

US Army Corps
Of Engineers
Chicago District

LAKE MICHIGAN DIVERSION ACCOUNTING WATER YEAR 1995 ANNUAL REPORT

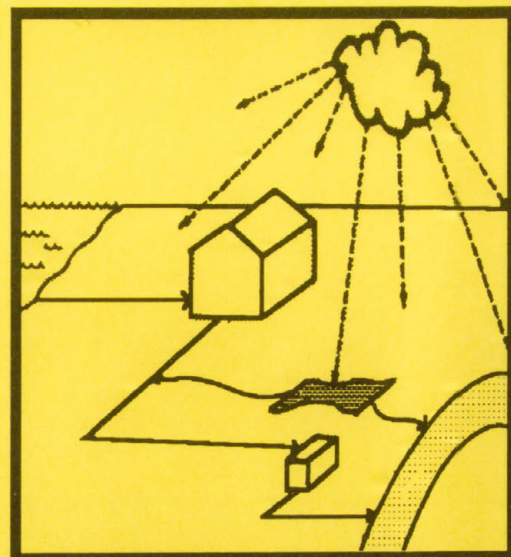
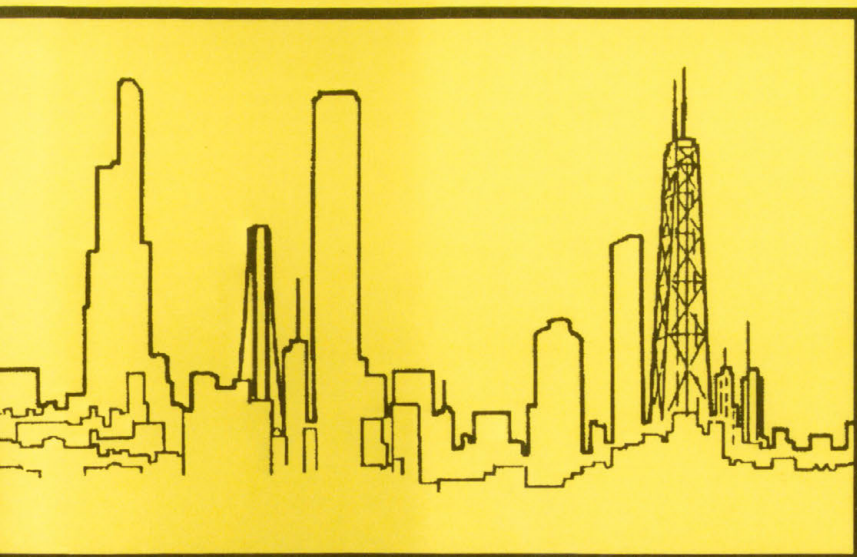
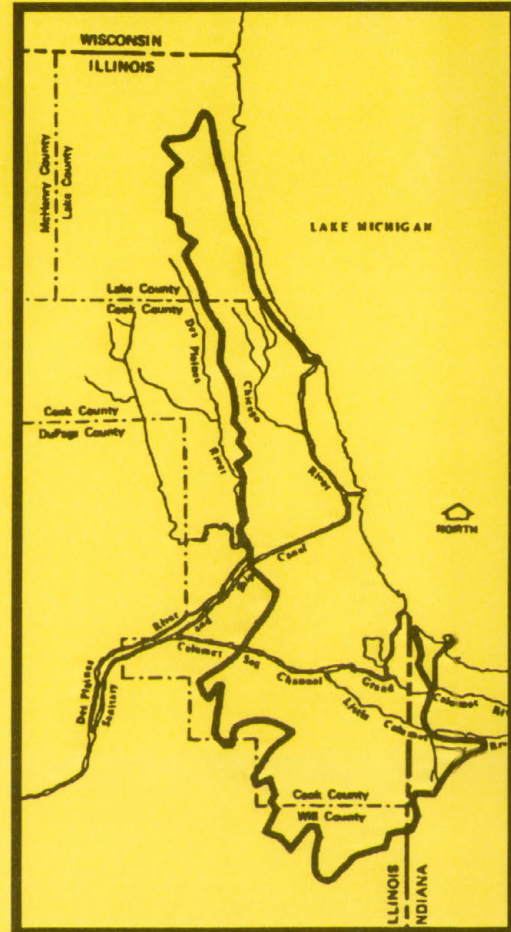


Table of Contents	Page
EXECUTIVE SUMMARY	1
INTRODUCTION.....	2
AUTHORITY FOR REPORT	2
HISTORY OF THE DIVERSION	2
SIGNIFICANT HYDROLOGIC EVENTS.....	7
STATUS OF ACCOUNTING REPORTS.....	8
SOURCES OF DIVERSION.....	9
ACCOUNTING PROCEDURES.....	10
DIVERSION COMPUTATION	10
DIVERSION BUDGET CHECKS.....	11
ACCOMPLISHMENTS DURING FY 1995	11
DES PLAINES TARP SYSTEM MODELING.....	11
DEDUCTIBLE WATER SUPPLY FROM THE GRAND CALUMET RIVER.....	12
MODELING OF RUNOFF FROM THE UNGAGED CALUMET WATERSHED	12
ACTIVITIES FOR FY 1996 AND 1997	12
RUNOFF STUDY.....	13
CONSUMPTIVE USE STUDY.....	13
ACCOUNTING REPORTS.....	13
SUMMARY AND CONCLUSIONS.....	13
SUMMARY.....	13
CONCLUSIONS.....	14

Table of Figures and Tables

FIGURE 1 DEVELOPMENT OF THE CHICAGO SANITARY AND SHIP CANAL SYSTEM.....	4
FIGURE 2 LOCATION PLAN - LAKE MICHIGAN DIVERSION AT CHICAGO	5
TABLE 1 WY 1995 MONTHLY AND ANNUAL PRECIPITATION (INCHES).....	7
TABLE 2 STATUS OF THE STATE OF ILLINOIS DIVERSION	9

List of Appendices

APPENDIX A : WY1993 LAKE MICHIGAN DIVERSION ACCOUNTING REPORT
APPENDIX B : WY1994 LAKE MICHIGAN DIVERSION ACCOUNTING REPORT

EXECUTIVE SUMMARY

This document is the Water Year (WY) 1995 Annual Report of the Chicago District, U. S. Army Corps of Engineers activities in the monitoring and review of the accounting of Lake Michigan diversion flows through Chicago, Illinois as directed by 1980 amendment to the U. S. Supreme Court Decree. Additionally, this report serves to summarize the Corps' major accomplishment with respect to the mission as mandated by the Water Resources Development Act of 1986, PL99-662, Section 1142. This act gave the Corps complete responsibility for diversion accounting effective 1 October 1987. This report provides an overview and audit of flow measurements and accounting computed by the Corps of Engineers for WY 1993 and WY 1994, 1 October 1992 through 30 September 1994.

The Lake Michigan Diversion Accounting Reports for WY 1993 and WY 1994 have been completed. The State of Illinois diverted 3,841 cfs during WY 1993 and 3,064 cfs during WY 1994. These diversions are 641 cfs greater than and 136 cfs less than the 3,200 cfs 40 year average diversion specified in the modified decree. The running average of the diversion for WY 1981 through WY 1994 is 3,456 cfs, or 256 cfs over the annual allocation. Also, the annual average diversion has now exceeded the 3680 cfs annual limit three times, once more than the maximum number of times allowed in the decree. Additionally, WY93 has exceeded the absolute annual maximum of 3840 cfs by one cfs. The cumulative deviation is now -3,589 cfs-years. The negative sign indicates a cumulative flow deficit. The maximum allowable cumulative flow deficit specified in the decree is 2,000 cfs-years.

INTRODUCTION

The diversion of water from the Lake Michigan watershed is important to the Great Lake states and to the Canadian province of Ontario. The states and province that border the Great Lakes have concerns with diversions during periods of low lake levels and the long term effects of diversion. To insure these concerns are considered, the U.S. Army Corps of Engineers is responsible for the accounting of flow diverted from the Lake Michigan watershed.

The Water Year (WY) 1995 Annual Report on Lake Michigan Diversion Accounting presents activities by the Corps of Engineers in accounting for the diversion from Lake Michigan by the State of Illinois. The accounting of the diversion is performed according to the guidelines established in the 1980 modified U.S. Supreme Court Decree concerning the diversion.

Presented in this report is the history of the diversion and its accounting, the certification of WY 1993 and WY 1994 diversion flows, a description of the sources of the diversion, a description of the accounting procedures, and a summary of all significant activities that occurred during WY 1995.

AUTHORITY FOR REPORT

Under the provisions of the U.S. Supreme Court Decree in the Wisconsin, et al v. Illinois et al, 388 U.S. 426, 87 S.Ct. 1774 (1967) as modified by 449 U.S. 48, 101 S. CT. 557 (1980), the Corps of Engineers monitors the measurement and computation Lake Michigan diversion by the State of Illinois. The terms of the modified decree require the Corps of Engineers to prepare an annual report on the accounting of the Lake Michigan water diverted by the State of Illinois and actions taken by the involved agencies.

HISTORY OF THE DIVERSION

Water was first diverted from Lake Michigan at Chicago into the Mississippi River Basin with the completion of the Illinois and Michigan (I & M) Canal in 1848. The Illinois and Michigan Canal was primarily for transportation and diverted up to 500 cubic feet per second (cfs).

Development of the Chicago sewer system led to severe sanitation problems in the Chicago River by the mid to late 1800's. The newly constructed sewers moved water and wastes into the Chicago River, which until 1900 drained to Lake Michigan. The water quality of Lake Michigan deteriorated and contaminated the city's primary water supply.

A second problem during this time was an increase in the overbank flooding within the city. The sewer system expanded as more roads and buildings were built. This construction increased the rate and volume of runoff and resulted in increased flooding.

As a solution to the sanitation and flooding problems, the Chicago Sanitary and Ship Canal (CSSC) was built. The construction reversed the flow direction of the Chicago River (figure 1). The Chicago Sanitary and Ship Canal was completed in 1900 by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC, formerly the Metropolitan Sanitary District of Greater Chicago, MSDGC). The Sanitary and Ship Canal followed the course of the older I & M Canal. This canal is much larger than the I & M Canal and can handle the Chicago River flow as well as increased shipping. The Chicago River Controlling Works were constructed at the mouth of the Chicago River in the 1930s. The lock and sluice gates regulate the amount of Lake Michigan water allowed to pass into the river and restricts river flooding entering Lake Michigan.

Between 1907 and 1910, the MWRDGC constructed a second sanitary canal called the North Shore Canal. This canal extends from Lake Michigan at Wilmette south 6.14 miles to the North Branch of the Chicago River. The Wilmette Controlling Works regulate the amount of Lake Michigan flow allowed down the channel.

Construction of a third canal, the Calumet Sag Canal, was completed in 1922. The canal connects Lake Michigan, through the Grand Calumet River, to the Sanitary and Ship Canal. This canal carried combined sewage overflows from South Chicago, Illinois and East Chicago, Indiana. The O'Brien Lock and Dam located on the Calumet River, regulates the flow of Lake Michigan waters down the canal. Figure 2 shows the affected watershed.

Upon completion of the Chicago Sanitary and Ship Canal in 1901, the Secretary of War issued a permit authorizing a diversion of 4,167 cfs. In 1908 and 1913, the United States brought actions to enjoin the MWRDGC from diverting more than the 4,167 cfs previously authorized in 1901. The two actions were consolidated and the Supreme Court entered a decree on 5 January 1925 allowing the Secretary of War to issue diversion permits. In March 1925, the permit issued limited the diversion to 8,500 cfs, about the average then being used.

In 1922, 1925, and 1926, several Great Lakes States filed similar original actions in the U.S. Supreme Court seeking to restrict the diversion at Chicago. A Special Master, appointed by the U.S. Supreme Court to hear the combined three suits, found the 1925 permit to be valid and recommended dismissal of the action. The U.S. Supreme Court, however, reversed the Special Master's finding. Subsequently, the Court instructed the Special Master to determine the steps necessary for Illinois and MWRDGC to reduce the diversion. Consequently, a 1930 decree reduced the allowable diversion (which did not include domestic pumpage) in three steps: to 6,500 cfs after 1 July 1930; to 5,000 cfs after 30 December 1935; and to 1,500 cfs after 31 December 1938.

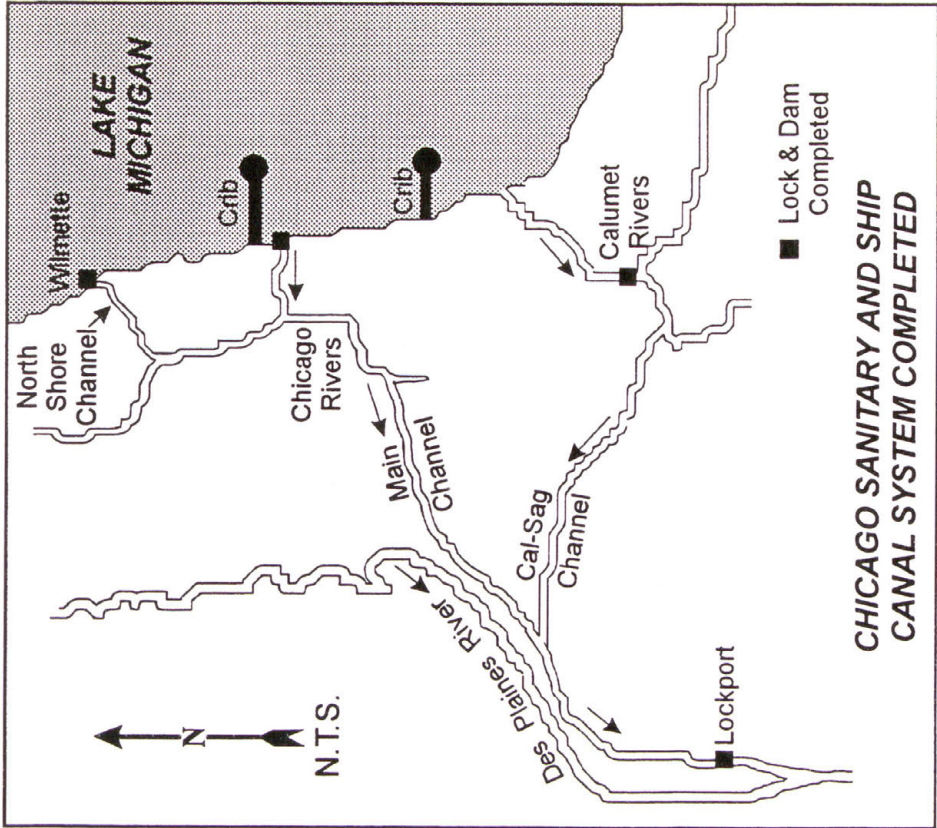
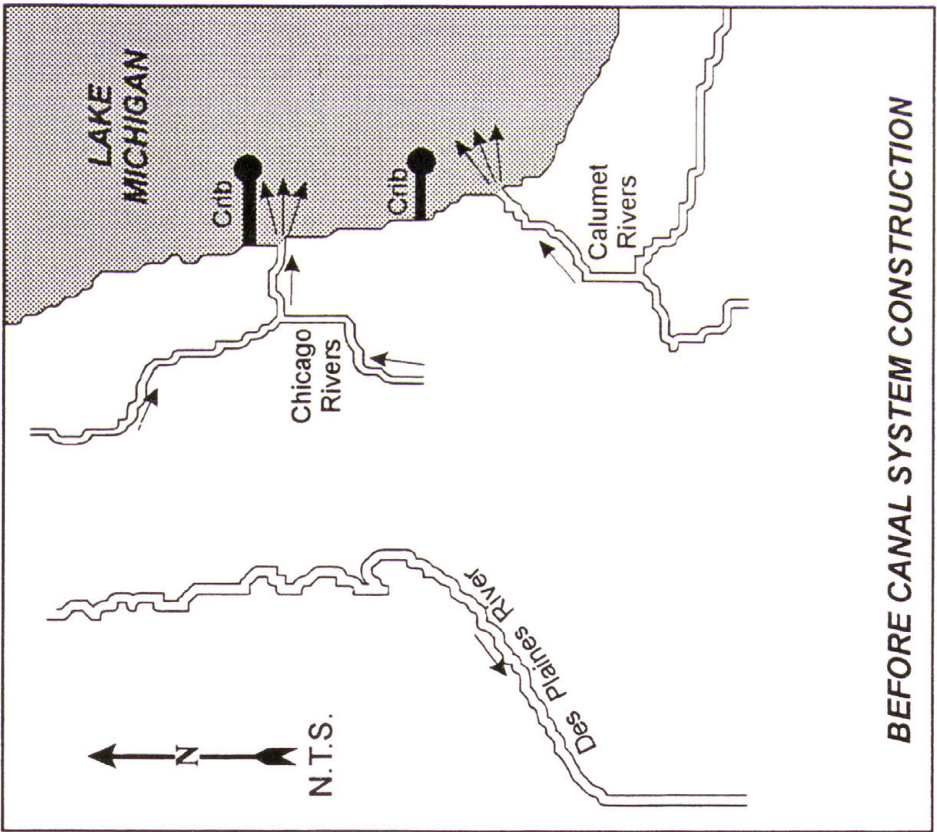


FIGURE 1 DEVELOPMENT OF THE CHICAGO SANITARY AND SHIP CANAL SYSTEM

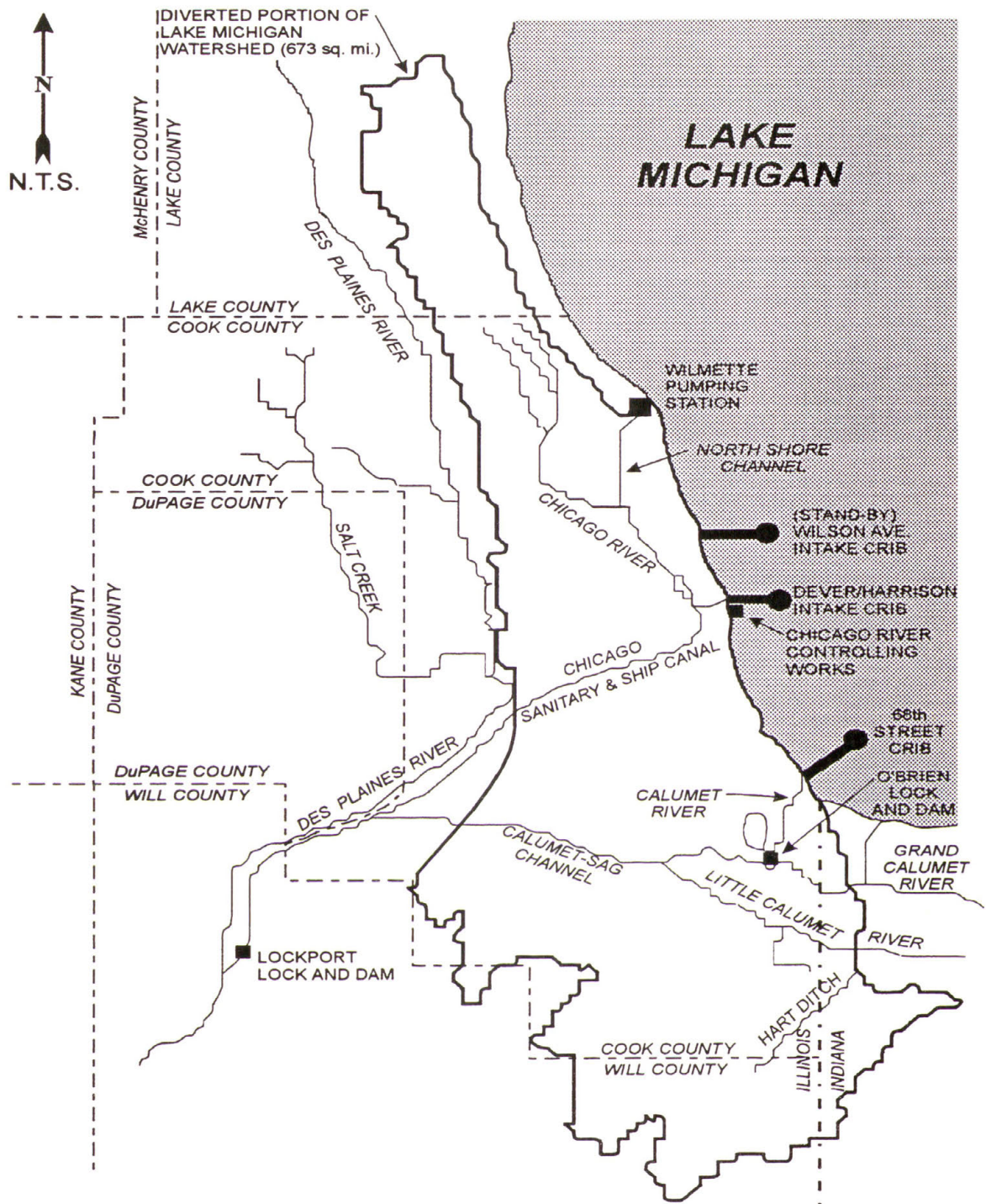


FIGURE 2 LOCATION PLAN - LAKE MICHIGAN DIVERSION AT CHICAGO

In 1967, an additional Supreme Court Decree limited the diversion of Lake Michigan water by the State of Illinois and its municipalities, including domestic pumpage, to a five year average of 3,200 cfs effective 1 March 1970. The 1967 Supreme Court Decree gave full responsibility to the State of Illinois for diversion measurements and computations. The role of the Corps of Engineers, as specified in the decree, was to be one of "general supervision and direction."

The 1967 decree was modified on 1 December 1980. This modified decree changed the beginning of the accounting year from 1 March to 1 October. The modified decree also extended the period for the running average diversion from five years to forty years beginning with WY 1981.

The amended decree contains three provisions that affected the role of the Corps of Engineers in the diversion accounting program. First, although the State of Illinois was primarily responsible for measurement and computation of diversion flows, the decree allowed the Corps of Engineers to participate in the function, subject to agreement and cost sharing with the State of Illinois. Negotiations were held on cost sharing the computation of the diversion. No agreement was reached due to lack of funding. The measurement and computation of the diversion continued to be done by the Illinois Department of Transportation (IDOT) through its consultants, the Northeastern Illinois Planning Commission (NIPC), MWRDGC, and the United States Geological Survey (USGS).

Second, the supervisory role for the Corps of Engineers increased so the Corps of Engineers was responsible for auditing the computations and measurements performed by the State of Illinois.

Third, the modified decree states that the Chief of Engineers shall appoint a Three Member Technical Committee to determine the best current engineering practice and scientific knowledge for measuring the diversion and to make recommendations as appropriate. The decree states that "...the members should be selected on the basis of recognized experience and technical expertise in flow measurement or hydrology." A technical committee is to be reconvened at least once every five years. The first Technical Committee convened in June 1981 and completed its work in April 1982. The second Technical Committee convened in July 1986, and completed their final report in November 1987. The third Technical Committee completed their final report in August 1994.

The Water Resources Development Act of 1986 gave the Corps of Engineers responsibility for the computation of diversion flows as formerly done by the State of Illinois. The Corps of Engineers' new mission became effective 1 October 1987.

SIGNIFICANT HYDROLOGIC EVENTS

During WY 1995, a total of 33.00 inches of precipitation fell at the National Weather Service (NWS) O'Hare Weather Station. This recorded precipitation for 1995 is 8% less than the long term (1951-1990) average of 35.82 inches. The recorded monthly rainfall data during WY 1995, and the deviation from long term annual and monthly average precipitation, are tabulated in Table 1.

TABLE 1 WY 1995 MONTHLY AND ANNUAL PRECIPITATION (INCHES)
National Weather Service, O'Hare Weather Station

<u>Month</u>	<u>Precipitation</u>	1951 - 1990 Average <u>Precipitation</u>	<u>Deviation</u>	Percent of <u>Average</u>
Oct-94	3.23	2.41	0.82	134%
Nov-94	3.75	2.92	0.83	128%
Dec-94	1.61	2.47	-0.86	65%
Jan-95	3.21	1.53	1.68	210%
Feb-95	0.41	1.36	-0.95	30%
Mar-95	1.43	2.69	-1.26	53%
Apr-95	5.79	3.64	2.15	159%
May-95	4.47	3.32	1.15	135%
Jun-95	1.40	3.78	-2.38	37%
Jul-95	3.17	3.66	-0.49	87%
Aug-95	3.49	4.22	-0.73	83%
Sep-95	1.04	3.82	-2.78	27%
Annual	33.00	35.82	-2.82	92%

Five significant meteorological events were experienced within the greater metropolitan Chicago area. These events and their impacts are summarized in the following paragraphs.

HYDROLOGIC AND METEOROLOGICAL EVENTS

On 1-6 November 1994, up to 3.5" of rain fell on northwest Indiana. The Kankakee River at Davis crested 1' over the NWS flood stage.

On 8-12 April 1995, 2.3" fell at O'Hare Airport and up to 4" in northwest Indiana. Iroquois River at Iroquois crested 1.8' over the NWS flood stage. The Kankakee River at Davis crested 1.8' over the NWS flood stage, at Shelby crested 1.5' over, and at Wilmington crested 0.5' over.

On 25-28 April 1995, up to 3" fell on metropolitan Chicago. The Des Plaines River at Riverside crested 1' over the NWS flood stage.

On 23-28 May 1995, up to 3.3" fell on metropolitan Chicago. The Kankakee River at Shelby crested 1.1' and at Wilmington 0.3' over the NWS flood stage.

Several minor events throughout the water year caused stages to exceed flood stage without significant damage.

STATUS OF ACCOUNTING REPORTS

Lake Michigan diversion flow data is summarized in accounting reports prepared on an annual basis as flows are certified. Since implementation of the modified Supreme Court Decree of 1 December 1980 and before this report, the Corps of Engineers has certified diversion flows for WY 1981 through WY 1992. The WY 1993 and WY 1994 Lake Michigan Diversion Accounting Reports are certified and included as appendices A and B of this Water Year 1995 Annual Report. The State of Illinois diverted 3,841 cfs during WY 1993 and 3,064 cfs during WY 1994. These diversions are 641 cfs greater than and 136 cfs less than the 3,200 cfs 40 year average diversion specified in the 1980 modified decree. Table 2 shows the accounting year, the certified flows, the running average flows, and the cumulative deviation from the allowable diversion of 3,200 cfs.

The running average diversion for the period WY 1981 through WY 1994 is 3,456 cfs, 256 cfs greater than the 3,200 cfs 40 year average diversion specified by the modified decree. Also, the annual average diversion has now exceeded the 3680 cfs annual limit three times, once more than the maximum number of times allowed in the decree. Additionally, WY93 has exceeded the absolute annual maximum of 3840 cfs by one cfs. The cumulative deviation, the sum of the differences between the annual average flows and 3,200 cfs, is -3,589 cfs-years. The negative cumulative deviation indicates a cumulative flow deficit. The decree specifies a maximum allowable deficit of 2,000 cfs-years over the first 39 years of the 40 year averaging period.

Data collection and preparation, diversion computation, and report writing for the WY 1993 and WY 1994 accounting reports were performed by the Corps. Data collection and preparation for this report began in Fiscal Year (FY) 1994. Certification of the WY 1995 accounting report is scheduled for FY 1997.

TABLE 2 STATUS OF THE STATE OF ILLINOIS DIVERSION
Under the 1980 modified U.S. Supreme Court decree

<u>Year</u>	<u>Flow (cfs)</u>	<u>Average (cfs)</u>	<u>Deviation (cfs)</u>
1981	3,106	3,106	94
1982	3,087	3,097	207
1983	3,613	3,269	-206
1984	3,432	3,310	-438
1985	3,472	3,342	-710
1986	3,751	3,410	-1,261
1987	3,774	3,462	-1,835
1988	3,376	3,451	-2,011
1989	3,378	3,443	-2,189
1990	3,531	3,452	-2,520
1991	3,555	3,461	-2,875
1992	3,409	3,457	-3,084
1993	3,841	3,487	-3,725
1994	3,064	3,456	-3,589

SOURCES OF DIVERSION

The Lake Michigan diversion consists of three primary components. These components are domestic pumpage from Lake Michigan used for water supply and not returned to Lake Michigan, stormwater runoff from the diverted Lake Michigan watershed, and direct diversions through the three lakefront control structures.

Domestic pumpage from Lake Michigan is used for water supply and its effluent is discharged to the canals by various Water Reclamation Plants (WRP's). Currently, the WRP's that divert domestic pumpage from the lake either discharge to the canal system or to the Des Plaines River and its tributaries. In the future as more communities convert to Lake Michigan water supply, water supply effluent may also be discharged to the Fox River. The Fox River is approximately 35 miles west of downtown Chicago.

Stormwater runoff that previously drained to Lake Michigan through the Chicago River and the Calumet River now drains to the Chicago Sanitary and Ship Canal (CSSC) and the Calumet Sag Channel, respectively. The Calumet Sag Channel drains to the CSSC, and the CSSC ultimately drains into the Illinois River and the Mississippi River. The drainage area of the diverted Lake Michigan watershed is approximately 673 square miles.

Direct diversion locations are at the Chicago River Controlling Works (CRCW), the O'Brien Lock and Dam, and the Wilmette Controlling Works. These controlling structures are located downtown, at the south end, and at the north end of the Chicago area, respectively.

The direct diversion consists of four components; lockage, discretionary flow, navigation makeup flow, and leakage. The lockage component is the flow used in locking vessels to and from the lake. The purpose of the discretionary diversion is to dilute effluent from sewage discharges. When large storms are forecast, the canal is drawn down before the storm to prevent flooding. If the runoff is not enough to refill the canal, navigation makeup water is passed. The leakage component is water estimated to pass, in an uncontrolled way, through or around the lakefront structures.

ACCOUNTING PROCEDURES

Diversion accounting uses both measured and estimated flows. A series of hydrologic and hydraulic computer models use various meteorological data to simulate flows not measured. These simulated flows as well as measured flows are used to compute the diversion. Along with the diversion calculation, a number of water budgets verify simulated flows and estimate the reliability of the computed diversion.

DIVERSION COMPUTATION

An acoustic velocity meter (AVM) was installed and has been operating at Romeoville (five miles upstream of the Lockport Powerhouse and three miles upstream of the Lockport Controlling Works) since 12 June 1984. The AVM directly measures total flow through the canal above both the Powerhouse and the Controlling Works. The overwhelming majority of the Lake Michigan diversion and some non-Lake Michigan flows pass through the AVM. The diversion accounting procedure uses the flow measured at Romeoville and deducts flows not accountable in the diversion. Diversion flows which bypass Lockport are added to yield the net computed diversion of water from Lake Michigan. This procedure represents the accounting technique as required by the modified Supreme Court Decree.

The flow measured at Romeoville was approximately 106 % of the annual diversion during WY 1993 and 101 % during WY 1994. Approximately 94 % of the diverted water was measured by the AVM during WY 1993 and 92 % during WY 1994, the latter diversion being reduced due to the influx of western suburbs using Lake Michigan water as their primary domestic water supply source. Most of these new users of Lake Michigan water do not discharge their sewage effluent to the canal system. As more communities are added, more water will be discharged outside the canal system, further lowering the percentage measured by the AVM.

Deductions from the Romeoville AVM flow include runoff from 217 square miles of the Des Plaines River watershed discharged to the canal, groundwater supply effluent and groundwater seepage into the Tunnel and Reservoir Plan (TARP) tunnels discharged to the canal, and Indiana water supply discharged to the canal through the Calumet River system and the Calumet Sag Channel (see figure 2 for locations). The computer models of the Des Plaines watershed area estimate the runoff deduction. The groundwater pumpage deductions are obtained directly from pumping records. The Indiana water supply is computed from pumping records and a calculation to determine the portion of the water supply draining west to the Calumet Sag Channel.

The additions for diversion flow that do not flow through Romeoville are primarily Lake Michigan water supply pumpage effluent treated and released to the Des Plaines River or its tributaries. This flow is obtained directly through pumping records of the communities involved and accounts for approximately 6 % of the diversion in WY 1993 and 8 % in WY 1994. As more communities convert to Lake Michigan water supply, the percentage will increase.

DIVERSION BUDGET CHECKS

Water budgets verify those flows not measured. Most of the budgets compare simulated flows to recorded flows and these comparisons indicate the accuracy of the diversion accounting. The four primary budgets are the budgets for the three major Water Reclamation Plants (WRP's) that serve the area involved in diversion accounting and the canal balance budget for the CSSC. The Upper Des Plaines pump station budget will also become a significant budget after measurement problems are resolved. The remaining budgets estimate runoff from stream gaged areas in the Lake Michigan watershed or are budgets of non-simulated flows such as water supply pumpage. The budgets were discussed in detail in the WY 1993 and WY 1994 accounting reports.

ACCOMPLISHMENTS DURING FY 1995

In each accounting year, various changes to the diversion procedures and other activities help to improve the accuracy and efficiency of the diversion accounting.

DES PLAINES TARP SYSTEM MODELING

Beginning in June 1993 the southern and middle portions of the Des Plaines TARP system became operational. Consequently, these tunnels were added to the modeling of the TARP system for WY 1993. The Des Plaines TARP system, like that of the Mainstream TARP system, captures a portion of the combined sewer overflows which are then conveyed by gravity to the West Southwest Water Reclamation facility in Stickney.

Flows are then pumped from the Des Plaines tunnel to the West Southwest plant using pumps that are independent of those used for the Mainstream tunnel. The addition of the Des Plaines TARP system impacts the deductible runoff from the Des Plaines river watershed contained in Column 6 as well as the groundwater deduction contained in Column 4. Therefore, the inclusion of the Des Plaines TARP system into the modeling directly affects the computed diversion. Detailed information regarding these modifications are provided in the WY 1993 and WY 1994 accounting reports.

DEDUCTIBLE WATER SUPPLY FROM THE GRAND CALUMET RIVER

The estimate of the Grand Calumet river portion of the water supply pumpage from Indiana that reaches the CSSC was revised to better account for the unique hydraulics of the river. The revised computation of Grand Calumet river water supply impacts the deduction of Column 5 and thus directly impacts the computed diversion. A more detailed description of this revision is contained in the WY 1993 and WY 1994 accounting reports.

MODELING OF RUNOFF FROM THE UNGAGED CALUMET WATERSHED

Prior to WY 1993 there existed a double accounting of a portion of the runoff from the ungaged Calumet watershed. The flow that was double accounted was the infiltration into the separate sanitary sewers within the ungaged Calumet watershed. This revision only impacts Column 12, the diverted runoff from the Lake Michigan watershed, which is used as a component verification of the overall diversion contained in Column 10. Therefore, this revision does not impact the computed diversion. For a detailed description of this double accounting refer to the Lake Michigan Diversion Accounting Water Year 1990 report contained in the Water Year 1993 Annual Report.

ACTIVITIES FOR FY 1996 AND FY 1997

The activities for FY 1996 centered on completing WY 1993 and WY 1994 accounting reports, thereby enabling the diversion accounting program to be on schedule. Additionally, the Corps supported the Great Lakes Mediation Committee (as discussed in the next paragraph). The efforts in FY 1997 will be to complete the WY 1995 accounting report, to address the recommendations of the Third Technical Committee and to initiate the contracting for the Fourth Technical Committee.

In response to a dispute over the alleged violation by the State of Illinois of the diversion limits set forth in the 1967 and 1980 Supreme Court Consent Decree in *Wisconsin v. Illinois*, 388 U.S. 426 (1967), *as modified*, 449 U.S. 48 (1980) ("Decree"), voluntary negotiations were carried out among the State of Illinois, the other seven Great Lakes states, the Metropolitan Water Reclamation District of Greater Chicago and the United States during a mediation (The Great Lakes Mediation) that began in December

1995. Representatives from Canada and the Province of Ontario observed the negotiations and participated in the discussions. The negotiators involved in the Great Lakes Mediation agreed to principles set forth in a Memorandum of Understanding ("MOU"), dated July 29, 1996. The final acceptance of these terms was ratified by principals not present at the mediation. In support of the mediation process the Corps provided technical support, including long-term runoff and consumptive use studies. These studies provide the technical basis of an agreement between the states to potential move the accounting process to the lakefront.

RUNOFF STUDY

In support of negotiations for changing the Decree, Chicago District conducted a model study for estimating runoff from the Lake Michigan watershed for 44 years (1951 through 1994). The model was based on the hydrologic models used in the accounting procedures. The report for this study will be included in the WY 1996 Annual Report.

CONSUMPTIVE USE STUDY

In support of negotiations for changing the Decree, Chicago District briefly studied and modeled the water supply for metropolitan Chicago. The results of the study give a range of consumptive use of Chicago's water supply. The report for this study will be included in the WY 1996 Annual Report.

ACCOUNTING REPORTS

The Accounting Reports for WY 1993 and WY 1994 were completed in FY 1996 and the Accounting Reports for WY 1995 will be completed in FY 1997. Thereafter, additional accounting reports are expected to be completed in the second fiscal year following the end of the water year for which the diversion is computed.

SUMMARY AND CONCLUSIONS

SUMMARY

The Lake Michigan Diversion Accounting procedure continues to evolve and improve. Further improvements are being implemented. A comprehensive manual is being completed during FY 1997 to include all the improvements. This manual will be included in the WY 1996 Annual Report.

CONCLUSIONS

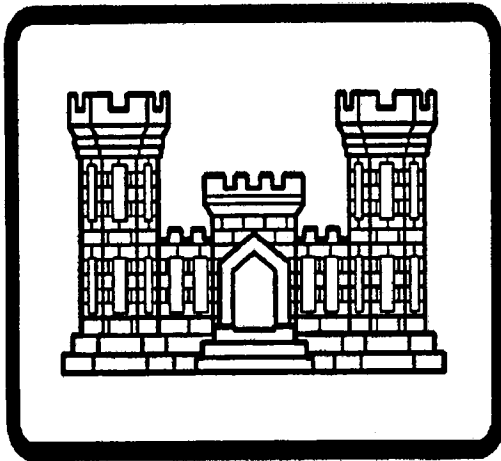
The Lake Michigan Diversion Accounting Reports for WY 1993 and WY 1994 have been completed as required by the Supreme Court Decree.

The State of Illinois diverted 3,841 cfs during WY 1993 and 3,064 cfs during WY 1994. These flows are 641 cfs greater than and 136 cfs less than the 3,200 cfs limit specified in the decree. The running average of the diversion for WY 1981 through WY 1994 is 3,456 cfs, or 256 cfs over the annual allocation. Also, the annual average diversion has now exceeded the 3680 cfs annual limit three times, once more than the maximum number of times allowed in the decree. Additionally, WY93 has exceeded the absolute annual maximum of 3840 cfs by one cfs. The cumulative deviation is now -3,589 cfs-years. The negative sign indicates a cumulative flow deficit. The maximum allowable cumulative flow deficit specified in the decree is 2,000 cfs-years.

APPENDIX A

LAKE MICHIGAN DIVERSION ACCOUNTING

WATER YEAR 1993 REPORT



US Army Corps of Engineers
Chicago District

Lake Michigan Diversion Accounting

Water Year 1993 Report

Table Of Contents

List of Tables.....	ii
List of Figures	iii
Executive Summary	iv
Introduction	1
Authority for Report.....	1
History of the Diversion.....	1
Background of Lake Michigan Diversion Accounting	5
Diversion Accounting Procedures.....	9
Revisions to the Lake Michigan Diversion Accounting Procedures	12
Accounting Results.....	12
Discussions of Results.....	15
Columns.....	15
Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, USGS AVM Gage Record.....	15
Column 2: Diversions from the CSSC Above the Gage	15
Column 3: Total Flow Through the CSSC.....	16
Column 4: Groundwater Discharged to the CSSC And Adjoining Channels.....	16
Column 5: Water Supply Pumpage from Indiana Reaching the CSSC.....	17
Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC	18
Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC	19
Column 8: Total Deductions from the CSSC Romeoville Gage Record.....	19
Column 9: Lake Michigan Pumpage Not Discharged to the CSSC.....	19
Column 10: Total Diversion.....	21
Column 11 Through Column 13: Lake Michigan Diversion Components.....	21
Budgets.....	25
Budget 1 and Budget 2: Water Supply Pumpage	25
<i>Budget 1: Diverted Lake Michigan Water Supply</i>	25

<i>Budget 2: Groundwater Diverted to the CSSC</i>	25
Budgets 3 Through Budget 6: Stream Gaging Stations	26
Budgets 7 Through Budget 13: MWRDGC Water Reclamation Facilities.....	27
<i>Budget 7: Northside Water Reclamation Facility</i>	27
<i>Budget 8: Upper Des Plaines Pump Station</i>	27
<i>Budget 9: Mainstream and Des Plaines TARP Pumping Stations</i>	32
<i>Budget 10: Stickney Water Reclamation Facility</i>	33
<i>Budget 11: Calumet TARP Pumping Station</i>	37
<i>Budget 12: Calumet Water Reclamation Facility</i>	39
<i>Budget 13: Lemont Water Reclamation Facility</i>	39
Budget 14: CSSC System Balance	42
Areas for Improvement	45
Impervious Model Estimates.....	45
Tunnel and Reservoir Plan Models	45
MWRDGC Upper Des Plaines Pump Station	46
O'Hare and Egan Basin Flow Transfer	47
Summary	48
References	49
Appendix A - Summary of Daily Diversion Flows	A-1

List of Tables

Table 1 - Description of the Diversion Accounting Columns	10
Table 2 - Description of the Diversion Accounting Computational Budgets	11
Table 3 - Status of the State of Illinois' Diversion from Lake Michigan under the 1980 Modified Supreme Court Decree.....	13
Table 4 - Lake Michigan Diversion Accounting - WY1993 Summary of Diversion Flows	14
Table 5 - Breakdown of the Diversion by the State of Illinois Based on Columns 11 Through 13.....	23
Table 6 - Stream Gage Flow Separation	26
Table 7 - WY 1993 Summary of Simulation Statistics	29
Table 8 - WY 1993 Summary of Flow Components for the CSSC System Balance.....	44

-

List of Figures

Figure 1 - Development of the Chicago Sanitary and Ship Canal System	3
Figure 2 - Location Plan - Lake Michigan Diversion at Chicago	4
Figure 3 - WY 93 Component Breakdown of Illinois' Diversion Based Upon Columns 11 through 13	24
Figure 4 - Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility	30
Figure 5 - Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station.....	31
Figure 6 - Map of Mainstream and Calumet TARP	34
Figure 7 - Budget 9 - Simulation of the MWRDGC Mainstream TARP Pumping Station.....	35
Figure 9 - Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station.....	38
Figure 10 - Budget 12 - Simulation of the MWRDGC Calumet Water Reclamation Facility	40
Figure 11 - Budget 13 - Simulation of the MWRDGC Lemont Water Reclamation Facility	41
Figure 12 - Budget 14 - CSSC System Balance	43

Executive Summary

In compliance with the modified 1980 U.S. Supreme Court decree (hereinafter, the Decree), the WY93 diversion was computed using the best engineering technology available to date.

Given the complexity of the hydrologic cycle in the heavily urbanized Chicago metropolitan area, and given the number of human and other factors that cannot be adequately represented in numerical modeling procedures, the results of the simulations which compute diversion flows worked exceptionally well.

The WY93 diversion accountable to the State of Illinois is 3,840.8 cfs. This is 640.8 cfs greater than the 3,200 cfs average specified by the Decree. The 40 year running average, rounded to the nearest cfs, beginning with WY81 is 3,487 cfs and the cumulative deviation from the 3,200 cfs average is -3,725 cfs-years. The negative cumulative deviation indicates a water allocation deficit and the maximum allowable debt is 2,000 cfs-years.

Introduction

The diversion of water from the Lake Michigan watershed is of major importance to the Great Lakes states and to the Canadian province of Ontario. The states and province that border the Great Lakes have concerns with both diversions during periods of low lake levels, as well as the long term effects of diversion. To insure that the concerns of these interested parties are considered, the U. S. Army Corps of Engineers has been given the responsibility for the accounting of flow that is diverted from the Lake Michigan watershed.

The Corps of Engineers, Chicago District, is responsible for monitoring the measurements and the computation of the diversion of Lake Michigan water by the State of Illinois. The computations for Water Year 1983 (WY83), WY84 and WY85 (1 October 1982 through 30 September 1985) were completed by the Northeastern Illinois Planning Commission (NIPC) for the Illinois Department of Natural Resources - Office of Water Resources (IDNR-OWR), formerly known as the Illinois Department of Transportation - Division of Water Resources (IDOT-DWR). Prior to the WY83 report, the calculations were made by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), formerly known as the Metropolitan Sanitary District of Greater Chicago (MSDGC) for IDNR-OWR. The Corps reviewed, modified, and updated the WY84 and WY85 diversion accounting completed by NIPC. The computations for WY86 were performed jointly by NIPC (under contract to the Corps of Engineers) and the Corps of Engineers. Beginning in WY87, the computations were performed solely by the Corps of Engineers. This report represents the final Lake Michigan diversion accounting for WY93.

Authority for Report

Under the provisions of the U.S. Supreme Court Decree in the Wisconsin, et. al. v. Illinois et. al., 388 U.S. 426, 87 S.Ct. 1774 (1967) as modified 449 U.S. 48, 101 S.Ct. 557 (1980), the Chicago District of the Corps of Engineers is responsible for monitoring the measurement and computation of diversion of Lake Michigan water by the State of Illinois. The Water Resources Development Act of 1986 (Section 1142 of PL 99-662) gave the Corps total responsibility for the computation of diversion flows as formerly done by the State of Illinois. The Corps' new mission became effective 1 October 1987.

History of the Diversion

Water has been diverted from Lake Michigan at Chicago into the Mississippi River Watershed since the completion of the Illinois and Michigan (I and M) Canal

in 1848. At that time, diversion averaged about 500 cubic feet per second (cfs). The I and M Canal was built primarily to serve transportation needs providing a connecting watercourse between the Great Lakes and the Mississippi River system.

With the development of the Chicago metropolitan area, sewer and drainage improvements led to severe sanitation problems in the mid to late 1800's. The newly constructed sewers moved water and wastes into the Chicago River, which until 1900 drained to Lake Michigan. The water quality of Lake Michigan deteriorated and contaminated the city's primary water supply.

A second problem that occurred during this time period was an increase in the overbank flooding within the city. As more roads were built and buildings constructed, the sewer system was correspondingly expanded. The increase in impervious area from the newly constructed roads and buildings increased the rate and volume of stormwater runoff and resulted in increased flooding.

As a solution to the sanitation and flooding problems, construction of the Chicago Sanitary and Ship Canal (CSSC) was undertaken. Construction of the CSSC allowed the flow direction of the Chicago River to be reversed (Figure 1). Construction of the Chicago Sanitary and Ship Canal was completed in 1900 by the MWRDGC. The CSSC followed the course of the older I and M Canal. The CSSC is much larger than the I and M canal and can handle the Chicago River flow, as well as increased shipping. In the 1930's, the Chicago River Controlling Works (CRCW) was constructed at the mouth of the Chicago River. The CRCW regulates the amount of Lake Michigan water allowed to pass into the river and restricts river flooding from entering Lake Michigan. The water levels in the CSSC are controlled by the Lockport Lock and Dam.

Between 1907 and 1910, the MWRDGC constructed a second canal called the North Shore Channel. It extended from Lake Michigan at Wilmette in a southerly direction 6.14 miles to the north branch of the Chicago River. The Wilmette Pumping Station regulates the amount of Lake Michigan flow allowed down the channel.

Construction of a third canal, the Calumet Sag Channel, was completed in 1922. The canal connects Lake Michigan through the Grand Calumet River, to the CSSC. The Calumet Sag Channel was constructed to carry sewage from South Chicago, Illinois and East Chicago, Indiana. The O'Brien Lock and Dam, which was completed in 1967, is located on the Calumet River and regulates the flow of Lake Michigan waters down the Calumet Sag Channel. The O'Brien Lock and Dam replaced the Blue Island Lock and Dam. Figure 2 shows the affected watershed.

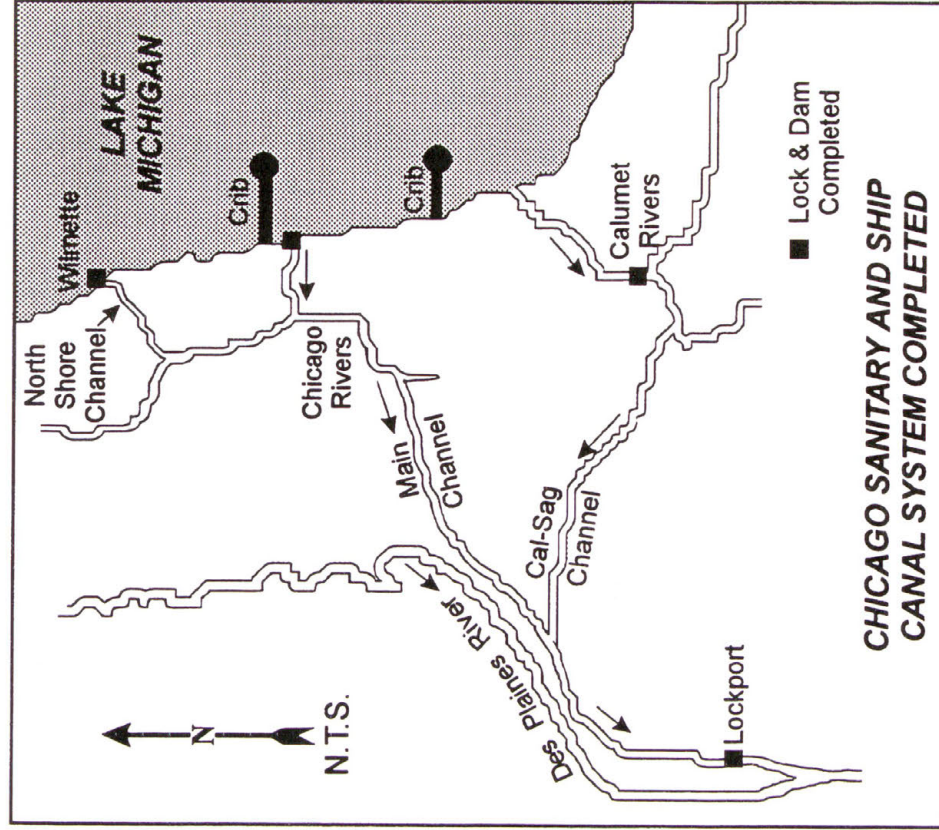
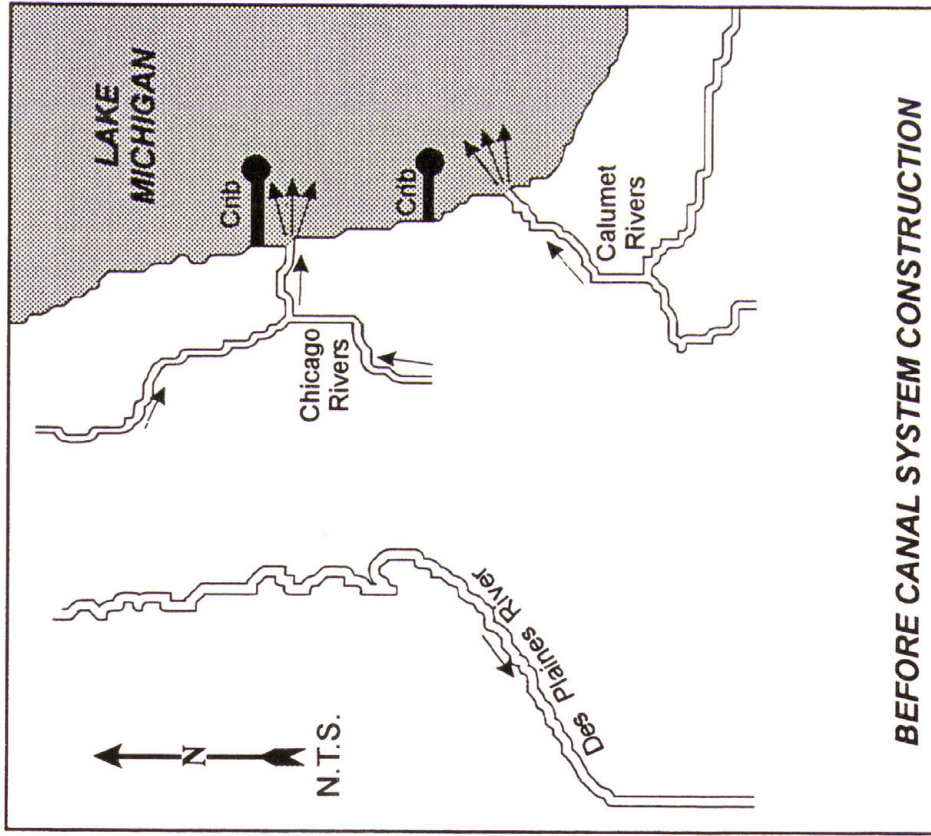


Figure 1

Development of the Chicago Sanitary and Ship Canal System

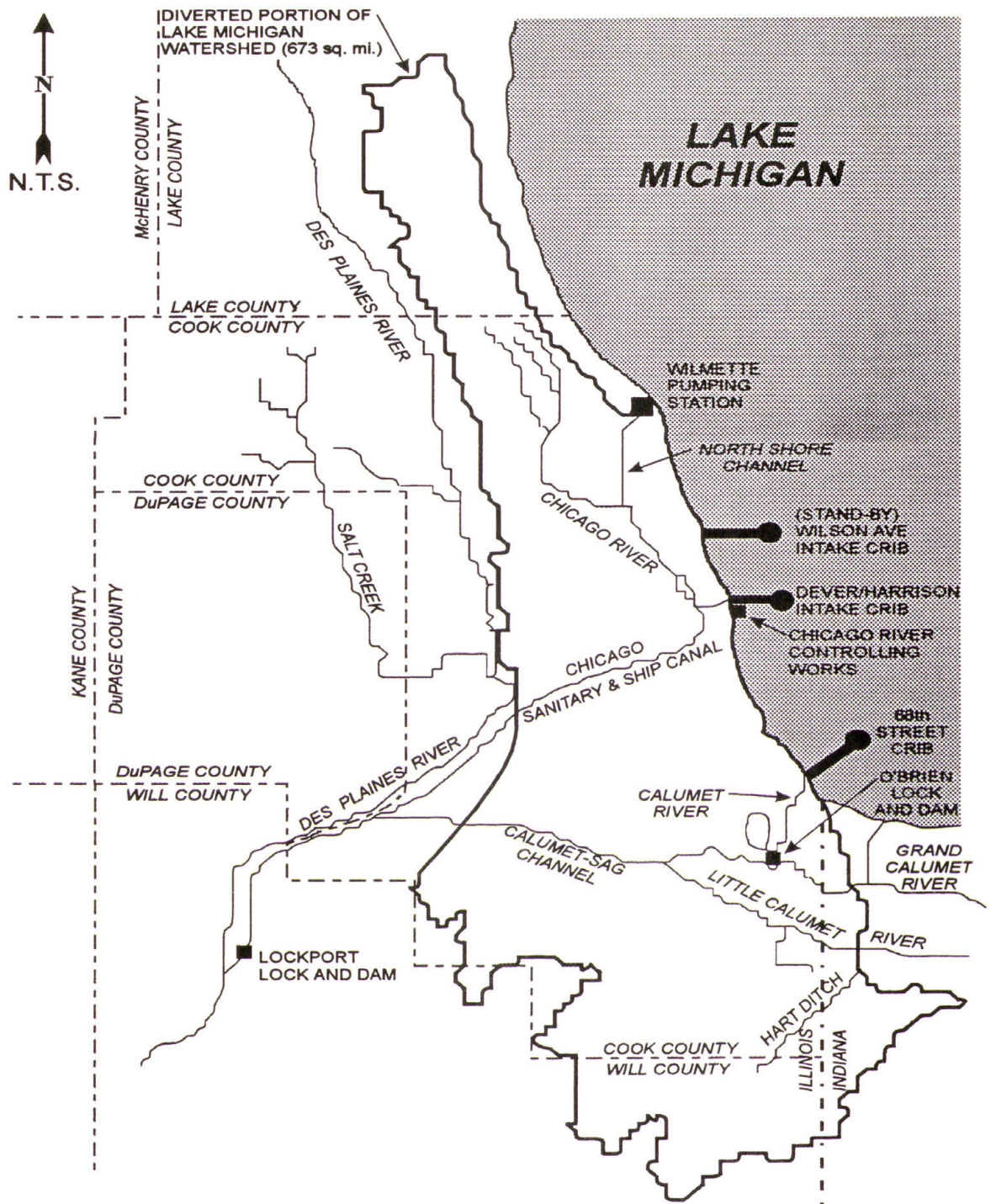


Figure 2

Location Plan - Lake Michigan Diversion at Chicago

Background of Lake Michigan Diversion Accounting

The Lake Michigan diversion accountable to Illinois is limited to 3,200 cubic feet per second (cfs) over a forty (40) year averaging period. During the forty (40) year period, the average diversion in any annual accounting period may not exceed 3,680 cfs, except in any two accounting periods in which the average diversion may not exceed 3,840 cfs as a result of extreme hydrologic conditions. During the first thirty nine (39) year period, the maximum allowable cumulative difference between the calculated diversion and 3,200 cfs is 2,000 cfs-years. These limits apply to the period beginning with WY81.

Prior to the 1983 accounting report, diversion accounting was done by the MWRDGC in the form of monthly hydraulic reports. As required by Supreme Court Decree, the diversion was calculated by deducting non-diversion flows from the Lockport record measured by MWRDGC and adding those diversion flows not discharging to the CSSC. All of the deductible flows could not be measured, therefore MWRDGC used flow records from gaged areas to get typical flow values and then extrapolated to arrive at the total deduction.

The State of Illinois contracted with NIPC to revise the diversion accounting calculations. At the same time, the State of Illinois moved from monthly hydraulic reports to annual accounting reports. NIPC adapted computer models of the diverted Lake Michigan and the Des Plaines River watersheds previously developed for studies in Northeastern Illinois under Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), to calculate those flows that could not be measured. Like MWRDGC, NIPC deducted non-diversion flows from the Lockport record and added those flows not discharged to the canal to calculate the Lake Michigan diversion. However, NIPC modeled both the gaged and ungaged areas to calculate much of the deduction and addition flows. Then computational budgets were developed around each of the gaged areas to verify the models. The budgets aid in identifying problem areas in the procedure. The procedure developed by NIPC is a significant improvement over the previous approach, because of the more rigorous approach and because of the verification provided by the budgets.

As required by Supreme Court Decree, a three (3) member technical committee is convened every five (5) years to evaluate the diversion accounting program to ensure that the accounting is accomplished using the best current engineering practice and scientific knowledge.

The first technical committee was convened during the period when diversion accounting was done by MWRDGC. The committee was primarily concerned with the rating of the various components at the Lockport facility, the primary diversion measurement location (Espey et. al., 1981). In response to the Committee's concerns, the Corps' Waterways Experiment Station (WES) revised the ratings of the two sets of Lockport sluice gates (Hart and McGee, 1985).

In response to the Committee's concerns, the State of Illinois installed an acoustic velocity meter (AVM) at Romeoville five (5) miles upstream of Lockport. The AVM is a highly accurate flow measuring device that proved to provide better flow measurements than the MWRDGC reported Lockport flows and the new Corps rating curves. The AVM became operational 12 June 1984. However, USGS did not publish the AVM flows until 1 October 1985. Because of significant equipment problems with the original AVM, a replacement AVM was installed in November 1988.

To provide flows during periods of malfunction, various regression analyses were performed to relate the MWRDGC reported Lockport flows to the AVM flows. Several sets of equations were proposed by the Corps of Engineers, the United States Geological Survey (USGS), Harza Engineering Co., and the Second Technical Committee. The report, *Chicago Sanitary and Ship Canal at Romeoville Acoustical Velocity Meter Backup System*, was completed September 1989 (USACE, 1989). The report documents the many efforts taken by various parties to develop useful regression equations. The regression equations that were ultimately used to estimate missing AVM flows from WY86 through WY92 were developed by the USGS in a report titled *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary and Ship Canal at Romeoville, Illinois* (USGS, 1994). This report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

The second technical committee reviewed the NIPC hydrologic and hydraulic computer models and agreed that the approach was consistent with what was required by the decree (Espey et. al., 1987). However, the committee felt that some of the parameters used in the models were out of date and in need of revision. To address the committee's concerns, the Corps hired a consultant (Christopher B. Burke Engineering, Ltd., (CBBEL)) in September of 1988 to review and update the modeling parameters. The final report (CBBEL, 1990) concerning the updating of modeling parameters was submitted to the Corps in October 1990.

The Water Resources Development Act of 1986 gave the Corps of Engineers the full responsibility for computation of the Illinois Lake Michigan diversion as of 1 October 1987. When the Corps' new responsibility became effective, the WY84

diversion accounting report, developed by NIPC, had not been certified. As a result, the Corps was responsible for the WY84 and all subsequent reports.

NIPC completed the WY84 diversion accounting report in April of 1987. It was subsequently reviewed by the Corps. The Corps found the report to be adequate with two exceptions. First, the 1984 accounting was completed with the modeling parameters questioned by the second technical committee. Second, the MWRDGC Lockport flows, which were adjusted using the WES rating curves, were used rather than the AVM flows. The Corps, knowing that the modeling parameters required updating and that AVM flows for the period prior to installation could be calculated accurately using regression equations, refrained from certifying the WY84 report until these issues were resolved.

NIPC completed the WY85 diversion accounting report in December of 1988 and the report was reviewed by the Corps. Like the WY84 report, the WY85 accounting was done with the modeling parameters questioned by the second technical committee. Additionally, NIPC used the AVM flows published by the USGS in their WY85 Water Resources Data for Illinois report. Since the publication of the WY85 USGS report, more reliable equations have been developed for calculating flows when the AVM was malfunctioning. These equations are periodically reviewed and updated as necessary.

Upon completion of the analysis of the modeling parameters by CBBEL, the WY84 and WY85 diversion flows were recalculated using the revised modeling parameters and the Romeoville AVM flows. The diversion flows were certified by the Corps of Engineers and transmitted to all interested parties in the Lake Michigan Diversion Accounting 1989 Annual Report (USACE, 1990).

The computation of Illinois' diversion from Lake Michigan for WY86 was undertaken as a joint effort between NIPC (under contract to the Corps of Engineers) and the Corps of Engineers. The computation of Illinois' diversion from Lake Michigan for WY87 through WY90 was performed solely by the Corps of Engineers. The WY91 and WY92 diversion accounting was performed as a joint effort between Christopher Burke Engineering (under contract to the Corps of Engineers) and the Corps of Engineers. The WY93 and WY94 accounting was performed solely by the Corps of Engineers. The WY86 through WY89 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Annual Report covering WY90 through WY92 (USACE, 1994). The WY90 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Water Year 1993 Annual Report (USACE, 1994). The WY91 and WY92 Diversion Accounting Reports are contained in the LMDA Water Year 1994 Annual Report (USACE, 1996). The WY93 and WY94 Diversion Accounting Reports are

contained in the Lake Michigan Diversion Accounting Water Year 1995 Annual Report.

The primary revision implemented for the WY90 diversion accounting was the incorporation of the new 25-gage precipitation network into the runoff simulation models. The 25-gage precipitation network replaces the previously used 13-gage network. The new precipitation network has solved many of the problems associated with the old network, such as poor exposure and distribution patterns. The Illinois State Water Survey (ISWS) installed and maintains the precipitation network for the Corps of Engineers. They also collect the data and adjust it if necessary. A description of the new 25-gage precipitation network can be found in the ISWS report titled *Installation and Operation of a Dense Raingage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990* (ISWS, 1991). That report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

In addition to the installation and use of the new 25-gage precipitation network was the subsequent modifications to the hydrologic runoff models and hydraulic sewer routing models. These models were revised in order to reflect the changes in the precipitation network. Many of the model changes were accomplished by Rust Environment and Infrastructure under contract with the Corps of Engineers. Their work culminated in a report titled *Diversion Accounting Update for the New 25-Gage Precipitation Network* (Rust,1993). That report is also contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

Rust's work involved review and correction of map delineations of combined sewer special contributing areas, delineation of precipitation gage assigned areas for the 25-gage network, land-use/land-cover delineations, modifications to the hydraulic sewer routing model to reflect the revised precipitation network and land cover assignments, and an assessment of the model parameters used in the hydrologic runoff model, Hydrologic Simulation Program - FORTRAN (HSPF).

The Corps of Engineers modified the hydraulic sewer model, Special Contributing Area Loading Program (SCALP), in separate sewer areas in order to incorporate changes in the precipitation network. Since actual boundaries have not been mapped for those areas, some assumptions as to the location of the separate sewer areas were made. This was necessary since effective areas have been applied for the separate sewer areas in the SCALP model. These assumptions will continue until a further study can be accomplished that will reflect actual boundaries for these separately sewered areas.

A study was also done by the Corps to improve the response of the HSPF hydrologic runoff models. Input on parameter improvements were received from NIPC and Rust. The study resulted in some minor parameter modifications to the HSPF runoff model to correct for past inconsistencies and improve parameter accuracy.

Diversion Accounting Procedures

The Lake Michigan diversion accountable to the State of Illinois is calculated by using the AVM measured flow in the Chicago Sanitary and Ship Canal at Romeoville and deducting flows that do not constitute Lake Michigan diversion and are not accountable to the State of Illinois. Finally, additions are made to the Romeoville record for diversions that are not discharged to the canal. The deductions include groundwater water supply pumpage whose effluent is discharged to the canal, runoff from the Des Plaines River watershed that is discharged to the canal, Lake Michigan water supply pumpage from Indiana that is discharged to the canal, and water supply pumpage from Lake Michigan used for Federal facilities that is discharged to the canal. The additions to the Romeoville record include flows diverted from the canal upstream of Romeoville, and Lake Michigan water supply whose effluent is not discharged to the canal. This procedure represents the accounting method required by the Supreme Court Decree.

The diversion accounting results are presented as a series of columns that are listed in Table 1. Column 1 through Column 3 compute the total flow in the CSSC. Column 4 through Column 7 presents the deductions from the canal system flows with the total deduction being presented in Column 8. Column 9 presents the additions to the canal system record. Column 10 is the computed Lake Michigan diversion accountable to Illinois and is equal to the canal system flow minus the deductions plus the additions. Columns 11 through 13 are independent flow estimates for the three sources of diversion: water supply pumpage from Lake Michigan, runoff from the diverted Lake Michigan Watershed, and direct diversion through the lakefront structures. Column 11 through Column 13 are not used in the diversion calculation but are included as another estimate of the diversion for verification of the accounting flows in Column 10. The sum of Column 11 through Column 13 should theoretically equal the flow in Column 10.

In addition to the diversion calculations presented in the 13 columns, 14 computational budgets are prepared as input to the diversion calculation and to verify the estimated flows that cannot be measured. A summary of these budgets is presented in Table 2. Budgets 1 and 2 do not compare simulated to measured

flows but are summations of critical water supply pumpage data. Budget 3 through Budget 6 partition stream gage records into runoff and sanitary/industrial discharge components to estimate a portion of the runoff from the diverted watershed that is used as input to Column 12, Runoff from the Diverted Lake Michigan Watershed. Budget 7 through Budget 13 compare simulated to measured flows at MWRDGC facilities. These budgets simulate all the deductible Des Plaines River Watershed contained in Column 6 and the deductible groundwater seepage into TARP contained in Column 4. These budgets also are used for verification of the diversion accounting procedures and give an indication of the accuracy of the diversion accounting models. Budget 14 compares canal system inflows and outflows. It is used primarily as a verification of modeling results as well as an indicator of the accuracy and completeness of measured/reported flows.

Table 1

Description of the Diversion Accounting Columns

Column Number	Description
1	Chicago Sanitary and Ship Canal (CSSC) at Romeoville AVM Gage Record
2	Diversion from the CSSC above the Romeoville AVM Gage
3	Total Flow Through the CSSC
4	Groundwater Pumpage Discharged into the CSSC and Adjoining Channels
5	Water Supply Pumpage from Indiana Reaching the CSSC
6	Runoff from the Des Plaines River Watershed which Reaches the CSSC
7	Lake Michigan Pumpage by Federal Facilities which Discharge to the CSSC and Adjoining Channels
8	Total Deduction from the CSSC Romeoville AVM Gage Record
9	Lake Michigan Pumpage Which is not Discharged into the CSSC
10	Total Diversion Accountable to the State of Illinois
11	Pumpage from Lake Michigan Which is Accountable to the State of Illinois
12	Runoff from the Diverted Lake Michigan Watershed
13	Direct Diversions Through Lake Front Control Structures Which is Accountable to the State of Illinois

Table 2
Description of the Diversion Accounting Computational Budgets

Budget Number	Title	Description
1	Diverted Lake Michigan Pumpage	This budget sums the Lake Michigan water diverted by the State of Illinois in the form of Industrial and Municipal water supply. The results of this budget are used in Column 11.
2	Groundwater Discharged to the CSSC	This budget sums groundwater pumpages that are discharged to the CSSC. The results of this budget are used in Column 4.
3	North Branch Chicago River at Niles, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
4	Little Calumet River at the IL-IN State Line	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
5	Thorn Creek at Thorton, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
6	Little Calumet River at South Holland, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
7	MWRDGC Northside Water Reclamation Plant	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Northside Water Reclamation Facility. The simulations estimates the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Northside service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
8	Upper Des Plaines Pumping Station	This budget performs hydrologic and hydraulic simulation of the MWRDGC Upper Des Plaines Pumping Station. This budget provides a calibration point to verify models of the Des Plaines River watershed
9	MWRDGC Mainstream TARP Pumping Station	This budget performs hydrologic and hydraulic simulation of the MWRDGC Mainstream TARP Pumping Station. The results of this simulation are used in Budgets 10 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
10	MWRDGC Stickney Water Reclamation Facility	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Stickney Water Reclamation Facility. The simulations estimates the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Stickney service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
11	MWRDGC Calumet TARP Pumping Station	This budget performs hydrologic and hydraulic simulation of the MWRDGC Calumet TARP Pumping Station. The results of this simulation are used in Budgets 12 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
12	MWRDGC Calumet Water Reclamation Facility	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Calumet Water Reclamation Facility. The simulations estimates the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Calumet service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
13	MWRDGC Lemont Water Reclamation Facility	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Lemont Water Reclamation Facility. The simulations estimates the runoff from portions of the Des Plaines River watershed within the Lemont service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Column 6.
14	Chicago Canal System	This budget performs a water balance of the Chicago Canal System which includes the CSSC and adjoining channels. This budget provides a verification point for the accounting procedures.

Revisions to the Lake Michigan Diversion Accounting Procedures

Three primary revisions were made to the WY93 and WY94 diversion accounting procedures. The estimate of the Grand Calumet river portion of the water supply pumpage from Indiana that reaches the CSSC was revised to better account for the unique hydraulics of this river. The revised computation of Grand Calumet river water supply impacts the deduction of Column 5 and is described in detail in that section of the report. The revised computation also impacts the computed runoff from the Lake Michigan watershed in Column 12. The second revision was the modeling of the portion of the Des Plaines TARP system that became operational on 6 June 1993. The Des Plaines TARP system impacts the deductible runoff from the Des Plaines river watershed that is contained in Column 6, as well as the groundwater deduction contained in Column 4. The Des Plaines TARP system is discussed further in the section on Budget 9, the Mainstream and Des Plaines TARP pumping stations. The third revision to the accounting is the adjustment of the double accounting of a portion of the runoff from the ungaged Calumet watershed. This change only impacts Column 12, the runoff from the Lake Michigan watershed, and therefore has no impact on the computed diversion. This revision will be discussed further in the section on Column 12.

Accounting Results

The WY93 diversion accounting monthly summary is presented in Table 4. Table 4 shows the total WY93 Lake Michigan diversion accountable to the State of Illinois is 3,840.7 cfs (Column 10). This diversion is 640.8 cfs greater than the 3,200 cfs average specified by the Decree. The 40 year running average (Table 3), rounded to the nearest cfs, beginning with WY81 is 3,487 cfs and the cumulative deviation from the 3,200 cfs average is -3,725 cfs-years. The negative cumulative deviation indicates a water allocation deficit. The maximum allowable deficit is 2,000 cfs-years. Tabular data on daily diversion flows is presented in Appendix A.

Table 3

**Status of the State of Illinois' Diversion from Lake Michigan Under the 1980
Modified U.S. Supreme Court Decree**

Accounting Year	Certified Flow (cfs)	Running Average (cfs)	Cumulative Deviation (cfs-years)
1981	3,106	3,106	94
1982	3,087	3,097	207
1983	3,613	3,269	- 206
1984	3,432	3,309	- 438
1985	3,472	3,342	- 710
1986	3,751	3,410	-1,261
1987	3,774	3,462	-1,835
1988	3,376	3,451	-2,011
1989	3,378	3,443	-2,189
1990	3,531	3,452	-2,520
1991	3,555	3,461	-2,875
1992	3,409	3,457	-3,084
1993	3,841	3,487	-3,725

Table 4

Lake Michigan Diversion Accounting - WY1993
Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEDEVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
Oct-92	3005.4	3.8	3009.2	64.4	23.2	82.6	1.3	151.5	226.6	3086.3	1774.8	209.4	670.2
Nov-92	3595.0	2.7	3597.7	105.1	25.7	371.7	1.4	503.9	226.5	3322.3	1699.9	1603.4	98.6
Dec-92	2917.5	3.0	2920.5	78.4	24.5	292.2	1.6	394.7	222.2	2748.0	1698.4	1151.0	88.9
Jan-93	4348.9	1.8	4348.7	107.0	31.3	476.5	1.5	618.3	213.7	3944.1	1694.7	2244.7	71.6
Feb-93	2315.9	4.1	2320.0	59.4	31.5	111.9	1.5	204.3	216.4	2334.1	1691.9	286.0	78.0
Mar-93	3895.5	3.1	3898.6	110.1	29.0	443.4	1.6	564.1	227.9	3542.4	1728.0	2130.0	74.4
Apr-93	5041.2	1.2	5042.4	114.5	36.4	549.6	1.5	702.0	223.7	4564.1	1690.9	2327.3	177.5
May-93	2879.8	0.6	2880.4	71.0	42.5	183.7	1.5	278.7	230.5	2852.2	1829.1	556.5	221.5
Jun-93	6404.6	0.8	6405.4	110.4	57.1	713.3	1.7	882.5	259.2	5782.1	1855.7	3200.0	808.8
Jul-93	4574.8	1.0	4575.8	79.8	76.6	222.3	1.7	380.4	263.5	4458.9	2033.7	1062.8	1246.3
Aug-93	4722.8	0.9	4723.7	81.3	70.3	222.8	1.9	376.3	275.4	4622.8	2066.3	1254.3	1462.1
Sep-93	4954.1	0.6	4954.7	93.6	51.8	405.9	1.6	552.9	235.0	4636.8	1794.6	1706.1	1214.5
Averages	4074.4	2.0	4076.4	89.3	41.7	340.4	1.6	473.1	237.4	3840.8	1798.6	1504.7	519.0

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 equals Column 3 minus Column 8 plus Column 9.



Deductions from the Romeoville Gage Record



Additions to the Romeoville Gage Record

Discussions of Results

The following is a discussion of the column functions and computational budgets. The discussion of the column functions describes the purpose of each column, as well as some observations on the WY93 values in the columns. The discussion of the computational budgets presents the purpose of each budget and the results of the budget flow balances. The results of the computational budgets are used in the diversion calculations where seven (7) budgets are used to verify the diversion simulation models. The columns are discussed first, followed by the discussion of the budgets.

Columns

The first ten (10) columns display the components of the diversion calculation and include the Romeoville flow, as well as the various deductions and additions to the Romeoville record. The final three (3) columns (Columns 11 through 13) display the three (3) diversion components (Lake Michigan pumpage accountable to Illinois, runoff from the diverted watershed, and direct diversion through the lakefront control structures). The sum of Columns 11 through 13 should theoretically equal the Romeoville based diversion calculation. A comparison of the sum of these three (3) columns to the calculated diversion (Column 10) is presented in the discussion of Column 11 through Column 13.

Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, USGS AVM Gage Record

The discharge at Romeoville for WY93 was 4,074.4 cfs. For the fifteen (15) days when the AVM was inoperable, the flow at the Romeoville site was calculated from the USGS regression equations.

Column 2: Diversions from the CSSC Above the Gage

Argonne Laboratories and Uno-Ven Corporation were the only diversions from the CSSC upstream of the Romeoville gage in WY93. The average withdrawal upstream of the AVM for WY93 was 1.9 cfs.

Column 3: Total Flow Through the CSSC

Column 3 is the sum of Column 1 and Column 2 and represents the total flow entering the canal system. The average CSSC flow was 4,076.4 cfs for WY93.

Column 4: Groundwater Discharged to the CSSC And Adjoining Channels

Column 4 is groundwater pumpage by communities, industrial users and other private users whose effluent is discharged to the CSSC. The groundwater pumpage data is reported by the ISWS. It also includes the groundwater seepage into the TARP system that is discharged to the CSSC. This quantity is determined by summing all reported groundwater pumpages tributary to the CSSC, along with the estimated groundwater seepage into the Mainstream TARP (Budget 9) and Calumet TARP (Budget 11) systems. This total is then adjusted by subtracting the groundwater normally tributary to the canal that is contained in the combined sewer overflows that discharge to the Des Plaines River and other watercourses not tributary to the CSSC. This method prevents double accounting of the combined sewer overflow portion of the groundwater supply pumpage.

Using ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake Michigan watershed in Illinois or if they were located within MWRDGC Water Reclamation Plant (WRP) service boundaries in which their effluent was discharged into the CSSC and adjoining channels. Groundwater seepage into the Mainstream and Des Plaines TARP systems and the Calumet TARP system was determined through simulation and is discussed in Budgets 9 and 11. The groundwater constituent of combined sewer overflows is determined entirely thorough simulation.

Groundwater pumpage from the Lake Michigan watershed whose effluent is discharged to the CSSC is a deduction, except to the extent that the groundwater sources are recharged by Lake Michigan. Current piezometric levels indicate that groundwater is discharging to the lake. Therefore, groundwater pumpage from within the Lake Michigan Watershed that reaches the canal continues to be a deduction. Research literature will be reviewed periodically to verify this assumption.

Column 4 represents a deduction from the Romeoville record and averaged 89.3 cfs. This flow is a decrease of 20.9 cfs from WY92. Groundwater pumpage tributary to the canal is composed of 20.2 cfs of groundwater pumpage from the

Lake Michigan watershed, 16.8 cfs of groundwater pumpage from outside of the Lake Michigan watershed, 47.9 cfs of groundwater seepage into the Mainstream and Des Plaines TARP systems, and 6.7 cfs of groundwater seepage into the Calumet TARP system. The total of these components is 89.6 cfs. However, the deduction from the Romeoville gage record is 89.3 cfs, since 0.3 cfs of this groundwater supply pumpage was determined, through simulation, to be discharged to the Des Plaines River and other watercourses not tributary to the CSSC in the form of combined sewer overflows.

Column 5: Water Supply Pumpage from Indiana Reaching the CSSC

Column 5 represents the computation of Indiana water supply reaching the canal through the Grand Calumet and the Little Calumet Rivers. In the case of the Little Calumet River, a drainage divide exists east of the confluence with Hart Ditch. Therefore, flows from Hart Ditch, including virtually all dry weather flows, normally flow westward into Illinois. Under high flow conditions, the drainage divide may shift westward and a portion of the Hart Ditch flows may be diverted eastward to Burns Ditch and ultimately to Lake Michigan. However, it is believed that the occurrence in the shift in the drainage divide is infrequent and the flow that is diverted eastward is insignificant. Therefore, it is assumed that all effluent discharged into Hart Ditch and the Little Calumet River west of the divide flow westward. For WY93, total flow in the Little Calumet River was 106.0 cfs, with 6.0 cfs of that flow being determined to be Indiana water supply.

The Grand Calumet River has a summit. On one side of the summit, the flow is toward Lake Michigan. On the other side of the side of the summit, the flow is toward the Calumet Sag Channel which flows into the CSSC. However, the location of the summit is variable and highly influenced by Lake Michigan levels (USGS, 1984). Thus the calculation of this deduction from the Romeoville record is influenced by Lake Michigan levels. Beginning with the WY92 accounting, Grand Calumet River flow was measured by a gage that was installed in 1991 that began officially measuring flows on 1 October 1991.

Flow in the Grand Calumet River contains a very high proportion of treatment plant discharge. Through WY92, the flow in the Grand Calumet River attributed to Indiana water supply pumpage was set to the sum of water supply for East Chicago, Whiting, and Hammond (whose pumpage includes water supply for Munster, Highland, and Griffith). This method is an oversimplification of the actual conditions. Chicago District developed a reconnaissance level, unsteady state model of the river for the US EPA. From this model, relationships were developed to proportion the treatment plant discharge into the flow to the CSSC and Lake Michigan. The flow summit generally occurs at the Hammond outfall or between the

Hammond and East Chicago outfalls. The equations below determine the percentage of flow from each treatment plant flowing west to the CSSC based on Lake Michigan water level:

For $CCD < 0.3$ ft

$$\text{Flow} = 0.45 * HW$$

For $CCD \geq 0.3$ ft and $CCD < 1.5$ ft

$$\text{Flow} = (0.22 * CCD^3 - 0.15 * CCD^2 + 0.06 * CCD + 0.45) * HW$$

For $CCD \leq 1.5$ ft and $CCD < 1.8$ ft

$$\text{Flow} = HW + (CCD - 1.5) / 0.3 * EC$$

For $CCD > 1.8$ ft

$$\text{Flow} = HW + EC$$

Where CCD is the lake level in feet (Chicago City Datum) measured at Calumet Harbor, HW is the daily combined water supply pumpage by Hammond and Whiting, and EC is the daily water supply pumpage by East Chicago.

The total Grand Calumet flow reaching Illinois in WY93 was measured as 51.6 cfs. Of that, 35.7 cfs was determined to be water supply pumpage. Therefore, the total WY93 Indiana water supply deduction, including the flow from the Little Calumet and Grand Calumet Rivers is 41.7 cfs. This flow is 11.3 cfs more than the Indiana water supply deduction for WY92, which was 30.4 cfs.

Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC

The WY93 average discharge of Des Plaines River watershed runoff reaching the canal (Column 6) is 340.4 cfs. This deduction is determined almost entirely through simulation. The runoff is composed of two elements, surface runoff and subsurface runoff. Surface runoff that enters sewers is referred to as inflow, while subsurface runoff is referred to as infiltration. The infiltration and inflow discharged to the water reclamation plants is 192.6 cfs, the infiltration and inflow reaching the canal through combined sewer overflows is 20.2 cfs and the runoff from the Lower Des Plaines and Summit Conduit areas is 127.7 cfs. The deduction is also influenced by the O'Hare basin flow transfer that contributed 14.6 cfs of the 192.6 cfs of runoff to the water reclamation facilities during WY93. The deductible Des Plaines River watershed runoff increased 163.8 cfs from WY92 to WY93. Increased runoff was due to the increased rainfall volumes that occurred during WY93.

Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC

Column 7 represents Lake Michigan diversions for Federal use, not chargeable to the State of Illinois, and is typically comprised of water supply pumpage used by federal facilities. Also included is emergency navigation makeup water used for federal purposes. Column 7 represents a deduction from the Romeoville record and the total amount of the WY93 deduction is 1.6 cfs.

Column 8: Total Deductions from the CSSC Romeoville Gage Record

Column 8 is the sum of Columns 4, 5, 6, and 7 and represents the total deduction from the Romeoville record. The total deduction for WY93 is 473.1 cfs.

Column 9: Lake Michigan Pumpage Not Discharged to the CSSC

This column represents water supply pumpage from Lake Michigan that is not discharged to the canal. The water supply pumpage not discharged to the canal is composed of two components:

- Lake Michigan water supply used by communities serviced by water reclamation facilities that do not discharge to the CSSC (235.3 cfs). This increase is 44.4 cfs from WY92. The increase in the WY93 value is due to the addition of two (2) water supply agencies, Central Lake County Joint Action Water Agency and the DuPage Water Commission which became fully operational in the latter part of WY92.
- The sanitary portion of combined sewer overflows attributable to Lake Michigan domestic water supply that does not discharge to the CSSC (2.1 cfs).

The communities that make up the flow in the first component are suburbs whose treated effluent is discharged to the Des Plaines River and other watercourses not tributary to the CSSC. The water supply agencies or communities are:

- Northwest Suburban Joint Action Water Agency (NWJAWA) - Member communities include Elk Grove Village, Hanover Park, Hoffman Estates, Mount Prospect, Rolling Meadows, Schaumburg and Streamwood.

- Northwest Water Commission - Member communities include Arlington Heights, Buffalo Grove, Palatine, Prospect Heights and Wheeling.
- Central Lake County Joint Action Water Agency (CLCJAWA) - Member communities include Grayslake, Gurnee, Lake County Public Works Department (Vernon Hills and Wildwood-Gages Lake), Libertyville, Mundeline, Round Lake, Round Lake Park and Round Lake Beach.
- Lake County Public Water District - Member communities include Illinois Beach State Park, Winthrop Harbor and Zion.
- DuPage Water Commission - Member communities include Addison, Bensenville, Bloomingdale, Carol Stream, Citizen's Utilities (Arrowhead, Country Club Highlands, Lombard Heights and Valley View), Clarendon Hills, Darien, Downers Grove, Elmhurst, Glen Ellyn, Glendale Heights, Hinsdale, Itasca, Lisle, Lombard, Naperville, Oak Brook, Roselle, Villa Park, Westmont, Wheaton, Willowbrook, Wood Dale, Woodridge, DuPage County Water Works (Farmington, Glen Ellyn Heights, Hinsdale, Lake in the Woods, Rosewood Trace, Steeple Run).
- Lincolnshire
- Riverwoods
- Waukegan
- Lake County - Bradley Road
- North Chicago - 76 percent
- Des Plaines - 38.2 percent

The communities of Lake Bluff and Knollwood-Roundout (who receive their water from CLCJAWA) are not included in Column 9, as they discharge their effluent into the Chicago River System.

It should also be noted that the Lake Michigan water supply component of the O'Hare flow transfer is subtracted from the total Lake Michigan water supply of the above communities since:

- The O'Hare flow transfer is treated at the Northside WRP which discharges sanitary effluent that is tributary to the CSSC.
- The entire Lake Michigan water supply component of the O'Hare flow transfer is from communities contained in the above list.

The Lake Michigan water supply for these communities is measured, while the sanitary portion of the CSO's is derived through simulation. Column 9 represents an addition to the Romeoville record and the total WY93 addition is 237.4 cfs. This flow is an increase of 45.1 cfs from WY92 to WY93 and is primarily due to the startup of the two (2) water agencies, CLCJAWA and the DuPage Water Commission during the latter part of WY92.

Column 10: Total Diversion

Column 10 is equivalent to Column 3 with the deduction of Column 8 and the addition of Column 9. The total diversion for WY93 is 3,840.8 cfs. This amount is 640.8 cfs greater than Illinois's long term diversion allocation of 3,200 cfs. The 40-year running average diversion, rounded to the nearest cfs, beginning with WY81, is 3,487 cfs and the cumulative deviation from the 3,200 cfs allocation is -3,725 cfs. The negative deviation indicates that the cumulative diversion is greater than an average of 3,200 cfs for the period.

Column 11 Through Column 13: Lake Michigan Diversion Components

Columns 11 through 13 represent the three (3) Lake Michigan diversion components:

- Column 11 - Lake Michigan pumpage accountable to Illinois (1,798.6 cfs)
- Column 12 - Runoff from the diverted Lake Michigan watershed (1,504.7 cfs)
- Column 13 - Direct diversion through the lakefront structures (519.0 cfs)

Prior to WY93, a double accounting of runoff from the Calumet ungaged watershed existed. The flow that was double accounted was the infiltration into the separate sanitary sewers within the Calumet ungaged watershed. For a detailed description of this double accounting refer to the Lake Michigan Diversion Accounting Water Year 1990 report contained in the Water Year 1993 Annual Report. This area is discussed in the section on ungaged watershed modeling under the main section on areas for improvement. The correction in WY93 for this double accounting was based solely on area proportioning from sewer maps.

Unfortunately, separately sewer SCAs in SCALP do not contain actual areas. Therefore, the approximations that were made for tributary areas for the separate sewers could not be cross checked against the SCALP models for accuracy. The infiltration into the separate sewers within the ungaged Calumet watershed was ultimately subtracted from the computation of runoff from the Lake Michigan watershed.

The sum of the columns (3,822.3 cfs) should theoretically equal the total diversion as shown in Column 10 (3,840.8 cfs), with one exception. The Romeoville record measures sewer effluent instead of water supply pumpage, while Column 11 (Lake Michigan water supply pumpage accountable to Illinois) does not account for consumptive use. This difference is consumptive loss (water supply pumpage that is consumed or lost prior to reaching the water reclamation facilities), estimated as 10% of the water supply pumpage (International Great Lake Diversion Consumptive Use Study Board, 1981).

Because the diversion estimate from Columns 11 - 13 is based on simulation, suspect ratings of the lakefront structures, and simple flow separation techniques, the estimate is not expected to be as accurate as the AVM based calculations. Consequently, a difference between estimates of 18.5 cfs or 0.5% is an excellent balance. However, this discrepancy becomes greater when consumptive use is accounted for in Column 11. The discrepancy in these two (2) estimates is related to the canal system balance in Budget 14, discussed in a subsequent section and potential sources of the discrepancy are addressed in that budget discussion.

Using the figures from these three (3) columns, 47.0% of the WY93 Illinois diversion is attributable to pumpage from Lake Michigan for domestic water supply. Runoff from the diverted Lake Michigan Watershed accounted for 39.4% of the diversion, and direct diversion through the lakefront structures accounted for 13.6% of the diversion. Water supply from Lake Michigan increased 13.5 cfs from WY92 to WY93. Due to the increased volume of rainfall between WY92 and WY93, the runoff from the Lake Michigan watershed increased 656.3 cfs between WY92 and WY93. A more detailed breakdown of these percentages is shown in Table 5 and Figure 3.

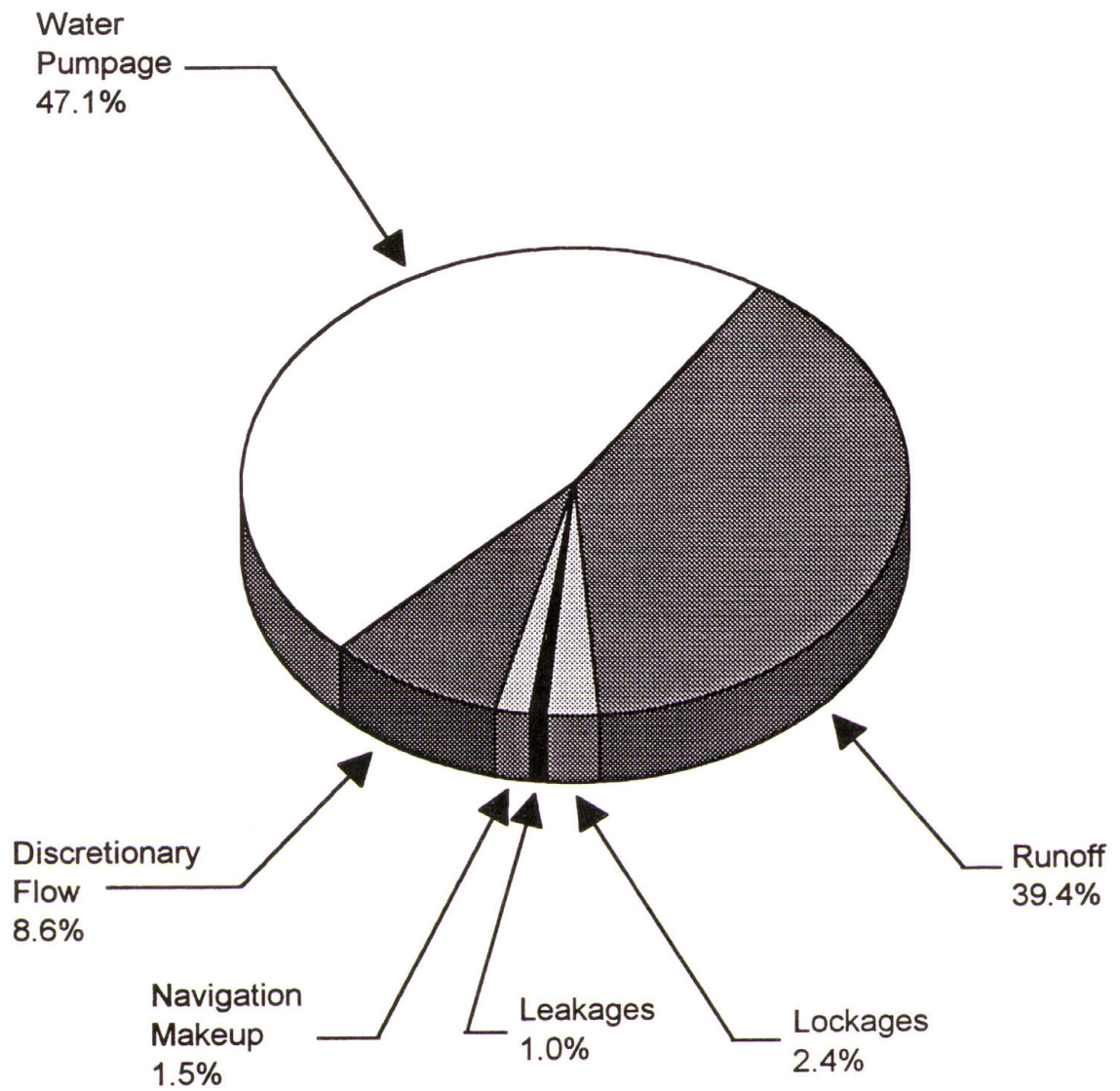
Table 5

**Breakdown of the Diversion by the State of Illinois
Based on Columns 11 Through 13**

Description	Average Flow (cfs)	Percentage of Total Flow
Lake Michigan Pumpage by the State of Illinois	1,798.6	47.0%
Runoff from the Diverted Lake Michigan Watershed	1,504.7	39.4%
Direct Diversions		
Lockages	91.6	2.4%
Leakages	38.3	1.0%
Navigation Makeup Flow	58.6	1.5%
Discretionary Flow	330.5	8.6%
Total Direct Diversions	519.0	13.6%

Note: The direct diversions shown in Table 5 do not agree with the results contained in Column 13 of Table 4 due to the different rounding methodologies employed. The direct diversions shown in Table 5 is the yearly average of each of the direct diversion components, while the yearly average value shown in Column 13 of Table 4 is the yearly average of each of the monthly averages.

Figure 3



Component Breakdown of Illinois' Diversion Based Upon Columns 11 through 13

Budgets

The first two (2) budgets are used to sum the water supply for the area influenced by the diversion. The next four (4) budgets are of stream gage sites that are not simulated and are used as part of the calculation of the runoff from the diverted Lake Michigan watershed. The remaining seven (7) budgets compare measured and simulated flows and compute Column inputs used in the diversion computations.

Budget 1 and Budget 2: Water Supply Pumpage

Budgets 1 and 2 are summations of critical water supply pumpage data. Budget 1 sums Lake Michigan water supply diverted by the State of Illinois. The Lake Michigan water supply data is supplied by the state as daily values for primary users and monthly data for secondary users. Budget 2 sums groundwater pumpages in the Lake Michigan and Des Plaines River watersheds that are diverted to the CSSC. Groundwater pumpage data is recorded by the ISWS as a total annual withdrawal based on calendar years.

Budget 1: Diverted Lake Michigan Water Supply

Budget 1 represents the summation of Lake Michigan pumpage accountable to the State of Illinois. For WY93, the average annual Lake Michigan pumpage accountable to Illinois is 1798.6 cfs. This flow is an increase of 13.5 cfs from WY92.

Budget 2: Groundwater Diverted to the CSSC

Budget 2 is groundwater water supply pumpage by communities, industrial users, and other private users whose effluent is discharged to the canal. The groundwater pumpage data are reported by the ISWS on a calendar year basis. The groundwater quantity is determined by summing all reported groundwater sources in the area tributary to the CSSC, less groundwater not discharged to the CSSC in the form of combined sewer overflows.

Using the ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake Michigan watershed in Illinois, or if they were located within MWRDGC service boundaries in which their effluent was discharged into the CSSC and adjoining channels.

The total groundwater pumpage by communities, industrial users, and other private users whose sanitary effluent is tributary to the canal is 35.1 cfs for WY93. Simulation determined that 0.3 cfs of this flow never reached the canal. Instead it was discharged to the Des Plaines River or other watercourses not tributary to the canal in the form of combined sewer overflows. The total groundwater pumpage reaching the canal represents a decrease of 1.9 cfs from WY92 to WY93.

In addition to groundwater supply pumpage, there was also a significant amount of groundwater infiltration into the two TARP systems that ultimately reached the canal. Mainstream TARP and Calumet TARP accounted for 47.9 cfs and 6.7 cfs, respectively, of groundwater discharged to the canal during WY93.

Budgets 3 Through Budget 6: Stream Gaging Stations

The stream gage budgets are used to make estimates of runoff from portions of the diverted Lake Michigan watershed. Sanitary and other point source flows are subtracted from the stream gaging record to develop the runoff estimates. The runoff estimates are used in Column 12. The flows at the stream gaging sites are also part of Budget 14, the canal system budget.

Table 6 presents the estimated runoff from these budgets. Note that Budgets 4 through 6 are a composite calculation of the runoff above the Little Calumet River at the South Holland gage. Also note that the Little Calumet River is a losing stream (i.e. it recharges groundwater). The computations in deriving runoff account for this when recharge is significant (i.e., when groundwater recharge is computed).

The runoff for Budget 6 is an incremental runoff, runoff that occurs downstream of Little Calumet River at the State Line and Thorn Creek at Thornton.

Table 6

Stream Gage Flow Separation

Budget Number	Location	Stream Flow (cfs)	Sanitary Flow (cfs)	Runoff (cfs)
3	North Branch Chicago River at Niles, IL	170.6	19.9	150.7
4	Little Calumet River at IL-IN State Line	106.0	6.0	100.0
5	Thorn Creek at Thornton, IL	198.3	19.5	178.8
6	Little Calumet River at South Holland, IL	332.4	294.6	37.8

Budgets 7 Through Budget 13: MWRDGC Water Reclamation Facilities

The budgets for the water reclamation plants compare the simulated flows to the measured inflows at the MWRDGC facilities and perform verifications of the diversion accounting program. The simulated flows were developed from an estimated sanitary flow with a daily, weekly, and monthly flow variation, from hydrologic precipitation-based runoff models, and from hydraulic sewer routing models. The estimated sanitary flow input to the hydraulic simulation models is based on the population estimates for each plant's service basin. Per capita sanitary flows are determined based on the service basin's water supply minus an assumed 10 percent consumptive loss. Simulated flows were compared with recorded inflows at each facility to assess the accuracy of the simulations.

The discussion of the budgets will concentrate on the results of each simulation as the development of these models have been discussed in previous reports. A summary of the simulation results is presented in Table 7. At all four (4) water reclamation plants and the Upper Des Plaines Pump Station, the simulation results were maintained. This is the result of the new 25-gage precipitation network first utilized for the WY90 diversion accounting, improvements and updates in the land cover delineations, and modifications to the hydrologic and hydraulic models .

Budget 7: Northside Water Reclamation Facility

Budget 7 analyzes the water balance at the MWRDGC Northside Water Reclamation Facility (Figure 4). The balance for WY93 of the inflow to the Northside facility is very good. The simulated to adjusted recorded inflow ratio (S/R) for the Northside WRP is 0.95, indicating that the simulated inflow volume is slightly less than the adjusted observed inflow volume. The coefficient of correlation (R) of simulated to observed flow is 0.90, indicating that the model predicted the inflow hydrograph to the Northside facility very well.

Budget 8: Upper Des Plaines Pump Station

Budget 8 analyzes the water balance at Upper Des Plaines Pump Station (UDPPS) (Figure 5). The pump station budget is used to verify simulated flows. Although it has no direct impact on the diversion calculation, it is intended to be used as a primary calibration point for the models that simulate the deductible runoff from the Des Plaines watershed contained in Column 6. This will be possible only after the existing measurement problems at that site are resolved. This has been discussed in the WY90 diversion report.

The balance at UDPPS for WY93 was reasonable. The simulated to recorded flow ratio (S/R) for the UDPPS is 0.92, indicating that the simulated inflow volume to UDPPS closely matches the recorded inflow volume. However, the daily S/R ratio shows a high degree of variability, indicating that the trends within the recorded and simulated inflow may not correspond very well. The coefficient of correlation (R) of simulated to recorded flow is 0.50, indicating room for improvement in correlation in the trends of simulated versus recorded flows. The slight improvement in the coefficient of correlation may be the direct result of the revised raingage network and subsequent modifications to the hydrologic and hydraulic models for WY90.

While the statistical results for WY93 at the Upper Des Plaines Pump Station have been maintained, this does not lead to the conclusion that flow measurement alternatives should not be investigated. This site has continued to experience its share of problems. During WY93, 157 days of records were unavailable that were attributable to meter malfunctions, problems with the recording charts which made data transformation impossible, and various other reasons. In view of the significant quantity of missing data (43% missing data), the quantitative analyses of the simulation are of limited value. Second, the accuracy of the flow meters at the pump station is questionable and unmetered bypass flows are a frequent occurrence. Therefore, total flow may not be measured in storm events and the recycling of flow is possible. Further investigation of the accuracy of flow measurement at the pump station is required to verify and calibrate the simulation models that compute the deductible runoff from the Des Plaines watershed contained in Column 6.

Table 7

WY 1993 Summary of Simulation Statistics

Budget No.	7	8	9	10	11	12	13	14
Description	Northside WRP (1)	Upper Des Plaines Pump Station (1),(3)	Mainstream TARP Pump Station (2)	Stickney WRP (1),(4)	Calumet TARP Pump Station (2)	Calumet WRP (1),(4)	Lemont WRP (1)	Chicago Canal System Balance (1)
Mean Recorded Flow, cfs	477.6	93.5	125.7	1,168.6	65.5	398.9	2.6	4,086.6
Max. Recorded Flow, cfs	772.3	144.9	367.9	2,250.1	204.3	624.0	9.1	14,787.0
Min. Recorded Flow, cfs	326.8	33.1	14.1	735.1	4.6	398.9	1.1	1,875.2
Mean Simulated Flow, cfs	451.6	86.4	133.4	1,255.8	39.7	424.4	2.3	4,027.4
Max. Simulated Flow, cfs	704.1	215.6	307.8	3,135.4	131.6	642.1	5.4	18,232.0
Min. Simulated Flow, cfs	305.9	43.9	33.5	847.8	4.7	304.7	1.3	1,816.4
Mean S/R	0.95	0.92	1.06	1.07	0.61	1.06	0.88	0.99
Max. S/R	1.25	3.12	10.31	1.87	3.10	1.44	2.27	2.38
Min. S/R	0.64	0.48	0.25	0.53	0.25	0.77	0.33	0.65
Correlation	0.90	0.50	0.74	0.84	0.74	0.85	0.79	0.90

(1) Based on daily values.

(2) Based on weekly values.

(3) Does not include days with missing records.

(4) Does not include pumpage from TARP.

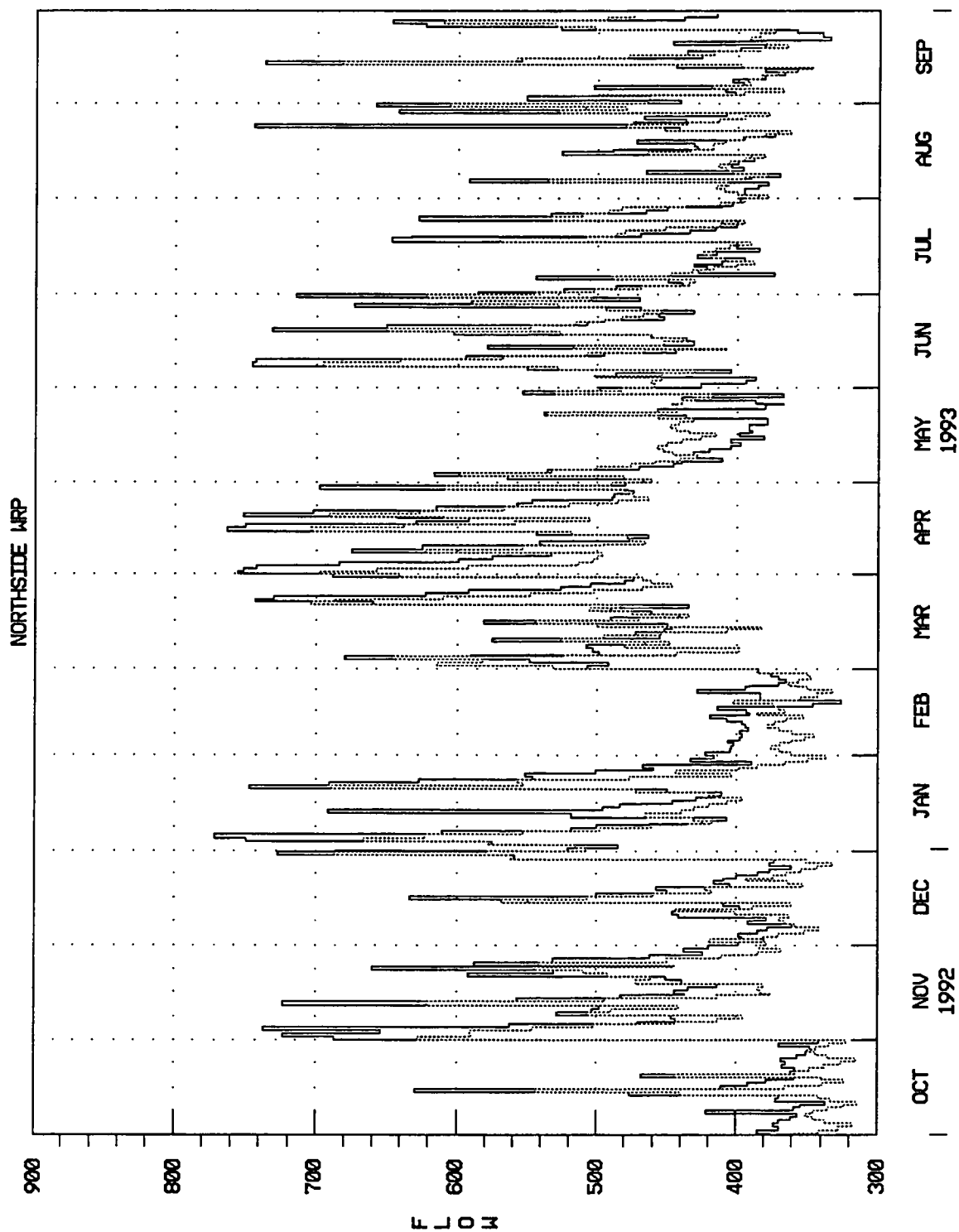


Figure 4

Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility

— OBSERVED FLOW
 SIMULATED FLOW

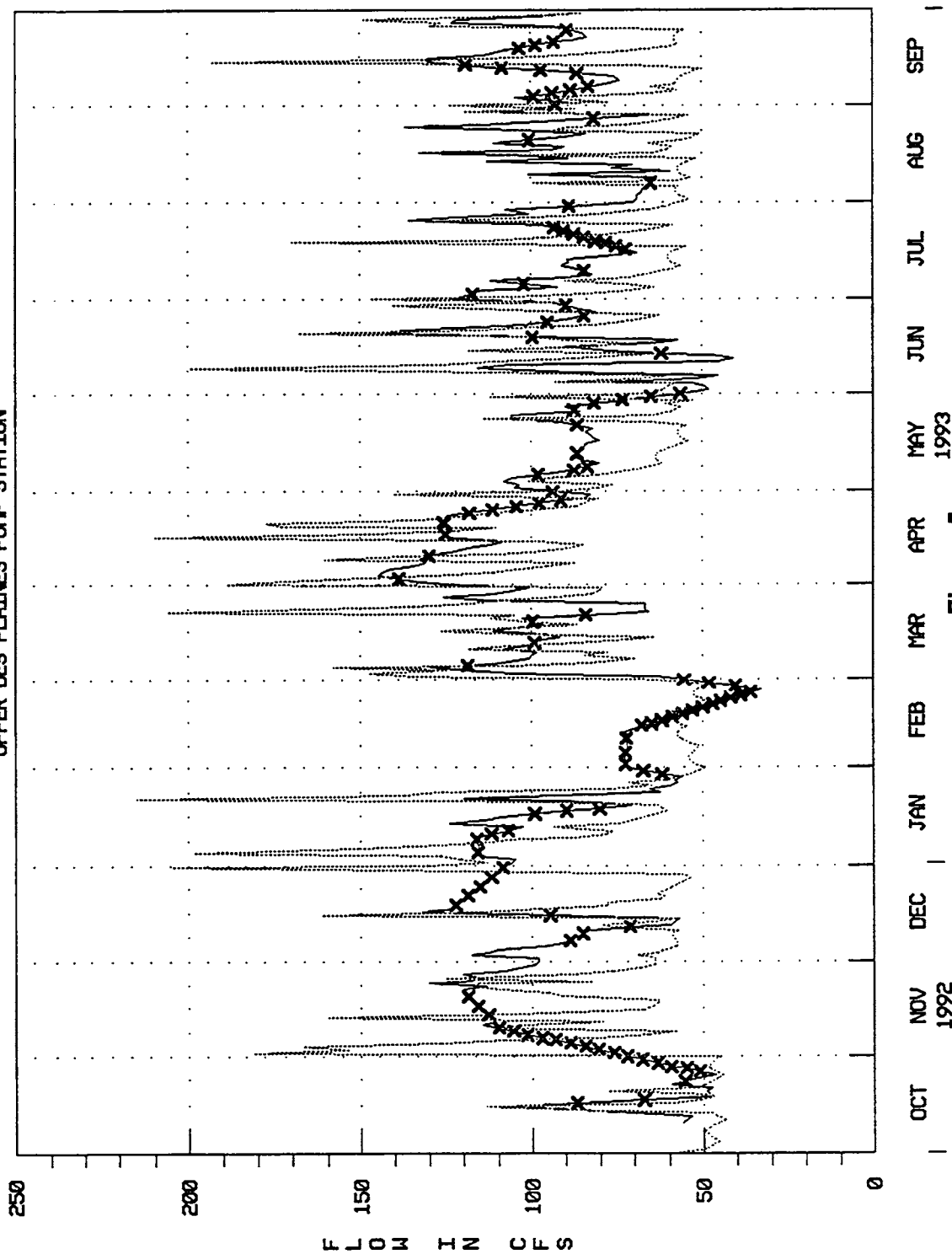


Figure 5

Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station

UPPER DES PLAINES PUMP STATION OBSERVED FLOW
UPPER DES PLAINES PUMP STATION SIMULATED FLOW

Budget 9: Mainstream and Des Plaines TARP Pumping Stations

Beginning 6 June 1993 the south and middle legs of the Des Plaines TARP system became operational. Consequently, these tunnels were added to the modeling of the TARP system for WY93. The Des Plaines tunnel system, like that of the Mainstream TARP system, flows by gravity to the West Southwest Water Reclamation facility in Stickney. Flows are pumped from the Des Plaines tunnel to the West Southwest plant using pumps independent of those used for the Mainstream tunnels. The Des Plaines system, like the Mainstream system, is modeled with independent index drop shafts which set the opening and closing sequence of various control structures along the tunnel system. The opening and closing sequences are based on water surface elevations at the index drop shafts. Water surface elevation trigger points are set at the downstream pumping station. These points tell the model when to turn the pumps on or off.

Budget 9 analyzes the water budget at the MWRDGC Mainstream and Des Plaines TARP Pumping Stations. The results of Budget 9 are used as a verification point for simulated flows. Budget 9 also is used for the purpose of computing a portion of Column 6 (Des Plaines River watershed runoff deduction). The deductible portion of Budget 9 includes groundwater seepage into the TARP tunnel walls and Des Plaines River watershed runoff captured by Mainstream and Des Plaines TARP as overflows. The modeling of Mainstream and Des Plaines TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Mainstream and Des Plaines TARP is contained in Figure 6. A more in-depth description of Mainstream TARP and the simulation model is contained in the Water Year 1986 report which is an appendix to the Diversion Accounting Annual Report for WY90-92 (USACE, 1994).

In analyzing the balance at the Mainstream and Des Plaines TARP Pumping Stations, weekly flows were used rather than daily flows. While MWRDGC maintains daily pumpage records, days with no pumpage occur frequently. Therefore, it is not possible to compute a daily S/R ratio.

The balance for WY93 of the inflow to the Mainstream and Des Plaines TARP Pumping Stations is good. The simulated to recorded flow ratio (S/R) for the Mainstream and Des Plaines TARP Pumping Stations is 1.06, indicating that the simulated inflow volume is slightly greater than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.74, indicating an improvement in the ability of the model to predict trends in the pump station flows.

From a review of the plot of the simulated versus recorded flow at the pump station (Figure 7), it appears that the model responds similarly to recorded pumpage record. However, the model is sometimes out of phase with the observed record. This could be the result of simulated pumpages occurring sooner and more

frequently than actual pumpages. The TNET model pumps normally turn on sooner and pump more frequently in order to maintain computational stability during a simulation.

In summary, it appears that the simulation of the Mainstream and Des Plaines TARP systems is reasonable. However, there is concern regarding the difference in simulated and recorded pumpage time series.

Budget 10: Stickney Water Reclamation Facility

Budget 10 analyzes the water balance at the MWRDGC Stickney Water Reclamation Facility (Figure 8). Simulated Mainstream TARP pumpages from Budget 9 are no longer combined with simulated interceptor inflow to the Stickney Water Reclamation Facility to derive the total simulated inflow to the Stickney Facility. Instead, only simulated interceptor inflows are compared with recorded interceptor inflows to assess the accuracy of the simulation. The decision to not include TARP pumpages in the treatment plant budgets was based on the fact that the TARP systems are already analyzed in separate budgets. Including TARP pumpages in the treatment plant budgets is detrimental to the statistical results of the treatment plant budgets, since the TARP models generally do not respond as well. When simulations of interceptor flows are treated separately, the response of the hydrologic runoff models (HSPF) and the hydraulic sewer routing models (SCALP) can be better isolated and not diluted by the TARP model results, which are analyzed separately on their own merits and contained in their own budgets (Budgets 9 and 11).

Overall, the balance for WY93 of the inflow to the Stickney facility is very good. The simulated to recorded flow ratio (S/R) for the Stickney is 1.07, indicating that the simulated interceptor inflow volume is greater than the recorded interceptor inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.76, indicating that the model performed well in predicting the trends in the interceptor inflow hydrographs to the Stickney facility.

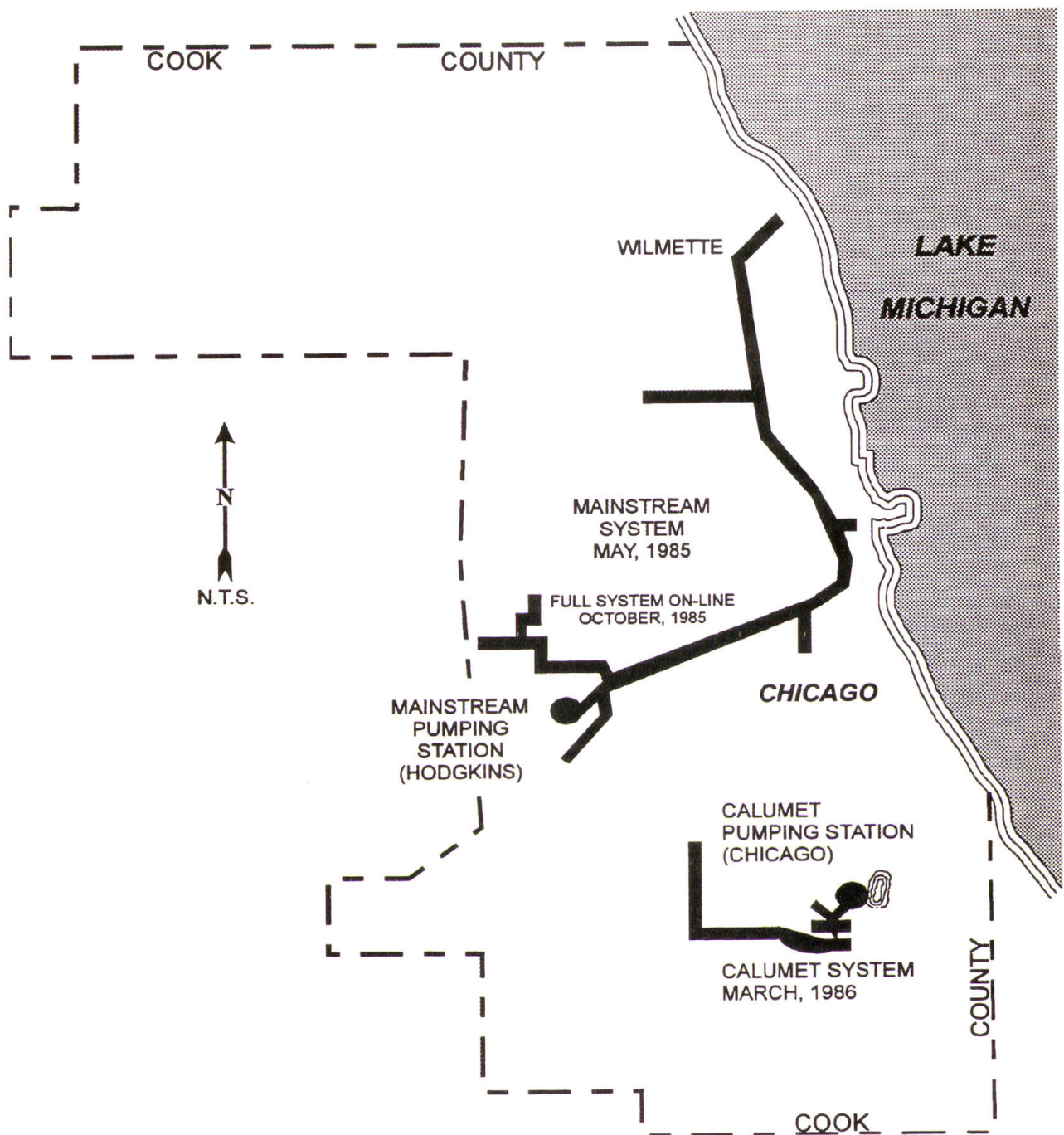


Figure 6

Map of Mainstream and Calumet TARP

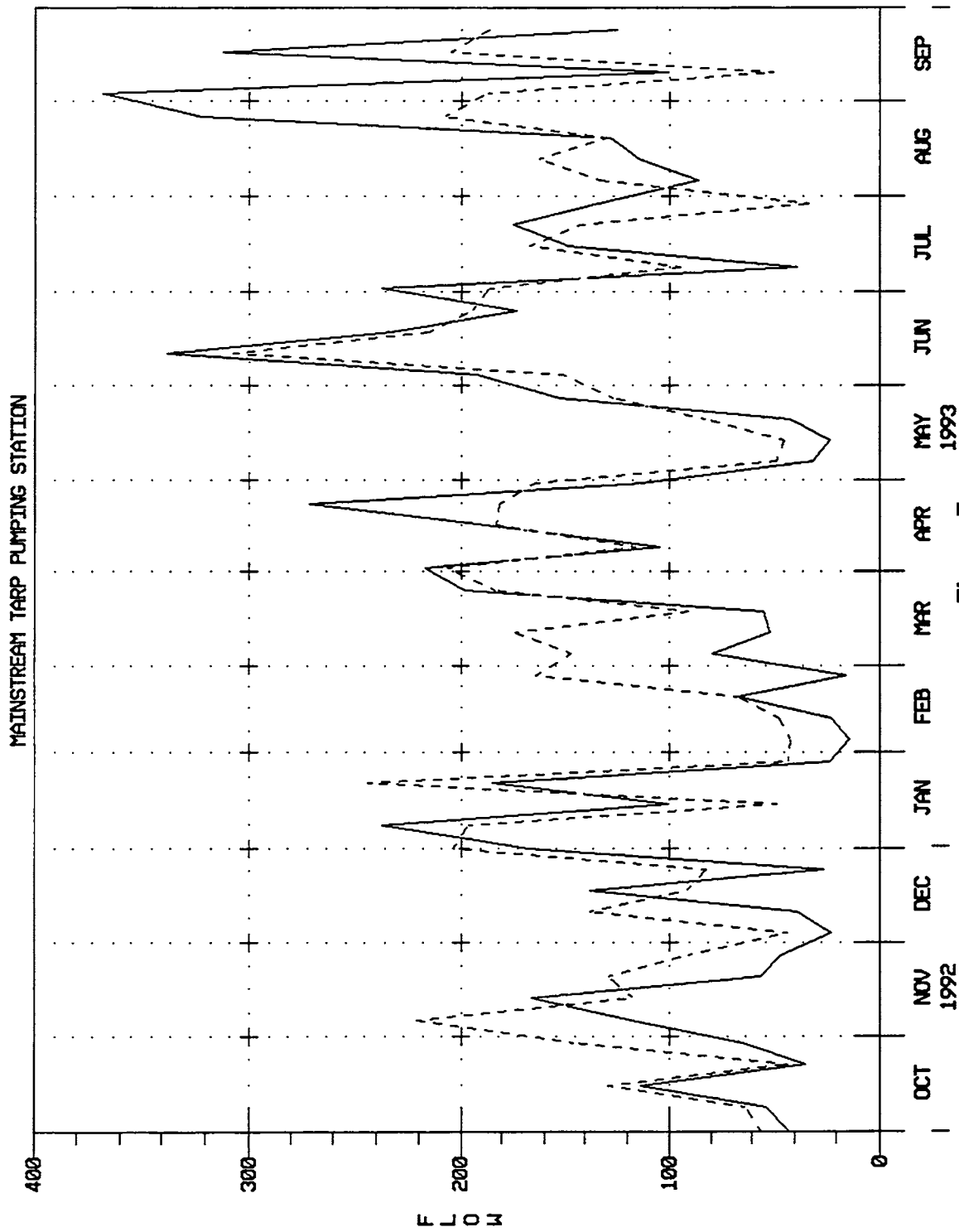


Figure 7

Budget 9 - Simulation of the MWRDGC Mainstream TARP Pumping Station

— OBSERVED FLOW TO STICKNEY WRP
 --- SIMULATED FLOW TO STICKNEY WRP

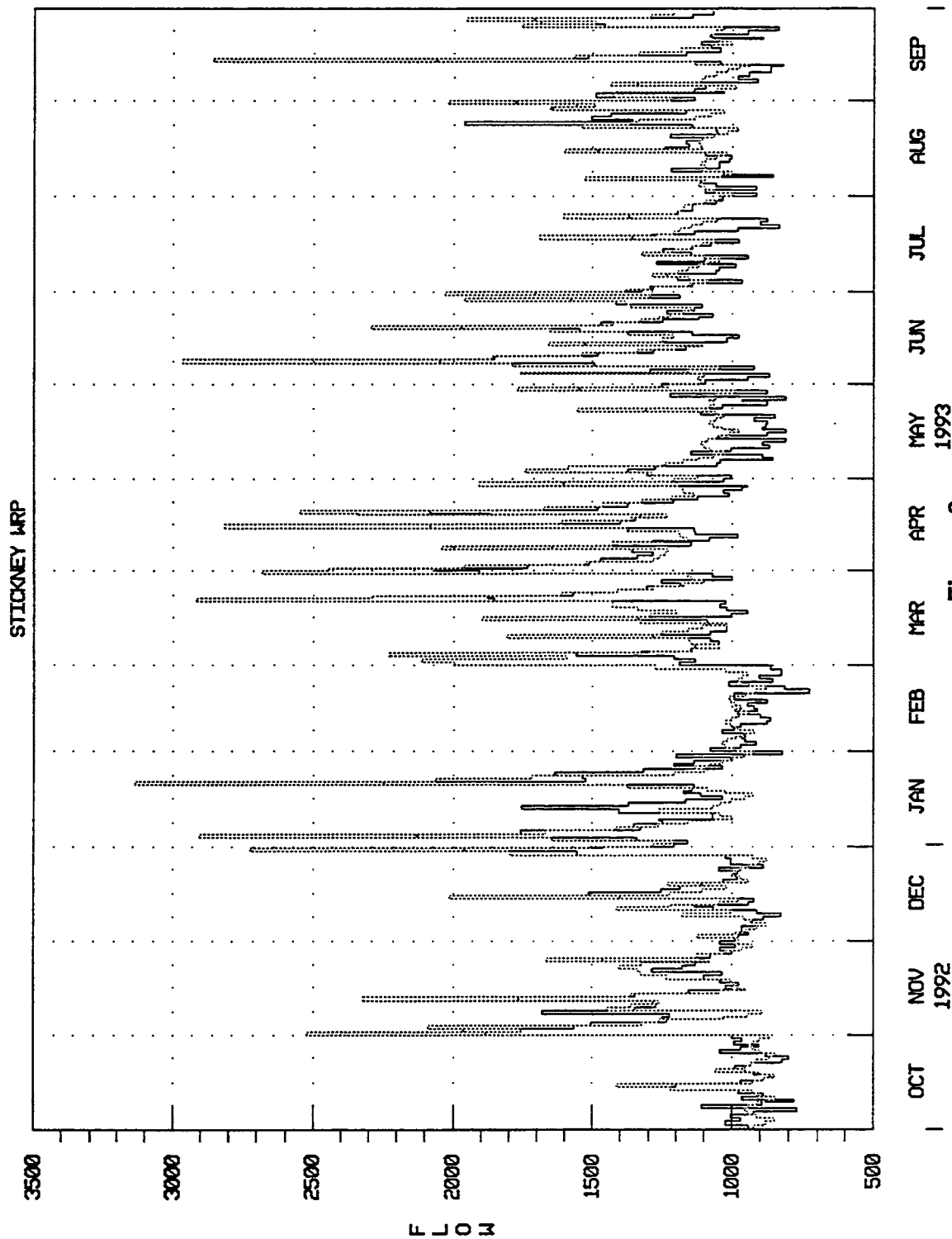


Figure 8

Budget 10 - Simulation of the MWRDGC Stickney Water Reclamation Facility

— OBSERVED FLOW NOT INCL. TARP
 SIMULATED FLOW NOT INCL. TARP

Budget 11: Calumet TARP Pumping Station

Budget 11 analyzes the water budget at the MWRDGC Calumet TARP Pumping Station (Figure 9). The results of Budget 11 are used as a verification point for simulated flows. The modeling of Calumet TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Calumet TARP is contained in Figure 6. A more in-depth description of Calumet TARP and the simulation model is contained in the Water Year 1987 report contained in the Diversion Accounting Annual Report for WY90-92 (USACE, 1994).

In analyzing the balance at the Calumet TARP Pumping Station, weekly flows were used instead of daily flows. While MWRDGC maintain daily pumpage records, days with no pumpage occur frequently. Therefore, it is not possible to compute a daily S/R ratio.

The balance for WY93 of the inflow to the Calumet TARP Pumping Station is fair. The simulated to recorded flow ratio (S/R) for the Calumet TARP Pumping Station is 0.61 indicating that the simulated inflow volume is significantly less than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.74, indicating that there is a good agreement between the trends of the simulated and observed Calumet TARP pumpages.

Volume matching between the simulated and recorded Calumet TARP pumpages also was more difficult for WY93 as evidenced by the 0.61 S/R ratio. Because of the instability of the TARP model, as well as uncertainties in the Calumet TARP system, it was difficult to improve on this ratio. However, as the system is presently modeled, this does not impact the computed diversion, since all Des Plaines River watershed areas whose overflows are modeled as tributary to Calumet TARP are also modeled such that "non-captured" overflows flow to rivers that are tributary to the CSSC. Therefore, whether or not these Des Plaines River watershed runoff flows enter the tunnel or not, they are presently included in the Des Plaines River watershed runoff deduction in Column 6. This assumption will remain until separately sewered areas are modeled such that actual areas are used instead of effective areas in the hydraulic models. This has been discussed in the WY90 diversion accounting report.

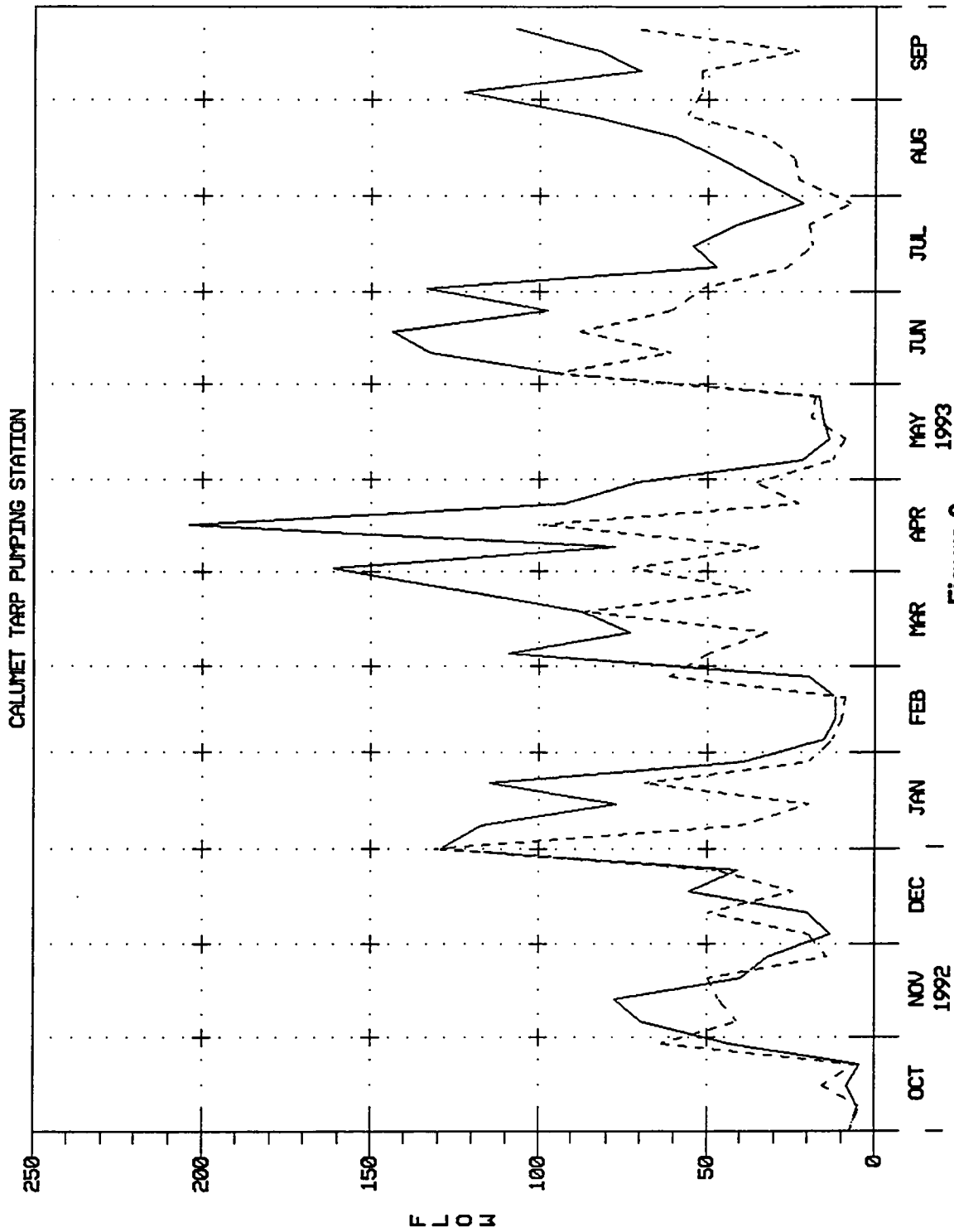


Figure 9
Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station

— OBSERVED FLOW TO CALUMET WRP
 - - - SIMULATED FLOW TO CALUMET WRP

Budget 12: Calumet Water Reclamation Facility

Budget 12 analyzes the water balance at the MWRDGC Calumet Water Reclamation Facility (Figure 10). Simulated Calumet TARP pumpages from Budget 11 are no longer combined with simulated interceptor inflows to the Calumet Water Reclamation Facility to derive the total simulated inflow to the Calumet Facility. Instead, only simulated interceptor inflows are compared with recorded inflows to assess the accuracy of the simulation. This was revised for the same reasons as outlined previously in the discussion for Budget 10.

The annual simulated to recorded flow ratio (S/R) and the coefficient of correlation for the Calumet Water Reclamation Facility are considered good. The S/R ratio is 1.06 indicating that the simulated Calumet interceptor flow volume was slightly higher than the recorded interceptor flow volume. The coefficient of correlation was 0.85 indicating a good correlation between simulated and recorded interceptor flows.

Budget 13: Lemont Water Reclamation Facility

Budget 13 analyzes the water balance at the MWRDGC Lemont Water Reclamation Facility (Figure 11). Overall, the balance for WY93 of the inflow to the Lemont facility is good. The simulated to recorded flow ratio (S/R) for the Lemont is 0.88, indicating that the simulated inflow volume was slightly less than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.79, indicating that the model predicted the inflow hydrograph to the Lemont facility fairly well.

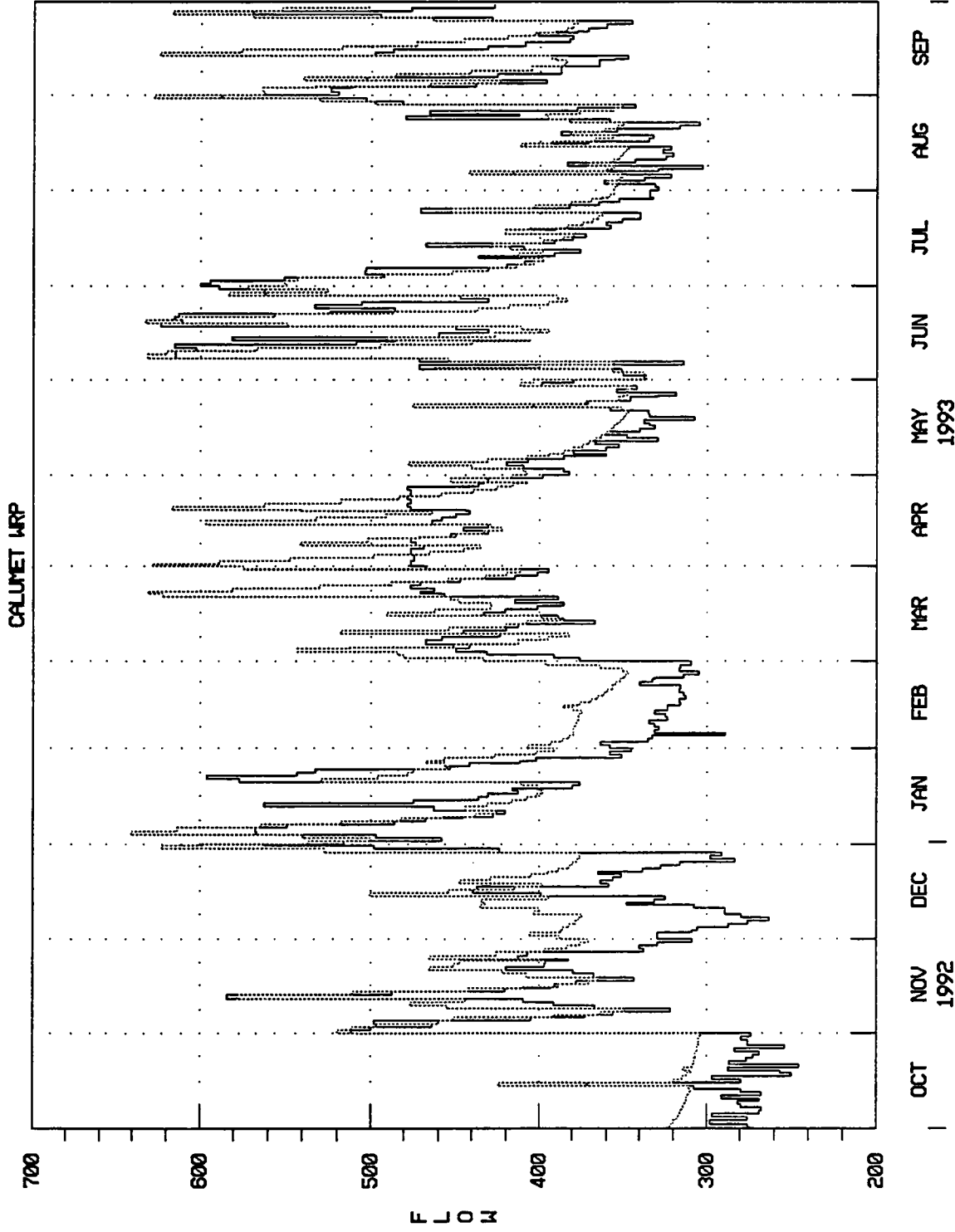


Figure 10

Budget 12 - Simulation of the MWRDGC Calumet Water Reclamation Facility

— OBSERVED FLOW NOT INCL. TARP
 SIMULATED FLOW NOT INCL. TARP

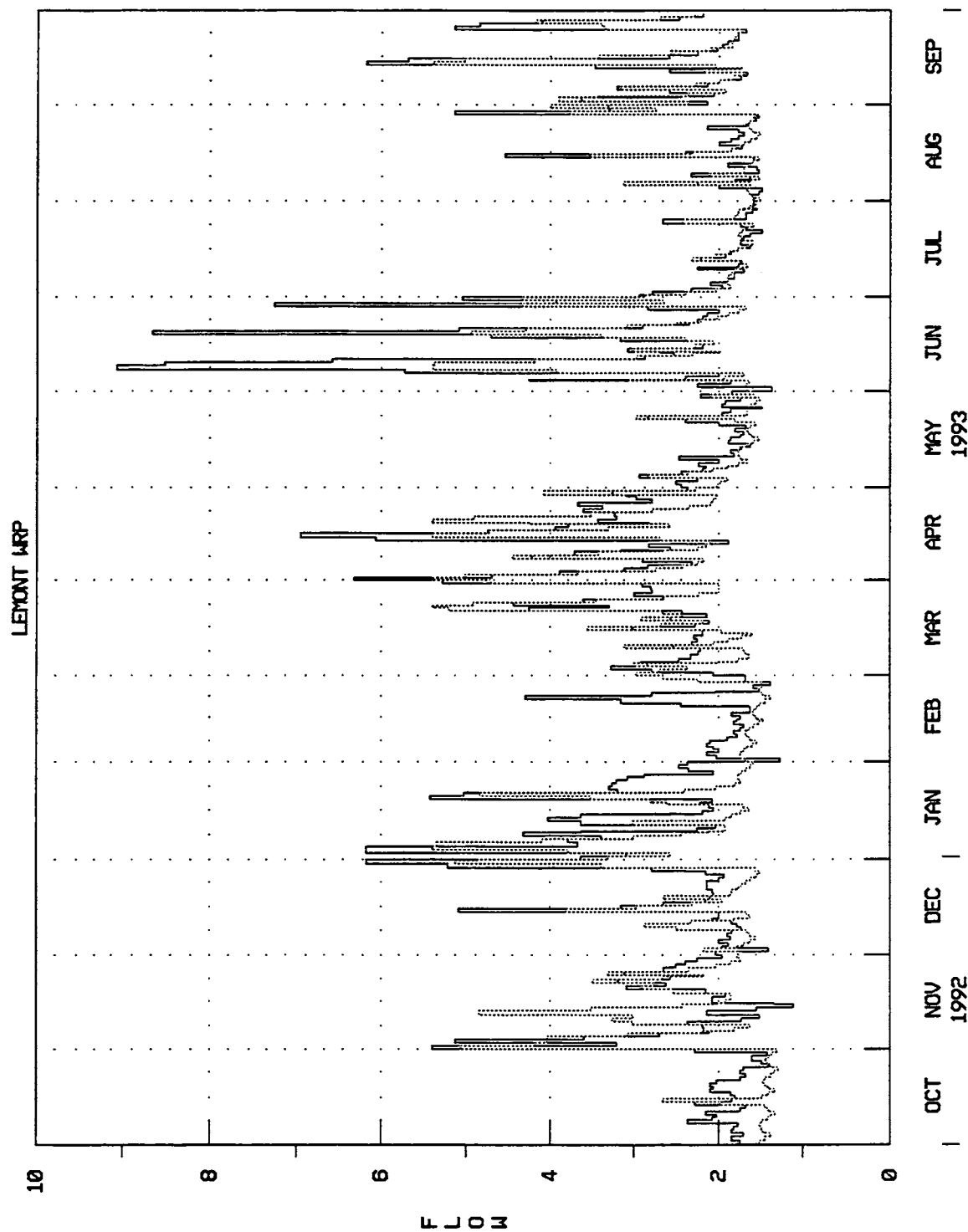


Figure 11

Budget 13 - Simulation of the MWRDGC Lemont Water Reclamation Facility

— OBSERVED FLOW
 SIMULATED FLOW

Budget 14: CSSC System Balance

Budget 14 compares the inflows and outflows to the CSSC system (Figure 12). The inflow components include direct diversions through the lakefront structures, stormwater runoff discharged to the canal system, and domestic water supply whose effluent discharges to the canal system. The outflows from the canal system include the discharge past the Romeoville AVM, backflows through the lakefront structures and withdrawals upstream of Romeoville by Argonne National labs and Uno-Ven Corporation. The individual components are presented in Table 8 for WY93.

Overall, the balance for WY93 between the inflows to the canal system and the outflows from the canal system is very good. The S/R (inflow/outflow) for the canal system is 0.99, indicating that the inflow to the canal system is virtually equal to the outflow from the canal system. The average measured/simulated inflow was 4,027.4 cfs while the average measured/simulated outflow was 4,086.6 cfs. The difference is 59.2 cfs (1.4%) for WY93, as compared to 419.0 cfs (10.8%) for the previous water year, WY92.

The coefficient of correlation (R) of inflow to outflow is 0.90, indicating that the time series trends of inflow to outflow are well correlated. The coefficient of correlation is based on daily flows. Therefore, timing between inflows and measured outflows at Romeoville is a major issue, especially during changes in flow that occur at the beginning or end of a day. This is the result of travel time from inflow locations downstream to the Romeoville AVM site. Therefore, variability in the coefficient of correlation from year to year may be attributed to the variability in the timing of significant flow changes during a particular year.

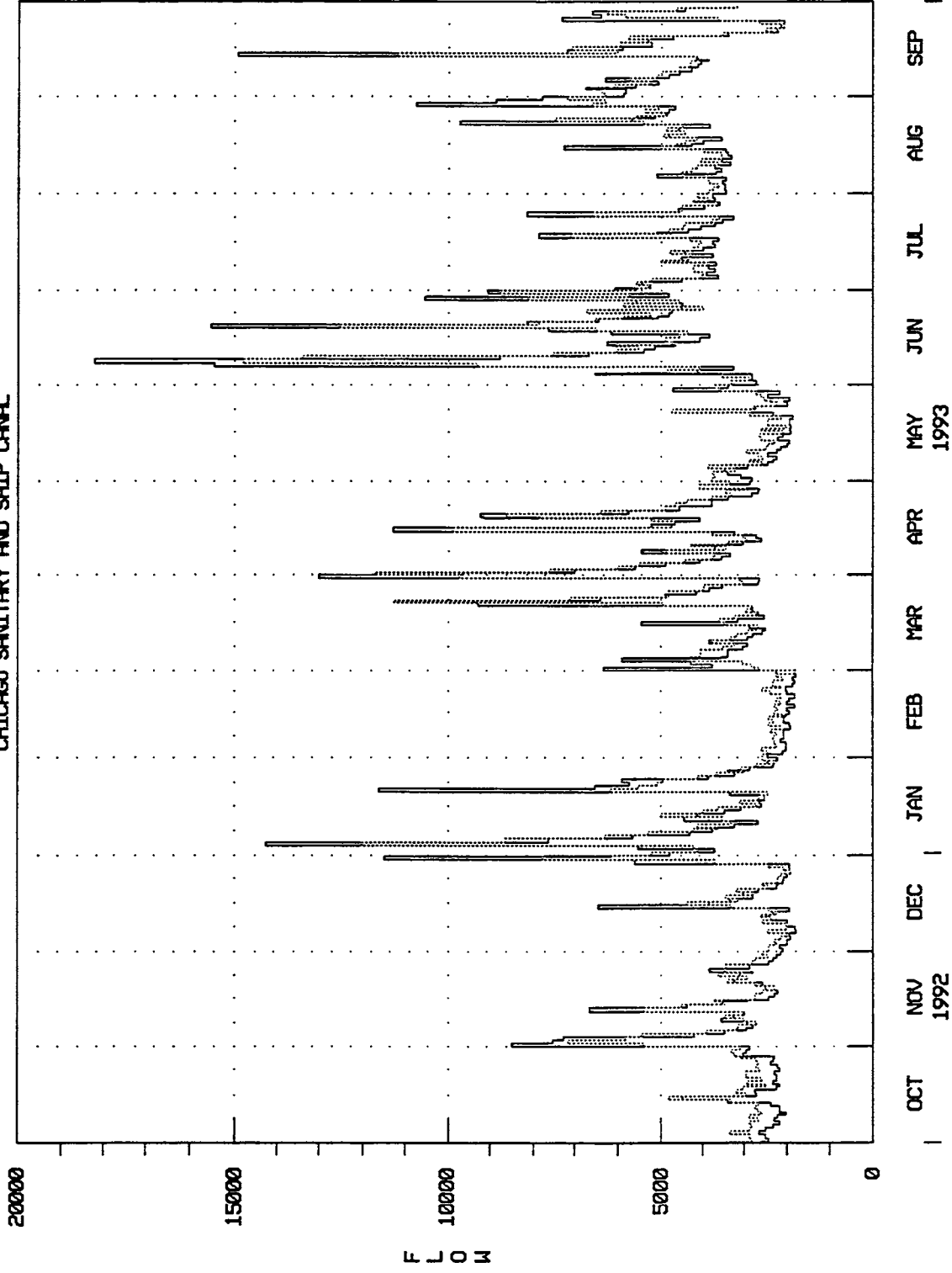


Figure 12
Budget 14 - CSSC System Balance

— CANAL SYSTEM INFLOWS
..... CANAL SYSTEM OUTFLOWS

Table 8

WY 1993 Summary of Flow Components for the CSSC System Balance

INFLOWS (cfs)	
Lake Controlling Structures (measured)	
- Wilmette Controlling Works	44.0
- Chicago River Controlling Works	237.9
- O'Brien Lock and Dam	237.0
Streamflows (measured)	
- North Branch Chicago River at Niles	170.6
- Little Calumet River at South Holland	332.4
- Grand Calumet River at Holman Ave.	51.6
MWRDGC Water Reclamation Facilities (measured)	
- Northside	477.6
- Stickney	1,294.1
- Calumet	464.4
- Calumet TARP Pumpage to River	0.0
- Lemont	2.6
Other Point Sources (measured)	7.8
Summit Conduit (simulated)	15.2
Combined Sewer Overflows (simulated)	372.0
Direct Runoff to CSSC (simulated)	320.2
TOTAL INFLOWS (cfs)	4,027.4
OUTFLOWS (cfs)	
Cal-Sag Flow Transferred to Calumet WRP as Steel Mill Blow-down	4.2
Lake Front Backflows	0.0
Argonne Laboratory	0.5
Uno-Ven Corporation	7.3
USGS AVM Record	4,074.4
TOTAL OUTFLOWS (cfs)	4,086.6
DIFFERENCE (cfs)	-59.2

Areas for Improvement

Impervious Model Estimates

During a review of the detailed Lake Michigan watershed runoff study conducted by the Corps of Engineers during the Lake Michigan Diversion Accounting mediations, it was determined that the hydraulic connectivity of the impervious areas used in the rainfall-runoff modeling was not fully accounted for when the models were revised for the WY90 accounting. As a result, the models appear to overestimate runoff. However, the treatment plant balances remained very good after the model revisions. The most significant effect is in the simulated overflows, which greatly increased after WY90. A detailed study should be conducted of the pervious and impervious percentages applied to the various landuse types used for the model development should be conducted and, if necessary, the hydraulically connected impervious areas within the SCALP models should be adjusted for each SCA.

Tunnel and Reservoir Plan Models

The TARP models should be revised such that they are more representative of actual operating conditions, if possible. Due to model instability, simulated gate closing and pump operation parameters have been simplified or modified. Improvements for model stability are required before the models can better represent the operating procedures. Even after this change, representation of "actual" operating procedures may be difficult due to deviations from the TARP system operation plan, i.e. pumping at night, down times for various pumps, changes in pump ratings, implementation of forecasting algorithms, etc.

The primary purpose of the TARP models is to accurately estimate deductible components of the diversion such as the Des Plaines River watershed runoff and groundwater infiltration through tunnel walls. Low flows, or dry weather flows, must be modeled accurately so that groundwater infiltration into the two TARP systems is properly modeled. These flows constitute a substantial deduction to the diversion and are included in the deductible groundwater flows of Column 4. Therefore, the estimates of simulated groundwater infiltration rates need to be updated periodically to better match the simulated to the recorded dry-weather flows. Procedures for updating simulated dry-weather flows are similar to those used for improving the simulated groundwater infiltration rates for WY89 Calumet TARP as discussed in

the WY89 Accounting Report in the Lake Michigan Diversion Accounting Annual Report for WY90-92.

In the Calumet system, some sanitary sewers are connected to TARP. These sewers must be accurately accounted for in the modeling of groundwater infiltration since they contribute to the baseflow, or dry weather, flow into TARP. Currently, some uncertainty remains as to the connection of these separately sewered areas. For accurate modeling of the Calumet TARP system, these connections need to be verified and adjusted if necessary.

Other areas exist where the TARP models can be improved. First, the modeling should more accurately simulate MWRDGC operational procedures which include less frequent pumping and pumping during the night. Second, the incorporation of a pseudo-forecasting algorithm would allow the model to simulate MWRDGC dewatering procedures prior to a storm. Third, dynamic constituent (inflow-infiltration versus sanitary versus groundwater) tracking can be incorporated to allow more accurate determination of the deductible components of TARP flow. Currently, constant constituent proportions, based on annual volumes, are applied to all simulated pumpages from the TARP tunnels. Therefore, constituent flow percentages from TARP remain unchanged during an entire water year. Fourth, the inclusion of an algorithm to operate index dropshafts based on average water surface elevation in a tunnel reach would provide better simulation of "actual" operations. Sudden, localized changes in water surface elevations would not result in frequent opening and closing of control structure gates that regulate the flows into the drop shafts.

MWRDGC Upper Des Plaines Pump Station

A review of the Upper Des Plaines pump station and its flow record indicates that the flow at the pump station is suspect and subject to operator error. Better flow measurements are needed at the pump station. With better flow measurements, this site will become the most important point for calibrating and verifying the simulation models for the Des Plaines watershed. In the diversion calculation, the primary purpose of modeling is to calculate the deduction for runoff from the Des Plaines watershed that enters the CSSC. The Upper Des Plaines Pump Station is the only point at which a model of the inflow-infiltration can be calibrated and extrapolated to the remaining portions of the Des Plaines River watershed. Because of the many problems associated with the current measurements of flow at this site, the benefits as the primary model calibration point have yet to be realized. Installation of better flow measurement equipment at the pump station would facilitate better model calibration.

O'Hare and Egan Basin Flow Transfer

A portion of the flows originating in the O'Hare and Egan Water Reclamation Plants' (WRP) service basins are transferred east to the Northside WRP. The extent of this transfer of flow is not known and the diverted flow is not currently measured. An estimate of the annual flow transfer is provided by MWRDGC. The total O'Hare-Egan flow transfer has been estimated by the MWRDGC as 31 cfs for the past several years.

This transfer is significant to diversion since the O'Hare and Egan facilities discharge outside of the CSSC while the Northside WRP discharges flows that reach the CSSC. Therefore, this transfer contains two components that are deductions to the flow measured in the CSSC. The two deductible components are groundwater pumpage contained in the sanitary portion of the transfer (Column 4), and diverted Des Plaines River watershed runoff (Column 6).

To determine the two deductible components requires an estimate of the sanitary and runoff portions of the flow transfer. Presently the sanitary and runoff portions of the flow transfer are estimated using the same constituent (sanitary, inflow, and infiltration) proportions simulated for the Upper Des Plaines Pump Station by SCALP. Additionally, estimates must be made of the groundwater and Lake Michigan water components of the sanitary portion of the transfer. For WY93, the estimated water supply from the O'Hare and Egan service basins was composed of 5.6 percent groundwater (0.9 cfs) and 94.4 percent Lake Michigan water (15.5 cfs). The diverted Des Plaines river watershed runoff was estimated at 14.6 cfs.

For future accounting, simply measuring the basin transfer will not provide any information on the component makeup of the transfer. Thus, a review of the complex hydraulics and hydrology is necessary to determine the best procedure for estimating these flows. Several alternatives, including flow measurement and modeling are under consideration. A more detailed discussion of the flow transfer can be found in the Lake Michigan Diversion Accounting WY86 Report in the Lake Michigan Diversion Accounting WY90-92 Annual Report.

Summary

In compliance with the modified 1980 U.S. Supreme Court decree, the WY93 diversion was computed using the best engineering technology available to date.

Overall, the simulations that comprise a significant portion of the diversion accounting computations worked well. The two most significant budgets to the diversion accounting computations, Budget 7, Northside Water Reclamation Facility, and Budget 10, Stickney Water Reclamation Facility, performed very well. Together, Budgets 7 and 10 compute the majority of the deductible Des Plaines River watershed runoff. These budgets have simulated to recorded ratios of 0.95 and 1.09 and correlations of 0.90 and 0.84, respectively. Given the complexity of the hydrologic cycle in the heavily urbanized Chicago metropolitan area, and given the number of human and other factors that cannot be adequately represented in numerical modeling procedures, the results of these two (2) budgets are good. Additionally, results for Budget 12, the Calumet WRP, were also very good. This budget also models a portion of the deductible Des Plaines River watershed runoff. The S/R ratio was 1.06 while the coefficient of correlation was 0.86.

The WY93 diversion accountable to the State of Illinois is 3,840.8 cfs. This flow is 640.8 cfs greater than the 3,200 cfs average specified by the Decree. The 40 year running average beginning with WY81 and rounded to the nearest cfs is 3,487 cfs, and the cumulative deviation from the 3,200 cfs average is -3,725 cfs-years. The negative cumulative deviation indicates a water allocation deficit and the maximum allowable deficit is 2,000 cfs-years.

References

1. Barkau, Robert L. 1991. *Modeling of the Chicago Tunnel and Canal System*. Prepared for Christopher B. Burke Engineering Ltd. as part of reference 2.
2. Christopher B. Burke Engineering, Ltd. 1991. *Data Collection and Model Revisions*. Prepared for the U.S. Army Corps of Engineers, Chicago.
3. Christopher B. Burke Engineering, Ltd. 1990. *Infiltration and Inflow Study and Diversion Accounting Model Modification*. Prepared for the U.S. Army Corps of Engineers, Chicago.
4. Espey, William H., Harry H. Barnes, and Svein Vigander. 1981. *Lake Michigan Diversion Findings of the Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures*. Prepared for the U.S. Army Corps of Engineers, Chicago.
5. Espey, William H., Harry H. Barnes, and David Westfall. 1987. *Lake Michigan Diversion Findings of the Second Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures*. Prepared for the U.S. Army Corps of Engineers, Chicago.
6. Hart, Dale E., and Richard G. McGee. 1985. *Final Report - Lockport Power Plant Sluice Gate and Control Works Discharge Evaluation*. Waterways Experiment Station. Vicksburg, MS.
7. Illinois State Water Survey. 1991, *Installation and Operation of a Dense Rainage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990*.
8. International Joint Commission. 1981. *Great Lakes Diversions and Consumptive Uses, Annex F, Consumptive Use*.
9. Keifer Engineering. 1982. *Input Data CRSM for Existing Conditions - Mainstream System*. Prepared for the U.S. Army Corps of Engineers, Chicago.
10. Kleinbaum, David G., and Lawrence L Kupper. 1978. *Applied Regression Analysis and Other Multivariable Methods*. Wadsworth Publishing Company.

11. Metropolitan Water Reclamation District of Greater Chicago. 1984. *1984 Facility Planning Study - MSDGC Update Supplement and Summary*.
12. Metropolitan Water Reclamation District of Greater Chicago. 1989. *1988 Annual Report of the Maintenance and Operations Department*.
13. Neubauer, Ronald A. 1990. Request for TARP Information from the Army Corps of Engineers. Memorandum to Mr. William Eyre, Supervising Civil Engineer, Metropolitan Water Reclamation District of Greater Chicago.
14. Northeastern Illinois Planning Commission. 1985. *Lake Michigan Diversion Accounting Manual of Procedures*.
15. Kleinbaum, David G., and Lawrence L Kupper. 1978. *Applied Regression Analysis and Other Multivariable Methods*. Wadsworth Publishing Company.
16. Rust Environment & Infrastructure. 1993. *Diversion Accounting Update for the New 25-Gage Precipitation Network*.
17. Steel, Robert G. D., and James H. Torrie. 1980. *Principles and Procedures of Statistics - A Biometrical Approach*. McGraw-Hill, Inc.
18. U.S. Army Corps of Engineers. 1990. *Lake Michigan Diversion Accounting 1989 Annual Report Including WY84 and WY85 Accounting*.
19. U.S. Army Corps of Engineers. 1990. *Current Meter Measurements of Discretionary and Leakage Flows at the Chicago River Controlling Works, O'Brien Lock and Dam, and the Wilmette Controlling Works*.
20. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Annual Report, Water Years 1990-92*.
21. U.S. Army Corps of Engineers. 1995. *Lake Michigan Diversion Accounting Water Year 1993 Annual Report*.
22. U.S. Army Corps of Engineers. 1996. *Lake Michigan Diversion Accounting Water Year 1994 Annual Report*.
23. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1986 Report*.

24. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1987 Report.*
25. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1988 Report.*
26. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1989 Report.*
27. U.S. Army Corps of Engineers. 1995. *Lake Michigan Diversion Accounting Water Year 1990 Report.*
28. U.S. Army Corps of Engineers. 1996. *Lake Michigan Diversion Accounting Water Year 1991 Report.*
29. U.S. Army Corps of Engineers. 1996. *Lake Michigan Diversion Accounting Water Year 1992 Report.*
30. U.S. Geological Survey. 1984. *Streamflow and Water Quality of the Grand Calumet River, Lake County, Indiana, and Cook County, Illinois.*
31. U.S. Geological Survey. 1992. *Water Resources Data, Illinois, Water Year 1991, Volume 2, Illinois River Basin.*
32. U.S. Geological Survey. 1994. *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary Ship Canal at Romeoville, Illinois.*
33. U.S. Geological Survey. 1994. *Measurements of Leakage through Chicago River Controlling Works and Other Control Structures Near Chicago Illinois.*
34. Wisconsin et. al., v. Illinois et. al., Michigan v. Illinois et. al. New York v. Illinois et. al. U.S. 2, 3, and 4, Original 1 - 18, 1980.

Appendix A

Summary of Daily Diversion Flows

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 equals Column 3 minus Column 8 plus Column 9.



Deductions from the Romeoville Gage Record



Additions to the Romeoville Gage Record

Lake Michigan Diversion Accounting - WY1993 October 1992 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEIOVILLE AVM GAGE RECORD	2 DIVERSIONS ABOVE THE GAGE	3 TOTAL FLOW THROUGH THE CANAL	GROUNDWATER		WATER SUPPLY		RUNOFF FROM THE DES PLAINES RIVER		LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL		TOTAL DEDUCTION FROM THE ROMEIOVILLE GAGE RECORD		LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL		10 TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	11 PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	12 RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	13 DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
				4 PUMPAGE DISCHARGED INTO THE CANAL	5 PUMPAGE FROM INDIANA REACHING THE CANAL	6 PUMPAGE FROM INDIANA REACHING THE CANAL	7 PUMPAGE FROM INDIANA REACHING THE CANAL	8 PUMPAGE FROM INDIANA REACHING THE CANAL	9 PUMPAGE FROM INDIANA REACHING THE CANAL	10 PUMPAGE FROM INDIANA REACHING THE CANAL	11 PUMPAGE FROM INDIANA REACHING THE CANAL	12 PUMPAGE FROM INDIANA REACHING THE CANAL	13 PUMPAGE FROM INDIANA REACHING THE CANAL	14 PUMPAGE FROM INDIANA REACHING THE CANAL	15 PUMPAGE FROM INDIANA REACHING THE CANAL				
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
01-Oct-92	3474.0	3.9	3477.9	107.7	22.8	92.6	1.2	224.3	231.5	3486.1	1844.2	217.2	665.0						
02-Oct-92	2865.0	4.0	2869.0	35.1	21.9	50.8	1.3	109.0	227.8	2987.8	1874.4	94.3	682.0						
03-Oct-92	2914.0	4.0	2918.0	36.9	22.8	49.3	1.3	110.4	229.0	3036.6	1875.6	89.9	714.0						
04-Oct-92	3369.0	4.0	3373.0	62.4	24.9	53.7	1.3	142.4	229.4	3480.0	1812.5	115.7	774.0						
05-Oct-92	2926.0	3.8	2929.8	63.9	23.4	50.8	1.3	139.5	229.5	3018.8	1851.9	98.0	718.0						
06-Oct-92	2886.0	3.9	2889.9	36.9	22.4	43.4	1.3	104.1	229.1	3014.9	1830.4	69.7	686.0						
07-Oct-92	2927.0	3.9	2930.9	69.1	21.8	50.8	1.3	143.0	227.8	3016.7	1812.2	97.9	697.0						
08-Oct-92	2700.0	3.9	2703.9	61.9	22.7	46.2	1.2	132.1	229.3	2801.1	1820.8	103.6	378.0						
09-Oct-92	2927.0	3.9	2930.9	36.9	22.8	39.9	1.3	101.0	226.7	3066.6	1783.9	66.4	495.0						
10-Oct-92	2621.0	3.9	2624.9	36.8	21.7	38.9	1.2	98.7	225.7	2761.9	1754.3	59.2	516.0						
11-Oct-92	2719.0	3.9	2722.9	96.5	22.1	53.0	1.1	172.7	225.8	2776.0	1732.0	115.7	526.0						
12-Oct-92	2805.0	3.9	2808.9	35.1	22.3	35.0	1.3	93.7	227.7	2842.9	1811.3	49.9	553.0						
13-Oct-92	2699.0	3.9	2702.9	58.2	21.4	40.3	1.3	121.3	232.2	2813.8	1806.5	72.5	580.0						
14-Oct-92	3349.0	3.9	3352.9	102.6	24.2	198.8	1.2	326.9	236.0	3282.0	1798.8	1657.1	458.0						
15-Oct-92	4849.0	4.0	4853.0	204.4	31.0	367.6	1.3	604.4	228.8	4477.4	1759.5	1722.2	1125.0						
16-Oct-92	2980.0	3.8	2983.8	108.2	29.2	80.1	1.3	218.8	228.4	2993.4	1767.2	289.1	622.0						
17-Oct-92	3236.0	3.8	3239.8	35.1	24.3	46.9	1.3	107.6	227.4	3358.6	1767.6	129.7	593.0						
18-Oct-92	3086.0	3.8	3089.8	62.7	23.1	50.2	1.3	137.3	227.0	3178.6	1711.5	126.3	538.0						
19-Oct-92	2505.0	3.9	2508.9	64.0	22.4	45.9	1.4	133.7	229.4	2604.6	1751.0	101.2	560.0						
20-Oct-92	2951.0	3.7	2954.7	113.6	22.0	95.8	1.3	232.7	230.6	2952.6	1767.0	389.8	480.0						
21-Oct-92	2622.0	3.7	2625.7	35.1	22.9	37.6	1.3	96.8	228.3	2787.2	1760.6	82.5	548.0						
22-Oct-92	2986.0	3.8	2989.8	36.9	22.2	37.6	1.3	98.0	229.2	3121.0	1770.8	73.4	566.0						
23-Oct-92	2995.0	3.8	2998.8	69.9	21.7	43.7	1.2	136.5	229.9	3092.2	1770.2	96.3	631.0						
24-Oct-92	2661.0	3.8	2664.8	63.5	22.5	40.8	1.3	128.1	227.4	2764.1	1724.3	89.4	655.0						
25-Oct-92	2751.0	3.7	2754.7	36.9	23.3	34.3	1.3	95.8	227.1	2889.0	1742.8	59.5	626.0						
26-Oct-92	2729.0	3.8	2732.8	82.1	22.7	45.9	1.4	152.0	228.6	2909.4	1729.4	102.0	582.0						
27-Oct-92	2768.0	3.8	2771.8	48.5	21.4	34.5	1.2	105.7	230.0	2895.1	1759.5	61.4	583.0						
28-Oct-92	3122.0	3.8	3125.8	36.9	21.8	32.2	1.2	92.1	228.3	3282.0	1739.4	50.4	695.0						
29-Oct-92	3254.0	3.7	3257.7	60.1	24.5	37.8	1.4	123.8	226.2	3360.1	1708.2	85.9	1323.0						
30-Oct-92	3327.0	3.9	3330.9	62.8	23.1	36.6	1.2	123.8	228.5	3435.6	1694.9	80.6	1257.0						
31-Oct-92	3164.0	3.7	3167.7	35.1	22.4	28.5	1.3	87.2	223.2	3303.7	1685.1	45.7	950.0						
Averages	3005.4	3.8	3009.2	64.4	23.2	62.6	1.3	151.5	226.6	3086.3	1774.8	209.4	670.2						

Lake Michigan Diversion Accounting - WY1993 November 1992 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEOVILLE AVM GAGE RECORD	2	3	4	5	6	7	8	9	10	11	12	13
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Nov-92	5409.0	2.7	5411.7	70.7	29.9	1285.5	1.6	1387.8	241.5	4266.4	1678.1	7137.9	81.0
02-Nov-92	7184.0	2.6	7186.6	150.7	29.1	910.8	1.6	1092.2	227.8	6322.2	1720.8	4824.6	627.0
03-Nov-92	5840.0	2.6	5842.6	179.9	28.6	1123.5	1.6	1333.5	235.5	4744.6	1719.7	5729.1	86.0
04-Nov-92	5462.0	2.7	5464.7	162.4	27.8	422.4	1.7	614.3	222.8	5073.0	1715.3	1734.0	104.0
05-Nov-92	3916.0	2.7	3918.7	225.9	24.8	401.3	1.5	653.4	223.1	3488.4	1706.2	1407.9	86.0
06-Nov-92	3217.0	2.7	3219.7	178.0	24.6	222.3	1.6	426.5	218.9	3012.1	1711.6	767.3	81.0
07-Nov-92	3193.0	2.6	3195.6	36.5	24.1	127.9	1.3	189.7	218.6	3224.5	1681.7	426.1	96.0
08-Nov-92	2736.0	2.7	2738.7	97.2	22.5	117.1	1.5	238.3	220.1	2720.6	1672.0	395.0	78.0
09-Nov-92	3031.0	2.7	3033.7	157.6	24.5	447.0	1.2	630.3	226.7	2630.1	1732.0	1830.6	73.0
10-Nov-92	3480.0	2.7	3482.7	60.2	24.8	335.7	1.7	422.4	224.4	3284.7	1708.1	1273.1	66.0
11-Nov-92	3081.0	2.7	3083.7	152.9	24.9	288.5	1.2	467.5	220.0	2636.2	1696.7	1143.9	90.0
12-Nov-92	5430.0	2.7	5432.7	96.3	28.4	946.6	1.5	1072.7	233.2	4693.2	1711.7	4539.5	79.0
13-Nov-92	4533.0	2.6	4535.6	180.0	27.7	436.9	1.4	646.0	219.8	4108.4	1683.5	2171.8	61.0
14-Nov-92	3518.0	2.6	3520.6	133.1	24.8	249.8	2.2	409.9	223.5	3334.2	1684.5	1116.3	67.0
15-Nov-92	3739.0	2.6	3741.6	37.6	24.5	167.5	1.3	230.9	218.0	3728.7	1673.9	658.7	87.0
16-Nov-92	2792.0	2.7	2794.7	36.2	23.2	138.6	1.4	199.5	220.1	2816.3	1723.6	489.5	78.0
17-Nov-92	2784.0	2.6	2786.6	108.7	26.2	136.6	1.4	270.9	220.2	2756.9	1709.2	464.2	90.0
18-Nov-92	2578.0	2.7	2580.7	36.5	25.2	106.2	1.2	169.1	389.5	2801.1	1880.5	336.7	80.0
19-Nov-92	2323.0	2.7	2325.7	73.7	23.2	250.3	1.1	232.1	389.5	2189.6	1687.5	783.6	115.0
20-Nov-92	2810.0	2.7	2812.7	77.9	23.1	332.3	1.4	434.8	220.7	2898.6	1673.1	1008.0	86.0
21-Nov-92	3422.0	2.8	3424.8	180.0	24.3	408.1	2.2	614.6	221.9	3032.1	1685.7	1295.1	61.0
22-Nov-92	2958.0	2.7	2960.7	77.8	27.2	454.3	0.9	560.1	221.9	2822.6	1684.8	1439.9	68.0
23-Nov-92	3642.0	2.7	3644.7	95.1	31.5	317.6	0.9	445.1	222.5	3422.1	1697.1	1413.1	83.0
24-Nov-92	3028.0	2.7	3030.7	101.5	25.9	195.9	0.9	324.1	218.5	2923.1	1707.9	899.3	93.0
25-Nov-92	3511.0	2.6	3513.6	57.1	26.8	465.1	1.4	550.4	227.0	3180.2	1729.6	1891.2	82.0
26-Nov-92	3470.0	2.7	3472.7	184.3	26.2	289.4	2.0	481.9	219.0	3209.8	1687.6	989.4	70.0
27-Nov-92	2888.0	2.6	2890.6	38.2	24.5	170.5	1.4	234.9	221.8	2877.5	1672.9	619.1	80.0
28-Nov-92	2789.0	2.6	2791.6	36.4	24.5	146.7	1.4	208.9	218.6	2801.3	1683.3	489.9	71.0
29-Nov-92	2491.0	2.7	2493.7	38.4	24.3	135.9	1.4	200.0	218.5	2612.2	1681.0	403.1	63.0
30-Nov-92	2596.0	2.6	2598.6	93.1	24.8	141.0	1.5	260.3	220.3	2668.6	1697.8	424.3	77.0
Averages	3595.0	2.7	3597.7	105.1	25.7	371.7	1.4	503.9	228.5	3322.3	1699.9	1603.4	98.6

Lake Michigan Diversion Accounting - WY1993
December 1992 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEIOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	6	7	8	9	10	11	12	13
01-Dec-92	2441.0	3.0	2444.0	36.3	24.3	116.8	1.5	1.5	179.0	219.6	2484.5	1700.1	318.4	71.0
02-Dec-92	2422.0	2.9	2424.9	90.1	25.0	199.9	1.5	1.5	316.5	221.0	2329.4	1680.7	536.3	77.0
03-Dec-92	2291.0	2.9	2293.9	50.3	24.4	130.6	1.6	1.6	206.8	222.2	2309.3	1685.6	296.1	82.0
04-Dec-92	2325.0	2.9	2327.9	36.3	24.2	112.7	1.6	1.6	174.8	219.6	2372.7	1679.5	264.2	72.0
05-Dec-92	2166.0	2.9	2168.9	36.4	24.2	107.6	1.4	1.4	169.6	219.6	2218.8	1693.8	218.4	71.0
06-Dec-92	2008.0	3.0	2011.0	97.1	21.9	123.1	1.6	1.6	243.6	217.5	1984.9	1676.5	281.2	58.0
07-Dec-92	2493.0	3.1	2496.1	36.4	21.9	100.0	1.5	1.5	159.8	222.5	2658.8	1707.1	201.6	52.0
08-Dec-92	2039.0	3.0	2042.0	47.9	22.9	100.0	1.9	1.9	172.7	221.7	2091.0	1721.2	201.9	73.0
09-Dec-92	2033.0	3.0	2036.0	86.3	23.3	292.9	1.0	1.0	403.4	221.0	1863.8	1721.4	589.2	73.0
10-Dec-92	2602.0	3.1	2605.1	94.1	26.0	198.8	1.0	1.0	319.9	222.8	2608.0	1687.0	313.8	87.0
11-Dec-92	2634.0	3.1	2637.0	98.7	28.6	334.5	1.8	1.8	463.6	222.8	2163.3	1715.2	921.2	87.0
12-Dec-92	2272.0	3.0	2275.0	110.8	24.6	188.7	1.5	1.5	340.3	219.0	2616.7	1698.1	753.8	77.0
13-Dec-92	2437.0	3.0	2440.0	37.7	23.8	121.7	1.3	1.3	185.0	222.8	2477.8	1720.5	280.5	76.0
14-Dec-92	3359.0	3.0	3362.0	77.0	29.0	936.5	1.6	1.6	1043.1	237.3	2668.2	1722.2	5439.1	83.0
15-Dec-92	4399.0	3.1	4402.1	190.8	28.0	386.3	1.7	1.7	606.8	220.5	4016.8	1702.8	1725.3	61.0
16-Dec-92	3203.0	3.0	3206.0	156.7	26.5	279.3	1.7	1.7	464.1	222.2	2684.1	1709.7	1185.9	80.0
17-Dec-92	3460.0	3.0	3463.0	36.3	24.7	179.9	1.6	1.6	242.4	218.8	3439.4	1719.9	676.4	60.0
18-Dec-92	2835.0	3.0	2838.0	84.1	24.2	340.7	1.6	1.6	450.5	218.7	2808.2	1682.1	1121.8	67.0
19-Dec-92	3233.0	3.1	3236.1	76.5	23.7	181.6	1.6	1.6	283.4	220.8	3173.5	1655.6	554.8	68.0
20-Dec-92	2430.0	3.1	2433.1	36.2	22.4	142.3	1.6	1.6	202.4	221.9	2462.6	1716.4	376.3	64.0
21-Dec-92	2585.0	3.0	2588.0	78.0	22.5	143.5	1.6	1.6	245.5	221.0	2663.6	1718.6	433.8	59.0
22-Dec-92	2246.0	3.0	2249.0	61.7	24.0	122.0	1.7	1.7	209.4	219.3	2268.9	1716.0	336.8	64.0
23-Dec-92	2226.0	2.9	2228.9	38.3	22.1	110.9	1.5	1.5	172.8	220.5	2278.8	1702.8	256.8	63.0
24-Dec-92	2181.0	3.0	2184.0	36.4	19.7	104.3	1.6	1.6	161.9	216.9	2239.0	1642.0	235.7	53.0
25-Dec-92	1946.0	3.0	1949.0	95.6	18.7	118.8	1.6	1.6	234.7	218.9	1933.2	1654.3	268.8	70.0
26-Dec-92	2106.0	3.0	2109.0	36.4	19.7	98.2	1.3	1.3	156.1	220.2	2173.1	1654.7	188.6	53.0
27-Dec-92	2436.0	3.1	2439.1	69.9	21.5	105.6	1.5	1.5	198.5	223.6	2464.2	1737.3	220.0	81.0
28-Dec-92	3726.0	3.3	3729.3	161.1	28.7	870.3	1.7	1.7	1062.8	229.7	2898.2	1731.3	3827.9	68.0
29-Dec-92	7778.0	3.0	7781.0	89.5	30.6	186.6	1.5	1.5	198.2	242.2	6035.0	1704.8	9184.5	65.0
30-Dec-92	7731.0	3.1	7734.1	104.9	30.6	710.9	1.7	1.7	848.1	222.3	7108.3	1696.6	3801.8	60.0
Averages	2917.5	3.0	2920.5	76.4	24.5	292.2	1.5	1.5	394.7	222.2	2748.0	1698.4	1151.0	68.9

Lake Michigan Diversion Accounting - WY1993 January 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEDEVILLE AVM GAGE RECORD	2 GAGE ABOVE THE DIVERSIONS	3 TOTAL FLOW THROUGH THE CANAL	4 GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	5 WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	6 RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	7 LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	8 TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	9 LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	10 TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	11 PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	12 RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	13 DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Jan-93	5223.0	1.7	5224.7	170.8	29.7	603.8	1.5	705.9	208.9	4727.7	1665.9	2511.6	55.0
02-Jan-93	4128.0	1.8	4129.8	266.6	29.9	492.1	1.5	790.2	209.4	3549.0	1666.2	1637.2	62.0
03-Jan-93	4198.0	1.7	4199.7	141.8	29.8	768.5	1.5	941.6	211.8	3489.7	1680.6	2999.8	46.0
04-Jan-93	12042.0	1.8	12043.8	74.9	31.4	2129.0	1.2	2236.5	233.9	10041.2	1716.9	11893.0	41.0
05-Jan-93	8664.0	1.8	8665.8	71.2	31.7	822.1	1.6	926.7	220.4	7959.5	1716.7	4914.8	54.0
06-Jan-93	6322.0	1.7	6323.7	131.7	30.7	594.4	1.7	758.5	211.2	6776.4	1746.8	3347.1	62.0
07-Jan-93	5313.0	1.7	5314.7	176.7	30.6	461.7	1.7	660.7	211.0	4885.0	1729.6	1971.7	56.0
08-Jan-93	4225.0	1.8	4226.8	213.8	33.1	370.7	1.7	619.3	208.5	3817.0	1737.3	1434.4	81.0
09-Jan-93	3709.0	1.8	3710.8	110.3	39.1	281.2	1.7	432.3	209.7	3488.2	1690.9	1018.7	80.0
10-Jan-93	4128.0	1.7	4129.7	40.1	34.6	227.9	1.7	304.3	207.9	4033.3	1674.4	732.0	83.0
11-Jan-93	3349.0	1.8	3350.8	37.4	31.6	205.2	1.6	275.8	212.0	3287.0	1738.3	644.4	96.0
12-Jan-93	3532.0	1.7	3533.7	96.3	32.6	781.8	1.7	911.4	214.4	2838.7	1724.3	1685.9	90.0
13-Jan-93	4991.0	1.8	4992.8	155.8	36.7	243.1	1.6	447.2	209.9	4755.5	1687.7	1099.1	92.0
14-Jan-93	4020.0	1.8	4021.8	37.7	32.0	173.3	1.5	244.7	213.0	3980.1	1714.2	794.7	96.0
15-Jan-93	3658.0	1.8	3659.8	38.1	31.3	160.3	1.5	231.1	212.0	3640.7	1717.5	648.3	87.0
16-Jan-93	2770.0	1.8	2771.8	87.2	29.8	161.5	1.5	279.9	209.0	2700.9	1677.1	589.8	65.0
17-Jan-93	3159.0	1.9	3160.9	50.7	30.6	148.9	1.5	231.7	211.2	3140.4	1675.5	490.8	67.0
18-Jan-93	2713.0	1.9	2714.9	38.0	30.6	219.6	1.3	289.5	211.1	2838.6	1706.8	481.7	81.0
19-Jan-93	2693.0	1.9	2694.9	89.4	29.8	306.6	1.4	427.3	212.5	2480.1	1726.5	523.1	76.0
20-Jan-93	2494.0	1.9	2495.9	63.6	29.8	845.5	1.3	740.3	213.9	1969.5	1714.5	1690.9	91.0
21-Jan-93	6222.0	1.8	6223.8	86.5	31.3	1884.4	1.5	2003.7	241.5	4481.8	1723.6	10832.0	67.0
22-Jan-93	5551.0	1.8	5552.8	101.8	31.0	806.3	1.5	940.5	219.9	4832.2	1657.6	4971.8	67.0
23-Jan-93	5116.0	1.9	5117.9	145.9	30.4	573.8	1.6	751.7	219.5	4586.7	1569.6	3973.9	61.0
24-Jan-93	4931.0	1.8	4932.8	493.1	31.6	424.6	1.5	706.4	210.3	4436.7	1589.8	2871.6	72.0
25-Jan-93	4119.0	1.8	4120.8	237.6	30.5	322.2	1.5	591.8	213.8	3742.8	1708.2	1439.2	66.0
26-Jan-93	3679.0	1.7	3680.7	74.1	29.8	247.9	1.4	353.1	213.9	3641.5	1744.6	1073.2	73.0
27-Jan-93	3021.0	1.8	3022.8	107.3	30.7	219.6	1.6	359.2	209.6	2873.2	1694.7	1103.1	81.0
28-Jan-93	3091.0	1.8	3092.8	41.6	31.7	161.8	1.6	256.7	210.9	3047.0	1699.3	799.8	72.0
29-Jan-93	2767.0	1.7	2768.7	40.3	29.8	166.4	1.4	237.8	212.1	2743.0	1685.7	534.9	78.0
30-Jan-93	2339.0	1.8	2340.8	37.7	29.8	165.0	1.6	224.1	209.3	2328.0	1673.9	409.0	57.0
31-Jan-93	2588.0	1.7	2589.7	95.5	29.8	163.5	1.7	290.5	212.4	2511.6	1681.0	468.2	65.0
Averages	4346.9	1.8	4348.7	107.0	31.3	478.5	1.5	618.3	213.7	3944.1	1694.7	2244.7	71.6

Lake Michigan Diversion Accounting - WY1993 February 1993- Summary of Diversion Flows (All in cfs)

LAKE	ROMEOVILLE AVM GAGE RECORD	2	3	4	6	7	8	9	10	11	12	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1											
01-Feb-93	2580.0	4.1	2584.1	37.9	32.3	145.6	1.5	217.2	2688.1	1675.3	468.0	74.0
02-Feb-93	2486.0	4.1	2490.1	48.6	30.3	143.1	1.5	223.5	2482.2	1687.7	316.7	66.0
03-Feb-93	2637.0	4.1	2641.1	87.6	30.3	148.1	1.5	267.5	2691.4	1689.6	329.9	74.0
04-Feb-93	2293.0	4.1	2297.1	38.3	30.3	132.4	1.5	202.4	2312.6	1690.4	266.5	74.0
05-Feb-93	2315.0	4.2	2319.2	36.3	30.9	127.0	1.6	195.8	2343.4	1705.4	251.8	84.0
06-Feb-93	2334.0	4.0	2338.0	95.8	32.8	142.4	1.5	272.5	2278.7	1674.2	327.9	81.0
07-Feb-93	2353.0	4.1	2357.1	36.4	31.0	121.6	1.4	190.4	2393.0	1641.7	249.0	57.0
08-Feb-93	2289.0	4.1	2273.1	59.5	31.8	124.0	1.5	216.8	2378.0	1706.3	274.4	80.0
09-Feb-93	2388.0	4.1	2392.1	75.4	31.2	124.5	1.5	232.6	2379.0	1708.4	279.7	74.0
10-Feb-93	2155.0	4.2	2159.2	36.4	31.8	111.6	1.5	181.3	2196.0	1650.9	243.3	86.0
11-Feb-93	2431.0	4.1	2435.1	49.3	37.1	114.5	1.5	202.4	2453.9	1677.5	258.6	104.0
12-Feb-93	2374.0	4.1	2378.1	90.2	37.0	121.8	1.5	250.4	2344.7	1690.4	312.1	65.0
13-Feb-93	2438.0	4.1	2442.1	36.4	31.4	104.7	1.5	174.0	2489.0	1656.7	257.1	79.0
14-Feb-93	2145.0	4.1	2149.1	105.0	30.2	126.3	1.6	263.0	2100.2	1629.4	485.9	77.0
15-Feb-93	2306.0	4.1	2310.1	36.4	30.8	98.4	1.4	166.9	2384.1	1707.0	226.9	68.0
16-Feb-93	2260.0	4.2	2264.2	36.4	32.1	92.2	1.5	162.3	2320.7	1700.2	220.7	76.0
17-Feb-93	2331.0	4.2	2335.2	36.6	30.3	87.3	1.5	155.6	2397.2	1712.1	197.4	90.0
18-Feb-93	2155.0	4.2	2159.2	90.6	30.3	104.2	1.5	226.5	2149.9	1717.8	305.3	78.0
19-Feb-93	2286.0	4.2	2290.2	36.5	30.3	78.7	1.4	147.0	2391.2	1700.3	165.9	66.0
20-Feb-93	2156.0	4.1	2160.1	105.4	31.0	94.0	1.5	231.9	2162.4	1695.5	231.2	67.0
21-Feb-93	2383.0	4.1	2387.1	36.5	32.3	71.8	1.6	142.1	2482.2	1696.3	162.9	74.0
22-Feb-93	2612.0	4.2	2616.2	36.5	32.4	68.7	1.7	139.3	2696.6	1721.0	189.2	90.0
23-Feb-93	2150.0	4.1	2154.1	103.3	31.1	84.2	1.5	220.0	2162.2	1712.2	227.8	84.0
24-Feb-93	2377.0	4.2	2381.2	36.6	30.3	63.2	1.6	131.7	2498.6	1723.0	141.8	85.0
25-Feb-93	2360.0	4.1	2364.1	36.6	30.3	60.8	1.5	129.1	2451.7	1719.5	130.8	96.0
26-Feb-93	2141.0	4.1	2145.1	36.6	31.2	58.6	1.5	127.9	2234.9	1703.8	142.9	105.0
27-Feb-93	2266.0	4.1	2270.1	97.2	30.4	91.7	1.6	220.8	2286.6	1705.2	354.8	70.0
28-Feb-93	1864.0	4.1	1868.1	105.2	30.2	290.4	1.3	427.1	1681.6	1675.6	989.0	60.0
Averages	2315.9	4.1	2320.0	59.4	31.6	111.9	1.5	204.3	2334.1	1691.9	286.0	78.0

Lake Michigan Diversion Accounting - WY1993 March 1993 - Summary of Diversion Flows (All in cfs)

Lake Michigan Diversion Accounting WY 1993	Romeoville AVM Gage Record	Diversion Above the Gage	Total Flow Through the Canal	Groundwater Pumpage Discharged into the Canal	Water Supply Pumpage from Indiana Reaching the Canal	Runoff from the Des Plaines River Watershed Reaching the Canal	Lake Michigan Pumpage by Federal Facilities Discharged to the Canal	Total Deduction from the Romeoville Gage Record	Lake Michigan Pumpage Not Discharged to the Canal	Total Diversion Accountable to the State of Illinois	Pumpage from Lake Michigan Accountable to the State of Illinois	Runoff from the Diverted Lake Michigan Watershed	Direct Diversion Accountable to the State of Illinois
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Mar-93	2662.0	3.0	2665.0	146.2	28.0	1176.4	1.7	1352.2	244.9	1657.7	1747.1	8024.0	64.0
02-Mar-93	2863.0	3.1	2866.1	148.9	28.0	829.3	1.7	807.8	238.8	2287.1	1750.9	2950.9	65.0
03-Mar-93	3076.0	3.2	3079.2	199.5	29.2	445.5	1.7	675.9	227.9	2631.2	1757.5	2465.0	80.0
04-Mar-93	4226.0	3.1	4229.1	149.3	34.3	710.9	1.7	896.1	232.9	3666.9	1733.1	4118.7	77.0
05-Mar-93	4281.0	3.1	4284.1	158.4	29.3	337.0	1.7	526.4	223.2	3980.9	1765.4	1517.3	66.0
06-Mar-93	4071.0	3.2	4074.2	149.6	28.0	234.5	1.5	413.6	227.3	3887.9	1745.0	1361.5	73.0
07-Mar-93	4034.0	3.1	4037.1	36.2	27.9	147.6	1.6	213.2	221.5	4046.4	1710.8	1206.6	57.0
08-Mar-93	3548.0	3.1	3551.1	38.0	28.6	147.0	1.6	215.0	224.2	3660.3	1754.9	1078.9	81.0
09-Mar-93	3251.0	3.2	3254.2	108.1	28.1	143.5	1.6	281.3	223.6	3196.5	1766.5	1035.4	84.0
10-Mar-93	3759.0	3.1	3762.1	72.4	28.8	518.4	1.7	621.3	231.8	3372.6	1727.6	2061.5	80.0
11-Mar-93	3371.0	3.2	3374.2	163.4	29.2	283.2	1.7	477.5	223.2	3119.9	1723.7	1198.4	89.0
12-Mar-93	3208.0	3.1	3211.1	37.5	28.7	187.5	1.6	255.3	224.2	3180.0	1737.6	774.9	81.0
13-Mar-93	2934.0	3.1	2937.1	36.2	33.6	147.6	1.5	218.9	223.0	2841.2	1736.0	656.5	108.0
14-Mar-93	2747.0	3.1	2750.1	38.2	28.9	123.1	1.6	191.8	224.5	2782.8	1700.5	441.2	97.0
15-Mar-93	2730.0	3.1	2733.1	177.3	28.0	325.1	1.5	532.0	231.0	2432.1	1772.2	1620.6	69.0
16-Mar-93	3479.0	3.0	3482.0	155.7	28.1	733.1	1.7	918.5	233.8	2787.1	1761.3	3775.0	74.0
17-Mar-93	3628.0	3.1	3631.1	159.1	29.2	375.8	1.5	565.6	224.0	3289.5	1742.4	1317.0	72.0
18-Mar-93	3273.0	3.2	3276.2	76.4	28.8	247.4	1.5	354.1	227.1	3149.2	1729.5	772.8	72.0
19-Mar-93	2747.0	3.2	2750.2	58.1	28.1	372.7	1.6	460.5	225.3	2815.0	1720.1	927.1	77.0
20-Mar-93	2973.0	3.1	2976.1	151.3	28.0	356.2	1.6	537.1	228.5	2866.0	1693.5	1140.6	63.0
21-Mar-93	2815.0	3.1	2818.1	83.7	28.0	399.8	1.6	513.0	224.9	2830.0	1672.5	1318.5	67.0
22-Mar-93	4950.0	3.1	4953.1	77.8	28.9	1631.6	1.7	1740.0	250.5	3463.6	1714.9	7667.3	74.0
23-Mar-93	11258.0	3.1	11261.1	64.3	29.8	1204.2	1.5	1299.8	233.8	10196.1	1709.6	7022.9	58.0
24-Mar-93	7140.0	3.1	7143.1	81.8	29.2	646.3	1.6	758.8	228.8	6611.1	1695.4	3733.6	66.0
25-Mar-93	4819.0	3.1	4822.1	116.3	28.8	461.1	1.5	607.7	226.2	4440.6	1701.2	2317.8	72.0
26-Mar-93	4815.0	3.0	4818.0	165.1	28.9	372.2	1.5	567.7	224.8	4474.8	1687.9	1624.9	66.0
27-Mar-93	4009.0	3.0	4012.0	207.1	29.0	308.7	1.6	546.3	220.1	3886.8	1734.9	1301.3	63.0
28-Mar-93	3986.0	3.1	3989.1	171.3	29.0	257.0	1.3	458.8	224.0	3764.3	1670.2	1039.0	77.0
29-Mar-93	3083.0	3.1	3086.1	37.8	28.9	196.2	1.6	264.6	225.9	3047.4	1728.4	755.4	73.0
30-Mar-93	3129.0	3.1	3132.1	37.8	29.0	182.3	1.5	250.7	222.3	3103.7	1739.7	676.7	86.0
31-Mar-93	9740.0	3.1	9743.1	60.9	35.1	1905.5	1.5	2002.9	255.6	7995.8	1727.0	11295.0	77.0
Averages	3895.5	3.1	3898.6	110.1	29.0	443.4	1.6	584.1	227.9	3642.4	1728.0	2130.0	74.4

Lake Michigan Diversion Accounting - WY1993 April 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEDEVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Apr-93	11706.0	1.0	11707.0	64.5	66.0	1152.0	1.4	1283.9	231.7	10654.8	1696.4	7014.9	95.0
02-Apr-93	7610.0	1.1	7611.1	76.6	32.8	841.0	1.6	951.0	226.5	8886.6	1720.3	4442.5	70.0
03-Apr-93	6021.0	1.1	6022.1	99.6	31.7	563.6	1.5	696.3	218.8	5644.6	1701.7	2610.6	69.0
04-Apr-93	5504.0	1.0	5505.0	164.9	31.8	425.4	1.5	623.5	218.2	5097.7	1665.6	1867.8	76.0
05-Apr-93	4427.0	1.2	4428.2	171.0	32.5	343.0	1.5	548.1	221.1	4101.2	1732.7	1497.0	66.0
06-Apr-93	3764.0	1.1	3765.1	181.0	32.1	296.8	1.4	511.2	221.1	3476.0	1701.1	1304.2	76.0
07-Apr-93	3735.0	1.2	3736.2	145.9	32.0	266.1	1.5	435.4	220.3	3621.1	1703.4	1044.0	86.0
08-Apr-93	4867.0	1.1	4868.1	72.7	32.2	901.1	1.5	1007.4	234.6	4096.3	1692.5	3015.5	156.0
09-Apr-93	3468.0	1.1	3469.1	110.8	31.7	505.3	1.4	649.1	218.9	3038.9	1669.0	1579.3	95.0
10-Apr-93	4299.0	1.1	4300.1	178.7	31.5	392.9	1.5	604.6	217.8	3913.3	1712.3	1198.5	85.0
11-Apr-93	3430.0	1.1	3431.1	56.5	34.1	289.0	1.6	381.1	217.7	3297.7	1610.8	857.1	115.0
12-Apr-93	2971.0	1.2	2972.2	37.5	33.8	236.8	1.6	309.6	218.0	2880.8	1691.8	710.9	79.0
13-Apr-93	3086.0	1.1	3087.1	37.3	33.0	210.1	1.6	281.9	220.8	3006.0	1690.9	623.5	106.0
14-Apr-93	3771.0	1.2	3772.2	115.0	36.4	361.4	1.5	514.3	227.6	3486.6	1688.9	1196.4	287.0
15-Apr-93	9907.0	1.1	9908.1	137.6	40.9	1727.3	1.5	1907.2	247.5	8248.4	1677.9	8439.3	1393.0
16-Apr-93	4760.0	1.1	4751.1	201.3	36.6	700.0	1.7	939.5	221.9	4036.6	1668.4	2742.6	202.0
17-Apr-93	4766.0	1.1	4767.1	132.5	32.8	484.1	1.5	651.0	218.9	4336.0	1662.0	1806.0	107.0
18-Apr-93	5228.0	1.1	5229.1	181.2	32.2	392.1	1.4	606.9	219.4	4841.8	1646.6	1286.6	127.0
19-Apr-93	7865.0	1.0	7866.0	76.5	39.9	1290.7	1.5	1408.5	242.8	8700.3	1706.2	6823.3	525.0
20-Apr-93	8654.0	1.0	8655.0	70.6	61.4	1441.1	1.5	1574.5	233.3	7313.8	1680.2	6555.7	122.0
21-Apr-93	6438.0	1.1	6439.1	66.2	37.6	689.8	1.6	804.1	222.4	6667.4	1699.7	3029.9	94.0
22-Apr-93	4925.0	1.0	4926.0	97.2	33.9	509.9	1.5	642.6	218.7	4602.2	1696.4	1793.3	207.0
23-Apr-93	4667.0	1.6	4668.6	147.2	33.9	407.8	1.5	590.1	221.0	4299.6	1690.8	1330.1	141.0
24-Apr-93	4394.0	1.7	4395.7	188.7	33.9	345.7	1.6	569.7	217.7	4043.7	1690.0	1155.2	143.0
25-Apr-93	3828.0	1.2	3829.2	221.7	35.8	302.6	1.6	561.6	218.8	3486.4	1650.9	1089.0	123.0
26-Apr-93	3322.0	1.1	3323.1	47.7	38.7	221.8	1.5	309.4	220.7	3234.4	1707.9	747.5	110.0
27-Apr-93	3450.0	1.6	3451.6	37.9	35.9	197.7	1.5	273.0	221.6	3400.2	1729.6	617.8	122.0
28-Apr-93	2955.0	1.9	2956.9	37.6	34.3	182.2	1.5	255.5	220.3	2821.7	1731.4	541.3	195.0
29-Apr-93	4066.0	1.2	4067.2	140.7	37.4	539.6	1.5	719.1	229.4	3677.6	1698.9	2079.8	113.0
30-Apr-93	3382.0	1.4	3383.4	140.9	36.6	271.5	1.5	450.6	220.7	3163.5	1711.8	818.4	161.0
Averages	5041.2	1.2	5042.4	114.5	36.4	549.6	1.5	702.0	223.7	4684.1	1690.9	2327.3	177.5

Lake Michigan Diversion Accounting - WY1993 May 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEDEVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-May-93	3809.0	1.0	3810.0	36.2	44.6	197.9	1.4	280.1	246.4	3776.3	1713.8	538.3	197.0
02-May-93	3716.0	0.8	3716.8	39.6	43.6	269.1	1.5	353.8	245.0	3806.0	1657.0	816.5	206.0
03-May-93	3764.0	0.7	3764.7	118.8	42.2	456.7	1.5	619.2	249.9	3398.4	1677.5	1507.0	117.0
04-May-93	3245.0	0.5	3245.5	140.7	43.4	408.4	1.5	593.9	249.0	2601.1	1701.1	1486.7	179.0
05-May-93	3901.0	0.6	3901.6	126.4	41.0	246.0	1.5	414.9	247.8	3734.6	1756.5	784.0	142.0
06-May-93	2590.0	0.5	2590.5	37.7	38.6	179.2	1.5	257.1	248.8	2692.2	1749.5	502.6	149.0
07-May-93	2906.0	0.6	2906.6	38.3	41.8	155.6	1.4	237.1	247.5	2617.0	1773.7	410.9	200.0
08-May-93	2611.0	0.5	2611.5	92.4	42.4	152.6	1.4	286.8	248.1	2670.8	1828.3	412.8	233.0
09-May-93	2704.0	1.0	2705.0	47.6	40.5	128.4	1.4	218.0	249.8	2736.9	1853.5	334.9	228.0
10-May-93	3003.0	0.9	3003.9	38.5	42.3	117.9	1.5	200.2	249.8	3068.9	1962.3	300.8	180.0
11-May-93	2507.0	0.3	2507.3	36.4	41.7	107.7	1.5	187.4	246.5	2666.4	1897.3	275.6	144.0
12-May-93	2459.0	0.6	2459.6	105.0	43.0	119.7	1.5	269.2	251.2	2441.6	1853.8	327.6	132.0
13-May-93	2304.0	0.4	2304.4	36.4	47.3	94.4	1.5	179.6	249.8	2374.6	1834.9	233.6	151.0
14-May-93	2632.0	0.7	2632.7	36.5	38.6	88.6	1.5	163.2	250.8	2718.3	1875.9	214.0	166.0
15-May-93	2677.0	0.4	2677.4	74.9	39.9	93.7	1.7	210.2	252.6	2719.8	1951.2	239.0	227.0
16-May-93	2121.0	0.4	2121.4	62.0	39.2	85.2	2.4	188.8	248.6	2181.2	1869.8	214.3	193.0
17-May-93	2649.0	0.5	2649.5	36.6	41.4	74.2	1.6	153.8	251.6	2747.3	1906.2	174.6	137.0
18-May-93	2043.0	0.5	2043.5	36.7	44.8	70.5	1.5	153.6	249.6	2139.6	1836.3	169.5	129.0
19-May-93	2490.0	0.5	2490.5	99.9	40.5	84.5	1.6	226.6	250.2	2614.1	1874.6	233.0	127.0
20-May-93	2474.0	0.6	2474.6	36.6	39.5	64.0	1.5	141.7	251.9	2694.8	1869.9	153.7	137.0
21-May-93	2178.0	0.5	2178.5	36.8	40.8	60.9	1.4	139.7	258.6	2296.4	1939.4	143.2	161.0
22-May-93	2917.0	0.4	2917.4	92.3	40.8	123.3	1.5	257.8	256.9	2916.6	1991.8	335.0	204.0
23-May-93	4755.0	0.6	4755.6	80.6	39.3	457.6	1.5	578.9	254.7	4431.4	1753.7	1645.8	1274.0
24-May-93	2828.0	0.6	2828.6	178.0	38.4	142.7	1.4	360.6	249.0	2717.0	1797.7	537.4	417.0
25-May-93	2295.0	0.6	2295.6	36.6	38.3	73.4	1.6	149.8	248.2	2394.0	1809.6	207.9	154.0
26-May-93	2404.0	0.7	2404.7	36.6	40.1	66.1	1.5	144.3	250.3	2610.7	1958.7	176.3	202.0
27-May-93	2550.0	0.5	2550.5	64.1	41.3	68.0	1.6	175.0	252.5	2628.0	1942.2	186.5	190.0
28-May-93	2622.0	0.4	2622.4	74.4	48.6	92.7	1.6	217.4	250.5	2666.6	1902.3	204.2	204.0
29-May-93	2751.0	0.4	2751.4	36.9	44.0	56.5	1.5	138.8	247.7	2860.3	1771.5	169.9	235.0
30-May-93	3627.0	0.4	3627.4	67.9	49.2	549.4	1.4	668.0	263.6	3223.0	1688.9	3520.9	236.0
31-May-93	3743.0	0.5	3743.5	220.5	58.9	191.4	1.4	472.3	244.4	3616.6	1703.5	856.8	237.0
Averages	2879.8	0.6	2880.4	71.0	42.5	163.7	1.5	278.7	250.5	2662.2	1829.1	568.5	221.5

Lake Michigan Diversion Accounting - WY1993
June 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEOVILLE AVM GAGE RECORD	2	3	4	5	6	7	8	9	10	11	12	13
DATE			TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
01-Jun-93	3380.0	0.5	3380.5	121.6	40.6	100.1	1.6	263.8	257.5	3384.2	1784.5	333.1	353.0
02-Jun-93	2918.0	0.7	2918.7	35.1	43.5	64.4	1.7	144.6	254.9	3028.0	1754.8	184.4	920.0
03-Jun-93	3523.0	0.5	3523.5	55.7	47.6	76.4	1.6	181.2	255.6	3587.8	1762.7	223.6	766.0
04-Jun-93	3563.0	0.8	3563.8	58.2	56.5	813.7	1.6	929.9	259.8	2893.7	1748.2	3977.4	477.0
05-Jun-93	4874.0	0.4	4874.4	175.9	46.6	290.9	1.7	515.1	263.6	4812.9	1755.2	836.2	585.0
06-Jun-93	4101.0	0.4	4101.4	181.2	42.7	233.8	1.6	459.3	260.9	3903.0	1756.8	472.0	823.0
07-Jun-93	9329.0	1.0	9330.0	63.5	44.3	2712.2	1.7	2821.7	264.2	8772.5	1776.4	10296.0	280.0
08-Jun-93	14775.0	0.7	14775.7	73.4	44.3	2607.1	1.7	2926.4	278.0	15127.3	1792.4	15313.0	53.0
09-Jun-93	13438.0	1.1	13439.1	63.1	44.4	962.7	1.6	1071.8	235.1	12802.4	1798.3	5553.9	81.0
10-Jun-93	7518.0	1.2	7519.2	90.0	44.6	633.4	1.8	769.8	266.4	7005.8	1852.5	3642.2	166.0
11-Jun-93	6054.0	0.6	6054.6	116.3	55.5	455.5	1.5	628.8	256.9	6684.7	1890.8	1838.5	903.0
12-Jun-93	5530.0	0.9	5530.9	168.7	56.3	371.9	1.6	590.5	257.8	5198.2	1879.6	1225.7	1186.0
13-Jun-93	6085.0	0.8	6085.8	186.6	56.7	319.1	1.6	564.0	258.5	6780.3	1911.6	947.2	1208.0
14-Jun-93	4748.0	0.9	4748.9	110.5	50.8	693.5	1.7	856.5	261.4	4153.8	1885.9	2831.0	1097.0
15-Jun-93	4906.0	1.0	4907.0	144.9	49.0	335.5	1.7	531.0	258.4	4834.4	1872.8	961.8	1068.0
16-Jun-93	4537.0	0.9	4537.9	154.3	55.1	276.0	1.7	485.9	257.8	4308.8	1886.9	681.2	1136.0
17-Jun-93	4354.0	1.1	4355.1	70.7	55.6	1125.1	1.7	1253.0	264.0	3366.1	2068.3	2269.6	911.0
18-Jun-93	8527.0	0.9	8527.9	121.3	60.2	1067.1	1.7	1250.2	261.5	6639.2	1955.4	3748.0	590.0
19-Jun-93	12571.0	0.9	12571.9	76.2	60.0	2222.6	1.7	2360.5	264.5	10475.9	1871.7	11176.0	430.0
20-Jun-93	7877.0	0.8	7877.8	114.1	62.4	706.8	1.7	885.0	253.8	7246.6	1788.8	4549.9	451.0
21-Jun-93	6571.0	0.9	6571.9	124.9	60.1	501.8	1.6	688.4	257.8	6141.1	1877.6	3205.0	711.0
22-Jun-93	5882.0	0.8	5882.8	140.6	62.6	382.2	1.8	587.1	263.9	6449.6	1957.7	1663.5	951.0
23-Jun-93	5272.0	0.8	5272.8	150.9	77.6	311.8	1.6	541.6	268.9	4998.1	2087.7	1132.5	1370.0
24-Jun-93	6758.0	0.9	6758.9	133.9	70.4	262.9	1.7	458.8	261.2	6581.3	2029.4	882.5	1455.0
25-Jun-93	4011.0	0.6	4011.6	38.3	60.3	147.9	1.7	248.1	280.9	4024.4	1937.9	672.4	1696.0
26-Jun-93	5873.0	0.8	5873.8	48.9	48.9	209.7	1.6	309.2	266.0	6830.6	1959.0	1983.7	1134.0
27-Jun-93	4543.0	0.9	4543.9	173.2	64.3	373.2	1.7	612.4	268.1	4190.6	1883.2	1537.8	1775.0
28-Jun-93	8131.0	0.6	8131.6	112.9	79.4	1463.9	1.7	1657.8	261.6	6735.4	1829.0	6193.7	374.0
29-Jun-93	5715.0	0.6	5715.6	134.2	84.7	408.2	1.6	628.6	256.2	5343.2	1843.0	2167.5	209.0
30-Jun-93	8795.0	0.8	8795.8	82.6	86.6	1081.3	1.8	1252.2	258.7	7802.3	1790.5	5500.0	1146.0
Averages	6404.6	0.8	6405.4	110.4	57.1	713.3	1.7	882.5	256.2	6782.1	1865.7	3200.0	808.8

Lake Michigan Diversion Accounting - WY1993 July 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEOVILLE A/M GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Jul-93	5571.0	0.9	5571.9	118.3	85.7	494.4	1.8	700.1	258.3	6130.1	1806.0	2592.0	517.0
02-Jul-93	5302.0	0.9	5302.9	145.3	76.1	416.1	1.8	639.1	280.2	4924.0	1837.3	2210.2	227.0
03-Jul-93	5567.0	0.9	5567.9	180.1	76.2	344.5	1.7	602.5	282.0	5227.4	1965.6	2750.4	245.0
04-Jul-93	5202.0	1.0	5203.0	85.9	70.2	201.7	1.7	339.6	259.9	5123.3	1928.3	1882.0	308.0
05-Jul-93	4043.0	0.9	4043.9	37.9	80.0	167.8	1.7	267.5	261.0	4037.4	2095.6	959.4	374.0
06-Jul-93	4021.0	1.0	4022.0	60.3	83.7	226.9	1.8	352.8	262.3	3931.5	1988.4	920.0	751.0
07-Jul-93	4195.0	0.9	4195.9	88.8	88.3	185.4	1.8	344.1	260.2	4112.0	2059.3	621.3	981.0
08-Jul-93	4240.0	1.0	4241.0	51.7	70.5	138.2	1.8	262.2	262.9	4241.7	2047.6	477.5	1359.0
09-Jul-93	3886.0	1.1	3887.1	37.8	68.6	115.7	1.7	223.9	261.8	3926.0	2124.8	407.2	1386.0
10-Jul-93	4982.0	0.9	4982.9	36.2	78.3	118.7	1.7	232.8	259.9	5010.0	2076.7	577.8	1351.0
11-Jul-93	4371.0	1.0	4372.0	49.0	78.3	115.9	1.8	244.8	258.0	4386.2	1986.1	1766.0	1537.0
12-Jul-93	4304.0	1.0	4305.0	92.1	76.5	144.2	1.7	314.4	262.8	4283.4	2037.9	467.1	1637.0
13-Jul-93	4791.0	0.9	4791.9	67.5	81.7	297.7	1.7	448.6	260.1	4803.4	2067.0	1022.8	1241.0
14-Jul-93	4224.0	1.0	4225.0	141.6	93.6	221.0	1.7	458.0	263.3	4030.3	1982.0	560.0	1350.0
15-Jul-93	4108.0	0.9	4108.9	36.3	86.1	103.2	1.7	227.3	265.8	4147.4	2014.5	262.4	1238.0
16-Jul-93	4057.0	1.1	4058.1	46.4	83.9	99.8	1.7	231.8	268.2	4092.6	2078.0	238.8	1489.0
17-Jul-93	4304.0	0.9	4304.9	36.4	88.9	83.1	1.7	210.0	263.0	4357.9	2024.0	198.3	1451.0
18-Jul-93	7137.0	1.1	7138.1	97.0	86.0	831.1	1.7	1015.8	272.5	6394.8	1975.5	5319.4	1962.0
19-Jul-93	4713.0	1.0	4714.0	142.6	81.6	339.0	1.7	564.8	265.2	4414.4	1997.8	1194.0	1697.0
20-Jul-93	4836.0	1.0	4837.0	152.3	78.8	250.9	1.7	483.7	260.9	4814.2	2044.8	700.8	1499.0
21-Jul-93	4485.0	1.0	4486.0	106.6	81.9	174.1	1.8	364.4	266.7	4368.3	2031.6	456.2	1516.0
22-Jul-93	4422.0	0.9	4422.9	36.5	81.8	93.9	1.8	214.1	261.8	4470.6	1946.8	257.3	1448.0
23-Jul-93	3825.0	0.9	3825.9	36.5	84.0	81.3	1.7	203.6	262.9	3886.2	1983.9	181.6	1432.0
24-Jul-93	3624.0	0.8	3624.8	46.9	89.1	82.6	1.7	220.4	263.0	3667.4	1935.2	167.8	1379.0
25-Jul-93	6638.0	1.0	6639.0	92.1	81.7	730.4	1.7	906.0	269.2	6002.2	1960.4	5902.8	1543.0
26-Jul-93	4514.0	1.2	4515.2	155.0	88.5	283.8	1.7	509.0	263.8	4270.0	2084.2	828.4	1542.0
27-Jul-93	4523.0	1.2	4523.2	149.9	88.7	222.5	1.8	442.8	267.8	4348.2	2218.1	504.2	1354.0
28-Jul-93	3667.0	1.0	3668.0	50.6	86.6	109.0	1.7	230.0	266.5	3704.5	2284.1	263.4	1285.0
29-Jul-93	4258.0	1.1	4259.1	36.8	86.5	79.8	1.7	186.8	267.1	4339.4	2159.0	167.2	1500.0
30-Jul-93	3895.0	0.8	3895.8	35.1	84.0	67.7	1.8	168.6	268.4	3993.6	2169.2	133.6	1420.0
31-Jul-93	4134.0	0.8	4134.8	45.7	65.9	70.6	1.8	184.0	266.9	4217.7	2176.3	132.5	1486.0
Averages	4574.8	1.0	4575.8	79.8	76.6	222.3	1.7	380.4	263.5	4468.9	2033.7	1062.8	1246.3

Lake Michigan Diversion Accounting - WY1993

August 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Aug-93	3888.0	0.9	3888.9	76.7	76.7	91.4	1.8	246.7	272.8	3915.0	2160.7	147.8	1601.0
02-Aug-93	3777.0	0.9	3777.9	56.8	67.7	72.0	1.8	198.2	275.7	3855.4	2258.0	121.1	1440.0
03-Aug-93	3654.0	0.6	3654.6	36.7	70.6	52.8	1.8	161.8	274.9	3767.7	2195.0	174.3	1435.0
04-Aug-93	3864.0	0.5	3864.5	36.7	78.3	50.3	1.8	167.1	278.8	3974.2	2134.4	121.2	1515.0
05-Aug-93	3898.0	0.7	3898.7	46.3	65.2	56.0	1.9	169.3	276.6	4006.0	2082.5	99.5	1459.0
06-Aug-93	4494.0	0.6	4494.6	139.2	79.7	354.6	1.9	575.3	275.4	4194.7	1900.7	1626.5	1588.0
07-Aug-93	4522.0	0.6	4522.6	189.3	90.9	166.9	1.8	458.8	271.7	4335.5	1926.4	377.0	1441.0
08-Aug-93	4296.0	0.7	4296.7	36.7	72.9	52.7	1.9	164.1	272.3	4404.9	1988.2	109.5	1544.0
09-Aug-93	4150.0	0.7	4150.7	49.1	57.7	202.2	1.8	310.7	275.1	4115.1	1986.4	293.9	1230.0
10-Aug-93	3639.0	0.8	3639.8	36.6	65.6	58.2	1.9	162.1	271.8	3749.5	1985.9	149.0	1240.0
11-Aug-93	4036.0	0.9	4036.9	55.9	69.4	66.1	1.9	193.2	278.1	4119.8	2125.2	124.5	1447.0
12-Aug-93	3526.0	0.8	3526.8	73.5	70.2	77.0	1.9	222.5	277.9	3682.2	2060.5	126.6	1394.0
13-Aug-93	3589.0	1.2	3590.2	36.6	72.1	42.6	1.8	153.0	278.3	3715.5	2170.2	72.2	1510.0
14-Aug-93	3968.0	0.9	3968.9	45.2	70.1	47.3	1.8	164.3	278.0	4082.8	2177.1	81.7	1350.0
15-Aug-93	5004.0	0.9	5004.9	75.7	66.9	920.3	1.9	1064.7	281.0	4221.2	1930.6	4483.2	1270.0
16-Aug-93	4645.0	0.9	4645.9	188.4	74.7	239.1	1.8	501.8	270.5	4414.8	1963.7	686.0	1254.0
17-Aug-93	4423.0	1.0	4424.0	151.5	74.6	171.8	1.9	399.6	272.0	4298.4	1989.7	337.8	1462.0
18-Aug-93	4167.0	1.1	4168.1	47.1	72.0	66.3	1.8	187.1	271.8	4262.8	2038.6	131.6	1149.0
19-Aug-93	4938.0	1.0	4939.0	40.5	72.3	127.9	1.7	242.4	273.8	4870.4	1966.2	246.0	2361.0
20-Aug-93	4449.0	0.8	4449.8	36.5	78.3	66.9	1.9	183.6	271.6	4537.8	1985.2	139.6	1853.0
21-Aug-93	4887.0	0.9	4887.9	49.0	81.4	62.0	1.8	194.1	274.1	4987.9	1980.7	99.7	2298.0
22-Aug-93	4493.0	0.8	4493.8	85.6	65.3	82.0	1.8	234.6	271.1	4630.3	1911.7	141.4	1921.0
23-Aug-93	5433.0	1.3	5434.3	45.5	99.8	670.9	2.0	728.1	286.4	4992.8	2158.1	9935.7	1488.0
24-Aug-93	7505.0	1.0	7506.0	138.2	58.2	240.0	1.8	438.2	277.4	7946.2	2131.1	1305.2	1424.0
25-Aug-93	5586.0	1.0	5587.0	161.8	65.5	195.4	1.8	424.4	277.2	6439.8	2149.8	822.7	1818.0
26-Aug-93	4922.0	1.2	4923.2	151.1	65.6	157.9	2.0	376.6	278.8	4826.4	2306.8	583.8	1622.0
27-Aug-93	5385.0	1.1	5386.1	60.2	61.9	60.5	2.0	174.5	281.0	6492.8	2466.5	221.7	1870.0
28-Aug-93	5082.0	0.9	5082.9	35.1	61.5	40.0	1.9	138.4	275.7	5220.2	2035.8	128.0	1925.0
29-Aug-93	6621.0	0.7	6621.7	92.8	78.0	1109.4	1.8	1282.0	278.1	5617.8	1836.0	6793.4	580.0
30-Aug-93	6328.0	1.2	6329.2	164.2	67.1	658.3	1.9	891.4	273.7	6711.5	2133.6	4255.3	700.0
31-Aug-93	7239.0	0.6	7239.6	93.8	77.9	678.7	1.8	850.2	271.6	6661.0	1949.4	4946.0	137.0
Averages	4722.8	0.9	4723.7	81.3	70.3	222.8	1.9	376.3	275.4	4622.8	2086.3	1254.3	1462.1

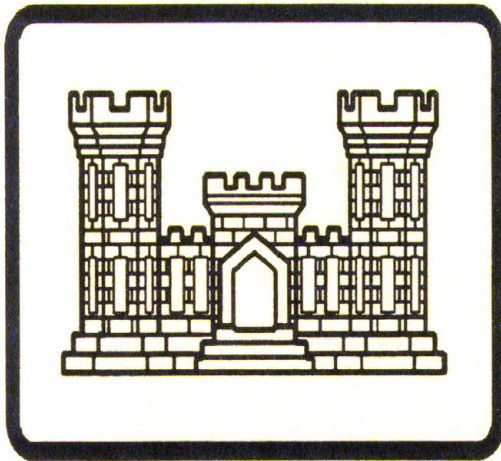
Lake Michigan Diversion Accounting - WY1993 September 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1993	ROMEIOVILLE AVM GAGE RECORD	2	3	4	5	6	7	8	9	10	11	12	13
DATE													
01-Sep-93	6322.0	0.6	6322.6	169.0	63.0	353.6	1.6	577.2	232.7	8978.1	1871.3	2204.6	1425.0
02-Sep-93	6404.0	0.8	6404.8	168.2	55.3	491.2	1.5	716.3	237.3	9926.8	1869.7	2112.0	1094.0
03-Sep-93	6245.0	0.6	6245.6	154.7	68.3	637.4	1.5	861.9	236.0	9619.7	1850.3	2362.3	2052.0
04-Sep-93	6127.0	0.9	6127.9	114.3	47.7	223.0	1.6	386.6	232.0	8973.3	1815.6	939.3	2028.0
05-Sep-93	5288.0	0.6	5288.6	48.1	55.2	122.9	1.6	227.8	230.7	9271.6	1777.3	565.7	2036.0
06-Sep-93	5723.0	0.5	5723.5	121.7	62.7	544.7	1.6	730.7	232.7	9226.6	1723.6	1941.5	1689.0
07-Sep-93	5108.0	0.8	5108.6	55.3	53.7	192.1	1.6	302.8	235.4	9041.2	1853.1	785.1	2147.0
08-Sep-93	4970.0	0.7	4970.7	37.2	51.9	126.0	1.3	216.4	235.4	4988.7	1840.0	507.4	2089.0
09-Sep-93	4539.0	0.5	4539.5	102.8	37.4	151.0	1.6	292.7	234.0	4480.8	1846.9	469.3	1979.0
10-Sep-93	4327.0	0.6	4327.6	36.4	48.7	80.2	1.6	164.9	233.8	4396.5	1828.6	299.0	2053.0
11-Sep-93	4303.0	0.5	4303.5	36.4	43.2	77.2	1.5	158.4	234.8	4378.9	1815.6	344.2	1804.0
12-Sep-93	4048.0	0.7	4048.7	46.9	37.3	77.2	1.6	163.0	234.6	4120.3	1770.7	329.3	1907.0
13-Sep-93	4142.0	0.8	4142.8	37.8	38.9	252.1	1.5	330.3	236.8	4048.3	1893.3	787.8	1464.0
14-Sep-93	11208.0	0.6	11208.6	68.3	43.3	2574.9	1.7	2688.3	252.7	8773.0	1823.3	13277.0	277.0
15-Sep-93	6063.0	0.5	6063.5	82.0	75.0	670.1	1.5	828.7	233.6	8488.4	1779.4	2706.5	1948.0
16-Sep-93	7101.0	0.5	7101.5	123.6	58.3	476.6	1.6	660.2	232.4	8673.7	1783.9	1641.9	1946.0
17-Sep-93	5984.0	0.5	5984.5	164.9	48.9	369.9	1.6	585.3	235.3	6634.6	1777.2	958.3	2013.0
18-Sep-93	5229.0	0.5	5229.5	195.6	50.2	314.4	1.6	561.9	234.1	4801.7	1745.9	737.6	1987.0
19-Sep-93	5755.0	0.6	5755.6	97.5	60.6	189.9	1.6	349.6	231.5	6637.6	1741.1	476.0	2016.0
20-Sep-93	3517.0	0.6	3517.6	38.1	53.4	117.7	1.5	210.8	236.4	3642.2	1779.1	355.4	1094.0
21-Sep-93	2395.0	0.6	2395.6	36.3	60.7	103.1	1.6	201.7	238.1	2430.0	1788.3	318.2	106.0
22-Sep-93	2500.0	0.6	2500.6	46.1	46.3	104.7	1.5	198.7	234.1	2636.0	1784.9	305.0	148.0
23-Sep-93	2087.0	0.5	2087.5	93.4	50.2	140.2	1.6	285.4	233.4	2036.5	1813.1	345.2	153.0
24-Sep-93	2665.0	0.5	2665.5	47.0	45.2	98.5	1.6	192.4	233.0	2706.1	1784.7	257.0	175.0
25-Sep-93	3664.0	0.9	3664.9	51.7	54.9	1022.4	1.6	1130.7	239.9	2774.1	1743.7	5409.6	191.0
26-Sep-93	5859.0	0.6	5859.6	133.1	53.4	753.5	1.8	941.8	233.3	6161.1	1732.9	2829.5	191.0
27-Sep-93	6267.0	0.5	6267.5	103.8	51.5	837.1	1.5	993.9	238.2	6511.8	1775.4	3955.9	86.0
28-Sep-93	4633.0	0.5	4633.5	136.3	47.3	462.0	1.6	647.2	233.2	4219.5	1744.2	2180.5	110.0
29-Sep-93	3237.0	0.5	3237.5	154.3	53.4	365.6	1.5	564.8	235.1	2607.6	1758.0	1219.8	101.0
30-Sep-93	2934.0	0.5	2934.5	115.8	40.4	257.9	1.6	415.7	233.0	2761.8	1727.4	560.8	127.0
Averages	4954.1	0.6	4954.7	93.6	51.8	406.9	1.6	552.9	236.0	4636.8	1794.6	1706.1	1214.5

APPENDIX B

LAKE MICHIGAN DIVERSION ACCOUNTING

WATER YEAR 1994 REPORT



US Army Corps of Engineers
Chicago District

Lake Michigan Diversion Accounting

Water Year 1994 Report

Table Of Contents

List of Tables.....	ii
List of Figures	iii
Executive Summary	iv
Introduction	1
Authority for Report.....	1
History of the Diversion.....	1
Background of Lake Michigan Diversion Accounting	5
Diversion Accounting Procedures.....	9
Revisions to the Lake Michigan Diversion Accounting Procedures	12
Accounting Results.....	12
Discussions of Results.....	15
Columns.....	15
Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, USGS AVM Gage Record.....	15
Column 2: Diversions from the CSSC Above the Gage	15
Column 3: Total Flow Through the CSSC.....	16
Column 4: Groundwater Discharged to the CSSC And Adjoining Channels.....	16
Column 5: Water Supply Pumpage from Indiana Reaching the CSSC.....	17
Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC	18
Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC	19
Column 8: Total Deductions from the CSSC Romeoville Gage Record.....	19
Column 9: Lake Michigan Pumpage Not Discharged to the CSSC.....	19
Column 10: Total Diversion.....	21
Column 11 Through Column 13: Lake Michigan Diversion Components.....	21
Budgets.....	25
Budget 1 and Budget 2: Water Supply Pumpage	25
<i>Budget 1: Diverted Lake Michigan Water Supply</i>	25

<i>Budget 2: Groundwater Diverted to the CSSC</i>	25
Budgets 3 Through Budget 6: Stream Gaging Stations	26
Budgets 7 Through Budget 13: MWRDGC Water Reclamation Facilities.....	27
<i>Budget 7: Northside Water Reclamation Facility</i>	27
<i>Budget 8: Upper Des Plaines Pump Station</i>	27
<i>Budget 9: Mainstream and Des Plaines TARP Pumping Stations</i>	32
<i>Budget 10: Stickney Water Reclamation Facility</i>	33
<i>Budget 11: Calumet TARP Pumping Station</i>	37
<i>Budget 12: Calumet Water Reclamation Facility</i>	39
<i>Budget 13: Lemont Water Reclamation Facility</i>	39
Budget 14: CSSC System Balance	42
Areas for Improvement	45
Impervious Model Estimates.....	45
Tunnel and Reservoir Plan Models	45
MWRDGC Upper Des Plaines Pump Station	46
O'Hare and Egan Basin Flow Transfer.....	47
Summary	48
References	49
Appendix A - Summary of Daily Diversion Flows	A-1

List of Tables

Table 1 - Description of the Diversion Accounting Columns	10
Table 2 - Description of the Diversion Accounting Computational Budgets	11
Table 3 - Status of the State of Illinois' Diversion from Lake Michigan under the 1980 Modified Supreme Court Decree.....	13
Table 4 - Lake Michigan Diversion Accounting - WY1994 Summary of Diversion Flows	14
Table 5 - Breakdown of the Diversion by the State of Illinois Based on Columns 11 Through 13.....	23
Table 6 - Stream Gage Flow Separation	26
Table 7 - WY 1994 Summary of Simulation Statistics	29
Table 8 - WY 1994 Summary of Flow Components for the CSSC System Balance.....	44

-

List of Figures

Figure 1 - Development of the Chicago Sanitary and Ship Canal System	3
Figure 2 - Location Plan - Lake Michigan Diversion at Chicago	4
Figure 3 - WY 94 Component Breakdown of Illinois' Diversion Based Upon Columns 11 through 13	24
Figure 4 - Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility	30
Figure 5 - Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station.....	31
Figure 6 - Map of Mainstream and Calumet TARP	34
Figure 7 - Budget 9 - Simulation of the MWRDGC Mainstream TARP Pumping Station.....	35
Figure 9 - Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station.....	38
Figure 10 - Budget 12 - Simulation of the MWRDGC Calumet Water Reclamation Facility	40
Figure 11 - Budget 13 - Simulation of the MWRDGC Lemont Water Reclamation Facility	41
Figure 12 - Budget 14 - CSSC System Balance	43

Executive Summary

In compliance with the modified 1980 U.S. Supreme Court decree (hereinafter, the Decree), the WY94 diversion was computed using the best engineering technology available to date.

Given the complexity of the hydrologic cycle in the heavily urbanized Chicago metropolitan area, and given the number of human and other factors that cannot be adequately represented in numerical modeling procedures, the results of the simulations which compute diversion flows worked exceptionally well.

The WY94 diversion accountable to the State of Illinois is 3,063.6 cfs. This flow is 136.4 cfs less than the 3,200 cfs average specified by the Decree. The 40 year running average, rounded to the nearest cfs, beginning with WY81 is 3,456 cfs and the cumulative deviation from the 3,200 cfs average is -3,589 cfs-years. The negative cumulative deviation indicates a water allocation deficit and the maximum allowable debt is 2,000 cfs-years.

Introduction

The diversion of water from the Lake Michigan watershed is of major importance to the Great Lakes states and to the Canadian province of Ontario. The states and province that border the Great Lakes have concerns with both diversions during periods of low lake levels, as well as the long term effects of diversion. To insure that the concerns of these interested parties are considered, the U. S. Army Corps of Engineers has been given the responsibility for the accounting of flow that is diverted from the Lake Michigan watershed.

The Corps of Engineers, Chicago District, is responsible for monitoring the measurements and the computation of the diversion of Lake Michigan water by the State of Illinois. The computations for Water Year 1983 (WY83), WY84 and WY85 (1 October 1982 through 30 September 1985) were completed by the Northeastern Illinois Planning Commission (NIPC) for the Illinois Department of Natural Resources - Office of Water Resources (IDNR-OWR), formerly known as the Illinois Department of Transportation - Division of Water Resources (IDOT-DWR). Prior to the WY83 report, the calculations were made for IDNR-OWR by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), formerly known as the Metropolitan Sanitary District of Greater Chicago (MSDGC). The Corps reviewed, modified, and updated the WY84 and WY85 diversion accounting completed by NIPC. The computations for WY86 were performed jointly by NIPC (under contract to the Corps of Engineers) and the Corps of Engineers. Beginning in WY87, the computations were performed solely by the Corps of Engineers. This report represents the final Lake Michigan diversion accounting for WY93.

Authority for Report

Under the provisions of the U.S. Supreme Court Decree in the Wisconsin, et. al. v. Illinois et. al., 388 U.S. 426, 87 S.Ct. 1774 (1967) as modified 449 U.S. 48, 101 S.Ct. 557 (1980), the Chicago District of the Corps of Engineers is responsible for monitoring the measurement and computation of diversion of Lake Michigan water by the State of Illinois. The Water Resources Development Act of 1986 (Section 1142 of PL 99-662) gave the Corps total responsibility for the computation of diversion flows as formerly done by the State of Illinois. The Corps' new mission became effective 1 October 1987.

History of the Diversion

Water has been diverted from Lake Michigan at Chicago into the Mississippi River Watershed since the completion of the Illinois and Michigan (I and M) Canal

in 1848. At that time, diversion averaged about 500 cubic feet per second (cfs). The I and M Canal was built primarily to serve transportation needs providing a connecting watercourse between the Great Lakes and the Mississippi River system.

With the development of the Chicago metropolitan area, sewer and drainage improvements led to severe sanitation problems in the mid to late 1800's. The newly constructed sewers moved water and wastes into the Chicago River, which until 1900 drained to Lake Michigan. The water quality of Lake Michigan deteriorated and contaminated the city's primary water supply.

A second problem that occurred during this time period was an increase in the overbank flooding within the city. As more roads were built and buildings constructed, the sewer system was correspondingly expanded. The increase in impervious area from the newly constructed roads and buildings increased the rate and volume of stormwater runoff and resulted in increased flooding.

As a solution to the sanitation and flooding problems, construction of the Chicago Sanitary and Ship Canal (CSSC) was undertaken. Construction of the CSSC allowed the flow direction of the Chicago River to be reversed (Figure 1). Construction of the Chicago Sanitary and Ship Canal was completed in 1900 by the MWRDGC. The CSSC followed the course of the older I and M Canal. The CSSC is much larger than the I and M canal and can handle the Chicago River flow, as well as increased shipping. In the 1930's, the Chicago River Controlling Works (CRCW) was constructed at the mouth of the Chicago River. The CRCW regulates the amount of Lake Michigan water allowed to pass into the river and restricts river flooding from entering Lake Michigan. The water levels in the CSSC are controlled by the Lockport Lock and Dam.

Between 1907 and 1910, the MWRDGC constructed a second canal called the North Shore Channel. It extended from Lake Michigan at Wilmette in a southerly direction 6.14 miles to the north branch of the Chicago River. The Wilmette Pumping Station regulates the amount of Lake Michigan flow allowed down the channel.

Construction of a third canal, the Calumet Sag Channel, was completed in 1922. The canal connects Lake Michigan through the Grand Calumet River, to the CSSC. The Calumet Sag Channel was constructed to carry sewage from South Chicago, Illinois and East Chicago, Indiana. The O'Brien Lock and Dam, which was completed in 1967, is located on the Calumet River and regulates the flow of Lake Michigan waters down the Calumet Sag Channel. The O'Brien Lock and Dam replaced the Blue Island Lock and Dam. Figure 2 shows the affected watershed.

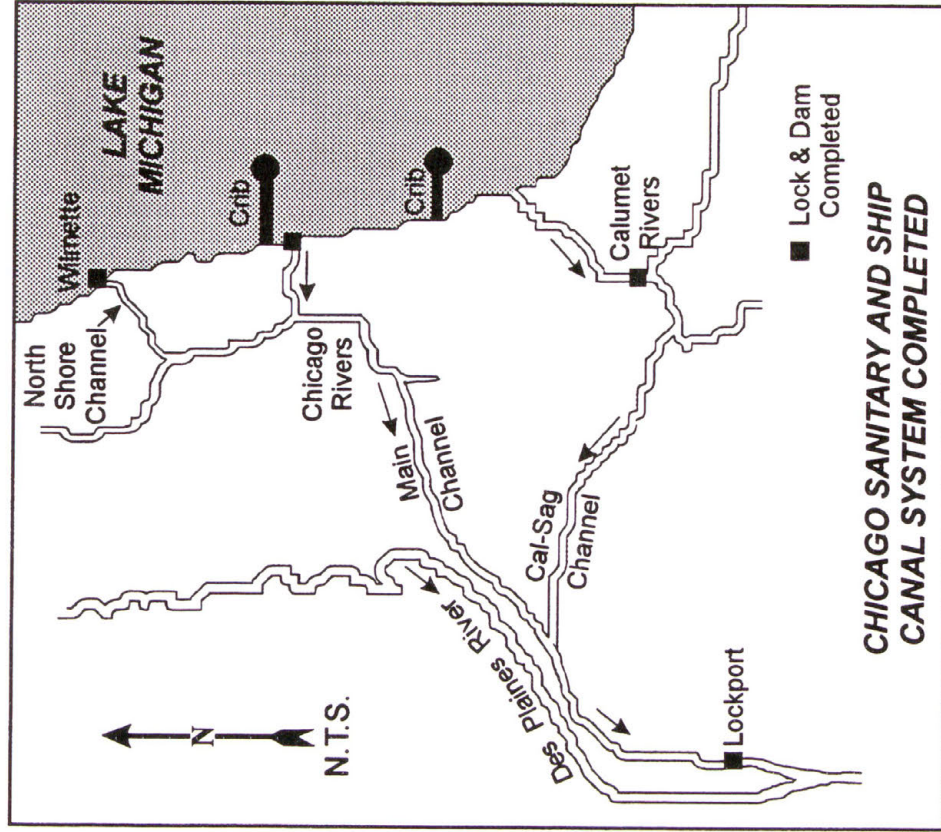
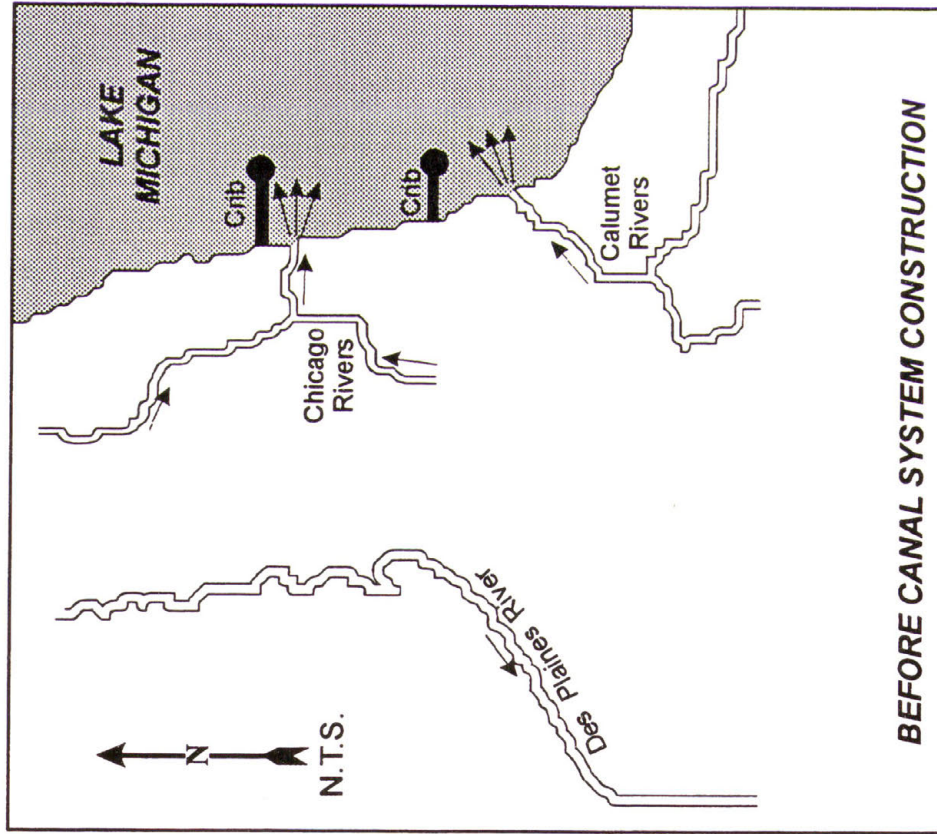


Figure 1

Development of the Chicago Sanitary and Ship Canal System

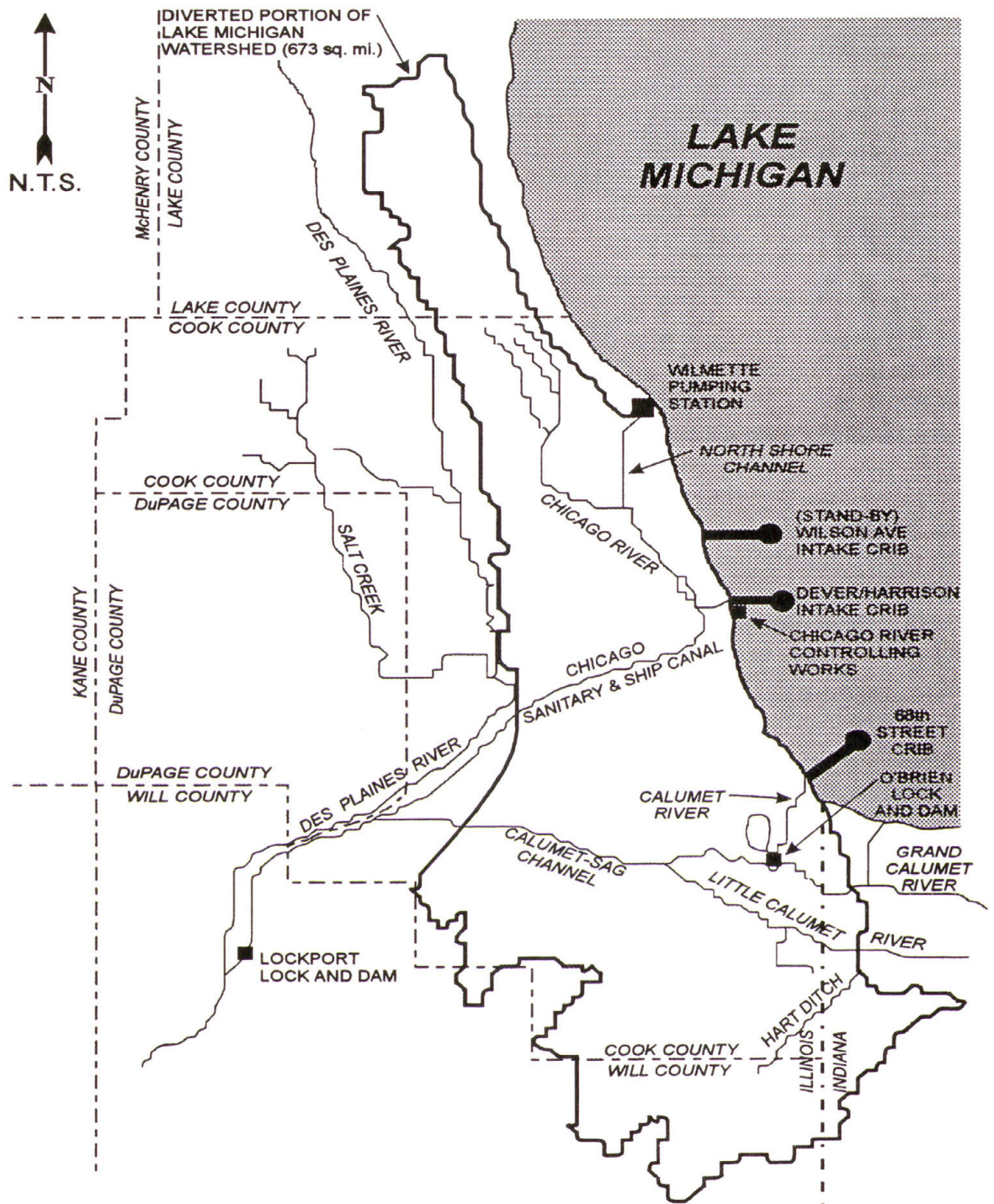


Figure 2

Location Plan - Lake Michigan Diversion at Chicago

Background of Lake Michigan Diversion Accounting

The Lake Michigan diversion accountable to Illinois is limited to 3,200 cubic feet per second (cfs) over a forty (40) year averaging period. During the forty (40) year period, the average diversion in any annual accounting period may not exceed 3,680 cfs, except in any two accounting periods in which the average diversion may not exceed 3,840 cfs as a result of extreme hydrologic conditions. During the first thirty nine (39) year period, the maximum allowable cumulative difference between the calculated diversion and 3,200 cfs is 2,000 cfs-years. These limits apply to the period beginning with WY81.

Prior to the 1983 accounting report, diversion accounting was done by the MWRDGC in the form of monthly hydraulic reports. As required by Supreme Court Decree, the diversion was calculated by deducting non-diversion flows from the Lockport record measured by MWRDGC and adding those diversion flows not discharging to the CSSC. All of the deductible flows could not be measured, therefore MWRDGC used flow records from gaged areas to get typical flow values and then extrapolated to arrive at the total deduction.

The State of Illinois contracted with NIPC to revise the diversion accounting calculations. At the same time, the State of Illinois moved from monthly hydraulic reports to annual accounting reports. NIPC adapted computer models of the diverted Lake Michigan and the Des Plaines River watersheds previously developed for studies in Northeastern Illinois under Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), to calculate those flows that could not be measured. Like MWRDGC, NIPC deducted non-diversion flows from the Lockport record and added those flows not discharged to the canal to calculate the Lake Michigan diversion. However, NIPC modeled both the gaged and ungaged areas to calculate much of the deduction and addition flows. Then computational budgets were developed around each of the gaged areas to verify the models. The budgets aid in identifying problem areas in the procedure. The procedure developed by NIPC is a significant improvement over the previous approach, because of the more rigorous approach and because of the verification provided by the budgets.

As required by Supreme Court Decree, a three (3) member technical committee is convened every five (5) years to evaluate the diversion accounting program to ensure that the accounting is accomplished using the best current engineering practice and scientific knowledge.

The first technical committee was convened during the period when diversion accounting was done by MWRDGC. The committee was primarily concerned with the rating of the various components at the Lockport facility, the primary diversion measurement location (Espey et. al., 1981). In response to the Committee's concerns, the Corps' Waterways Experiment Station (WES) revised the ratings of the two sets of Lockport sluice gates (Hart and McGee, 1985).

In response to the Committee's concerns, the State of Illinois installed an acoustic velocity meter (AVM) at Romeoville five (5) miles upstream of Lockport. The AVM is a highly accurate flow measuring device that proved to provide better flow measurements than the MWRDGC reported Lockport flows and the new Corps rating curves. The AVM became operational 12 June 1984. However, USGS did not publish the AVM flows until 1 October 1985. Because of significant equipment problems with the original AVM, a replacement AVM was installed in November 1988.

To provide flows during periods of malfunction, various regression analyses were performed to relate the MWRDGC reported Lockport flows to the AVM flows. Several sets of equations were proposed by the Corps of Engineers, the United States Geological Survey (USGS), Harza Engineering Co., and the Second Technical Committee. The report, *Chicago Sanitary and Ship Canal at Romeoville Acoustical Velocity Meter Backup System*, was completed September 1989 (USACE, 1989). The report documents the many efforts taken by various parties to develop useful regression equations. The regression equations that were ultimately used to estimate missing AVM flows from WY86 through WY92 were developed by the USGS in a report titled *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary and Ship Canal at Romeoville, Illinois* (USGS, 1994). This report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

The second technical committee reviewed the NIPC hydrologic and hydraulic computer models and agreed that the approach was consistent with what was required by the decree (Espey et. al., 1987). However, the committee felt that some of the parameters used in the models were out of date and in need of revision. To address the committee's concerns, the Corps hired a consultant (Christopher B. Burke Engineering, Ltd., (CBBEL)) in September of 1988 to review and update the modeling parameters. The final report (CBBEL, 1990) concerning the updating of modeling parameters was submitted to the Corps in October 1990.

The Water Resources Development Act of 1986 gave the Corps of Engineers the full responsibility for computation of the Illinois Lake Michigan diversion as of 1 October 1987. When the Corps' new responsibility became effective, the WY84

diversion accounting report, developed by NIPC, had not been certified. As a result, the Corps was responsible for the WY84 and all subsequent reports.

NIPC completed the WY84 diversion accounting report in April of 1987. It was subsequently reviewed by the Corps. The Corps found the report to be adequate with two exceptions. First, the 1984 accounting was completed with the modeling parameters questioned by the second technical committee. Second, the MWRDGC Lockport flows, which were adjusted using the WES rating curves, were used rather than the AVM flows. The Corps, knowing that the modeling parameters required updating and that AVM flows for the period prior to installation could be calculated accurately using regression equations, refrained from certifying the WY84 report until these issues were resolved.

NIPC completed the WY85 diversion accounting report in December of 1988 and the report was reviewed by the Corps. Like the WY84 report, the WY85 accounting was done with the modeling parameters questioned by the second technical committee. Additionally, NIPC used the AVM flows published by the USGS in their WY85 Water Resources Data for Illinois report. Since the publication of the WY85 USGS report, more reliable equations have been developed for calculating flows when the AVM was malfunctioning. These equations are periodically reviewed and updated as necessary.

Upon completion of the analysis of the modeling parameters by CBBEL, the WY84 and WY85 diversion flows were recalculated using the revised modeling parameters and the Romeoville AVM flows. The diversion flows were certified by the Corps of Engineers and transmitted to all interested parties in the Lake Michigan Diversion Accounting 1989 Annual Report (USACE, 1990).

The computation of Illinois' diversion from Lake Michigan for WY86 was undertaken as a joint effort between NIPC (under contract to the Corps of Engineers) and the Corps of Engineers. The computation of Illinois' diversion from Lake Michigan for WY87 through WY90 was performed solely by the Corps of Engineers. The WY91 and WY92 diversion accounting was performed as a joint effort between Christopher Burke Engineering (under contract to the Corps of Engineers) and the Corps of Engineers. The WY93 and WY94 accounting was performed solely by the Corps of Engineers. The WY86 through WY89 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Annual Report covering WY90 through WY92 (USACE, 1994). The WY90 Diversion Accounting Reports are contained in the Lake Michigan Diversion Accounting Water Year 1993 Annual Report (USACE, 1994). The WY91 and WY92 Diversion Accounting Reports are contained in the LMDA Water Year 1994 Annual Report (USACE, 1996). The WY93 and WY94 Diversion Accounting Reports are

contained in the Lake Michigan Diversion Accounting Water Year 1995 Annual Report.

The primary revision implemented for the WY90 diversion accounting was the incorporation of the new 25-gage precipitation network into the runoff simulation models. The 25-gage precipitation network replaces the previously used 13-gage network. The new precipitation network has solved many of the problems associated with the old network, such as poor exposure and distribution patterns. The Illinois State Water Survey (ISWS) installed and maintains the precipitation network for the Corps of Engineers. They also collect the data and adjust it if necessary. A description of the new 25-gage precipitation network can be found in the ISWS report titled *Installation and Operation of a Dense Raingage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990* (ISWS, 1991). That report is contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

In addition to the installation and use of the new 25-gage precipitation network was the subsequent modifications to the hydrologic runoff models and hydraulic sewer routing models. These models were revised in order to reflect the changes in the precipitation network. Many of the model changes were accomplished by Rust Environment and Infrastructure under contract with the Corps of Engineers. Their work culminated in a report titled *Diversion Accounting Update for the New 25-Gage Precipitation Network* (Rust,1993). That report is also contained in the Lake Michigan Diversion Accounting WY93 Annual Report.

Rust's work involved review and correction of map delineations of combined sewer special contributing areas, delineation of precipitation gage assigned areas for the 25-gage network, land-use/land-cover delineations, modifications to the hydraulic sewer routing model to reflect the revised precipitation network and land cover assignments, and an assessment of the model parameters used in the hydrologic runoff model, Hydrologic Simulation Program - FORTRAN (HSPF).

The Corps of Engineers modified the hydraulic sewer model, Special Contributing Area Loading Program (SCALP), in separate sewer areas in order to incorporate changes in the precipitation network. Since actual boundaries have not been mapped for those areas, some assumptions as to the location of the separate sewer areas were made. These assumptions were necessary since effective areas have been applied for the separate sewer areas in the SCALP model. These assumptions will continue until a further study can be accomplished that will reflect actual boundaries for these separately sewered areas.

A study was also done by the Corps to improve the response of the HSPF hydrologic runoff models. Input on parameter improvements were received from NIPC and Rust. The study resulted in some minor parameter modifications to the HSPF runoff model to correct for past inconsistencies and improve parameter accuracy.

Diversion Accounting Procedures

The Lake Michigan diversion accountable to the State of Illinois is calculated by using the AVM measured flow in the Chicago Sanitary and Ship Canal at Romeoville and deducting flows that do not constitute Lake Michigan diversion and are not accountable to the State of Illinois. Finally, additions are made to the Romeoville record for diversions that are not discharged to the canal. The deductions include groundwater water supply pumpage whose effluent is discharged to the canal, runoff from the Des Plaines River watershed that is discharged to the canal, Lake Michigan water supply pumpage from Indiana that is discharged to the canal, and water supply pumpage from Lake Michigan used for Federal facilities that is discharged to the canal. The additions to the Romeoville record include flows diverted from the canal upstream of Romeoville, and Lake Michigan water supply whose effluent is not discharged to the canal. This procedure represents the accounting method required by the Supreme Court Decree.

The diversion accounting results are presented as a series of columns that are listed in Table 1. Column 1 through Column 3 compute the total flow in the CSSC. Column 4 through Column 7 presents the deductions from the canal system flows with the total deduction being presented in Column 8. Column 9 presents the additions to the canal system record. Column 10 is the computed Lake Michigan diversion accountable to Illinois and is equal to the canal system flow minus the deductions plus the additions. Columns 11 through 13 are independent flow estimates for the three sources of diversion: water supply pumpage from Lake Michigan, runoff from the diverted Lake Michigan Watershed, and direct diversion through the lakefront structures. Column 11 through Column 13 are not used in the diversion calculation but are included as another estimate of the diversion for verification of the accounting flows in Column 10. The sum of Column 11 through Column 13 should theoretically equal the flow in Column 10.

In addition to the diversion calculations presented in the 13 columns, 14 computational budgets are prepared as input to the diversion calculation and to verify the estimated flows that cannot be measured. A summary of these budgets is presented in Table 2. Budgets 1 and 2 do not compare simulated to measured

flows but are summations of critical water supply pumpage data. Budget 3 through Budget 6 partition stream gage records into runoff and sanitary/industrial discharge components to estimate a portion of the runoff from the diverted watershed that is used as input to Column 12, Runoff from the Diverted Lake Michigan Watershed. Budget 7 through Budget 13 compare simulated to measured flows at MWRDGC facilities. These budgets simulate all the deductible Des Plaines River Watershed contained in Column 6 and the deductible groundwater seepage into TARP contained in Column 4. These budgets also are used for verification of the diversion accounting procedures and give an indication of the accuracy of the diversion accounting models. Budget 14 compares canal system inflows and outflows. It is used primarily as a verification of modeling results as well as an indicator of the accuracy and completeness of measured/reported flows.

Table 1

Description of the Diversion Accounting Columns

Column Number	Description
1	Chicago Sanitary and Ship Canal (CSSC) at Romeoville AVM Gage Record
2	Diversion from the CSSC above the Romeoville AVM Gage
3	Total Flow Through the CSSC
4	Groundwater Pumpage Discharged into the CSSC and Adjoining Channels
5	Water Supply Pumpage from Indiana Reaching the CSSC
6	Runoff from the Des Plaines River Watershed which Reaches the CSSC
7	Lake Michigan Pumpage by Federal Facilities which Discharge to the CSSC and Adjoining Channels
8	Total Deduction from the CSSC Romeoville AVM Gage Record
9	Lake Michigan Pumpage Which is not Discharged into the CSSC
10	Total Diversion Accountable to the State of Illinois
11	Pumpage from Lake Michigan Which is Accountable to the State of Illinois
12	Runoff from the Diverted Lake Michigan Watershed
13	Direct Diversions Through Lake Front Control Structures Which is Accountable to the State of Illinois

Table 2
Description of the Diversion Accounting Computational Budgets

Budget Number	Title	Description
1	Diverted Lake Michigan Pumpage	This budget sums the Lake Michigan water diverted by the State of Illinois in the form of Industrial and Municipal water supply. The results of this budget are used in Column 11.
2	Groundwater Discharged to the CSSC	This budget sums groundwater pumpages that are discharged to the CSSC. The results of this budget are used in Column 4.
3	North Branch Chicago River at Niles, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
4	Little Calumet River at the IL-IN State Line	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
5	Thorn Creek at Thornton, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
6	Little Calumet River at South Holland, IL	This budget performs a simple separation of stream flow into sanitary and runoff portions. The results of this budget are used in Budget 14 and Column 12.
7	MWRDGC Northside Water Reclamation Plant	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Northside Water Reclamation Facility. The simulations estimates the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Northside service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
8	Upper Des Plaines Pumping Station	This budget performs hydrologic and hydraulic simulation of the MWRDGC Upper Des Plaines Pumping Station. This budget provides a calibration point to verify models of the Des Plaines River watershed
9	MWRDGC Mainstream TARP Pumping Station	This budget performs hydrologic and hydraulic simulation of the MWRDGC Mainstream TARP Pumping Station. The results of this simulation are used in Budgets 10 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
10	MWRDGC Stickney Water Reclamation Facility	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Stickney Water Reclamation Facility. The simulations estimates the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Stickney service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
11	MWRDGC Calumet TARP Pumping Station	This budget performs hydrologic and hydraulic simulation of the MWRDGC Calumet TARP Pumping Station. The results of this simulation are used in Budgets 12 and 14 and Columns 6 and 12. The budget also provides internal verification of the accounting procedures.
12	MWRDGC Calumet Water Reclamation Facility	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Calumet Water Reclamation Facility. The simulations estimates the runoff from portions of the Lake Michigan and Des Plaines River watersheds within the Calumet service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Columns 6 and 12.
13	MWRDGC Lemont Water Reclamation Facility	This budget performs hydrologic and hydraulic simulation of the service basin tributary to the MWRDGC Lemont Water Reclamation Facility. The simulations estimates the runoff from portions of the Des Plaines River watershed within the Lemont service basin that is diverted to the CSSC in the form of inflow-infiltration. The budget provides an internal verification of the accounting procedures. The results of this budget are used in Budget 14 and Column 6.
14	Chicago Canal System	This budget performs a water balance of the Chicago Canal System which includes the CSSC and adjoining channels. This budget provides a verification point for the accounting procedures.

Revisions to the Lake Michigan Diversion Accounting Procedures

Three primary revisions were made to the WY93 and WY94 diversion accounting procedures. The estimate of the Grand Calumet river portion of the water supply pumpage from Indiana that reaches the CSSC was revised to better account for the unique hydraulics of this river. The revised computation of Grand Calumet river water supply impacts the deduction of Column 5 and is described in detail in that section of the report. The revised computation also impacts the computed runoff from the Lake Michigan watershed in Column 12. The second revision was the modeling of the portion of the Des Plaines TARP system that became operational on 6 June 1993. The Des Plaines TARP system impacts the deductible runoff from the Des Plaines river watershed that is contained in Column 6, as well as the groundwater deduction contained in Column 4. The Des Plaines TARP system is discussed further in the section on Budget 9, the Mainstream and Des Plaines TARP pumping stations. The third revision to the accounting is the adjustment of the double accounting of a portion of the runoff from the ungaged Calumet watershed. This change only impacts Column 12, the runoff from the Lake Michigan watershed, and therefore has no impact on the computed diversion. This revision will be discussed further in the section on Column 12.

Accounting Results

The WY94 diversion accounting monthly summary is presented in Table 4. Table 4 shows the total WY94 Lake Michigan diversion accountable to the State of Illinois is 3,063.6 cfs (Column 10). This diversion is 136.4 cfs less than the 3,200 cfs average specified by the Decree. The 40 year running average (Table 3), rounded to the nearest cfs, beginning with WY81 is 3,456 cfs and the cumulative deviation from the 3,200 cfs average is -3,589 cfs-years. The negative cumulative deviation indicates a water allocation deficit. The maximum allowable deficit is 2,000 cfs-years. Tabular data on daily diversion flows is presented in Appendix A.

Table 3**Status of the State of Illinois' Diversion from Lake Michigan Under the 1980
Modified U.S. Supreme Court Decree**

A c c o u n t i n g Y e a r	C e r t i f i e d F l o w (cfs)	R u n n i n g A v e r a g e (cfs)	C u m u l a t i v e D e v i a t i o n (cfs)
1981	3,106	3,106	94
1982	3,087	3,097	207
1983	3,613	3,269	-206
1984	3,432	3,310	-438
1985	3,472	3,342	-710
1986	3,751	3,410	-1,261
1987	3,774	3,462	-1,835
1988	3,376	3,451	-2,011
1989	3,378	3,443	-2,189
1990	3,531	3,452	-2,520
1991	3,555	3,461	-2,875
1992	3,409	3,457	-3,084
1993	3,841	3,487	-3,725
1994	3,064	3,456	-3,589

Table 4

**Lake Michigan Diversion Accounting - WY1994
Summary of Diversion Flows (All in cfs)**

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEIOVILLE AVM GAGE RECORD	2	3	4	5	6	7	8	9	10	11	12	13
			TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEIOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
Oct-93	2795.3	0.5	2795.8	83.3	42.5	191.1	1.0	317.9	217.9	2695.8	1709.9	815.6	156.6
Nov-93	2486.5	0.4	2486.9	84.5	38.1	120.1	1.0	243.7	215.3	2458.5	1675.6	572.3	119.9
Dec-93	2282.5	0.3	2282.8	85.0	33.3	159.5	1.3	279.1	211.1	2224.8	1674.3	499.1	97.1
Jan-94	2496.1	0.3	2496.4	75.8	31.5	93.3	1.7	202.3	248.0	2542.1	1817.4	372.3	111.5
Feb-94	3325.1	0.4	3325.5	110.2	31.6	289.8	2.1	433.7	228.6	3121.4	1818.2	1504.0	85.1
Mar-94	3132.1	0.4	3132.5	90.6	30.1	288.0	1.8	390.5	228.1	2970.1	1767.1	1229.4	86.1
Apr-94	2773.2	0.4	2773.6	83.9	32.3	159.6	1.6	277.4	227.9	2724.1	1778.1	708.9	130.5
May-94	2369.8	3.5	2373.3	68.3	39.6	39.0	1.9	148.8	276.2	2500.7	1951.5	188.6	199.6
Jun-94	3862.4	3.2	3865.6	101.9	50.9	133.9	2.2	288.9	344.6	3921.3	2336.1	1012.5	884.7
Jul-94	3992.9	4.2	3997.1	96.4	52.1	89.2	1.8	239.5	283.9	4041.5	2147.9	429.6	1415.2
Aug-94	4206.0	0.7	4206.7	116.0	49.2	241.9	1.9	409.0	268.8	4066.6	1995.5	789.6	1339.0
Sep-94	3451.0	3.0	3454.0	71.2	46.7	63.1	2.0	183.0	264.3	3535.3	1971.1	174.6	1317.4
Averages	3093.8	1.4	3095.3	88.6	39.9	152.8	1.7	283.0	251.4	3063.6	1886.8	691.1	497.3

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 equals Column 3 minus Column 8 plus Column 9.

Deductions from the Romeioville Gage Record

Additions to the Romeioville Gage Record

Discussions of Results

The following is a discussion of the column functions and computational budgets. The discussion of the column functions describes the purpose of each column, as well as some observations on the WY94 values in the columns. The discussion of the computational budgets presents the purpose of each budget and the results of the budget flow balances. The results of the computational budgets are used in the diversion calculations where seven (7) budgets are used to verify the diversion simulation models. The columns are discussed first, followed by the discussion of the budgets.

Columns

The first ten (10) columns display the components of the diversion calculation and include the Romeoville flow, as well as the various deductions and additions to the Romeoville record. The final three (3) columns (Columns 11 through 13) display the three (3) diversion components (Lake Michigan pumpage accountable to Illinois, runoff from the diverted watershed, and direct diversion through the lakefront control structures). The sum of Columns 11 through 13 should theoretically equal the Romeoville based diversion calculation. A comparison of the sum of these three (3) columns to the calculated diversion (Column 10) is presented in the discussion of Column 11 through Column 13.

Column 1: Chicago Sanitary and Ship Canal (CSSC) at Romeoville, USGS AVM Gage Record

The discharge at Romeoville for WY94 was 3,093.8 cfs. For the seven (7) days when the AVM was inoperable, the flow at the Romeoville site was calculated from the USGS regression equations.

Column 2: Diversions from the CSSC Above the Gage

Argonne Laboratories and Uno-Ven Corporation were the only diversions from the CSSC upstream of the Romeoville gage in WY94. The average withdrawal upstream of the AVM for WY94 was 1.4 cfs.

Column 3: Total Flow Through the CSSC

Column 3 is the sum of Column 1 and Column 2 and represents the total flow entering the canal system. The average CSSC flow was 3,095.3 cfs for WY94.

Column 4: Groundwater Discharged to the CSSC And Adjoining Channels

Column 4 is groundwater pumpage by communities, industrial users and other private users whose effluent is discharged to the CSSC. The groundwater pumpage data is reported by the ISWS. It also includes the groundwater seepage into the TARP system that is discharged to the CSSC. This quantity is determined by summing all reported groundwater pumpages tributary to the CSSC, along with the estimated groundwater seepage into the Mainstream TARP (Budget 9) and Calumet TARP (Budget 11) systems. This total is then adjusted by subtracting the groundwater normally tributary to the canal that is contained in the combined sewer overflows that discharge to the Des Plaines River and other watercourses not tributary to the CSSC. This method prevents double accounting of the combined sewer overflow portion of the groundwater supply pumpage.

Using ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake Michigan watershed in Illinois or if they were located within MWRDGC Water Reclamation Plant (WRP) service boundaries in which their effluent was discharged into the CSSC and adjoining channels. Groundwater seepage into the Mainstream and Des Plaines TARP systems and the Calumet TARP system was determined through simulation and is discussed in Budgets 9 and 11. The groundwater constituent of combined sewer overflows is determined entirely thorough simulation.

Groundwater pumpage from the Lake Michigan watershed whose effluent is discharged to the CSSC is a deduction, except to the extent that the groundwater sources are recharged by Lake Michigan. Current piezometric levels indicate that groundwater is discharging to the lake. Therefore, groundwater pumpage from within the Lake Michigan Watershed that reaches the canal continues to be a deduction. Research literature will be reviewed periodically to verify this assumption.

Column 4 represents a deduction from the Romeoville record and averaged 88.6 cfs. This flow is a decrease of 0.7 cfs from WY93. Groundwater pumpage tributary to the canal is composed of 20.2 cfs of groundwater pumpage from the

Lake Michigan watershed, 15.6 cfs of groundwater pumpage from outside of the Lake Michigan watershed, 49.4 cfs of groundwater seepage into the Mainstream and Des Plaines TARP systems, and 3.5 cfs of groundwater seepage into the Calumet TARP system. The total of these components is 88.7 cfs. However, the deduction from the Romeoville gage record is 88.6 cfs, since 0.1 cfs of this groundwater supply pumpage was determined, through simulation, to be discharged to the Des Plaines River and other watercourses not tributary to the CSSC in the form of combined sewer overflows.

Column 5: Water Supply Pumpage from Indiana Reaching the CSSC

Column 5 represents the computation of Indiana water supply reaching the canal through the Grand Calumet and the Little Calumet Rivers. In the case of the Little Calumet River, a drainage divide exists east of the confluence with Hart Ditch. Therefore, flows from Hart Ditch, including virtually all dry weather flows, normally flow westward into Illinois. Under high flow conditions, the drainage divide may shift westward and a portion of the Hart Ditch flows may be diverted eastward to Burns Ditch and ultimately to Lake Michigan. However, it is believed that the occurrence in the shift in the drainage divide is infrequent and the flow that is diverted eastward is insignificant. Therefore, it is assumed that all effluent discharged into Hart Ditch and the Little Calumet River west of the divide flow westward. For WY94, total flow in the Little Calumet River was 54.5 cfs, with 5.6 cfs of that flow being determined to be Indiana water supply.

The Grand Calumet River has a summit. On one side of the summit, the flow is toward Lake Michigan. On the other side of the side of the summit, the flow is toward the Calumet Sag Channel which flows into the CSSC. However, the location of the summit is variable and highly influenced by Lake Michigan levels (USGS, 1984). Thus the calculation of this deduction from the Romeoville record is influenced by Lake Michigan levels. Beginning with the WY92 accounting, Grand Calumet River flow was measured by a gage that was installed in 1991 that began officially measuring flows on 1 October 1991.

Flow in the Grand Calumet River contains a very high proportion of treatment plant discharge. Through WY92, the flow in the Grand Calumet River attributed to Indiana water supply pumpage was set to the sum of water supply for East Chicago, Whiting, and Hammond (whose pumpage includes water supply for Munster, Highland, and Griffith). This method is an oversimplification of the actual conditions. Chicago District developed a reconnaissance level, unsteady state model of the river for the US EPA. From this model, relationships were developed to proportion the treatment plant discharge into the flow to the CSSC and Lake Michigan. The flow summit generally occurs at the Hammond outfall or between the

Hammond and East Chicago outfalls. The equations below determine the percentage of flow from each treatment plant flowing west to the CSSC based on Lake Michigan water level:

$$\begin{aligned} \text{For CCD} < 0.3 \text{ ft} \\ \text{Flow} &= 0.45 * \text{HW} \end{aligned}$$

$$\begin{aligned} \text{For CCD} \geq 0.3 \text{ ft and CCD} < 1.5 \text{ ft} \\ \text{Flow} &= (0.22 * \text{CCD}^3 - 0.15 * \text{CCD}^2 + 0.06 * \text{CCD} + 0.45) * \text{HW} \end{aligned}$$

$$\begin{aligned} \text{For CCD} \leq 1.5 \text{ ft and CCD} < 1.8 \text{ ft} \\ \text{Flow} &= \text{HW} + (\text{CCD} - 1.5) / 0.3 * \text{EC} \end{aligned}$$

$$\begin{aligned} \text{For CCD} > 1.8 \text{ ft} \\ \text{Flow} &= \text{HW} + \text{EC} \end{aligned}$$

Where CCD is the lake level in feet (Chicago City Datum) measured at Calumet Harbor, HW is the daily combined water supply pumpage by Hammond and Whiting, and EC is the daily water supply pumpage by East Chicago.

The total Grand Calumet flow reaching Illinois in WY94 was measured as 49.2 cfs. Of that, 24.5 cfs was determined to be water supply pumpage. Therefore, the total WY94 Indiana water supply deduction, including the flow from the Little Calumet and Grand Calumet Rivers is 39.8 cfs. This flow is 1.9 cfs less than the Indiana water supply deduction for WY93, which was 41.7 cfs.

Column 6: Runoff from the Des Plaines River Watershed Reaching the CSSC

The WY94 average discharge of Des Plaines River watershed runoff reaching the canal (Column 6) is 152.8 cfs. This deduction is determined almost entirely through simulation. The runoff is composed of two elements, surface runoff and subsurface runoff. Surface runoff that enters sewers is referred to as inflow, while subsurface runoff is referred to as infiltration. The infiltration and inflow discharged to the water reclamation plants is 93.0 cfs, the infiltration and inflow reaching the canal through combined sewer overflows is 6.1 cfs and the runoff from the Lower Des Plaines and Summit Conduit areas is 53.7 cfs. The deduction is also influenced by the O'Hare basin flow transfer that contributed 8.6 cfs of the 192.6 cfs of runoff to the water reclamation facilities during WY94. The deductible Des Plaines River watershed runoff decreased 187.6 cfs from WY93 to WY94. The decreased runoff was due to the reduced rainfall volumes that occurred during WY94.

Column 7: Lake Michigan Pumpage by Federal Facilities Which Discharge to the CSSC

Column 7 represents Lake Michigan diversions for Federal use, not chargeable to the State of Illinois, and is typically comprised of water supply pumpage used by federal facilities. Also included is emergency navigation makeup water used for federal purposes. Column 7 represents a deduction from the Romeoville record and the total amount of the WY94 deduction is 1.7 cfs.

Column 8: Total Deductions from the CSSC Romeoville Gage Record

Column 8 is the sum of Columns 4, 5, 6, and 7 and represents the total deduction from the Romeoville record. The total deduction for WY94 is 283.0 cfs.

Column 9: Lake Michigan Pumpage Not Discharged to the CSSC

This column represents water supply pumpage from Lake Michigan that is not discharged to the canal. The water supply pumpage not discharged to the canal is composed of two components:

- Lake Michigan water supply used by communities serviced by water reclamation facilities that do not discharge to the CSSC (250.8 cfs). This increase is 15.5 cfs from WY93.
- The sanitary portion of combined sewer overflows attributable to Lake Michigan domestic water supply that does not discharge to the CSSC (0.6 cfs).

The communities that make up the flow in the first component are suburbs whose treated effluent is discharged to the Des Plaines River and other watercourses not tributary to the CSSC. The water supply agencies or communities are:

- Northwest Suburban Joint Action Water Agency (NWJAWA) - Member communities include Elk Grove Village, Hanover Park, Hoffman Estates, Mount Prospect, Rolling Meadows, Schaumburg and Streamwood.
- Northwest Water Commission - Member communities include Arlington Heights, Buffalo Grove, Palatine, Prospect Heights and Wheeling.

- Central Lake County Joint Action Water Agency (CLCJAWA) - Member communities include Grayslake, Gurnee, Lake County Public Works Department (Vernon Hills and Wildwood-Gages Lake), Libertyville, Mundeline, Round Lake, Round Lake Park and Round Lake Beach.
- Lake County Public Water District - Member communities include Illinois Beach State Park, Winthrop Harbor and Zion.
- DuPage Water Commission - Member communities include Addison, Bensenville, Bloomingdale, Carol Stream, Citizen's Utilities (Arrowhead, Country Club Highlands, Lombard Heights and Valley View), Clarendon Hills, Darien, Downers Grove, Elmhurst, Glen Ellyn, Glendale Heights, Hinsdale, Itasca, Lisle, Lombard, Naperville, Oak Brook, Roselle, Villa Park, Westmont, Wheaton, Willowbrook, Wood Dale, Woodridge, DuPage County Water Works (Farmington, Glen Ellyn Heights, Hinsdale, Lake in the Woods, Rosewood Trace, Steeple Run).
- Lincolnshire
- Riverwoods
- Waukegan
- Lake County - Bradley Road
- North Chicago - 76 percent
- Des Plaines - 38.2 percent

The communities of Lake Bluff and Knollwood-Roundout (who receive their water from CLCJAWA) are not included in Column 9, as they discharge their effluent into the Chicago River System.

It should also be noted that the Lake Michigan water supply component of the O'Hare flow transfer is subtracted from the total Lake Michigan water supply of the above communities since:

- The O'Hare flow transfer is treated at the Northside WRP which discharges sanitary effluent that is tributary to the CSSC.

- The entire Lake Michigan water supply component of the O'Hare flow transfer is from communities contained in the above list.

The Lake Michigan water supply for these communities is measured, while the sanitary portion of the CSO's is derived through simulation. Column 9 represents an addition to the Romeoville record and the total WY94 addition is 251.4 cfs. This flow is an increase of 14.0 cfs from WY93 to WY94.

Column 10: Total Diversion

Column 10 is equivalent to Column 3 with the deduction of Column 8 and the addition of Column 9. The total diversion for WY94 is 3,063.6 cfs. This amount is 136.4 cfs less than Illinois's long term diversion allocation of 3,200 cfs. The 40-year running average diversion, rounded to the nearest cfs, beginning with WY81, is 3,456 cfs and the cumulative deviation from the 3,200 cfs allocation is -3,589 cfs. The negative deviation indicates that the cumulative diversion is greater than an average of 3,200 cfs for the period.

Column 11 Through Column 13: Lake Michigan Diversion Components

Columns 11 through 13 represent the three (3) Lake Michigan diversion components:

- Column 11 - Lake Michigan pumpage accountable to Illinois (1,886.8 cfs)
- Column 12 - Runoff from the diverted Lake Michigan watershed (681.1 cfs)
- Column 13 - Direct diversion through the lakefront structures (497.3 cfs)

Prior to WY93, a double accounting of runoff from the Calumet ungaged watershed existed. The flow that was double accounted was the infiltration into the separate sanitary sewers within the Calumet ungaged watershed. For a detailed description of this double accounting refer to the Lake Michigan Diversion Accounting Water Year 1990 report contained in the Water Year 1993 Annual Report. This area is discussed in the section on ungaged watershed modeling under the main section on areas for improvement. The correction in WY93 for this double accounting was based solely on area proportioning from sewer maps. Unfortunately, separately sewer SCAs in SCALP do not contain actual areas. Therefore, the approximations that were made for tributary areas for the separate sewers could not be cross checked against the SCALP models for accuracy. The infiltration into the separate sewers within the ungaged Calumet watershed was

ultimately subtracted from the computation of runoff from the Lake Michigan watershed.

The sum of the columns (3,065.2 cfs) should theoretically equal the total diversion as shown in Column 10 (3,072.3 cfs), with one exception. The Romeoville record measures sewer effluent instead of water supply pumpage, while Column 11 (Lake Michigan water supply pumpage accountable to Illinois) does not account for consumptive use. This difference is consumptive loss (water supply pumpage that is consumed or lost prior to reaching the water reclamation facilities), estimated as 10% of the water supply pumpage (International Great Lake Diversion Consumptive Use Study Board, 1981).

Because the diversion estimate from Columns 11 - 13 is based on simulation, suspect ratings of the lakefront structures, and simple flow separation techniques, the estimate is not expected to be as accurate as the AVM based calculations. Consequently, a difference between estimates of 7.1 cfs or 0.2% is an excellent balance. However, this discrepancy becomes greater when consumptive use is accounted for in Column 11. The discrepancy in these two (2) estimates is related to the canal system balance in Budget 14, discussed in a subsequent section and potential sources of the discrepancy are addressed in that budget discussion.

Using the figures from these three (3) columns, 61.6% of the WY94 Illinois diversion is attributable to pumpage from Lake Michigan for domestic water supply. Runoff from the diverted Lake Michigan Watershed accounted for 22.2% of the diversion, and direct diversion through the lakefront structures accounted for 16.2% of the diversion. Water supply from Lake Michigan increased 88.2 cfs from WY93 to WY94. Due to the large decreased volume of rainfall between WY93 and WY94, the runoff from the Lake Michigan watershed decreased 823.6 cfs between WY93 and WY94. A more detailed breakdown of these percentages is shown in Table 5 and Figure 3.

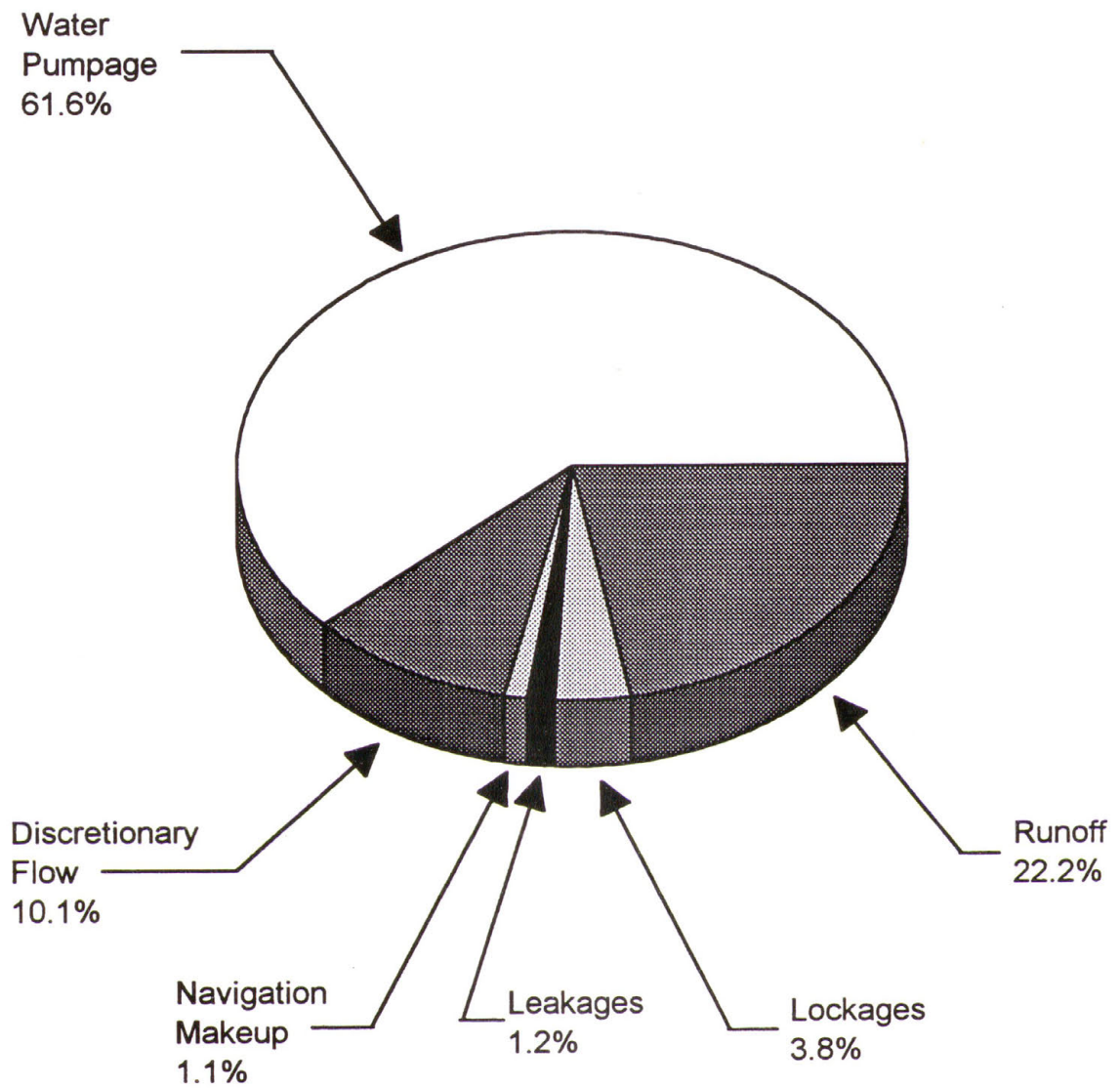
Table 5

**Breakdown of the Diversion by the State of Illinois
Based on Columns 11 Through 13**

Description	Average Flow (cfs)	Percentage of Total Flow
Lake Michigan Pumpage by the State of Illinois	1,886.8	61.6%
Runoff from the Diverted Lake Michigan Watershed	681.1	22.2%
Direct Diversions		
Lockages	117.9	3.8%
Leakages	37.2	1.2%
Navigation Makeup Flow	33.9	1.1%
Discretionary Flow	308.3	10.1%
Total Direct Diversions	497.3	16.2%

Note: The direct diversions shown in Table 5 do not agree with the results contained in Column 13 of Table 4 due to the different rounding methodologies employed. The direct diversions shown in Table 5 is the yearly average of each of the direct diversion components, while the yearly average value shown in Column 13 of Table 4 is the yearly average of each of the monthly averages.

Figure 3



Component Breakdown of Illinois' Diversion Based Upon Columns 11 through 13

Budgets

The first two (2) budgets are used to sum the water supply for the area influenced by the diversion. The next four (4) budgets are of stream gage sites that are not simulated and are used as part of the calculation of the runoff from the diverted Lake Michigan watershed. The remaining seven (7) budgets compare measured and simulated flows and compute Column inputs used in the diversion computations.

Budget 1 and Budget 2: Water Supply Pumpage

Budgets 1 and 2 are summations of critical water supply pumpage data. Budget 1 sums Lake Michigan water supply diverted by the State of Illinois. The Lake Michigan water supply data is supplied by the state as daily values for primary users and monthly data for secondary users. Budget 2 sums groundwater pumpages in the Lake Michigan and Des Plaines River watersheds that are diverted to the CSSC. Groundwater pumpage data is recorded by the ISWS as a total annual withdrawal based on calendar years.

Budget 1: Diverted Lake Michigan Water Supply

Budget 1 represents the summation of Lake Michigan pumpage accountable to the State of Illinois. For WY94, the average annual Lake Michigan pumpage accountable to Illinois is 1,886.8 cfs. This flow is a decrease of 88.2 cfs from WY92.

Budget 2: Groundwater Diverted to the CSSC

Budget 2 is groundwater water supply pumpage by communities, industrial users, and other private users whose effluent is discharged to the canal. The groundwater pumpage data are reported by the ISWS on a calendar year basis. The groundwater quantity is determined by summing all reported groundwater sources in the area tributary to the CSSC, less groundwater not discharged to the CSSC in the form of combined sewer overflows.

Using the ISWS groundwater records, groundwater pumpages were assumed to reach the CSSC and adjoining channels if they were located in the diverted Lake Michigan watershed in Illinois, or if they were located within MWRDGC service boundaries in which their effluent was discharged into the CSSC and adjoining channels.

The total groundwater pumpage by communities, industrial users, and other private users whose sanitary effluent is tributary to the canal is 35.8 cfs for WY94. Simulation determined that 0.1 cfs of this flow never reached the canal. Instead it was discharged to the Des Plaines River or other watercourses not tributary to the canal in the form of combined sewer overflows. The total groundwater pumpage reaching the canal represents an increase of 0.7 cfs from WY93 to WY94.

In addition to groundwater supply pumpage, there was also a significant amount of groundwater infiltration into the two TARP systems that ultimately reached the canal. Mainstream TARP and Calumet TARP accounted for 49.4 cfs and 3.5 cfs, respectively, of groundwater discharged to the canal during WY94.

Budgets 3 Through Budget 6: Stream Gaging Stations

The stream gage budgets are used to make estimates of runoff from portions of the diverted Lake Michigan watershed. Sanitary and other point source flows are subtracted from the stream gaging record to develop the runoff estimates. The runoff estimates are used in Column 12. The flows at the stream gaging sites are also part of Budget 14, the canal system budget.

Table 6 presents the estimated runoff from these budgets. Note that Budgets 4 through 6 are a composite calculation of the runoff above the Little Calumet River at the South Holland gage. Also note that the Little Calumet River is a losing stream (i.e. it recharges groundwater). The computations in deriving runoff account for this when recharge is significant (i.e., when groundwater recharge is computed). The runoff for Budget 6 is an incremental runoff, runoff that occurs downstream of Little Calumet River at the State Line and Thorn Creek at Thornton.

Table 6

Stream Gage Flow Separation

Budget Number	Location	Stream Flow (cfs)	Sanitary Flow (cfs)	Runoff (cfs)
3	North Branch Chicago River at Niles, IL	86.5	18.7	67.8
4	Little Calumet River at IL-IN State Line	54.5	5.8	48.7
5	Thorn Creek at Thornton, IL	108.5	19.5	89.0
6	Little Calumet River at South Holland, IL	173.5	156.9	16.6

Budgets 7 Through Budget 13: MWRDGC Water Reclamation Facilities

The budgets for the water reclamation plants compare the simulated flows to the measured inflows at the MWRDGC facilities and perform verifications of the diversion accounting program. The simulated flows were developed from an estimated sanitary flow with a daily, weekly, and monthly flow variation, from hydrologic precipitation-based runoff models, and from hydraulic sewer routing models. The estimated sanitary flow input to the hydraulic simulation models is based on the population estimates for each plant's service basin. Per capita sanitary flows are determined based on the service basin's water supply minus an assumed 10 percent consumptive loss. Simulated flows were compared with recorded inflows at each facility to assess the accuracy of the simulations.

The discussion of the budgets will concentrate on the results of each simulation as the development of these models have been discussed in previous reports. A summary of the simulation results is presented in Table 7. At all four (4) water reclamation plants and the Upper Des Plaines Pump Station, the simulation results were maintained. This is the result of the new 25-gage precipitation network first utilized for the WY90 diversion accounting, improvements and updates in the land cover delineations, and modifications to the hydrologic and hydraulic models .

Budget 7: Northside Water Reclamation Facility

Budget 7 analyzes the water balance at the MWRDGC Northside Water Reclamation Facility (Figure 4). The balance for WY94 of the inflow to the Northside facility is very good. The simulated to adjusted recorded inflow ratio (S/R) for the Northside WRP is 0.97, indicating that the simulated inflow volume is slightly less than the adjusted observed inflow volume. The coefficient of correlation (R) of simulated to observed flow is 0.78, indicating that the model predicted the inflow hydrograph to the Northside facility well.

Budget 8: Upper Des Plaines Pump Station

Budget 8 analyzes the water balance at Upper Des Plaines Pump Station (UDPPS) (Figure 5). The pump station budget is used to verify simulated flows. Although it has no direct impact on the diversion calculation, it is intended to be used as a primary calibration point for the models that simulate the deductible runoff from the Des Plaines watershed contained in Column 6. This will be possible only after the existing measurement problems at that site are resolved. This has been discussed in the WY90 diversion report.

The balance at UDPPS for WY94 was reasonable. The simulated to recorded flow ratio (S/R) for the UDPPS is 0.86, indicating that the simulated inflow volume to UDPPS is less than the recorded inflow volume. The daily S/R ratio shows a high degree of variability, indicating that the trends within the recorded and simulated inflow may not correspond very well. The coefficient of correlation (R) of simulated to recorded flow is 0.72, indicating room for improvement in correlation in the trends of simulated versus recorded flows. The slight improvement in the coefficient of correlation may be the direct result of the revised raingage network and subsequent modifications to the hydrologic and hydraulic models for WY90.

While the statistical results for WY94 at the Upper Des Plaines Pump Station have been maintained, this does not lead to the conclusion that flow measurement alternatives should not be investigated. This site has continued to experience its share of problems. During WY94, 125 days of records were unavailable that were attributable to meter malfunctions, problems with the recording charts which made data transformation impossible, and various other reasons. In view of the significant quantity of missing data (34% missing data), the quantitative analyses of the simulation are of limited value. Second, the accuracy of the flow meters at the pump station is questionable and unmetered bypass flows are a frequent occurrence. Therefore, total flow may not be measured in storm events and the recycling of flow is possible. Further investigation of the accuracy of flow measurement at the pump station is required to verify and calibrate the simulation models that compute the deductible runoff from the Des Plaines watershed contained in Column 6.

Table 7

WY 1994 Summary of Simulation Statistics

Budget No.	7	8	9	10	11	12	13	14
Description	Northside WRP (1)	Upper Des Plaines Pump Station (1),(3)	Mainstream TARP Pump Station (2)	Stickney WRP (1),(4)	Calumet TARP Pump Station (2)	Calumet WRP (1),(4)	Lemont WRP (1)	Chicago Canal System Balance (1)
Mean Recorded Flow, cfs	402.6	73.2	87.6	1,053.2	28.6	361.7	2.2	3,105.3
Max. Recorded Flow, cfs	750.6	143.2	227.9	1,890.1	90.6	640.1	6.8	8,430.3
Min. Recorded Flow, cfs	319.7	26.3	11.5	691.8	4.2	264.1	1.5	1,834.4
Mean Simulated Flow, cfs	390.4	62.6	107.9	1,095.2	21.4	368.4	1.8	3,036.7
Max. Simulated Flow, cfs	658.3	171.2	308.2	2,323.9	77.5	583.2	4.6	9,896.1
Min. Simulated Flow, cfs	311.1	43.5	38.2	841.7	5.8	304.5	1.3	1,742.3
Mean S/R	0.97	0.86	1.23	1.04	0.75	1.02	0.82	0.98
Max. S/R	1.54	2.26	6.35	1.73	3.60	1.28	1.43	2.37
Min. S/R	0.52	0.36	0.24	0.54	0.15	0.66	0.28	0.69
Correlation	0.78	0.72	0.64	0.77	0.51	0.80	0.71	0.87

(1) Based on daily values.

(2) Based on weekly values.

(3) Does not include days with missing records.

(4) Does not include pumpage from TARP.

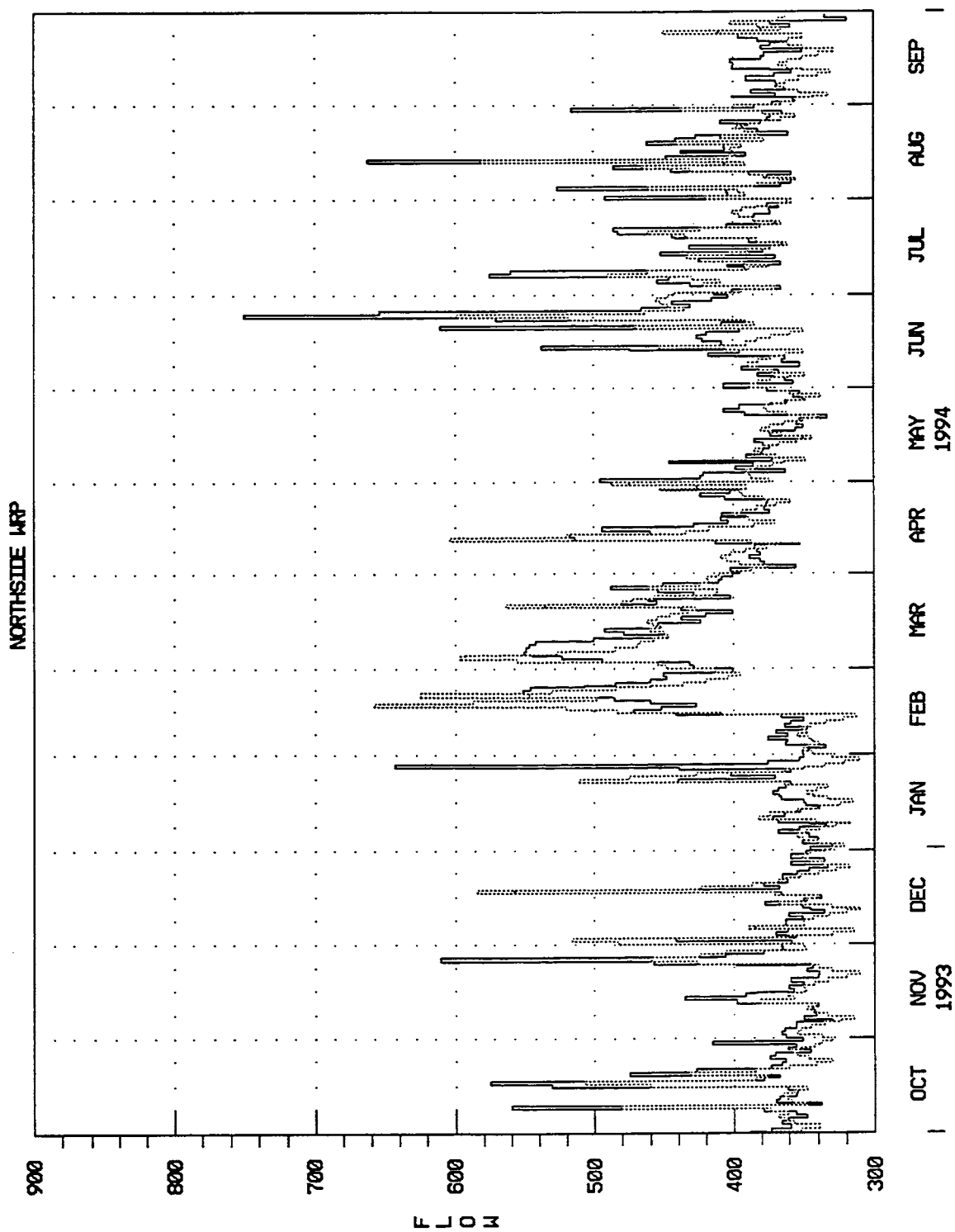


Figure 4

Budget 7 - Simulation of the MWRDGC Northside Water Reclamation Facility

— OBSERVED FLOW
 SIMULATED FLOW

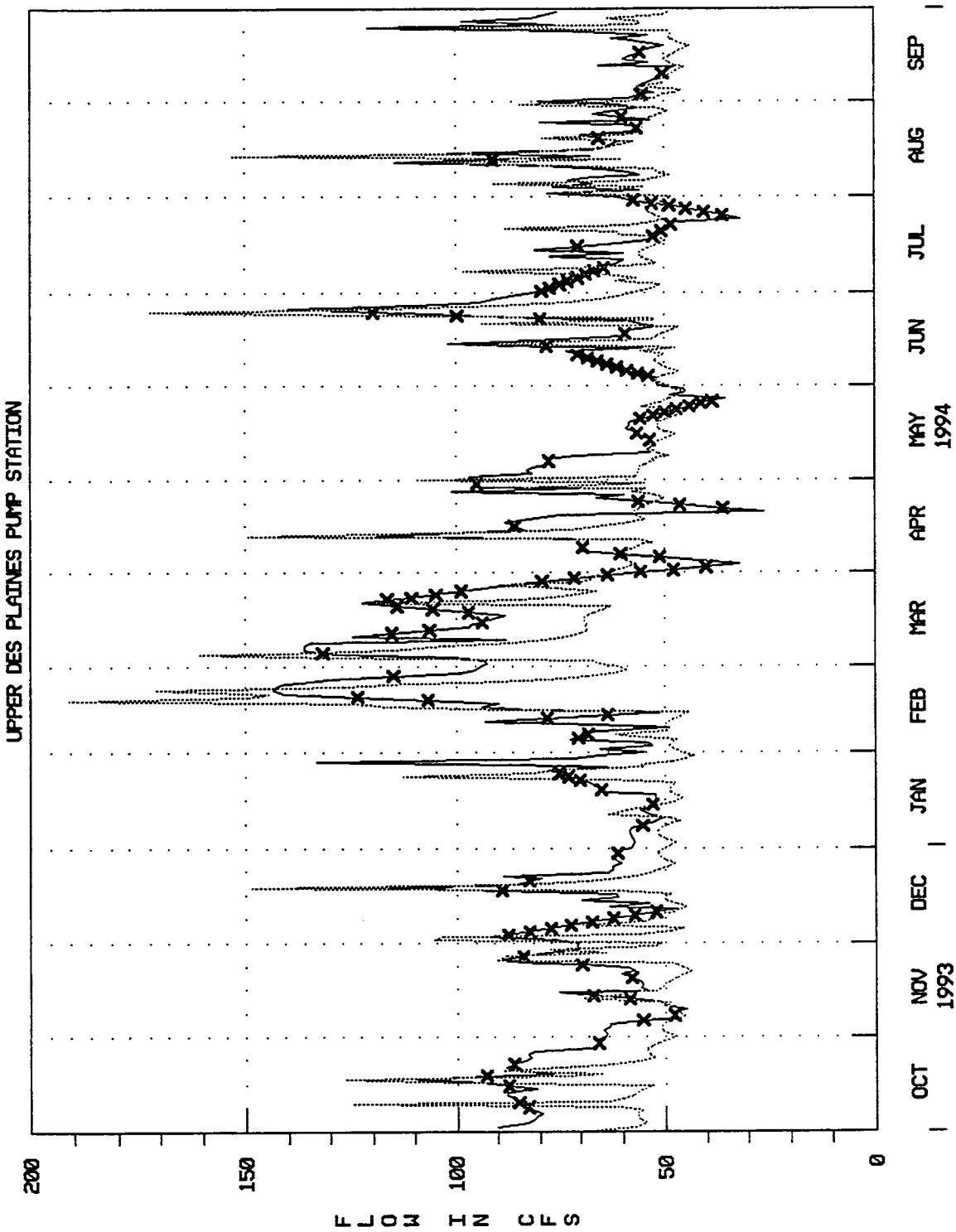


Figure 5
Budget 8 - Simulation of the MWRDGC Upper Des Plaines Pump Station

Budget 9: Mainstream and Des Plaines TARP Pumping Stations

Beginning 6 June 1993 the south and middle legs of the Des Plaines TARP system became operational. Consequently, these tunnels were added to the modeling of the TARP system for WY93. The Des Plaines tunnel system, like that of the Mainstream TARP system, flows by gravity to the West Southwest Water Reclamation facility in Stickney. Flows are pumped from the Des Plaines tunnel to the West Southwest plant using pumps independent of those used for the Mainstream tunnels. The Des Plaines system, like the Mainstream system, is modeled with independent index drop shafts which set the opening and closing sequence of various control structures along the tunnel system. The opening and closing sequences are based on water surface elevations at the index drop shafts. Water surface elevation trigger points are set at the downstream pumping station. These points tell the model when to turn the pumps on or off.

Budget 9 analyzes the water budget at the MWRDGC Mainstream and Des Plaines TARP Pumping Stations. The results of Budget 9 are used as a verification point for simulated flows. Budget 9 also is used for the purpose of computing a portion of Column 6 (Des Plaines River watershed runoff deduction). The deductible portion of Budget 9 includes groundwater seepage into the TARP tunnel walls and Des Plaines River watershed runoff captured by Mainstream and Des Plaines TARP as overflows. The modeling of Mainstream and Des Plaines TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Mainstream and Des Plaines TARP is contained in Figure 6. A more in-depth description of Mainstream TARP and the simulation model is contained in the Water Year 1986 report which is an appendix to the Diversion Accounting Annual Report for WY90-92 (USACE, 1994).

In analyzing the balance at the Mainstream and Des Plaines TARP Pumping Stations, weekly flows were used rather than daily flows. While MWRDGC maintains daily pumpage records, days with no pumpage occur frequently. Therefore, it is not possible to compute a daily S/R ratio.

The balance for WY94 of the inflow to the Mainstream and Des Plaines TARP Pumping Stations is good. The simulated to recorded flow ratio (S/R) for the Mainstream and Des Plaines TARP Pumping Stations is 1.23, indicating that the simulated inflow volume is slightly greater than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.64, indicating an improvement in the ability of the model to predict trends in the pump station flows.

From a review of the plot of the simulated versus recorded flow at the pump station (Figure 7), it appears that the model responds similarly to recorded pumpage record. However, the model is sometimes out of phase with the observed record. This could be the result of simulated pumpages occurring sooner and more frequently than actual pumpages. The TNET model pumps normally turn on sooner and pump more frequently in order to maintain computational stability during a simulation.

In summary, it appears that the simulation of the Mainstream and Des Plaines TARP systems is reasonable. However, there is concern regarding the difference in simulated and recorded pumpage time series.

Budget 10: Stickney Water Reclamation Facility

Budget 10 analyzes the water balance at the MWRDGC Stickney Water Reclamation Facility (Figure 8). Simulated Mainstream TARP pumpages from Budget 9 are no longer combined with simulated interceptor inflow to the Stickney Water Reclamation Facility to derive the total simulated inflow to the Stickney Facility. Instead, only simulated interceptor inflows are compared with recorded interceptor inflows to assess the accuracy of the simulation. The decision to not include TARP pumpages in the treatment plant budgets was based on the fact that the TARP systems are already analyzed in separate budgets. Including TARP pumpages in the treatment plant budgets is detrimental to the statistical results of the treatment plant budgets, since the TARP models generally do not respond as well. When simulations of interceptor flows are treated separately, the response of the hydrologic runoff models (HSPF) and the hydraulic sewer routing models (SCALP) can be better isolated and not diluted by the TARP model results, which are analyzed separately on their own merits and contained in their own budgets (Budgets 9 and 11).

Overall, the balance for WY94 of the inflow to the Stickney facility is very good. The simulated to recorded flow ratio (S/R) for the Stickney is 1.04, indicating that the simulated interceptor inflow volume is greater than the recorded interceptor inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.77, indicating that the model performed well in predicting the trends in the interceptor inflow hydrographs to the Stickney facility.

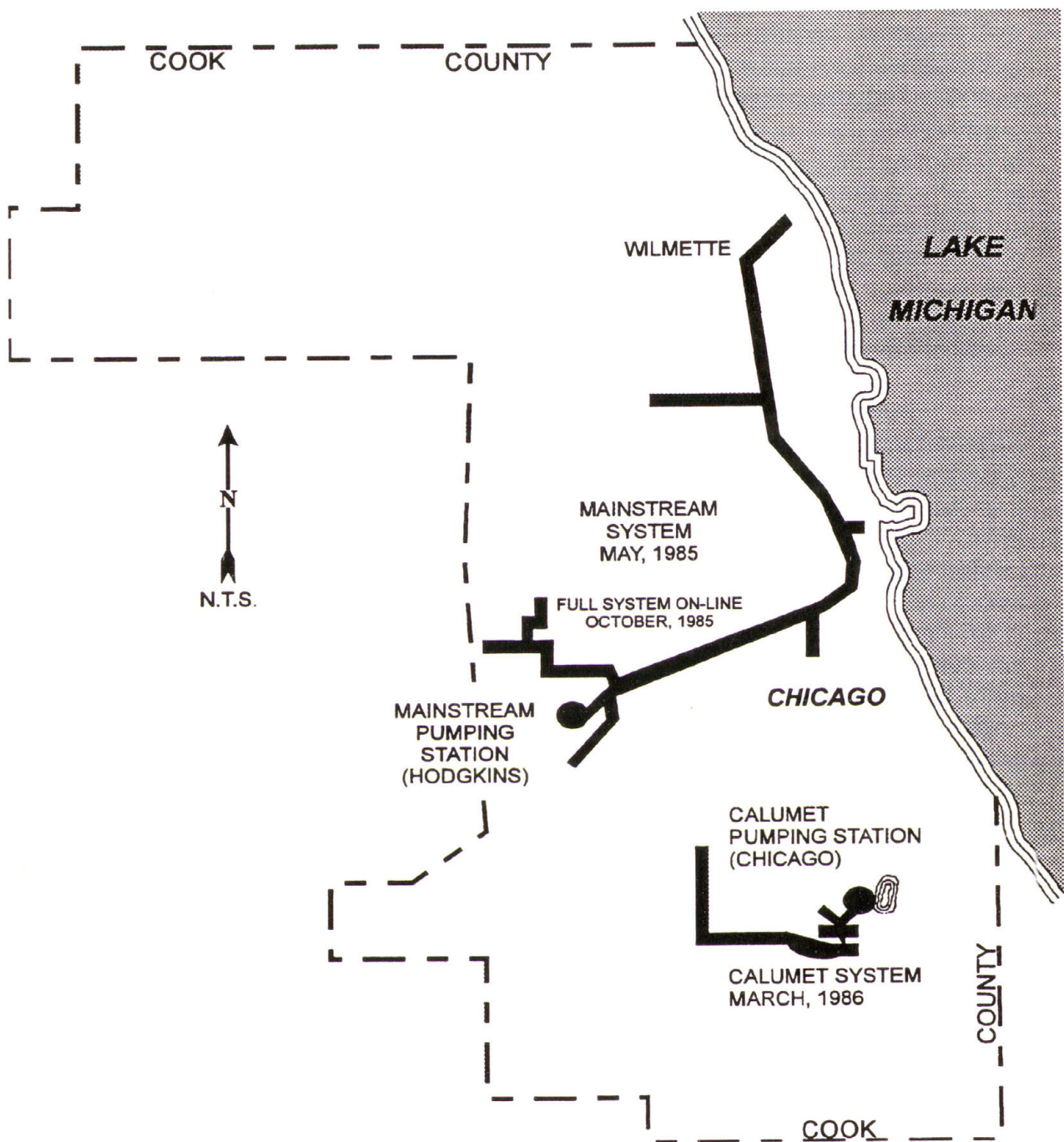


Figure 6
Map of Mainstream and Calumet TARP

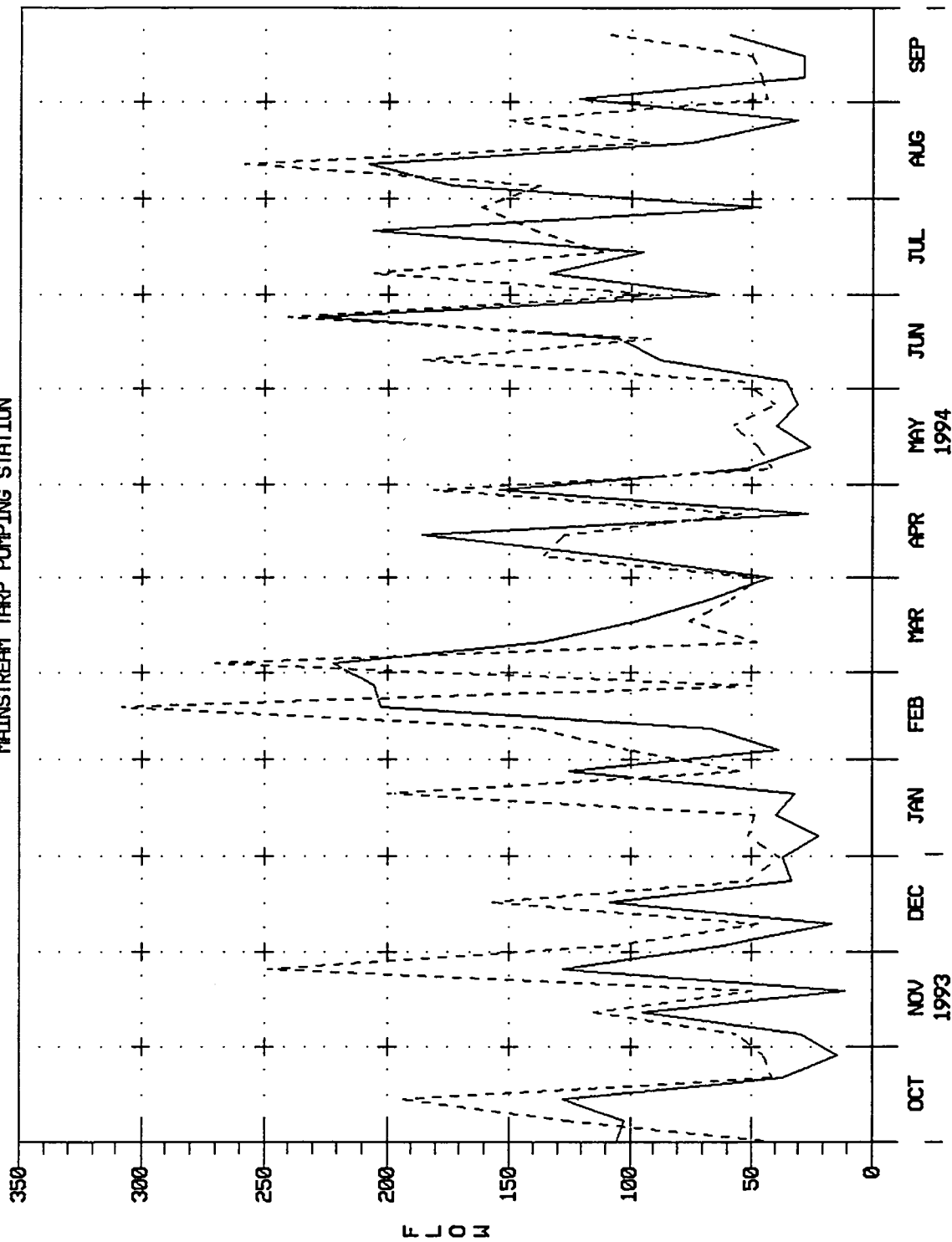


Figure 7

Budget 9 - Simulation of the MWRDGC Mainstream TARP Pumping Station

— OBSERVED FLOW TO STICKNEY WRP
 --- SIMULATED FLOW TO STICKNEY WRP

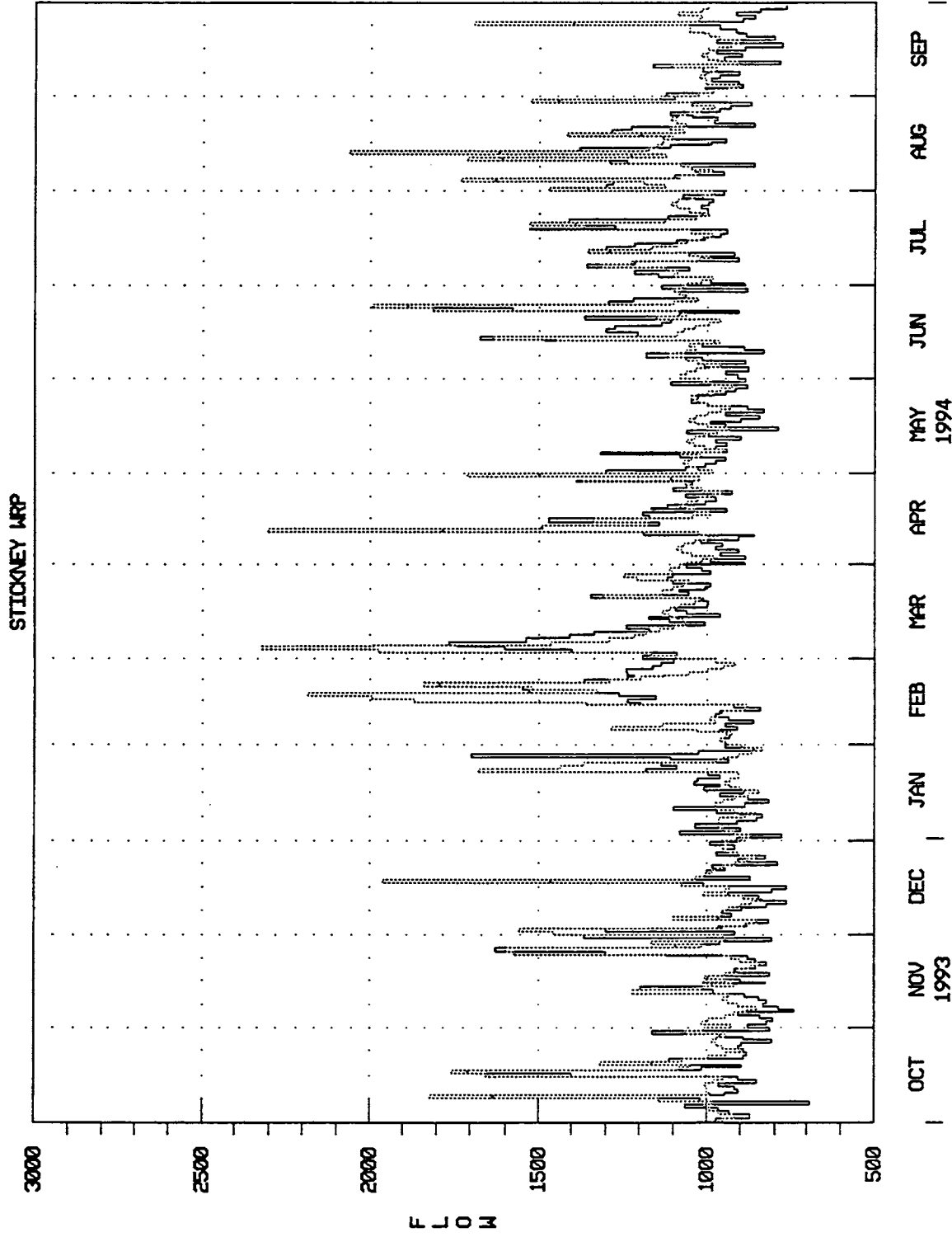


Figure 8

Budget 10 - Simulation of the MWRDGC Stickney Water Reclamation Facility

— OBSERVED FLOW NOT INCL. TRRP
 SIMULATED FLOW NOT INCL. TRRP

Budget 11: Calumet TARP Pumping Station

Budget 11 analyzes the water budget at the MWRDGC Calumet TARP Pumping Station (Figure 9). The results of Budget 11 are used as a verification point for simulated flows. The modeling of Calumet TARP is performed using the Tunnel Network (TNET) dynamic hydraulic model. A simplified map of Calumet TARP is contained in Figure 6. A more in-depth description of Calumet TARP and the simulation model is contained in the Water Year 1987 report contained in the Diversion Accounting Annual Report for WY90-92 (USACE, 1994).

In analyzing the balance at the Calumet TARP Pumping Station, weekly flows were used instead of daily flows. While MWRDGC maintain daily pumpage records, days with no pumpage occur frequently. Therefore, it is not possible to compute a daily S/R ratio.

The balance for WY94 of the inflow to the Calumet TARP Pumping Station is fair. The simulated to recorded flow ratio (S/R) for the Calumet TARP Pumping Station is 0.75 indicating that the simulated inflow volume is significantly less than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.51, indicating the need for improving to predict trends of the recorded Calumet TARP pumpages.

Volume matching between the simulated and recorded Calumet TARP pumpages also was more difficult for WY94 as evidenced by the 0.75 S/R ratio. Because of the instability of the TARP model, as well as uncertainties in the Calumet TARP system, it was difficult to improve on this ratio. However, as the system is presently modeled, this does not impact the computed diversion, since all Des Plaines River watershed areas whose overflows are modeled as tributary to Calumet TARP are also modeled such that "non-captured" overflows flow to rivers that are tributary to the CSSC. Therefore, whether or not these Des Plaines River watershed runoff flows enter the tunnel or not, they are presently included in the Des Plaines River watershed runoff deduction in Column 6. This assumption will remain until separately sewered areas are modeled such that actual areas are used instead of effective areas in the hydraulic models. This has been discussed in the WY90 diversion accounting report.

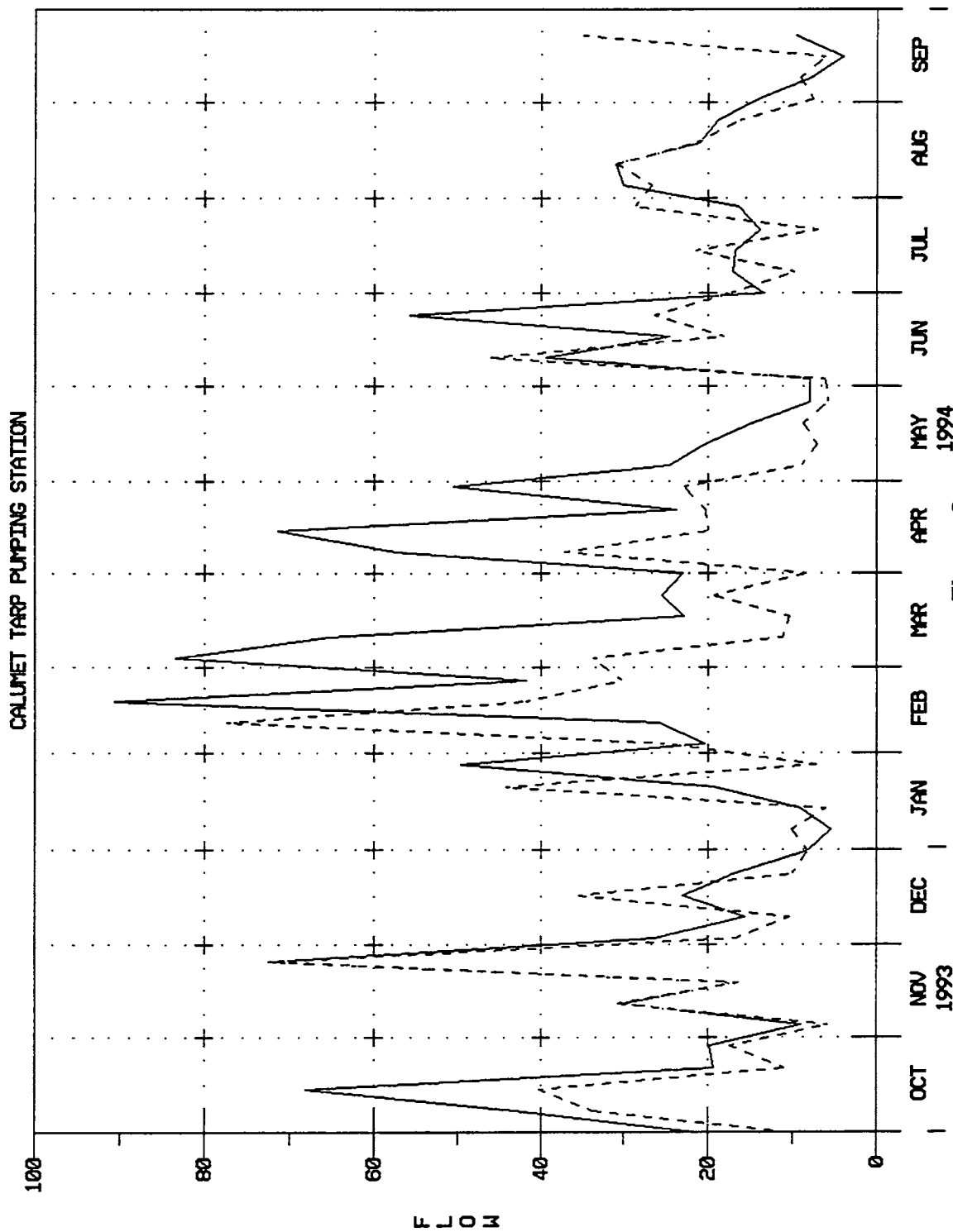


Figure 9
Budget 11 - Simulation of the MWRDGC Calumet TARP Pumping Station

— OBSERVED FLOW TO CALUMET WRP
 - - - SIMULATED FLOW TO CALUMET WRP

Budget 12: Calumet Water Reclamation Facility

Budget 12 analyzes the water balance at the MWRDGC Calumet Water Reclamation Facility (Figure 10). Simulated Calumet TARP pumpages from Budget 11 are no longer combined with simulated interceptor inflows to the Calumet Water Reclamation Facility to derive the total simulated inflow to the Calumet Facility. Instead, only simulated interceptor inflows are compared with recorded inflows to assess the accuracy of the simulation. This was revised for the same reasons as outlined previously in the discussion for Budget 10.

The annual simulated to recorded flow ratio (S/R) and the coefficient of correlation for the Calumet Water Reclamation Facility are considered good. The S/R ratio is 1.02 indicating that the simulated Calumet interceptor flow volume was slightly higher than the recorded interceptor flow volume. The coefficient of correlation was 0.80 indicating a good correlation between simulated and recorded interceptor flows.

Budget 13: Lemont Water Reclamation Facility

Budget 13 analyzes the water balance at the MWRDGC Lemont Water Reclamation Facility (Figure 11). Overall, the balance for WY94 of the inflow to the Lemont facility is good. The simulated to recorded flow ratio (S/R) for the Lemont is 0.82, indicating that the simulated inflow volume was slightly less than the recorded inflow volume. The coefficient of correlation (R) of simulated to recorded flow is 0.71, indicating that the model predicted the inflow hydrograph to the Lemont facility fairly well.

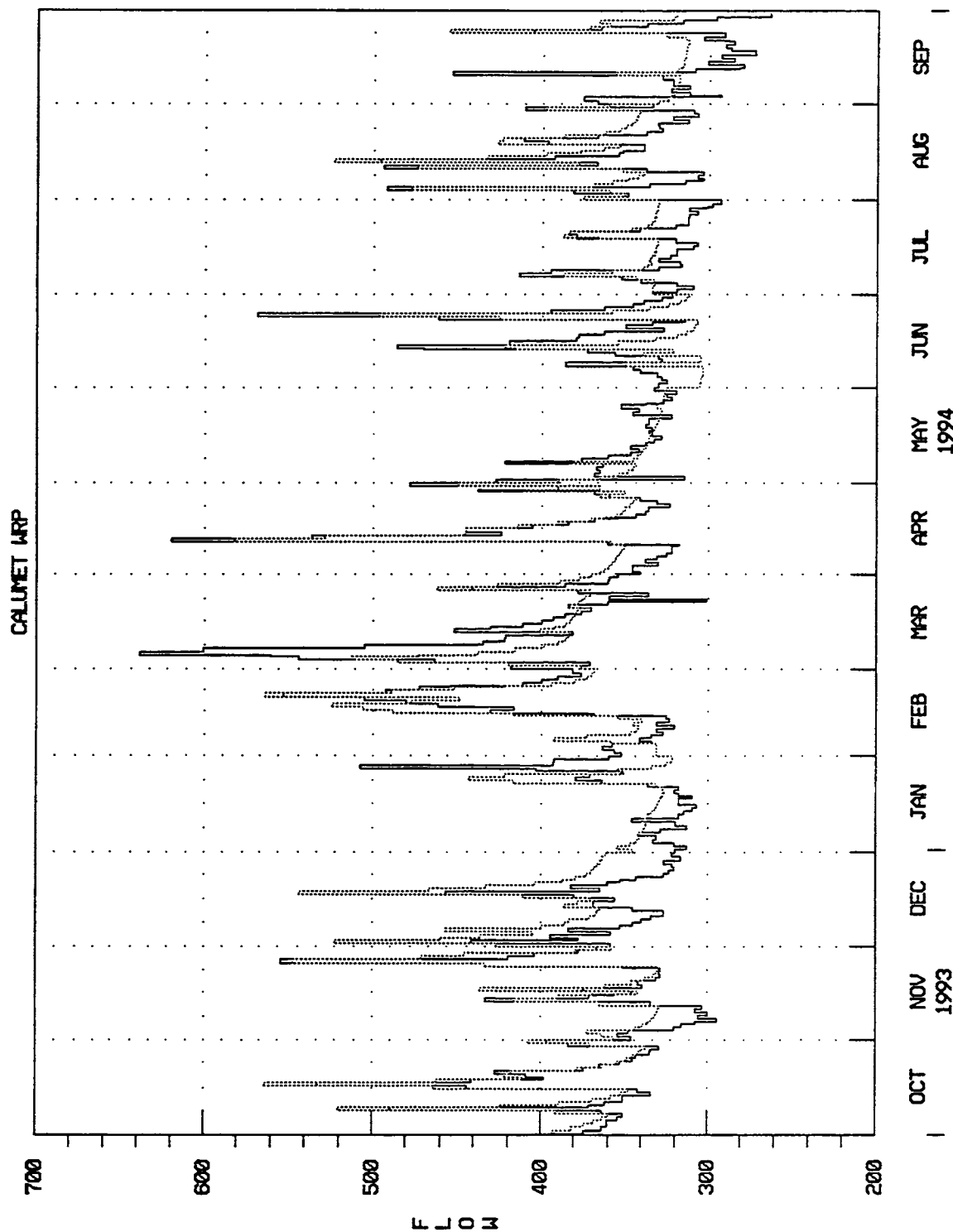


Figure 10

Budget 12 - Simulation of the MWRDGC Calumet Water Reclamation Facility

— OBSERVED FLOW NOT INCL. TARP
 SIMULATED FLOW NOT INCL. TARP

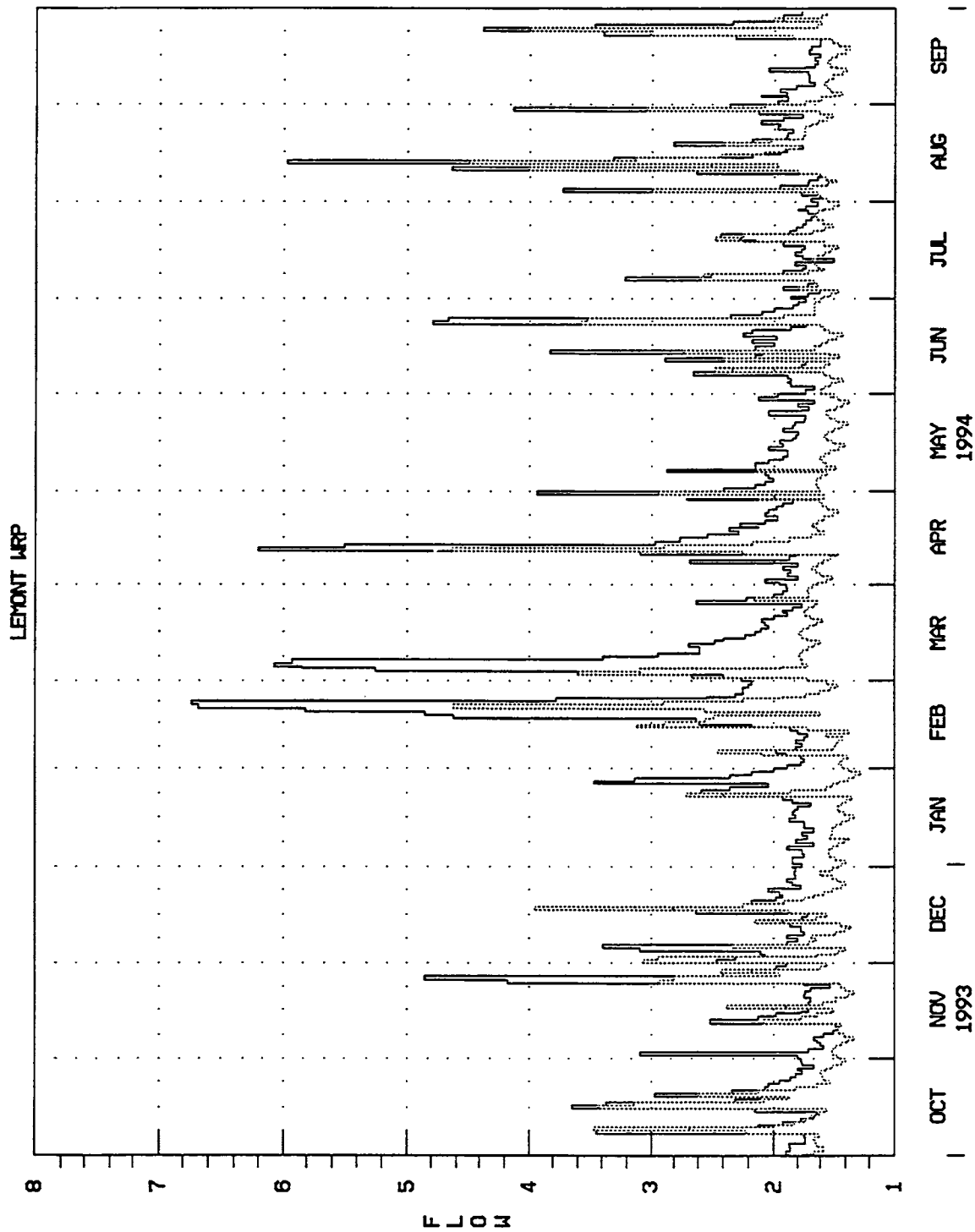


Figure 11

Budget 13 - Simulation of the MWRDGC Lemont Water Reclamation Facility

— OBSERVED FLOW
 SIMULATED FLOW

Budget 14: CSSC System Balance

Budget 14 compares the inflows and outflows to the CSSC system (Figure 12). The inflow components include direct diversions through the lakefront structures, stormwater runoff discharged to the canal system, and domestic water supply whose effluent discharges to the canal system. The outflows from the canal system include the discharge past the Romeoville AVM, backflows through the lakefront structures and withdrawals upstream of Romeoville by Argonne National labs and Uno-Ven Corporation. The individual components are presented in Table 8 for WY94.

Overall, the balance for WY94 between the inflows to the canal system and the outflows from the canal system is very good. The S/R (inflow/outflow) for the canal system is 0.98, indicating that the inflow to the canal system is slightly less than the outflow from the canal system. The average measured/simulated inflow was 3,036.7 cfs while the average measured/simulated outflow was 3,105.3 cfs. The difference is 68.6 cfs (2.4%) for WY94, as compared to 59.2 cfs (1.4%) for the previous water year, WY93.

The coefficient of correlation (R) of inflow to outflow is 0.87, indicating that the time series trends of inflow to outflow are well correlated. The coefficient of correlation is based on daily flows. Therefore, timing between inflows and measured outflows at Romeoville is a major factor, especially during changes in flow that occur at the beginning or end of a day. Part of the difference in the correlation is the result of travel time from inflow locations downstream to the Romeoville AVM site. Therefore, variability in the coefficient of correlation from year to year may be attributed to the variability in the timing of significant flow changes during a particular year.

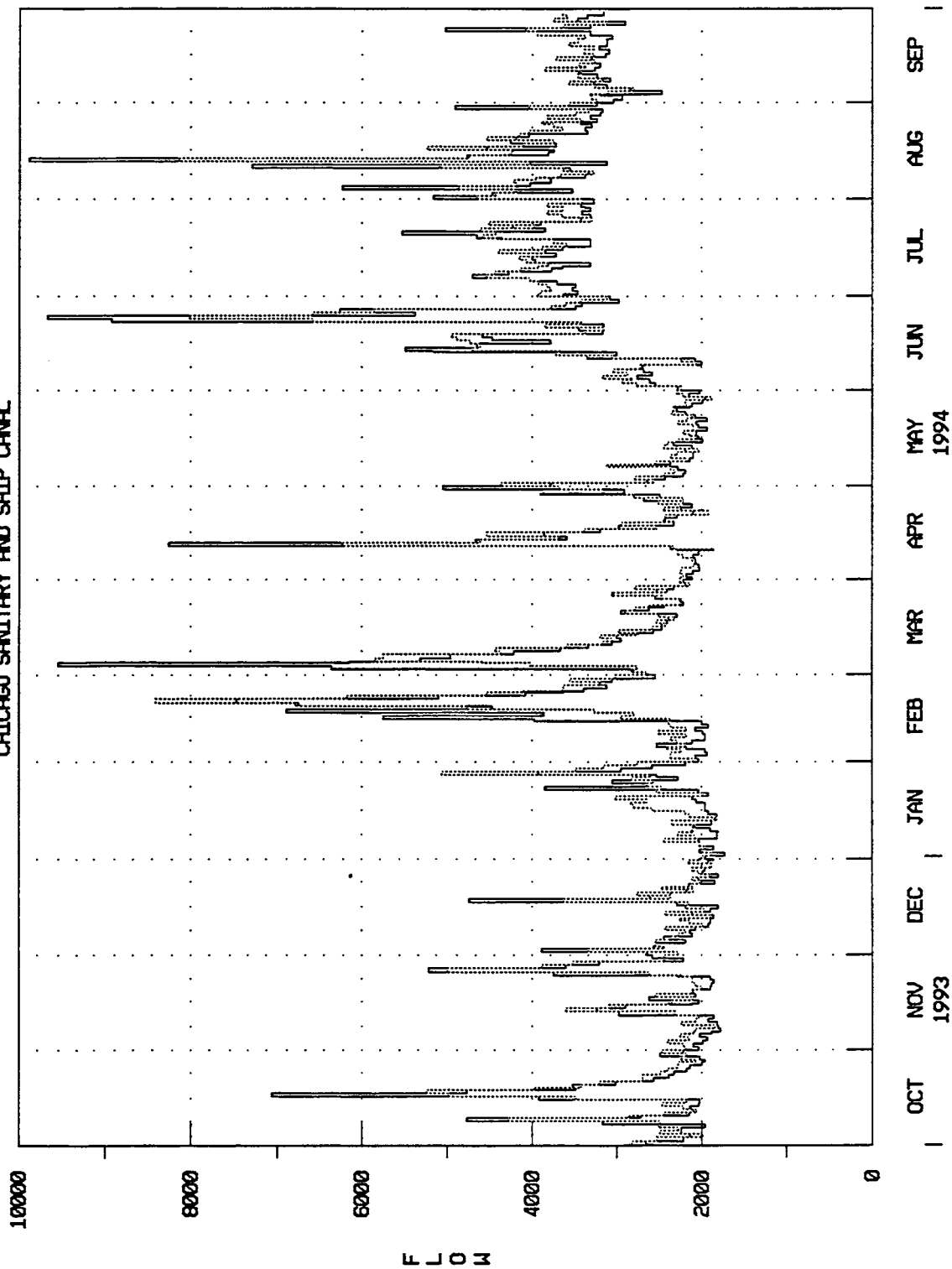


Figure 12
Budget 14 - CSSC System Balance

Table 8

WY 1994 Summary of Flow Components for the CSSC System Balance

INFLOWS (cfs)	
Lake Controlling Structures (measured)	
- Wilmette Controlling Works	37.8
- Chicago River Controlling Works	233.6
- O'Brien Lock and Dam	225.9
Streamflows (measured)	
- North Branch Chicago River at Niles	86.5
- Little Calumet River at South Holland	173.5
- Grand Calumet River at Holman Ave.	49.2
MWRDGC Water Reclamation Facilities (measured)	
- Northside	390.3
- Stickney	1,140.6
- Calumet	402.6
- Calumet TARP Pumpage to River	0.0
- Lemont	2.2
Other Point Sources (measured)	7.7
Summit Conduit (simulated)	11.6
Combined Sewer Overflows (simulated)	139.3
Direct Runoff to CSSC (simulated)	135.9
TOTAL INFLOWS (cfs)	3,036.7
OUTFLOWS (cfs)	
Cal-Sag Flow Transferred to Calumet WRP as Steel Mill Blow-down	3.8
Lake Front Backflows	0.0
Argonne Laboratory	0.5
Uno-Ven Corporation	7.2
USGS AVM Record	3,093.8
TOTAL OUTFLOWS (cfs)	3,105.3
DIFFERENCE (cfs)	-68.6

Areas for Improvement

Impervious Model Estimates

During a review of the detailed Lake Michigan watershed runoff study conducted by the Corps of Engineers during the Lake Michigan Diversion Accounting mediations, it was determined that the hydraulic connectivity of the impervious areas used in the rainfall-runoff modeling was not fully accounted for when the models were revised for the WY90 accounting. As a result, the models appear to overestimate runoff. However, the treatment plant balances remained very good after the model revisions. The most significant effect is in the simulated overflows, which greatly increased after WY90. A detailed study should be conducted of the pervious and impervious percentages applied to the various landuse types used for the model development should be conducted and, if necessary, the hydraulically connected impervious areas within the SCALP models should be adjusted for each SCA.

Tunnel and Reservoir Plan Models

The TARP models should be revised such that they are more representative of actual operating conditions, if possible. Due to model instability, simulated gate closing and pump operation parameters have been simplified or modified. Improvements for model stability are required before the models can better represent the operating procedures. Even after this change, representation of "actual" operating procedures may be difficult due to deviations from the TARP system operation plan, i.e. pumping at night, down times for various pumps, changes in pump ratings, implementation of forecasting algorithms, etc.

The primary purpose of the TARP models is to accurately estimate deductible components of the diversion such as the Des Plaines River watershed runoff and groundwater infiltration through tunnel walls. Low flows, or dry weather flows, must be modeled accurately so that groundwater infiltration into the two TARP systems is properly modeled. These flows constitute a substantial deduction to the diversion and are included in the deductible groundwater flows of Column 4. Therefore, the estimates of simulated groundwater infiltration rates need to be updated periodically to better match the simulated to the recorded dry-weather flows. Procedures for updating simulated dry-weather flows are similar to those used for improving the simulated groundwater infiltration rates for WY89 Calumet TARP as discussed in

the WY89 Accounting Report in the Lake Michigan Diversion Accounting Annual Report for WY90-92.

In the Calumet system, some sanitary sewers are connected to TARP. These sewers must be accurately accounted for in the modeling of groundwater infiltration since they contribute to the baseflow, or dry weather, flow into TARP. Currently, some uncertainty remains as to the connection of these separately sewered areas. For accurate modeling of the Calumet TARP system, these connections need to be verified and adjusted if necessary.

Other areas exist where the TARP models can be improved. First, the modeling should more accurately simulate MWRDGC operational procedures which include less frequent pumping and pumping during the night. Second, the incorporation of a pseudo-forecasting algorithm would allow the model to simulate MWRDGC dewatering procedures prior to a storm. Third, dynamic constituent (inflow-infiltration versus sanitary versus groundwater) tracking can be incorporated to allow more accurate determination of the deductible components of TARP flow. Currently, constant constituent proportions, based on annual volumes, are applied to all simulated pumpages from the TARP tunnels. Therefore, constituent flow percentages from TARP remain unchanged during an entire water year. Fourth, the inclusion of an algorithm to operate index dropshafts based on average water surface elevation in a tunnel reach would provide better simulation of "actual" operations. Sudden, localized changes in water surface elevations would not result in frequent opening and closing of control structure gates that regulate the flows into the drop shafts.

MWRDGC Upper Des Plaines Pump Station

A review of the Upper Des Plaines pump station and its flow record indicates that the flow at the pump station is suspect and subject to operator error. Better flow measurements are needed at the pump station. With better flow measurements, this site will become the most important point for calibrating and verifying the simulation models for the Des Plaines watershed. In the diversion calculation, the primary purpose of modeling is to calculate the deduction for runoff from the Des Plaines watershed that enters the CSSC. The Upper Des Plaines Pump Station is the only point at which a model of the inflow-infiltration can be calibrated and extrapolated to the remaining portions of the Des Plaines River watershed. Because of the many problems associated with the current measurements of flow at this site, the benefits as the primary model calibration point have yet to be realized. Installation of better flow measurement equipment at the pump station would facilitate better model calibration.

O'Hare and Egan Basin Flow Transfer

A portion of the flows originating in the O'Hare and Egan Water Reclamation Plants' (WRP) service basins are transferred east to the Northside WRP. The extent of this transfer of flow is not known and the diverted flow is not currently measured. An estimate of the annual flow transfer is provided by MWRDGC. The total O'Hare-Egan flow transfer has been estimated by the MWRDGC as 31 cfs for the past several years.

This transfer is significant to diversion since the O'Hare and Egan facilities discharge outside of the CSSC while the Northside WRP discharges flows that reach the CSSC. Therefore, this transfer contains two components that are deductions to the flow measured in the CSSC. The two deductible components are groundwater pumpage contained in the sanitary portion of the transfer (Column 4), and diverted Des Plaines River watershed runoff (Column 6).

To determine the two deductible components requires an estimate of the sanitary and runoff portions of the flow transfer. Presently the sanitary and runoff portions of the flow transfer are estimated using the same constituent (sanitary, inflow, and infiltration) proportions simulated for the Upper Des Plaines Pump Station by SCALP. Additionally, estimates must be made of the groundwater and Lake Michigan water components of the sanitary portion of the transfer. For WY94, the estimated water supply from the O'Hare and Egan service basins was composed of 3.7 percent groundwater (0.8 cfs) and 96.3 percent Lake Michigan water (21.6 cfs). The diverted Des Plaines river watershed runoff was estimated at 8.6 cfs.

For future accounting, simply measuring the basin transfer will not provide any information on the component makeup of the transfer. Thus, a review of the complex hydraulics and hydrology is necessary to determine the best procedure for estimating these flows. Several alternatives, including flow measurement and modeling are under consideration. A more detailed discussion of the flow transfer can be found in the Lake Michigan Diversion Accounting WY86 Report in the Lake Michigan Diversion Accounting WY90-92 Annual Report.

Summary

In compliance with the modified 1980 U.S. Supreme Court decree, the WY94 diversion was computed using the best engineering technology available to date.

Overall, the simulations that comprise a significant portion of the diversion accounting computations worked well. The two most significant budgets to the diversion accounting computations, Budget 7, Northside Water Reclamation Facility, and Budget 10, Stickney Water Reclamation Facility, performed very well. Together, Budgets 7 and 10 compute the majority of the deductible Des Plaines River watershed runoff. These budgets have simulated to recorded ratios of 0.97 and 1.04 and correlations of 0.78 and 0.77, respectively. Given the complexity of the hydrologic cycle in the heavily urbanized Chicago metropolitan area, and given the number of human and other factors that cannot be adequately represented in numerical modeling procedures, the results of these two (2) budgets are good. Additionally, results for Budget 12, the Calumet WRP, were also very good. This budget also models a portion of the deductible Des Plaines River watershed runoff. The S/R ratio was 1.02 while the coefficient of correlation was 0.80.

The WY94 diversion accountable to the State of Illinois is 3,063.6 cfs. This flow is 136.4 cfs greater than the 3,200 cfs average specified by the Decree. The 40 year running average beginning with WY81 and rounded to the nearest cfs is 3,456 cfs, and the cumulative deviation from the 3,200 cfs average is -3,589 cfs-years. The negative cumulative deviation indicates a water allocation deficit and the maximum allowable deficit is 2,000 cfs-years.

References

1. Barkau, Robert L. 1991. *Modeling of the Chicago Tunnel and Canal System*. Prepared for Christopher B. Burke Engineering Ltd. as part of reference 2.
2. Christopher B. Burke Engineering, Ltd. 1991. *Data Collection and Model Revisions*. Prepared for the U.S. Army Corps of Engineers, Chicago.
3. Christopher B. Burke Engineering, Ltd. 1990. *Infiltration and Inflow Study and Diversion Accounting Model Modification*. Prepared for the U.S. Army Corps of Engineers, Chicago.
4. Espey, William H., Harry H. Barnes, and Svein Vigander. 1981. *Lake Michigan Diversion Findings of the Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures*. Prepared for the U.S. Army Corps of Engineers, Chicago.
5. Espey, William H., Harry H. Barnes, and David Westfall. 1987. *Lake Michigan Diversion Findings of the Second Technical Committee for Review of Diversion Flow Measurements and Accounting Procedures*. Prepared for the U.S. Army Corps of Engineers, Chicago.
6. Hart, Dale E., and Richard G. McGee. 1985. *Final Report - Lockport Power Plant Sluice Gate and Control Works Discharge Evaluation*. Waterways Experiment Station. Vicksburg, MS.
7. Illinois State Water Survey. 1991. *Installation and Operation of a Dense Rainage Network to Improve Precipitation Measurements for Lake Michigan Diversion Accounting: Water Year 1990*.
8. International Joint Commission. 1981. *Great Lakes Diversions and Consumptive Uses, Annex F, Consumptive Use*.
9. Keifer Engineering. 1982. *Input Data CRSM for Existing Conditions - Mainstream System*. Prepared for the U.S. Army Corps of Engineers, Chicago.
10. Kleinbaum, David G., and Lawrence L. Kupper. 1978. *Applied Regression Analysis and Other Multivariable Methods*. Wadsworth Publishing Company.

11. Metropolitan Water Reclamation District of Greater Chicago. 1984. *1984 Facility Planning Study - MSDGC Update Supplement and Summary*.
12. Metropolitan Water Reclamation District of Greater Chicago. 1989. *1988 Annual Report of the Maintenance and Operations Department*.
13. Neubauer, Ronald A. 1990. Request for TARP Information from the Army Corps of Engineers. Memorandum to Mr. William Eyre, Supervising Civil Engineer, Metropolitan Water Reclamation District of Greater Chicago.
14. Northeastern Illinois Planning Commission. 1985. *Lake Michigan Diversion Accounting Manual of Procedures*.
15. Kleinbaum, David G., and Lawrence L Kupper. 1978. *Applied Regression Analysis and Other Multivariable Methods*. Wadsworth Publishing Company.
16. Rust Environment & Infrastructure. 1993. *Diversion Accounting Update for the New 25-Gage Precipitation Network*.
17. Steel, Robert G. D., and James H. Torrie. 1980. *Principles and Procedures of Statistics - A Biometrical Approach*. McGraw-Hill, Inc.
18. U.S. Army Corps of Engineers. 1990. *Lake Michigan Diversion Accounting 1989 Annual Report Including WY84 and WY85 Accounting*.
19. U.S. Army Corps of Engineers. 1990. *Current Meter Measurements of Discretionary and Leakage Flows at the Chicago River Controlling Works, O'Brien Lock and Dam, and the Wilmette Controlling Works*.
20. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Annual Report, Water Years 1990-92*.
21. U.S. Army Corps of Engineers. 1995. *Lake Michigan Diversion Accounting Water Year 1993 Annual Report*.
22. U.S. Army Corps of Engineers. 1996. *Lake Michigan Diversion Accounting Water Year 1994 Annual Report*.
23. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1986 Report*.

24. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1987 Report.*
25. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1988 Report.*
26. U.S. Army Corps of Engineers. 1994. *Lake Michigan Diversion Accounting Water Year 1989 Report.*
27. U.S. Army Corps of Engineers. 1995. *Lake Michigan Diversion Accounting Water Year 1990 Report.*
28. U.S. Army Corps of Engineers. 1996. *Lake Michigan Diversion Accounting Water Year 1991 Report.*
29. U.S. Army Corps of Engineers. 1996. *Lake Michigan Diversion Accounting Water Year 1992 Report.*
30. U.S. Geological Survey. 1984. *Streamflow and Water Quality of the Grand Calumet River, Lake County, Indiana, and Cook County, Illinois.*
31. U.S. Geological Survey. 1992. *Water Resources Data, Illinois, Water Year 1991, Volume 2, Illinois River Basin.*
32. U.S. Geological Survey. 1994. *Comparison, Analysis, and Estimation of Discharge Data from Two Acoustic Velocity Meters on the Chicago Sanitary Ship Canal at Romeoville, Illinois.*
33. U.S. Geological Survey. 1994. *Measurements of Leakage through Chicago River Controlling Works and Other Control Structures Near Chicago Illinois.*
34. Wisconsin et. al., v. Illinois et. al., Michigan v. Illinois et. al. New York v. Illinois et. al. U.S. 2, 3, and 4, Original 1 - 18, 1980.

Appendix A

Summary of Daily Diversion Flows

Computations:

1. Column 3 equals the sum of Columns 1 and 2.
2. Column 8 equals the sum of Columns 4 through 7.
3. Column 10 equals Column 3 minus Column 8 plus Column 9.



Deductions from the Romeoville Gage Record



Additions to the Romeoville Gage Record

Lake Michigan Diversion Accounting - WY1994
October 1993 - Summary of Diversion Flows (All in cfs)

Lake Michigan Diversion Accounting WY 1994	Romeoville AVM Gage Record	Diversion Above the Gage	Total Flow Through the Canal	Groundwater Pumpage Discharged into the Canal	Water Supply Pumpage from Indiana Reaching the Canal	Runoff from the Des Plaines River Watershed Reaching the Canal	Lake Michigan Pumpage by Federal Facilities Discharged to the Canal	Total Deduction from the Romeoville Gage Record	Lake Michigan Pumpage Not Discharged to the Canal	Total Diversion Accountable to the State of Illinois	Pumpage from Lake Michigan Accountable to the State of Illinois	Runoff from the Diverted Lake Michigan Watershed	Direct Diversion Accountable to the State of Illinois
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Oct-93	2912.0	0.5	2912.5	45.8	37.0	155.9	1.0	239.5	217.9	2890.8	1731.8	524.6	151.0
02-Oct-93	2829.0	0.4	2829.4	39.0	39.3	128.8	1.0	206.1	218.8	2842.1	1719.7	433.2	198.0
03-Oct-93	2528.0	0.5	2528.5	99.8	35.0	135.0	1.0	270.7	216.2	2474.0	1685.4	404.0	171.0
04-Oct-93	1986.0	0.5	1986.5	37.1	39.4	104.3	1.0	181.8	219.9	2024.8	1744.7	318.2	163.0
05-Oct-93	2497.0	0.4	2497.4	53.8	38.8	104.5	1.0	198.0	221.0	2520.4	1765.8	300.1	230.0
06-Oct-93	2282.0	0.5	2282.5	61.6	36.6	102.1	1.0	201.3	219.7	2300.9	1791.9	282.8	162.0
07-Oct-93	2505.0	0.7	2505.7	51.4	38.6	93.6	1.0	184.6	223.5	2444.8	1801.7	251.2	201.0
08-Oct-93	2479.0	0.6	2479.6	53.8	56.2	386.3	1.0	497.3	220.3	2202.6	1789.4	1011.5	213.0
09-Oct-93	4282.0	0.4	4282.4	154.0	87.0	664.3	1.0	916.3	219.8	3585.8	1674.7	2418.7	115.0
10-Oct-93	2866.0	0.6	2866.6	269.2	39.9	282.7	1.0	592.7	215.3	2489.2	1656.5	658.8	157.0
11-Oct-93	2444.0	0.5	2444.5	47.7	35.2	147.0	1.0	230.9	214.3	2427.9	1729.3	368.4	151.0
12-Oct-93	2054.0	0.5	2054.5	37.1	39.4	111.1	1.0	188.6	216.4	2082.3	1738.8	294.8	136.0
13-Oct-93	2209.0	0.4	2209.4	70.3	40.1	106.2	1.0	217.5	219.1	2210.9	1707.9	274.6	154.0
14-Oct-93	2463.0	0.6	2463.6	51.1	36.0	89.4	1.0	177.5	218.3	2504.4	1702.9	234.9	181.0
15-Oct-93	2167.0	0.5	2167.5	48.0	38.3	82.0	1.0	169.2	221.1	2219.4	1739.9	217.6	181.0
16-Oct-93	3496.0	0.5	3496.5	142.9	43.8	627.2	1.0	714.8	217.8	2999.5	1639.9	1820.4	193.0
17-Oct-93	4976.0	0.4	4976.4	172.7	52.8	761.3	1.0	987.7	218.9	4207.6	1670.1	4480.9	179.0
18-Oct-93	5226.0	0.5	5226.5	275.8	42.7	319.4	1.0	638.9	219.4	4807.0	1731.5	2645.3	145.0
19-Oct-93	3974.0	0.6	3974.6	45.1	45.6	163.0	1.0	254.7	216.7	3936.6	1671.5	1479.4	167.0
20-Oct-93	3429.0	0.5	3429.5	44.7	43.7	306.1	1.0	395.4	217.8	3251.9	1692.1	1382.7	151.0
21-Oct-93	3209.0	0.4	3209.4	187.0	36.9	241.3	1.0	466.2	215.1	2958.3	1695.6	1076.3	106.0
22-Oct-93	2713.0	0.4	2713.4	38.9	35.5	133.7	1.0	209.0	222.9	2727.3	1716.8	691.7	128.0
23-Oct-93	2697.0	0.4	2697.4	61.5	35.8	112.3	1.0	200.5	214.2	2711.1	1679.5	543.4	184.0
24-Oct-93	2495.0	0.5	2495.5	89.2	37.0	111.7	1.0	238.8	216.1	2472.8	1663.9	473.0	185.0
25-Oct-93	2413.0	0.5	2413.5	37.3	43.7	84.3	1.0	166.3	218.2	2485.4	1714.7	380.6	162.0
26-Oct-93	2288.0	0.5	2288.5	46.7	46.6	81.6	1.0	175.9	217.3	2329.9	1733.1	343.8	149.0
27-Oct-93	2275.0	0.4	2275.4	80.1	39.1	89.1	1.0	209.2	215.8	2282.0	1701.9	340.4	112.0
28-Oct-93	2075.0	0.5	2075.5	52.1	33.8	75.5	1.0	162.3	217.6	2130.8	1707.5	269.1	77.0
29-Oct-93	2236.0	0.4	2236.4	35.8	36.0	65.1	1.0	137.8	214.5	2313.1	1671.6	235.1	109.0
30-Oct-93	2178.0	0.4	2178.4	79.9	50.8	61.0	1.0	212.7	214.8	2180.5	1670.5	496.6	128.0
31-Oct-93	2471.0	0.3	2471.3	71.4	56.8	90.3	1.0	208.5	217.2	2480.0	1607.6	651.2	116.0
Averages	2795.3	0.5	2795.8	83.3	42.5	191.1	1.0	317.9	217.9	2695.8	1709.9	815.6	156.6

Lake Michigan Diversion Accounting - WY1994 November 1993 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEDEVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Nov-93	2200.0	0.4	2200.4	64.3	38.1	85.5	1.0	158.8	216.7	2267.3	1685.7	325.0	113.0
02-Nov-93	2205.0	0.3	2205.3	85.9	33.5	74.7	1.0	195.1	216.0	2228.2	1688.0	494.8	104.0
03-Nov-93	2402.0	0.4	2402.4	49.9	33.4	60.4	1.0	144.6	218.3	2474.1	1696.3	401.4	109.0
04-Nov-93	2184.0	0.5	2184.5	37.6	35.9	53.8	1.0	128.2	218.2	2262.6	1710.4	287.6	137.0
05-Nov-93	2262.0	0.4	2262.4	88.2	56.0	69.9	1.0	215.0	214.3	2261.7	1688.9	301.2	148.0
06-Nov-93	2105.0	0.4	2105.4	35.8	45.4	48.1	1.0	130.2	214.1	2189.3	1677.7	236.9	146.0
07-Nov-93	2070.0	0.3	2070.3	76.5	32.9	62.3	1.0	172.7	213.3	2110.9	1657.1	236.6	101.0
08-Nov-93	1842.0	0.4	1842.4	49.0	33.7	48.7	1.0	133.3	217.1	1928.2	1714.1	194.1	111.0
09-Nov-93	2227.0	0.4	2227.4	35.8	37.0	43.4	1.0	117.1	214.9	2326.2	1689.5	176.7	111.0
10-Nov-93	2074.0	0.4	2074.4	60.1	37.0	52.0	1.0	150.0	216.1	2140.6	1693.4	186.7	129.0
11-Nov-93	2030.0	0.4	2030.4	90.4	35.9	61.3	1.0	188.5	216.1	2068.0	1698.7	204.9	111.0
12-Nov-93	2317.0	0.6	2317.6	61.6	37.0	310.0	1.0	399.5	217.8	2135.9	1679.7	1269.7	115.0
13-Nov-93	3611.0	0.4	3611.4	304.7	35.0	233.2	1.0	573.9	216.3	3262.8	1645.0	934.5	118.0
14-Nov-93	3101.0	0.3	3101.3	39.3	41.2	115.5	1.0	196.9	215.7	3120.1	1653.4	525.9	386.0
15-Nov-93	2385.0	0.4	2385.4	37.3	38.7	70.3	1.0	147.3	217.2	2465.3	1652.9	472.7	106.0
16-Nov-93	2350.0	0.4	2350.4	84.3	34.4	70.7	1.0	190.3	216.2	2376.3	1678.1	318.3	100.0
17-Nov-93	2111.0	0.4	2111.4	47.8	39.7	194.2	1.0	282.6	216.0	2044.8	1677.1	696.4	95.0
18-Nov-93	2555.0	0.4	2555.4	87.9	34.5	84.6	1.0	207.9	216.1	2663.6	1687.4	405.4	87.0
19-Nov-93	2117.0	0.5	2117.5	52.3	34.8	58.6	1.0	146.6	213.4	2184.3	1661.4	294.3	128.0
20-Nov-93	1991.0	0.3	1991.3	49.9	33.1	50.7	1.0	134.7	212.8	2069.4	1653.1	244.6	87.0
21-Nov-93	2083.0	0.4	2083.4	88.1	32.2	60.5	1.0	181.7	214.9	2116.6	1655.2	232.2	68.0
22-Nov-93	2111.0	0.4	2111.4	46.9	35.9	41.9	1.0	125.7	216.3	2202.0	1707.0	176.6	113.0
23-Nov-93	2119.0	0.4	2119.4	116.3	43.3	36.3	1.0	116.3	215.4	2218.5	1697.0	162.9	117.0
24-Nov-93	2228.0	0.4	2228.4	90.2	60.1	57.2	1.0	208.4	215.4	2236.4	1699.5	226.5	123.0
25-Nov-93	2623.0	0.3	2623.3	65.9	44.3	44.2	1.0	555.4	217.4	2265.3	1638.9	1674.0	181.0
26-Nov-93	4993.0	0.4	4993.4	239.3	40.4	454.4	1.0	735.1	212.2	4470.5	1637.7	2863.7	95.0
27-Nov-93	3880.0	0.3	3880.3	333.3	35.4	248.8	1.0	618.5	212.0	3473.8	1628.6	1582.3	83.0
28-Nov-93	3527.0	0.3	3527.3	115.3	34.6	287.6	1.0	438.4	214.5	3303.4	1627.6	1203.6	81.0
29-Nov-93	2453.0	0.4	2453.4	54.1	35.8	83.4	1.0	174.3	215.6	2494.7	1691.4	489.6	90.0
30-Nov-93	2458.0	0.3	2458.3	47.2	34.6	60.9	1.0	143.7	214.5	2628.1	1687.0	346.7	103.0
Averages	2486.5	0.4	2486.9	84.5	38.1	120.1	1.0	243.7	216.3	2468.6	1675.6	572.3	119.9

Lake Michigan Diversion Accounting - WY1994
December 1993 - Summary of Diversion Flows (All in cfs)

Lake Michigan Diversion Accounting WY 1994	Romeoville AVM Gage Record	Diversion Above the Gage	Total Flow Through the Canal	Groundwater Pumpage Discharged into the Canal	Water Supply Pumpage from Indiana Reaching the Canal	Runoff from the Des Plaines River Watershed Reaching the Canal	Lake Michigan Pumpage by Federal Facilities Discharged to the Canal	Total Deduction from the Romeoville Gage Record	Lake Michigan Pumpage Not Discharged to the Canal	Total Diversion Accountable to the State of Illinois	Pumpage from Lake Michigan Accountable to the State of Illinois	Runoff from the Diverted Lake Michigan Watershed	Direct Diversion Accountable to the State of Illinois
	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Dec-93	2272.0	0.3	2272.3	137.3	32.2	539.0	1.3	709.8	214.7	1777.2	1685.4	1271.8	95.0
02-Dec-93	3333.0	0.3	3333.3	203.0	32.5	531.2	1.3	768.0	212.7	2778.0	1684.8	2107.1	93.0
03-Dec-93	2448.0	0.3	2448.3	231.3	32.6	178.4	1.3	443.5	210.2	2215.0	1687.4	731.9	102.0
04-Dec-93	2540.0	0.3	2540.3	57.2	39.1	83.7	1.3	181.3	210.3	2688.3	1688.9	528.8	289.0
05-Dec-93	2555.0	0.3	2555.3	36.9	33.2	60.7	1.3	132.0	211.2	2834.5	1628.3	411.1	85.0
06-Dec-93	2375.0	0.3	2375.3	116.9	35.0	238.0	1.3	391.2	214.6	2198.7	1713.4	780.9	97.0
07-Dec-93	2275.0	0.3	2275.3	52.3	32.4	110.2	1.3	196.2	211.8	2280.7	1680.3	344.6	84.0
08-Dec-93	2190.0	0.3	2190.3	38.5	32.1	89.7	1.3	161.6	211.8	2240.5	1684.8	287.8	91.0
09-Dec-93	2430.0	0.4	2430.4	76.7	31.4	94.8	1.3	203.2	210.9	2438.1	1688.2	287.1	76.0
10-Dec-93	1987.0	0.4	1987.4	39.3	37.6	64.4	1.3	142.6	209.8	2064.8	1683.2	236.6	98.0
11-Dec-93	2134.0	0.3	2134.3	71.5	35.6	69.6	1.3	178.0	209.0	2165.3	1635.4	228.1	79.0
12-Dec-93	2245.0	0.3	2245.3	63.4	30.5	60.8	1.3	146.0	211.9	2311.2	1688.1	188.8	73.0
13-Dec-93	1905.0	0.3	1905.3	51.6	31.7	59.0	1.3	143.6	211.0	1972.7	1686.6	177.6	86.0
14-Dec-93	2429.0	0.4	2429.4	71.0	38.3	115.1	1.3	225.7	210.7	2414.4	1684.1	362.8	122.0
15-Dec-93	1985.0	0.4	1985.4	73.2	42.0	76.6	1.3	193.1	212.2	1984.5	1683.3	226.6	107.0
16-Dec-93	2184.0	0.3	2184.3	52.0	36.1	64.5	1.3	154.0	212.3	2242.8	1676.8	188.4	98.0
17-Dec-93	2151.0	0.3	2151.3	101.1	32.9	180.2	1.3	315.5	209.4	2046.2	1682.0	544.3	94.0
18-Dec-93	3625.0	0.3	3625.3	155.6	32.9	818.4	1.3	1008.1	214.7	2831.9	1643.6	2937.9	93.0
19-Dec-93	2379.0	0.3	2379.3	296.5	31.8	357.5	1.3	687.0	208.5	1900.8	1632.9	833.5	104.0
20-Dec-93	2758.0	0.3	2758.3	91.7	32.0	201.3	1.3	326.2	212.2	2844.3	1676.5	485.7	74.0
21-Dec-93	2094.0	0.3	2094.3	50.1	33.2	131.6	1.3	216.2	210.3	2088.4	1699.0	348.1	81.0
22-Dec-93	2487.0	0.3	2487.3	37.0	34.0	97.2	1.3	169.5	211.3	2509.1	1678.8	268.6	101.0
23-Dec-93	2106.0	0.3	2106.3	63.2	32.6	93.1	1.3	190.2	210.7	2128.8	1682.7	247.0	89.0
24-Dec-93	2012.0	0.4	2012.4	70.4	31.8	90.1	1.3	193.6	211.2	2030.0	1688.6	220.6	91.0
25-Dec-93	2118.0	0.2	2118.2	49.7	32.1	77.2	1.3	160.2	207.3	1866.3	1614.1	188.9	95.0
26-Dec-93	1907.0	0.3	1907.3	80.4	31.8	85.9	1.3	199.4	209.3	1817.2	1589.9	196.4	101.0
27-Dec-93	2029.0	0.4	2029.4	48.2	31.8	72.8	1.3	154.1	210.3	2086.6	1707.2	168.1	109.0
28-Dec-93	2114.0	0.3	2114.3	37.1	31.3	67.7	1.3	137.4	210.8	2187.7	1719.1	152.4	104.0
29-Dec-93	1885.0	0.3	1885.3	57.8	31.3	74.4	1.3	164.8	211.4	1931.9	1716.1	161.0	75.0
30-Dec-93	2145.0	0.3	2145.3	82.3	30.5	82.1	1.3	196.2	210.6	2169.7	1696.4	167.7	60.0
31-Dec-93	2012.0	0.3	2012.3	51.8	29.6	80.2	1.3	162.8	212.0	2081.5	1716.3	190.8	65.0
Averages	2292.5	0.3	2292.8	85.0	33.3	159.5	1.3	279.1	211.1	2224.8	1674.3	499.1	97.1

Lake Michigan Diversion Accounting - WY1994 January 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEDEVILLE AVM GAGE RECORD	2 DIVERSIONS ABOVE THE GAGE	3 TOTAL FLOW THROUGH THE CANAL	4 GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	5 WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	6 RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	7 LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	8 TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	9 LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	10 TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	11 PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	12 RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	13 DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1												
01-Jan-94	1997.0	0.3	1997.3	37.3	30.4	71.5	1.7	140.8	226.6	2083.1	1682.8	166.2	80.0
02-Jan-94	1886.0	0.2	1886.2	82.0	31.9	84.2	1.7	199.7	228.6	1815.1	1680.5	216.3	92.0
03-Jan-94	1983.0	0.3	1983.3	37.4	33.4	64.5	1.7	137.0	230.0	2076.3	1762.5	149.9	89.0
04-Jan-94	1961.0	0.3	1961.3	90.4	33.4	82.0	1.7	207.4	231.0	1884.9	1735.6	177.6	103.0
05-Jan-94	2022.0	0.4	2022.4	37.5	31.1	61.7	1.7	131.9	228.3	2119.8	1727.3	124.1	100.0
06-Jan-94	2440.0	0.4	2440.4	46.3	33.4	62.7	1.7	144.1	228.9	2526.2	1723.3	151.7	125.0
07-Jan-94	2079.0	0.3	2079.3	64.6	34.5	69.7	1.7	170.4	227.6	2136.4	1717.9	188.3	125.0
08-Jan-94	2278.0	0.3	2278.3	64.8	31.9	68.6	1.7	167.0	228.4	2340.7	1726.1	141.1	102.0
09-Jan-94	2086.0	0.3	2086.3	37.3	30.7	66.5	1.7	126.2	228.2	2188.3	1698.8	111.4	59.0
10-Jan-94	2121.0	0.3	2121.3	96.2	28.3	78.9	1.7	205.1	229.6	2146.8	1788.1	157.1	85.0
11-Jan-94	2071.0	0.3	2071.3	37.2	30.8	72.0	1.7	141.7	228.6	2169.2	1781.9	190.9	79.0
12-Jan-94	2353.0	0.4	2353.4	64.6	29.6	76.4	1.7	162.2	231.8	2423.0	1742.7	165.3	99.0
13-Jan-94	1821.0	0.3	1821.3	70.5	31.1	69.5	1.7	172.8	230.6	1878.1	1749.7	148.0	193.0
14-Jan-94	2136.0	0.4	2136.4	53.0	31.4	55.2	1.7	141.3	228.3	2224.4	1757.3	121.4	115.0
15-Jan-94	2194.0	0.2	2194.2	87.4	31.4	64.8	1.7	185.2	233.2	2242.2	1773.9	141.8	114.0
16-Jan-94	2587.0	0.7	2587.7	52.2	29.6	61.4	1.7	134.9	236.7	2689.6	1793.3	112.2	92.0
17-Jan-94	2793.0	0.4	2793.4	37.4	30.4	44.0	1.7	113.5	236.9	2916.8	1854.4	99.2	119.0
18-Jan-94	2837.0	0.5	2837.5	81.2	29.8	58.3	1.7	171.0	237.0	2903.6	1935.6	131.3	169.0
19-Jan-94	2642.0	0.3	2642.3	60.8	29.8	44.7	1.7	126.9	702.1	3217.6	2403.1	103.8	161.0
20-Jan-94	3023.0	0.4	3023.4	50.7	29.8	44.8	1.7	126.9	236.7	3133.2	1914.7	108.0	130.0
21-Jan-94	1978.0	0.3	1978.3	65.1	26.4	50.9	1.7	144.1	243.1	2077.3	1906.2	133.9	101.0
22-Jan-94	2532.0	0.3	2532.3	78.5	29.7	91.1	1.7	201.0	237.6	2688.9	1876.7	289.7	72.0
23-Jan-94	2469.0	0.4	2469.4	70.3	30.4	64.7	1.7	667.1	246.5	2048.8	1919.8	2391.0	86.0
24-Jan-94	2635.0	0.3	2635.3	290.6	30.6	313.8	1.7	636.5	238.4	2237.2	1903.0	1410.9	100.0
25-Jan-94	2566.0	0.3	2566.3	264.8	34.8	247.9	1.7	549.1	236.2	2263.4	1883.6	1557.2	120.0
26-Jan-94	2814.0	0.4	2814.4	116.7	37.2	90.6	1.7	246.2	232.6	2800.8	1863.4	389.6	135.0
27-Jan-94	2608.0	0.3	2608.3	57.1	32.8	75.4	1.7	167.0	232.3	2873.6	1823.0	370.1	188.0
28-Jan-94	5065.0	0.3	5065.3	89.5	32.2	60.3	1.7	183.6	231.7	6113.4	1795.9	854.9	93.0
29-Jan-94	3495.0	0.3	3495.3	49.1	32.6	41.2	1.7	124.7	232.0	3602.6	1807.6	582.9	100.0
30-Jan-94	3152.0	0.4	3152.4	35.8	34.4	32.0	1.7	103.8	231.4	3280.0	1792.4	377.3	117.0
31-Jan-94	2756.0	0.3	2756.3	62.7	31.2	42.2	1.7	137.8	236.4	2863.9	1838.8	277.8	134.0
Averages	2496.1	0.3	2496.4	75.8	31.5	93.3	1.7	202.3	248.0	2642.1	1817.4	372.3	111.5

Lake Michigan Diversion Accounting - WY1994 February 1994- Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEOWILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER		WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOWILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS		PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS		RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED		DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
				4	5	6	7				10	11	12	13			
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
01-Feb-94	2089.0	0.3	2089.3	69.4	30.6	43.7	2.1	145.7	228.9	2170.6	1866.4	229.0	86.0	86.0	86.0	86.0	86.0
02-Feb-94	2366.0	0.3	2366.3	46.7	29.7	35.1	2.1	113.6	228.2	2480.9	1841.3	173.1	62.0	62.0	62.0	62.0	62.0
03-Feb-94	2368.0	0.3	2368.3	79.3	29.6	48.2	2.1	169.2	227.2	2438.3	1848.3	171.5	79.0	79.0	79.0	79.0	79.0
04-Feb-94	2226.0	0.3	2226.3	45.6	29.6	42.7	2.1	120.0	228.8	2336.1	1835.2	141.2	70.0	70.0	70.0	70.0	70.0
05-Feb-94	2408.0	0.3	2408.3	102.2	29.5	172.4	2.1	306.2	229.7	2331.8	1814.1	404.3	64.0	64.0	64.0	64.0	64.0
06-Feb-94	2194.0	0.3	2194.3	144.2	30.2	381.7	2.1	558.2	228.7	1864.8	1838.2	973.5	86.0	86.0	86.0	86.0	86.0
07-Feb-94	2298.0	0.3	2298.3	112.5	31.8	85.4	2.1	231.7	230.6	2297.2	1828.2	489.2	129.0	129.0	129.0	129.0	129.0
08-Feb-94	2372.0	0.3	2372.3	67.0	32.6	53.2	2.1	154.8	227.9	2445.4	1820.4	168.9	107.0	107.0	107.0	107.0	107.0
09-Feb-94	2175.0	0.4	2175.4	37.6	32.3	37.5	2.1	109.5	228.7	2292.8	1821.7	151.2	106.0	106.0	106.0	106.0	106.0
10-Feb-94	2512.0	0.3	2512.3	92.1	30.7	58.4	2.1	183.2	228.7	2657.8	1838.0	208.4	74.0	74.0	74.0	74.0	74.0
11-Feb-94	2169.0	0.7	2169.7	39.4	31.1	64.5	2.1	137.1	228.6	2261.2	1821.3	216.2	91.0	91.0	91.0	91.0	91.0
12-Feb-94	2371.0	0.2	2371.2	53.6	31.0	44.2	2.1	130.9	228.7	2469.0	1812.5	131.8	86.0	86.0	86.0	86.0	86.0
13-Feb-94	2386.0	0.3	2386.3	74.0	30.2	71.5	2.1	177.9	227.0	2435.4	1797.4	242.4	82.0	82.0	82.0	82.0	82.0
14-Feb-94	2375.0	0.4	2375.4	162.3	29.5	93.7	2.1	1131.2	233.8	1478.0	1838.5	1745.2	72.0	72.0	72.0	72.0	72.0
15-Feb-94	2966.0	0.5	2966.5	215.0	30.4	850.5	2.1	1098.0	237.5	2108.0	1820.5	437.2	84.0	84.0	84.0	84.0	84.0
16-Feb-94	2803.0	0.4	2803.4	174.0	29.5	601.7	2.1	807.3	234.4	230.5	1834.5	3003.1	69.0	69.0	69.0	69.0	69.0
17-Feb-94	3245.0	0.5	3245.5	53.6	30.3	895.3	2.1	791.3	248.2	2702.4	1842.3	7946.9	78.0	78.0	78.0	78.0	78.0
18-Feb-94	4766.0	0.5	4766.5	167.2	30.2	328.5	2.1	529.0	231.6	4469.1	1822.8	2414.8	75.0	75.0	75.0	75.0	75.0
19-Feb-94	6783.0	0.3	6783.3	250.9	29.5	806.0	2.1	1088.5	227.3	6922.1	1794.3	4889.5	75.0	75.0	75.0	75.0	75.0
20-Feb-94	8417.0	0.5	8417.5	99.3	30.3	912.1	2.1	1043.8	228.8	7800.5	1778.5	4906.5	56.0	56.0	56.0	56.0	56.0
21-Feb-94	6167.0	0.3	6167.3	182.3	30.9	513.5	2.1	728.8	228.5	6867.0	1794.9	2707.5	64.0	64.0	64.0	64.0	64.0
22-Feb-94	4525.0	0.4	4525.4	224.8	36.9	386.8	2.1	650.5	229.7	4104.8	1838.4	1813.4	86.0	86.0	86.0	86.0	86.0
23-Feb-94	4086.0	0.4	4086.4	252.3	42.8	292.8	2.1	589.9	226.3	3722.8	1783.0	1305.8	86.0	86.0	86.0	86.0	86.0
24-Feb-94	3637.0	0.3	3637.3	107.8	33.8	180.2	2.1	323.8	228.7	3642.2	1806.2	922.1	120.0	120.0	120.0	120.0	120.0
25-Feb-94	3624.0	0.3	3624.3	50.2	34.3	129.7	2.1	216.4	226.5	3834.4	1785.4	707.8	107.0	107.0	107.0	107.0	107.0
26-Feb-94	3203.0	0.3	3203.3	50.8	35.4	116.2	2.1	204.5	225.5	3224.3	1793.4	611.8	103.0	103.0	103.0	103.0	103.0
27-Feb-94	3552.0	0.2	3552.2	85.1	31.0	122.2	2.1	240.4	227.4	3539.2	1777.6	575.5	100.0	100.0	100.0	100.0	100.0
28-Feb-94	3021.0	0.4	3021.4	37.1	30.9	102.3	2.1	172.4	230.2	3079.2	1815.7	483.1	85.0	85.0	85.0	85.0	85.0
Averages	3325.1	0.4	3325.5	110.2	31.6	289.8	2.1	433.7	229.6	3121.4	1818.2	1504.0	85.1	85.1	85.1	85.1	85.1

Lake Michigan Diversion Accounting - WY1994 March 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEORVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Mar-94	2635.0	0.3	2635.3	104.5	30.6	125.5	1.8	262.4	226.4	2699.3	1807.4	502.1	83.0
02-Mar-94	2822.0	0.4	2822.4	42.7	30.7	152.3	1.8	227.5	226.8	2821.7	1809.4	707.6	87.0
03-Mar-94	2771.0	0.3	2771.3	73.0	29.4	1064.1	1.8	1168.3	236.1	1839.1	1793.9	3948.6	77.0
04-Mar-94	4019.0	0.4	4019.4	118.2	29.8	1685.1	1.8	1734.9	240.0	2524.5	1807.5	8816.9	81.0
05-Mar-94	4586.0	0.3	4586.3	89.1	29.8	739.7	1.8	860.2	231.1	3997.2	1729.2	4354.4	77.0
06-Mar-94	5835.0	0.5	5835.5	116.8	30.0	433.2	1.8	581.7	227.0	6480.8	1801.6	2237.9	64.0
07-Mar-94	5734.0	0.5	5734.5	176.5	29.6	329.3	1.8	537.2	230.3	5427.6	1798.5	2221.2	77.0
08-Mar-94	4379.0	0.5	4379.5	211.9	29.4	266.1	1.8	509.2	226.7	4097.0	1809.0	1649.8	68.0
09-Mar-94	4433.0	0.3	4433.3	226.2	30.3	231.9	1.8	490.2	228.2	4171.3	1793.8	1157.8	73.0
10-Mar-94	3579.0	0.3	3579.3	213.3	29.8	209.3	1.8	454.2	226.6	3351.6	1776.9	888.1	83.0
11-Mar-94	3183.0	0.3	3183.3	37.0	29.7	134.9	1.8	203.4	227.2	3207.1	1760.7	620.6	89.0
12-Mar-94	3062.0	0.4	3062.4	52.7	29.7	137.6	1.8	222.0	227.0	3087.4	1751.0	589.4	80.0
13-Mar-94	3195.0	0.3	3195.3	91.9	29.7	165.3	1.8	288.7	226.6	3133.1	1745.8	746.4	76.0
14-Mar-94	2740.0	0.3	2740.3	50.4	28.5	136.9	1.8	217.6	229.0	2761.7	1779.1	571.7	90.0
15-Mar-94	2978.0	0.3	2978.3	37.1	30.3	127.7	1.8	196.9	227.4	3008.8	1773.4	519.6	91.0
16-Mar-94	2579.0	0.3	2579.3	107.1	30.5	149.9	1.8	289.3	228.2	2518.2	1781.3	514.2	91.0
17-Mar-94	2424.0	0.3	2424.3	39.2	29.4	124.9	1.8	195.3	228.1	2457.1	1766.9	409.1	83.0
18-Mar-94	2532.0	0.3	2532.3	45.8	31.4	123.6	1.8	202.6	226.7	2666.4	1766.3	385.1	84.0
19-Mar-94	2332.0	0.3	2332.3	37.0	29.4	118.4	1.8	186.6	228.2	2373.9	1741.3	349.5	81.0
20-Mar-94	2501.0	0.4	2501.4	105.2	30.5	141.6	1.8	279.0	226.2	2447.6	1733.2	380.0	115.0
21-Mar-94	2903.0	0.4	2903.4	142.2	31.4	223.8	1.8	399.1	230.6	2734.8	1768.0	976.0	90.0
22-Mar-94	2778.0	0.5	2778.5	37.0	29.3	132.4	1.8	200.6	228.3	2806.2	1763.8	506.3	84.0
23-Mar-94	2621.0	0.3	2621.3	76.2	30.3	134.4	1.8	242.8	225.8	2804.3	1784.0	449.2	97.0
24-Mar-94	2249.0	0.4	2249.4	62.7	30.7	121.5	1.8	216.7	227.4	2290.1	1765.8	385.9	79.0
25-Mar-94	2255.0	0.3	2255.3	54.6	30.7	113.5	1.8	200.6	229.0	2283.7	1737.4	322.5	110.0
26-Mar-94	2470.0	0.4	2470.4	61.1	30.5	148.1	1.8	241.5	227.4	2466.3	1734.9	379.2	98.0
27-Mar-94	3039.0	0.3	3039.3	121.0	31.0	284.1	1.8	437.9	221.5	2826.9	1701.8	954.9	111.0
28-Mar-94	2410.0	0.4	2410.4	38.9	30.0	144.0	1.8	214.7	226.0	2421.7	1738.1	646.7	84.0
29-Mar-94	2781.0	0.3	2781.3	51.3	30.6	117.0	1.8	200.7	225.6	2806.2	1748.7	354.6	87.0
30-Mar-94	2139.0	0.3	2139.3	96.8	29.6	122.2	1.8	250.3	226.0	2116.0	1743.2	335.7	94.0
31-Mar-94	2261.0	0.3	2261.3	37.2	28.4	93.6	1.8	161.1	221.7	2324.9	1747.4	254.6	89.0
Averages	3132.1	0.4	3132.5	90.6	30.1	268.0	1.8	390.5	223.1	2970.1	1767.1	1229.4	86.1

Lake Michigan Diversion Accounting - WY1994 April 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEDEVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Apr-94	2257.0	0.4	2257.4	52.3	30.1	94.1	1.6	178.2	225.9	2306.1	1741.0	239.8	127.0
02-Apr-94	2210.0	0.4	2210.4	85.2	30.5	101.8	1.6	219.1	228.1	2217.4	1728.2	250.8	156.0
03-Apr-94	2250.0	0.3	2250.3	46.1	30.0	84.0	1.6	161.8	224.6	2313.1	1649.4	224.4	107.0
04-Apr-94	2236.0	0.6	2236.6	37.2	30.1	77.5	1.6	146.4	231.2	2321.4	1751.7	189.1	102.0
05-Apr-94	2104.0	0.2	2104.2	98.1	48.2	96.2	1.6	244.2	227.9	2087.6	1733.1	242.9	123.0
06-Apr-94	2052.0	0.3	2052.3	37.2	39.4	71.4	1.6	149.6	223.8	2126.6	1752.5	194.0	96.0
07-Apr-94	2116.0	0.4	2116.4	51.6	30.7	73.9	1.6	157.8	227.6	2186.2	1765.4	184.1	102.0
08-Apr-94	2222.0	0.3	2222.3	37.2	30.3	66.2	1.6	135.3	228.2	2315.2	1758.4	157.5	108.0
09-Apr-94	2280.0	0.3	2280.3	84.2	30.3	80.4	1.6	196.5	228.0	2311.8	1764.0	176.6	141.0
10-Apr-94	1878.0	0.4	1878.4	37.3	30.5	50.9	1.6	130.3	228.7	1976.8	1705.8	138.3	131.0
11-Apr-94	2321.0	0.4	2321.4	104.6	32.4	86.1	1.6	224.7	226.9	2323.6	1763.0	273.4	105.0
12-Apr-94	6226.0	0.3	6226.3	90.2	33.4	1221.4	1.6	1346.6	232.2	6111.9	1741.0	5660.7	99.0
13-Apr-94	4612.0	0.5	4612.5	141.7	30.3	433.5	1.6	607.2	230.1	4235.4	1742.5	1999.8	120.0
14-Apr-94	3679.0	0.7	3679.7	233.2	30.3	259.2	1.6	524.3	224.4	3379.8	1781.3	1080.6	142.0
15-Apr-94	4527.0	0.3	4527.3	235.7	29.7	260.3	1.6	527.4	228.4	4228.3	1722.3	1482.0	93.0
16-Apr-94	3380.0	0.2	3380.2	160.1	29.5	146.4	1.6	337.7	224.4	3266.9	1711.0	663.2	122.0
17-Apr-94	2536.0	0.3	2536.3	48.8	28.5	87.1	1.6	167.0	225.3	2694.8	1760.1	400.5	128.0
18-Apr-94	2949.0	0.5	2949.5	37.1	30.2	70.3	1.6	139.2	228.7	3039.0	1791.3	304.0	155.0
19-Apr-94	2330.0	0.5	2330.5	110.3	31.0	89.5	1.6	232.4	227.6	2326.6	1921.5	313.4	135.0
20-Apr-94	2439.0	0.4	2439.4	37.2	30.4	58.1	1.6	127.3	227.8	2639.8	1875.8	216.6	123.0
21-Apr-94	2438.0	0.5	2438.5	52.6	31.8	60.1	1.6	146.1	227.2	2619.6	1887.5	203.4	133.0
22-Apr-94	1920.0	0.5	1920.5	47.4	30.8	55.2	1.6	135.0	227.9	2013.4	1910.6	183.1	142.0
23-Apr-94	2445.0	0.4	2445.4	69.0	29.7	60.3	1.6	160.6	229.1	2613.9	1736.3	182.0	154.0
24-Apr-94	2255.0	0.4	2255.4	47.4	29.5	49.9	1.6	128.4	231.3	2366.3	1828.9	158.5	136.0
25-Apr-94	2507.0	0.8	2507.8	83.2	32.7	60.0	1.6	177.6	230.4	2660.8	1926.1	181.6	143.0
26-Apr-94	2209.0	0.5	2209.5	63.9	31.0	52.6	1.6	139.1	231.1	2301.5	1851.2	524.8	128.0
27-Apr-94	2801.0	0.4	2801.4	37.4	33.7	39.5	1.6	112.3	227.8	2816.7	1836.5	469.2	125.0
28-Apr-94	3170.0	0.3	3170.3	106.9	40.4	252.3	1.6	401.2	228.6	2997.8	1757.9	1356.8	224.0
29-Apr-94	3163.0	0.4	3163.4	163.4	33.6	94.1	1.6	292.8	226.4	3096.0	1755.2	644.0	177.0
30-Apr-94	3684.0	0.3	3684.3	91.2	39.4	646.1	1.6	678.4	231.8	3237.6	1704.2	2772.3	138.0
Averages	2773.2	0.4	2773.6	83.9	32.3	199.6	1.6	277.9	227.9	2724.1	1778.1	708.9	130.5

Lake Michigan Diversion Accounting - WY1994 May 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-May-94	4361.0	3.3	4364.3	317.0	38.8	179.7	1.9	537.3	265.9	4092.9	1706.0	969.2	188.0
02-May-94	2558.0	3.4	2561.4	82.7	37.0	77.1	1.9	193.6	272.7	2635.6	1767.7	455.9	162.0
03-May-94	2781.0	3.3	2784.3	52.1	38.9	63.5	1.9	146.3	269.8	2807.8	1803.9	315.9	177.0
04-May-94	2442.0	3.4	2445.4	84.9	39.7	58.9	1.9	185.3	268.8	2628.9	1806.4	283.2	175.0
05-May-94	2318.0	3.3	2321.3	63.1	38.6	46.0	1.9	149.6	268.9	2440.6	1803.8	227.6	178.0
06-May-94	2373.0	3.5	2376.5	46.7	37.4	38.9	1.9	124.9	272.8	2624.4	1789.1	194.4	182.0
07-May-94	3121.0	3.2	3124.2	84.3	41.5	98.8	1.9	226.4	272.6	3170.4	1747.9	510.9	214.0
08-May-94	2548.0	3.3	2551.3	47.5	36.1	40.8	1.9	126.3	261.9	2686.9	1697.4	257.0	204.0
09-May-94	2186.0	3.3	2189.3	37.4	36.2	34.3	1.9	103.7	271.8	2361.4	1838.7	186.8	144.0
10-May-94	2388.0	3.4	2371.4	63.0	37.6	39.6	1.9	142.0	271.4	2600.8	1851.7	172.9	189.0
11-May-94	2301.0	3.4	2304.4	63.6	34.9	37.8	1.9	136.2	270.8	2437.1	1827.1	158.5	143.0
12-May-94	2042.0	3.4	2045.4	50.9	36.7	31.5	1.9	121.0	270.8	2195.2	1851.2	139.4	280.0
13-May-94	2443.0	3.5	2446.5	89.2	38.6	43.6	1.9	173.2	270.8	2644.1	1875.8	153.1	202.0
14-May-94	2419.0	3.6	2422.6	47.0	40.7	28.5	1.9	118.0	270.3	2574.8	1836.0	130.3	239.0
15-May-94	2270.0	3.6	2273.6	37.4	40.6	23.9	1.9	103.8	272.8	2442.8	1806.1	145.5	251.0
16-May-94	2065.0	3.5	2068.5	53.4	38.5	28.2	1.9	122.0	273.8	2220.3	1854.9	135.9	178.0
17-May-94	2138.0	3.5	2141.5	82.2	43.5	37.2	1.9	164.8	277.9	2264.6	1898.9	132.3	169.0
18-May-94	2211.0	3.6	2214.6	52.9	44.5	25.4	1.9	124.6	273.2	2363.2	1932.0	107.4	174.0
19-May-94	2091.0	3.5	2094.5	47.9	41.6	21.1	1.9	112.4	277.1	2268.2	1973.8	82.2	208.0
20-May-94	2104.0	3.8	2107.8	82.7	39.9	34.0	1.9	158.5	284.7	2234.0	2083.7	106.4	228.0
21-May-94	2264.0	3.7	2267.7	37.4	39.3	16.5	1.9	95.0	287.1	2468.8	2200.0	75.5	241.0
22-May-94	2177.0	3.6	2180.6	106.6	39.3	40.2	1.9	188.0	282.9	2286.5	2289.0	112.9	236.0
23-May-94	2115.0	4.2	2119.2	37.5	41.1	14.8	1.9	95.0	281.3	2315.6	2283.7	69.4	178.0
24-May-94	2356.0	3.7	2359.7	51.5	40.9	23.8	1.9	118.0	279.5	2621.2	2050.2	92.7	189.0
25-May-94	2326.0	3.7	2329.7	48.9	40.9	21.5	1.9	113.2	278.6	2483.1	1994.9	139.7	189.0
26-May-94	2310.0	3.6	2313.6	80.5	54.1	29.6	1.9	168.0	271.5	2419.1	1856.8	167.7	171.0
27-May-94	2175.0	3.4	2178.4	48.2	39.2	16.5	1.9	103.7	277.3	2392.0	1959.1	84.8	218.0
28-May-94	2196.0	3.5	2199.5	85.6	37.5	29.9	1.9	154.9	281.5	2326.1	2162.3	95.0	228.0
29-May-94	1890.0	3.5	1893.5	45.8	38.6	13.4	1.9	99.7	286.0	2076.8	2195.8	50.2	251.0
30-May-94	2219.0	3.9	2222.9	35.8	39.1	9.1	1.9	85.8	287.5	2424.8	2355.4	37.7	238.0
31-May-94	2295.0	3.6	2298.6	56.9	37.3	16.0	1.9	111.1	282.1	2476.6	2397.0	55.7	185.0
Averages	2369.8	3.5	2373.3	68.3	39.6	39.0	1.9	148.8	276.2	2600.7	1951.5	188.6	199.6

Lake Michigan Diversion Accounting - WY1994 June 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Jun-94	2229.0	3.0	2232.0	55.7	45.3	20.7	2.2	134.0	348.9	2445.9	2238.1	52.7	476.0
02-Jun-94	2764.0	2.9	2766.9	50.7	45.6	15.3	2.2	113.9	345.1	2686.1	2229.6	37.7	766.0
03-Jun-94	2932.0	3.2	2935.2	78.0	48.6	23.8	2.2	152.7	348.7	3131.2	2338.4	51.0	853.0
04-Jun-94	2820.0	3.0	2823.0	37.6	45.7	10.6	2.2	96.1	354.2	3081.1	2486.3	28.1	926.0
05-Jun-94	3172.0	3.1	3175.1	86.1	48.4	28.1	2.2	164.8	368.4	3396.7	2492.0	59.5	833.0
06-Jun-94	2881.0	3.3	2884.3	35.8	50.7	8.6	2.2	97.3	349.8	3136.8	2619.0	20.7	869.0
07-Jun-94	3038.0	3.1	3041.1	90.2	55.5	28.2	2.2	176.1	342.3	3207.3	2338.7	58.1	795.0
08-Jun-94	2715.0	3.0	2718.0	50.2	63.6	51.8	2.2	167.8	332.9	2683.1	1981.2	222.4	442.0
09-Jun-94	2057.0	3.0	2060.0	51.5	50.3	16.4	2.2	120.5	341.9	2281.4	2171.3	69.8	214.0
10-Jun-94	2241.0	3.0	2244.0	47.9	50.3	13.4	2.2	113.8	346.5	2476.7	2358.1	35.5	362.0
11-Jun-94	3058.0	3.1	3061.1	79.1	48.3	177.9	2.2	307.5	344.8	3088.4	2390.1	575.0	823.0
12-Jun-94	3733.0	3.3	3736.3	43.1	46.6	20.9	2.2	112.8	343.2	3866.7	2275.3	169.2	795.0
13-Jun-94	3658.0	3.4	3661.4	213.6	46.0	348.8	2.2	610.6	342.7	3393.5	2181.9	2438.2	410.0
14-Jun-94	4702.0	3.5	4705.5	192.5	48.3	400.5	2.2	643.5	345.4	4407.4	2320.8	3489.2	192.0
15-Jun-94	4612.0	3.4	4615.4	269.3	49.8	102.5	2.2	423.9	349.6	4541.1	2740.0	2079.7	386.0
16-Jun-94	4732.0	3.5	4735.5	51.2	47.9	20.6	2.2	121.9	362.0	4976.6	2887.6	833.0	472.0
17-Jun-94	4889.0	3.4	4892.4	37.6	49.6	13.9	2.2	103.3	361.2	6160.3	2903.8	274.7	1763.0
18-Jun-94	4933.0	3.6	4936.6	44.4	49.4	13.7	2.2	109.7	360.8	6187.5	2992.0	180.2	2154.0
19-Jun-94	3364.0	3.2	3367.2	69.9	51.3	22.0	2.2	145.5	355.1	3676.8	2560.7	143.9	1022.0
20-Jun-94	3157.0	3.3	3160.3	230.1	51.5	159.7	2.2	443.5	347.6	3064.4	2352.3	1023.0	512.0
21-Jun-94	3840.0	3.3	3843.3	35.8	47.7	11.1	2.2	96.8	340.3	4086.8	2356.6	188.4	1028.0
22-Jun-94	3403.0	3.2	3406.2	50.1	47.9	15.0	2.2	115.3	346.0	3634.9	2407.0	100.5	1523.0
23-Jun-94	6561.0	3.1	6564.1	95.8	56.7	1047.0	2.2	1201.7	344.9	6707.3	2103.0	6914.0	716.0
24-Jun-94	8023.0	2.9	8025.9	130.0	66.0	797.2	2.2	1015.4	335.4	7346.9	1909.5	6938.8	1046.0
25-Jun-94	6559.0	3.2	6562.2	283.0	52.8	219.9	2.2	537.7	332.6	6367.1	1930.9	1585.9	970.0
26-Jun-94	5869.0	3.1	5872.1	295.8	49.5	181.9	2.2	529.4	328.0	6670.7	1914.3	961.3	2664.0
27-Jun-94	3778.0	3.1	3781.1	167.1	50.0	107.1	2.2	326.4	330.4	3785.1	2054.0	658.1	827.0
28-Jun-94	3599.0	3.3	3602.3	51.2	46.6	49.7	2.2	149.8	333.7	3766.2	2163.2	505.8	801.0
29-Jun-94	3436.0	3.1	3439.1	36.8	49.0	34.4	2.2	121.4	332.5	3660.2	2169.5	366.0	808.0
30-Jun-94	3116.0	3.2	3121.2	108.5	48.2	57.2	2.2	216.2	335.3	3240.3	2197.3	294.3	890.0
Averages	3862.4	3.2	3865.6	101.9	50.8	133.9	2.2	288.9	344.6	3921.3	2336.1	1012.5	884.7

Lake Michigan Diversion Accounting - WY1994 July 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEOVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Jul-94	3934.0	4.4	3938.4	37.3	43.9	28.5	1.8	111.6	288.0	4114.8	2351.2	188.0	1507.0
02-Jul-94	3907.0	3.9	3910.9	46.4	47.3	29.6	1.8	124.1	278.7	4086.5	2039.6	96.3	1573.0
03-Jul-94	3778.0	4.3	3782.3	37.4	47.9	25.6	1.8	112.8	276.8	3948.3	2002.0	66.4	1613.0
04-Jul-94	3830.0	4.2	3834.2	78.6	47.2	52.2	1.8	179.9	287.1	3941.4	2105.1	187.5	1431.0
05-Jul-94	3913.0	4.7	3917.7	119.1	48.7	54.4	1.8	224.1	280.4	3974.0	2380.3	247.5	1411.0
06-Jul-94	4026.0	4.3	4030.3	39.1	50.3	38.9	1.8	130.1	285.8	4186.0	2423.0	990.6	1089.0
07-Jul-94	4538.0	4.3	4542.3	192.2	58.1	262.5	1.8	504.7	282.2	4318.8	2192.2	1442.8	1006.0
08-Jul-94	4446.0	4.2	4450.2	204.5	54.5	263.5	1.8	524.3	283.4	4208.3	2070.5	1480.8	847.0
09-Jul-94	4144.0	4.0	4148.0	214.7	47.6	93.9	1.8	358.1	277.7	4087.6	1928.0	372.6	1440.0
10-Jul-94	3949.0	4.1	3953.1	64.1	47.3	31.0	1.8	134.2	279.5	4088.4	1953.3	120.9	1521.0
11-Jul-94	3804.0	4.4	3808.4	37.3	47.7	20.2	1.8	107.0	285.0	3988.4	2141.0	73.6	1535.0
12-Jul-94	4050.0	4.5	4054.5	57.7	48.0	155.4	1.8	262.9	288.3	4078.9	2258.2	1004.1	1287.0
13-Jul-94	4160.0	4.4	4164.4	233.5	52.8	96.1	1.8	384.2	281.3	4081.5	2041.8	453.3	1604.0
14-Jul-94	3883.0	4.5	3887.5	119.6	56.0	47.9	1.8	225.3	278.5	3940.7	2056.9	297.5	1136.0
15-Jul-94	4399.0	4.3	4403.3	35.8	55.0	14.8	1.8	107.4	282.2	4578.1	2131.2	163.3	1538.0
16-Jul-94	3877.0	4.2	3881.2	44.5	51.7	16.8	1.8	114.8	281.5	4047.9	2165.4	90.7	1511.0
17-Jul-94	3592.0	4.2	3596.2	81.8	52.4	29.3	1.8	165.3	279.2	3710.1	2135.4	90.3	1512.0
18-Jul-94	3738.0	4.2	3742.2	50.8	53.5	17.5	1.8	123.6	285.7	3904.3	2327.6	57.0	1506.0
19-Jul-94	4412.0	4.3	4416.3	150.3	54.5	285.7	1.8	492.3	287.3	4211.3	2166.0	817.0	1419.0
20-Jul-94	4592.0	4.2	4596.2	207.7	56.0	339.9	1.8	605.5	286.4	4276.1	2124.6	844.9	1433.0
21-Jul-94	4438.0	4.2	4442.2	59.4	48.8	455.9	1.8	566.0	286.5	4182.7	2063.1	3097.7	1320.0
22-Jul-94	4614.0	4.2	4618.2	252.7	55.8	141.3	1.8	451.6	280.7	4447.3	1991.9	441.7	1224.0
23-Jul-94	3973.0	4.3	3977.3	189.0	51.3	90.1	1.8	332.3	280.0	3925.0	2039.1	227.0	1491.0
24-Jul-94	4512.0	4.2	4516.2	37.3	56.2	25.6	1.8	120.9	281.4	4876.7	2102.2	72.9	1519.0
25-Jul-94	3290.0	4.1	3294.1	51.6	53.1	25.4	1.8	131.9	287.2	3449.4	2168.1	61.8	1478.0
26-Jul-94	3640.0	4.1	3644.1	89.1	54.3	36.0	1.8	181.2	285.5	3748.4	2106.9	80.8	1405.0
27-Jul-94	3827.0	4.0	3831.0	49.6	60.5	18.9	1.8	130.8	283.9	3984.1	2089.7	42.1	1476.0
28-Jul-94	3642.0	4.3	3646.3	35.8	61.2	12.8	1.8	111.7	287.7	3822.3	2129.5	37.9	1478.0
29-Jul-94	3644.0	4.1	3648.1	53.5	53.2	19.8	1.8	128.3	280.5	3810.3	2264.5	52.8	1517.0
30-Jul-94	3815.0	4.1	3819.1	79.0	52.8	28.3	1.8	162.0	280.2	3947.3	2318.5	67.3	1525.0
31-Jul-94	3414.0	4.0	3418.0	51.2	46.9	17.8	1.8	117.7	293.3	3593.6	2319.0	49.2	1520.0
Averages	3992.9	4.2	3997.1	96.4	52.1	89.2	1.8	239.6	283.9	4041.5	2147.9	429.6	1415.2

Lake Michigan Diversion Accounting - WY1994 August 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEDEVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEDEVILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Aug-94	4641.0	0.9	4641.9	60.2	46.6	553.0	1.9	661.7	277.5	4267.7	2175.1	2166.9	969.0
02-Aug-94	4442.0	0.6	4442.6	252.0	57.0	133.9	1.9	444.8	271.8	4269.6	2068.7	321.1	2110.0
03-Aug-94	4200.0	0.8	4200.8	179.6	46.4	102.8	1.9	330.7	272.5	4142.6	2083.2	313.7	1058.0
04-Aug-94	4857.0	0.5	4857.5	123.7	66.5	748.5	1.9	942.6	269.3	4184.2	1995.5	2742.7	688.0
05-Aug-94	4195.0	0.4	4195.4	273.7	71.7	183.3	1.9	530.7	265.8	3930.3	1877.8	370.0	1552.0
06-Aug-94	4218.0	0.5	4218.5	73.3	48.9	73.9	1.9	198.0	266.8	4286.3	1923.6	124.7	1467.0
07-Aug-94	3958.0	0.6	3958.6	37.3	48.8	39.2	1.9	127.2	266.2	4097.8	1962.9	59.1	1560.0
08-Aug-94	3678.0	0.9	3678.9	63.7	52.0	37.0	1.9	154.7	271.4	3795.6	2132.3	61.7	1421.0
09-Aug-94	3276.0	0.4	3276.4	64.9	59.3	31.5	1.9	157.6	269.8	3388.6	2018.1	55.2	1954.0
10-Aug-94	3626.0	0.5	3626.5	147.4	55.2	1322.2	1.9	413.2	263.7	3482.0	1948.6	496.6	918.0
11-Aug-94	5083.0	0.5	5083.5	147.4	55.2	1322.2	1.9	1526.8	270.1	3928.6	1898.6	3544.1	212.0
12-Aug-94	4018.0	0.8	4018.8	273.2	48.7	255.0	1.9	578.8	263.9	3703.9	1863.5	388.3	857.0
13-Aug-94	8137.0	0.7	8137.7	139.2	44.7	1165.4	1.9	1351.3	272.2	7058.6	1837.8	7145.3	1470.0
14-Aug-94	4742.0	0.4	4742.4	232.6	43.7	383.3	1.9	661.5	263.6	4344.5	1810.7	601.8	1488.0
15-Aug-94	4257.0	0.6	4257.6	242.6	43.8	257.3	1.9	545.6	266.2	3978.2	1888.0	374.8	1425.0
16-Aug-94	4232.0	0.5	4232.5	75.7	44.9	125.8	1.9	248.2	268.7	4263.0	1976.9	162.7	1483.0
17-Aug-94	5237.0	0.7	5237.7	111.0	44.9	100.4	1.9	258.3	271.2	5260.8	2032.6	141.5	2451.0
18-Aug-94	4109.0	0.9	4109.9	37.3	44.8	53.5	1.9	137.6	268.1	4240.4	2039.2	65.0	1476.0
19-Aug-94	3755.0	0.7	3755.7	54.2	44.9	279.5	1.9	380.6	271.8	3646.8	1982.9	1062.5	1079.0
20-Aug-94	4533.0	0.6	4533.6	236.4	50.0	175.0	1.9	463.4	266.1	4336.3	1913.0	463.5	1445.0
21-Aug-94	4169.0	0.8	4169.6	37.0	53.5	70.1	1.9	162.6	263.1	4270.1	1877.7	322.5	1509.0
22-Aug-94	4042.0	0.7	4042.7	52.6	48.8	55.2	1.9	158.6	266.8	4160.9	1965.1	97.1	1542.0
23-Aug-94	3653.0	0.7	3653.7	100.0	49.1	63.6	1.9	214.7	268.8	3707.8	2061.9	103.6	1506.0
24-Aug-94	3756.0	0.9	3756.9	37.3	43.1	36.1	1.9	118.5	270.7	3908.1	2111.4	50.1	1456.0
25-Aug-94	3877.0	0.9	3877.9	62.3	43.2	38.4	1.9	135.9	272.6	4014.6	2248.1	58.0	1514.0
26-Aug-94	3427.0	0.7	3427.7	35.8	46.2	29.2	1.9	113.1	270.2	3684.8	2129.7	43.0	1208.0
27-Aug-94	3819.0	1.1	3820.1	76.4	41.8	42.3	1.9	162.5	272.1	3929.7	2103.2	74.2	1503.0
28-Aug-94	3493.0	0.4	3493.4	37.6	37.8	28.5	1.9	105.8	266.1	3863.7	2013.1	48.1	1353.0
29-Aug-94	3336.0	0.7	3336.7	87.1	43.8	44.9	1.9	177.8	269.8	3428.5	2080.2	73.3	1494.0
30-Aug-94	4048.0	0.5	4048.5	94.4	39.9	620.0	1.9	756.3	272.3	3664.5	1992.3	2072.4	770.0
31-Aug-94	3573.0	0.5	3573.5	246.6	63.5	150.9	1.9	463.2	264.3	3374.6	1899.1	253.9	1172.0
Averages	4206.0	0.7	4206.7	116.0	48.2	241.9	1.9	409.0	268.9	4066.6	1995.5	769.6	1339.0

Lake Michigan Diversion Accounting - WY1994 September 1994 - Summary of Diversion Flows (All in cfs)

LAKE MICHIGAN DIVERSION ACCOUNTING WY 1994	ROMEOVILLE AVM GAGE RECORD	DIVERSIONS ABOVE THE GAGE	TOTAL FLOW THROUGH THE CANAL	GROUNDWATER PUMPAGE DISCHARGED INTO THE CANAL	WATER SUPPLY PUMPAGE FROM INDIANA REACHING THE CANAL	RUNOFF FROM THE DES PLAINES RIVER WATERSHED REACHING THE CANAL	LAKE MICHIGAN PUMPAGE BY FEDERAL FACILITIES DISCHARGED TO THE CANAL	TOTAL DEDUCTION FROM THE ROMEVOILLE GAGE RECORD	LAKE MICHIGAN PUMPAGE NOT DISCHARGED TO THE CANAL	TOTAL DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS	PUMPAGE FROM LAKE MICHIGAN ACCOUNTABLE TO THE STATE OF ILLINOIS	RUNOFF FROM THE DIVERTED LAKE MICHIGAN WATERSHED	DIRECT DIVERSION ACCOUNTABLE TO THE STATE OF ILLINOIS
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13
01-Sep-94	3227.0	2.9	3229.9	171.7	51.2	98.8	2.0	323.4	282.0	3188.6	1899.6	156.8	939.0
02-Sep-94	3285.0	2.8	3287.8	37.6	51.2	39.6	2.0	130.4	283.6	3421.0	1902.7	44.7	822.0
03-Sep-94	3305.0	2.7	3307.7	50.1	51.2	37.6	2.0	140.9	280.0	3428.8	1808.9	50.0	902.0
04-Sep-94	3113.0	2.9	3115.9	89.5	46.9	47.1	2.0	185.5	268.7	3189.1	1791.7	75.1	691.0
05-Sep-94	2801.0	2.8	2803.8	47.1	45.5	42.8	2.0	137.3	258.1	2824.6	1785.4	74.3	1076.0
06-Sep-94	3280.0	2.9	3282.9	37.4	47.7	27.3	2.0	114.4	284.1	3412.6	1912.8	47.8	1288.0
07-Sep-94	3560.0	2.9	3562.9	99.7	41.8	47.0	2.0	190.4	284.8	3637.3	1991.3	78.6	1430.0
08-Sep-94	3188.0	3.0	3188.0	37.6	43.7	24.9	2.0	108.1	285.3	3348.2	2009.1	31.9	1382.0
09-Sep-94	3482.0	3.2	3485.2	46.5	48.1	28.9	2.0	123.5	268.3	3608.0	2034.4	39.7	1374.0
10-Sep-94	3425.0	3.0	3428.0	96.1	50.8	43.9	2.0	192.7	285.2	3600.5	1955.5	393.4	1120.0
11-Sep-94	3837.0	3.1	3840.1	48.1	46.7	26.8	2.0	122.6	266.1	3982.6	1983.8	74.5	1529.0
12-Sep-94	3379.0	3.1	3379.1	37.4	43.7	21.0	2.0	104.0	287.6	3642.7	2133.9	45.2	1479.0
13-Sep-94	3452.0	3.3	3455.3	81.1	41.3	35.8	2.0	160.1	286.6	3581.8	2166.9	65.8	1443.0
14-Sep-94	3249.0	3.3	3252.3	49.7	46.1	22.1	2.0	119.9	273.1	3405.6	2254.6	40.3	1525.0
15-Sep-94	3723.0	3.3	3726.3	47.7	46.3	21.7	2.0	117.6	289.3	3876.0	2238.8	45.6	1461.0
16-Sep-94	3280.0	3.1	3283.1	37.6	43.1	17.3	2.0	99.9	287.5	3460.7	2206.9	33.1	1357.0
17-Sep-94	3386.0	3.0	3389.0	97.0	48.2	36.7	2.0	183.9	289.6	3474.7	2055.9	67.2	1545.0
18-Sep-94	3270.0	3.1	3273.1	37.5	43.8	16.1	2.0	99.3	288.1	3441.8	2073.5	34.0	1465.0
19-Sep-94	3575.0	3.1	3578.1	90.6	44.6	34.7	2.0	171.9	272.0	3678.2	2188.2	65.6	1455.0
20-Sep-94	3462.0	3.1	3465.1	50.2	43.7	18.3	2.0	114.2	289.9	3620.8	2189.5	32.9	1459.0
21-Sep-94	3480.0	2.9	3482.9	51.5	43.9	19.8	2.0	117.0	287.5	3633.4	2106.4	32.4	1453.0
22-Sep-94	3364.0	3.1	3367.1	53.3	44.5	54.3	2.0	154.0	286.5	3478.6	2003.8	102.2	1295.0
23-Sep-94	3947.0	2.9	3949.9	97.6	50.6	148.6	2.0	296.7	280.0	3811.2	1839.3	191.9	1394.0
24-Sep-94	4085.0	2.9	4087.9	205.7	50.6	628.8	2.0	887.0	282.3	3463.2	1779.0	2081.6	1149.0
25-Sep-94	3620.0	2.9	3622.9	46.2	47.7	99.0	2.0	194.9	281.3	3688.3	1794.5	516.0	867.0
26-Sep-94	3115.0	2.8	3117.8	99.6	55.4	81.0	2.0	237.9	282.3	3142.2	1791.9	293.8	1074.0
27-Sep-94	3741.0	2.9	3743.9	99.3	47.6	63.6	2.0	232.4	287.5	3769.3	1811.9	311.7	1593.0
28-Sep-94	3593.0	2.8	3595.8	49.7	46.7	26.8	2.0	125.1	289.8	3730.5	1794.3	60.9	1609.0
29-Sep-94	3638.0	2.9	3640.9	37.6	40.2	22.2	2.0	101.9	285.6	3784.6	1804.4	48.4	1648.0
30-Sep-94	3713.0	2.9	3715.9	103.9	48.9	44.6	2.0	193.3	259.9	3776.6	1825.0	102.3	1719.0
Averages	3451.0	3.0	3454.0	71.2	46.7	63.1	2.0	183.0	284.3	3638.3	1971.1	174.6	1317.4

