Illinois State Water Survey Division

SURFACE WATER SECTION

SWS Contract Report 441

7-DAY 10-YEAR LOW FLOWS OF STREAMS IN THE KANKAKEE, SANGAMON, EMBARRAS, LITTLE WABASH, AND SOUTHERN REGIONS

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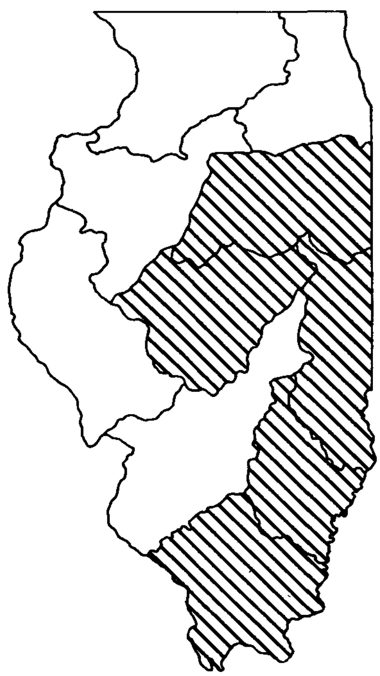

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INTRODUCTION

State and federal agencies that regulate stream pollution have based their stream water quality standards on a flow condition in a stream specified as the 7-day 10-year low flow. This is defined as the lowest average flow that occurs for a consecutive 7-day period at an average recurrence interval of 10 years. That is, over a long period of years, the average time interval between 7-day low flows of this severity will be 10 years. The 7-day 10-year low flow (Q7,10) maps for all streams in Illinois and the interstate rivers were first developed by Singh and Stall (1973) and included in State Water Survey Bulletin 57. The following steps are used in preparing a Q7,10 map for a river basin or region:

1. The drainage area associated with the streams or river system in a particular region is marked on the 2-degree maps of the U.S. Geological Survey. The maps have a scale of 1 to 250,000 or about 1 inch = 4 miles. Where the elevation contours are not defined well enough to draw the drainage boundary accurately, 15-minute and 7-1/2-minute USGS quadrangle maps are used that have a scale of 1 to 62,500 and 1 to 24,000, respectively. A base map is then prepared showing the drainage boundary, the stream network, all towns that have wastewater treatment plants and lagoons, and county lines. The USGS stream gaging stations on Illinois streams and any bordering rivers are located on the base map from the detailed descriptions of their locations published in U.S. Geological Survey *Water-Supply Papers* and *Water Resources Data for Illinois.*

2. The locations of wastewater effluent outfalls to streams were obtained from the USGS 7-1/2-minute and 15-minute quadrangle maps, from the Illinois Environmental Protection Agency offices, or from direct telephone inquiries to the wastewater treatment plants. Locations are given in terms of latitude and longitude, or section, township, and range. Arrows are drawn on the base map to indicate the locations of effluent discharges to a stream. The magnitudes of 7-day low effluents (which may occur during the months of 7-day 10-year low flows in the streams) from municipal and industrial wastewater treatment plants and lagoons are determined from the 2 to 3 years of most recent data available. The amounts of wastewater effluents indicated on the maps represent the 1984 condition of effluents entering the receiving stream during the 7-day 10-year low-flow condition.

3. Dams, regulating structures, and lakes (those large enough to be accurately represented on the map) are also located on the base map. Dams, fords, and in-channel impoundments for municipal water supply are located on the various streams from the available information in USGS maps, county plat books, river basin reports, and similar references. All large and medium lakes, and some small ones (natural or man-made) are shown on the maps because of their significant effect on the 7-day 10-year low flows.

4. Streams with zero 7-day 10-year low flow are defined first From graphs of the natural (excluding the effect of effluents and regulation) low flow versus drainage area, the streams with zero 7-day 10-year low flow are determined and shown as dot-dash lines on the map. Any wastewater plant effluents entering these intermittent-flow streams are then considered. If the effluent is lost in the dry streambed before reaching the perennial stream, the zero 7-day 10-year low-flow stream remains as such. But if the effluent is not lost, the stream starts with a 7-day 10-year low flow at the outfall equal to the magnitude of the effluent, and this flow is

reduced downstream to the point where the natural 7-day 10-year low flow begins. Downstream, the 7-day 10-year low flow equals the reduced effluent flow plus the natural flow.

S. Streams with non-zero 7-day 10-year low flows are mapped next. To natural 7-year 10-year low flows along such streams are added the effluents from wastewater plants and lagoons to obtain the 7-day 10-year low flow for 1984 conditions. Any withdrawal of water from a stream for a municipal supply or industrial use is shown by a decrease in the 7-day 10-year low-flow value.

The state was divided into 10 regions as shown in Figure 1. For Bulletin 57 (Singh and Stall, 1973), one 7-day 10-year low-flow map was prepared for each region. An extra map provided the information for the Illinois River and the main stems of the Mississippi, Wabash, and Ohio Rivers along the Illinois boundary. Descriptions of these eleven maps are given below.

Map 1. Rock River Region -- Rock River and Mississippi River drainage upstream of Rock Island

Map 2. Northeast Region - Chicago Sanitary and Ship Canal and Chicago, Des Plaines, DuPage, and Fox Rivers

Map 3. Kankakee Region — Kankakee, Mazon, Vermilion, and Mackinaw Rivers, and Illinois River drainage from the east upstream of the Sangamon River

Map 4. Spoon River Region ~ Bureau Creek, Spoon River, and Mississippi River drainage north of Henderson Creek

Map 5. Sangamon Region - Sangamon River with Salt Creek and other tributaries

Map 6. La Moine River Region - La Moine River, Macoupin Creek, and Mississippi River drainage upstream of the mouth of the Illinois River

Map 7. Kaskaskia Region -- Kaskaskia River and Mississippi River drainage between the Illinois and Kaskaskia Rivers

Map 8. Embarras Region - Vermilion and Embarras Rivers, and Wabash River drainage above the Embarras River

Map 9. Little Wabash Region - Little Wabash River and Wabash River drainage between the Embarras and Little Wabash Rivers

Map 10. Southern Region ~ Saline, Big Muddy, and Cache Rivers, plus direct drainage into the Wabash, Ohio, and Mississippi Rivers

Map 11. Border Rivers - The Illinois River and the main stems of the Mississippi, Wabash, and Ohio Rivers along the Illinois boundary

The objective of this study was to develop 7-day 10-year low-flow maps for the Kankakee, Sangamon, Embarras, Little Wabash, and Southern regions and for border rivers for the 1984 conditions of effluent discharges, water withdrawals, and flow regulation. The corresponding map numbers are 3, 5, 8, 9, 10, and 11. Maps 1, 2, 4, 6, and 7 covering the rest of the state have also been developed. Map 2 covering northeastern Illinois is given in SWS Contract Report 307 (Singh, 1983). The other four maps are given in SWS Contract Report 440 (Singh et al., 1988).

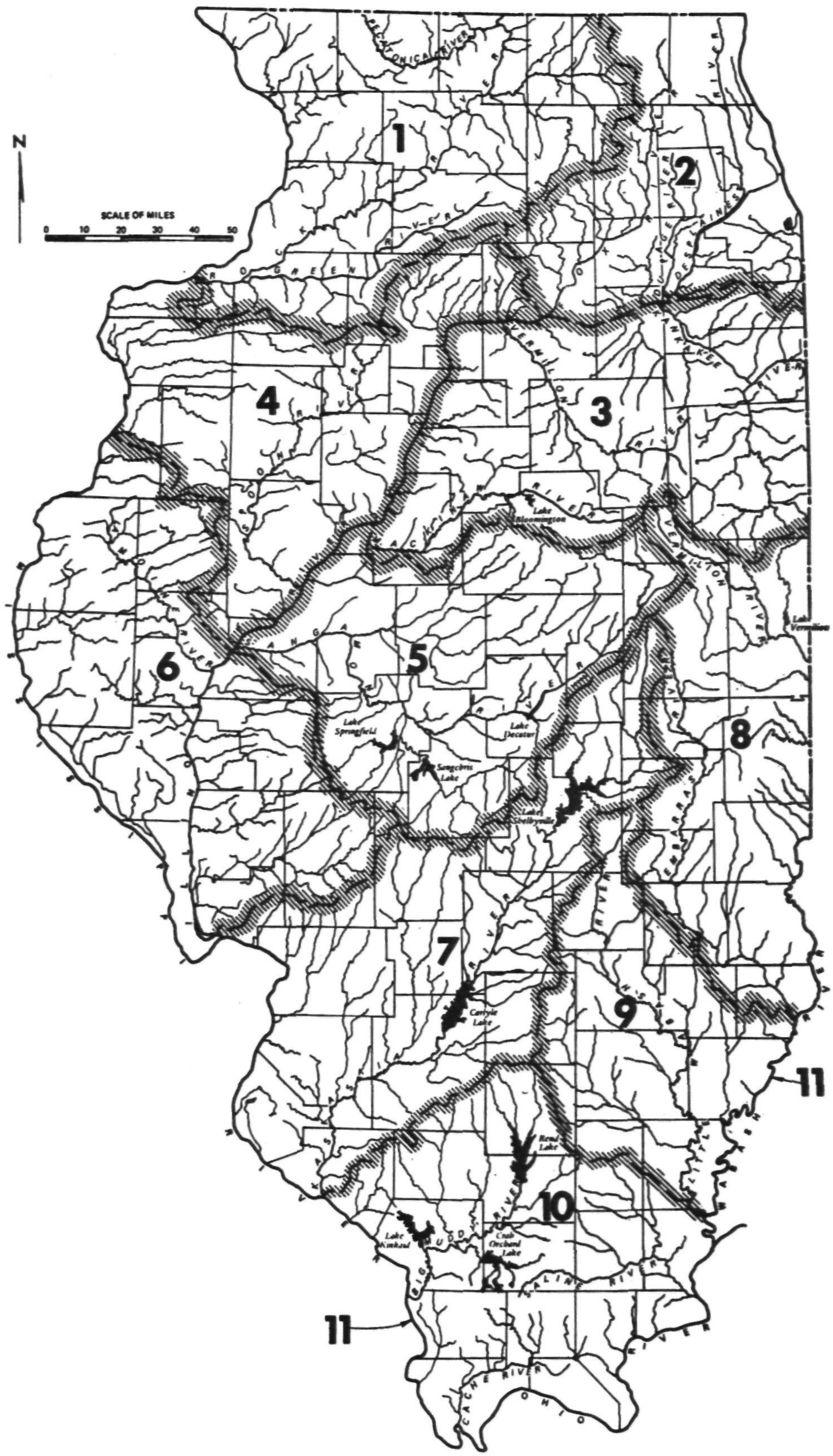

Figure 1. Rivers and other drainage areas included in the 11 separate maps

Acknowledgments

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METHODOLOGY

General procedures for developing the 7-day 10-year low flows along Illinois streams are described briefly. Any special features applicable to a particular region are noted under the relevant map description.

Flows at Stream Gaging Stations

The primary data used in this study are the measured flows at the USGS gaging stations on streams in Illinois and the border rivers. These stations are shown on the 7-day 10-year low-flow maps. The flow data were brought up-to-date to the year 1984 and stored on computer disk for quick computer processing. Low flows in Illinois streams occur most often during August to November and do not occur in March or April, which are the months of high spring flows, snowmelt, and high water table. Therefore the water year selected for low-flow analysis was taken to begin April 1 and end March 31 of the following year.

A computer program was written to compute the lowest 7-day flow each year of the available record for each station, and to print the year, the flow value, and the beginning day of the 7-day period. The computer program also ranked these 7-day low flows in ascending order of magnitude and computed the corresponding probability of nonexceedance and recurrence interval in years from

$$p_m = \frac{m}{n+1} \times 100$$

$$T_m = \frac{n+1}{m}$$

in which m is the rank of 7-day low flow, m = 1, 2, ... , n; n denotes the total number of years; pm represents percent probability of the low flow being equal to or less than the mth low flow; and T_m is the average recurrence interval in years, for the mth flow. If mere are no wastewater treatment plants upstream that discharge effluents that affect the low flow at the gage under consideration, the 7-day low flow corresponding to the 10-year recurrence interval yields the 7-day 10-year low flow at the gage. The 7-day low-flow values at some stations do indicate a trend for increases in low flow when the drainage area upstream of the gaging station is slowly or rapidly urbanizing and thus is discharging more and more wastewater effluents to the stream. By properly keeping track of the effluent discharges for the years with small 7-day low flows, the 7-day 10-year low flows are developed for the natural condition (without any effluent discharges, water withdrawals, or regulation) as well as for the 1984 condition of effluent discharges, water withdrawals, and/or regulation.

Flows along the Streams

The 7-day 10-year low flows at the gaging stations serve as benchmarks for estimating these low-flow values along the streams and tributaries. Another type of pertinent information is the location of wastewater treatment plant effluents entering the stream and their low-flow effluents during the months in which 7-day 10-year low flow may occur in the receiving stream. For maximum utility, 7-day 10-year low-flow values need to be estimated at locations near towns, at junctions with medium and major tributaries, at sizeable inflows from wastewater treatment plants, and at regulation or control works. The 7-day 10-year low-flow values were estimated at these various points along the streams, but not all of them are shown on the low-flow maps to avoid overcrowding the maps.

The 7-day 10-year low flows along the streams were derived with the use of the following tools, singly or in combination, as dictated by the prevailing conditions in each general area.

Low Flow vs Area Curves

The curve for the natural 7-day 10-year low flow versus drainage area, applicable to the area under consideration, indicates the drainage area A_o, for which the natural 7-day 10-year low flow is zero. The creeks, streams, and tributaries with drainage area less than A_o are shown by dot-dash lines on the low-flow maps. When the drainage area equals A_o, the low-flow value is shown as 0.00 and the stream is drawn as a solid line downstream, which means it is then a perennial-flow stream.

Wastewater Treatment Plant Effluents

The wastewater effluents entering the streams pose some problems in estimations of low flows. If these effluents enter streams that have drainage area less than A_o, an estimate has to be made of the losses occurring in the intermittent streams to determine whether these effluents are absorbed before reaching the natural perennial-flow stream. If the effluent additions are small and enter the stream in the upper reach, generally they are lost in the dry streambed. However, if the effluent additions are considerable, they may contribute to some flow at the stream point with drainage area A_o. The larger the effluent is and the closer it is to the point of entrance to the A_O point, the larger the flow contribution will be. Once the stream has non-zero natural 7-day 10-year low flow, any effluent additions simply increase the 7-day 10-year low flow by the amount of effluent addition.

Water Withdrawals for Municipal and Industrial Uses

Generally any town or industry pumping water from a stream returns it to the stream after use in the form of effluents from its wastewater plant. Such use does cause reduction in the 7-day 10-year low flow because the amount of return water is always less, though the deficit varies. Adjustments in 7-day 10-year low-flow values are made for these losses where necessary.

Timing of Low Flows in Two Major Branches

When two major branches drain sufficiently large areas before joining together, the curves for 7-day 10-year low flow versus area that are applicable to these branches may be quite different because of hydrologic, geologic, and soil factors. Further, the low flows may not occur during the same month. Under such conditions, the 7-day 10-year flow below the junction will be higher than a simple addition of the 7-day 10-year low flows in the two branches.

Modification of Low Flows because of Lakes and Pools

Instream lakes and pools generally reduce the 7-day 10-year low flow unless a significant minimum flow release is provided in the project design. Lakes and pools expose considerable water surface areas to evaporation. If the water levels are regulated for recreational or other purposes, the flow needed to maintain lake level combined with evaporation loss may reduce the 7-day 10-year low flow at the lake outlet to zero. If no water is released from lakes in order to hold water for municipal or industrial use during critical dry periods, the 7-day 10-year low flow below the impounding structure is zero. However, in large multipurpose reservoirs (e.g., Shelbyville, Carlyle, and Rend Lake), some minimum flow release is stipulated downstream of the dam, and this can be taken as the 7-day 10-year low flow at the outlet

Flow Regulation for Navigation

Flows in the Illinois River are regulated through a series of locks and dams for navigation purposes. On the Illinois River there are five locks and dams near Dresden, Marseilles, Starved Rock, Peoria, and La Grange, creating pools with very little slope during 7-day 10-year low-flow conditions. There are three USGS gaging stations on the Illinois River, at Marseilles, Kingston Mines, and Meredosia. The observed losses are attributed to evaporation and storage as needed for satisfactory flow regulation. These are proportional to water-surface area. Therefore the distribution of losses along the river is found by determining the use of the lake, river, and backwater surface areas at different points along the river.

Ground-Water Accretion to Low Flow

A stream becomes a gaining stream when ground water flows into the stream. The amount of this accretion has been shown (Singh, 1968) to be related to the depth of streambed incision or entrenchment. The amount of this gain is estimated from the low-flow data at gaging stations along a major stream, streambed conditions, existence of permeable deposits, and other pertinent factors.

Flow Data from Gaging Stations in Adjoining Stales

For determining 7-day 10-year low flows in the Mississippi River bordering Illinois, the daily-flow data at some USGS gaging stations in the neighboring states of Wisconsin, Iowa, and Missouri, as well as at stations along the Mississippi itself, were used. The multi-station computer program provided the information on concurrent flows. With the exception of the timing problem for low flows in the Missouri-Mississippi Rivers at their confluence, the period of low flows was decided primarily by low flows in the Mississippi River.

Other Considerations

Some other assumptions have been made in deriving 7-day 10-year low flows along the streams and showing them on the low-flow maps.

1) Effluents from wastewater treatment plants serving schools have not been considered because these would be practically zero during school closure in July and August, the usual months of low flow in streams.

2) Effluents from wastewater treatment plants serving trailer parks and recreation areas (and some small towns) are not considered if such effluents are very small -- say, 0.01 cfs or less.

3) Many wastewater polishing lagoons have no or negligible outflow during July to September, though they may have flow in many other months. The effluent flow from such lagoons under the 7-day 10-year low-flow conditions in the receiving stream is taken as zero.

4) Any local conditions that are atypical of the general area were not considered. For example, flow from a local spring was not considered unless springs were distributed over the general area.

5) The 7-day 10-year low flows for the 1984 condition of effluents may need adjustment in later years with increases in effluent flows because of increased population. The impact of such increases may be greater in streams having small natural low flows.

MAP 3. KANKAKEE REGION

The Kankakee region includes the Kankakee, Mazon, Vermilion, and Mackinaw Rivers and the areas drained by streams directly entering the Illinois River from the east, upstream of the Sangamon River.

The *Kankakee River* flows westward from Indiana into Illinois. The headwaters are near South Bend, Indiana, and the mouth is at the confluence of the Kankakee and the Des Plaines River where these rivers combine to become the Illinois River. Of the 5165 square miles in the Kankakee River drainage basin, 2169 are in Illinois. The river has a total length of about 150 miles, with 57 miles in Illinois. There is a very small dam at Momence, a larger dam at Kankakee, and an overflow dam at Wilmington, but most of the river remains a natural, meandering stream. A major tributary to the Kankakee River is the Iroquois River, which joins the Kankakee just below Aroma Park. About one-third of its Iroquois drainage basin lies in Indiana. Singleton Ditch, a channelized tributary with most of its drainage area in Indiana, joins the Kankakee about 6 miles downstream of the Illinois-Indiana border.

The Kankakee River basin is covered with a mantle of glacial deposits (from Kansan, Illinoian, and Wisconsinan glaciations) overlying Paleozoic bedrock. In Illinois most of the bedrock in the basin is Silurian dolomite, and in Indiana much of the bedrock is Devonian shale. The surficial deposits in the Kankakee basin belong to the Wisconsinan glaciation. The morphology of the present-day Kankakee River basin in Indiana is due to channelization (completed in 1918) and dredging over its entire length from South Bend, Indiana, to the Indiana-Illinois state line. In Illinois the Kankakee River flows as a natural, meandering stream. Between the state line and Momence lies an area commonly called the Momence Wetlands, in which the Kankakee River flows over thick sand deposits. Between Momence and Kankakee, the Kankakee River, for the most part, flows on bedrock.

The *Mackinaw River* begins in northwestern Ford County and flows in a generally westward course, entering the Illinois River below Pekin in Tazewell County. Two man-made reservoirs, Lake Bloomington on Money Creek and Evergreen Lake on Six Mile Creek, collectively drain an area of 100 square miles. Physiographically, most of the Mackinaw River basin is located within the Bloomington Ridged Plain except the area near the confluence with the Illinois River, which is located within the Springfield Plain (Leighton et al., 1948).

The *Vermilion River* is 113 miles long with a drainage area of 1330 square miles. The river basin is located within the Bloomington Ridged Plain (Leighton et al., 1948) except for the headwaters of the North Fork Vermilion River in northwestern Ford County. The Bloomington Ridged Plain is characterized by low, broad morainic ridges with intervening wide stretches of relatively flat or gently undulatory ground moraine. The glacial deposits are relatively thick throughout the basin. Illinoian and older drift are present below the Wisconsinan in most places. Basin soils mainly comprise soils developed primarily from loess and glacial drift (Fehrenbacher et al., 1967).

$Q_{7,10}$ at Gaging Stations

U.S. Geological Survey daily-flow records for 27 gaging stations were analyzed to determine the 7-day 10-year low-flow, Q7,10, values at each gaging station by following the procedures outlined by Singh and Stall (1973). The gaging station, USGS number, drainage area, and 7-day 10-year low-flow information is given in Table 1-3.

Wastewater Plants and Effluents

The municipal and industrial plants and their effluents during dry conditions (applicable to Q7,10 flow conditions in the receiving stream) are listed in Table 2-3 together with the counties in which they are located. The effluents from the Commonwealth Edison Dresden and Powerton plants are shown as negative (the Braidwood plant is not in operation at present). These power plants withdraw water from the Illinois River for cooling purposes and return it after use. Water loss occurs in this exchange. Net losses also take place in the Kankakee River near Kankakee and the Vermilion River near Pontiac and Streator because of water withdrawal for water supply and reduced return flow from the municipal wastewater treatment plants. The effluents at these locations are also shown as negative.

Illinois River

The Illinois River basin covers 28,906 miles in northern and central Illinois. The flow in the Illinois River is regulated through a series of locks and dams for navigation purposes. Figure 2 shows the bed profile, the longitudinal water surface profile during low flows, the five locks and dams (Dresden, Marseilles, Starved Rock, Peoria, and La Grange) and the five pools they create, and the three USGS gaging stations. The pools have very little surface slope during 7-day 10-year low-flow conditions. The gaging stations included in map 3 and their 7-day 10-year low flows are station 05543500, Illinois River at Marseilles, 3180 cfs, and station 05568500, Illinois River at Kingston Mines, 3050 cfs. The third gaging station in the Illinois River basin, station 05585500 (Illinois River at Meredosia) has a 7-day, 10-year low flow of 3700 cfs (see maps 6 and 7 in SWS Contract Report 440 [Singh et al., 1988]).

The 7-day 10-year low flow at the beginning of the Illinois River at the confluence of the Des Plaines and Kankakee Rivers has been estimated at 3123 cfs from a study of concurrent flows at the following gaging stations:

05527500 - Kankakee River near Wilmington

05532500 - Des Plaines River at Riverside

05537000 - Chicago Sanitary and Ship Canal

05539000 - Hickory Creek at Joliet

05540500 - DuPage River at Shorewood

05542000 - Mazon River near Coal City

05543500 - Illinois River at Marseilles

Changes in $Q_{7,10}$: An Example

The 7-day 10-year low flow in the Vermilion River at Pontiac was calculated as 0.2 cfs under the 1970 effluent flow conditions (Singh and Stall, 1973). The flow of 0.2 cfs comprised 1.9 cfs natural flow minus 1.7 cfs water withdrawal for Pontiac. In 1984, the natural flow increased to 3.7 cfs and withdrawal for the city of Pontiac increased to 2.5 cfs, a net increase of 1.0 cfs over that in 1970. Thus the Q7,10 for the 1984 effluent flow condition becomes 1.2 cfs.

Table 1-3. Map 3: Gaging Stations, Drainage Areas, and $Q_{7,10}$

USGS number	*Station*	*Drainage area, mi²*	*$Q_{7,10}$, cfs*
05519500	West Creek near Schneider, IN	54.7	6.3
05520000	Singleton Ditch at Illinoi	220	21.7
05520500	Kankakee River at Momence	2,294	426
05525000	Iroquois River at Iroquois	686	15.0
05525500	Sugar Creek at Milford	446	3.6
05526000	Iroquois River near Chebanse	2,091	30.0
05526500	Terry Creek near Custer Park	12.1	0.03
05527500	Kankakee River near Wilmington	5,150	480
05542000	Mazon River near Coal City	455	020
05543500	Illinois River at Marseilles	8,259	3,180
05554000	North Fork Vermilion R. near Charlotte	186	0.0
05554500	Vermilion River at Pontiac	579	\2
05555500	Vermilion River at Lowell	1,278	6.6
05559500	Crow Creek near Washburn	115	0.0
05560500	Farm Creek at Farmdale	27.4	0.0
05561000	Ackerman Creek at Farmdale	11.2	0.0
05561500	Fondulac Creek near East Peoria	5.54	0.0
05562000	Farm Creek at East Peoria	61.2	0.0
05564400	Money Creek near Towanda	49.0	0.0
05564500	Money Creek above Lake Bloomington	53.1	0.0
05565000	Hickory Creek above Lake Bloomington	9.81	0.0
05566000	East Branch Panther Creek near Gridley	6.3	0.0
05566500	East Branch Panther Creek at El Paso	30.5	0.0
05567000	Panther Creek near El Paso	93.9	0.0
05567500	Mackinaw River near Congerville	767	*1.2*
05568000	Mackinaw River near Green Valley	1,089	*252*
05568500	Illinois River at Kingston Mines	15,819	3,050

Table 2-3. Map 3: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions

County	*Wastewater plant*	*Effluent, cfs*
Municipal		
Bureau	DePue	0.29
	Spring Valley	0.88
Ford	Piper City	-
Grundy	Coal City	0.26
	Gardner	0.20
	Mazon	-
	Morris	1.2
	South Wilmington	0.07
Iroquois	Buckley	-
	Cissna Park	0.04
	Gilman	-
	Loda	-
	Milford	-
	Onarga	-
	Sheldon	-
	Watseka	0.77
Kankakee	Bourbonnais	1.2
	Bradley	1.0
	Herscher	0.09
	Kankakee, STP	8.5
	Kankakee, withdrawal for water supply	-14.5
	Manteno	0.56
	Momence	0.84
	Sun River Terrace	0.03
La Salle	Cedar Point	-
	La Salle	1.3
	Lostant	-
	Marseilles	0.84
	North Utica	0.13
	Oglesby	0.38
	Ottawa	2.7
	Peru	1.7
	Ransom	-
	Rutland	-
	Seneca	0.25
	Streator, STP	2.1
	Streator, withdrawal for water supply	-3.0
	Tonica	0.05
Livingston	Chatsworth	-
	Cullom	-
	Dwight	0.60
	Fairbury	0.50
	Flanagan	0.07
	Forrest	0.18
	Odell	-
	Pontiac, STP	2.1
	Pontiac, withdrawal for water supply	-2.5

Table 2-3. Map 3: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions
(Continued)

County	*Wastewater plant*	*Effluent, cfs*
McLean	Chenoa	-
	Colfax	-
	Gridley	-
	Hudson	-
	Lexington	-
	Towanda	-
Marshall	Lacon	0.24
	Toluca	0.07
	Varna	-
	Wenona	-
Peoria	Chillicothe	0.64
	Peoria	20.4
Putnam	Granville	0.18
	Hennepin	0.22
	Magnolia	-
Tazewell	Creve Coeur	0.65
	Deer Creek	-
	East Peoria, #1	2.3
	Easr Peoria, #2	0.74
	Green Valley	-
	Hopedale	0.04
	Mackinaw	-
	Marquette Heights	029
	Morton, South	2.6
	Morton, NW	0.28
	Pekin,#l	2.5
	Pekin,#2	1.0
	Sunnyland	0.05
	Tremont	0.08
	Washington, #1	0.68
	Washington, #2	0.52
Will	Beecher	0.23
	Braidwood	0.21
	Manhattan	0.19
	Peotone	0.26
	Wilmington	0.38
Woodford	El Paso	0.33
	Eureka	0.28
	Germantown Hills	0.05
	Goodfield	0.04
	Metamora	-
	Minonk	0.11
	Roanoke	025
	Secor	-
	Washburn	-

Table 2-3. Map 3: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions
(Concluded)

County	*Wastewater plant*	*Effluent, cfs*
Industrial and others		
Bureau	Mobile Chemical Corp. (M.C.C.)	-0.75
	New Jersey Zinc Co. (NJ.Z.C.)	0.09
Grundy	Burst Estates Mobile Home Park (B.E.M.H.P.)	0.05
	Bookwalter Woods Mobile Home Park (B.W.M.H.P.)	-
	Commonwealth Edison Dresden Plant (C.E.D.P.)	-23.4
	Dupont Seneca Works (D.S.W.)	1.1
	Norchem Inc. (N.I.)	2.8
	Northern Illinois Gas Co. (N.I.G.C.)	0.23
	Reichhold Chemicals Inc. (R.C.I.)	0.03
Kankakee	A.O. Smith Corp. (A.O.S.C.)	0.14
	Armstrong World Industries (A.W.I.)	0.13
	Lehigh Quarry (L.Q.)	4.5
	Manteno Mobile Home Park (M.M.H.P.)	0.02
	Manteno Rock Quarry (M.R.Q.)	3.3
	Momence Quarry (M.Q.)	2.5
	Strongheart Products Inc. (S.P.I.)	0.09
La Salle	American Hoechst Corp. (A.H.C.)	1.8
	American Nickeloid Co. (A.N.C.)	0.07
	Borg Warner Chemical Inc. (B.W.C.I.)	2.1
	County Acres Mobile Home Park (C.A.M.H.P.)	0.03
	Libbey Owens Ford Co. (L.OJ.F.C.)	-0.70
Marshall	B.F. Goodrich Co. (B.P.G.C.)	0.91
	W.P. Grace & Co. (W.P.G.C.)	0.20
Peoria	Central Illinois Light Co. (C.I.L.C.)	1.3
	Caterpillar Tractor Co. (C.T.C.)	\2
	Caterpillar Tractor Co. (C.T.C.)	1.7
	Keystone Steel & Wire Co. (K.S.W.C.)	5.3
	Pinewood Mobile Home Park (P.M.H.P.)	0.02
	Peoria Water Co. (P.W.C.)	0.12
Putnam	Illinois Power Co. (I.P.C.)	-1.5
	Jones & Laughlin Steel Co. (J.L.S.C.)	-0.46
Tazewell	Commonwealth Edison Powerton Plant (C.E.P.P.)	-11.0
	Grandview Mobile Home Park (G.M.H.P.)	0.03
	Highview Estates (H.E.)	0.06
	Midwest Grain Products (M.G.P.)	25
	Pekin Energy Co. (PJ5.C.)	0.46
	Sundale Sewer Inc. & Washington Estates Inc.(S.S.I. & W.E.I.)	0.28
Will	Joliet Army Ammunition Plant (J.A.A.P.)	0.08

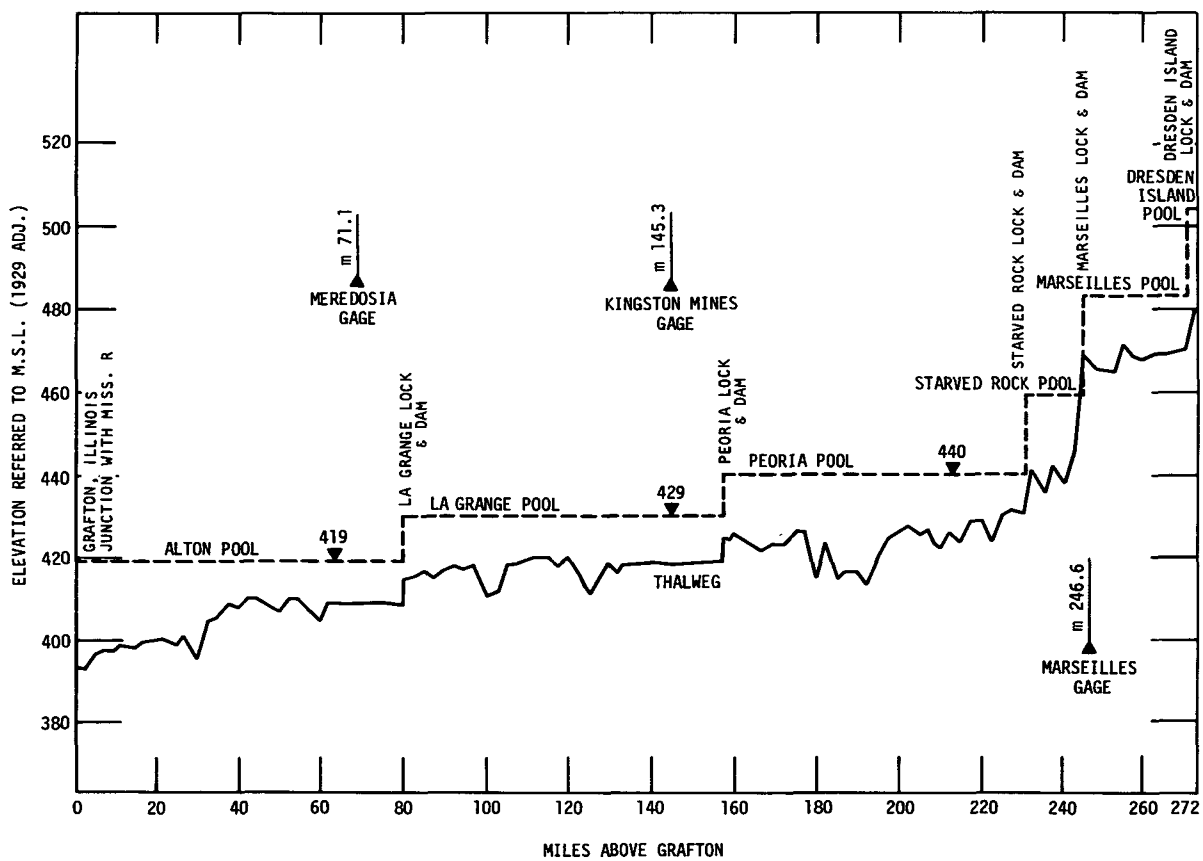

Figure 2. Bed profile and water surface elevations in the various pools of the Illinois River

MAP 5: SANGAMON REGION

The Sangamon region includes the Sangamon River and areas drained by small streams directly entering the Illinois River (between miles 147 and 96) from the east.

The *Sangamon River* drains an area of 5419 square miles and is 241 miles in length. The major tributaries of the river are the South Fork Sangamon River and Salt Creek. These tributaries drain 885 and 1868 square miles, respectively. The river rises in McLean and Ford Counties and flows southwest for about 70 miles to Lake Decatur. It is a man-made lake created by a dam across the river in Decatur for the purpose of municipal water supply. From Decatur, the Sangamon continues west about 33 miles to a point about 13 miles southeast of Springfield, where it takes a northwesterly course for some 67 miles until joined by Salt Creek about 10 miles north of Petersburg. The river course is marked by flat valleys which vary in width according to the resistance of the drift to erosion. From its confluence with Salt Creek, the river flows westerly about 33 miles, through straightened channels, and then empties into the Illinois River above Beardstown.

The *South Fork* drains 88S square miles. It originates in southwestern Macon and northwestern Shelby Counties. It flows southwest up to 5 miles beyond Taylorville and then bends around to flow northwest It is 88 miles long and joins the Sangamon 2 miles upstream of Riverton.

Salt Creek rises in the southeast quarter of McLean County and flows southwest about 35 miles through rolling country. It turns west near Lane and continues through typical prairie to its confluence with the Sangamon, some 8 miles southwest of Mason City. For about 5 miles before joining the Sangamon, it flows through straightened channels. Salt Creek is 118 miles long and drains 1868 square miles.

Q7,10 at Gaging Stations

U.S. Geological Survey daily-flow records for 23 gaging stations were analyzed to determine the 7-day 10-year low-flow, Q7,10, values at each gaging station by following the procedures outlined by Singh and Stall (1973). The gaging station, USGS number, drainage area, and 7-day 10-year low-flow information is given in Table 1-5.

Wastewater Plants and Effluents

The municipal and industrial plants and their effluents during dry conditions (applicable to Q7,10 flow conditions in the receiving stream) are listed in Table 2-5 together with the counties in which they are located.

Lake Springfield

Lake Springfield was completed in 1935 by the construction of Spaulding Dam across the valley of Sugar Creek. The dam is 1900 feet long and has a spillway elevation of 560 feet msl. The reservoir is approximately 12 miles in length, extending south and west from the dam. Its present storage capacity is about 52,000 acre-feet, and its surface area is about 4000 acres. The reservoir is used for the City of Springfield's water supply and also for boiler and cooling water for the city's coal-fired power plant The city's water treatment plant and power plant are located along the lakeshore south of the dam. There is no mandatory low-flow release.

Lake Decatur

Lake Decatur was created by a 1900-foot-long dam, built in 1922 across the Sangamon River near Decatur. The pool level is normally maintained at 613.S feet msl. At present, the lake has a storage capacity of about 19,000 acre-feet and a surface area of about 3000 acres, and it is used for the Decatur public water supply and for recreation purposes. There is no mandatory low-flow release.

Clinton Lake

The dam across Salt Creek, about 5 miles east of Clinton, was built in 1977 by the Illinois Power Company to create Clinton Lake. The lake has a storage capacity of about 73,000 acre-feet and a surface area of 5000 acres. The total shore line is estimated as 130 miles. The lake is used primarily for cooling purposes for the nuclear power plant, and for recreation. The mandatory low-flow release is 5.0 cfs.

Table 1-5. Map 5: Gaging Stations, Drainage Areas, and $Q_{7,10}$

USGS number	*Station*	*Drainage area, mi^2*	*$Q_{7,10}$, cfs*
05568500	Illinois River at Kingston Mines	15,819	3,050
05570910	Sangamon River at Fisher	240	0.03
05571000	Sangamon River at Mahomet	362	0.45
05571500	Goose Creek near DeLand	47.9	0.0
05572000	Sangamon River at Monticello	550	1.9
05572450	Friends Creek at Argenta	111	0.0
05572500	Sangamon River near Oakley	774	5.8
05574000	South Fork Sangamon River near Nokomis	11.0	0.0
05574500	Flat Branch near Taylorville	276	0.0
05575500	South Fork Sangamon River at Kincaid	562	1.5
05575800	Horse Creek at Pawnee	52.2	0.0
05576000	South Fork Sangamon River near Rochester	867	0.89
05576500	Sangamon River at Riverton	2,618	59.5
05577500	Spring Creek at Springfield	107	0.0
05578500	Salt Creek near Rowell	335	6.4
05579500	Lake Fork near Comland	214	2.4
05580000	Kickapoo Creek at Waynesville	227	\2
05580500	Kickapoo Creek near Lincoln	306	3.2
05580950	Sugar Creek near Bloomington	34.4	15.6
05581500	Sugar Creek near Hartsburg	333	15.7
05582000	Salt Creek near Greenview	1304	86.0
05582500	Crane Creek near Easton	26.5	0.89
05583000	Sangamon River near Oakford	5,093	238

Table 2-5. Map 5: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions

County	*Wastewater plant*	*Effluent, cfs*
Municipal		
Champaign	Fisher	0.18
	Mahomet	0.20
	Rantoul	0.32
Christian	Assumption	0.22
	Edinburg	0.07
	Kincaid	0.21
	Morrisonville	0.07
	Mount Auburn	-
	Stonington	-
	Taylorville	2.2
	Tovey	-
DeWitt	Clinton	0.48
	Farmer City	0.24
	Kenney	0.03
	Waynesville	-
	Weldon	-
Ford	Gibson City	0.35
Logan	Atlanta	-
	Emden	-
	Lincoln	3.2
	Mount Pulaski	-
	San Jose	0.05
McLean	Bellflower	-
	Bloomington	15.7
	Danvers	-
	Heyworth	0.06
	LeRoy	0.22
	McLean	-
	Saybrook	-
Macon	Argenta	-
	Blue Mound	0.05
	Decatur, #1	31.2
	Decatur, #2	3.2
	Harristown	0.05
	Macon	-
	Maroa	0.14
	Mount Zion	-
	Niantic	-
	Warrensburg	-
Macoupin	Virden, East	0.19
	Virden, North	0.03
Mason	Bath	-
	Easton	0.02
	Havana	0.30
	Kilbourne	-
	Manito	0.15
	Mason City	-

Table 2-5. Map 5: Wastewater Plants and Effluents for $Q_{7,10}$, Conditions (Concluded)

County	*Wastewater plant*	*Effluent, cfs*
Menard	Athens	0.06
	Greenview	-
	Petersburg	0.13
	Tallula	-
Piatt	Cerro Gordo	0.01
	Mansfield	-
	Monticello	0.68
Sangamon	Auburn	0.32
	Buffalo	-
	BDM Lagoon	-
	Chatham	-
	Dawson	-
	Divernon	0.08
	Illiopolis	-
	Loami	-
	Mechanicsville	-
	New Berlin	-
	Pawnee	-
	Riverton	0.12
	Rochester, North	0.01
	Rochester, West	0.12
	Springfield, #1	17.8
	Springfield, #2	9.3
	Williamsville	0.09
Shelby	Moweaqua	0.14
Tazewell	Delavan	0.16
	Minier	0.10
Industrial and others		
Ford	Central Soya Co. (C.S.C.)	0.06
Logan	Pierce Glass Co. (P.G.C.)	0.15
McLean	Cargill,Inc.(C.L)	0.96
	Nestle-Beich Co. (N.B.C.)	0.14
Piatt	Viobin Corp. (V.C.)	0.90
Sangamon	Borden Chemical Co. (B.C.C.)	0.93
	City Water, Light, and Power (C.W.L.P.)	6.2
	St Francis Convent (S.F.C.)	0.09

MAP 8: EMBARRAS REGION

The Embarras region includes the Vermilion and Embarras Rivers and the areas drained by streams directly entering the Wabash River from the west, upstream of the Embarras River.

The *Vermilion River* has a drainage area of 1434 square miles and is 106 miles long. Major tributaries are the North Fork, Middle Fork, and Salt Fork. The topography of the Vermilion River basin (Barker et al., 1967) varies from flat throughout most of the area to gently rolling along the morainal ridges. Steep slopes are confined to the valley walls of the larger streams and their tributaries, particularly in the southeastern or lower end of the basin. The parent materials of the Vermilion River basin soils are almost entirely of glacial origin. These materials usually consist of loess on till, outwash, or lakebed deposits. The only soils of postglacial origin are the alluvial, silt loams in the bottomlands of the river.

The *Embarras River* drains an area of 2440 square miles and is 194 miles long. The headwater of the basin is in Champaign County, and the river joins the Wabash River at mile 122 in Lawrence County. At the northern end of the basin the land is rough and hilly and tributary streams have steep gradients, while at the southern end of the basin lands are generally more flat, and the stream and tributary gradients are quite mild. For a distance of five miles upstream of Lawrenceville, the stream flows are affected by backwater from the Wabash River.

The present topography of the entire basin is the result of recent modification of glacial activity during the Wisconsinan and Illinoian glacial periods. The northern part of the basin lies in the Bloomington Ridged Plain physiographic division (Leighton et al., 1948), which exhibits low and broad morainic ridges of Tazewell age, with intervening wide areas of flat or gently undulatory ground moraines. The central portion of the basin is within the Springfield Plain, which was not subjected to the more recent Wisconsinan glacial activity. The lower portion is within the Mt. Vernon Hill Country physiographic province, where the Illinoian glacial drift exhibits mature topography with low relief and rather restricted areas of upland between the developed paths of drainage.

Q7,10 at Gaging Stations

U.S. Geological Survey daily-flow records for 21 gaging stations were analyzed to determine the 7-day 10-year low-flow, *Q7,10*, values at each gaging station by following the procedures outlined by Singh and Stall (1973). The gaging station, USGS number, drainage area, and 7-day 10-year low-flow information is given in Table 1-8.

Wastewater Plants and Effluents

The municipal and industrial plants and their effluents during dry conditions (applicable to *Q7,10* flow conditions in the receiving stream) are listed in Table 2-8 together with the county in which they are located. Effluents from the Central Illinois Public Service Company in Crawford County and Central Foundry in

Vermilion County are shown as negative. These plants withdraw water from the river and return it after use, and in this exchange net losses take place.

Wabash River

The Wabash River rises near Celina, Ohio, flows northwesterly for 67 miles to Huntington, Indiana; thence generally west and southwest 312 miles to its confluence with the White River (its major tributary); and thence southwesterly % miles to join the Ohio River. The overall length of the Wabash River is about 475 miles and its total drainage area is 33,100 square miles, of which 319 square miles lie in Ohio, 24,218 in Indiana, and 8563 in eastern Illinois (U.S. Army Corps of Engineers, 1967). From Clark County south to a point ten miles north of Shawneetown, where the river joins the Ohio River, its winding course forms the boundary between Illinois and Indiana. The portion of the Wabash River from river miles 272 to 122 is included in this region.

Lake Vermilion

Lake Vermilion is located northwest of the city of Danville in Vermilion County. The reservoir is owned and operated by Interstate Water Company as a water source for the city of Danville. The dam is a 525-foot-long earthfill and concrete structure, and was completed in 1925. As of 1976, the surface area at spillway level, 567 feet above mean sea level, was 608 acres and the storage capacity was 4641 acre-feet There is no mandatory low-flow release during dry conditions.

Table 1-8. Map 8: Gaging Stations, Drainage Areas, and $Q_{7,10}$

USGS number	*Station*	*Drainage area, mi²*	*$Q_{7,10}$, cfs*
03336000	Wabash River at Covington, IN	8,218	756
03336500	Bluegrass Creek at Potomac	35.0	0.0
03336900	Salt Fork near St Joseph	134	4.1
03337000	Boneyard Creek at Urbana	4.46	0.56
03337500	Saline Branch at Urbana	68.0	2.4
03338000	Salt Fork near Homer	340	22.7
03338500	Vermilion River near Catlin	958	30.2
03339000	Vermilion River near Danville	1,290	42.2
03339150	Little Vermilion River near Newport, IN	240	0.0
03340500	Wabash River at Montezuma, IN	11,118	895
03341420	Brouilletts Creek near Universal, IN	331	1.1
03341500	Wabash River at Terre Haute, IN	12,265	1,040
03342000	Wabash River at Riverton, IN	13,161	1,274
03343000	Wabash River at Vincennes, IN	13,706	1,337
03343400	Embarras River near Camargo	186	0.51
03344000	Embarras River near Diona	919	4.9
03344500	Range Creek near Casey	7.60	0.0
03345000	Embarras River at Newton	1,392	13.2
03345500	Embarras River at St Marie	1,516	16.6
03346000	North Fork Embarras River near Oblong	318	0.17
03346500	Embarras River at Lawrenceville	2,333	35.3

Table 2-8. Map 8: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions

County	*Wastewater plant*	*Effluent, cfs*
Municipal		
Champaign	Philo	-
	Rantoul, East	2.1
	Rantoul, West	0.32
	St. Joseph	0.18
	Savoy	-
	Sidney	-
	Tolono	0.12
	Urbana	14.9
Clark	Casey	0.28
	Marshall, East	0.22
	Marshall, West	0.18
	Martinsville	0.06
	Westfield	-
Coles	Charleston	1.7
	Mattoon	3.5
	Oakland	-
Crawford	Flat Rock	-
	Hutsonville	0.08
	Oblong	0.04
	Palestine	0.18
	Robinson	1.4
Cumberland	Greenup	-
	Toledo	0.10
Douglas	Arcola	0.33
	Hindsboro	-
	Newman	-
	Tuscola, South	0.29
	Tuscola, North	0.24
	Villa Grove	0.24
Edgar	Chrisman	0.06
	Kansas	-
	Paris, South	1.0
	Paris, North	0.49
Ford	Paxton	0.38
Jasper	Newton	0.25
Lawrence	Bridgeport	-
	Lawrenceville	0.42
	Summer	0.10
Vermilion	Catlin	0.24
	Danville	9.1
	Fithian	-
	Georgetown	0.46
	Hoopeston	0.87
	Oakwood	0.10
	Potomac	-
	Ridge Farm	0.06
	Rossville	0.05
	Tilton	0.21
	Westville	0.52

Table 2-8. Map 8: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions (Concluded)

County	*Wastewater plant*	*Effluent, cfs*
Industrial and others		
Champaign	Chanute Air Force Base (C.A.F.B.)	1.3
Coles	Anamet, Inc. (A.I.)	0.02
	General Electric Co. (G.E.C.)	0.15
Crawford	Briggs Plumbingware Co. (B.P.C.)	0.08
	Central Illinois Public Service Co. (C.I.P.S.C.)	-0.20
	Marathon Petroleum Co. (M.P.C.)	1.4
Douglas	Cabot Corp. (C.C.)	0.15
Lawrence	Texaco Refining & Marketing, Inc. (T.R.M.I.)	0.08
Vermilion	Central Foundry (C J.)	-1.5
	Lauhoff Grain Co. (L.G.C.)	3.7

MAP 9: LITTLE WABASH REGION

The Little Wabash region includes the Little Wabash River and areas drained by small streams directly entering the Wabash River between its confluences with the Embarras River and the Little Wabash River.

The *Little Wabash River* drains about 3203 square miles, is 237 miles long, starts south of Mattoon, and flows in a generally southerly direction to join the Wabash River near New Haven. The river is located within the Glacial Plain Region; the northern portion lies in the Springfield Plain and the central and southern portions in Mt. Vernon Hill Country. It flows in a fairly narrow valley and is generally a meandering stream. The average fall of the river below Carmi is about 0.6 feet per mile. The soil in the basin of the Little Wabash is almost entirely a gray soil with a moisture-resisting, non-calcareous subsoil (Illinois State Planning Commission, 1938). Backwater from both the Ohio River and Wabash River affects the lower reaches of the Little Wabash River during high-flow and flood stages.

The *Skillet Fork,* the largest tributary of the Little Wabash River, drains an area of about 1061 square miles and is 102 miles long. It joins the Little Wabash River about 40 miles above its confluence with the Wabash River. The topography in the extreme upper reaches is slightly rolling, but it is comparatively flat in most of the remaining area.

$Q_{7,10}$ at Gaging Stations

U.S. Geological Survey daily-flow records for 11 gaging stations were analyzed to determine the 7-day 10-year low-flow, Q7,10. values at each gaging station by following the procedure outlined by Singh and Stall (1973). The gaging station, USGS number, drainage area, and 7-day 10-year low-flow information is given in Table 1-9.

Wastewater Plants and Effluents

The municipal and industrial plants and their effluents during dry conditions (applicable to Q7,10 flow conditions in the receiving stream) are listed in Table 2-9 together with the counties in which they are located.

Table 1-9. Map 9: Gaging Stations, Drainage Areas, **and $Q_{7,10}$**

USGS number	*Station*	*Drainage area, mi²*	*$Q_{7,10}$, cfs*
03343000	Wabash River at Vincennes, IN	13,706	1,337
03377500	Wabash River at Mount Carmel	28,635	2,504
03378000	Bonpas Creek at Browns	228	0.0
03378500	Wabash River at New Harmony, IN	29,234	2,634
03378635	Little Wabash River near Effingham	240	0.0
03378900	Little Wabash River at Louisville	745	0.60
03379500	Little Wabash River below Clay City	1,131	1.4
03380350	Skillet Fork near Iuka	208	0.0
03380475	Horse Creek near Keenes	97.2	0.0
03380500	Skillet Fork at Wayne City	464	0.05
03381500	Little Wabash River at Carmi	3,102	6.8

Table 2-9. Map 9: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions

County	*Wastewater plant*	*Effluent, cfs*
Municipal		
Clay	Clay City	0.08
	Flora	0.56
	Louisville	0.06
	Xenia	0.02
Cumberland	Neoga	0.16
Edwards	Albion	0.20
	West Salem, #1	0.04
	West Salem, #2	0.02
Effingham	Altamont, South	0.04
	Altamont, North	0.02
	Dieterich	-
	Edgewood	-
	Effingham	1.8
	Mason	-
	Teutopolis	-
	Watson	-
Hamilton	Dahlgren	0.03
Jefferson	Bluford	0.04
	Harmony	-
Lawrence	St. Francisville	0.04
Marion	Iuka	-
Richland	Claremont	-
	Dundas	-
	Noble	-
	Olney	1.5
Shelby	Sigel	-
	Strasburg	-
Wabash	Allendale	-
	Bellmont	0.02
	Keensburg	-
	Mount Carmel	1.5
Wayne	Cisne	0.07
	Fairfield	0.42
	Jeffersonville	-
	Sims	-
	Wayne City	0.07
White	Carmi	1.1
	Crossville	0.09
	Enfield, East	0.07
	Enfield, West	0.04
	Grayville	0.28
	Maunie	-
	Mill Shoals	-
	Springerton	-
Industrial and others		
Jasper	Central Illinois Public Service Co. (C.I.P.S.C.)	-
Richland	American Machine & Foundry Co. (A.M.&F.C.)	0.36

MAP 10: SOUTHERN REGION

The Southern region includes the Saline, Big Muddy, and Cache Rivers and areas drained by small streams directly entering the Ohio and Mississippi Rivers. The region lies just outside the southern limit of glacial drift in Illinois; the underlying rock strata vary a great deal over the region. The general topography is hilly. A range of hills and high tablelands extends from east to west, separating the valleys of the Cache River and Big Bay Creek from the valley of the Saline River. The area north of the Saline River is comparatively flat, and the valley of the river itself broadens to several miles in width where it joins the valley of the Ohio.

The *Ohio River* forms the Illinois-Kentucky boundary line in this region. It flows into the Mississippi River at Cairo. About ten miles above Cairo, the valleys of the Ohio and the Mississippi merge to form a flat, wide delta. This area is periodically flooded by both rivers.

The *Saline River* is 84 miles long and drains 1177 square miles. Three major tributaries are the North Fork, Middle Fork, and South Fork Saline River. The North Fork rises in central Hamilton County and flows south through a flat plain, emptying into the Saline River about one mile east of Equality. Rising in the northeast quarter of Williamson County, the Middle Fork flows southeast through a wide, flat valley and joins the Saline about five miles below the gaging station near Harrisburg. The South Fork originates in the northern part of Johnson County and flows eastward through the southern portions of Williamson and Saline Counties to its confluence with the Middle Fork. Below the confluence of the Middle Fork and South Fork, the Saline River flows east to a point near Equality, where the North Fork joins, and then turns southeast, emptying into the Ohio River about ten miles south of Shawneetown. The southern part of the basin is very hilly, but the northern part is generally flat

The *Big Muddy River* rises in the northwestern part of Jefferson County, flows southward to the Franklin/Williamson county line, men southwesterly to a point about five miles west of Murphysboro, and thence southward to its junction with the Mississippi River about four miles south of Grand Tower. It is 154 miles long and has a total drainage area of 2387 square miles. This basin lies mostly in ML Vernon Hill Country (Leighton et al., 1948), which is characterized by mature topography of low relief. The present land surface is primarily a bedrock surface of low relief, and it is only slightly modified by a thin mantle of Illinoian drift.

In the *Cache River* basin, three physiographic provinces (coastal plain province, interior low plateaus province, and Ozark plateaus province) meet and provide the basin with unique, varying physiography (Leighton et al., 1948). The bed of the Cache River upstream of the Post Creek Cutoff is gradually eroding and lowering because of the steep gradient of the Cutoff. The flow at the USGS gaging station at Forman has not been affected significantly by the Post Creek Cutoff, which is about four miles downstream.

$Q_{7,10}$ at Gaging Stations

U.S. Geological Survey daily-flow records for 26 gaging stations were analyzed to determine the 7-day 10-year low-flow, Q7,10, values at each gaging station by following the procedure outlined by Singh and Stall

(1973). The gaging station, USGS number, drainage area, and 7-day 10-year low-flow information is given in Table 1-10.

Wastewater Plants and Effluents

The municipal and industrial plants and their effluents during dry conditions (applicable to Q7,10 flow conditions in the receiving stream) are listed in Table 2-10 together with the counties in which they are located. Effluents from the Central Illinois Public Service Company in Jackson County and Electric Energy Inc. in Massac County are shown as negative. These plants withdraw water from the river and return it after use, and in this exchange net losses take place.

Rend Lake

Rend Lake, situated in Jefferson and Franklin Counties, was created in 1970 by damming of the Big Muddy River. The lake is managed by the U.S. Army Corps of Engineers. The normal pool elevation is 405 feet msl, the storage capacity is 185,000 acre-feet, and the surface area is 18,900 acres. The lake is used for flood control and water supply as well as for recreational activities. It also serves as a source of public water supply for about 55 communities under the Rend Lake Conservancy District (Illinois State Water Survey, 1978). The mandatory low-flow release during dry conditions is 30 cfs.

Crab Orchard Lake

This lake was completed in 1940. Its storage capacity is 63,511 acre-feet, and its surface area is 6965 acres. The lake is used for recreational purposes; for conservation of water, soil, and forests; and as a migratory waterfowl refuge. There is no mandatory low-flow release during dry weather.

Lake Egypt

This lake was completed in 1962 by impoundment of the South Fork of the Saline River. Its storage capacity is 42,550 acre-feet, and its surface area is 2300 acres. The lake is owned by the Southern Illinois Power Cooperative, Marion, Illinois, and is used as a cooling reservoir for the coal-fired power generating station located at the west end of the dam.

Table 1-10. Map 10: Gaging Stations, Drainage Areas, and $Q_{7,10}$

USGS number	*Station*	*Drainage area, mi²*	*$Q_{7,10}$, cfs*
03382000	Middle Fork Saline River near Harrisburg	198	0.65
03382100	South Fork Saline River near Carrier Mills	147	2.3
03382170	Brush Creek near Harco	13.3	0.0
03382350	North Fork Saline River near Ridgeway	423	0.0
03382500	Saline River near Junction	1,051	4.2
03382510	Eagle Creek near Equality	8.51	0.0
03384450	Lusk Creek near Eddyville	42.9	0.0
03384500	Ohio River at Golconda	143,900	14,610
03385000	Hays Creek at Glendale	19.1	0.0
03385500	Lake Glendale Inlet near Dixon Springs	1.05	0.0
03386000	Lake Glendale Outlet near Dixon Springs	1.98	0.0
03386500	Sugar Creek near Dixon Springs	9.93	0.0
03611500	Ohio River at Metropolis	203,000	53320
03612000	Cache River at Forman	244	0.0
05595500	Marys River near Sparta	17.8	0.0
05595800	Sevenmile Creek near ML Vernon	21.1	0.0
05596000	Big Muddy River near Benton	502	32.0
05596500	Tilley Creek near West Frankfort	3.87	0.0
05597000	Big Muddy River at Plumfield	794	37.0
05597500	Crab Orchard Creek near Marion	31.7	0.0
05598500	Beaucoup Creek near Pinckneyville	231	0.0
05599000	Beaucoup Creek near Matthews	292	0.0
05599500	Big Muddy River at Murphysboro	2,169	55.0
05600000	Big Creek near Wetaug	*322*	0.0
07020500	Mississippi River at Chester	708,600	47,600
07022000	Mississippi River at Thebes	713,200	48,610

Table 2-10. Map 10: Wastewater Plants and Effluents for $Q_{7,10}$ Conditions

County	*Wastewater plant*	*Effluent, cfs*
Municipal		
Alexander	Cairo	1.0
	Tamms	0.02
	Thebes	0.06
Franklin	Benton, Main	0.59
	Benton, Southeast	0.02
	Christopher	0.20
	Royalton	0.07
	Sesser	0.17
	Thompsonville	0.03
	Valier	0.07
	West Frankfort	0.70
	Zeigler	0.15
Gallatin	Equality	-
	Ridgeway	0.13
	Shawneetown	0.35
Hamilton	McLeansboro	0.28
Hardin	Cave in Rock	-
	Elizabethtown	0.02
	Rosiclare	0.11
Jackson	Ava	0.05
	Campbell Hill	-
	Carbondale, SE	3.6
	Carbondale, NW	0.93
	DeSoto	0.07
	Elkville	-
	Grand Tower	0.04
	Gorham	-
	Murphysboro	0.71
	Vergennes	-
Jefferson	Bonnie	-
	Dix	-
	Ina	-
	ML Vernon	2.6
	Waltonville	-
	Woodlawn	0.02
Johnson	Goreville	0.04
	Vienna	-
Massac	Brookport	0.10
	Joppa	0.04
	Metropolis	1.3
Pope	Golconda	0.10
Pulaski	Karnak	-
	Mound City	0.14
	Mounds	0.14
	Olmsted	0.02

Table 2-10. Map 10: Wastewater Plants and Effluents for $Q_{7,10}$, Conditions (Concluded)

County	*Wastewater plant*	*Effluent, cfs*
Randolph	Chester	0.82
	Coulterville	-
	Percy	0.09
	Sparta	0.54
	Steelville	0.07
Saline	Carrier Mills	0.07
	Eldorado	0.54
	Galatia	0.13
	Harrisburg	0.88
	Muddy	-
Union	Anna	0.70
	Cobden	0.11
	Dongola	-
	Jonesboro	0.13
Washington	Ashley	0.02
White	Norris City	0.10
Williamson	Cambria	-
	Carterville	0.28
	Colp	0.02
	Crainville	0.02
	Creal Springs	0.05
	Energy	0.04
	Herrin	0.71
	Hurst	0.04
	Johnston City	0.27
	Marion	1.9
Industrial and others		
Jackson	Central Illinois Public Service Co. (C.J.P.S.C.)	-2.0
Jefferson	General Tire Co. (G.T.C.)	0.93
Johnson	Illinois State Penitentiary	0.19
Massac	Allied Corp. (A.C.)	5.5
	Electric Energy Inc. (E.E.I.)	-5.0
Williamson	Crab Orchard Natl. Wildlife Refuge (G.O.N.W.I.L)	0.31
	Little Grassy Fish Hatchery (L.G.J.F.H.)	2.3
	Magic Chef Norge Division (M.C.N.D.)	0.37
	Southern Illinois Power Corp. (S.I.P.C.)	4.2

MAP 11: BORDER RIVERS

The Illinois River and the main stems of the Mississippi, Wabash, and Ohio Rivers along the Illinois boundary are shown in this map. The 7-day 10-year low-flow values at the 19 gaging stations on this map are the same as those shown in maps 1 through 10. The gaging station, USGS number, drainage area, and 7-day 10-year low-flow information is given in Table 1-11.

Table 1-11. Map 11 Gaging Stations, Drainage Areas, and $Q_{7,10}$

USGS number	*Station*	*Drainage area, mi²*	*$Q_{7,10}$, cfs*
03336000	Wabash River at Covington, IN	8,218	756
03340500	Wabash River at Montezuma, IN	11,118	895
03341500	Wabash River at Terre Haute, IN	12,265	1,040
03342000	Wabash River at Riverton, IN	13,161	1,274
03343000	Wabash River at Vincennes, IN	13,706	1,337
03377500	Wabash River at Mount Carmel	28,635	2,504
03378500	Wabash River at New Harmony	29,234	2,634
03384500	Ohio River at Golconda	143,900	14,610
03611500	Ohio River at Metropolis	203,000	53,820
05420500	Mississippi River at Clinton, IA	85,600	13,990
05474500	Mississippi River at Keokuk	119,000	15,260
05537000	Chicago Sanit. & Ship Canal at Lockport	740	1,700
05543500	Illinois River at Marseilles	8,259	3,180
05568500	Illinois River at Kingston Mines	15,819	3,050
05585500	Illinois River at Meredosia	26,028	3,700
05587500	Mississippi River at Alton	171,500	21,490
07010000	Mississippi River at St. Louis, MO	697,000	46,500
07020500	Mississippi River at Chester	708,600	47,600
07022000	Mississippi River at Thebes	713,200	48,610

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