DEPARTMENT OF THE INTERIOR UNIVERSITY EXTENSION—THE UNIVERSITY OF WISCONSIN HYDROLOGIC INVESTIGATIONS UNITED STATES GEOLOGICAL SURVEY ATLAS HA-360 (SHEET 4 OF 4) GEOLOGICAL AND NATURAL HISTORY SURVEY

WITHDRAWAL USE OF WATER IN 1966 IN MILLIONS OF GALLONS PER DAY

	Source and type of supply						
TI	G	round water	er	S	Total		
Use	Public s	supply	Private supply	Public s	supply	Private supply	Total
	Municipal	Other		Municipal	Other		
Domestic	24.4	2.0	13.7	0	0	0	40.1
Industrial and commercial, excluding fuel-electric power	27.9	1.0	20	0	0	0.1	49.0
Fuel-electric power	0	0	0	0	0	430	430
Irrigation	1.0	0	0.1	0	0	0.1	1.2
Stock	0	0	9.9	0	0	2.4	12.3
Other	17.3	0.8	1	0	0	0	19.1
Subtotal	70.6	3.8	44.7	0	0	433	
Total		119			433		552

Over 200 billion gallons of water were withdrawn for use in the Rock-Fox River basin in 1966. About 20 percent of this amount, or 119 mgd, came from wells and the remainder, 433 mgd, came from streams, natural lakes, and manmade impoundments.

About 99 percent of the surface water withdrawn in the basin, 430 mgd, was for cooling condensers in steam-powered generating plants located at Madison, Janesville, and Beloit. In this use the only important change in quality or quantity of the water is an increase

Ground water is the source for all municipal supplies, for most rural supplies, and for industrial purposes (with the exception of electric power generation). In the table above, public supply use is that of municipalities, subdivisions, sanitary districts, and self-supplied schools and institutions. Under public supply, irrigation is largely parks and golf

courses. In the use column "other" includes losses from the distribution system, street washing, main flushing, and use by schools and

other public buildings. Private supply use is all other use, including rural farm and nonfarm, industries, and commerce. Withdrawal use of water in 1966 was equivalent to about 37 percent of the average streamflow leaving the basin. However, because water is usually discharged into the nearest stream or lake after use, it is available for reuse downstream. Therefore, data on withdrawals cited in this section include an undetermined amount of reuse of the same

Probably less than 5 percent of the water withdrawn was consumed, that is transported from the basin or lost to evapotrans-

WAUKESHA **EXPLANATION** Pumpage in millions of gallons per day RACINE 0 0.1-0.5 0.5-1 1-5 5-10 10-50 Municipal ground-water use Showing principal pumpage centers SCALE 1:1000000 10 5 0 10 20 KILOMETERS Surface-water use by hydroelectric plant DISTRIBUTION OF USE Surface-water use for Large municipal and industrial users of water are concentrated along the valleys of the Yahara and lower Rock Rivers. Future

well as in the Waukesha area.

recreation and serve as fish and game habitat.

fuel-electric cooling water

Large recreational lake

Showing area in square miles

Surface-water divide

 \sim 8.0

WATER USE

Municipality	County	Population 1960	Average daily pumpage, in million gallons per day (mgd)	Maximum daily pumpage mgd	Source of water	Municipality	County	Population 1960	Average daily pumpage, in million gallons per day (mgd)	Maximum daily pumpage mgd	Source of water
Arlington	Columbia	349	0.02	0.06	Sandstone aquifer	Lake Mills	Jefferson	2,951	0.42	0.78	Sandstone aquifer
Beaver Dam	Dodge	13,118	1.3	2.3	Sandstone aquifer	Lomira	Dodge	807	0.08	0.27	Niagara aquifer,
Beloit	Rock	32,846	5.9	8.8	Sand and gravel aquifer and sandstone aquifer						Platteville-Galena aquifer, and sandstone
Brandon	Fond du Lac	758	0.10	0.14	Sandstone aquifer						aquifer
Brookfield	Waukesha	19,812	0.23	-	Niagara aquifer,	Madison	Dane	126,706	23.5	42.4	Sandstone aquifer
Divolincia	77 441105114	10,012	0.20		Plattville-Galena	Maple Bluff	Dane	1,565	0.21	-	City of Madison
					aquifer, and sandstone	Marshall	Dane	736	0.06	0.13	Sandstone aquifer
					aquifer	Mayville	Dodge	3,607	0.74	5.5	Platteville-Galena
Brownsville	Dodge	276	0.06	0.24	Sandstone aquifer			2,2.7	200 5 2000		aquifer and sandstone
Burlington	Racine	5,856	1.0	2.1	Platteville-Galena aquifer						aquifer
				Park Artist St	and sandstone aquifer	McFarland	Dane	1,272	0.11	0.22	Sandstone aquifer
Cambridge	Jefferson	605	0.06	0.11	Sandstone aquifer	Middleton	Dane	4,410	0.72	1.6	Sandstone aquifer
Clinton	Rock	1,274	0.12	0.22	Sandstone aquifer	Milton	Rock	1,671	0.14	0.34	Sandstone aquifer
Clyman	Dodge	259	0.10	0.48	Platteville-Galena aquifer	Milton Junction	Rock	1,433	0.11	0.22	Sandstone aquifer
100 100	ALC U SPACE	199 SERVE D.	2001 507000	Mov./Salena	and sandstone aquifer	Monona	Dane	8,178	0.77	1.8	Sandstone aquifer
Columbus	Columbia	3,467	0.45	0.77	Sandstone aquifer	Mukwonago	Waukesha	1,877	0.21	0.40	Niagara aquifer,
Cottage Grove	Dane	1,195	0.04	0.11	Sandstone aquifer	212 U.S. W 021 U.S. O.S. W 021 U.S. W 021 U.	71.44.1.05.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.				Platteville-Galena
Deerfield	Dane	795	0.66	0.99	Sandstone aquifer	1					aquifer, and sandstone
De Forest	Dane	1,223	0.21	0.36	Sandstone aquifer		W 1 1	0.000	0.00	0.0	aquifer
Delavan	Walworth	4,846	0.62	1.0	Sand and gravel aquifer	Oconomowoc	Waukesha	6,682	0.98	2.0	Sand and gravel aquifer,
Eagle	Waukesha	620	0.03	0.06	Platteville-Galena aquifer and sandstone aquifer	1					Platteville-Galena
Don't Trace	Walworth	1,455	0.23	0.48	Sand and gravel aquifer,						aquifer, and sandstone
East Troy	walworth	1,400	0.28	0.40	Platteville-Galena	0	Dane	1,701	0.18	0.30	aquifer Sandstone aquifer
					aquifer, and sandstone	Oregon	Jefferson	1,000	0.12	0.32	Sandstone aquifer
					aquifer	Pewaukee	Waukesha	2,484	0.37	0.61	Platteville-Galena aquifer
Edgerton	Rock	4,000	0.44	0.85	Sandstone aquifer	1 ewaukee	Waukesiia	2,404	0.51	0.01	and sandstone aquifer
Elkhorn	Walworth	3,586	0.46	0.75	Platteville-Galena aquifer	Randolph	Columbia and	1,507	0.14	0.21	Sandstone aquifer
	11.02.0.02.0	,,,,,,	3.22	31	and sandstone aquifer	- Turing of the state of the st	Dodge	2,001	V.2.2	V.=1	bunacione aquirer
Fall River	Columbia	584	0.09	0.16	Sandstone aquifer	Reeseville	Dodge	491	0.09	0.38	Sandstone aquifer
Fontana-on	Walworth	1,326	0.20	_	Sand and gravel aquifer	Sharon	Walworth	1,167	0.06	0.10	Platteville-Galena aquifer
Geneva Lake	Miles Control Control of the Control					Ditti oii	War wor on	2,201	0.00		and sandstone aquifer
Footville	Rock	675	0.07	0.22	Sandstone aquifer	Shorewood Hills	Dane	2,320		_	City of Madison
Fort Atkinson	Jefferson	7,908	2.2	4.7	Sandstone aquifer	Slinger	Washington	1,141	0.17	0.27	Sand and gravel aquifer
Fox Lake	Dodge	1,181	0.11	0.27	Sandstone aquifer						and Niagara aquifer
Genoa City	Walworth	1,005	0.07	0.18	Sand and gravel aquifer,	Stoughton	Dane	5,555	1.3	2.2	Sandstone aquifer
					Platteville-Galena	Sun Prairie	Dane	4,008	0.92	3.1	Sandstone aquifer
					aquifer, and sandstone	Theresa	Dodge	576	0.04	0.07	Sand and gravel aquifer
** ** *	***	F 005		0.1	aquifer	Union Grove	Racine	1,970	0.39	0.91	Platteville-Galena aquifer
Hartford	Washington	5,627	1.1	2.1	Sand and gravel aquifer,						and sandstone aquifer
					Platteville-Galena aquifer, and sandstone	Walworth	Walworth	1,494	0.25	0.39	Sand and gravel aquifer, Platteville-Galena
					aquifer	1					aquifer, and sandstone
Hartland	Waukesha	2,088	0.23	0.40	Sand and gravel aquifer						aquifer, and sandstone aquifer
Horicon	Dodge	2,996	0.42	1.8	Sandstone aquifer	Waterford	Racine	1,500	0.20	0.35	Niagara aquifer,
Hustisford	Dodge	708	0.07	0.45	Platteville-Galena	wateriord	Nacine	1,500	0.20	0.55	Platteville-Galena
Trubulbioru	Douge	100	0.01	0.10	aquifer, and sandstone						aquifer, and sandstone
					aquifer						aquifer
Iron Ridge	Dodge	419	0.02	_	Platteville-Galena	Waterloo	Jefferson	1,947	0.44	0.82	Sandstone aquifer
					aquifer and sandstone	Watertown	Jefferson and	13,943	1.5	2.8	Platteville-Galena aquifer
					aquifer		Dodge				and sandstone aquifer
Janesville	Rock	35,164	8.9	16.0	Sand and gravel aquifer	Waukash	Waukesha	20.004	C F	11.0	Plattavilla Calana agrif
T	T	9 Bross	2.22	3 12	and sandstone aquifer	Waukesha	waukesna	30,004	6.5	11.0	Platteville-Galena aquifer and sandstone aquifer
Jefferson	Jefferson	4,548	0.99	1.6	Sandstone aquifer	Waunakee	Dane	1,611	0.23	0.65	Sandstone aquifer
Johnson Creek	Jefferson	686	0.26	0.44	Sandstone aquifer	Waupun	Dodge and Fond-	7,935	0.66	1.5	Sandstone aquifer
Juneau	Dodge	1,718	0.14	0.25	Sandstone aquifer	waupuii	du Lac	1,300	0.00	1.0	bandsone aquiter
Lake Geneva	Walworth	4,929	0.81	1.6	Sand and gravel aquifer,	White		c 900	0.97	1.6	Plattovilla Calana amif
					Platteville-Galena	Whitewater	Walworth	6,380	0.97	1.0	Platteville-Galena aquifer and sandstone aquifer
					aquifer, and sandstone aquifer	Williams Bay	Walworth	1,347	0.28	0.76	Sand and gravel aquifer
					aquilei		11 GL 11 OI UII		$\frac{0.28}{70.57}$	0.10	Sand and graver aquiter
						Total		419,878	10.07		

All municipal water supplies in the basin are from ground water. sandstone aquifer, 23 obtain part from the Platteville-Galena

The table above lists the municipalities using ground water, but it aquifer, 5 obtain all or part from the Niagara aquifer, and 14 obtain

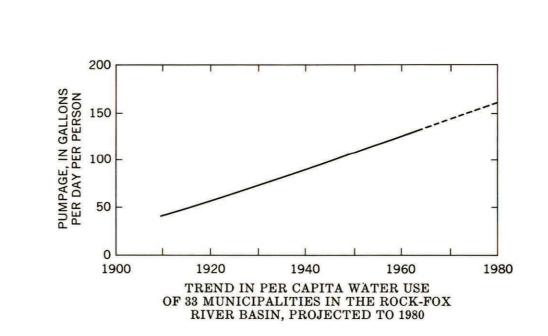
does not include sanitary districts and subdivisions. Sixty-three of all or part of their supplies from the sand and gravel aquifer.

MUNICIPAL WATER USE IN 1966 AND SOURCE OF WATER

the 69 municipalities listed obtain all or part of their water from the Nonwithdrawal uses of water have great social and economic ortance in our society. The most important of these uses are fish and wildlife habitat, recreation, hydroelectric power generation, navigation and transportation, and waste transport and disposal. In Wisconsin the management of fish and wildlife habitat and recreation are extremely important because the State derives great

100 3 ≥ 400 300 1920 1940 1960 POPULATION AND PUMPAGE TRENDS OF 33 MUNICIPALITIES IN THE ROCK-FOX

RIVER BASIN, PROJECTED TO 1980



Pumpage data from Wisconsin

for calendar year 1966

The pumpage, population, and per capita water use of municipali- increase in pumpage reflects the rapid population growth and ties are compared in the graphs above. Data from 33 municipalities development of industry in Madison, Janesville, Beloit, and Wauin the basin indicate that per capita use increased from about 40 gpd kesha. In fact, three-fourths of the pumpage of the 33 municipalities in 1910 to about 140 gpd in 1965. An extrapolation of this trend is by these four cities. Increased per capita use also results from the shows that per capita use may be 160 gpd by 1980. Much of the increased availability of cheap water to operate domestic conveniences.

SUMMARY

Large amounts of good quality water are available in the RockFox River basin. Of the 31.4 inches of average annual precipitation

River valley. Most municipalities have adequate supplies of ground municipal supplies, for most rural supplies, and for most industrial water available for future growth and development.

River valley. Most municipalities have adequate supplies of ground municipal supplies, for most rural supplies, and for most industrial water available for future growth and development. that falls on the basin, about 6.6 inches or 1,500 mgd runs off as purposes. 1,200 mgd), fuel-electric cooling water (430 mgd), and for recreation, 1,000 gpm to wells, as does the sand and gravel in the lower Rock glacial drift, are locally polluted by man's wastes from surface sources. because of its confined nature and long flow paths.

industrial water use will probably increase in these same areas, as

The lakes shown represent only a few of the many water-dependent

recreation areas within the basin. Small lakes, wetlands, and streams,

too numerous to show on this map, are utilized extensively for

streamflow. This represents the amount of water available for use, Ground water is more widespread than surface water. It is avail- quality. Both ground and surface water have high natural hardness; habitat. although man can also borrow from a "bank" of over 150 times this able from four aquifers in the basin: the sandstone aquifer, the high iron content is a local problem in ground water. Some lakes and Two potential problems are flooding, and pollution of the artesian The quantity of surface water used in the basin greatly exceeds gravel aquifer. Any of these aquifers is capable of yielding domestic wastes, rendering them less useful as wildlife habitat and for recrea-flood damage will increase. Surface disposal of wastes in the recharge that of ground water. Surface water is used for water power (about and stock supplies. The sandstone aquifer commonly yields over tional purposes. Shallow aquifers, be they dolomite, sandstone, or area of the artesian system could pollute large areas of the aquifer

NONWITHDRAWAL USE

economic gain from tourism. Wetlands make up a significant part of the fish and wildlife habitat in the basin, as well as furnish land for agricultural purposes. Since the mid-1930's the acreage of wet-

lands in the basin has decreased by about one-third. For example, in the Fox River basin there were 86,000 acres of wetlands in the

1930's and 58,500 acres in 1968. The draining of wetlands for agricultural purposes may be in conflict with the use of wetlands for

Recreation facilities in the Rock-Fox River basin show increasing

daily and weekend use by residents of the nearby urban areas of

Milwaukee and Chicago. This increased use is expected to become

more intensive as continued highway development improves access to

and within the basin. Water sports and special activities such as

golfing, camping, skiing, pleasure driving, and sightseeing will be

River basin total participants in all recreation activities are expected

to increase from 151,000 persons in 1960 to a projected 562,000

persons in 1990 (Wis. Dept. of Nat. Resources, written commun.,

protect and develop the natural resources required for outdoor

recreation through an environmental (natural resource) corridor

management program. A natural resource corridor is an assemblage

of natural resource or natural resource related elements (water,

flora, and fauna), which provide the necessary environmental

economic growth.

municipal and other uses.

impact in the Rock-Fox River basin.

quality aspects required for cultural, scientific, recreational and

In the Rock-Fox basin 1,200 mgd is used to generate about 9.2 mil-

Navigation and water transportation, although very important

Many streams in the basin are being used to transport treated

wastes from many sources. Reaches of streams in areas of high water

use and waste disposal are subject to pollution (see sheet 2, Surface

lion kilowatt hours of electricity per year for industry, and for

to Wisconsin because of the Great Lakes, have very little economic

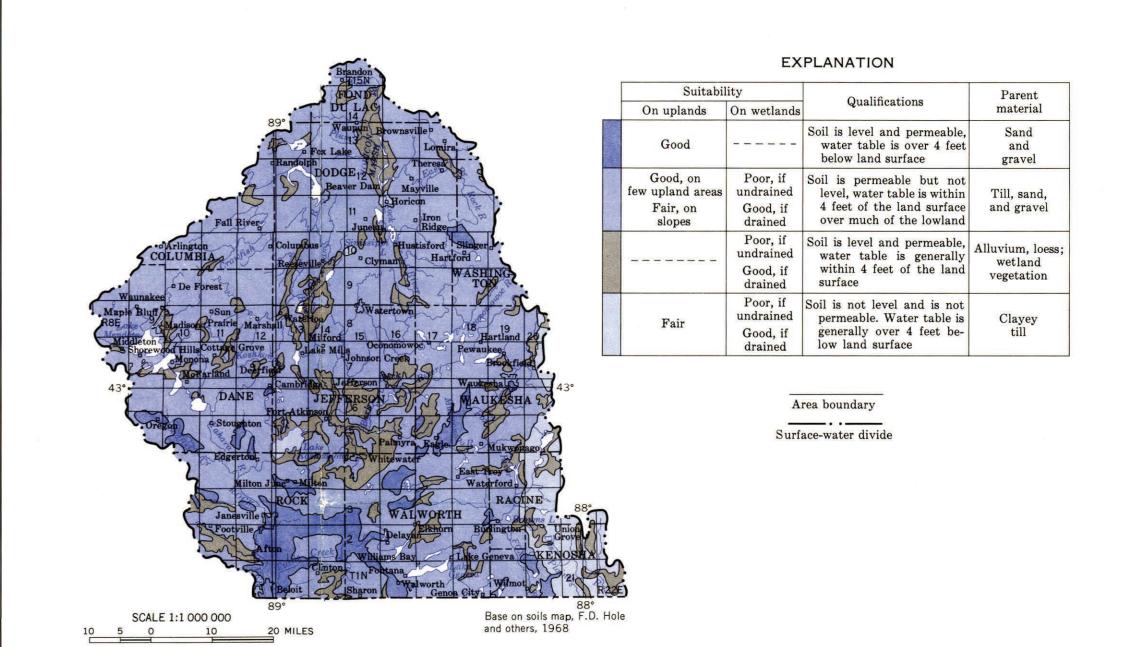
The Wisconsin Department of Natural Resources proposes to

the major recreation activities demanded in this area. In the Fox

The principal water problems in the basin are related to water production in conflict with the use of wetlands for fish and wildlife Platteville-Galena aquifer, the Niagara aquifer, and the sand and reaches of streams are polluted by industrial, municipal, or domestic system. With a continued increase in occupation of flood plains,

Use Source Rock Rive	Poek Piyer	Rock River Fox River	Des Plaines River	Tributary streams	Large lakes	Small lakes and wetlands	Sand and gravel aquifers		Niagara Dolomite	Platteville-Galena	~	
	Itock Itivei						Surface	Buried	aquifer	aquifer	Sandstone aquifer	
Municipal and industrial supply downstrear Less minerali ground wa Treatment re domestic us Storage requi Pollution	Adequate flow in downstream reaches Less mineralized than ground water	Less mineralized than ground water			Adequate quantity Adequate quality for industrial use		Well yields of over 500 gpm possible Rapidly recharged Generally adequate quality	Wide areal distribution Generally adequate quality	Well yields of a few hundred gpm possible Generally adequate quality Well yields erratic; may	Generally adequate quality Well yields commonly	Well yields of over 100 gpm possible Underlies the entire ba Generally adequate	
	Treatment required for domestic use Storage required Pollution Ease of pollution		Storage required		Treatment required for domestic use Pollution Ease of pollution	Treatment required for domestic use Storage required Some are polluted Ease of pollution	Limited areal distribution Ease of pollution May require iron and hardness removal	Well yields commonly inadequate May require iron and hardness removal	be inadequate Restricted to eastern ½ of basin May require iron and hardness removal Easily contaminated where shallow	inadequate Productive over only about ¼ of basin May require iron and hardness removal Easily contaminated where shallow	In eastern ½ of bas wells are deep and costly and rechar- poor May require iron an hardness removal	
Rural domestic	Adequate flow Low-cost stock watering Limited to frontage	Adequate flow Low-cost stock watering Limited to frontage on	Low-cost stock watering No flow during dry seasons	Adequate flow in larger streams Low-cost stock watering Wide distribution	Adequate quantity Low-cost stock watering	Low-cost stock watering Wide distribution Adequate quality	Adequate well yields Generally adequate quality	Adequate well yields Wide areal distribution Generally adequate quality Aquifers are not continuous	Adequate well yields Generally adequate quality Restricted to eastern ½ of basin Easily contaminated where shallow Well yields of a few hundred gpm possible Adequate quality Well yields erratic; may be inadequate Restricted to eastern ½ of basin	Adequate well yields Generally adequate quality	Adequate well yield Underlies entire bas Generally adequate	
and on river stock supply Treatment required domestic use Pollution	on river Treatment required for domestic use	river Treatment required for domestic use Pollution Ease of pollution	Limited to frontage on river Treatment required for domestic use Ease of pollution	Limited to frontage on river Treatment required for domestic use May be polluted	Limited to lake frontage Treatment required for domestic use Pollution Ease of pollution	May dry up during dry seasons Treatment required for domestic use Ease of pollution	Limited areal distribution Ease of pollution			Productive only in central part of basin Easily contaminated where shallow	quality Costly to develop wh deeply buried Easily contaminated where shallow	
Irrigation supply	Irrigable soils adjoin lower reaches of stream Adequate quality Limited to areas near the river	Adequate quality Limited to areas near the river	Inadequate flow during irrigation season Soils are clayey Limited to areas near the river	Adequate quality Smaller streams have inadequate flow during irrigation season	Adequate quantity Limited to lake frontage Lake frontage is costly	Adequate quality Quantity may be inadequate especially during growing season	Rapidly recharged Commonly underlies irrigable soils Adequate quality Limited areal distribution	Adequate quality Adequate well yields are unlikely		Well yields commonly inadequate Productive only in central part of basin	gpm possible Underlies entire basin Quality adequate In eastern 1/3 of basin wells are deep and costly and recharge poor	
Recreation	Suitable for fishing; for boating in downstream reaches Flow highly variable in upstream reaches Pollution limits bodycontact activity Water colored from swamps Limited public access Limited shoreline zoning	Suitable for fishing; for boating in downstream reaches Flow highly variable in upstream reaches Pollution limits bodycontact activity Water colored from swamps Limited public access Limited shoreline zoning	Flow highly variable; no flow for 25 percent of the time Too small for boating	Suitable for fishing Larger streams suitable for boating and some swimming Small tributaries have intermittent flow and are too small for boating Ease of pollution	Suitable for boating, fishing, and water skiing Some suitable for swimming Limited public access Few public beaches Limited shoreline zoning Pollution	Wide distribution Many suitable for fishing, boating, water skiing and swimming Limited public access Few public beaches Limited shoreline zoning Pollution	Adequa	EXPLANAT Advantages above the	TION General suitability for use es for use			
Fish and wildlife habitat	Suitable for fish The river, its floodplain, and its associated lakes and wetlands suitable for wildlife	Suitable for fish The river, its floodplain, and its associated lakes are suitable for wildlife	Small wetland areas suitable for wild life	Many are suitable for fish Most have associated wetlands suitable for wildlife	Ease of pollution Suitable for fish The lake and its associated wetlands suitable for wildlife	Ease of pollution Most lakes suitable for fish Wetlands and lakes suitable for wild life				This table lists advanta	ges and limitations of vario	
navitat	Pollution may affect fish Limited shoreline zoning	Pollution may affect fish Limited shoreline zoning	Flow highly variable; no flow for 25 percent of	Small tributaries have intermittent flow	Pollution may affect fish Limited shoreline zoning	Pollution may affect fish Limited shoreline zoning	sources without regard for legal withdrawals from streams, lakes, (over 100,000 gpd) wells require Wisconsin Department of Natural				eams, lakes, and high capaci vells require permits from t	

POTENTIAL WATER USE FOR IRRIGATION



SOIL SUITABILITY FOR IRRIGATION

Water for irrigation is available nearly everywhere within the basin; however, the suitability of soils varies greatly depending upon the topography of the land, the permeability of the soil, and the depth to the water table. Soils in this basin are grouped into four categories (Hole and others, 1968), as shown above. The soil suitability shown does not take into account water availability or soil

Under the best conditions (good suitability in table), the topography is level to allow uniform distribution of water and to prevent excessive water runoff, the soil is permeable so that water can infiltrate and percolate to the root zone, and the depth to the water table is 4 feet or more so that plant roots remain in the zone

of aerated soil for proper assimilation of oxygen and nutrients.

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AGENCIES HAVING ADDITIONAL INFORMATION

University Extension-The University of Wisconsin Geological and Natural History Survey 1815 University Avenue, Madison, Wis. 53706 U.S. Department of the Interior, Geological Survey, Water Resources Division 1815 University Avenue, Madison, Wis. 53706

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U.S. Department of Agriculture, Soil Conservation Service 4601 Hammersley Road, P. O. Box 4248, Madison, Wis. 53711 U.S. Department of Defense, Army Corps of Engineers Clock Tower Building, Rock Island, Ill. 6120 Land Use: Wisconsin Department of Natural Resources P. O. Box 450, Madison, Wis. 53701 Wisconsin Department of Local Affairs and Development

1 West Wilson Street, Madison, Wis. 53702

P. O. Box 450, Madison, Wis. 53701

Wisconsin Department of Agriculture 103B Hill Farms State Office Building, Madison, Wis. 53702 Southeastern Wisconsin Regional Planning Commission 916 North East Avenue, Waukesha, Wis. 53186 U.S. Department of Agriculture, Soil Conservation Service 4601 Hammersley Road, P. O. Box 4248, Madison, Wis. 53711 Water Budget: U.S. Department of the Interior, Geological Survey, Water

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