GROUND WATER POLLUTION POTENTIAL OF MONTGOMERY COUNTY, OHIO

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ABSTRACT

A ground water pollution potential map of Montgomery County has been prepared using the DRASTIC mapping process. The DRASTIC system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system for pollution potential.

Hydrogeologic settings form the basis of the system and incorporate the major hydrogeologic factors that affect and control ground water movement and occurrence, including depth to water, net recharge, aquifer media, soil media, topography, impact of the vadose zone media, and hydraulic conductivity of the aquifer. These factors, which form the acronym DRASTIC, are incorporated into a relative ranking scheme that uses a combination of weights and ratings to produce a numerical value called the ground water pollution potential index. Hydrogeologic settings are combined with the pollution potential indexes to create units that can be graphically displayed on a map.

Montgomery County lies within the Glaciated Central hydrogeologic region. The county is covered by variable thicknesses of glacial till, lacustrine deposits, and outwash. These unconsolidated glacial deposits are underlain by limestone, shale and shaley limestone bedrock. Ground water yields are dependent on the type of aquifer and vary greatly throughout the county. Pollution potential indexes are relatively low to moderate in areas of till or lacustrine cover over bedrock. Buried valleys containing sand and gravel aquifers, and areas covered by outwash have moderate to high vulnerabilities to contamination.

Ground water pollution potential analysis in Montgomery County resulted in a map with symbols and colors which illustrates areas of varying ground water contamination vulnerability. Twelve hydrogeologic settings were identified in Montgomery County with computed ground water pollution potential indexes ranging from 41 to 206.

The ground water pollution potential mapping program optimizes the use of existing data to rank areas with respect to relative vulnerability to contamination. The ground water pollution potential map of Montgomery County has been prepared to assist planners, managers, and local officials in evaluating the potential for contamination from various sources of pollution. This information can be used to help direct resources and land use activities to appropriate areas, or to assist in protection, monitoring, and clean-up efforts.

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INTRODUCTION

The need for protection and management of ground water resources in Ohio has been clearly recognized. About 42 percent of Ohio citizens rely on ground water for drinking and household use from both municipal and private wells. Industry and agriculture also utilize significant quantities of ground water for processing and irrigation. In Ohio, approximately 700,000 rural households depend on private wells; over 10,000 of these wells exist in Montgomery County.

The characteristics of the many aquifer systems in the state make ground water highly vulnerable to contamination. Measures to protect ground water from contamination usually cost less and create less impact on ground water users than clean up of a polluted aquifer. Based on these concerns for protection of the resource, staff of the Division of Water conducted a review of various mapping strategies useful for identifying vulnerable aquifer areas. They placed particular emphasis on reviewing mapping systems that would assist in state and local protection and management programs. Based on these factors and the quantity and quality of available data on ground water resources, the DRASTIC mapping process (Aller et al., 1987) was selected for application in the program.

Considerable interest in the mapping program followed successful production of a demonstration county map and led to the inclusion of the program as a recommended initiative in the Ohio Ground Water Protection and Management Strategy (Ohio EPA, 1986). Based on this recommendation, the Ohio General Assembly funded the mapping program. A dedicated mapping unit has been established in the Division of Water, Water Resources Section to implement the ground water pollution potential mapping program on a county-wide basis in Ohio.

The purpose of this report and map is to aid in the protection of our ground water resources. This protection can be enhanced by understanding and implementing the results of this study which utilizes the DRASTIC system of evaluating an area's potential for ground water pollution. The mapping program identifies areas that are more or less vulnerable to contamination and displays this information graphically on maps. The system was not designed or intended to replace site-specific investigations, but rather to be used as a planning and management tool. The map and report can be combined with other information to assist in prioritizing local resources and in making land use decisions.

APPLICATIONS OF POLLUTION POTENTIAL MAPS

The pollution potential mapping program offers a wide variety of applications in many counties. The ground water pollution potential map of Montgomery County has been prepared to assist planners, managers, and state and local officials in evaluating the relative vulnerability of areas to ground water contamination from various sources of pollution. This information can be used to help direct resources and land use activities to appropriate areas, or to assist in protection, monitoring, and clean-up efforts.

An important application of the pollution potential maps for many areas will be assisting in county land use planning and resource expenditures related to solid waste disposal. A county may use the map to help identify areas that are more or less suitable for disposal activities. Once these areas have been identified, a county can collect more site-specific information and combine this with other local factors to determine site suitability.

Pollution potential maps may also be applied successfully where non-point source contamination is a concern. Non-point source contamination occurs where land use activities over large areas impact water quality. Maps providing information on relative vulnerability can be used to guide the selection and implementation of appropriate best management practices in different areas. Best management practices should be chosen based upon consideration of the chemical and physical processes that occur from the practice, and the effect these processes may have in areas of moderate to high vulnerability to contamination. For example, the use of agricultural best management practices that limit the infiltration of nitrates, or promote denitrification above the water table, would be beneficial to implement in areas of relatively high vulnerability to contamination.

A pollution potential map can also assist in developing ground water protection strategies. By identifying areas more vulnerable to contamination, officials can direct resources to areas where special attention or protection efforts might be warranted. This information can be utilized effectively at the local level for integration into land use decisions and as an educational tool to promote public awareness of ground water resources. Pollution potential maps may also be used to prioritize ground water monitoring and/or contamination clean-up efforts. Areas that are identified as being vulnerable to contamination may benefit from increased ground water monitoring for pollutants or from additional efforts to clean up an aquifer.

Other beneficial uses of the pollution potential maps will be recognized by individuals in the county who are familiar with specific land use and management problems. Planning commissions and zoning boards can use these maps to help make informed decisions about the development of areas within their jurisdiction. Developments proposed to occur within ground-water sensitive areas may be required to show how ground water will be protected.

Regardless of the application, emphasis must be placed on the fact that the system is not designed to replace a site-specific investigation. The strength of the system lies in its ability to make a "first-cut approximation" by identifying areas that are vulnerable to contamination. Any potential applications of the system should also recognize the assumptions inherent in the system.

SUMMARY OF THE DRASTIC MAPPING PROCESS

The system chosen for implementation of a ground water pollution potential mapping program in Ohio, DRASTIC, was developed by the National Water Well Association for the United States Environmental Protection Agency. A detailed discussion of this system can be found in Aller et al. (1987).

The DRASTIC mapping system allows the pollution potential of any area to be evaluated systematically using existing information. Vulnerability to contamination is a combination of hydrogeologic factors, anthropogenic influences, and sources of contamination in any given area. The DRASTIC system focuses only on those hydrogeologic factors which influence ground water pollution potential. The system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system to determine pollution potential.

The application of DRASTIC to an area requires the recognition of a set of assumptions made in the development of the system. DRASTIC evaluates the pollution potential of an area, assuming a contaminant with the mobility of water introduced at the surface and flushed into the ground water by precipitation. Most important, DRASTIC cannot be applied to areas smaller than 100 acres in size, and is not intended or designed to replace site-specific investigations.

Hydrogeologic Settings and Factors

To facilitate the designation of mappable units, the DRASTIC system used the framework of an existing classification system developed by Heath (1984), which divides the United States into 15 ground water regions based on the factors in a ground water system that affect occurrence and availability.

Within each major hydrogeologic region, smaller units representing specific hydrogeologic settings are identified. Hydrogeologic settings form the basis of the system and represent a composite description of the major geologic and hydrogeologic factors that control ground water movement into, through, and out of an area. A hydrogeologic setting represents a mappable unit with common hydrogeologic characteristics and, as a consequence, common vulnerability to contamination (Aller et al., 1987).

Figure 1 illustrates the format and description of a typical hydrogeologic setting found within Montgomery County. Inherent within each hydrogeologic setting are the physical characteristics which affect the ground water pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D - Depth to Water

R - Net Recharge

A - Aquifer Media

S - Soil Media

T - Topography

I - Impact of the Vadose Zone Media

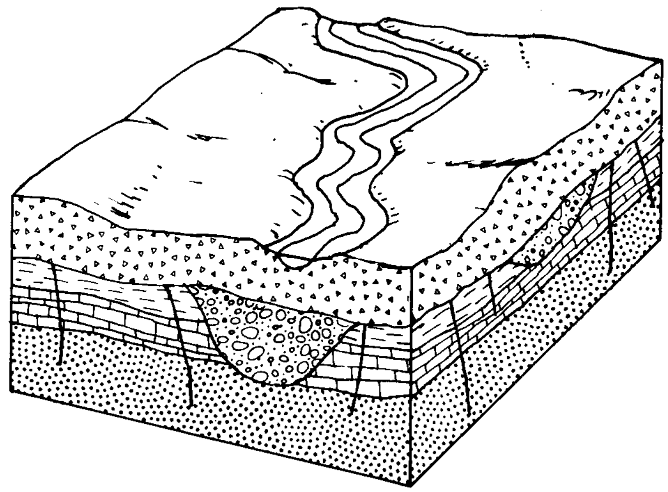
C - Conductivity (Hydraulic) of the Aquifer

These factors incorporate concepts and mechanisms such as attenuation, retardation, and time or distance of travel of a contaminant with respect to the physical characteristics of the hydrogeologic setting. Broad consideration of these factors and mechanisms coupled with existing conditions in a setting provide a basis for determination of the area's relative vulnerability to contamination.

Depth to water is considered to be the depth from the ground surface to the water table in unconfined aquifer conditions or the depth to the top of the aquifer under confined aquifer conditions. The depth to water determines the distance a contaminant would have to travel before reaching the aquifer. The greater the distance the contaminant has to travel, the greater the opportunity for attenuation to occur or restriction of movement by relatively impermeable layers.

Net recharge is the total amount of water reaching the land surface that infiltrates into the aquifer measured in inches per year. Recharge water is available to transport a contaminant from the surface into the aquifer and also affects the quantity of water available for dilution and dispersion of a contaminant. Factors to be included in the determination of net recharge include contributions due to infiltration of precipitation, in addition to infiltration from rivers, streams and lakes, irrigation, and artificial recharge.

Aquifer media represents consolidated or unconsolidated rock material capable of yielding sufficient quantities of water for use. Aquifer media accounts for the various physical characteristics of the rock that provide mechanisms of attenuation, retardation, and flow pathways that affect a contaminant reaching and moving through an aquifer.



7D Buried Valley

This hydrogeologic setting is characterized by thick layers of sand and gravel that have been deposited in a former topographic low (usually a pre-glacial river valley) by glacial meltwaters. These deposits are capable of yielding large quantitites of ground water. The deposits may or may not underlie a present day river and may or may not be in direct hydraulic connection with a stream. Glacial till or recent alluvium often overlies the buried valley. The deposits are several times more permeable than the surrounding bedrock. Recharge to the sand and gravel is moderate to high and water levels are commonly relatively shallow although in some areas they may be quite variable.

Figure 1. Format and description of the hydrogeologic setting - 7D Buried Valley.

Soil media refers to the upper six feet of the unsaturated zone that is characterized by significant biological activity. The type of soil media influences the amount of recharge that can move through the soil column due to variations in soil permeability. Various soil types also have the ability to attenuate or retard a contaminant as it moves throughout the soil profile. Soil media is based on textural classifications of soils and considers relative thicknesses and attenuation characteristics of each profile within the soil.

Topography refers to the slope of the land expressed as percent slope. The slope of an area affects the likelihood that a contaminant will run off or be ponded and ultimately infiltrate into the subsurface. Topography also affects soil development and often can be used to help determine the direction and gradient of ground water flow under water table conditions.

The impact of the vadose zone media refers to the attenuation and retardation processes that can occur as a contaminant moves through the unsaturated zone above the aquifer. The vadose zone represents that area below the soil horizon and above the aquifer that is unsaturated or discontinuously saturated. Various attenuation, travel time, and distance mechanisms related to the types of geologic materials present can affect the movement of contaminants in the vadose zone. Where an aquifer is unconfined, the vadose zone media represents the materials below the soil horizon and above the water table. Under confined aquifer conditions, the vadose zone is simply referred to as a confining layer. The presence of the confining layer in the unsaturated zone significantly impacts the pollution potential of the ground water in an area.

Hydraulic conductivity of an aquifer is a measure of the ability of the aquifer to transmit water, and is also related to ground water velocity and gradient. Hydraulic conductivity is dependent upon the amount and interconnectivity of void spaces and fractures within a consolidated or unconsolidated rock unit. Higher hydraulic conductivity typically corresponds to higher vulnerability to contamination. Hydraulic conductivity considers the capability for a contaminant that reaches an aquifer to be transported throughout that aquifer over time.

Weighting and Rating System

DRASTIC uses a numerical weighting and rating system that is combined with the DRASTIC factors to calculate a ground water pollution potential index or relative measure of vulnerability to contamination. The DRASTIC factors are weighted from 1 to 5 according to their relative importance to each other with regard to contamination potential (Table 1). Each factor is then divided into ranges or media types and assigned a rating from 1 to 10 based on their significance to pollution potential (Tables 2-8). The rating for each factor is selected based on available information and professional judgement. The selected rating for each factor is multiplied by the assigned weight for each factor. These numbers are summed to calculate the DRASTIC or pollution potential index.

Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination. The index generated provides only a relative evaluation tool and is not designed to produce absolute answers or to represent units of vulnerability. Pollution potential indexes of various settings should be compared to each other only with consideration of the factors that were evaluated in determining the vulnerability of the area.

Pesticide DRASTIC

A special version of DRASTIC was developed to be used where the application of pesticides is a concern. The weights assigned to the DRASTIC factors were changed to reflect the processes that affect pesticide movement into the subsurface with particular emphasis on soils. Where other agricultural practices, such as the application of fertilizers, are a concern, general DRASTIC should be used to evaluate relative vulnerability to contamination. The process for calculating the Pesticide DRASTIC index is identical to the process used for calculating the general DRASTIC index. However, general DRASTIC and Pesticide DRASTIC numbers should not be compared because the conceptual basis in factor weighting and evaluation differs significantly. Table 1 lists the weights used for general and pesticide DRASTIC.

TABLE 1. ASSIGNED WEIGHTS FOR DRASTIC FEATURES

Feature	General DRASTIC Weight	Pesticide DRASTIC Weight
Depth to Water	5	5
Net Recharge	4	4
Aquifer Media	3	3
Soil Media	2	5
Topography	1	3
Impact of the Vadose Zone Media	5	4
Hydraulic Conductivity of the Aquifer	3	2

TABLE 2. RANGES AND RATINGS FOR DEPTH TO WATER

DEPTH TO WATER (FEET)	
Range	Rating
0-5	10
5-15	9
15-30	7
30-50	5
50-75	3
75-100	2
100+	1
Weight: 5	Pesticide Weight: 5

TABLE 3. RANGES AND RATINGS FOR NET RECHARGE

NET RECHARGE (INCHES)	
Range	Rating
0-2	1
2-4	3
4-7	6
7-10	8
10+	9
Weight: 4	Pesticide Weight: 4

TABLE 4. RANGES AND RATINGS FOR AQUIFER MEDIA

AQUIFER MEDIA		
Range	Rating	Typical Rating
Massive Shale	1-3	2
Metamorphic / Igneous	2-5	3
Weathered Metamorphic / Igneous	3-5	4
Glacial Till	4-6	5
Bedded Sandstone, Limestone and Shale Sequences	5-9	6
Massive Sandstone	4-9	6
Massive Limestone	4-9	6
Sand and Gravel	4-9	8
Basalt	2-10	9
Karst Limestone	9-10	10
Weight: 3	Pesticide Weight: 3	

TABLE 5. RANGES AND RATINGS FOR SOIL MEDIA

SOIL MEDIA	
Range	Rating
Thin or Absent	10
Gravel	10
Sand	9
Peat	8
Shrinking and / or Aggregated Clay	7
Sandy Loam	6
Loam	5
Silty Loam	4
Clay Loam	3
Muck	2
Nonshrinking and Nonaggregated Clay	1
Weight: 2	Pesticide Weight: 5

TABLE 6. RANGES AND RATINGS FOR TOPOGRAPHY

TOPOGRAPHY (PERCENT SLOPE)	
Range	Rating
0-2	10
2-6	9
6-12	5
12-18	3
18+	1
Weight: 1	Pesticide Weight: 3

TABLE 7. RANGES AND RATINGS FOR IMPACT OF THE VADOSE ZONE MEDIA

IMPACT OF THE VADOSE ZONE MEDIA		
Range	Rating	Typical Rating
Confining Layer	1	1
Silt/Clay	2-6	3
Shale	2-5	3
LImestone	2-7	6
Sandstone	4-8	6
Bedded Limestone, Sandstone, Shale	4-8	6
Sand and Gravel with significant Silt and Clay	4-8	6
Metamorphic/Igneous	2-8	4
Sand and Gravel	6-9	8
Basalt	2-10	9
Karst Limestone	8-10	10
Weight: 5	Pesticide Weight: 4	

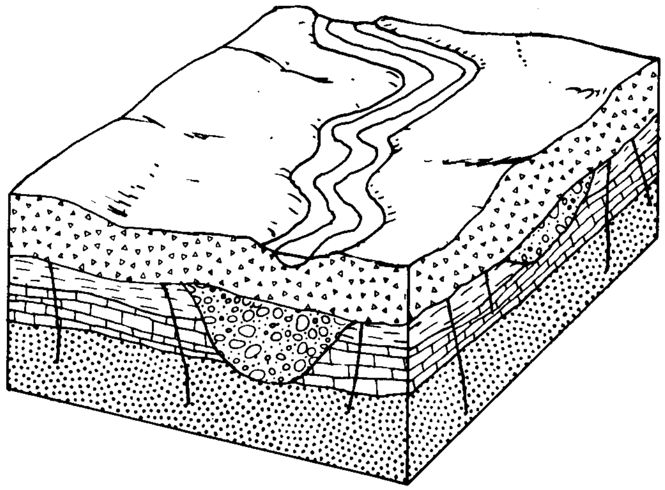
TABLE 8. RANGES AND RATINGS FOR HYDRAULIC CONDUCTIVITY

HYDRAULIC CONDUCTIVITY (GPD/FT^2)	
Range	Rating
1-100	1
100-300	2
300-700	4
700-1000	6
1000-2000	8
2000+	10
Weight: 3	Pesticide Weight: 2

Integration of Hydrogeologic Settings and DRASTIC Factors

Figure 2 illustrates the hydrogeologic setting 7D Buried Valley, identified in mapping Montgomery County, and the pollution potential index calculated for the setting. Based on selected ratings for this setting, the pollution potential index is calculated to be 119. This numerical value has no intrinsic meaning, but can be readily compared to a value obtained for other settings in the county. DRASTIC indexes for typical hydrogeologic settings and values across the United States range from 65 to 223. The diversity of hydrogeologic conditions in Montgomery County produces settings with a wide range of vulnerability to ground water contamination. Calculated pollution potential indexes for the twelve settings identified in the county range from 41 to 206.

Hydrogeologic settings identified in an area are combined with the pollution potential indexes to create units that can be graphically displayed on maps. Pollution potential analysis in Montgomery County resulted in a map with symbols and colors that illustrate areas of ground water vulnerability. The map describing the ground water pollution potential of Montgomery County is included with this report.



SETTING 7D1		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	NUMBER
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		DRASTIC	INDEX	119

Figure 2. Description of the hydrogeologic setting - 7D Buried Valley.

INTERPRETATION AND USE OF A GROUND WATER POLLUTION POTENTIAL MAP

The application of the DRASTIC system to evaluate an area's vulnerability to contamination produces hydrogeologic settings with corresponding pollution potential indexes. The higher the pollution potential index, the greater the susceptibility to contamination. This numeric value determined for one area can be compared to the pollution potential index calculated for another area.

The map accompanying this report displays both the hydrogeologic settings identified in the county and the associated pollution potential indexes calculated in those hydrogeologic settings. The symbols on the map represent the following information:

7D1 - defines the hydrogeologic region and setting
119 - defines the relative pollution potential

Here the first number (7) refers to the major hydrogeologic region and the upper case letter (D) refers to a specific hydrogeologic setting. The following number (1) references a certain set of DRASTIC parameters that are unique to this setting and are described in the corresponding setting chart. The second number (119) is the calculated pollution potential index for this unique setting. The charts for each setting provide a reference to show how the pollution potential index was derived.

The maps are color-coded using ranges depicted on the map legend. The color codes used are part of a national color-coding scheme developed to assist the user in gaining a general insight into the vulnerability of the ground water in the area. The color codes were chosen to represent the colors of the spectrum, with warm colors (red, orange, and yellow) representing areas of higher vulnerability (higher pollution potential indexes), and cool colors (greens, blues, and violet) representing areas of lower vulnerability to contamination.

The map also includes information on the locations of selected observation wells. Available information on these observation wells is referenced in Appendix A, Description of the Logic in Factor Selection. Large man-made features such as landfills, quarries, or strip mines have also been marked on the map for reference.

GENERAL INFORMATION ABOUT MONTGOMERY COUNTY

Montgomery County occupies an area of approximately 460 square miles in southwestern Ohio. It is bounded on the north by Miami and Darke Counties, on the east by Clark and Greene Counties, on the west by Preble County, and on the south by Butler and Warren Counties. The County Seat is Dayton. According to the U.S. Census Bureau, the population of Montgomery County in 1990 was 573,809 (Ohio Department of Development, 1991).

Physiography and Climate

Montgomery County lies within the Till Plains section of the Central Lowlands physiographic province (Fenneman, 1938). The land surface is flat to gently rolling with the most pronounced relief in areas of kames and terminal moraines (Norris and Spieker, 1966). The maximum relief in the county is 420 feet. The high point and the low point are 1,100 and 680 feet above sea level, respectively (Davis et al., 1976).

All of Montgomery County is within the Ohio River drainage basin. The majority of the county is drained by the Great Miami River and its tributaries. Only the southeastern corner of the county is drained by tributaries of the Little Miami River (Ohio Department of Natural Resources, 1985).

The climate of Montgomery County is typical of the continental interior. Summers are moderately warm and humid, and winters are cold and cloudy (Davis et al., 1976).

NOAA (National Oceanic and Atmospheric Administration) data for the thirty year period from 1961 to 1990 show an average annual temperature of 53.4 degrees Fahrenheit at Dayton and 51.7 degrees at the Dayton Airport (U.S. Department of Commerce, 1992). January is the coldest month of the year and July is the warmest month at both stations.

Precipitation for the 1961 to 1990 period averaged 38.82 inches per year at Dayton, 36.64 inches per year at the Dayton Airport, and 39.18 inches per year at Miamisburg. May is typically the wettest month and January the driest month at all three stations (U.S. Department of Commerce, 1992).

Pre- and Inter-Glacial Drainage

A complex network of drainage channels, eroded deeply into the bedrock, underlies Montgomery County. These channels, developed prior to or between periods of Pleistocene glaciation, are now totally or partially filled by glacial deposits. Commonly called buried valleys, these channels often contain thick layers of sand and gravel which serve as important aquifers for the county.

One of the largest of the buried valleys enters near the northeast corner of the county and continues to the southwest, following approximately the same course as the Mad River. A second large channel intersects the first just east of the confluence of the Mad and Great Miami Rivers. At this point, the combined channel takes a somewhat more southerly course through the county, roughly similar to the route of the Great Miami River.

All of the channels (buried valleys) were eroded into the bedrock by ancient streams. Prior to the beginning of Pleistocene glaciation, the Teays River and its tributaries were the dominant river system in Ohio. The Teays River was approximately the size of the modern-day Ohio River but followed a much different course. With its head waters in the Blue Ridge area of Virginia and the Carolinas, the Teays flowed east and entered Ohio near Portsmouth in Scioto County. From Scioto County, the Teays followed a generally northward course to southern Ross County. At that point, the Teays changed to a northwesterly route, crossing the Ohio-Indiana state line at Mercer County.

At its closest point, the Teays River passed about 20 miles northeast of Montgomery County. However, tributaries to the Teays are responsible for establishing the entrenched bedrock valley system in the county. Figure 4a illustrates Teays stage drainage in Montgomery and adjacent counties.

Two contrasting theories exist for Teays tributary drainage in Montgomery County. Stout et al. (1943) and Norris and Spieker (1966) determined that there was a major drainage divide in the far northeastern portion of Montgomery County which separated drainage within the county from the main trunk of the Teays River as it flowed through Clark County. Montgomery County drained into the headwaters of a large, southwesterly flowing stream referred to as the Hamilton River (Stout et al., 1943). This stream roughly followed the course of the modern Great Miami River. The Hamilton River eventually joined the Teays in southwestern Indiana.

Wayne (1952) and Durrell (1977) theorized that drainage within the ancestral Great Miami River Valley was to the northeast, towards the Teays River. The main trunk stream was referred to as the Licking River which flowed northward from Kentucky, through Montgomery County, and joined the Teays River in Clark County.

Figure 3. Location of Montgomery County, Ohio

Clinch (1991), using abundant recent well log data, favored the theory of Stout et al. (1943) that drainage was to the southwest. The majority of current research supports this opinion as the cols, or breaches, in the drainage divide in northeastern Montgomery County do not appear to be sufficiently deep or wide enough to allow for a stream the size of the Licking River.

With the advent of Pleistocene glaciation, flow of the Teays was blocked, and water pooled in the drainage ways and eventually overtopped the valleys in many areas. This resulted in a new drainage system forming in many parts of the state. This new drainage system is commonly called the "Deep Stage" because of the very deep valleys eroded into the bedrock at that time. Some streams established during Deep Stage time followed entirely different courses from the Teays or its tributaries. Other streams, like those in Montgomery County, followed and deepened already established Teays stage channels. Deep stage drainage in southwestern Ohio is illustrated in Figure 4b.

Subsequent episodes of glaciation (Illinoian and Wisconsinan) disrupted Deep Stage drainage and partially or entirely filled the valleys with glacial-derived sediments. In Montgomery County these sediments are primarily sand and gravel outwash. Outwash is composed of material (sand, gravel, silt, and clay) trapped in glacial ice and then released as the ice melts. The melting ice creates large volumes of flowing water which tend to follow the already established river valleys. As the melt water flows away from the glacier, it carries along with it the sand, gravel, silt and clay released from the ice. The heavier sediments (sand and gravel) tend to be deposited near the melting glacier, while the lighter sediments (silt and clay) are carried far downstream. Over time, thick deposits of outwash sand and gravel can accumulate in a bedrock valley. In Montgomery County, the bedrock valleys are filled with outwash deposits along with some till and lacustrine (lake bottom) deposits.

Glacial Geology

During the Pleistocene Epoch (2 million to 10,000 years before present or Y.B.P.), several episodes of ice advance occurred in southwestern Ohio. Older ice advances are now typically referred to as pre-Illinoian (formerly Kansan) in age and pre-date the most recent (Brunhes) magnetic reversal (about 730,000 Y.B.P.). Evidence for these deposits has been inferred from ancient, buried soil profiles west of Cincinnati (Norton et al., 1983). Pre-Illinoian deposits may exist at depth in some of the deeper buried valleys within Montgomery County. Illinoian deposits have been determined to be at least 120,000 Y.B.P. Norris et al. (1948) identified Illinoian glacial till at the base of a limited number of stream exposures in southern Montgomery County. The majority of the glacial deposits in the county are Wisconsinan in age (approximately 15,000 to 25,000 Y.B.P.).

The majority of the glacial deposits fall into four main categories: glacial till, outwash, lacustrine, and kames (ice-contact sand and gravel). Many of these deposits are also associated with typical landforms. Drift is an older term that collectively refers to the entire assemblage of glacial deposits. Till is an unsorted, non-bedded mixture of sand, silt, clay, and gravel directly deposited by the ice sheet. There are two main types, or facies, of till. Lodgement till is "plastered" or "bull-dozed" at the base of an actively moving ice sheet. Lodgement till tends to be relatively dense and compacted with broken and angular pebbles. Ablation or "melt-out" till is deposited as the ice sheet stagnates and melts. Debris is laid down at the base or other portions of the ice sheet as the ice melts. Ablation till tends to be less dense, less compacted, and is coarser-grained as water has washed some of the fines away.

Till deposition is commonly associated with two types of surficial landforms: ground moraines and end moraines. Ground moraines are relatively flat-lying to gently rolling upland areas. Till thickness typically varies from 20 to 50 feet. An interesting feature of the ground moraine is the presence of concentrations of large boulders at the land surface referred to as "boulder belts." Norris et al. (1948) offer explanations for the presence of these boulder belts. End moraines are more ridge-like; their terrain is considered to be rolling or hummocky. Thickness of till and interbedded sand and gravels may exceed 100 feet. The relief, or steepness, of end moraines may be enhanced by stream erosion along the base of the moraine. End moraines also often serve as local drainage divides.

Till is also found filling the deeper portions of many of the buried valleys within the county (Norris et al., 1948; Norris and Spieker, 1966; and Schalk, 1992). Within the buried valleys, the till is commonly interbedded with outwash and lacustrine deposits.

Outwash deposits are created by the active deposition of sediments by meltwater streams. These deposits are bedded and sorted. Outwash deposits in Montgomery County are predominantly located within stream valleys. Such outwash deposits were referred to in the older literature as valley trains. The degree of sorting, bedding, and relative coarseness of the deposits depends upon the nature of the stream and the proximity of the melting ice sheet. Outwash is typically deposited by a network of braided streams. Such streams have multiple channels which migrate across the width of the valley floor, leaving behind a complex record of erosion and deposition. As modern streams downcut, the older, now higher elevation remnants of the valley floor are referred to as terraces. Terraces within Montgomery County are all believed to be Wisconsinan in age.

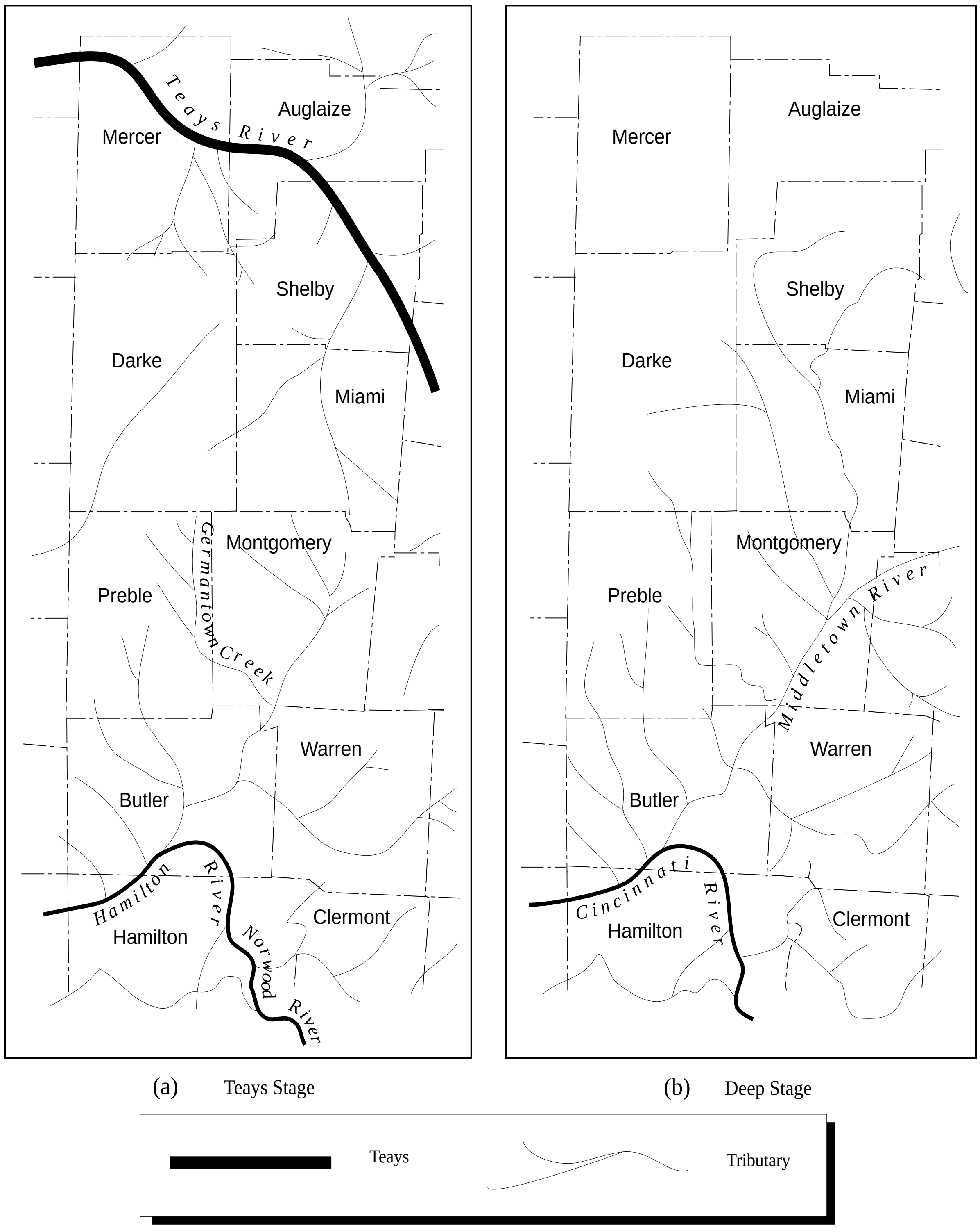


Figure 4. Teays and Deep Stage drainage in southwestern Ohio
(Modified from Stout et al., 1943)

Lacustrine deposits are created as a result of lakes formed by the damming of streams by either ice sheets or by thick deposits of sediments which block tributaries from the main trunk streams. Lacustrine sediments tend to be deposited in a quiet, low-energy environment with little or no current. These deposits are composed of dense, fairly uniform clay and silt with minor fine sand. These deposits may display very thin bedding referred to as laminations. Lacustrine deposits are found interbedded with till and outwash within the buried valleys. Recent studies (Dumouchelle and de Roche, 1991) in the vicinity of Wright-Patterson Air Force Base (W.P.A.F.B.) have identified lacustrine deposits interbedded with outwash.

Kames and eskers are ice-contact features. They are composed of masses of sand and gravel with minor till which are deposited in depressions, holes, and tunnels within and underlying the ice. As the surrounding ice melts, a mound of sediment remains behind. Typically, these deposits may collapse, flow, or merge together as melting continues. These deposits commonly display high angle, distorted or tilted bedding, faults, folds, and signs of collapse.

Numerous kame features are found within central Montgomery County in the vicinity of Dayton. These features coalesce and appear to overlap with the Farmersville Moraine in this area. In this area, the Farmersville Moraine contains appreciably more sand and gravel than what is commonly found elsewhere in southwestern Ohio. This area has been referred to as a "kame moraine" due to the close association of the end moraine and kames in this area. Foerste (1915) suggested that some of the more elongated features could be eskers. Eskers are graded, elongated, narrow, twisting sand and gravel deposits associated with tunnels underlying the ice sheets. Norris et al. (1948) proposed that the kames were deposited during the ablation of the ice sheet and the formation of the moraine. Pair (1994) and Clinch (1994) suggest that the thickness of both the sand and gravel and till in the area infers actively-moving ice accounted for a substantial amount of the deposition.

Meltwater derived from the Farmersville Moraine and kame moraine probably contributed outwash to the nearby Great Miami River Valley. Additional outwash was later contributed by melting ice sheets further to the north.

In many areas within the buried valley underlying the modern Great Miami River, a fairly persistent layer of till separates an upper and lower outwash deposit. The ice apparently readvanced within the valley between the two periods of outwash deposition. Both of these outwash layers serve as aquifers. Historically, this "two-layer" aquifer has been the subject of detailed study by Norris et al. (1948), Norris (1959), Walton and Scudder (1960), and Norris and Spieker (1966).

Schmidt (1986) reported finding some moderately persistent sand and gravel layers that serve as aquifers within the Camden Moraine in extreme southwestern Montgomery County. These deposits do not appear to be associated with any major kames or outwash deposits locally.

Bedrock Geology

Much of Montgomery County lies on the wide, poorly defined crest of the Cincinnati Arch. The arch is a broad, low, uplifted ridge of rock tilted slightly to the northeast. Rocks along the crest of the arch dip to the northeast at approximately five feet per mile. Along the flanks of the arch in Montgomery County rocks dip less than one foot per mile (Norris et al., 1948).

Bedrock in Montgomery County consists of limestones, dolomites, and shales of the Ordovician and Silurian Systems. Silurian rocks crop out in the northwestern quarter of Montgomery County and in a series of outliers to the southwest of Dayton. Ordovician rocks crop out in the remainder of the county and in the deep buried valleys in the northwestern quarter of the county. The stratigraphy of these rocks varies somewhat across the county as shown in Table 9. The Lockport Dolomite lithology of the northern and western two-thirds of the county becomes the Cedarville, Springfield, and the Euphemia Formations in the southeastern portion of the county. Likewise, the sub-Lockport undifferentiated becomes the Massie, Laurel, Osgood, Dayton, and Brassfield Formations in southwest Montgomery County. Ordovician rocks also vary across the county. The well-defined individual Ordovician formations in the southern two-thirds of the county (Drakes, Whitewater, Liberty, etc.) become Undifferentiated Ordovician rocks in the northern third of the county.

Deposition of the sediments which eventually solidified into the bedrock of Montgomery County occurred in a warm sea which covered most of western Ohio during a portion of Ordovician and Silurian time. Shales result from the deposition of clay-rich sediments in relatively deep, quiet-water environments. The clay-rich sediments are derived from the erosion of terrigenous (dry land) rocks and the transport of these sediments to the sea by streams.

Limestones and dolomites, collectively termed carbonates, are the result of near shore sedimentation. Shells from various forms of marine life and the direct precipitation of carbonate from sea water are the principal components of these rocks.

Table 9. Generalized Bedrock Stratigraphy of Montgomery County (Shrake, 1994a,b; Swinford, 1994a,b,c,d,e,f,g,h,i; Swinford and Pavey, 1994a,b; Swinford and Shrake, 1994a,b; and Swinford and Slucher, 1994)

SYSTEM	SERIES	FORMATIONS	
		Northwestern two-thirds of county	*Southeastern third of county*
SILURIAN	Niagaran	Lockport	Cedarville Dolomite
			Springfield Dolomite
			Euphemia Dolomite
	?		
	Alexandrian	Sub Lockport	Massie Dolomite
			Laurel Dolomite
			Osgood Shale
			Dayton Limestone
			Brassfield Limestone
ORDOVICIAN	Cincinnatian	*Northern third of county*	*Southern two-thirds of county*
		Undifferentiated Ordovician	Drakes Formation
			Whitewater Formation
			Liberty Formation
			Waynesville Formation
			Arnheim Formation
			Grant Lake Formation
			Miamitown Formation
			Fairview Formation
			Kope Formation

The alternation of the clay and carbonate sediments, as described in Table 9, may be caused by any one of three factors: periodic fluctuation of sea level, periodic subsidence and uplift of the earth's crust, or storms which churn up sediments on the shallow sea bottom and subsequently deposit carbonate and clay-rich sediments differentially.

Hydrogeology

Aquifers in Montgomery County fall into two main types: sand and gravel, and bedrock. The highest-yielding aquifers are the thick sand and gravel deposits found in buried valleys underlying the Great Miami and Mad Rivers. Outwash deposits here consist of thick, highly permeable sand and gravel in good hydraulic contact with the overlying rivers. Wells tapping the outwash aquifer induce recharge from the rivers and generally yield over a thousand gallons per minute (Schmidt, 1986). Portions of the main buried valley well away from the large rivers, and some smaller tributary valleys, contain permeable sand and gravel aquifers which are not in contact with surface water bodies (i.e., rivers). The outwash aquifers at these locations are capable of yielding up to 500 gallons per minute (Schmidt, 1986).

Scattered at various locations across the county are lenses and thin layers of sand and gravel contained within glacial till. These lenses generally serve as ground water sources for small private wells and may yield up to 20 gallons per minute (Schmidt, 1986).

The most prolific bedrock aquifer consists of the Niagaran rocks found in the northwestern portion of the county. Wells penetrating this aquifer may yield up to 75 gallons per minute (Schmidt, 1986). Wells penetrating the Brassfield formation at locations scattered across the county can expect yields of 10 gallons per minute or less.

As a rule, the Ordovician formations are very poor aquifers. These rocks are typically shales, or limestones with high shale content, and have very low permeability. Wells drilled into Ordovician rocks typically yield three gallons per minute or less, generally from the upper few feet of the formation where fracturing has increased their permeability somewhat. Drilling deep into the Ordovician bedrock may yield salt water.

REFERENCES

Aller, L., T. Bennet, J.H. Lehr, R.J. Petty and G. Hackett, 1987. DRASTIC: A standardized system for evaluating ground water pollution potential using hydrogeologic settings. U.S. Environmental Protection Agency EPA/600/2-87-035, 622 pp.

CH2M Hill Inc., 1986. Miami well field study. Project No. L18852.A0. For the City of Dayton, Ohio. Volumes I, II, III, and I Appendix.

Clinch, J.M., 1991. Bedrock topography mapping of southwest Ohio: Procedures, results, and a few speculations on the Teays problem. Ohio Journal of Science, Vol. 91, No. 2, April Program Abstracts, p. 35.

________, 1994. Personal communication, HOKK/Q-Source.

Dames and Moore, 1971a. Hydrogeologic survey of ground water potential in southwest Ohio, Province III, Bear and Twin Creeks. Unpublished report for the Ohio Department of Natural Resources, 77 p.

________, 1971b. Hydrogeologic survey of ground water potential in southwest Ohio, Province XIII, Upper Great Miami River. Unpublished report for the Ohio Department of Natural Resources, 31 p.

________, 1971c. Hydrogeologic survey of ground water potential in southwest Ohio, Province III, Bear and Twin Creeks. Unpublished report for the Ohio Department of Natural Resources, 41 p.

________, 1972. Ground water for planning in southwest Ohio. Ohio Department of Natural Resources, Division of Water. Ohio Water Plan Inventory Report Number 23, 69 pp.

Davis, P.E., N. Lerch; L. Tornes, J. Steiger, N. Smech, H. Andrus, J. Trimmer, and G. Bottrell, 1976. Soil survey of Montgomery County, Ohio. United States Department of Agriculture, Soil Conservation Service.

Dumouchelle, D.H. and J. T. de Roche, 1991. Lithologic, natural-gamma, grain-size, and well-construction data for Wright-Patterson Air Force Base, Ohio. U.S. Geological Survey, Open-File Report 91-181, 94 pp.

Durrell, R.H., 1977. A recycled landscape. Quarterly of the Cincinnati Museum of Natural History, May, 1977, Vol. 14, no. 2, 9 pp.

Fenneman, N.M., 1938. Physiography of the eastern United States. New York, McGraw-Hill Publishing Co., 714 pp.

Foerste, A.F., 1915. Geology of Dayton and vicinity. Hollenbeck Press, Indianapolis, IN, 21 pp.

Freeze, R.A. and J. A. Cherry, 1979. Groundwater. Englewood Cliffs, New Jersey, Prentice-Hall Inc., 604 pp.

Geraghty & Miller, Inc., 1987. Mad River well field assessment. Prepared for the City of Dayton, Ohio.

Leow, J.A., 1984. Bedrock topography of Montgomery County. Ohio Department of Natural Resources, Division of Geological Survey, Unpublished, Draft Map.

Norris, S.E., 1959. Vertical leakage through till as a source of recharge to a buried-valley aquifer at Dayton, Ohio. Ohio Department of Natural Resources, Division of Water, Technical Report No. 2, 16 pp.

Norris, S.E., W.P Cross, and R.P. Goldthwait, 1948. The water resources of Montgomery County, Ohio. Ohio Department of Public Works, Bulletin 12, 83 pp.

Norris, S.E., and R.E. Fidler, 1973. Availability of water from limestone and dolomite aquifers in southwest Ohio and the relation of water quality to the regional flow system. U.S. Geological Survey Water-Resources Investigations 17-73, 42 pp.

Norris S.E. and A.M. Spieker, 1966. Ground-water resources of the Dayton area, Ohio. U.S. Department of the Interior, Geological Survey, Water-Supply Paper 1808, 167 p., 9 plates.

Norton, L.D., G.F. Hall, and R.P. Goldthwait, 1983. Pedologic evidence of two major pre-Illinoian glaciations near Cleves, Ohio. Ohio Journal of Science, Vol. 83, No. 4, pp 168-176.

Ohio Department of Development, 1991. Ohio population by race and governmental unit 1970-1980-1990. Prepared by Ohio Data Users Center.

Ohio Environmental Protection Agency, 1986. Ohio ground water protection and management strategy, 67 pp.

Ohio Department of Natural Resources, 1985. Principal streams and their drainage areas. Division of Water, 1 map.

Ohio Department of Natural Resources, no date. Pumping test, Valley View School project, near Germantown, Ohio, Montgomery County. Unpublished Report. 13 pp.

Pair, D., 1994. Personal communication, University of Dayton.

Pettyjohn, W. A. and R. Henning, 1979. Preliminary estimate of ground-water recharge rates, related stream flow and water quality in Ohio. Water Resources Center, The Ohio State University, 323 pp.

Plummer, P.M., 1971. Groundwater resources near Grayson, Miami County, Ohio. Unpublished Report, The Miami Conservancy District. 42 pp and appendix.

Schmidt, J.J., 1986. Ground water resources of Montgomery County. Ohio Department of Natural Resources, Division of Water, Columbus, 1 map.

Schalk, C.W., 1992. Ground-water levels and flow in the vicinity of Wright-Patterson Air Force Base, Ohio, October-December, 1987. U.S. Geological Survey Water-Resources Investigations Report 92-4022, map with text.

Shrake D.L., 1994a. Reconnaissance bedrock geology map of the Springboro quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5E2.

__________, 1994b. Reconnaissance bedrock geology map of the Waynesville quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5E1.

Spieker, A.M., 1968. Ground-water hydrology and geology of the lower Great Miami River valley, Ohio. U.S. Geological Survey Prof. Paper 605-A, 37 pp.

Struble, R.A., 1987. Sand and gravel resources of Montgomery County, Ohio. Ohio Department of Natural Resources, Division of Geological Survey, Report of Investigations, No. 135, 1 map.

Stout, W.E., K. Ver Steeg, and G.F. Lamb, 1943. Geology of water in Ohio. Ohio Department of Natural Resources, Division of Geological Survey, Bulletin 44, 694 pp.

Swinford, E.M., 1994a. Reconnaissance bedrock geology map of the Bellbrook quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5F1.

____________, 1994b. Reconnaissance bedrock geology map of the Brookville quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5G4.

____________, 1994c. Reconnaissance bedrock geology map of the Dayton North quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5G2.

____________, 1994d. Reconnaissance bedrock geology map of the Dayton South quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5F2.

____________, 1994e. Reconnaissance bedrock geology map of the Fairborn quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5G1.

_____________, 1994f. Reconnaissance bedrock geology map of the Miamisburg quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5F3.

____________, 1994g. Reconnaissance bedrock geology map of the Middletown quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5E4.

____________, 1994h. Reconnaissance bedrock geology map of the Tipp City quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5H2.

_____________, 1994i. Reconnaissance bedrock geology map of the Trotwood quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5G3.

____________, and R.R. Pavey, 1994a. Reconnaissance bedrock geology map of the Laura quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5H4.

___________, and __________, 1994b. Reconnaissance bedrock geology map of the New Carlisle quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5H1.

____________, and D.L. Shrake, 1994a. Reconnaissance bedrock geology map of the Franklin quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5E3.

____________, and __________, 1994b. Reconnaissance bedrock geology map of the West Milton quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5H3.

____________, and E.R. Slucher, 1994. Reconnaissance bedrock geology map of the Farmersville quadrangle. Ohio Department of Natural Resources, Division of Geological Survey Open-file map BG-B5F4.

U.S. Dept of Commerce, 1992. Monthly station normals of temperature, precipitation, and heating and cooling degree days, 1961-1990. National Oceanic and Atmospheric Administration, Climatography of the United States No. 81.

Walton, W.C. and G.D. Scudder, 1960. Ground-water resources of the valley-train deposits in the Fairborn area, Ohio. Ohio Department of Natural Resources, Division of Water, Technical Report No. 357 pp.

Wayne, W.W., 1952. Pleistocene evolution of the Ohio and Wabash valleys. Journal Geology, v. 60, no. 6, p. 575-585.

UNPUBLISHED DATA

Ohio Department of Natural Resources, Division of Soil and Water Conservation, Ohio Capability Analysis Program. Land use and land cover data.

Ohio Department of Natural Resources, Division of Water, Water Resources Section. Unpublished water well log reports for Montgomery County.

Ohio Department of Natural Resources, Division of Geological Survey. Unpublished Stratigraphic Sections

APPENDIX A

DESCRIPTION OF THE LOGIC IN FACTOR SELECTION

Depth to Water

Aquifers in Montgomery County range from unconfined to semi-confined to completely confined. The DRASTIC system recognizes only unconfined and confined aquifers; semi-confined aquifers, depending on the degree of confinement, must be rated as either confined or unconfined (Aller et al., 1987). In Montgomery County, only aquifers which were clearly confined, or were nearly confined, were rated as confined. The DRASTIC system dictates that the depth to water in confined aquifers must be defined as the depth to the top of the aquifer (Aller et al., 1987).

In Montgomery County, depth to water was evaluated primarily using information obtained from water well logs on file at the Ohio Department of Natural Resources, Division of Water and the piezometric surface maps contained in Norris and Spieker (1966). Additional information for specific areas was obtained from the following sources: Norris et al. (1948), Spieker (1968), and Dames and Moore (1971a, b, and c).

Depth to water in the buried valley aquifers ranged from less than 5 feet (DRASTIC rating of 9) in some areas near streams or rivers to 30 to 50 feet (5) in a few portions of aquifers well away from surface water bodies. In most parts of these aquifers, a range of 5 to 15 feet (9) predominates.

Special consideration was given to the buried valleys underlying Dayton. These aquifers are used extensively for public water supplies and industrial process water. The extensive exploitation of the buried valley aquifers has resulted in an artificial lowering of the water table. Because heavy pumping at any wellfield could stop at some point in the future, the depth to water in the buried valleys underlying Dayton was evaluated as the natural water table, unaffected by pumping.

Depth to water in the bedrock aquifers, both carbonate and shale, varies somewhat based on topography. In upland areas adjacent to valleys, the depth to water is often lower than in areas with less relief. Local variations in topography also play a role in depth to water. In the unconfined/semi-confined bedrock aquifers, depth to water ranges from a low of 5 to 15 feet (9) to a high of 30 to 50 feet (5).

Close proximity to streams in both the Alluvium over Glacial Till (7Ec) and Alluvium over Bedded Sedimentary Rock (7Ed) settings typically results in high water tables. Depths to water of 5 to 15 feet (9) are most common in these settings; however, some areas have depths of 15 to 30 feet (7).

Local changes in topography along with variations in the depths of water-bearing sand and gravel lenses are the primary factors affecting depth to water in the Sand and Gravel Interbedded in Glacial Till (7Af) setting. Depth to water ranged from 15 to 30 feet (7) to 30 to 50 feet (5).

Net Recharge

By definition, net recharge is the total amount of water from any source which reaches the water table (Aller et al., 1987).

Walton and Scudder (1960) calculated a recharge rate of 12 inches per year for a portion of a buried valley aquifer near Fairborn in Greene County, just east of the Greene/Montgomery County line. The hydrogeology of this aquifer is essentially the same as the buried valley aquifer underlying the Mad and Great Miami Rivers in Montgomery County. Norris and Spieker (1966), in their extensive report on the ground water resources of the Dayton area, also used an average recharge value of 12 inches per year for the main buried valley aquifers. For these reasons, the recharge to the large buried valleys was assigned a value of 10+ inches per year (9). Recharge to the tributary buried valley aquifers found throughout Montgomery County was based primarily on how closely these aquifers match the hydrogeologic conditions described by Walton and Scudder (1960). Factors such as vadose material, soil type, slope, and depth to water all have an impact on the amount of recharge reaching the water table. For example, steep slopes and clay-rich soils both increase the amount of run off and consequently decrease the amount of water available for recharge. Clay-rich soils have lower permeability which retards the rate of movement of water through the soil, allowing more time for direct evaporation of precipitation back into the atmosphere. Low permeability vadose zone materials and a deep depth to water allow more time for evapotranspiration losses. Estimates of recharge to the tributary buried valley aquifers are based on these factors taken in conjunction with the hydrogeologic conditions described by Walton and Scudder (1960) and the recharge values listed in Pettyjohn and Henning (1979). Actual values for recharge in the tributary valleys range from 10+ inches per year (9), where soil and vadose permeabilities are high and water table depths are shallow to 2 to 4 inches per year (3) where factors affecting recharge are not favorable.

An additional factor which was taken into consideration for all geologic settings in Montgomery County was the presence of large developed and paved areas. Developed and paved areas (e.g., parking lots and rooftops) direct a large percentage of precipitation into storm sewers. This precipitation is, therefore, not available for ground water recharge. USGS topographic maps delineate large developed and paved areas with a pink or purple tint. Net recharge in the tinted areas was diminished by one DRASTIC range for all settings in Montgomery County. For example, if an area overlying the buried valley aquifer would normally receive a recharge value of 10+ inches (9) but the area was highly developed and paved it would receive a recharge value of 7 to 10 inches (8).

Recharge to the Till Over Limestone (7AC) setting was estimated at 4 to 7 inches per year based on values published in Pettyjohn and Henning (1979), and on the hydrogeology of the areas where this setting is used. In the Thin Till Over Limestone (7GB) setting, the recharge was estimated at 7 to 10 inches (8) because there is only a thin layer of soil above the aquifer allowing rapid movement of precipitation to the water table.

In areas where sand and gravel lenses are the predominant aquifer (7Af and 7C), the net recharge was assigned a value of 4 to 7 inches (6) based on Pettyjohn and Henning (1979) and hydrogeological factors. Recharge to the Ordovician bedrock aquifers was estimated to be 2 to 4 inches per year (3) because of the relatively impermeable nature of the aquifers. The Alluvium over Sedementary Rocks (7Ec) and Alluvium over Till (7Ed) settings generally were assigned recharge values of 4 to 7 inches (6) because of the proximity of these settings to streams. Streams may provide additional recharge to aquifers during certain times of year.

Aquifer Media

Aquifer characteristics and geographic distributions were determined using information obtained from the following sources: well log records on file at the Ohio Department of Natural Resources Division of Water; Norris (1948); Norris and Spieker (1966); Spieker (1968); Dames & Moore (1971a, b, and c, and 1972); Schmidt (1986); Walton and Scudder (1960); Plummer (1971); Struble (1987); Geraghty and Miller (1987); CH2M Hill (1986); Leow (1984), and unpublished stratigraphic sections on file at the Ohio Department of Natural Resources, Division of Geological Survey.

The sand and gravel deposits in the main buried valley traversing Montgomery County were assigned an aquifer media rating of (9) because of the well-sorted nature of these deposits and the overall large grain size. Sand and gravel deposits in the tributary valleys received ratings of (4) to (9), depending on the grain size, sorting, clay content, etc. of these aquifers. Aquifers in the Sand and Gravel Interbedded in Till (7Af) setting received ratings of (4) to (6), depending on the nature of the deposits.

Bedrock aquifers received a wide variety of aquifer ratings. The Silurian carbonates received ratings of (6) or (4). The Niagaran rocks generally were rated as a (6) and the Brassfield was rated as a (4). The Niagaran rocks are generally considered a significantly better aquifer (with more pathways for ground water circulation) than the Brassfield formation.

The Ordovician bedrock is generally considered a poor aquifer. Because of the low permeability and high clay content of its rocks, it was assigned an aquifer media rating of (3).

Soil Media

Soil media were evaluated using the procedures described in Aller et al. (1987). The Soil Survey of Montgomery County (Davis et al., 1976) was the sole resource used in the actual evaluations. Soils were classified according to texture, permeability, and shrink-swell potential. Digitized maps of soil texture based on the DRASTIC (Aller et al., 1987) evaluation of each soil type were obtained from the Ohio Capability Analysis Program (OCAP).

Topography

Digitized slope maps were obtained for Montgomery County from the Ohio Capability Analysis Program (OCAP).

Impact of the Vadose Zone Media

Aquifer characteristics were determined using information obtained from the following sources: well log records on file at the Ohio Department of Natural Resources Division of Water; Norris (1948); Norris and Spieker (1966); Spieker (1968); Dames & Moore (1971 and 1972); Schmidt (1986); Walton and Scudder (1960); Plummer (1971); Struble (1987); Geraghty and Miller (1987); CH2M Hill (1986); and Davis et al. (1976).

Till was evaluated as the vadose zone material in most of the uplands, which are areas away from the main buried valleys. The vadose zone material was also till in some of the smaller buried valley areas, especially in the northwestern portion of the county.

The tills in Montgomery County tend to be rather impermeable and contain a significant clay portion. In addition, till contains a large percentage of locally derived material. Tills overlying the Ordovician shales have somewhat higher clay content (derived from the pulverization of the shale bedrock) than tills over the Silurian carbonate bedrock. In general, tills overlying an Ordovician bedrock aquifer were assigned a vadose rating of (3). Tills over the Silurian carbonate aquifer were rated as a (4). These ratings varied somewhat, depending on local conditions such as thickness, sand and gravel lenses and layers, weathering, etc., as described by available information. The till vadose zone in the Sand and Gravel Interbedded in Glacial Till (7Af) setting received ratings of (3) or (4), depending on local conditions.

Alluvium (silt and clay) was often the vadose zone material in the Alluvium Over Sedimentary Rocks (7Ec) setting and the Alluvium Over Glacial Till (7Ed) setting. Ratings were typically (4) in both settings.

At a few locations where the carbonate bedrock is near the surface, limestone was determined to be the vadose zone material. Because of its permeable nature and the lack of clay, limestone was given a rating of (6) as a vadose zone material.

Ordovician bedrock is the prime vadose zone material in the Thin Till Over Interbedded Limestone and Shale (7G) setting. This vadose zone material received a rating of (3) because of the impermeable nature of the rocks and their high clay content.

Vadose zone materials within the main buried valley and the significant tributary valleys are primarily sand and gravel; however, the clay and silt content varied somewhat from location to location. The main valley contained relatively clean sand and gravel vadose materials and generally received a rating of (8). Sand and gravel making up the vadose zone of the tributary valleys was less consistent, varying from a sand and gravel with significant silt clay (5) to a clean sand and gravel (8).

Hydraulic Conductivity

Hydraulic conductivity values and information useful for the estimation of hydraulic conductivity for the sand and gravel aquifer in the main buried valley and the major tributary valleys came from Norris and Spieker (1966), Plummer (1971), Spieker (1968), Walton and Scudder (1960), Dames and Moore (1971a, b, and c), CH2MHill (1986), and Geraghty and Miller (1987). Values for hydraulic conductivity ranged from 2000+ gpd/ft^2 (10) to 1000-2000 gpd/ft^2 (8) in the main buried valley and the major tributary buried valleys.

Data for determining hydraulic conductivity values for the smaller buried valleys and for sand and gravel aquifers outside buried valleys were derived or estimated from the above-mentioned references in conjunction with the Ground Water Resources Map for Montgomery County (Schmidt, 1986) and lithology and specific capacity data taken from Well Log and Drilling Reports on file at the Ohio Department of Natural Resources. Tables from Freeze and Cherry (1979) were also useful in estimating hydraulic conductivity in some areas. Hydraulic conductivity for these aquifers ranged from 1000-2000 gpd/ft^2 (8) to 100 to 300 gpd/ft^2 (2).

Bedrock hydraulic conductivity values were estimated based on yield data contained in Schmidt (1986) and on yield and specific capacity data from Well Log and Drilling Reports on file at the Ohio Department of Natural Resources. Additional data relating to the hydraulic conductivity of these aquifers came from Norris et al. (1948), Norris and Fidler (1973), Ohio Department of Natural Resources, Division of Water (no date), and Schmidt (1986). Based on available data, Silurian carbonates other than the Brassfield formation received a rating of 100 to 300 gpd/ft^2 (2). The Brassfield was judged to have a lower hydraulic conductivity than the upper Silurian carbonates and was given a value of 1-100 gpd/ft^2 (1). Because of their extremely poor water-yielding properties, the Ordovician bedrock aquifers were believed to have a hydraulic conductivity of 1-100 gpd/ft^2 (1).

APPENDIX B

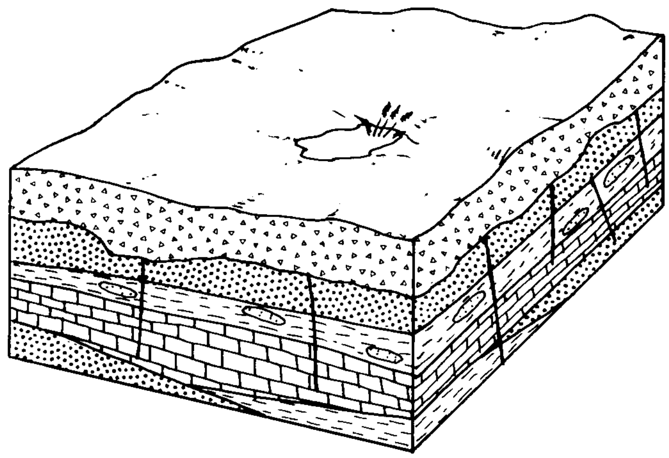
DESCRIPTION OF HYDROGEOLOGIC SETTINGS AND CHARTS

Ground water pollution potential mapping in Montgomery County resulted in the identification of twelve hydrogeologic settings within the Glaciated Central Region. The list of these settings, the range of pollution potential index calculations, and the number of index calculations for each setting are provided in Table 10. Computed pollution potential indexes for Montgomery County range from 41 to 206.

The following information provides a description of each hydrogeologic setting identified in the county, a block diagram illustrating the characteristics of the setting, and a listing of the charts for each unique combination of pollution potential indexes calculated for each setting. The charts provide information on how the ground water pollution potential index was derived and are a quick and easy reference for the accompanying ground water pollution potential map. A complete discussion of the rating and evaluation of each factor in the hydrogeologic settings is provided in Appendix A, Description of the Logic in Factor Selection.

Table10. Hydrogeologic Settings Mapped in Montgomery County, Ohio.

Hydrogeologic Settings	Range of GWPP Indexes	Number of Index Calculations
7Aa - Glacial Till Over Bedded Sedimentary Rock	41 -133	47
7Ac - Glacial Till Over Solution Limestone	93 - 141	40
7Af - Sand & Gravel Interbedded in Glacial Till	85 - 135	30
7Ba - Outwash	149 - 153	2
7Bb - Outwash Over Bedded Sedimentary Rock	114	1
7Bd - Outwash Over Glacial Till	127 - 136	3
7C - Moraine	97 - 119	7
7D - Buried Valley	96 - 206	125
7Ec - Alluvium Over Sedimentary Rock	97 - 138	14
7Ed - Alluvium Over Glacial Till	112 - 151	10
7G - Thin Till Over Interbedded Limestones/Shales	75 - 103	7
7Gb - Thin Till Over Limestone	120 - 147	9



7Aa Till Over Bedded Sedimentary Rock

This hydrogeologic setting is characterized by low topography and flat-lying, fractured sedimentary rock. The underlying bedrock consists of thick sequences of Ordovician shale interbedded with thin layers of limestone. These sedimentary rock units are covered by varying thicknesses of glacial till. The till layer consists of unsorted deposits of interbedded clay, silt, and sand. Although ground water occurs in both the glacial deposits and the fractured bedrock, bedrock is usually the principal aquifer. The main source of recharge to the bedrock aquifer is from the overlying glacial till. This recharge is low to moderate due to the impermeable nature of the till and soils. Depth to water varies depending on glacial till thickness, but is usually between 15-30 feet.

GWPP index values for the hydrogeologic setting till over bedded sedimentary rock range from 41 to 133 with the total number of GWPP index calculations equaling 47.

Setting: 7Aa1		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	90

Setting: 7Aa2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	100

Setting: 7Aa3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	99

Setting: 7Aa4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	100+	5	1	5
Net Recharge	0-2	4	1	4
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	confined	5	1	5
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	42

Setting: 7Aa5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	89

Setting: 7Aa6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	100+	5	1	5
Net Recharge	0-2	4	1	4
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	confined	5	1	5
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	41

Setting: 7Aa7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	87

Setting: 7Aa8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	97

Setting: 7Aa9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	85

Setting: 7Aa10		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	0-2	4	1	4
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	18+	1	1	1
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	73

Setting: 7Aa11		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	100+	5	1	5
Net Recharge	0-2	4	1	4
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Confined	5	1	5
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	42

Setting: 7Aa12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	0-2	4	1	4
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	18+	1	1	1
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	83

Setting: 7Aa13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Loam	2	5	10
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	99

Setting: 7Aa14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Loam	2	5	10
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	103

Setting: 7Aa15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Thin / Absent	2	10	20
Topography	12-18	1	3	3
Impact of Vadose Zone	Limestone / Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	97

Setting: 7Aa16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	96

Setting: 7Aa17		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone / Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	102

Setting: 7Aa18		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	101

Setting: 7Aa19		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Thin or Absent	2	10	20
Topography	6-12	1	5	5
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	109

Setting: 7Aa20		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	133

Setting: 7Aa21		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	18+	1	1	1
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	91

Setting: 7Aa22		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	106

Setting: 7Aa23		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	95

Setting: 7Aa24		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	18+	1	1	1
Impact of Vadose Zone	Limestone / Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	81

Setting: 7Aa25		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Thin / Absent	2	10	20
Topography	18+	1	1	1
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	95

Setting: 7Aa26		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	12-18	1	3	3
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	85

Setting: 7Aa27		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Loam	2	5	10
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	98

Setting: 7Aa28		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	94

Setting: 7Aa29		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	90

Setting: 7Aa30		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	91

Setting: 7Aa31		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	94

Setting: 7Aa32		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	102

Setting: 7Aa33		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	97

Setting: 7Aa34		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	12-18	1	3	3
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	83

Setting: 7Aa35		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	84

Setting: 7Aa36		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	85

Setting: 7Aa37		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	82

Setting: 7Aa38		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	77

Setting: 7Aa39		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	87

Setting: 7Aa40		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	18+	1	1	1
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	83

Setting: 7Aa41		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	101

Setting: 7Aa42		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	80

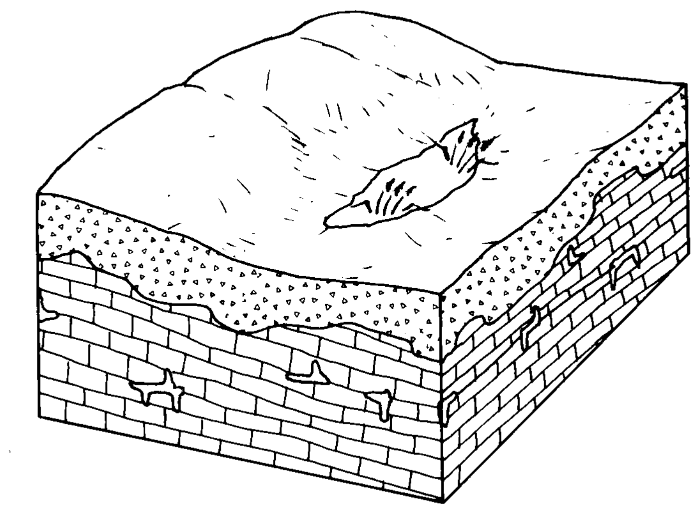
Setting: 7Aa43		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	79

Setting: 7Aa44		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	103

Setting: 7Aa45		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	95

Setting: 7Aa46		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gavel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	105

Setting: 7Aa47		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Shrink Swell Clay	2	7	14
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel	5	6	30
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	112



7Ac Glacial Till Over Solution Limestone

This hydrogeologic setting is characterized by low topography and limestone bedrock covered by varying thicknesses of glacial till. The till consists primarily of clay with varying amounts of silt, sand, and gravel. Sand and gravel layers within the till are extremely thin or nonexistent. The limestone bedrock serves as the aquifer in this setting. Ground water occurs in fractures and solution channels within the formation. The limestone is in direct hydraulic connection with the glacial till and precipitation infiltrating through the till serves as a source of recharge for the underlying limestone. Depth to water is extremely variable depending in part on the thickness of the glacial till, but is usually moderately deep. Soils are typically clay loam.

GWPP index values for the hydrogeologic setting glacial till over solution limestone range from 93 to 141 with the total number of GWPP index calculations equaling 40.

Setting: 7Ac1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	129

Setting: 7Ac2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	141

Setting: 7Ac3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	140

Setting: 7Ac4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	128

Setting: 7Ac5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	119

Setting: 7Ac6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	118

Setting: 7Ac7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	120

Setting: 7Ac8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	110

Setting: 7Ac9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	109

Setting: 7Ac10		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	131

Setting: 7Ac11		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	123

Setting: 7Ac12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	125

Setting: 7Ac13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	115

Setting: 7Ac14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	134

Setting: 7Ac15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	102

Setting: 7Ac16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	100

Setting: 7Ac17		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	112

Setting: 7Ac18		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	4	16
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	114

Setting: 7Ac19		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	111

Setting: 7Ac20		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Thin or Absent	2	10	20
Topography	0-6	1	10	10
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	124

Setting: 7Ac21		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	125

Setting: 7Ac22		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	100

Setting: 7Ac23		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	107

Setting: 7Ac24		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	123

Setting: 7Ac25		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	97

Setting: 7Ac26		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	98

Setting: 7Ac27		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	106

Setting: 7Ac28		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	107

Setting: 7Ac29		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	119

Setting: 7Ac30		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	116

Setting: 7Ac31		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	117

Setting: 7Ac32		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	108

Setting: 7Ac33		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	107

Setting: 7Ac34		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	136

Setting: 7Ac35		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	127

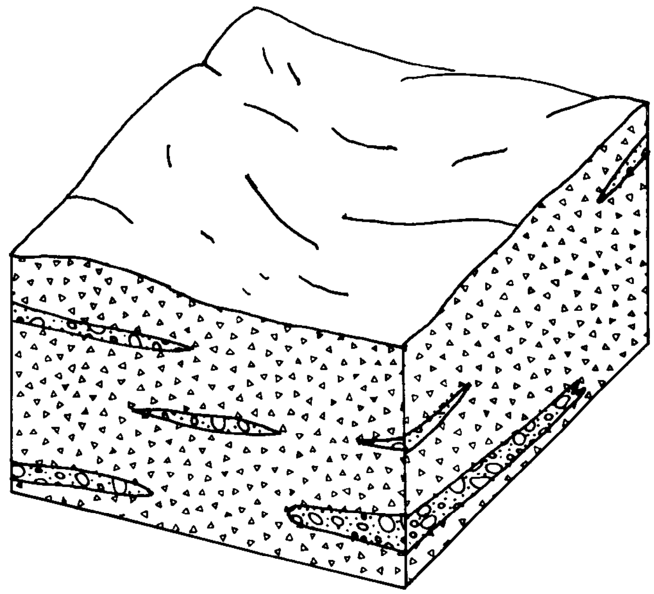
Setting: 7Ac36		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	110

Setting: 7Ac37		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	3	12
Aquifer Media	Limestone	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	93

Setting: 7Ac38		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Loam	2	5	10
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	132

Setting: 7Ac39		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	130

Setting: 7Ac40		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	121



7Af Sand and Gravel Interbedded in Glacial Till

This hydrogeologic setting is characterized by low to moderate relief and sand and gravel deposits interbedded in glacial till. The till is composed primarily of clay with varying amounts of unsorted silt, sand, and gravel. The sand and gravel may be relatively thin and discontinuous, lens-shaped bodies, or thick layers which cover a large area. The thick units are usually confined to common horizons within the till. Ground water occurs in both the till and the sand and gravel; however, the sand and gravel serves as the principal aquifer. Recharge to the sand and gravel is primarily due to infiltration of precipitation through the till. Depth to water is highly variable, but averages around 30 feet. Soils are typically described as clay loams.

GWPP index values for the hydrogeologic setting sand and gravel interbedded in glacial till range from 85 to 135 with the total number of GWPP index calculations equaling 30.

Setting: 7Af1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	108

Setting: 7Af2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Silt and Clay	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP		107

Setting: 7Af3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	3	15
Hydraulic Conductivity	100-300	3	4	12
		GWPP	INDEX	120

Setting: 7Af4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Silt and Clay	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	119

Setting: 7Af5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Silt and Clay	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	103

Setting: 7Af6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	96

Setting: 7Af7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Loam	2	5	10
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	128

Setting: 7Af8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	124

Setting: 7Af9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	133

Setting: 7Af10		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	12-18	1	3	3
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	127

Setting: 7Af11		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	135

Setting: 7Af12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	3	6
Topography	2-6	1	5	5
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	4	12
		GWPP	INDEX	120

Setting: 7Af13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	125

Setting: 7Af14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	133

Setting: 7Af15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	2	6
		GWPP	INDEX	122

Setting: 7Af16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	123

Setting: 7Af17		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	112

Setting: 7Af18		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	95

Setting: 7Af19		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	109

Setting: 7Af20		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	97

Setting: 7Af21		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	93

Setting: 7Af22		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	92

Setting: 7Af23		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	91

Setting: 7Af24		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	101

Setting: 7Af25		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	107

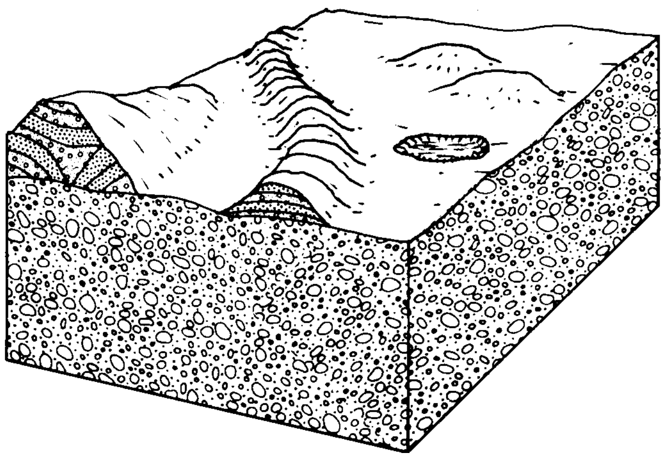
Setting: 7Af26		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	114

Setting: 7Af27		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	109

Setting: 7Af28		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	0-2	4	1	4
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	12-18	1	3	3
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	85

Setting: 7Af29		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-6	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	120

Setting: 7Af30		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-6	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	122



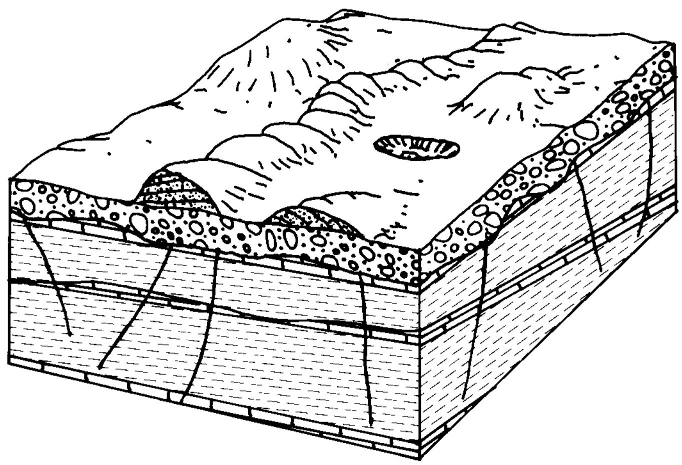
7Ba Outwash

This hydrogeologic setting is characterized by moderate topography and varying thicknesses of outwash. The outwash consists of water-washed deposits of sand and gravel which serve as the principal aquifer. Soils are permeable and recharge to the sand and gravel is relatively high. The outwash also serves as a source of recharge to the underlying bedrock.

GWPP index values for the hydrogeologic setting outwash range from 149 to 153 with the total number of GWPP index calculations equaling 2.

Setting: 7Ba2			**GENERAL**	
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	153

Setting: 7Ba3			**GENERAL**	
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Sand	2	9	18
Topography	6-12	1	5	5
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	149

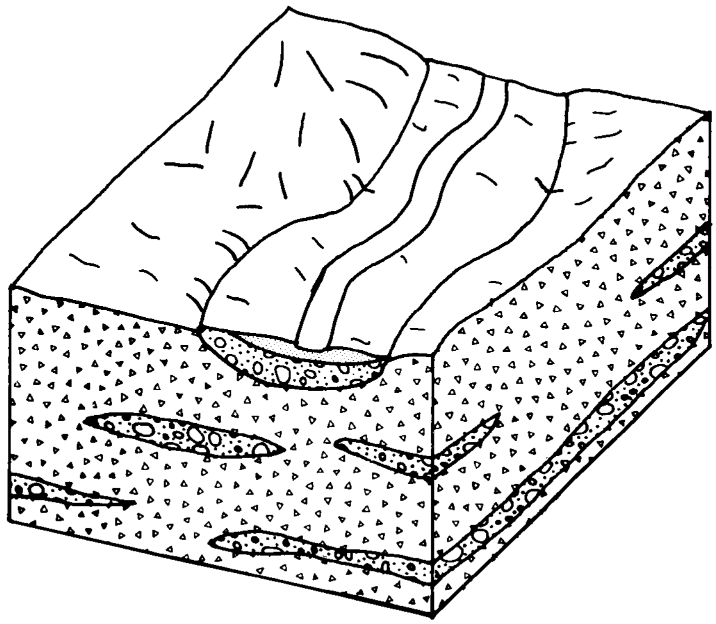


7Bb Outwash Over Bedded Sedimentary Rock

This setting is characterized by sedimentary rocks consisting of interbedded limestone and shales covered by outwash deposits. The outwash of this setting consists primarily of sand and gravel occasionally containing interbedded deposits of till or lacustrine clays. Ground water is obtained from the bedrock. Infiltration of precipitation serves as the primary source of recharge. Recharge is moderate.

The GWPP index value for the hydrogeologic setting outwash over bedded sedimentary rock is 114 with the total number of GWPP index calculations equaling 1.

Setting: 7Bb1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Sand	2	9	18
Topography	6-12	1	5	5
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	114



7Bd Outwash Over Glacial Till

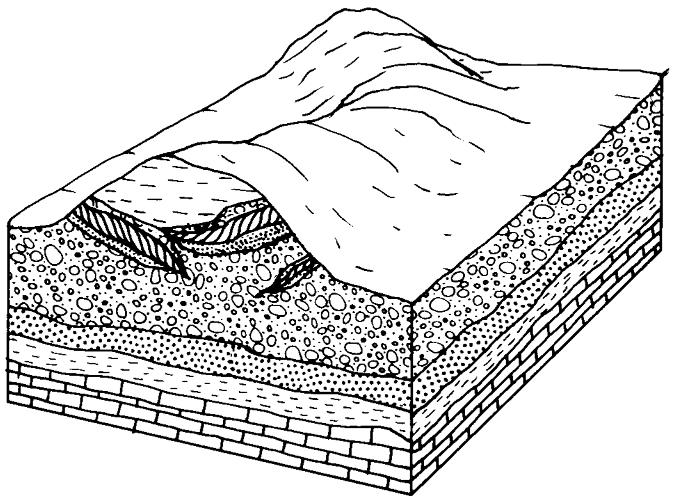
This hydrogeologic setting is characterized by low topography and varying thicknesses of outwash sand and gravel deposited over glacial till. Streams fed by water from melting ice cut channels in the till and left behind relatively clean sand and gravel deposits. Present-day streams maybe flowing within these channels. A thin layer of alluvium may overlie these deposits at some locations. Where the outwash is thick, drilled wells may yield several hundred gallons per minute. Surficial deposits are usually sand, gravel, or sandy loam. Water levels are shallow in depth.

GWPP index values for the hydrogeologic setting outwash over glacial till range from 127 to 136 with the total number of GWPP index calculations equaling 3.

Setting: 7Bd1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	131

Setting: 7Bd2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	136

Setting: 7Bd3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Sand	2	9	18
Topography	6-12	1	5	5
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	127



7C Moraine

This hydrogeologic setting is characterized by hilly to moderately steep topography with varying thicknesses of glacial deposits overlying flat-lying sedimentary rocks. Moraines are typically mounds or ridges of glacial till which were deposited along the margin of a stagnant or retreating glacier. Depth to water varies, ranging from 15 to 75 feet; this is due to varying till thickness. Ground water recharge is moderate to poor because of impermeable fines. Soils are clay loam or loam.

GWPP index values for the hydrogeologic setting moraine range from 97 to 119 with the total number of GWPP index calculations equaling 7.

Setting: 7C1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	119

Setting: 7C2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	106

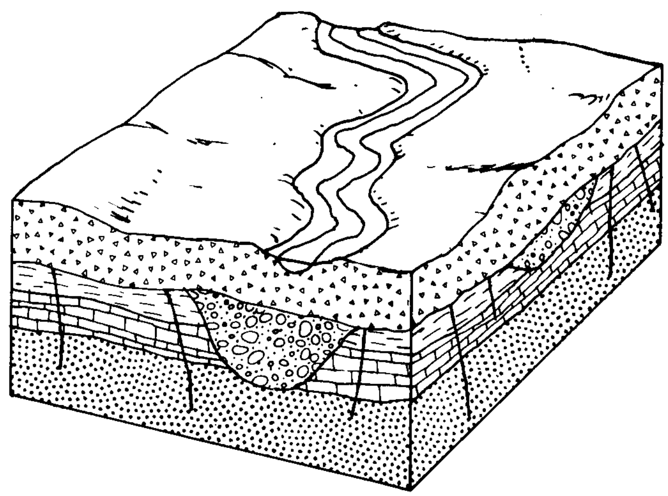
Setting: 7C3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	100

Setting: 7C4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	101

Setting: 7C5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Loam	2	5	10
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	6	30
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	113

Setting: 7C6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	98

Setting: 7C7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	97



7D Buried Valley

This hydrogeologic setting is characterized by thick layers of sand and gravel that have been deposited in a former topographic low (usually a pre-glacial river valley) by glacial meltwaters. These deposits are capable of yielding large quantitites of ground water. The deposits may or may not underlie a present day river and may or may not be in direct hydraulic connection with a stream. Glacial till or recent alluvium often overlies the buried valley. The deposits are several times more permeable than the surrounding bedrock. Recharge to the sand and gravel is moderate to high and water levels are commonly relatively shallow although in some areas they may be quite variable.

GWPP index values for the hydrogeologic setting buried valley range from 96 to 206 with the total number of GWPP index calculations equaling 125.

Setting: 7D1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	119

Setting: 7D2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	178

Setting: 7D3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	131

Setting: 7D4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	124

Setting: 7D5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	132

Setting: 7D6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	133

Setting: 7D7		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	142

Setting: 7D8		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	143

Setting: 7D9		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	112

Setting: 7D10		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	160

Setting: 7D11		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	188

Setting: 7D12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	122

Setting: 7D13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	18+	1	1	1
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	104

Setting: 7D14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	158

Setting: 7D15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	125

Setting: 7D16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	108

Setting: 7D17		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	107

Setting: 7D18		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	120

Setting: 7D19		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	119

Setting: 7D20		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	144

Setting: 7D21		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	142

Setting: 7D22		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Loam	2	5	10
Topography	6-12	1	5	5
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	122

Setting: 7D23		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	96

Setting: 7D24		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	118

Setting: 7D25		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	5	15
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	139

Setting: 7D26		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	128

Setting: 7D27		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	127

Setting: 7D28		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	155

Setting: 7D29		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	123

Setting: 7D30		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	122

Setting: 7D31		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	170

Setting: 7D32		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	133

Setting: 7D33		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	142

Setting: 7D34		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Loam	2	5	10
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	141

Setting: 7D35		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	175

Setting: 7D36		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	132

Setting: 7D37			**GENERAL**	
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	165

Setting: 7D38			**GENERAL**	
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	169

Setting: 7D39			**GENERAL**	
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	155

Setting: 7D40			**GENERAL**	
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Clay Loam	2	3	6
Topography	18+	1	1	1
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	99

Setting: 7D41			**GENERAL**	
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	115

Setting: 7D42		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	12-18	1	3	3
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	136

Setting: 7D43		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	177

Setting: 7D44		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Gravel	2	10	20
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	190

Setting: 7D45		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Gravel	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	184

Setting: 7D46		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	184

Setting: 7D47		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	182

Setting: 7D48		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	192

Setting: 7D49		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	139

Setting: 7D50		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	148

Setting: 7D51		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	139

Setting: 7D52				**GENERAL**
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	151

Setting: 7D53				**GENERAL**
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	153

Setting: 7D54				**GENERAL**
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	160

Setting: 7D55				**GENERAL**
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	158

Setting: 7D56				**GENERAL**
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	1000-2000	3	6	18
		GWPP	INDEX	138

Setting: 7D57		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	18+	1	1	1
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	130

Setting: 7D58		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	141

Setting: 7D59		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	145

Setting: 7D60		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	128

Setting: 7D61		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	143

Setting: 7D62		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	129

Setting: 7D63		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	131

Setting: 7D64		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	187

Setting: 7D65		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sandy Loam	2	6	12
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	191

Setting: 7D66		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	197

Setting: 7D67		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	187

Setting: 7D68		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	149

Setting: 7D69		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	144

Setting: 7D70		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	146

Setting: 7D71		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	178

Setting: 7D72		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	158

Setting: 7D73		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	169

Setting: 7D74		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	6	30
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	156

Setting: 7D75		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	129

Setting: 7D76		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	129

Setting: 7D77		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	139

Setting: 7D78		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	132

Setting: 7D79		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	126

Setting: 7D80		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	125

Setting: 7D81		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	135

Setting: 7D82		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	133

Setting: 7D83		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	189

Setting: 7D84		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	179

Setting: 7D85		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	180

Setting: 7D86		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	180

Setting: 7D87		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Gravel	2	10	20
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	194

Setting: 7D88		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	176

Setting: 7D89		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	168

Setting: 7D90		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	113

Setting: 7D91		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	150

Setting: 7D92		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	148

Setting: 7D93		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	130

Setting: 7D94		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	143

Setting: 7D95		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	175

Setting: 7D96		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	182

Setting: 7D97		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	0-5	5	10	50
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	183

Setting: 7D98		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	0-5	5	10	50
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	187

Setting: 7D99		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	177

Setting: 7D100		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	0-5	5	10	50
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	201

Setting: 7D101		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	196

Setting: 7D102		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	151

Setting: 7D103		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	201

Setting: 7D104		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	187

Setting: 7D105		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Sand	2	9	18
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	168

Setting: 7D106		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	121

Setting: 7D107		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	138

Setting: 7D108		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	206

Setting: 7D109		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	202

Setting: 7D110		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	192

Setting: 7D111		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	196

Setting: 7D112		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	192

Setting: 7D113		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	123

Setting: 7D114		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	168

Setting: 7D115		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	178

Setting: 7D116		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	164

Setting: 7D117		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sandy Loam	2	6	12
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	200

Setting: 7D118		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	7	35
Net Recharge	10+	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	164

Setting: 7D119		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Sand	2	9	18
Topography	18+	1	1	1
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	160

Setting: 7D120		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	5	25
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	167

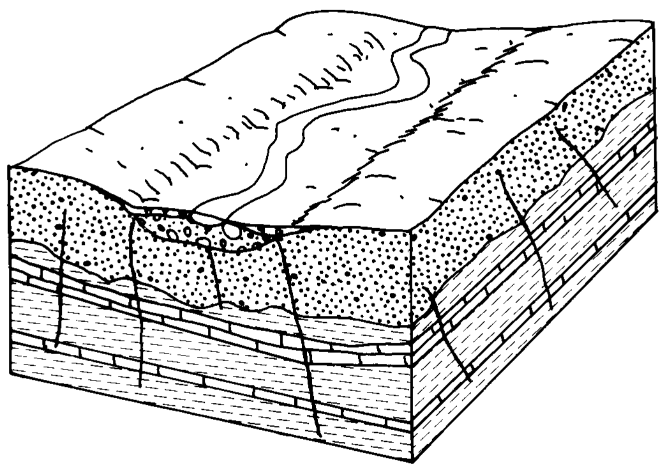
Setting: 7D121		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel	5	8	40
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	186

Setting: 7D122		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	10+	4	9	36
Aquifer Media	Sand and Gravel	3	8	24
Soil Media	Gravel	2	10	20
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	184

Setting: 7D123		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP	INDEX	175

Setting: 7D124		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Sand and Gravel	3	9	27
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	2	2
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	7	35
Hydraulic Conductivity	2000+	3	10	30
		GWPP		167

Setting: 7D125		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	˚4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silty Loam	2	4	8
Topography	˚6-12	1	5	5
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP		126



7Ec Alluvium Over Sedimentary Rock

This hydrogeologic setting is characterized by low relief with thin to moderate thicknesses of modern, stream-deposited alluvium. The alluvium is composed of silt, sand, gravel, and clay. Depth to water is shallow, and the stream is usually in hydraulic contact with the alluvial deposits. The alluvial deposits are underlain by limestone and shale. These rocks are described in settings 7Ac and 7G. Usually the upper, weathered portion of the bedrock serves as the principal aquifer in this setting. The alluvial deposits may serve as a source of recharge to the bedrock. Soils are variable.

GWPP index values for the hydrogeologic setting alluvium over sedimentary rock range from 97 to 138 with the total number of GWPP index calculations equaling 14.

Setting: 7Ec1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	129

Setting: 7Ec2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	133

Setting: 7Ec3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	124

Setting: 7Ec4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Shale and Limestone	3	4	12
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	124

Setting: 7Ec5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	138

Setting: 7Ec6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	134

Setting: 7Ec7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	97

Setting: 7Ec8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	134

Setting: 7Ec9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Sand	2	9	18
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	119

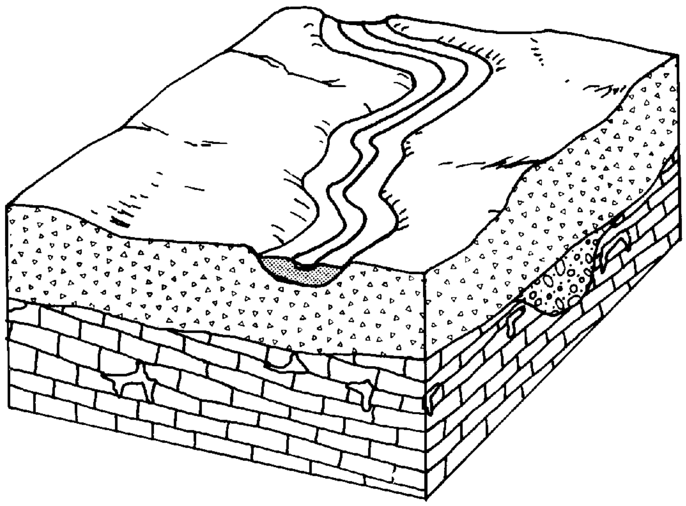
Setting: 7Ec10		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	94

Setting: 7Ec11		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	114

Setting: 7Ec12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	121

Setting: 7Ec13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	112

Setting: 7Ec14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	104



7Ed Alluvium Over Glacial Till

This hydrogeologic setting is characterized by low topography with surficial deposits of present-day, stream-deposited alluvium, confined to valley areas. The alluvium is composed of silt, sand, gravel, and clay that is deposited directly over the glacial till. Sand and gravel deposits serve as the aquifer in this hydrogeologic setting. Depth to water is typically shallow and the overlying stream is usually in hydraulic contact with the aquifer material. The underlying till is described in setting 7Af.

GWPP index values for the hydrogeologic setting alluvium over glacial till range from 112 to 151 with the total number of GWPP index calculations equaling 10.

Setting: 7Ed1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	127

Setting: 7Ed2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Loam	2	5	10
Topography	6-12	1	5	5
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	122

Setting: 7Ed3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	144

Setting: 7Ed4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	142

Setting: 7Ed5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	112

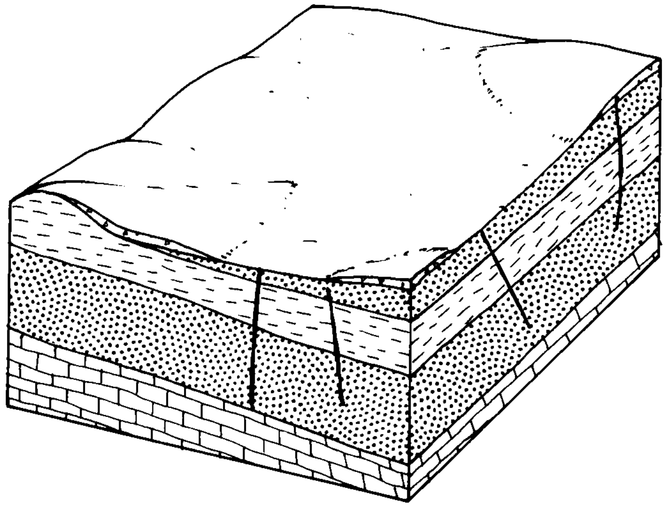
Setting: 7Ed6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	700-1000	3	6	18
		GWPP	INDEX	151

Setting: 7Ed7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	125

Setting: 7Ed8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Sand and Gravel w/ Silt and Clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	132

Setting: 7Ed9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	127

Setting: 7Ed10		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7	4	6	24
Aquifer Media	Sand and Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Silt and Clay	5	4	20
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	135



<u>7G Thin Till Over Interbedded Limestones/Shales</u>

This hydrogeologic setting is characterized by moderate to steep relief with thin deposits of glacial till overlying interbedded layers of limestone and shale. The till and soil are usually very thin or absent in areas of steep relief. The till consists of clay with little, if any, sand and gravel and does not serve as a source of water. Till thicknesses are usually less than five feet for this setting. The till is typically weathered and fractured. Small supplies of ground water are obtained from the upper weathered portion of the bedrock or from the intersection of fractures and bedding planes. Recharge is moderate. Depth to water is variable. This setting is similar to the Thin Till Over Limestone (7Gb) setting except for the underlying bedrock.

GWPP index values for the hydrogeologic setting thin till over interbedded limestones/shales range from 75 to 103 with the total number of GWPP index calculations equaling 7.

Setting: 7G1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	6-12	1	5	5
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	0-100	3	1	3
		GWPP	INDEX	75

Setting: 7G2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Thin or absent	2	10	20
Topography	12-18	1	3	3
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	0-100	3	1	3
		GWPP	INDEX	87

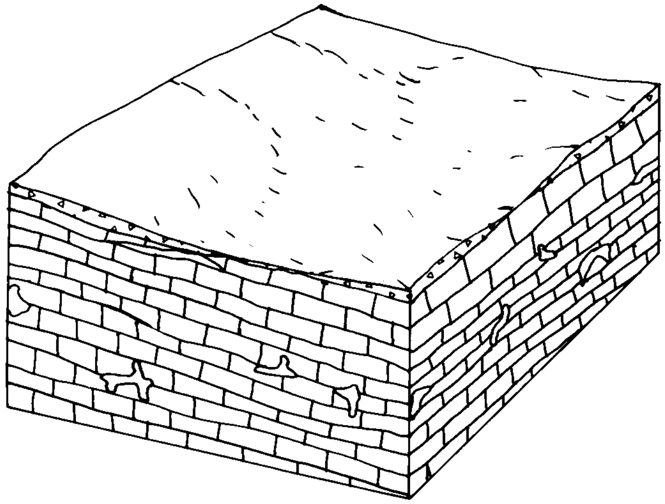
Setting: 7G3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	101

Setting: 7G4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Shale and Limestone	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	89

Setting: 7G5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Till	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	79

Setting: 7G6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Silt Loam	2	4	8
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	91

Setting: 7G7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	2-4	4	3	12
Aquifer Media	Limestone and Shale	3	3	9
Soil Media	Thin or Absent	2	10	20
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone and Shale	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	103



7Gb Thin Till Over Limestone

This hydrogeologic setting is characterized by low relief with thin deposits of glacial till overlying limestone bedrock. The till and soil are usually thin to absent in areas of steep relief. The till consists of clay with little, if any, sand and gravel and does not serve as a source of water. Till thicknesses are usually less than five feet for this setting. Ground water is obtained from the limestone bedrock. Recharge is moderate to high. Depth to water is variable. This setting is similar to the Thin Till Over Bedded Sedimentary Rock (7G) settin, except for the underlying bedrock.

GWPP index values for the hydrogeologic setting thin till over limestone range from 120 to 147 with the total number of GWPP index calculations equaling 9.

Setting: 7Gb1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	137

Setting: 7Gb2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	137

Setting: 7Gb3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	7-10	4	7	28
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	123

Setting: 7Gb4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	6	18
Soil Media	Shrink Swell Clay	2	7	14
Topography	0-2	1	10	10
Impact of Vadose Zone	Till	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	145

Setting: 7Gb5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	147

Setting: 7Gb6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	136

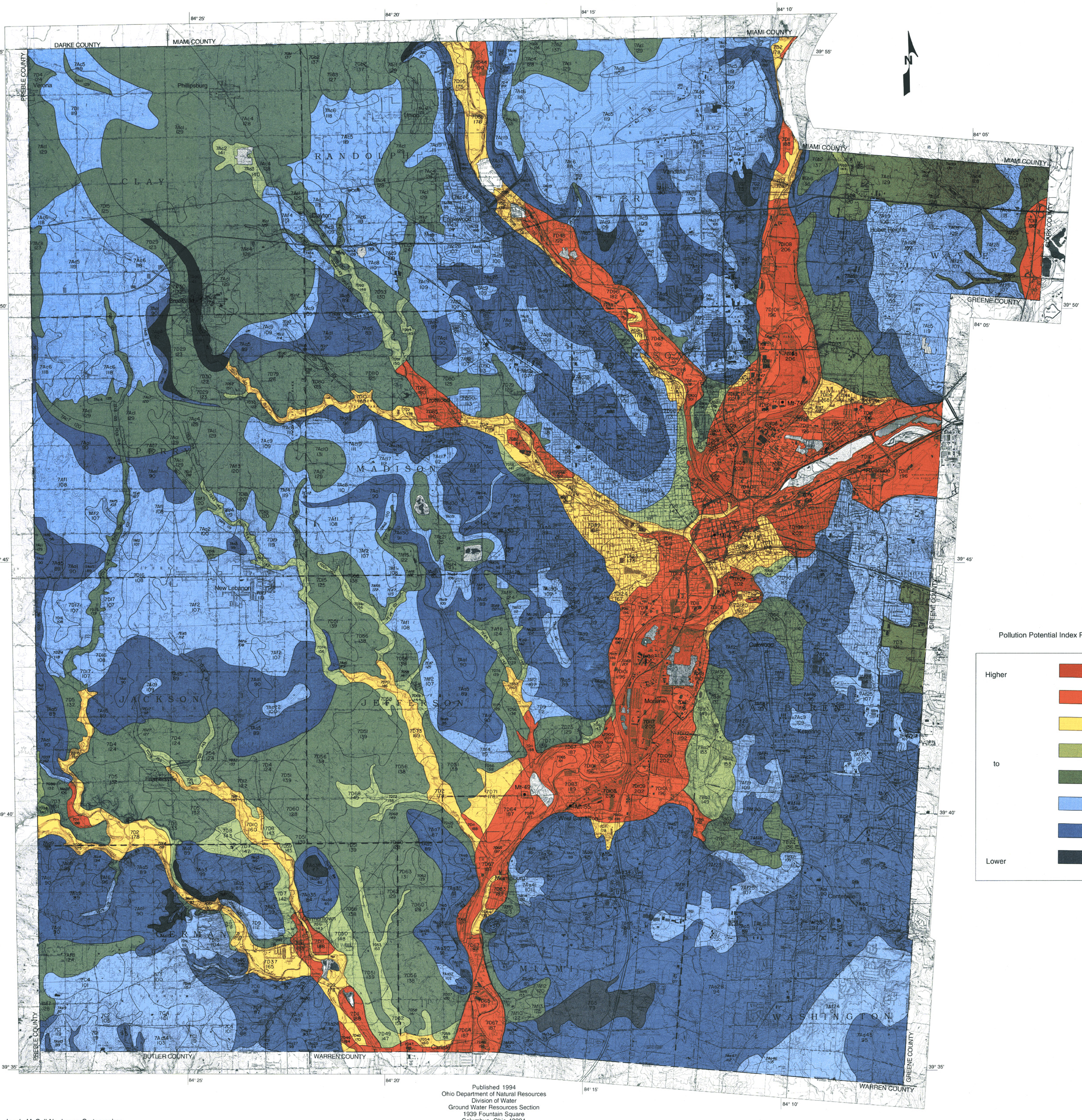
Setting: 7Gb7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50	5	5	25
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	126

Setting: 7Gb8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	4	12
Soil Media	Silt Loam	2	4	8
Topography	0-2	1	10	10
Impact of Vadose Zone	Limestone	5	4	20
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	120

Setting: 7Gb9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	7-10	4	8	32
Aquifer Media	Limestone	3	6	18
Soil Media	Shrink Swell Clay	2	7	14
Topography	2-6	1	9	9
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	144

Ground Water Pollution Potential of MONTGOMERY COUNTY

by
Michael Hallfrisch
and
Michael P. Angle



Miles

Kilometers

CONTOUR INTERVAL 10 FEET

County Line

Township Line

Incorporated City Limit

Description of Map Symbols

Hydrogeologic Region — Hydrogeologic Setting

7Ad6
98 — Relative Pollution Potential

Observation Well Site *

Gravel Pit / Quarry

*Observation well sites indicate the location of wells used to collect ground water level information. These wells are part of the state observation well network. Hydrographs of the water levels recorded in these and other State observation wells can be obtained through ODNR-Division of Water.

Pollution Potential Index Range

Higher	200+
	180 - 199
	160 - 179
to	140 - 159
	120 - 139
	100 - 119
	80 - 99
Lower	< 79

Hydrogeologic Settings

7Aa – Till Over Bedded Sedimentary Rock
7Ac – Glacial Till Over Limestone
7Af – Sand & Gravel Interbedded in Glacial Till
7C – Moraine
7D – Buried Valley
7Ec – Alluvium Over Sedimentary Rock
7Ed – Alluvium Over Glacial Till
7G – Thin Till Over Interbedded Limestones/Shales
7Gb – Thin Till Over Limestone

A more detailed description of the hydrogeologic settings and the evaluation of the pollution potential may be found in the publication "Ground Water Pollution Potential of Montgomery County", GWPP Report No. 28, Ohio Department of Natural Resources, Division of Water.

The ground water pollution potential of this county has been mapped using the methodology described in U.S. EPA Publication EPA/600-2-87/035, "DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings" (Aller et al., 1987).

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