U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

In cooperation with Illinois Environmental Protection Agency and City of Gillespie, Illinois

Water, Sediment, and Nutrient Budgets, and Bathymetric Survey of Old and New Gillespie Lakes, Macoupin County, Illinois, May 1996–April 1997

(With a discussion of lake-management practices)

By Gary P. Johnson

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CONVERSION FACTORS, WATER-QUALITY ABBREVIATION, AND VERTICAL DATUM

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
	Area	
acre	0.4047	hectare
square mile (mi^2)	259.0	hectare
square mile (mi^2)	2.590	square kilometer
	Volume	
cubic foot (ft^3)	0.02832	cubic meter
acre-foot (acre-ft)	1,233	cubic meter
	Flow rate	
acre-foot per day (acre-ft/d)	1,233	cubic meter per day
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
gallon per day (gal/d)	0.003785	cubic meter per day
	Mass	
ounce, avoirdupois (oz)	28.35	gram
pound, avoirdupois (lb)	0.4536	kilogram
ton, short (2,000 lb)	0.9072	metric ton
ton per day (ton/d)	0.9072	metric ton per day
ton per square mile (ton/mi^2)	0.3503	metric ton per square kilometer
	Density	
pound per cubic foot (lb/ft^3)	16.02	kilogram per cubic meter

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L). For concentrations reported here, milligrams per liter are equivalent to parts per million.

Water, Sediment, and Nutrient Budgets, and Bathymetric Survey of Old and New Gillespie Lakes, Macoupin County, Illinois, May 1996–April 1997

By Gary P. Johnson

Abstract

The Gillespie Lakes system serves as a drinking water source for the city of Gillespie, Ill., and is a major recreational area. As part of an investigation of a concern that the lakes are being adversely affected by excessive sediment and nutrient inflows, hydrologic, sediment, and nutrient budgets for Old Gillespie Lake and New Gillespie Lake were calculated on the basis of data collected during May 1996–April 1997. Bathymetric data also were collected in the two lakes to produce maps of the lakebed elevations.

During the study period, sediment, phosphorus, and nitrogen influxes into Old Gillespie Lake were 4,063, 6.02, and 52.3 tons, respectively. Old Gillespie Lake retained 92 percent of the inflowing sediment (which agrees with theoretical calculations of trapping efficiency for Old Gillespie Lake), 84 percent of the inflowing phosphorus, and 87 percent of the inflowing nitrogen.

During the study period, sediment, phosphorus, and nitrogen influxes into New Gillespie Lake were 4,792, 7.56, and 64.3 tons, respectively. New Gillespie Lake retained 95 percent of the inflowing sediment (which agrees with theoretical calculations of trapping efficiency for New Gillespie Lake), 82 percent of the inflowing phosphorus, and 81 percent of the inflowing nitrogen.

The loads per area of phosphorus and nitrogen to the Old and New Gillespie Lakes were 1.06 tons per square mile (ton/mi^2) and 9.26 ton/mi^2, respectively. For row crops of corn and soybeans, the literature reports phosphorus loads per area range from 0.15 to 1.43 ton/mi^2, and nitrogen loads per area range from 0.86 to 11.43 ton/mi^2. Therefore, loads to the Gillespie Lakes are relatively high for the given cropping practices, and application of Best Management Practices may substantially reduce the per area loads of these nutrients.

Considering these loads and the retention of sediment and nutrients, a review of basic lake-management practices is presented and discussed. Lake-restoration techniques, such as implementation of Best Management Practices, are compared to maintenance-based techniques such as sediment dredging and herbicide application. This review is presented to assist lake managers in the achievement of lake water-quality goals.

INTRODUCTION

Old and New Gillespie Lakes are in Macoupin County in southwestern Illinois (fig. 1). Old Gillespie Lake is an impoundment reservoir of the North Branch of the Dry Fork Creek (constructed in 1926) and is approximately 5 mi west of the city of Gillespie. The reservoir serves as the public-water supply for the city. It has a drainage area of 5.73 mi^2 above the dam with a surface area of 71 acres. New Gillespie Lake also is an impoundment reservoir of the North Branch of the Dry Fork Creek (constructed in 1956) and located downstream from the outflow of Old Gillespie Lake. It has a drainage area of 12.3 mi^2 and a surface area of 215.8 acres.

The drainage area of the lakes system is composed of glacial drift overlying bedrock. The

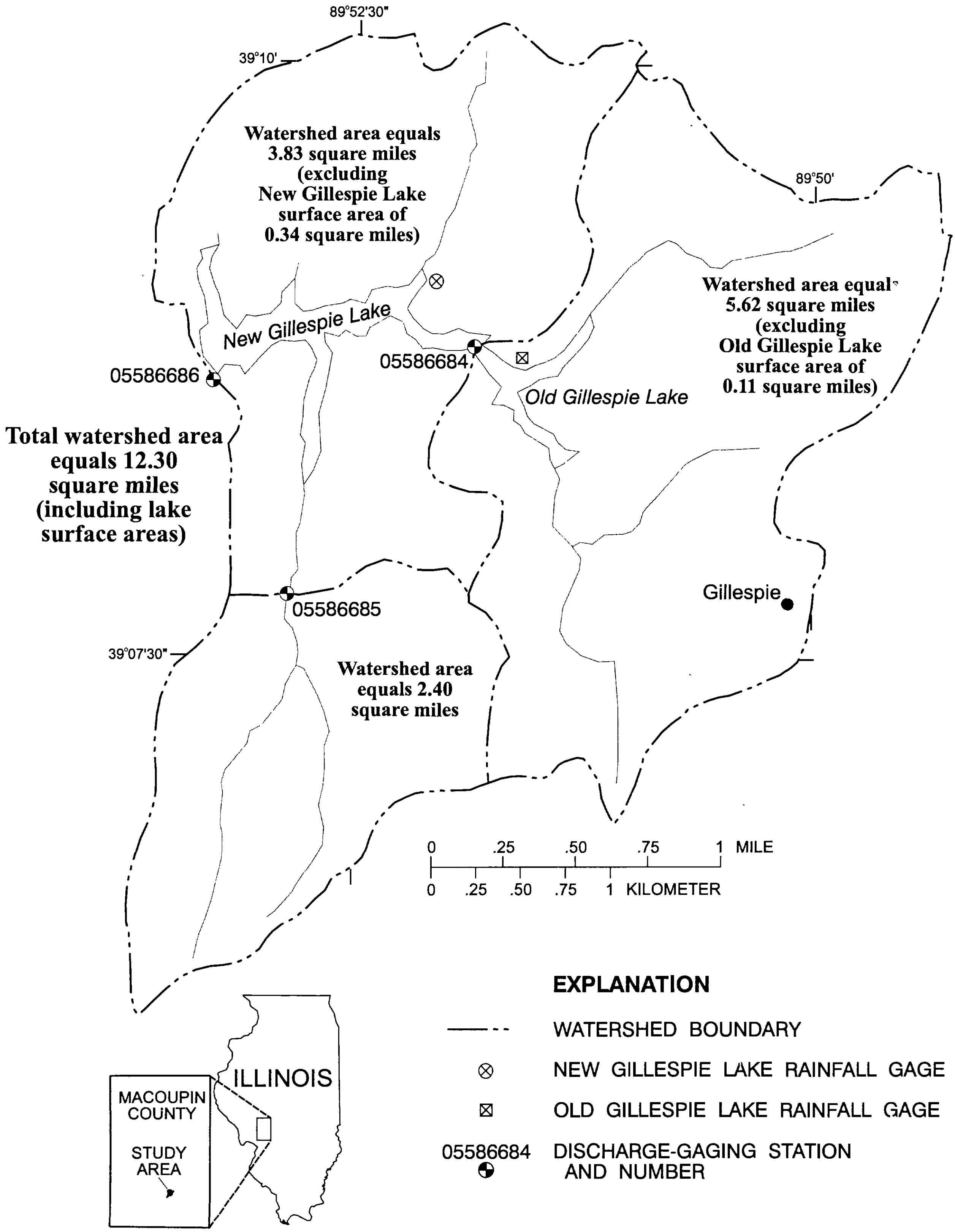


Figure 1. Locations of discharge-gaging sites and rainfall gages in the Gillespie Lakes watershed, Macoupin County, Ill.

glacial drift is low permeability soil; hard, compact, sandy till (Wolock, 1997). The till is a Vandalia Till Member of the Glasford Formation (Lineback, 1979). The area is mainly agricultural, with corn and bean row crops raised on the level areas, and pasture and timber on the higher sloped areas.

The Gillespie Lakes are a eutrophic system, as indicated by excessive weeds and algae. Generally, August through September is the period of peak biomass in the lakes. Currently (1998), five types of problems affect the Gillespie Lakes system: (1) nuisance algae; (2) excessive shallowness; (3) excessive rooted plants, weeds, or macrophytes; (4) objectionable taste, odor, and color of the drinking-water supply; and (5) degraded fishing quality. Causes of these types of problems generally are agricultural management practices; runoff from the fields, pavement, and lawns; sewage-treatment-plant or septic-systems discharge; destruction of shoreline vegetation; atmospheric deposition; urbanization; and boating activities.

In May 1996, the U.S. Geological Survey (USGS), in cooperation with the Illinois Environmental Protection Agency (IEPA) and the city of Gillespie, Ill., initiated a 1-year study of the Gillespie Lakes system. This report documents the results of that study and presents water, sediment, and nutrient budgets for the system, bathymetric maps of the lakes, and a discussion of lake-management practices. These budgets of the Gillespie Lakes system are determined by a complex set of physical, chemical, and biological factors that vary with current conditions. Important factors include surface-water and ground-water hydrology, climate, watershed geology, soil fertility, hydraulic residence time (average period of time required to completely exchange the water volume in a lake), lake-basin shapes, external and internal nutrient-loading rates, presence or absence of thermal stratification, lake habitats, and lake biota. For this study, surface-water hydrologic data continuously recorded and water-quality data were collected periodically at three sites in the watershed; daily rainfall and weekly waterfowl data were collected at two sites in the watershed; and bathymetric data were collected in both lakes.

DATA-COLLECTION AND SAMPLING METHODS, AND SAMPLE ANALYSIS

Water Discharge

The water discharge over the two dams was calculated using the following theoretical equation for discharge over a broad-crested weir:

$$Q_W = C_S b h^{(3/2)},$$

where

Q_w is water discharge, in cubic feet per second,
C_s is a dimensionless coefficient representing the roughness and shape of the spillway (obtained from discharge measurements at the spillway),
b is the width of the spillway, in feet, and
h is the head of the water at the spillway, in feet.

Discharge measurements were made for a range of stages at each spillway to determine the correct coefficient for the equation for each spillway. The coefficient for Old Gillespie Lake was calculated as 2.950 on the basis of six discharge measurements, and the New Gillespie Lake coefficient was calculated as 3.032 on the basis of five discharge measurements. These calculated coefficients agree with literature values for similar sized and shaped spillways (Chow, 1959). Two local observers, one a resident near Old Gillespie Lake and the other a resident near New Gillespie Lake, recorded daily lake elevations (gage heights) by reading stage-monitoring gages (sometimes referred to as staff gages) located at the dams of each lake. Outflows from the two lakes over the spillways were computed using the above equation and the daily gage-height data.

The drainage areas of the Gillespie Lakes system are shown in figure 1. Several tributary inflows account for runoff from 11.85 mi^2, or 96.4 percent of the total drainage area (12.3 mi^2), of the watershed for the lake system. The largest tributary, a tributary to New Gillespie Lake called the Southwest Branch of Dry Fork Creek (USGS site number 05586685), with a drainage area of 2.4 mi^2, was monitored with a continuous-recording stream gage. Those results were applied to the remaining ungaged tributary-inflow drainage area of each lake in proportion to the drainage area. The watershed of this inflow to New Gillespie Lake is representative of the total Gillespie Lakes watershed and presented the largest drainage area in the total watershed suitable for use as a stream-gaging and sampling site. The stream was monitored using standard USGS methods, as described in the U.S. Geological Survey Techniques of Water Resources Investigations 3-A Series. A stilling well was mounted to the downstream side of the Illinois State Route 16 Highway bridge, and a datalogger recorded the surface-water elevation, or stage, every 15 minutes. Because the stream stage could rise and fall very quickly because of heavy rainfall, the datalogger was programmed to record stage data every 5 minutes during rapid changes in stream-water elevation. On the basis of 18 streamflow discharge measurements collected over a range of stages, a simple stage-discharge relation was computed (fig. 2). Site descriptions, daily surface-water elevations, and computed daily water discharges for the three gaged sites (Southwest Branch Dry Fork Creek at Highway 16 near Gillespie, Ill.; Dry Fork Creek at Old Gillespie Lake Dam near Gillespie, Ill.; and Dry Fork Creek at New Gillespie Lake Dam near Gillespie, Ill.) are given in appendix 1.

Water Quality

Sample Collection

During the 1-year period of data collection, water samples were collected from the Southwest Branch Dry Fork Creek at Highway 16 near Gillespie, Ill. (USGS site number 05586685), and from the spillways of the Old and New Gillespie Lakes. Within this 1-year period, these samples were collected during a wide range of hydrologic conditions and with application of methods appropriate for the conditions. Opportunities for collecting water samples were limited because of very low to zero flow over the spillways and in the tributary during approximately 8 months of the 1-year period.

An automatic sampler was installed at the Southwest Branch Dry Fork Creek site and interfaced with the electronic datalogger at the site that recorded the streamflow data. The sampler was equipped with flexible tubing in a peristaltic pump and 1-liter plastic collection bottles. The automatic sampler was capable of collecting 24 samples between visits by field

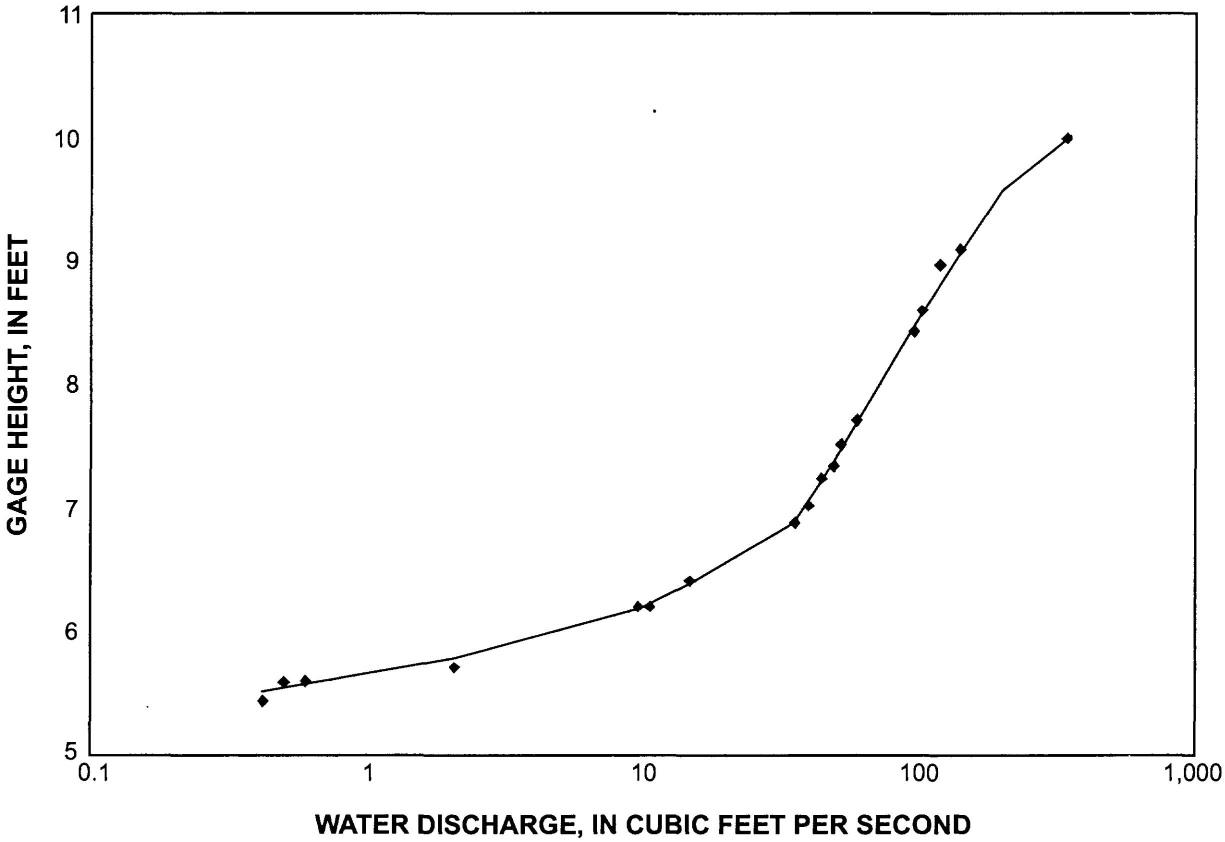


Figure 2. Stage-discharge relation of Southwest Branch Dry Fork Creek at Highway 16 near Gillespie, Ill. (U.S. Geological Survey site number 05586685).

personnel. The datalogger had the capability to trigger the automatic sampler. The sampler was programmed to collect one sample per hour when the gage height was above a certain stage and also to collect a sample if the gage height changed rapidly over a specified time period, such as shortly after a storm. During the study period, more than 100 water-quality samples were collected with the automatic sampler. Sometimes the samples were not retrieved for several days to weeks after the storm event, however, because field personnel were not always aware of the event. These samples were discarded because of concern that they may have degraded with time. Manual samples, sometimes called grab samples or dip samples, also were collected at this site. At the spillway sites, all samples were collected manually. During sample collection, specific conductance, pH, temperature, and dissolved oxygen (DO) concentration were measured with a multiparameter water-quality meter.

Laboratory Analysis

Immediately after collection, samples were prepared for laboratory analysis by USGS personnel before transport to the IEPA Laboratory in Champaign, Ill. During sample preparation, each sample was shaken to insure sample homogeneity, and raw sample water was poured into bottles to be analyzed for total concentrations of constituents. Then the homogenized water was filtered through 142-millimeter diameter, 0.45-micron pore-size cellulose nitrate membrane filters into bottles to be analyzed for dissolved constituents. After all sample bottles were filled, they were immediately chilled on ice for transport to the IEPA Laboratory. Then USGS personnel analyzed most samples on site for total alkalinity. Upon delivery to the IEPA Laboratory, the samples were analyzed for the parameters listed in table 1. All field parameters and analytical data are listed in appendix 2.

Table 1. Water-quality parameters and codes analyzed by the Illinois Environmental Protection Agency Laboratory

[mg/L, milligrams per liter]

Parameter	Parameter code
Ammonia as nitrogen, total, in mg/L	00610
Nitrate plus nitrite, total as nitrogen, in mg/L	00630
Nitrogen as nitrogen, total kjeldahl, in mg/L	00625
Phosphorus, dissolved as phosphorus, in mg/L	00666
Phosphorus as phosphorus, total, in mg/L	00665
Solids, total suspended, in mg/L	00530
Solids, volatile, in mg/L	00535
Turbidity, in Nepholometric turbidity units	00076

HYDROLOGIC BUDGETS FOR OLD AND NEW GILLESPIE LAKES

A hydrologic budget is the basis for understanding many of the processes in a lake and its watershed. Because determining the nutrient and sediment budgets depend on the water budget, the nutrient and sediment budgets cannot be reliably evaluated without an accurate water budget. If the water budget is inaccurate, propagation and magnification of error results when computing the subsequent nutrient and sediment budgets. In some cases, however, literature values are not appropriate for estimating the water budget.

The components of the water-balance equation are shown in figure 3, and the equation can be represented as

$$INFLOW + PRECIPITATION = OUTFLOW + EVAPORATION + CHANGE\ IN\ STORAGE$$

Studies have verified that sediment and constituent concentrations in streams can vary greatly depending on the duration and intensity of

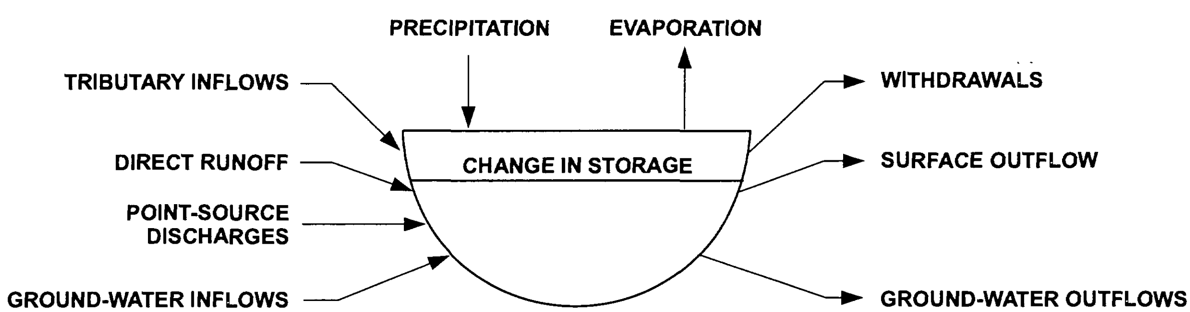


Figure 3. Water-balance components of lakes (North American Lake Management Society, 1990).

rainfall and the time of year of the rainfall (Goolsby and others, 1991; Johnson and Coupe, 1993). Conditions in the watershed at the time of the rainfall can substantially affect the chemical composition and quantity of the runoff. Therefore, similar to estimating water discharges, application of literature values or modeling results to estimate watershed constituent yields can result in an estimate with uncertain reliability. If possible, water samples should be collected to determine sediment and nutrient budgets.

Although phosphorus and nitrogen are not the only nutrients required for algal growth, they are generally considered the principal nutrients affecting the lake-eutrophication process. The effect of carbon as a limiting nutrient is not entirely certain. Phosphorus commonly is the key nutrient in determining the quantity of algae in a lake (North American Lake Management Society, 1990). For eutrophication studies, total phosphorus (parameter code 00665 in table 1) is the most important nutrient to determine in the inflows and outflows of the lake system because many lake-management decisions will be made on the basis of the concentration of this nutrient. Dissolved phosphorus is not used in calculating a phosphorus budget but may be helpful to lake managers because dissolved phosphorus is the form of phosphorus most readily available for uptake by plants.

Lake-nutrient budgets, similar to lake water and sediment budgets, are a summation of all inflows and outflows of nutrients of the lake system. Inflows of nutrients result from tributary inflows, precipitation and dustfall, point-source discharges, ground-water inflows and shoreline septic tanks, and input from migrant waterfowl. Outflows from a lake system can be in the form of surface outflow, withdrawals, and ground-water outflows. Net sedimentation of nutrients also can result, where the nutrients are retained or accumulated in the bottom sediments. Because several complex processes are involved and vary temporally and spatially, it is generally infeasible to directly measure net sedimentation of nutrients. Consequently, net sedimentation of nutrients usually is calculated as the difference between inflow and outflow values.

Water Budgets

A water budget for Old and New Gillespie Lakes was determined to account for all water inflows to and outflows from the lake system during the period from May 1996 through April 1997. The stage-discharge relation shown in figure 2 was applied to the recorded gage heights to compute monthly totals for this site as shown in table 3. These monthly totals for the 2.4 mi^2 of gaged drainage area were applied to the remaining ungaged drainage area of the tributary and direct surface inflow of each lake in proportion to the drainage area, as shown in tables 2 and 3.

The remaining 3.6 percent of the drainage area is the actual surface area of the lakes. Precipitation falling on the surface areas of each lake was considered direct inflow. Monthly totals of precipitation computed from daily readings of precipitation collected by the two local observers are shown in table 4. These monthly precipitation totals were applied directly to the surface area of the lakes, and these totals of direct inflow are shown in tables 2 and 3. The Gillespie Lakes area received about 33 in. of precipitation over the 1-year period of data collection. This amount is 1 in. less than the long-term average rainfall for the region of about 34 in. (Roberts and Stall, 1967).

Net ground-water inflow and outflow to the lake was assumed to be negligible or zero. It was assumed that the relatively impervious soil structure in the area does not allow for appreciable exchange of water between the lakes and ground water.

Generally, tributary inflows, direct runoff, and ground-water input account for the major inflows to a lake. For the Gillespie Lakes system, however, a unique condition is present. Water flowing out of Old Gillespie Lake over the spillway enters directly into New Gillespie Lake; therefore, Old Gillespie Lake outflow must be treated as a tributary inflow to New Gillespie Lake. Likewise, in order to maintain Old Gillespie Lake levels at an elevation suitable for withdrawals of drinking water by the city of Gillespie Water Treatment Plant, water occasionally is pumped from New Gillespie Lake to Old Gillespie Lake. This pumpage must be considered as an outflow of New Gillespie Lake and an inflow of Old Gillespie Lake. A pump rating was applied to the pump log kept by the operator to calculate total pumpage from New Gillespie Lake into Old Gillespie Lake. The pump was reported (oral communication, Mr. Ron Durbin, city of Gillespie) to operate at a rate of 350,000 gal/d (1.074109 acre-ft/d). Applying this pump rating to the number of days the pump ran each month, the total pumpage from New Gillespie Lake into Old Gillespie Lake was calculated, and these data also are shown in tables 2 and 3.

Table 2. Water budget for Old Gillespie Lake, May 1996–April 1997

[na, not applicable]

Month and year	Inflows: Ungaged tributaries ($5.62\ mi^2$), in acre-feet	Inflows: Pumpage into Old Gillespie Lake from New Gillespie Lake, in acre-feet	Inflows: Rainfall-direct inflow, in acre-feet	Outflows: Flow over Old Gillespie Lake spillway, in acre-feet	Outflows: Drinking water withdrawals, in acre-feet	Outflows: Evaporation, in acre-feet	Net total (in-out)
May 1996	1,190.41	0.00	41.54	1,014.55	75.40	27.90	114.10
June 1996	82.22	.00	16.63	65.06	76.50	33.10	−75.81
July 1996	.00	24.70	8.28	.00	84.00	37.90	−88.92
August 1996	12.36	18.26	6.63	.00	92.50	30.70	−85.95
September 1996	.19	21.48	14.97	.00	75.50	21.30	−60.16
October 1996	18.57	22.56	11.12	.00	76.40	13.80	−37.95
November 1996	406.77	.00	36.80	.00	68.80	6.50	368.27
December 1996	16.39	.00	2.07	.00	81.30	3.00	−65.84
January 1997	15.29	.00	16.45	.00	90.20	3.00	−61.46
February 1997	1,044.66	18.26	18.70	545.85	78.30	4.70	452.77
March 1997	205.67	.00	14.67	264.99	75.80	10.70	−131.15
April 1997	59.03	.00	8.76	.00	74.00	18.90	−25.11
Total	3,051.56	105.26	196.62	1,890.45	948.70	211.50	302.79
Percent of inflow and outflow	91.0	3.1	5.9	62.0	31.1	6.9	na

Table 3. Water budget for New Gillespie Lake, May 1996–April 1997

[na, not applicable]

Month and year	Inflows: Southwest Branch Dry Fork Creek, in acre-feet	Inflows: Remaining ungaged tributaries ($3.83\ mi^2$), in acre-feet	Inflows: Inflow from Old Gillespie Lake, in acre-feet	Inflows: Rainfall-direct inflow, in acre-feet	Outflows: Pumpage from New Gillespie Lake into Old Gillespie Lake, in acre-feet	Outflows: Evaporation, in acre-feet	Outflows: Flow over New Gillespie Lake spillway, in acre-feet	Net total (in-out)
May 1996	508.36	811.89	1,014.55	102.33	0.00	84.70	2,477.95	−125.52
June 1996	35.11	56.07	65.06	59.17	.00	100.70	395.70	−280.99
July 1996	.00	.00	.00	28.05	24.70	115.10	.00	−111.75
August 1996	5.28	8.43	.00	21.04	18.26	93.20	.00	−76.71
September 1996	.08	.13	.00	44.78	21.48	64.70	.00	−41.19
October 1996	7.93	12.66	.00	36.51	22.56	41.90	.00	−7.36
November 1996	173.71	277.43	.00	109.10	.00	19.80	.00	540.44
December 1996	7.00	11.18	.00	6.29	.00	9.00	.00	15.47
January 1997	6.53	10.43	.00	49.99	.00	9.00	.00	57.95
February 1997	446.12	712.49	545.85	56.82	18.26	14.40	821.95	906.67
March 1997	87.83	140.27	264.99	48.02	.00	32.50	756.30	−247.69
April 1997	25.21	40.26	.00	26.80	.00	57.50	125.55	−90.78
Total	1,303.16	2,081.24	1,890.45	588.90	105.26	642.50	4,577.45	538.54
Percent of inflow and outflow	22.2	35.5	32.2	10.0	2.0	12.1	86.0	na

Table 4. Monthly rainfall totals from daily observer readings near Gillespie, Ill.

[All values are in inches]

Month and year	Old Gillespie Lake observer	New Gillespie Lake observer
May 1996	7.02	5.69
June 1996	2.81	3.29
July 1996	1.40	1.56
August 1996	1.12	1.17
September 1996	2.53	2.49
October 1996	1.88	2.06
November 1996	6.22	6.07
December 1996	.35	.35
January 1997	2.78	2.78
February1997	3.16	3.16
March 1997	2.48	2.67
April 1997	1.48	1.49
Yearly total	33.23	32.78

The city of Gillespie Water Treatment Plant withdraws raw water from Old Gillespie Lake for use as a public-water supply. This water is metered and exact numbers for withdrawals were available from the treatment plant. For the purpose of computing the hydrologic budget, these withdrawals for consumptive use are considered an outflow of Old Gillespie Lake and also are included in table 2. Finally, outflow of water by evaporation from the two lakes was determined on the basis of methods and data described in Roberts and Stall (1967). These data also are shown in tables 2 and 3.

The water budget for the Gillespie Lakes system was computed for the period from May 1996 through April 1997 and is summarized in tables 2 and 3. The relatively small net difference between inflow and outflow (approximately 9 percent of the total inflow) could be attributed to various factors—measurement error, error associated with applying the gaged drainage-area yield to the ungaged drainage area, net ground-water inflows and outflows may not have been zero, errors in the pump and drinking water withdrawal data, or other factors. Monthly change in storage of the two lakes accounts for some difference. However, differences in lake elevations at the beginning and end of the data-collection period were 0.09 ft and 1.00 ft for New Gillespie Lake and Old Gillespie Lake, respectively; therefore, this difference over the year should be negligible. It is interesting to note that the months with the highest precipitation totals generally indicate more water inflow than outflow during that month; for example May, November, and February at Old Gillespie Lake. This result gives an indication of the storage capability of the lakes.

Sediment Budgets

A sediment budget was calculated for Old and New Gillespie Lakes on the basis of streamflow and water-quality data collected by USGS personnel. The sediment budget quantifies all sediment inflows and outflows of a lake system, and the net difference indicates whether the lake is a net source or sink for sediment.

For the sediment budget, the hydrologic data (explained earlier) were used in conjunction with the Total Suspended Solids (TSS, parameter code 00530) data to compute total sediment loads in the tributary to New Gillespie Lake (05586685), the outflow of Old Gillespie Lake (05586684), and the outflow of New Gillespie Lake (05586686). The results of the sediment-load calculations from the tributary to New Gillespie Lake (05586685) were applied using a per-area yield basis to the remaining ungaged tributary drainage area for each lake. The results of these analyses are summarized in tables 5 and 6. Again, the outflow of Old Gillespie Lake was considered an inflow of New Gillespie Lake, and the pumpage from New Gillespie Lake to Old Gillespie Lake was considered an outflow of New Gillespie Lake and an inflow of Old Gillespie Lake. For purposes of this calculation, it was assumed that water pumped, for water-treatment plant withdrawals and from New Gillespie Lake to Old Gillespie Lake, was at a constant 20 mg/L concentration of TSS.

The load calculations were done using the daily streamflow data at each gaged site (presented in appendix 1). These daily streamflow data were applied to transport curves developed using the TSS data from each site. Transport curves are plots of water discharge, in cubic feet per second, in relation to the load of a constituent, usually reported in tons per day. These constituent-transport rating curves have been widely used to compute loads at sites by the USGS, U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation (Colby, 1956).

The transport curves for each of the three gaged sites are presented in figures 4, 5, and 6. By inspection, excellent correlation of data is indicated in the plots. The equation of the best-fit line in each of the three plots was used to calculate the daily loads at the sites. These daily loads then were summed to obtain the monthly totals shown in the sediment-budget tables (tables 5 and 6). The daily loads at each site are included in appendix 2.

Of the approximately 4,063 tons of sediment that entered Old Gillespie Lake during the 1-year study period, only about 314 tons exited the lake. Therefore,

Table 5. Sediment budget for Old Gillespie Lake, May 1996-April 1997

[mi^2, square miles; na, not applicable]

Month and year	Inflows: Ungaged tributaries (5.62 mi^2), in tons	Inflows: Pumpage into Old Gillespie Lake from New Gillespie Lake, in ton	Outflows: Flow over Old Gillespie Lake spillway, in tons	Outflows: Drinking water withdrawals, in tons	Net total (in-out)
May 1996	1,162.33	0	165.10	2.05	995.18
June 1996	1.66	0	3.18	2.08	−3.60
July 1996	.00	.67	.00	2.29	−1.62
August 1996	.33	.5	.00	2.52	−1.69
September 1996	.00	.58	.00	2.06	−1.48
October 1996	.30	.61	.00	2.08	−1.17
November 1996	580.73	0	.00	1.87	578.86
December 1996	.21	0	.00	2.21	−2.00
January 1997	.19	0	.00	2.62	−2.43
February 1997	2,263.64	.5	100.91	2.13	2,161.10
March 1997	49.15	0	19.11	2.06	27.98
April 1997	1.87	0	.00	2.01	−.14
Total	4,060.41	2.86	288.30	25.98	3,748.99
Percent of inflow and outflow	99.90	.10	91.70	8.30	na

Table 6. Sediment budget for New Gillespie Lake, May 1996–April 1997

[mi^2, square miles; na, not applicable]

Month and year	Inflows: Southwest Branch Dry Fork Creek, in tons	Inflows: Ungaged tributaries (3.83 mi^2), in tons	Inflows: Inflow from Old Gillespie Lake outflow, in tons	Outflows: Flow over New Gillespie Lake spillway, in tons	Outflows: Pumpage from New Gillespie Lake into Old Gillespie Lake, in tons	Net total (in-out)
May 1996	496.37	792.74	165.10	134.31	0	1,319.90
June 1996	.71	1.13	3.18	17.52	0	−12.50
July 1996	.00	0	0	0	.67	−.67
August 1996	.14	.22	0	0	.5	−.14
September 1996	.00	0	0	0	.58	−.58
October 1996	.13	.21	0	0	.61	−.27
November 1996	248.00	396.08	0	0	0	644.08
December 1996	.09	.14	0	0	0	.23
January 1997	.08	.13	0	0	0	.21
February 1997	966.68	1,543.9	100.91	48.13	.5	2,562.86
March 1997	20.99	33.5	19.11	34.55	0	39.05
April 1997	.80	1.3	0	4.45	0	−2.35
Total	1,733.99	2,769.35	288.30	238.96	2.86	4,549.82
Percent of inflow and outflow	36.20	57.70	6.00	98.80	1.20	na

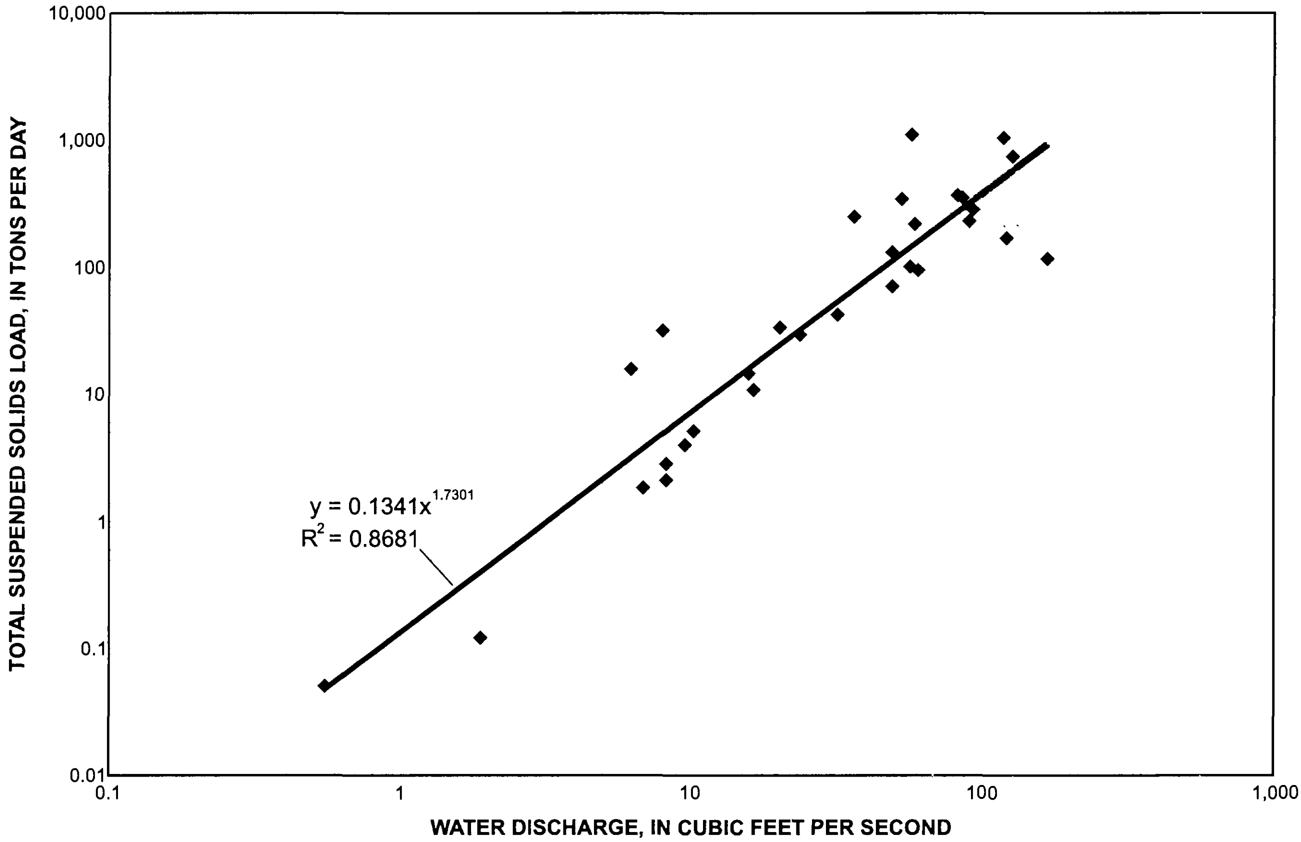


Figure 4. Relation of total suspended solids load and water discharge, Southwest Branch Dry Fork Creek near Gillespie, Illinois (U.S. Geological Survey site number 05586685).

from May 1996 through April 1997, approximately 3,749 tons of sediment were deposited in Old Gillespie Lake, or about 92 percent of the incoming load. This value agrees with literature values based on Brune's curve for estimating trap efficiency of a reservoir (Brune, 1953). Brune's curve is shown in figure 7. The hydraulic residence time ($R_{C/I}$) of Old Gillespie Lake is calculated by

$$R_{C/I} = \text{(Lake capacity, in acre-feet)} \; / \; \text{(Yearly inflow of the lake, in acre-feet)}$$

Using a capacity of 592 acre-ft for Old Gillespie Lake and the inflow for the study year of 3,052 acre-ft, $R_{C/I}$ is equal to 0.19. Applying this number to figure 7 and using the median curve for normal ponded reservoirs, a trap efficiency of about 92 percent is estimated with Brune's curve. This value for trap efficiency is identical to the results from data analysis. Likewise, applying Brune's curve to the New Gillespie Lake $R_{C/I}$ of 0.40 (2,325 acre-ft capacity divided by yearly inflow of 5,863 acre-ft), a theoretical trapping efficiency of about 95 percent is determined. This value is identical to the results from data analysis. In the New Gillespie Lake sediment budget (table 6), about 95 percent (4,552 tons) of the 4,792 tons of sediment entering the lake is trapped in the lake.

Using the methods described in Linsley and Franzini (1979, p. 162–163), the storage capacity projections of each of the Gillespie Lakes was calculated. Using the inflow data presented in the Hydrologic Budget section, the hydraulic residence time of Old Gillespie Lake is 0.19 years and for New Gillespie Lake is 0.40 years. The hydraulic residence times represent an average of how long it would take for the lakes to fill with water if they were empty. The hydrologic and sediment budget data presented earlier and Brune's curve (fig. 7) were used in the calculations presented in tables 7 and 8. For these calculations, it was assumed the deposited sediment is permanently submerged silt with a specific weight of 70 lb/ft^3. These projections are the calculated number of years until the storage capacities for each reservoir is one-half of its original capacity.

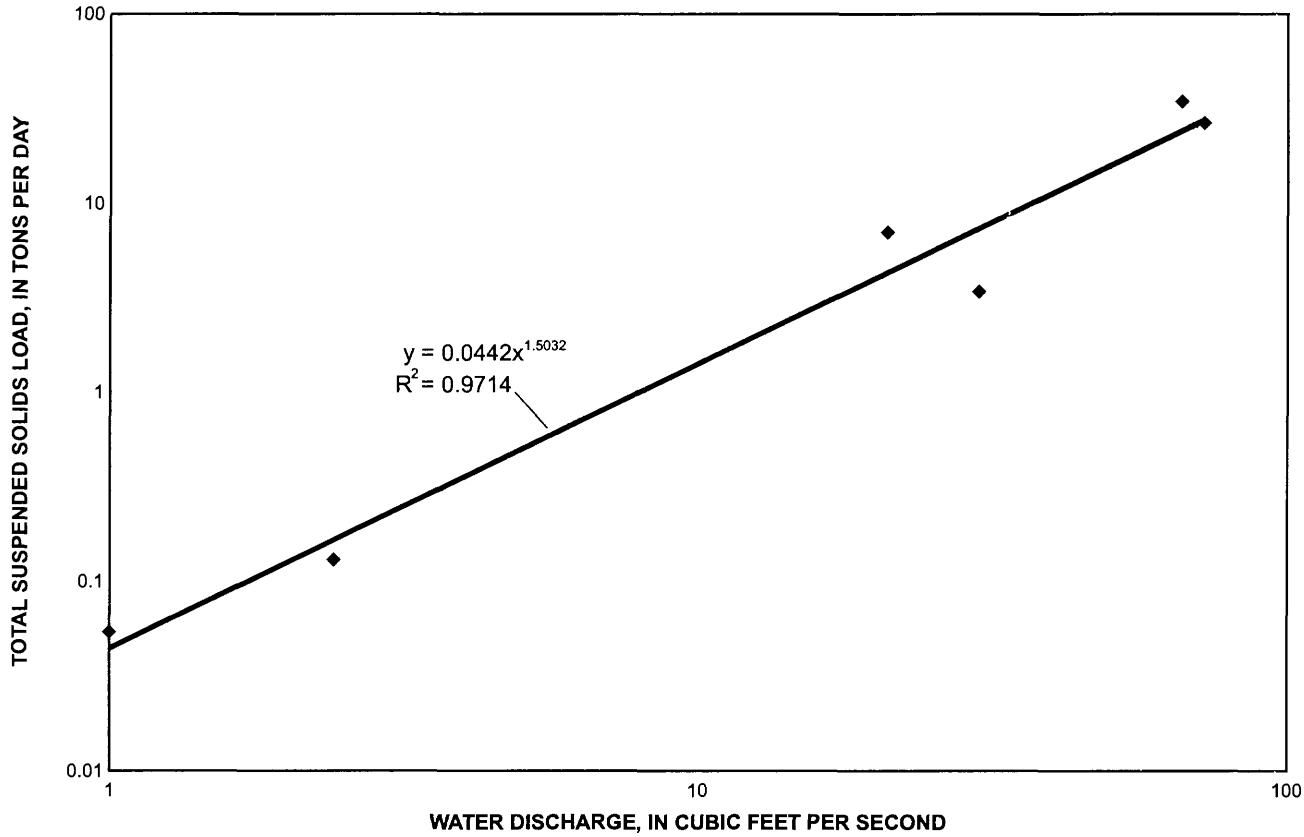


Figure 5. Relation of total suspended solids load and water discharge, Dry Fork Creek at Old Gillespie Lake Dam near Gillespie, Illinois (U.S. Geological Survey site number 05586684).

Nutrient Budgets

Phosphorus Budgets

On the basis of methodology previously described, a total phosphorus budget was calculated for Old and New Gillespie Lakes. Results for Old Gillespie Lake are shown in table 9. Inflows to Old Gillespie Lake were calculated as described below. The inflow of phosphorus from the 5.62 mi^2 of ungaged tributary area was extrapolated from the yield for the gaged and sampled tributary to New Gillespie Lake (U.S. Geological Survey site number 05586685) on a per-area basis as described in the Hydrologic and Sediment Budget sections. A transport curve was developed for this site that related total phosphorus load, in tons per day, to streamflow, in cubic feet per second (fig. 8).

The total phosphorus load per area for the sampled tributary for the study period was 1.06 ton/mi^2. Beaulac and Reckhow (1982) summarized load per area information for a wide variety of land-use and cropping practices. They reported loads per acre for phosphorus ranging from about 0.15 ton/mi^2 to 1.43 ton/mi^2 for corn and soybean row crops, which compose the Gillespie Lakes watershed. This comparison illustrates the reliability (that is, the measured value in the Gillespie tributary falls in the expected range) and usefulness (because the range is broad, the measured data allow a more accurate analysis) of the measured data. The per-area yield for the Gillespie Lakes area for phosphorus (1.06 ton/mi^2) is on the high end of the range of available literature values.

Ground-water inflows were assumed to be zero for the Gillespie Lakes; however, septic-tank leachate from the numerous septic systems at cabins around the lake was estimated on the basis of literature values of 0.88 kg/yr (1.94 lb/yr) per person and an 80 percent soil-retention factor (Jacoby and others, 1981), and an estimated year-round average population at Old Gillespie Lake of 50 persons. Discharge of septic tank effluent to a lake or tributary stream, either through overland flow or ground-water seepage, can contribute to localized increases in algae or aquatic plant growth. Originally, septic systems were used to serve individual homes in rural areas where population densities were

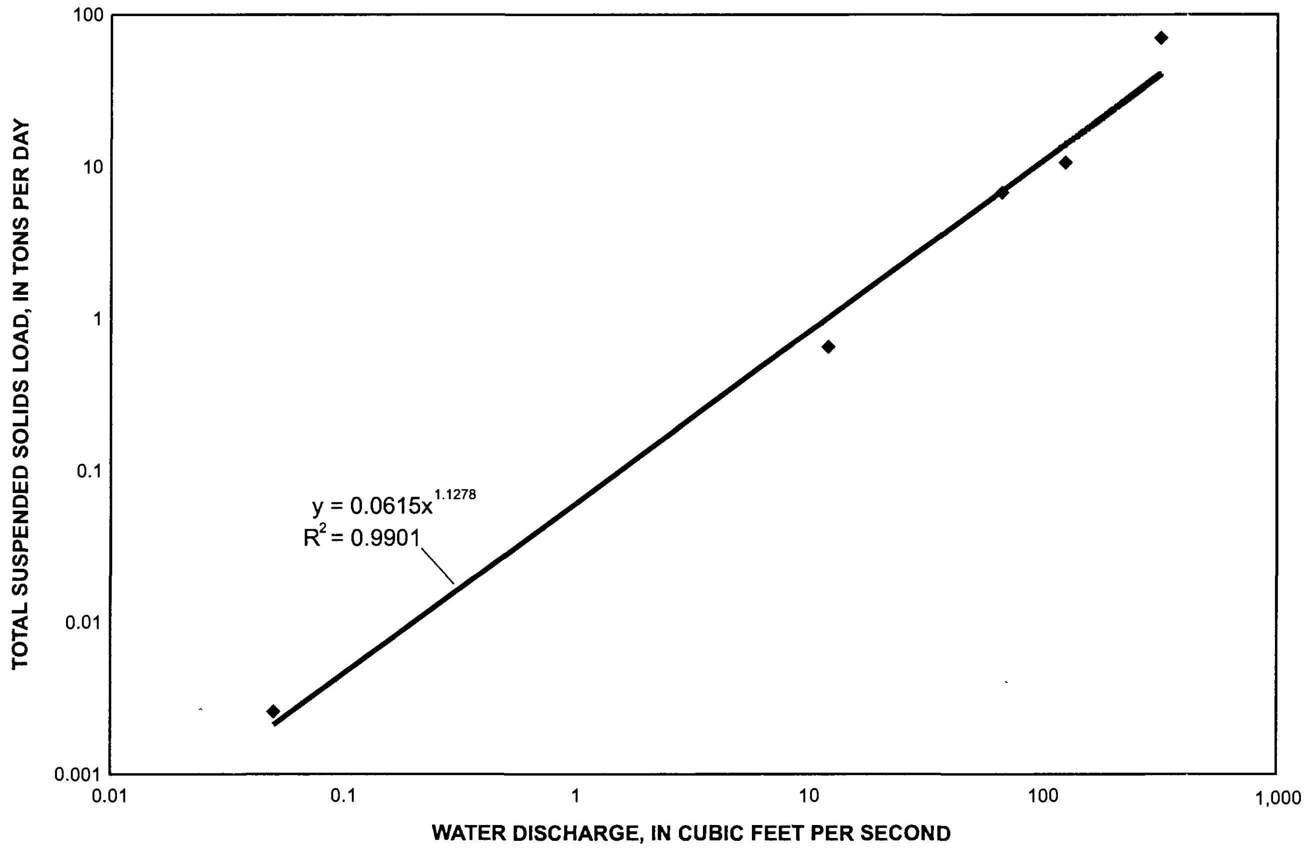


Figure 6. Relation of total suspended solids load and water discharge, Dry Fork Creek at New Gillespie Lake Dam near Gillespie, Illinois, (U.S. Geological Survey site number 05586686).

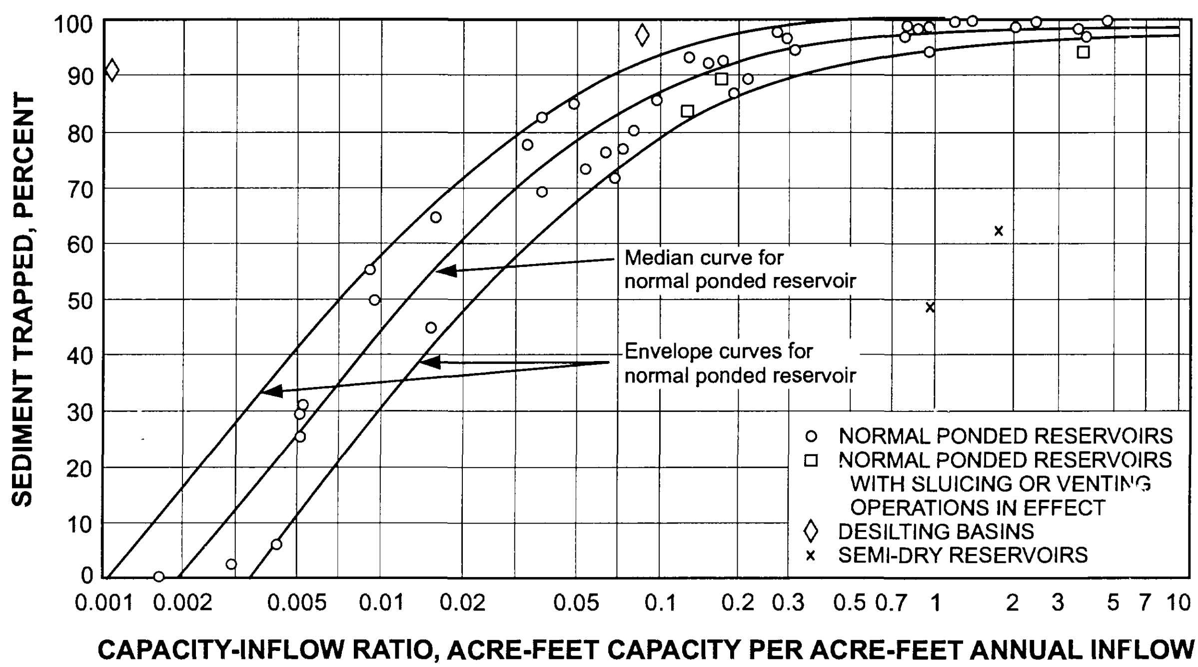


Figure 7. Brune's (1953) curve for estimating reservoir sediment trap efficiency.

too low to economically justify public sanitary sewers. Septic systems also have been used to serve more densely populated areas where, at least originally, occupancy was seasonal, such as at Gillespie Lakes.

Table 7. Sedimentation-rate projections for Old Gillespie Lake

Beginning and ending capacity for fill period[1] (acre-feet)	Hydraulic residence time	Percent trapped	Sediment per year		Change in volume (cubic feet)	Years to fill for change in volume[1]
			tons	(cubic feet)		
592.0–511.6	0.19	92	3,750	107,143	3,500,000	32.6
511.6–431.2	.15	90	3,657	104,486	3,500,000	33.5
431.2–350.9	.15	89	3,616	103,314	3,500,000	33.9
350.9–296.0	.10	86	3,494	99,829	2,391,000	24

[1]Total time to fill from the original capacity of the lake (592.0 acre-feet) to one-half of the original capacity (296.0 acre-feet) is 124 years.

Table 8. Sedimentation-rate projections for New Gillespie Lake

Beginning and ending capacity for fill period[1] (acre-feet)	Hydraulic residence time	Percent trapped	Sediment per year		Change in volume (cubic feet)	Years to fill for change in volume
			tons	cubic feet		
2,325–2,084	0.40	95	4,550	130,000	10,500,000	80.8
2,084–1,843	.36	95	4,550	130,000	10,500,000	80.8
1,843–1,602	.31	95	4,550	130,000	10,500,000	80.8
1,602–1,162.5	.27	95	4,550	130,000	19,131,500	147

[1]Total time to fill from the original capacity of the lake (2,325 acre-feet) to one-half of the original capacity (1,162.5 acre-feet) is 389.4 years.

Table 9. Phosphorus budget for Old Gillespie Lake, May 1996–April 1997

[mi^2, square miles; na, not applicable]

Month and year	Inflows				Outflows		Net total (in-out)
	Ungaged tributaries (5.62 mi^2), in tons	Pumpage into Old Gillespie Lake from New Gillespie Lake, in ton	Septic tank input from cabins, in ton	Waterfowl inputs, in ton	Flow over Old Gillespie Lake spillway, in ton	Drinking water withdrawals, in ton	
May 1996	1.971	0	0.004	0.000	0.491	0.005	1.479
June 1996	.043	0	.004	.000	.026	.005	.016
July 1996	0	.002	.004	.000	.000	.006	.000
August 1996	.002	.001	.004	.000	.000	.006	.001
September 1996	0	.001	.004	.000	.000	.005	.000
October 1996	.002	.001	.004	.001	.000	.005	.003
November 1996	.871	0	.004	.003	.000	.005	.873
December 1996	.019	0	.004	.002	.000	.005	.020
January 1997	.002	0	.004	.000	.000	.006	.000
February 1997	2.9	.001	.004	.001	.270	.005	2.631
March 1997	.135	0	.004	.003	.113	.005	.024
April 1997	.012	0	.004	.001	.000	.005	.012
Total	5.957	0.006	0.048	0.011	0.899	0.063	5.060
Percent of inflow and outflow	98.90	.10	.80	.20	93.50	6.50	na

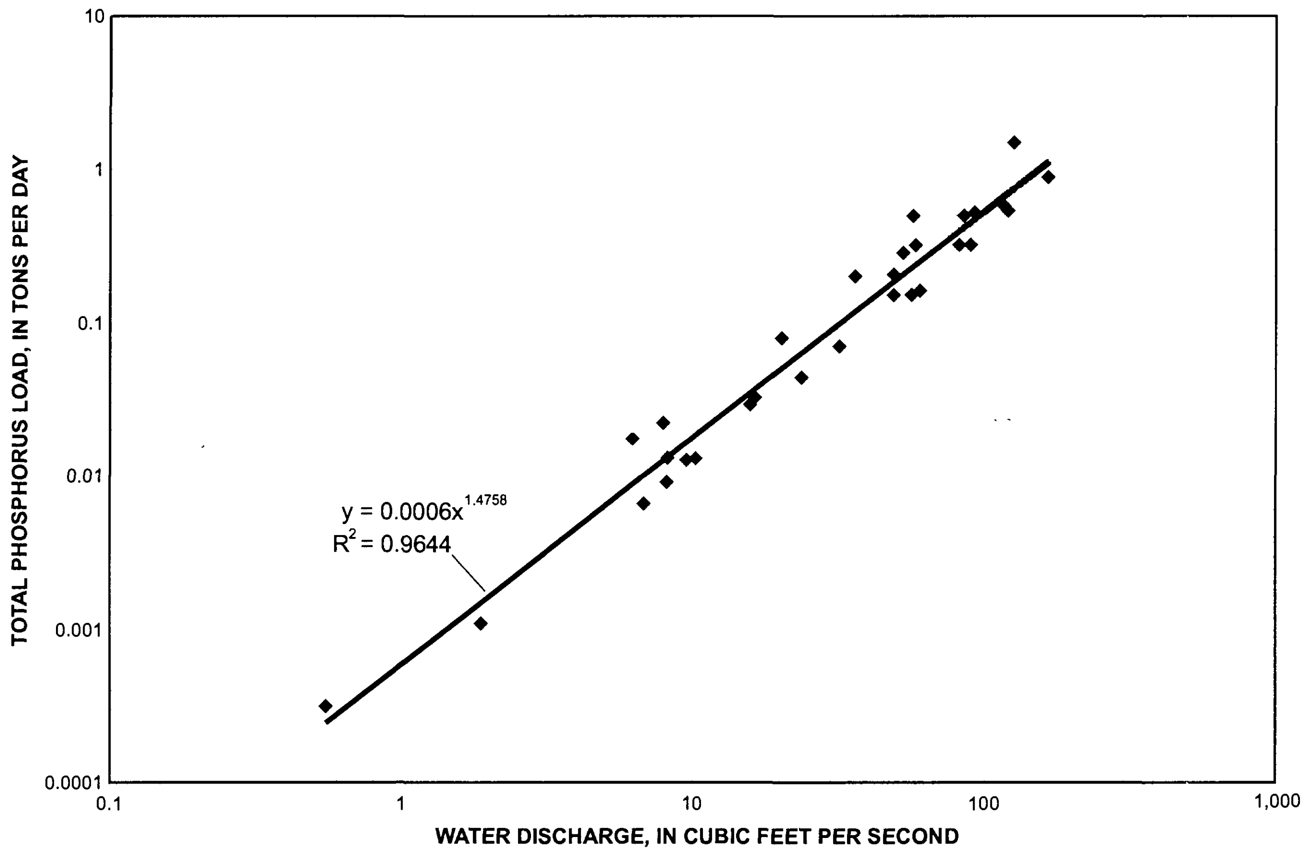


Figure 8. Relation of total phosphorus load and water discharge, Southwest Branch Dry Fork Creek near Gillespie, Illinois, (U.S. Geological Survey site number 05586685).

Because phosphorus leaves a lake system slowly, sewage inputs often affect the system long after the input has been discontinued.

Waterfowl manure inputs to the lake system, which are deposited directly into the water and are washed in from the shoreline or boat docks, were estimated by calculating loads on the basis of a per-bird loading rate times the number of waterfowl observed by the two volunteer local observers. The volume of manure that waterfowl produce varies with age and size of the waterfowl and the season (Boss, 1994). The biggest problem in estimating nutrient loading by aquatic birds is usually counting the birds. More than one-half of the birds that use a lake may be airborne during the day or difficult to see during the night. For greatest accuracy of nutrient loadings, birds were counted weekly during seasonal migrations when the number of birds using lakes is highest. Most of the annual load of phosphorus from aquatic birds is added during migrations. The daily nutrient load to a lake (on average) by a migrant Canadian goose is 1.57 gr (0.0554 oz) nitrogen and 0.49 gr (0.0173 oz) phosphorus (Manny and others, 1994).

Atmospheric deposition of phosphorus to the lakes was assumed to be negligible. For computational purposes, outflows of Old Gillespie Lake were measured at the spillway and the water-treatment plant. Water from Old Gillespie Lake was withdrawn for consumptive use at the plant. Water pumped from New Gillespie Lake to Old Gillespie Lake and from Old Gillespie Lake to the water-treatment plant was assumed to have a constant concentration of 0.05 mg/L of total phosphorus. A total phosphorus budget for New Gillespie Lake was computed in the same manner and is shown in table 10. Transport curves for Old and New Gillespie Lakes are shown in figures 9 and 10.

The phosphorus budget data indicate a net retention of 5.06 tons of phosphorus in Old Gillespie Lake out of an inflow of 6.02 tons for the year and 6.17 tons of phosphorus retention in New Gillespie Lake out of an inflow of 7.56 tons for the year. About 84 percent of the phosphorus entering Old Gillespie Lake was retained in Old Gillespie Lake. Similarly, about

82 percent of the phosphorus entering New Gillespie Lake was retained in New Gillespie Lake.

Nitrogen Budgets

The monthly nitrogen budgets for Old and New Gillespie Lakes are presented in tables 11 and 12. The total nitrogen load of a stream is calculated by summing the totals of Kjeldahl nitrogen as nitrogen load (which is ammonia nitrogen plus organic nitrogen) and the total nitrate plus nitrite as nitrogen load in tons per day. The daily loads of these compounds were summed by month and are included in the nitrogen budgets for Old and New Gillespie Lakes shown in tables 11 and 12. The transport curves for the three gaged and sampled sites are presented in figures 11–16. The daily load data are presented in appendix 2.

Table 10. Phosphorus budget for New Gillespie Lake, May 1996–April 1997

[mi^2, square mile; na, not applicable]

	Inflows					Outflows		
Month and year	Southwest Branch Dry Fork Creek, in tons	Remaining ungaged tributaries (3.83 mi^2), in tons	Septic tank input from cabins, in ton	Waterfowl input, in ton	Old Gillespie Lake spillway inflow, in ton	Flow over New Gillespie Lake spillway, in ton	Pumpage from New Gillespie Lake into Old Gillespie Lake, in ton	Net total (in-out)
May 1996	0.84	1.34	0.004	0.001	0.491	0.790	0.000	1.89
June 1996	.02	.03	.004	.001	.026	.096	.000	–.02
July 1996	.00	.00	.004	.001	.000	.000	.002	.00
August 1996	.00	.00	.004	.001	.000	.000	.001	.01
September 1996	.00	.00	.004	.001	.000	.000	.001	.00
October 1996	.00	.00	.004	.002	.000	.000	.001	.01
November 1996	.37	.59	.004	.008	.000	.000	.000	.98
December 1996	.00	.00	.004	.005	.000	.000	.000	.01
January 1997	.00	.00	.004	.001	.000	.000	.000	.01
February 1997	1.24	1.97	.004	.002	.270	.290	.001	3.20
March 1997	.06	.09	.004	.008	.113	.192	.000	.08
April 1997	.01	.01	.004	.002	.000	.023	.000	.00
Total	2.54	4.03	0.048	0.033	0.900	1.391	0.006	6.17
Percent of inflow and outflow	33.50	53.50	.60	.40	11.90	99.60	.40	na

The total nitrogen load per area for the sampled tributary for the study period was calculated at 9.26 ton/mi^2. Beaulac and Reckhow (1982) summarized load per area information for a wide variety of land-use and cropping practices. They reported loads for nitrogen ranging from about 0.86 to 11.43 ton/mi^2 for corn and soybean row crops, which compose the Gillespie Lakes watershed. As with phosphorus, the per-area yield of nitrogen for the Gillespie Lakes area (9.26 ton/mi^2) is on the high end of the available literature values.

The nitrogen budget data indicate that of the 52.3 tons of nitrogen inflow to Old Gillespie Lake during the study year, about 45.7 tons of nitrogen (or 87 percent) was retained in Old Gillespie Lake. Similarly, of the 64.3 tons of nitrogen inflow into New Gillespie Lake, about 52.1 tons (or 81 percent) was retained in New Gillespie Lake.

BATHYMETRIC SURVEYS OF OLD AND NEW GILLESPIE LAKES

A bathymetric survey of Old Gillespie Lake and New Gillespie Lake was completed by the USGS in August 1996. Contour maps of the lakebed elevations were produced from the bathymetric survey. Horizontal-position data were collected utilizing a differentially corrected global-positioning-system (GPS) unit. GPS units are specialized radio receivers that receive data transmitted from 24 U.S. Department of Defense (DOD) satellites orbiting the earth in six planes and calculate a position on the basis of that data.

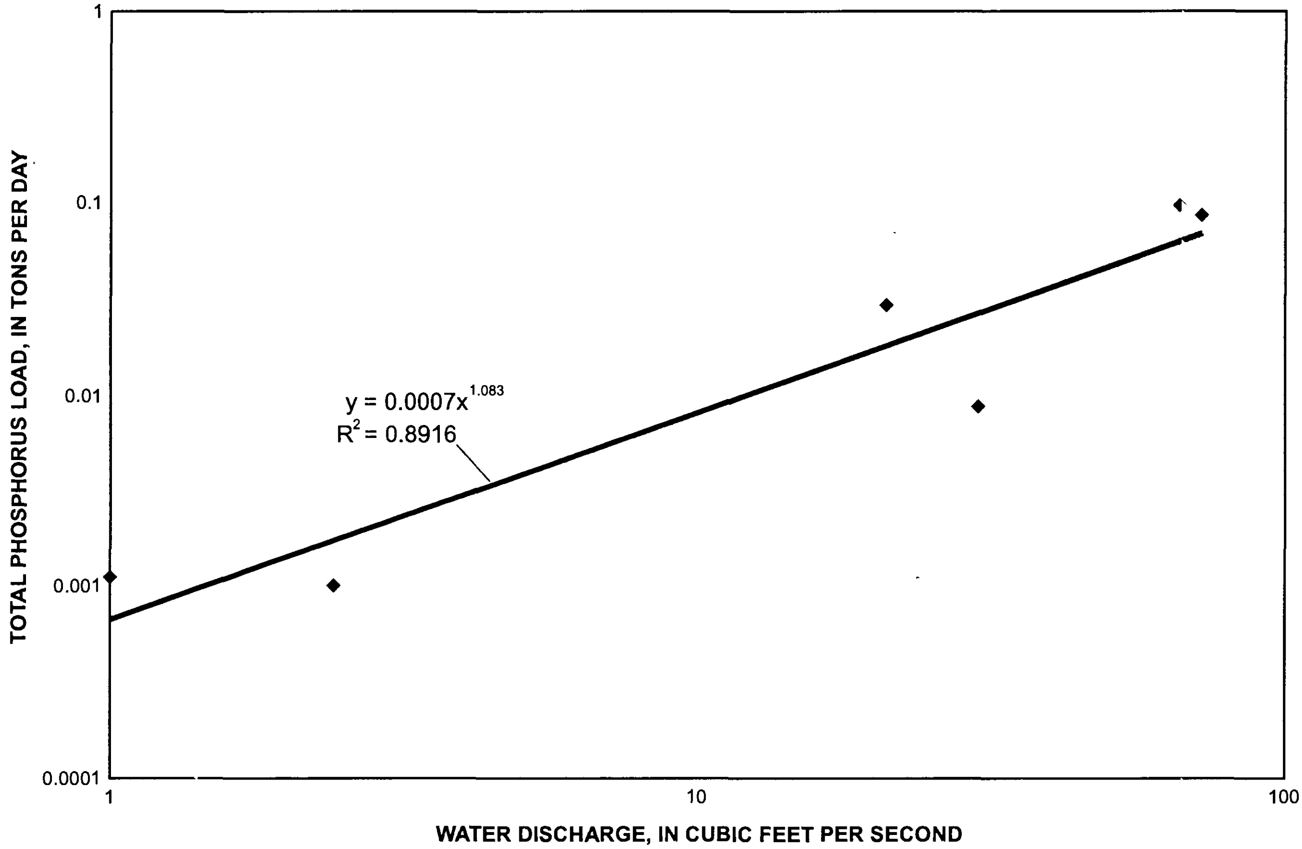


Figure 9. Relation of total phosphorus load and water discharge, Dry Fork Creek at Old Gillespie Lake Dam near Gillespie, Illinois (U.S. Geological Survey site number 05586684).

Common hand held GPS units typically have an accuracy of +/-50 m (164 ft) because of errors intentionally introduced in the satellite transmissions by the DOD. The differentially corrected GPS unit that was used in this project, however, computes the error introduced and corrects for it, such that the horizontal position data have a horizontal position accuracy of +/-1 m (3.28 ft).

Water-depth data were collected utilizing a PTS1000 digital fathometer, or echo sounder, produced by Ocean Data Equipment Corporation. This echo sounder collects water-depth data at an accuracy of +/-2 cm (0.7874 in.) . Inherent errors of the data-collection setup (tilt, roll, and pitch of the boat because of wave action and boat instability), however, can make the accuracy of the echo sounder as high as +/-30 cm (11.81 in.). This error was greatly reduced because the data were collected in relatively calm water.

In the field, the GPS and echo-sounder data were merged in the field during data collection by utilizing a hydrographic surveying software package called Hypack. The software produced an x, y, z file (x and y are horizontal position, and z is water depth) that was read into a mapping software.

The survey output was an ASCII file of Universal Transverse Mercator zone 16 (UTM 16) coordinates (in meters) and depth measurements (in feet). A geographically referenced data layer of points was created using Arc/Info Geographic Information System (GIS) software with the file of UTM 16 coordinates. The data layer was attributed with the lake-depth measurements, resulting in a two-dimensional, digital representation of the survey data. A module within the Arc/Info software called TOPOGRIDTOOL was used to generate a raster representation of the lake bottom from the data layer. This raster representation, known as a grid or lattice, is a continuous representation of the data layer. A grid consists of geographically referenced, discrete, and uniform units called cells. Every cell represents a specified portion of the earth, such as a square kilometer, hectare, or square meter. Each cell is given a value to correspond to the feature or characteristic that is located at or describes the site.

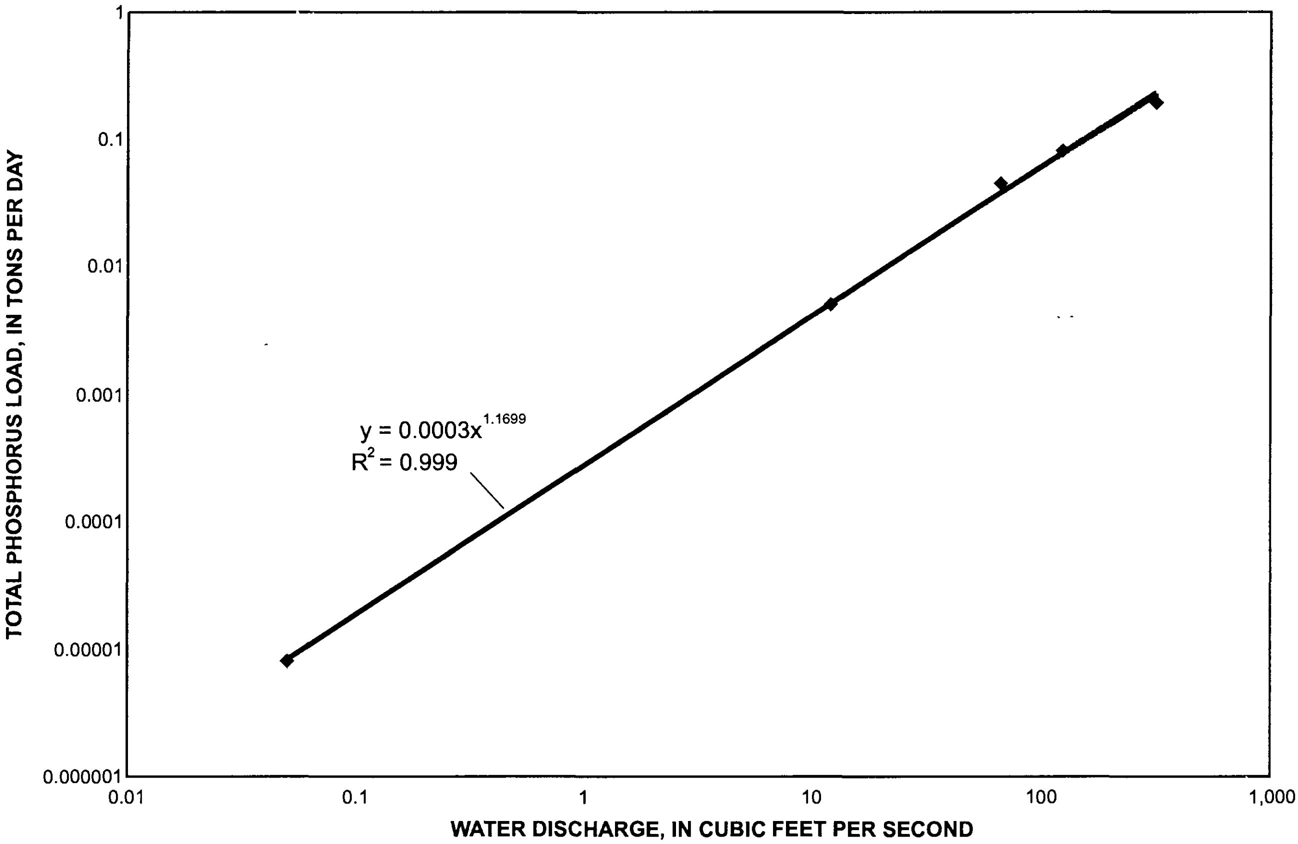


Figure 10. Relation of total phosphorus load and water discharge, Dry Fork Creek at New Gillespie Lake Dam near Gillespie, Illinois (U.S. Geological Survey site number 05586686).

Input data for grids of Old and New Gillespie Lakes included a digitized outline of each lake (attributed with zero elevation) and the data layer of survey points. All data outside the lake boundaries were designated "no data." The cell size for Old and New Gillespie Lakes was 2 m (6.56 ft). The grid for each lake was input into the Arc/Info command LATTICECONTOUR, generating contours at a specified contour interval of 2 ft. No smoothing or filtering was done to the generated contours. The Arcplot module was used to prepare the contours for final map production. The color maps are included in figures 17 and 18. Maximum depths of 20.2 ft and 25.0 ft were measured at Old Gillespie Lake and New Gillespie Lake, respectively.

REVIEW OF LAKE-MANAGEMENT PRACTICES

The following discussion presents and describes summaries of some potential restoration and maintenance techniques that could be applied to the Gillespie Lakes system. Restoration and maintenance techniques for the Gillespie Lakes system should be considered separately. A restoration oriented technique, such as a technique that improves the water quality of lake inflows, would usually cost more at the outset to implement but probably would have longer lasting effects on water quality. A maintenance-based technique, such as dredging or treating with herbicide, is sometimes less expensive and easier to implement but often is only a temporary solution for water-quality problems. When considering the lake-management practices described in the following sections, remember that fish production is related to lake fertility. Nutrient-rich water favors and encourages fish biomass but also may promote algal blooms repugnant to swimmers.

Improvement of fishing (increases in number, size, and health of popular game fish) requires fish management. An evaluation of fish conditions is the first step in a fish-management strategy. A balance between a healthy fishing lake and a lake suitable for swimming, boating, and drinking water is sometimes difficult to achieve.

Restoration Techniques

Restoration techniques involve treating the cause of the water-quality problem rather than treating the symptoms. If the inflows to a waterbody are of poor quality and it is not feasible or practical to improve the inflows, then protection of the waterbody will be impossible. Also, reducing nutrient loading from inflows will not correct weed problems if the nutrients, which are already in the lake sediments, are capable of sustaining the weeds. The lake watershed system is a functioning unit with interacting biological, physical, chemical, and human components. The goals of lake restoration must be realistically set to the limits imposed by the natural background of inflows and the chemistry of the lake bottom sediments. It is important to consider the limits of what is practical to achieve in lake restoration.

Table 11. Nitrogen budget for Old Gillespie Lake, May 1996–April 1997

[mi^2, square miles; na, not applicable]

Month and year	Inflows				Outflows		Net total (in-out)
	Ungaged tributaries (5.62 mi^2), in tons	Pumpage into Old Gillespie Lake from New Gillespie Lake, in ton	Septic tank input from cabins, in ton	Waterfowl input, in ton	Flow over Old Gillespie Lake spillway, in tons	Drinking water withdrawals, in ton	
May 1996	15.66	0	0.004	0.003	3.59	0.005	12.07
June 1996	.33	0	.004	.003	.17	.005	.16
July 1996	0	.03	.004	.003	0	.006	.03
August 1996	0.03	.03	.004	.003	0	.006	.05
September 1996	0	.03	.004	.003	0	.005	.03
October 1996	.04	.03	.004	.006	0	.005	.07
November 1996	7.39	0	.004	.025	0	.005	7.41
December 1996	.04	0	.004	.016	0	.005	.05
January 1997	.03	0	.004	.004	0	.006	.03
February 1997	27.38	.03	.004	.006	2.00	.005	25.41
March 1997	1.00	0	.004	.025	.77	.005	.25
April 1997	.14	0	.004	.005	0	.005	.15
Total	52.04	0.15	0.048	0.102	6.53	0.063	45.71
Percent of inflow and outflow	99.40	.30	.10	.20	99.00	1.00	na

Lake ecosystems are complex and highly interrelated. In the long term, the condition of a waterbody is affected primarily by the water entering it. Protecting and maintaining the watershed is critical for the quality of the lake system. Major contributors of nutrients and sediment can be agricultural runoff and wastewater discharges, such as feed-lot and pasture runoff, wastewater-treatment plants, and septic systems (Wisconsin Department of Natural Resources, 1974). Inflows to the Gillespie Lakes system result from extensive areas of nonpoint source discharges over several property lines. These high inflows make loadings high and improvements in stream water quality challenging and require participation by land owners in the watershed.

Sediment budgets and nutrient budgets presented earlier in this report indicate that sediment and nutrient loads will continue to affect the water quality of the Gillespie Lakes system. Currently, the large volumes of inflowing sediment that is deposited in the Gillespie Lakes is a problem and will undoubtedly become a larger problem as the years go by. High retention of the nutrients in the inflows is most likely a major cause of excessive weed and algae growth, which inhibits recreation, fishing, and aesthetics, and can cause poor taste and odor in the finished water from the water-treatment plant.

The implementation of Best Management Practices (BMP's), such as conservation tillage, grassed waterways, filter strips, sediment control/retention basins, grade stabilization structures, and many others, can be used to prevent sediments and nutrients from entering the lakes through inflow of surface water. Other BMP's that can be applied to agricultural land include permanent seeding, terraces, livestock watering facilities (as opposed to watering livestock directly in streams), windbreaks and shelterbelts, water-impoundment reservoirs, wildlife-cover plantings, animal waste-control structures, and rotation seedings (North American Lake Management Society, 1990). Combining several complementary BMP's typically results in effective reduction of nutrients and sediment in runoff from agricultural areas (Melching, 1997). Because of the relatively high range of nutrient loads in the Gillespie Lakes system when compared with watersheds with similar cropping practices, implementation of BMP's in the watershed probably would result in the improvement of water entering the lake system.

Table 12. Nitrogen budget for New Gillespie Lake, May 1996–April 1997

[mi^2, square miles; na, not applicable]

Month and year	Inflows				Outflows		Net total (in-out)
	Southwest Branch Dry Fork Creek, in tons	Remaining ungaged tributaries (3.83 mi^2), in tons	Waterfowl input, in ton	Flow from Old Gillespie Lake spillway, in tons	Flow over New Gillespie Lake spillway, in tons	Pumpage from New Gillespie Lake into Old Gillespie Lake, in ton	
May 1996	6.68	10.67	0.003	3.59	6.67	0.000	14.27
June 1996	.14	.22	.003	.17	.96	.000	–.42
July 1996	.00	.00	.003	.00	.00	.033	–.03
August 1996	.01	.02	.003	.00	.00	.025	.01
September 1996	.00	.00	.003	.00	.00	.029	–.03
October 1996	.02	.03	.006	.00	.00	.030	.02
November 1996	3.16	5.04	.025	.00	.00	.000	8.22
December 1996	.01	.02	.016	.00	.00	.000	.05
January 1997	.01	.02	.004	.00	.00	.000	.04
February 1997	11.69	18.66	.006	2.00	2.31	.025	30.02
March 1997	.43	.68	.025	.77	1.86	.000	.04
April 1997	.06	.10	.005	.00	.27	.000	–.11
Total	22.21	35.46	0.102	6.53	12.07	0.142	52.08
Percent of inflow and outflow	34.60	55.10	0.20	10.10	98.80	1.20	na

The activities of homeowners around a lake can substantially affect lake water quality. For example, rain can wash improperly applied fertilizers and pesticides into lakes. On the other hand, prudent lawn care and landscaping can improve and protect water quality (Northeastern Illinois Planning Commission, 1995). Education programs on BMP's for farmers and other landowners pertaining to proper fertilization and lawn care can help remind landowners that excessive nutrient inputs can negatively affect the lakes, as well as property values, recreational opportunities, and raw water usage. Several governmental agencies (U.S. Department of Agriculture, Soil Conservation Service, Extension Service, and others) advise, educate, and provide assistance in implementation of BMP's in a watershed.

Most of the restoration measures mentioned above, such as the implementation of BMP's, not only attempt to decrease the incoming nutrient loads but also decrease the incoming sediment loads. Reductions in sediment and nutrient loads and improvements in lake water quality resulting from BMP's may take many years to be detected. Thus, BMP's should not be thought of as a "quick fix" to lake quality problems (Melching, 1997).

Lake community homeowners, such as those in cabins around Old and New Gillespie Lakes, have a special responsibility to also ensure that their septic systems are not polluting the lakes. Sewage is high in phosphorus, which usually is the nutrient that limits algae and rooted aquatic plant growth in Illinois. A properly functioning septic system will remove most disease-causing organisms and some nutrients and chemicals from wastewater. Many septic systems, however, will not remove all nutrients or treat many water-soluble pollutants, such as solvents, drain cleaners, and many household chemicals. Consequently, the proper location, design, construction,

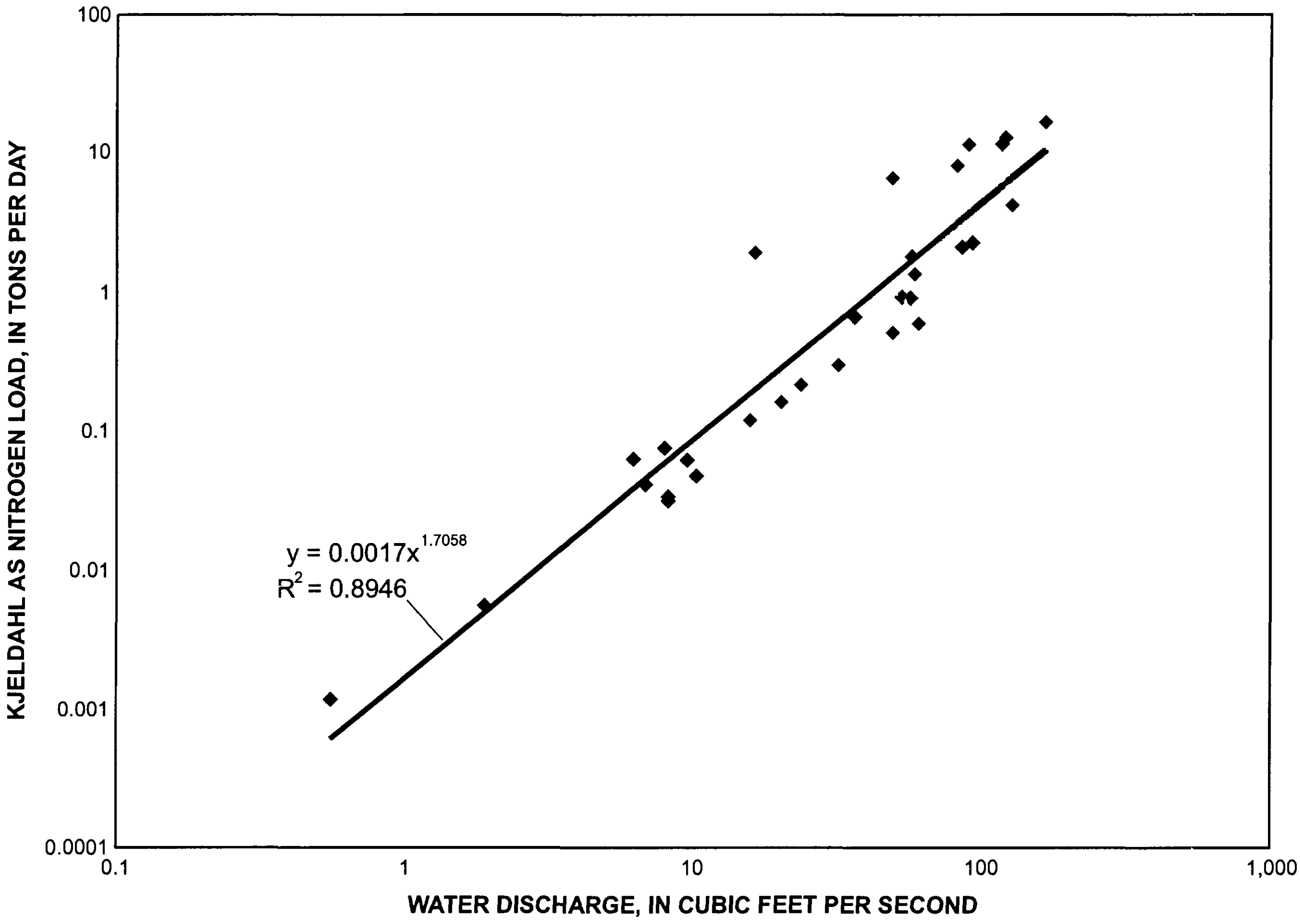


Figure 11. Relation of total kjeldahl nitrogen load and water discharge, Southwest Branch Dry Fork Creek near Gillespie, Illinois (U.S. Geological Survey site number 05586685).

and operation of septic systems are critical in areas close to lakes and streams, as well as in shallow ground water. Additionally, septic tanks require regular maintenance to operate efficiently. Many septic systems do not have sufficient capacity for the type of use they receive, are located too close to the water table, or are located in poor soils (Northeastern Illinois Planning Commission, 1995). The County Soil and Water Conservation District can help determine the type, depth, and location of the various soils on a residential property and their suitability for septic systems.

Maintenance Techniques

Maintenance techniques for management of lake water quality can address an existing problem that cannot be rectified by restoration techniques. Some alternative maintenance-based techniques are described below.

Sedimentation Control

Some areas of the Gillespie Lakes system are excessively shallow. Removal of silt by dredging can deepen the lakes, but incoming silt will return the lake to its predredged condition if no improvements are made in the incoming water. First, attempts should be made to control silt sources. Sediment removal also can limit submerged weed growth by deepening the water and, thereby, limiting the light penetration needed for weed growth. Weed roots also can be removed. Weed removal is effective only when the source of the sediments is controlled. The sediment layer that contains the highest concentration of phosphorus needs to be removed. Sediment removal to retard nutrient release can be highly effective but can be very expensive

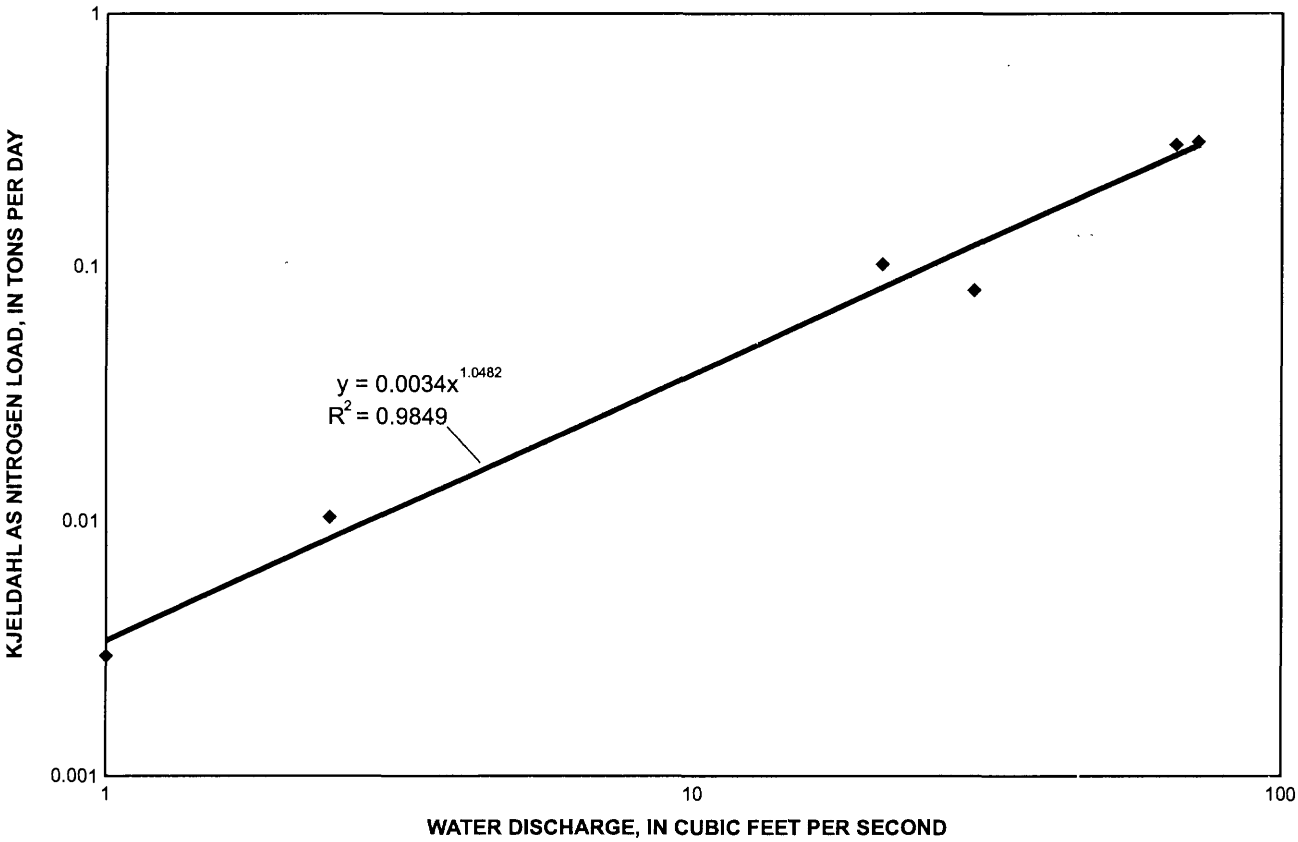


Figure 12. Relation of total kjeldahl nitrogen load and water discharge, Dry Fork Creek at Old Gillespie Lake Dam near Gillespie, Illinois (U.S. Geological Survey site number 05586684).

(Pullman, 1992). Removing sediments creates a major disruption throughout lake systems and can become a particular problem when heavy metals or other toxins are present in the dredging spoils. Normally, a permit is required from the U.S. Army Corps of Engineers before dredging can be done.

Sediment aggradation impairs fish respiration and plant productivity, reduces water depth, and reduces aesthetic enjoyment of lakes. Although most of the sediment aggradation in the Gillespie Lakes comes from overland erosion, shoreline erosion also contributes to aggradation. Shoreline erosion is evident in large areas of bare soil on a steep, high shoreline bank; in noticeable areas of a receding shoreline over time; by leaning or downed trees with exposed roots along the shoreline; by muddy patches of water near the shore; or by excessive deposits of sediments on the bed along the shoreline.

Shoreline stabilization can improve the aesthetics and "useful" life of a lake. The powerful forces of waves, currents, wind, and ice can move soil particles toward, away from, and along the shoreline. Points usually have relatively high erosion rates because they are attacked from all sides by these forces, whereas bays are usually the most bank-erosion-resistant areas. Generally, natural erosion proceeds very slowly, and the plants and animals that live along the shoreline can adjust to these slow changes, maintaining a healthy, productive ecosystem. When some catastrophic natural or human disturbance causes the equilibrium of the shoreline to be upset, accelerated erosion can result. Examples of natural disturbances include large trees uprooted by a windstorm or a flood. Human disturbances include vegetation removal, dredging, filling, or construction on or near the shoreline.

To control or prevent shoreline erosion, rocks and vegetation present along the banks could be preserved; major construction could be prevented within a specified distance from the shoreline; and the amount of foot traffic, boat wakes, and other recreational activities in erosion-prone areas could be limited. There are three types of reactive shoreline erosion control methods: (1) vegetative—planting

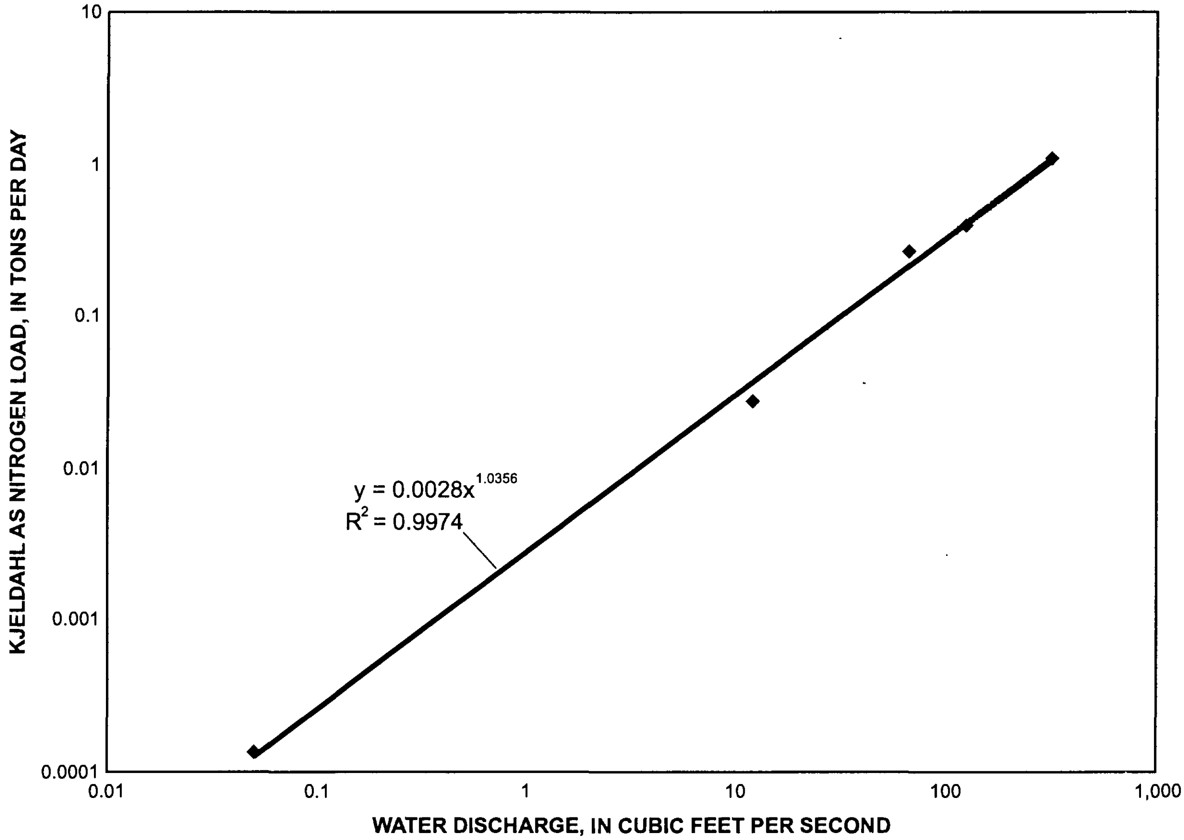


Figure 13. Relation of total kjeldahl nitrogen load and water discharge, Dry Fork Creek at New Gillespie Lake Dam near Gillespie, Illinois (U.S. Geological Survey site number 05586686).

trees or woody shrubs (for their effect of soil binding by their large root systems), grass and herbaceous plants (for their effect of protecting against raindrop impact and scouring from surface-runoff), or emergent aquatic plants to stabilize bottom sediments and dampen wave actions; (2) structural—constructing protective structures, possibly rip-rap, bulkheads, gabions (rock-filled baskets), sandbags filled with concrete, or railroad ties; and (3) manipulative—removing streamflow obstructions, grading banks, and rerouting flows (mostly used on streams) (Fuller, 1995). State permits are required for most erosion control projects.

Aquatic-Plant Control

Aquatic plants are beneficial and necessary features of lakes and ponds. Plants stabilize shorelines, prevent wave erosion, provide cover for fish and nesting areas for other wildlife, and can be aesthetically pleasing. Thus, complete eradication of plants in lakes and ponds is not desirable. Aquatic plants can become problems, however, when they interfere with the intended use of a lake or pond, whether it is fishing or swimming or boating, drinking water, or other purposes. Most plant problems start in shallow water (Wisconsin Department of Natural Resources, 1974).

The application of herbicides is perhaps the oldest and most widely used method for management of weeds, but herbicides are usually expensive for what they accomplish. Herbicides produce no restorative benefit and must be applied at least annually. Application can be an effective short-term solution but cannot be equated with lake restoration because the causes of the weed growth are not addressed and nutrients are not removed. Also, caution must be exercised when using herbicides. Herbicides should be applied in the early spring when the aquatic vegetation is actively growing

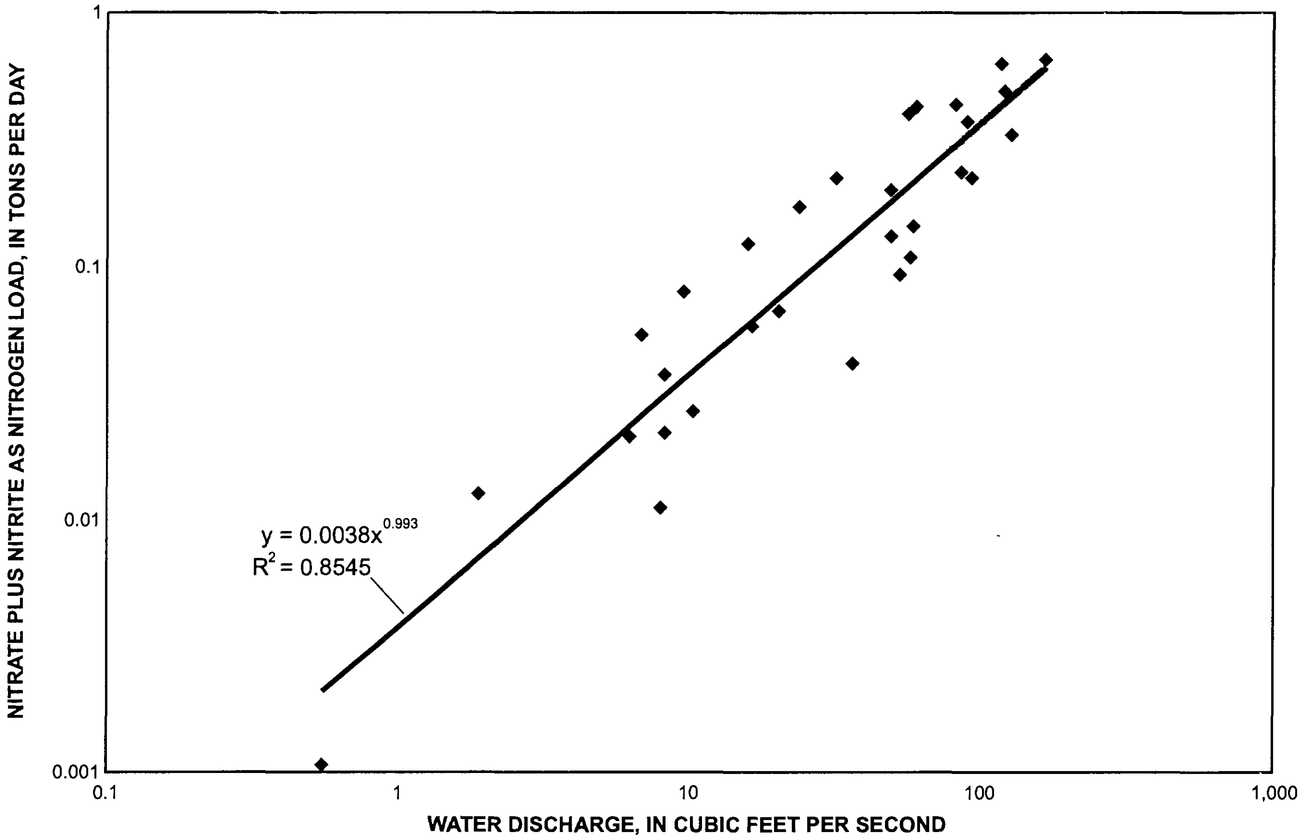


Figure 14. Relation of total nitrate plus nitrite as nitrogen load and water discharge, Southwest Branch Dry Fork Creek near Gillespie, Illinois (U.S. Geological Survey site number 05586685).

and before it has reached the seeding stage. As mentioned earlier, if herbicides are applied after the weeds have become well established, the dieback caused by the herbicides can lower DO concentrations, release nutrients, and cause numerous other problems (Pullman, 1992).

Algae Control

As explained earlier, phosphorus generally is the key, or controlling, nutrient in the quantity of algae in a lake (North American Lake Management Society, 1990). Because phosphorus is not a volatile chemical, its sources in a watershed are limited. Controlling phosphorus at its sources is usually the only practical solution to the problems of algal growth in a lake. Sometimes, however, the lake and watershed can be manipulated to make phosphorus concentrations low enough to limit algal growth. The restoration techniques for phosphorus described earlier concentrated on controlling the inflow of phosphorus, whereas maintenance-based solutions for phosphorus problems depend on curtailing internal phosphorus release from the bottom sediments in the lake. A few maintenance-based techniques for phosphorus problems are described below.

Internal loading of phosphorus is a major eutrophication factor in many lakes. Phosphorus can be released from rich, flocculent sediment as a result of high pH or very low DO concentrations. Phosphorus also can be indirectly introduced by macrophyte uptake from sediments and through subsequent decomposition. Decomposing macrophytes also may supply substantial amounts of phosphorus to the lake during winter dieback. Macrophytes also release phosphorus to the water column by excretion during growth. Internal loading of nutrients can decrease the effectiveness of restoration measures that are aimed at controlling external inputs (North American Lake Management Society, 1990).

Anaerobic release of phosphorus generally does not occur in shallower nonstratified lakes where DO concentrations near the bottom sediments stay relatively high. The presence or absence of thermal

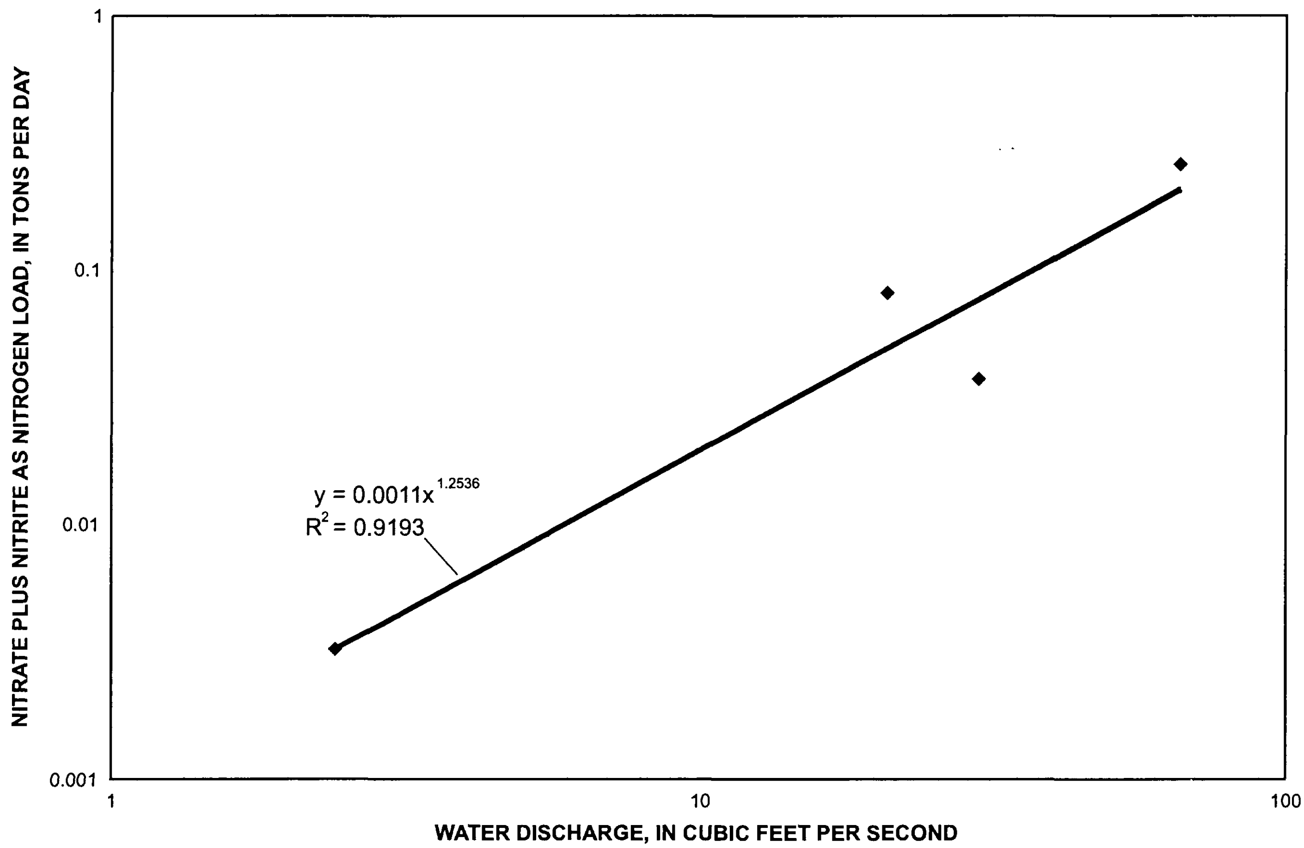


Figure 15. Relation of total nitrate plus nitrite as nitrogen load and water discharge, Dry Fork Creek at Old Gillespie Lake Dam near Gillespie, Illinois (U.S. Geological Survey statioin number 05586684).

stratification in the water column is important because plant nutrients, commonly stored in bottom sediment, can be stirred up during the two turnovers per year that occur in most stratified waterbodies and also because of internal cycling, where more nutrients are released when low DO concentrations are present (Jacoby and others, 1981). In the Gillespie Lakes system, the lakes do become stratified. However, the DO concentration at the greatest depths, although low enough that they may not support fish respiration, are high enough that release of nutrients from the bottom sediments because of anaerobic conditions is not accelerated.

If in-lake phosphorus concentrations are high or if appreciable amounts of phosphorus are released in a lake, an alum treatment may be effective in lowering phosphorus concentrations. Alum bonds with the phosphorus and creates a floc precipitate that settles to the bottom. If enough alum is added, a layer of 1–2 inches of aluminum hydroxide will cover the sediments and prevent phosphorus from entering as an "internal load." The floc appears to continue to sorb phosphorus as it settles to the bottom and in this way acts as a chemical barrier to phosphorus release from the sediments. Although alum treatments are highly effective in thermally stratified lakes, they may not be effective in smaller reservoirs like the Gillespie Lakes and could significantly lower the pH of the water. Alum treatments also could increase water clarity so that light penetration is deeper; and, thus, a potential problem with increased macrophytes may result (Jacoby and others, 1981).

Underwater currents from outboard motors can stir up bottom sediments in shallow lakes and, thus, release nutrients available for algae. Boat wakes also can greatly affect shoreline erosion (Fuller, 1995). Old and New Gillespie Lakes have ordinances to enforce no-wake zones, maximum speed limits, and horsepower ratings to limit stirring up of nutrient-laden sediments. Recently, personal watercraft, sometimes called jet skis, have risen in popularity and have great potential to stir up the nutrient-laden bottom sediments if operated in shallow areas. Restricting personal watercraft usage to deeper parts of lakes could minimize the stirring up of these bottom sediments.

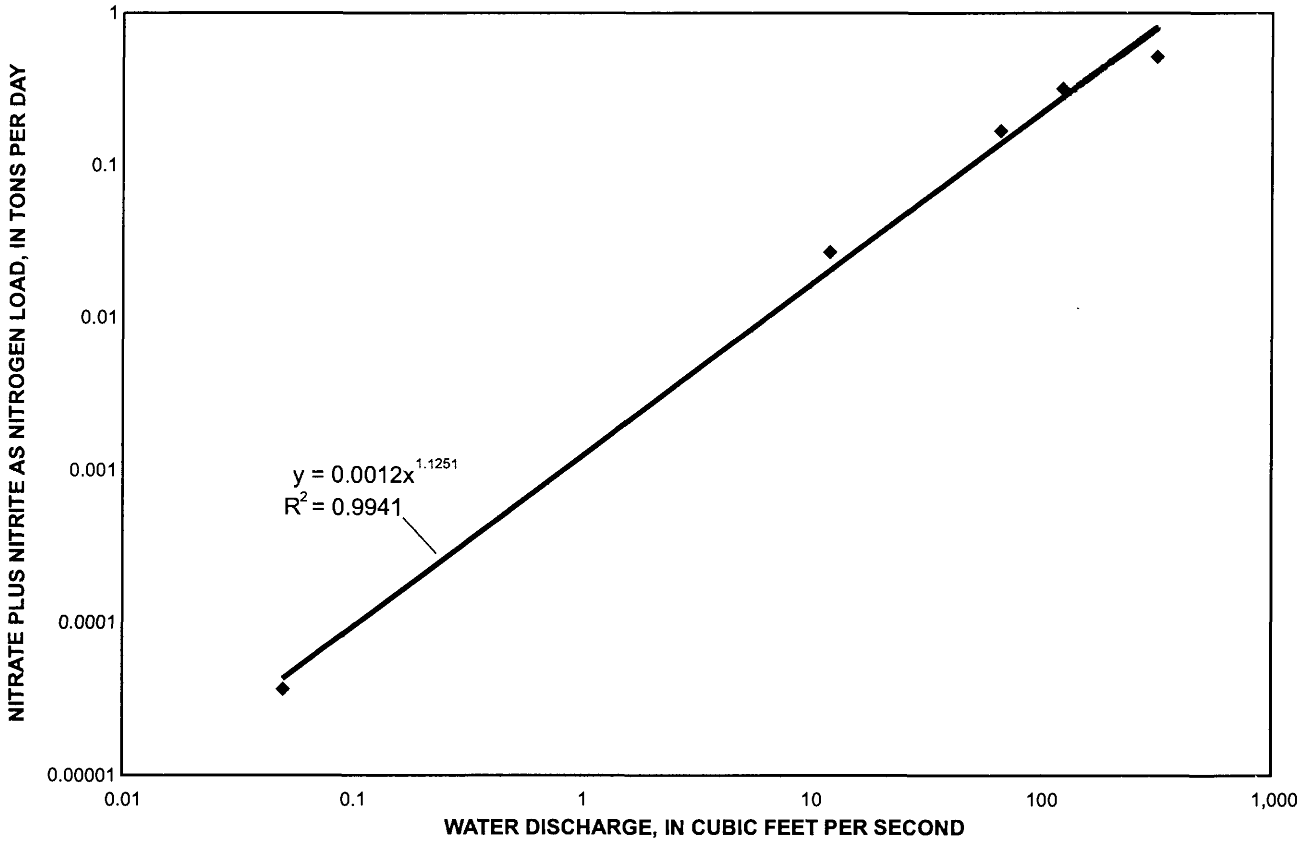


Figure 16. Relation of total nitrate plus nitrite as nitrogen load and water discharge, Dry Fork Creek at New Gillespie Lake Dam near Gillespie, Illinois (U.S. Geological Survey site number 05586686).

An effective, maintenance treatment for excessive algae is copper sulfate, the most widely used algicidal chemical. Simazine also is used extensively to control algae. Copper inhibits algal photosynthesis and alters nitrogen metabolism. Copper sulfate often is very effective, but response may be brief and frequent applications may be required—again, the causes of the original problem are not addressed. Application should be in the spring (Illinois Department of Conservation, 1994).

Use of dyes in the water and coverings on the water surface to limit the light available to plants and the application of sheets over the sediments are effective methods to limit weed and algae growth. Applications of silt, sand, clay, and gravel also can be used, but eventually plants root through. Best results are obtained when sediment covers the black plastic sheeting; however, adding more sediment to the Gillespie Lakes probably is not an option at this time. Shading also can be accomplished by use of dyes, which contain only inert coloring matter and nontoxic material. The dye limits light penetration and thus photosynthesis, which inhibits plant growth. This method will work only in water deeper than about 3 ft (Illinois Department of Conservation, 1994).

Drawdown of a lake can cause nuisance plants to be dried out and killed and is especially successful if the water level can be kept down during the winter. This practice obviously can be used only in lakes with water control structures. Some plants are not affected by drying, so it is important to understand the biology of the plant species present in the lake before using this method. Drawdown also can consolidate sediments (Wisconsin Department of Natural Resources, 1974).

Harvesting the weeds from a lake, whereby nuisance rooted plants and associated filamentous algae are cut and removed, provides temporary relief from nuisance plants without addition of potentially toxic substances. Disposal of the material usually is not a problem; the spoils can be used as mulch and fertilizer. Harvesting can be very expensive, however, and could possibly cause the spread of some plants because of spreading fragments of plants from which new growth can begin. Also, when bottom-dwelling

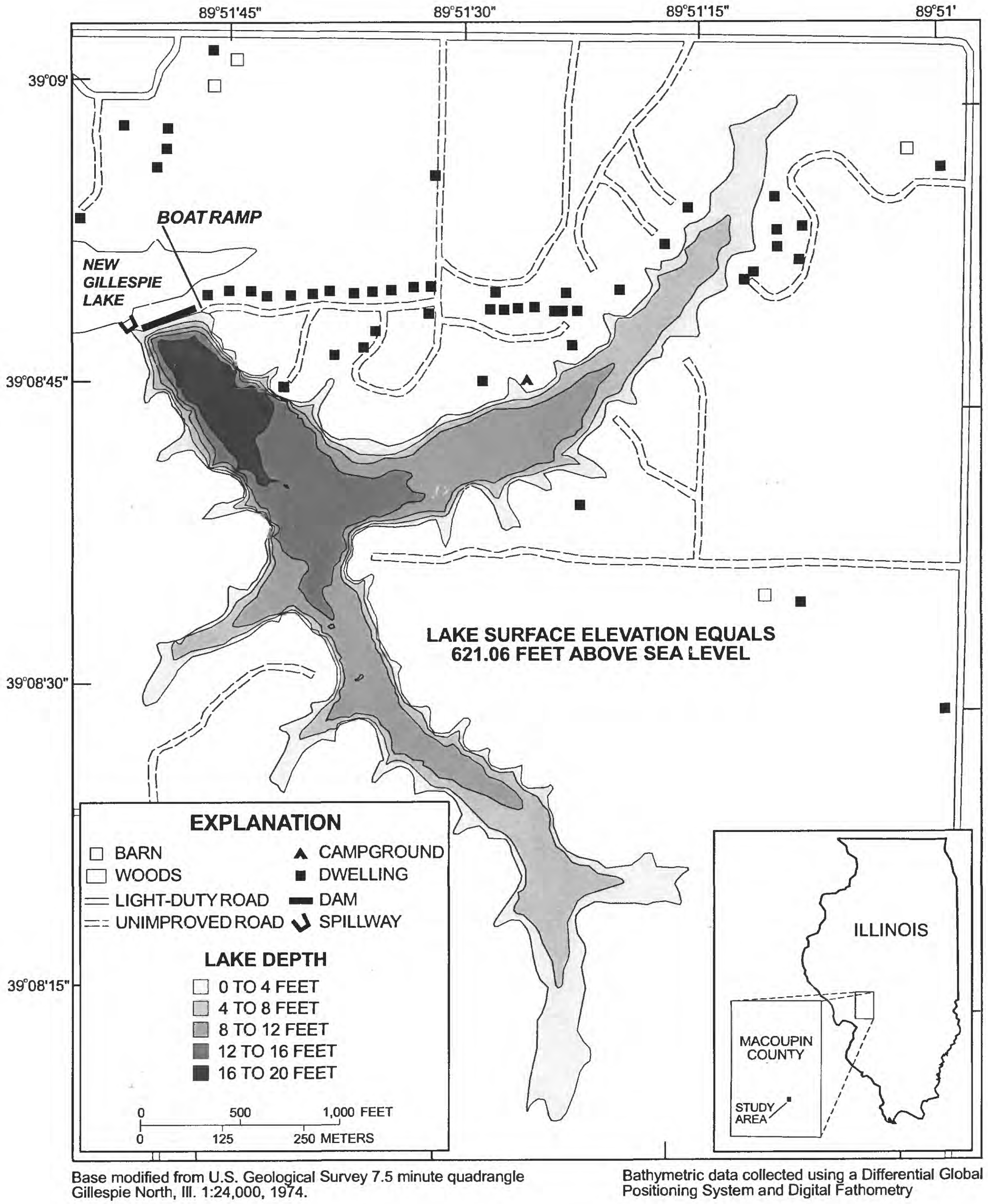
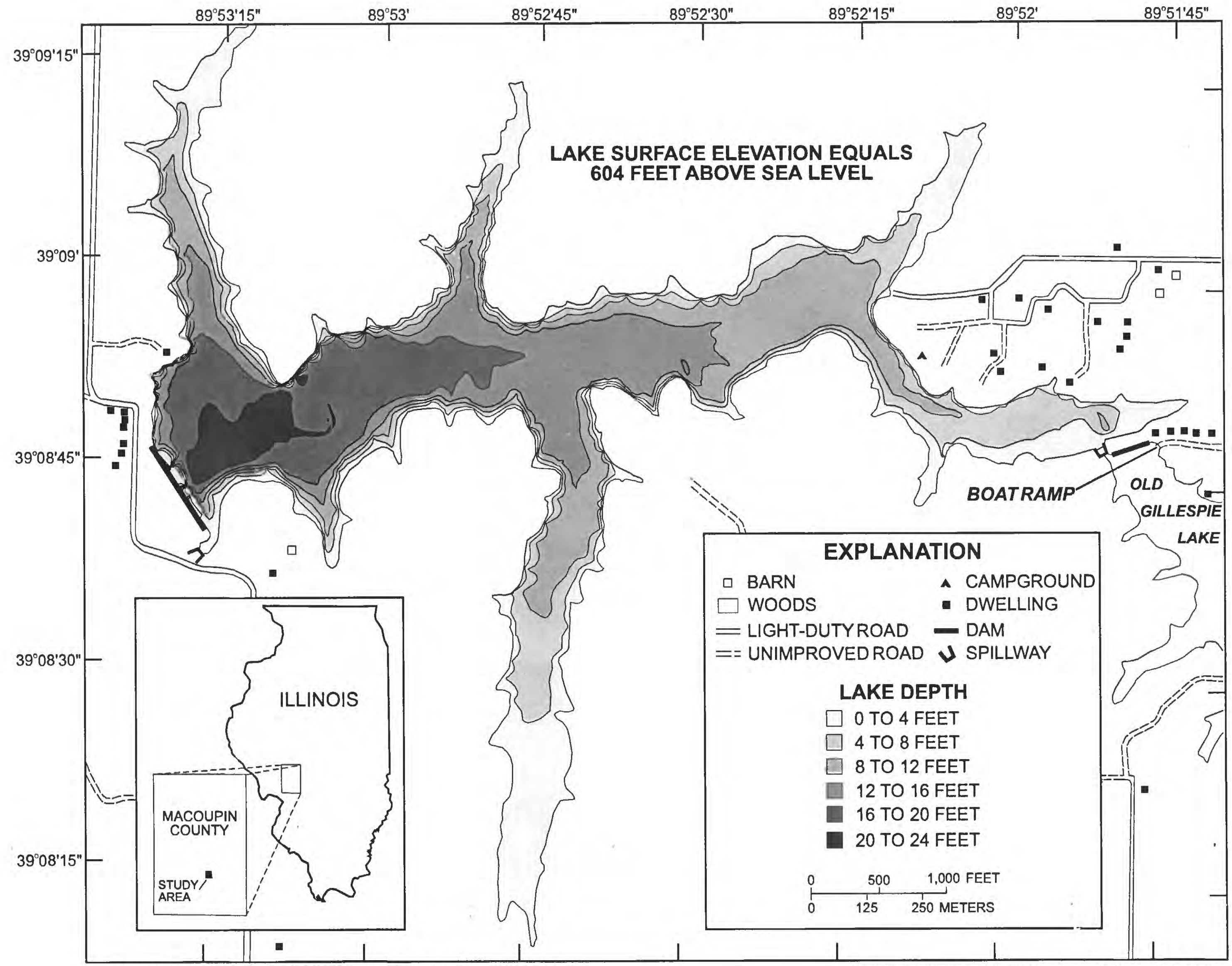


Figure 17. Bathymetric map of Old Gillespie Lake near Gillespie, Illinois, August 1996.

plants are cut off or die off, phosphorus from the plants is released into the water column to be used by suspended algae or phytoplankton, which support algal blooms. Plants, such as cattails, arrowhead, and water lily, can be removed by pulling them at first growth. Cut vegetation should always be removed from



Base modified from U.S. Geological Survey 7.5 minute quadrangle Gillespie North, Ill. 1:24,000, 1974.

Bathymetric data collected using a Differential Global Positioning System and Digital Fathometry

Figure 18. Bathymetric map of New Gillespie Lake near Gillespie, Illinois, August 1996.

the lake so that it does not decompose in the lake. Mowing cattails after the heads are well formed but not mature and following up with another mowing about a month later will kill most of the plants (Illinois Department of Conservation, 1994).

Biological control of weeds also may be an option for the Gillespie Lakes. Triploid sterile grass carp are voracious consumers of macrophytes and have very high growth rates (up to 6 lbs per year). However, grass carp cannot only control but may eradicate all plants. Most studies find that fish are exceptionally effective in eliminating nuisance vegetation but can significantly alter the structure of a lake, particularly when the macrophytes are completely eradicated. Triploid sterile grass carp also do not need to be "applied" each year; they will live for many years in a lake. Aquatic-vegetation control with triploid grass carp will take time to implement. If desired results are not achieved within three summers after stocking, lake managers sometimes increase the number of grass carp in the lake. Use of grass carp to control aquatic vegetation is possible but sometimes at the expense of the bass, bluegill, and catfish, whose well-being is dependent upon some of the aquatic vegetation remaining in the lake (Illinois Department of Conservation, 1994).

SUMMARY

Water, sediment, and nutrient budgets for Old Gillespie Lake and New Gillespie Lake were calculated by the U.S. Geological Survey with data collected during May 1996–April 1997. Bathymetric data also were collected in the two lakes to produce maps of the lakebed elevations. This study was done in cooperation with the Illinois Environmental Protection Agency and the city of Gillespie, Illinois.

Of the approximately 4,063 tons of sediment that entered Old Gillespie Lake during the 1-year study period, only about 314 tons exited the lake system. From May 1996 through April 1997, approximately 3,749 tons of sediment were deposited in Old Gillespie Lake, or about 92 percent of the incoming load. This value agrees with literature values using Brune's curve for estimating trap efficiency of a reservoir. Likewise, applying Brune's curve to New Gillespie Lake, a theoretical trap efficiency of about 95 percent is found. This theoretical value is identical to the results from the data analysis. Approximately 4,792 tons of sediment entered New Gillespie Lake during the study period and 4,550 tons (or 95 percent) were trapped in the lake.

The phosphorus budget data indicate a net retention of 5.06 tons of phosphorus in Old Gillespie Lake from an inflow of 6.02 tons for the year and 6.17 tons of phosphorus retention in New Gillespie Lake from an inflow of 7.56 tons for the year. About 84 percent of the phosphorus entering Old Gillespie Lake was retained in Old Gillespie Lake. Similarly, about 82 percent of the phosphorus entering New Gillespie Lake was retained in New Gillespie Lake. The total phosphorus load per area for the sampled tributary, the Southwest Branch Dry Fork Creek near Gillespie, Illinois, for the study period was 1.06 ton/mi^2.

The nitrogen budget data indicate that of the 52.3 tons of nitrogen inflow to Old Gillespie Lake during the study year, about 45.7 tons of nitrogen (or 87 percent) was retained in Old Gillespie Lake. Similarly, of the 64.3 tons of nitrogen inflow into New Gillespie Lake, about 52.1 tons (or 81 percent) was retained in New Gillespie Lake. The total nitrogen load per area for the sampled tributary for the study period was 9.26 ton/mi^2.

Considering these loads and retention of sediment and nutrients, a review of basic lake-management practices is presented and discussed. Lake-restoration techniques, such as implementation of Best Management Practices, are compared to maintenance-based techniques such as sediment dredging and herbicide application. This review is presented to assist lake managers in the achievement of lake water-quality goals.

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APPENDIXES

Appendix 1. Hydrologic Data

STATION NO.	05586684
WRITTEN	06-11-96
BY	J. D. Muhs
CK	06-12-96
BY	G. P. Johnson

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Description of Gaging Station on Dry Fork Creek at Old Gillespie Lake Dam near Gillespie, Ill.

LOCATION.--Lat 39° 08′ 48″ , Long 89° 51′ 51″, in SW1/4 sec.10 T.8N. R.7W., Macoupin County, Hydrologic Unit 07130012, at dam and spillway of Old Lake Gillespie, 2.3 mi. northwest of Gillespie, Ill.

TO REACH GAGE.--Drive 1.3 mi west of Gillespie on State Highway 16, 1.5 mi north on Lake Road, follow road west 0.5 mi, turn south and follow road to Old Gillespie Lake Dam and Spillway.

ESTABLISHMENT.--The staff gage was installed May 1, 1996 by J. J. Duncker and G. P. Johnson on a round, concrete water intake structure on Old Gillespie Lake Dam.

DRAINAGE AREA.-- 5.73 mi^2

GAGE.--Staff gage is mounted on the water intake structure on the Old Gillespie Lake Dam. The elevation of 16.72′ on the staff gage is 623.57″ MSL.

REFERENCE AND BENCHMARKS.--A chiseled square on the right bank wingwall of the spillway has an elevation of 627.00′ MSL (from levels run by local surveying firm, Crawford and Associates).

CHANNEL AND CONTROL.--The flow is controlled by the dam and spillway. The spillway is a concrete ogee weir that is 70′ wide.

DISCHARGE MEASUREMENTS.--During periods of low flow the flow from Old Lake Gillespie can be zero. Measurements during high flows can be made by wading at top of spillway.

POINT OF ZERO FLOW.--The lowest elevation of the crest of the spillway, 621.02′ MSL, is the point of zero flow. This is a staff gage height of 14.17′.

REGULATION AND DIVERSION.--None.

COOPERATION.--This station was established to collect data which will be used in an IEPA Clean Lakes Program study.

OBSERVER.--Mr. Bill Loges, 1 Western Lane, Gillespie, IL 62033, (217) 839-3171, is the observer at this site. He records daily staff gage readings and rainfall totals.

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ILLINOIS INSTALLATION 01/14/1999

STATION NUMBER 05586684 DRY F AT OLD GILLESPIE LK DAM NR GILLESPIE, IL LAKE SOURCE AGENCY USGS
LATITUDE 390848 LONGITUDE 0895151 DATUM 606.85 STATE 17 COUNTY 117

PROVISIONAL DATA observer SUBJECT TO REVISION

GAGE HEIGHT, FEET, YEAR MAY 1996 TO APRIL 1997
DAILY MEAN VALUES

DAY	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
1	14.28	14.27	13.30	13.39	12.72	13.17	13.80	13.67	12.70	12.47	14.37	13.96
2	14.25	14.33	13.26	13.40	12.67	13.18	13.75	13.68	12.68	12.50	14.31	13.94
3	14.27	14.28	13.20	13.41	12.62	13.20	13.71	13.68	12.63	12.62	14.28	13.91
4	14.89	14.22	13.13	13.44	12.57	13.20	13.68	13.68	12.58	12.93	14.28	13.88
5	14.65	14.19	13.07	13.45	12.52	13.22	13.64	13.68	12.56	13.01	14.27	13.88
6	14.38	14.25	13.01	13.47	12.45	13.26	13.67	13.68	12.51	13.10	14.28	13.88
7	14.59	14.26	12.96	13.48	12.44	13.29	14.02	13.66	12.48	13.17	14.30	13.86
8	14.54	14.22	12.84	13.48	12.44	13.30	14.14	13.62	12.48	13.19	14.32	13.81
9	14.46	14.22	12.86	13.47	12.48	13.32	14.11	13.58	12.45	13.25	14.38	13.77
10	14.44	14.22	12.88	13.46	12.50	13.34	14.07	13.55	12.43	13.30	14.34	13.74
11	14.35	14.26	12.90	13.46	12.52	13.36	14.03	13.51	12.47	13.39	14.28	13.72
12	14.27	14.21	12.91	13.46	12.55	13.38	13.99	13.45	12.46	13.44	14.26	13.71
13	14.27	14.18	12.94	13.46	12.56	13.40	13.96	13.41	12.46	13.46	14.29	13.66
14	14.28	14.14	13.00	13.46	12.58	13.43	13.92	13.38	12.44	13.50	14.43	13.64
15	14.35	14.12	13.04	13.46	12.60	13.46	13.83	13.36	12.44	13.57	14.32	13.58
16	14.28	14.06	13.07	13.45	12.65	13.48	13.79	13.30	12.45	13.62	14.26	13.54
17	14.25	14.01	13.09	13.44	12.68	13.50	13.81	13.26	12.46	13.66	14.24	13.50
18	14.21	13.98	13.12	13.41	12.70	13.55	13.80	13.24	12.46	13.68	14.22	13.46
19	14.18	13.95	13.14	13.40	12.72	13.58	13.73	13.22	12.44	13.77	14.22	13.44
20	14.12	13.90	13.16	13.38	12.74	13.60	13.70	13.20	12.42	14.02	14.20	13.41
21	14.09	13.82	13.18	13.31	12.76	13.63	13.68	13.14	12.40	14.41	14.18	13.42
22	14.06	13.78	13.21	13.25	12.80	13.68	13.66	13.09	12.38	14.40	14.16	13.40
23	14.04	13.73	13.25	13.21	12.85	13.76	13.64	13.05	12.37	14.32	14.14	13.36
24	14.00	13.69	13.28	13.17	12.88	13.79	13.65	13.02	12.41	14.28	14.12	13.30
25	13.99	13.64	13.28	13.09	12.90	13.81	13.69	13.00	12.44	14.32	14.10	13.26
26	14.25	13.57	13.28	13.04	12.98	13.84	13.73	12.95	12.44	14.89	14.08	13.24
27	14.61	13.49	13.30	13.01	13.05	13.86	13.71	12.91	12.46	14.67	14.06	13.22
28	14.45	13.43	13.32	12.91	13 08	13.86	13.68	12.87	12.47	14.39	14.06	13.20
29	14.27	13.36	13.35	12.87	13.11	13.88	13.65	12.81	12.48	---	14.04	13.16
30	14.23	13.32	13.36	12.84	13.15	13.88	13.67	12.77	12.49	---	14.05	13.14
31	14.19	---	13.38	12.79	---	13.85	---	12.73	12.48	---	13.99	---
TOTAL	443.49	419.10	407.07	412.32	381.27	419.06	413.91	412.15	386.82	381.33	440.83	406.99
MEAN	14.31	13.97	13.13	13.30	12.71	13.52	13.80	13.30	12.48	13.62	14.22	13.57
MAX	14.89	14.33	13.38	13.48	13.15	13.88	14.14	13.68	12.70	14.89	14.43	13.96
MIN	13.99	13.32	12.84	12.79	12.44	13.17	13.64	12.73	12.37	12.47	13.99	13.14

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ILLINOIS INSTALLATION 01/14/1999

STATION NUMBER 05586684 DRY F AT OLD GILLESPIE LK DAM NR GILLESPIE, IL LAKE SOURCE AGENCY USGS
LATITUDE 390848 LONGITUDE 0895151 DATUM 606.85 STATE 17 COUNTY 117

PROVISIONAL DATA cmptd from th rating SUBJECT TO REVISION

DISCHARGE, CUBIC FEET PER SECOND, YEAR MAY 1996 TO APRIL 1997
DAILY MEAN VALUES

DAY	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
1	5.9	5.0	.00	.00	.00	.00	.00	.00	.00	.00	14	.00
2	2.3	9.6	.00	.00	.00	.00	.00	.00	.00	.00	7.7	.00
3	7.0	5.1	.00	.00	.00	.00	.00	.00	.00	.00	4.7	.00
4	124	.78	.00	.00	.00	.00	.00	.00	.00	.00	4.3	.00
5	66	.02	.00	.00	.00	.00	.00	.00	.00	.00	3.3	.00
6	17	2.7	.00	.00	.00	.00	.00	.00	.00	.00	4.5	.00
7	52	2.9	.00	.00	.00	.00	.00	.00	.00	.00	6.4	.00
8	43	1.1	.00	.00	.00	.00	.00	.00	.00	.00	8.8	.00
9	29	.71	.00	.00	.00	.00	.00	.00	.00	.00	16	.00
10	24	1.0	.00	.00	.00	.00	.00	.00	.00	.00	11	.00
11	13	3.2	.00	.00	.00	.00	.00	.00	.00	.00	4.7	.00
12	3.9	.69	.00	.00	.00	.00	.00	.00	.00	.00	3.1	.00
13	4.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	5.8	.00
14	4.6	.00	.00	.00	.00	.00	.00	.00	.00	.00	23	.00
15	12	.00	.00	.00	.00	.00	.00	.00	.00	.00	9.2	.00
16	4.5	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.1	.00
17	2.2	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.9	.00
18	.62	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.1	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.84	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.6	.15	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	21	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	19	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	8.2	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	4.4	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	13	.00	.00
26	5.9	.00	.00	.00	.00	.00	.00	.00	.00	122	.00	.00
27	55	.00	.00	.00	.00	.00	.00	.00	.00	69	.00	.00
28	31	.00	.00	.00	.00	.00	.00	.00	.00	17	.00	.00
29	4.1	.00	.00	.00	.00	.00	.00	.00	.00	---	.00	.00
30	1.5	.00	.00	.00	.00	.00	.00	.00	.00	---	.00	.00
31	.05	---	.00	.00	---	.00	---	.00	.00	---	.00	---
TOTAL	512.57	32.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	275.20	133.59	0.00
MEAN	16.5	1.09	.000	.000	.000	.000	.000	.000	.000	9.83	4.31	.000
MAX	124	9.6	.00	.00	.00	.00	.00	.00	.00	122	23	.00
MIN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

STATION NO.	05586685
WRITTEN	06-11-96
BY	J. E. Muhs
CK	06-12-96
BY	G. P. Johnson

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Description of Gaging Station on Southwest Branch Dry Fork at Hwy 16 near Gillespie, Ill.

LOCATION.--Lat 39° 07′ 45″, Long 89° 52′ 52″, in SW1/4SE1/4SW1/4 sec.16 T.8N. R.7W., Macoupin County, Hydrologic Unit 07130012, at State Highway 16, 3.0 mi west of Gillespie, Ill.

TO REACH GAGE.--Drive 3.0 mi west of Gillespie on State Highway 16 to bridge crossing the creek.

ESTABLISHMENT.-- A stilling well and 55 gallon drum (to house gaging equipment) were installed at the site on May 1, 1996 by J. J. Duncker and G. P. Johnson.

DRAINAGE AREA.-- 2.40 sq. miles

GAGE.--A 6′ in pvc stilling well is located on the downstream side of the triple box culverts (8′ by 8′) under the Route 16 bridge. A float, tape and weight, and potentiometer are inside the well. Inside the drum is a CR10, SM192, and an ISCO 3700 automatic sampler.

Two file marks on the outer lip of the Hoffman Box mounted on the top of the pvc stilling well have an arbitrary datum of 15.00 ft.

CHANNEL AND CONTROL.--During low flow, the control is a weir in the channel made of concrete blocks. At high flow, control above the gage is the triple 8 ft by 8 ft box culverts under Rt. 16.

DISCHARGE MEASUREMENTS.--During periods of low flow measurements taken by wading 40 ft below bridge. During high flows discharge is calculated using water velocity measured in box culverts of bridge along with the geometry of the culverts.

REGULATION AND DIVERSION.--None.

COOPERATION.--This station was established to collect data which will be used in an IEPA Clean Lakes Program study.

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ILLINOIS INSTALLATION 01/14/1999

STATION NUMBER 05586685 SOUTHWEST B DRY FORK AT HWY 16 NR GILLESPIE, IL STREAM SOURCE AGENCY USGS
LATITUDE 390745 LONGITUDE 0895252 DRAINAGE AREA 2.4 DATUM STATE 17 COUNTY 117
PROVISIONAL DATA cr10 SUBJECT TO REVISION
GAGE HEIGHT, FEET, YEAR MAY 1996 TO APRIL 1997
DAILY MEAN VALUES

DAY	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
1	5.62	5.86	5.31	5.30	5.00	5.38	5.44	5.45	5.42	5.43	5.67	5.57
2	5.64	5.77	5.30	5.30	5.00	5.37	5.44	5.43	5.42	5.43	5.67	5.57
3	5.63	5.61	5.30	5.30	4.98	5.41	5.44	5.43	5.42	5.43	5.58	5.56
4	6.67	5.59	5.30	5.30	5.02	5.41	5.43	5.42	5.42	5.43	5.56	5.56
5	6.06	5.58	5.30	5.30	5.11	5.41	5.37	5.44	5.42	5.52	5.56	5.56
6	5.84	5.67	5.30	5.30	5.10	5.41	5.52	5.44	5.42	5.58	5.55	5.56
7	7.05	5.59	5.30	5.30	5.09	5.42	7.22	5.43	5.42	5.58	5.55	5.56
8	6.38	5.58	5.30	5.30	5.08	5.43	5.56	5.42	5.42	5.55	5.54	5.56
9	5.88	5.63	5.30	5.30	5.10	5.43	5.42	5.42	5.42	5.51	5.92	5.55
10	6.28	5.61	5.30	5.30	5.11	5.42	5.41	5.42	5.42	5.51	5.66	5.55
11	5.94	5.59	5.30	5.30	5.10	5.42	5.41	5.42	5.42	5.51	5.59	5.55
12	5.80	5.55	5.30	5.30	5.12	5.42	5.41	5.42	5.42	5.51	5.58	5.55
13	5.65	5.50	5.30	5.31	5.13	5.42	5.41	5.42	5.42	5.51	5.97	5.55
14	5.75	5.45	5.30	5.38	5.12	5.43	5.40	5.42	5.42	5.51	6.07	5.55
15	5.73	5.40	5.30	5.50	5.14	5.44	5.40	5.42	5.42	5.52	5.60	5.55
16	5.62	5.35	5.30	5.50	5.13	5.43	5.40	5.42	5.42	5.51	5.60	5.55
17	5.59	5.35	5.30	5.50	5.12	5.43	5.40	5.42	5.42	5.52	5.59	5.54
18	5.56	5.35	5.30	5.50	5.14	5.46	5.40	5.42	5.42	5.55	5.59	5.54
19	5.55	5.35	5.30	5.50	5.17	5.46	5.40	5.42	5.42	5.55	5.59	5.54
20	5.53	5.35	5.30	5.50	5.21	5.46	5.40	5.42	5.42	6.15	5.58	5.54
21	5.57	5.35	5.30	5.50	5.23	5.45	5.40	5.42	5.42	6.23	5.58	5.56
22	5.52	5.35	5.30	5.50	5.27	5.44	5.40	5.42	5.42	5.75	5.58	5.55
23	5.53	5.35	5.30	5.33	5.32	5.47	5.40	5.43	5.42	5.59	5.57	5.55
24	5.51	5.35	5.30	4.99	5.31	5.44	5.40	5.43	5.42	5.56	5.57	5.54
25	5.79	5.35	5.30	5.00	5.34	5.44	5.64	5.43	5.43	5.54	5.57	5.54
26	5.73	5.35	5.30	5.03	5.34	5.44	5.59	5.43	5.43	7.67	5.57	5.54
27	6.62	5.35	5.30	5.03	5.36	5.44	5.58	5.43	5.43	6.43	5.57	5.54
28	5.68	5.35	5.30	5.02	5.37	5.44	5.54	5.43	5.43	5.66	5.57	5.54
29	5.59	5.35	5.30	4.99	5.38	5.44	5.46	5.43	5.43	---	5.57	5.54
30	5.58	5.34	5.30	5.00	5.38	5.44	5.59	5.42	5.43	---	5.57	5.53
31	5.57	---	5.30	5.00	---	5.44	---	5.42	5.43	---	5.57	---
TOTAL	180.46	164.22	164.31	163.68	155.27	168.34	165.28	168.19	168.09	159.24	174.31	166.49
MEAN	5.82	5.47	5.30	5.28	5.18	5.43	5.51	5.43	5.42	5.69	5.62	5.55
MAX	7.05	5.86	5.31	5.50	5.38	5.47	7.22	5.45	5.43	7.67	6.07	5.57
MIN	5.51	5.34	5.30	4.99	4.98	5.37	5.37	5.42	5.42	5.43	5.54	5.53

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ILLINOIS INSTALLATION 01/14/1999

STATION NUMBER 05586685 SOUTHWEST B DRY FORK AT HWY 16 NR GILLESPIE, IL STREAM SOURCE AGENCY USGS
LATITUDE 390745 LONGITUDE 0895252 DRAINAGE AREA 2.4 DATUM STATE 17 COUNTY 117
PROVISIONAL DATA cr10 SUBJECT TO REVISION
DISCHARGE, CUBIC FEET PER SECOND, YEAR MAY 1996 TO APRIL 1997
DAILY MEAN VALUES

DAY	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
1	.75	7.4	.00	.00	.00	.02	.15	.16	.10	.13	1.3	.47
2	.89	3.1	.00	.00	.00	.01	.15	.13	.10	.13	1.3	.47
3	.90	.60	.00	.00	.00	.07	.15	.12	.10	.13	.50	.46
4	62	.53	.00	.00	.00	.08	.12	.10	.10	.13	.46	.46
5	9.2	.50	.00	.00	.00	.07	.01	.14	.10	.35	.45	.45
6	4.3	1.4	.00	.00	.00	.07	2.3	.16	.10	.49	.44	.45
7	61	.52	.00	.00	.00	.11	77	.12	.10	.50	.42	.45
8	20	.50	.00	.00	.00	.14	1.9	.11	.10	.42	.40	.44
9	4.0	.97	.00	.00	.00	.13	.09	.10	.10	.32	7.3	.43
10	14	.68	.00	.00	.00	.11	.07	.10	.10	.32	1.2	.43
11	4.7	.54	.00	.00	.00	.11	.06	.10	.10	.32	.53	.43
12	2.7	.43	.00	.00	.00	.10	.06	.10	.10	.32	.50	.42
13	1.2	.30	.00	.00	.00	.11	.06	.10	.10	.31	11	.43
14	3.9	.18	.00	.07	.00	.13	.06	.10	.10	.32	10	.42
15	2.0	.05	.00	.30	.00	.14	.06	.10	.10	.34	.58	.42
16	.69	.00	.00	.30	.00	.13	.05	.10	.10	.32	.54	.41
17	.51	.00	.00	.30	.00	.13	.05	.10	.10	.34	.53	.41
18	.46	.00	.00	.30	.00	.19	.05	.10	.10	.43	.52	.41
19	.41	.00	.00	.30	.00	.20	.05	.10	.10	.42	.52	.40
20	.37	.00	.00	.30	.00	.21	.05	.10	.10	15	.50	.41
21	.48	.00	.00	.30	.00	.17	.05	.10	.10	12	.50	.44
22	.34	.00	.00	.30	.00	.14	.05	.10	.10	2.4	.50	.42
23	.38	.00	.00	.19	.00	.22	.05	.12	.10	.53	.48	.41
24	.32	.00	.00	.00	.00	.16	.05	.13	.11	.44	.48	.41
25	8.8	.00	.00	.00	.00	.15	2.4	.13	.12	.41	.48	.40
26	2.1	.00	.00	.00	.00	.15	.62	.13	.13	164	.48	.40
27	47	.00	.00	.00	.00	.15	.50	.13	.13	23	.48	.40
28	1.4	.00	.00	.00	.00	.15	.41	.13	.12	1.1	.48	.39
29	.53	.00	.00	.00	.02	.15	.20	.12	.12	---	.47	.39
30	.50	.00	.00	.00	.02	.15	.76	.10	.13	---	.47	.38
31	.47	---	.00	.00	---	.15	---	.10	.13	---	.47	---
TOTAL	256.30	17.70	0.00	2.66	0.04	4.00	87.58	3.53	3.29	224.92	44.28	12.71
MEAN	8.27	.59	.000	.086	.001	.13	2.92	.11	.11	8.03	1.43	.42
MAX	62	7.4	.00	.30	.02	.22	77	.16	.13	164	11	.47
MIN	.32	.00	.00	.00	.00	.01	.01	.10	.10	.13	.40	.38

STATION NO.	05586686
WRITTEN	06-11-96
BY	J. D. Muhs
CK	06-12-96
BY	G. P. Johnson

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Description of Gaging Station on Dry Fork Creek at New Gillespie Lake Dam near Gillespie, Ill.

LOCATION.--Lat 39° 08′ 39″, Long 89° 53′ 17″, in SE1/4SE1/4SE1/4 sec.8 T.8N. R.7W., Macoupin County, Hydrologic Unit 07130012, at dam and spillway of New Lake Gillespie, 3.6 mi. northwest of Gillespie, Ill.

TO REACH GAGE.--Drive 3.3 mi west of Gillespie on State Highway 16, 1.1 mi north to Old Gillespie Lake spillway.

ESTABLISHMENT.--The wire-weight gage was installed May 1, 1996 by J. J. Duncker and G. P. Johnson 20 ft above New Gillespie Lake spillway. The staff gage was installed below May 1, 1996 by J. J. Duncker and G. P. Johnson at right concrete edge just below the spillway.

DRAINAGE AREA.—12.3 mi^2

GAGE.--Wire-weight gage is 20 ft above New Gillespie Lake spillway near the public road at the dam. The staff gage is on the right edge concrete retaining wall, above the 5 ft wide outlet channel, and a crest stage gage is beside and above staff gage.

REFERENCE AND BENCHMARKS.--The top of the staff gage mounting board is 582.04 ft MSL. A chiseled square in the concrete wingwall on the left edge of the spillway is 613.01 ft MSL (from levels run by local surveying firm, Crawford and Associates).

CHANNEL AND CONTROL.--The dam and spillway control the flow at this station. A 5′ wide flume at the bottom of the spillway is the ultimate control of flow at this station.

DISCHARGE MEASUREMENTS.--Measurements taken in 5ft channel just below New Gillespie Lake spillway.

POINT OF ZERO FLOW.--The lowest elevation of the crest of the spillway is 604.09 ft MSL, which is a wire weight gage height of 10.00 ft, is the point of zero flow.

REGULATION AND DIVERSION.--None.

COOPERATION.--This station was established to collect data which will be used in an IEPA Clean Lakes Program study.

OBSERVER.--Observer is Mr. Ron Durbin, #1 Carney Drive, Gillespie, IL 62033, 618-362-6363. He records daily gage elevations and rainfall totals.

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ILLINOIS INSTALLATION 01/14/1999

STATION NUMBER 05586686 DRY F AT NEW GILLESPIE LK DAM NR GILLESPIE, IL LAKE SOURCE AGENCY USGS
LATITUDE 390839 LONGITUDE 0895317 DATUM STATE 17 COUNTY 117

PROVISIONAL DATA wire weight gage SUBJECT TO REVISION

GAGE HEIGHT, FEET, YEAR MAY 1996 TO APRIL 1997
DAILY MEAN VALUES

DAY	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
1	10.13	10.07	9.86	9.02	8.32	7.69	6.90	8.24	7.84	8.55	10.16	10.04
2	10.08	10.26	9.86	8.98	8.31	7.67	6.86	8.24	7.83	8.57	10.14	10.03
3	10.10	10.17	9.87	8.94	8.30	7.65	6.82	8.22	7.82	8.60	10.11	10.03
4	10.50	10.08	9.83	8.90	8.28	7.63	6.81	8.20	7.81	8.77	10.08	10.03
5	10.48	10.06	9.82	8.86	8.27	7.61	6.78	8.19	7.81	8.86	10.07	10.06
6	10.26	10.12	9.79	8.83	8.25	7.59	6.89	8.18	7.80	8.88	10.07	10.04
7	10.52	10.10	9.76	8.80	8.24	7.56	7.70	8.16	7.80	8.88	10.05	10.03
8	10.40	10.07	9.73	8.76	8.22	7.54	8.51	8.14	7.80	8.88	10.06	10.03
9	10.29	10.08	9.70	8.72	8.20	7.52	8.62	8.12	7.80	8.87	10.20	10.03
10	10.20	10.09	9.66	8.68	8.18	7.50	8.60	8.10	7.80	8.86	10.22	10.04
11	10.17	10.08	9.62	8.64	8.14	7.47	8.58	8.08	7.82	8.85	10.15	10.03
12	10.12	10.06	9.58	8.59	8.09	7.44	8.56	8.06	7.84	8.85	10.10	10.02
13	10.08	10.06	9.55	8.55	8.04	7.42	8.54	8.05	7.86	8.84	10.11	10.01
14	10.11	10.05	9.55	8.51	8.01	7.39	8.52	8.03	7.88	8.83	10.27	10.00
15	10.17	10.05	9.55	8.47	7.98	7.35	8.50	8.01	7.90	8.82	10.19	10.00
16	10.13	10.05	9.51	8.44	7.96	7.32	8.48	8.00	7.92	8.80	10.11	10.00
17	10.10	10.04	9.48	8.42	7.93	7.29	8.46	7.99	7.94	8.78	10.08	10.00
18	10.07	10.03	9.45	8.42	7.89	7.27	8.44	7.98	7.95	8.76	10.07	9.98
19	10.06	10.03	9.42	8.41	7.85	7.27	8.44	7.97	7.98	8.73	10.06	9.97
20	10.05	10.02	9.40	8.40	7.81	7.24	8.42	7.96	8.05	8.90	10.05	9.98
21	10.06	10.00	9.40	8.40	7.78	7.21	8.40	7.95	8.10	9.22	10.04	10.04
22	10.05	9.99	9.37	8.38	7.75	7.22	8.38	7.94	8.15	9.66	10.04	10.04
23	10.05	9.98	9.34	8.38	7.72	7.24	8.36	7.93	8.24	9.84	10.04	10.03
24	10.05	9.97	9.30	8.42	7.74	7.21	8.33	7.92	8.29	9.90	10.04	10.03
25	10.09	9.96	9.26	8.42	7.75	7.19	8.33	7.91	8.40	9.98	10.04	10.03
26	10.38	9.94	9.21	8.42	7.75	7.14	8.32	7.90	8.47	10.52	10.04	10.03
27	10.58	9.91	9.18	8.40	7.75	7.10	8.32	7.89	8.51	10.62	10.03	10.03
28	10.33	9.89	9.16	8.39	7.75	7.05	8.30	7.89	8.52	10.26	10.03	10.02
29	10.12	9.87	9.12	8.37	7.73	7.00	8.28	7.87	8.52	---	10.03	10.02
30	10.07	9.85	9.09	8.35	7.71	6.98	8.26	7.86	8.51	---	10.04	10.02
31	10.05	---	9.05	8.34	---	6.94	---	7.85	8.51	---	10.04	---
TOTAL	315.85	300.93	294.47	265.61	239.70	227.70	242.71	248.83	249.47	255.88	312.76	300.64
MEAN	10.19	10.03	9.50	8.57	7.99	7.35	8.09	8.03	8.05	9.14	10.09	10.02
MAX	10.58	10.26	9.87	9.02	8.32	7.69	8.62	8.24	8.52	10.62	10.27	10.06
MIN	10.05	9.85	9.05	8.34	7.71	6.94	6.78	7.85	7.80	8.55	10.03	9.97

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - ILLINOIS INSTALLATION 01/14/1999

STATION NUMBER 05586686 DRY F AT NEW GILLESPIE LK DAM NR GILLESPIE, IL LAKE SOURCE AGENCY USGS
LATITUDE 390839 LONGITUDE 0895317 DATUM STATE 17 COUNTY 117

PROVISIONAL DATA from wire weight SUBJECT TO REVISION

DISCHARGE, CUBIC FEET PER SECOND, YEAR MAY 1996 TO APRIL 1997
DAILY MEAN VALUES

DAY	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR
1	12	7.1	.00	.00	.00	.00	.00	.00	.00	.00	25	3.2
2	9.2	53	.00	.00	.00	.00	.00	.00	.00	.00	21	2.6
3	16	29	.00	.00	.00	.00	.00	.00	.00	.00	14	2.6
4	144	8.0	.00	.00	.00	.00	.00	.00	.00	.00	7.7	2.9
5	130	5.9	.00	.00	.00	.00	.00	.00	.00	.00	6.7	5.6
6	53	16	.00	.00	.00	.00	.00	.00	.00	.00	6.4	3.8
7	147	12	.00	.00	.00	.00	.00	.00	.00	.00	4.6	2.8
8	99	6.4	.00	.00	.00	.00	.00	.00	.00	.00	5.7	2.6
9	62	8.1	.00	.00	.00	.00	.00	.00	.00	.00	36	2.7
10	36	11	.00	.00	.00	.00	.00	.00	.00	.00	42	3.3
11	28	7.8	.00	.00	.00	.00	.00	.00	.00	.00	24	2.7
12	17	5.7	.00	.00	.00	.00	.00	.00	.00	.00	12	1.8
13	7.6	5.3	.00	.00	.00	.00	.00	.00	.00	.00	15	.99
14	15	4.5	.00	.00	.00	.00	.00	.00	.00	.00	55	.12
15	26	4.4	.00	.00	.00	.00	.00	.00	.00	.00	33	.00
16	19	4.4	.00	.00	.00	.00	.00	.00	.00	.00	14	.00
17	11	3.6	.00	.00	.00	.00	.00	.00	.00	.00	7.7	.00
18	6.8	2.7	.00	.00	.00	.00	.00	.00	.00	.00	6.6	.00
19	5.5	2.6	.00	.00	.00	.00	.00	.00	.00	.00	5.6	.00
20	4.7	1.8	.00	.00	.00	.00	.00	.00	.00	.00	4.6	.06
21	5.2	.33	.00	.00	.00	.00	.00	.00	.00	.00	3.7	3.3
22	4.6	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.5	3.5
23	4.4	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.5	2.8
24	4.4	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.5	2.6
25	12	.00	.00	.00	.00	.00	.00	.00	.00	8.1	3.5	2.6
26	93	.00	.00	.00	.00	.00	.00	.00	.00	157	3.4	2.6
27	172	.00	.00	.00	.00	.00	.00	.00	.00	195	2.7	2.6
28	77	.00	.00	.00	.00	.00	.00	.00	.00	54	2.6	1.9
29	17	.00	.00	.00	.00	.00	.00	.00	.00	---	2.7	1.8
30	7.2	.00	.00	.00	.00	.00	.00	.00	.00	---	3.3	1.7
31	4.6	---	.00	.00	---	.00	---	.00	.00	---	3.5	---
TOTAL	1250.2	199.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	414.10	382.5	63.17
MEAN	40.3	6.65	.000	.000	.000	.000	.000	.000	.000	14.8	12.3	2.11
MAX	172	53	.00	.00	.00	.00	.00	.00	.00	195	55	5.6
MIN	4.4	.00	.00	.00	.00	.00	.00	.00	.00	.00	2.6	.00

**Raw water metered, May 1996 through April 1997
city of Gillespie water treatment plant
from Dan Fisher, Consultant to City of Gillespie**

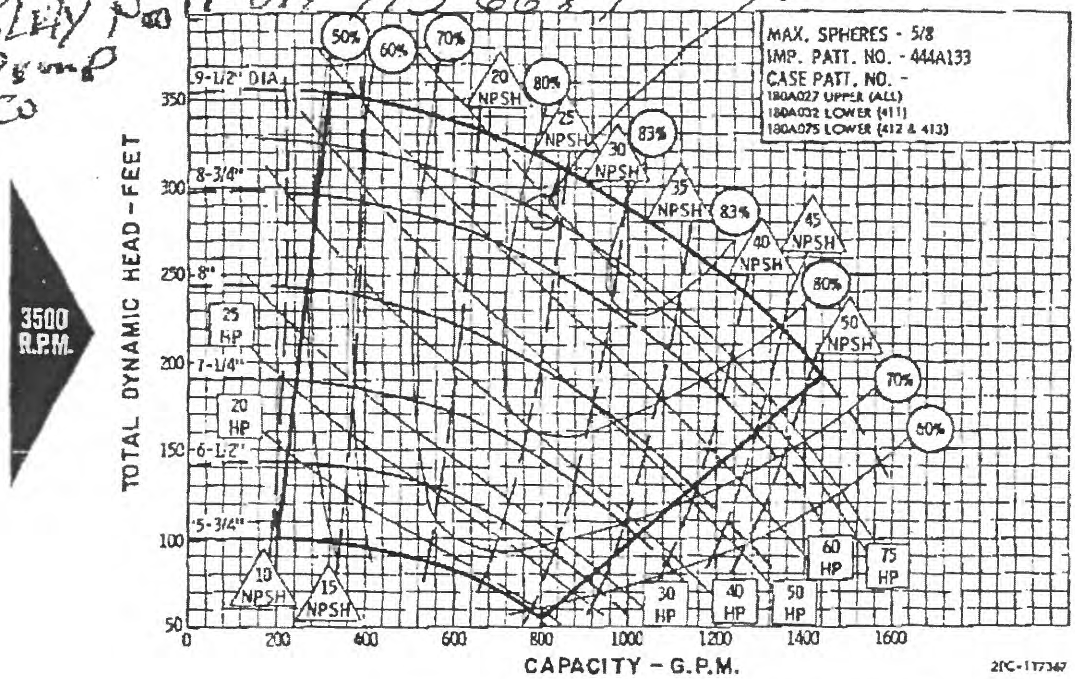
Month and Year	Gallons/month	Acre-feet/month
May 1996	24,560,000	75.4
June 1996	24,920,000	76.5
July 1996	27,360,000	84.0
August 1996	30,145,000	92.5
September 1996	24,600,000	75.5
October 1996	24,900,000	76.4
November 1996	22,403,000	68.8
December 1996	26,500,000	81.3
January 1997	29,400,000	90.2
February 1997	25,500,000	78.3
March 1997	24,700,000	75.8
April 1997	24,100,000	74.0
Total	309,088,000	948.7

SECTION 410 PAGE 408 — **4x5x10B SERIES 410** AURORA Pump old LAKe

DATED JULY 1971 — ENCLOSED IMPELLER

1-314-773 6689

800 GPM @ 285' @ 3500 RPM



AURORA PUMP

A UNIT OF GENERAL SIGNAL CORPORATION

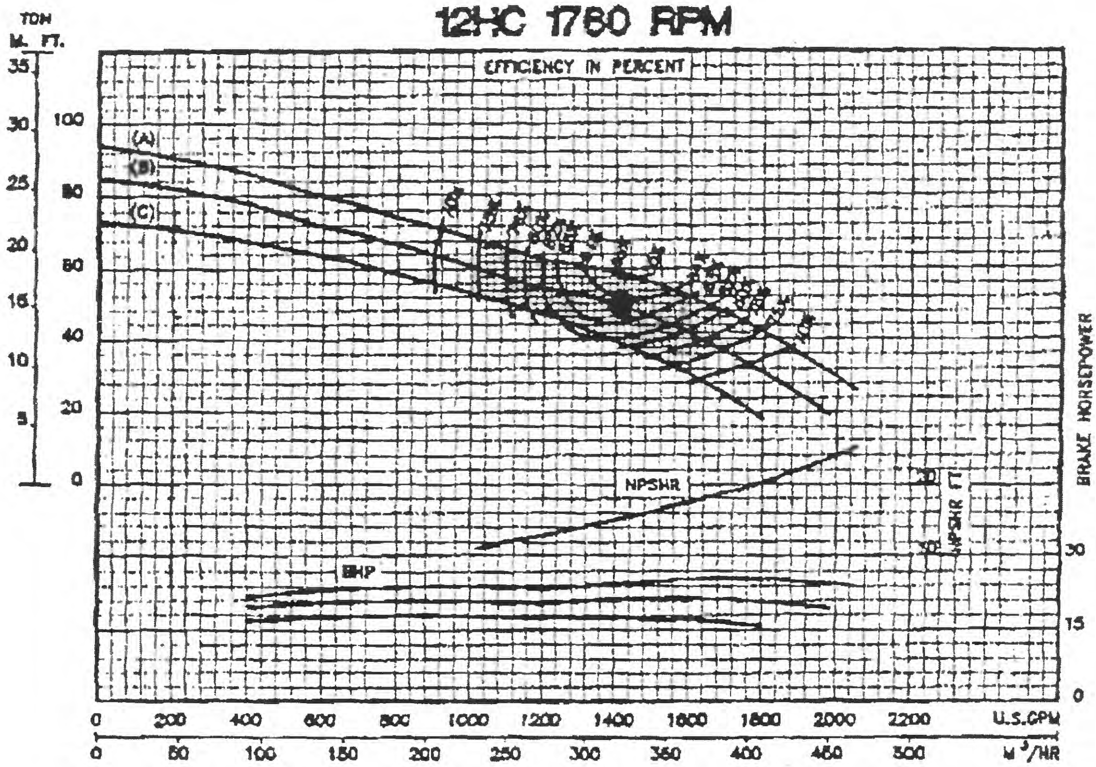
AURORA · ILLINOIS

J·LINE.

TURBINE PUMP CURVE

JANUARY 1995

12HC 1760 RPM



IMPELLER DATA			
Impeller Number:	2914	TRIM:	(A) 9.583" X 30°
Material:	BRONZE		(B) 9.281" X 30°
Type:	CLOSED		(C) 8.875" X 30°
Thrust Factor:	K=16.50		
Eye Area:	32.40 sq. in.		Minimum submergence above eye of bottom impeller: 26 in.
Weight:	11.50 lb.		

BOWL DATA		
Bowl Number	2915 C.I./ENAM.	
Bowl Dia.	11.563"max 11.250"min	
Max. No. Stages	15	
One Stage Weight	340	lb
Add'l Stage Weight	100	lb
Std. Shaft Dia.	1.688	in
Std. Lateral	0.750	in
Discharge Size	6–8–10	in
Suction Size	8 – 10	in
Max. Sphere Size	0.750	in
Max. Operation P.S.I.	564 (special)	

EFFICIENCY CORRECTION					
Number of Bowls	1	2	3	4	
Change as follows	−4	−2	−1	0	

Change in efficiency may affect both head and horsepower.

Performance based on pumping clear, fresh water at [illegible] abrasives, and with bowls properly adjusted and sub[illegible]

Appendix 2. Water-Quality Data

Dry Fork Creek at Old Gillespie Lake Dam, 05586684, Sample analysis results

Date	Time	p00630	p00666	p00530	p00625	p00020	p00299	p00400	p00610	p00665	p00535	p00076	p00010	p00094	p00000
5/8/96	13:15	1.44	0.278	124	1.8	26		7.31	0.14	0.52	20	75	17	171	14.41
5/8/96	19:15	1.45	0.279	192	1.7	26		7.32	0.14	0.543	32	69	17	172	14.65
6/10/96	14:40		0.307	20	1.1	21	9.73	7.35	0.38	0.412	4	32	21.3	242	14.22
2/20/97	17:40	0.5	0.018	20	1.6	12.5	9.7	7.63	0.16	0.155	8	16	2	286	14.25
2/21/97	12:00	0.46	0.019	42	1	10	9.5	7.6	0.16	0.108	8	17	2	289	14.45
2/27/97	11:00		0.17	136	1.6	3	9.5	7.76	0.16	0.44	20	77	2	225	14.7

Code	Analyte
p00630	Total Nitrate + Nitrite, in mg/L
p00666	Dissolved Phosphorus, in mg/L
p00530	Total suspended solids, in mg/L
p00625	Total Kjeldahl Nitrogen, in mg/L
p00020	Air temp, in degrees C
p00299	D.O., in mg/L
p00400	pH
p00610	Total Ammonia, in mg/L
p00665	Total Phosphorus, in mg/L
p00535	Solids, volatile, in mg/L
p00076	Turbidity, in NTU
p00010	Water temp, in degrees C
p00094	Spec. Cond
p00000	Gage Height, in feet

Southwest Br Dry Fork Creek at Highway 16 near Gillespie, IL, 05586685, sample analysis results

Date	Time	p00630	p00666	p00530	p00625	p00020	p00299	p00400	p00410	p00610	p00665	p00535	p00076	p00010	p00094	p00000
96/06/10	13:00	0.72	0.122	34	0.8	21	9.2	7.65	64	0.04	0.213	6	36	19	548	5.6
96/05/27	5:09	0.65	0.153	2425	6.5	21		6.84	30	0.4	2	180	230		276	7.46
96/05/27	4:59	0.52	0.217	1470	3.5			6.92	38	0.096	1.04	135	170		329	6.09
96/05/26	1:09	1.26	0.341	935	3.7	21		6.95	31	0.135	1.04	110	310		238	6.01
96/05/25	23:14	1.22	0.279	610	3			6.93	19	0.321	1.45	70	180		206	6.52
96/05/25	22:20	1	0.315	995	3.9	21		6.9	17	0.347	1.56	110	190		180	7.35
96/05/25	22:04	0.92	0.259	1390	8.6			7.18	25	0.358	2.03	130	250		172	7.61
96/05/25	21:44	1.03	0.3	1535	9.1			6.9	16	0.472	2.17	165	200		171	8.22
96/05/25	20:59	0.97	0.242	2185	12.3			6.9	15	1.13	4.38	205	210		170	8.89
96/05/25	20:44	0.9	0.272	1145	9	21		7.14	23	0.667	2.09	150			182	8.35
96/05/25	20:34	0.71	0.122	7105	11.6			6.93	32	0.886	3.22	515	220		289	7.58
96/05/25	20:29	0.42	0.145	2595	6.8			6.9	54	0.319	2.05	205	170		430	6.97
96/05/08	16:05	1.52	0.254	536	49	26		7.18		0.15	1.15	56	400	26	154	7.35
96/05/08	15:20	1.53	0.254	956	47	26		7.18		0.14	1.33	100	400	16	139	8.3
96/05/08	15:00	1.5	0.238	524	39	26		7.16		0.14	1.65	56	400	16	127	8.8
96/05/08	18:46	1.31	0.265	244	43	26		7.19		0.07	0.735	52	400	16	208	6.4
96/05/08	14:37	1.45	0.226	262	37	26		7.22		0.14	1.99	64	400	16	1287	9.25
96/05/08	14:15	1.98	0.226	3296	36	26		7.4		0.21	1.81	252	400	16	150	8.75
96/05/08	14:00	1.95	0.238	1676	36	26		7.6		0.02	1.46	132	400	16	238	8.16
96/05/06	14:15	2.5	0.155	24	1.1	20	9.11	7.6		0.11	0.218	6	22	13	413	5.71
97/02/27	9:30	0.96	0.215	188	1.7	3	12.4	7.84	40	0.13	0.47	20	80	2	167	6.19
97/02/21	12:15	2.9	0.288	100	2.2	10	12	7.67	55	0.01	0.359	16	97	2.5	276	6.04
97/02/20	15:00	2.6	0.29	665	6	12.5	12	7.5	33	0.21	1	60	920	2.5	198	7.56
97/02/20	14:40	2.6	0.316	585	3.7	12.5	12	7.52	31	0.04	1	75	93	2.5	200	7.66
97/02/20	17:00	2.6	0.276	490	3.5	12.5	12	7.44	35	0.02	0.814	55	52	2.5	202	6.86
97/02/20	18:00	2.7	0.316	455	3.4	12.5	12	7.54	38	0.07	0.687	50	160	2.5	207	6.63
97/02/20	20:00	2.9	0.298	340	2.8	12.5	12	7.64	41	0.24	0.685	35	150	2.5	225	6.38
97/02/21	10:18	3.1	0.297	155	2.4	10	12	7.68	56	0.01	0.493	25	96	2.5	272	6.16
97/02/27	11:45	0.99	0.212	128	1.4	3	14.4	7.85	42	0.14	0.411	16	81	2	178	6.1
97/02/27	11:40	1.67	0.35	96	1.5	3	12.1	7.78	31	0.16	0.59	12	75	2	167	6.1

Code	Analyte
p00630	Total Nitrate + Nitrite, in mg/L
p00666	Dissolved Phosphorus, in mg/L
p00530	Total suspended solids, in mg/L
p00625	Total Kjeldahl Nitrogen, in mg/L
p00020	Air temp, in degrees C
p00299	D.O., in mg/L
p00400	pH
p00610	Total Ammonia, in mg/L
p00665	Total Phosphorus, in mg/L
p00535	Solids, volatile, in mg/L
p00076	Turbidity, in NTU
p00010	Water temp, in degrees C
p00094	Spec. Cond
p00000	Gage Height, in feet

Dry Fork Creek at New Gillespie Lake Dam, 05586686, Sample analysis results

Date	Time	p00630	p00666	p00530	p00625	p00020	p00299	p00400	p00610	p00665	p00535	p00076	p00010	p00094	p00000
5/8/96	12:30	0.94	0.131	38	1.5	26	8.8	7.48	0.22	0.25	6	22	15.5	239	10.3
5/8/96	18:06	0.95	0.133	32	1.2	26	8.81	7.42	0.22	0.243	6	25	15.5	236	10.46
6/10/96	13:45	0.83	0.088	20	0.85	21	10.1	8.7	0.01	0.155	6	35	22.8	268	10.1
2/21/97	11:15	0.27	0.009	19	1	10	9.5	7.7	0.02	0.06	5	6.8	2	343	10
2/27/97	10:20	0.6	0.06	82	1.3	3	10.1	7.76	0.23	0.23	10	47	2	280	10.7

Code	Analyte
p00630	Total Nitrate + Nitrite, in mg/L
p00666	Dissolved Phosphorus, in mg/L
p00530	Total suspended solids, in mg/L
p00625	Total Kjeldahl Nitrogen, in mg/L
p00020	Air temp, in degrees C
p00299	D.O., in mg/L
p00400	pH
p00610	Total Ammonia, in mg/L
p00665	Total Phosphorus, in mg/L
p00535	Solids, volatile, in mg/L
p00076	Turbidity, in NTU
p00010	Water temp, in degrees C
p00094	Spec. Cond
p00000	Gage Height, in feet

Daily water discharge at Old Gillespie Lake outflow, May 1996–April 1997, in cubic feet per second

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	5.9	5	0	0	0	0	0	0	0	0	14	0
2	2.3	9.6	0	0	0	0	0	0	0	0	7.7	0
3	7	5.1	0	0	0	0	0	0	0	0	4.7	0
4	124	.78	0	0	0	0	0	0	0	0	4.3	0
5	66	.02	0	0	0	0	0	0	0	0	3.3	0
6	17	2.7	0	0	0	0	0	0	0	0	4.5	0
7	52	2.9	0	0	0	0	0	0	0	0	6.4	0
8	43	1.1	0	0	0	0	0	0	0	0	8.8	0
9	29	.71	0	0	0	0	0	0	0	0	16	0
10	24	1	0	0	0	0	0	0	0	0	11	0
11	13	3.2	0	0	0	0	0	0	0	0	4.7	0
12	3.9	.69	0	0	0	0	0	0	0	0	3.1	0
13	4	0	0	0	0	0	0	0	0	0	5.8	0
14	4.6	0	0	0	0	0	0	0	0	0	23	0
15	12	0	0	0	0	0	0	0	0	0	9.2	0
16	4.5	0	0	0	0	0	0	0	0	0	3.1	0
17	2.2	0	0	0	0	0	0	0	0	0	1.9	0
18	.62	0	0	0	0	0	0	0	0	0	1.1	0
19	0	0	0	0	0	0	0	0	0	0	.84	0
20	0	0	0	0	0	0	0	0	0	1.6	.15	0
21	0	0	0	0	0	0	0	0	0	21	0	0
22	0	0	0	0	0	0	0	0	0	19	0	0
23	0	0	0	0	0	0	0	0	0	8.2	0	0
24	0	0	0	0	0	0	0	0	0	4.4	0	0
25	0	0	0	0	0	0	0	0	0	13	0	0
26	5.9	0	0	0	0	0	0	0	0	122	0	0
27	55	0	0	0	0	0	0	0	0	69	0	0
28	31	0	0	0	0	0	0	0	0	17	0	0
29	4.1	0	0	0	0	0	0	0	0		0	0
30	1.5	0	0	0	0	0	0	0	0		0	0
31	.05		0	0		0		0	0		0	
Total	512.57	32.80	0	0	0	0	0	0	0	275.2	133.59	0

Daily total kjeldahl nitrogen loads at Old Gillespie Lake outflow, May 1996–April 1997, in ton per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
2	.01	.04	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00
3	.03	.02	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
4	.53	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
5	.27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
6	.07	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
7	.21	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
8	.18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00
9	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00
10	.10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
11	.05	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
12	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
13	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
14	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.09	.00
15	.05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00
16	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
17	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.08	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.07	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.05	.00	.00
26	.02	.00	.00	.00	.00	.00	.00	.00	.00	.52	.00	.00
27	.23	.00	.00	.00	.00	.00	.00	.00	.00	.29	.00	.00
28	.12	.00	.00	.00	.00	.00	.00	.00	.00	.07	.00	.00
29	.01	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.01	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	
Total	2.10	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.50	0.00

Daily total nitrite plus nitrate loads at Old Gillespie Lake outflow, May 1996–April 1997, in tons per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
2	.00	.02	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
3	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
4	.46	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
5	.21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
7	.16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
8	.12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
9	.07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
10	.06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
11	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
12	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
14	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00
15	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
16	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.05	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00	.00
26	.01	.00	.00	.00	.00	.00	.00	.00	.00	.45	.00	.00
27	.17	.00	.00	.00	.00	.00	.00	.00	.00	.22	.00	.00
28	.08	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00	.00
29	.01	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	
Total	1.50	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.26	0.00

Daily total suspended sediment loads at Old Gillespie Lake outflow, May 1996–April 1997, in tons per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.64	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00
2	.15	1.32	.00	.00	.00	.00	.00	.00	.00	.00	.95	.00
3	.82	.51	.00	.00	.00	.00	.00	.00	.00	.00	.45	.00
4	61.98	.03	.00	.00	.00	.00	.00	.00	.00	.00	.40	.00
5	24.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.27	.00
6	3.13	.20	.00	.00	.00	.00	.00	.00	.00	.00	.42	.00
7	16.78	.22	.00	.00	.00	.00	.00	.00	.00	.00	.72	.00
8	12.61	.05	.00	.00	.00	.00	.00	.00	.00	.00	1.16	.00
9	6.98	.03	.00	.00	.00	.00	.00	.00	.00	.00	2.85	.00
10	5.25	.04	.00	.00	.00	.00	.00	.00	.00	.00	1.62	.00
11	2.09	.25	.00	.00	.00	.00	.00	.00	.00	.00	.45	.00
12	.34	.03	.00	.00	.00	.00	.00	.00	.00	.00	.24	.00
13	.36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.62	.00
14	.44	.00	.00	.00	.00	.00	.00	.00	.00	.00	4.92	.00
15	1.85	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.24	.00
16	.42	.00	.00	.00	.00	.00	.00	.00	.00	.00	.24	.00
17	.14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.12	.00
18	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.05	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.09	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	4.30	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.70	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.04	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.41	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	2.09	.00	.00
26	.64	.00	.00	.00	.00	.00	.00	.00	.00	60.48	.00	.00
27	18.26	.00	.00	.00	.00	.00	.00	.00	.00	25.68	.00	.00
28	7.71	.00	.00	.00	.00	.00	.00	.00	.00	3.13	.00	.00
29	.37	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.08	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	.00
Total	165.08	3.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.92	19.08	0.00

Daily total phosphorus loads at Old Gillespie Lake outflow, May 1996–April 1997, in ton per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
2	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
3	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7	.05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
8	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
9	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
10	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
11	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
15	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00
26	.00	.00	.00	.00	.00	.00	.00	.00	.00	.13	.00	.00
27	.05	.00	.00	.00	.00	.00	.00	.00	.00	.07	.00	.00
28	.03	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00
29	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	.00
Total	0.47	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.09	0.00

Daily water discharge at W Br. Dry Fork Creek at Rt. 16, May 1996–April 1997, in cubic feet per second

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.75	7.4	0.00	0.00	0.00	0.02	0.15	0.16	0.1	0.13	1.3	0.47
2	.89	3.1	.00	.00	.00	.01	.15	.13	.1	.13	1.3	.47
3	.9	.6	.00	.00	.00	.07	.15	.12	.1	.13	.5	.46
4	62	.53	.00	.00	.00	.08	.12	.1	.1	.13	.46	.46
5	9.2	.5	.00	.00	.00	.07	.01	.14	.1	.35	.45	.45
6	4.3	1.4	.00	.00	.00	.07	2.3	.16	.1	.49	.44	.45
7	61	.52	.00	.00	.00	.11	77	.12	.1	.5	.42	.45
8	20	.5	.00	.00	.00	.14	1.9	.11	.1	.42	.4	.44
9	4	.97	.00	.00	.00	.13	.09	.1	.1	.32	7.3	.43
10	14	.68	.00	.00	.00	.11	.07	.1	.1	.32	1.2	.43
11	4.7	.54	.00	.00	.00	.11	.06	.1	.1	.32	.53	.43
12	2.7	.43	.00	.00	.00	.1	.06	.1	.1	.32	.5	.42
13	1.2	.3	.00	.00	.00	.11	.06	.1	.1	.31	11	.43
14	3.9	.18	.00	.07	.00	.13	.06	.1	.1	.32	10	.42
15	2	.05	.00	.3	.00	.14	.06	.1	.1	.34	.58	.42
16	.69	.00	.00	.3	.00	.13	.05	.1	.1	.32	.54	.41
17	.51	.00	.00	.3	.00	.13	.05	.1	.1	.34	.53	.41
18	.46	.00	.00	.3	.00	.19	.05	.1	.1	.43	.52	.41
19	.41	.00	.00	.3	.00	.2	.05	.1	.1	.42	.52	.4
20	.37	.00	.00	.3	.00	.21	.05	.1	.1	15	.5	.41
21	.48	.00	.00	.3	.00	.17	.05	.1	.1	12	.5	.44
22	.34	.00	.00	.3	.00	.14	.05	.1	.1	2.4	.5	.42
23	.38	.00	.00	.19	.00	.22	.05	.12	.1	.53	.48	.41
24	.32	.00	.00	.00	.00	.16	.05	.13	.11	.44	.48	.41
25	8.8	.00	.00	.00	.00	.15	2.4	.13	.12	.41	.48	.4
26	2.1	.00	.00	.00	.00	.15	.62	.13	.13	164	.48	.4
27	47	.00	.00	.00	.00	.15	.5	.13	.13	23	.48	.4
28	1.4	.00	.00	.00	.00	.15	.41	.13	.12	1.1	.48	.39
29	.53	.00	.00	.00	.00	.15	.2	.12	.12		.47	.39
30	.5	.00	.00	.00	.00	.15	.76	.1	.13		.47	.38
31	.47		.00	.00		.15		.1	.13		.47	
Total	256.3	17.7	0.00	2.66	0.00	4	87.58	3.53	3.29	224.92	44.28	12.71

Daily total kjeldahl nitrogen loads at W Br. Dry Fork Creek at Rt. 16, May 1996–April 1997, in tons per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	1.94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.02	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
7	1.89	.00	.00	.00	.00	.00	2.81	.00	.00	.00	.00	.00
8	.28	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
9	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.05	.00
10	.15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.10	.00
14	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.09	.00
15	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.17	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.12	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.07	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
26	.01	.00	.00	.00	.00	.00	.00	.00	.00	10.20	.00	.00
27	1.21	.00	.00	.00	.00	.00	.00	.00	.00	.36	.00	.00
28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	
Total	5.72	0.06	0.00	0.00	0.00	0.00	2.84	0.00	0.00	10.86	0.24	0.00

Daily total nitrite plus nitrate loads at W Br. Dry Fork Creek at Rt. 16, May 1996–April 1997, in ton

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.02	.01	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
7	.23	.00	.00	.00	.00	.00	.28	.00	.00	.00	.00	.00
8	.07	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
9	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00
10	.05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
14	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
15	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.03	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00
26	.01	.00	.00	.00	.00	.00	.00	.00	.00	.60	.00	.00
27	.17	.00	.00	.00	.00	.00	.00	.00	.00	.09	.00	.00
28	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	
Total	0.92	0.05	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.80	0.11	0.00

Daily total suspended sediment loads at W Br. Dry Fork Creek at Rt. 16, May 1996–April 1997, in tons per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.08	4.28	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.21	0.04
2	.11	.95	.00	.00	.00	.00	.01	.00	.00	.00	.21	.04
3	.11	.06	.00	.00	.00	.00	.01	.00	.00	.00	.04	.04
4	169.22	.04	.00	.00	.00	.00	.00	.00	.00	.00	.04	.04
5	6.24	.04	.00	.00	.00	.00	.00	.00	.00	.02	.03	.03
6	1.67	.24	.00	.00	.00	.00	.57	.01	.00	.04	.03	.03
7	164.52	.04	.00	.00	.00	.00	246.18	.00	.00	.04	.03	.03
8	23.90	.04	.00	.00	.00	.00	.41	.00	.00	.03	.03	.03
9	1.48	.13	.00	.00	.00	.00	.00	.00	.00	.02	4.18	.03
10	12.89	.07	.00	.00	.00	.00	.00	.00	.00	.02	.18	.03
11	1.95	.05	.00	.00	.00	.00	.00	.00	.00	.02	.04	.03
12	.75	.03	.00	.00	.00	.00	.00	.00	.00	.02	.04	.03
13	.18	.02	.00	.00	.00	.00	.00	.00	.00	.02	8.49	.03
14	1.41	.01	.00	.00	.00	.00	.00	.00	.00	.02	7.20	.03
15	.44	.00	.00	.02	.00	.00	.00	.00	.00	.02	.05	.03
16	.07	.00	.00	.02	.00	.00	.00	.00	.00	.02	.05	.03
17	.04	.00	.00	.02	.00	.00	.00	.00	.00	.02	.04	.03
18	.04	.00	.00	.02	.00	.01	.00	.00	.00	.03	.04	.03
19	.03	.00	.00	.02	.00	.01	.00	.00	.00	.03	.04	.03
20	.02	.00	.00	.02	.00	.01	.00	.00	.00	14.53	.04	.03
21	.04	.00	.00	.02	.00	.01	.00	.00	.00	9.87	.04	.03
22	.02	.00	.00	.02	.00	.00	.00	.00	.00	.61	.04	.03
23	.03	.00	.00	.01	.00	.01	.00	.00	.00	.04	.04	.03
24	.02	.00	.00	.00	.00	.01	.00	.00	.00	.03	.04	.03
25	5.77	.00	.00	.00	.00	.01	.61	.00	.00	.03	.04	.03
26	.48	.00	.00	.00	.00	.01	.06	.00	.00	910.61	.04	.03
27	104.79	.00	.00	.00	.00	.01	.04	.00	.00	30.43	.04	.03
28	.24	.00	.00	.00	.00	.01	.03	.00	.00	.16	.04	.03
29	.04	.00	.00	.00	.00	.01	.01	.00	.00		.04	.03
30	.04	.00	.00	.00	.00	.01	.08	.00	.00		.04	.03
31	.04		.00	.00		.01		.00	.00		.04	
Total	496.66	0.60	0.00	0.17	0.00	0.13	248.02	0.02	0.00	966.68	21.45	0.94

Daily total phosphorus loads at W Br. Dry Fork Creek at Rt. 16, May 1996–April 1997, in ton per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7	.26	.00	.00	.00	.00	.00	.37	.00	.00	.00	.00	.00
8	.05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
10	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.11	.00	.00
27	.18	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	.00
28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	
Total	0.84	0.01	0.00	0.00	0.00	0.00	0.37	0.00	0.00	1.22	0.05	0.00

Daily water discharges at New Gillespie Lake outflow, May 1996–April 1997, in cubic feet per second

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	12	7.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25	3.2
2	9.2	53	.00	.00	.00	.00	.00	.00	.00	.00	21	2.6
3	16	29	.00	.00	.00	.00	.00	.00	.00	.00	14	2.6
4	144	8	.00	.00	.00	.00	.00	.00	.00	.00	7.7	2.9
5	130	5.9	.00	.00	.00	.00	.00	.00	.00	.00	6.7	5.6
6	53	16	.00	.00	.00	.00	.00	.00	.00	.00	6.4	3.8
7	147	12	.00	.00	.00	.00	.00	.00	.00	.00	4.6	2.8
8	99	6.4	.00	.00	.00	.00	.00	.00	.00	.00	5.7	2.6
9	62	8.1	.00	.00	.00	.00	.00	.00	.00	.00	35	2.7
10	36	11	.00	.00	.00	.00	.00	.00	.00	.00	42	3.3
11	28	7.8	.00	.00	.00	.00	.00	.00	.00	.00	24	2.7
12	17	5.7	.00	.00	.00	.00	.00	.00	.00	.00	12	1.8
13	7.6	5.3	.00	.00	.00	.00	.00	.00	.00	.00	15	.99
14	15	4.5	.00	.00	.00	.00	.00	.00	.00	.00	55	.12
15	26	4.4	.00	.00	.00	.00	.00	.00	.00	.00	33	.00
16	19	4.4	.00	.00	.00	.00	.00	.00	.00	.00	14	.00
17	11	3.6	.00	.00	.00	.00	.00	.00	.00	.00	7.7	.00
18	6.8	2.7	.00	.00	.00	.00	.00	.00	.00	.00	6.6	.00
19	5.5	2.6	.00	.00	.00	.00	.00	.00	.00	.00	5.6	.00
20	4.7	1.8	.00	.00	.00	.00	.00	.00	.00	.00	4.6	.06
21	5.2	.33	.00	.00	.00	.00	.00	.00	.00	.00	3.7	3.3
22	4.6	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.5	3.5
23	4.4	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.5	2.8
24	4.4	.00	.00	.00	.00	.00	.00	.00	.00	.00	3.5	2.6
25	12	.00	.00	.00	.00	.00	.00	.00	.00	8.1	3.5	2.6
26	93	.00	.00	.00	.00	.00	.00	.00	.00	157	3.4	2.6
27	172	.00	.00	.00	.00	.00	.00	.00	.00	195	2.7	2.6
28	77	.00	.00	.00	.00	.00	.00	.00	.00	54	2.6	1.9
29	17	.00	.00	.00	.00	.00	.00	.00	.00		2.7	1.8
30	7.2	.00	.00	.00	.00	.00	.00	.00	.00		3.3	1.7
31	4.6		.00	.00		.00		.00	.00		3.5	
Total	1,250.2	199.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	414.10	382.5	63.17

Daily total phosphorus loads at New Gillespie Lake outflow, May 1996–April 1997, in ton per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
2	.00	.03	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
3	.01	.02	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
4	.10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.03	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7	.10	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8	.06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
10	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
11	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
12	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
14	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00
15	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
16	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26	.06	.00	.00	.00	.00	.00	.00	.00	.00	.11	.00	.00
27	.12	.00	.00	.00	.00	.00	.00	.00	.00	.14	.00	.00
28	.05	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00	.00
29	.01	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.00	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.00		.00	.00		.00		.00	.00		.00	
Total	0.76	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.16	0.00

Daily total nitrite plus nitrate loads at New Gillespie Lake outflow, May 1996–April 1997, in ton per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
2	.01	.10	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
3	.03	.05	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
4	.32	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
5	.29	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
6	.10	.03	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
7	.33	.02	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
8	.21	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
9	.12	.01	.00	.00	.00	.00	.00	.00	.00	.00	.07	.00
10	.07	.02	.00	.00	.00	.00	.00	.00	.00	.00	.08	.00
11	.05	.01	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
12	.03	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
13	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00
14	.03	.01	.00	.00	.00	.00	.00	.00	.00	.00	.11	.00
15	.05	.01	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00
16	.03	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
17	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
18	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
19	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
20	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
21	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
22	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.02	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00
26	.20	.00	.00	.00	.00	.00	.00	.00	.00	.35	.00	.00
27	.39	.00	.00	.00	.00	.00	.00	.00	.00	.45	.00	.00
28	.16	.00	.00	.00	.00	.00	.00	.00	.00	.11	.00	.00
29	.03	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
30	.01	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00
31	.01		.00	.00		.00		.00	.00		.00	
Total	2.61	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.63	0.02

Daily total suspended sediment loads at New Gillespie Lake outflow, May 1996–April 1997, in tons per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	1.01	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.32	0.23
2	.75	5.41	.00	.00	.00	.00	.00	.00	.00	.00	1.91	0.18
3	1.40	2.74	.00	.00	.00	.00	.00	.00	.00	.00	1.21	0.18
4	16.71	.64	.00	.00	.00	.00	.00	.00	.00	.00	.61	.20
5	14.89	.46	.00	.00	.00	.00	.00	.00	.00	.00	.53	.43
6	5.41	1.40	.00	.00	.00	.00	.00	.00	.00	.00	.50	.28
7	17.11	1.01	.00	.00	.00	.00	.00	.00	.00	.00	.34	.20
8	10.95	.50	.00	.00	.00	.00	.00	.00	.00	.00	.44	.18
9	6.46	.65	.00	.00	.00	.00	.00	.00	.00	.00	3.50	.19
10	3.50	.92	.00	.00	.00	.00	.00	.00	.00	.00	4.16	.24
11	2.64	.62	.00	.00	.00	.00	.00	.00	.00	.00	2.22	.19
12	1.50	.44	.00	.00	.00	.00	.00	.00	.00	.00	1.01	.12
13	.61	.40	.00	.00	.00	.00	.00	.00	.00	.00	1.30	.06
14	1.30	.34	.00	.00	.00	.00	.00	.00	.00	.00	5.64	.01
15	2.42	.33	.00	.00	.00	.00	.00	.00	.00	.00	3.17	.00
16	1.70	.33	.00	.00	.00	.00	.00	.00	.00	.00	1.21	.00
17	.92	.26	.00	.00	.00	.00	.00	.00	.00	.00	.61	.00
18	.53	.19	.00	.00	.00	.00	.00	.00	.00	.00	.52	.00
19	.42	.18	.00	.00	.00	.00	.00	.00	.00	.00	.43	.00
20	.35	.12	.00	.00	.00	.00	.00	.00	.00	.00	.34	.00
21	.39	.02	.00	.00	.00	.00	.00	.00	.00	.00	.27	.24
22	.34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.25	.25
23	.33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.25	.20
24	.33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.25	.18
25	1.01	.00	.00	.00	.00	.00	.00	.00	.00	.65	.25	.18
26	10.21	.00	.00	.00	.00	.00	.00	.00	.00	18.43	.24	.18
27	20.42	.00	.00	.00	.00	.00	.00	.00	.00	23.53	.19	.18
28	8.25	.00	.00	.00	.00	.00	.00	.00	.00	5.53	.18	.13
29	1.50	.00	.00	.00	.00	.00	.00	.00	.00		.19	.12
30	.57	.00	.00	.00	.00	.00	.00	.00	.00		.24	.11
31	.34		.00	.00		.00		.00	.00		.25	
Total	134.27	17.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.14	34.53	4.46

Daily total kjeldahl nitrogen loads at New Gillespie Lake outflow, May 1996–April 1997, in tons per day

Day	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01
2	.03	.17	.00	.00	.00	.00	.00	.00	.00	.00	.07	.01
3	.05	.09	.00	.00	.00	.00	.00	.00	.00	.00	.04	.01
4	.48	.02	.00	.00	.00	.00	.00	.00	.00	.00	.02	.01
5	.43	.02	.00	.00	.00	.00	.00	.00	.00	.00	.02	.02
6	.17	.05	.00	.00	.00	.00	.00	.00	.00	.00	.02	.01
7	.49	.04	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
8	.33	.02	.00	.00	.00	.00	.00	.00	.00	.00	.02	.01
9	.20	.02	.00	.00	.00	.00	.00	.00	.00	.00	.11	.01
10	.11	.03	.00	.00	.00	.00	.00	.00	.00	.00	.13	.01
11	.09	.02	.00	.00	.00	.00	.00	.00	.00	.00	.08	.01
12	.05	.02	.00	.00	.00	.00	.00	.00	.00	.00	.04	.01
13	.02	.02	.00	.00	.00	.00	.00	.00	.00	.00	.05	.00
14	.05	.01	.00	.00	.00	.00	.00	.00	.00	.00	.18	.00
15	.08	.01	.00	.00	.00	.00	.00	.00	.00	.00	.10	.00
16	.06	.01	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
17	.03	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
18	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
19	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
20	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
21	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
22	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
23	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
24	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01
25	.04	.00	.00	.00	.00	.00	.00	.00	.00	.02	.01	.01
26	.31	.00	.00	.00	.00	.00	.00	.00	.00	.53	.01	.01
27	.58	.00	.00	.00	.00	.00	.00	.00	.00	.66	.01	.01
28	.25	.00	.00	.00	.00	.00	.00	.00	.00	.17	.01	.01
29	.05	.00	.00	.00	.00	.00	.00	.00	.00		.01	.01
30	.02	.00	.00	.00	.00	.00	.00	.00	.00		.01	.00
31	.01		.00	.00		.00		.00	.00		.01	
Total	4.07	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	1.19	0.22