EXPLANATION

Soil is level to gently undulating | Silt and sand

Good to fair lating, with some wetlands wash, and organic

Mixed soil types, level to undu- | Sandstone, sandy out-

Soil is gently rolling to very Loess, loess over clay

Mixed soil types, level to very | Loess, sandy loam,

MINNESOTA

IOWA

Based on soil data from Hole

and others (1968) and Hole

1° (written commun., 1968)

SCALE 1:1 000 000

SOIL SUITABILITY FOR IRRIGATION

Only a small part of the basin has soils suitable for irrigation of

row and truck crops. The most suitable soils are silty and sandy allu-

vial soils on flat flood plains in the major stream valleys. Most of the

basin has steep slopes that preclude use of sprinkler equipment or has

irrigation, based on topography, soil type, and depth to water, according to a classification by F. D. Hole (written commun., 1968). Water avail-

ability, soil fertility, and air temperature were not included in this

classification and must be evaluated locally. Most of the soils suitable for irrigation are underlain by fairly productive aquifers (see section

About 700 acres of row and truck crops and almost 1,200 acres of

cranberries were irrigated in 1970. The main row and truck crops

were corn and beans, grown for canning at local plants. The most

important irrigation in this basin is that done with surface water as

part of cranberry culture (see section "Withdrawal Use"). There are

almost 1,200 acres of cranberry bogs in the basin, of which about 90 percent have provisions for a combination of flooding and sprinkling

(Wisconsin Statistical Reporting Service, oral commun., 1971).

Soils in the basin are arranged in four groups of suitability for

clayey soils that would not drain properly.

"Ground-Water Availability").

10 5 0 10 20 KILOMETERS

steep; moderate permeability glacial till, sandstone, in "Driftless Area" but low and alluvium

Characteristics

and is permeable; water table

is more than 4 feet below land

steep; moderate to high per-

meability in glaciated area

but low permeability in Drift-

permeability in glaciated area.

Water table is less than 1 foot below land surface along

Surface-water divide

Mississippi River

that must be drained

IRRIGATION

Parent material

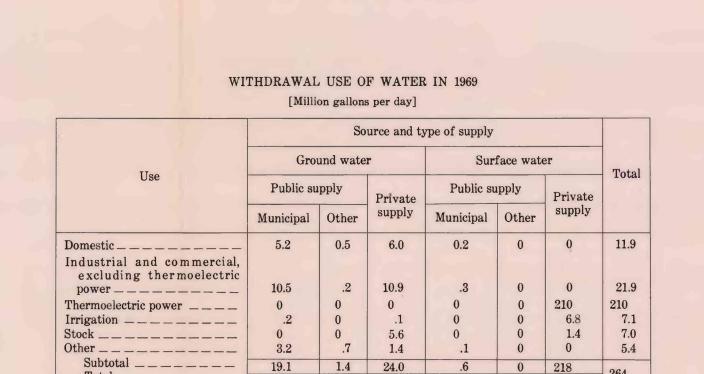
residuum above dolo-

mite, siltstone and

sandstone, and sandy

loam till

WATER USE



WITHDRAWAL USE

About 264 million gallons of water per day were withdrawn for about 26 percent of the ground water used in 1969. Consumption in use in the Trempealeau-Black River basin in 1969. Of this water, about this use is low because most of the water withdrawn is discharged into 17 percent was from wells and 83 percent was from surface-water streams through sewage-treatment plants or to the ground through bodies. The 264 mgd (million gallons per day) is equivalent to almost septic tanks. 410 cfs, which is about 14 percent of the average runoff from the basin.

Most of the water withdrawn was discharged to streams and was irrigation use. Most of this use was for frost protection and harvesting available for reuse downstream. The largest use of water in the basin was for cooling condensers in thermoelectric power plants at Alma, La Crosse, and Genoa, which drains from the bogs into streams or reservoirs or seeps into the ground. produced 2.29 billion kilowatt-hours of electricity in 1969. The 210 mgd taken from the Mississippi River was 80 percent of all water withdrawn. The discharge of this water back to the river produces an irrigation of field crops from private wells. This use has a very high increase in stream temperature. The second largest water use, that by industry and commerce, was growth or is evaporated from the soil. primarily of ground water and in 1969 accounted for 49 percent of the Of the 7 mgd used for stock, about 80 percent was ground water. ground water used. Much of this use was for industrial cooling. Consumption of water is very low in this use because most water withdrawn

and also was almost entirely ground water. This use accounted for ground.

plants, or to the ground through settling basins.

rather than actual irrigation, but quantitative separation is not practical. Consumption of water is low in this use because most of the water A very small amount of ground water was used for irrigation in 1969. It was largely for irrigation of municipal golf courses and consumption rate because most water applied is consumed in plant In the use column, "other" includes losses from distribution systems, is discharged to streams through storm drains or waste-treatment street washing, main flushing, and use by schools and other public buildings. Consumption of water is low in this use because most of the

Water for domestic purposes was the third largest withdrawal use water discharges to streams through storm drains or is returned to the EXPLANATION TREMPEALEAU 0.1-0.5 0.5-1 1-5 5-10 10-50 50-200 Water pumpage, in million gallons per day

MINNESOTA

IOWA

Data from Public Service

Commission of Wisconsin,

Wisconsin Department of

Natural Resources, and

Wisconsin Statistical

Reporting Service

SCALE 1:1 000 000

10 5 0 10 20 KILOMETERS

Self-supplied industrial ground water Self-supplied industrial surface water for thermoelectric power Surface-water supply for cranberry culture Surface-water divide

an average of 0.1 mgd or more.

Municipal ground water

Municipal surface water

Withdrawal use of water was concentrated mainly along the Mississippi River and in municipalities throughout the basin. The largest withdrawal was from the Mississippi River for thermoelectric power production. Moderate quantities of ground water were withdrawn at La Crosse, Holmen, Prairie du Chien, and Sparta. Of the 44

municipal supplies in the basin, only the 20 shown on the map withdrew

DISTRIBUTION OF WITHDRAWAL USE

MUNICIPAL WATER USE IN 1969 [Pumpage and use data from Public Service Commission of Wisconsin]

Municipanty	County	1970	(mgd)	(mgd)	Domestic	Industrial and commercial	Other	water ¹	
Alma	Buffalo	956	0.082	0.198	14.4	5.27	10.2	S	
Alma Center	Jackson	495	.025	.040	5.29	1.77	2.23	S	
Arcadia	Trempealeau_	2,159	.304	.490	21.8	83.3	5.72	S	
Bangor	La Crosse	974	.145	.365	14.7	27.1	10.9	S	
Black River Falls	Jackson	3,273	.423	.739	43.1	72.2	39.2	Town Creek	
Blair	Trempealeau	1,036	.119	.237	11.0	7.73	19.9	S	
Cashton	Monroe	824	.171	.397	11.1	37.9	13.3	S	
Cochrane	Buffalo	506	.046	.136	5.44	2.64	8.62	S	
Coon Valley	Vernon	596	.059	.107	7.37	15.6	5.50	S	
Oorchester	Clark	491	2036	.075	5.16	4.55	.26	G	
Eastman	Crawford	319	.017	.035	2.09	3.42	.75	S, D	
Eleva	Trempealeau	574	.029	.076	6.48	1.29	2.68	S'	
Ettrick	Trempealeau	463	.052	.140	5.90	9.02	3.21	Š	
Fountain City	Buffalo	1,017	.014	.024	1.41	2.27	1.27	Š	
Galesville	Trempealeau	1,162	.122	.317	15.6	16.2	12.7	Š	
Genoa	Vernon	305	.013	.139	_	_		ŝ	
Granton	Clark	288	.013	.024	2.77	.51	1.54	Š	
Greenwood	Clark	1.036	.085	.160	10.2	17.9	21.1	Ğ	
Hixton	Jackson	300	.023	.048	3.47	1.39	.25	S	
	La Crosse	1,081	.142	.351	17.3	19.0	15.7	Ğ	
Holmen	Trempealeau	1,036	.086	.204	11.9	9.66	11.3	S	
	-	51,153	11.9	27.7	1,200	2,690	462	G,S	
LaCrosse	La Crosse	1,126	.070	.120	12.8	8.91	4.74	G, S	
Loyal Medford	Clark	3,454	.404	.510	44.9	57.9	14.2	G	
	Taylor	505	.042	.098	7.75	3.84	5.26	S	
Melrose	Jackson	612	.086	.162	-	-		S	
Merrillan	Jackson						-	S	
Mondovi	Buffalo	2,338	.216	.458	35.3	21.3	22.4		
Mount Sterling	Crawford	181	.010	.013	1.84	1.03	.77	S	
Neillsville	Clark	2,750	.179	2.86	28.3	24.5	12.9	Black River	
Onalaska	La Crosse	4,909	.498	1.56	94.4	.15	68.1	G	
Osseo	Trempealeau	1,356	.137	.315	15.1	12.7	22.3	S	
Owen	Clark	1,031	.201	.345	9.39	34.4	29.3	G, S	
Prairie du Chien	Crawford	5,540	.918	1.54	74.1	149	113	G	
Rockland	La Crosse	278	.010	.039	2.40	.44	.80	S	
Sparta	Monroe	6,258	1.57	2.71	102	292	179	S	
Stoddard	Vernon	750	2.044					S	
Strum	Trempealeau	738	.058	.157	9.84	6.17	5.16	S	
Taylor	Jackson	322	.038	.070	3.30	1.56	9.08	S	
rempealeau	Trempealeau	743	.045	.105	9.12	2.98	4.41	G, S	
Viroqua	Vernon	3,739	.374	.555	47.5	35.0	56.9	S, D	
Westby	Vernon	1,568	.252	.365	19.3	46.1	16.7	S, D	
West Salem	La Crosse	2,180	.202	.446			21.7	S	
Whitehall	Trempealeau	1,486	.453	.772	18.3	126	21.0	S	
Withee	Clark	480	.026	.270	5.27	.58	3.57	G	
Total		112,388	19.739		1,957.39	3,853.28	1,259.62		

G, sand and gravel aquifer; S, Cambrian sandstones of sandstone aquifer; and D, Prairie du Chien Group of sandstone aquifer.

Pumpage estimated from 1968 data.

Most municipal water supplies in the basin are from ground water. Of the 44 municipal supplies, seven were from the sand and gravel aquifer, 31 were from the sandstone aquifer, and four were from a combination of these aguifers. Neillsville and Black River Falls had surface-water supplies, but in 1970 the latter developed a ground-water supply from the sand and gravel aquifer. More than half of the municipal pumpage was from the sand and gravel aquifer at La Crosse. Other moderately large withdrawals were made, in decreasing order, by Sparta, Prairie du Chien, Onalaska, Whitehall, Black River Falls, and Medford. Industrial and commercial use accounted for 55 percent of municipal pumpage. Domestic use was 27 percent, and 17 percent was used for public buildings, street washing, and main flushing, or was lost in distribution. Public water supplies in unincorporated places,

not included in the table, accounted for about 1.4 mgd of pumpage in 1969.

NONWITHDRAWAL USE



DISTRIBUTION OF NONWITHDRAWAL USE

basin. Much of the flood plain of the Mississippi River is a series of at the seven locks within the basin (U.S. Corps of Engineers, 1970d).

Among nonwithdrawal uses of water in the basin are hydroelectric sumed in nonwithdrawal uses, its physical and chemical quality may be Three hydroelectric plants used about 690 mgd in 1969 to generate Many streams in the basin transport wastes from municipalities waste disposal is concentrated. Fish and wildlife habitat and recreation are important within the the Mississippi in 1966 accounted for 60 percent of the 32,228 lockages

National fish and wildlife refuges. The pools behind the navigation power generation, waste disposal and assimilation, fish and wildlife dams on the Mississippi are the major bodies of water in the basin that habitat, recreation, and transportation. Although water is not conwater skiing, camping, hiking, and picnicing. Also, the Black River downstream from Lake Arbutus to the Mississippi River is considered an interesting canoe trail and is described in "Wisconsin Water Trails" about 25.6 million kilowatt-hours of electricity. Although this use (Wisconsin Department of Natural Resources, 1968b). Many tributary does not consume water, quality and temperature changes occur in streams in the western and southern parts of the basin are trout streams. Both commercial shipping and recreational boating are important activities on the Mississippi River. Commercial cargo mainly to or and industries. Pollution occurs locally in reaches of streams where from Minneapolis-St. Paul, was almost 7 million tons in 1964 and is expected to be about 10 million tons in 1980. Recreational boating on

SUMMARY

WATER AVAILABILITY AND SUITABILITY

Source Mississippi River Use and considerations		SURFACI	E WATER	GROUND WATER					
	Minimin Direct	Duffele and Theorem colour Pinner	DI I DI			Sand and g			
	Mississippi River	Buffalo and Trempealeau Rivers	Black River	La Crosse River	Bad Axe River and Coon Creek	Surficial deposits	Isolated buried deposits	Sandstone aquifer	
Aunicipal and industrial supplies Quantity-100,000 gallons per day for a	Adequate discharge Generally good chemical quality Very little pollution	Adequate discharge Good chemical quality	Adequate discharge Good chemical quality	Adequate discharge Good chemical quality	Generally good chemical quality Very little pollution	Large well yields Generally good chemical quality	Good chemical quality Not generally subject to pollution	Large well yields Locally artesian Good chemical quality	
population of 1,000 or a small industry Quality-cost of sanitary treatment of	very little pollution	Variable flow	Variable flow	Variable flow	Adequate discharge for limited uses Variable flow	Limited primarily to Mississippi River flood plain	Small well yields Limited areal extent	Not subject to pollution	
surface water for domestic use Water hard Slightly colored Sanitary treatment necessary	Water hard in lower reaches Some local pollution Sanitary treatment necessary	Some local pollution Colored Sanitary treatment necessary	Water hard in lower reach Some local pollution Sanitary treatment necessary	Water very hard High sediment loads Sanitary treatment necessary	Easily polluted May be high in iron	Commonly high in iron	Deep wells necessary for large supplies Limited to southwestern half of basin Commonly high in iron		
Rural domestic and stock supply Quantity-5 gallons per minute adequate for pressure system	Adequate discharge Generally good chemical quality Very little pollution	Adequate discharge Good chemical quality Very little pollution	Adequate discharge Good chemical quality Water soft to moderately hard	Adequate discharge Good chemical quality Water soft in headwaters	Adequate discharge Generally good chemical quality	Adequate well yields Generally shallow water table Good chemical quality	Generally adequate well yields Generally shallow water table Good chemical quality	Adequate well yields Good chemical quality Not subject to pollution	
Quality-prohibitive cost of sanitary treatment of surface water for domestic use Very little pollution Available only to shorelands Water hard Slightly colored Sanitary treatment necessary for domestic use	Available only to shorelands	Little pollution	Little pollution	Available only to shorelands Water very hard	Easily polluted	Not generally subject to pollution	Very deep water table under ridges		
	Water hard in lower reaches Sanitary treatment necessary for domestic use	Available only to shorelands Colored Sanitary treatment necessary for domestic use	Available only to shorelands Water hard in lower reach Sanitary treatment necessary for domestic use	High sediment loads Sanitary treatment necessary for domestic use	May be high in iron	Limited areal extent Commonly high in iron	Commonly high in iron		
rrigation supply Adequate discharge		Adequate discharge	Adequate discharge	Adequate discharge		Large well yields		Large well yields	
Quantity-1 cubic foot per second or 450 gallons per minute per 40 to 60 acres	Available only to shorelands	Available only to shorelands	Available only to shorelands	Available only to shorelands	Inadequate discharge Available only to shorelands	Generally shallow water table	Generally inadequate well yields Limited areal extent	Deep wells necessary for large supplie Limited to southwestern half of basin	
Recreation Adequate public access and user facilities Attractive physical setting and recreation opportunities Water free from pollution, excessive weed growth, odor, and high sediment loads Access at many sites Two State parks and large areas of National wildlife and fish refuges Suitable for fishing, hunting, boating, and swimming Nearly constant pool levels Extensive variety of game fish Very little pollution Occasional floods	Two State parks and large areas of	Access at many sites Suitable for fishing and hunting Trout in headwaters	Access at many sites Suitable for fishing, hunting, boating, and swimming	Suitable for fishing Trout in headwaters Little pollution	Suitable for fishing Trout in headwaters Very little pollution		EXPLANATION General suitability		
		Good variety of game fish Trout in some tributaries	Limited boating Occasional floods	Shallow in summer	Adequate discharge Generally good chemical quality		for use		
	Limited boating Occasional floods	Little pollution		Limited boating Floods	Very little pollution	Advantages for use	Good		
		Very small low flows in headwaters Occasional floods		High sediment loads	Water hard Slightly colored Sanitary treatment necessary	Limitations for use	Fair Poor		
Adequate depth and quality for game Excellent cover fish	Nearly constant pool levels	Very little pollution	Excellent cover	Fair cover	Very little pollution	- l	This table lists a love	August 1	
	Excellent cover in marshes and sloughs Very little pollution	Variable flow	Little pollution Variable flow	Little pollution Variable flow	Shallow in summer Variable flow		regard for legal limitatio	s and limitations of various sources without ns. Water withdrawals from streams, lakes,	
	Occasional floods	Fair to poor cover along rivers	Variable 10W	variable 110 w	High sediment loads		and high-capacity wells per day) require permits Resources	and high-capacity wells (capacity to yield more than 100,000 gallons per day) require permits from the Wisconsin Department of Natural Resources	

Large amounts of good quality water are available in much of the Trempealeau-Black River basin. Ground water is more widespread than surface water and, except for hydroelectric and thermoelectric power generation, ground water is used more extensively. It is available from the sand and gravel aquifer and the sandstone aquifer, both of which commonly yield 1,000 gpm to wells in some areas. Most municipalities and industries, except in the northeast, have adequate supplies of ground water available for growth and development. In the northeast these aquifers are thin or missing, and domestic well yields are very low, some less than 1 gpm. Streamflow in the basin is generally dependable, but the geologic conditions causing poor ground-water availability in the northeast also cause small low flows. Floods in the basin are infrequent except on the Mississippi River, where damages are sometimes severe. Small farm ponds, navigation pools on the Mississippi, and flowages for cran-

berry bogs comprise most of the drainage impoundments in the basin. There are few natural lakes. The quality of both ground and surface water in the basin is generally good except for hardness and iron. About 70 percent of the ground water sampled has hardness of more than 120 mg/l (hard or very hard). Surface water ranges from soft in the northeast to very hard in the south and west. Ground water is locally high in iron except in the sandstone aquifer. Neither surface nor ground water is significantly Very little of the available water in the basin is withdrawn for man's use. Of the 31.6 inches of average annual precipitation on the basin, 8.3 inches (710 billion gallons) leaves the basin as streamflow. This runoff represents the theoretical yield of the basin that is available for

use. In addition, about 6,000 billion gallons per year are available in

the Mississippi River.

AGENCIES HAVING ADDITIONAL INFORMATION

Agency	Geology	Soils	Topography and drainage	Land use	Water budget	Ground-and surface- water relationships	Surface water	Surface-water quality	Pollution	Ground water	Ground-water quality	Water use	Recreation and fish
The Geological and Natural History Survey, University of Wisconsin—Extension 1815 University Avenue, Madison,													
Wis. 53706	×	×	×		X					×	X	X	
U.S. Department of the Interior, Geological Survey, Water Resources Division 1815 University Avenue, Madison,			^										
Wis. 53706U.S. Department of Agriculture, Soil Conservation Service	X		X		×	X	Х	X		X	X	X	
4601 Hammersley Road, P.O. Box 4248, Madison, Wis. 53711		X	X	×			x					X	
Wisconsin Department of Natural Resources 4610 University Avenue, P.O. Box 450, Madison, Wis. 53701							×	X	X	X	x		
U.S. Department of the Army, Corps of Engineers, St. Paul District 1217 U.S. Post Office and Custom House,				X		X	*	*	^	^	^	X	ľ
St. Paul, Minn. 55101 U.S. Environmental Protection Agency, Water Quality Office (formerly Federal Water Quality Administration)	4 1		X				х	5 					
7401 Lyndale Avenue South, Minneapolis, Minn. 55423						1 4		×	X				
Minnesota Pollution Control Agency 717 Delaware Street S.E., Minneapolis, Minn. 55440													
Public Service Commission of Wisconsin 432 Hill Farms State Office Building, Madison, Wis. 53702								X	X				
Minnesota Department of Natural Resources Centennial Office Building, St. Paul, Minn. 55101									34			X	
Minnesota Outdoor Recreation Resources Commission													
324 State Capitol, St. Paul, Minn. 55101 U.S. Department of the Interior, Bureau of Outdoor Recreation, Lake Central Region	7												
3853 Research Park Drive, Ann Arbor, Mich. 48104U.S. Department of the Interior, Bureau of													
Sport Fisheries and Wildlife Room 630 Federal Building, Fort Snelling, Minn. 55111													

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