



# MONTHLY WATER INVENTORY REPORT FOR OHIO

January 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

## NOTES AND COMMENTS

### FACT SHEETS AVAILABLE

The Ohio Department of Natural Resources (ODNR) Division of Water is preparing a series of fact sheets concerning a variety of topics. These fact sheets detail services and information available at the Division of Water as well as cover topics and issues of interest to both laymen and water resources professionals. These one-page, easily reproducible fact sheets make ideal handouts for distribution at information booths, schools or government offices.

Eight new fact sheets have been completed and are now available. Two others are in progress and will be available soon. The new fact sheets are:

- FS-11 "Precipitation in Ohio"
- FS-12 "Floods and Flood Damage Prevention"
- FS-13 "Facts About Flood Insurance"
- FS-14 "Well Construction Materials and Techniques"
- FS-15 "Before You Have a Well Drilled"
- FS-16 "How to Read Well Log and Drilling Reports"
- FS-17 "Services of the Ground Water Resources Section"
- FS-18\* "The Hydrologic Cycle"
- FS-19\* "Cable Tool Grouting While Driving Well Casing"
- FS-20 "Ground Water Level Monitoring in Ohio"

\* Available April 1, 1993

Single copies of the fact sheets can be ordered at no cost from the ODNR Division of Water, 1939 Fountain Square, Building E-3, Columbus, Ohio, 43224-1336, phone (614) 265-6717.

### GOVERNOR VOINOVICH CREATES BLUE RIBBON TASK FORCE

Governor Voinovich has announced the establishment of a Blue Ribbon Task Force on Water Resources Planning and Development. The mission of the Task Force will be to evaluate the present status of water resources in Ohio; to assess the organizational, financial and planning programs that are currently available to support the development and protection of this resource; and to propose the actions necessary to insure Ohio's water resources are optimized, now and in the future.

The Task Force will be chaired by Department of Natural Resources Assistant Director Don Anderson and consists of a wide variety of water resource and other specialists outside of state government. The first meeting of the Task Force will be held on February 9, 1993. A final report to the Governor is to be completed by the end of the year. Several staff members from the departments of Natural Resources, Health, Transportation and Development along with the Environmental Protection Agency and the Water Development Authority have been asked to be available for input and technical assistance as well as chair and serve on several work groups.

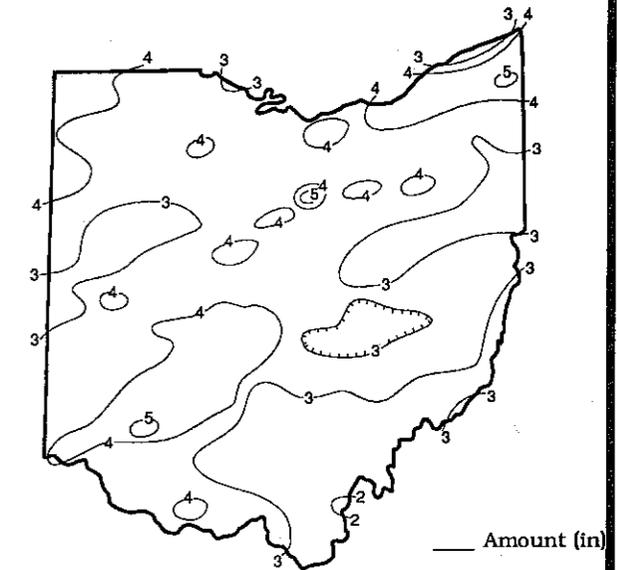
**PRECIPITATION** for January was above normal throughout most of the state; only the South Central Region had below normal precipitation. The state average was 3.47 inches, 0.71 inch above normal. Regional averages ranged from 3.93 inches, 0.70 inch above normal, for the Southwest Region to 2.72 inches, 0.65 inch below normal, for the South Central Region. Mansfield Airport (Richland County) reported the greatest amount of precipitation for the month, 5.54 inches. Other areas reporting more than five inches of precipitation for the month were Andover (Ashtabula County) and Stonelick State Park (Clermont County). Gallipolis Locks and Dam (Gallia County) reported the least amount of precipitation for January, 1.91 inches.

Precipitation during January fell mostly in the form of rain. Snow amounts were noticeably below normal in the southern two-thirds of Ohio and near to slightly below normal in the northern one-third. Widespread precipitation fell across Ohio on January 4-5. Several areas in north-central and northwestern Ohio received more than two inches of rain while the rest of the state received about one inch and slightly less in southeastern Ohio. The entire state was wet during January 10-13 with the heaviest storms occurring on January 12-13. Most of the state received more than one inch of rain with slightly smaller amounts falling in some western and southeastern Ohio areas. Showers crossed the state again during January 21-24 with most of the state again receiving more than one inch of precipitation. The last week of the month was rather dry with only a few scattered flurries and snow showers.

Precipitation for the 1993 water year is above normal in the northern two-thirds of Ohio and below normal in the southern one-third. The state average is 11.68 inches, 1.35 inches above normal. Regional averages range from 14.58 inches, 3.75 inches above normal, for the Northeast Region to 8.82 inches, 2.52 inches below normal, for the South Central Region. The North Central Region has the greatest departure from normal precipitation for the 1993 water year averaging 14.25 inches, 5.10 inches above normal.

Precipitation for the 1993 calendar year is off to a good start in most areas of the state as far as water supplies are concerned. Continued normal or near normal precipitation during the next several months will insure adequate recharge to ground-water supplies.

### PRECIPITATION JANUARY 1993

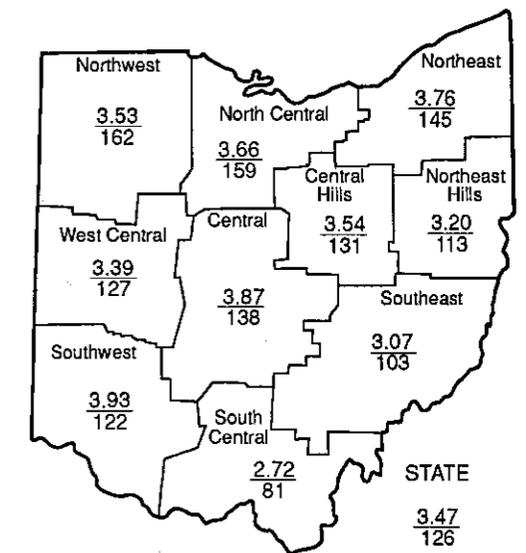


### PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+1.35	+4.24	+7.25	+9.03	+6.24	+4.2
North Central	+1.36	+4.76	+7.72	+11.30	+4.50	+5.2
Northeast	+1.17	+3.66	+6.89	+9.65	+1.02	+6.0
West Central	+0.72	+1.69	+1.08	+5.74	-2.04	+3.3
Central	+1.06	+1.80	+1.11	+4.92	-3.78	+3.1
Central Hills	+0.84	+1.77	+1.69	+3.93	-6.13	+1.7
Northeast Hills	+0.37	+0.90	+1.98	+1.41	-8.86	+3.2
Southwest	+0.70	+0.61	-0.75	-0.87	-3.59	+1.8
South Central	-0.65	-0.96	-4.50	-5.85	-9.15	+0.3
Southeast	+0.10	0	-2.63	-3.49	-8.38	+0.7
State	+0.71	+1.85	+1.98	+3.57	-3.00	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To -0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought



Average (in)  
Percent of normal

### ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

- Precipitation data:
  - U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conserancy District; U.S. Army Corps of Engineers, Muskingum Area.
- Streamflow and reservoir storage data:
  - U.S. Geological Survey, Water Resources Division.
- Lake Erie level data:
  - U.S. Army Corps of Engineers, Detroit District.
- Palmer Drought Severity Index:
  - U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

George V. Voinovich  
Governor

Frances S. Buchholzer  
Director

James R. Morris  
Chief

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**MEAN STREAM DISCHARGE**

River and Location	Drainage Area (Sq. Mi.)	This Month		% of Normal Past		
		Mean Discharge (CFS)	% of Normal	3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	2,218	210	146	160	103
Great Miami River at Hamilton	3,630	7,591	256	142	147	103
Huron River at Milan	371	1,185	334	419	428	187
Killbuck Creek at Killbuck	464	1,017	270	223	282	131
Little Beaver Creek near East Liverpool	496	1,180	238	212	267	102
Maumee River at Waterville	6,330	21,984	698	326	320	165
Muskingum River at McConnellsville	7,422	15,720	199	129	157	88
Scioto River near Prospect	567	1,580	467	308	306	145
Scioto River at Higby	5,131	14,195	382	201	194	108
Stillwater River at Pleasant Hill	503	1,110	307	207	201	121

**STREAMFLOW** during January was above normal throughout the state. Flows were high enough to be considered excessive statewide. Flows during January were noticeably greater than December's flows. Preliminary data indicates that flows in the northern one-third of Ohio were at near-record January levels. The Grand River near Painesville gauging station recorded its second greatest flow for January; the Huron River at Milan gauging station recorded its third greatest January flow; and the Maumee River at Waterville gauging station recorded its fourth greatest January flow.

Flows at the beginning of the month were above normal in northern Ohio but below normal in southern Ohio. Most drainage basins in the southern

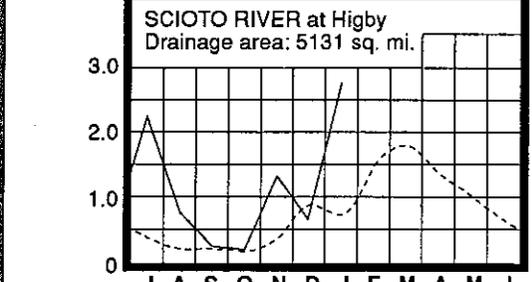
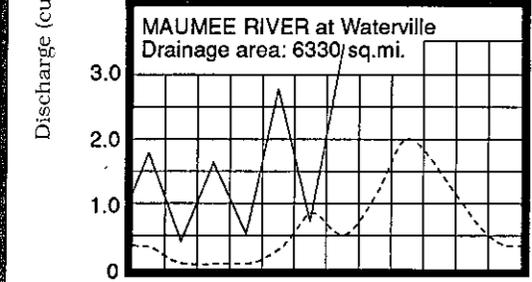
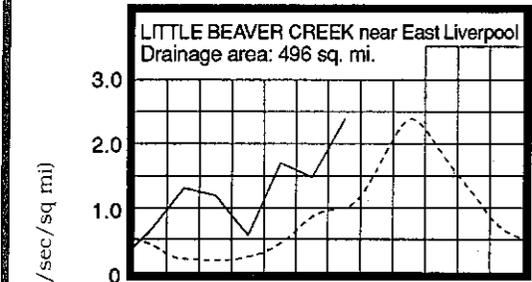
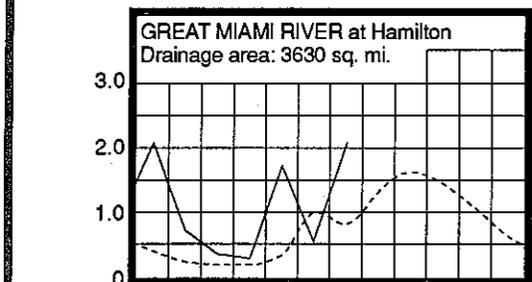
two-thirds of the state recorded their lowest flows for January during the first few days of the month. Most other drainage basins reached their lowest flows around January 20 and a few, at the end of the month. Widespread precipitation on January 4-5 and 12-13 brought streamflows up. The northern and western parts of Ohio recorded their month's greatest flows on January 5 while drainage basins in eastern and southeastern Ohio reached peak flows around mid-month. Most drainage basins were still flowing at above normal levels at the end of the month, but a few basins along Lake Erie were at slightly below normal levels.

**RESERVOIR STORAGE** for water supply during January decreased slightly in the Mahoning River basin and increased slightly in the Scioto River basin. Storage remained above normal in both basins.

Reservoir storage at the end of January in the Mahoning basin index reservoirs was 79 percent of rated capacity for water supply compared with 80 percent for last month and 43 percent for January 1992. Storage at the end of January in the Scioto basin index reservoirs was 105 percent of rated capacity for water supply compared with 103 percent for last month and 64 percent for January 1992.

Surface-water supplies are at or above normal seasonal levels throughout the state. These favorable conditions of early 1993 are a noticeable improvement over the unusually low levels of early 1992.

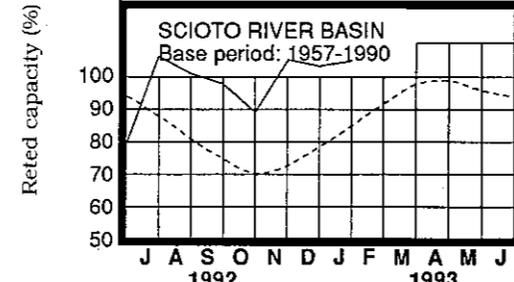
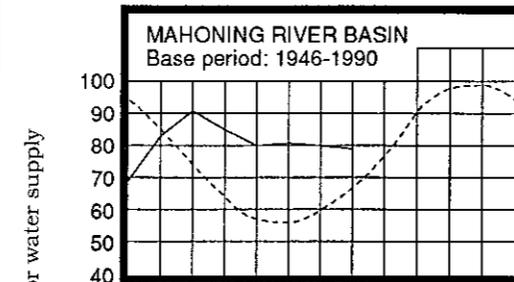
**MEAN STREAM DISCHARGE**



Base period for all streams: 1961-1990

Normal - - - - Current - - - -

**RESERVOIR STORAGE FOR WATER SUPPLY**



Base period: 1946-1990 (Mahoning), 1957-1990 (Scioto)

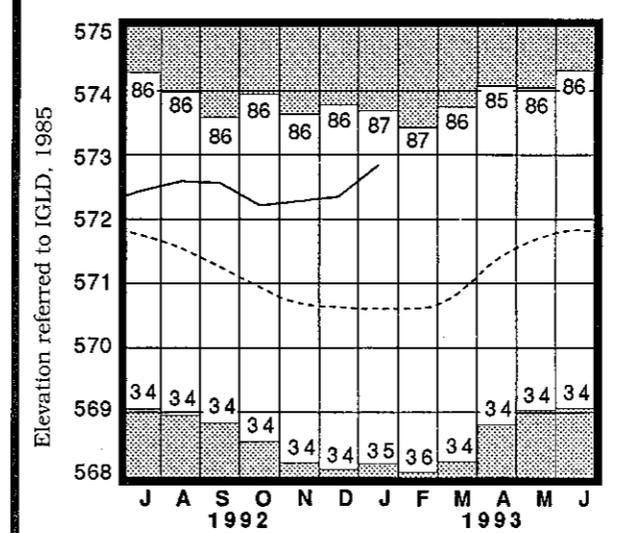
**GROUND-WATER LEVELS** during January rose throughout the state. Net rises from December's levels ranged from nearly equal to about half that usually observed. Ground-water storage is currently above normal in the western half of Ohio, but remains below normal in the eastern half, still recovering from the drought conditions of 1991 and early 1992.

Ground-water storage continues to improve from the drought-induced low levels of last year. Current levels range from slightly above to more than five feet above the levels of a year ago. Even though eastern Ohio's aquifers continue to remain below normal, ground-water storage is at acceptable levels throughout the state.

**LAKE ERIE** level rose noticeably during January. The mean level was 572.83 feet (IGLD-1985), 0.47 foot above last month's mean level and 2.23 feet above normal. This month's level is 1.65 feet above the January 1992 level and 3.63 feet above Low Water Datum.

**SUMMARY**  
Precipitation was above normal throughout most of Ohio with only the South Central Region having below normal precipitation. Streamflow was excessive statewide. Reservoir storage was about the same as last month and remained at above normal seasonal levels. Ground-water storage improved and remains above normal in western Ohio and below normal in eastern Ohio. Lake Erie level rose 0.47 foot and was 2.23 feet above the long-term January average.

**LAKE ERIE LEVELS at Fairport**



Base period: 1900-1991  
Record high and low, year of occurrence

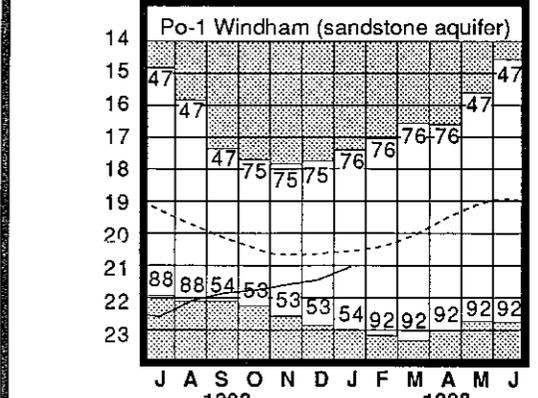
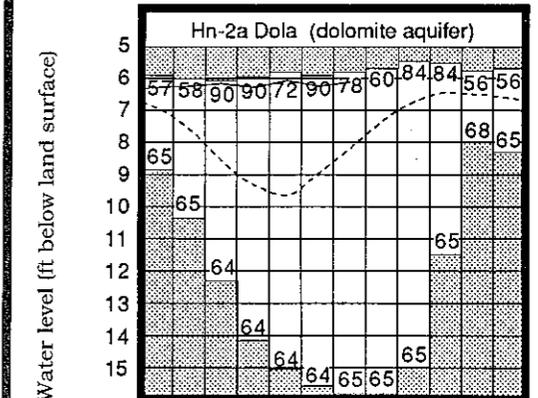
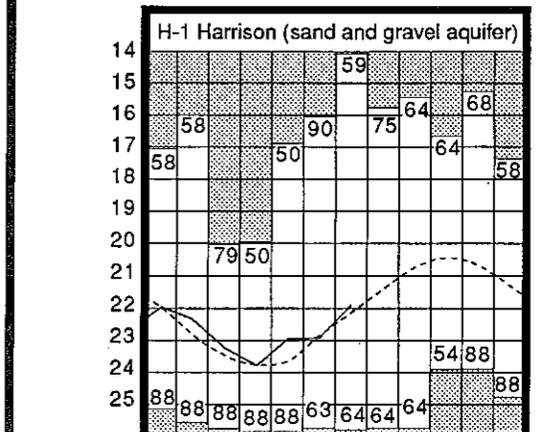
Normal - - - - Current - - - -

**GROUND-WATER LEVELS**

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	17.54	-1.99	+0.83	+4.11
Fa-1	Jasper Mill, Fayette Co.	Limestone	7.36	+0.08	+0.30	+2.79
Fr-10	Columbus, Franklin Co.	Gravel	42.60	+1.01	+0.36	+0.31
H-1	Harrison, Hamilton Co.	Gravel	21.90	+0.23	+1.00	+1.76
Hn-2a	Dola, Hardin Co.	Dolomite	6.12	+2.08	+0.13	+5.27
Po-1	Windham, Portage Co.	Sandstone	21.04	-0.49	+0.40	+1.83
Tu-1	Strasburg, Tuscarawas Co.	Gravel	13.73	-0.80	+0.59	+2.17

**GROUND-WATER LEVELS**



Base periods: H-1, 1951-1990; Hn-2a, 1955-1990; Po-1, 1947-1990  
Record high and low, year of occurrence

Normal - - - - Current - - - -



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Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

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one-third. The state average is 13.82 inches, 1.25 inches above normal. Regional averages range from 16.68 inches, 3.68 inches above normal, for the Northeast Region to 11.30 inches, 2.82 inches below normal, for the South Central Region. Precipitation during the first five months of the 1993 water year has been favorable for both surface and ground water supplies. Near-normal precipitation for the next few months, the remainder of the recharge season, will continue to benefit both surface and ground water supplies throughout Ohio.

## NOTES AND COMMENTS

### ENVIROLINK 1993 - THE GOVERNOR'S CONFERENCE ON OHIO AND THE ENVIRONMENT

Mark your calendar now for Monday, June 14 and plan to take part in "EnviroLink 1993-The Governor's Conference on Ohio and the Environment." You'll also want to reserve the following day, Tuesday, June 15, for one of several informative field trips which relate to key conference topics. Initiated by Governor George V. Voinovich, EnviroLink 1993 seeks to strengthen existing linkages and build strong new partnerships for tackling Ohio's environmental challenges through an unprecedented gathering of representatives from Ohio business and industry, education, government, agriculture, community groups and environmental organizations.

The day-long EnviroLink 1993 program, to be held at the Radisson Airport Inn, Columbus, will offer three concurrent conference sessions:

- Pollution Prevention
- An Ecosystem Approach to the Environment
- Environmental Stewardship.

A series of optional, day-long field trips is scheduled for the following day. Cost for the one-day EnviroLink 1993 program, including the luncheon and conference materials, is \$45. Optional field trip costs vary. For registration materials and further information, contact Irene Probasco, Ohio Alliance for the Environment, 445 King Ave., Columbus, Oh, 43201, phone (614) 421-7819.

EnviroLink 1993 is being coordinated by the Ohio Department of Education, Ohio Department of Natural Resources, Ohio Environmental Protection Agency, Ohio Alliance for the Environment, Ohio Chamber of Commerce and the Ohio Conservation and Outdoor Education Association. Funding is provided by the Ohio Environmental Education Fund, a program of the OEPA.

### NEW PUBLICATION RAINFALL FREQUENCY ATLAS OF THE MIDWEST (BULLETIN 71)

by Floyd A. Huff and James R. Angel

The Midwestern Climate Center and the Illinois State Water Survey have just released this new publication which updates the information contained in the Weather Bureau's Technical Paper 40, published in 1961. The new report presents the results and methodology of an intense study of rainfall frequency relationships throughout the Midwest (Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio and Wisconsin). Rainfall amounts have been determined for recurrence intervals from 2 months to 100 years for durations of 5 minutes to 10 days. The results are presented as spatial distribution (isohyetal) maps. Additionally, statistical calculations have been made that determined the same information for each climatic division within all the midwestern states. This is presented in tabular form. The report also examines such things as the time distribution characteristics of heavy rainfall during a storm and other storm characteristics including orientation and movement, seasonal distribution of heavy rainfall and areal, spatial and temporal variability.

Bulletin 71 costs \$15 (includes postage and handling) and can be ordered from the Midwestern Climate Center, Attn: Jean Dennison, 2204 Griffith Dr., Champaign, IL, 61820-7495, phone (217) 244-8226. Make checks payable to University of Illinois c/o Illinois State Water Survey.

### SUBSCRIPTION RENEWAL

All recipients of the "Monthly Water Inventory Report for Ohio" must return the notice in last month's report by April 9, 1993 in order to continue to receive this publication. Please notify the Division of Water immediately of a change in address as this will help us reduce our mailing costs. As always, comments and suggestions are welcome and can be addressed to the author.

## ACKNOWLEDGEMENTS

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U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service: The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.  
Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
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**PRECIPITATION** for February was slightly below normal throughout most of Ohio; scattered locations in the southwestern and eastern areas of the state had above normal precipitation. The state average was 2.14 inches, 0.10 inch below normal. Regional averages ranged from 2.62 inches which is normal for the Southwest Region to 1.65 inches, 0.19 inch below normal, for the Northwest Region. Andover (Ashtabula County) reported the greatest amount of precipitation for the month, 3.98 inches. Wauseon (Fulton County) reported the least amount, 1.00 inch.

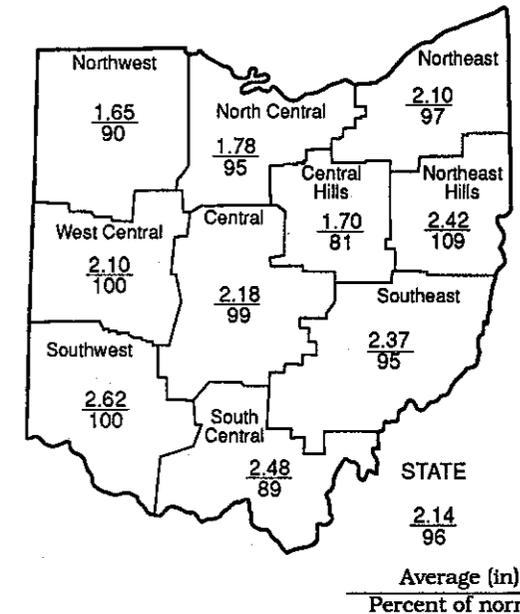
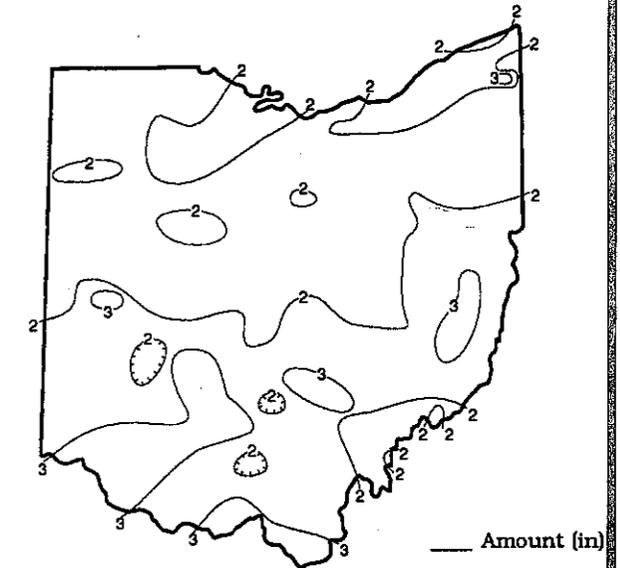
Precipitation during February fell in the form of both rain and snow as winter finally made its arrival statewide during the second half of the month. The first 10 or 11 days of the month were dry with generally above normal temperatures. Conditions deteriorated quickly as rain moved through the state and, as cold air pushed in, this changed to snow. It was the season's first significant accumulation of snow for many areas including central Ohio. Precipitation fell on most days during February 12-16, mostly in the form of snow after the 14th. The season's first arctic air mass moved into Ohio on February 17 bring with it sub-zero temperatures. Temperatures warmed up and melted much of the snow on February 21. The warm air also brought moisture into the state which fell as rain. However, another cold front moved through Ohio and changed the precipitation to snow by February 22. A tornado was reported in Scioto County with the passage of this cold front. More snow fell in many areas of the state on February 26. Snow remained on the ground in most areas of the state at the month's end. February snow totals were above normal in most areas of Ohio. Cleveland Hopkins Airport (Cuyahoga County) reported its snowiest February on record receiving slightly more than 39 inches of snow. Chardon (Geauga County), Ohio's snow capitol, reported 33 inches of snow in February bringing its winter season total to about 91 inches, 9 inches above normal.

Precipitation for the 1993 calendar year is above normal throughout most of the state with only the South Central and Southeast regions having below normal precipitation. The state average is 5.61 inches, 0.61 inch above normal. Regional averages range from 6.55 inches, 0.70 inch above normal, for the Southwest Region to 5.18 inches, 1.16 inches above normal, for the Northwest Region. The South Central Region average is 5.20 inches, 0.95 inch below normal.

Precipitation for the 1993 water year is above normal in the northern two-thirds of the state and below normal in the southern

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## PRECIPITATION FEBRUARY 1993



## PRECIPITATION

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	This Month	3 Mos.	6 Mos.	12 Mos.	24 Mos.	
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North Central	-0.09	+1.55	+6.50	+11.30	+4.81	+4.6
Northeast	-0.07	+1.43	+5.05	+9.76	+1.40	+5.5
West Central	-0.01	-0.82	+0.84	+6.93	-1.68	+2.6
Central	-0.03	-0.32	+0.86	+5.98	-3.60	+2.4
Central Hills	-0.39	-0.72	+1.26	+4.36	-5.90	+1.4
Northeast Hills	+0.19	-0.01	+1.01	+2.34	-8.34	+2.7
Southwest	0	-1.09	-0.75	+0.82	-3.80	+1.6
South Central	-0.30	-2.06	-3.98	-5.13	-9.80	+0.4
Southeast	-0.12	-0.94	-2.07	-2.42	-8.55	+0.6
State	-0.10	-0.14	+1.56	+4.33	-2.84	

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**MEAN STREAM DISCHARGE**

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Huron River at Milan	371	186	40	142	276	181
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Maumee River at Waterville	6,330	2,783	40	166	247	160
Muskingum River at McConnellsville	7,422	8,773	72	114	113	93
Scioto River near Prospect	567	388	58	140	189	149
Scioto River at Higby	5,131	6,504	86	140	145	116
Stillwater River at Pleasant Hill	503	440	79	113	136	126

**STREAMFLOW** during February was below normal throughout Ohio. Flows during February were noticeably lower than the excessive flows during January. Flows in the Huron River basin were low enough to be considered deficient.

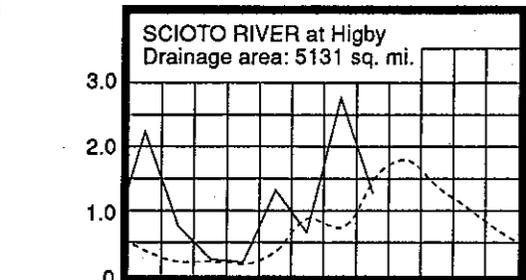
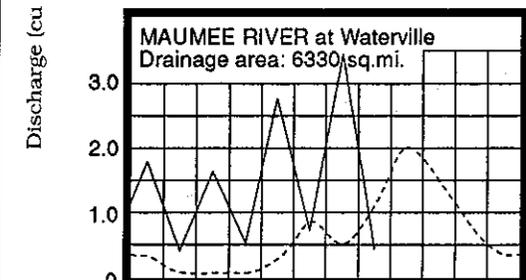
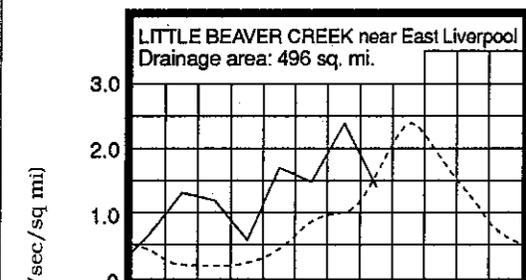
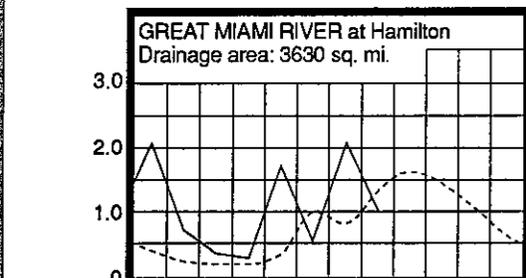
Flows at the beginning of February were near or slightly below normal throughout the state. Generally, flows continued to decline until just before the middle of the month with most drainage basins reaching the month's lowest flows during February 9-11. Flows increased following the month's first precipitation during February 12-16 and then again following widespread precipitation and snowmelt during February 21-22. Most drainage basins recorded the month's greatest flows during February 22-23. Flows declined after these peak flows until the end of the month finishing February with below normal flows in most drainage basins.

flows during February 22-23. Flows declined after these peak flows until the end of the month finishing February with below normal flows in most drainage basins.

**RESERVOIR STORAGE** for water supply during February was nearly unchanged from last month, increasing slightly in the Mahoning River basin and decreasing slightly in the Scioto River basin. Storage remained above normal in both basins.

Reservoir storage at the end of February in the Mahoning basin index reservoirs was 80 percent of rated capacity for water supply compared with 79 percent for last month and 46 percent for February 1992. Storage at the end of February in the Scioto basin index reservoirs was 104 percent of rated capacity for water supply compared with 105 percent for last month and 64 percent for February 1992.

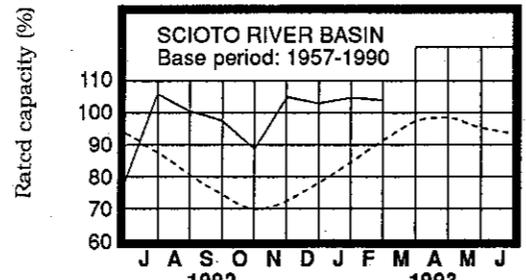
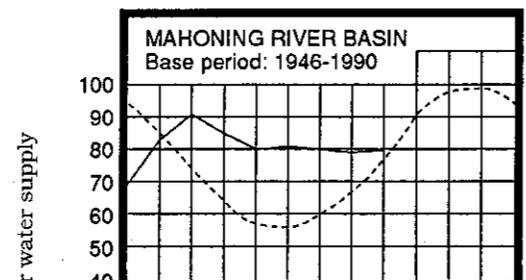
**MEAN STREAM DISCHARGE**



Base period for all streams: 1961-1990

Normal - - - - Current - - - -

**RESERVOIR STORAGE FOR WATER SUPPLY**



Base period: 1946-1990 (Mahoning), 1957-1990 (Scioto)

**GROUND-WATER LEVELS** during February were stable or rose slightly when compared with last month's levels. Generally, ground-water levels declined during the first three weeks of February and rose during the last week responding to the precipitation and snowmelt during February 21-22. Ground-water storage continues to show slow improvement throughout the state; however, ground-water levels remain below normal in the eastern half of the state.

Ground-water storage currently is more favorable than at this time last year. Current levels range from one to nearly six feet above the February 1992 levels. Current conditions, including such things as soil moisture, streamflows and long-range forecasts, favor a continued improvement in ground-water storage throughout the remainder of the recharge season.

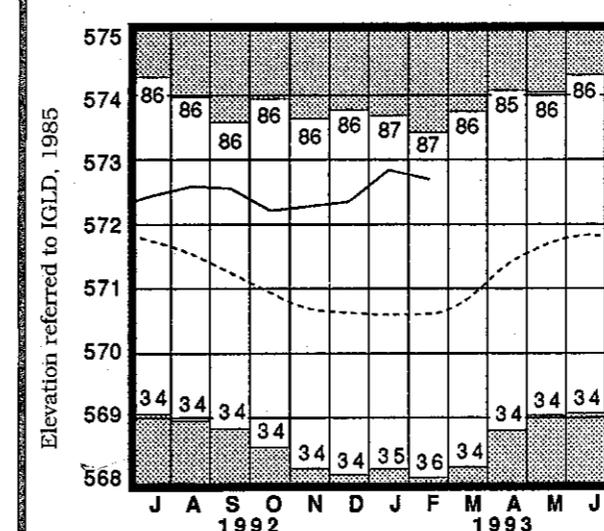
**LAKE ERIE** level declined during February. The mean level was 572.70 feet (IGLD-1985), 0.13 foot below last month's mean level and 2.10 feet above normal. This month's level is 1.40 feet above the February 1992 level and 3.50 feet above Low Water Datum.

Lake levels throughout the Great Lakes are above normal and noticeably above normal in the lower lakes, especially Lake Erie and Lake Ontario. Many of the lower lakes did not experience the normal seasonal decline usually observed during the late summer, fall and early winter months. As a result, current Great Lakes' levels are generally higher than last year's levels as the season for rising lake levels begins. The U.S. Army Corps of Engineers is projecting levels throughout the Great Lakes to remain above normal for the foreseeable future, but below the record-high levels established during the mid-80s in most of the lakes.

**SUMMARY**

Precipitation during February was slightly below normal throughout most of the state. Streamflow was below normal statewide. Reservoir storage was unchanged and remained above normal. Ground-water storage was stable or improved slightly in most aquifers. Lake Erie level declined and was 2.10 feet above the long-term February average. Water supplies are in good shape throughout the state.

**LAKE ERIE LEVELS at Fairport**



Base period: 1900-1991  
Record high and low, year of occurrence

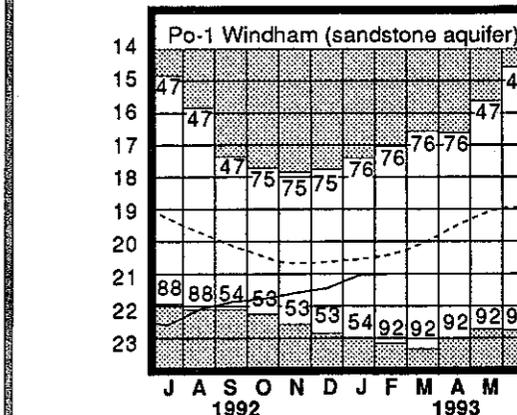
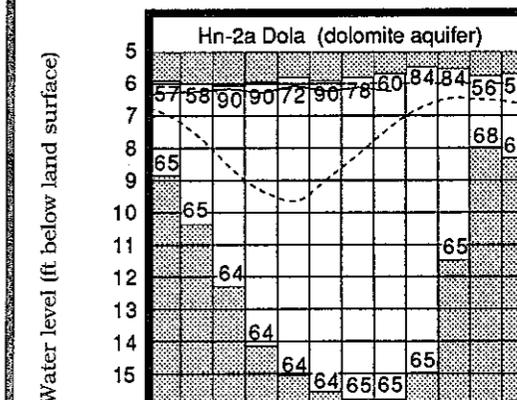
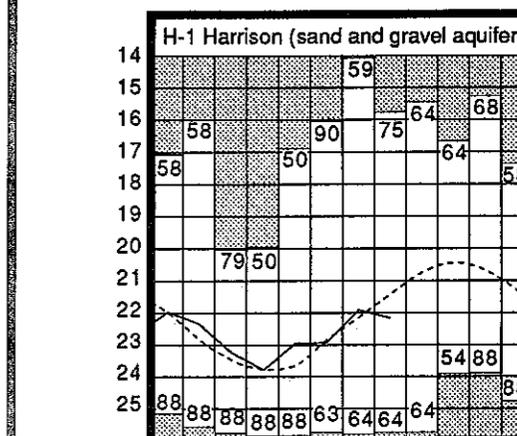
Normal - - - - Current - - - -

**GROUND-WATER LEVELS**

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	15.84	-1.36	+1.70	+5.90
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.96	+0.12	+0.40	+2.00
Fr-10	Columbus, Franklin Co.	Gravel	42.09	+1.00	+0.51	+0.75
H-1	Harrison, Hamilton Co.	Gravel	22.15	-0.75	-0.25	+1.27
Hn-2a	Dola, Hardin Co.	Dolomite	6.24	+1.10	-0.12	+3.28
Po-1	Windham, Portage Co.	Sandstone	21.00	-0.60	+0.04	+2.02
Tu-1	Strasburg, Tuscarawas Co.	Gravel	13.63	-1.49	+0.10	+2.02

**GROUND-WATER LEVELS**



Base periods: H-1, 1951-1990; Hn-2a, 1955-1990; Po-1, 1947-1990  
Record high and low, year of occurrence

Normal - - - - Current - - - -



# MONTHLY WATER INVENTORY REPORT FOR OHIO

March 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

(continued from front page)

Southwest and West Central regions. The state average is 9.16 inches, 0.79 inch above normal. Regional averages range from 10.12 inches, 1.04 inches above normal, for the Southeast Region to 7.80 inches, 0.24 inch below normal, for the West Central Region (see Precipitation table, departure from normal, past three months column).

## NOTES AND COMMENTS

### REPRINTED PUBLICATIONS

The Division of Water announces the availability of the following publications which had been out of print:

The Ground Water Resources of Butler County  
by James J. Schmidt

The Ground Water Resources of Columbiana County  
by Katie Crowell

The Ground Water Resources of Wayne County  
by Katie Crowell

These maps are three in a series of county ground-water resources maps which have been completed for 83 of Ohio's 88 counties. Ground-water resource maps are prepared by staff hydrogeologists. These maps show the regional ground-water characteristics based on interpretations of water well drilling records and local geology. These color-coded maps provide well log data for many point locations. Information provided by the maps also include typical depths of wells, water-bearing formations and estimated yields for wells in the area.

Ground-water resources maps can be used as a guide to locate new or expand existing ground-water supplies. The maps are useful to homeowners, ground-water consultants, engineers, planners and developers.

These maps cost \$7.29 each (includes postage, handling and tax). They can be ordered from: ODNR-Publications Center, 4383 Fountain Square, Building B-1, Columbus, Ohio 43224-1362. Make checks payable to ODNR-Publications Center.

### ADAMS LAKE DAM REPAIR PROJECT UNDERWAY

Investigations to determine the permanent repairs needed to the dam at Adams Lake State Park were begun in early March. The lake level was lowered six feet last December while making temporary repairs after a leak in the earthen dam caused concern. Temporary repairs were completed on Christmas Eve and five families, evacuated as a precaution, were allowed to return home. Although seepage continues to occur from the area stabilized by the temporary repairs, the dam, built in 1947, is considered to be stable with the lowered lake levels.

Soil borings from the dam to determine the type of material and stability of the soil are needed to evaluate the full extent of the possible internal structure problems and repair options. A preliminary report detailing the repair options is expected soon. A final report including construction drawings, specifications and cost estimates is expected by mid-summer. While work on the dam is being made, plans are underway to re-evaluate the entire lake ecology including sedimentation issues. Construction on the dam should begin later this year.

### OWWA WELL CONSTRUCTION CONFERENCE

The Ohio Water Well Association (OWWA) will hold its annual well construction conference on May 20-21, 1993 at the Kent State University in Kent, Ohio. This two-day event will include both classroom instruction and field demonstrations.

The May 20 classroom sessions will include wide-ranging topics covering well logs, well screens, pump sizing, grouting techniques, well and bore hole abandonment and others. Activities during the May 21 field day will demonstrate several of the classroom topics as well as drilling methods and well pump tests. Two six inch production wells will be drilled to serve the irrigation system for Kent State's outdoor practice facilities.

For registration material or additional information, contact Dan Schlosser, Executive Director, OWWA, P.O. Box 310, Caledonia, Ohio 43314, phone: (419) 845-2023.

## ACKNOWLEDGEMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

- Precipitation data:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.  
Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

George V. Vohnovich  
Governor

Frances S. Buchholzer  
Director

James R. Morris  
Chief

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**PRECIPITATION** for March was above normal in the eastern two-thirds of Ohio and below normal in the western one-third. The state average was 3.56 inches, 0.18 inch above normal. Regional averages ranged from 4.68 inches, 1.06 inches above normal, for the Southeast Region to 2.31 inches, 0.95 inch below normal, for the West Central Region. Chardon (Geauga County) reported the greatest amount of precipitation for the month, 6.81 inches; Belleville Locks and Dam (Meigs County) reported 6.62 inches, the only other location reporting more than 6 inches. Fort Loramie (Shelby County) reported the least amount of precipitation for March, 1.69 inches. A few other locations in the west-central area of the state also reported less than 2 inches of precipitation for the month.

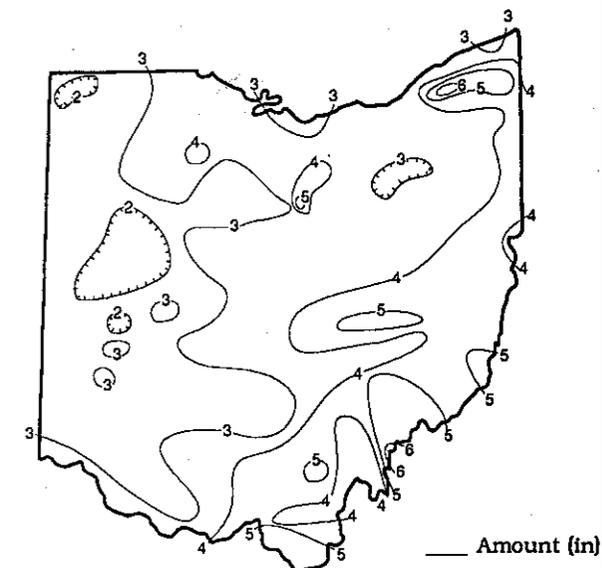
Precipitation during March fell in the form of both rain and snow, but the snow was the most memorable for many areas. Precipitation fell over much of the state on more than half of the days of the month, but daily amounts were generally light with a few exceptions. During March 3-5, many areas of the state received around 1 inch of precipitation and some areas in extreme southern and southeastern Ohio, more than 2 inches. The most notable storm event during the month was the blizzard experienced on March 13. The eastern and southeastern areas of the state were hit the hardest. Snow amounts of more than 20 inches were reported. Drifts of up to six feet closed many roads. Snow totals for the month were above normal in the eastern half of the state. Youngstown Airport (Trumbull County) reported nearly 31 inches of snow, a record for March and the second highest amount for any month. The month's last significant precipitation fell during March 22-25 during which time more than 1 inch fell in many areas of the state.

Precipitation for the first half of the 1993 water year is above normal in the northern two-thirds of the state and below normal in the southern one-third. The state average is 17.38 inches, 1.43 inches above normal. Regional averages range from 20.76 inches, 4.65 inches above normal, for the Northeast Region to 15.39 inches, 2.82 inches below normal, for the South Central Region (see Precipitation table, departure from normal, past six months column on this page). The precipitation during the 1993 water year recharge season has been beneficial for both surface and ground water supplies.

Precipitation for the 1993 calendar year is above normal throughout most of Ohio but slightly below normal in the South Central,

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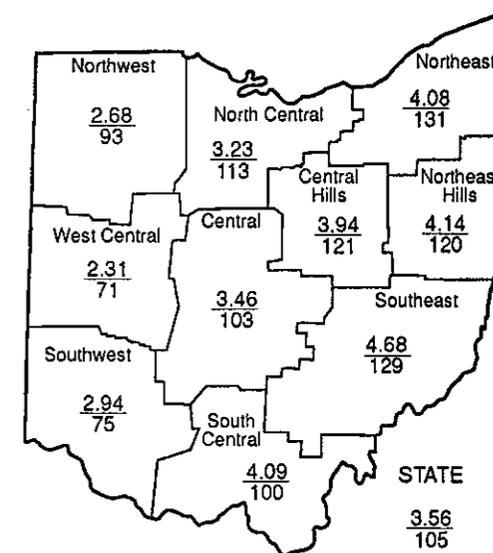
PRECIPITATION  
March 1993



PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.19	+0.97	+3.84	+9.07	+8.09	+4.5
North Central	+0.37	+1.64	+5.38	+11.74	+6.09	+5.0
Northeast	+0.97	+2.07	+4.65	+10.71	+2.62	+5.5
West Central	-0.95	-0.24	+0.23	+6.65	-2.80	+2.3
Central	+0.09	+1.12	+1.45	+5.79	-3.93	+2.4
Central Hills	+0.68	+1.13	+1.43	+5.03	-4.72	+2.1
Northeast Hills	+0.69	+1.25	+1.31	+2.89	-6.97	+2.7
Southwest	-0.98	-0.28	-1.00	+0.25	-6.31	+1.4
South Central	0.00	-0.95	-2.82	-5.20	-11.77	+0.6
Southeast	+1.06	+1.04	-0.24	-1.75	-8.00	+1.4
State	+0.18	+0.79	+1.43	+4.52	-2.75	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To -0.4 = Near Normal  
-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought



Average (in)  
Percent of normal

MEAN STREAM DISCHARGE

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	This Month		
				% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	4,308	226	156	151	129
Great Miami River at Hamilton	3,630	9,069	153	132	130	129
Huron River at Milan	371	1,585	226	179	254	215
Killbuck Creek at Killbuck	464	1,515	162	162	198	155
Little Beaver Creek near East Liverpool	496	2,072	175	161	186	131
Maumee River at Waterville	6,330	20,859	163	191	221	182
Muskingum River at McConnelsville	7,422	24,490	151	143	131	111
Scioto River near Prospect	567	2,018	208	176	189	181
Scioto River at Higby	5,131	16,945	184	156	154	138
Stillwater River at Pleasant Hill	503	1,388	168	131	142	150

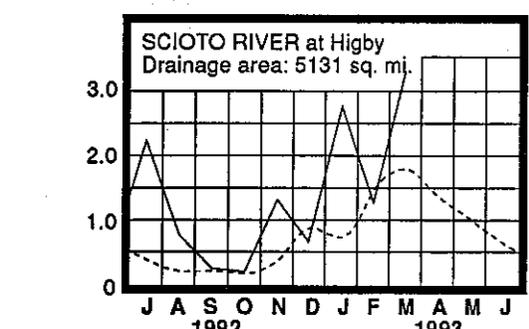
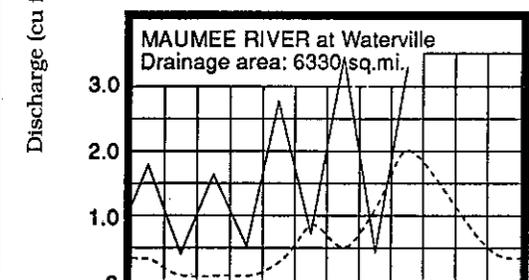
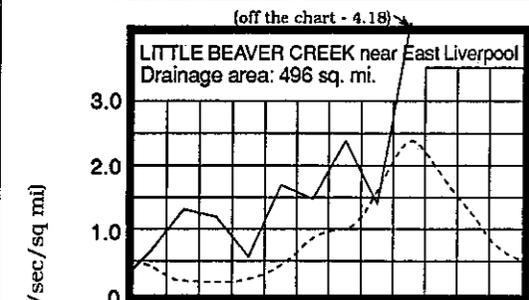
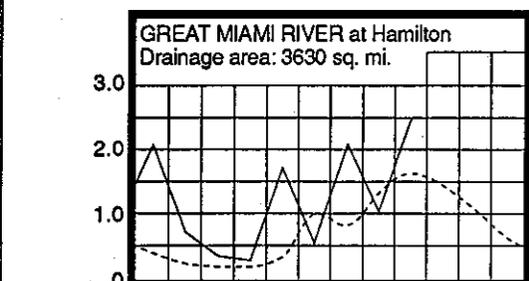
**STREAMFLOW** during March was above normal throughout Ohio. Flows were high enough to be considered excessive in all but the southwestern area of the state. Flows during March were noticeably greater than the flows during February. Preliminary data indicates that the Grand River near Painesville gauging station recorded its greatest flow for March for its period of record; the Huron River at Milan had its second greatest March flow; the Maumee River at Waterville had its third greatest; Little Beaver Creek near East Liverpool and Scioto River near Prospect had their fourth greatest March flows; and the Killbuck Creek at Killbuck had its sixth greatest March flow.

Flows at the beginning of the month were below normal in most areas of the state. Most drainage basins had their lowest flows for March on the first or second day of the month; a couple basins had their lowest flows on March 16. Flows increased following widespread precipitation during March 3-5. Basins in the southern two-thirds of Ohio had their greatest flows on March 5-6. After these peaks, flows slowly decreased until mid-month after which time melting snow and rain brought flows back up. Drainage basins in the northern one-third of the state had their highest flows during March 24-26. Minor flooding was reported. Flows at the end of the month were above normal in most larger basins, but below normal in many smaller basins.

**RESERVOIR STORAGE** for water supply during March increased in both the Mahoning and Scioto river basins. Storage remained above normal in both basins.

Reservoir storage at the end of March in the Mahoning basin index reservoirs was 96 percent of rated capacity for water supply compared with 80 percent for last month and 63 percent for March 1992. Storage at the end of March in the Scioto basin index reservoirs was 105 percent of rated capacity for water supply compared with 104 percent for last month and 74 percent for March 1992.

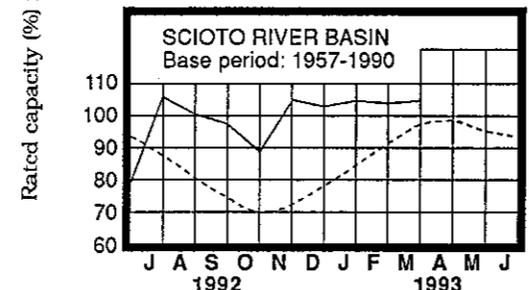
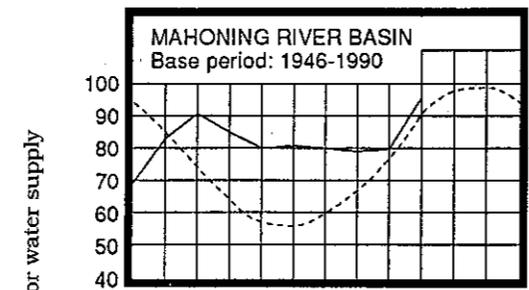
MEAN STREAM DISCHARGE



Base period for all streams: 1961-1990

Normal - - - - Current - - - -

RESERVOIR STORAGE FOR WATER SUPPLY



Base period: 1992 1993

**GROUND-WATER LEVELS** during March rose throughout the state. Net changes from last month's levels ranged from nearly average to twice that usually observed. Generally, ground-water levels rose during the first part of the month, were stable or declined slightly during the middle of the month, and then rose again during the last part of the month.

Ground-water storage continues to improve from the low levels of a year ago throughout the state. Current levels range from more than one foot to well over seven feet above the March 1992 levels. Ground-water storage is favorable statewide even though it remains at slightly below normal levels in the eastern half of Ohio.

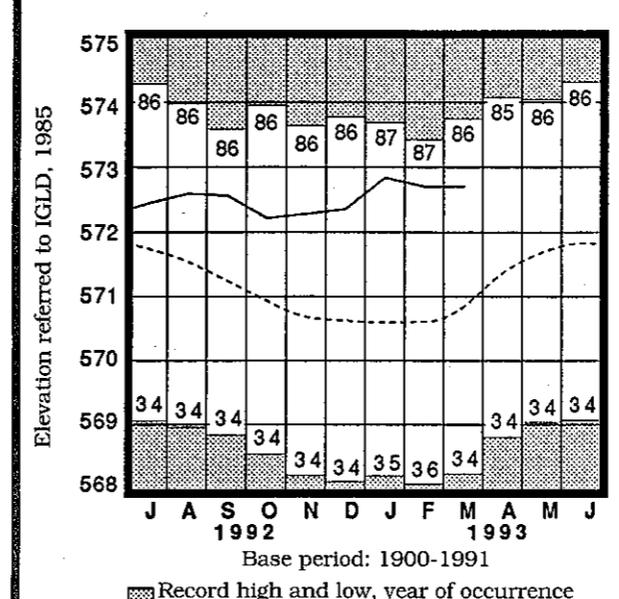
**LAKE ERIE** level remained stable during March. The mean level was 572.70 feet (IGLD-1985), the same as last month's level and 1.83 feet above normal. This month's level is 1.05 feet above the March 1992 level and 3.50 feet above Low Water Datum.

The U.S. Army Corps of Engineers reports that precipitation in the Lake Erie basin during March averaged 2.9 inches, 0.1 inch above normal. For the entire Great Lakes basin, March precipitation averaged 1.4 inches, 0.8 inch below normal. Precipitation for 1993 through March in the Lake Erie basin has averaged 8.8 inches, 1.5 inches above normal. 1993 precipitation in the entire Great Lakes basin has averaged 5.2 inches, 0.9 inch below normal.

SUMMARY

Precipitation was above normal in the eastern two-thirds of the state and below normal in the western one-third. Streamflows were noticeably above normal statewide. Reservoir storage increased and remained at above normal levels. Ground-water levels rose and are noticeably higher than the levels of a year ago. Lake Erie level was unchanged and was 1.83 feet above the long-term March average.

LAKE ERIE LEVELS at Fairport



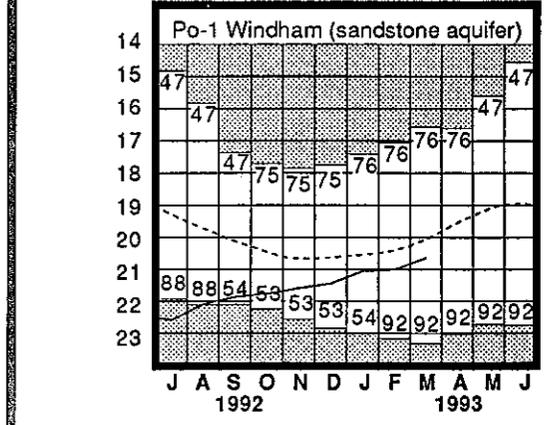
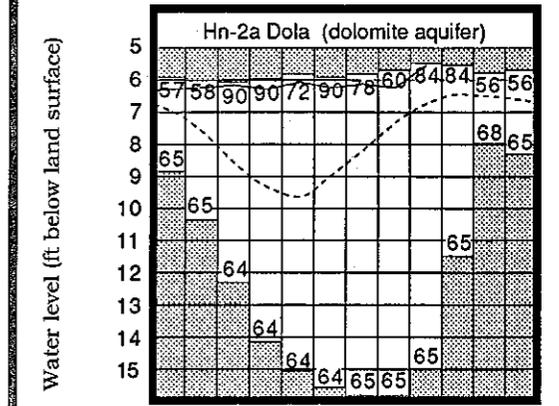
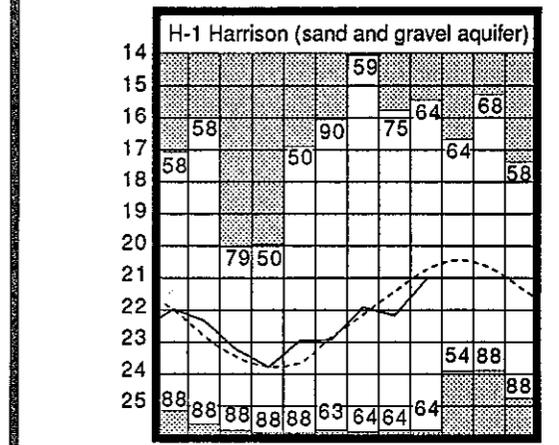
Record high and low, year of occurrence

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
					F-1	W. Rushville, Fairfield Co.
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.62	+0.23	+0.34	+1.54
Fr-10	Columbus, Franklin Co.	Gravel	41.53	+1.14	+0.56	+1.20
H-1	Harrison, Hamilton Co.	Gravel	21.06	-0.35	+1.09	+2.25
Hn-2a	Dola, Hardin Co.	Dolomite	5.54	+1.24	+0.70	+2.26
Po-1	Windham, Portage Co.	Sandstone	20.65	-0.62	+0.35	+2.55
Tu-1	Strasburg, Tuscarawas Co.	Gravel	12.16	-0.76	+1.47	+2.98

GROUND-WATER LEVELS



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990

Normal - - - - Current - - - -



# MONTHLY WATER INVENTORY REPORT FOR OHIO

April 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

(continued from front page)

third. The state average is 21.35 inches, 1.89 inches above normal. Regional averages range from 24.30 inches, 4.80 inches above normal, for the Northeast Region to 18.40 inches, 3.55 inches below normal, for the South Central Region.

## SUMMARY

Precipitation was above normal throughout most of the state but below normal in extreme southeastern Ohio. Streamflow was above normal throughout the state. Reservoir storage improved and remained at above normal levels. Ground-water levels showed mixed responses and remained below normal in the eastern half of the state. Lake Erie level rose seasonally and was 1.81 feet above the long-term April average. Water supplies are favorable throughout Ohio.

## NOTES AND COMMENTS

### STUDENTS RECEIVE AWARDS FOR WATER RESOURCES RESEARCH

Six outstanding students from around Ohio were presented the Governor's Award for Excellence in Water Resources Research at the State Science Day competition on April 17, 1993. Students who advance from local and regional science fairs are eligible to compete at the State Science Day.

Recipients of this year's awards were:

#### Grade 10-12 Category

- 1st Place - Sara White, Harding H. S., Marion  
"Draw the Right Tap"
- 2nd Place - Jennifer Weghorst, Carroll H. S., Dayton  
"Macroinvertebrates: Stream Health Indicators"
- 3rd Place - Donald Melvin, Chaminade-Julienne, Dayton  
"Water Quality: Our Planet, Our Future, Our Responsibilities"

#### Grade 7-9 Category

- 1st Place - Christopher Halfmann, Kilbourne H. S., Worthington  
"Biodegradation of LAS"
- 2nd Place - Tom Caprella, St. Charles, Lima  
"The Bacteria and Heavy Metal Content in Sewage Before and After Treatment"
- 3rd Place - John Gowan, Tuscarawas Jr. H., Zoarville  
"The Effect of Mercury on Zebra Mussel Filtration"

Congratulations to these students for their winning research projects. In addition to the Governor's Award plaques, first place winners received \$150 in U.S. Savings Bonds, second place winners received \$100 Savings Bonds and third place winners received \$50 Savings Bonds. The Savings Bonds awards were made possible by generous donations from the Ohio Water Well Association and the staff of the ODNR Division of Water. Thanks to these two groups for their support of State Science Day.

**PRECIPITATION** for April was above normal throughout most of Ohio but below normal in the extreme southeastern part of the state. The state average was 3.98 inches, 0.47 inch above normal. Regional averages ranged from 4.64 inches, 0.83 inch above normal, for the Southwest Region to 3.01 inches, 0.73 inch below normal, for the South Central Region. Dayton Municipal Airport (Montgomery County) reported the greatest amount of precipitation for the month, 6.78 inches. Other areas reporting more than six inches of precipitation during April were Eaton (Preble County), 6.14 inches and Mansfield Airport (Richland County), 6.12 inches. Marietta State Nursery (Washington County) reported the least amount of precipitation during April, 2.07 inches.

Precipitation during April fell regularly throughout the month. Most of the precipitation fell as rain with only small amounts of snow reported. Although there were several days with precipitation, only on a few days, and at scattered locations, did more than one inch fall. April started off with light showers statewide with northwestern and north-central Ohio reporting the greatest amounts of 0.5 to 1 inch. Most areas of the state received about 0.5 inch of precipitation during April 9-10, but some areas in west-central and north-central Ohio reported more than 1 inch. Storms crossing the state during April 14-16 produced the greatest amount of precipitation of around 1 inch in the western half of the state while widespread precipitation during April 19-21 was lighter and somewhat more evenly distributed. For many areas of the state, some of the heaviest precipitation fell during April 24-26. Much of Ohio received around 1 inch of precipitation with some areas in the central part of the state reporting 2 inches. The month ended as it started with light showers in many areas of the state.

Precipitation for the 1993 calendar year is above normal throughout most of the state with only the South Central Region having below normal precipitation. The state average is 13.14 inches, 1.25 inches above normal. Regional averages range from 14.13 inches, 0.55 inch above normal, for the Southwest Region to 11.87 inches, 1.67 inches above normal, for the Northwest Region. Precipitation during 1993 has averaged 12.30 inches in the South Central Region, 1.68 inches below normal.

Precipitation for the 1993 water year is above normal in the northern two-thirds of Ohio and below normal in the southern one-

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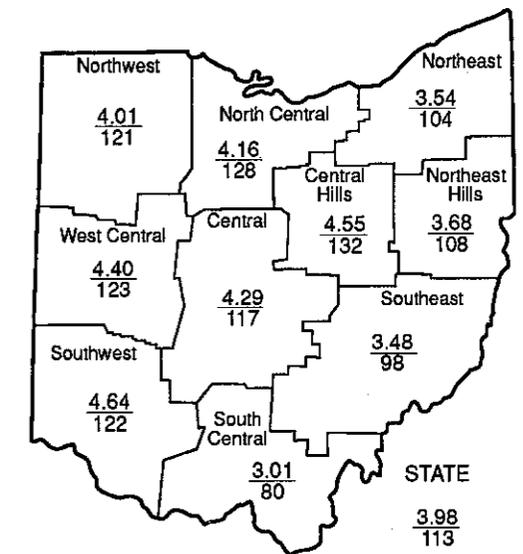
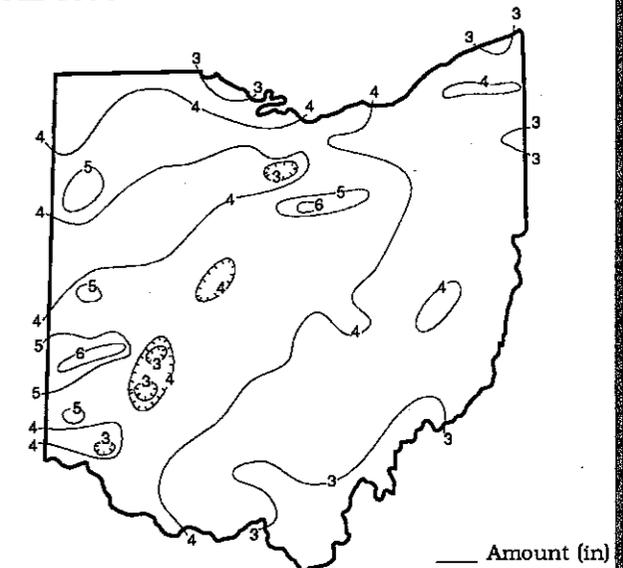
## PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+0.70	+0.32	+4.56	+9.57	+8.09	+3.7
North Central	+0.91	+1.19	+5.95	+12.21	+7.13	+4.9
Northeast	+0.15	+1.05	+4.71	+10.78	+2.58	+3.8
West Central	+0.82	-0.14	+1.55	+6.60	-2.00	+1.8
Central	+0.63	+0.69	+2.49	+6.75	-3.30	+2.1
Central Hills	+1.10	+1.39	+3.16	+6.74	-4.10	+3.6
Northeast Hills	+0.28	+1.16	+2.06	+4.06	-6.72	+1.7
Southwest	+0.83	-0.15	+0.46	+1.63	-5.58	+1.3
South Central	-0.73	-1.03	-1.99	-4.14	-12.71	-0.7
Southeast	-0.06	+0.88	+0.88	-0.22	-8.59	+0.4
State	+0.47	+0.55	+2.40	+5.40	-2.50	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To-0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought

## PRECIPITATION APRIL 1993



Average (in)  
Percent of normal

## ACKNOWLEDGMENTS

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Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

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Frances S. Buchholzer  
Director

James R. Morris  
Chief

An Equal Opportunity Employer-M/F/H

**MEAN STREAM DISCHARGE**

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	This Month		
				% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Palmsville	685	2,430	169	157	152	140
Great Miami River at Hamilton	3,630	7,784	146	112	136	136
Huron River at Milan	371	878	170	152	224	224
Killbuck Creek at Killbuck	464	1,104	146	132	171	166
Little Beaver Creek near East Liverpool	496	972	108	135	161	138
Maumee River at Waterville	6,330	13,012	136	123	192	185
Muskingum River at McConnelville	7,422	15,500	103	117	125	119
Scioto River near Prospect	567	1,119	137	122	173	190
Scioto River at Higby	5,131	11,563	164	130	148	149
Stillwater River at Pleasant Hill	503	1,062	148	108	147	151

**STREAMFLOW** during April was above normal throughout the state. April flows declined seasonally from the March flows. Flows in some north-central and northeastern Ohio drainage basins were high enough to be considered excessive.

Flows at the beginning of the month were above normal in most areas of the state, but near or slightly below normal in some western Ohio drainage basins. Flows declined in most basins during the early part of the month with many areas recording their lowest flows on April 9. Some drainage basins in the northern part of the state had their lowest flows on April 24. Streamflows increased at various times throughout the month following local precipitation. North-central Ohio had its greatest

flows during April 10-12, southwestern Ohio on April 16, and on April 26-29, the northwestern area and the eastern half of Ohio had their greatest flows. Flows at the end of the month were above normal in the eastern half of the state and below normal in the western half.

**RESERVOIR STORAGE** for water supply during April increased in the Mahoning River basin and was unchanged in the Scioto River basin. Storage remained above normal in both basins.

Reservoir storage at the end of April in the Mahoning basin index reservoirs was 105 percent of rated capacity for water supply compared with 96 percent for last month and 79 percent for April 1992. Month-end storage in the Scioto basin index reservoirs was 105 percent of rated capacity for water supply compared with the same for last month and 84 percent for April 1992.

Surface water supplies are at or near capacity throughout most of the state. Above normal streamflows have benefited both on- and off-stream reservoirs. Surface water supplies are at favorable levels statewide, a sharp contrast to levels of a year ago.

**GROUND-WATER LEVELS** during April showed mixed responses across the state, rising in areas with above normal precipitation and declining in areas with near or below normal precipitation.

Generally, net positive changes from last month's levels were less than usually observed. Most aquifers showed some improvement near the end of the month responding to some of the month's heaviest and most widespread precipitation.

Ground-water storage has improved favorably during the 1993 water year recharge season. Current levels range from one to more than five feet above the April 1992 levels. Ground-water storage continues to remain at below normal levels in the eastern half of the state where the greatest departures from normal levels were observed during the 1991 and early 1992 drought conditions. In addition, ground-water storage has fallen to slightly below normal levels in the southern part of the state where precipitation has only occurred at near or slightly below normal amounts during the current recharge season. Even with these below normal levels, ground-water supplies are adequate throughout the state.

**LAKE ERIE** level rose seasonally during April. The mean level was 573.20 feet (IGLD-1985), 0.50 foot above last month's mean level and 1.81 feet above normal. This month's level is 1.20 feet above the April 1992 level and 4.00 feet above Low Water Datum.

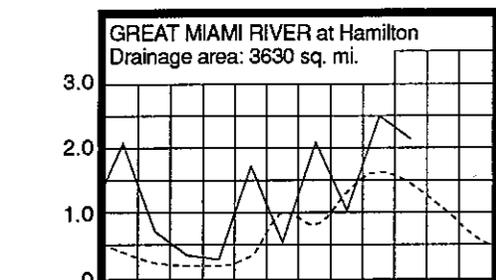
Lake Erie level is expected to remain noticeably above normal for quite some time. Lake levels are not expected to be above the record-high levels reached during the mid 1980's; however, large deviations from normal climatic conditions could sway the range of forecasted lake levels up or down during the next several months.

**GROUND-WATER LEVELS**

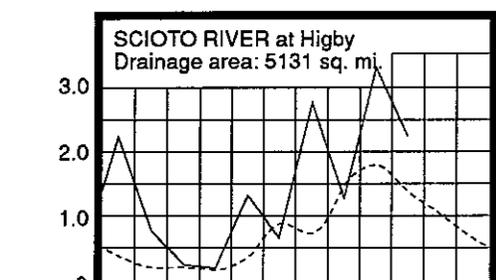
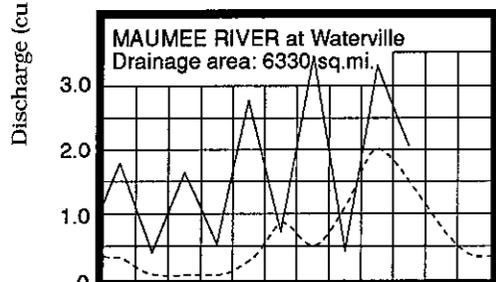
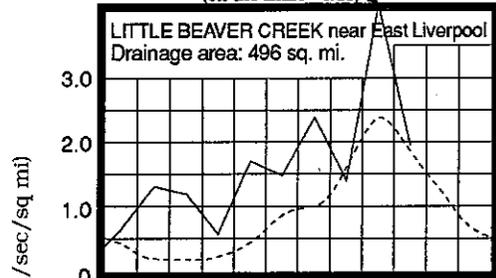
Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	13.09	-0.66	+0.35	+5.06
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.76	-0.02	-0.14	+0.99
Fr-10	Columbus, Franklin Co.	Gravel	40.90	+1.50	+0.63	+1.63
H-1	Harrison, Hamilton Co.	Gravel	21.08	-0.65	-0.02	+1.58
Hn-2a	Dola, Hardin Co.	Dolomite	5.77	+0.70	-0.23	+1.04
Po-1	Windham, Portage Co.	Sandstone	20.09	-0.57	+0.56	+2.76
Tu-1	Strasburg, Tuscarawas Co.	Gravel	11.61	-0.81	+0.55	+2.69

**MEAN STREAM DISCHARGE**



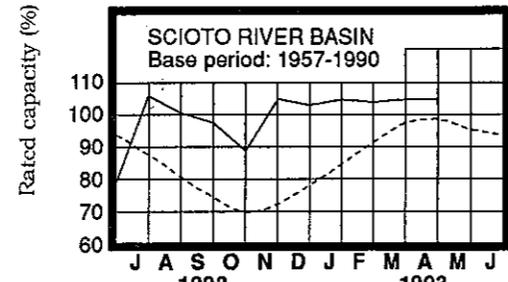
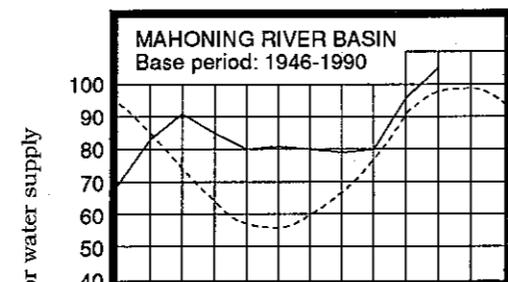
(off the chart - 4.18)



Base period for all streams: 1961-1990

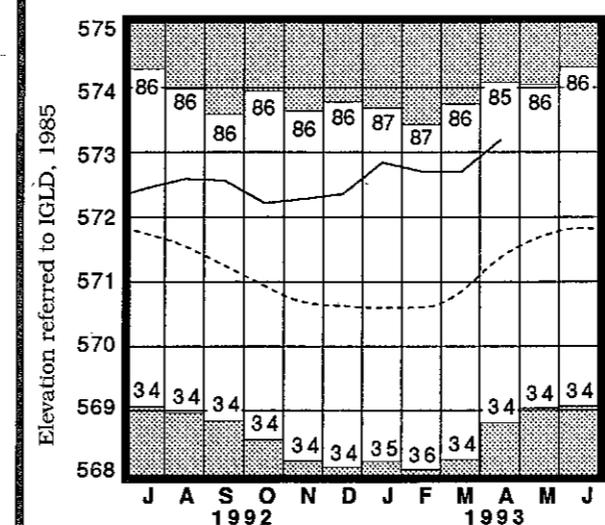
Normal - - - - Current - - - -

**RESERVOIR STORAGE FOR WATER SUPPLY**



Base period: 1946-1990 (Mahoning), 1957-1990 (Scioto)

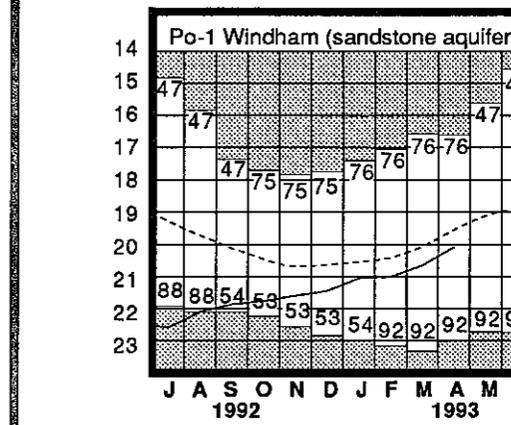
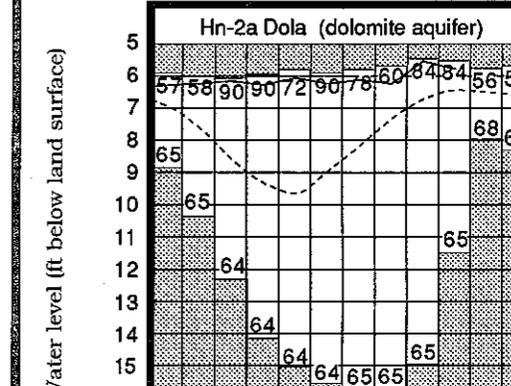
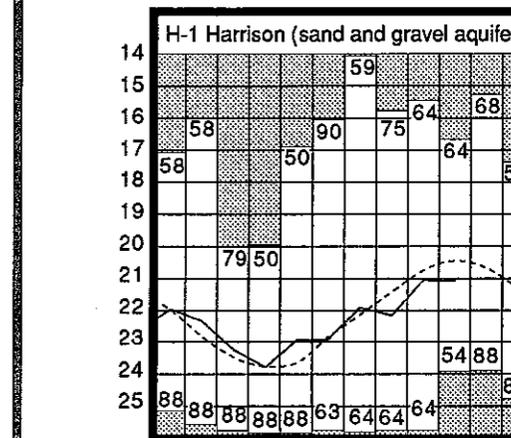
**LAKE ERIE LEVELS at Fairport**



Base period: 1900-1991  
Record high and low, year of occurrence

Normal - - - - Current - - - -

**GROUND-WATER LEVELS**



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990  
Record high and low, year of occurrence

Normal - - - - Current - - - -



# MONTHLY WATER INVENTORY REPORT FOR OHIO

May 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

## NOTES AND COMMENTS

### NEW PUBLICATION

The Division of Water announces the availability of the following new periodical:

#### "Spillway"

The purpose of this periodical is to provide general and technical information regarding dam safety and the many related topics. This publication is intended for all who own, maintain, design or rehabilitate dams, dikes or levees in Ohio. Each issue will cover topics ranging from maintenance through regulations as well as notable "news" events.

To request single copies or to be placed on the mailing list to receive this free periodical, write to: Ohio Department of Natural Resources, Division of Water, Dam Safety Section, c/o "Spillway", 1939 Fountain Square, Building E-3, Columbus, Ohio 43224-1336.

### ODNR OWNED LOW-HEAD DAM FAILS

A section of a low-head dam on the Great Miami River owned by the Division of Water failed on May 13, 1993. The Middletown Hydraulic Dam was originally built during the canal era (1850's) with additions and modifications over the years. The dam is approximately 12 feet high and 1000 yards wide. The 60-foot-long section that failed is part of the dam that was constructed after the 1913 flood washed out the left abutment. Before the breach, the pool created by the dam maintained water levels in an adjacent hydraulic canal that flows through Middletown used by industries for water supply and for stormwater discharges.

The Division of Water's Dam Safety Section is currently monitoring the dam and the erosion which is occurring downstream due to the redirected river flow through the breach. The Department is reviewing its options concerning the dam.

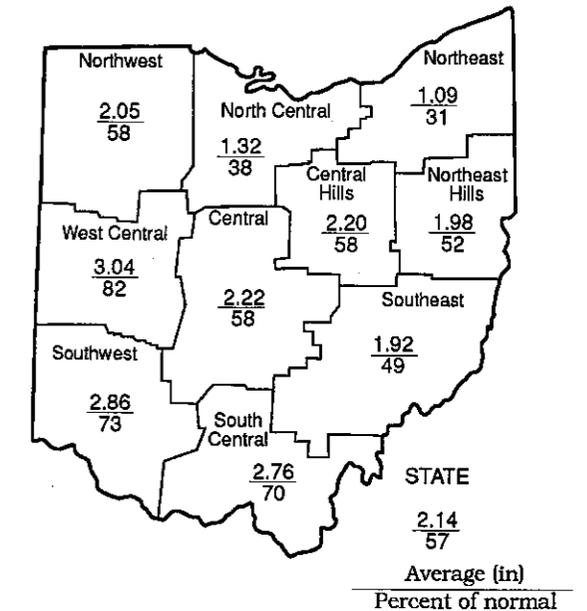
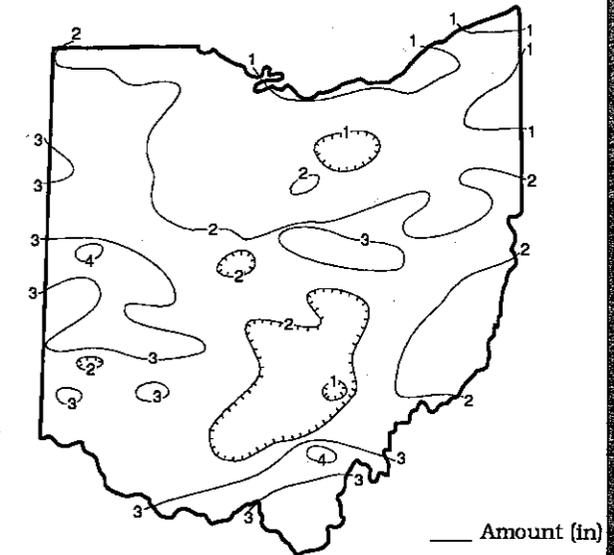
**PRECIPITATION** for May was below normal throughout Ohio. The state average was 2.14 inches, 1.61 inches below normal. This ranks as the 13th driest May for the state as a whole in 111 years of record. Regional averages ranged from 3.04 inches, 0.68 inch below normal, for the West Central Region to 1.09 inches, 2.44 inches below normal, for the Northeast Region. This was the 3rd driest May on record for both the Northeast and North Central regions. Salem Center (Meigs County) reported the greatest amount of precipitation for the month, 4.66 inches. Fort Loramie (Shelby County) reported 4.08 inches, the only other location reporting more than 4 inches of rain for May. Ashtabula (Ashtabula County) reported the least amount of precipitation during May, 0.40 inch. Several areas in northeastern and north-central Ohio reported less than 1 inch of precipitation for May.

Precipitation during May was light with most falling in the form of scattered showers. Most locations had only one or two days with more than 0.5 inch of rain. Early in the month farmers were eager for fields to dry. Crop planting was behind schedule. The fields dried during the first half of the month; however, cool temperatures and little rainfall slowed germination. Most areas of the state received rain during May 4-5 with many areas reporting around 0.5 inch, much less in some northern Ohio areas. Scattered showers were common throughout May 11-15. Most of the state received around another 0.5 inch of rain during this period, but some areas in western and southwestern Ohio reported from 1 to more than 2 inches of rain. A few light showers were around Ohio during May 18-19 and then stronger storms crossed Ohio during May 28-30. Many areas again received around 0.5 inch of rain with a few areas reporting more than 1 inch.

Precipitation for the 1993 calendar year has fallen below normal in the eastern and southern areas of Ohio but remains slightly above normal in the central and northwestern areas. The state average is 15.28 inches, 0.36 inch below normal. Regional averages range from 16.99 inches, 0.51 inch below normal, for the Southwest Region to 13.92 inches, 0.18 inch above normal, for the Northwest Region.

Precipitation for the 1993 water year is generally above normal in the northern half of Ohio and below normal in the southern half. The state average is 23.50 inches, 0.29 inch above normal. Regional averages range from 25.39 inches, 2.36 inches above normal, for the Northeast Region to 21.16 inches, 4.72 inches below normal, for the South Central Region. The 1993 water year recharge season was good for water supplies in most areas of the state.

## PRECIPITATION MAY 1993



## PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-1.49	-0.98	+0.56	+8.41	+5.54	-0.1
North Central	-2.19	-0.91	+0.64	+10.90	+5.29	+0.6
Northeast	-2.44	-1.32	+0.11	+9.30	+1.45	-0.4
West Central	-0.68	-0.81	-1.63	+6.52	-2.13	-1.4
Central	-1.59	-0.87	-1.19	+5.67	-3.45	-0.8
Central Hills	-1.57	+0.21	-0.51	+6.34	-4.30	0.0
Northeast Hills	-1.80	-0.83	-0.84	+3.15	-6.81	-1.5
Southwest	-1.06	-1.21	-2.30	+1.24	-6.92	-0.1
South Central	-1.17	-1.90	-3.96	-5.66	-11.64	-1.5
Southeast	-2.02	-1.02	-1.96	-1.07	-8.25	-1.4
State	-1.61	-0.96	-1.10	+4.48	-3.11	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To 0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought

## ACKNOWLEDGMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service: The Miami Conservancy District: U.S. Army Corps of Engineers, Muskingum Area.  
Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

George V. Vohnovich  
Governor

Frances S. Buchholzer  
Director

James R. Morris  
Chief

An Equal Opportunity Employer-M/F/H

**MEAN STREAM DISCHARGE**

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	This Month		
				% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	72	12	163	126	138
Great Miami River at Hamilton	3,630	2,978	76	106	108	139
Huron River at Milan	371	82	31	157	149	223
Killbuck Creek at Killbuck	464	490	99	146	137	170
Little Beaver Creek near East Liverpool	496	449	77	123	141	142
Maumee River at Waterville	6,330	2,530	50	136	145	185
Muskingum River at McConnelsville	7,422	8,195	84	115	117	124
Scioto River near Prospect	567	164	39	141	126	190
Scioto River at Higby	5,131	3,782	71	130	133	150
Stillwater River at Pleasant Hill	503	296	77	118	109	154

**STREAMFLOW** during May was below normal throughout the state. Flows in many drainage basins in northern Ohio were low enough to be considered deficient. May streamflows declined noticeably from the streamflows observed during April.

Flows at the beginning of the month were above normal in most areas of the state, but below normal in western and northwestern Ohio. Generally, flows declined throughout the month with slight, temporary increases noted following local precipitation. Most drainage basins recorded their greatest flows for May at the start of the month. Drainage basins in western and southwestern Ohio had their greatest flows just before mid-month following some local thunderstorms. Lowest flows for

May occurred just before the end of the month in all areas of the state. Streamflows were noticeably below normal at the end of May statewide.

**RESERVOIR STORAGE** for water supply during May declined in both the Mahoning and Scioto river basins. Storage remained above normal in the Scioto basin index reservoirs but fell to slightly below normal in the Mahoning basin index reservoirs.

Reservoir storage at the end of May in the Mahoning basin index reservoirs was 97 percent of rated capacity for water supply compared with 105 percent for last month and 77 percent for May 1992. Month-end storage in the Scioto basin index reservoirs was 99 percent of rated capacity for water supply compared with 105 percent for last month and 82 percent for May 1992. Surface-water supplies continue to remain at favorable levels in spite of the below normal precipitation received during May.

**GROUND-WATER LEVELS** during May declined in most aquifers throughout Ohio. In a few areas, levels remained rather stable as a result of receiving some delayed recharge. The below normal precipitation during May brought an abrupt end to the 1993 water year recharge season for most aquifers.

Net declines in May's ground-water levels from April's levels were greater than usually observed in most aquifers. Ground-water storage in the eastern half of Ohio remains at below normal levels and has also fallen to below normal in many aquifers in the southern part of the state. Ground-water storage ranges from near to slightly above normal elsewhere. Current levels continue to remain noticeably higher than the levels observed last year ranging up to 3.5 feet above the May 1992 levels. Even with the below normal levels, ground-water supplies are currently adequate throughout the state.

**LAKE ERIE** level declined slightly during May. The mean level was 573.10 feet (IGLD-1985), 0.10 foot below last month's mean level and 1.41 feet above normal. This month's level is 0.81 foot above the May 1992 level and 3.90 feet above Low Water Datum.

The U. S. Army Corps of Engineers reports that precipitation in the Lake Erie basin during May averaged 1.6 inches, 1.7 inches below normal. May precipitation in the entire Great Lakes basin averaged 3.2 inches, 0.2 inch above normal. Precipitation for 1993 through May in the Lake Erie basin has averaged 13.9 inches, 0.2 inch above normal. For the entire Great Lakes basin, cumulative 1993 precipitation has averaged 12.0 inches, 0.4 inch above normal.

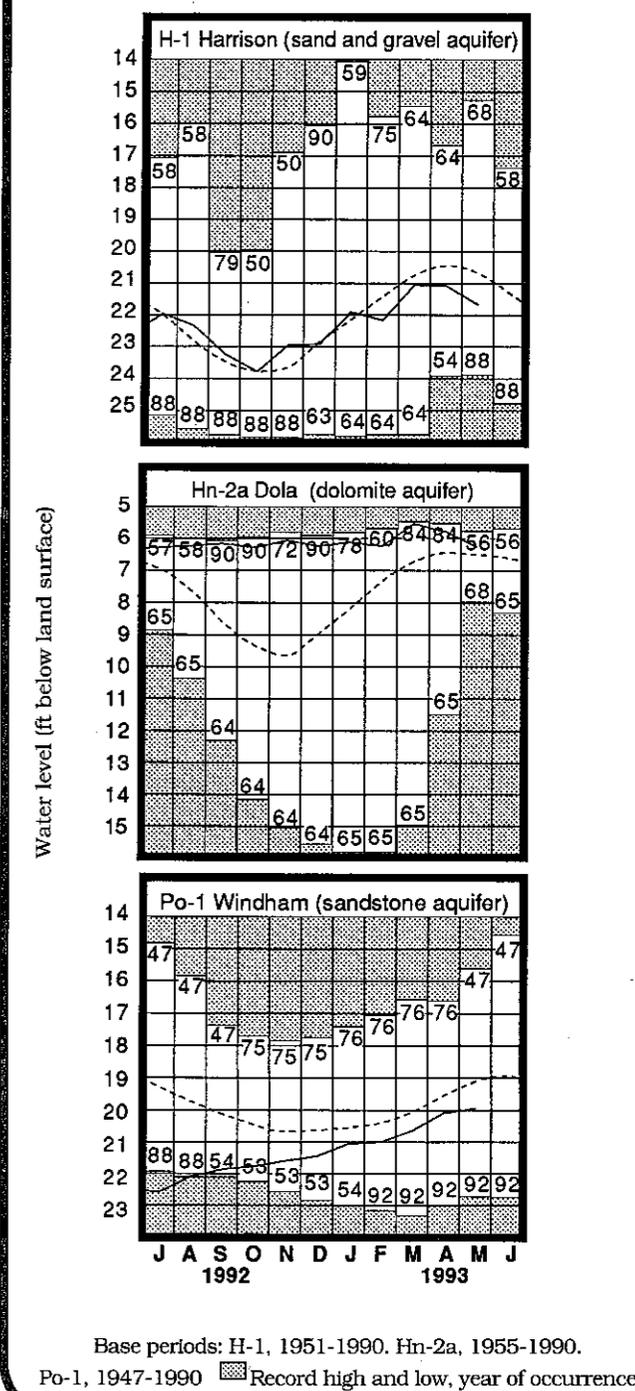
**SUMMARY**  
Precipitation was below normal throughout the State. Streamflow was below normal in all drainage basins. Reservoir storage declined but remained at near normal levels. Ground-water storage declined and is at below normal levels in eastern and southern Ohio. Lake Erie level declined and was 1.41 feet above the long-term May average. Water supplies remain adequate throughout Ohio.

**GROUND-WATER LEVELS**

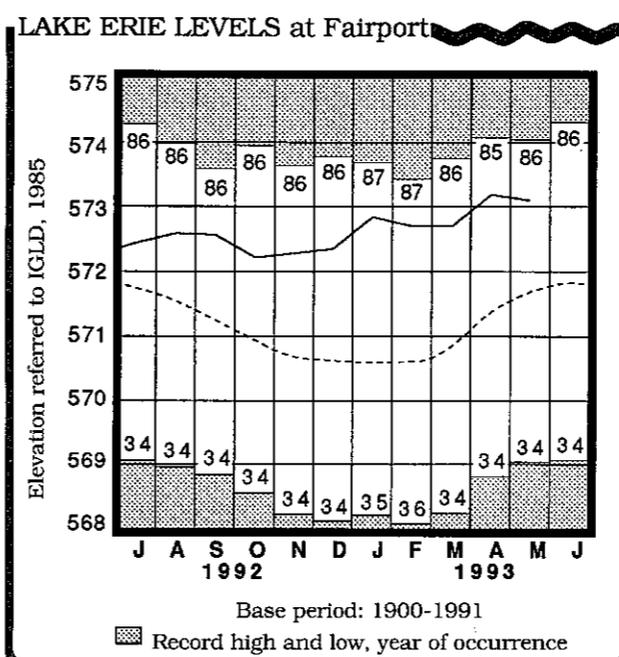
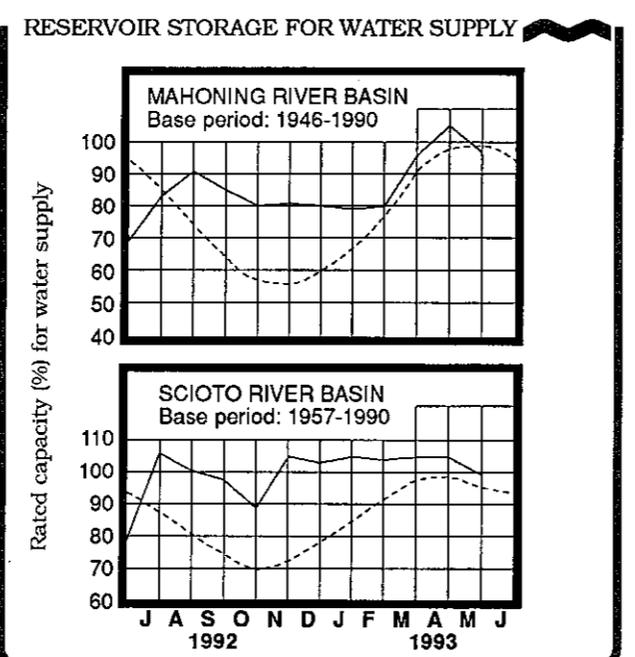
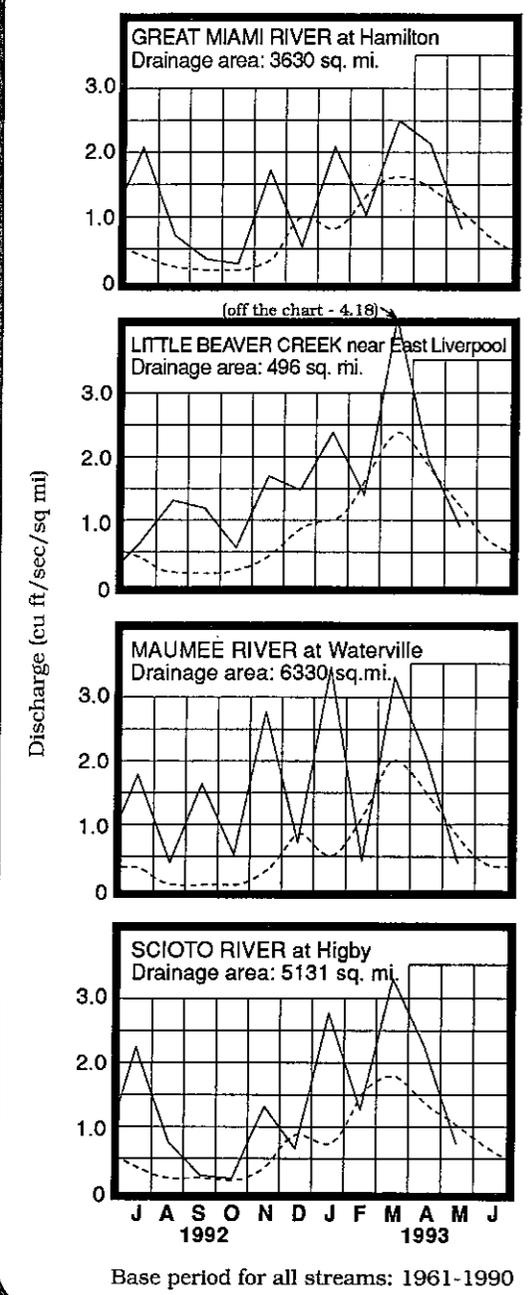
Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	14.04	-1.32	-0.95	+3.40
Fa-1	Jasper Mill, Fayette Co.	Limestone	6.97	+0.05	-0.21	+0.76
Fr-10	Columbus, Franklin Co.	Gravel	40.67	+1.96	+0.23	+1.96
H-1	Harrison, Hamilton Co.	Gravel	21.67	-0.99	-0.59	+1.10
Hn-2a	Dola, Hardin Co.	Dolomite	6.27	+0.26	-0.50	+0.27
Po-1	Windham, Portage Co.	Sandstone	19.94	-0.85	+0.15	+2.51
Tu-1	Strasburg, Tuscarawas Co.	Gravel	12.18	-1.05	-0.57	+2.15

**GROUND-WATER LEVELS**



**MEAN STREAM DISCHARGE**



Normal - - - - - Current - - - - -

Normal - - - - - Current - - - - -



# MONTHLY WATER INVENTORY REPORT FOR OHIO

June 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

(continued from front page)

Precipitation for the 1993 water year is also above normal in the northern two-thirds of Ohio and below normal in the southern one-third. The state average is 28.21 inches, 1.04 inches above normal. Regional averages range from 31.18 inches, 4.47 inches above normal, for the Northeast Region to 24.80 inches, 4.96 inches below normal, for the South Central Region.

### SUMMARY

Precipitation was above normal in most of Ohio but below normal in the South Central and Southeast regions. Streamflow was above normal in most drainage basins but below normal in the south-central and southeastern basins. Reservoir storage increased slightly and was at above normal seasonal levels. Ground-water storage declined in most aquifers and remains below normal in the eastern and southern parts of Ohio. Lake Erie level declined slightly and was 1.24 feet above the long-term June average.

### NOTES AND COMMENTS

The Division of Water announces the availability of the following report:

Assessment of Surface/Ground Water System  
and NPS Impacts in a Buried Valley

The Division of water has just completed a three-year study of the ground water/surface water interaction within the buried valley aquifer along the North Fork of the Licking River centered around St. Louisville (Licking County). The project was funded by a Non-Point Source (NPS) Implementation Grant administered by the US Environmental Protection Agency. This study identified areas susceptible to non-point source pollution within the watershed. Extensive water quality sampling and ground-water level mapping were employed as well as other investigative techniques including test drilling and aquifer pump testing.

The report includes the raw data collected, analysis of the data and recommendation of Best Management Practices for the study area. In addition, this report will serve as a model for the hydrology of other similar buried valley aquifers located in the glaciated terrain.

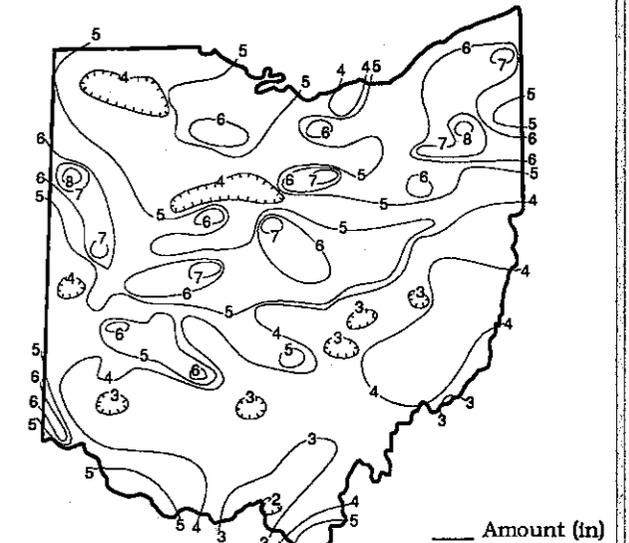
This report is available on a limited basis. The cost is \$10.00 (includes postage and handling) and can be ordered from: The Ohio Department of Natural Resources, Division of Water, Ground Water Resources Section, 1939 Fountain Square, Building E-1, Columbus, Ohio 43224-1336. Makes checks payable to the ODNR Division of Water.

### ACKNOWLEDGMENTS

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Precipitation data:  
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Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

### PRECIPITATION JUNE 1993



**PRECIPITATION** for June was above normal throughout most of the state but below normal in the South Central and Southeast regions. Scattered locations throughout Ohio also had below normal rainfall. The state average was 4.72 inches, 0.76 inch above normal. Regional averages ranged from 5.79 inches, 2.11 inches above normal, for the Northeast Region to 3.64 inches, 0.24 inch below normal, for the South Central Region. The City of Van Wert (Van Wert County) reported the greatest amount of precipitation for the month, 8.68 inches. Kirwin Dam (Portage County) reported 8.11 inches of rain in June, the only other location reporting more than 8 inches of precipitation in June. Greenup Locks and Dam (Scioto County) reported the least amount of precipitation in June, 1.98 inches.

Precipitation during June fell as showers and thunderstorms while slow-moving frontal systems passed through the state. Locally severe storms were common often containing drenching rains and high winds. Most of the state received rain during June 3-5 with total amounts of up to 1 inch common, less falling in the north-central area but more in extreme southern Ohio along the Ohio River. Severe storms rocked many areas in northern Ohio during June 7-10. Most of the northern one-third of the state received more than 2 inches of rain during this period with some locations in northeastern and extreme northwestern Ohio reporting more than 4 inches. The rest of the state received between 0.25 and 1.35 inches with the least amounts falling in central and southern Ohio. The next week of June was drier with widely scattered storms occurring during June 14-15 and on the 19th in the central and northern areas of the state, but missing most of southeastern Ohio. The rains started again during June 21-22 with many areas receiving more than 1 inch of rain. Scattered showers and thunderstorms were daily events during June 27-30 in many areas of Ohio with the greatest amounts falling in the southern half of the state. The warmer temperatures and ample rain during June has benefited crops in Ohio.

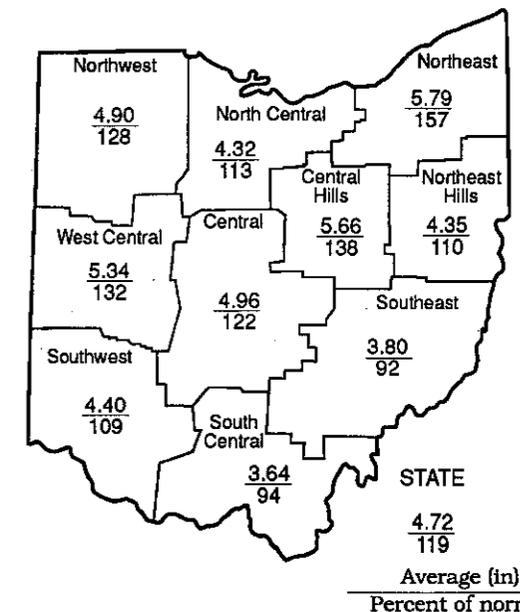
Precipitation for the 1993 calendar year is above normal in the northern two-thirds of Ohio and below normal in the southern one-third. The state average is 20.01 inches, 0.41 inch above normal. Regional averages range from 21.59 inches, 2.21 inches above normal, for the Central Hills Region to 18.47 inches, 0.86 inch above normal, for the North Central Region. The South Central Region average is 18.70 inches, 3.09 inches below normal (see Precipitation table, departure from normal, past six months column).

(continued on back)

### PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+1.07	+0.28	+1.25	+10.84	+9.34	+0.5
North Central	+0.50	-0.78	+0.86	+12.46	+8.32	-0.1
Northeast	+2.11	-0.18	+1.89	+13.30	+6.23	-0.3
West Central	+1.30	+1.44	+1.20	+7.69	+1.17	-0.9
Central	+0.90	-0.06	+1.06	+7.68	-0.16	+0.7
Central Hills	+1.55	+1.08	+2.21	+9.52	-0.02	+1.2
Northeast Hills	+0.39	-1.13	+0.12	+6.21	-3.96	+0.2
Southwest	+0.35	+0.12	-0.16	+2.37	-4.31	+0.6
South Central	-0.24	-2.14	-3.09	-5.47	-10.04	-0.9
Southeast	-0.34	-2.42	-1.38	+0.27	-7.12	-1.8
State	+0.76	-0.38	+0.41	+6.49	-0.04	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To -0.4 = Near Normal  
-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

George V. Vohnovich  
GOVERNOR

Frances S. Buchholzer  
Director

James R. Morris  
Chief

An Equal Opportunity Employer-M/F/H

**MEAN STREAM DISCHARGE**

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				This Month		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	721	277	124	134	143
Great Miami River at Hamilton	3,630	2,979	128	98	117	139
Huron River at Milan	371	276	160	119	152	224
Killbuck Creek at Killbuck	464	300	114	110	129	172
Little Beaver Creek near East Liverpool	496	566	181	97	139	149
Maumee River at Waterville	6,330	7,143	314	109	155	190
Muskingum River at McConnsville	7,422	5,444	92	87	116	127
Scioto River near Prospect	567	171	64	79	121	188
Scioto River at Higby	5,131	2,414	69	89	124	148
Stillwater River at Pleasant Hill	509	416	155	102	121	151

**STREAMFLOW** during June was above normal in most drainage basins but below normal in the south-central and southeastern areas of the state. Flows in northwest and north-central Ohio drainage basins were high enough to be considered excessive. Flows during June declined seasonally in the southern two-thirds of the state but increased in many drainage basins in the northern one-third.

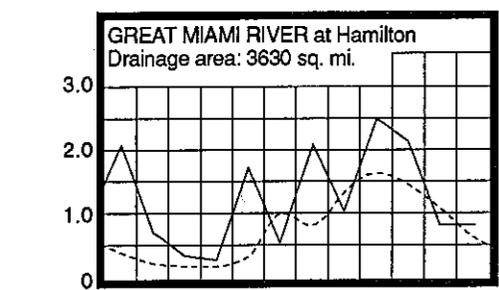
Flows at the beginning of the month were near or below normal in most areas of the state but above normal in some western and northern basins where rain at the end of May brought up streamflows. Flows during the month varied greatly, increasing noticeably following local precipitation. Greatest flows for the month occurred

during June 9-10 in the northern half of the state and just before the end of the month in the southern half. Lowest flows for the month occurred at various times generally being June 3-4 in the northern drainage basins, June 19-20 in the central basins and June 27-28 in the southern basins. Flows at the end of the month were above normal in the western two-thirds of Ohio and below normal in the eastern one-third.

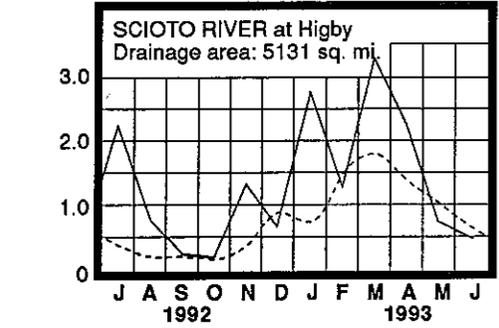
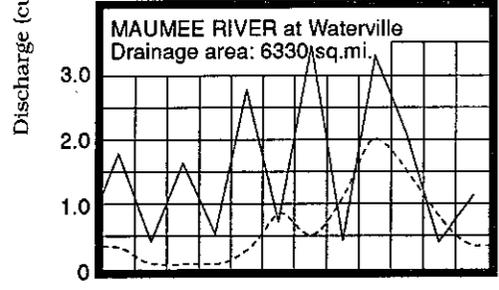
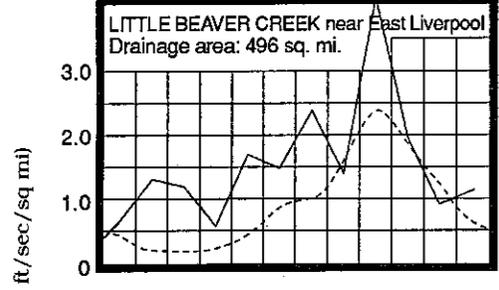
**RESERVOIR STORAGE** for water supply during June increased in both the Mahoning and Scioto river basins. Month-end storage was above normal in both basins.

Reservoir storage at the end of June in the Mahoning basin index reservoirs was 100 percent of rated capacity for water supply compared with 97 percent for last month and 69 percent for June 1992. Month-end storage in the Scioto basin index reservoirs was 101 percent of rated capacity for water supply compared with 99 percent for last month and 79 percent for June 1992. Surface water supplies continue to remain in excellent shape throughout Ohio.

**MEAN STREAM DISCHARGE**

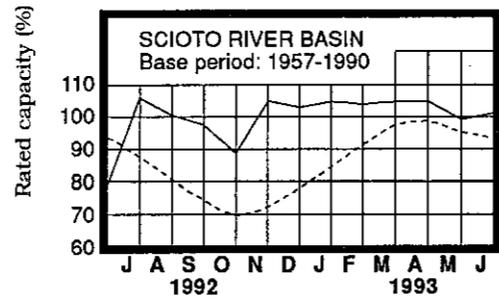
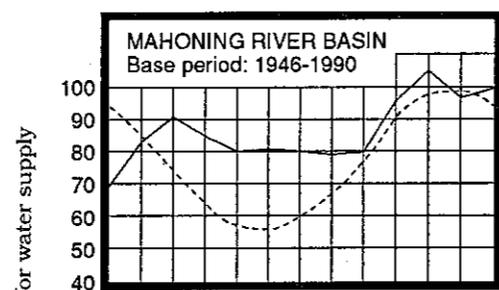


(off the chart - 4.18)



Base period for all streams: 1961-1990

**RESERVOIR STORAGE FOR WATER SUPPLY**



**GROUND-WATER LEVELS** during June declined in most aquifers throughout Ohio. A few exceptions were noted in areas that received noticeably above normal rainfall where levels were stable, especially in shallow aquifers. Net declines in ground-water levels during June from May's levels were greater than usually observed, continuing to respond to the unusually dry conditions of May.

Ground-water storage remains at below normal seasonal levels in the eastern half of Ohio and throughout most of the southern part of the state. Current levels, although below normal, are higher than last year's levels which were just beginning to recover from the drought conditions of 1991 and early 1992. Current levels generally range from 1 to 2 feet above the June 1992 levels. Ground-water supplies remain adequate throughout Ohio.

**LAKE ERIE** level declined slightly during June. The mean level was 573.06 feet (IGLD-1985), 0.04 foot below last month's mean level and 1.24 feet above normal. This month's level is 0.80 foot above the June 1992 level and 3.86 feet above Low Water Datum.

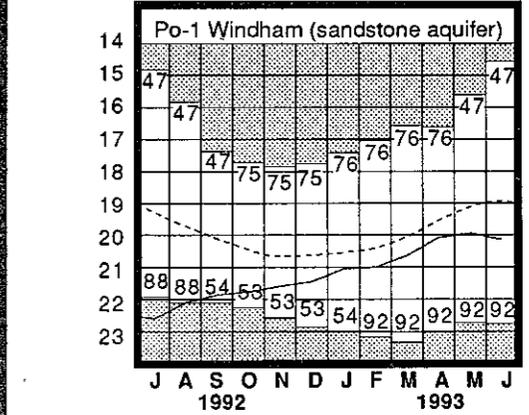
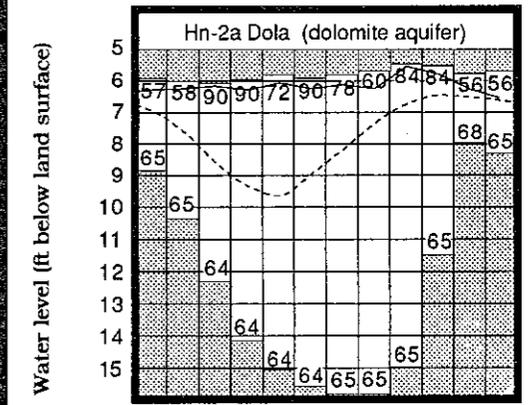
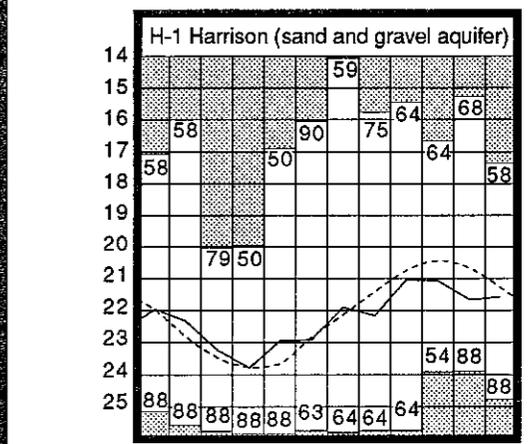
Lake Erie level has declined slightly during each of the past two months after reaching a seasonal high level during April. Current Lake Erie levels continue to remain noticeably above the long-term average, but below the record-high levels established during 1985-87. The U. S. Army Corps of Engineers predicts the Lake Erie level to remain above normal for the foreseeable future.

**GROUND-WATER LEVELS**

Based on daily lowest level in feet below land-surface datum

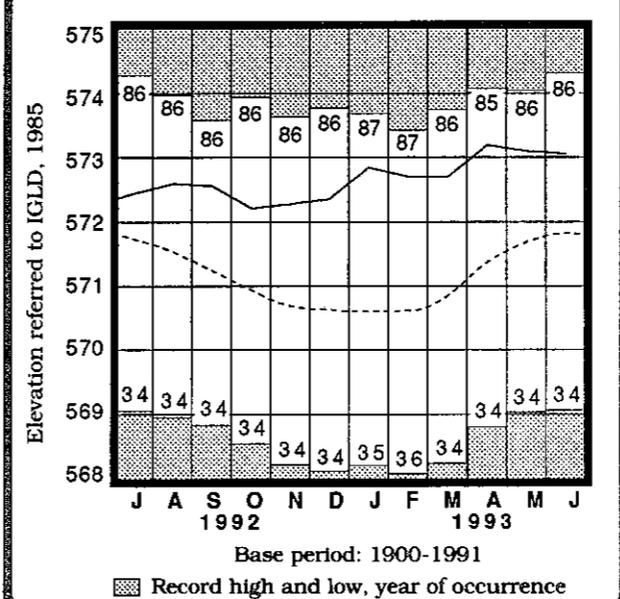
Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	16.58	-2.67	-2.54	+1.28
Fa-1	Jasper Mill, Fayette Co.	Limestone	7.51	-0.14	-0.54	+0.40
Fr-10	Columbus, Franklin Co.	Gravel	41.61	+1.44	-0.94	+1.60
H-1	Harrison, Hamilton Co.	Gravel	21.59	-0.29	+0.08	+1.07
Hn-2a	Dola, Hardin Co.	Dolomite	6.52	+0.11	-0.25	-0.15
Po-1	Windham, Portage Co.	Sandstone	20.15	-1.23	-0.21	+2.33
Tu-1	Strasburg, Tuscarawas Co.	Gravel	13.41	-1.52	-1.23	+1.54

**GROUND-WATER LEVELS**



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990

**LAKE ERIE LEVELS at Fairport**



Normal - - - - Current - - - -

Normal - - - - Current - - - -



# MONTHLY WATER INVENTORY REPORT FOR OHIO

July 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

(continued from front page)

Precipitation for the 1993 calendar year is above normal in the Central, Central Hills, Northeast, Northwest and West Central regions, but below normal elsewhere. The state average is 23.77 inches, 0.25 inch above normal. Regional averages range from 27.59 inches, 4.50 inches above normal, for the West Central Region to 20.43 inches, 0.64 inch below normal, for the North Central Region. The South Central Region average is 21.78 inches, 4.47 inches below normal.

Precipitation for the 1993 water year is above normal in the northern two-thirds of the state and below normal in the southern one-third and also in some eastern areas. The state average is 31.99 inches, 0.90 inch above normal. Regional averages range from 35.43 inches, 4.97 inches above normal, for the West Central Region to 27.88 inches, 6.34 inches below normal, for the South Central Region.

## SUMMARY

Precipitation was below normal throughout most of Ohio but above normal in the Central and West Central regions. Streamflow ranged from noticeably above normal in the western half of the state to noticeably below normal in the northeastern area. Reservoir storage declined but remained above normal. Ground-water levels declined in most aquifers and are below normal in all but some central and west-central areas. Lake Erie level declined slightly and was 1.28 feet above the long-term July average.

## NOTES AND COMMENTS

### NEW EMPLOYEE JOINS GWRs STAFF

Phillip Schoendorff has joined the Ground Water Resources Section (GWRs) as a records management officer. Phil previously worked for the ODNR Division of Reclamation as an environmental technician and the Office of General Services as a radio technician. At the GWRs, he will be assisting in maintaining the division's well log data base and computerization process on the Wang computer/optical disk system. Phil has an associate degree in general studies from Ohio University and a two-year electronics certificate from the Muskingum Perry Career Center. He is also an Eagle Scout. After work, Phil enjoys working with electronic repairs, computers, and is active in the Boy Scouts of America.

### WATER WITHDRAWAL ANNUAL REPORTS AVAILABLE

The "Ohio Water Withdrawal Facility Registration Program: 1992" annual report pamphlet is now available. This four-page report depicts on a statewide basis the amount of water withdrawn by registered facilities in 1992. It also details on a county basis the water withdrawals for each of the five reporting categories. Those categories are power, public water supply, industrial, agriculture/irrigation (includes golf courses), and miscellaneous.

Substitute H. B. 662 (1988) requires the Ohio Department of Natural Resources Division of Water to establish a Water Withdrawal Facility Registration Program. Owners of all facilities (surface and/or ground water) with the capacity to withdraw 100,000 gallons of water or more per day are required to register that facility and submit annual reports of actual withdrawals pursuant to Section 1521.16 of the Ohio Revised Code.

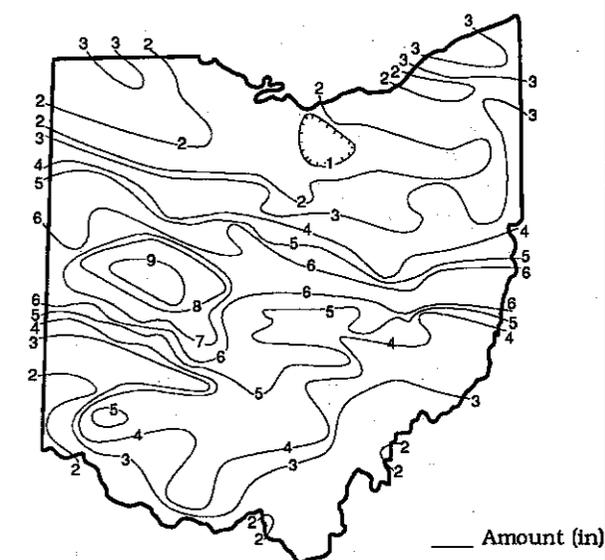
Copies of the 1992 annual report are available from the Ohio Department of Natural Resources, Division of Water, Water Resources Section, 1939 Fountain Square, Building E-3, Columbus, Ohio 43224-1336, phone (614) 265-6735.

## ACKNOWLEDGMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service: The Miami Conserancy District; U.S. Army Corps of Engineers, Muskingum Area.  
Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

## PRECIPITATION JULY 1993



**PRECIPITATION** for July was below normal throughout most of Ohio, but above normal in the Central and West Central regions and at a few other scattered locations, mainly in the east-central area. The state average was 3.77 inches, 0.15 inch below normal. Regional averages ranged from 7.01 inches, 3.30 inches above normal, for the West Central Region to 1.96 inches, 1.50 inches below normal, for the North Central Region. Urbana (Champaign County) reported the greatest amount of precipitation in July, 9.69 inches; Sidney (Shelby County) reported 9.23 inches. Findley State Park (Lorain County) reported the least amount of precipitation for the month, 0.70 inch. Several other locations in Ashland, Huron and Lorain counties also reported less than 1 inch of rain during July.

Precipitation during July fell in typical summer fashion as scattered showers and thunderstorms with locally heavy downpours. Generally, the first half of the month was wetter than the second half. Most of the state received rain during the first several days of the month. Storms on July 1 produced heavy rain in the west-central through the central sections of the state. Amounts of around 3 inches were reported at some west-central locations with minor flooding common. By the end of the 4th of July holiday weekend, most of the middle section of the state had received 2 to 4 inches of rain with amounts tapering to the south and north with northeast Ohio being the driest area. Storms were common during July 8-11 in many areas of Ohio. Once again, the middle section of the state received the most rain with 1 to more than 2 inches falling at some locations. Scattered storms continued across the southern two-thirds of the state during July 12-19 with the heaviest amounts of 1 inch or so generally reported on July 19. The last 11 days of July were much drier statewide with the storms becoming very widely scattered. Less than 0.5 inch was reported at most locations during this period. An exception was in northeastern Ohio where some locations recorded nearly half or more of their month's precipitation total during the last few days of the month. On July 28, a storm packing near hurricane force winds swept through northeastern Ohio causing considerable damage. The hardest hit areas were in Cuyahoga, Geauga and Lake counties, and to a lesser extent, Ashtabula and Trumbull counties. Agricultural crops have been adversely affected by the below normal precipitation in some north-central, northeastern and southern Ohio areas.

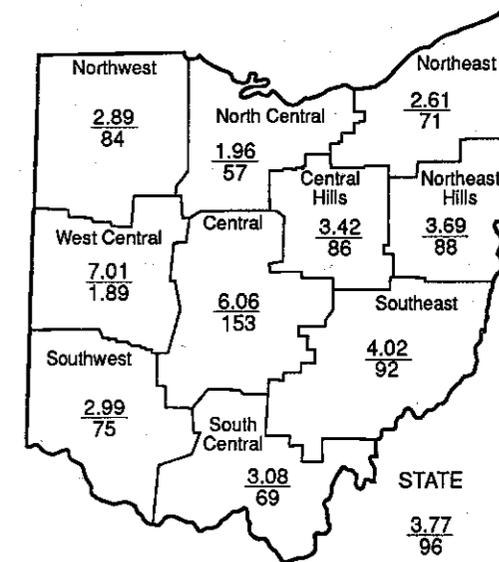
(continued on back)

## PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.55	-0.97	-0.65	+6.60	+9.78	-1.9
North Central	-1.50	-3.19	-2.00	+5.72	+8.48	-2.6
Northeast	-1.07	-1.40	-0.35	+6.54	+6.17	-2.0
West Central	+3.30	+3.92	+3.78	+4.86	+5.82	-0.7
Central	+2.10	+1.41	+2.10	+3.21	+3.81	+0.3
Central Hills	-0.57	-0.59	+0.80	+2.49	+1.65	-1.1
Northeast Hills	-0.52	-1.93	-0.77	+1.21	-3.16	-1.9
Southwest	-0.98	-1.69	-1.84	-2.59	-4.85	-0.9
South Central	-1.38	-2.79	-3.82	-3.82	-9.96	-2.5
Southeast	-0.35	-2.71	-1.83	-4.46	-10.22	-2.5
State	-0.15	-1.00	-0.45	+1.53	+1.14	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To 0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought



Average (in)  
Percent of normal



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
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Director

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Chief

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**MEAN STREAM DISCHARGE**

**STREAMFLOW** during July was above normal in most areas of the state but below normal in the north-central and northeastern drainage basins. Flows in the western half of the state were high enough to be considered excessive while in the north-central and northeast sections, flows were low enough to be considered deficient. Preliminary data indicates that the Stillwater River at Pleasant Hill gauging station recorded its greatest July mean flow and the Great Miami River at Hamilton gauging station recorded its second greatest July mean flow for their periods of record. In contrast, the Grand River near Painesville gauging station recorded its lowest mean July flow for its period of record.

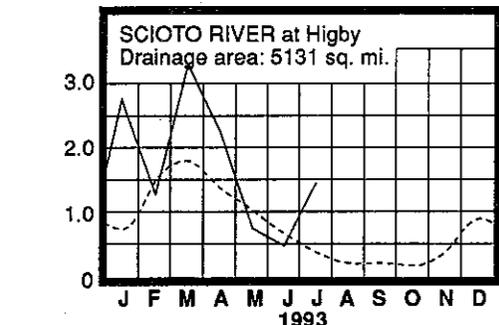
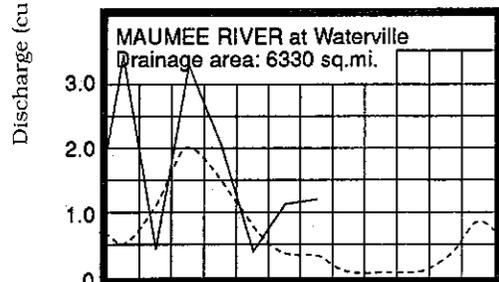
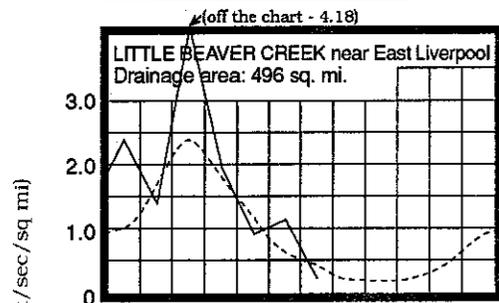
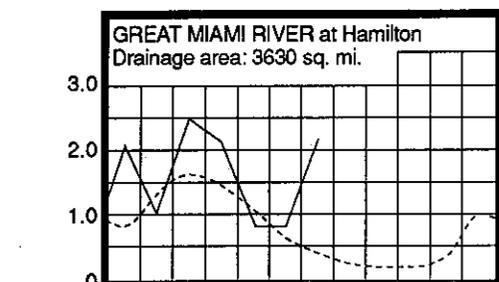
River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	This Month		
				% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	32	11	54	129	137
Great Miami River at Hamilton	3,630	7,955	543	168	127	140
Huron River at Milan	371	23	32	64	126	200
Killbuck Creek at Killbuck	464	201	110	90	109	158
Little Beaver Creek near East Liverpool	496	114	54	81	113	146
Maumee River at Waterville	6,330	7,623	339	163	127	184
Muskingum River at McConnellsville	7,422	5,228	121	91	105	121
Scioto River near Prospect	567	754	739	110	106	164
Scioto River at Higby	5,131	7,464	374	124	116	141
Stillwater River at Pleasant Hill	503	1,303	944	224	146	153

Flows at the beginning of the month were above normal in the western two-thirds of the state and below normal in the eastern one-third. Flows increased early in the month following widespread precipitation during the first few days. The greatest flows for the month in most basins occurred during July 2-5 following this precipitation. Flows declined during the remainder of the month with increases noted following local precipitation. The lowest flows for the month occurred at, or just before, the end of the month and were noticeably below normal.

**RESERVOIR STORAGE** for water supply during July decreased in both the Mahoning and Scioto river basins. Storage remained above normal in both basins.

Reservoir storage at the end of July in the Mahoning basin index reservoirs was 89 percent of rated capacity for water supply compared with 100 percent for last month and 83 percent for July 1992. Month-end storage in the Scioto basin index reservoirs was 99 percent of rated capacity for water supply compared with 101 percent for last month and 106 percent for July 1992. Surface water supplies remain adequate throughout the state.

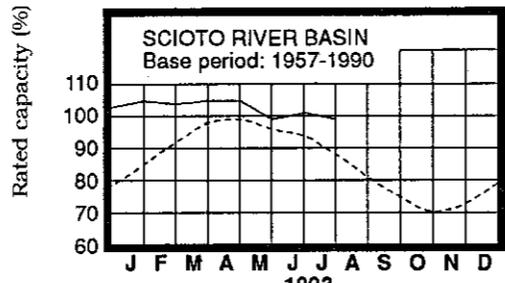
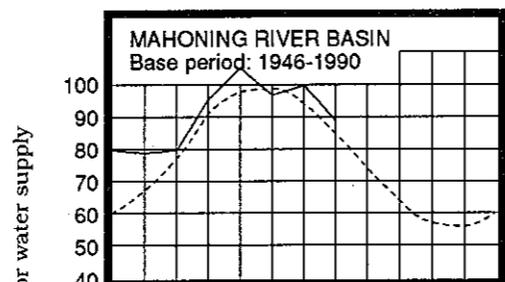
**MEAN STREAM DISCHARGE**



Base period for all streams: 1961-1990

Normal - - - - Current - - - -

**RESERVOIR STORAGE FOR WATER SUPPLY**



Normal - - - - Current - - - -

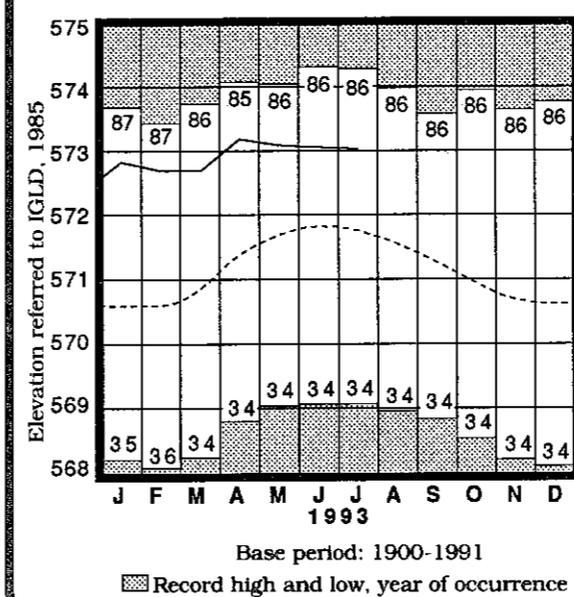
**GROUND-WATER LEVELS** during July declined in most aquifers throughout Ohio. A few exceptions were noted in some west-central areas where levels rose slightly in response to above normal precipitation during the past two months. Generally, ground-water levels declined throughout July in most aquifers; in shallow sand and gravel aquifers adjacent to streams in central and west-central Ohio levels rose early in the month and then declined until the month's end. Net ground-water level declines during July were near the expected amounts.

Ground-water storage is at below normal levels in most of Ohio with only some aquifers in central and west-central Ohio being at above normal levels. Current ground-water levels range from nearly the same to more than 2 feet above the levels of July 1992. Ground-water supplies remain adequate throughout Ohio, but continued below normal precipitation will accelerate the seasonal decline until the recharge season begins.

**LAKE ERIE** level declined slightly during July. The mean level was 573.03 feet (IGLD-1985), 0.03 foot below last month's mean level and 1.28 feet above normal. This month's level is 0.59 foot above the July 1992 level and 3.83 feet above Low Water Datum.

The U. S. Army Corps of Engineers reports that precipitation during July in the Lake Erie basin averaged 3.0 inches, 0.3 inch below normal. For the entire Great Lakes basin, July precipitation averaged 3.5 inches, 0.4 inch above normal. Cumulative precipitation for 1993 through July in the Lake Erie basin averages 21.4 inches, 1.0 inch above normal; the entire Great Lakes basin averages 19.7 inches, 1.8 inches above normal.

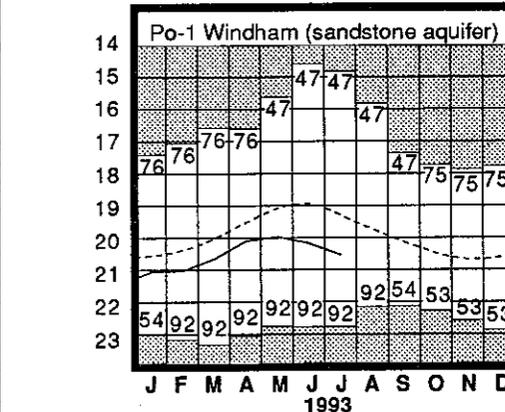
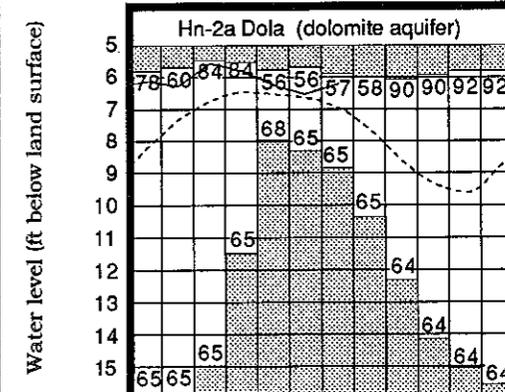
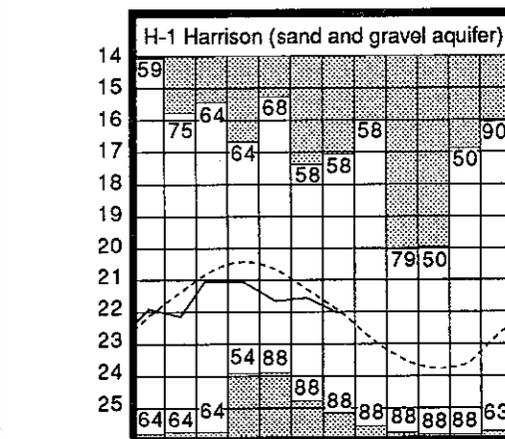
**LAKE ERIE LEVELS at Fairport**



**GROUND-WATER LEVELS**  
Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	17.80	-2.48	-1.02	-0.15
Fa-1	Jasper Mill, Fayette Co.	Limestone	7.86	-0.06	-0.35	-0.24
Fr-10	Columbus, Franklin Co.	Gravel	42.20	+1.26	-0.59	+1.31
H-1	Harrison, Hamilton Co.	Gravel	22.03	-0.07	-0.44	-0.13
Hn-2a	Dola, Hardin Co.	Dolomite	6.21	+0.74	+0.31	+0.06
Po-1	Windham, Portage Co.	Sandstone	20.52	-1.23	-0.37	+2.07
Tu-1	Strasburg, Tuscarawas Co.	Gravel	14.10	-1.58	-0.69	+1.06

**GROUND-WATER LEVELS**



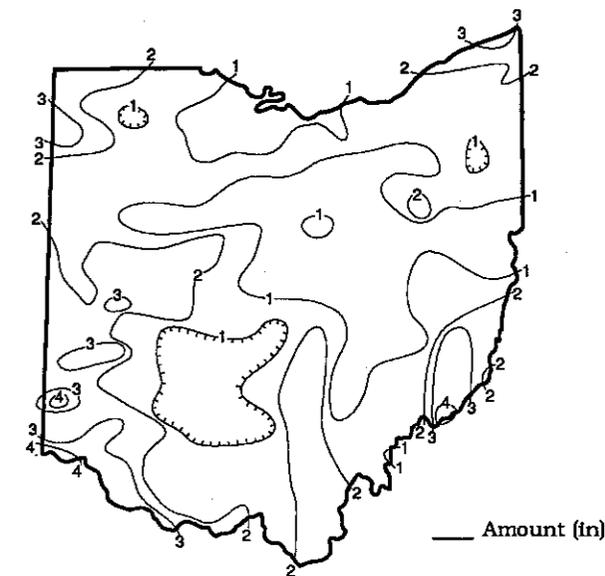
Normal - - - - Current - - - -  
Record high and low, year of occurrence



# MONTHLY WATER INVENTORY REPORT FOR OHIO

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

## PRECIPITATION AUGUST 1993



**PRECIPITATION** for August was noticeably below normal across Ohio with only a few locations, mainly in the southwest area, having above normal precipitation. The state average was 1.52 inches, 1.96 inches below normal. This ranks as the fourth driest August for the state as a whole in 111 years of record. Regional averages ranged from 2.60 inches, 0.87 inch below normal, for the Southwest Region to 0.72 inch, 2.51 inches below normal, for the North Central Region. This was the second driest August on record for both the North Central and Central Hills regions. Marietta State Nursery (Washington County) reported the greatest amount of precipitation for the month, 4.88 inches. Dover Dam (Tuscarawas County) reported the least amount, only 0.16 inch.

August was markedly dry across most of Ohio. Scattered showers and thunderstorms were very spotty, with no major widespread storms. Also, above normal temperatures placed additional stress on agricultural crops. Some rain did fall during every week of the month, but weekly rainfall totals at most locations ranged from only 0.1 to 0.7 inch. A few exceptions were noted, especially in southwestern Ohio, where weekly precipitation totals ranged from 1 to more than 2 inches at some locations during 1 or more weeks of the month. Some urban flooding was reported in Hamilton County following local storms on August 15-16.

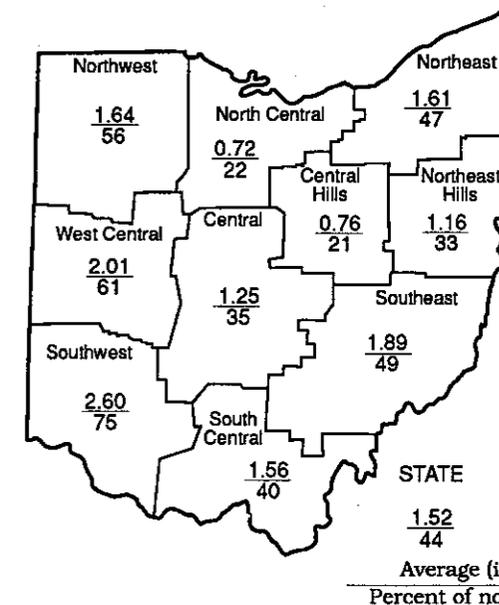
Precipitation for the 1993 calendar year is below normal throughout most of Ohio but above normal in the Central and West Central regions. The state average is 25.22 inches, 1.78 inches below normal. Regional averages range from 29.49 inches, 3.10 inches above normal, for the West Central Region to 20.97 inches, 3.33 inches below normal, for the North Central Region.

Precipitation for the 1993 water year is below normal in the southern and eastern areas of the state and above normal elsewhere. The state average is 33.44 inches, 1.13 inches below normal. Regional averages range from 37.33 inches, 3.57 inches above normal, for the West Central Region to 29.41 inches, 8.70 inches below normal, for the South Central Region.

## PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-1.29	-0.77	-1.75	+5.12	+7.82	-3.2
North Central	-2.51	-3.51	-4.42	+2.08	+5.92	-4.0
Northeast	-1.79	-0.75	-2.07	+2.98	+5.07	-3.3
West Central	-1.29	+3.31	+2.50	+3.34	+5.46	-2.3
Central	-2.30	+0.70	-0.17	+0.69	+2.59	-1.8
Central Hills	-2.90	-1.92	-1.71	-0.45	-0.66	-3.0
Northeast Hills	-2.36	-2.49	-3.32	-2.31	-4.10	-2.9
Southwest	-0.87	-1.50	-2.71	-3.46	-5.98	-1.1
South Central	-2.33	-3.95	-5.85	-9.83	-12.18	-3.2
Southeast	-1.95	-2.64	-3.66	-5.73	-8.33	-3.4
State	-1.96	-1.35	-2.31	-0.75	-0.43	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To 0.4 = Near Normal  
-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought



## SUMMARY

Precipitation was noticeably below normal throughout most of the state. August 1993 ranks as the fourth driest August on record. Streamflow was noticeably below normal in all drainage basins except those in the southwestern part of the state. Reservoir storage declined but remained at slightly above normal levels. Ground-water storage declined and is at below normal levels in most areas of the state. Lake Erie level declined 0.36 foot but continues to remain above the long-term average. Above normal temperatures and below normal precipitation have adversely affected agricultural crops, but water supplies remain adequate statewide.

## NOTES AND COMMENTS

### THE OHIO PARKS AND NATURAL RESOURCES BOND ISSUE (STATE ISSUE #1)

If approved by voters this November 2, State Issue #1 would create the Ohio Parks and Natural Resources Fund, a stable, long-term source of assistance for parks and outdoor recreation at both the state and local levels. Issue #1 was proposed by Governor George V. Voinovich and, with strong bipartisan support of the state's legislative leaders, was placed on the November 2 ballot by the Ohio General Assembly. The Ohio Chamber of Commerce and many other business, labor, civic, environmental and outdoor recreation groups have endorsed Issue #1.

Issue #1 would authorize the State of Ohio to issue bonds to finance capital improvements for state and local parks and recreation areas, preserve Ohio's natural areas and habitats, and promote health and safety through flood control, pollution prevention and water quality improvement. The state would be able to issue up to \$50 million in bonds annually, with a maximum of \$200 million in bonds outstanding at any time. Issue #1 will not raise taxes. Issue #1 is a bond issue, to be repaid with existing state revenues. According to state budget officials, the cost of paying off these bonds is easily affordable within Ohio's existing tax base.

### Issue #1 will:

- Protect and improve our parks, forests and recreation areas by repairing, restoring and modernizing these aging facilities.
- Protect our precious water resources by addressing the problems of erosion, pollution and agricultural runoff.
- Protect Ohioans' health and safety by rehabilitating state-owned dams, upgrading state-owned water-supply and wastewater systems, and providing technical flood information.
- Protect Ohio's natural resources and unique habitats by providing geological information for use in wise land use decision making and obtaining available lands to preserve unique natural areas, outstanding examples of Ohio's natural heritage and scenic rivers.
- Improve Ohio's local parks and recreation facilities by making at least \$40 million in state matching grants available to local Ohio communities through a competitive program requiring only 25 percent in local matching funds.

## ACKNOWLEDGMENTS

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Precipitation data:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.  
Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

George V. Voinovich  
GOVERNOR

Frances S. Buchholzer  
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James R. Morris  
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An Equal Opportunity Employer-M/F/H

MEAN STREAM DISCHARGE

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	This Month		
				% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	30	27	69	128	131
Great Miami River at Hamilton	3,630	1,148	124	232	130	136
Huron River at Milan	371	14	29	89	141	189
Killbuck Creek at Killbuck	464	58	45	83	124	147
Little Beaver Creek near East Liverpool	496	48	46	109	112	136
Maumee River at Waterville	6,330	499	75	276	149	181
Muskingum River at McConnelsville	7,422	1,339	51	91	106	113
Scioto River near Prospect	567	38	93	175	121	154
Scioto River at Higby	5,131	728	62	154	123	135
Stillwater River at Pleasant Hill	503	61	104	350	144	149

**STREAMFLOW** during August was noticeably below normal throughout most of the state. Some drainage basins in southwestern Ohio had above normal flows, still responding early in the month to the excessive local precipitation that fell during July in western Ohio. Flows in the remainder of the state were low enough to be considered deficient.

Flows at the beginning of the month were below normal in most drainage basins, but slightly above normal in some basins in the western part of the state. Greatest flows for August occurred at the beginning of the month throughout most of Ohio; a few basins in northern Ohio had their greatest flows on August 3-4 following some local precipitation. Generally, flows declined steadily throughout the month reflecting the below normal precipitation. Almost all drainage basins had their lowest flows for August on the last day of the month. At the end of the month, streamflows were noticeably below normal statewide.

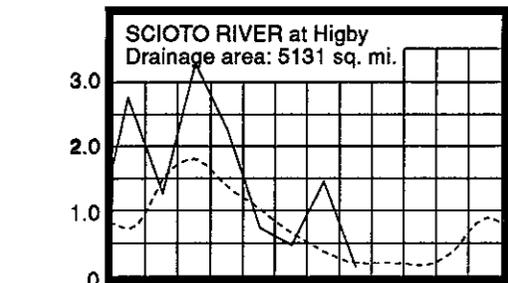
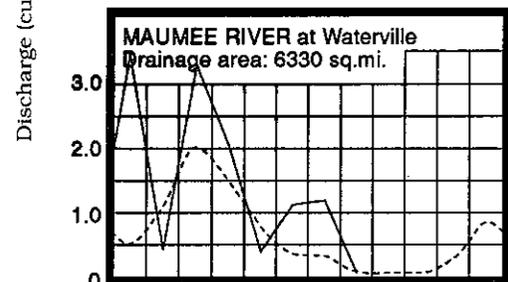
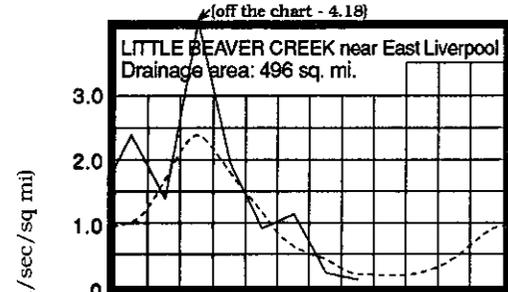
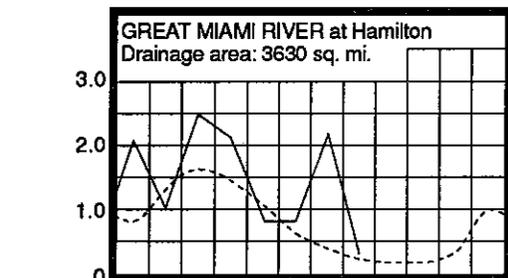
**RESERVOIR STORAGE** for water supply during August declined in both the Mahoning and Scioto river basins. Storage remained at slightly above normal seasonal levels in both basins.

Reservoir storage at the end of August in the Mahoning basin index reservoirs was 77 percent of rated capacity for water supply compared with 89 percent for last month and 91 percent for August 1992. Month-end storage in the Scioto basin index reservoirs was 87 percent of rated capacity for water supply compared with 99 percent for last month and 101 percent for August 1992.

Surface-water supplies remain in good shape throughout the state. Storage in both on- and off-stream reservoirs ranges from slightly below to slightly above normal seasonal levels.

Storage in both on- and off-stream reservoirs ranges from slightly below to slightly above normal seasonal levels.

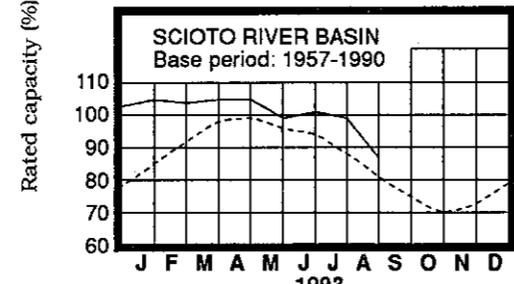
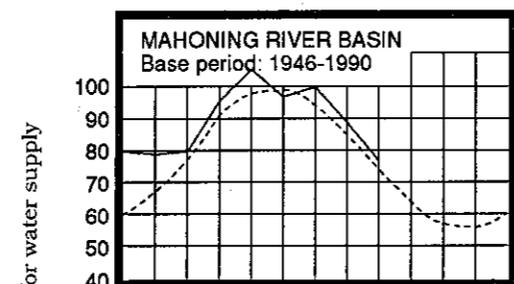
MEAN STREAM DISCHARGE



Base period for all streams: 1961-1990

Normal - - - - Current - - - -

RESERVOIR STORAGE FOR WATER SUPPLY



**GROUND-WATER LEVELS** during August declined in all of Ohio's aquifers. Net declines during August were greater than usually observed in most aquifers, being the most pronounced in shallow sand and gravel aquifers. The noticeably below normal precipitation that fell during August and much of July in many areas of Ohio has resulted in an increased rate of decline in ground-water levels. Ground-water levels are expected to continue to decline until soil moisture is replenished and excess moisture is available as recharge, usually beginning in late autumn.

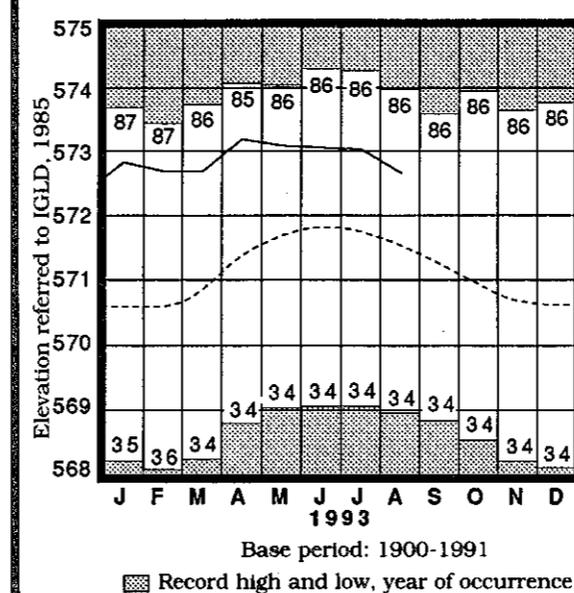
Ground-water storage is at below normal seasonal levels in most areas of the state with only a few exceptions of above normal levels occurring in western Ohio. Current levels range from about 1 foot above normal to nearly 3 feet below normal across the state. Index observation well Tu-1, reflecting ground-water storage in sand and gravel aquifers in eastern and northeastern Ohio, reached a record-low level for August.

Current ground-water levels are lower than the August 1992 levels. Last year, ground-water storage was improving following record-setting precipitation in July 1992. Even though ground-water levels are below normal and lower than last year, ground-water storage appears to be adequate throughout the state. As stated above, ground-water levels are expected to continue to decline for another two or three months; hence, water-supply managers using ground water as their source should monitor their situations from now through the recharge season.

**LAKE ERIE** level declined during August. The mean level was 572.67 feet (IGLD-1985), 0.36 foot below last month's mean level and 1.11 feet above normal. This month's level is 0.07 foot above the August 1992 level and 3.47 feet above Low Water Datum.

Lake Erie has apparently started its normal annual decline. The lake level has declined for the past four months, but the August decline was the only significant amount. With normal climatic conditions throughout the entire Great Lakes basin, the level of Lake Erie would be expected to continue to decline through late winter 1994, but still remain above normal according to the U. S. Army Corps of Engineers.

LAKE ERIE LEVELS at Fairport



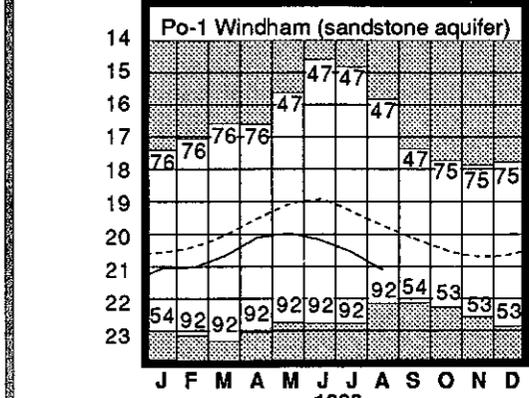
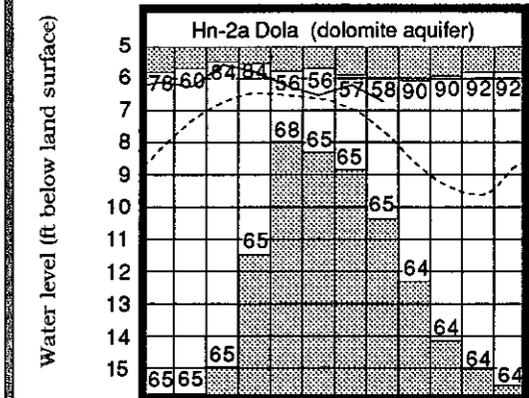
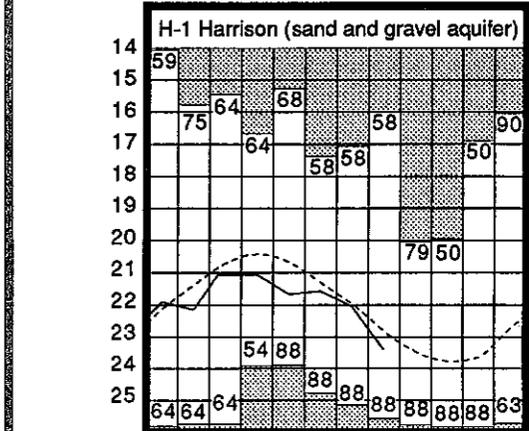
Normal - - - - Current - - - -

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	18.52	-2.73	-0.92	-3.94
Fa-1	Jasper Mill, Fayette Co.	Limestone	9.02	-0.74	-1.16	-1.74
Fr-10	Columbus, Franklin Co.	Gravel	42.93	+1.09	-0.73	-0.52
H-1	Harrison, Hamilton Co.	Gravel	23.37	-0.56	-1.34	-1.08
Hn-2a	Dola, Hardin Co.	Dolomite	6.72	+0.94	-0.51	-0.48
Po-1	Windham, Portage Co.	Sandstone	21.10	-1.38	-0.58	+0.94
Tu-1	Strasburg, Tuscarawas Co.	Gravel	15.10	-2.01	-1.00	-0.70

GROUND-WATER LEVELS



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990. Record high and low, year of occurrence

Normal - - - - Current - - - -



# MONTHLY WATER INVENTORY REPORT FOR OHIO

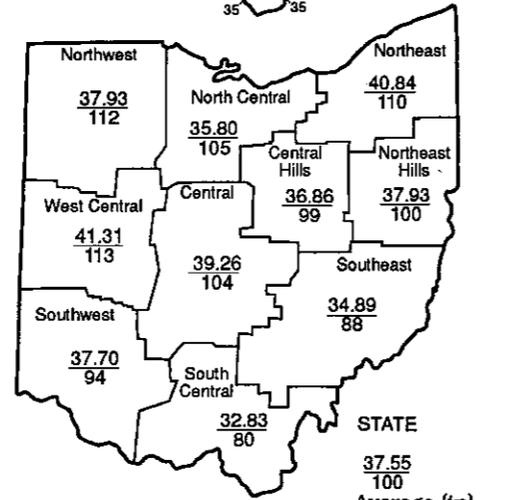
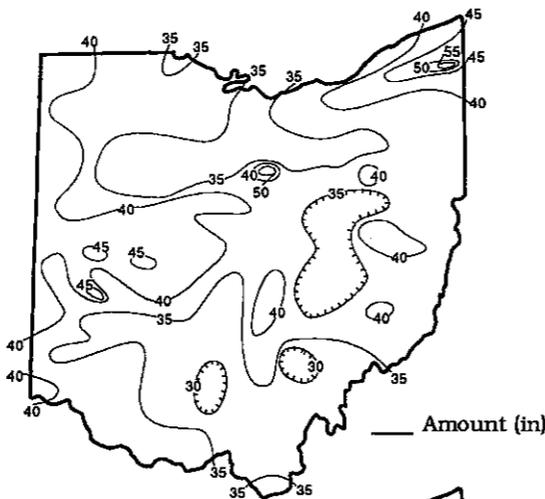
September 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

(continued from front page)  
year, 56.50 inches. Nelsonville (Athens County) reported the least amount, 28.83 inches. An isohyetal map and regional averages with percentages of normal precipitation for the 1993 water year appear below.

Precipitation during the 1993 water year was generally above normal during the first six months and below normal during the second six months. The water year started off with below normal precipitation in October followed with noticeably above normal precipitation during November, the sixth wettest November on record. December's precipitation was below normal in most of the state, but precipitation in January through April was above normal, a benefit to water supplies. May was dry statewide and was the third driest on record. Precipitation was above normal in June and the first half of July, but then drought-like conditions began to develop. August was the fourth driest on record. Above normal precipitation during September eased the drought conditions. For the water year, the southern one-third of the state was the driest.

### TOTAL PRECIPITATION 1993 WATER YEAR



### SUMMARY

Precipitation during September was above normal throughout most of Ohio, but below normal in some southern areas of the state. Streamflow was above normal in western Ohio and below normal in central and eastern Ohio. Reservoir storage declined but remained above normal. Ground-water storage declined and is noticeably below normal in the eastern half of the state and near to slightly below normal in the western half. Lake Erie level declined 0.36 foot and was 1.05 feet above the long-term September average.

Precipitation for the 1993 water year was generally above normal in the northern half of the state and below normal in the southern half. Surface water supplies were consistently at above normal levels while ground-water supplies were generally at below normal levels.

**PRECIPITATION** for September was above normal throughout much of Ohio, but below normal in some south-central and southwestern areas. The state average was 4.02 inches, 1.01 inches above normal. Regional averages ranged from 5.20 inches, 2.02 inches above normal, for the Northeast Region to 3.02 inches, 0.07 inch below normal, for the Southwest Region. Dorset (Ashtabula County) reported the greatest amount of precipitation for the month, 8.63 inches; Andover, also in Ashtabula County, reported 8.27 inches. Sedalia (Madison County) reported the least amount of precipitation in September, 1.22 inches. A few other areas in the southern half of the state also reported less than 2 inches of rain in September.

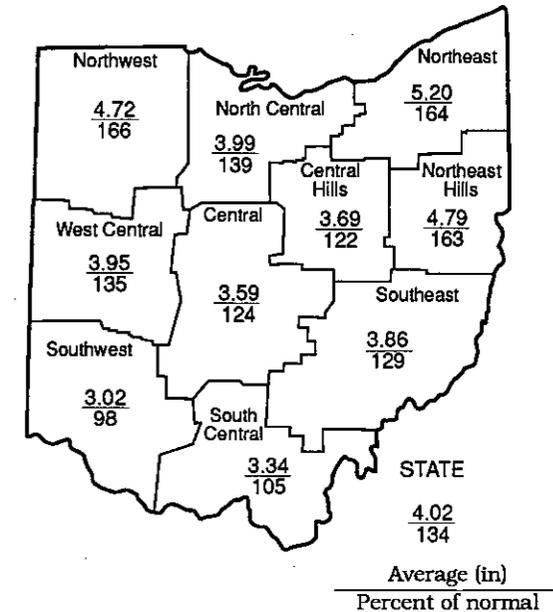
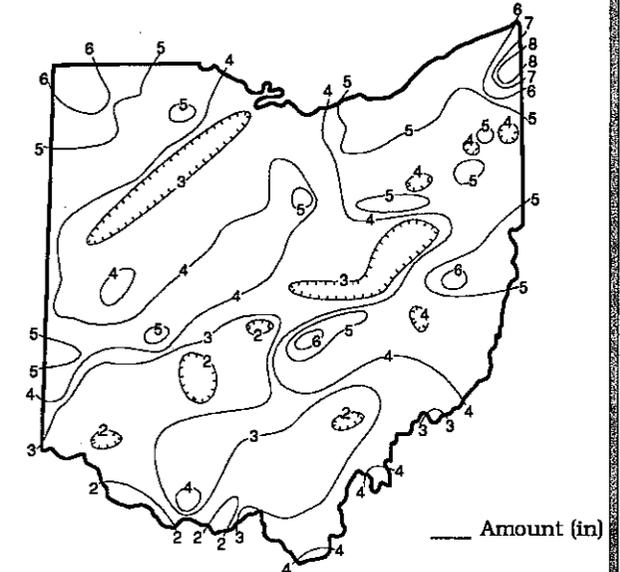
Most of the precipitation during September fell during the first five days and the last five days of the month. Storms during September 2-3 were widespread and generally produced the greatest amount of rain for many areas with amounts of 1 to more than 2 inches common; portions of Fairfield, Licking and Perry counties recorded 4 to nearly 6 inches. The middle two weeks of the month were rather dry with precipitation totals each week under 0.5 inch; a few locations received 0.5 to 1 inch on September 14-15. Precipitation was widespread during September 25-30. Storms during September 25-26 produced 1 to more than 2 inches of rain in the northern half of the state tapering to around 0.5 inch in southern Ohio. Some areas in northeastern Ohio received more than 1 inch of rain on September 29-30.

Precipitation for the 1993 calendar year is below normal in the southern, eastern and north-central areas of Ohio and above normal in the central, western and northeastern areas. The state average is 29.32 inches, 0.68 inch below normal. Regional averages range from 33.47 inches, 4.15 inches above normal, for the West Central Region to 25.21 inches, 1.97 inches below normal, for the North Central Region. The South Central Region's average is 26.73 inches, 6.59 inches below normal.

Precipitation for the 1993 water year was generally above normal in the northern half of Ohio and below normal in the southern half. The state average was 37.55 inches, 0.02 inch below normal. Regional averages ranged from 41.31 inches, 4.62 inches above normal, for the West Central Region to 32.83 inches, 8.46 inches below normal, for the South Central Region (see Precipitation table, departure from normal, past 12 months column). Andover (Ashtabula County) reported the greatest amount of precipitation for the water

(continued on back)

### PRECIPITATION SEPTEMBER 1993



### PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+1.87	+0.18	+0.44	+4.11	+10.87	-2.4
North Central	+1.11	-2.69	-3.61	+1.77	+7.38	-3.3
Northeast	+2.02	-0.93	-0.80	+3.87	+7.98	-0.7
West Central	+1.02	+3.06	+4.43	+4.62	+7.27	-1.3
Central	+0.70	+0.35	+0.11	+1.65	+3.28	-1.3
Central Hills	+0.66	-2.61	-2.05	-0.54	-0.30	-2.2
Northeast Hills	+1.85	-0.36	-1.41	-0.10	-1.77	-1.4
Southwest	-0.07	-1.81	-1.63	-2.57	-5.16	-0.1
South Central	+0.16	-3.47	-5.63	-8.46	-12.87	-2.8
Southeast	+0.87	-1.49	-4.13	-4.70	-8.06	-2.8
State	+1.02	-0.97	-1.42	-0.02	+0.88	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
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Lake Erie level data:  
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Palmer Drought Severity Index:  
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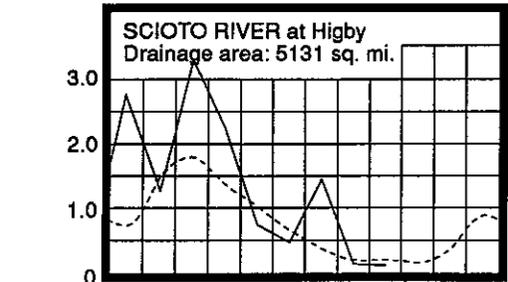
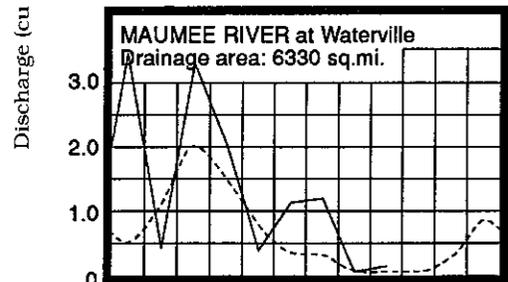
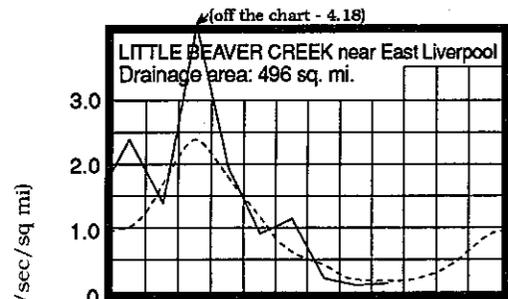
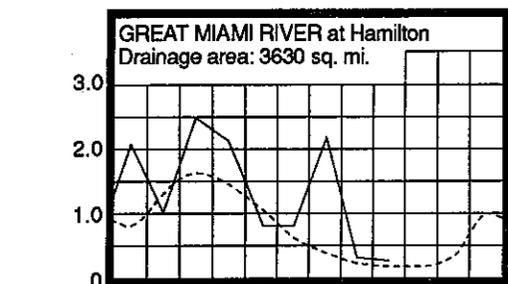
James R. Morris  
Chief

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**MEAN STREAM DISCHARGE**

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
				This Month		
Grand River near Painesville	685	34	15	10	80	125
Great Miami River at Hamilton	3,630	993	129	298	129	136
Huron River at Milan	371	15	46	25	96	176
Killbuck Creek at Killbuck	464	67	66	76	98	137
Little Beaver Creek near East Liverpool	496	77	84	50	82	128
Maumee River at Waterville	6,330	896	141	237	115	166
Muskingum River at McConnellsville	7,422	2,121	108	87	85	110
Scioto River near Prospect	567	27	88	373	111	152
Scioto River at Higby	5,131	596	49	168	107	134
Stillwater River at Pleasant Hill	503	54	109	482	147	148

**MEAN STREAM DISCHARGE**



Base period for all streams: 1961-1990

Normal - - - - Current - - - -

**STREAMFLOW** during September was above normal in the western drainage basins of Ohio and below normal in most central and eastern drainage basins. Flows in the northeastern and south-central areas of the state were low enough to be considered deficient. Streamflows in most areas during September were greater than the flows during August.

Flows at the beginning of the month were noticeably below normal throughout most of the state. Many drainage basins had their lowest flows for the month on September 1-2; some areas had slightly lower flows during September 19-22. Flows increased statewide during Labor Day weekend following widespread precipitation during the first several days of the month.

Greatest flows for the month in most areas of Ohio occurred during September 4-6; drainage basins in the north-central area of the state recorded their greatest flows on September 26. Flows at the end of the month were above normal in the western one-third of the state and below normal in the eastern two-thirds.

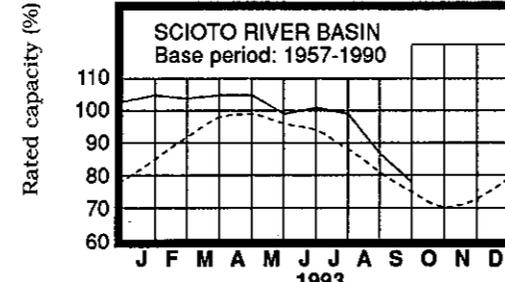
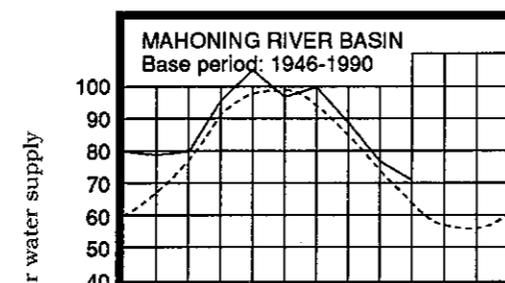
Streamflow for the 1993 water year was above normal throughout the state (see Mean Stream Discharge table, percent of normal, past 12 months column). Flows during the first half of the 1993 water year were noticeably above normal throughout the state. Flows during the second half of the water year were slightly above normal in the western half of the state and moderately below normal in the eastern half. Minor flooding occurred during November, March and July.

**RESERVOIR STORAGE** for water supply during September decreased in both the Mahoning and Scioto river basins. Storage remained above normal in both basins.

Reservoir storage at the end of September in the Mahoning basin index reservoirs was 71 percent of rated capacity for water supply compared with 77 percent for last month and 85 percent for September 1992. Month-end storage in the Scioto basin index reservoirs was 78 percent of rated capacity for water supply compared with 87 percent for last month and 98 percent for September 1992.

Reservoir storage was above normal throughout the 1993 water year. Storage was noticeably above normal during the first half of the water year and declined seasonally during the second half. Surface water supplies remain in good shape even with the dry conditions of the past few months.

**RESERVOIR STORAGE FOR WATER SUPPLY**



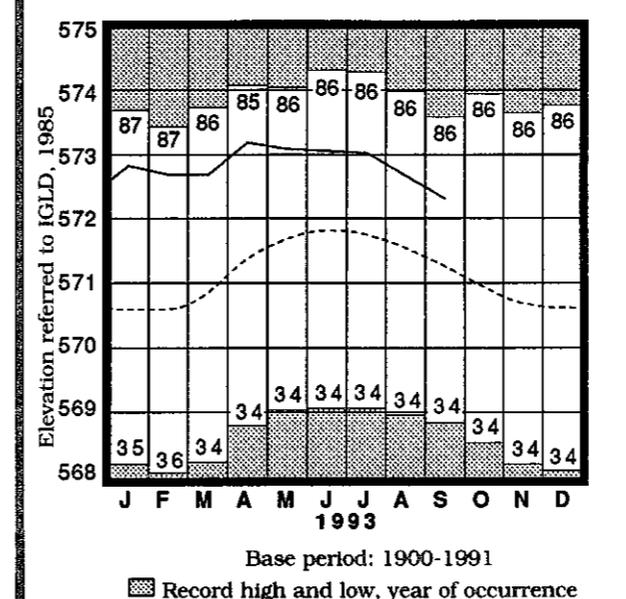
**GROUND-WATER LEVELS** during September declined throughout the state. Net declines during September were greater than usually observed in most aquifers. Ground-water storage is below normal throughout most of the state with only a few exceptions in some western areas. Aquifers in eastern Ohio have the greatest departures below normal. Current ground-water levels range from slightly above to more than 3 feet below the September 1992 levels. Index observation well Tu-1, reflecting ground-water storage in sand and gravel aquifers in eastern and northeastern Ohio, reached a record low level for September.

Ground-water storage during the 1993 water year started at below normal levels, just beginning to recover from the drought conditions of 1991 and the first half of 1992. Storage improved during the 1993 water year recharge season, rising to above normal levels in the western half of the state but remaining below normal in the eastern half. Ground-water storage declined seasonally during the second half of the water year. The rate of decline was accelerated by unusually dry conditions during late summer 1993. Ground-water storage at the end of the 1993 water year was noticeably below normal in the eastern half of the state and near to slightly below normal in the western half.

**LAKE ERIE** level declined during September. The mean level was 572.31 feet (IGLD-1985), 0.36 foot below last month's mean level and 1.05 feet above normal. This month's level is 0.27 foot below the September 1992 level and 3.11 feet above Low Water Datum.

Lake Erie remained at above normal levels throughout the 1993 water year. Levels were noticeably above normal through early summer 1993, but began to decline seasonally the past two months.

**LAKE ERIE LEVELS at Fairport**

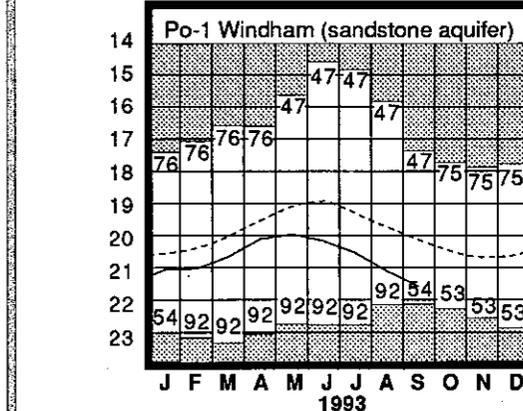
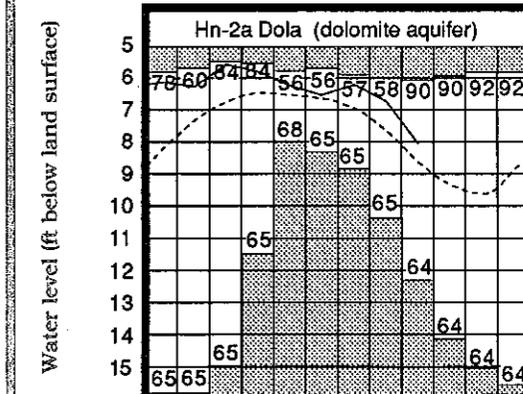
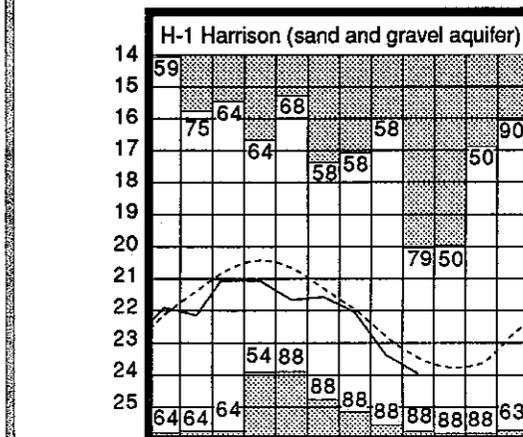


**GROUND-WATER LEVELS**

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	19.39	-2.97	-0.87	-3.02
Fa-1	Jasper Mill, Fayette Co.	Limestone	10.17	-1.50	-1.15	-2.18
Fr-10	Columbus, Franklin Co.	Gravel	43.50	+1.00	-0.57	+0.25
H-1	Harrison, Hamilton Co.	Gravel	23.93	-0.46	-0.56	-0.71
Hn-2a	Dola, Hardin Co.	Dolomite	8.05	+0.56	-1.33	-1.86
Po-1	Windham, Portage Co.	Sandstone	21.59	-1.47	-0.49	+0.28
Tu-1	Strasburg, Tuscarawas Co.	Gravel	15.78	-2.27	-0.68	-1.30

**GROUND-WATER LEVELS**



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990

Normal - - - - Current - - - -



# MONTHLY WATER INVENTORY REPORT FOR OHIO

October 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

## SUMMARY

Precipitation was above normal throughout most of the state but below normal in the Northwest Region. Streamflow was above normal in the western half of the state and below normal in the eastern half. Reservoir storage declined seasonally but remained at above normal levels. Ground-water storage declined and is below normal in most areas of the state. Lake Erie level declined 0.39 foot and was 0.96 foot above the long-term October average.

## NOTES AND COMMENTS

### MIDDLETOWN HYDRAULIC DAM PARTIALLY REMOVED

A portion of the Middletown Hydraulic Dam, located on the Great Miami River, is being removed as a temporary measure to redirect river flows. A section of this low-head dam failed on May 13, 1993 (see the May issue of this report). As a result, river flows were redirected through this breach. The Division of Water's Dam Safety Section has been monitoring the dam and the downstream erosion caused by the redirected flow. It was decided to remove a section of the dam to reduce the erosion threat to a nearby Miami Conservancy District flood control levee and adjacent city landfill. The Department is reviewing its options concerning the dam and it is not known at this time if the dam will be rebuilt.

### 1994 CALENDARS AVAILABLE NOW

Two different 1994 calendars featuring scenic views of Ohio are now available. Each is beautifully illustrated with color photographs. They also contain educational facts and helpful information.

The new Ohio Department of Natural Resources (ODNR) 1994 calendar, titled "Ohio's Natural Heritage," features full-color photographs of some of Ohio's most beautiful state parks, forests and nature preserves. The calendar also offers a complete list of Ohio's state parks, forests, nature preserves, wildlife areas and boating-access sites, as well as a schedule of Ohio hunting and trapping seasons.

The ODNR 1994 calendar costs \$8.00 (includes postage and tax) and can be ordered from: ODNR Public Information Center, 1952 Belcher Drive, Building C-1, Columbus, Ohio 43224-1386, phone (614) 265-6605. Make checks payable to ODNR.

Another new 1994 calendar is available through the Ohio Lake Erie Office (ODNR is a member of the Lake Erie Commission). The 1994 "Life on Lake Erie" calendar is illustrated with photographs taken by Ohioans of the Lake Erie shoreline as part of the 1992 Coastweeks Life on Lake Erie photography contest. The calendar also contains educational facts about Lake Erie, the history of Coastweeks and 10 ways each Ohioan can help Lake Erie everyday. All proceeds from the sale of this calendar will be deposited into the Lake Erie Protection Fund.

The 1994 "Life on Lake Erie" calendar costs \$10.00 (includes postage and tax) and can be ordered from: Ohio Lake Erie Office, One Maritime Plaza, Toledo, Ohio 43604-1866, phone (419) 245-2514. Make checks payable to the Ohio Lake Erie Office.

## ACKNOWLEDGMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

Precipitation data:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service: The Miami Conservancy District: U.S. Army Corps of Engineers, Muskingum Area.  
Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

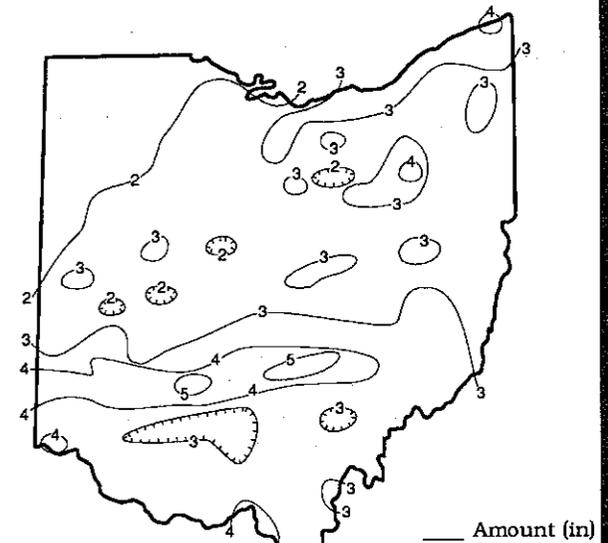
**PRECIPITATION** for October was above normal throughout most of Ohio with only the Northwest Region having below normal precipitation. The state average was 2.84 inches, 0.50 inch above normal. Regional averages ranged from 3.36 inches, 1.12 inches above normal, for the South Central Region to 1.77 inches, 0.52 inch below normal, for the Northwest Region. Washington Court House (Fayette County) reported the greatest amount of precipitation for the month, 5.49 inches. Grover Hill (Paulding County) reported the least amount, 1.02 inches.

Most of the precipitation during October fell during the second half of the month. Light showers across Ohio during October 1-2 and 9-10 generally produced less than 0.5 inch of rain in most areas of the state during each period. The wettest period was October 16-21 during which time precipitation fell nearly every day. Most areas of Ohio received at least 0.5 inch of rain during October 16-17 with some eastern and southern areas recording nearly 1.5 inches. Storms during October 20-21 were more scattered, but 1-2 inches of precipitation were reported at some locations in the southern and eastern areas of Ohio. The end of the month was wet with rain and snow falling during October 30-31. Several areas established new October snowfall records with 2 to nearly 10 inches of snow falling in most areas during this period.

Precipitation for the 1993 calendar year is below normal in the southern one-third of the state and also in the North Central and Central Hills regions; precipitation is above normal elsewhere. The state average is 32.15 inches, 0.19 inch below normal. Regional averages range from 36.03 inches, 4.37 inches above normal, for the West Central Region to 27.71 inches, 1.61 inches below normal, for the North Central Region. The South Central Region averages 30.09 inches of precipitation for the 1993 calendar year, 5.47 inches below normal.

The 1994 water year is off to a good start as far as precipitation is concerned. Near-normal precipitation during the next several months, the 1994 water year recharge season, will have positive benefits for water supplies throughout the state.

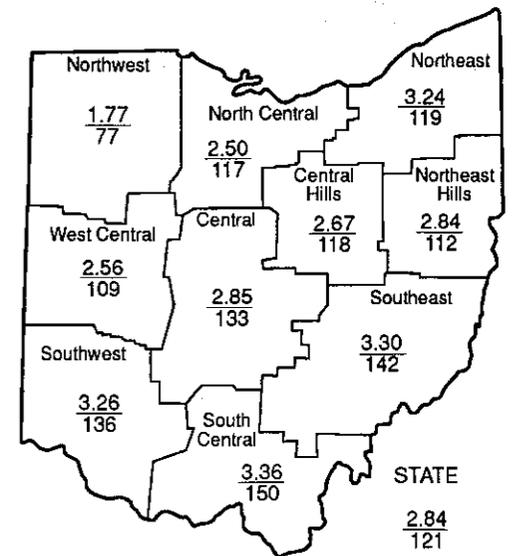
## PRECIPITATION OCTOBER 1993



## PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.52	+0.05	-0.79	+3.61	+6.96	-1.7
North Central	+0.36	-0.89	-4.02	+1.79	+6.84	-1.7
Northwest Hills	+0.52	+0.75	-0.47	+4.30	+8.82	+0.5
West Central	+0.22	-0.02	+3.83	+5.34	+8.04	-0.3
Central	+0.71	-0.96	+0.24	+2.77	+4.76	-0.1
Central Hills	+0.41	-1.83	-2.71	+0.50	+0.94	-1.4
Northwest Hills	+0.31	-0.20	-1.38	+0.68	+0.29	+0.2
Southwest	+0.87	-0.07	-1.55	-1.07	-3.25	+0.8
South Central	+1.12	-1.14	-3.77	-5.78	-10.63	-1.4
Southeast	+0.97	-0.09	-3.17	-2.55	-5.72	-1.5
State	+0.50	-0.44	-1.37	+0.98	+1.73	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To -0.4 = Near Normal  
-0.5 To -0.9 = Incipient Drought  
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-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought



Average (in)  
Percent of normal



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

George V. Vohnovich  
Governor

Frances S. Buchholz  
Director

James R. Morris  
Chief

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MEAN STREAM DISCHARGE

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	This Month		
				% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	185	53	19	34	121
Great Miami River at Hamilton	3,630	1,154	152	112	138	136
Huron River at Milan	371	35	104	40	58	172
Killbuck Creek at Killbuck	464	82	82	60	82	131
Little Beaver Creek near East Liverpool	496	73	61	56	77	125
Maumee River at Waterville	6,330	879	144	86	123	162
Muskingum River at McConnellsville	7,422	1,421	75	71	76	108
Scioto River near Prospect	567	31	112	54	95	152
Scioto River at Higby	5,131	772	84	50	95	133
Stillwater River at Pleasant Hill	503	151	255	131	187	148

**STREAMFLOW** during October was above normal in the western half of the state and below normal in the eastern half. Flows in southwestern Ohio were high enough to be considered excessive for October.

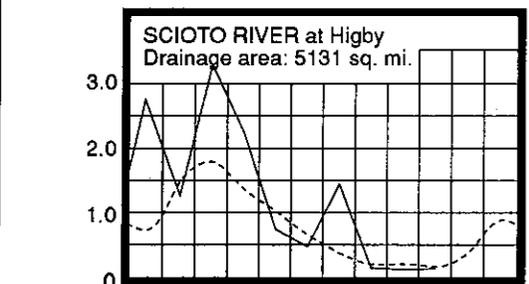
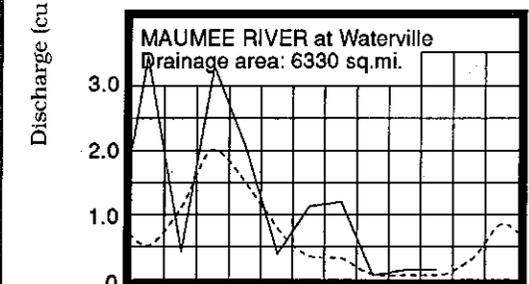
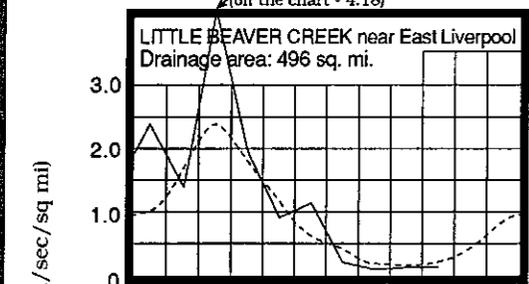
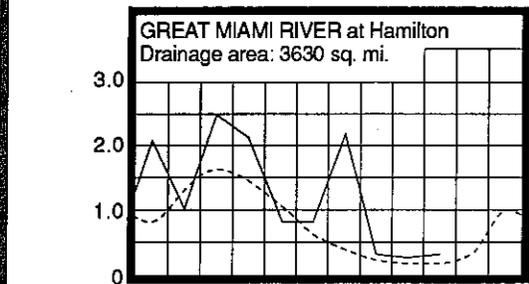
Flows at the beginning of the month were above normal in the northern and western Ohio drainage basins and below normal in the central, eastern and southeastern basins. Generally, flows declined during the first half of the month. Lowest flows for the month occurred at various times during the October 5-15 period centering around October 8-11. Flows increased noticeably after mid-month during several days of precipitation. Greatest flows for the month in most areas occurred during October 21-23. Flows at the end of the month were near or slightly above normal statewide.

during October 21-23. Flows at the end of the month were near or slightly above normal statewide.

**RESERVOIR STORAGE** for water supply during October declined seasonally in both the Mahoning and Scioto river basins. Storage remained above normal in both basins.

Reservoir storage at the end of October in the Mahoning basin index reservoirs was 65 percent of rated capacity for water supply compared with 71 percent for last month and 80 percent for October 1992. Month-end storage in the Scioto basin index reservoirs was 71 percent of rated capacity for water supply compared with 78 percent for last month and 89 percent for October 1992. Surface water supplies are favorable throughout Ohio as the start of the 1994 water year recharge season begins.

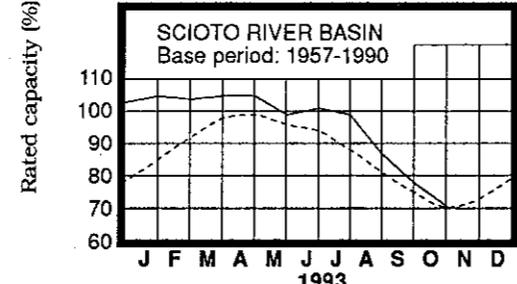
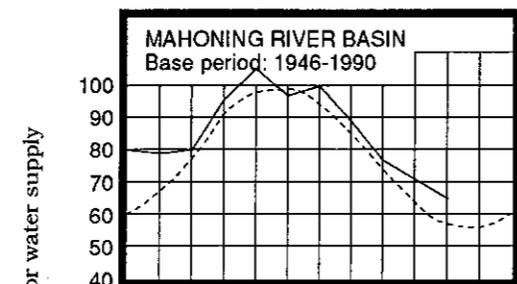
MEAN STREAM DISCHARGE



Base period for all streams: 1961-1990

Normal - - - - Current

RESERVOIR STORAGE FOR WATER SUPPLY



**GROUND-WATER LEVELS** during October declined throughout the state. Net declines during October from last month's levels were greater than usually observed in most aquifers. Generally, levels in unconsolidated aquifers and deeper unconsolidated aquifers declined throughout the month while levels in some shallow aquifers declined during the first three weeks of October and then rose during the last 10 days of the month.

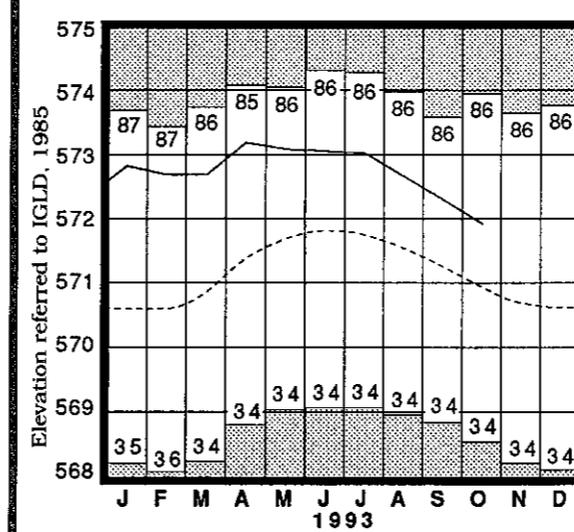
At the start of the 1994 water year, ground-water storage is below normal in most areas of the state; some aquifers in northwestern Ohio are at near or slightly above normal levels. Aquifers in the eastern half of the state and in some southern Ohio aquifers are at noticeably below normal levels. Index observation well Tu-1, reflecting ground-water storage in sand and gravel aquifers in eastern and northeastern Ohio, reached its lowest level since records began back in 1946.

Current ground-water levels range from about the same to more than three feet lower than the levels of October 1992. The above normal precipitation during September and October has improved soil moisture conditions and has set the stage for the up-coming recharge season. Near-normal climatic conditions during the next several months could improve the ground-water storage situation considerably. Water supply managers utilizing ground water as their source should monitor their situation throughout the recharge season.

**LAKE ERIE** level declined seasonally during October. The mean level was 571.92 feet (IGLD-1985), 0.39 foot below last month's mean level and 0.96 foot above normal. This month's level is 0.29 foot below the October 1992 level and 2.72 feet above Low Water Datum.

The U. S. Army Corps of Engineers reports that precipitation during October in the Lake Erie basin averaged 2.6 inches, 0.1 inch below normal. For October, the entire Great Lakes basin averaged 2.9 inches, 0.1 inch above normal. Cumulative precipitation for 1993 through October has averaged 30.2 inches, 0.8 inch above normal, in the Lake Erie basin and 29.3 inches, 2.1 inches above normal, for the entire Great Lakes basin.

LAKE ERIE LEVELS at Fairport



Base period: 1900-1991  
Record high and low, year of occurrence

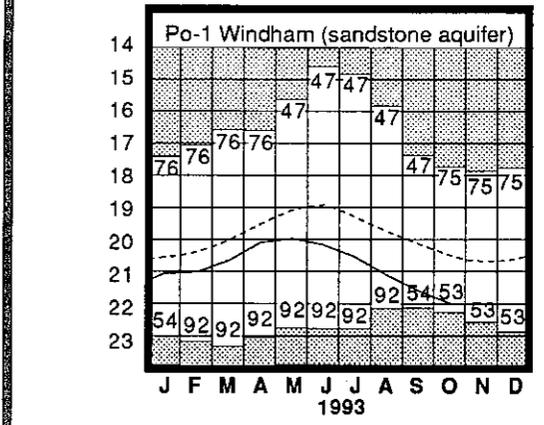
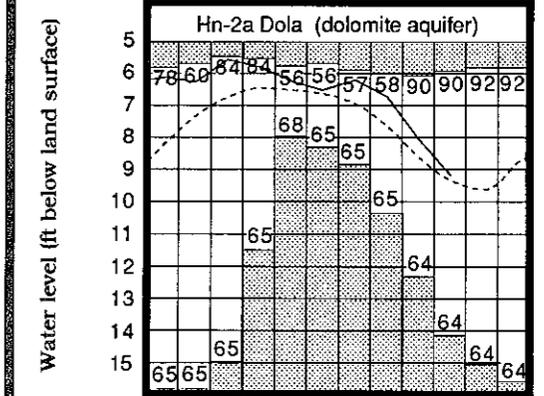
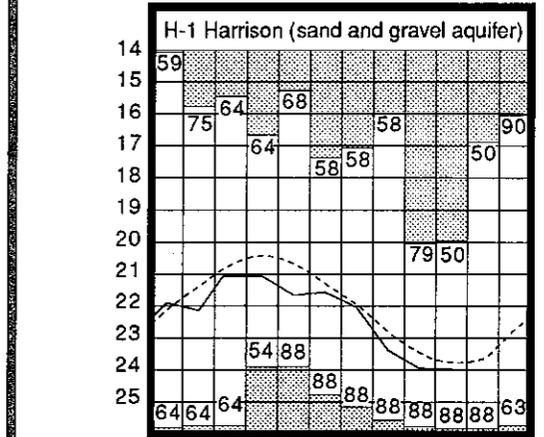
Normal - - - - Current

GROUND-WATER LEVELS

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	19.92	-3.03	-0.53	-2.22
Fa-1	Jasper Mill, Fayette Co.	Limestone	11.63	-2.62	-1.46	-3.19
Fr-10	Columbus, Franklin Co.	Gravel	43.71	+0.73	-0.21	+0.07
H-1	Harrison, Hamilton Co.	Gravel	29.95	-0.19	-0.02	-0.20
Hn-2a	Dola, Hardin Co.	Dolomite	9.20	+0.13	-1.15	-2.91
Po-1	Windham, Portage Co.	Sandstone	21.98	-1.51	-0.39	-0.25
Tu-1	Strasburg, Tuscarawas Co.	Gravel	16.10	-2.49	-0.32	-1.37

GROUND-WATER LEVELS



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990  
Record high and low, year of occurrence

Normal - - - - Current



# MONTHLY WATER INVENTORY REPORT FOR OHIO

November 1993

Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

(continued from front page)

2.70 inches above normal. Regional averages range from 8.59 inches, 2.99 inches above normal, for the Northeast Region to 5.04 inches, 0.32 inch above normal, for the Northwest Region. The 1994 water year recharge season is off to a good start as far as water supplies are concerned. Soil moisture is reported as ranging from adequate to surplus across the state. Long-range weather forecasts are also favorable for continued improvement in recharge to water supplies across the state.

## SUMMARY

Precipitation was above normal throughout Ohio in November. Streamflow was above normal and high enough to be considered excessive in the southern half of the state. Reservoir storage increased and continued to remain at above normal levels. Ground-water storage increased the second half of the month as widespread precipitation began to recharge aquifers. Lake Erie seasonally declined 0.2 foot and was 1.02 feet above normal.

## NOTES AND COMMENTS

### NEW PUBLICATIONS

The Division of Water announces the availability of the following new publication:

The Ground Water Resources of Darke County  
by James M. Raab

This map is one in a series of county ground-water resources maps which have been completed for 84 of Ohio's 88 counties. Ground-water resources maps are prepared by staff hydrogeologists. These maps show the regional ground-water characteristics based on interpretations of water well drilling records and local geology. These color-coded maps provide well log data for many point locations. Information provided by the maps include typical depths of wells, water-bearing formations and estimated yields for wells in the area.

Ground-water resources maps can be used as a guide to locate new or expand existing ground-water supplies. The maps are useful to homeowners, ground-water consultants, engineers, planners and developers.

In addition to the new Ground Water Resources of Darke County map, another county ground-water resources map that has been out of print has been reprinted and is now available. The reprinted map is:

The Ground Water Resources of Franklin County  
by James J. Schmidt

The Ground Water Resources of Franklin County map has been revised since its last printing in 1958.

Ground-Water resources maps cost \$5.00 each plus 5.75% sales tax\*. They can be purchased at or ordered from: ODNR Publications Center, 1952 Belcher Drive, Building C-1, Columbus, Ohio 43224-1386. Make checks payable to the Ohio Department of Natural Resources. If ordered through the mail, please include the correct postage and handling charges.

### Postage and Handling Charges

Cost of Publications	Add
under \$10.01	\$ 2.00
\$10.01 - \$20.00	\$ 3.00
\$20.01 - \$50.00	\$ 5.00
\$50.01 - \$100.00	\$ 8.50
\$100.01 and over	\$10.00

\*Out of state orders do not need to include sales tax.

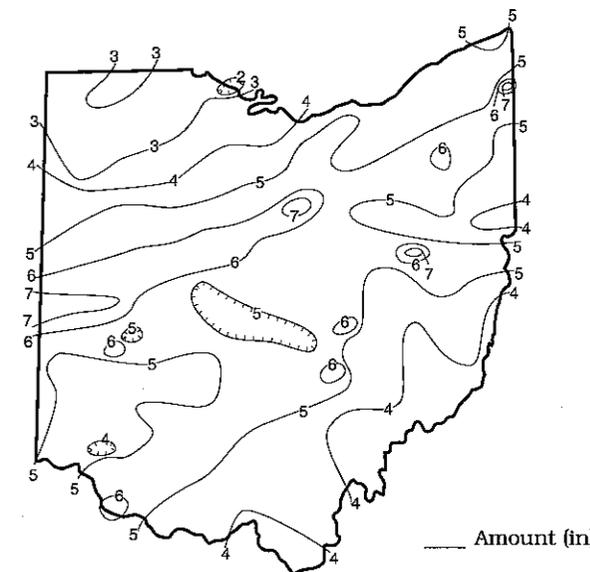
**PRECIPITATION** for November was above normal throughout Ohio. The state average was 4.85 inches, 2.20 inches above normal. Regional averages ranged from 5.94 inches, 3.38 inches above normal, for the West Central Region to 3.27 inches, 0.84 inch above normal, for the Northwest Region. This was the fourth wettest November on record for the West Central Region. Greenville (Darke County) reported the greatest amount of precipitation for the month, 7.66 inches. Other locations reporting more than 7 inches of precipitation in November were: Piqua (Miami County); Mansfield Airport (Richland County); Dover (Tuscarawas County); and Andover (Ashtabula County). Crane Creek State Park (Ottawa County) reported the least amount of November precipitation, 1.72 inches, the only location reporting less than 2 inches for the month.

Precipitation during November fell mostly in the form of rain. The early part of the month was rather dry with most areas of Ohio receiving less than 0.5 inch of precipitation during November 1-12. However, the remainder of the month was rather wet with three periods of widespread precipitation. The first was November 13-14 during which time most areas of the state received more than 1 inch of rain, and some west and north-central areas, nearly 3 inches. The next storm system crossed Ohio during November 16-17. Once again, most areas of the state, excluding southeastern and northwestern Ohio, received nearly 2 inches of precipitation. The third period of precipitation fell over the long Thanksgiving weekend. Most of the eastern two-thirds of Ohio recorded around 1 inch of precipitation. Generally, snow totals for the month were noticeably below normal throughout the state.

Precipitation for the 1993 calendar year is above normal throughout most of Ohio; only the South Central and Southeast regions have below normal precipitation. The state average is 37.01 inches, 2.02 inches above normal. Regional averages range from 41.97 inches, 7.75 inches above normal, for the West Central Region to 32.23 inches, 0.48 inch above normal, for the North Central Region. The South Central Region average precipitation is 34.23 inches, 4.10 inches below normal; the Southeast Region average is 36.27 inches, 0.60 inch below normal.

Precipitation for the first two months of the 1994 water year is above normal throughout Ohio. The state average is 7.69 inches, (continued on back)

## PRECIPITATION NOVEMBER 1993

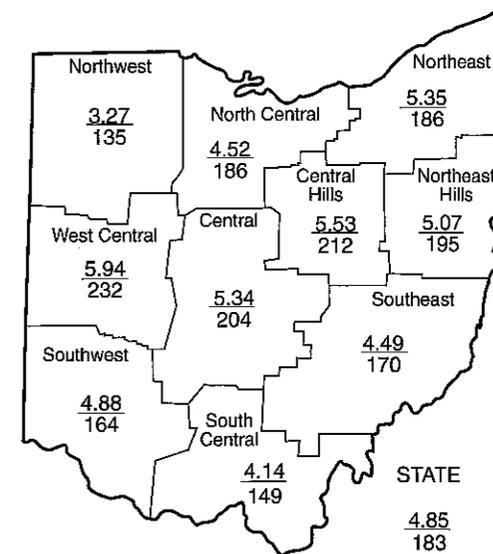


## PRECIPITATION

Region	DEPARTURE FROM NORMAL (IN.)					Palmer Drought Severity Index*
	This Month	Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	+0.84	+2.19	+1.59	+1.94	+7.96	-1.0
North Central	+2.09	+3.56	+0.23	+0.76	+9.55	-0.2
Northeast	+2.47	+5.01	+4.31	+4.61	+12.28	+2.3
West Central	+3.38	+4.62	+7.89	+6.22	+12.01	+1.4
Central	+2.72	+4.13	+4.52	+3.40	+8.86	+1.5
Central Hills	+2.92	+3.99	+1.80	+1.32	+4.96	+0.8
Northeast Hills	+2.47	+4.63	+2.81	+2.05	+3.68	+2.1
Southwest	+1.90	+2.70	+1.34	-0.87	+0.27	+1.4
South Central	+1.37	+2.65	-1.16	-5.21	-8.52	-0.4
Southeast	+1.85	+3.69	+0.76	-1.52	-3.62	+0.3
State	+2.20	+3.72	+2.42	+1.29	+4.76	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To 0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought



Average (in)  
Percent of normal

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Streamflow and reservoir storage data:

U.S. Geological Survey, Water Resources Division.

Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER  
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COLUMBUS, OHIO 43224

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**MEAN STREAM DISCHARGE**

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				This Month		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	1,674	147	91	85	114
Great Miami River at Hamilton	3,630	7,768	594	285	239	140
Huron River at Milan	371	301	346	149	111	140
Killbuck Creek at Killbuck	464	337	164	105	89	119
Little Beaver Creek near East Liverpool	496	350	154	91	82	117
Maumee River at Waterville	6,330	3,547	199	132	174	140
Muskingum River at McConnelsville	7,422	8,549	182	127	98	115
Scioto River near Prospect	567	1,083	1,118	502	253	143
Scioto River at Higby	5,131	5,709	302	145	143	132
Stillwater River at Pleasant Hill	503	1,960	2,130	745	465	160

**STREAMFLOW** during November was above normal throughout Ohio. Flows in the southern half of the state and also in the central section were high enough to be considered excessive. Preliminary data indicates that the Stillwater River at Pleasant Hill gauging station recorded the greatest mean flow for November for its period of record; the Great Miami River at Hamilton gauging station recorded its second greatest November mean flow; and the Scioto River near Prospect gauging station recorded its third greatest November mean flow.

Flows at the beginning of the month were near or slightly below normal in most areas of the state. Generally, flows declined during the first two weeks of November with the lowest flows for the month occurring during November 11-13. Streamflows increased sharply after mid-month following several days with widespread precipitation. Greatest flows for the month in most drainage basins occurred during November 18-19. Flows at the end of the month were noticeably above normal throughout the state.

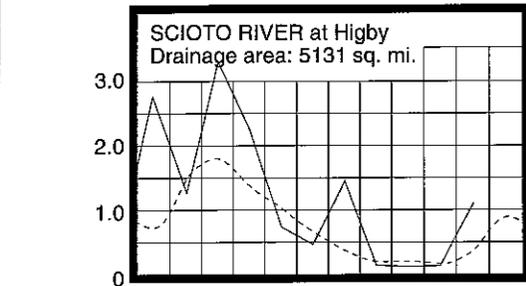
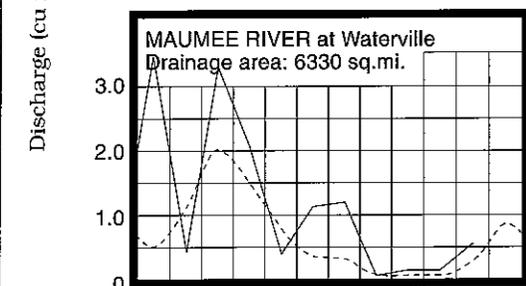
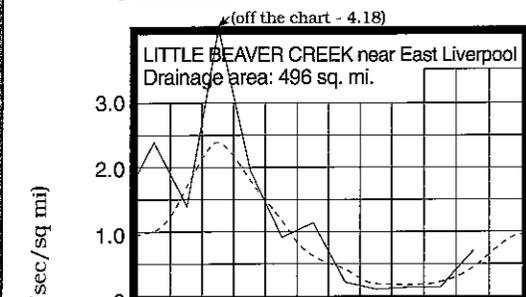
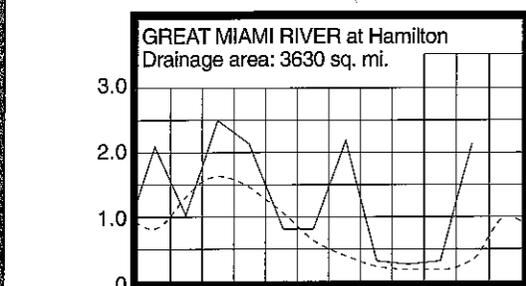
**RESERVOIR STORAGE** for water supply during November increased in both the Mahoning and Scioto river basins. Storage continued to remain above normal in both basins. Reservoir storage at the end of November in the Mahoning basin index reservoirs was 77 percent of rated capacity for water supply compared with 65 percent for last month and 81 percent for November 1992. Reservoir storage at the end of November in the Scioto basin index reservoirs was 83 percent of rated capacity for water supply compared with 71 percent for last month and 105 percent for November 1992.

**GROUND-WATER LEVELS** during November showed net improvement from last month's levels in most of Ohio's aquifers. A few exceptions were noted in some consolidated aquifers where delayed recharge can be expected. Generally, the net changes in ground-water levels during November ranged from about equal to slightly greater than normally expected. During November, ground-water levels were stable or declined slightly during the first half of the month and then rose during the second half in response to precipitation and resulting recharge.

Based on daily lowest level in feet below land-surface datum

Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	19.23	-1.97	+0.69	-0.68
Fa-1	Jasper Mill, Fayette Co.	Limestone	11.40	-2.45	+0.23	-2.96
Fr-10	Columbus, Franklin Co.	Gravel	43.55	+0.74	+0.16	-0.24
H-1	Harrison, Hamilton Co.	Gravel	22.51	+1.15	+1.44	+0.40
Hn-2a	Dola, Hardin Co.	Dolomite	9.70	-0.07	-0.50	-3.65
Po-1	Windham, Portage Co.	Sandstone	21.97	-1.29	+0.01	-0.38
Tu-1	Strasburg, Tuscarawas Co.	Gravel	16.10	-2.54	0.00	-1.44

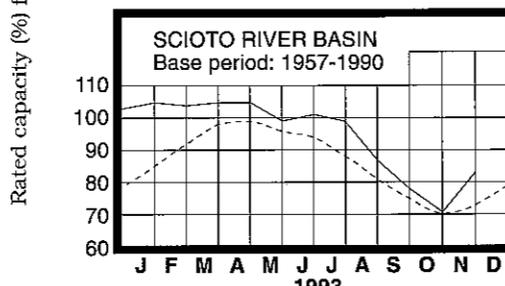
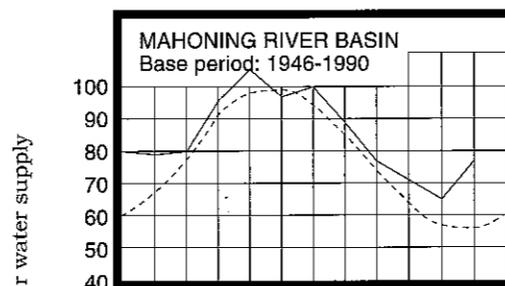
**MEAN STREAM DISCHARGE**



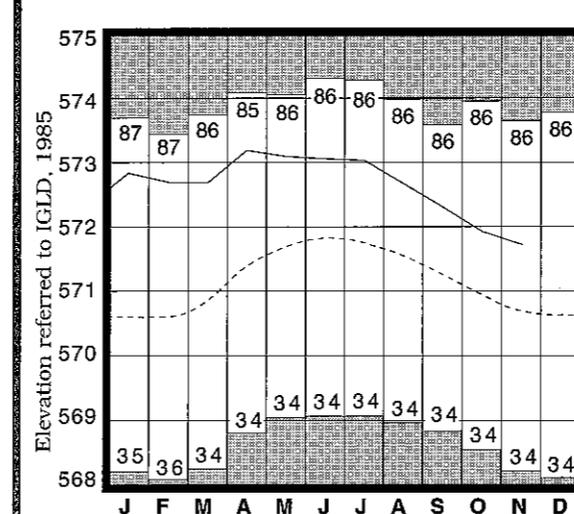
Base period for all streams: 1961-1990

Normal - - - - Current

**RESERVOIR STORAGE FOR WATER SUPPLY**



**LAKE ERIE LEVELS at Fairport**

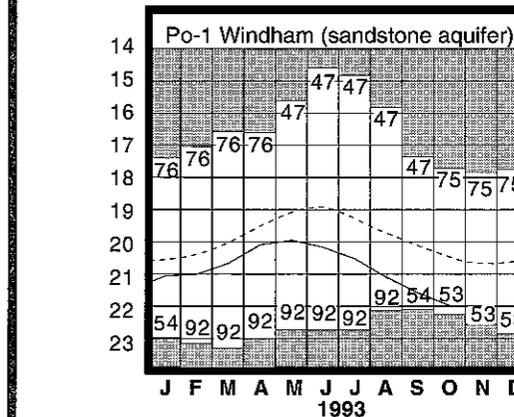
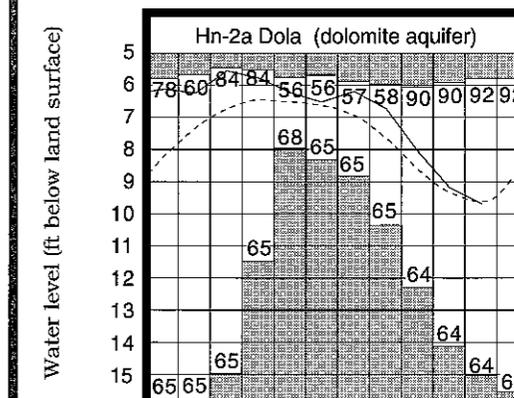
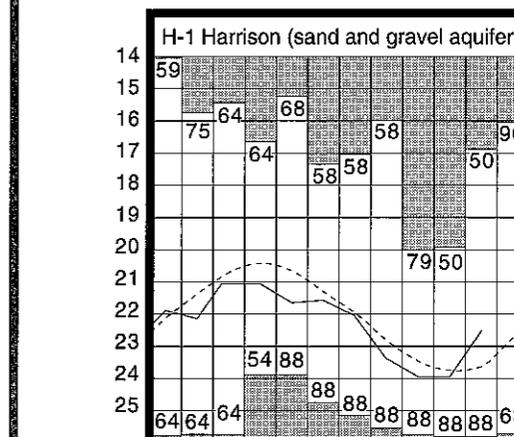


Base period: 1900-1991  
 Record high and low, year of occurrence

Normal - - - - Current

**GROUND-WATER LEVELS**

**GROUND-WATER LEVELS**



Base periods: H-1, 1951-1990. Hn-2a, 1955-1990.  
 Po-1, 1947-1990  
 Record high and low, year of occurrence

Normal - - - - Current



# MONTHLY WATER INVENTORY REPORT FOR OHIO

December 1993

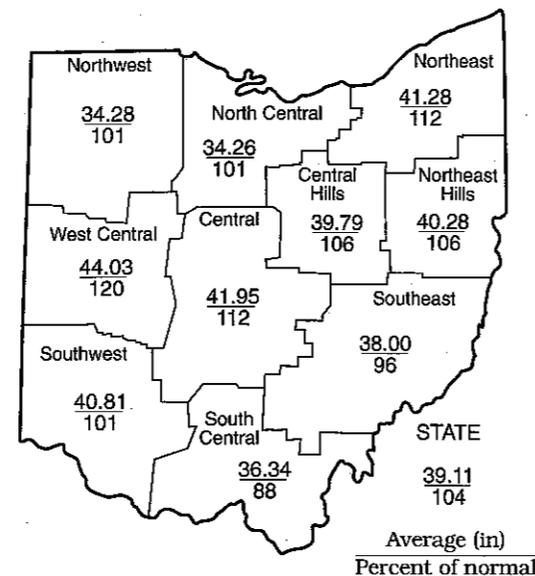
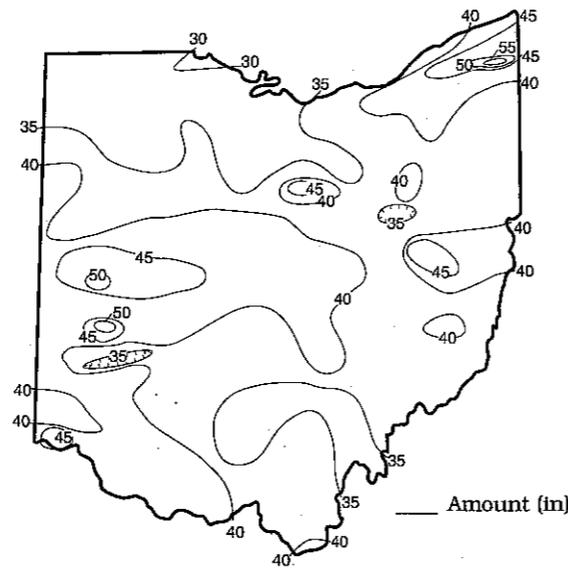
Compiled By David H. Cashell  
Hydrologist  
Water Inventory Unit

(continued from front page)

to 34.26 inches, 0.23 inch above normal, for the North Central Region. The South Central Region averaged 36.34 inches, 4.95 inches below normal (see Precipitation table, departure from normal, past 12 months column). Andover (Ashtabula County) reported the greatest amount of precipitation for the year, 57.66 inches. Toledo Express Airport (Lucas County) reported the least amount of precipitation during 1993, 29.87 inches. An isohyetal map and regional averages with percentages of normal precipitation for the 1993 calendar appear below.

Precipitation during the 1993 calendar year was generally above normal during the first four months, below normal during the middle four months and above normal during the last four months. The above normal precipitation during January through April in most areas of Ohio was beneficial for water supplies. Conditions changed abruptly with May being the third driest on record; however, adequate precipitation during June and the first half of July erased these dry conditions. After mid-July it dried out again, and these dry conditions continued through August. August was the fourth driest on record. Rains in early and late September eased the drought conditions. Above normal precipitation in October and November got the new water supply recharge season off to a good start. Even with the below normal precipitation in December, conditions favor improvement in water supplies.

PRECIPITATION - 1993 CALENDAR YEAR



**PRECIPITATION** for December was below normal throughout Ohio with only a few scattered locations having above normal precipitation. The state average was 2.12 inches, 0.46 inch below normal. Regional averages ranged from 2.61 inches, 0.03 inch below normal, for the Northeast Region to 1.33 inches, 0.98 inch below normal, for the Northwest Region. Chardon (Geauga County) reported the greatest amount of precipitation for the month, 5.41 inches. Hicksville (Defiance County) reported the least amount, only 0.83 inch.

Precipitation during December generally fell as rain during the first 20 days and as snow during the last 11 days. The greatest amount of precipitation for most areas of Ohio fell as rain during December 2-4. Excluding northwestern Ohio, most areas recorded more than 1 inch of precipitation during this period. Scattered rain and snow showers passed through the state during December 9-14, but only small amounts of precipitation were recorded. Moisture re-entered Ohio starting on December 18. The precipitation started as rain but quickly changed to snow as cold temperatures moved in by December 20. With the below normal temperatures, the snow on the ground remained, providing a white Christmas for most of Ohio. Some fairly large accumulations of snow occurred in northeastern Ohio, especially during December 20-21 and 24-25, when several areas recorded more than 5 inches of snow during each storm period. Chardon, Ohio's snow capital, recorded more than 52 inches of snow during December, more than twice its average. Much of the snow that fell remained on the ground at the end of the month.

Precipitation for the first three months of the 1994 water year is above normal throughout most of Ohio with only the Northwest Region having below normal precipitation. The state average is 9.80 inches, 2.23 inches above normal. Regional averages range from 11.26 inches, 3.02 inches above normal, for the Northeast Region to 6.35 inches, 0.68 inch below normal, for the Northwest Region. Water supplies have benefitted from the above normal precipitation so far during the 1994 water year recharge season. Conditions favor continued improvement in both surface and ground-water supplies throughout the remainder of the recharge period.

Precipitation for the 1993 calendar year was above normal throughout most of Ohio with only the South Central and Southeast regions having below normal precipitation. The state average was 39.11 inches, 1.54 inches above normal. Regional averages ranged from 44.03 inches, 7.34 inches above normal, for the West Central Region (continued on back)

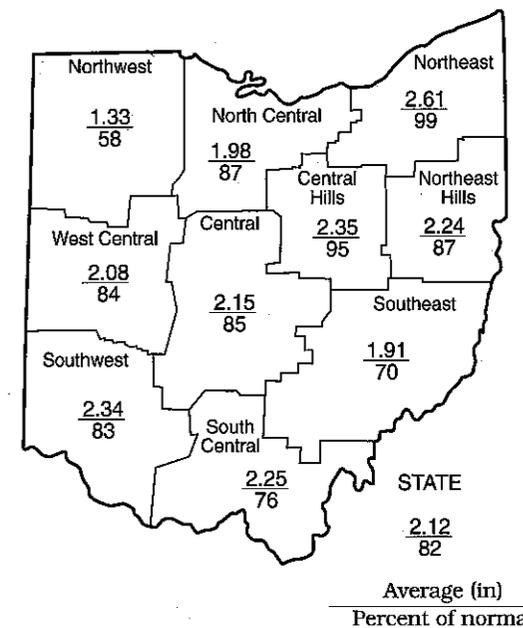
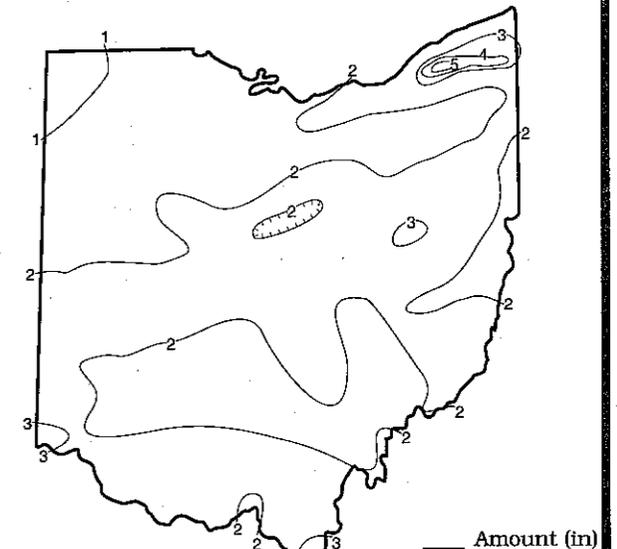
PRECIPITATION

Region	This Month	DEPARTURE FROM NORMAL (IN.)				Palmer Drought Severity Index*
		Past				
		3 Mos.	6 Mos.	12 Mos.	24 Mos.	
Northwest	-0.98	-0.68	-0.60	+0.46	+7.77	-1.0
North Central	-0.30	+2.27	-0.49	+0.23	+10.11	-0.2
Northeast	-0.03	+3.02	+2.09	+4.31	+12.39	+2.2
West Central	-0.39	+3.19	+6.25	+7.34	+12.07	+0.6
Central	-0.38	+3.14	+3.37	+4.34	+7.77	+1.4
Central Hills	-0.12	+3.23	+0.62	+2.39	+4.75	+0.7
Northeast Hills	-0.34	+2.41	+2.05	+2.25	+2.10	+1.9
Southwest	-0.48	+2.36	+0.58	+0.54	-1.35	+0.9
South Central	-0.71	+1.62	-1.83	-4.95	-12.02	-0.5
Southeast	-0.81	+1.85	+0.34	-1.59	-6.60	+0.6
State	-0.46	+2.23	+1.23	+1.54	+3.70	

\*Above +4 = Extreme Moist Spell  
3.0 To 3.9 = Very Moist Spell  
2.0 To 2.9 = Unusual Moist Spell  
1.0 To 1.9 = Moist Spell  
0.5 To 0.9 = Incipient Moist Spell  
0.4 To 0.4 = Near Normal

-0.5 To -0.9 = Incipient Drought  
-1.0 To -1.9 = Mild Drought  
-2.0 To -2.9 = Moderate Drought  
-3.0 To -3.9 = Severe Drought  
Below -4.0 = Extreme Drought

PRECIPITATION  
DECEMBER 1993



ACKNOWLEDGMENTS

This report has been compiled from Division of Water data and from information supplied by the following:

- Precipitation data:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service; The Miami Conservancy District; U.S. Army Corps of Engineers, Muskingum Area.  
Streamflow and reservoir storage data:  
U.S. Geological Survey, Water Resources Division.  
Lake Erie level data:  
U.S. Army Corps of Engineers, Detroit District.  
Palmer Drought Severity Index:  
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.



DIVISION OF WATER  
1939 FOUNTAIN SQUARE  
COLUMBUS, OHIO 43224

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Governor

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Director

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**MEAN STREAM DISCHARGE**

This Month

River and Location	Drainage Area (Sq. Mi.)	Mean Discharge (CFS)	% of Normal	% of Normal Past		
				3 Mos.	6 Mos.	12 Mos.
Grand River near Painesville	685	1,529	91	95	80	117
Great Miami River at Hamilton	3,630	5,181	141	240	230	148
Huron River at Milan	371	293	198	183	95	137
Killbuck Creek at Killbuck	464	473	127	135	99	120
Little Beaver Creek near East Liverpool	496	450	101	117	76	112
Maumee River at Waterville	6,330	3,372	62	84	125	138
Muskingum River at McConnellsville	7,422	9,425	132	147	114	117
Scioto River near Prospect	567	738	282	440	290	152
Scioto River at Higby	5,131	5,641	123	161	155	136
Stillwater River at Pleasant Hill	503	718	178	483	383	170

**STREAMFLOW** during December was above normal in most areas of the state, but below normal in the northwestern and some northeastern Ohio drainage basins. Flows during December increased seasonally from the November flows in most eastern Ohio drainage basins while in the central and western areas, flows were slightly less than those in November.

Flows at the beginning of the month were above normal in most areas of the state, but below normal across the northern section. Flows increased rapidly following the month's greatest precipitation, peaking during December 5-7. Generally, flows declined throughout the remainder of the month with the lowest flows occurring just before the month's end. Exceptions were

noted in the north-central and northeastern areas of Ohio where the lowest flows occurred around December 18 and then increased until the end of the month following some rain and snow. Flows at the end of December were below normal except in these north-central and northeastern drainage basins.

Streamflow for 1993 was above normal throughout the state (see Mean Stream Discharge table, percent of normal, past 12 months column). Monthly flows fluctuated between above and below normal throughout the year with some unusually high flows occurring in March, July and November in many drainage basins in the central and western areas of the state.

**RESERVOIR STORAGE** for water supply during December increased in the Scioto basin reservoirs and decreased slightly in the Mahoning basin reservoirs. Storage remained above normal in both basins.

Reservoir storage at the end of December in the Mahoning basin index reservoirs was 75 percent of rated capacity for water supply compared with 77 percent for last month and 80 percent for December 1992. Month-end storage in Scioto basin index reservoirs was 93 percent of rated capacity for water supply compared with 83 percent for last month and 103 percent for December 1992.

Reservoir storage was at above normal seasonal levels throughout 1993. Water supplies in both on- and off-stream reservoirs were adequate statewide, even during the dry period experienced in the late summer.

**GROUND-WATER LEVELS** during December rose in most aquifers throughout Ohio. Net rises during December were noticeably greater than usually expected. Ground-water levels in consolidated aquifers and deeper unconsolidated aquifers rose throughout the month responding to delayed recharge from the above normal

precipitation that fell during November. Levels in shallow unconsolidated aquifers rose during the early part of December and then declined until the end of the month.

Ground-water storage during 1993 was generally adequate in most areas of Ohio; however, storage in the eastern half of the state was below normal throughout the year. Some aquifers in the northeastern section of the state were at noticeably below normal levels, having never fully recovered from the drought conditions of 1991 and early 1992. At the end of 1993, ground-water storage remains noticeably below normal in the eastern and northeastern areas of the state and near or above normal elsewhere. Even though current ground-water storage is below last year's levels in many areas of the state, conditions favor continued improvement throughout the remainder of the recharge period.

**LAKE ERIE** level rose during December. The mean level was 571.88 feet (IGLD-1985), 0.16 foot above last month's mean level and 1.25 feet above normal. This month's level is 0.48 foot below the December 1992 level and 2.68 feet above Low Water Datum.

Lake Erie remained at above normal levels throughout 1993. Levels were noticeably above normal during the first half of the year, but below the record-high levels of the mid 1980s.

The U. S. Army Corps of Engineers reports that precipitation during December in the Lake Erie basin averaged 1.8 inches, 0.8 inch below normal. For December, the entire Great Lakes basin averaged 1.6 inches of precipitation, 0.8 inch below normal. Precipitation for 1993 averaged 35.9 inches, 1.0 inch above normal, in the Lake Erie basin and 33.8 inches, 1.6 inches above normal, in the entire Great Lakes basin.

**SUMMARY**

December precipitation was below normal throughout the state. Streamflow was above normal in all but northwestern and northeastern Ohio drainage basins. Reservoir storage remained at above normal levels. Ground-water storage increased but remains below normal in much of the eastern half of the state. Lake Erie level rose 0.16 foot and was 1.25 feet above the long-term December average.

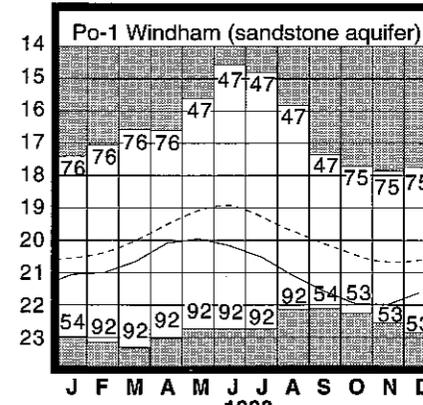
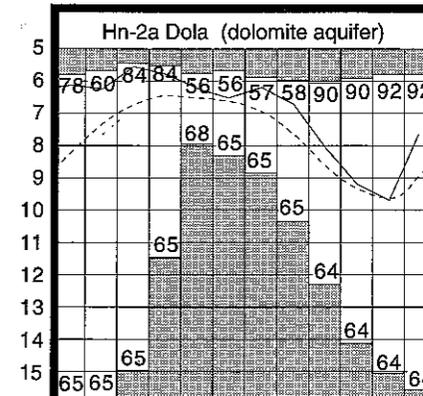
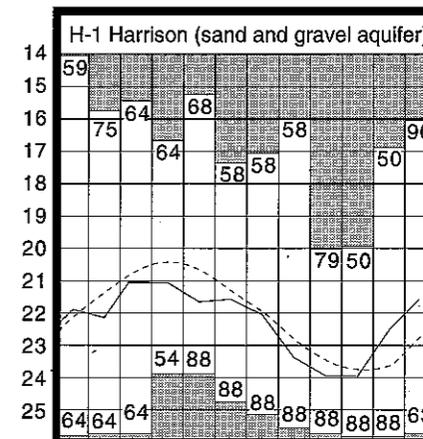
Precipitation for the 1993 calendar year was above normal in all but the South Central and Southeast regions. Streamflow was above normal throughout the year. Surface-water supplies were in good shape throughout the year. Ground-water supplies were adequate, but remained below normal in the eastern half of the state. Lake Erie was at above normal levels throughout the year.

**GROUND-WATER LEVELS**

Based on daily lowest level in feet below land-surface datum

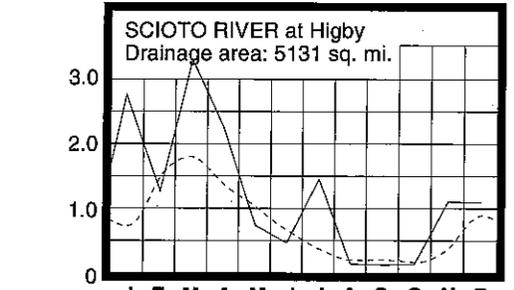
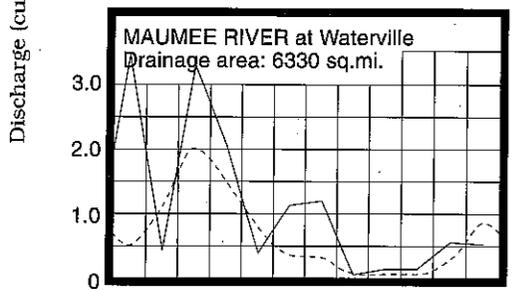
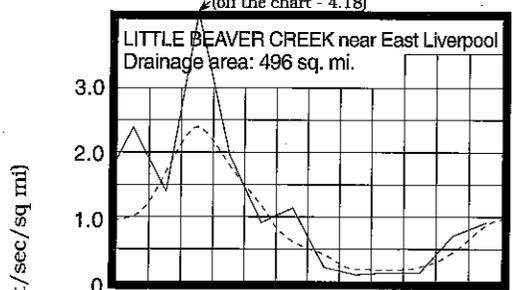
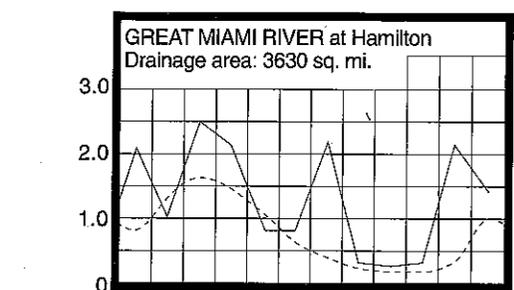
Index Well	Location	Aquifer	Mean This Month	Departure From Normal	Change in feet from:	
					Last Month	Year Ago
F-1	W. Rushville, Fairfield Co.	Sandstone	16.88	-0.03	+2.35	+1.49
Fa-1	Jasper Mill, Fayette Co.	Limestone	8.41	-0.25	+2.99	-0.75
Fr-10	Columbus, Franklin Co.	Gravel	42.97	+1.13	+0.58	-0.01
H-1	Harrison, Hamilton Co.	Gravel	21.59	+1.23	+0.92	+1.31
Hn-2a	Dola, Hardin Co.	Dolomite	7.63	+1.31	+2.07	-1.38
Po-1	Windham, Portage Co.	Sandstone	21.61	-1.00	+0.36	-0.17
Tu-1	Strasburg, Tuscarawas Co.	Gravel	15.21	-1.93	+0.89	-0.89

**GROUND-WATER LEVELS**



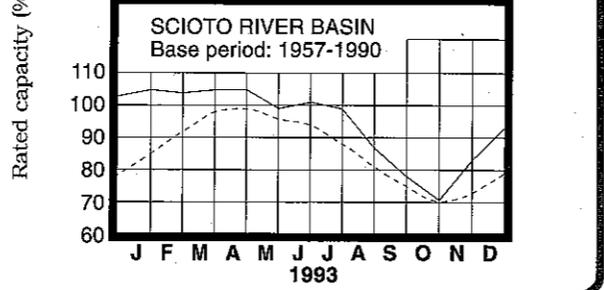
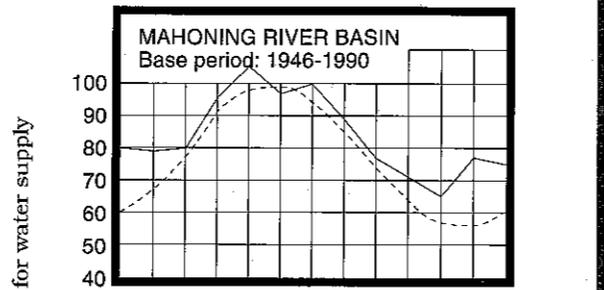
Base periods: H-1, 1951-1990. Hn-2a, 1955-1990. Po-1, 1947-1990. Record high and low, year of occurrence

**MEAN STREAM DISCHARGE**

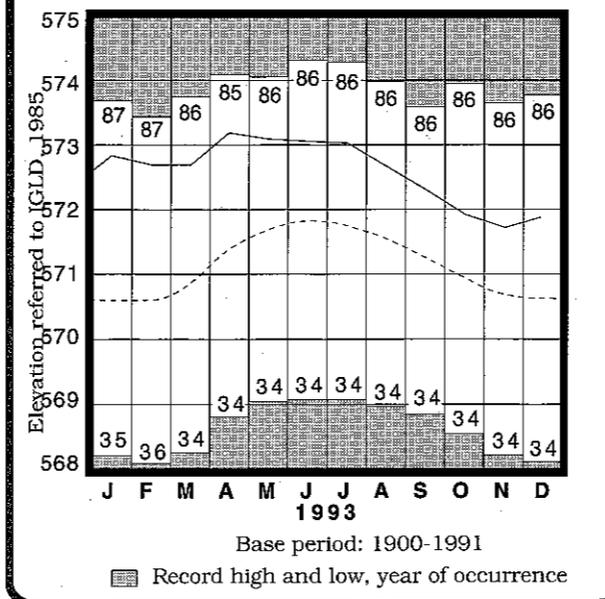


Base period for all streams: 1961-1990

**RESERVOIR STORAGE FOR WATER SUPPLY**



**LAKE ERIE LEVELS at Fairport**



Normal - - - - Current - - - -

Normal - - - - Current - - - -