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The Computation and Graphical Display of the NSF Water Quality Index from the STORET Data Base Using the Integrated Plotting Package

PROGRAM DOCUMENTATION AND USERS GUIDE

2nd Edition

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ABSTRACT

The NSF - Water Quality Index is a numerical expression which reflects the composite influence of nine physical, chemical and bacteriological parameters to water quality (1). It was developed and has been widely field tested by the National Sanitation Foundation as a means for reporting the current status and trends of water quality.

To address this need of analyzing and reporting trends in water quality a set of three computer programs have been developed to present this data in both report and graphical forms. The source of the data is a file created from the STORET data base by a standard retrieval. The graphical output is generated by the Integrated Plotting Package (2,3).

This report documents the logic and operation of the programs and presents the data from the Raritan River Basin as a test application.

INTRODUCTION

One of the most effective and meaningful ways in communicating information on water quality to top management and the general public is with a water quality index.

The "PDI" index which was developed by the MITRE Corporation[4] (Prevalence - Duration - Intensity Index), allows for a water body to be described in terms of the prevalence, duration and intensity of its water pollution. This index was based on how much water quality deviates from water quality standards, which vary on location depending on its intended use.

Other proposed indices are oriented towards a particular water use or are constructed for specific areas. Only the National Sanitation Foundation Water Quality Index can be consistently applied to any area and can be quantitatively compared in reporting overall quality trends.

The cummulative form of the NSF - WQI may be written as:

$$WQI(c) = \sum_{i=1}^{n} w_i \, q_i \qquad (1)$$

where

$WQI(c)$ = the cummulative Water Quality Index, a number between 0 and 100

q_i = the quality of the ith parameter, a number between 0 and 100, (read from unit qualigram curves - see appendix A)

w_i = the unit weight of the ith parameter, a number between 0 and 0.17

n = 9, the number of parameters

In the WQI(c) expression above the nine parameters are:

- dissolved oxygen (DO), as percent saturation
- fecal coliform density (FC), no./100 ml
- pH
- nitrates (NO_3), mg/l NO_3-N
- phosphates (PO_4), mg/l PO_4-P
- 5 day biochemical oxygen demand (BOD_5), mg/l

- temperature, °C departure from equilibrium
- total solids, mg/l
- turbidity, JTU (Jackson turbidity units)

This additive model was adequate when all parameters are within a reasonable range, but it lacked sensitivity in forcing the effect of a single low value or poor quality on the overall water quality. As a result, a multiplicative form of the NSF - WQI was developed as:

$$WQI(M) = \prod_{i=1}^{n} q_i^{w_i} \qquad (2)$$

where

WQI(M) = the multiplicative water quality index, a number between 0 and 100 (theoretical),

q_i = the quality of the ith parameter, a number between 0 and 100,

w_i = the unit weight of the ith parameter, a number between 0 and 0.17

n = the number of parameters.

The computer programs:

Four distinct programs will be described:

a) The reporting and graphical display of the cummulative or multiplicative NSF - WQI for the retrieved STORET stations, as a function of time.

b) The reporting and graphical display of the parameters used to compute the NSF - WQI, by plotting five parameters to a frame as a function of time.

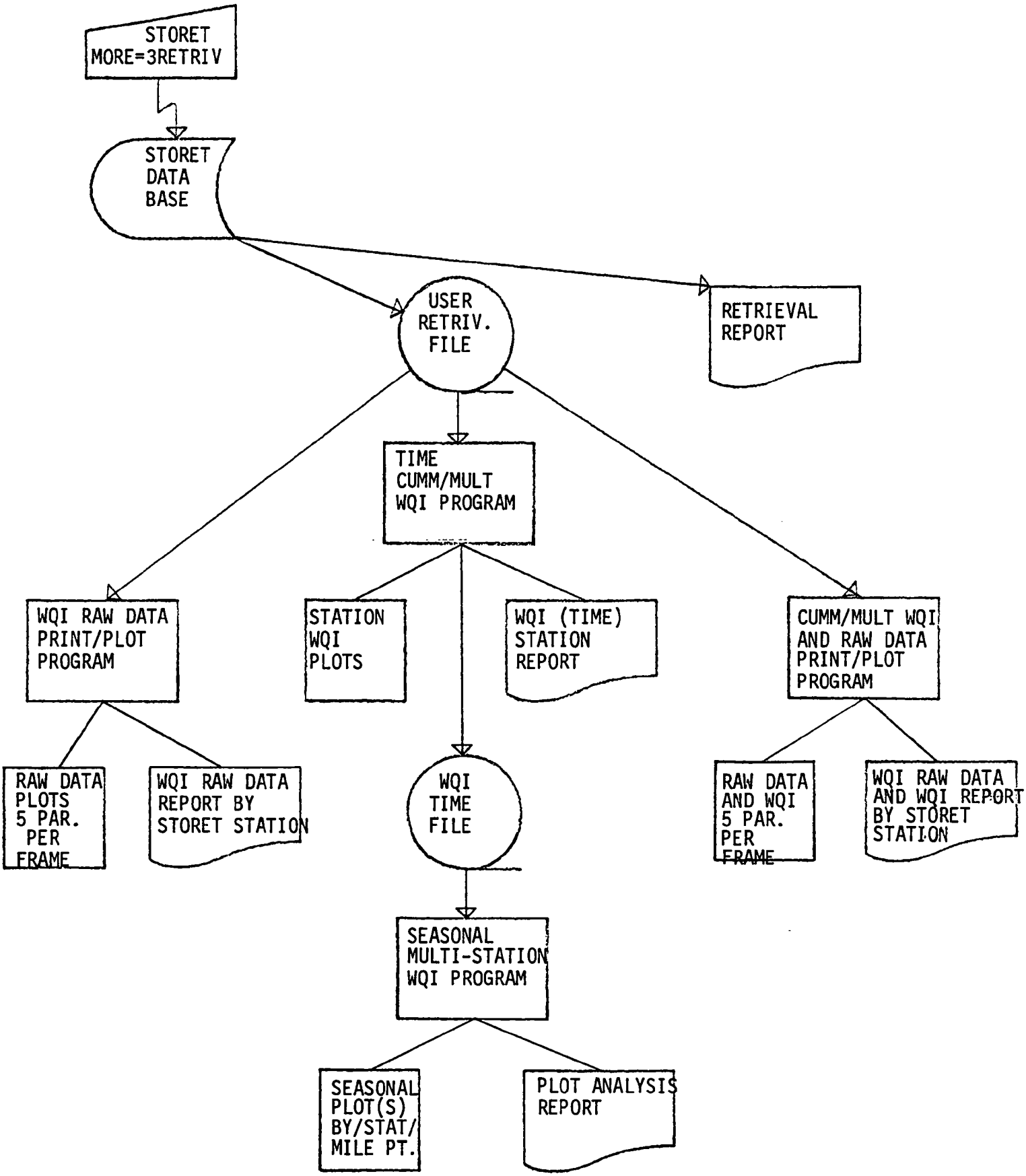
c) The graphical display of the NSF - WQI for the specified time intervals versus STORET station numbers or station mile points.

d) The reporting and graphical display of the parameters used to compute the NSF - WQI, and the cummulative or multiplicative NSF - WQI by plotting five parameters to a frame as a function of time.

The graphical output is generated by calling subroutines of the Integrated Plotting Package. This procedure creates a neutral text of instructions, which are subsequently processed as line printer plots, or as calcomp plots or by using the Time Sharing Option at WCC, the plot can be created interactively on the 4014 Tektronics terminal.

FIGURE 1

SYSTEM FLOWCHART OF NSF-WQI GRAPHICS FROM STORET DATA BASE



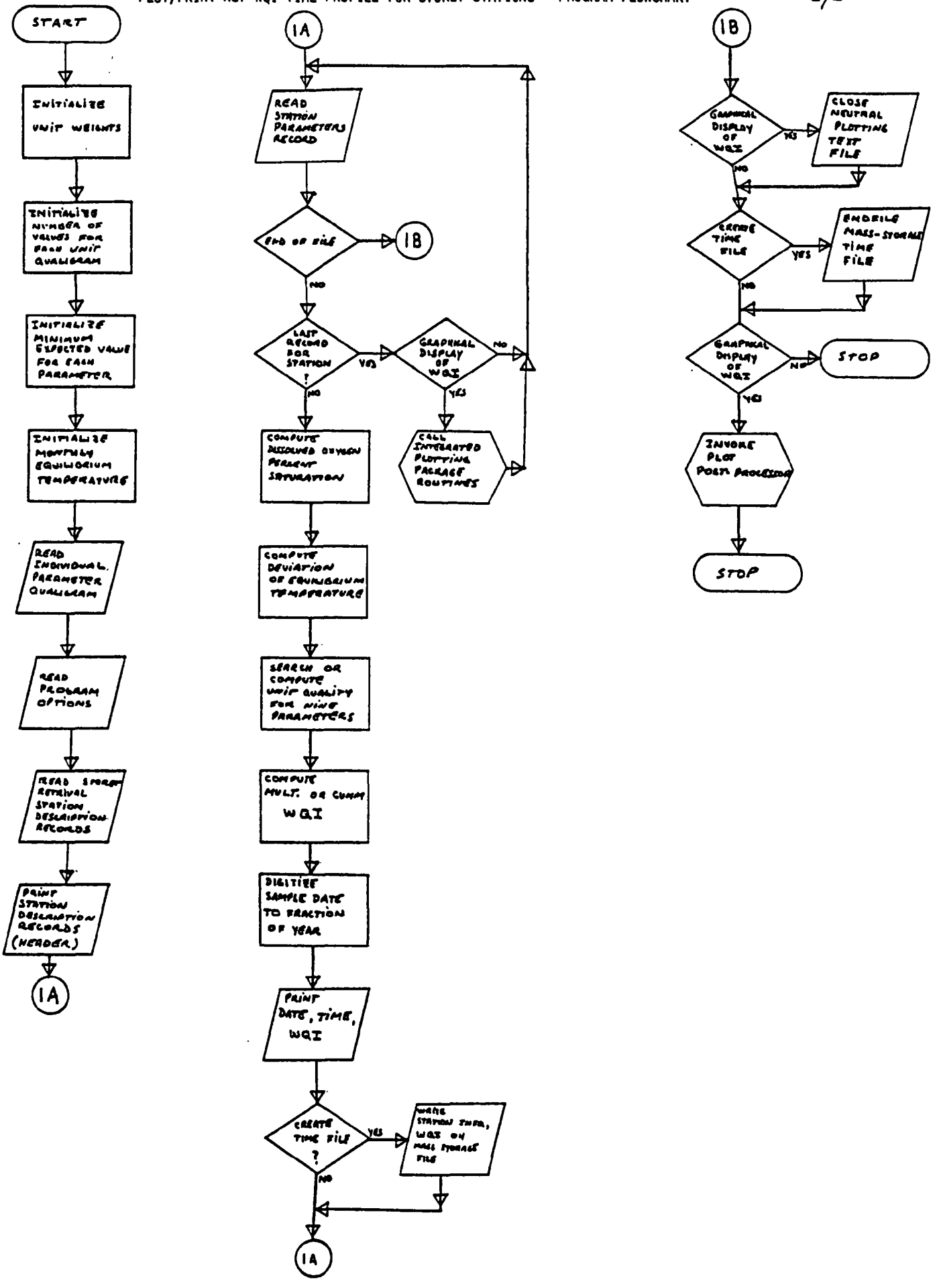
PROGRAM A: PLOT/PRINT NSF - WQI TIME PROFILE FOR STORET STATIONS

This program reads input from a STORET "More = 3" retrieval and computes multiplicative or cummulative water quality indices and outputs these on a report format. The user can also direct the program to produce printer or calcomp plots, by modifying Job Control statements. The program has been written in a general form so that it may be applied with very minor modifications anywhere in the United States.

The program begins by setting monthly equilibrium temperatures for the given area[5], then reads control options specified by the user and the digitized unit qualigrams. Then the first station in the storet retrieval is processed. If all the nine parameters used in the index are not present, the data for this date/time record is bypassed. Observations with all parameters present are first edited so that extraneous values (if present) are eliminated. The the saturation level of oxygen is computed using temperature and chloride concentration, from this value the dissolved oxygen concentration as % saturation is arrived. Next, the deviation from equilibrium temperature is computed.

If the unit quality of a parameter falls in between two defined values, a linear interpolation is performed to compute the unit quality for the parameter. Once all nine unit qualities are known a cummulative or multiplicative index is computed. Then the sample date is digitized to a fraction of the year. These two values; the index and the digitized date are then saved in a vector for plotting. The program then goes to the next date/time observation and performs these same operations. Once the last record for this station is processed, the program breaks control and calls Integrated Plotting routines. These routines create a so-called "neutral-text" on a mass storage file and returns to process the next station as outlined above.

Once all the stations have been processed, a plot post-processor is invoked which will produce a printer-plot, a calcomp plot or if interactively, a Tektronics CRT display.


START
INITIALIZE UNIT WEIGHTS
INITIALIZE NUMBER OF VALUES FOR EACH UNIT QUALIGRAM
INITIALIZE MINIMUM EXPECTED VALUE FOR EACH PARAMETER
INITIALIZE MONTHLY EQUILIBRIUM TEMPERATURE
READ INDIVIDUAL PARAMETER QUALIGRAM
READ PROGRAM OPTIONS
READ STORET RETRIEVAL STATION DESCRIPTION RECORDS
PRINT STATION DESCRIPTION RECORDS (HEADER)
1A
1A
READ STATION PARAMETERS RECORD
END OF FILE
1B
NO
LAST RECORD FOR STATION ?
YES
GRAPHICAL DISPLAY OF WQI
NO
YES
CALL INTEGRATED PLOTTING PACKAGE ROUTINES
NO
COMPUTE DISSOLVED OXYGEN PERCENT SATURATION
COMPUTE DEVIATION OF EQUILIBRIUM TEMPERATURE
SEARCH OR COMPUTE UNIT QUALITY FOR NINE PARAMETERS
COMPUTE MULT. OR CUMM WQI
DIGITIZE SAMPLE DATE TO FRACTION OF YEAR
PRINT DATE, TIME, WQI
CREATE TIME FILE ?
YES
NO
1A
1B
GRAPHICAL DISPLAY OF WQI
YES
CLOSE NEUTRAL PLOTTING TEXT FILE
NO
CREATE TIME FILE
YES
ENDFILE MASS-STORAGE TIME FILE
NO
GRAPHICAL DISPLAY OF WQI
NO
STOP
YES
INVOKE PLOT POST PROCESSOR
STOP

PROGRAM A: PLOT/PRINT NSF-WQI TIME PROFILE FOR STORET STATIONS

PROGRAM INPUT

(1) TO UPDATE PROGRAM WITH EQUILIBRIUM TEMPERATURES:
If necessary, change source statement number 53 to the applicable equilibrium temperatures. Reference no. 5 has tables listing these values applicable to most locations in the United States.

(2) TO MODIFY DIGITIZED UNIT QUALIGRAMS FOR PARAMETERS:
The data shown on page 10 is for linear approximations to the mean curve of the unit qualigrams for each of the nine parameters as shown on Appendix A. This data is provided with the program. If the user desires to improve these values, first modify source statement number 32 to the new number values to be read for each parameter, then read these values as follows:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 10	TABLE (1,1,1)	F10.0	1st value of x-scale for 1st parameter
11 - 20	TABLE (2,1,1)	F10.0	2nd value of x-scale for 1st parameter
.	.	.	.
.	.	.	.
.	.	.	.
71 - 80	TABLE (8,1,1)	F10.0	8th value of x-scale for 1st parameter

The card above is repeated until all x-scale values for the 1st parameter unit qualigrams have been read.

The y-values (unit qualities) for the corresponding x-values read above are now entered:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 10	TABLE (1,2,1)	F10.0	corresponding 1st value of y-scale for 1st parameter
11 - 20	TABLE (2,2,1)	F10.0	corresponding 2nd value of y-scale for 1st parameter
.	.	.	.
.	.	.	.
.	.	.	.
71 - 80	TABLE (8,2,1)	F10.0	8th value of y-scale for 1st parameter

This card above is repeated (if necessary) until all corresponding y values for the x-values read in previously have been entered.

Next the x-values and the associated unit quality for the 2,3...9 parameters are entered in an identical manner. For the last parameter this input would be:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 10	TABLE (1,1,9)	F10.0	1st value of x-scale for 9th parameter
11 - 20	TABLE (2,1,9)	F10.0	2nd value of x-scale for 9th parameter
.	.	.	.
.	.	.	.
.	.	.	.
71 - 80	TABLE (8,1,9)	F10.0	8th value of x-scale for 9th parameter

As previously, the above card is repeated if necessary.

Next the y-values for the corresponding x-values are entered:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 10	TABLE (1,2,9)	F10.0	corresponding 1st value of y-scale for 9th parameter
11 - 20	TABLE (2,2,9)	F10.0	corresponding 2nd value of y-scale for 9th parameter
.	.	.	.
.	.	.	.
.	.	.	.
71 - 80	TABLE (8,2,9)	F10.0	corresponding 8th value of y-scale of 9th parameter

Again, as in the first parameter, the above card is repeated if it was necessary in inputting the x-scale for this parameter.

3) PROGRAM OPTIONS CARD

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 2	OPTION (1)	I2	OPTION (1) = 0 for CUMM WQI OPTION (1) > 0 for MULT WQI
3 - 4	OPTION (2)	I2	OPTION (2) = 0, REPORT ONLY OPTION (2) > 0, PRINT REPORT AND ALSO PLOT
5 - 6	OPTION (3)	I2	OPTION (3) > 0 TO CREATE TIME FILE USED IN MULTI-STATION WQI PROGRAM (SEE FORTRAN FILE 25) IN JCL STATEMENTS

4) STORET "MORE = 3" RETRIEVAL

This retrieval must precede this program, and is referenced in the JCL statements as "fortran file (20)", see sample deck set up in the following section.

SAMPLE INPUT

1) Deck setup for program execution from source statements:

```
//EPAIIIaa JOB(AAAA)
//  EXEC IPPPRCGP,REGION=130K
//*  THIS PROCEDURE WILL INVOKE THE PRINTER POST-PROCESSOR
//FORT.SYSIN DD *
          .                                .                                .
          .                                .                                .
          .                                .                                .
                 S O U R C E   P R O G R A M   G O E S   H E R E
          .                                .                                .
          .                                .                                .
          .                                .                                .
//GO.FT20F001 DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(OLD,KEEP),
//  LABEL=(,,,IN),DSN=CN.EPAIII.AAAA.(FILE NAME FROM STORET RETRIEVAL)
//GO.FT25F001 DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(NEW,KEEP),
// DCB=(RECFM=FB,LRECL=99,BLKSIZE=12969),SPACE=(TRK,(5,1),RLSE),
//  DSNAME=CN.EPAIII.AAAA.(TIME FILE NAME GOES HERE)
//GO.FT08F001  DD *
  0.0      20.0      30.0      40.0      50.0      60.0      78.0      80.0
  100.0    120.0     140.0
  3.0      12.0      20.0      30.0      44.0      60.0      75.0      86.0
  100.0    89.0      73.0
  1.0      2.0       5.0       10.0      20.0      50.0      100.0     300.0
  500.0    1000.0    2000.0    5000.0    10000.0   20000.0   100000.0
  100.0    88.0      77.0      68.0      58.0      47.0      40.0      30.0
26.0       21.0      18.0      12.0      9.0       7.0       5.0
  2.0      3.0       3.3       4.0       4.5       5.0       5.5       6.0
  6.4      7.0       7.2       7.4       7.8       8.0       8.5       9.0
  10.0     10.5      11.0      12.0
  2.0      4.0       7.0       10.0      16.0      27.0      42.0      62.0
80.0       91.0      93.0      94.0      90.0      87.0      80.0      45.0
  18.0     10.0      6.0       3.0
  0.0      5.        10.       15.        20.      25.       30.
 100.      53.       31.       18.       11.       7.        5.
 0.0       5.0       10.       20.        30.       40.      50.       60.
  70.      80.       90.       100.
  100.      66.      49.       32.       23.       17.       12.       7.
 4.        2.0       1.2       1.1
  0.0      .5        1.        2.        3.       4.          5.       6.
 7.        8.        9.        10.
 100.      60.       41.       25.       18.       12.        10.       8.
 7.        6.        5.        4.
 0.0      1.25      2.5       5.0       6.25      7.5       8.9       10.0
 12.5      15.0      17.5      20.0
  52.0     71.0      81.0      93.0      86.0      76.0      50.0      40.0
  26.0     18.0      12.0      9.0
 0.0       10.       20.       30.       40.       50.       60.       70.
 80.       90.       100.
 100.      77.       62.       52.       44.       38.        32.       28.
 24.       20.       17.
0.0        50.       100.      150.      200.      250.      300.      350.
 400.      450.      500.
 80.       86.       84.       81.       74.       68.       61.       54.
 47.        39.      33.
000101
/*
```

2) Execution of program from load module:

```
//EPAIIIaa JOB(AAAA)
//S1 EXEC PGM=TIMEWQI,REGION=130K
//STEPLIB DD DSN=CN.EPAGAN.R2TW.WQI.LOADLIB,DISP=SHR
//FT02F001 DD DSN=&IPPTAPE,UNIT=SYSDA,SPACE=(CYL,(2,2),RLSE),
// DCB=(RECFM=VBS,LRECL=516,BLKSIZE=3156),DISP=(NEW,PASS,DELETE)
//FT06F001 DD SYSOUT=A
//FT20F001 DD UNIT=3330,VOL=SER=TSO001,DISP=(OLD,KEEP),
//  DSNAME=CN.EPAIII.AAAA.(FILE NAME FROM STORET RETRIEVAL FOLLOWS)
//FT25F001 DD UNIT=3330,VOL=SER=TSO001,DISP=(NEW,KEEP),
// DCB=(RECFM=FB,LRECL=99,BLKSIZE=12969),SPACE=(TRK,(5,1),RLSE),
//  DSNAME=CN.EPAIII.AAAA.(TIME FILE NAME GOES HERE)
//FT08F001 DD *
  0.0      20.0     30.0     40.0     50.0     60.0     78.0     80.0
  100.0    120.0    140.0
  3.0      12.0     20.0     30.0     44.0     60.0     75.0     86.0
  100.0    89.0     73.0
  1.0      2.0      5.0      10.0     20.0     50.0     100.0    300.0
  500.0    1000.0   2000.0   5000.0   10000.0  20000.0  100000.0
  100.0    88.0     77.0     68.0     58.0     47.0     40.0     30.0
26.0       21.0     18.0     12.0     9.0      7.0      5.0
  2.0      3.0      3.3      4.0      4.5      5.0      5.5      6.0
  6.4      7.0      7.2      7.4      7.8      8.0      8.5      9.0
  10.0     10.5     11.0     12.0
  2.0      4.0      7.0      10.0     16.0     27.0     42.0     62.0
80.0       91.0     93.0     94.0     90.0     87.0     80.0     45.0
  18.0     10.0     6.0      3.0
  0.0      5.       10.      15.       20.     25.      30.
 100.      53.      31.      18.      11.      7.       5.
 0.0       5.0      10.      20.       30.      40.     50.      60.
  70.      80.      90.      100.
  100.      66.     49.      32.      23.      17.      12.      7.
 4.        2.0      1.2      1.1
  0.0      .5       1.       2.       3.      4.        5.      6.
 7.        8.       9.       10.
 100.      60.      41.      25.      18.      12.       10.     8.
 7.        6.       5.       4.
 0.0      1.25     2.5      5.0      6.25     7.5      8.9      10.0
 12.5     15.0     17.5     20.0
  52.0     71.0     81.0     93.0     86.0     76.0     50.0     40.0
  26.0     18.0     12.0     9.0
 0.0       10.      20.      30.      40.      50.      60.      70.
 80.       90.      100.
 100.      77.      62.      52.      44.      38.       32.      28.
 24.       20.      17.
0.0        50.      100.     150.     200.     250.     300.     350.
 400.      450.     500.
 80.       86.      84.      81.      74.      68.      61.      54.
 47.        39.     33.
010101

/*
//PLOT EXEC PGM=IPPPRCGP,COND=(8,LE),REGION=130K
//STEPLIB DD DSN=CN.EPAZAF.SSSS.IPP.LOAD,DISP=SHR
//FT01F001 DD DDNAME=SYSIN
//FT02F001 DD DSN=&IPPTAPE,DISP=(OLD,DELETE,DELETE)
//FT06F001 DD SYSOUT=A
//FT15F001 DD SYSOUT=A
/*
```

WHERE:

AAAA IS THE USER'S ACCOUNT NUMBER

III IS THE USER'S INITIALS

TTTTTT IS THE MAGNETIC TAPE NUMBER

PROGRAM A: PLOT/PRINT NSF - WQI TIME PROFILE
FOR STORET STATIONS

SAMPLE OUTPUT

STATION 340028

340028 170
40 55 16.0 074 50 27.0 2
PEQUEST RIVER
34 NEW JERSEY
NORTH ATLANTIC 020392
DELAWARE RIVER
21NJDEP1 2111204
0000 FEET DEPTH CLASS 00

DATE	DIG. YR.	TIME	CUMM WQI
8/22/66	0.641		64.
10/31/66	0.833		73.
6/21/67	0.471		73.
9/26/67	0.737		71.
11/20/67	0.888		71.
1/23/68	0.063		74.
4/16/68	0.292		72.
8/20/68	0.637		73.
12/ 2/68	0.921		73.
3/11/69	0.192		76.
5/27/69	0.403	1100	75.
12/17/69	0.962	1038	75.
3/ 5/70	0.175	1045	76.
5/ 4/70	0.340		69.
11/16/70	0.877	1015	66.
2/ 9/71	0.110	1045	69.
5/11/71	0.359	1030	70.
9/ 8/71	0.688	1100	75.
12/ 7/71	0.934	1040	72.
3/ 9/72	0.189	1045	77.
6/14/72	0.454	1230	74.
10/18/72	0.798		74.
3/ 6/73	0.178		74.
5/16/73	0.373		72.
10/ 1/73	0.751		77.
12/11/73	0.945		70.

STATION 341004

341004 4
40 04 52.0 074 09 07.0 2
METEDECONK RIVER N. BRANCH
34 NEW JERSEY
NORTHEAST
NEW JERSEY COASTAL
21NJDEP1 2111204
0000 FEET DEPTH CLASS 00

DATE	DIG. YR.	TIME	MULT WQI
11/22/66	0.893		77.
2/28/67	0.162		83.
9/13/67	0.701		62.
11/ 1/67	0.836		66.
6/ 4/68	0.426		59.
8/ 1/68	0.585	1310	49.
10/22/68	0.809		59.
1/22/70	0.060		77.
3/16/70	0.205	1300	67.
3/29/71	0.241	1245	77.
1/19/72	0.052	1310	78.
1/19/72	0.052		78.
4/10/72	0.276	1245	72.
4/10/72	0.276		72.
12/12/72	0.948		79.
2/20/73	0.140		83.
5/ 7/73	0.348		71.
9/24/73	0.732		60.
12/ 5/73	0.929		64.
1/14/74	0.038		74.

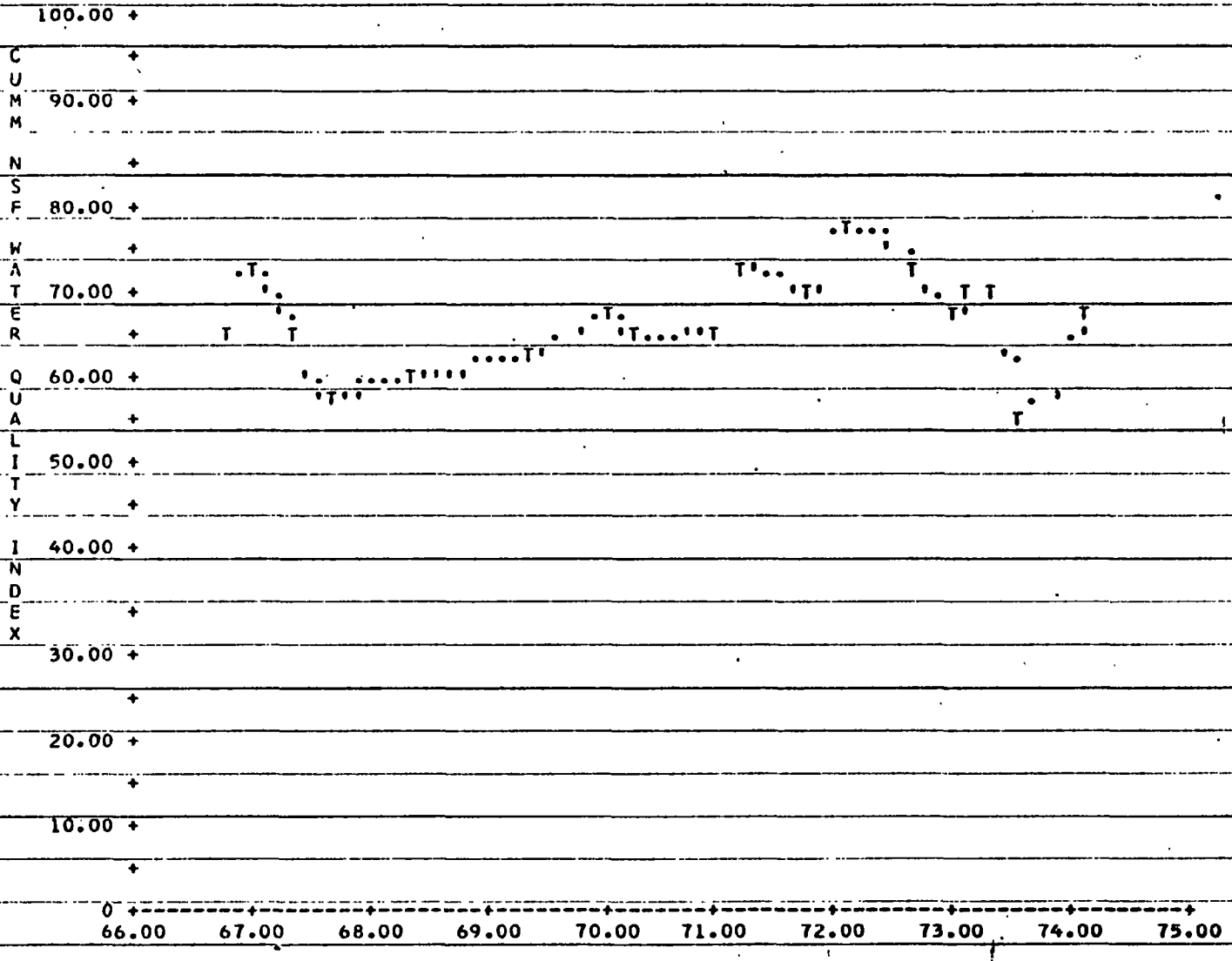
P R I N T E R P O S T P R O C E S S O R OF IPP - COMMENTS AND ERROR MESSAGES - VERSION 01 MAY 74

FRAME NUMBER 1 STARTING WITH RECORD NUMBER 1
FRAME NUMBER 1 PROCESSED WITH 0 ERRORS DETECTED

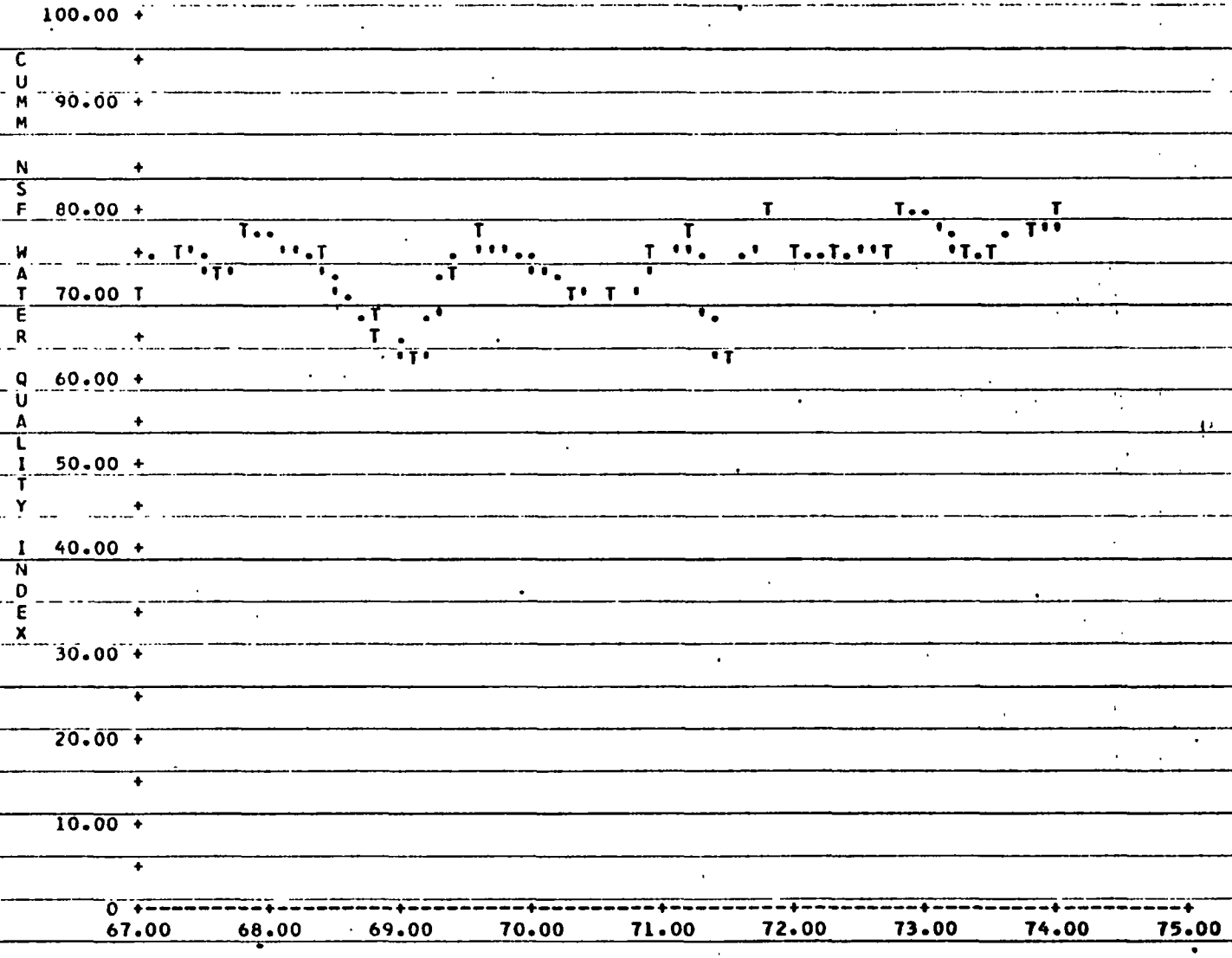
SUMMARY

RECORDS	67
FRAMES	1
ERRORS	0

END OF POSTPROCESSOR RUN FOR IPP



STORET STATION NO. 343045 MILLSTONE RIVER



STORET STATION NO. 343051 STONY BROOK

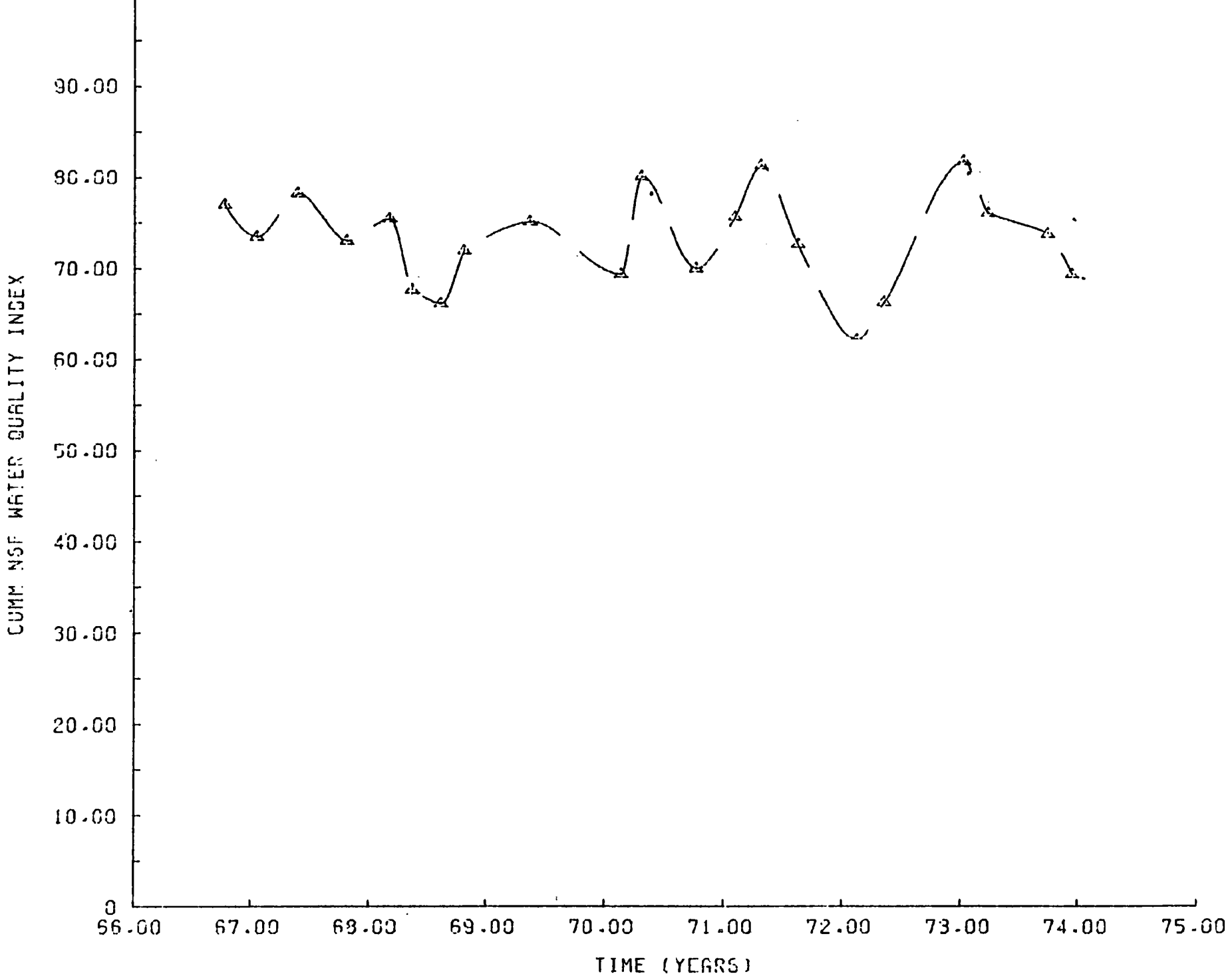
C A L C O M P P O S T P R O C E S S O R OF IPP - COMMENTS AND ERROR MESSAGES - VERSION 01 MAY 74

FRAME NUMBER 1 STARTING WITH RECORD NUMBER 1
FRAME NUMBER 1 PROCESSED WITH 0 ERRORS DETECTED

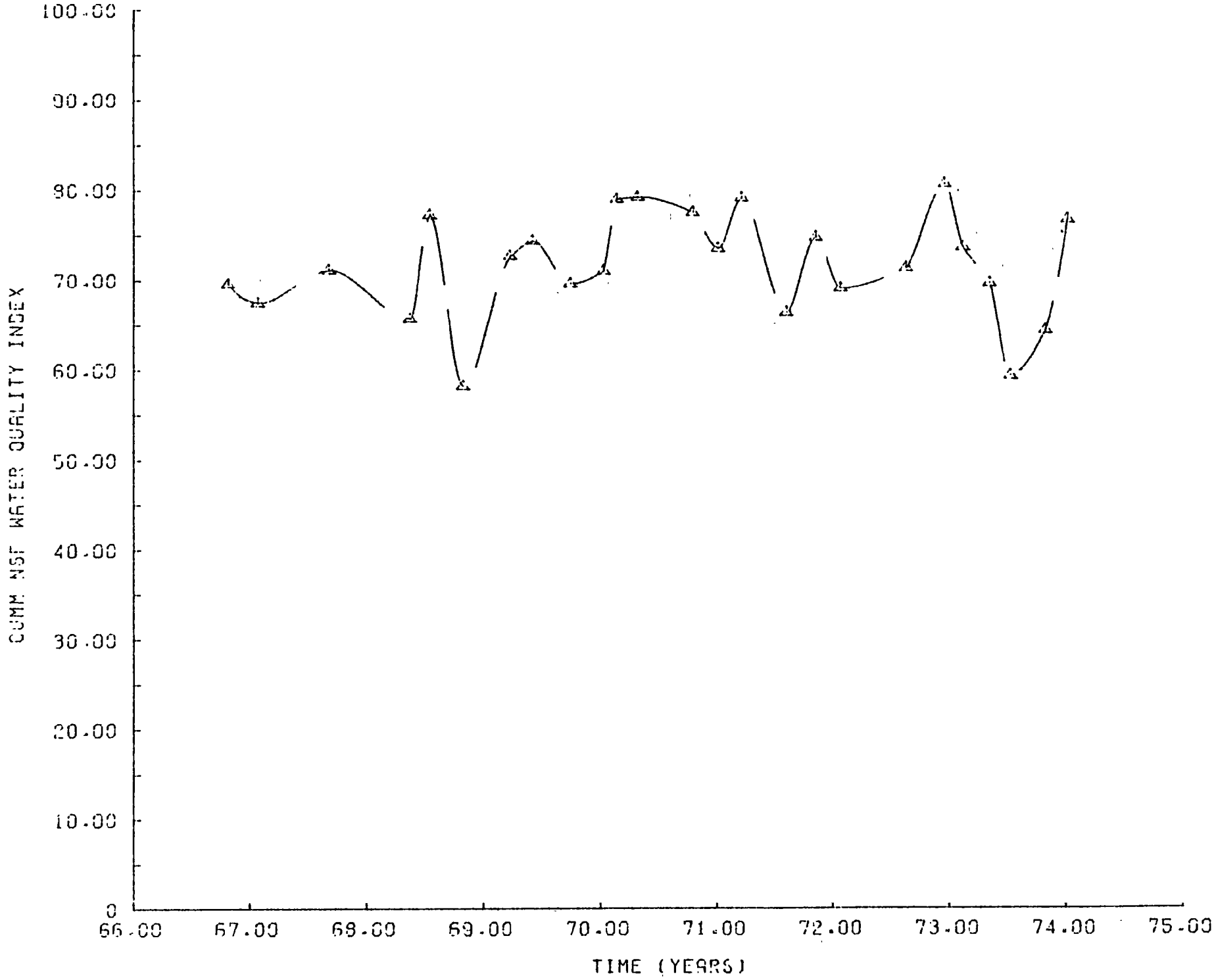
SUMMARY

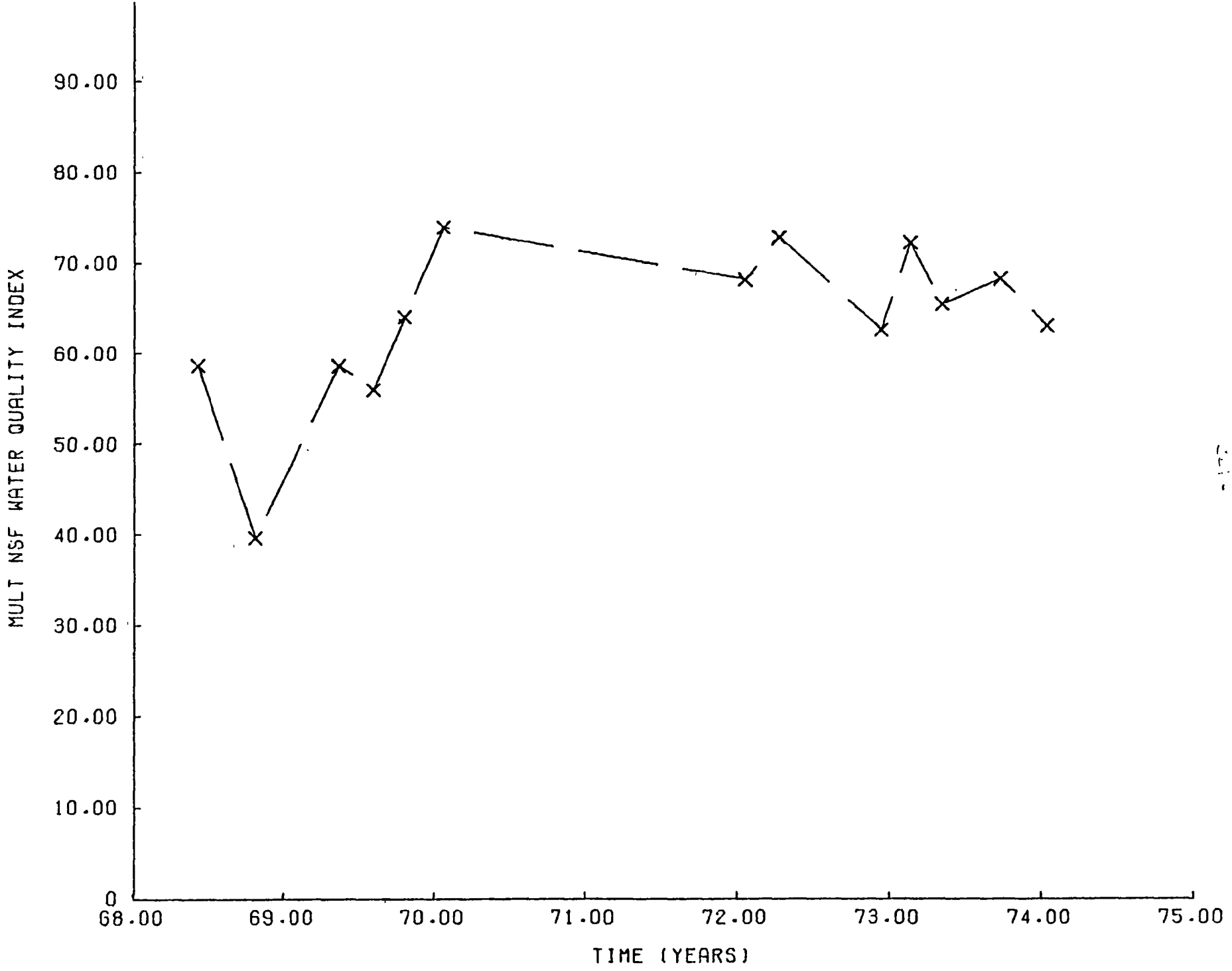
RECORDS	77
FRAMES	1
ERRORS	0

END OF POSTPROCESSOR RUN FOR IPP

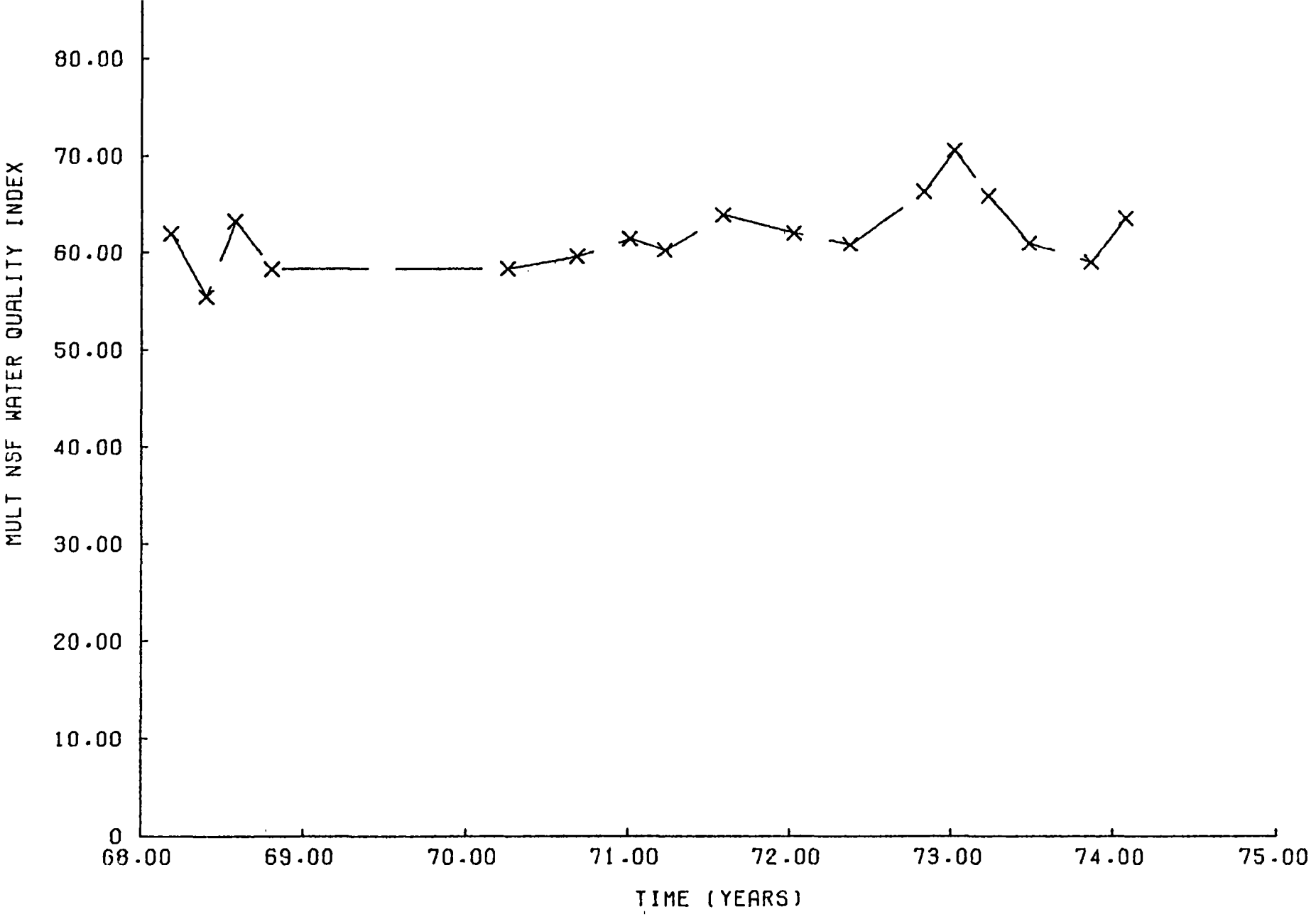


STORET STATION NO. 343014 RARITAN RIVER (R14)


100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0
COMM NSF WATER QUALITY INDEX
66.00
67.00
68.00
69.00
70.00
71.00
72.00
73.00
74.00
75.00
TIME (YEARS)



STORET STATION NO. 341007 TOMS RIVER RIDGEWAY BRANCH



STORET STATION NO. 341008 WADING RIVER W. BRANCH

PROGRAM A - SOURCE LISTING

```
C                                                                       TWQI000
C     ********************************************************************* TWQI001
C     ********************************************************************* TWQI002
C                                                                       TWQI003
C     GENERALIZED NSF WATER QUALITY INDEX PROGRAM                       TWQI004
C                                                                       TWQI005
C     *** USER SPECIFIES CUMMULATIVE OR MULTIPLICATIVE INDEX ***        TWQI006
C                                                                       TWQI007
C     *** OPTIONNAL GRAPHS ON PRINTER OR DIGITAL PLOTTER ***            TWQI008
C                                                                       TWQI009
C     ********************************************************************* TWQI010
C     ********************************************************************* TWQI011
C                                                                       TWQI012
      INTEGER OPTION(3)                                                 TWQI013
      DIMENSION PLDATA(30),SYMBOL(14),XXVAL(100),YYVAL(100),SCL(5)      TWQI014
      DIMENSION TOP(12),TABLE(20,2,9),MAXX(9),WEIGHT(9),QMAX(9)         TWQI015
      DIMENSION AGENCY(2),DESCRP(30),EQTEMP(12),PARAM(10),SMALL(9),     TWQI016
     1QUAL(9),STAT(4),DAYS(12),HSTAT(4)                                 TWQI017
      DIMENSION BUFX(500),BUFY(500)                                     TWQI018
C     ********************************************************************* TWQI019
C                                                                       TWQI020
C     THE NEXT STATEMENT HAS THE UNIT WEIGHT FACTORS FOR EACH PARAMETER TWQI021
C                                                                       TWQI022
C     ********************************************************************* TWQI023
      DATA WEIGHT/.17,.15,.12,.10,.10,.10,.10,.08,.08/                  TWQI024
C     ********************************************************************* TWQI025
C                                                                       TWQI026
C     THIS NEXT DATA STATEMENT HAS THE MAXIMUM NO. OF POINTS IN EACH    TWQI027
C     UNIT QUALIGRAM  --  FOR PROGRAM CONTROL                           TWQI028
C                                                                       TWQI029
C     ********************************************************************* TWQI030
      DATA MAXX/11,15,20,7,12,12,12,11,11/                              TWQI031
      DATA DAYS/31.,28.,31.,30.,31.,30.,31.,31.,30.,31.,30.,31./        TWQI032
      DATA SKPTIM/'2500'/,SPACE/'    '/                                 TWQI033
      DATA SMALL/0.,1.,2.,0.,0.,0.,-10.,0.0,0.0/                        TWQI034
      DATA SYMBOL/'Q','O','T','+','X','D','A','M','Z','Y','B','*','H','I TWQI035
     1'/                                                                TWQI036
C     ********************************************************************* TWQI037
C                                                                       TWQI038
C     THE NEXT DATA STATEMENT IS THE UNIT QUALITY, ASSIGNED TO A        TWQI039
C     PARAMETER EXCEEDING THE RANGES IN THE QUALIGRAMS                  TWQI040
C                                                                       TWQI041
C     ********************************************************************* TWQI042
      DATA QMAX/50.,2.,0.0,2.,1.,2.,5.,5.,20./                          TWQI043
C                                                                       TWQI044
C     ********************************************************************* TWQI045
C                                                                       TWQI046
C     THESE NEXT VALUES ARE MONTHLY EQUILIBRIUM TEMPERATURES FOR THE    TWQI047
C     STATE OF NEW JERSEY   REF  'EFFECT OF GEOGRAPHICAL LOCATION ON    TWQI048
C     COOLING POND REQUIREMENT AND PERFORMANCE 16130 FDQ 03/71          TWQI049
C                                                                       TWQI050
C     ********************************************************************* TWQI051
      DATA EQTEMP/33.,37.,45.,57.,69.,78.,83.,81.,73.,60.,46.,38./      TWQI052
C                                                                       TWQI053
```

PROGRAM A - SOURCE LISTING

```
      M=8                                                                TWQI054
C     ******************************************************************* TWQI055
C                                                                        TWQI056
C     READ INDIVIDUAL PARAMETER QUALIGRAMS                               TWQI057
C                                                                        TWQI058
C     ******************************************************************* TWQI059
      DO 150  I=1,9                                                      TWQI060
      MAX=MAXX(I)                                                        TWQI061
C                                                                        TWQI062
C     FIRST -- THE X-SCALE IS READ INTO TABLE(J,1,I)                     TWQI063
C                                                                        TWQI064
      READ(M,151)(TABLE(J,1,I),J=1,MAX)                                  TWQI065
  151 FORMAT(8F10.0)                                                     TWQI066
C                                                                        TWQI067
C     NOW READ IN THE ASSOCIATED Y VALUE FOR THE X'S ABOVE               TWQI068
C                                                                        TWQI069
      READ(M,151)(TABLE(J,2,I),J=1,MAX)                                  TWQI070
  150 CONTINUE                                                           TWQI071
      ISEQ=0                                                             TWQI072
C                                                                        TWQI073
C     'ISEQ' IS USED TO IDENTIFY STORET STATIONS BY A UNIQUE SEQUENTIAL  TWQI074
C     NUMBER ... USED IF PLOTTING SEASONAL WQI BY MILE PTS. OR STAT. NO. TWQI075
C                                                                        TWQI076
      KK=0                                                               TWQI077
      XXMAX=0.0                                                          TWQI078
      YYMAX=0.0                                                          TWQI079
C                                                                        TWQI080
C     ******************************************************************* TWQI081
C                                                                        TWQI082
C     READ PROGRAM OPTIONS  ...                                          TWQI083
C                                                                        TWQI084
C     OPTION(1)=0, FOR CUMM. INDEX   =1,FOR MULTIPLICATIVE INDEX         TWQI085
C     OPTION(2)=0, FOR NO PLOT,  ... =1,FOR WQI PLOT                     TWQI086
C     OPTION(3)=1, TO CREATE FILE USED IN PLOTTING WQI BY STATIONS       TWQI087
C     IF STATION  PLOTTING WILL NOT FOLLOW  --  LEAVE OPTION(3) BLANK    TWQI088
C                                                                        TWQI089
C     ******************************************************************* TWQI090
      READ(M,101)OPTION                                                  TWQI091
101   FORMAT(3I2)                                                        TWQI092
C     ******************************************************************* TWQI093
C                                                                        TWQI094
C     CONVERT MONTHLY EQUILIBRIUM TEMPERATURES TO DEGREES CENTIGRADE     TWQI095
C                                                                        TWQI096
C     ******************************************************************* TWQI097
      DO 1  I=1,12                                                       TWQI098
      EQTEMP(I)=(EQTEMP(I)-32.)*.55556                                   TWQI099
    1 CONTINUE                                                           TWQI100
C     ******************************************************************* TWQI101
C                                                                        TWQI102
C **READ DELIMITER RECORD - VERIFY BEGINNING OF DATA RECORDS**           TWQI103
C                                                                        TWQI104
C     ******************************************************************* TWQI105
 12   READ(20,111,END=400) IDUMMY                                        TWQI106
 111  FORMAT(25X,I2)                                                     TWQI107
```

PROGRAM A - SOURCE LISTING

```
      IF (IDUMMY.EQ.99) GOTO 22                                          TWQI108
      GOTO 12                                                            TWQI109
  232 IF(OPTION(2).LE.0)GO TO 432                                        TWQI110
C                                                                        TWQI111
C     GRAPH OF WATER QUALITY INDEX FOR STATION WILL BE DONE IF DESIRED   TWQI112
C                                                                        TWQI113
C     ********************************************************************TWQI114
C                                                                        TWQI115
C     *** COMMANDS BELOW USE THE INTEGRATED PLOTTING PACKAGE ***         TWQI116
C                                                                        TWQI117
C     ********************************************************************TWQI118
G                                                                        TWQI119
C     SET INITIAL VALUES ON SPECIFICATIONS ARRAY                         TWQI120
      CALL SSPECS(PLDATA)                                                TWQI121
C                                                                        TWQI122
C     SET PLOTTING SYMBOL DESIRED                                        TWQI123
C                                                                        TWQI124
      PLDATA(16)=SYMBOL(3)                                               TWQI125
C                                                                        TWQI126
C     RESET SIZE OF AXES (INCHES)  Y ONLY                                TWQI127
C                                                                        TWQI128
      PLDATA(8)=7.0                                                      TWQI129
C                                                                        TWQI130
C     MOVE X-AXIS 2 INCHES AWAY FROM ORIGIN                              TWQI131
C                                                                        TWQI132
      PLDATA(2)=2.0                                                      TWQI133
C                                                                        TWQI134
C     ENTER NUMBER OF DATA POINTS TO PLOT                                TWQI135
C                                                                        TWQI136
      PLDATA(13)=MM-1                                                    TWQI137
C                                                                        TWQI138
C     CLEAR WORK AREA                                                    TWQI139
C                                                                        TWQI140
      DO 15  K=1,5                                                       TWQI141
   15 SCL(K)=0.0                                                         TWQI142
C                                                                        TWQI143
C     SET RANGE OF VALUES ON X-AXIS,  NO. DIVISIONS=NO. YEARS ANALYZED   TWQI144
C                                                                        TWQI145
      KK=XXMAX+1                                                         TWQI146
      PLDATA(3)=KK                                                       TWQI147
      KK2=XXVAL(1)                                                       TWQI148
      PLDATA(4)=KK2                                                      TWQI149
      PLDATA(9)=KK-KK2                                                   TWQI150
C                                                                        TWQI151
C     SET RANGE OF VALUES ON Y-AXIS                                      TWQI152
C                                                                        TWQI153
      PLDATA(5)=100.                                                     TWQI154
      PLDATA(6)=0.0                                                      TWQI155
C                                                                        TWQI156
C     CHANGE DEFAULT VALUE OF DIVISIONS FOR Y-AXIS                       TWQI157
C                                                                        TWQI158
      PLDATA(10) = 10.                                                   TWQI159
C                                                                        TWQI160
C     DRAW ANNOTATION NUMBERS AT THE BOTTOM SCALE MARKS                  TWQI161
```

PROGRAM A - SOURCE LISTING

```
C                                                                       TWQI162
      CALL NODLIB(PLDATA)                                               TWQI163
C                                                                       TWQI164
C     DRAW ANNOTATION NUMBER AT THE LEFT SCALE MARKS                    TWQI165
C                                                                       TWQI166
      CALL NODLIL(PLDATA)                                               TWQI167
C                                                                       TWQI168
C     DRAW  X-Y  AXES ... DOUBLE NO. OF TICK MARKS IN Y-AXIS            TWQI169
C                                                                       TWQI170
      PLDATA(10)=20.0                                                   TWQI171
      CALL AXLILI(PLDATA)                                               TWQI172
C                                                                       TWQI173
CC    CLEAR ZONES VARIABLES --  SINCE UPDATED BY ABOVE SUBROUTINE       TWQI174
C                                                                       TWQI175
      CALL ZZONES(PLDATA)                                               TWQI176
C                                                                       TWQI177
C     PLOT SYMBOL AT DATA POINT LOCATIONS                               TWQI178
C                                                                       TWQI179
      CALL PSLILI(XXVAL,YYVAL,PLDATA)                                   TWQI180
C                                                                       TWQI181
C     NOW CONNECT DATA POINTS WITH PARABOLAS TO FIT THE DATA ...        TWQI182
C                                                                       TWQI183
C                                                                       TWQI184
      CALL PFLILI(XXVAL,YYVAL,BUFX,BUFY,PLDATA)                         TWQI185
C                                                                       TWQI186
C                                                                       TWQI187
C     NOW LABEL THE AXES ......                                         TWQI188
C     CHANGE DEFAULT SPACING OF TITLES TO THE AXES                      TWQI189
C                                                                       TWQI190
      PLDATA(24)=.30                                                    TWQI191
      PLDATA(26)=.75                                                    TWQI192
      CALL TITLEB('+  TIME (YEARS)+',PLDATA)                            TWQI193
      IF(OPTION(1).EQ.0)CALL TITLEL('+CUMM NSF WATER QUALITY INDEX+',   TWQI194
     1PLDATA)                                                           TWQI195
      IF(OPTION(1).NE.0)CALL TITLEL('+MULT NSF WATER QUALITY INDEX+',   TWQI196
     1PLDATA)                                                           TWQI197
C                                                                       TWQI198
C     PRINT GRAPH DESCRIPTION AT LOWER, RIGHT HAND SIDE OF GRAPH        TWQI199
C                                                                       TWQI200
      PLDATA(22)=3.0                                                    TWQI201
      PLDATA(23)=1.0                                                    TWQI202
      CALL GTITLE('+STORET STATION NO.+',PLDATA)                        TWQI203
      PLDATA(22)=4.6                                                    TWQI204
      CALL GTITLE(TOP,PLDATA)                                           TWQI205
C                                                                       TWQI206
C     ADVANCE GRAPH PAPER FOR NEXT STATION                              TWQI207
C                                                                       TWQI208
      CALL NXTFRM(PLDATA)                                               TWQI209
  432 STAT(1)=SPACE                                                     TWQI210
   22 READ(20,30,END=330) AGENCY,STAT,DESCRP                            TWQI211
 30   FORMAT(2A4,4A4,1X,30A4)                                           TWQI212
      MM=1                                                              TWQI213
      WRITE(6,40) STAT,DESCRP                                           TWQI214
 40   FORMAT('1STATION ',4A4,/,' ',30A4)                                TWQI215
```

PROGRAM A - SOURCE LISTING

```
      DO 60 I=1,8                                                       TWQI216
      READ(20,30,END=310) AGENCY,STAT,DESCRP                            TWQI217
      WRITE(6,50) DESCRP                                                TWQI218
 50   FORMAT(' ',30A4)                                                  TWQI219
      IF(I.EQ.2)GO TO 61                                                TWQI220
      GO TO 60                                                          TWQI221
   61 TOP(1)=SYMBOL(4)                                                  TWQI222
      TOP(2)=STAT(1)                                                    TWQI223
      TOP(3)=STAT(2)                                                    TWQI224
      TOP(4)=SPACE                                                      TWQI225
      TOP(5)=DESCRP(17)                                                 TWQI226
      TOP(6)=DESCRP(18)                                                 TWQI227
      TOP(7)=DESCRP(19)                                                 TWQI228
      TOP(8)=DESCRP(20)                                                 TWQI229
      TOP(9)=DESCRP(21)                                                 TWQI230
      TOP(10)=DESCRP(22)                                                TWQI231
      TOP(11)=DESCRP(23)                                                TWQI232
      TOP(12)=SYMBOL(4)                                                 TWQI233
C     ********************************************************************TWQI234
C                                                                       TWQI235
C     ADVANCE 'ISEQ' FOR NEXT STATION ...                               TWQI236
C                                                                       TWQI237
C     ********************************************************************TWQI238
      ISEQ=ISEQ+1                                                       TWQI239
 60   CONTINUE                                                          TWQI240
      IF(OPTION(1).EQ.0)WRITE(6,51)                                     TWQI241
      IF(OPTION(1).NE.0)WRITE(6,52)                                     TWQI242
   51 FORMAT(//,31X,'CUMM')                                             TWQI243
   52 FORMAT(//,31X,'MULT')                                             TWQI244
      WRITE(6,70)                                                       TWQI245
 70   FORMAT('   DATE     DIG. YR.   TIME    WQI')                     TWQI246
 80   CONTINUE                                                          TWQI247
      DO 90 I=1,9                                                       TWQI248
      QUAL(I)=0.0                                                       TWQI249
 90   CONTINUE                                                          TWQI250
C     ********************************************************************TWQI251
C                                                                       TWQI252
C     READ STATION PARAMETRIC DATA                                      TWQI253
C                                                                       TWQI254
C     ********************************************************************TWQI255
  100 READ(20,110,END=310) AGENCY,STAT,IYR,IMON,IDAY,TIME,PARAM         TWQI256
  110 FORMAT(2A4,3A4,A3,2X,3I2,A4,10A4)                                 TWQI257
      IF (IYR.EQ.99) GOTO 232                                           TWQI258
      DO 120 I=1,9                                                      TWQI259
C     ********************************************************************TWQI260
C                                                                       TWQI261
C     TEST FOR DUMMY VALUE IF NO SAMPLE WAS TAKEN                       TWQI262
C                                                                       TWQI263
C     ********************************************************************TWQI264
      IF ((PARAM(I).LT.1E-15).AND.(PARAM(I).GT.0.)) GOTO 100            TWQI265
      IF (PARAM(I).GE.0.) GOTO 120                                      TWQI266
      WRITE(6,115) I,PARAM(I)                                           TWQI267
115   FORMAT(' ***WARNING - PARAMETER ',I1,' IS NEGATIVE, ',F3.1        TWQI268
     1,' IS SUBSTITUTED***')                                            TWQI269
```

PROGRAM A - SOURCE LISTING

```
  120 CONTINUE                                                          TWQI270
      IF (TIME.EQ.SKPTIM) TIME=SPACE                                    TWQI271
C     ******************************************************************TWQI272
C                                                                       TWQI273
C     TEST PARAMETERS FOR MINIMUM POSSIBLE VALUES  -- IF LESS ADJUST    TWQI274
C                                                                       TWQI275
C     ******************************************************************TWQI276
      DO 156 I=1,9                                                      TWQI277
      IF (PARAM(I).LT.SMALL(I)) PARAM(I)=SMALL(I)                       TWQI278
  156 CONTINUE                                                          TWQI279
      IF(EQTEMP(IMON)-PARAM(7).LT.-5)PARAM(7)=-5.0                      TWQI280
C     ******************************************************************TWQI281
C                                                                       TWQI282
C     COMPUTE SATURATION LEVEL OF OXYGEN AT STATION  --USING TEMPERATURE TWQI283
C     AND CHLORIDE CONCENTRATION                                        TWQI284
C                                                                       TWQI285
C     ******************************************************************TWQI286
      DOSAT=(1.-.000009*PARAM(10))*(14.652-.41022*PARAM(7)              TWQI287
     1+.007991*PARAM(7)**2 -.000077774*PARAM(7)**3)                     TWQI288
C     ******************************************************************TWQI289
C                                                                       TWQI290
C     COMPUTE OXYGEN CONCENTRATION AS PERCENT SATURATION                TWQI291
C                                                                       TWQI292
C     ******************************************************************TWQI293
       PARAM(1)=PARAM(1)/DOSAT*100.                                     TWQI294
C     ******************************************************************TWQI295
C                                                                       TWQI296
C     COMPUTE DEVIATION FROM EQUILIBRIUM TEMPERATURE                    TWQI297
C                                                                       TWQI298
C     ******************************************************************TWQI299
      PARAM(7)=EQTEMP(IMON)-PARAM(7)                                    TWQI300
C     ******************************************************************TWQI301
C                                                                       TWQI302
C     ADD CONSTANT OF '5' TO TEMPERATURE VALUES -- NOTE - THIS IS DONE  TWQI303
C     TO ELIMINATE NEGATIVE TEMPERATURES IN UNIT QUALIGRAM              TWQI304
C     X-SCALE OF TEMPERATURE QUALIGRAM HAS ALSO BEEN CHANGED ACCORDINGLY TWQI305
C                                                                       TWQI306
C     ******************************************************************TWQI307
      PARAM(7)=PARAM(7)+5.                                              TWQI308
C     ******************************************************************TWQI309
C                                                                       TWQI310
C     SEARCH FOR QUALITY VALUE --  LINEARLY INTERPOLATE IF NECESSARY    TWQI311
C                                                                       TWQI312
C     ******************************************************************TWQI313
      DO 285 IPARAM=1,9                                                 TWQI314
      MAX=MAXX(IPARAM)                                                  TWQI315
      DO 157  ISCAN=1,MAX                                               TWQI316
      IF(PARAM(IPARAM).GT.TABLE(ISCAN,1,IPARAM))GO TO 157               TWQI317
      IF(PARAM(IPARAM).LT.TABLE(ISCAN,1,IPARAM))GO TO 158               TWQI318
      QUAL(IPARAM)=TABLE(ISCAN,2,IPARAM)                                TWQI319
      GO TO 285                                                         TWQI320
  157 CONTINUE                                                          TWQI321
C     ******************************************************************TWQI322
C                                                                       TWQI323
```

PROGRAM A - SOURCE LISTING

```
C     SET QUALITY OF PARAMETER FOR VALUE ABOVE DEFINED MAXIMUM                TWQI324
C                                                                             TWQI325
C     ***************************************************************       TWQI326
      QUAL(IPARAM)=QMAX(IPARAM)                                               TWQI327
      GO TO 285                                                               TWQI328
C     ***************************************************************       TWQI329
C                                                                             TWQI330
C     PARAMETER IS BETWEEN TWO VALUES -- LINEARLY INTERPOLATE FOR UNIT        TWQI331
C     QUALITY BY USING THE HIGH VALUE AND SUBTRACTING THE DIFFERENCE          TWQI332
C                                                                             TWQI333
C     ***************************************************************       TWQI334
  158 XDIF=TABLE(ISCAN,1,IPARAM)-PARAM(IPARAM)                                TWQI335
      XDELTA=TABLE(ISCAN,1,IPARAM)-TABLE(ISCAN-1,1,IPARAM)                    TWQI336
      SLOPE=(TABLE(ISCAN,2,IPARAM)-TABLE(ISCAN-1,2,IPARAM))/XDELTA            TWQI337
      QUAL(IPARAM)=TABLE(ISCAN,2,IPARAM)-(SLOPE*XDIF)                         TWQI338
285   CONTINUE                                                                TWQI339
      WQIA=0.                                                                 TWQI340
C     ***************************************************************       TWQI341
C                                                                             TWQI342
C     TEST OPTION OF MULTIPLICATIVE OR ADDITIVE INDEX                         TWQI343
C                                                                             TWQI344
C     ***************************************************************       TWQI345
      IF(OPTION(1).GT.0)GO TO 275                                             TWQI346
      DO 290 I=1,9                                                            TWQI347
      WQIA=WQIA+QUAL(I)*WEIGHT(I)                                             TWQI348
290   CONTINUE                                                                TWQI349
      GO TO 278                                                               TWQI350
  275 WQIA=1.0                                                                TWQI351
      DO 276  I=1,9                                                           TWQI352
      WQIA=WQIA*QUAL(I)**WEIGHT(I)                                            TWQI353
  276 CONTINUE                                                                TWQI354
C     ***************************************************************       TWQI355
C                                                                             TWQI356
C     DIGITIZE SAMPLE DATE TO FRACTION OF YEAR                                TWQI357
C                                                                             TWQI358
C     ***************************************************************       TWQI359
  278 SUM=0.                                                                  TWQI360
      IF (IMON.EQ.1) GOTO 675                                                 TWQI361
      INDEX=IMON-1                                                            TWQI362
      DO 670 I=1,INDEX                                                        TWQI363
      SUM=SUM+DAYS(I)                                                         TWQI364
670   CONTINUE                                                                TWQI365
675   CONTINUE                                                                TWQI366
      SUM=SUM+IDAY                                                            TWQI367
      IF ((MOD(IYR,4).EQ.0).AND.(IMON.GT.2)) SUM=SUM+1                        TWQI368
      TOTDAY=365                                                              TWQI369
      IF (MOD(IYR,4).EQ.0) TOTDAY=366                                         TWQI370
      FRAC=SUM/TOTDAY                                                         TWQI371
      WRITE(6,300) IMON,IDAY,IYR,FRAC,TIME,WQIA                               TWQI372
300   FORMAT(' ',I2,'/',I2,'/',I2,4X,F5.3,5X,A4,3X,F4.0)                      TWQI373
C     ***************************************************************       TWQI374
C                                                                             TWQI375
C     SAVE DATE AND WQI FOR PLOTTING OR FOR DISK STATION FILE                 TWQI376
C                                                                             TWQI377
```

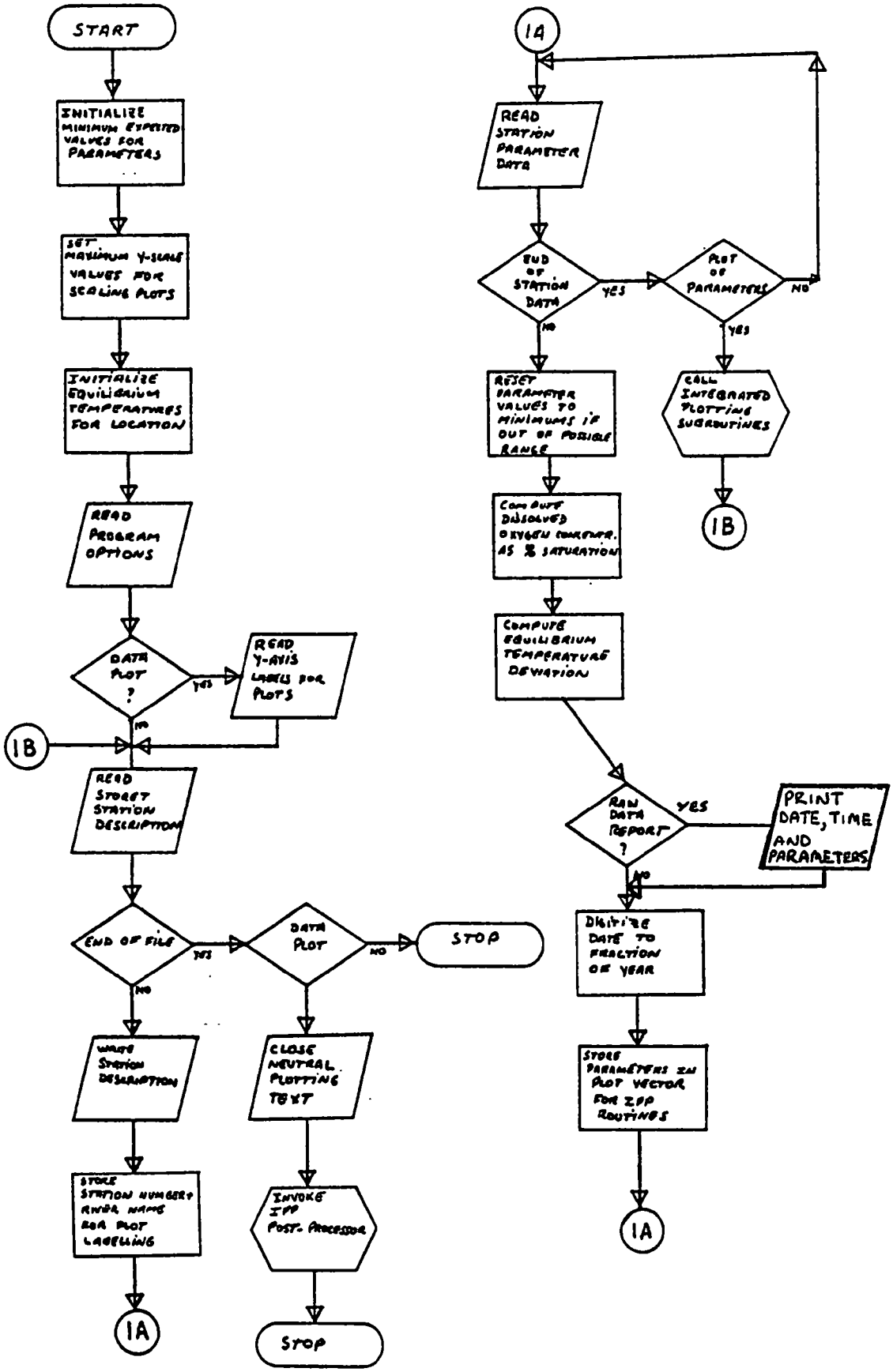
PROGRAM A - SOURCE LISTING

```
C     ************************************************************** TWQI378
  191 XXVAL(MM)=IYR+FRAC                                             TWQI379
      YYVAL(MM)=WQIA                                                 TWQI380
C     ************************************************************** TWQI381
C                                                                    TWQI382
C     SAVE HIGHEST VALUE OF Y-VALUES FOR SCALING PLOT                TWQI383
C                                                                    TWQI384
C     ************************************************************** TWQI385
      IF(YYVAL(MM).GT.YYMAX)YYMAX=YYVAL(MM)                          TWQI386
C     ************************************************************** TWQI387
C                                                                    TWQI388
C     SAVE HIGHEST OF YEARS FOR SCALING PLOT                         TWQI389
C                                                                    TWQI390
C     ************************************************************** TWQI391
      IF(XXVAL(MM).GT.XXMAX)XXMAX=XXVAL(MM)                          TWQI392
C     ************************************************************** TWQI393
C                                                                    TWQI394
C     SAVE RECORD ON DISK FILE IF PLOTTING WQI BY STATION            TWQI395
C                                                                    TWQI396
C     ************************************************************** TWQI397
      IF(OPTION(3).GT.0)WRITE(25,91)IYR,IMON,IDAY,OPTION(1),STAT,ISEQ TWQI398
     1,XXVAL(MM),YYVAL(MM),TOP                                       TWQI399
   91 FORMAT(3I2,I2,4A4,I3,2F12.4,12A4)                              TWQI400
      MM=MM+1                                                        TWQI401
  192 GO TO 100                                                      TWQI402
310   CONTINUE                                                       TWQI403
      WRITE(6,320) STAT                                              TWQI404
320   FORMAT(//,' ABNORMAL FILE END WHILE READING STATION ',4A4)     TWQI405
      STOP                                                           TWQI406
400   WRITE(6,112)                                                   TWQI407
  112 FORMAT(10X,'BEGINNING OF DATA RECORDS NOT CONFIRMED')          TWQI408
  330 IF(OPTION(2).LE.0)GO TO 333                                    TWQI409
C     ************************************************************** TWQI410
C                                                                    TWQI411
C     PLOTTING IS FINISH  -- NOW CLOSE THE NEUTRAL TEXT              TWQI412
C                                                                    TWQI413
C     ************************************************************** TWQI414
      CALL PPPEND(PLDATA)                                            TWQI415
  333 IF(OPTION(3).GT.0)END FILE 25                                  TWQI416
C     ************************************************************** TWQI417
C                                                                    TWQI418
C     IF NOT PLOTTING SET HI COND CODE TO  BYPASS PLOT POST-PROCESSOR TWQI419
C                                                                    TWQI420
C     ************************************************************** TWQI421
      IF(OPTION(2).LE.0) STOP 40                                     TWQI422
      CALL EXIT                                                      TWQI423
      END                                                            TWQI424
/*                                                                   TWQI425
```

PROGRAM B: PLOT/PRINT NSF - WQI PARAMETER DATA

This program works quite similar to program A; but instead of computing the WQI, the data for the index is saved in a nine element two dimensional array. The plotting for all the data is done in two frames, by placing five parameters on each frame. As presently written each frame is 8 ½ x 11 inches and due to the high resolution required, it can only be satisfactorily produced on the calcomp plotter. The scale factors for all parameters are set at specified values for ease in comparisons. In applying this program to the State of New Jersey we found two extremes in total dissolved solids concentrations and therefore two sets of scales are used for this parameter.

PLOT/PRINT NSF-WQI PARAMETER DATA - PROGRAM FLOWCHART



PROGRAM B - PLOT/PRINT NSF-WQI PARAMETER DATA

PROGRAM INPUT

1) PROGRAM OPTIONS

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 2	IPRNT	I2	Set > 0, to produce report of WQI Parameter Data
3 - 4	IPLOT	I2	Set > 0, to plot 5 parameters/frame of above data

2) Y-AXIS PARAMETER LABEL (IF IPLOT > 0)

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 20	PTITLE (1,1-5)	5A4	y-axis label for first parameter in character balanced notation (see sample input in next section or reference 2)
1 - 20	PTITLE (2,1-5)	5A4	y-axis label for 2nd parameter
.	.	.	.
.	.	.	.
.	.	.	.
1 - 20	PTITLE (9,1-5)	5A4	y-axis label for 9th parameter

note: The titles above must be in the same sequence as the parameters were specified on the STORET retrieval.

3) STORET "MORE = 3" RETRIEVAL

This retrieval must have preceded as a separate step or as a separate job altogether. In this program it will be referred as input file (20). See deck setup following this section for details.

SAMPLE INPUT

1) EXECUTION OF PROGRAM FROM SOURCE STATEMENTS:

```
//EPAIIIaa JOB(AAAA)
//S2 EXEC IFP1136G,REGION=130K,PRINT=A
//*  THIS PROCEDURE WILL INVOKE THE CALCOMP POST PROCESSOR
//FORT.SYSIN DD *
         .                          .                          .
         .                          .                          .
         .                          .                          .
         .                          .                          .
                 S O U R C E  P R O G R A M  G O E S  H E R E
         .                          .                          .
         .                          .                          .
         .                          .                          .
         .                          .                          .
//GO.FT20F001  DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(OLD,KEEP),
//  LABEL=(,,,IN),DSN=CN.EPAIII.AAAA.(FILE NAME FROM STORET RETRIEVAL)
//GO.FT08F001  DD *
0101
/D.O.  PERCENT SAT/
+FECAL COLI  MPN/ML+
/       PH        /
+     BOD5  MG/L   +
+      NO3  MG/L   +
+      PO4  MG/L   +
/EQUIL TEMP DELTA /
/  TURBIDITY  JTU /
+ TOT SOLIDS  MG/L+

/*
//PLOT.PLOTTAPE  DD UNIT=2400,DSN=PL.EPAIII.AAAA.PLOTNAME,
//  DISP=(NEW,CATLG,DELETE),LABEL=RETPD=60,VOL=SER=
//PLOT.SYSIN  DD DUMMY
/*
```

2) EXECUTION OF PROGRAM FROM LOAD MODULE:

```
//EPAIIIaa JOB(AAAA)
//S1 EXEC PGM=FIVEPARM,REGION=130K
//STEPLIB DD DSN=CN.EPAGAN.R2TW.WQI.LOADLIB,DISP=SHR
//FT02F001 DD DSN=&IPPTAPE,UNIT=SYSDA,SPACE=(CYL,(2,2),RLSE),
// DCB=(RECFM=VBS,LRECL=516,BLKSIZE=3156),DISP=(NEW,PASS,DELETE)
//FT06F001 DD SYSOUT=A
//FT20F001 DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(OLD,KEEP),
//  DSNAME=CN.EPAIII.AAAA.(FILE NAME FROM STORET RETRIEVAL FOLLOWS)
//FT08F001 DD *
0101
/D.O.  PERCENT SAT/
+FECAL COLI  MPN/ML+
/       PH        /
+    BOD5  MG/L  +
+     NO3  MG/L  +
+     PO4  MG/L  +
/EQUIL TEMP DELTA /
/  TURBIDITY  JTU /
+ TOT SOLIDS  MG/L+

/*
//PLOT EXEC PGM=CCMP1136,COND=(8,LE),REGION=130K
//STEPLIB DD DSN=CNSSSS.ZAF.IPP.LOAD1,DISP=SHR
//FT01F001 DD DDNAME=SYSIN
//FT02F001 DD DSN=&IPPTAPE,DISP=(OLD,DELETE,DELETE)
//FT06F001 DD SYSOUT=A
//FT15F001 DD SYSOUT=A
//* USE THE NEXT FOUR STATEMENTS WITH CALCOMP POSTPROCESSOR ONLY.
//FT03F001 DD DDNAME=PLOTTAPE
//PLOT.PLOTTAPE DD UNIT=2400,DSN=PL.EPAIII.AAAA.PLOTNAME,
//  LABEL=RETPD=60,DISP=(NEW,CATLG,DELETE),VOL=SER=
//PLOT.SYSIN DD DUMMY
/*
```

PROGRAM B: PLOT/PRINT NSF - WQI PARAMETER DATA

SAMPLE OUTPUT

STATION 343016

343016 87
40 33 34.0 074 31 41.0 2
RARITAN RIVER
34035 NEW JERSEY
NORTHEAST 013391
LOWER HUDSON N.Y. METROPOLITAN AREA
21NJDEP1 04001004
0000 FEET DEPTH CLASS 00

/TYPA/AMBNT/STREAM

DATE	TIME	D O (SAT)	F.C. MPN	PH	BOD5	NO3	PO4	TEMP DELTA	TURB	TOT SOLIDS	CL
10/10/66		55.6480	9180.0000	7.2000	4.0000	0.6000	0.5000	-2.7443	20.5000	798.0000	0.0000
1/17/67		96.8442	16090.0000	6.9000	5.0000	1.4400	0.5000	-0.4444	8.6000	344.0000	0.0000
5/24/67		82.7172	24000.0000	7.4000	5.0000	0.5400	0.3000	5.5557	12.4000	356.0000	0.0000
9/11/67		71.2497	2400.0000	7.4000	7.0000	0.5100	1.1000	4.7780	8.6000	446.0000	0.0000
10/23/67		67.9343	24000.0000	7.2000	7.0000	1.0000	1.3000	3.5557	22.0000	655.0000	0.0000
2/ 4/69		76.4631	240000.0000	7.2000	10.0000	3.0000	2.0000	0.7778	125.0000	408.0000	0.0000
5/14/69		59.0895	240000.0000	7.2000	11.0000	1.0000	1.0000	4.5557	36.0000	533.0000	0.0000
12/ 3/69		76.8997	91800.0000	7.4000	10.0000	1.0000	0.0	-0.6666	43.0000	445.0000	0.0000
2/18/70		94.3315	22100.0000	6.9000	4.0000	2.0000	4.0000	0.2778	25.0000	291.0000	0.0000
4/23/70		87.4771	24000.0000	7.4000	2.0000	1.0000	0.0	1.8890	16.0000	246.0000	0.0000
10/ 7/70		75.9977	1720.0000	7.2000	10.0000	2.0000	1.0000	-1.4443	10.0000	854.0000	0.0000
2/ 4/71		84.2123	2300.0000	7.3000	11.0000	5.0000	1.0000	1.7778	30.0000	426.0000	0.0000
4/26/71		91.7934	50.0000	8.0000	4.0000	3.0000	1.0000	2.8890	16.0000	354.0000	0.0000
8/17/71		79.1900	16000.0000	7.3000	4.0000	6.0000	1.3000	3.2224	9.0000	460.0000	0.0000
11/11/71		81.3075	540.0000	7.5000	3.0000	3.0000	0.3800	2.7778	9.0000	306.0000	0.0000
2/14/72		84.9141	2400.0000	6.9000	4.0000	4.0000	0.5000	1.7778	130.0000	270.0000	0.0000
5/ 9/72		93.3444	2400.0000	7.1000	4.0000	2.0000	1.0000	7.5557	88.0000	218.0000	0.0000
1/11/73		83.2651	5.0000	7.1000	5.0000	2.0000	0.5600	0.5556	17.0000	262.0000	0.0000
3/27/73		83.1594	2.0000	6.8000	2.0000	1.0000	0.7000	0.2223	65.0000	210.0000	0.0000
9/27/73		45.7884	34.0000	7.3000	3.0000	1.2000	1.5000	21.0779	8.0000	616.0000	0.0000
12/13/73		82.9552	540.0000	7.4000	4.0000	1.8000	1.0000	1.3334	16.0000	210.0000	0.0000

PRINTED IN U.S.A.

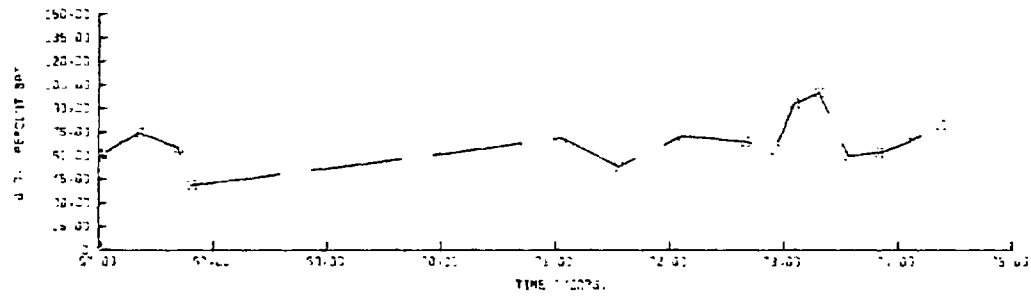
STATION 343017

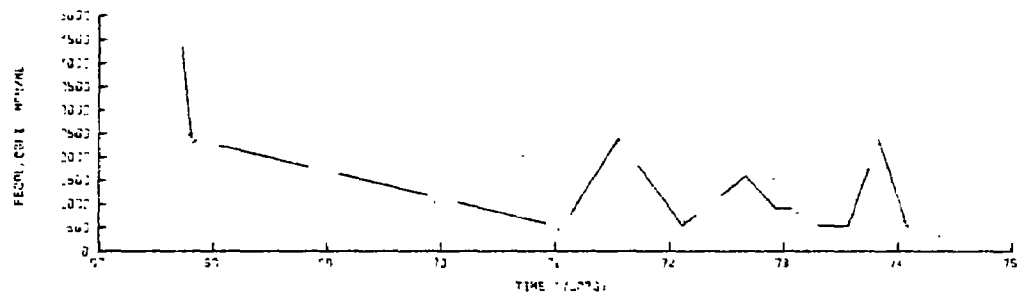
343017 88
40 29 50.0 074 26 18.0 2
RARITAN RIVER (R17)
34023 NEW JERSEY
NORTHEAST 013391
LOWER HUDSON N.Y. METROPOLITAN AREA
21NJDEP1 04001004
0000 FEET DEPTH CLASS 00

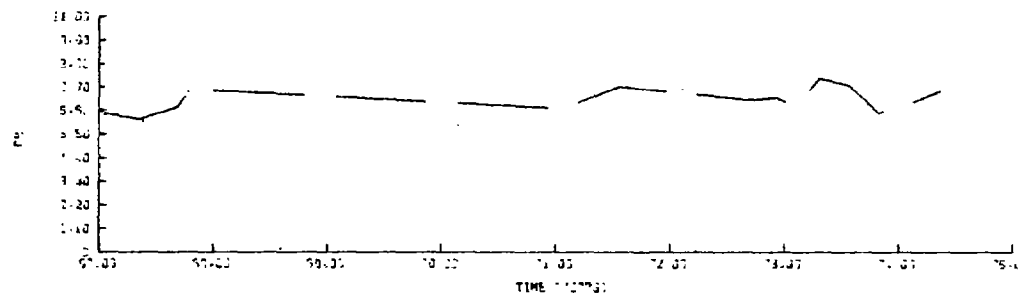
/TYPA/AMBNT/STREAM

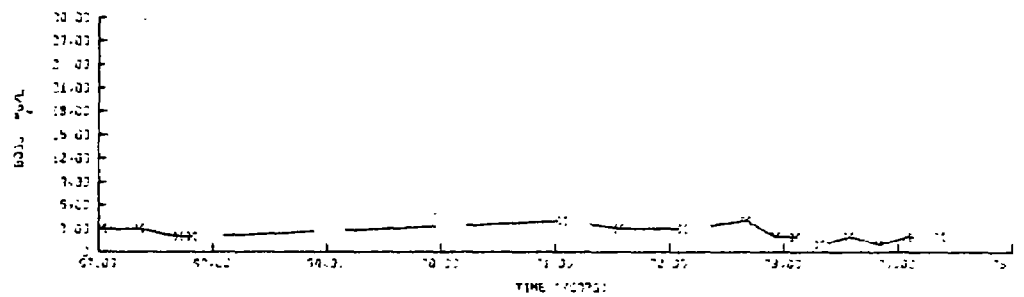
DATE	TIME	D O (SAT)	F.C. MPN	PH	BOD5	NO3	PO4	TEMP DELTA	TURB	TOT SOLIDS	CL
10/10/66		62.4780	330.0000	7.3000	6.0000	1.2400	0.4000	-2.2443	24.5000	523.0000	0.0000
1/17/67		95.6182	16090.0000	7.9000	4.0000	0.9200	0.9000	-2.4444	17.0000	253.0000	0.0000
5/24/67		91.6987	9180.0000	7.4000	5.0000	0.8000	0.2000	5.0557	6.6000	280.0000	0.0000
9/11/67		70.5822	16090.0000	7.3000	6.0000	1.2800	0.9000	3.7780	6.3000	361.0000	0.0000
10/23/67		64.3165	24000.0000	7.3000	6.0000	1.0000	0.9000	1.5557	26.0000	404.0000	0.0000
3/ 5/68		81.4680	24000.0000	7.2000	9.0000	1.0000	0.0	3.2223	15.0000	292.0000	0.0000
2/ 4/69		84.2123	24000.0000	7.3000	8.0000	2.0000	2.0000	1.7778	140.0000	381.0000	0.0000
5/14/69		126.5480	24000.0000	7.4000	5.0000	1.0000	1.0000	2.5557	17.0000	392.0000	0.0000
12/ 3/69		74.8414	2300.0000	7.4000	4.0000	1.0000	0.0	-1.1666	12.0000	850.0000	0.0000
10/ 7/70		65.1528	490.0000	7.4000	6.0000	4.0000	0.0	-3.4443	10.0000	1838.0000	0.0000
4/26/71		91.7934	50.0000	7.9000	4.0000	3.0000	1.0000	2.8890	15.0000	326.0000	0.0000
8/17/71		152.0962	170.0000	7.7000	4.0000	6.0000	0.9000	1.2224	16.0000	450.0000	0.0000
11/11/71		81.0493	130.0000	7.6000	2.0000	4.0000	0.5400	1.7778	16.0000	272.0000	0.0000
2/14/72		84.9141	2400.0000	6.9000	5.0000	4.0000	0.4800	1.7778	120.0000	274.0000	0.0000
3/27/73		89.6095	2.0000	6.9000	2.0000	1.5000	0.5000	-2.7777	54.0000	204.0000	0.0000
9/27/73		47.8543	240.0000	7.3000	2.0000	2.0000	1.2000	4.7780	6.0000	532.0000	0.0000
12/13/73		85.1193	1600.0000	7.4000	3.0000	1.4000	0.5000	1.3334	17.0000	206.0000	0.0000

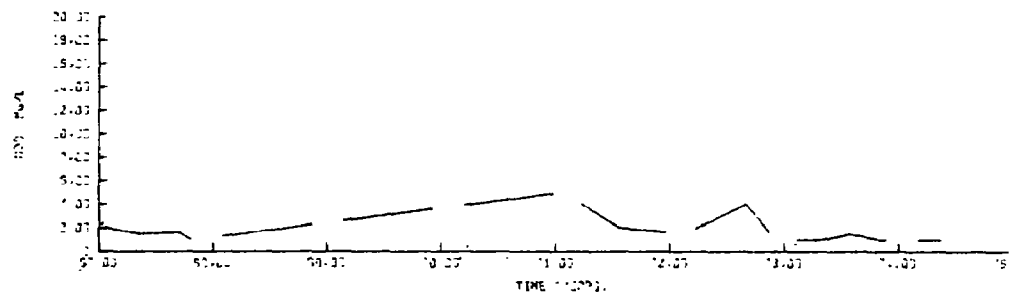
STORET STATION NO. 343024 RARITAN RIVER



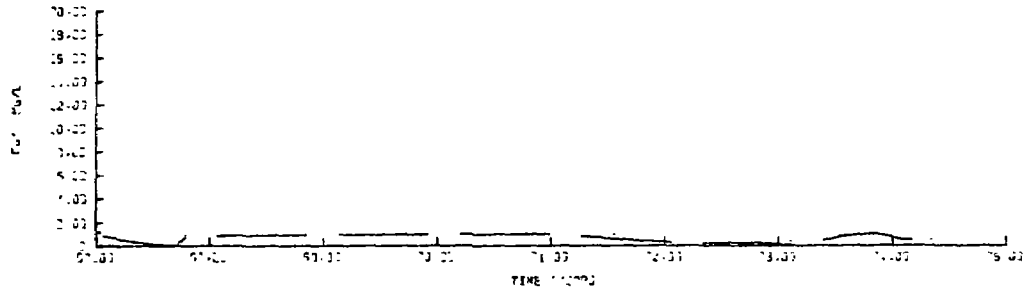


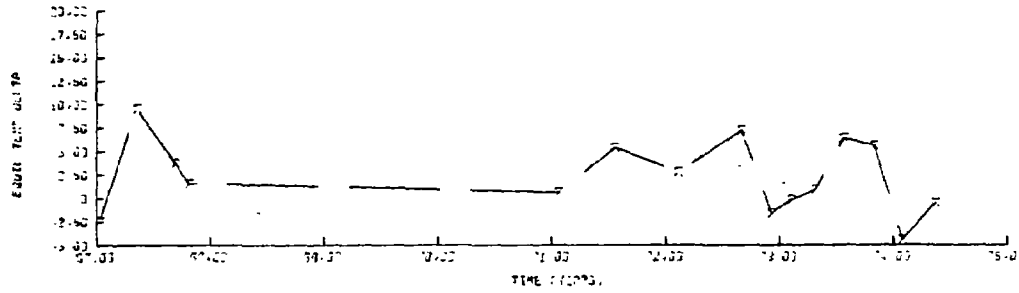


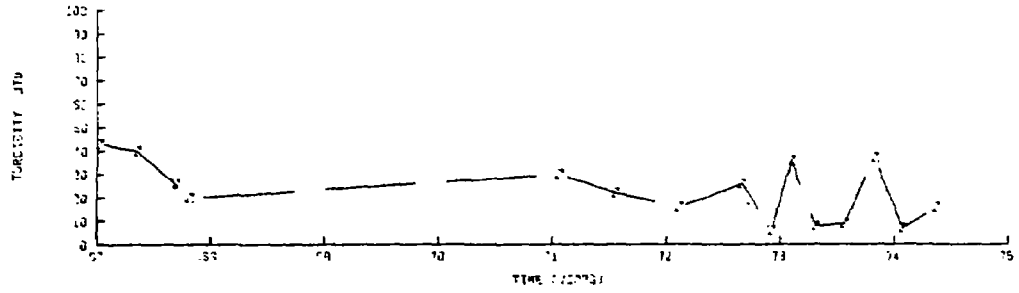


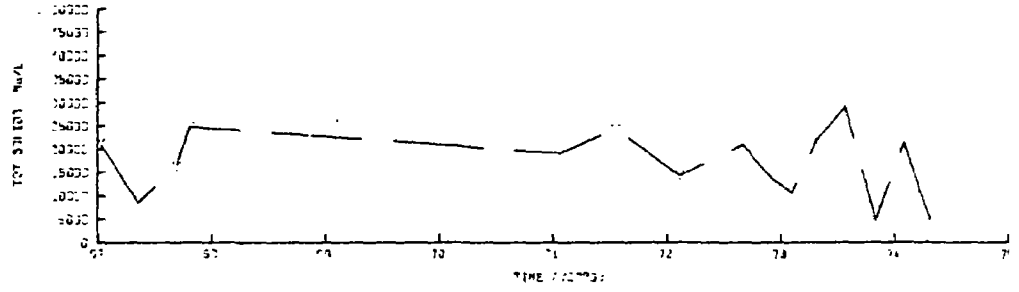


STORET STATION NO. 343024 RARITAN RIVER

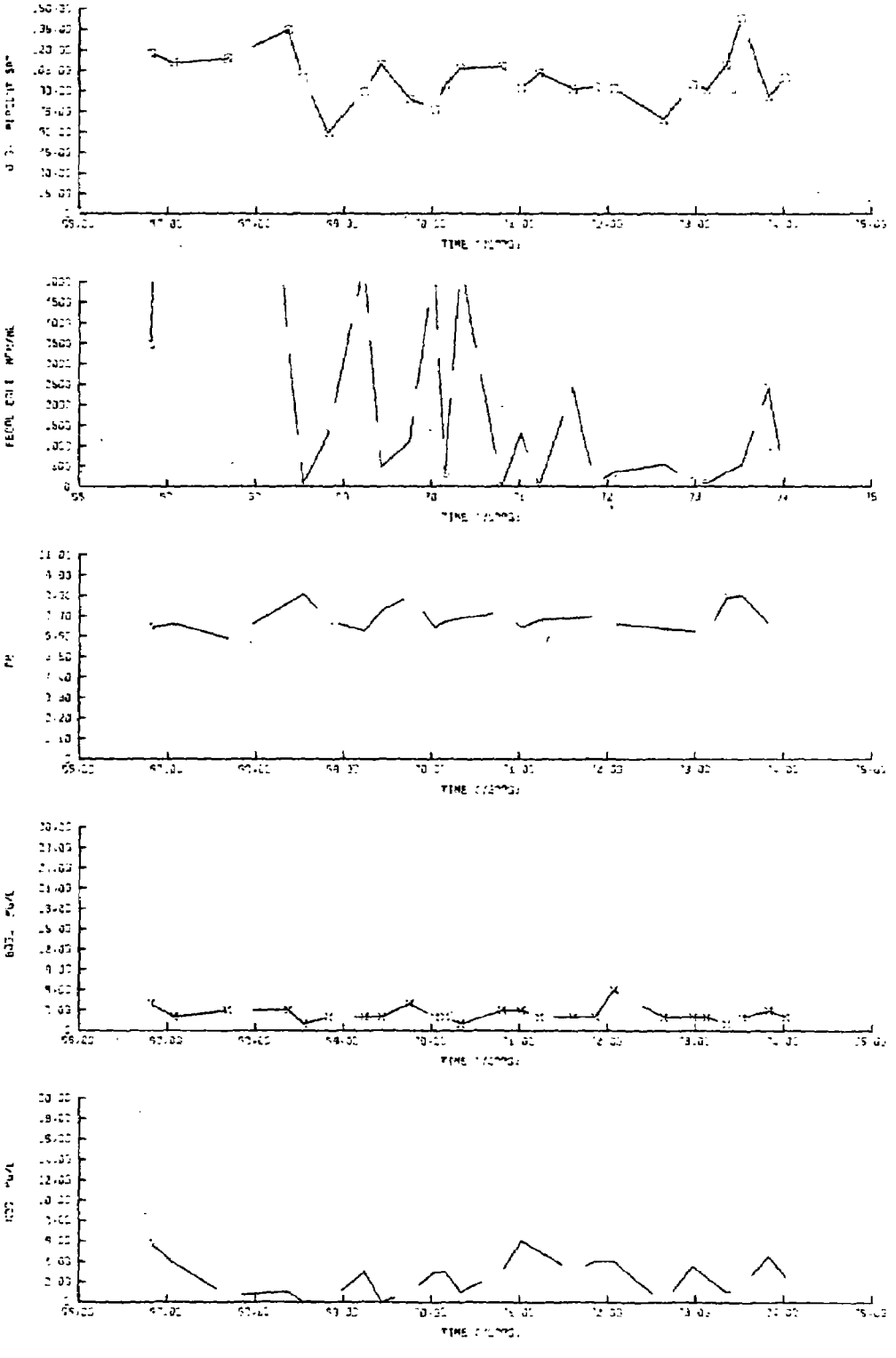




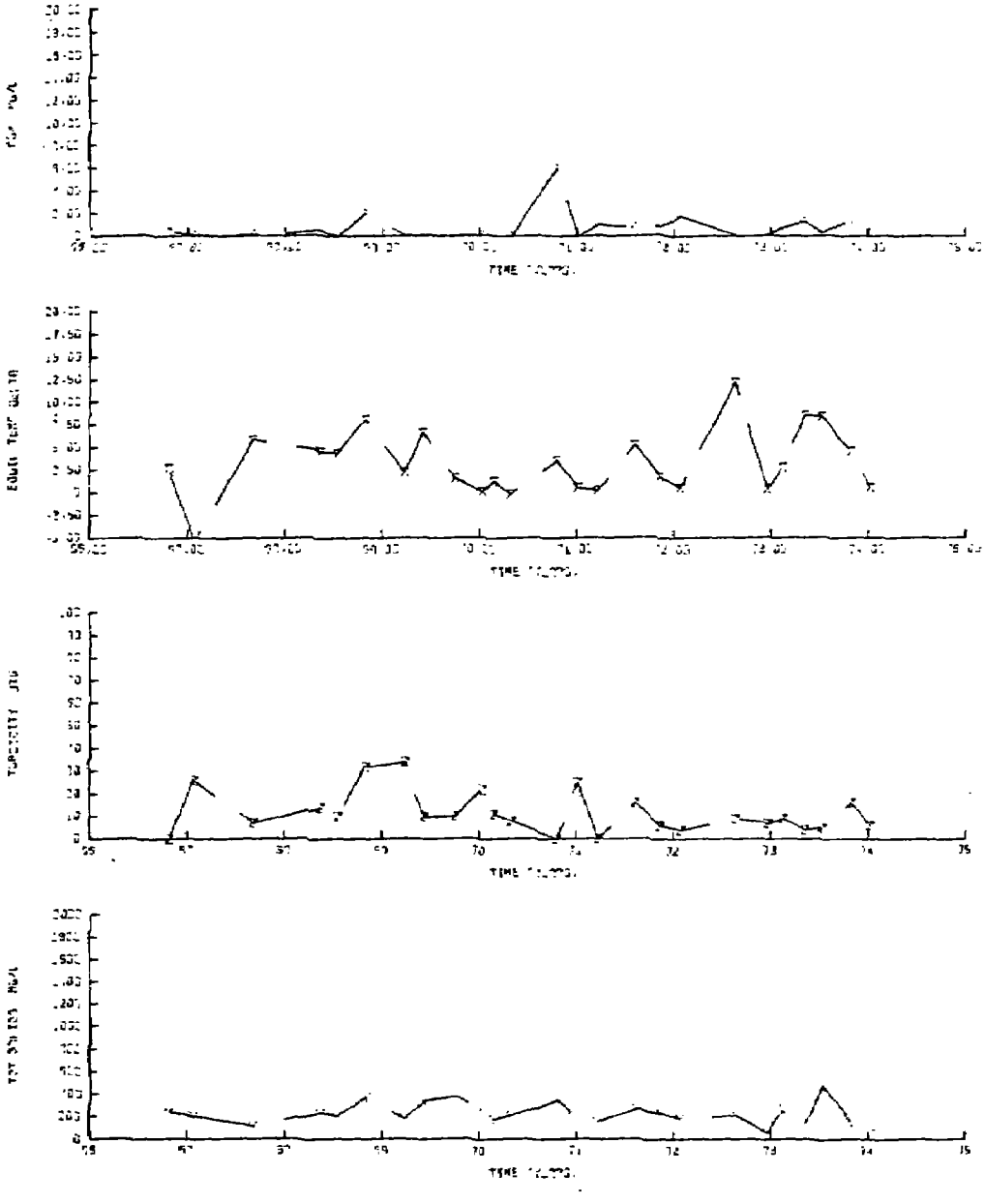




STORET STATION NO. 043052 RARITAN RIVER S. BRANCH



STORET STATION NO 043062 RARITAN RIVER S. BRANCH



PROGRAM B SOURCE LISTING

```
C     ******************************************************************
C     ******************************************************************
C
C     THIS PROGRAM PLOTS AND/OR PRINTS THE RAW DATA USED TO COMPUTE
C     THE WQI AT STORET STATIONS, FOR THE RETRIEVED TIME INTERVAL
C
C     *** THIS VERSION PLOTS UP TO FIVE PARAMETERS PER FRAME ***
C
C     ******************************************************************
C     ******************************************************************
C
      DIMENSION PLDATA(30),SYMBOL(14),XXVAL(100),SCL(5),YYVAL(100)
      DIMENSION TOP(12),HIGHY(9),PTITLE(9,5),YTITLE(5),VAL(9,100)
      DIMENSION AGENCY(2),DESCRP(30),EQTEMP(12),PARAM(10),SMALL(9),
     1STAT(4),DAYS(12)
      DATA DAYS/31.,28.,31.,30.,31.,30.,31.,31.,30.,31.,30.,31./
      DATA SMALL/0.,1.,2.,0.,0.,0.,-10.,0.0,0.0/
      DATA HIGHY/150., 5000.,11.,30.,20.,20.,20.,100.,50000./
      DATA SKPTIM/'2500'/,SPACE/'    '/
      DATA SYMBOL/'Q','O','T','X','D','A','M','Z','Y','B','*','H','I'/
C     ******************************************************************
C
C     THESE VALUES ARE MONTHLY EQUILIBRIUM TEMPERATURES FOR THE
C     STATE OF NEW JERSEY   REF: 'EFFECT OF GEOGRAPHICAL LOCATION ON
C     COOLING POND REQUIREMENT AND PERFORMANCE 16130 FDQ 03/71
C
C     ******************************************************************
      DATA EQTEMP/33.,37.,45.,57.,69.,78.,83.,81.,73.,60.,46.,38./
      M=8
C
      READ(M,1)IPRNT,IPLOT
    1 FORMAT(2I2)
C     ******************************************************************
C
C     READ Y-AXIS PARAMETER LABEL TO ARRAY IF PLOTING
C
C     ******************************************************************
      IF(IPLOT.GT.0)READ(M,4)((PTITLE(L,JX),JX=1,5),L=1,9)
    4 FORMAT(5A4)
      KK=0
      XXMAX=0.0
      YYMAX=0.0
C     ******************************************************************
C
C **READ DELIMITER RECORD - VERIFY BEGINNING OF DATA RECORDS**
C
C     ******************************************************************
 12   READ(20,111,END=400) IDUMMY
 111  FORMAT(25X,I2)
      IF (IDUMMY.EQ.99) GOTO 22
      GOTO 12
C
```

```
C     ********************************************************************
C     *** COMMANDS BELOW USE THE INTEGRATED PLOTTING PACKAGE ***
C
C     ********************************************************************
  232 IF(IPLOT.LE.0)GO TO 100
      HINIT=10.75
      LN=1
C     ********************************************************************
C
C     THIS NEXT CALL IS REQUIRED FOR PLOTS LARGER THAN 10.5 INCHES...
C
C     ********************************************************************
      CALL CMLBF('PLOT IS 8-1/2 X 11 IN ')
C
C     SET INITIAL VALUES ON SPECIFICATIONS ARRAY
C
      CALL SSPECS(PLDATA)
      H17=PLDATA(17)/2.
      H18=PLDATA(18)/2.
C
C     ENTER NUMBER OF DATA POINTS TO PLOT
C
      PLDATA(13)=MM-1
C
C     MOVE Y-AXIS 1.5 INCHES AWAY FROM THE FRAME ORIGIN
C
      PLDATA(1)=1.5
C
C     RESET SIZE OF AXES (INCHES)
C
      PLDATA(7)=6.0
      PLDATA(8)=1.5
      DO 2  L=1,9
C
C     SET PLOTTING SYMBOL DESIRED
C
      PLDATA(16)=SYMBOL(L)
C
C     SET LETTER SIZE OF LABELS TO HALF DEFAULT (.05)
C
      PLDATA(17)=H17
      PLDATA(18)=H18
C
C     MOVE X-AXIS 8.75 INCHES AWAY FROM ORIGIN - USING 2.0 INCHES FOR
C     EACH GRAPH FOR A TOTAL FRAME SIZE OF 8-1/2 X 11 INCHES
C
      PLDATA(2)=HINIT-(LN*2.0)
C
C     CLEAR WORK AREA
C
      DO 15  K=1,5
   15 SCL(K)=0.0
C
C     SET RANGE OF VALUES ON X-AXIS ** NO. DIVISIONS=NO.YEARS ANALYZED
C
```

```
      KK=XXMAX+1
      PLDATA(3)=KK
      KK2=XXVAL(1)
      PLDATA(4)=KK2
      PLDATA(9)=KK-KK2
C
C     SET RANGE OF VALUES ON Y-AXIS
C
      PLDATA(5)=HIGHY(L)
C
C     TEST SOLIDS AMOUNT AT STATION -- RESET Y-SCALE IF NECESSARY
C
      IF(L.EQ.9.AND.VAL(9,1).LT.1000)PLDATA(5)=2000.
      PLDATA(6)=0.0
C
C     FOR TEMPERATURE CHANGE -- Y-SCALE MUST ACCOMODATE NEGATIVE VALUES
C
      IF(L.EQ.7)PLDATA(6)=-5.0
C
C     SET NO. OF DECIMALS ON Y-AXIS DEPENDING ON PARAMETER ...
C
      PLDATA(28)=2.0
      IF(L.EQ.2.OR.L.EQ.8.OR.L.EQ.9)PLDATA(28)=0.0
C
C     CHANGE DEFAULT VALUE OF DIVISIONS FOR Y-AXIS
C
      PLDATA(10) = 10.
C
C     CLEAR ZONES -- UPDATED BY TITLES ON PREVIOUS GRAPH
C
      CALL ZZONES(PLDATA)
C
C     DRAW  X-Y  AXES
C
      CALL AXLILI(PLDATA)
C
C     DRAW ANNOTATION NUMBERS AT THE BOTTOM SCALE MARKS
C
      CALL NODLIB(PLDATA)
C
C     DRAW ANNOTATION NUMBER AT THE LEFT SCALE MARKS
C
      CALL NODLIL(PLDATA)
C
C     CLEAR ZONES VARIABLES --  SINCE UPDATED BY ABOVE SUBROUTINE
C
      CALL ZZONES(PLDATA)
C
C     PLOT SYMBOL AT DATA POINT LOCATIONS
C
      KK=MM-1
      DO 6  K=1,KK
      YYVAL(K)=VAL(L,K)
    6 CONTINUE
      CALL PSLILI(XXVAL,YYVAL,PLDATA)
```

```
C
C       NOW CONNECT DATA POINTS WITH DASHED LINE
C
        CALL DLLILI(XXVAL,YYVAL,PLDATA)
C
C       CHANGE DEFAULT SPACING OF TITLES TO THE AXES
C
        PLDATA(24)=.15
        PLDATA(26)=.45
C       ********************************************************************
C
C       NOW LABEL THE AXES ......
C
C       ********************************************************************
        CALL TITLEB('+  TIME (YEARS)+',PLDATA)
C
C       MOVE APPROPIATE Y-AXES LABEL TO VECTOR FOR PLOTTING
C
        DO 8 JX=1,5
        YTITLE(JX)=PTITLE(L,JX)
      8 CONTINUE
        CALL TITLEL(YTITLE,PLDATA)
        IF(L.NE.5)GO TO 24
C
C       RESTORE TEXT LETTER SIZE FOR STATION DESCRIPTION LABEL
C
        PLDATA(17)=H17*2.
        PLDATA(18)=H18*2.0
C
C       PRINT GRAPH DESCRIPTION AT UPPER, RIGHT HAND SIDE OF GRAPH
C
        PLDATA(22)=1.75
        PLDATA(23)=10.50
        CALL GTITLE('+STORET STATION NO.+',PLDATA)
        PLDATA(22)=3.65
        CALL GTITLE(TOP,PLDATA)
C       ********************************************************************
C
C       ADVANCE GRAPH PAPER FOR NEXT FOUR PARAMETERS ...
C
C       ********************************************************************
        CALL NXTFRM(PLDATA)
        LN = 0
     24 LN=LN + 1
      2 CONTINUE
C
C       RESTORE TEXT LETTER SIZE FOR STATION DESCRIPTION LABEL
C
        PLDATA(17)=H17*2.
        PLDATA(18)=H18*2.0
C
C       PRINT GRAPH DESCRIPTION AT UPPER, RIGHT HAND SIDE OF GRAPH
C
        PLDATA(22)=1.75
        PLDATA(23)=10.50
```

```
      CALL GTITLE('+STORET STATION NO.+',PLDATA)
      PLDATA(22)=3.65
      CALL GTITLE(TOP,PLDATA)
C
C     ADVANCE GRAPH PAPER FOR NEXT STATION
C
      CALL NXTFRM(PLDATA)
  432 STAT(1)=SPACE
   22 READ(20,30,END=330) AGENCY,STAT,DESCRP
 30   FORMAT(2A4,4A4,1X,30A4)
      MM=1
      IF(IPRNT.GT.0) WRITE(6,40) STAT,DESCRP
 40   FORMAT('1STATION ',4A4,/,' ',30A4)
      DO 60 I=1,8
      READ(20,30,END=310) AGENCY,STAT,DESCRP
      IF(IPRNT.GT.0) WRITE(6,50) DESCRP
 50   FORMAT(' ',30A4)
      IF(I.EQ.2.AND.IPLOT.GT.0)GO TO 61
      GO TO 60
   61 TOP(1)=SYMBOL(4)
      TOP(2)=STAT(1)
      TOP(3)=STAT(2)
      TOP(4)=SPACE
      TOP(5)=DESCRP(17)
      TOP(6)=DESCRP(18)
      TOP(7)=DESCRP(19)
      TOP(8)=DESCRP(20)
      TOP(9)=DESCRP(21)
      TOP(10)=DESCRP(22)
      TOP(11)=DESCRP(23)
      TOP(12)=SYMBOL(4)
 60   CONTINUE
C     PRINT HEADINGS IF PRINTING RAW DATA ...
      IF(IPRNT.GT.0)WRITE(6,5)
    5 FORMAT(    5X,'  DATE  ',2X,'TIME',3X,'D O (SAT)',3X,'F.C. MPN',
     16X,'PH',9X,'BOD5',7X,'NO3',8X,'PO4',6X,'TEMP DELTA',3X,'TURB',
     23X,'TOT SOLIDS',5X,'CL')
C     ******************************************************************
C
C     READ STATION PARAMETRIC DATA
C
C     ******************************************************************
  100 READ(20,110,END=310) AGENCY,STAT,IYR,IMON,IDAY,TIME,PARAM
  110 FORMAT(2A4,3A4,A3,2X,3I2,A4,10A4)
      IF (IYR.EQ.99) GOTO 232
      DO 120 I=1,9
C     ******************************************************************
C
C     TEST FOR DUMMY VALUE IF NO SAMPLE WAS TAKEN
C
C     ******************************************************************
      IF ((PARAM(I).LT.1E-15).AND.(PARAM(I).GT.0.)) GOTO 100
      IF (PARAM(I).GE.0.) GOTO 120
      WRITE(6,115) I,PARAM(I)
115   FORMAT(' ***WARNING - PARAMETER ',I1,' IS NEGATIVE, ',F3.1
```

```
     1,' IS SUBSTITUTED***')
  120 CONTINUE
      IF (TIME.EQ.SKPTIM) TIME=SPACE
C     ******************************************************************
C
C     TEST PARAMETERS FOR MINIMUM POSSIBLE VALUES  -- IF LESS ADJUST
C
C     ******************************************************************
      DO 156 I=1,9
      IF (PARAM(I).LT.SMALL(I)) PARAM(I)=SMALL(I)
156   CONTINUE
C     ******************************************************************
C
C     COMPUTE SATURATION LEVEL OF OXYGEN AT STATION  --USING TEMPERATURE
C     AND CHLORIDE CONCENTRATION
C
C     ******************************************************************
      DOSAT=(1.-.000009*PARAM(10))*(14.652-.41022*PARAM(7)
     1+.007991*PARAM(7)**2 -.000077774*PARAM(7)**3)
C     ******************************************************************
C
C     COMPUTE OXYGEN CONCENTRATION AS PERCENT SATURATION
C
C     ******************************************************************
       PARAM(1)=PARAM(1)/DOSAT*100.
C     ******************************************************************
C
C     COMPUTE DEVIATION FROM EQUILIBRIUM TEMPERATURE
C
C     ******************************************************************
      PARAM(7)=(EQTEMP(IMON)-32.)*.55556 - PARAM(7)
C     ******************************************************************
C
C     TEST OPTION TO PRINT RAW DATA ...
C
C     ******************************************************************
      IF(IPRNT.GT.0)WRITE(6,3)IMON,IDAY,IYR,TIME,(PARAM(I),I=1,10)
    3 FORMAT(5X,I2,'/',I2,'/',I2,3X,A4,10F11.4)
C     ******************************************************************
C
C     DIGITIZE SAMPLE DATE TO FRACTION OF YEAR
C
C     ******************************************************************
  278 SUM=0.
      IF (IMON.EQ.1) GOTO 675
      INDEX=IMON-1
      DO 670 I=1,INDEX
      SUM=SUM+DAYS(I)
670   CONTINUE
675   CONTINUE
      SUM=SUM+IDAY
      IF ((MOD(IYR,4).EQ.0).AND.(IMON.GT.2)) SUM=SUM+1
      TOTDAY=365
      IF (MOD(IYR,4).EQ.0) TOTDAY=366
      FRAC=SUM/TOTDAY
```

```
  191 XXVAL(MM)=IYR+FRAC
      DO 9  JX=1,9
      VAL(JX,MM)=PARAM(JX)
    9 CONTINUE
C     SAVE HIGHEST OF YEARS FOR SCALING PLOT
      IF(XXVAL(MM).GT.XXMAX)XXMAX=XXVAL(MM)
      MM=MM+1
  192 GO TO 100
310   CONTINUE
      WRITE(6,320) STAT
320   FORMAT(//,' ABNORMAL FILE END WHILE READING STATION ',4A4)
      STOP
400   WRITE(6,112)
  112 FORMAT(10X,'BEGINNING OF DATA RECORDS NOT CONFIRMED')
C     ***************************************************************
C
C     IF NOT PLOTTING SET HI COND CODE TO  BYPASS PLOT POST-PROCESSOR
C
C     ***************************************************************
  330 IF(IPLOT.LE.0)STOP 40
C     ***************************************************************
C
C     PLOTTING IS FINISH  -- NOW CLOSE THE NEUTRAL TEXT
C
C     ***************************************************************
      CALL PPPEND(PLDATA)
  333 STOP
      END
```

PROGRAM C: SEASONAL NSF - WQI PLOTS FOR MULTIPLE STORET STATIONS

This program will plot water quality indices selectively by specified time periods. The user can specify up to fifty time periods in creating one curve and a maximum of five curves can be plotted on a frame for up to one hundred STORET stations. The graph can be sealed in the x-direction by station number sequence or by station mile point.

The water quality data input to this program is a mass storage file called "WQI Time File" and created by program A. (See system flowchart on figure 1)

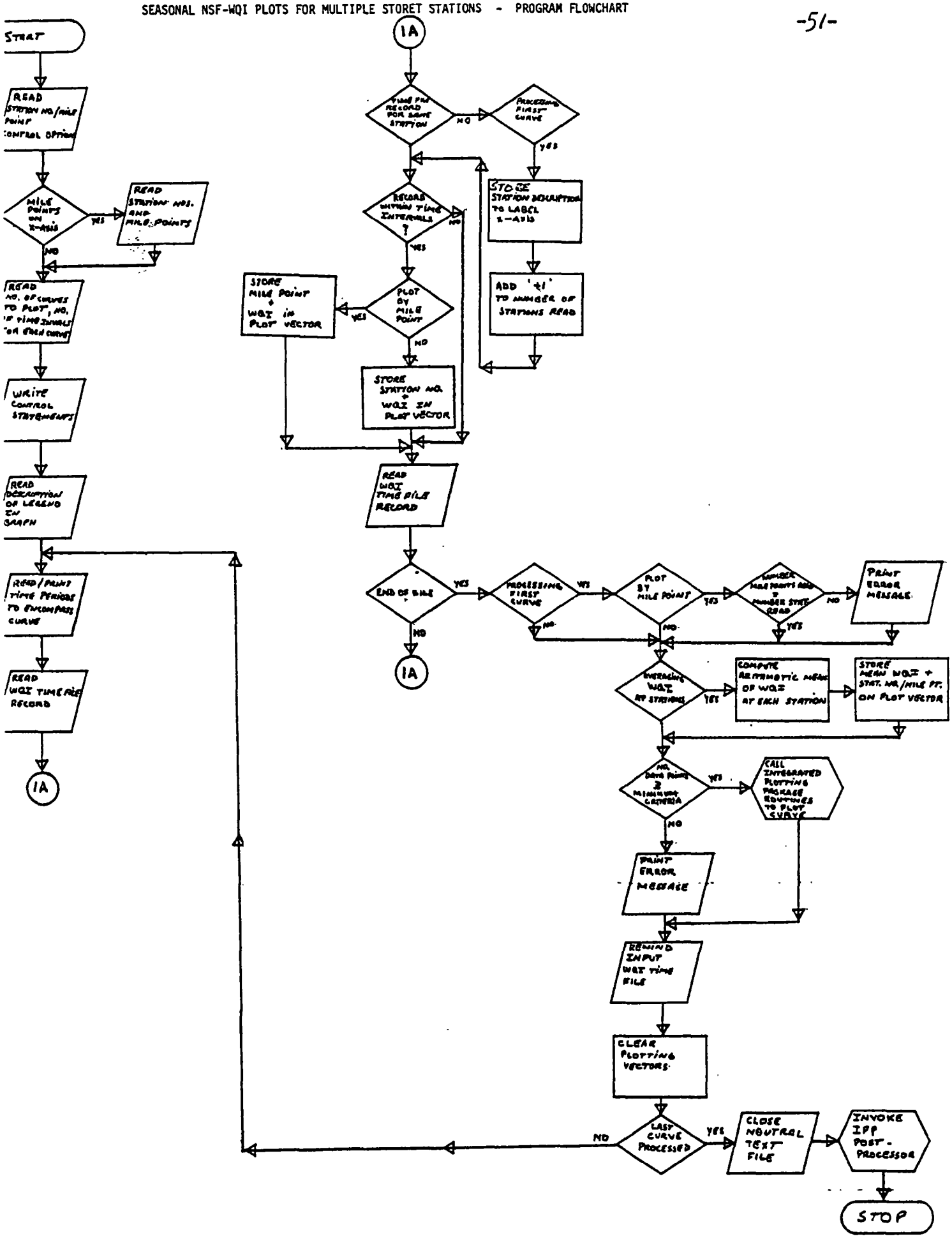
The program first reads control variables, such as the total number of curves to be plotted and the number of dates to be read for each curve, then using these the WQI Time File is read and compared to the specified time periods, those records within these periods are saved in a plotting vector with their corresponding station number or mile point.

Once all records in the WQI Time File are read the program calls Integrated Plotting Routines to draw these points in the graph and to enter the plotting symbol in the graph legend. During the first curve processing the axes are drawn and labelled, including the station name which is printed in the x-axis with the text rotated -90°.

For each of the remaining curves, the WQI Time File is re-read and the appropriate records selected. At the end of file the plotting routines are called to draw the symbol and the curve, and to enter the symbol in the graph legend. The text written in this legend is read in the program by data cards, another input by means of data cards is the station mile points (if this option is chosen).

The user can also specify a minimum number of data points, such that this criteria must be met before plotting takes place. Another option is the plotting of the arithmetic mean of a number of points in a station, for a particular curve rather than the actual data; this option generally yields a smoother curve and is used in the data presented.

SEASONAL NSF-WQI PLOTS FOR MULTIPLE STORET STATIONS - PROGRAM FLOWCHART



PROGRAM C - SEASONAL NSF-WQI MULTI-STATION PLOTS

PROGRAM INPUT

1) STATION CONTROL OPTION

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 2	ICNTL	I2	ICNTL = 0, for plots by station sequence ICNTL > 0, for plotting by station mile points
3 - 4	IAVER	I2	IAVER > 0, to average the WQI values at each station for a particular curve IAVER = 0, actual data will be plotted

2) STORET RETRIEVAL MILE POINTS (ICNTL > 0)

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 4	STNO (1)	I4	sequence number for first station (usually 0001)
11 - 20	X (1)	F10.0	mile point location of first station
21 - 24	STNO (2)	I4	sequence number for second station
31 - 40	X (2)	F10.0	mile point location of 2nd station
.	.	.	.
.	.	.	.
.	.	.	.
61 - 64	STNO (4)	I4	sequence number for 4th station
71 - 80	X (4)	F10.0	mile point location of 4th station

NOTE: The sequence number above refers to the actual sequential order of the stations in the graph. This number is used as an index to store the mile points read and to match the data to a similar sequence number in the input mass - storage WQI time file. These sequence numbers do not have to follow any particular order.

The above card is repeated as necessary until all mile points have been read in. A blank field will terminate this type of input.

3) TIME INTERVALS FOR GRAPHICAL DISPLAY

CARD COLUMNS	VARIABLE	FORMAT	DESCRIPTION
1 - 2	NTOTAL	I2	total number of curves to be plotted
4 - 5	MINPTS	I2	minimum number of data points desired by user, (if criteria is not met, plotting for particular curve will not occur)
6 - 10	INVAL (1)	I5	number of date cards to be read for plot of first curve

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
11 - 15	INVAL (2)	I5	number of date cards to be read for second curve
.	.	.	.
.	.	.	.
.	.	.	.
26 - 30	INVAL (5)	I5	number of date cards to be read for 5th curve

NOTE: A maximum of five curves can be plotted, any one curve can specify a maximum of fifty time intervals (dates)

4) DESCRIPTION FOR GRAPH LEGEND

The text entered here will be written next to the symbol being plotted under the graph legend.

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1-48	LEGEND (1,1-12)	12A4	text describing the first curve

The card above is repeated if necessary to enter the description of 'NTOTAL' number of curves.

5) DATE CARDS FOR EACH CURVE

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1 - 6	IBEGIN (1,1-3)	3I2	beginning date (as MONTH-DAY-YEAR) of time period
11 - 16	IEND (1,1-3)	3I2	ending date (as MMDDYY) of time period

In order for the logic of the program to work properly, the change of the year within a season would be written on two separate statements, so that the ending date is a higher numerical value than the beginning date. eg: WINTER 1975 would be entered as:

```
1234567890123456789O
111575    123175, followed by:
010176    023076
```

The card above is repeated if necessary for the other time intervals, until the number of intervals specified on variable INVAL (1) for the first curve have been met, followed by the date cards for the second curve specified on variable INVAL (2) ... and repeated for the number of curves desired.

6) NSF-WQI TIME FILE (CREATED IN PROGRAM 1)

RECORD POSITIONS	VARIABLE	FORMAT	DESCRIPTION
1 - 6	IDATE	I6	sample date
7 - 8	IOPTN	I2	IOPTN = 0, CUMM WQI IOPTN > 1, MULT WQI
9 - 24	STAT (1-4)	4A4	STORET primary station number
25 - 27	ISEQ	I3	station sequence number, used to label plots by station number or for matching mile points entered previously
28 - 39	XXVAL	F12.4	date + year digitized - this value is presently not used by this program
40 - 51	WQI	F12.4	NSF-WQI for given date
52 - 99	TOP (1-12)	12A4	station description

SAMPLE DECK SETUP FOR PROGRAM EXECUTION FROM SOURCE STATEMENTS:

```
//EPAIIIaa JOB(AAAA)
//S2 EXEC IPP1136G,REGION=130K,PRINT=A
//*  THIS PROCEDURE WILL INVOKE THE CALCOMP POST PROCESSOR
//FORT.SYSIN DD *
         .                          .                          .
         .                          .                          .
         .                          .                          .
         .                          .                          .
                 S O U R C E  P R O G R A M  G O E S  H E R E
         .                          .                          .
         .                          .                          .
         .                          .                          .
         .                          .                          .
//GO.FT25F001 DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(OLD,KEEP),
//  LABEL=(,,,IN),DSN=CN,EPAIII.AAAA.(TIME FILE NAME GOES HERE)
//GO.FT08F001  DD *
0101
0001       2.4      0002       13.5     0003       20.9     0004       24.9
0005       27.3     0006       32.6     0007       38.6     0008       42.4
0009       55.4     0010       58.3     0011       64.2     0012       71.1
0013       77.3     0014       80.7
03 01    2    3    3
* = SUMMER 1968 AND 1969*
* = SUMMER  1970-1972*
* = SUMMER FROM 1973 - PRESENT*
060168    093068
060169    093069
060170    093170
060171    093171
060172    093172
060173    093173
060174    093174
060175    093175
/*
//PLOT.PLOTTAPE  DD UNIT=2400,DSN=PL.EPAIII.AAAA.PLOTNAME,
//  LABEL=RETPD=60,DISP=(NEW,CATLG,DELETE),VOL=SER=
//PLOT.SYSIN DD DUMMY
/*
```

SAMPLE DECK SETUP FOR PROGRAM EXECUTION FROM LOAD MODULE:

```
//EPAIIIaa JOB(AAAA)
//S1 EXEC PGM=SEASONAL,REGION=130K
//STEPLIB DD DSN=CN.EPAGAN.R2TW.WQI.LOADLIB,DISP=SHR
//FT02F001 DD DSN=&IPPTAPE,UNIT=SYSDA,SPACE=(CYL,(2,2),RLSE),
// DCB=(RECFM=VBS,LRECL=516,BLKSIZE=3156),DISP=(NEW,PASS,DELETE)
//FT06F001 DD SYSOUT=A
//FT25F001 DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(OLD,KEEP),
// DCB=(RECFM=FB,LRECL=99,BLKSIZE=12969),SPACE=(TRK,(5,1),RLSE),
//  DSNAME=CN.EPAIII.AAAA.(TIME FILE NAME GOES HERE)
//FT08F001 DD *
0101
0001        2.4      0002        13.5     0003        20.9     0004        24.9
0005        27.3     0006        32.6     0007        38.6     0008        42.4
0009        55.4     0010        58.3     0011        64.2     0012        71.1
0013        77.3     0014        80.7
03 01    2    3    3
* = SUMMER 1968 AND 1969*
* = SUMMER  1970-1972*
* = SUMMER FROM 1973 - PRESENT*
060168    093068
060169    093069
060170    093170
060171    093171
060172    093172
060173    093173
060174    093174
060175    093175

/*
//PLOT EXEC PGM=IPP1136G,COND=(8,LE),REGION=130K
//STEPLIB DD DSN=CN.EPAZAF.SSSS.IPP.LOAD1,DISP=SHR
//FT03F001 DD DDNAME=PLOTTAPE
//PLOT.PLOTTAPE DD UNIT=2400,DSN=PL.EPAIII.AAAA.PLOTNAME,
// LABEL=RETPD=60,DISP=(NEW,CATLG,DELETE),VOL=SER=
//PLOT.SYSIN DD DUMMY
/*
```

COPYLIB for on-line billing file available - see NEWS BL060.

PROGRAM C: SEASONAL NSF - WQI PLOTS FOR MULTIPLE STORET STATIONS

SAMPLE OUTPUT

INPUT CONTROL PARAMETERS

TOTAL NO. OF INTERVAL SETS = 3

*** CURVE NO. 1 ***

NO. OF TIME INTERVALS FOR THIS SET= 2

FROM	TO
6/ 1/68	9/30/68
6/ 1/69	9/30/69

PLOTTING FOR CURVE NO. 1 -- PROCESSED SUCCESSFULLY WITH 21 POINTS

*** CURVE NO. 2 ***

NO. OF TIME INTERVALS FOR THIS SET= 3

FROM	TO
6/ 1/70	9/31/70
6/ 1/71	9/31/71
6/ 1/72	9/31/72

PLOTTING FOR CURVE NO. 2 -- PROCESSED SUCCESSFULLY WITH 35 POINTS

*** CURVE NO. 3 ***

NO. OF TIME INTERVALS FOR THIS SET= 3

FROM	TO
6/ 1/73	9/31/73
6/ 1/74	9/31/74
6/ 1/75	9/31/75

PLOTTING FOR CURVE NO. 3 -- PROCESSED SUCCESSFULLY WITH 18 POINTS

```
C A L C O M P  P O S T P R O C E S S O R  OF IPP    - COMMENTS AND ERROR MESSAGES -     VERSION 01 MAY 74

FRAME NUMBER     1 STARTING WITH RECORD NUMBER       1
FRAME NUMBER     1 PROCESSED WITH     0 ERRORS DETECTED

SUMMARY
          RECORDS     84
          FRAMES       1
          ERRORS       0

END OF POSTPROCESSOR RUN FOR IPP
```

CUMM NSF WATER QUALITY INDEX

0 10 20 30 40 50 60 70 80 90 100

STATION NUMBER

1 2 3 4 5 6 7 8 9 10 11 12

INPUT CONTROL PARAMETERS

TOTAL NO. OF INTERVAL SETS = 3

*** CURVE NO. 1 ***

NO. OF TIME INTERVALS FOR THIS SET= 8

FROM	TO
11/ 1/66	12/31/66
1/ 1/67	2/30/67
11/ 1/67	12/31/67
1/ 1/68	2/30/68
11/ 1/68	12/31/68
1/ 1/69	2/30/69
11/ 1/69	12/31/69
1/ 1/70	2/30/70

PLOTTING FOR CURVE NO. 1 -- PROCESSED SUCCESSFULLY WITH 34 POINTS

*** CURVE NO. 2 ***

NO. OF TIME INTERVALS FOR THIS SET= 6

FROM	TO
11/ 1/70	12/31/70
1/ 1/71	2/30/71
11/ 1/71	12/31/71
1/ 1/72	2/30/72
11/ 1/72	12/31/72
1/ 1/73	2/30/73

PLOTTING FOR CURVE NO. 2 -- PROCESSED SUCCESSFULLY WITH 36 POINTS

*** CURVE NO. 3 ***

NO. OF TIME INTERVALS FOR THIS SET= 6

FROM	TO
11/ 1/73	12/31/73
1/ 1/74	2/30/74
11/ 1/74	12/31/74
1/ 1/75	2/30/75
11/ 1/75	12/31/75
1/ 1/76	2/30/76

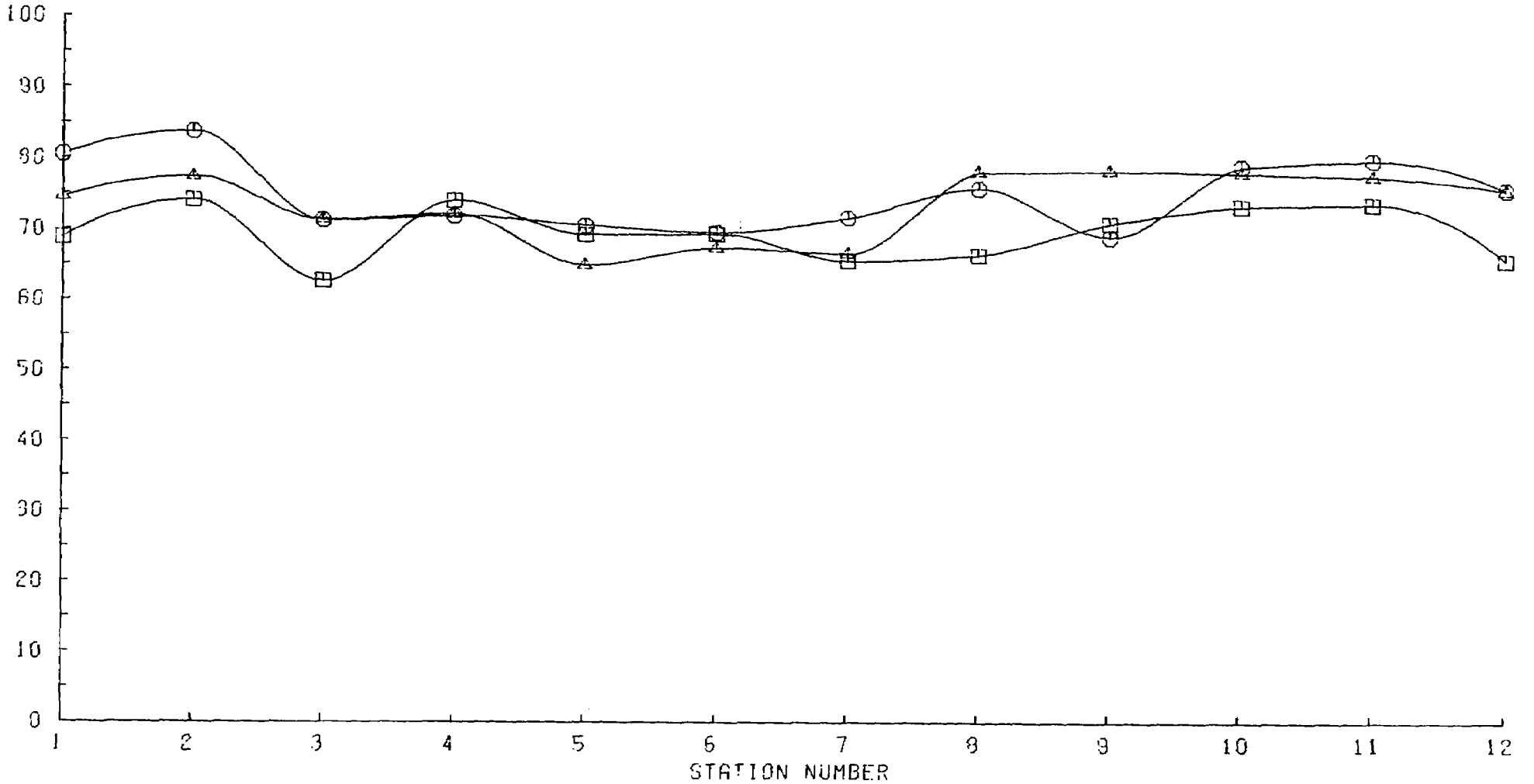
PLOTTING FOR CURVE NO. 3 -- PROCESSED SUCCESSFULLY WITH 17 POINTS

```
C A L C O M P  P O S T P R O C E S S O R  OF IPP    - COMMENTS AND ERROR MESSAGES -     VERSION 01 MAY 74

FRAME NUMBER     1 STARTING WITH RECORD NUMBER       1
FRAME NUMBER     1 PROCESSED WITH     0 ERRORS DETECTED

SUMMARY
          RECORDS     67
          FRAMES       1
          ERRORS       0

END OF POSTPROCESSOR RUN FOR IPP
```


100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
STATION NUMBER

PROGRAM C - SOURCE LISTING

```
C     ********************************************************************* SWQI004
C     ********************************************************************* SWQI005
C                                                                           SWQI006
C     ** THIS PROGRAM WILL SELECT STATIONS ACCORDING TO TIME PERIODS AND    SWQI007
C     PLOT THE NSF-WQI OR THE RAW DATA USING OSI IPP PLOTTING PACKAGE **     SWQI008
C                                                                           SWQI009
C     ** USER MAY SPECIFY UP TO 5 TIME INTERVALS --                         SWQI010
C        FOR UP TO 100 STORET STATIONS **                                   SWQI011
C                                                                           SWQI012
C     THE GRAPHS CAN BE BY MILE POINT OR BY STATION NUMBERS                 SWQI013
C                                                                           SWQI014
C     FILE INPUT IS CREATED BY THE STATION WQI PLOT PROGRAM ..              SWQI015
C     (TIME PLOT) --  THIS FILE IS BY STATION/DATE SEQUENCE                 SWQI016
C     ********************************************************************* SWQI017
C                                                                           SWQI018
C     ********************************************************************* SWQI019
C     ********************************************************************* SWQI020
C                                                                           SWQI021
      INTEGER STATNO(100),INVAL(5),SNAMES(100,12),TOP(12),STNO(4)           SWQI022
      DIMENSION X(4),DIST(100),IBEGIN(50,4),IEND(50,4),GIVEN(5),            SWQI023
     1SYMBOL(14),STAT(4),YPOINT(800),XPOINT(800),PLDATA(30),LEGEND(5,12)    SWQI024
      DIMENSION BUFX(500),BUFY(500),XAVER(100),YAVER(100)                   SWQI025
      DATA SYMBOL/'Q','O','T','+','X','D','A','M','Z','Y','B','*','H','I   SWQI026
     1'/                                                                    SWQI027
      IL=1                                                                  SWQI028
      M=8                                                                   SWQI029
C     ********************************************************************* SWQI030
C                                                                           SWQI031
C     READ STATION CONTROL OPTION  --  MILE POINT OR STATION ID SEQUENCE    SWQI032
C                                                                           SWQI033
C     READ ALSO OPTION TO AVERAGE VALUES AT A STATION FOR A PARTICULAR      SWQI034
C     CURVE (IAVER .GT. 1 )  ....                                           SWQI035
C                                                                           SWQI036
C     NOTE  --  ICNTL = 0  FOR PLOTS BY SEQUENCE OF STATION                 SWQI037
C               ICNTL = 1 FOR PLOTTING STATION MILE POINTS                  SWQI038
C                                                                           SWQI039
C     ********************************************************************* SWQI040
      READ(M,21)ICNTL,IAVER                                                 SWQI041
   21 FORMAT(2I2)                                                           SWQI042
      IF(ICNTL.LE.0)GO TO 5                                                 SWQI043
    4 READ(M,20)(STNO(K),X(K) , K=1,4)                                      SWQI044
   20 FORMAT(4(I4,6X,F10.0))                                                SWQI045
      DO 3 J=1,4                                                            SWQI046
C     ********************************************************************* SWQI047
C                                                                           SWQI048
C     NOTE ... BLANK FIELD WILL INTERRUPT INPUT  ...                        SWQI049
C                                                                           SWQI050
C     ********************************************************************* SWQI051
      IF(STNO(J).EQ.0)GO TO 5                                               SWQI052
      STATNO(IL)=STNO(J)                                                    SWQI053
C     ********************************************************************* SWQI054
C                                                                           SWQI055
C     MILE POINT IS SAVED USING STAT. NO. AS INDEX ...                      SWQI056
C                                                                           SWQI057
```

PROGRAM C - SOURCE LISTING

```
C     ********************************************************************** SWQI058
      ILOC =STNO(J)                                                          SWQI059
      DIST(ILOC)=X(J)                                                        SWQI060
      IL=IL+1                                                                SWQI061
    3 CONTINUE                                                               SWQI062
      GO TO 4                                                                SWQI063
C     ********************************************************************** SWQI064
C                                                                            SWQI065
C     VARIABLE IL WILL CONTAIN ACTUAL NO. OF MILE PTS.FOR STATIONS READ      SWQI066
C                                                                            SWQI067
C     ********************************************************************** SWQI068
    5 IL=IL-1                                                                SWQI069
C     ********************************************************************** SWQI070
C                                                                            SWQI071
C     READ TIME INTERVALS (MMDDYY) DESIRED FOR PLOTTING  ...                 SWQI072
C                                                                            SWQI073
C     ********************************************************************** SWQI074
      READ(M,26)NTOTAL,MINPTS,(INVAL(J),J=1,5)                               SWQI075
   26 FORMAT(I2,1X,I2,5I5)                                                   SWQI076
C     ********************************************************************** SWQI077
C                                                                            SWQI078
C               TO PRODUCE ONE CURVE ...                                     SWQI079
C     NOTE ... INVAL(I)= NO. OF DATES TO BE READ AT EACH INTERVAL            SWQI080
C              NTOTAL= TOTAL NUMBER OF CURVES TO BE PLOTTED                  SWQI081
C                                                                            SWQI082
C     ********************************************************************** SWQI083
      WRITE(6,23)NTOTAL                                                      SWQI084
   23 FORMAT('1',///,50X,'INPUT CONTROL PARAMETERS',/,5X,                    SWQI085
     1'TOTAL NO. OF INTERVAL SETS =' ,I3,/)                                  SWQI086
C     ********************************************************************** SWQI087
C                                                                            SWQI088
C     PRINT STATION NUMBERS AND MILE POINTS ...                              SWQI089
C                                                                            SWQI090
C     ********************************************************************** SWQI091
      IF(ICNTL.LE.0) GO TO 11                                                SWQI092
      WRITE(6,8)                                                             SWQI093
    8 FORMAT(//,5X,'STATION NUMBER',5X,'MILE POINT')                         SWQI094
      WRITE(6,16)(STATNO(J),DIST(J),J=1,IL)                                  SWQI095
   16 FORMAT(9X,I6,10X,F6.1)                                                 SWQI096
C     ********************************************************************** SWQI097
C                                                                            SWQI098
C     READ TEXT FOR LEGEND IN CHARACTER BALANCED NOTATION ...                SWQI099
C                                                                            SWQI100
C     ********************************************************************** SWQI101
   11 READ(M,2)((LEGEND(J,K),K=1,12),J=1,NTOTAL)                             SWQI102
    2 FORMAT(12A4)                                                           SWQI103
      DO 99  KL=1,NTOTAL                                                     SWQI104
      INDEX=1                                                                SWQI105
      ICNT=0                                                                 SWQI106
      IOLD=0                                                                 SWQI107
      LAST=INVAL(KL)                                                         SWQI108
      DO 6  J=1,LAST                                                         SWQI109
      READ(M,22)((IBEGIN(J,K),K=1,3),(IEND(J,K),K=1,3))                      SWQI110
   22 FORMAT(3I2,4X,3I2)                                                     SWQI111
```

PROGRAM C - SOURCE LISTING

```
    6 CONTINUE                                                              SWQI112
C     ********************************************************************* SWQI113
C                                                                           SWQI114
C     WRITE INPUT PARAMETERS                                                SWQI115
C                                                                           SWQI116
C     ********************************************************************* SWQI117
      WRITE(6,33)KL,INVAL(KL)                                               SWQI118
   33 FORMAT(//,5X,'*** CURVE NO. ',I2,' ***',//,5X,                        SWQI119
     1'NO.  OF TIME INTERVALS FOR THIS SET= ',I3,//,5X,'FROM',10X,'TO')     SWQI120
      WRITE(6,24) ((IBEGIN(J,K),K=1,3),(IEND(J,K),K=1,3),J=1,LAST)          SWQI121
   24 FORMAT(2(5X,I2,'/',I2,'/',I2))                                        SWQI122
      READ(25,25)IDATE,IOPTN,STAT,ISEQ,XXVAL,WQI,TOP                        SWQI123
   25 FORMAT(I6,I2,4A4,I3,2F12.4,12A4)                                      SWQI124
C     ********************************************************************* SWQI125
C                                                                           SWQI126
C     SAVE FIRST STATION NUMBER -- NEEDED FOR PLOT CONTROL                  SWQI127
C                                                                           SWQI128
C     ********************************************************************* SWQI129
      IS1=ISEQ                                                              SWQI130
      GO TO 1                                                               SWQI131
C     ********************************************************************* SWQI132
C                                                                           SWQI133
C     READ STATION RECORD ... IF LAST RECORD GO TO PLOT ROUTINE             SWQI134
C                                                                           SWQI135
C     ********************************************************************* SWQI136
   18 READ(25,25,END=30)IDATE,IOPTN,STAT,ISEQ,XXVAL,WQI,TOP                 SWQI137
    1 IF(ISEQ.EQ.IOLD.OR.KL.GT.1)GO TO 19                                   SWQI138
C     ********************************************************************* SWQI139
C                                                                           SWQI140
C     SAVE STATION DESCRIPTION TO LABEL THE X-AXIS                          SWQI141
C                                                                           SWQI142
C     ********************************************************************* SWQI143
      DO 29  J=1,12                                                         SWQI144
      SNAMES(ISEQ,J)=TOP(J)                                                 SWQI145
   29 CONTINUE                                                              SWQI146
C     ********************************************************************* SWQI147
C                                                                           SWQI148
C     COUNT NUMBER OF STATIONS READ ... FOR TEST VS. NO. OF MILE PTS. RE    SWQI149
C                                                                           SWQI150
C     ********************************************************************* SWQI151
      ICNT=ICNT+1                                                           SWQI152
      IOLD=ISEQ                                                             SWQI153
   19 DO 10  J=1,LAST                                                       SWQI154
C     ********************************************************************* SWQI155
C                                                                           SWQI156
C     SET BEGINNING DAY TO 1 ...  LAST DAY TO 31 IF BLANK                   SWQI157
C                                                                           SWQI158
C     ********************************************************************* SWQI159
      IF(IBEGIN(J,2).LE.0)IBEGIN(J,2)=1                                     SWQI160
      IF(IEND(J,2).LE.0)IEND(J,2)=31                                        SWQI161
C     ********************************************************************* SWQI162
C                                                                           SWQI163
C     MERGE BEGINNING AND ENDING DATES TO ONE FIELD  ... ALSO ..            SWQI164
C     CHANGE DATE AS MMDDYY TO YYMMDD ...                                   SWQI165
```

PROGRAM C - SOURCE LISTING

```
C                                                                       SWQI166
C     ***************************************************************** SWQI167
      IBEGIN(J,4)=IBEGIN(J,3)*10000+IBEGIN(J,1)*100+IBEGIN(J,2)         SWQI168
      IEND(J,4)=IEND(J,3)*10000+IEND(J,1)*100+IEND(J,2)                 SWQI169
   10 CONTINUE                                                          SWQI170
C     ***************************************************************** SWQI171
C                                                                       SWQI172
C     SELECT THE DATA TO BE PLOTTED  --- USING THE TIME INTERVALS ...   SWQI173
C                                                                       SWQI174
C     ***************************************************************** SWQI175
      DO 9  J=1,LAST                                                    SWQI176
      IF(IDATE.GE.IBEGIN(J,4).AND.IDATE.LE.IEND(J,4))GO TO 27           SWQI177
    9 CONTINUE                                                          SWQI178
C                                                                       SWQI179
C     NO DATA WITHIN DESIRED TIME PERIODS -- READ NEXT RECORD ...       SWQI180
C                                                                       SWQI181
      GO TO 18                                                          SWQI182
C     ***************************************************************** SWQI183
C     TEST IF PLOT BY MILE PT. OR BY STATION  ...                       SWQI184
C     ***************************************************************** SWQI185
   27 IF(ICNTL.LE.0)GO TO 28                                            SWQI186
      XPOINT(INDEX)=DIST(ISEQ)                                          SWQI187
      YPOINT(INDEX)=WQI                                                 SWQI188
      INDEX=INDEX+1                                                     SWQI189
      GO TO 18                                                          SWQI190
   28 XPOINT(INDEX)=ISEQ                                                SWQI191
      YPOINT(INDEX)=WQI                                                 SWQI192
      INDEX=INDEX+1                                                     SWQI193
      GO TO 18                                                          SWQI194
C     ***************************************************************** SWQI195
C                                                                       SWQI196
C     COMPARE MILE POINTS READ VS STATIONS READ ON FIRST PASS ...       SWQI197
C                                                                       SWQI198
C     ***************************************************************** SWQI199
   30 IF(KL.EQ.1.AND.ICNTL.GT.0.AND.ICNT.NE.IL)WRITE(6,31)IL,ICNT       SWQI200
   31 FORMAT(///,10X,'WARNING ***  ',5X,I3,'  MILE POINTS READ    DO NOT SWQI201
     1 MATCH ',I3,'  STATIONS READ')                                    SWQI202
C     ***************************************************************** SWQI203
C                                                                       SWQI204
C     IF DESIRED .. AVERAGE WQI AT SAME STATION FOR A SMOOTH CURVE ...  SWQI205
C                                                                       SWQI206
C     ***************************************************************** SWQI207
      IF(IAVER.LE.0)GO TO 17                                            SWQI208
      INDEX2=1                                                          SWQI209
      IHI=INDEX-1                                                       SWQI210
      XPOINT(INDEX)=-358.                                               SWQI211
      SUM=0.0                                                           SWQI212
      INUM=0                                                            SWQI213
      DO 12  J=1,IHI                                                    SWQI214
   13 SUM = SUM + YPOINT(J)                                             SWQI215
      INUM=INUM + 1                                                     SWQI216
      IF(XPOINT(J+1).EQ.XPOINT(J)) GO TO 12                             SWQI217
C     ***************************************************************** SWQI218
C                                                                       SWQI219
```

PROGRAM C - SOURCE LISTING

```
C     NEW STATION  ... AVERAGE VALUES FOR PREVIOUS STAT....                SWQI220
C                                                                          SWQI221
C     ********************************************************************* SWQI222
      YAVER(INDEX2)=SUM/FLOAT(INUM)                                        SWQI223
      XAVER(INDEX2)=XPOINT(J)                                              SWQI224
      INDEX2=INDEX2+1                                                      SWQI225
      SUM=0.0                                                              SWQI226
      INUM=0                                                               SWQI227
   12 CONTINUE                                                             SWQI228
C     ********************************************************************* SWQI229
C                                                                          SWQI230
C     *** COMMANDS BELOW USE THE INTEGRATED PLOTTING PACKAGE ***           SWQI231
C                                                                          SWQI232
C     ********************************************************************* SWQI233
C                                                                          SWQI234
C     TEST IF NO. OF DATA POINTS MEET THE MINIMUM REQUIRED NUMBER          SWQI235
C                                                                          SWQI236
   17 IF(INDEX-1.GE.MINPTS)GO TO 7                                         SWQI237
      WRITE(6,34)INDEX,MINVAL,KL                                           SWQI238
   34 FORMAT(///,5X,'** NOTE **',5X,I3,' DATA POINTS DO NOT MEET THE',     SWQI239
     1' MINIMUM ',I3,' POINTS -- PLOTTING OF CURVE',I3,' WILL BE BYPASSE   SWQI240
     2D')                                                                 SWQI241
      GO TO 92                                                             SWQI242
C     ********************************************************************* SWQI243
C                                                                          SWQI244
C     INITIAL SET-UP IS DONE DURING FIRST CURVE PROCESSING                 SWQI245
C                                                                          SWQI246
C     ********************************************************************* SWQI247
    7 IF(KL.GT.1)GO TO 45                                                  SWQI248
C                                                                          SWQI249
C     SET FRAME FOR 36 INCH PLOTTER ...                                    SWQI250
C                                                                          SWQI251
      CALL CMLBF('PLEASE RUN ON 1136 PLOTTER')                             SWQI252
C                                                                          SWQI253
C     SET INITIAL VALUES ON SPECIFICATIONS ARRAY                           SWQI254
C                                                                          SWQI255
      CALL SSPECS(PLDATA)                                                  SWQI256
C                                                                          SWQI257
C     RESET SIZE OF AXES (INCHES)                                          SWQI258
C                                                                          SWQI259
      XSCALE=10.0                                                          SWQI260
      YSCALE=5.0                                                           SWQI261
      PLDATA(7)=XSCALE                                                     SWQI262
      PLDATA(8)=YSCALE                                                     SWQI263
C                                                                          SWQI264
C     MOVE X-AXIS 5.5 INCHES AWAY FROM ORIGIN                              SWQI265
C                                                                          SWQI266
      PLDATA(2)=5.5                                                        SWQI267
      IF(ICNT.LT.ISEQ)ICNT=ISEQ                                            SWQI268
C     ********************************************************************* SWQI269
C                                                                          SWQI270
C     SET RANGE OF VALUES ON X-AXIS ** FOR MILE POINTS OR STATION NOS.     SWQI271
C                                                                          SWQI272
C     ********************************************************************* SWQI273
```

PROGRAM C - SOURCE LISTING

```
      IF(ICNTL.GT.0)GO TO 35                                              SWQI274
      PLDATA(3)=IS1+ICNT-1                                                SWQI275
      PLDATA(4)=IS1                                                       SWQI276
      PLDATA(9)=ICNT-1                                                    SWQI277
C                                                                         SWQI278
C     ANNOTATIONS WILL HAVE NO DECIMALS                                   SWQI279
C                                                                         SWQI280
      PLDATA(28)=0.0                                                      SWQI281
      GO TO 36                                                            SWQI282
C     ********************************************************************SWQI283
C                                                                         SWQI284
C     CHOOSE SCALE NUMBERS FOR MILE POINTS ...                            SWQI285
C                                                                         SWQI286
C     ********************************************************************SWQI287
   35 GIVEN(1)=DIST(IL)                                                   SWQI288
      GIVEN(2)=DIST(1)                                                    SWQI289
      GIVEN(3)=IL - 1                                                     SWQI290
      CALL FABLIX(GIVEN,PLDATA)                                           SWQI291
C                                                                         SWQI292
C     ALLOW ONE DECIMAL IN MILE POINTS                                    SWQI293
C                                                                         SWQI294
      PLDATA(28)=1.0                                                      SWQI295
C     ********************************************************************SWQI296
C                                                                         SWQI297
C     SET RANGE OF VALUES ON Y-AXIS                                       SWQI298
C                                                                         SWQI299
C     ********************************************************************SWQI300
   36 PLDATA(5)=100.                                                      SWQI301
      PLDATA(6)=0.0                                                       SWQI302
C     CHANGE DEFAULT VALUE OF DIVISIONS FOR Y-AXIS                        SWQI304
C                                                                         SWQI307
C     DRAW ANNOTATION NUMBERS AT THE BOTTOM SCALE MARKS                   SWQI308
C                                                                         SWQI309
      CALL NODLIB(PLDATA)                                                 SWQI310
C                                                                         SWQI311
C     DRAW ANNOTATION NUMBER AT THE LEFT SCALE MARKS                      SWQI312
C                                                                         SWQI313
      CALL NODLIL(PLDATA)                                                 SWQI314
C     ********************************************************************SWQI315
C                                                                         SWQI316
C     DRAW  X-Y AXES - WITH TWICE AS MANY TICKS AS  ANNOTATIONS IN Y-AXI  SWQI317
C                                                                         SWQI318
C     ********************************************************************SWQI319
      PLDATA(10)=PLDATA(10)*2.0                                           SWQI320
      CALL AXLILI(PLDATA)                                                 SWQI321
C                                                                         SWQI322
CC    CLEAR ZONES VARIABLES --  SINCE UPDATED BY ABOVE SUBROUTINE         SWQI323
C                                                                         SWQI324
      CALL ZZONES(PLDATA)                                                 SWQI325
C     ********************************************************************SWQI326
C                                                                         SWQI327
C     WRITE LEGEND IDENTIFICATION ...                                     SWQI328
C                                                                         SWQI329
C     ********************************************************************SWQI330
```

PROGRAM C - SOURCE LISTING

```
      PLDATA(22)=5.0                                                    SWQI331
      PLDATA(23)=12.0                                                   SWQI332
      CALL GTITLE('/*** LEGEND ***/',PLDATA)                            SWQI333
C                                                                       SWQI334
C     SET PLOTTING SYMBOL DESIRED                                       SWQI335
C                                                                       SWQI336
   45 PLDATA(16)=SYMBOL(KL)                                             SWQI337
      IF(IAVER.GT.0)GO TO 14                                            SWQI338
C                                                                       SWQI339
C     ENTER NUMBER OF DATA POINTS TO PLOT                               SWQI340
C                                                                       SWQI341
      PLDATA(13)=INDEX-1                                                SWQI342
C     PLOT SYMBOL AT DATA POINT LOCATIONS                               SWQI343
      CALL PSLILI(XPOINT,YPOINT,PLDATA)                                 SWQI344
C     ****************************************************************  SWQI345
C                                                                       SWQI346
C     NOW CONNECT DATA POINTS WITH PARABOLAS TO FIT THE DATA ...        SWQI347
C                                                                       SWQI348
C     ****************************************************************  SWQI349
      CALL PFLILI(XPOINT,YPOINT,BUFX,BUFY,PLDATA)                       SWQI350
      GO TO 15                                                          SWQI351
C                                                                       SWQI352
C     ENTER NUMBER OF DATA POINTS TO PLOT                               SWQI353
C                                                                       SWQI354
   14 PLDATA(13)=INDEX2-1                                               SWQI355
C                                                                       SWQI356
C     PLOT SYMBOL AT DATA POINT LOCATIONS                               SWQI357
C                                                                       SWQI358
      CALL PSLILI(XAVER,YAVER,PLDATA)                                   SWQI359
C     ****************************************************************  SWQI360
C                                                                       SWQI361
C     NOW CONNECT DATA POINTS WITH PARABOLAS TO FIT THE DATA ...        SWQI362
C                                                                       SWQI363
C     ****************************************************************  SWQI364
      CALL PFLILI(XAVER,YAVER,BUFX,BUFY,PLDATA)                         SWQI365
C     ****************************************************************  SWQI366
C                                                                       SWQI367
C     WRITE TEXT IN GRAPH LEGEND FOR THIS CURVE ...                     SWQI368
C                                                                       SWQI369
C     ****************************************************************  SWQI370
   15 DO 48  J=1,12                                                     SWQI371
      TOP(J)=LEGEND(KL,J)                                               SWQI372
   48 CONTINUE                                                          SWQI373
C                                                                       SWQI374
C     REDUCE SIZE OF TEXT BY HALF ...                                   SWQI375
C                                                                       SWQI376
      PLDATA(17)=PLDATA(17)/2.0                                         SWQI377
      PLDATA(18)=PLDATA(18)/2.0                                         SWQI378
C                                                                       SWQI379
C     SET INITIAL POSITION OF LEGEND TEXT                               SWQI380
C                                                                       SWQI381
      PLDATA(22)=5.0                                                    SWQI382
      PLDATA(23)=11.8 - (.2*(KL-1))                                     SWQI383
C                                                                       SWQI384
```

PROGRAM C - SOURCE LISTING

```
C     WRITE LEGEND TWICE SO ITS LEGIBLE ...                                  SWQI385
C                                                                            SWQI386
      DO 47  LL=1,2                                                          SWQI387
      CALL SYMKEY(TOP,PLDATA)                                                SWQI388
   47 CONTINUE                                                               SWQI389
C                                                                            SWQI390
C     RESTORE SIZE OF TEXT ...                                               SWQI391
C                                                                            SWQI392
      PLDATA(17)=PLDATA(17)*2.0                                              SWQI393
      PLDATA(18)=PLDATA(18)*2.0                                              SWQI394
C     ************************************************************************ SWQI395
C                                                                            SWQI396
C     LABELLING OF GRAPH -- ONLY ON PROCESSING OF FIRST CURVE ...            SWQI397
C                                                                            SWQI398
C     ************************************************************************ SWQI399
      IF(KL.GT.1)GO TO 91                                                    SWQI400
C                                                                            SWQI401
C     CHANGE DEFAULT SPACING OF TITLES TO THE AXES                           SWQI402
C                                                                            SWQI403
      PLDATA(24)=.20                                                         SWQI404
      PLDATA(26)=.60                                                         SWQI405
      IF(ICNTL.GT.0)GO TO 37                                                 SWQI406
      CALL TITLEB('+  STATION NUMBER+',PLDATA)                               SWQI407
      GO TO 38                                                               SWQI408
   37 CALL TITLEB('+  STATION MILE POINT+',PLDATA)                           SWQI409
   38 IF(IOPTN.EQ.0)CALL TITLEL('+CUMM NSF WATER QUALITY INDEX+',PLDATA)     SWQI410
      IF(IOPTN.NE.0)CALL TITLEL('+MULT NSF WATER QUALITY INDEX+',PLDATA)     SWQI411
C                                                                            SWQI412
C     PRINT GRAPH DESCRIPTION AT X-AXIS ROTATING TEXT 270 DEGREES            SWQI413
C                                                                            SWQI414
      PLDATA(20)=-90.0                                                       SWQI415
C                                                                            SWQI416
C     REDUCE SIZE OF LETTERS BY HALF ...                                     SWQI417
C                                                                            SWQI418
      PLDATA(17)=PLDATA(17)/2.                                               SWQI419
      PLDATA(18)=PLDATA(18)/2.                                               SWQI420
C                                                                            SWQI421
C     SET DISTANCE FROM FRAME ORIGIN FOR STAT. DESCRIPTION                   SWQI422
C                                                                            SWQI423
      PLDATA(23)=4.8                                                         SWQI424
C     ************************************************************************ SWQI425
C                                                                            SWQI426
C     COMPUTE INCREMENT BETWEEN STATIONS IN X-AXIS ... THEN USE THIS         SWQI427
C     INCREMENT TO PLOT STATION NAME AT MILE PT. OR STATION NO. ...          SWQI428
C                                                                            SWQI429
C     ************************************************************************ SWQI430
      IF(ICNTL.LE.0)FACTOR=XSCALE/(ICNT- 1)                                  SWQI431
      IF(ICNTL.GT.0)FACTOR=XSCALE/(PLDATA(3)-PLDATA(4))                      SWQI432
      DO 40 J=1,ICNT                                                         SWQI433
      IF(ICNTL.LE.0) GO TO 41                                                SWQI434
      PLDATA(22)=FACTOR*DIST(J)+PLDATA(1)-FACTOR*PLDATA(4)                   SWQI435
      GO TO 42                                                               SWQI436
   41 PLDATA(22)=FACTOR*(IS1+(J-2) ) + PLDATA(1)                             SWQI437
   42 DO 44  JJ=1,12                                                         SWQI438
```

PROGRAM C - SOURCE LISTING

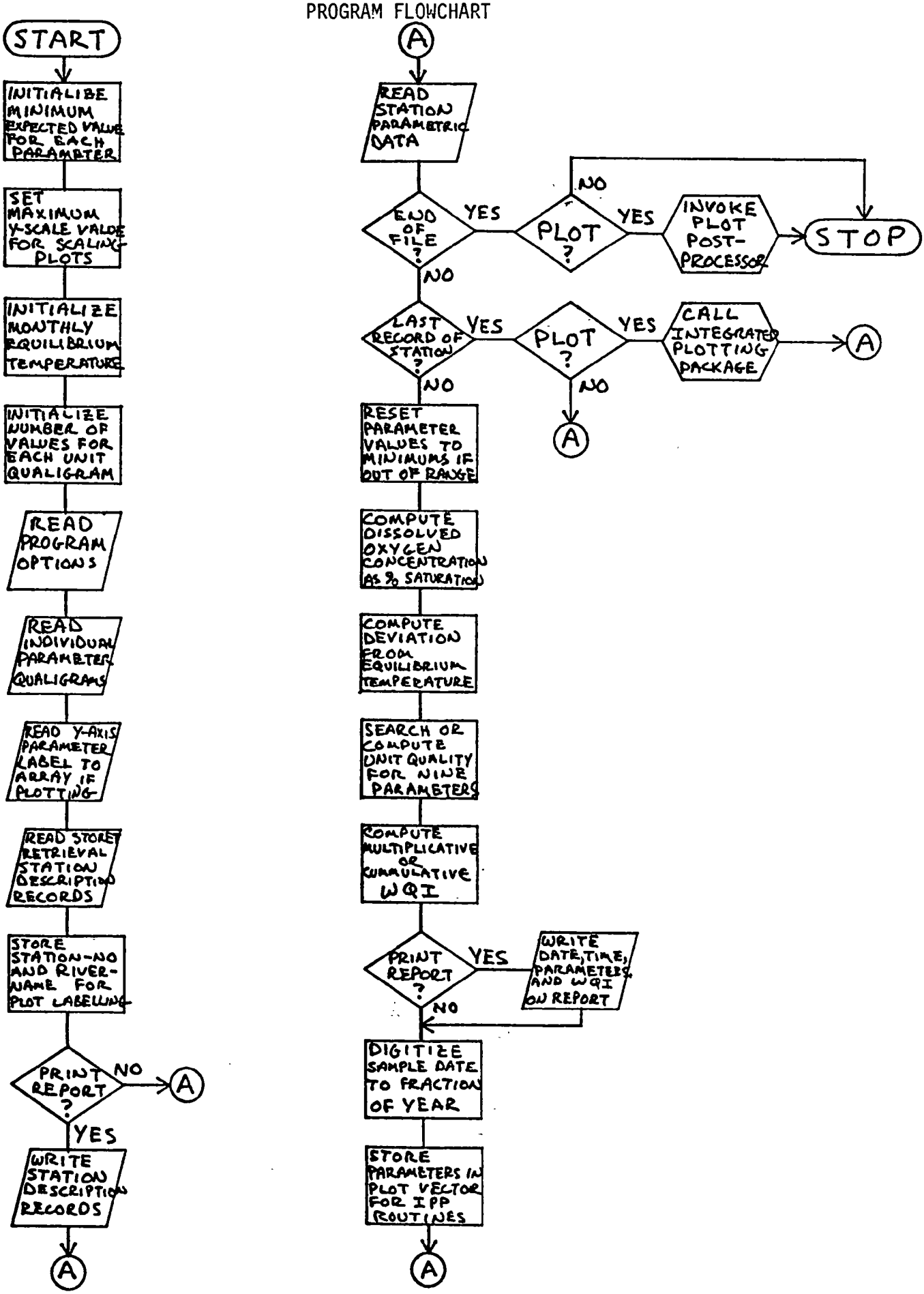
```
      TOP(JJ)=SNAMES(J,JJ)                                              SWQI439
   44 CONTINUE                                                          SWQI440
      CALL GTITLE(TOP,PLDATA)                                           SWQI441
   40 CONTINUE                                                          SWQI442
C                                                                       SWQI443
C     RESTORE SIZE OF TEXT ...                                          SWQI444
C                                                                       SWQI445
      PLDATA(17)=PLDATA(17)*2.                                          SWQI446
      PLDATA(18)=PLDATA(18)*2.                                          SWQI447
C                                                                       SWQI448
C     RESTORE ANGLE OF TEXT TO HORIZONTAL POSITION ...                  SWQI449
C                                                                       SWQI450
      PLDATA(20)=0.0                                                    SWQI451
C     ********************************************************************SWQI452
C                                                                       SWQI453
C     RE-INITIALIZE STATION FILE, CLEAR DATA ARRAYS ...                 SWQI454
C                                                                       SWQI455
C     ********************************************************************SWQI456
   91 INDEX=INDEX-1                                                     SWQI457
      WRITE(6,46)KL,INDEX                                               SWQI458
   46 FORMAT(/,9X,'PLOTTING FOR CURVE NO.',I3,' -- PROCESSED SUCCESSFULL SWQI459
     1Y WITH',I4,' POINTS')                                             SWQI460
   92 REWIND 25                                                         SWQI461
      DO 39 J=1,INDEX                                                   SWQI462
      XPOINT(J)=0.0                                                     SWQI463
      YPOINT(J)=0.0                                                     SWQI464
   39 CONTINUE                                                          SWQI465
   99 CONTINUE                                                          SWQI466
C     ********************************************************************SWQI467
C                                                                       SWQI468
C     CLOSE NEUTRAL TEXT ...                                            SWQI469
C                                                                       SWQI470
C     ********************************************************************SWQI471
      CALL PPPEND(PLDATA)                                               SWQI472
      STOP                                                              SWQI473
      END                                                               SWQI474
/*                                                                      SWQI475
```

PROGRAM D: PLOT/PRINT NSF-WQI TIME PROFILE AND NSF-WQI PARAMETER DATA

This program is a combination of programs A and B. The report is similar to the report from program B. The only change is the addition of the Cummulative or Multiplicative WQI on the right side of the report.

The plot is similar to the plot in program B. The program plots the first five parameters on the first frame. It then plots the next four parameters and the Cummulative or Multiplicative WQI (as computed in program A) on the next frame. As presently written, each frame is 8½ x 11 inches and due to the high resolution required, it can only be satisfactorily produced on the calcomp plotter.

PLOT/PRINT NSF-WQI PARAMETER DATA AND INDEX PROGRAM FLOWCHART



PROGRAM D: PLOT/PRINT NSF-WQI TIME PROFILE AND NSF-WQI PARAMETER DATA

PROGRAM INPUT

1) TO UPDATE PROGRAM WITH EQUILIBRIUM TEMPERATURES:

If necessary, change source statement number 31 to the applicable equilibrium temperatures. Reference number 5 has tables listing these values applicable to most locations in the United States.

2) PROGRAM OPTIONS CARD:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1-2	IPRNT	I2	Set 0, to produce report of WQI parameter data and index.
3-4	IPLOT	I2	Set 0, to plot 5 parameters/ frame of above data.
5-6	OPTION	I2	Set 0, for Mult. WQI Set 0, for Cumm. WQI

3) TO MODIFY DIGITIZED UNIT QUALIGRAMS FOR PARAMETERS:

The data shown on page 78 is for linear approximations to the mean curve of the input qualigrams for each of the nine parameters as shown on appendix A. This data is provided with the program. If the user desires to improve these values, first modify source statement number ___ to the new number values to be read for each parameter, then read these values as follows:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1-10	TABLE (1,1,1)	F1Ø.Ø	First value of x-scale for 1st parameter.
11-20	TABLE (2,1,1)	F1Ø.Ø	Second value of x-scale for 1st parameter.
.	.	.	.
.	.	.	.
.	.	.	.
71-80	TABLE (8,1,1)	F1Ø.Ø	Eighth value of x-scale for 1st parameter.

The card above is repeated until all x-scale values for the 1st parameter unit qualigrams have been read.

The y-values (unit qualities) for the corresponding x-values read above are now entered:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1-10	TABLE (1,2,1)	F1Ø.Ø	Corresponding 1st value of y-scale for 1st parameter.
11-20	TABLE (2,2,1)	F1Ø.Ø	Corresponding 2nd value of y-scale for 1st parameter.
.	.	.	.
.	.	.	.
.	.	.	.
71-80	TABLE (8,2,1)	F1Ø.Ø	Corresponding 8th value of y-scale for 1st parameter.

The card above is repeated until all corresponding y-values for the x-values read in previously have been entered.

Next the x-values and the associated y-values (unit quality) for the 2,3, ...9 parameters are entered in an identical manner. For the last parameter this input would be:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1-10	TABLE (1,1,9)	F1Ø.Ø	First value of x-scale for the 9th parameter.
11-20	TABLE (2,1,9)	F1Ø.Ø	Second value of x-scale for the 9th parameter.
.	.	.	.
.	.	.	.
.	.	.	.
71-80	TABLE (8,1,9)	F1Ø.Ø	Eighth value of x-scale for the 9th parameter.

As previously, the above card is repeated if necessary.

Next the y-values for the corresponding x-values are entered:

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1-10	TABLE (1,2,9)	F1Ø.Ø	Corresponding 1st value of y-scale for 9th parameter.
11-20	TABLE (2,2,9)	F1Ø.Ø	Corresponding 2nd value of y-scale for 9th parameter.
.	.	.	.
.	.	.	.
.	.	.	.
71-80	TABLE (8,2,9)	F1Ø.Ø	Corresponding 8th value of y-scale for 9th parameter.

Again, as in the first parameter, the above card is repested if it was necessary in inputting the x-scale for this parameter.

4) Y-AXIS PARAMETER LABEL (if IPLOT 0)

CARD COLUMN	VARIABLE	FORMAT	DESCRIPTION
1-20	PTITLE (1,1-5)	5A4	Y-axis label for first parameter in character balanced notation (see sample input in next section or reference 2)
1-20	PTITLE (2,1-5)	5A4	Y-axis label for second parameter.
.	.	.	.
.	.	.	.
.	.	.	.
1-20	PTITLE (2,1-5)	5A4	Y-axis label for ninth parameter.

NOTE: The titles above must be in the same sequence as the parameters were specified on the storet retrieval.

5) STORET "MORE = 3" RETRIEVAL

This retrieval must have preceded as a seperate step or a seperate job altogether. In this program it will be referred to as input file (20). See deck setup following this section for details.

SAMPLE INPUT

1) Deck setup for execution of program from source listing:

```
//EPAIIIaa JOB(AAAA)
//S2 EXEC IPP1136G,REGION=130K,PRINT=A
//*  THIS PROCEDURE WILL INVOKE THE CALCOMP POST PROCESSOR
//FORT.SYSIN DD *
        .                       .                       .
        .                       .                       .
        .                       .                       .
        .                       .                       .
              S O U R C E  P R O G R A M  G O E S  H E R E
        .                       .                       .
        .                       .                       .
        .                       .                       .
        .                       .                       .
//GO.FT20F001  DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(OLD,KEEP),
//  LABEL=(,,,IN),DSN=CN.EPAIII.AAAA.(FILE NAME FROM STORET RETRIEVAL)
//GO.FT08F001  DD *
010101
  0.0       20.0      30.0      40.0      50.0      60.0      78.0      80.0
  100.0     120.0     140.0
  3.0       12.0      20.0      30.0      44.0      60.0      75.0      86.0
  100.0     89.0      73.0
  1.0       2.0       5.0       10.0      20.0      50.0      100.0     300.0
  500.0     1000.0    2000.0    5000.0    10000.0   20000.0   100000.0
  100.0     88.0      77.0      68.0      58.0      47.0      40.0      30.0
26.0        21.0      18.0      12.0      9.0       7.0       5.0
  2.0       3.0       3.3       4.0       4.5       5.0       5.5       6.0
  6.4       7.0       7.2       7.4       7.8       8.0       8.5       9.0
  10.0      10.5      11.0      12.0
  2.0       4.0       7.0       10.0      16.0      27.0      42.0      62.0
80.0        91.0      93.0      94.0      90.0      87.0      80.0      45.0
  18.0      10.0      6.0       3.0
  0.0       5.        10.       15.        20.      25.       30.
 100.       53.       31.       18.       11.       7.        5.
 0.0        5.0       10.       20.        30.       40.      50.       60.
  70.       80.       90.       100.
  100.       66.      49.       32.       23.       17.       12.       7.
 4.         2.0       1.2       1.1
  0.0       .5        1.        2.        3.       4.          5.       6.
 7.         8.        9.        10.
 100.       60.       41.       25.       18.       12.        10.      8.
 7.         6.        5.        4.
 0.0       1.25      2.5       5.0       6.25      7.5       8.9       10.0
 12.5       15.0      17.5      20.0
  52.0      71.0      81.0      93.0      86.0      76.0      50.0      40.0
  26.0      18.0      12.0      9.0
 0.0        10.       20.       30.       40.       50.       60.       70.
 80.        90.       100.
 100.       77.       62.       52.       44.       38.        32.       28.
 24.        20.       17.
0.0         50.       100.      150.      200.      250.      300.      350.
 400.       450.      500.
 80.        86.       84.       81.       74.       68.       61.       54.
 47.         39.      33.
/D.O.  PERCENT SAT/
+FECAL COLI  MPN/ML+
/      PH       /
+    BOD5  MG/L  +
+     NO3  MG/L  +
+     PO4  MG/L  +
/EQUIL TEMP DELTA /
/  TURBIDITY  JTU /
+ TOT SOLIDS  MG/L+

/*
//PLOT.PLOTTAPE  DD UNIT=2400,DSN=PL.EPAIII.AAAA.PLOTNAME,
//  DISP=(NEW,CATLG,DELETE),LABEL=RETPD=60,VOL=SER=
//PLOT.SYSIN  DD DUMMY
/*
```

2) Deck setup for program execution from load module:

```
//EPAIIIaa JOB(AAAA)
//S1 EXEC PGM=WQIPARM,REGION=130K
//STEPLIB DD DSN=CN.EPAGAN.R2TW.WQI.LOADLIB,DISP=SHR
//FT02F001 DD DSN=&IPPTAPE,UNIT=SYSDA,SPACE=(CYL,(2,2),RLSE),
// DCB=(RECFM=VBS,LRECL=516,BLKSIZE=3156),DISP=(NEW,PASS,DELETE)
//FT06F001 DD SYSOUT=A
//FT20F001 DD UNIT=3330-1,VOL=SER=DDDDDD,DISP=(OLD,KEEP),
//  DSNAME=CN.EPAIII.AAAA.(FILE NAME FROM STORET RETRIEVAL FOLLOWS)
//FT08F001 DD *
010101
  0.0      20.0      30.0      40.0      50.0      60.0      78.0      80.0
  100.0    120.0     140.0
  3.0      12.0      20.0      30.0      44.0      60.0      75.0      86.0
  100.0    89.0      73.0
  1.0      2.0       5.0       10.0      20.0      50.0      100.0     300.0
  500.0    1000.0    2000.0    5000.0    10000.0   20000.0   100000.0
  100.0    88.0      77.0      68.0      58.0      47.0      40.0      30.0
26.0       21.0      18.0      12.0      9.0       7.0       5.0
  2.0      3.0       3.3       4.0       4.5       5.0       5.5       6.0
  6.4      7.0       7.2       7.4       7.8       8.0       8.5       9.0
  10.0     10.5      11.0      12.0
  2.0      4.0       7.0       10.0      16.0      27.0      42.0      62.0
80.0       91.0      93.0      94.0      90.0      87.0      80.0      45.0
  18.0     10.0      6.0       3.0
  0.0      5.        10.       15.       20.       25.       30.
 100.      53.       31.       18.       11.       7.        5.
 0.0       5.0       10.       20.       30.       40.       50.       60.
  70.      80.       90.       100.
  100.     66.       49.       32.       23.       17.       12.       7.
 4.        2.0       1.2       1.1
  0.0      .5        1.        2.        3.        4.        5.        6.
 7.        8.        9.        10.
 100.      60.       41.       25.       18.       12.       10.       8.
 7.        6.        5.        4.
 0.0      1.25      2.5       5.0      6.25       7.5       8.9       10.0
 12.5      15.0      17.5      20.0
  52.0     71.0      81.0      93.0      86.0      76.0      50.0      40.0
  26.0     18.0      12.0      9.0
 0.0       10.       20.       30.       40.       50.       60.       70.
 80.       90.       100.
 100.      77.       62.       52.       44.       38.       32.       28.
 24.       20.       17.
0.0        50.       100.      150.      200.      250.      300.      350.
 400.      450.      500.
 80.       86.       84.       81.       74.       68.       61.       54.
 47.       39.       33.
/D.O.  PERCENT SAT/
+FECAL COLI  MPN/ML+
/      PH       /
+    BOD5  MG/L  +
+     NO3  MG/L  +
+     PO4  MG/L  +
./EQUIL TEMP DELTA /
/  TURBIDITY  JTU /
+ TOT SOLIDS  MG/L+

/*
//PLOT EXEC PGM=CCMP1136,COND=(8,LE),REGION=130K
//STEPLIB DD DSN=CNSSSS.ZAF.IPP.LOAD1,DISP=SHR
//FT01F001 DD DDNAME=SYSIN
//FT02F001 DD DSN=&IPPTAPE,DISP=(OLD,DELETE,DELETE)
//FT06F001 DD SYSOUT=A
//FT15F001 DD SYSOUT=A
//* USE THE NEXT FOUR STATEMENTS WITH CALCOMP POSTPROCESSOR ONLY.
//FT03F001 DD DDNAME=PLOTTAPE
//PLOT.PLOTTAPE DD UNIT=2400,DSN=PL.EPAIII.AAAA.PLOTNAME,
//  LABEL=RETPD=60,DISP=(NEW,CATLG,DELETE),VOL=SER=
//PLOT.SYSIN DD DUMMY
/*
```

PROGRAM D: Plot/Print NSF-WQI Time Profile and Parameter Data

SAMPLE OUTPUT

STATION 343017

343017 88
40 29 50.0 074 26 18.0 2
RARITAN RIVER (R17)
34023 NEW JERSEY
NORTHEAST 013391
LOWER HUDSON N.Y. METROPOLITAN AREA
21NJDEP1
0000 FEET DEPTH CLASS 00

/TYPA/AMBNT/STREAM

DATE	TIME	D O (SAT)	F.C. MPN	PH	BOD5	NO3	PO4	TEMP DELTA	TURB	TOT SOLIDS	CL	WQAI
10/10/66		62.4780	330.	7.30	6.0	1.2400	0.4000	2.7557	24.5	523.0	0.	56.
1/17/67		95.6182	16090.	7.90	4.0	0.9200	0.9000	2.5556	17.0	253.0	0.	54.
5/24/67		91.6987	9180.	7.40	5.0	0.8000	0.2000	10.0557	6.6	280.0	0.	55.
9/11/67		70.5822	16090.	7.30	6.0	1.2800	0.9000	8.7780	6.3	361.0	0.	47.
10/23/67		64.3165	24000.	7.30	6.0	1.0000	0.9000	6.5557	26.0	404.0	0.	46.
3/ 5/68		81.4680	24000.	7.20	9.0	1.0000	0.0	8.2223	16.0	292.0	0.	52.
2/ 4/69		84.2123	24000.	7.30	8.0	2.0000	2.0000	6.7778	140.0	381.0	0.	37.
5/14/69		126.5480	24000.	7.40	5.0	1.0000	1.0000	7.5557	17.0	392.0	0.	49.
12/ 3/69		74.8414	2300.	7.40	4.0	1.0000	0.0	3.8334	12.0	850.0	0.	58.
10/ 7/70		65.1528	490.	7.40	6.0	4.0000	0.0	1.5557	10.0	1838.0	0.	57.
4/26/71		91.7934	50.	7.90	4.0	3.0000	1.0000	7.8890	16.0	326.0	0.	66.
8/17/71		152.0962	170.	7.70	4.0	6.0000	0.9000	6.2224	16.0	450.0	0.	56.
11/11/71		81.0493	130.	7.60	2.0	4.0000	0.5400	6.7778	16.0	272.0	0.	69.
2/14/72		84.9141	2400.	6.90	5.0	4.0000	0.4800	6.7778	120.0	274.0	0.	48.
3/27/73		89.6095	2.	6.90	2.0	1.5000	0.5000	2.2223	54.0	204.0	0.	77.
9/27/73		47.8543	240.	7.30	2.0	2.0000	1.2000	9.7780	6.0	532.0	0.	50.
12/13/73		85.1193	1600.	7.40	3.0	1.4000	0.5000	6.3334	17.0	206.0	0.	64.

STATION 343024

343024 95
40 30 55.0 074 17 28.0 2
RARITAN RIVER
34023 NEW JERSEY
NORTHEAST 013391
LOWER HUDSON N.Y. METROPOLITAN AREA
21NJDEP1
0000 FEET DEPTH CLASS 00

/TYPA/AMBNT/STREAM

DATE	TIME	D O (SAT)	F.C. MPN	PH	BOD5	NO3	PO4	TEMP DELTA	TURB	TOT SOLIDS	CL	WQAI
1/10/67		60.7805	9180.	6.50	3.0	2.0800	0.9000	2.5556	43.0	21255.0	0.	45.
5/10/67		74.5253	16090.	6.20	3.0	1.5200	0.3000	14.5557	40.0	8641.0	0.	40.
9/12/67		65.1528	5420.	6.80	2.0	1.6600	0.0	8.7780	26.0	16200.0	0.	50.
10/24/67		40.9287	2400.	7.60	2.0	1.0000	0.9000	6.5557	20.0	24730.0	0.	47.
1/21/71	0945	70.9801	500.	6.70	4.0	5.0000	1.0000	5.5556	30.0	18980.0	0.	52.
7/20/71		52.9542	2400.	7.70	3.0	2.0000	0.5600	10.3336	22.0	24220.0	0.	46.
2/ 9/72	1040	72.3451	540.	7.40	3.0	1.5000	0.2400	7.7778	16.0	14206.0	0.	59.
8/31/72		68.7224	1600.	7.10	4.0	4.0000	0.2400	12.2224	26.0	20878.0	0.	48.
12/ 5/72		64.1078	920.	7.20	2.0	1.0000	0.2200	3.3334	6.0	13340.0	0.	60.
2/ 6/73		93.3945	920.	6.80	2.0	1.0000	0.0200	4.7778	36.0	10640.0	0.	62.
4/25/73		100.0118	540.	8.10	1.0	1.0000	0.3000	5.8890	8.0	21830.0	0.	65.
7/26/73		60.0000	540.	7.80	2.0	1.5000	0.8000	11.3336	9.0	28910.0	0.	51.
10/31/73		62.1056	2400.	6.50	1.0	1.0000	1.0000	10.5557	37.0	4726.0	0.	46.
1/29/74		68.0168	540.	6.90	2.0	1.0000	0.5000	0.5556	7.0	21290.0	0.	57.
5/15/74		79.3342	330.	7.50	2.0	1.0000	0.5000	4.4557	16.0	528.0	0.	62.

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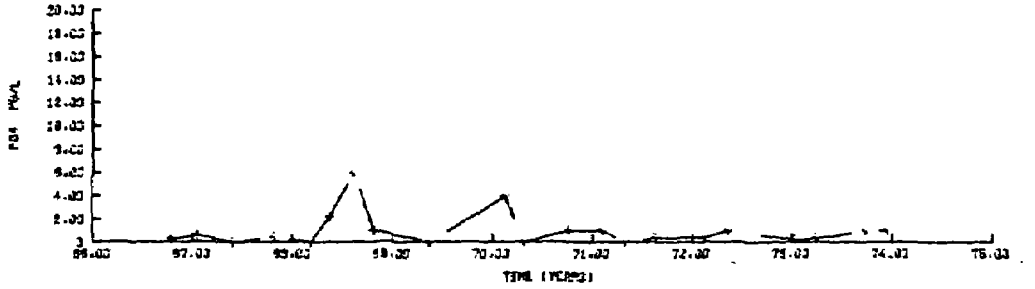
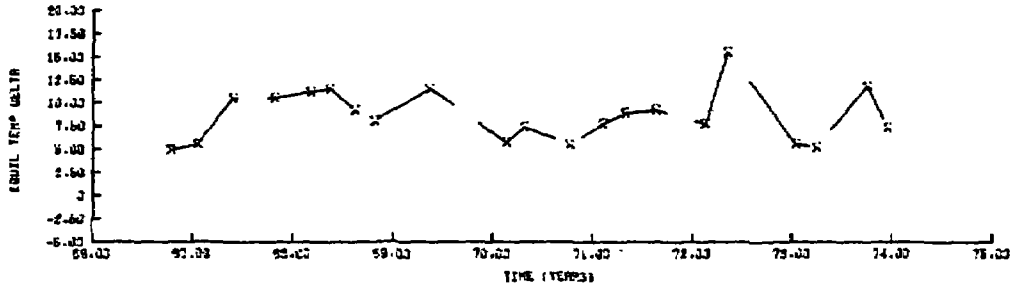
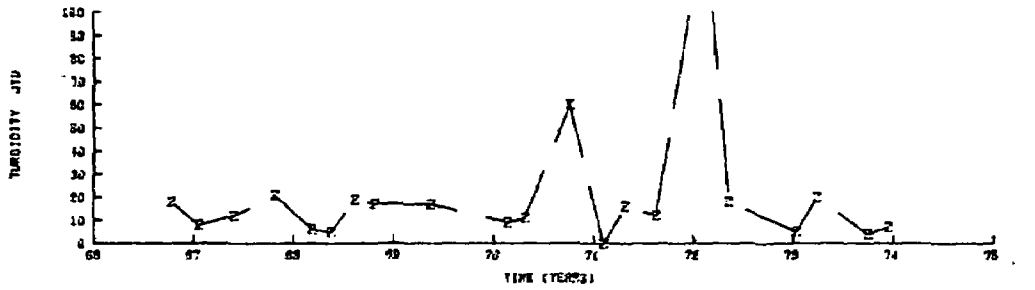
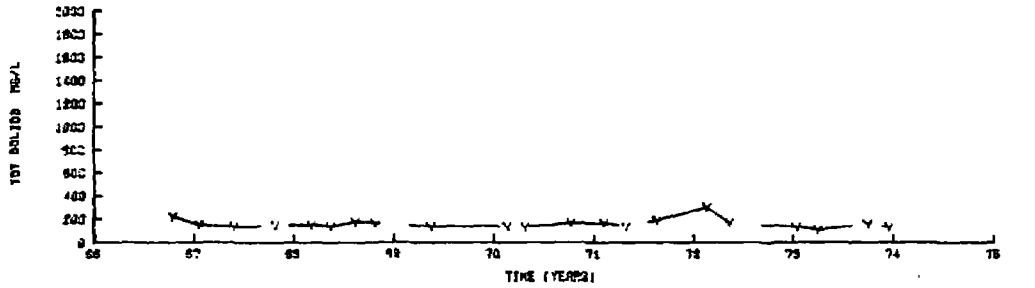
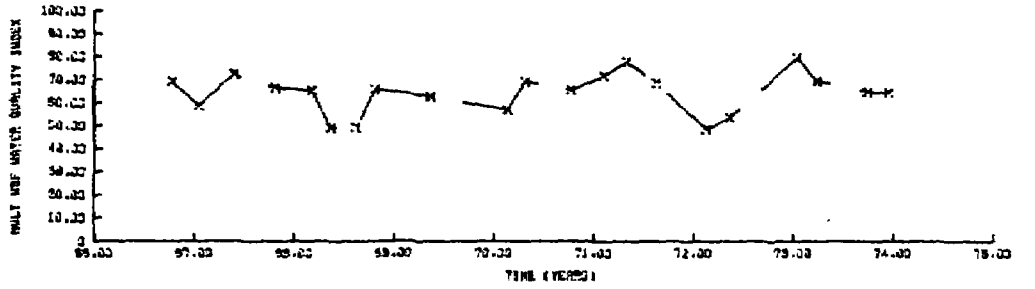
STORET STATION NO. 343014 RARITAN RIVER (R14)



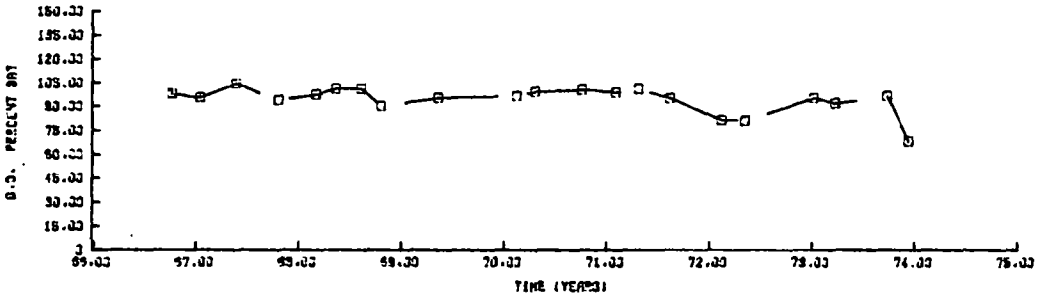


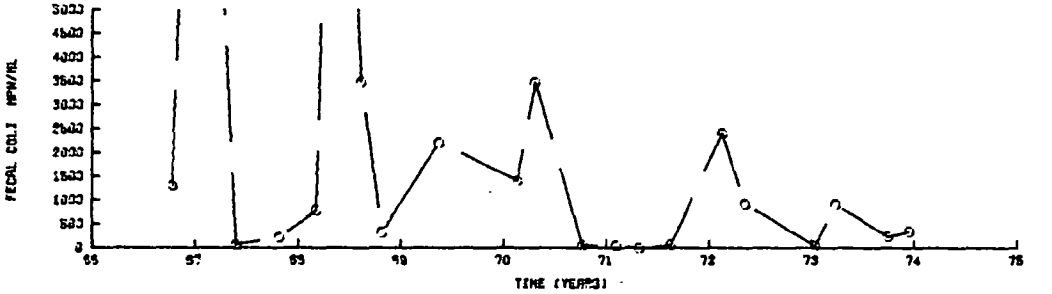


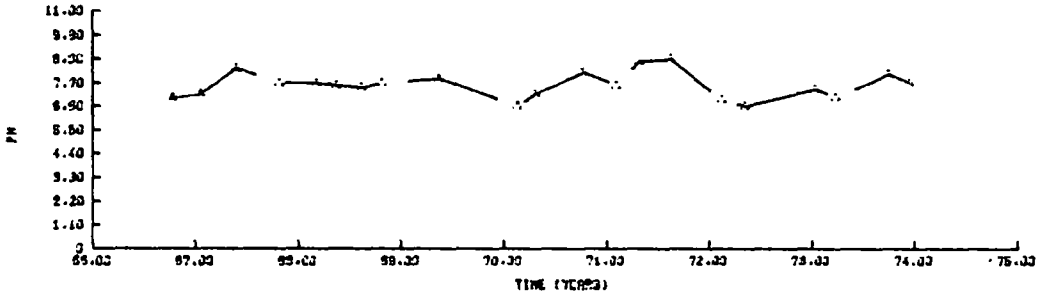


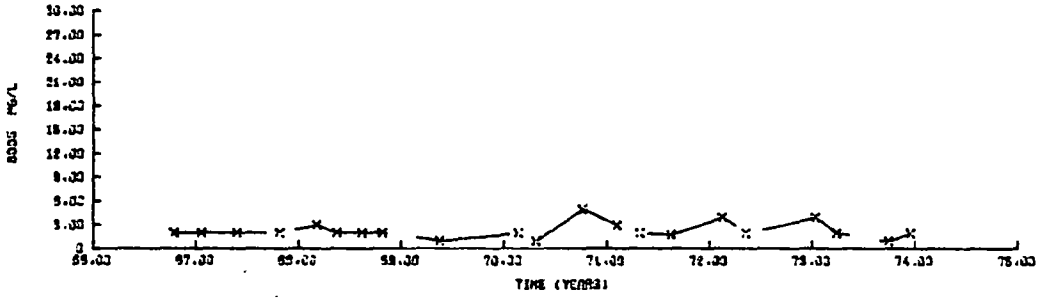


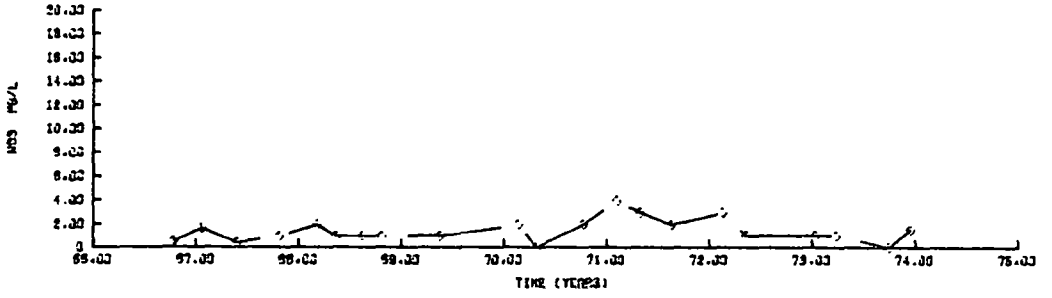
STORET STATION NO. 343014 RARITAN RIVER (R14)



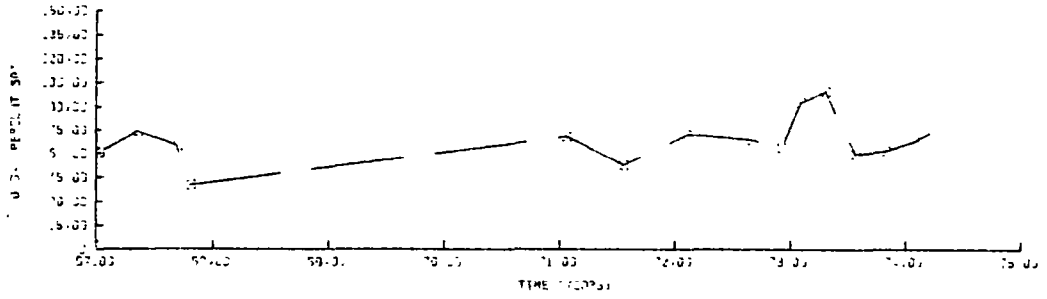


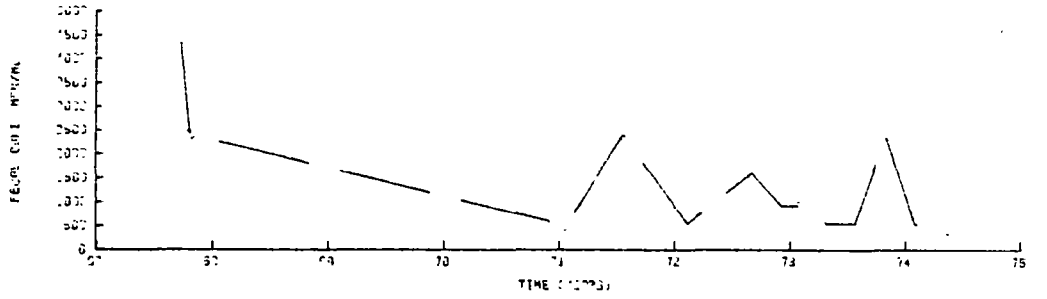


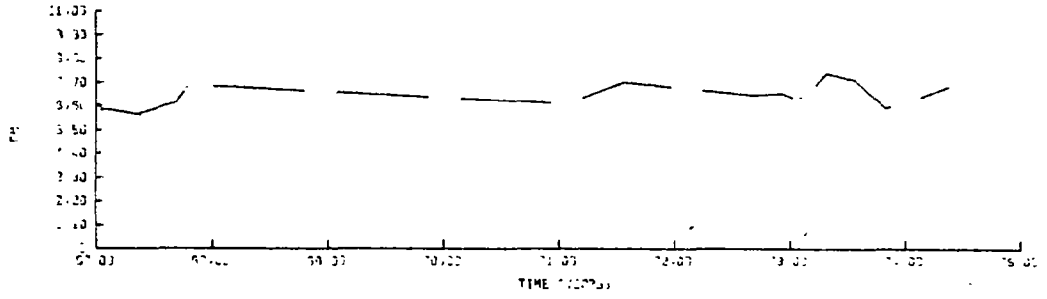


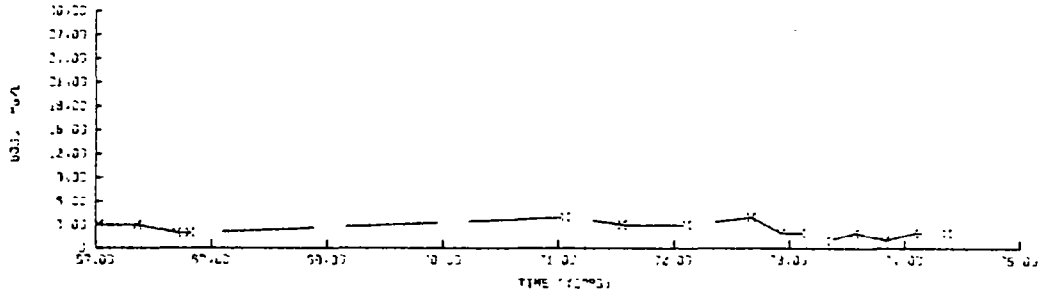


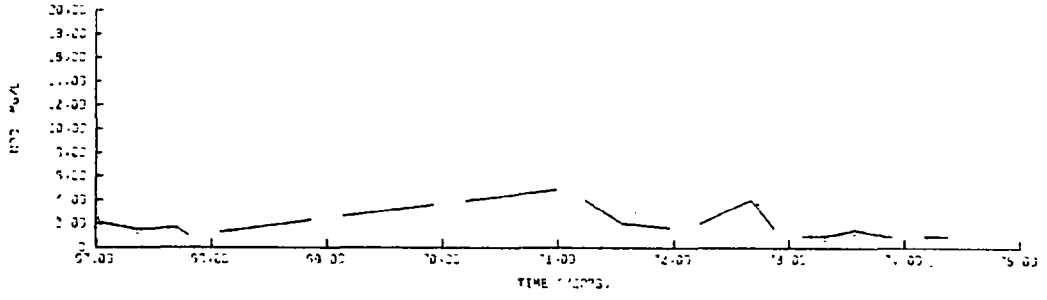
STORET STATION NO 343024 RARITAN RIVER



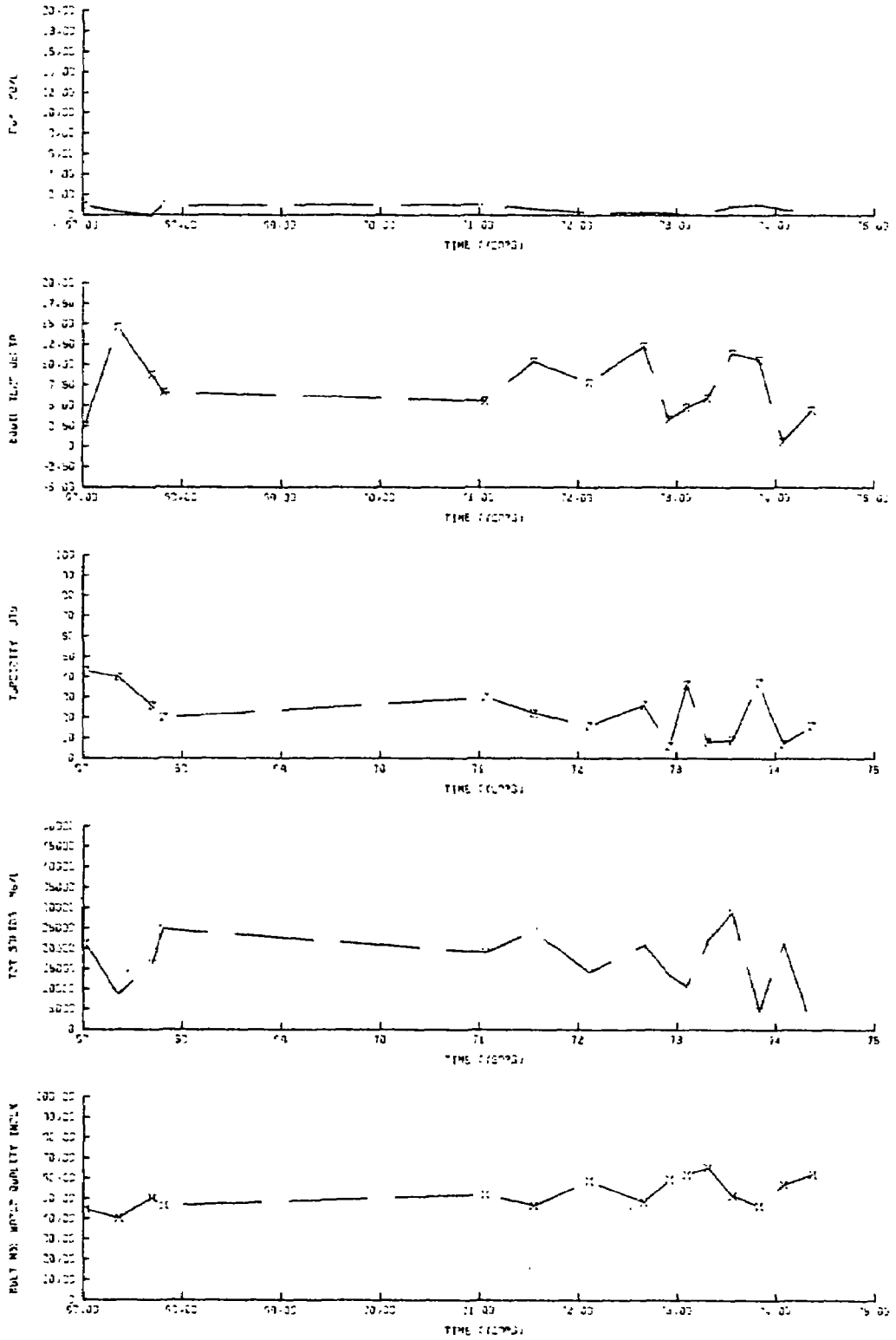








STORET STATION NO. 340324 RARITAN RIVER



PROGRAM D - SOURCE LISTING

```
C     ******************************************************************
C     ******************************************************************
C
C     THIS PROGRAM PLOTS AND/OR PRINTS THE RAW DATA USED TO COMPUTE
C     THE WQI AT STORET STATIONS AND THE CUMMULATIVE OR MULTIPLICATIVE
C     WQI, FOR THE RETRIEVED TIME INTERVAL
C
C     *** THIS VERSION PLOTS UP TO FIVE PARAMETERS PER FRAME ***
C
C     ******************************************************************
C     ******************************************************************
C
      INTEGER OPTION
      DIMENSION PLDATA(30),SYMBOL(14),XXVAL(100),SCL(5),YYVAL(100)
      DIMENSION TOP(12),HIGHY(10),PTITLE(9,5),YTITLE(5),VAL(10,100)
      DIMENSION AGENCY(2),DESCRP(30),EQTEMP(12),PARAM(10),SMALL(9),
     1STAT(4),DAYS(12)
      DIMENSION TABLE(20,2,9),MAXX(9),WEIGHT(9),QMAX(9),QUAL(9)
      DATA DAYS/31.,28.,31.,30.,31.,30.,31.,31.,30.,31.,30.,31./
      DATA SMALL/0.,1.,2.,0.,0.,0.,-10.,0.0,0.0/
      DATA HIGHY/150., 5000.,11.,30.,20.,20.,20.,100.,50000.,100./
      DATA SKPTIM/'2500'/,SPACE/'    '/
      DATA SYMBOL/'Q','O','T','X','D','A','M','Z','Y','B','*','H','I'/
C     ******************************************************************
C
C     THESE VALUES ARE MONTHLY EQUILIBRIUM TEMPERATURES FOR THE
C     STATE OF NEW JERSEY   REF: 'EFFECT OF GEOGRAPHICAL LOCATION ON
C     COOLING POND REQUIREMENT AND PERFORMANCE 16130 FDQ 03/71
C
C     ******************************************************************
      DATA EQTEMP/33.,37.,45.,57.,69.,78.,83.,81.,73.,60.,46.,38./
C     ******************************************************************
C
C     THE NEXT STATEMENT HAS THE UNIT WEIGHT FACTORS FOR EACH PARAMETER
C
C     ******************************************************************
      DATA WEIGHT/.17,.15,.12,.10,.10,.10,.10,.08,.08/
C     ******************************************************************
C
C     THIS NEXT STATEMENT HAS THE MAXIMUM NUMBER OF POINTS IN EACH
C     UNIT QUALIGRAM  --  FOR PROGRAM CONTROL
C
C     ******************************************************************
      DATA MAXX/11,15,20,7,12,12,12,11,11/
C     ******************************************************************
C
C     THE NEXT DATA STATEMENT IS THE UNIT QUALITY, ASSIGNED TO A
C     PARAMETER EXCEEDING THE RANGES IN THE QUALIGRAMS
C
C     ******************************************************************
      DATA QMAX/50.,2.,0.,2.,1.,2.,5.,5.,20./
      M=8
```

```
C
      READ(M,1)IPRNT,IPLOT,OPTION
    1 FORMAT(3I2)
C     ******************************************************************
C
C     READ INDIVIDUAL PARAMETER QUALIGRAMS
C
C     ******************************************************************
      DO 150  I=1,9
      MAX=MAXX(I)
C
C     FIRST -- THE X-SCALE IS READ INTO TABLE(J,1,I)
C
      READ(M,151)(TABLE(J,1,I),J=1,MAX)
  151 FORMAT(8F10.0)
C
C     NOW READ IN THE ASSOCIATED Y VALUE FOR THE X'S ABOVE
C
      READ(M,151)(TABLE(J,2,I),J=1,MAX)
  150 CONTINUE
C     ******************************************************************
C
C     READ Y-AXIS PARAMETER LABEL TO ARRAY IF PLOTING
C
C     ******************************************************************
      IF(IPLOT.GT.0)READ(M,4)((PTITLE(L,JX),JX=1,5),L=1,9)
    4 FORMAT(5A4)
      KK=0
      XXMAX=0.0
      YYMAX=0.0
C     ******************************************************************
C
C     CONVERT MONTHLY EQILIBRIUM TEMPERATURES TO DEGREES CENTIGRADE
C
C     ******************************************************************
      DO 7  I=1,12
      EQTEMP(I)=(EQTEMP(I)-32.)*.55556
    7 CONTINUE
C     ******************************************************************
C
C **READ DELIMITER RECORD - VERIFY BEGINNING OF DATA RECORDS**
C
C     ******************************************************************
 12   READ(20,111,END=400) IDUMMY
  111 FORMAT(25X,I2)
      IF (IDUMMY.EQ.99) GOTO 22
      GOTO 12
C
C     ******************************************************************
C     *** COMMANDS BELOW USE THE INTEGRATED PLOTTING PACKAGE ***
C
C     ******************************************************************
  232 IF(IPLOT.LE.0)GO TO 100
      HINIT=10.75
```

```
      LN=1
C     ****************************************************************
C
C     THIS NEXT CALL IS REQUIRED FOR PLOTS LARGER THAN 10.5 INCHES...
C
C     ****************************************************************
      CALL CMLBF('PLOT IS 8-1/2X11 IN.
C
C     SET INITIAL VALUES ON SPECIFICATIONS ARRAY
C
      CALL SSPECS(PLDATA)
      H17=PLDATA(17)/2.
      H18=PLDATA(18)/2.
C
C     ENTER NUMBER OF DATA POINTS TO PLOT
C
      PLDATA(13)=MM-1
C
C     MOVE Y-AXIS 1.5 INCHES AWAY FROM THE FRAME ORIGIN
C
      PLDATA(1)=1.5
C
C     RESET SIZE OF AXES (INCHES)
C
      PLDATA(7)=6.0
      PLDATA(8)=1.5
      DO 2  L=1,10
C
C     SET PLOTTING SYMBOL DESIRED
C
      PLDATA(16)=SYMBOL(L)
C
C     SET LETTER SIZE OF LABELS TO HALF DEFAULT (.05)
C
      PLDATA(17)=H17
      PLDATA(18)=H18
C
C     MOVE X-AXIS 8.75 INCHES AWAY FROM ORIGIN - USING 2.0 INCHES FOR
C     EACH GRAPH FOR A TOTAL FRAME SIZE OF 8-1/2 X 11 INCHES
C
      PLDATA(2)=HINIT-(LN*2.0)
C
C     CLEAR WORK AREA
C
      DO 15  K=1,5
   15 SCL(K)=0.0
C
C     SET RANGE OF VALUES ON X-AXIS ** NO. DIVISIONS=NO.YEARS ANALYZED
C
      KK=XXMAX+1
      PLDATA(3)=KK
      KK2=XXVAL(1)
      PLDATA(4)=KK2
      PLDATA(9)=KK-KK2
```

```
C
C       SET RANGE OF VALUES ON Y-AXIS
C
        PLDATA(5)=HIGHY(L)
C
C       TEST SOLIDS AMOUNT AT STATION -- RESET Y-SCALE IF NECESSARY
C
        IF(L.EQ.9.AND.VAL(9,1).LT.1000)PLDATA(5)=2000.
        PLDATA(6)=0.0
C
C       FOR TEMPERATURE CHANGE -- Y-SCALE MUST ACCOMODATE NEGATIVE VALUES
C
        IF(L.EQ.7)PLDATA(6)=-5.0
C
C       SET NO. OF DECIMALS ON Y-AXIS DEPENDING ON PARAMETER ...
C
        PLDATA(28)=2.0
        IF(L.EQ.2.OR.L.EQ.8.OR.L.EQ.9)PLDATA(28)=0.0
C
C       CHANGE DEFAULT VALUE OF DIVISIONS FOR Y-AXIS
C
        PLDATA(10) = 10.
C
C       CLEAR ZONES -- UPDATED BY TITLES ON PREVIOUS GRAPH
C
        CALL ZZONES(PLDATA)
C
C       DRAW  X-Y  AXES
C
        CALL AXLILI(PLDATA)
C
C       DRAW ANNOTATION NUMBERS AT THE BOTTOM SCALE MARKS
C
        CALL NODLIB(PLDATA)
C
C       DRAW ANNOTATION NUMBER AT THE LEFT SCALE MARKS
C
        CALL NODLIL(PLDATA)
C
C       CLEAR ZONES VARIABLES --  SINCE UPDATED BY ABOVE SUBROUTINE
C
        CALL ZZONES(PLDATA)
C
C       PLOT SYMBOL AT DATA POINT LOCATIONS
C
        KK=MM-1
        DO 6  K=1,KK
        YYVAL(K)=VAL(L,K)
    6   CONTINUE
        CALL PSLILI(XXVAL,YYVAL,PLDATA)
C
C       NOW CONNECT DATA POINTS WITH DASHED LINE
C
        CALL DLLILI(XXVAL,YYVAL,PLDATA)
```

```
C
C       CHANGE DEFAULT SPACING OF TITLES TO THE AXES
C
        PLDATA(24)=.15
        PLDATA(26)=.45
C       ****************************************************************
C
C       NOW LABEL THE AXES ......
C
C       ****************************************************************
        CALL TITLEB('+  TIME (YEARS)+',PLDATA)
C
C       MOVE APPROPIATE Y-AXES LABEL TO VECTOR FOR PLOTTING
C
        IF (L.EQ.10) GO TO 2
        DO 8 JX=1,5
        YTITLE(JX)=PTITLE(L,JX)
      8 CONTINUE
        CALL TITLEL(YTITLE,PLDATA)
        IF(L.NE.5)GO TO 24
C
C       RESTORE TEXT LETTER SIZE FOR STATION DESCRIPTION LABEL
C
        PLDATA(17)=H17*2.
        PLDATA(18)=H18*2.0
C
C       PRINT GRAPH DESCRIPTION AT UPPER, RIGHT HAND SIDE OF GRAPH
C
        PLDATA(22)=1.75
        PLDATA(23)=10.5
        CALL GTITLE('+STORET STATION NO.+',PLDATA)
        PLDATA(22)=3.65
        CALL GTITLE(TOP,PLDATA)
C       ****************************************************************
C
C       ADVANCE GRAPH PAPER FOR NEXT FOUR PARAMETERS ...
C
C       ****************************************************************
        CALL NXTFRM(PLDATA)
        LN = 0
     24 LN=LN + 1
      2 CONTINUE
        IF(OPTION.EQ.0)CALL TITLEL('+CUMM NSF WATER QUALITY INDEX+',
       1PLDATA)
        IF(OPTION.NE.0)CALL TITLEL('+MULT NSF WATER QUALITY INDEX+',
       1PLDATA)
C
C       RESTORE TEXT LETTER SIZE FOR STATION DESCRIPTION LABEL
C
        PLDATA(17)=H17*2.
        PLDATA(18)=H18*2.0
C
C       PRINT GRAPH DESCRIPTION AT UPPER, RIGHT HAND SIDE OF GRAPH
C
```

```
      PLDATA(22)=1.75
      PLDATA(23)=10.5
      CALL GTITLE('+STORET STATION NO.+',PLDATA)
      PLDATA(22)=3.65
      CALL GTITLE(TOP,PLDATA)
C
C     ADVANCE GRAPH PAPER FOR NEXT STATION
C
      CALL NXTFRM(PLDATA)
  432 STAT(1)=SPACE
   22 READ(20,30,END=330) AGENCY,STAT,DESCRP
 30   FORMAT(2A4,4A4,1X,30A4)
      MM=1
      IF(IPRNT.GT.0) WRITE(6,40) STAT,DESCRP
 40   FORMAT('1STATION ',4A4,/,' ',30A4)
      DO 60 I=1,8
      READ(20,30,END=310) AGENCY,STAT,DESCRP
      IF(IPRNT.GT.0) WRITE(6,50) DESCRP
 50   FORMAT(' ',30A4)
      IF(I.EQ.2.AND.IPLOT.GT.0)GO TO 61
      GO TO 60
   61 TOP(1)=SYMBOL(4)
      TOP(2)=STAT(1)
      TOP(3)=STAT(2)
      TOP(4)=SPACE
      TOP(5)=DESCRP(17)
      TOP(6)=DESCRP(18)
      TOP(7)=DESCRP(19)
      TOP(8)=DESCRP(20)
      TOP(9)=DESCRP(21)
      TOP(10)=DESCRP(22)
      TOP(11)=DESCRP(23)
      TOP(12)=SYMBOL(4)
 60   CONTINUE
C     PRINT HEADINGS IF PRINTING RAW DATA ...
      IF(IPRNT.GT.0)WRITE(6,5)
    5 FORMAT(    5X,'  DATE  ',3X,'TIME',3X,'D O (SAT)',3X,'F.C. MPN',
     17X,'PH',9X,'BOD5',7X,'NO3',8X,'PO4',3X,'TEMP DELTA',3X,'TURB',
     22X,'TOT SOLIDS',3X,'CL',3X,'WQAI')
      DO 90  I=1,9
      QUAL(I)=0.0
   90 CONTINUE
C     ***************************************************************
C
C     READ STATION PARAMETRIC DATA
C
C     ***************************************************************
  100 READ(20,110,END=310) AGENCY,STAT,IYR,IMON,IDAY,TIME,PARAM
  110 FORMAT(2A4,3A4,A3,2X,3I2,A4,10A4)
      IF (IYR.EQ.99) GOTO 232
      DO 120 I=1,9
C     ***************************************************************
C
C     TEST FOR DUMMY VALUE IF NO SAMPLE WAS TAKEN
```

```
C
C     ****************************************************************
      IF ((PARAM(I).LT.1E-15).AND.(PARAM(I).GT.0.)) GOTO 100
      IF (PARAM(I).GE.0.) GOTO 120
      WRITE(6,115) I,PARAM(I)
115   FORMAT(' ***WARNING - PARAMETER ',I1,' IS NEGATIVE, ',F3.1
     1,' IS SUBSTITUTED***')
  120 CONTINUE
      IF (TIME.EQ.SKPTIM) TIME=SPACE
C     ****************************************************************
C
C     TEST PARAMETERS FOR MINIMUM POSSIBLE VALUES  -- IF LESS ADJUST
C
C     ****************************************************************
      DO 156 I=1,9
      IF (PARAM(I).LT.SMALL(I)) PARAM(I)=SMALL(I)
156   CONTINUE
C     ****************************************************************
C
C     COMPUTE SATURATION LEVEL OF OXYGEN AT STATION  --USING TEMPERATURE
C     AND CHLORIDE CONCENTRATION
C
C     ****************************************************************
      DOSAT=(1.-.000009*PARAM(10))*(14.652-.41022*PARAM(7)
     1+.007991*PARAM(7)**2 -.000077774*PARAM(7)**3)
C     ****************************************************************
C
C     COMPUTE OXYGEN CONCENTRATION AS PERCENT SATURATION
C
C     ****************************************************************
       PARAM(1)=PARAM(1)/DOSAT*100.
C     ****************************************************************
C
C     COMPUTE DEVIATION FROM EQUILIBRIUM TEMPERATURE
C
C     ****************************************************************
      PARAM(7)=EQTEMP(IMON) - PARAM(7)
C     ****************************************************************
C
C     ADD CONSTANT OF '5' TO TEMPERATURE VALUES -- NOTE - THIS IS DONE
C     TO ELIMINATE NEGATIVE TEMPERATURES IN UNIT QUALIGRAM
C     X-SCALE OF TEMPERATURE QUALIGRAM HAS ALSO BEEN CHANGED ACCORDINGLY
C
C     ****************************************************************
      PARAM(7)=PARAM(7)+5.
      IF(PARAM(7).LT.0)PARAM(7)=0
C     ****************************************************************
C
C     SEARCH FOR QUALITY VALUE --  LINEARLY INTERPOLATE IF NECESSARY
C
C     ****************************************************************
      DO 285 IPARAM=1,9
      MAX=MAXX(IPARAM)
      DO 157  ISCAN=1,MAX
```

```
      IF(PARAM(IPARAM).GT.TABLE(ISCAN,1,IPARAM))GO TO 157
      IF(PARAM(IPARAM).LT.TABLE(ISCAN,1,IPARAM))GO TO 158
      QUAL(IPARAM)=TABLE(ISCAN,2,IPARAM)
      GO TO 285
  157 CONTINUE
C     ****************************************************************
C
C     SET QUALITY OF PARAMETER FOR VALUE ABOVE DEFINED MAXIMUM
C
C     ****************************************************************
      QUAL(IPARAM)=QMAX(IPARAM)
      GO TO 285
C     ****************************************************************
C
C     PARAMETER IS BETWEEN TWO VALUES -- LINEARLY INTERPOLATE FOR UNIT
C     QUALITY BY USING THE HIGH VALUE AND SUBTRACTING THE DIFFERENCE
C
C     ****************************************************************
  158 XDIF=TABLE(ISCAN,1,IPARAM)-PARAM(IPARAM)
      XDELTA=TABLE(ISCAN,1,IPARAM)-TABLE(ISCAN-1,1,IPARAM)
      SLOPE=(TABLE(ISCAN,2,IPARAM)-TABLE(ISCAN-1,2,IPARAM))/XDELTA
      QUAL(IPARAM)=TABLE(ISCAN,2,IPARAM)-(SLOPE*XDIF)
285   CONTINUE
      WQIA=0.
C     ****************************************************************
C
C     TEST OPTION OF MULTIPLICATIVE OR ADDITIVE INDEX
C
C     ****************************************************************
      IF(OPTION.GT.0)GO TO 275
      DO 290 I=1,9
      WQIA=WQIA+QUAL(I)*WEIGHT(I)
290   CONTINUE
      GO TO 278
  275 WQIA=1.0
      DO 276  I=1,9
      WQIA=WQIA*QUAL(I)**WEIGHT(I)
  276 CONTINUE
C     ****************************************************************
C
C     TEST OPTION TO PRINT RAW DATA ...
C
C     ****************************************************************
  278 IF(IPRNT.GT.0)WRITE(6,3)IMON,IDAY,IYR,TIME,(PARAM(I),I=1,10),WQIA
    3 FORMAT(5X,I2,'/',I2,'/',I2,3X,A4,F11.4,F11.0,F11.2,F12.1,2F11.4,
     1F10.4,2F9.1,F8.0,F7.0)
      PARAM(10)=WQIA
C     ****************************************************************
C
C     DIGITIZE SAMPLE DATE TO FRACTION OF YEAR
C
C     ****************************************************************
      SUM=0.
      IF (IMON.EQ.1) GOTO 675
```

```
      INDEX=IMON-1
      DO 670 I=1,INDEX
      SUM=SUM+DAYS(I)
670   CONTINUE
675   CONTINUE
      SUM=SUM+IDAY
      IF ((MOD(IYR,4).EQ.0).AND.(IMON.GT.2)) SUM=SUM+1
      TOTDAY=365
      IF (MOD(IYR,4).EQ.0) TOTDAY=366
      FRAC=SUM/TOTDAY
  191 XXVAL(MM)=IYR+FRAC
      DO 9  JX=1,10
      VAL(JX,MM)=PARAM(JX)
    9 CONTINUE
C     SAVE HIGHEST OF YEARS FOR SCALING PLOT
      IF(XXVAL(MM).GT.XXMAX)XXMAX=XXVAL(MM)
      MM=MM+1
  192 GO TO 100
310   CONTINUE
      WRITE(6,320) STAT
320   FORMAT(//,' ABNORMAL FILE END WHILE READING STATION ',4A4)
      STOP
400   WRITE(6,112)
  112 FORMAT(10X,'BEGINNING OF DATA RECORDS NOT CONFIRMED')
C     ****************************************************************
C
C     IF NOT PLOTTING SET HI COND CODE TO  BYPASS PLOT POST-PROCESSOR
C
C     ****************************************************************
  330 IF(IPLOT.LE.0)STOP 40
C     ****************************************************************
C
C     PLOTTING IS FINISH  -- NOW CLOSE THE NEUTRAL TEXT
C
C     ****************************************************************
      CALL PPPEND(PLDATA)
  333 STOP
      END
```

SOURCE DECKS AT OSI

For the convenience of potential users, the source language statements for these four programs have been stored at the WCC computer facility as Alpha Data sets:

DATASET NAME	DESCRIPTION
CL.SLIB.EPAGAN(TIMEWQI)	PROGRAM A
CL.SLIB.EPAGAN(FIVEPARM)	PROGRAM B
CL.SLIB.EPAGAN(SEASONAL)	PROGRAM C
CL.SLIB.EPAGAN(WQIPARM)	PROGRAM D

Source decks may also be obtained from the EPA Region II Data Systems Branch office.

PROGRAM EXECUTION FROM LOAD MODULES

To save expenses in compilation and link-editing, these programs also exist as core-image modules on a partitioned data set at WCC as follows:

DATASET NAME	DESCRIPTION
CN.EPAGAN.R2TW.WQI.LOADLIB(TIMEWQI)	PROGRAM A
CN.EPAGAN.R2TW.WQI.LOADLIB(FIVEPARM)	PROGRAM B
CN.EPAGAN.R2TW.WQI.LOADLIB(SEASONAL)	PROGRAM C
CN.EPAGAN.R2TW.WQI.LOADLIB(WQIPARM)	PROGRAM D

The JCL procedure for the execution of these data sets with the proper plot post-processor is shown in the sample input sections.

INTERACTIVE PROCESSING WITH TEKTRONICS TERMINAL

These programs presently have limited interactive application under the Time Sharing Option at the WCC facility. The programs execute successfully, but because the plotting text is hardware generated by the Tektronics terminal and not drawn by the software, the resulting plots are unsatisfactory. These problems will hopefully be resolved once Calcomp preview procedures for the Tektronics terminal are implemented and at the WCC facility.

Application to the Raritan River Basin

The Raritan River Basin is the largest intra-state surface watershed in New Jersey. The mainstream section which is approximately 30 miles long extends from the River's mouth at Raritan Bay to the confluence of the north and south branches. Figure 2 is a map of the area showing the Raritan River Basin and its major tributaries. The six digit numbers in this figure are the STORET primary station numbers.

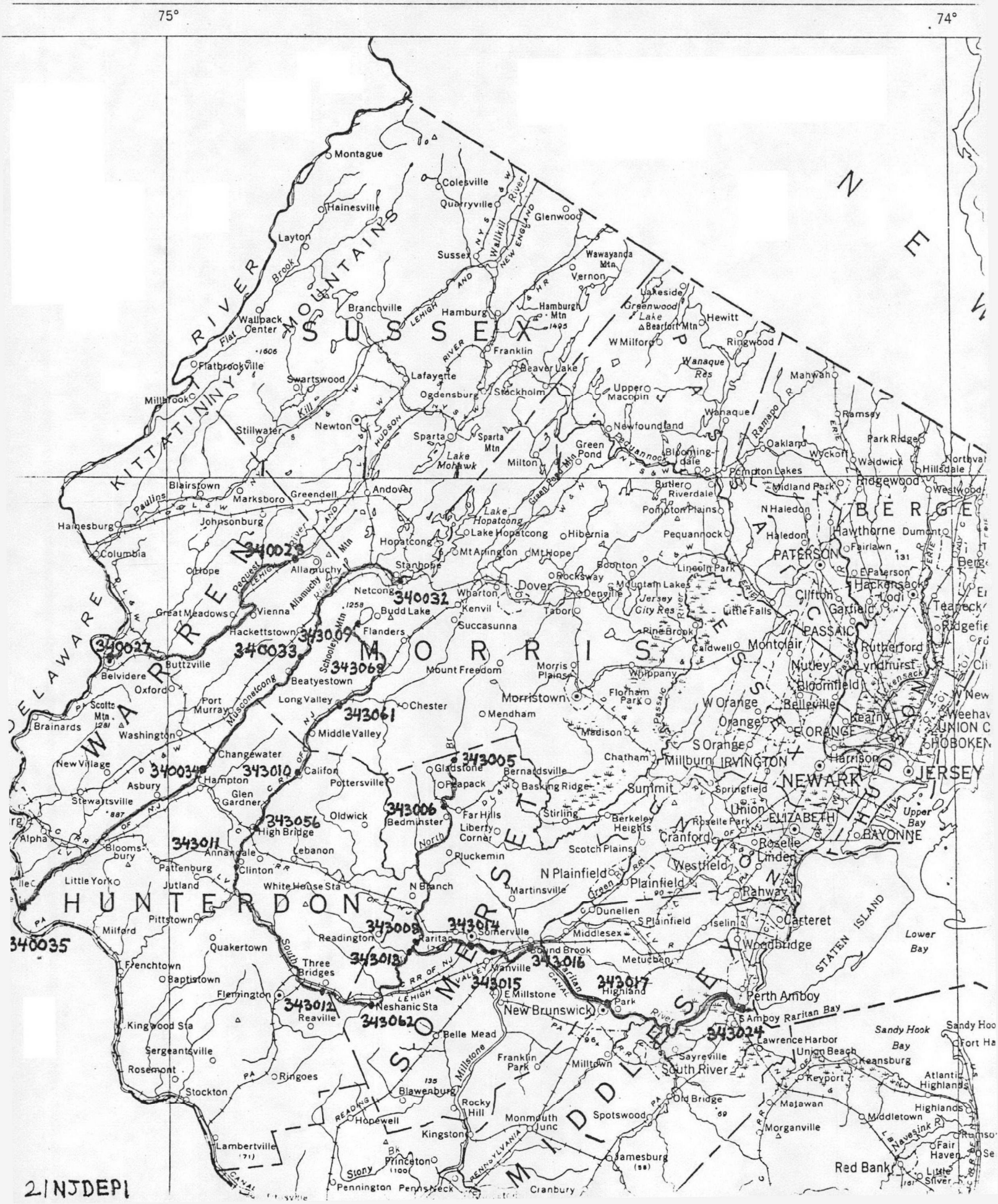
As a test application, the water quality parameters required were retrieved from the STORET system for these stations in the Raritan River South Branch and the mainstream. Programs A and C were processed using this data.

The water quality index profiles for winter and summer conditions for three separate time intervals:

1) 1968 - 1969
2) 1970 - 1972
3) 1973 - Present

are shown in the next four pages. The graphs by station number begin at the origin of the South Branch (the downstream end of Budd Lake) and ends at the Raritan Bay. The graphs by station mile point are in reverse order, they start at the mouth of the Raritan River and travel upstream to the origin of the South Branch. As expected, the index is overall higher during the winter season. Trends of the index as one goes up or down the Raritan Basin, as well as any changes during the defined time intervals can be easily assessed from these pages.

STATE OF NEW JERSEY



2/NJDEPI

INPUT CONTROL PARAMETERS

TOTAL NO. OF INTERVAL SETS = 3

*** CURVE NO. 1 ***

NO. OF TIME INTERVALS FOR THIS SET= 2

FROM	TO
6/ 1/68	9/30/68
6/ 1/69	9/30/69

PLOTTING FOR CURVE NO. 1 -- PROCESSED SUCCESSFULLY WITH 19 POINTS

*** CURVE NO. 2 ***

NO. OF TIME INTERVALS FOR THIS SET= 3

FROM	TO
6/ 1/70	9/31/70
6/ 1/71	9/31/71
6/ 1/72	9/31/72

PLOTTING FOR CURVE NO. 2 -- PROCESSED SUCCESSFULLY WITH 45 POINTS

*** CURVE NO. 3 ***

NO. OF TIME INTERVALS FOR THIS SET= 3

FROM	TO
6/ 1/73	9/31/73
6/ 1/74	9/31/74
6/ 1/75	9/31/75

PLOTTING FOR CURVE NO. 3 -- PROCESSED SUCCESSFULLY WITH 15 POINTS

INPUT CONTROL PARAMETERS

TOTAL NO. OF INTERVAL SETS = 3

*** CURVE NO. 1 ***

NO. OF TIME INTERVALS FOR THIS SET= 8

FROM	TO
11/ 1/66	12/31/66
1/ 1/67	2/30/67
11/ 1/67	12/31/67
1/ 1/68	2/30/68
11/ 1/68	12/31/68
1/ 1/69	2/30/69
11/ 1/69	12/31/69
1/ 1/70	2/30/70

PLOTTING FOR CURVE NO. 1 -- PROCESSED SUCCESSFULLY WITH 58 POINTS

*** CURVE NO. 2 ***

NO. OF TIME INTERVALS FOR THIS SET= 6

FROM	TO
11/ 1/70	12/31/70
1/ 1/71	2/30/71
11/ 1/71	12/31/71
1/ 1/72	2/30/72
11/ 1/72	12/31/72
1/ 1/73	2/30/73

PLOTTING FOR CURVE NO. 2 -- PROCESSED SUCCESSFULLY WITH 62 POINTS

*** CURVE NO. 3 ***

NO. OF TIME INTERVALS FOR THIS SET= 6

FROM	TO
11/ 1/73	12/31/73
1/ 1/74	2/30/74
11/ 1/74	12/31/74
1/ 1/75	2/30/75
11/ 1/75	12/31/75
1/ 1/76	2/30/76

PLOTTING FOR CURVE NO. 3 -- PROCESSED SUCCESSFULLY WITH 19 POINTS

*** LEGEND ***
□ = SUMMER 1960 AND 1969
○ = SUMMER 1970-1972
△ = SUMMER FROM 1973 - PRESENT
CUMBRIA WATER QUALITY INDEX
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
STATION NUMBER

LEGEND
GUMM NSF WATER QUALITY INDEX
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
STATION NUMBER

*** LEGEND ***
SUMM NSF WATER QUALITY INDEX
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
STATION MILE POINT

*** LEGEND ***
STATION MILE POINT

ACKNOWLEDGEMENTS

Thanks must be extended to Robert Hicke of Systems Architects Inc. for his assistance in the implementation of these programs. Thanks also to Barbara Sue Clark and George Lackowitz of EPA for their assistance in verifying results and refining the qualigram data. The typing was very professionally done by Ms. MaryAnn LaBarbera.

REFERENCES

(1) McClelland, N.I., Water Quality Index Application in the Kansas River Basin, USEPA, Region VII, Kansas City, Missouri. Report No. EPA-907/9-74-001 February 1974

(2) Ashbrook, J.D. and Sande, S., A User's Guide to the Integrated Plotting Package, National Institutes of Health, D.H.E.W., Bethesda, Maryland March 1975

(3) User's Manual for EPA Scientific Applications Software, MIDSD, Washington, D.C. July 1975

(4) Greeley, R.S., Johnson, A. et al, Water Quality Indices MITRE Corporation, Washington, D.C. 1972

(5) Effect of Geographical Location on Cooling Pond Requirements and Performance, pp. 146-234, USEPA, Water Quality Office, Washington, D.C. Report No. 16130FDQ03/71, March 1971

Appendix A

DIGITIZED UNIT QUALIGRAMS USED BY COMPUTER PROGRAMS

WATER QUALITY INDEX

DISSOLVED OXYGEN

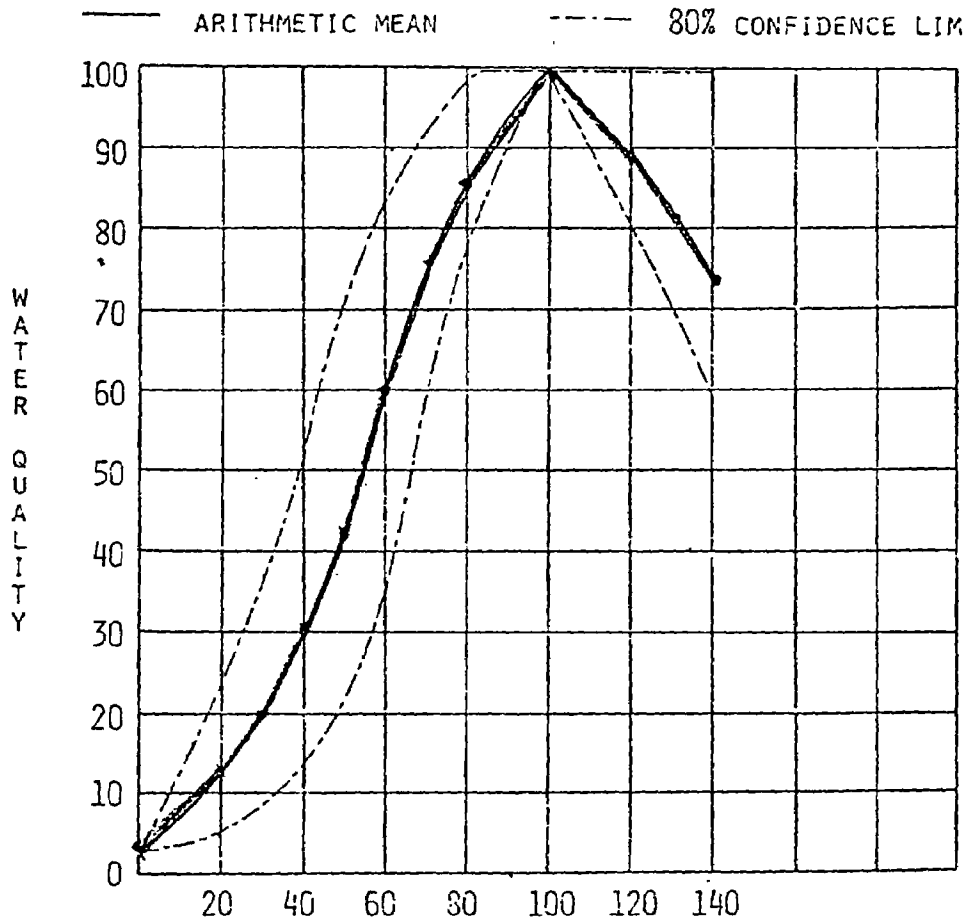


Figure A-1

$w = 0.17$

NOTE:
FOR D.O. >140% SAT,
$q_i = 50.$

WATER QUALITY INDEX

FECAL COLIFORMS

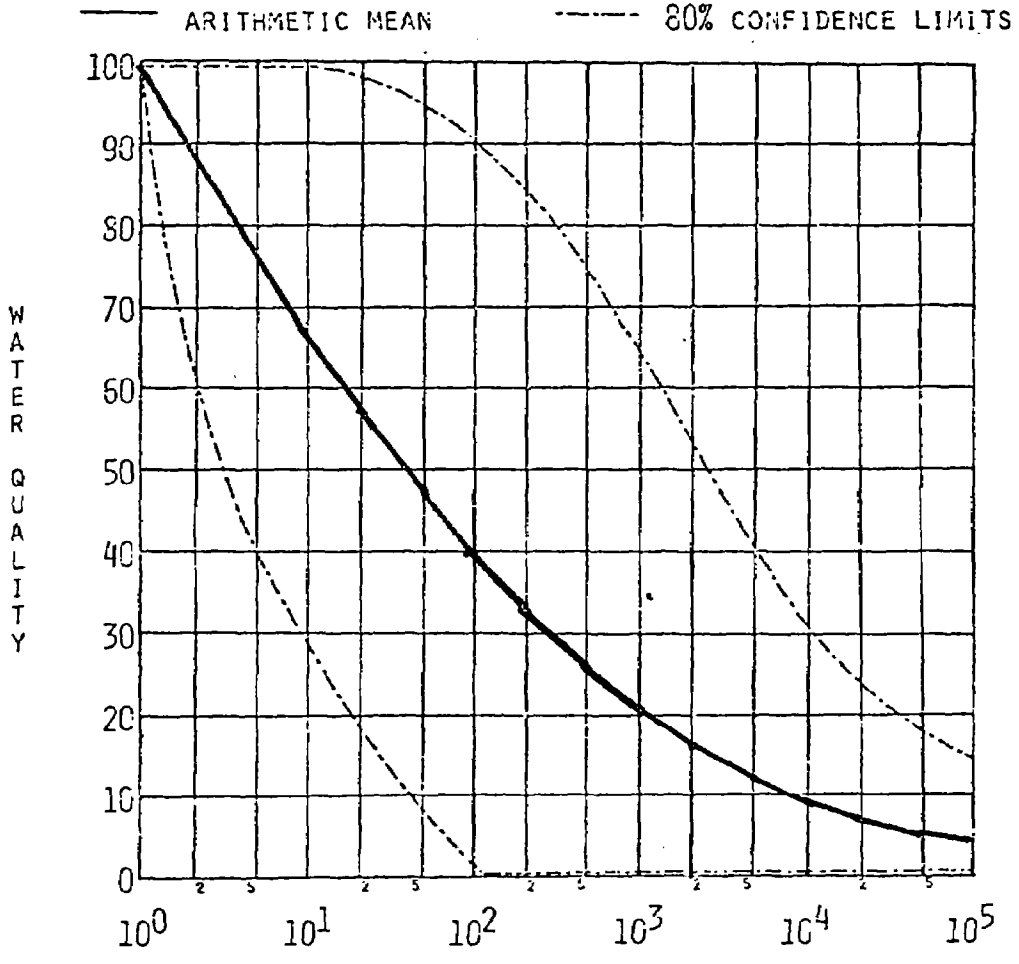
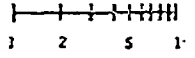


Figure A-2

W = 0.15



KEY FOR LOG SCALE INTERPOLATION

NOTE:
FOR F.C. >10(5)/100ML
q_i = 2.

WATER QUALITY INDEX

pH

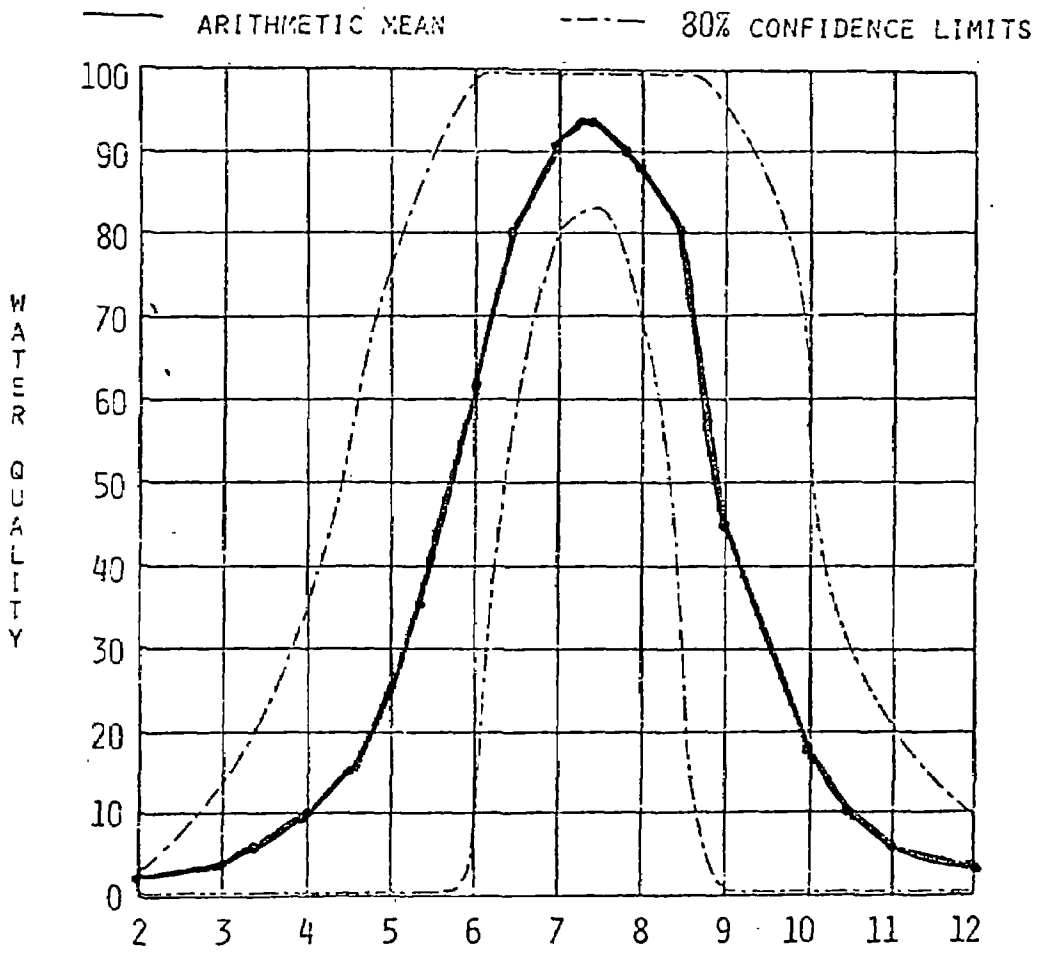


Figure A-3

w = 0.12

WATER QUALITY INDEX

BOD5

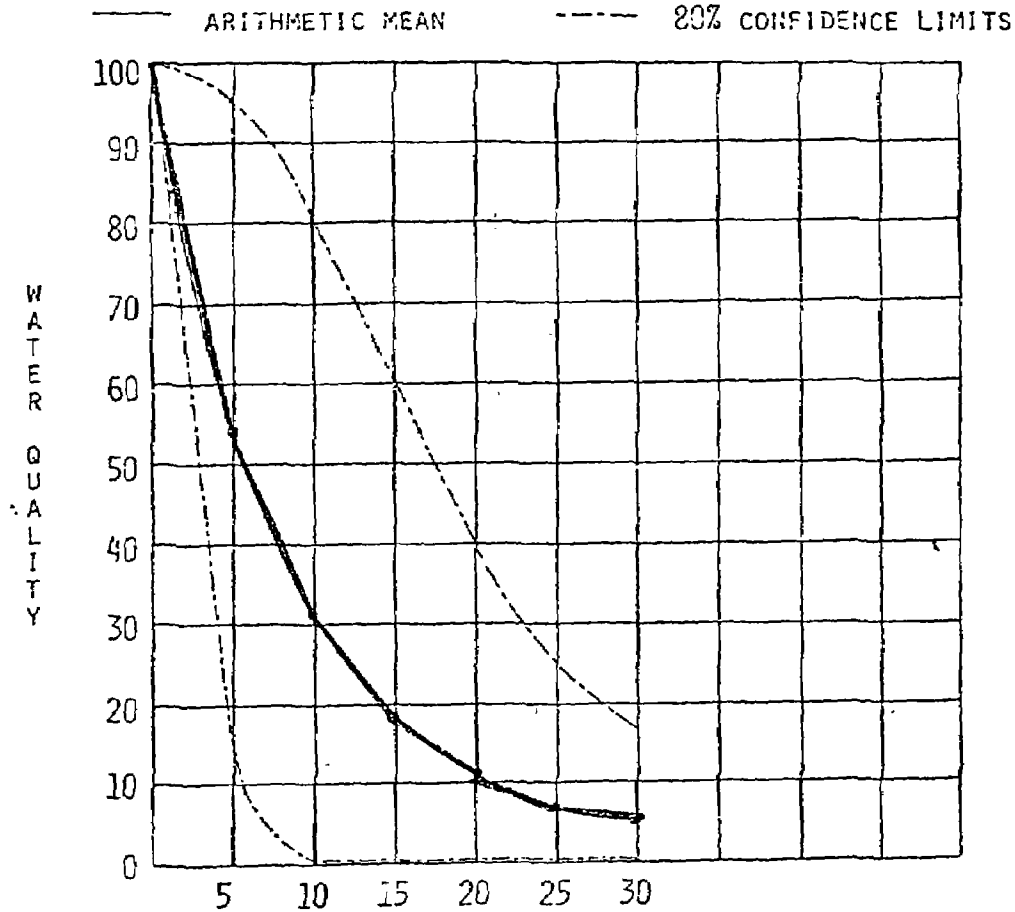


Figure A-4

W = 0.10

NOTE:
FOR BOD_5 >30,
q_i = 2.

WATER QUALITY INDEX

NITRATES

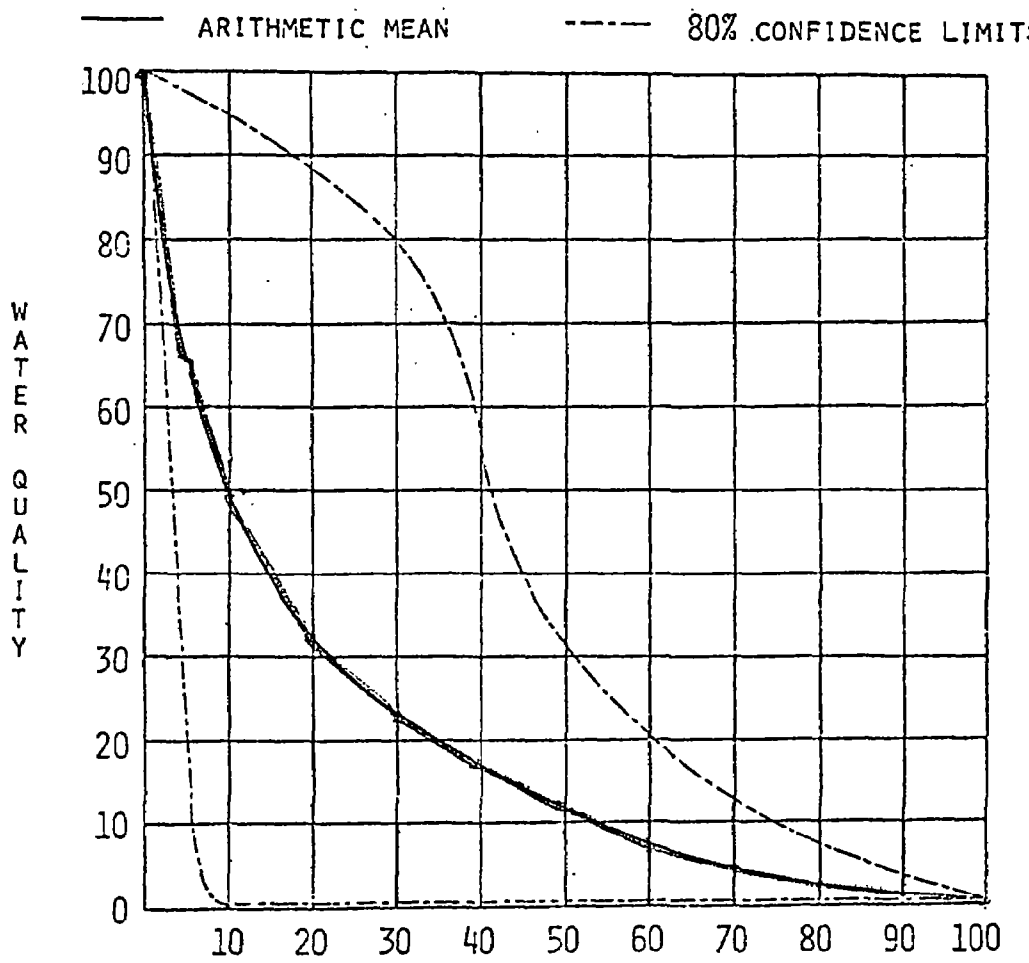


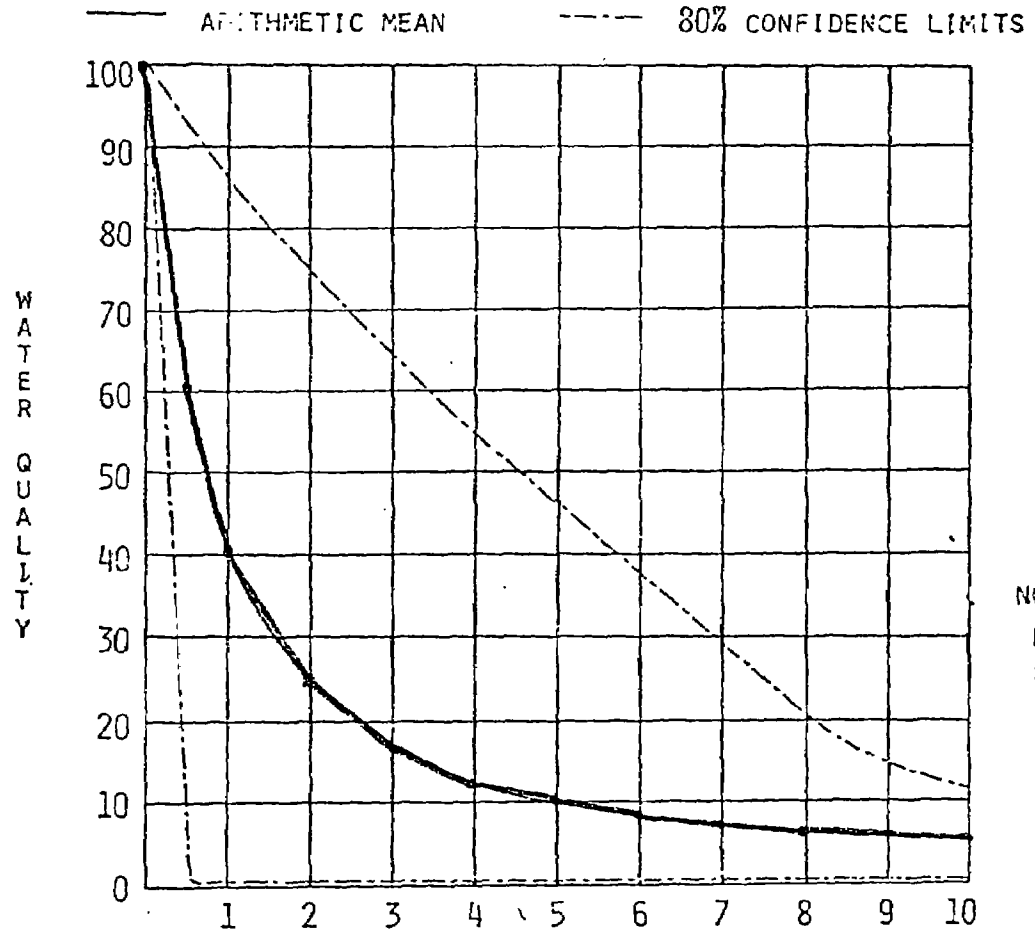
Figure A-5

$W = 0.10$

NOTE:
FOR NITRATES >100 MG/L
$q_i = 1.$

WATER QUALITY INDEX

TOTAL PHOSPHATES



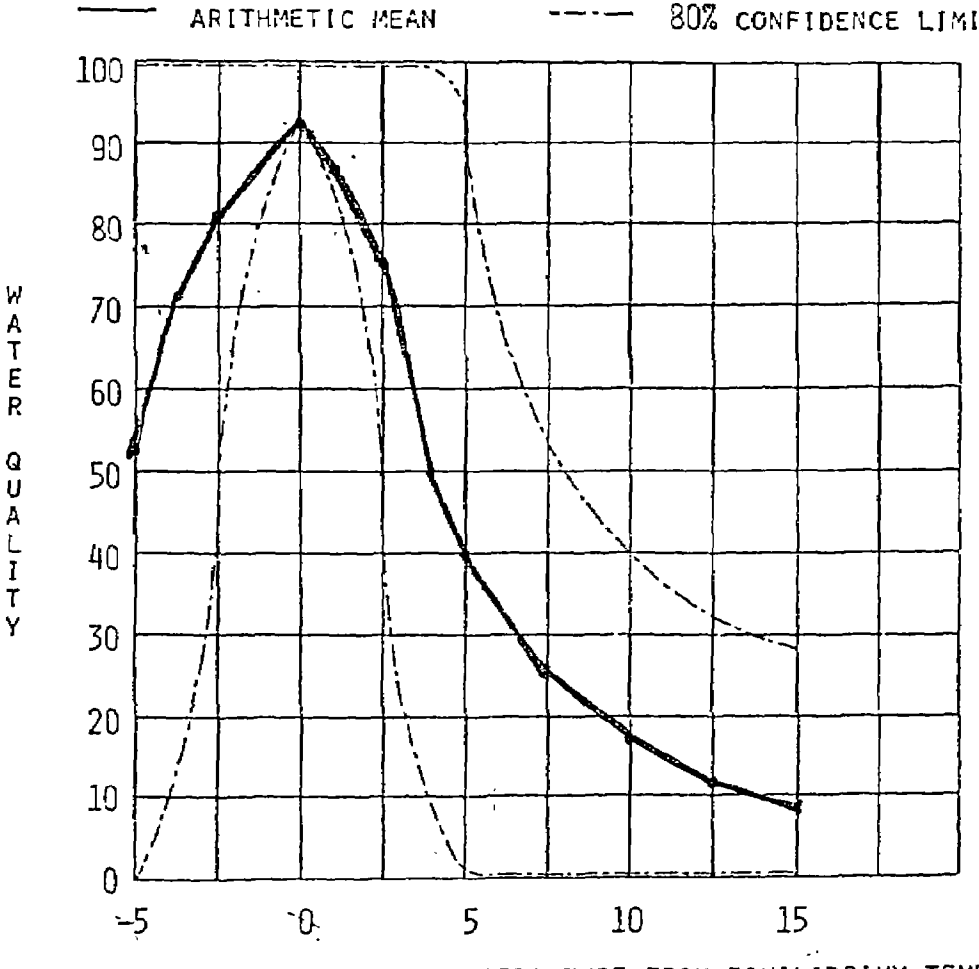
W = 0.10

NOTE:
FOR TOTAL PHOSPHATES >10 MG/L, q_i = 2.

Figure A-6

WATER QUALITY INDEX

TEMPERATURE



w = 0.10

NOTE:
FOR TEMPERATURE DEVIATION
>15°C, q_i = 5.

Figure A-7

WATER QUALITY INDEX

TURBIDITY

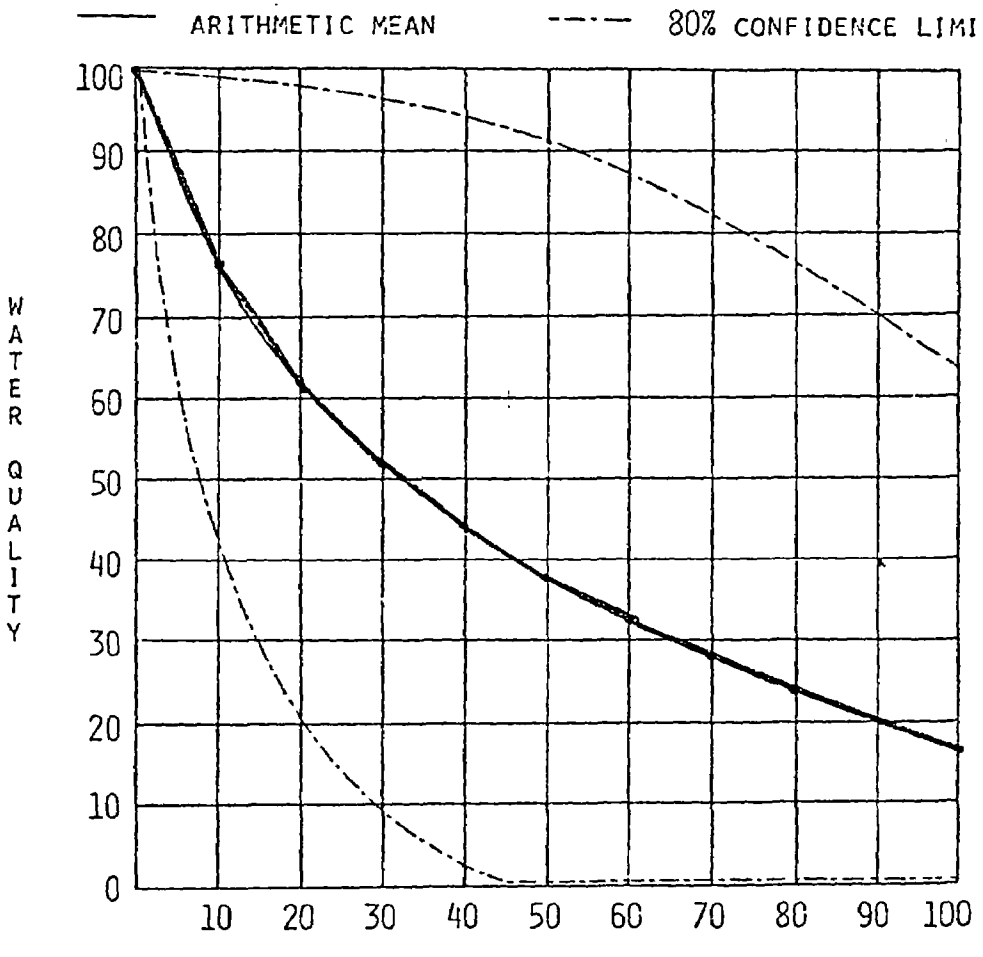


Figure A-8

$w = 0.08$

NOTE:
FOR TURBIDITY >100 JTU
$q_i = 5.$

WATER QUALITY INDEX

TOTAL SOLIDS

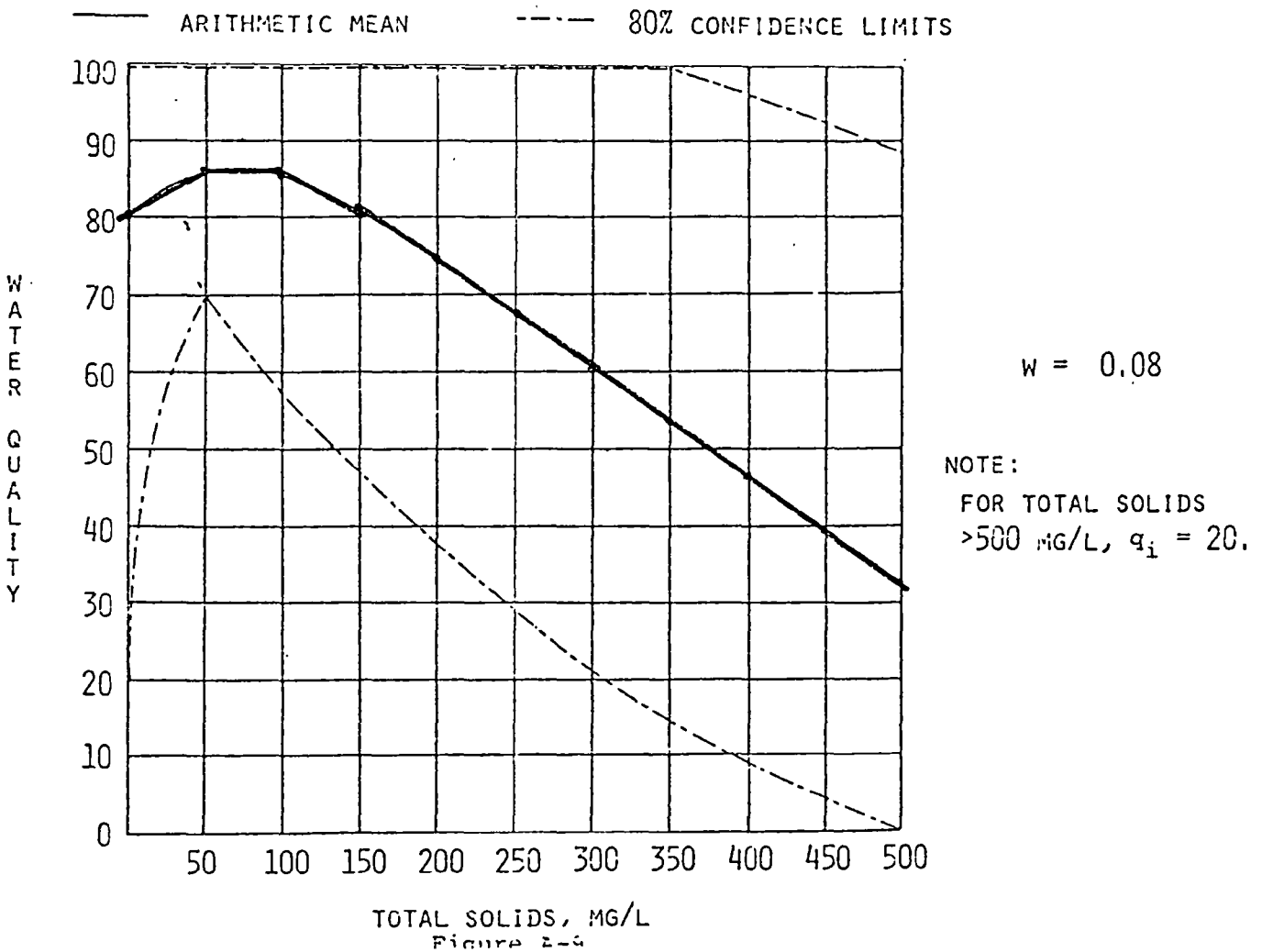


Figure 5-4

$W = 0.08$

NOTE:
FOR TOTAL SOLIDS
>500 MG/L, $q_i = 20.$