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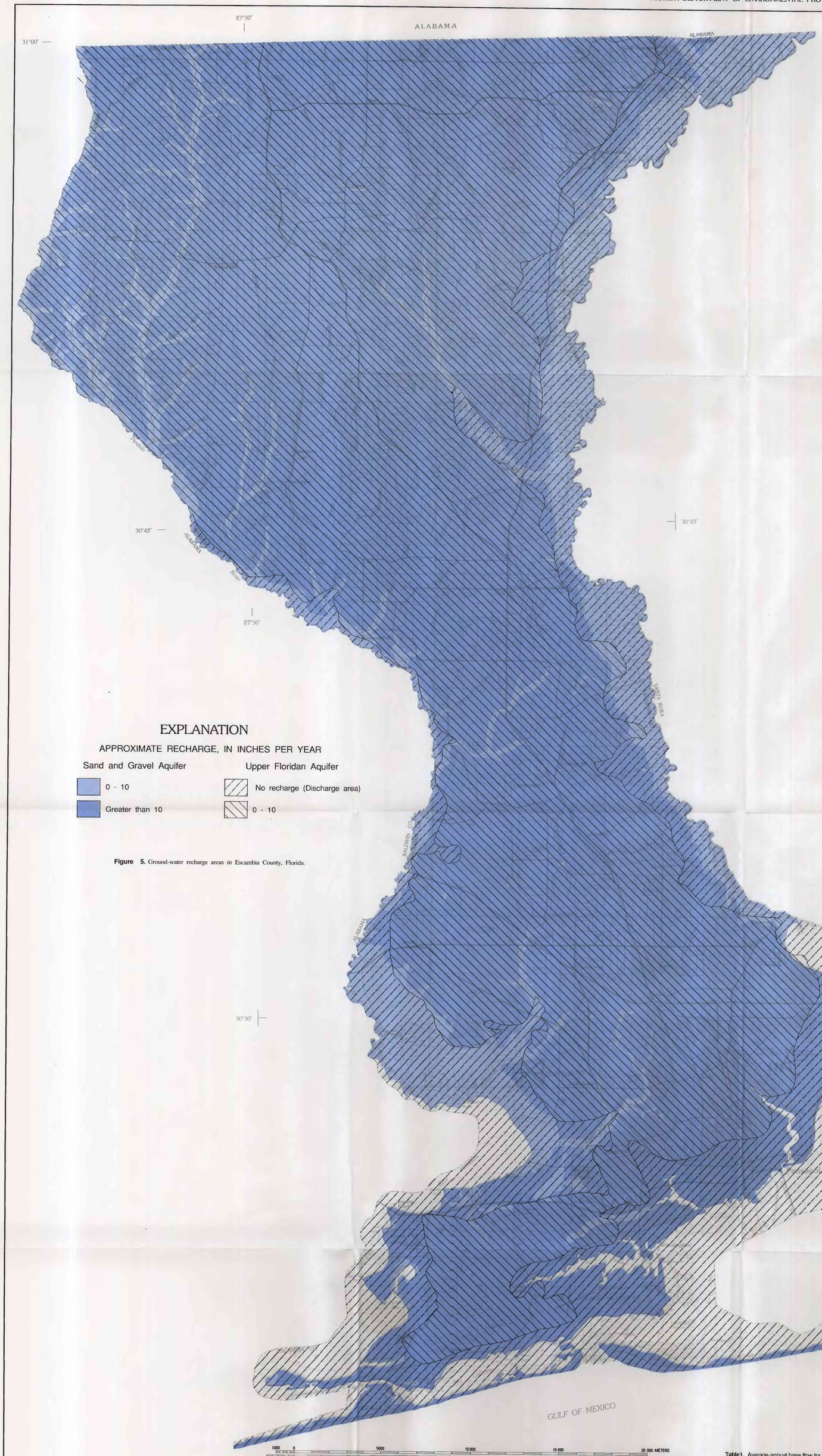

Figure 5. Ground-water recharge areas in Escambia County, Florida.

INTRODUCTION

Ground water is a major component of Florida's water resources, accounting for 90 percent of all public-supply and self-supplied domestic water withdrawals, and 58 percent of self-supplied commercial-industrial and agricultural withdrawals of freshwater (Marella, 1992). Ground-water is also an important source of water for streams, lakes, and wetlands in Florida. Because of their importance, a good understanding of these resources is essential for their sound development, use, and protection. One area in which our understanding is lacking is in characterizing the rate at which ground water in aquifers is recharged, and how recharge rates vary geographically. Ground-water recharge (recharge) is the replenishment of ground water by downward infiltration of water from rainfall, streams, and other sources (American Society of Civil Engineers, 1987, p. 222). The recharge rates in many areas of Florida are unknown, of insufficient accuracy, or mapped at scales that are too coarse to be useful. Improved maps of recharge rates will result in improved capabilities for managing Florida's ground-water resources.

In 1989, the U.S. Geological Survey, in cooperation with the Florida Department of Environmental Regulation, began a study to delineate high-rate recharge areas in several regions of Florida (Vecchioli and others, 1990). This study resulted in recharge maps that delineated areas of high (greater than 10 inches per year) and low (0 to 10 inches per year) recharge in three counties--Okaloosa, Pasco, and Volusia Counties--at a scale of 1:100,000. This report describes the results of a similar recharge mapping study for Escambia and Santa Rosa Counties (fig. 1), in which areas of high- and low-rates of recharge to the sand-and-gravel aquifer and Upper Floridan aquifer are delineated. The study was conducted in 1992 and 1993 by the U.S. Geological Survey in cooperation with the Florida Department of Environmental Protection.

HYDROGEOLOGIC SETTING OF ESCAMBIA AND SANTA ROSA COUNTIES

Three principal hydrogeologic units are found in Escambia and Santa Rosa Counties: the sand-and-gravel aquifer, the intermediate confining unit, and the Floridan aquifer system. The sand-and-gravel aquifer is the dominant source of water in Escambia and Santa Rosa Counties. In 1990, the average rate of withdrawal of water from the sand-and-gravel aquifer in these counties was 103 million gallons per day (Marella, 1992). This withdrawal rate represents 98 percent of all ground water withdrawn in the two counties, and 81 percent of all water (surface and ground water) withdrawn for agricultural irrigation, public, self-supplied domestic, and commercial-industrial supplies (Marella, 1992). The aquifer consists of deposits of sand and gravel with interbedded, discontinuous lenses of clay, which may confine or perch ground water locally. The sand-and-gravel aquifer has been subdivided into three zones: a surficial (water-table) zone, an intermediate zone, and a main producing zone (Barr and others, 1981, p.24). The top of the aquifer is coincident with the land surface in Escambia and Santa Rosa Counties, and the thickness of the aquifer ranges from approximately 100 feet in northeastern Santa Rosa County to more than 500 feet in northwestern Escambia County (Scott and others, 1991).

The sand-and-gravel aquifer is underlain by the intermediate confining unit (Scott and others, 1991) and the Floridan aquifer system. In Escambia and Santa Rosa Counties, the intermediate confining unit consists of clay sediments of the Pensacola Clay of Miocene age in the southern half of the two counties, and clayey sands with gravel and some shell material of the Miocene coarse clastics in the northern half of the two counties. The thickness of the intermediate confining unit varies from 200 to more than 1,200 feet (Scott and others, 1991).

The Floridan aquifer system consists of a thick sequence of carbonate rocks, and is subdivided into the Upper and Lower Floridan aquifers, which are separated in most areas by a middle confining unit. Although the Floridan aquifer system is the dominant source of water in most of Florida, only two percent of the ground water withdrawn in 1990 in Escambia and Santa Rosa Counties was obtained from the Floridan aquifer system (Marella, 1992) because of the high mineralization of the aquifer in this area. More detailed descriptions of the sand-and-gravel aquifer, the intermediate confining unit, and the Floridan aquifer system are in Marsh (1966), Barr and others (1981), Cushman Roisin (1982), Miller (1986), and Scott and others (1991).

RECHARGE TO THE SAND-AND-GRAVEL AQUIFER

Almost all of the recharge to the sand-and-gravel aquifer in Escambia and Santa Rosa Counties is derived from precipitation that falls on the land surface within the counties and moves downward to the water table. A smaller amount of recharge is derived from the infiltration of water from streams, lakes, and reservoirs in some areas. The factors that influence recharge rates to the sand-and-gravel aquifer include climatic characteristics, physical and vegetative characteristics of the land surface, and hydrogeologic characteristics of the aquifer. The climate of Escambia and Santa Rosa Counties favors high recharge rates because the difference between average-annual precipitation (60 to 64 inches per year) and potential evaporation (42 to more than 46 inches per year) ranges from 15 to more than 18 inches per year over the two-county area (Vischer and Hughes, 1975). High recharge rates are also favored in many upland areas that have deep, well-drained soils. Some of these areas are also nearly flat or only gently sloping, which further limits the amount of overland runoff, thereby increasing the potential for high recharge rates. Low recharge rates are typically associated with floodplain areas adjacent to streams. These areas are characterized by poorly-drained soils and shallow water tables, conditions that increase the potential for evapotranspiration and storm runoff, thus reducing the amount of water available for recharge.

Methods Used to Delineate Areas of High and Low Recharge

Average-annual recharge was estimated in Escambia and Santa Rosa Counties by evaluating ground-water discharge to streams (base flow), as well as the climatic, physiography, and hydrology of the study area. The approach and methodology used generally follows that used by Vecchioli and others (1990) to estimate recharge in nearby Okaloosa County. In the first step of this approach, average-annual recharge is estimated in basins with stream-discharge data (gaged basins) by assuming that average-annual recharge is equal to average-annual base flow at the basin outlet. Equating recharge with base flow requires that the following assumptions be satisfied: (1) annual storage changes in the aquifer are small relative to recharge and base flow (2) topographic and ground-water basin boundaries are approximately coincident, (3) additions to or withdrawals from the aquifer other than from natural recharge and discharge are either negligible or known, and (4) all of the ground-water discharge from the basin occurs as discharge to streams draining the basin. In the second step of the approach, areas are identified as having a high or low potential for recharge by evaluating the soils, topography, hydrography, and hydrogeology of the area. High- and low-rate recharge areas are delineated throughout the study area by integrating the results of the first two steps with information on average-annual precipitation and evapotranspiration rates in the study area.

Several methods were used to estimate average-annual base-flow for the gaged basins. The method chosen for a particular basin was dependent on the quantity of discharge data available for that basin. The first of these methods was a base-flow separation technique described by Rutledge (1991) that was applied to basins with 10 or more years of daily-mean discharge data at the basin outlet. These basins are referred to as continuous-record basins and the location of their outlets are referred to as continuous-record sites. Base-flow separation methods can generally be described as consisting of two steps: (1) identifying periods in which surface runoff and subsurface streamflow (storm runoff) were negligible and designating the base flow equal to measured streamflow during these periods, and (2) interpolating base flow between these periods (Rutledge, 1991). In the base-flow separation method used in this study, days were designated as having negligible storm runoff if the discharge had decreased continuously for a specific time period (or longer) prior to the day in question. This time period was computed as follows for each stream:

$$N = A^{0.2} \qquad (1)$$

where N is the length of the time, in days, and A is the drainage area of the stream, in square miles. For example, the drainage area for the continuous record site, Baggett Creek near Milligan, Fla., is 7.77 square miles, and $N = 7.77^{0.2}$ or 1.5 days. Equation (1) is an empirical relation, described by Linsley and others (1982), for estimating the length of time storm runoff is significant after a peak in the discharge hydrograph. Days with negligible storm runoff were further required to not be followed by a daily decline of more than 0.1 log cycle (Barnes, 1939; Rutledge, 1991). During periods of significant storm runoff, base-flow was computed by linear interpolation between the closest previous day when storm runoff was negligible, and the closest following day when storm runoff was negligible.

The base-flow separation analysis provides a continuous record of daily mean base-flow estimates for each continuous-record site, and an average-annual base-flow estimate for each site is then calculated from the daily mean base-flow estimates. An example of a base-flow hydrograph produced using the above base-flow separation technique is shown in figure 2. All of the available daily-mean discharge data (through calendar year 1991) were used in the analyses for each site, excluding data in years with one or more days of missing data. Base-flow estimates were also computed using three other base-flow separation techniques described by White and Sloto (1990) (fixed interval, sliding interval, and local minima), and the results were nearly identical to those obtained with Rutledge's algorithm.

A second method was used for basins with three or more discharge measurements made during base-flow conditions. These basins are referred to as partial-record basins and the location of their outlets are referred to as partial-record sites. For these basins, average-annual base-flow was computed by substituting an average-annual base-flow estimate from a nearby continuous-record site into a linear relation between discharge measurements from the partial-record site and concurrent discharge estimates from the nearby continuous-record site (fig. 3). This linear relation was developed using a linear regression technique (Helsel and Hirsch, 1992, p. 276) if ten or more pairs of concurrent discharge data were available; otherwise, the relation was developed from a graphical best fit of the data. This procedure for estimating base-flow at partial record sites has been used previously by Vecchioli and others (1990, 1991) and in many low-flow studies (Riggs, 1972).

A third method for estimating average-annual base-flow was applied to basins with less than three base-flow measurements or basins in which base-flow measurements correlated poorly with concurrent discharge data at nearby continuous record basins. These basins are referred to as miscellaneous basins and the location of their outlets are referred to as miscellaneous sites. Discharge measurements were made at these sites during periods in which hydrologic conditions in the study area were relatively stable (little precipitation immediately before or during the measurements) and streams were flowing at rates that approached their average-annual base-flow. Three sampling trips were made during 1992 and 1993 to obtain these measurements. Discharge measurements were also made at nearby partial- and continuous-record sites during these trips to evaluate the degree to which the discharge measurements approximated the average-annual base-flows of these sites. The measured streamflows at the partial- and continuous-record sites were generally in close agreement with their respective estimates of average-annual base flow. This result supports the conclusion that measured discharge values from the miscellaneous sites are reasonable estimates of average-annual base flow for these basins.

Delineation of Recharge Areas

The results of the base-flow analyses of the continuous-record, partial-record, and miscellaneous sites indicated that average-annual base flow (and therefore average-annual recharge) exceeds 10 inches throughout most of Escambia and Santa Rosa Counties. Of the 50 gaged basins evaluated in or near the two counties, 48 had average-annual base-flow values that were 10 or more inches (tables 1-3). The geographic distribution of the gaged basins and average-annual base-flow estimates are shown in figure 4. The highest base-flow values are at sites in the southeastern part of Santa Rosa County on or near Eglin Air Force Base. The extremely high base-flow values in this area are due largely to the presence of well-sorted, highly-permeable sands in the area, which limit overland storm runoff, and to ground-water discharge to the deeply incised streams.

Average-annual recharge is also assumed to be ten or more inches in the two gaged basins with base-flow values less than 10 inches per year (Eightmile Creek near West Pensacola and Jacks Branch near Muscogee). Leakage to deeper zones of the sand-and-gravel aquifer is assumed to account for the difference between a "high-recharge rate" base flow value of 10 or more inches per year and the lower average-annual base-flow values that were estimated for these sites. The low base flow at Eightmile Creek is probably due to its shallow incisement into the sand-and-gravel aquifer. The shallow incisement of this stream is apparent from a comparison of topographic and potentiometric surface maps, which indicate that the altitude of Eightmile Creek is generally higher than the altitude of the August 1991 potentiometric surface of the surficial zone of the sand-and-gravel aquifer (Rouza and others, 1993, plate 1). When streams are not deeply incised into their contiguous ground-water systems, the potential for ground-water discharge to the streams is reduced and the probability of not "recapturing" recharge as base flow measured at a basin outlet is increased. The Bayou Marcus Creek (which is adjacent to the Eightmile Creek basin) is deeply incised in the sand-and-gravel aquifer and has a much higher base flow than Eightmile Creek. The low base flow of Eightmile Creek may also be partially due to ground-water pumping in the vicinity of its basin. Shallow incisement may also account for the low base flow at Jacks Branch; however, limited ground-water-level data make it difficult to assess the degree of incisement of this stream relative to the potentiometric surface of the surficial zone of the sand-and-gravel aquifer. The low base flow of Jacks Branch may also be partially due to ground-water pumping in the vicinity of the basin.

Areas with low-recharge rates to the sand-and-gravel aquifer in Escambia and Santa Rosa Counties are shown in figures 5 and 6, respectively. These areas were defined as being coincident with stream floodplains and lake or wetland areas that were connected to a stream or similar feature that could act as a surface drain for the lake or wetland (open-basin lakes and wetlands). The floodplain areas were delineated from 1:62,500 scale topographic maps, and from 1:24,000 scale topographic maps in the southern (coastal) portion of the study area. Lake and wetland areas were delineated from the topographic maps and from 1:100,000 scale digital hydrography data (U.S. Geological Survey, 1989). Inspection of the above results and maps of soils (Walker and others, 1968; Weeks and others, 1980) indicated that wetland areas and areas with poorly-drained soils were generally associated with stream valleys. Because of their poorly drained soils and characteristically shallow water tables, floodplain areas typically become saturated quickly during storms and drain any accumulated water rapidly enough to an adjacent or connected drainage feature so that recharge of stored storm waters during interstorm periods is limited. Similarly, recharge beneath open-basin lakes or wetlands is typically limited because of low soil or lake-bed permeability, high evapotranspiration losses, and surface drainage of stored storm waters. Recharge in floodplains and wetlands is also typically low because these areas are often coincident with discharge areas of contiguous ground-water systems. Some open-basin wetlands in the coastal areas of southwestern Escambia County were assumed to be high recharge areas because of their permeable soils, flat topography (which limits storm runoff), and higher land-surface elevation relative to the potentiometric surface of the surficial zone of the sand-and-gravel aquifer. This assumption is also supported by discharge measurements made at wetland outlets shortly after a storm, which indicated that runoff rates were probably smaller than expected for coastal wetlands with low recharge rates. Lake and wetland areas that are not connected to a drainage feature (closed-basin lakes and wetlands) were not defined as areas of low recharge because the difference between average-annual precipitation and potential evaporation is approximately 15 to 18 inches throughout Escambia and Santa Rosa Counties.

High recharge rates are assumed to occur in all areas in the two counties that are not coincident with stream floodplains or open-basin wetlands (except as noted above). This assumption is supported by the high values of average-annual base flow that were estimated for nearly all of the gaged basins (tables 1, 2, and 3) and by the fact that these gaged basins cover much of the two-county study area and represent most of the climatic, physiographic, and hydrogeologic conditions that occur in the two counties. Areas with high recharge rates to the sand-and-gravel aquifer are depicted in figures 5 and 6. Areas with low-recharge rates probably exist within the high recharge-rate areas shown on figures 5 and 6, but were not delineated either because they were too small for the scale of the mapping effort or because of limitations in the information used to delineate such areas. Similarly, some areas with high recharge rates may not have been detected because of their small size or because of limitations in the information used to delineate the areas.

Recharge to the Upper Floridan Aquifer

The Upper Floridan aquifer in Escambia and Santa Rosa Counties is recharged by downward leakage from the sand and gravel aquifer through the intermediate confining unit. Upward leakage from the Lower Floridan aquifer is not a significant source of water to the Upper Floridan aquifer in this area because the middle confining unit restricts the exchange of water between the aquifers. Recharge is limited to areas in which the potentiometric surface of the sand-and-gravel aquifer is higher than that of the Upper Floridan aquifer. Conversely, areas of discharge from the Upper Floridan aquifer are those in which the potentiometric surface of the Upper Floridan aquifer is higher than that of the sand-and-gravel aquifer.

Areas of discharge from, and low and high recharge to the Upper Floridan aquifer were delineated using Darcy's law (Darcy, 1856):

$$q = K\frac{\Delta h}{L} \qquad (2)$$

where q is the volume of discharge from or recharge to the Upper Floridan aquifer, per unit area, per unit time, K is the vertical hydraulic conductivity of the intermediate confining unit, Δh is the elevation of the potentiometric surface of the surficial zone of the sand-and-gravel aquifer minus the elevation of the potentiometric surface of the Upper Floridan aquifer (head difference), and L is the thickness of the intermediate confining unit.

A potentiometric surface for the surficial zone of the sand-and-gravel aquifer was approximated by contouring point elevation data obtained from the intersection of a surface of digital elevation data (U.S. Geological Survey, 1987, p. 5) and a digital coverage of streams, lakes, and wetlands (U.S. Geological Survey, 1989). The potentiometric surface for the Upper Floridan aquifer was taken from Meadows (1991). Vertical hydraulic conductivity estimates were based on lithologic descriptions of the intermediate confining unit, vertical hydraulic conductivity estimates from Richards (1993, fig. 13) and Rouza and others (1993, plate 10) and from the leakance estimates of Maslia and Hayes (1988, plate 3) (the leakance of a confining unit is defined as the vertical hydraulic conductivity of the unit divided by its thickness). The isopach maps of Scott and others (1991, p. 58) were used to estimate the thickness of the intermediate confining unit. An analysis of the water-budgets of the gaged basins was also used to constrain the recharge rates calculated from the head-difference, hydraulic conductivity, and thickness estimates.

The results of the above analyses indicated that recharge rates to the Upper Floridan aquifer are negligible for most of Escambia and Santa Rosa Counties and that there are no areas of high recharge to the aquifer in the two counties (figs. 5 and 6). The highest recharge potential exists in some areas of northernmost Escambia and Santa Rosa Counties where the intermediate confining unit is thinnest, and in the northern part of the Pond Creek basin (central and north central Santa Rosa County) where the head difference is large, the confining unit is of moderate thickness, and the stream network is poorly developed. Discharge from the Upper Floridan aquifer was indicated for areas adjacent to the Escambia River and the lower reaches of the Perdido and Blackwater Rivers, and for areas adjacent to Perdido, Escambia, Pensacola, and East Bays (figs. 5 and 6). In all of these areas, discharge from the Upper Floridan aquifer was estimated to be less than 10 inches per year. The discharge areas delineated in figures 5 and 6 are generally consistent with those on maps by Aucott (1988) and Stewart (1980), with a few exceptions. Aucott (1988) and Stewart (1980) included the areas adjacent to the Yellow River, the upper reaches of the Perdido and Blackwater Rivers, and areas adjacent to the lower reaches of Big Coldwater and Big Juniper Creeks as discharge areas. These areas were not included as discharge areas in figures 5 and 6 because the potentiometric surface of the Upper Floridan aquifer of Meadows (1991) was lower than the older potentiometric surfaces used by Aucott (1988) and Stewart (1980).

SUMMARY AND CONCLUSIONS

Estimates of ground-water recharge rates and maps describing the geographic distribution of recharge rates are fundamental to understanding and managing ground-water resources in Florida. This report describes areas of high and low recharge for the sand-and-gravel aquifer and Upper Floridan aquifer in Escambia and Santa Rosa Counties. Estimates of average-annual recharge for the sand-and-gravel aquifer were made by evaluating streamflow, topographic, soils, and other physiographic data. Average-annual recharge for the sand-and-gravel aquifer ranged from 10 to 58 inches in 50 basins for which streamflow data were available. These basins covered most of the two county study area and represented the range of physiographic conditions in the area. This indicates that high recharge rates (greater than 10 inches per year) to the sand-and-gravel aquifer occur in almost all of the two county area. Areas with low recharge rates to the sand-and-gravel aquifer are generally restricted to floodplain and wetland areas adjacent to streams. Recharge to the Upper Floridan aquifer was evaluated using hydrogeologic, water-table, potentiometric-surface, and water-budget data. Recharge estimates for the Upper Floridan aquifer were generally much less than 10 inches throughout the area. The low recharge rate to the Upper Floridan aquifer was due to the thickness and low hydraulic conductivity of the sediments overlying the aquifer. Low recharge rates to the Upper Floridan aquifer are also supported by the generally well developed stream network that drains most of the water recharged to the sand-and-gravel aquifer, leaving little water for downward leakage to the Upper Floridan aquifer. Discharge areas for the Upper Floridan aquifer were delineated along the Escambia River, lower Perdido and Blackwater Rivers, and areas adjacent to Perdido, Escambia, Pensacola, and East Bays.

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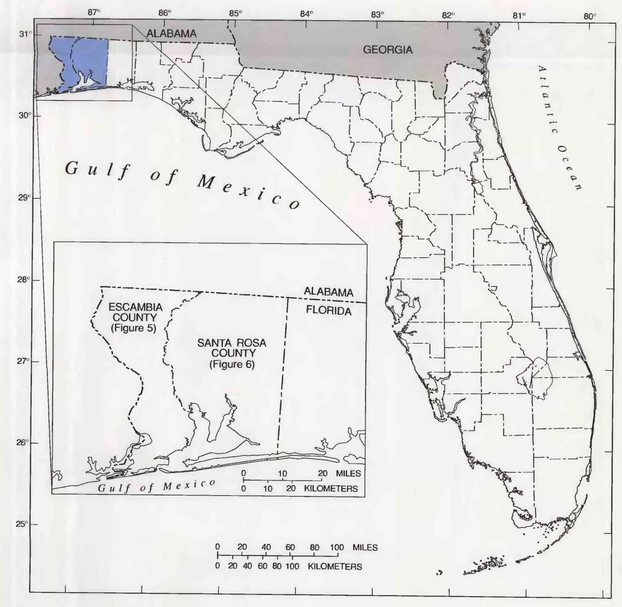

Figure 1. Location of Escambia and Santa Rosa Counties, Florida.

Table 1. Average-annual base flow for continuous-record sites

Station number	Station name	Time period	Drainage area, in square miles	Average-annual base flow, in inches	Average-annual base flow, in percent of mean streamflow
02367310	Juniper Creek at SHW 85 near Niceville, FL	1967-1991	27.6	43	92
02368300	Baggett Creek near Milligan, FL	1965-1981	7.77	32	85
02370000	Blackwater River near Baker, FL	1951-1991	205	15	64
02370500	Big Coldwater Creek near Milton, FL	1939-1991	237	23	72
02370700	Pond Creek near Milton, FL	1938-1977	58.7	15	83
02376000	Pine Barren Creek near Barth, FL	1953-1991	75.3	20	70
02376300	Brushy Creek near Walnut Hill, FL	1959-1990	49.0	20	69
02376500	Perdido River at Barrineau Park, FL	1942-1991	394	18	66

Table 2. Average-annual base flow at partial-record sites

Station number	Station name	Drainage area, in square miles	Average-annual base flow, in inches	Nearby continuous-record station
2367320	East Bay River near Wynnehaven Beach, FL	62.0	51	2367310
2367390	Turtle Creek near Ocean City, FL	22.3	32	2367310
2367397	Live Oak Creek near Florosa, FL	16.2	57	2367310
2369456	Malone Creek near Galiver, FL	7.51	58	2376310
2370015	Muddy Branch near Beaver Creek, FL	1.4	45	2368300
2370100	Blackwater River near Holt, FL	276	18	2370000
2370200	Big Juniper Creek near Munson, FL	36.0	15	2370000
2370230	Sweetwater Creek near Munson, FL	45.0	16	2370200
2370250	Big Juniper Creek near Springhill, FL	113.0	21	2370500
2370270	Big Juniper Creek near Harold, FL	142.0	18	2370500
2370280	East Fork Big Coldwater Creek near Munson, FL	64.0	16	2370500
2370290	East Fork Big Coldwater Creek near Allentown, FL	92.7	20	2370700
2370300	West Fork Big Coldwater Creek at Cobbtown, FL	39.9	17	2370700
2370400	West Fork Big Coldwater Creek near Allentown, FL	111	19	2370500
2370750	Hurricane Branch near Milton, FL	2.95	12	2370700
2375800	Moore Creek near Chumuckla, FL	22.0	20	2376000
2376077	Carpenter Creek near Pensacola, FL	4.31	16	2370700
2376100	Bayou Marcus Creek near Pensacola, FL	11.2	32	2376000
2376115	Elevenmile Creek near Pensacola, FL[1]	27.8	17	2376000
2376140	Eightmile Creek near West Pensacola, FL	10.5	7	2376300
2376400	McDavid Creek near Barrineau Park, FL	26.5	12	2376000
2376700	Jacks Branch near Muscogee, FL	23.2	4	2376300

[1]Estimate includes correction for treated wastewater discharges.

Table 3. Average-annual base flow at miscellaneous sites

Station number	Station name	Drainage area, in square miles	Average-annual base flow, in inches
2369084	Turkey Hen Creek near Crestview, FL	8.26	43
2369510	Camp Creek near Galiva, FL	2.70	30
2369520	Milligan Creek near Galiver, FL	8.76	40
2369585	Boiling Creek near Harold, FL	33.7	55
2370140	Blackwater River near Harold, FL	298	17
2370400	West Fork Big Coldwater Creek near Allentown, FL	111	19
2370550	Clear Creek near Milton, FL	24.3	37
2370758	Pond Creek at Milton, FL	72.4	16
2375660	Canoe Creek near Bluff Springs, FL	38.4	22
2375720	Mitchell Creek near McDavid, FL	10.9	19
2375750	Cotton Creek near McDavid, FL	7.68	17
2376008	Pine Barren Creek near Molino, FL	92.8	28
2376021	Thomas Creek near Chumuckla, FL	6.39	37
2376035	Tenmile Creek near Wallace, FL	6.52	24
2376273	Helverson Creek near Enon, FL	6.53	10
2376350	Boggy Creek near Bay Springs, FL	25.2	15
2376480	McDavid Creek at Barrineau Park, FL	34.5	13
303921-8723038	Cowdevil Creek near Cantonment, FL	4.60	11
304108-8724158	Pensaula Creek near Barrineau Park, FL	6.82	13
304241-8725228	Alligator Creek near Barrineau Park, FL	10.6	10

Base from U.S. Geological Survey
Bay Minette 1:100,000, 1978
Pensacola 1:100,000, 1978
Fort Walton Beach 1:100,000, 1978
Universal Transverse Mercator projection; Zone 16

GROUND-WATER RECHARGE IN ESCAMBIA AND SANTA ROSA COUNTIES, FLORIDA

By
J.W. Grubbs
1995