SOILS OF WOOD COUNTY AND THEIR ABILITY TO ATTENUATE CONTAMINANTS

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Introduction

Soils usually compose only the upper 2 to 4 feet of unconsolidated materials at the earth's surface. Soils are the basis of agricultural production; they provide the foundation for buildings and roads; and, if properly used, they aid in the treatment and recycling of wastes from homes, from the production of livestock and poultry, and from municipal and industrial sewage treatment plants. Soil characteristics (depth, texture, and permeability) are among the most significant factors that determine the rate and extent of groundwater recharge and the degree of natural protection against contamination. Land characteristics such as slope, vegetation type, and type of rock will, in conjunction with the soil, determine the overall potential of the environment to protect groundwater.

Soils in northern Wood County are formed in materials deposited by glaciers that moved over the land many thousands of years ago. In contrast, sands that meltwaters carried away from the most recent glacial ice to invade Wisconsin make up the parent material of the soils in the southern third of the county. Because of the geologic youth of these deposits, natural drainage is not well developed; organic soils have formed in those areas in this part of the county where water stands. When the glacial ice disappeared, silt-sized material called loess was deposited by wind over much of the county, providing a 1 to 3 foot covering on till and outwash deposits as well as residual materials weathered from bedrock.

Many factors influence the type of soil that develops in an area: the parent material from which the soil formed, relief, climate, natural vegetation, drainage, and the time that the soil has had to form. From east to west across the middle third of Wood County (about 36% of the total land area), bedrock is within 5 feet of the surface. In the west, the bedrock is primarily sandstones with interbedded shales; in the east, it consists of igneous and metamorphic rocks such as granite, rhyolite, gneiss, and quartzite.

For mapping, classification, and interpretive purposes, soils are grouped into soil series on the basis of similar physical and chemical characteristics, type of parent material, and arrangement of horizons or layers. A grouping of individual soils based solely on physical and chemical characteristics is required to evaluate the potential of soils for attenuating contaminants. An evaluative system was developed to assess those soil properties that play a role in the attenuation of potential groundwater contaminants resulting from land-use activities.

Capacity of soils to attenuate pollutants

Attenuation is a series of complex processes, all of which are not clearly understood. During attenuation, the soil holds essential plant nutrients for uptake by agronomic crops, immobilizes metals that might be contained in municipal sewage sludge, or removes bacteria contained in animal or human wastes. The soil is an integral part of the natural protection of groundwater from surface-applied contaminants.

However, the natural purification capacity of the soil, like that of any other natural resource is limited, and sometimes soils that retain contaminants may themselves become contaminated. Cleaning contaminated soil can be as difficult as cleaning contaminated groundwater. The evaluation system presented here must be looked upon as a supplemental planning tool only, as a time- and cost-saving guide for preliminary screening of the county for areas sensitive to the impact of normal land-use activities. This soil-potential map does not replace the need for detailed on-site investigations. It does, however, reduce the number of areas to be studied in detail by identifying the areas of best and least attenuation potential. Local details have been generalized to fit the mapping scale, which cannot accommodate small local variations in soil characteristics.

This system evaluates the ability of the soil solum (the A and B horizons) to attenuate potential contaminants resulting from activities above or within the soil zone. The soil attenuation capacity is considered here only in general terms and is not contaminant specific. Contaminants may behave in various ways–some may be completely eliminated by soil organisms, some may be used by plants, some may be adsorbed on soil particles, and some may eventually pass through the soil solum unchanged.

Physical and chemical characteristics to establish soil ratings

For assessing soil potential for attenuation of contaminants in Wood County, seven physical and chemical characteristics were selected for each soil series and were given weighted values (table 1). Values assigned to each characteristic were determined subjectively, with 1 being the poorest and 10 the best attenuation potential. These values were summed, and soils with total point scores within certain ranges were grouped into four soil associations, which, in turn, reflect different attenuation potentials (table 2). Soil associations consist of two or more dissimilar series that occur on the landscape in a regularly repeating pattern.

Information used for this assessment was taken entirely from the Wood County Soil Survey report. All soil series mapped in the county were ranked on the basis of their characteristics in a natural state. Man-induced changes, such as tiling and ditching, may affect the attenuation potential of a particular soil. In those instances where alteration has been extensive, a reassessment may be required. Those areas in Wood County where bedrock is within 5 feet of the surface are indicated on the map. Even though the rock may be covered with 1 to 3 feet of soil materials with good capacity for contaminant attenuation, the proximity of the bedrock to the surface still limits both subsurface and surface land use activities.

Soil attenuation potential

Soils rated as having **good** or **best** potential for attenuating contaminants occupy only about 12 percent of the total land area of Wood County. EauPleine, Dolph, and Marathon soils are formed in 15 to 36 inches of silts over medium- to fine-textured residuum from igneous and metamorphic rocks, primarily granites. Antigo and Onamia soils developed in 20 to 40 inches of loamy materials over outwash sands. Dunnville soils are similar, although they were covered by prairie grasses rather than hardwood forests. Gale and Hiles soils formed in up to 40 inches of silts over sandstone. All soils in these groups are relatively well suited to a variety of land-use activities, including agriculture and silviculture.

Soils that have **marginal** potential to attenuate contaminants include those formed in 20 to 40 inches of medium-textured materials over interbedded sandstones and shales (Vesper, Veedum, Kert). They are generally poorly drained under natural conditions, which means that water stands in the soil for a major part of the year. Withee and Marshfield soils are somewhat poor or poorly drained and have developed in 15 to 30 inches of silts over a dense, loam till. Medium- to coarse-textured materials from 15 to 36 inches thick overlie granite residuum in the somewhat poorly drained Point and Milladore soils.

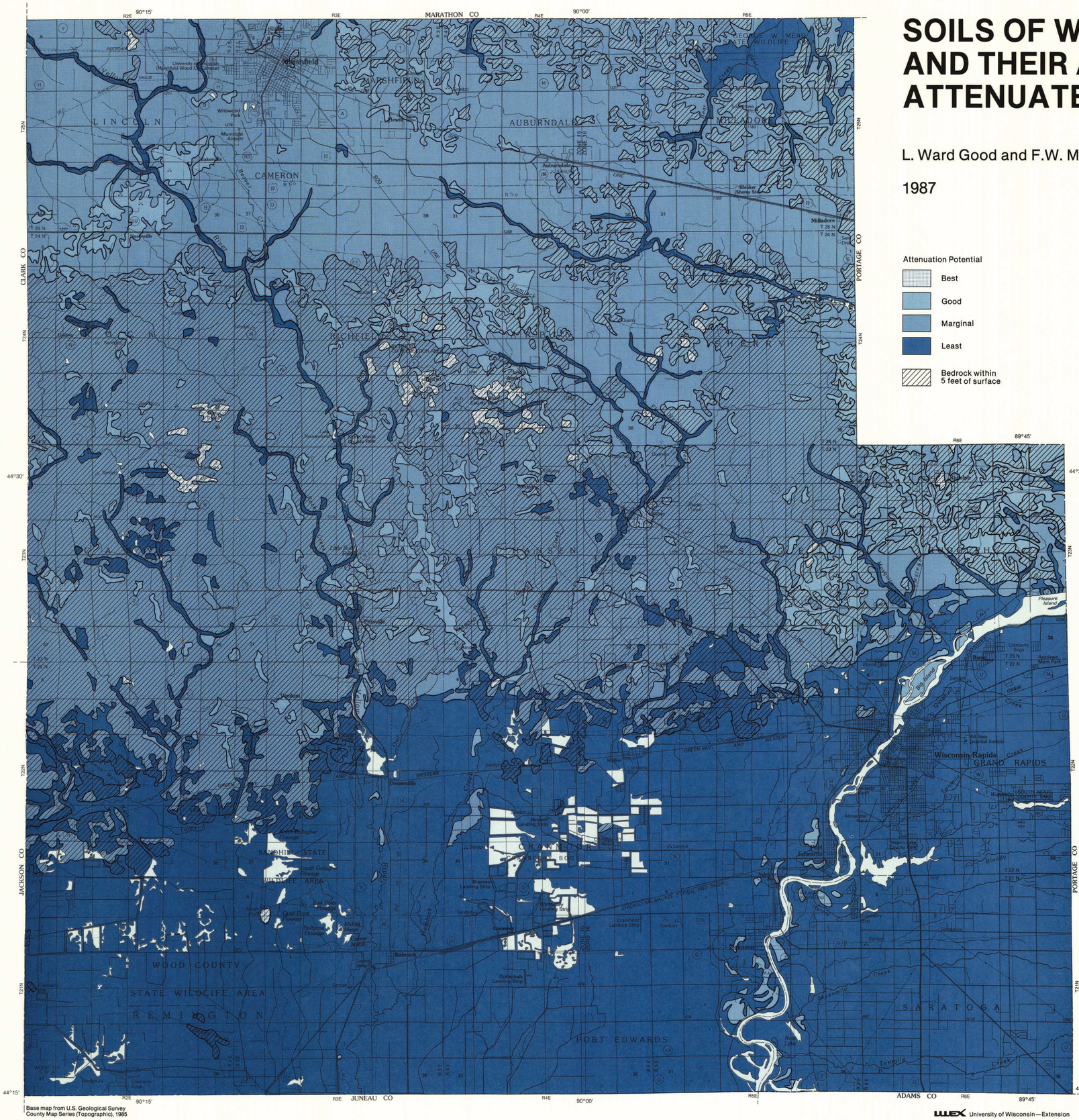
Collectively, the soils in this association illustrate the basic principles of attenuation. The processes involved depend on water moving through the soil solum at a rate that ensures maximum contact between the percolating water that contains contaminants and the soil particles. Deep (>35 in.), medium- and fine-textured, well drained soils are best. Some soils that have marginal attenuation potential are sufficiently deep, but saturated totally or partly for at least a portion of the year. Presence of the saturated zone within the soil solum interrupts the attenuation process and allows contaminants to be introduced into the groundwater.

Water moves through coarse-textured materials very rapidly; contact between contaminants and soil particles is minimal and attenuation is reduced. Many soils in this association are shallow and coarse textured and have only a limited ability to remove surface-applied contaminants.

Soils that have the **least** potential for contaminant attenuation include deep sands, some of which are well to excessively well drained (Plainfield, Friendship); others are poor or somewhat poorly drained (Meehan, Newson). Also included are organic soils (Cathro, Greenwood) and soils with 15 to 36 inches of coarse-textured coverings over sandstone (Elkmound, Eleva).

Soils in the least and marginal associations in Wood County are quite limited in their uses. High water tables limit conventional agriculture, although many areas are suitable for the production of cranberries. Well drained, coarse-textured soils are often droughty and supplemental water is required for successful agricultural production. These uses, if not properly managed, may exacerbate surface and groundwater problems.

The map shows the distribution of soils in Wood County. Till soils are found in the northwestern part; soils formed in relatively fine-textured residuum from igneous and metamorphic rocks cover the northeastern and east-central part of the county. Soils developed in interbedded sandstones and shales dominate the landscape in the west-central part of the county. The entire southern one-third of Wood County is covered with either coarse-textured mineral soils or organic materials (peat and muck).



Attenuation Potential

- Best
- Good
- Marginal
- Least
- Bedrock within 5 feet of surface

Table 1. Ranking system for evaluating the attenuation potential of soils in Wood County

Physical/chemical characteristics	Classes	Weighted values
Texture[1]—Surface (A) horizon	l, sil, scl, si	9
	c, sic, cl, sicl, sc	8
	lvfs, vfsl, lfs, fsl	4
	s, ls, sl, organic materials, and all textural classes with coarse fragment class modifiers	1
Texture[1]—Subsoil (B) horizon	c, sic, sc, si	10
	scl, l, sil, cl, sicl	7
	lvfs, vfsl, lfs, fsl	4
	s, ls, sl, organic materials, and all textural classes with coarse fragment class modifiers	1
Organic matter content[2]	Mollisols	8
	Alfisols	5
	Entisols; Inceptisols; Spodosols	3
	Histosols; Aquic suborder; and Lithic, Aquollic, and Aquic subgroups	1
pH—Surface (A) horizon	≥6.6	6
	<6.6	4
Depth of soil solum (A + B horizons)	>40 in.	10
	30-40 in.	8
	20-30 in.	3
	<20 in.	1
Permeability[2]—Subsoil (B) horizon	very low	10
	moderate	8
	high	4
	very high	1
Soil drainage class	well drained	10
	well to moderately well drained	7
	moderately well drained	4
	somewhat poorly, poorly, and very poorly drained; excessively well drained	1

[1] Soil textural classes: l = loam, sil = silt loam, scl = sandy clay loam, si = silt, c = clay, sic = silty clay, cl = clay loam, sicl = silty clay loam, sc = sandy clay, lvfs = loamy very fine sand, vfsl = very fine sandy loam, lfs = loamy fine sand, fsl = fine sandy loam, s = sand, ls = loamy sand, sl = sandy loam.

[2] Based on the ordinal, subordinal, or subgroup levels of the soil classification system; soils are assigned a lower number if they are wet or less than 20 inches thick over bedrock; see county soil survey report.

[3] Based on the particle-size class at the family level of the soil classification system, type and grade of structure, and consistency; see county soil survey report.

Table 2. Soil series in Wood County listed by attenuation potential

	Least potential	Marginal potential	Good potential	Best potential
Sum of weighted values	0-30	31-40	41-50	51+
	Alluvial land*	Fenwood	Altdorf	EauPleine, variant
	Alluvial land, wet*	stony phase	Antigo	Fenwood
	Au Gres	Guenther	Dolph	
	Cathro	Humbird	Dunnville	
	Croswell	Kert	EauPleine	
	Dancy	Mann	Gale	
	Dawson	Marshfield	Hiles	
	Eleva	Merrillan	Marathon	
	Elkmound	Milladore	Onamia	
	Elm Lake	Mosinee	Santiago	
	Friendship	Norgo		
	Greenwood	Point		
	Markey	Poskin		
	Marsh*	Rib		
	Meehan	Rietbrock		
	Newson	Sherry		
	Nymore	Veedum		
	Plainbo	Vesper		
	Plainfield	Withee		
	Rifle			
Acreage**	213,275	235,479	58,580	3,945
Percent of total land area**	41.7%	46.0%	11.4%	0.8%

*Undifferentiated land type.
**The remaining 0.1% of the total land area consists of gravel pits (490A) and made land (135A)

SCALE 1:100 000

1 0 1 2 3 4 5 KILOMETRES

1 0 1 2 MILES

INFORMATION CIRCULAR 60 Plate 2

Map 87-6

Cartography by B.R. Haskins-Grahn

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