

1970
WISCONSIN DEPARTMENT OF NATURAL RESOURCES

BASE-FLOW STUDY OF
DUCK CREEK BASIN
BROWN AND OUTAGAMIE
COUNTIES, WISCONSIN

by

Robert W. Devaul

U. S. Geological Survey

Prepared by
United States Geological Survey
in cooperation with the
Wisconsin Department of Natural Resources

Madison, Wisconsin

OFR

Duck Creek

Copy #3



United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
1815 University Avenue
Madison, Wisconsin - 53706
June 22, 1970

Mr. John O'Donnell
Wisconsin Department of Natural Resources
P. O. Box 450
Madison, Wisconsin - 53701

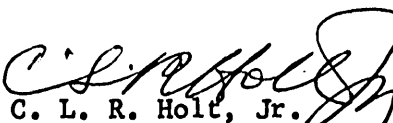
Dear Mr. O'Donnell:

Attached is the information collected as a result of the base-flow study of the Duck Creek basin, Brown and Outagamie Counties, Wisconsin, in August 1969. It includes one adjacent small basin tributary to Lake Michigan. This study was conducted by the U.S. Geological Survey in cooperation with the Wisconsin Department of Natural Resources.

Figure 2 is a map showing the locations of all stream measuring sites. Table 1 contains the streamflow information collected during the periods indicated; table 2 lists dissolved oxygen measurements. The additional tables were compiled from information already available from the files of the U.S. Geological Survey.

The streamflow at four continuous-record gaging sites in and near the Green Bay area (figure 1) indicated the discharge in the area to be at about the 50 to 55 percent duration point (table 2) during the first set of August measurements and at about the 70 to 80 percent duration point during the second set of August measurements. That is, about 55 and 80 percent of the time respectively, the discharge of these streams would exceed that which occurred on these dates. A representative summer base flow is considered to be on the order of 80 percent duration.

Very truly yours,


C. L. R. Holt, Jr.
District Chief

CLH/paz

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BASE-FLOW STUDY OF DUCK CREEK BASIN
BROWN AND OUTAGAMIE COUNTIES, WISCONSIN

Streams in the Duck Creek basin gain ground water throughout most of their reaches, however, ground-water pumping of the Green Bay - DePere area may reduce the water being gained by the streams from ground water. The August 11, 12 measurements were made during base-flow period when flow duration was about 50 to 55 percent (table 2). The August 27 measurements were made during a lower base-flow period when flow duration was about 70 to 80 percent. About 80 percent duration is more representative of low-flow conditions during the summer.

On August 11, 12, the sub-basins contributed ground water ranging from 0 to .108 cfs per sq mi. On August 11, 12, there was no measurable discharge at four sites and on August 28 there was no measurable discharge at six sites. Backwater at site 8 prevented a reliable measurement. The sub-basins contributing very small discharges are in the upper reaches of the stream near where the stream may become intermittent during dry periods. The high (.108 cfs per sq mi) discharge of Beaver Dam Creek (site 9) may be related to discharge from industries in western Green Bay.

Water temperatures during August 11, 12, and 28 ranged from 22.2°C (72°F) to 30.0°C (86°F). No temperature correlations were made because water temperatures were taken at different times during the day.

Specific conductance of water, measured in micromhos at 25°C, indicates the amount of dissolved minerals in the water. The specific conductance measured for the Duck Creek basin area ranged from 500 to 775 micromhos.

Dissolved oxygen measurements were made at least once at each site during the study. The values obtained indicated that at nearly every site the water was supersaturated. It would, however, be more useful to obtain a 24-hour dissolved oxygen profile at several points within the basin.

Table No. 1.--Low-flow and related water quality measurements in the Duck Creek basin, Brown and Outagamie Counties, Wisconsin.

Stream	Site No.	Drainage area above site (sq mi)	August 11, 12, 1968						August 27, 1968							
			Discharge		Mean vel. (ft/sec)	Spec. cond. (micro-mhos)	Temperature (°F)		Time CDT	Discharge		Mean vel. (ft/sec)	Spec. cond. (micro-mhos)	Temperature (°F)		Time CDT
			cfs	cfs/m ²			Air	Water		cfs	cfs/m ²			Air	Water	
Duck Creek	1	32.0	No measurable flow			640	79	77	1045	No measurable flow						
Tributary	2	7.81	No measurable flow			775	78	72	1100	No measurable flow						
Duck Creek	3	47.3	.10 ^e	.002	-	615	77	73	1020	No measurable flow						
Tributary	4	18.8	No measurable flow			580	78	78	0855	No measurable flow						
Duck Creek (sta. 04-0720.5)	5	92.2	.42	.004	.28	550	78	75	0835	.113	.001	.48	580	72	69	1135
Duck Creek	6	105	.84	.009	.50	580	84	84	1630	No measurable flow						
Trout Creek	7	18.4	.43	.023	.50	590	78	80	1700	.24	.013	.34	560	86	73	1220
Duck Creek	8	128	No measurable flow			700	83	74	0825	No measurable flow						
Beaver Dam Creek	9	6.55	.71	.108	.12	580	87	73	1045	.54	.082	.59	540	84	78	1425
Tributary	10	11.4	.47	.041	.41	580	87	74	1130	.13	.011	.45	500	84	78	1350
Miscellaneous measurement																
Duck Creek (sta. 04-0720.5)	5	92.2	1.25	.014	1.00	750	-	55	1800	October 3, 1968						

e - estimated

Table 2.--Discharge and flow duration of four long-term continuous record gaging stations and two long-term partial record sites in the Green Bay area on indicated dates. Includes 7-day Q₂ and 7-day Q₁₀ values*.

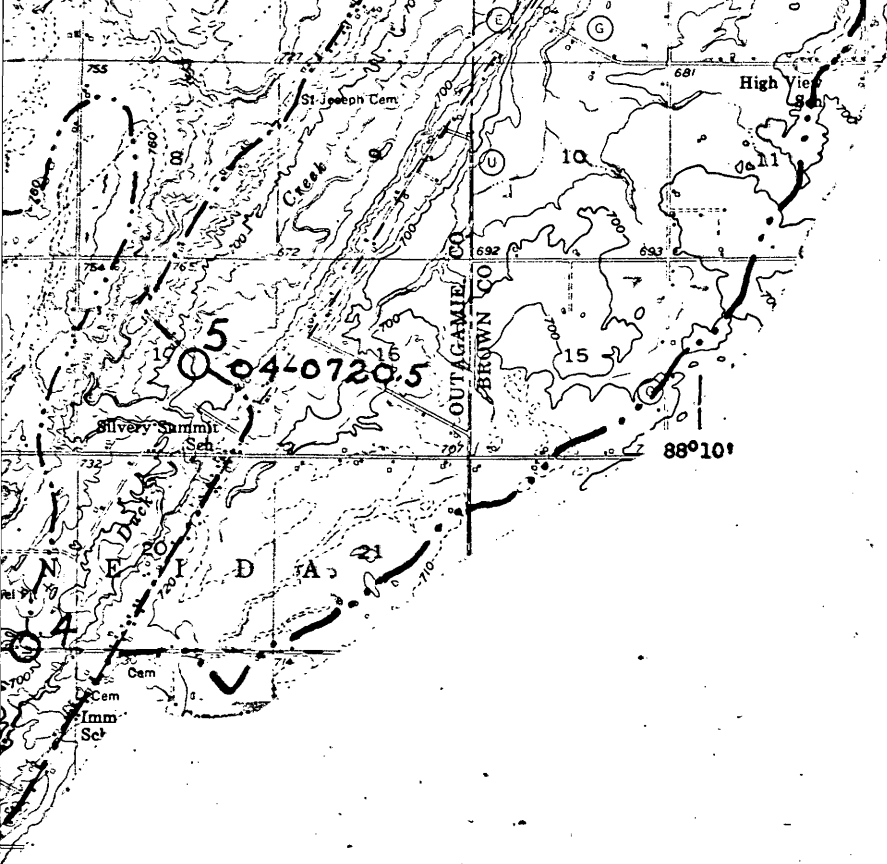
Stream	Drainage area (sq mi)	Date	Discharge		Flow duration % of time flow equaled or exceeded	7-day Q ₂ (cfs) ^a	7-day Q ₁₀ (cfs) ^b
			cfs (ave. daily)	cfs/sq mi			
Wolf River at Keshena Falls	812	8/11/69	584	.72	57.0	380	300
		8/12/69	597	.74	54.9		
		8/13/69	595	.73	55.2		
		8/26/69	472	.58	78.3		
		8/27/69	472	.58	78.3		
		8/24/69	473	.58	78.1		
Embarrass River near Embarrass	395	8/11/69	194	.49	44.8	75	45
		8/12/69	180	.46	48.7		
		8/13/69	168	.43	53.6		
		8/26/69	126	.32	70.8		
		8/27/69	126	.32	70.8		
		8/28/69	125	.32	71.4		
Wolf River at new London	2,240	8/11/69	1,180	.53	51.8	655	450
		8/12/69	1,140	.51	54.3		
		8/13/69	1,140	.51	54.3		
		8/26/69	824	.37	78.0		
		8/27/69	824	.37	78.0		
		8/28/69	824	.37	78.0		
Oconto River near Gillette	678	8/11/69	406	.60	54.0	230	175
		8/12/69	411	.61	53.1		
		8/13/69	397	.59	55.8		
		8/26/69	300 ^e	.44	78.2		
		8/27/69	290 ^e	.43	80.7		
		8/28/69	285 ^e	.42	82.4		
North Branch Embarrass River near Bowler	37.1	8/11/69	25.3 ^m	.68	-	9.2 ^c	5.6 ^c
		8/27/69	23.1 ^m	.62	-		
Apple Creek near Kaukauna	14.6	8/12/69	0 ^m	0	-	0	0
		8/26/69	0 ^m	0	-		

- * ^a 7-day Q₂ - The lowest mean discharge for 7 consecutive days that occurs on the average of once in 2 years or has a 50 percent chance of occurring in any year.
- ^b 7-day Q₁₀ - The lowest mean discharge for 7 consecutive days that occurs on the average of once in 10 years or has a 10 percent chance of occurring in any year.
- ^c - Values obtained by correlation with nearby long-term gaging stations.
- ^m - Measured discharge. ^e - Estimated.

Table No. 3.--Dissolved oxygen measurements made during period of low-flow investigations in the Duck Creek basin, Wisconsin.

Stream	Site No.	Date	Dissolved Oxygen			
			Time CDT	Temp. °C	mg/l	Percent Sat.
Duck Creek	3	Aug. 15, 1969	1720	27.7	11.6 ^a	153
Duck Creek	4	Aug. 15, 1969	1700	25.2	10.2 ^a	129
Duck Creek	5	Aug. 15, 1969	1625	23.7	11.0 ^a	134
Duck Creek	6	Aug. 15, 1969	1540	27.6	12.5 ^a	164
Trout Creek	7	Aug. 15, 1969	1535	25.0	11.2 ^a	140
Duck Creek	8*	Aug. 15, 1969	1425	27.5	9.8 ^a	129
Beaver Dam Creek	9	Aug. 15, 1969	1450	27.5	11.2 ^a	147
		Aug. 27, 1969	1435	25.6	10.0 ^b	127
Tributary	10	Aug. 15, 1969	1550	25.3	6.6 ^a	84

- * - D. O. measurement taken about 2 miles upstream.
- a - D. O. determination by D. O. meter.
- b - D. O. determination by field kit.



EXPLANATION

○₁

Measuring site and site number
for this study

DA-5.2

Drainage area of sub-basin in
square miles above measuring site

$\frac{.11}{.15}$

Discharge from basin in cfs per
sq mi (cubic feet per second
per square mile). Upper figure
is August 11, 12 measurement,
lower figure is August 27
measurement

Outline of Duck Creek drainage
basin

Outline of sub-basins

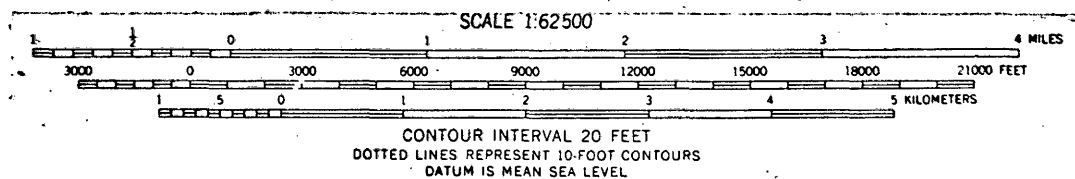
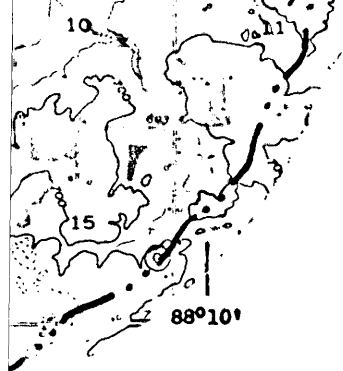


Figure 2.--Map of the Duck Creek basin, Brown and Outagamie Counties,
Wisconsin, showing locations of stream gaging sites.



O₁

Measuring site and site number
for this study

DA-5.2

Drainage area of sub-basin in
square miles above measuring site

$\frac{.11}{.15}$

Discharge from basin in cfs per
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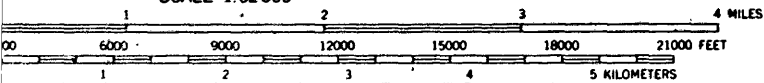


Outline of Duck Creek drainage
basin



Outline of sub-basins

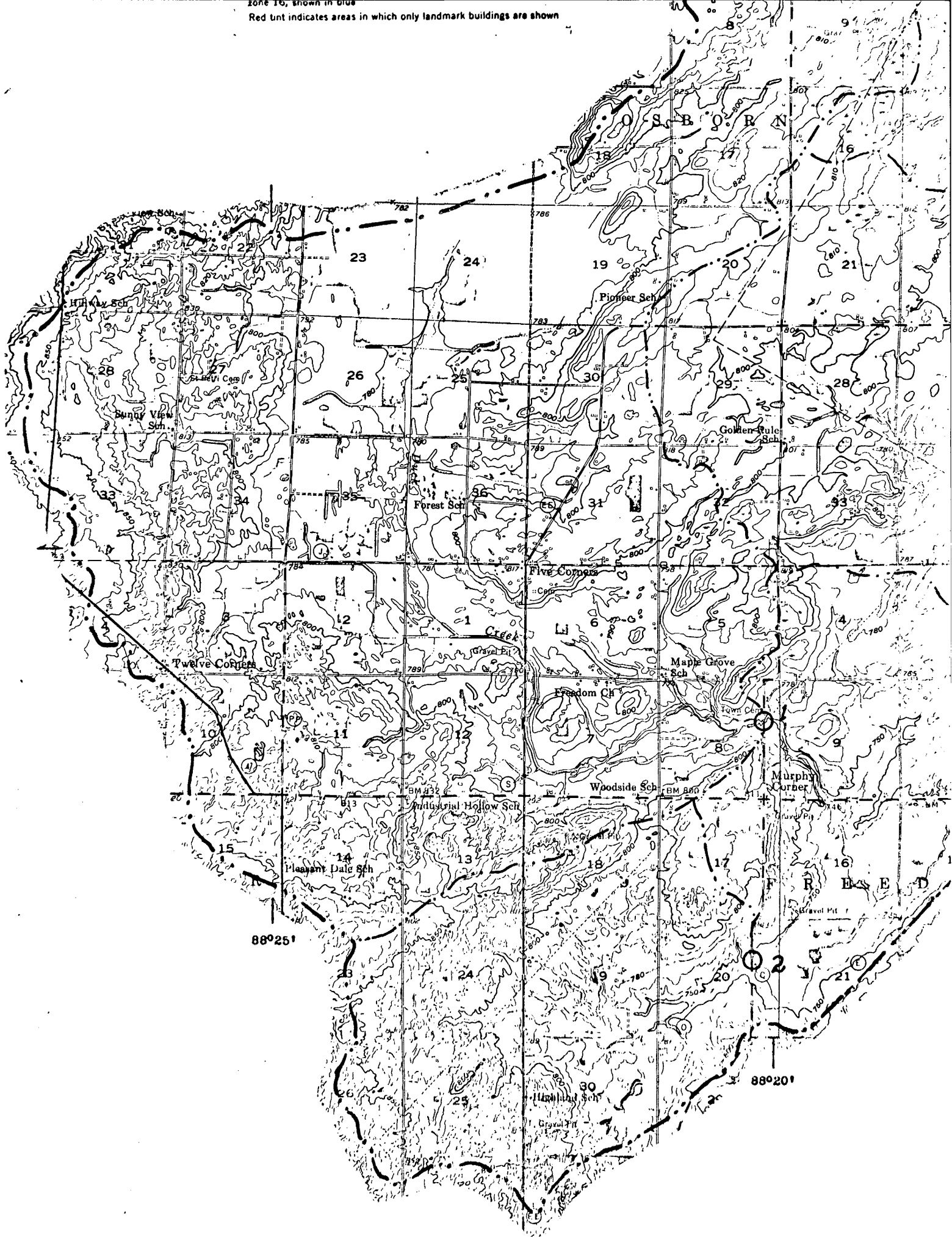
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CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

Duck Creek basin, Brown and Outagamie Counties,
showing locations of stream gaging sites.

Zone 16, shown in blue
Red tint indicates areas in which only landmark buildings are shown



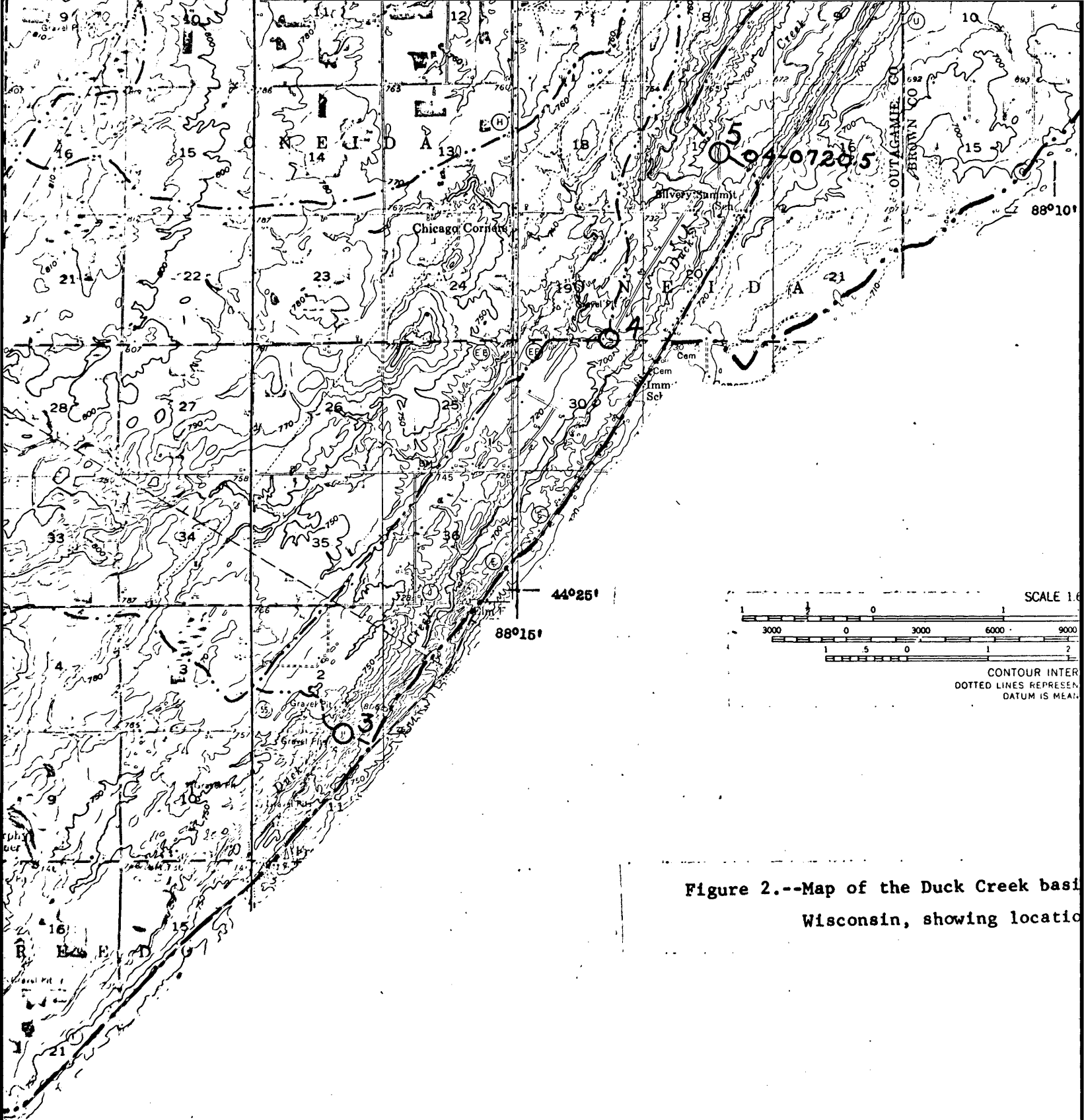


Figure 2.--Map of the Duck Creek basin
Wisconsin, showing location

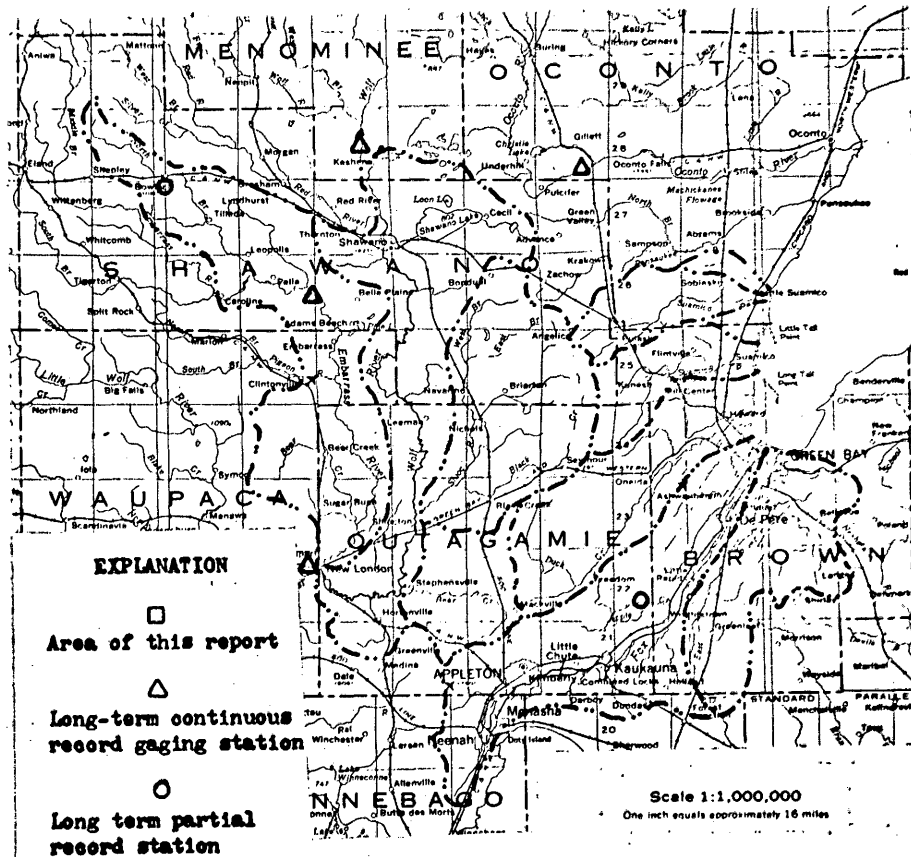


Figure 1.--Index map of basins studied in the Green Bay area, Wisconsin.

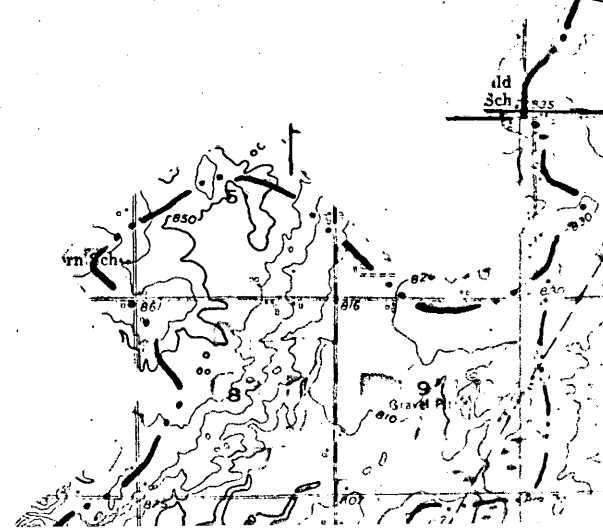
Topographic base maps

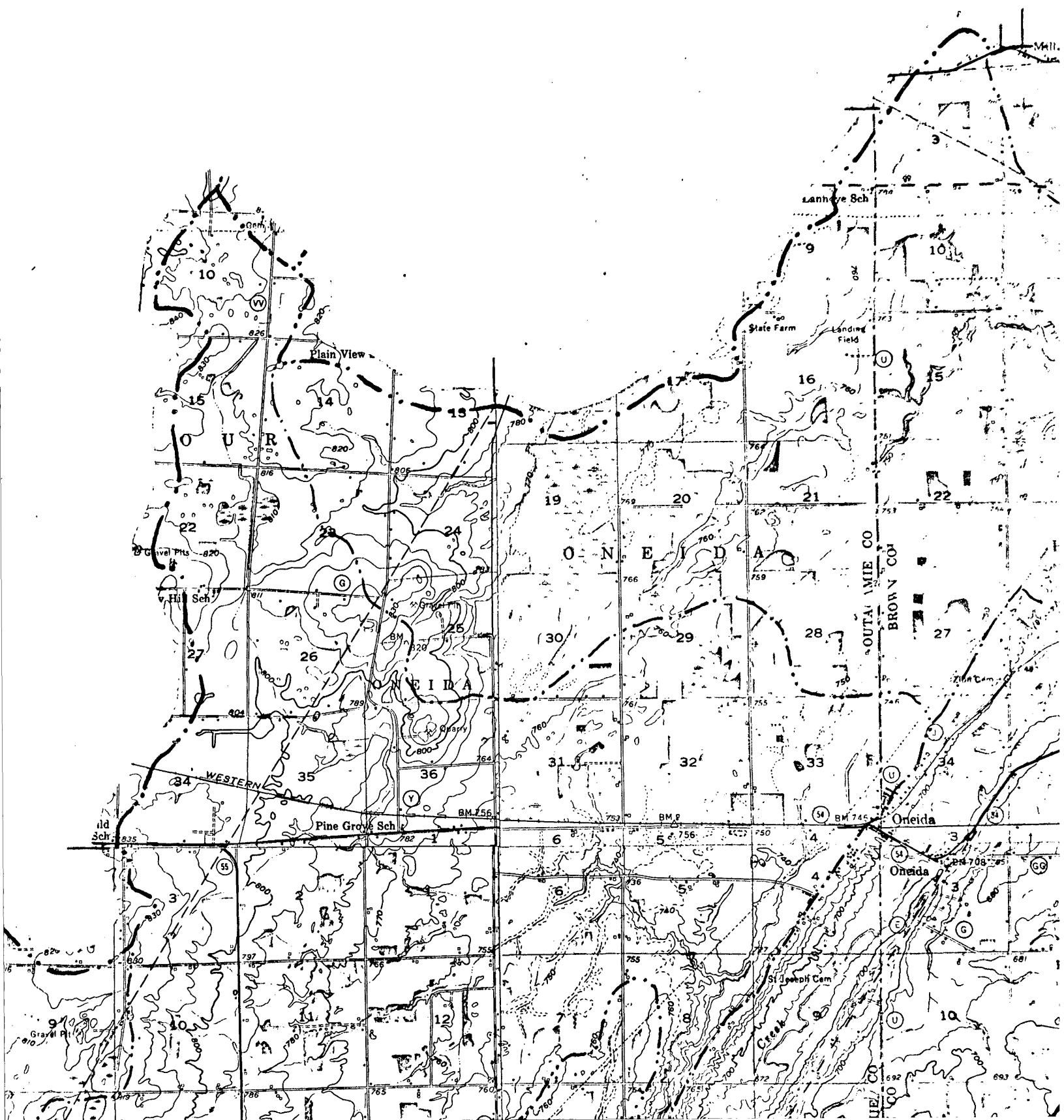
Mapped, edited, and published by the Geological Survey in cooperation with State of Wisconsin agencies

Control by USGS and USC&GS

Polyconic projection. 1927 North American datum
10,000-foot grid based on Wisconsin coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue

Red tint indicates areas in which only landmark buildings are shown







EXPLANATION

○₁

Measuring site and site number
for this study

