permeability[2] of surface 30 cm (cm/h)	>2	<2	---
Flooding during period of use	<1 in 5 yr	---	>1 in 5 yr
Slope (%)	<2	2-5	5-9
Available moisture[3] (cm)	>9	5-9	<5
Surface texture[4]	SL,L,SiL[5]	CL,SCL SiCL,LS	SC,SiC,C S, Organic
Depth to bedrock[6] (cm)	>100	50-100	<50
Coarse fragments on surface			
gravel & cobb.	<3%	3-20%	>20%
stoniness[7]	0-1	2	3
Potential frost action[8]	low	moderate	high
well,imperfectly drained	GW,GP SW,SP	SM,CL SC,GM,GC	ML,MH
poorly drained	GW,GP	SW,SP GC,CL	GM,SM,SC ML,MH

A fourth degree of soil limitation is also defined for Athletic Fields:

Unsuitable: >9% slope; flooding yearly; organic soils; persistent wetness; stoniness 4 and 5; >50 % gravel & cobbles

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This item reflects the ability of the soils to dry out in the spring and also after rains. Based on constant head hydraulic conductivity tests run on core samples.

[3]This item attempts to show possible moisture deficiencies as related to moisture requirements for adequate vegetative growth. Class limits are based on the available moisture in the top 50 cm of soils.

>9 cm	Slight or no moisture deficit
5-9 cm	Moderate moisture deficit
>9 cm	Severe moisture deficit

[4]Surface texture is related to maintenance as it effects trafficability, wetness conditions after rainfall, and wind erosion.

[5]Surface soils of this texture may be subject to wind erosion and, if so should be downgraded one class.

[6]The bedrock is rippable Pennsylvanian sandstone.

[7]On average the stones are less than 50 cm diameter and can be moved with light equipment, or even by hand.

[8]Susceptibilty to frost action based on United States Department of Agriculture. 1976. ibid.

Soil Limitations for Athletic Fields[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to water table during period of use (cm)	>75	75-50	<50
drainage	R,W,MW	I	P
Permeability[2] of surface 30 cm (cm/h)	>2	<2	---
Flooding during period of use	<1 in 5 yr	---	>1 in 5 yr
Slope (%)	<2	2-5	5-9
Available moisture[3] (cm)	>9	5-9	<5
Surface texture[4]	SL,L,SiL[5]	CL,SCL SiCL,LS[5]	SC,SiC,C S, Organic
Depth to bedrock[6] (cm)	>100	50-100	<50
Coarse fragments on surface			
gravel & cobb.	<3%	3-20%	>20%
stoniness	not a factor in PEI		
Potential Frost Action[7]	low	moderate	high
well,imperfectly drained	GW,GP SW,SP	SM,CL SC,GM,GC	ML,MH
poorly drained	GW,GP	SW,SP GC,CL	GM,SM,SC ML,MH

A fourth degree of soil limitation is also defined for Athletic Fields:

Unsuitable: >9% slope; flooding yearly; organic soils; persistent wetness; >50 % gravel & cobbles

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This item reflects the ability of the soils to dry out in the spring and also after rains. Based on constant head hydraulic conductivity tests run on core samples.

[3]This item attempts to show possible moisture deficiencies as related to moisture requirements for adequate vegetative growth. Class limits are based on the available moisture in the top 50 cm of soils.

>9 cm	Slight or no moisture deficit
5-9 cm	Moderate moisture deficit
>9 cm	Severe moisture deficit

[4]Surface texture is related to maintenance as it affects trafficability, wetness conditions after rainfalls, and wind erosion.

[5]Surface soils of this texture may be subject to wind erosion and, if so should be downgraded one class.

[6]The bedrock is rippable sandstone.

[7]Susceptibilty to frost action based on United States Department of Agriculture. 1976. ibid.

Soil Limitations for Athletic Fields[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Permeability[2] of surface 30 cm (cm/h)	>2	<2	---
Flooding during period of use	<1 in 5 yr	---	>1 in 5 yr
Coarse fragments on surface			
gravel & cobb.(%)	<3	3-20	>20
stoniness6	0-2	2	3
Depth to bedrock (cm)	>100	50-100	<50
Slope (%)	<2	2-5	5-9
Drainage	R,W,MW	I	P
Surface texture[3]	SL,L,SiL[4]	CL,SCL SiCL,LS[4]	SC,SiC,C S
Potential Frost Action[5]	low	moderate	high
well,imperfectly drained	GW,GP SW,SP	SM,CL SC,GM,GC	ML,MH
poorly drained	GW,GP	SW,SP GC,CL	GM,SM,SC ML,MH

A fourth degree of soil limitation (unsuitable) is also defined:

Unsuitable: >9% slope; organic soils; stoniness 4 and 5; very poor (VP) drainage; flooding yearly; persistent wetness; >50 % gravel & cobbles

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This item reflects the ability of the soils to dry out in the spring and also after rains. Based on constant head hydraulic conductivity tests run on core samples.

[3]Surface texture is related to maintenance as it effects trafficability, wetness conditions after rainfalls, and wind erosion.

[4]Surface soils of this texture may be subject to wind erosion and, if so should be downgraded one class.

[5]United States Department of Agriculture. ibid.

[6]On average the stones are less than 50 cm diameter and can be moved with light equipment, or even by hand.

Degrees of Soil Susceptibility to Frost Action

Soil Factors	Degree of Susceptibility		
	Low	Moderate	High
Particle size			
drainage P,VP	FR	S, SSK	CoL,FnL LSK,C CSK CoZ,FnZ
drainage I	FR,S,SSK	CoL,FnL,LSK C, CSK	CoZ,FnZ
drainage W,MW	FR,S,SSK C,CSK	CoL,FnL,LSK C, CSK,CoZ,FnZ	

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Housing[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to seasonal high water table (cm) and drainage			
with basement	>120 W,R	120-50 MW	<50 I,P
without basement	>50 R,W,MW	50-20 I	<20 P
Slope (%)	<9	9-15	15-30
Depth to bedrock[2] (cm)			
with basement	>100	<100	-----
without basement	>50	<50	-----
Flood Hazard	none	none	1 in 20 yr
Unified Soil[3] Group	GW,GP,SW SP,GM,GC SM,SC,CL, (PI<15)[4]	ML,CL (PI>15)[4]	CH,MH OL,OH
Potential Frost Action[5]	low	moderate	high
drainage W,I	GW,GP,SW,SP	GM,GC,SM,CL,SC	ML,MH
drainage P	GW,GP	SW,SP,GC,CL	GM,SM,SC,ML,MH
Stoniness[6]	0-2	3	4-5
Shrink-swell[7]	Except for Fundy, Tacadie and Mount Hope soils which are have moderate limitations, all soils rank slight.		

A fourth degree of soil limitation is also defined for Housing:
Unsuitable: slope >30%
permanently wet soils
flooding >1 in 20 yr
organic soils

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]Because the bedrock throughout the survey area is soft, easily split Pennsylvanian sandstone, it has only a moderate influence on excavation and construction costs for buildings or for installation of utility lines. Where it is very easily split the influence is slight to none.

[3]This item estimates the soils ability to to withstand applied loads.

[4]PI means plasticity index

[5]United States Department of Agriculture. ibid.

[6]In this area the surface stones tend to be relatively small in size (less than 50 cm), and thus are easily removed with light equipment when preparing the site. For this reason, stoniness is a less severe limitation than might be expected.

[7]Coen, G.M. and W.D. Holland. ibid.

Soil Limitations for Housing[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to seasonal high water table (cm) and drainage			
with basement	>120 W,R	120-50 MW	<50 I,P
without basement	>50 R,W,MW	50-20 I	<20 P
Slope (%)	<9	9-15	15-30
Depth to bedrock[2] (cm)			
with basement	>100	<100	-----
without basement	>50	<50	-----
Flood Hazard	none	none	1 in 20 yr
Unified Soil[3] Group	GW,GP,SW SP,GM,GC SM,SC,CL, (PI<15)	ML,CL (PI>15)[4]	CH,MH OL,OH
Potential Frost Action[5]	low	moderate	high
drainage W,I	GW,GP,SW,SP	GM,GC,SM,CL,SC	ML,MH
drainage P	GW,GP	SW,SP,GC,CL	GM,SM,SC,ML,MH
Stoniness	Not a factor in PEI		
Shrink-swell[6]	Except for Fifteen Point and Locke Road soils which are have moderate limitations, all soils rank slight.		

A fourth degree of soil limitation is also defined for Housing:
Unsuitable: slope >30%
permanently wet soils
flooding >1 in 20 yr
organic soils

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]Because the bedrock throughout the survey area is rippable sandstone, it has only a moderate influence on excavation and construction costs for buildings or for installation of utility lines. Where it is very soft, the influence is slight to none.

[3]This item estimates the soils ability to withstand applied loads.

[4]PI means plasticity index

[5]United States Department of Agriculture. ibid.

[6]Coen, G.M. and W.D. Holland. ibid.

Soil Limitations for Houses with Basements[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to seasonal high water table (cm)	>120	120-50	<50
drainage	W,R	MW	I,P
Slope (%)	<9	9-15	15-30
Depth to bedrock (cm)[3]	>150	100-150	<100
Flooding	none	none	1 in 20 yr
Unified group[2]	GW,GP,SW,SP GM,GC,SM,SC CL (PI<15)[4]	ML CL (PI>15)	CH,MH,OL,OH
Potential Frost Action[5]	low	moderate	high
drainage W,I	GW,GP,SW,SP	GM,GC,SC CL,SC	ML,MH
drainage P	GW,GP	SW,SP,GC,CL	GM,SM,SC,ML,MH
Stoniness	0-2	3	4-5

A fourth degree of soil limitation is also defined for Housing:
Unsuitable: slope >30%
permanently wet soils
flooding >1 in 20 yr
organic soils

Source: Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This item estimates the soil's ability to withstand applied loads.

[3]Where the bedrock is soft and easily excavated, ratings were raised by one class.

[4]Plasticity index.

[5]United States Department of Agriculture. ibid.

Proper house construction should include preventive measures to reduce or eliminate frost heaving.

Soil Limitations for Housing[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to seasonal high water table (cm) and drainage			
with basement	>120 W,R	120-50 MW	<50 I,P
without basement	>50 R,W,MW	50-20 I	<20 P
Slope (%)	<9	9-15	15-30
Depth to bedrock (cm)			
with basement	>150	100-150	<150
without basement	>100	50-100	<50
Flood Hazard	none	none	1 in 20 yr
Unified Soil[2] Group	GW,GP,SW SP,GM,GC SM,SC,CL, (PI<15)[3]	ML,CL (PI>15)[3]	CH,MH OL,OH
Potential frost action[4]	low	moderate	high
drainage W,I	GW,GP,SW,SP	GM,GC,SM,CL,SP	ML,MH
drainage P	GW,GP	SW,SP,GC,CL	GM,SM,SC,ML,MH
Stoniness[5]	0-2	3	4-5
Shrink-swell[6]	All soils in the survey area rank slight.		

A fourth degree of soil limitation is also defined for Housing:
Unsuitable: slope >30%
permanently wet soils
flooding >1 in 20 yr
organic soils

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This item estimates the soil's ability to withstand applied loads.

[3]Plasticity index.

[4]United States Department of Agriculture. ibid.

Proper house construction should include preventive measures to reduce or eliminate frost heaving.

[5]In this area the surface stones tend to be relatively small in size (<50 cm diameter) and thus are easily removed with light equipment when preparing the site, For this reason, stoniness is a less severe limitation than might be expected.

[6]Coen, G.M. and W.D. Holland. ibid.

Soil Limitations for Roads and Streets (All-weather Surfaces)

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to high water table (cm)	>100	100-20	<20
(drainage)	W,R	MW,I	P,VP
Slope (%)[2]	<5	5-15	15-20
Depth to bedrock[3] (cm)	>50	50-25	<25
Stoniness[4]	0-2	3	4-5
Flood Hazard	none	<1 in 5 yr	>1 in 5 yr
Subgrade[5]			
AASHO[6]	A1-A3	A4-A5	A6-A7
Unified[7]	GW,GP,SW SP,(GM,GC SM,SC)[8]	CL (PI<15)[9]	ML,CH,MH OL,OH CL (PI>15)
Shrink-swell[10]	Except for Fundy, Tracadie and Mount Hope soils which have moderate limitations, all soils rank slight.		
Potential frost Action[11]	low	moderate	high
drainage W,I	GW,GP,SW,SP	GM,GC,SM,CL,SC	ML,MH
drainage P	GW,GP	SW,SP,GC,CL	GM,SM,SC,ML,MH

A fourth degree of soil limitation is also defined for Roads & Streets:

Unsuitable: >20% slope
flooding yearly
organic soils

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]Due to winter conditions limitation classes for slope have been altered from standards as set in references.

[3]The bedrock, being rippable Pensylvanian sandstone, has a surface layer about 0.5-1.0m thick, which can be easily excavated by light powered equipment. Below this the bedrock material is more difficult to extract but still is easily movable with the type of equipment used in road construction,."Depth to Bedrock" limits are set accordingly and thus may deviate from the standard.

[4]In this survey area the stones are usually less than 50 cm in size. For equipment used in road construction they present little problem to move, however, in excess quantities they seriously interfere with operations.

[5]This rates the general load-carrying capacity and service characteristics of the soil as it is applied to subgrades or roadbeds.

[6]Asphalt Institute. 1961. Soils Manual for design of ashphalt pavement structures. College Park MaryLand.

[7]Unified Soil Group ratings according to Designation D2487-69.

[8]Downgrade limitation to moderate if more than 30% passes No. 200 seive.

[9]PI means plasticity index

[10]Coen, G.M. and W.D. Holland. ibid.

United States Department of Agriculture. 1976. ibid.

Proper road construction includes preventive measures which minimize or eliminate frost activity.

Soil Limitations for Roads and Streets (All-weather Surfaces)[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to high water table (cm)	>100	100-20	<20
drainage	W,R	MW,I	P,VP
Slope (%)[2]	<5	5-15	15-20
Depth to bedrock[3] (cm)	>100	50-100	<50
Stoniness	0-2	3	4-5
Flood Hazard	none	<1 in 5 yr	>1 in 5 yr
Subgrade[4]			
AASHO[5]	A1-A3	A4-A5	A6-A7
Unified[6]	GW,GP,SW SP,(GM,GC SM,SC)[7]	CL (PI<15)[8]	ML,CH,MH OL,OH CL (PI>15)
Potential frost Action[9]	low	moderate	high
drainage W,I	GW,GP,SW,SP	GM,GC,SM,CL,SC	ML,MH
drainage P	GW,GP	SW,SP,GC,CL	GM,SM,SC,ML,MH

A fourth degree of soil limitation is also defined for Roads & Streets:

Unsuitable: >20% slope
flooding yearly
organic soils

Source: Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]Due to winter conditions limitation classes for slope have been altered from standards as set in references.

[3]Where the bedrock is soft and easily excavated, ratings were raised by one class.

[4]This rates the general load-carrying capacity and service characteristics of the soil as it is applied to subgrades or roadbeds.

[5]Asphalt Institute. 1961. Soils Manual for design of ashphalt pavement structures. College Park MaryLand.

[6]Unified Soil Group ratings according to Designation D2487-69.

[7]Downgrade limitation to moderate if more than 30% passes No. 200 seive.

[8]PI means plasticity index

[9]United States Department of Agriculture. 1976. ibid.

Proper road construction includes preventive measures which minimize or eliminate frost activity.

Soil Limitations for Local Roads and Streets[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to seasonal high water table (cm)	>100	100-20	<20
drainage	W,R	M,I	P,VP
Slope (%)[2]	<5	5-15	15-20
Depth to bedrock (cm)	>100	50-100	<50
Stoniness	0-2	3	4-5
Flood Hazard	none	<1 in 5 yr	1 in 5 yr
Subgrade[3]			
AASHO[4]	A1-A3	A4-A5	A6-A7
Unified[5]	GW,GP,SW SP,(GM,GC SM,SC)[6]	CL (PI<15)[7]	ML,CH,MH OL,OH CL (PI>15)
Shrink-swell[8]	All soils in the survey area rank slight.		
Potential frost Action[9]	low	moderate	high
drainage W,I	GW,GP,SW,SP	GM,GC,SM,CL,SC	ML,MH
drainage P	GW,GP	SW,SP,GC,CL	GM,SM,SC,ML,MH

A fourth degree of soil limitation (unsuitable) is also defined:
Unsuitable: >20% slope
flooding yearly
organic soils

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]Due to winter conditions limitation classes for slope have been altered from standards as set in references.

[3]This rates the general load-carrying capacity and service characteristics of the soil as it is applied to subgrades or roadbeds.

[4]Asphalt Institute. 1961. Soils Manual for design of ashphalt pavement structures. College Park MaryLand.

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[6]Downgrade limitation to moderate if more than 30% passes No. 200 seive.

[7]PI means plasticity index

[8]Coen, G.M. and W.D. Holland. ibid.

[9]United States Department of Agriculture. 1976. ibid.

Proper road construction includes preventive measures which minimize or eliminate frost activity.

Degrees of Soil Suitability for Manure and Food Processing Waste Application

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth to bedrock (cm)	>100	50-100	20-50
Depth to seaonal high water table (cm)	>100	50-100	20-50
Depth to impervious layer (cm)	>100	50-100	20-50
Drainage	W,MW	I	P
Seepage	absent	absent	present
Texture	SL,L,SiL SCL	SiCL,CL SC,LS	SiC,C Gr,S
Slope (%)	<9	9-15	15-30
Stoniness	0-2	3	4,5
Erosion factor (k X %slope)	<3	3-7	>7

A fourth degree of soil suitability is defined as unsuitable: Bedrock <20 cm, seasonal high water table and/or impervious layer <20 cm, slope >30%, or very poor drainage.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Area-Type Sanitary Landfill[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to water table[2] (cm)	>150	150-100	100
drainage	R	W,MW	I,P,VP
Flooding	none	<1 in 50 yr	>1 in 50 yr
Permeability[3] (subsoil,cm/h)	<5	----	>5
Slope (%)	<9	9-15	15-25
Subsoil texture[4]	SL,L SiL,SCL	SiCL,CL SC,LS	SiC,C,gravel S, organic
Depth to bedrock[5] (cm)	>200	200-100	<100
Stoniness[6]	0-2	3	4-5

A fourth degree of soil limitation is also defined for Sanitary Landfill Areas

Unsuitable: slope >25%
flood more than once in ten years
organic soils
permeability >25 cm/h
depth to bedrock <50 cm
depth to seasonal high water table <30 cm

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

[2]This refers to the true groundwater table, and associated drainage classes are grouped accordingly. Soils that are poorly or imperfectly drained as a result of a perched water table (ie extremely slowly permeable subsoil, permeability less than 0.1 cm/h) can be rated one class higher.

[3]This reflects the soils ability to retard the movement of leachate from landfills. It is based on constant head hydraulic conductivity tests run on core samples.

[4]The subsoil texture reflects the ease of excavation and trafficability.

[5]Because the bedrock is a Pennsylvanian sandstone (with numerous cracks), its ability to act as a filtering agent is poor. This can result in contamination of the groundwater and wells using it.

[6]In the survey area the surface stones tend to be relatively small in size (usually less than 50 cm). They do not cause as serious a handicap as would an equal volume of large stones: however, in large quantities they still cause severe interference to landfill operations.

Soil Limitations for Area-Type Sanitary Landfill[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Depth to water table[2] (cm)	>150	150-100	<100
drainage	R	W,MW	I,P,VP
Flooding	none	<1 in 50 yr	>1 in 50 yr
Permeability[3] (subsoil,cm/h)	<5	----	>5
Slope (%)	<9	9-15	15-25
Subsoil texture[4]	SL,L SiL,SCL	SiCL,CL SC,LS	SiC,C,gravel S, organic
Depth to bedrock[5] (cm)	>200	200-100	<100
Stoniness	not a factor in PEI		

A fourth degree of soil limitation is also defined for Sanitary Landfill Areas

Unsuitable: slope >25%
flood more than once in ten years
organic soils
permeability >25 cm/h
depth to bedrock <50 cm
<30 cm to water table with permeability >1 cm/h

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

[2]This refers to the true groundwater table, and associated drainage classes are grouped accordingly. Soils that are poorly or imperfectly drained as a result of a perched water table (i.e. extremely slowly permeable subsoil, permeability less than 0.1 cm/h) can be rated one class higher.

[3]This reflects the soils ability to retard the movement of leachate from landfills. It is based on constant head hydraulic conductivity tests run on core samples.

[4]The subsoil texture reflects the ease of excavation and trafficability.

[5]Because the bedrock is a soft sandstone (with numerous cracks), its ability to act as a filtering agent is poor. This can result in contamination of the groundwater and wells using it.

Soil Limitations for Area Type Sanitary Landfill[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Permeability of subsoil[2] (cm/h)	<5	---	5-25
Flooding	---	<1 in 50 yr	1 in 11-50 yr
Stoniness	0-2	3	4-5
Depth to bedrock (cm)	>200	100-200	50-100
Slope (%)	<9	9-15	15-25
Depth to seasonal high water table[3] (cm)	>150	100-150	<100
drainage	R,W	MW	I,P
Subsoil texture[4]	SL,L,SiL SCL	SiCL,CL SC,LS	SiC,GS

A fourth degree of soil limitation (unsuitable) is also defined:
- permeability >25 cm/h
- <50 cm to bedrock
- organic soils
- flooding >1 in 10 yr
- very poor (VP) drainage

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

[2]This reflects the soils ability to retard the movement of leachate from landfills. It is based on constant head hydraulic conductivity tests run on core samples.

[3]This refers to the true groundwater table, and associated drainage classes are grouped accordingly. Soils that are poorly or imperfectly drained as a result of a perched water table (i.e. extremely slowly permeable subsoil, permeability less than 0.1 cm/h) can be rated one class higher.

[4]The subsoil texture reflects the ease of excavation and trafficability.

Soil Limitations for Septic Tanks[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Permeability[2,3] (subsoil,cm/h)	2-12	.5-2	<.5 or >12
Depth to water table[4] (cm)	>150	150-50	<50
drainage	R	W,MW	I,P
Depth to bedrock (cm)[5]	>150	150-100	<100
Slope (%)	<9	9-15	15-30
Flooding	none	---	<1 in 5 yr
Stoniness[6]	0-2	3	4-5

A fourth degree of soil limitation is also defined for Septic Tanks

Unsuitable: slope >30%
floods more than once in five years
organic soils
permeability >25 cm/hr
depth to bedrock <50 cm
permanently wet

Source: Wang, C. and H.W. Rees. 1983. Soils of the Rogersville-Richibucto Region of New Brunswick. Ninth report of the New Brunswick Soil Survey. Research Branch, Agriculture Canada and New Brunswick Department of Agriculture and Rural Development, Fredericton, New Brunswick. 239 pp.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This rating refers to the permeability (as determined by the constant head method using core samples) of the subsoil at and below the depth of the tile line.

[3]Soils with permeability rates greater than 12 cm/h are considered possible groundwater pollution hazards.

[4]The depth to seasonal high water table should be at least 100 cm below the depth of the tile (which is assumed to be at a depth of at least 50 cm). While the presence of a high groundwater table level, either continuous (true) or perched, is a serious problem to the functional operation of septic tanks, the continuous water table also presents the hazards of polluting the groundwater. Perched water tables do not pose this problem and can be rated more leniently.

[5]The bedrock, an easily split Pennsylvanian sandstone in this area, tends to be readily permeable in the upper 0.5 - 1 m but is very slowly permeable below.

[6]In this area the surface stones tend to be relatively small in size (less than 50 cm). They are easily moved with light equipment and pose a less severe limitation than do an equal amount of large stones.

Soil Limitations for Septic Tank Absorption Fields[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Permeability[2] (subsoil, cm/h)	2-12	.5-2	<.5 or >12
Depth to water table[4] (cm)	>150	150-50	<50
drainage	R[5]	W, MW	I, P
Depth to bedrock (cm)[5]	>150	150-100	<100
Slope (%)	<9	9-15	15-30
Flooding	none	---	<1 in 5 yr
Stoniness	not a factor in PEI		

A fourth degree of soil limitation is also defined for Septic Tanks

Unsuitable:
- slope >30%
- floods more than once in five years
- organic soils
- permeability >25 cm/hr
- depth to bedrock <50 cm
- permanently wet

Source: MacDougall, J.I., C. Veer and F. Wilson. 1981. Soils of Prince Edward Island. Preliminary Report of the Soil Survey of Prince Edward Island. LRRC Publ. No. 141. Supply and Services Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This rating refers to the permeability (as determined by the constant head method using core samples) of the subsoil at and below the depth of the tile line.

[3]Soils with permeability rates greater than 12 cm/h are considered possible groundwater pollution hazards.

[4]The depth to seasonal high water table should be at least 100 cm below the depth of the tile (which is assumed to be at a depth of at least 50 cm). While the presence of a high groundwater table level, either continuous (true) or perched, is a serious problem to the functional operation of septic tanks, the continuous water table also presents the hazards of polluting the groundwater. Perched water tables do not pose the problem and can be rated more leniently.

[5]The bedrock, a rippable sandstone, tends to be readily permeable in the upper 0.5-1m but may be erratic and very slowly permeable below. Water pollution hazard should be evaluated before installation.

Degrees of soil suitability for Septic Tank Adsorption Fields

Soil Factors	Degree of Suitability		
	Good	Fair	Poor
Depth to bedrock (cm)	>150	100-150	50-100
Depth to seaonal high water table (cm)	>150	100-150	50-100
Depth to impervious layer (cm)	>150	100-150	50-100
Drainage	W,MW	I	P
Seepage	absent	absent	present
Texure	SiL,L,SL LS,FS	CS,GR Si	VCS,VFS,C
Structure	granular	weak	structureless
Slope (%)	<9	9-15	15-30
Stoniness	0-2	3	4,5

A fourth degree of soil suitability for septic tank absorption fields is defined as unsuitable: Bedrock <50 cm, seasonal high water table and/or impervious layer <50 cm, slope >30%, or very poor drainage.

Source: van der Hulst, J. 1985. Soils of the Comfort Cove Peninsula, Newfoundland. Interim Report #15. Dept. Rural, Agricultural and Northern Development. St. John's.

Soil Limitations for Septic Tank Absorption Fields[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Permeability[2,3] (subsoil, cm/h)	2-12	.5-2	<.5 or >12
Depth to water table[4] (cm)	>150	150-50	<50
drainage	R	W, MW	I, P
Depth to bedrock (cm)	>150	150-100	<100
Slope (%)	<9	9-15	15-30
Flooding	none	---	<1 in 5 yr
Stoniness	0-2	3	4-5

A fourth degree of soil limitation is also defined for Septic Tanks

Unsuitable: slope >30%
floods more than once in five years
organic soils
permeability >25 cm/hr
depth to bedrock <50 cm
permanently wet

Source: Holmstrom, D.A. 1986. Soils of the Sussex Area, New Brunswick. Res. Br. Agr. Can. LRRC Contr. No. 83-38. N.B. Soil Surv. Rpt. No. 10.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

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Coen, G.M. and W.D. Holland. 1976. Soils of Waterton Lakes National Park. Alberta. Alberta Institute of Pedology. Information Report NOR-X-65: 1976.

[2]This rating refers to the permeability (as determined by the constant head method using core samples) of the subsoil at and below the depth of the tile line.

[3]Soils with permeability rates greater than 12 cm/h are considered possible groundwater pollution hazards.

[4]The depth to seasonal high water table should be at least 100 cm below the depth of the tile (which is assumed to be at a depth of at least 50 cm). While the presence of a high groundwater table level, either continuous (true) or perched, is a serious problem to the functional operation of septic tanks, the continuous water table also presents the hazards of polluting the groundwater. Perched water tables do not pose this problem and can be rated more leniently.

Soil Limitations for Septic Tank Absorption Fields[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Permeability of subsoil[2] (cm/h)	2-12	0.5-2	12-25 or <0.5
Flooding	---	---	<1 in 5 yr
Stoniness	0-2	3	4-5
Depth to bedrock (cm)	>150	100-150	50-100
Slope (%)	<9	9-15	15-30
Depth to seasonal high groundwater table[4] (cm)	>250	50-150	<50
drainage	R	W,MW	I,P

A fourth degree of soil limitation (unsuitable) is also defined:

permeability >25 cm/h
flooding >1 in 5 yr
<50 cm to bedrock
>30% slope
very poor (VP) drainage

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 18. Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Rose, R.D., G.F. Kling, J.G. Bockus, and G.W. Olson. 1969. Use of soils in the fourteen-county Appalachia region of New York State. Agronomy mimeo 69-5. Cornell Univ.

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[2]This rating refers to the permeability (as determined by the constant head method using core samples) of the subsoil at and below the depth of the tile line.

[3]The depth to seasonal high water table should be at least 100 cm below the depth of the tile (which is assumed to be at a depth of at least 50 cm). While the presence of a high groundwater table level, either continuous (true) or perched, is a serious problem to the functional operation of septic tanks, the continuous water table also presents the hazards of polluting the groundwater. Perched water tables do not pose the problem and can be rated more leniently.

Soil Limitations for Sewage Lagoons[1]

Soil Factors	Degree of Limitation		
	Slight	Moderate	Severe
Flooding[2]	none	---	1 in 50 yr
Permeability (subsoil, cm/h)	<0.5	0.5-5	5-15
Stoniness	0-2	3	4
Depth to bedrock (cm)	>150	100-150	50-100
Slope (%)	<2	2-5	5-9
Organic matter (%)	<2	2-10	10-30
Coarse fragments (% by volume)	<20	20-35	35-50
Unified class	GC,SC,CL,CH	GM,ML,SM,MH	GP,GW,SW,SP
Depth to seasonal water table[3] (cm)	>150	100-150	<100
drainage	R	W,MW	I,P

A fourth degree of soil limitation (unsuitable) is also defined:

- flooding every year
- stoniness 5
- >9% slope
- >50% coarse fragments
- very poor (VP) drainage
- permeability >15 cm/hr
- <50 cm to bedrock
- >30% organic matter
- Unified classes OL,OH,OL

Source: Webb, K.T. (in press). Soils of Pictou County, Nova Scotia. Report 188 Nova Scotia Soil Survey. LRRC, Research Branch, Agriculture Canada.

[1]Mills, G.F. and R.E. Smith. 1981. Soils of the Ste. Rose du Lac area, Canada-Manitoba Soil Surv. Rpt. No. 21.

United States Department of Agriculture. 1976. Guide for interpreting engineering uses of soils. Soils Memorandum SCS-45. Rev. ed. USDA Soil Conservation Service.

[2]Disregard flooding if it is not likely to enter or damage the lagoon (flood waters have low velocity and depth of <150 cm).

[3]If the floor of the lagoon has nearly impermeable material (<0.5 cm/h) and is at least 50 cm thick, disregard water table.

IMPROVING INTERPRETATION GUIDELINES

This section of the report is a critique of past performance with a view to improving future endeavors. Examples chosen from several Atlantic Region soil survey reports serve to illustrate shortcomings of past soil inventory and interpretation techniques. These criticisms are constructive and are not meant in any way to detract from the vital role of soil survey in land use planning and soil management.

ADDITIONAL SOIL ATTRIBUTES
Conrad Veer

Interpretations in early reports such as the "Soil Survey of the Fredericton-Gagetown Area" (P.C. Stobbe, 1940) were for local field crops such as wheat, barley, oats, buckwheat, hay, and potatoes. Crop ratings were described in terms of general suitability. For example: "The hardpan phase of the gravelly loam is of little value for agricultural purposes. Pastures are the main crops on this soil (Gagetown) and they are in very poor condition. The shaly loam occupies only a small area and most of this is in woods. The crops grown on it are similar to those grown on the gravelly loam and their yields are very low". There is a wealth of keen observation throughout the text of these reports. However, reccommendations were based on random observations and experience rather than quantitative soil physical and chemical analyses so it is difficult to transfer this information to other regions with confidence. In other words, certain parameters essential in predicting soil-plant behavior are not presented. This does not imply that valuable estimates of the required crop/soil functions cannot be made through careful reading of the text but there is room for improvement.

There was a tendency in those reports to concentrate on soil chemistry, particularly levels of major plant nutrients. The "Soil Survey of the Andover-Plaster Rock Area, N.B.", (Millette, J.F.G. and K.K. Langmaid, 1963) appears to be the first report in the Atlantic region to include soil physical properties other than particle size.

The problem of interpreting for soils in a "natural" vs an "improved" state is not a new one. The "Soil Survey of the Woodstock Area, N.B.", (Stobbe, P.C. and H. Aalund, 1943) presents a table showing the suitability of individual soil types for 10 crops. The soils are rated in 6 classes, from excellent to unsuitable but qualifications to the table are added. For example: "The yields of some crops are much less than what would be expected from the soil rating. On the other hand, in some instances, soils which have been rated as poor for certain crops have been greatly improved by artificial means, and they produce yields far in excess of the given rating. The suitability of a soil for certain crops may in some cases also vary from the given rating due to physical handicaps of the land, such as extremely steep slope, excessive stoniness." It is also interesting to note that land attributes, such as slope, did not affect the rating. The reader is expected to evaluate these as values change. This is also true of the "Soil Survey of the Annapolis Valley Fruit Growing Area, N.S.", (Harlow, L.C. and G.B. Whiteside, 1943).

The "Descriptions of Sandy Soils in Cleared Areas of Coastal Kent and Southern Northumberland Counties, N.B.", (K.K. Langmaid, et al, 1964) is the only report in the region surveyed specifically for soil suitability for a single crop. Cleared, well drained soils were the only ones surveyed. Texture and depth of the solum were the main criteria. Why the St. Charles Sandy Loam soil with a 2.5 cm cemented layer at 15-18 cm depth was rated unsuitable for tobacco is not entirely clear because normal cultivation practices or subsoiling to a very shallow depth seems a very feasible way to eliminate the problem.

The report "Soils of the Rogersville-Richibucto Region of New Brunswick." (Wang, C., et al, 1983) has many tables including soil limitations for forestry, agricultural crops, septic tanks, outdoor living, access roads, and as source material for roads,etc. The report illustrates the advances which civil engineers have made compared to pedologists. They discovered useful soil physical properties and adopted limits that have practical application. In contrast, pedology took the chemistry route to find useful class limits in soil classification, a path that solved many of the classification problems but left gaps in the interpretation for use. The answer to the question "have we made significant advancement in conveying soils information in the past 40 years?" depends on the reader's interest. A civil engineer would almost certainly say that we have not gone far enough while many extension workers would not be satisfied with what is presented (because of map scale and suitability recommendations), and many researchers in agriculture are uninformed about what is inside a soil survey report. A very important land user, the farmer, probably is more at ease reading the early reports rather than the more recent ones. If we compare the content of the early reports with the recent reports it is obvious that the tables of analyses in the early reports are reflections of the importance given to natural plant nutrient levels for crop production, to soil genesis, and the text was written for the benefit of the layman. Engineering applications were mainly limited to identifying sources for construction materials.

The almost complete elimination in agriculture of natural fertility as a limiting factor for crop yield requires an increased awareness of other limiting soil factors. Crops which are well supplied with water and nutrients do not require a deep rooting system, as evidenced in the high yields obtained in greenhouses. Nearly all agricultural and horticultural crops, however, are grown under much harsher conditions and, because management has less control over growing conditions, plants require a "buffered" rooting medium to produce high yields. We have to determine the upper and lower limits of these growing conditions. It is important also to differentiate between annual and perennial crops and between crops that require high moisture levels and those that tolerate dryer conditions. I have reservations of making actual yield predictions because of our lack of supporting data. Nor am I very much at ease with the concept of potential production for the same reason. I would feel very comfortable to state what a certain crop would yield, on what soil, under given conditions, but this information is very expensive to obtain. The situation for forest tree species is different and yield data can be obtained in the field, but this also requires caution because a forest makes its own environment. Foresters in P.E.I. are still having difficulties relating tree growth to soils that were mapped at a scale of 1:20000. Let me make myself clear: I am not saying that we should neglect yield data for agricultural and horticultural crops. On the contrary, where it is available we should record it and make use of it. Another reason for continuing problems in soil-crop suitability estimates is due to an inadequate knowledge of the growing conditions a particular crop requires to perform well, as well as an inadequate soil data base in terms of number of samples and map unit variability. To expand and upgrade that data base will need our continuing attention. This, however, does not mean that we cannot go on with the development of a crop suitability rating. Many soils have been sampled and the development of a crop suitability rating has already started for several crops. I propose that we approach our supervisors to find the funds and personnel to speed up the required sampling program.

I will list those attributes that are candidates to be considered for interpretive uses:

Climate

Climatic limitations: heat units (temperature), growing days, moisture, minimum winter temperature, wind and windchill, snow cover and other climatic factors affect crop suitability.

The Atlantic Region has a wide range of climatic conditions. Let us make use of these climatic limitations for specific crops at a very high level in any crop suitability rating.

Topography

It goes without saying that the slope limits for pasture are completely different from those for potatoes. Slope limitation for the kind of equipment used must be stated. Is it a four row potato harvester or a potato fork that is used for harvesting? Erosion potential should not be a limiting criteria. There are many ways to manage safe surface run-off. We should, however, indicate degree of erosion hazard as a subscript. Slope length and shape are as important as the steepness of grade and should be recorded.

Water Table

Water table data and soil temperature data were virtually not collected before 1970. We are still not using much of that data to aid us in our advising on single crop production potential. Can we agree on the kind of factors and their values which we will be using in our evaluations such as climate, microclimate, slope, stoniness, rockiness, 0 Kpa, 6 KPa, ? KPa to express rootability, what other yield functions or other factors should be looked at ?

The fluctuation of the soil water table is one factor we do not use efficiently. We have to come to grips with the problem of grouping the water table graphs which are the result of observing many sites over many years. See Table 1 for one way this might be accomplished.

Table 1. Main divisions of water table groups.

Group	1	2	3	4	5	6	7	8
AH*	0-50	0-50	0-50	>50	<50	50-100	>100	150-200
AL	<50	50-100	100-150	100-150	>150	>150	>150	>200

* AH = Average annual greatest depth in cm
AL = Average annual least depth in cm

These groups of water table classes are based on groupings which have proven to be useful elsewhere. The depth ranges are adapted to SWIG and group 8 is added to accommodate deep rooted plants. We should continue to observe sites and make detailed morphological observations until we are able to make water table observations based on morphology with confidence in the field.

I can not think of any crop for which water table data is not essential information to have. For too long we have only thought about annual crops which either could or could not be planted or harvested within a given period. This, possibly, came about because most of the land in the Atlantic Region is covered by soil composed of 40 to 60 cm of loose material underlain by compact mineral material which is incapable of supplying any significant amount of moisture to the plant. Under these dominantly rainfed growing conditions we never considered the very significant contribution groundwater can make or, conversely, the detrimental effect winter saturation might have on over wintering plants such as winter wheat or apple trees. The recent attention given to water table observations should be continued until such time that we are comfortable and confident with making predictions of as-sociated morphology.

The water table groups, as proposed, bring order to (multi year) fluctuations. The height of water in a water table group at a certain Julian day should also be known. A 30 day month would be a practical adoption also.

Water storage capacity

Water storage capacity is needed for those crops which are sensitive to saturation as well as to provide drainage engineers with an important value for designing an effective drainage system . Water storage capacity is about equal to drainable pore space. It is the buffer required under the rooting zone to prevent water logging of the rooting zone.

Available water capacity

Available water capacity requires soil moisture retention curves. For many soils in the Atlantic Region these curves are not available and estimates will have to be made until we catch up. Limits will have to be chosen, for example, less than 5 cm, 5 to 7.5 cm, 7.5 to 10 cm, and so on.

Stoniness

Is stoniness a limiting factor?- yes or no. If yes, can stones be economically removed ?

Natural fertility

Natural fertility is still important, especially to predict forest crop yields. As well, the national soil classification system is based on certain chemical limits.

Management

Another concern is that up to now we only consider one management system. Do we agree that we need to recognize two management systems (large highly mechanized and small little mechanized operations) ? If we agree, as I think NFL will, we need a different degree of limitation for both of these for certain functions. A climate limitation in vegetable production mitigated by glass or plastic enclosure or spotty shallow to bedrock in potato production, to name just two, might serve as examples. We also should pay more attention to the unique opportunities which certain soil attributes present. An example of this would be a situation where a low available water capacity causes summer water stress. This is a limiting factor for a fall potato crop but it is often an advantage when this soil is planted to an early potato crop.

Definition of Terms

The word compact as in "depth to compact material" needs clarification. No doubt we all have our pet limit. It is the plant, however, that should give us guidance. Depth limitation is dependent on support requirements of the plant (compare grass and apple trees), on the available water in this depth and also on the tolerance of the plant root system to saturation. It might be necessary to study field situations to establish limits for what is rootable and what is not for the species we want to indicate suitability for. Dave, with his experience with apple roots, may have soil rootability limits on the shelve for a number of plant species. Let us all search our files and see what data we have. We can then discuss this data in terms of relevance to this region and try it out in crop suitability ratings.

Conclusion

The reports reveal many loosely defined attributes. In addition to the soil-crop relationship attributes discussed above, other limiting values could have been discussed eg permissible hydraulic conductivity rates for sanitary landfill and the need for recommended site alterations for septic tank absorbtion fields. An agreement on all those items is needed before going further with the development of a key, or any other approach to presenting soil interpretations. We can make a big stride forward by agreeing on (and recording) the necessary soil attributes and crop requirements. The next step is to organize the data into flowchart, or other, format suitable for presentation to users.

ATTRIBUTES, GUIDELINES AND AN ALTERNATIVE TO ONE-WAY TABLES
D. Webster

Attributes

For an analysis of attributes one must first define what is meant by attributes and the context in which they are to be used (Figure 1). By attribute I mean some soil property [Pi] that has a bearing on land use or management. The values [ci] of these attributes are the known or observed soil conditions that (figure 2), in the context of a set of interpretive guidelines, lead to some conclusion. These conclusions may relate to suitability in the broadest sense, e.g. recreational, unmanaged woodlands, arable or to the details of soil management for a particular crop. This discussion is restricted to growth conditions for agricultural crops but I feel that the principles apply to the full field of land use evaluation and soil management.

Figure 1.

ATTRIBUTES (PROPERTY)		VALUES (CONDITION)
P1		c1
P2		c2
.	.	
.	.	
Pn		cn

Figure 2.

CONCLUSIONS= f(c1,c2,,,cn)

Form and Function of Interpretive Guidelines

So, given known soil conditions we are entering interpretive guidelines with the intent of reaching some conclusion or interpretation (Figure 3). The guideline is the black box. Good attributes can lead to sound conclusions only if the black box is wired right. So, before considering attributes I want to look briefly at guidelines. The qualifications of a good interpretive guideline are shown in Figure 4. Item 1 is determined by selection of attributes. Items 2 and 3 are determined by the form of the guideline.

Figure 3.

```
         ________________
c1---->|                |
c2---->|   GUIDELINE    |-------->CONCLUSION
------>|                |
cn---->|                |
        ----------------
```

Figure 4.

1) FEW ATTRIBUTES
2) UNAMBIGUOUS CONCLUSION
3) CONVENIENT

Now the best way to reach an unambiguous conclusion is a flowchart. Each decision that is made in reaching a final conclusion is either yes or no (Figure 5). Flow charts on paper are bulky and are not convenient to use. They are, however, compact and convenient when transcribed to a microchip. The really significant observation that I wish to make is that many guidelines should take the form of flow charts so that, once designed, they can readily be converted to programs or subroutines. Flow charts appear to be well suited for situations in which some consequence (e.g. growth conditions for some crop) arises from the inter- dependent effect of several soil conditions. On the other hand, a one-way table format is probably better suited to those situations in which a series of soil conditions (e.g. stoniness, slope) each leads to some consequence regardless of other soil conditions.

Figure 5.

```
QUESTION----->YES         NOT
    |                     QUESTION
    |                         |
    V                         |(YES + NO)/2
    NO                        |(GOOD*2 + POOR*3)/5
```

Number of Attributes (properties)

How many attributes is enough? If we want to determine the area of a plane rectangle we know from experience that we will need to know length and width (Figure 6). Color, solubility in water etc. are not relevant and just confuse the issue. If for some reason there is no way to measure or estimate length and width then indirect approaches, such as weight and weight per unit area, are needed. We know that both length and width will be correlated with area and we also know that given exact information on length, with width unknown, our estimate of area will frequently be incorrect. This is all obvious because we understand the functional relationship between length, width and area of plane rectangles.

Figure 6.

KNOWN	WANTED
Length	Area of plane rectangle
Color	
Texture	
Solubility	A=L*W
Width	

In the same way, a set of good attributes will---

1) be functionally related to the conclusion,
2) provide all information needed to reach a conclusion,
3) not contain irrelevant information,
4) be defined,
5) be amenable to measurement for calibration purposes and
6) be amenable to estimation.

Soils supply water and nutrients to plants and, for roots of most agricultural crops to function effectively, good aeration is needed. Consequently key attributes for crop growth are 1) available water within the rooting zone qualified by 2) drainage condition (Figure 7). Note that available water capacity (% volume) is indirectly also a measure of nutrient holding capacity. An example using these key attributes follows (next page). In this example the rooting zone is the depth expected to include 95% of roots, available water is referenced to 100 cm and 15 bar tension and drainage condition is referenced to water table height in early May compared to a known site. A more elaborate and perhaps better model could be constructed if bulk density, sand and clay for each horizon was known or estimated.

Figure 7.

P1. ROOTING DEPTH (95% of roots)

P2. AVAIL. WATER TO P1 (100 cm tension-15 bar)
P3. DRAINAGE (cm to water table early May)

Many of the one-way tables (Figure 8), have these key attributes but they are not clearly defined. For example, the one-way table for barley on page 14 includes available water, water table depth, and rooting depth. If available water represents total stored water that is available for the crop then 9 cm looks like a severe limitation. What is the upper limit for available water as used here, 1/3 bar (heaven forbid), 100 cm or something else? Over what depth of soil is this available water summed, rooting depth perhaps? If so one has to fit 9 cm of water into 15 cm of soil depth (60 % vol) so that can't be correct. Does rooting depth refer to 50%, 80% or 95% of roots? A rooting depth of 15-20 cm looks unsuitable for a crop that can extend roots to a depth of 290 cm (Borg and Grimes 1986. Trans ASAE 29:194-197) but the table says that 15-20 cm is a moderate limitation. Does water table depth refer to minimum during the growing season? And so on.

Figure 8. MODERATE LIMITATION

AVAIL H2O (cm)	9-12
WATER TABLE (cm)	40-80
ROOTING DEPTH (cm)	15-20 (290)

I do not imply that these rating tables, in the hands of those who compiled and use them, lead to incorrect conclusions. The job of pulling these all together represents a significant step forward and I do not belittle that accomplishment either. I would like to propose that the following be undertaken by way of building on this foundation:

1) clear definition of attributes so that the reader can know what the originator had in mind,

2) development of keys or flow charts to replace or supplement one-way tables.

SOIL PHYSICAL REQUIREMENTS FOR APPLE
SUMMARY KEY TO CHARTS

a) Drainage is not a significant problem (water table in early May more than 100 cm deep).

  b) Rooting depth more than 100 cm.

    c) Effective rooting depth more than 100 cm ....CHART 1

    cc) Effective rooting depth less than 100 cm due to bands of heavy texture in a light profile ....CHART 2

  bb) Rooting depth less than 100 cm.

    d) Rooting depth more than 75 cm .... CHART 2

    dd) Rooting depth less than 75 cm.

      e) Barrier consists of plow pan, abrupt change in texture, cemented horizon or rigid horizon; deep tillage would probably be beneficial ....CHART 2

      ee) Not as above; deep tillage would be of doubtful benefit and, if subsoil is capable of structural development, perhaps detrimental ....CHART 2

aa) Drainage is the dominant problem (water table in early May less than 100 cm deep).

  f) Water table less than 50 cm deep** in early May is probable after practical corrective action ....AVOID

  ff) Water table depth in early May after improvements is expected to exceed 50 cm**.

    g) Drainage after improvement will continue to be the limiting factor (profile is relatively free of other problems or drainage problem will be difficult to correct) ....CHART 3

    gg) Factors other than drainage will become dominant after drainage is improved; Go to a) at start of key.

CHART 1 EFFECTIVE ROOTING DEPTH >100 CM

AW TO 100 CM (cm)	RELATIVE TREE SIZE (%)	COMMENTS
0-10	Small & variable	Avoid
10	50	Use mulch & manure
15	75	
20	100	

CHART 2 EFFECTIVE ROOTING DEPTH <100 CM

AW IN ROOTING ZONE (CM)	RELATIVE TREE SIZE (%)	COMMENTS
0 - 7.5	small & variable	Avoid
7.5-12.5	33-60	Use mulch & manure; may need irrigation
15	75	
20	100	

CHART 3 DRAINAGE LIMITING

WATER TABLE DEPTH EARLY MAY (CM)	RELATIVE TREE SIZE	COMMENTS
0-50	small & variable	Avoid
50	100	Anchorage fair
75	120	Anchorage adequate
100	140	

* AW refers to water retained at a tension of 100 cm of water less water retained at 15 bar.

** Depth below soil surface or, if ridges are used, below ridge crown.

*** Note that the scale of tree size in CHART 3 differs from the scale in CHARTS 1 and 2.

Conclusion

The weaknesses of the one-way tables as they stand now have been covered in the previous discussion of attributes. To reiterate briefly these are:

1) need for clear definition of attributes, e.g. water table depth (over what period ?), rooting depth (what percent of total ?) and

2) need for some way (such as a flow chart or key) to in tegrate the effect of two or more attributes when they interactively affect some consequence, e.g. growing conditions.

The sample key is intended to illustrate this latter application. If charts 1, 2 and 3 of this summary are viewed as the three lines in a general one-way table that relate to growing conditions, then the key identifies which line is appropriate in a given circumstance.

The sample key and associated charts will I hope also illustrate a point that is so obvious that it is often overlooked. Guidelines that are adapted to soil survey purposes will in general not be well adapted for purposes of soil evaluation at the field level. The starting point, the scale and the objectives of the two processes will frequently be different.

However, as soil survey dispenses with the pioneer-type questions (e.g. how much arable land is there in this county?) and has more time for the more detailed secondary questions (e.g. by what means and to what extent can such-and-such soil limitations be overcome by management?), one may expect a convergence of soil survey and soil evaluation guidelines.

REGIONAL APPLICATION OF SOIL SURVEY INTERPRETIVE GUIDES
Jan van der Hulst

A good soil survey must be scientific in construction and practical in its purpose. Nearly all surveys are made under the auspices of agencies of government, and unless the soil survey report and the resulting soil capability ratings serve practical purposes, the government may no longer support the work.

The Canada Land Inventory presents a nation-wide picture 'comparing' the soil capabilities from coast to coast. Due to the wide climate and soil differences, the soil capability varies considerably from region to region. The soil capability of the Atlantic Provinces falls almost entirely in the three or four lowest classes of the CLI and experience has shown that this does not give the stratification necessary to resolve detailed planning matters involving agricultural and non-agricultural uses. Consequently a more refined system has been developed. Basic to the new approach is that land evaluation is meaningful only in relation to a clearly defined land use. Kinds of land use that are physically possible and economically promising. In other words, soil capability assessments are made in relation to an assumed set of technological and economic conditions. The conditions generally are those prevailing in the area for which the soil capability assessment is done, and often are assumed without formal statement.

Most soil assessors agree that new interpretations are needed whenever changes in varieties of crops or systems of crop production make old assumptions and interpretations obsolete. Likewise, regional changes in technological and economic conditions warrant changes in assumptions and interpretations.

These differences in assumptions and interpretations are reflected in this report which were developed by and for each Atlantic Province.

GLOSSARY OF TERMS

DEGREE OF LIMITATION/ RATING

Many soil survey interpretations are simply "single-factor" soil conditions. One grouping of soils that has proved to be extremely useful is that of classifying soils according to their drainage classes. Other interpretations can be made to show texture, stoniness, rockiness, slope, depth to bedrock, permeability, consistence and other soil and landscape factors. Single factor or derived maps are readily understood by the user and relatively easy to generate. More sophisticated soil survey interpretations require integration of the impacts of a number of soil and landscape properties on the intended use. They also represent attempts to assess the optimal range in soil characteristics as well as the sub-optimal. The approach used to formulate these interpretive ratings include among other techniques, mathematical equations, deduction of penalty points and the most limiting factor approach.

The interpretations included in this report categorize, into a tabular format, soil characteristics that are important for specific uses. The soils can then be grouped to show suitability, degree of limitation, or potential for the specific use. The ratings reflect the ease or difficulty of overcoming soil conditions for the specific use with present day technology. The four categories that are utilized are:

<u>Good, Well Suited or Slight Limitation:</u> The soil is relatively free of problems or the limitation can be easily overcome. The soil has properties that are suitable for the use proposed. Crop yields are high, standard management or installation and design methods are acceptable, and costs of development or maintenance are not higher because of soil conditions.

<u>Fair, Suitable or Moderate Limitation:</u> Limitations exist but they can be overcome with good or special management and careful design. The soil is basically acceptable for the proposed use but has one or more properties that are not compatible with the use intended. Development and maintenance costs are greater than for lands rated as Good, Well Suited or Slight Limitation.

<u>Poor, Marginal or Severe Limitation:</u> Limitations are severe enough to make use questionable because of costs of overcoming them or of continuing problems expected with such use. Costs of development and maintenance can be expected to be higher than for soils rated Good, Well Suited or Slight Limitation, or Fair, Suitable or Moderate Limitation. The environmental impact of utilizing these soils for the intended use can be significant. These soils are very difficult to bring into use.

<u>Very Poor or Unsuitable:</u> The soil is not suited to the proposed use because it has one or more properties that are so restrictive that development is impractical. Development and/or maintenance costs are prohibitive. Inputs required to utilize these

soils are too great to justify the efforts under existing conditions. Very significant impacts might occur on the environment if these soils are used for the proposed use.

DRAINAGE

Soil drainage classes are defined in terms of available water storage capacity and source of water. Soil drainage in a dynamic sense refers to the rapidity and extent of removal of water from soils in relation to additions. It is affected by a number of factors acting separately or in combination, including texture, structure, slope gradient, slope length, water holding capacity and evapotranspiration.

<u>VR Very Rapidly Drained</u> Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall provided there is a steep gradient. Soils have very low available water storage capacity (<2.5 cm)* within the control section and are usually coarse textured, or shallow, or both. Water source is precipitation.

<u>R Rapidly Drained</u> Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity (2.5-4 cm)* within the control section, and are usually coarse textured, or shallow, or both. Water source is precipitation.

<u>W Well Drained</u> Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Soils have intermediate available water storage capacity (4-5 cm)* within the control section, and are generally intermediate in texture and depth. Water source is precipitation. On slopes subsurface flow may occur for short durations but additions are equaled by losses.

<u>MW Moderately Well Drained</u> Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity (5-6 cm)* within the control section and are usually medium to fine textured. Precipitation is the dominant water source in medium to fine textured soils; precipitation and significant additions by subsurface flow are

necessary in coarse textured soils.

I Imperfectly Drained Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is the major supply. If subsurface water or groundwater, or both, is the main source, flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface flow or groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed equivalents of well drained subgroups.

P Poorly Drained Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil in not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow or both, in addition to precipitation are main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Soils have a wide range in available water storage capacity, texture, and depth, and are gleyed subgroups, Gleysols, or Organic Soils.

VP Very Poorly Drained Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are major water sources. Precipitation is less important except where there is a perched water table with precipitation exceeding evapotranspiration. Soils have a wide range in available water storage capacity, texture, and depth, and are either Gleysolic or Organic.

*EDITORS NOTE: The water holding capacities defined for VR, R, W, and MW soils seem low by a factor of 2-3.

FLOODING

Flooding refers to the condition that occurs when water overflows the natural or artifical confines of a stream or other body of water and accumulates on adjacent land areas. Flooding at any time of the year is hazardous to the survival and growth of perennial crops. Flooding during the growing season can be hazardous to the growth and survival of annual crops and can hinder planting and harvesting operations. Flooding can damage soils by eroding valuable topsoil. The eroded sediments can pollute adjacent water resources.

The following flooding classes are used to define the relative degrees of flooding.

None (N): soils are not susceptible to flooding.

Occasional (O): soils are subjected to flooding of short duration once or twice a year.

Frequent (F): soils are subjected to flooding of medium duration more than once a year.

Very frequent(VF): soils are subjected to prolonged flooding every year.

PARTICLE SIZE

The term particle size refers to the grain size distribution of the whole soil including the coarse fraction. It differs from texture, which refers to the fine earth (<2 mm) fraction only.

The numerically coded particle size classes below have been modified from the ECSS[1]. The alphabetically coded classes that follow are the standard ones used nationally.

0 Fine-Loamy soils have 18-35% clay in the fine earth fraction. Particles >2 mm occupy <20% by volume.

1 Fine-Loamy-Gravelly soils have 18-35% clay in the fine earth fraction. Particles greater than 2 mm occupy 20 - 35% by volume.

2 Coarse Loamy soils have less than 18% clay in the fine earth fraction. Particles greater than 2 mm occupy less than 20% by volume.

3 Coarse-Loamy-Gravelly soils have less than 18% clay in the fine earth fraction. Particles greater than 2 mm occupy 20 - 35% by volume.

4 Sandy - (Fine) soils have 50% or more fine sand (0.1-0.25 mm) OR less than 25% very coarse sand (1-2 mm) + coarse sand (0.5-1 mm) + medium sand (0.25-0.5 mm) and less than 50% very fine sand (0.05-0.1 mm). This class includes loamy fine sand and fine sand.

5 Sandy - (Medium-coarse) soils have (silt + 1.5 x clay) less than 15 and do not fit the definition for Sandy - (Fine). This class includes coarse sand, medium sand, loamy coarse sand, and loamy medium sand.

6 Sandy - Gravelly soils have (silt + 1.5 x clay) less than 15. Particles greater than 2 mm occupy 20 - 35% by volume.

7 Loamy - Skeletal soils are fine or coarse loamy. Particles greater than 2 mm occupy 35% or more by volume.

8 Sandy - Skeletal soils have (silt + 1.5 x clay) less than 15. Particles greater than 2 mm occupy 35% or more by volume.

9 Fragmental soils have particles >2 mm occupying >35% by volume with too little fine earth to fill the interstices.

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[1]Expert Committee on Soil Survey. 1982. The Canada Soil Information System (CanSIS) manual for describing soils in the field. Land Resource Research Institute, Agriculture Canada, Ottawa, 97 pp.

FR Fragmental - Particles >2 mm occupy >35% by volume with too little fine earth to fill interstices >1 mm.

SSK Sandy-Skeletal - Particles >2 mm occupy 35% or more by volume with enough fine earth to fill interstices >1 mm; the fraction finer than 2 mm is that defined for the sandy particle size class.

LSK Loamy-Skeletal - Particles >2 mm occupy 35% or more by volume with enough fine earth to fill interstices >1 mm; the fraction finer than 2 mm is that defined for the loamy particle size class.

CSK Clayey-Skeletal - Particles >2 mm occupy 35% or more by volume with enough fine earth to fill interstices >1 mm; the fraction finer than 2 mm is that defined for the clayey particle size class.

S Sandy - The texture of the fine earth includes sands and loamy sands, exclusive of loamy very fine sand and very fine sand textures; and particles >2 mm occupy <35% by volume.

L Loamy - The texture of the fine earth includes loamy very fine sand and very fine sand textures with <35% clay; and particles >2 mm occupy <35% by volume.

CoL Coarse Loamy - A loamy particle size that has >15% by weight of fine sand or coarser particles including fragments up to 7.5 cm, and has <18% clay in the fine earth fraction.

FnL Fine Loamy - A loamy particle size that has >15% by weight of fine sand or coarser particles including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

CoZ Coarse Silty - A loamy particle size that has <15% by weight of fine sand or coarser particles including fragments up to 7.5 cm, and has <18% clay in the fine earth fraction.

FnZ Fine Silty - A loamy particle size that has <15% by weight of fine sand or coarser particles including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

C Clayey - The fine earth fraction contains >=35% clay by weight and particles >2 mm occupy <35% by volume.

ROCKINESS

Rockiness refers to bedrock outcropping at the earth's surface. Bedrock outcrops are incapable of supporting crops and interfere with the efficient operation of farm machinery. The classes are distinguished on the percentage of surface area covered by exposed bedrock.

The following classes are defined in terms of the amount of surface covered by bedrock and the distance between bedrock exposures.

Class Name	Class	Surface Covered (%)	Distance Between Outcrops (meters)
Nonrocky	0	<2	>100
Slightly rocky	1	2-10	35-100
Moderately rocky	2	10-25	10-35
Very rocky	3	25-50	3.5-10
Exceedingly rocky	4	50-90	<3.5
Excessively rocky	5	>90	

STONINESS

Rock fragments on the surface of the soils or those protruding above ground interfere with the efficient operation of farm machinery for cultivation, seedbed preparation, and harvesting. Farming stony land increases the wear and frequency of repair on farming implements. The degree of limitation which stones impose is related to their number, size and spacing at the soil surface.

The following classes are defined in terms of the amount of surface stones greater than 25 cm in diameter (or greater than 38 cm if flat), and their spacing.

Class Name	Class	Surface Covered (%)	Distance Between Stones (meters)
Nonstony	0	<0.01	>25
Slightly stony	1	0.01-0.1	8-25
Moderately stony	2	0.1-3	1-8
Very stony	3	3-15	0.5-1
Exceedingly stony	4	15-50	0.1-0.5
Excessively stony	5	>50	<0.1

TEXTURE[1]

S Sand

- CS coarse sand
- S (medium) sand
- FS fine sand
- VFS very fine sand

LS Loamy sand

- LCS loamy coarse sand
- LS loamy (medium) sand
- LFS loamy fine sand
- LVFS loamy very fine sand

SL Sandy loam

- CSL coarse sandy loam
- SL sandy loam (medium)
- FSL fine sandy loam
- VFSL very fine sandy loam

L Loam
SiL Silt loam
Si Silt
SCL Sandy clay loam
CL Clay loam
SiCL Silty clay loam
SC Sandy clay
SiC Silty clay
C Clay
HC Heavy clay

Texture modifiers

G Gravelly (20-50% by volume)
VG Very gravelly (50-90% by volume)

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[1]Expert Committee on Soil Survey. 1982. The Canada Soil Information System (CanSIS) manual for describing soils in the field. Land Resource Research Institute, Agriculture Canada, Ottawa, 97 pp.

VON POST (DEGREE OF DECOMPOSITION)[1]

The degree of deomposition of organic material can be measured on the von Post scale which ranges from H1 (undecomposed) to H10 (completely decomposed).

H1 Completely undecomposed peat which, when squeezed, releases almost clear water. Plant remains are easily identifiable. No amorphous material present.

H2 Almost completely undecomposed peat which, when squeezed, releases clear or yellowish water. Plant remains are still easily identifiable. No amorphous material present.

H3 Very slightly decomposed peat which, when squeezed, releases very muddy water but no peat passes between the fingers. Plant remains are still identifiable, and no amorphous material present.

H4 Slightly decomposed peat which, when squeezed, releases very muddy dark water. No peat is passed between the fingers but the plant remains are slightly are slightly pasty and have lost some identifiable features.

H5 Moderately decomposed peat which, when squeezed, releases very muddy water while a very small amount of peat escapes between the fingers. The structure of plant remains is quite indistinct although it is still possible to recognize certain features. The residue is strongly pasty.

H6 Moderately to strongly decomposed peat with a very indistinct plant structure. When squeezed, about one-third of the peat escapes between the fingers. The residue is strongly pasty but shows the plant structure more distinctly than before squeezing.

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[1]Expert Committee on Soil Survey. 1982. The Canada Soil Information System (CanSIS) manual for describing soils in the field. Land Resource Research Institute, Agriculture Canada, Ottawa, 97 pp.

H7 Stongly decomposed peat. Contains a lot of amorphous material with very faintly recognizable plant structure. When aqueezed, about one-half of the peat excapes between the fingers. The water, if any is released, is very dark and almost pasty.

H8 Very strongly decomposed peat with a large quantity of amorphous material and very indistinct plant structure. When squeezed, about two-thirds of the peat escapes between the fingers. A small quantity of pasty water may be released. The plant material remaining in the hand consists of residues such as roots and fibres that resist decomposition.

H9 Practically fully decomposed peat in which there is hardly any recognizable plant structure. When sqyeezed, almost all the peat excapes between the fingers as a fairly uniform paste.

H10 Completely decomposed peat with no discernible plant structure. When squeezed, all the wet peat escapes between the fingers.