Informal Documentation for the Groundwater Contamination Susceptibility Model (GCSM) and Component Data Sets
Last updated 3/12/01

1. Groundwater Contamination Susceptibility Model or GCSM ("GCSPW95C")

This layer includes a polygon coverage ("gcspw95c") derived from 1:500,000-scale sources containing the output from the Groundwater Contamination Susceptibility Model (GCSM) for Wisconsin, and estimating the susceptibility of the state's groundwater to contamination from surface activities. The GCSM was developed by the DNR, the US Geological Survey (USGS), the Wisconsin Geological & Natural History Survey (WGNHS), and the University of Wisconsin – Madison in the mid-1980s. The results of the GCSM are illustrated in a map published in 1987 at a scale of 1:1,000,000.

Usage Notes

Groundwater contamination susceptibility is defined for the GCSM as the ease with which water (and any contaminant carried in the water) travels from the land surface to the top of the groundwater layer. Five physical resource characteristics were identified as important in determining groundwater contamination susceptibility. Resource characteristic maps used in the GCSM were compiled and automated from generalized maps at a scale of 1:250,000 or 1:500,000. These data layers and their corresponding coverage names in the DNR GIS Database Library are:

- Bedrock Depth or Depth-to-Bedrock ("brdpw92d")
- Bedrock Type ("brtpw95c")
- Soil Characteristics* ("schpw92d")
- Surficial Deposits ("sdppw95c")
- Water Table Depth or Depth-to-Water Table ("wtdpw92d")

*The DNR GIS Database Library also includes a Soil Associations layer ("saspw92") which is an intermediate data set used to prepare the Soil Characteristics layer.

A value was assigned for each attribute identified on a resource characteristic map. A weighting scheme was also developed to indicate the strength of each resource characteristic in estimating groundwater contamination susceptibility. The 5 resource characteristic layers were then overlaid in a GIS, with each polygon in the composite coverage receiving a numerical score composed of the value assigned to each attribute times the multiplier assigned to each resource characteristic. Because of the importance of depth to bedrock in determining the strength of other GCSM factors, the multiplier assigned to each resource characteristic resided in the brdpw92d layer.

For more information about the GCSM and its component layers, refer to the DNR publication, *Wisconsin's Groundwater Management Plan: Report No. 5: Groundwater Contamination Susceptibility in Wisconsin*, available from the DNR Bureau of Drinking Water & Groundwater.

A Note on Fitness for Use

The GCSM is derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes. For example, siting waste disposal facilities or locating an industry requires site-specific, geologic and hydrogeologic information, and cannot be made based on the composite groundwater contamination susceptibility map. The GCSM does not consider the individual characteristics of individual contaminants or the subsurface release of contaminants. That is, it only considers the ability of water to move from the land surface to the water table. The model is intended for use by state agencies and others when deciding where they should more closely study impacts on groundwater. Local officials can also use the GCSM in determining whether their region needs to be studied in more detail for potential groundwater problems.

Polygon Attribute - "GWCS_VALUE"

This item contains the groundwater contamination susceptibility numerical score obtained for each polygon in the composite coverage. Low scores represent areas that are more susceptible to contamination, and high scores represent areas that are less susceptible.

2. Bedrock Depth or Depth-to-Bedrock ("BRDPW92D")

This layer consists of a 1:250,000-scale polygon coverage containing depth-to-bedrock estimates and related information used in preparing the GCSM for Wisconsin. The primary source for this data layer is a 1973 map at 1:1,000,000 scale published by the WGNHS and USGS. Where more recent information was available, the USGS updated the 50-foot and 100-foot contours of the depth-to-bedrock map at a scale of 1:250,000. Soil associations data, and other information, were used to add a 5-foot contour to the data layer.

Usage Notes

Depth to bedrock is defined as the distance from the land surface to the top of the bedrock (uppermost consolidated deposit). Where the depth to bedrock is shallow, contaminants generally have less contact time with the earth's natural pollutant removal processes found in unconsolidated surficial deposits. Depth to bedrock was used in the GCSM as an indicator of how thick and thus how important the surficial deposits are in pollutant removal.

Depth to bedrock was also used to evaluate the importance of bedrock type in determining an area's susceptibility to groundwater contamination. The greater the depth to bedrock, the more likely that the water table is located above the bedrock layer, rendering the bedrock type insignificant for the GCSM. When the bedrock is shallow (i.e., less than 50 feet from the land surface), bedrock type can affect the ease with which infiltrating waters flow to the groundwater.

The GCSM rating scheme uses values for each individual resource characteristic attribute (type of bedrock, surficial deposits, etc.) together with a set of multipliers to determine a composite score. Because of the importance of depth to bedrock in determining the strength of other GCSM factors, the multiplier assigned to each resource characteristic resides in the Bedrock Depth layer.

Polygon Attribute - "DEPTH"

This item contains the depth-to-bedrock estimates:

CODE	DEFINITION
535	35% to 70% of the area has bedrock within 5 feet of the land surface
570	Greater than 70% of the area has bedrock within 5 feet of the land surface
5005	Bedrock is between 50 feet and 5 feet of the land surface
10050	Bedrock is between 100 feet and 50 feet of the land surface
10000	Bedrock is greater than 100 feet from the land surface

(Note: In this coverage, a code of "0" is assigned to the polygon representing Lake Winnebago, and to the background polygon.)

3. Bedrock Type ("BRTPW95C")

This layer consists of a polygon coverage at 1:500,000 scale with information about bedrock type used in the GCSM. Bedrock is the consolidated material that underlies the soils and surficial deposits; "bedrock type" is defined as type of the uppermost rock layer. Bedrock type is important in assessing an area's susceptibility to groundwater contamination, especially if the bedrock is located close to the land surface. The source for this layer is the set of 1:500,000-scale compilation sheets for a 1981 map of bedrock geology of Wisconsin published by the WGNHS. Because of the generalized nature of the GCSM project, bedrock types were grouped into 4 categories during automation of this data layer.

Polygon Attribute - "BTGW_VALUE"

This item contains the bedrock type information. Valid codes are:

CODE	DEFINITION
1	Carbonates
5	Sandstone
6	Igneous, metamorphic, and volcanic rock
10	Shale
0	Background ("universe") polygon

4. Soil Characteristics & Soil Associations ("SCHPW92D" & "SASPW92D")

This layer consists of 2 polygon coverages at 1:250,000 scale ("schpw92" and "saspw92d") used in preparing the GCSM, and containing information on Wisconsin soils. The coverage saspw92d includes data about soil associations. By definition, a soil association is a landscape that has a distinctive proportional pattern of soils; it normally consists of one or more major soils and at least one minor soil, and is named for the major soil. The soil associations layer was digitized from the 1:250,000-scale compilation sheets of a 1968 soils map of Wisconsin (Hole et. al). The soil associations in this coverage were subsequently grouped into 4 "soil characteristics" categories in the coverage schpw92d, for use in the GCSM. For the purposes of the GCSM, soil depth was considered to extend from the land surface to 5 feet below the land surface.

SCHPW92D – Polygon Attribute

This item contains the soil characteristics attribute value.

Code	Definition
1	Coarse texture / high permeability
3	Medium coarse texture / high-medium permeability
6	Medium texture / medium permeability
10	Fine texture / low permeability
99	Water body
0	Background, or "universe", polygon

SASPW92D – Polygon Attribute

The 4-digit codes contained in this item correspond to the soil association unit identifiers on the source map. Digits 1 and 2 identify the character forming the first part of the soil association identifier: a code of "1" indicates the letter "A"; "2" indicates "B"; and so on. Digits 3 and 4 contain the numeric portion of the soil association unit identifier. For descriptions of soil association units refer to the source map
(Hole, F. D., M. T. Beatty, C. J. Milford, G. B. Lee, A. J. Klingelhoets. 1968. "Soils of Wisconsin." Map in *Soils of Wisconsin*, Francis D. Hole. Madison, WI: University of Wisconsin – Extension.)

5. Surficial Deposits ("SDPPW95C")

This layer includes a polygon coverage with information about surficial deposits at 1:500,000 scale used in preparing the GCSM for Wisconsin. Surficial deposits are defined as the unconsolidated materials above the bedrock. Because the "soils" layer used in the GCSM includes only the material in the first 5 feet below the land surface, the surficial deposits layer is intended to account for the unconsolidated material between the soil and the top of the bedrock. The texture and permeability of the surficial deposits affect the rate at which infiltrating water will reach the water table. In Wisconsin, these surficial deposits are often the most important factor in determining groundwater contamination susceptibility.

Polygon Attribute - "SDGW_VALUE"

This item contains the surficial deposits attribute value.

Code	Definition
1	Sand and gravel
2	Sand
5	Peat

6	Loam
10	Clay
0	No materials (also assigned to the background, or "universe", polygon)

6. Water Table Depth or Depth-to-Water-Table ("WTDPW92D")

This layer consists of a polygon coverage at 1:250,000 scale ("wtdpw92d") containing depth-to-water table estimates used in preparing the GCSM for Wisconsin. The depth to water table is the distance from the land surface to the water table. The distance water must flow to reach the groundwater, combined with the ease with which movement occurs, play a significant role in determining the susceptibility of an area to contamination.

Usage Notes

The source for this data layer is a 1:250,000-scale map compiled by the USGS using computerized well log information and depth-to-water contours from other published sources such as county reports and county solid waste plans. Soil association information such as the location of poorly drained soils was also used to develop the 20-foot depth-to-water contours. Due to scarcity of data sources, variable topography, and water level fluctuations, this layer is considered the least reliable of the 5 used in the GCSM.

Polygon Attribute

This item contains the depth-to-water-table estimate.

Code	Definition
1	0 feet to 20 feet
5	20 feet to 50 feet
10	Greater than 50 feet
0	Background, or "universe", polygon

For more information, contact:

John Laedlein, GIS Data Specialist,
WI Dept.of Natural Resources,
Enterprise Data Management Section (ET/8)
Box 7921, 101 S. Webster St., Madison WI 53707
laedlj@dnr.state.wi.us
(608) 264-8914