

NOAA Technical Memorandum ERL GLERL-1

LAKE ONTARIO BASIN:
OVERLAND PRECIPITATION, 1972-73

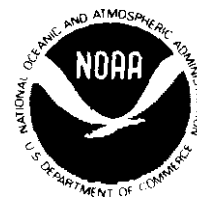
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2. Daily overland precipitation for the United States portion of the Lake Ontario Basin for 1973, in inches.	

ABSTRACT

Daily precipitation values were derived for the United States portion of the Lake Ontario land basin for 1972 and 1973. The daily precipitation values were generated using a Thiessen polygon procedure and National Weather Service station data. Isohyetal maps are provided for 1972 and 1973.

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1. INTRODUCTION

The need for accurate overland precipitation data was recognized early in the International Field Year for the Great Lakes (IFYGL) planning for use in terrestrial water balance studies. These studies indicated that daily precipitation values with monthly summaries would meet most requirements. This report is in partial fulfillment of IFYGL task number 48, "Island/Land Precipitation Data Analysis."

The computations were based on a Thiessen polygon procedure using National Weather Service (NWS) station data from the United States portion of the basin. Analysis indicated that the reporting times of the 84 available stations were not consistent, but varied through the day. Therefore, to provide more accurate daily values, a smaller network of 57 stations with similar reporting times was utilized.

Daily and monthly summaries are provided in this report. Isohyetal maps are provided for 1972 and 1973.

2. BASIC DATA

The NWS provided daily data for 84 precipitation stations located in the United States portion of the Lake Ontario Basin. Daily precipitation sums to the nearest hundredth of an inch were obtained on two magnetic tapes. Recorded precipitation values were of three types: either an actual hourly value, an accumulated value, or a trace (less than 0.005 in.). There were missing data for some stations for short periods of time.

3. PROCEDURE

The NWS stations had observation times which varied from 7 A.M. to 12 P.M. To insure accurate daily values, the same 24-hour observation period had to be utilized. Since the observation times of the stations varied up to 17 hours, it was decided to use a "precipitation window" in which most station observations occurred. The 7 A.M. to 10 A.M. period was selected; it afforded 57 stations (see appendix). The Adams, Alexandria Bay, and Auburn Water Works stations were not included due to a high incidence of missing data.

Morning observations record precipitation which fell predominately on the previous day; therefore, the data were assigned to the previous day. This practice is consistent with that of the Atmospheric Environment Service of Canada. Also, coordination of precipitation data with other data collected during the IFYGL necessitated this time shift.

Thiessen polygons were established for the precipitation network as shown in figure 1. The Thiessen procedure was chosen because it permitted the best precipitation determination over a large, topographically and climatologically diverse area and nonuniform distribution of gages. No adjacent gages were utilized from outside the drainage basin. Each station's weighting factor was calculated through planimetering its polygon area and converting this value to the percent of the basin by

$$W = A_p / A_b,$$

where

W is the Thiessen weighting factor

A_p is the Thiessen polygon area

A_b is the total basin area.

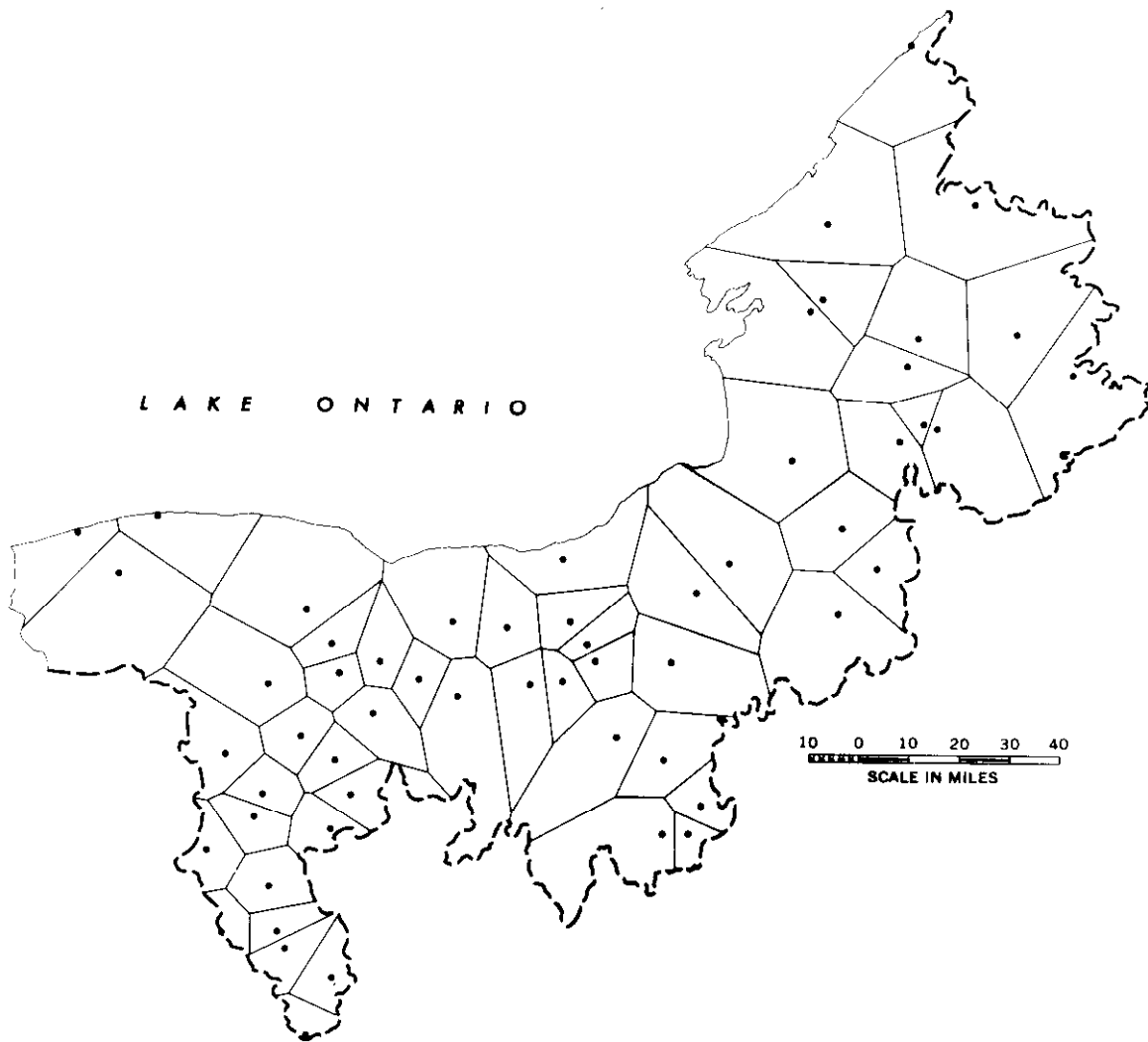


Figure 1. *The United States portion of the Lake Ontario drainage basin with the precipitation stations, as indicated by dots, and their respective Thiessen polygons.*

The data set was separated into the categories of measured precipitation and missing data. Traces were assigned the value of 0.00 inches. When daily precipitation values were not reported for several consecutive days, followed by a cumulative sum, the entire period was listed as missing data. This was done to avoid having to distribute the data through the pertinent time period arbitrarily. Daily precipitation sums for the basin were computed using the Thiessen weighting factors in the following manner:

$$P_i = S_{i,1}W_1 + S_{i,2}W_2 + S_{i,3}W_3 + \dots + S_{i,n}W_n$$

for $W_1 + W_2 + W_3 + \dots + W_n = 1.0$,

where

P_i is the weighted daily basin precipitation sum
 $S_{i,1} - S_{i,n}$ are daily precipitation values by station
 $W_1 - W_n$ are station weighting factors
 i is the Julian Day of the year
 n is the number of stations in the network.

In the above computation all missing data were assigned the value of zero. These missing data were then accounted for by the following procedure:

$$M_i = D_{i,1}W_1 + D_{i,2}W_2 + D_{i,3}W_3 + \dots + D_{i,n}W_n,$$

where

M_i is the daily sum of weighting factors for stations with missing data
 $D_{i,1} - D_{i,n}$ have ascribed values of 0.0 for stations with recorded daily data and 1.0 for stations with missing daily data
 $W_1 - W_n$ are station weighting factors
 i is the Julian Day of the year
 n is the number of stations in the network.

The daily precipitation sums were adjusted for missing data using the following relationship:

$$PA_i = P_i / (1.0 - M_i),$$

where

PA_i is the weighted and adjusted daily basin precipitation sum

P_i is the weighted daily basin precipitation sum

M_i is the daily sum of weighting factors for stations with missing data

i is the Julian Day of the year.

The daily basin precipitation values are contained in tables 1 and 2.

Isohyetal maps for 1972 and 1973 basin precipitation are given in figures 2 and 3. The isohyets are based on data published by NWS in the annual summary for the New York and Pennsylvania Climatological Data and include NWS estimated data. Stations of all reporting times were utilized in establishing the isohyets. The impact of Hurricane Agnes on 1972 basin precipitation is quite evident in the eastern end of the basin.

4. ACKNOWLEDGMENTS

This study was performed under the general guidance of Dr. Frank H. Quinn, Chief, Lake Hydrology Group, Great Lakes Environmental Research Laboratory, NOAA. The assistance of Mr. Vernon Maxey in computerized data analysis is gratefully acknowledged.

Table 1. Daily Overland Precipitation for the United States Portion of the Lake Ontario Basin for 1972, in Inches

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.05	0.00	0.21	0.09	0.37	0.12	0.00	0.09	0.00	0.04	0.28	0.14
2	0.24	0.01	0.76	0.03	0.65	0.01	0.21	0.57	0.05	0.00	0.44	0.02
3	0.03	0.83	0.01	0.04	0.19	0.20	0.53	0.20	0.05	0.00	0.03	0.02
4	0.18	0.17	0.09	0.05	0.36	0.09	0.00	0.00	0.00	0.00	0.18	0.43
5	0.01	0.10	0.06	0.02	0.03	0.00	0.05	0.00	0.00	0.00	0.01	0.06
6	0.02	0.09	0.07	0.28	0.23	0.02	0.02	0.35	0.00	0.96	0.00	0.37
7	0.05	0.04	0.16	0.00	0.08	0.03	0.07	0.55	0.03	0.06	0.59	0.02
8	0.00	0.02	0.06	0.00	0.59	0.50	0.03	0.10	0.30	0.08	1.01	0.27
9	0.04	0.01	0.02	0.00	0.10	0.06	0.29	0.01	0.01	0.01	0.01	0.06
10	0.00	0.01	0.00	0.14	0.00	0.00	0.30	0.00	0.00	0.00	0.05	0.07
11	0.05	0.00	0.01	0.01	0.01	0.00	0.00	0.04	0.01	0.05	0.11	0.01
12	0.00	0.04	0.01	0.33	0.00	0.01	0.00	0.00	0.01	0.16	0.00	0.46
13	0.20	0.68	0.18	0.22	0.08	0.03	0.35	0.20	0.31	0.00	0.39	0.00
14	0.02	0.02	0.39	0.07	0.11	0.00	0.26	0.32	0.15	0.11	0.44	0.01
15	0.03	0.04	0.00	0.11	0.40	1.22	0.54	0.00	0.00	0.03	0.00	0.60
16	0.03	0.01	0.11	0.37	0.21	0.00	0.06	0.10	0.00	0.07	0.00	0.14
17	0.01	0.00	0.06	0.00	0.05	0.00	0.00	0.10	0.03	0.03	0.00	0.01
18	0.06	0.16	0.01	0.00	0.00	0.05	0.02	0.06	0.23	0.07	0.00	0.07
19	0.01	0.81	0.00	0.37	0.01	0.08	0.02	0.00	0.00	0.00	0.36	0.13
20	0.24	0.03	0.00	0.09	0.11	0.66	0.04	0.00	0.00	0.00	0.01	0.04
21	0.00	0.10	0.12	0.00	0.00	2.21	0.00	0.00	0.00	0.12	0.01	0.41
22	0.17	0.01	0.38	0.27	0.00	1.17	0.29	0.05	0.00	0.48	0.01	0.05
23	0.08	0.09	0.14	0.02	0.00	0.43	0.25	0.18	0.45	0.29	0.01	0.00
24	0.14	0.03	0.04	0.02	0.00	0.12	0.17	0.08	0.30	0.04	0.01	0.00
25	0.09	0.21	0.01	0.00	0.00	0.07	0.24	0.00	0.04	0.01	0.60	0.03
26	0.03	0.05	0.00	0.00	0.00	0.01	0.14	0.10	0.14	0.00	0.27	0.12
27	0.13	0.04	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.02	0.03	0.21
28	0.06	0.03	0.00	0.00	0.00	0.01	0.00	0.05	0.01	0.30	0.11	0.05
29	0.01	0.00	0.09	0.00	0.00	0.79	0.00	0.00	0.77	0.22	0.03	0.07
30	0.07		0.04	0.00	0.83	0.22	0.00	0.00	0.22	0.01	0.32	0.07
31	0.03		0.00		0.62		0.01	0.00		0.01		0.33
SUM	2.08	3.63	3.03	2.53	5.03	8.11	3.89	3.65	3.11	3.17	5.31	4.27

Table 2. Daily Overland Precipitation for the United States Portion of the Lake Ontario Basin for 1973, in Inches

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.01	0.20	0.00	1.08	0.13	0.15	0.03	0.21	0.05	0.29	0.28	0.01
2	0.01	0.70	0.00	0.62	0.09	0.00	0.00	0.06	0.10	0.32	0.24	0.00
3	0.32	0.07	0.21	0.08	0.26	0.10	0.06	0.00	0.03	0.04	0.04	0.01
4	0.04	0.02	0.02	0.97	0.08	0.04	0.33	0.03	0.00	0.51	0.01	0.07
5	0.03	0.00	0.06	0.06	0.02	0.21	0.01	0.00	1.02	0.07	0.09	0.35
6	0.00	0.03	0.00	0.08	0.00	0.51	0.00	0.00	0.23	0.00	0.10	0.05
7	0.00	0.11	0.07	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.03	0.00
8	0.00	0.24	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.01	0.08
9	0.07	0.00	0.08	0.32	0.19	0.01	0.00	0.10	0.00	0.01	0.05	0.96
10	0.02	0.00	0.02	0.14	0.35	0.00	0.03	0.45	0.00	0.00	0.01	0.03
11	0.08	0.00	0.18	0.01	0.13	0.04	0.01	0.05	0.01	0.00	0.01	0.03
12	0.05	0.00	0.09	0.00	0.17	0.41	0.07	0.01	0.00	0.00	0.00	0.01
13	0.00	0.00	0.01	0.00	0.00	0.05	0.27	0.00	0.01	0.20	0.01	0.23
14	0.05	0.48	0.47	0.00	0.02	0.00	0.11	0.28	0.46	0.02	0.21	0.01
15	0.00	0.11	0.03	0.00	0.01	0.02	0.08	0.27	0.01	0.03	1.02	0.01
16	0.00	0.02	0.61	0.02	0.04	0.29	0.00	0.00	0.01	0.09	0.05	0.08
17	0.00	0.00	0.78	0.02	0.48	0.25	0.00	0.06	0.61	0.12	0.01	0.43
18	0.00	0.00	0.19	0.06	0.25	0.05	0.00	0.26	0.15	0.18	0.06	0.00
19	0.17	0.01	0.05	0.02	0.04	0.00	0.01	0.09	0.02	0.11	0.01	0.11
20	0.01	0.01	0.00	0.00	0.64	0.09	0.13	0.02	0.04	0.01	0.00	0.92
21	0.01	0.12	0.01	0.06	0.14	0.59	0.02	0.16	0.07	0.00	0.18	0.30
22	0.62	0.04	0.00	0.11	0.01	0.04	0.00	0.00	0.54	0.00	0.00	0.02
23	0.05	0.01	0.00	0.00	0.02	0.05	0.00	0.00	0.09	0.00	0.03	0.02
24	0.02	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.40	0.00
25	0.00	0.05	0.10	0.00	0.03	0.01	0.08	0.00	0.00	0.00	0.15	0.51
26	0.00	0.00	0.00	0.01	0.13	0.00	0.47	0.07	0.00	0.00	0.07	0.45
27	0.01	0.00	0.00	0.85	0.11	0.06	0.10	0.04	0.02	0.01	0.34	0.02
28	0.33	0.00	0.00	0.17	0.30	0.38	0.50	0.00	0.00	0.28	0.22	0.02
29	0.03		0.04	0.02	0.05	0.14	0.01	0.00	0.00	0.62	0.10	0.05
30	0.14		0.03	0.00	0.35	0.01	0.00	0.01	0.01	0.07	0.06	0.13
31	0.00		0.22		0.03		0.08	0.08		0.29		0.08
SUM	2.07	2.22	3.27	4.70	4.23	3.59	2.40	2.25	3.49	3.27	3.79	4.99



Figure 2. *Isohyetal map of overland precipitation for the Lake Ontario Basin for 1972, in inches.*

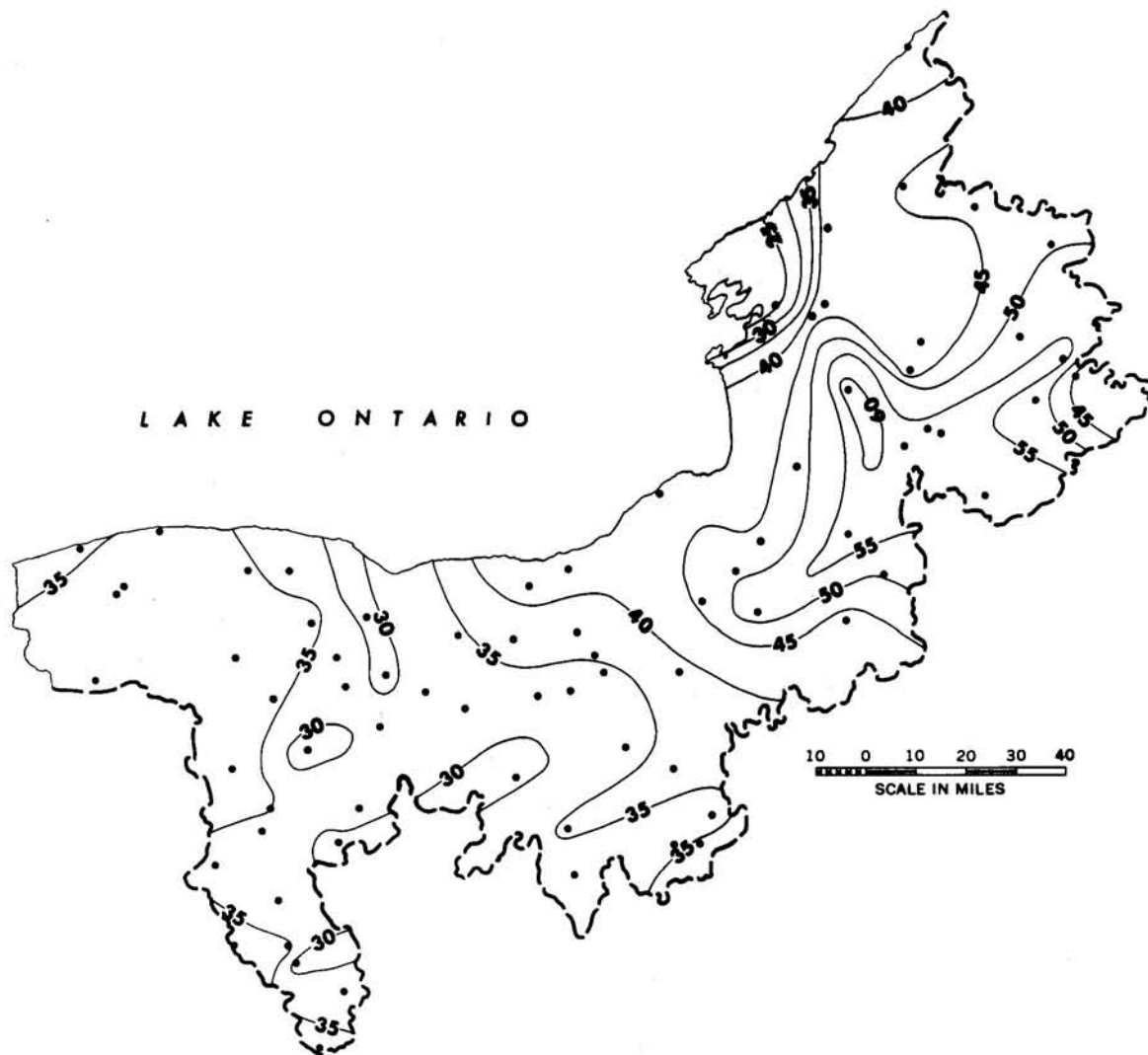


Figure 3. Isohyetal map of overland precipitation for the Lake Ontario Basin for 1973, in inches.

APPENDIX. LAKE ONTARIO STATION SUMMARY

(Including: National Weather Service numbers (NWS NO.), weighting factors (W) expressed as a percent, periods of missing data (41, entire month; m, partial month), and observation times (OT).)

10

NW NO.	NAME	W	1972												1973												OT
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
300183	Angelica	1.058																						7A.M.			
300331	Aurora Research Farm	2.839																						8A.M.			
300343	Avon	0.619																						7A.M.			
300379	Baldwinsville	2.348											M											8A.M.			
300412	Barker 4 NE	1.755																						7A.M.			
300500	Beaver Falls	2.168																						9A.M.			
300608	Bennett Bridge	3.845																						8A.M.			
300706	Black River 1 SW	1.342										M							M					7A.H.			
300870	Brewerton Lock 23	3.265																						0A.M.			
301110	Camden 2 NW	1.923																						10A.M.			
301152	Canandaigua 3 S	2.890																	M	M	M			8A.N.			
301156	Canaseraga	0.671				M																		7A.H.			
301160	Canastota	3.329																						8A.M.			
301265	Cayuga Lock 1	0.723																						8A.N.			
301484	Churchville	3.871	m	m	m						mm		mm		mm		m							7A.M.			
301580	Clyde Lock 26	0.903																						8A.M.			
301974	Dansville	0.968																						8A.M.			
302234	Eagle Bay 3 SE	3.200															m	m	m					8A.M.			
302277	East Bloomfield	0.748																						7A.H.			
303050	Freeville 1 NE	0.619				M	M	M	M	M														8A.M.			
303065	Friendship 7 SW	0.348																						7A.M.			
303128	Garbutt	0.813					M		M															7A.M.			
303184	Geneva Research Farm	1.677																						8A.M.			
303520	Groveland	0.748																	M	M	M	M	M	8A.M.			

APPENDIX. LAKE ONTARIO STATION SUMMARY (continued)

NWS NO.	NAME	W	1972												1973												OT
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
303773	Hemlock	1.277																							7A.M.		
303851	Highmarket	1.574																							8A.M.		
303957	Honeoye Falls	0.968	m																						8A.M.		
304174	Ithaca Cornell University	2.723																							8A.M.		
304836	Locke 2 W	1.523																							7A.M.		
304849	Lockport 4 NE	4.453																							8A.M.		
304912	Lowville	1.497																							8A.M.		
304944	Lyons Falls	2.877																							7A.M.		
304952	Macedon	2.348	m	m	m	m																			8A.M.		
305171	Mays Point Lock 25	0.619	m																						8A.M.		
305597	Mount Morris 2 W	0.929																							8A.M.		
305604	Mt. Pleasant Farm	0.374																							8A.M.		
305679	Newark	1.342																							8A.M.		
305751	New London Lock 22	1.239																							8A.M.		
306164	Ogdensburg 3 NE	2.129																							8A.M.		
306464	Pavilion	2.606																							7A.M.		
306745	Portageville	0.774	M																						7A.M.		
307329	Rushford 1 W	0.826																							7A.M.		
307557	Scio	0.555														M	M	M							7A.M.		
307780	Skaneateles	2.684																							8A.M.		
307944	South Edwards 1 E	3.819																							7A.M.		
308248	Stillwater Reservoir	3.252																							8A.M.		
308455	Theresa	4.374																		M					8A.M.		
308635	Turin 1 N	0.387																				M			8A.M.		

APPENDIX. LAKE ONTARIO STATION SUMMARY (continued)

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NWS NO.	NAME	W	1972												1973												OT
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
308962	Warsaw 5 SW	1.523																							m	7A.M.	
308987	Waterloo	0.774																								8A.M.	
309000	Watertown	3.665																								9A.M.	
309072	Wellsville	0.723																							M	9A.M.	
309425	Whitesville	0.774																								7A.M.	
309507	Wilson 2 NE	1.471																								7A.M.	
309533	Wiscoy 1 E	0.800																								8A.H.	
309544	Wolcott 3 NW	2.077																								7A.H.	
367310	Raymond	0.374																							m	7A.M.	

MM ENI