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A PROCEDURE FOR THE RETRIEVAL OF WATER SURVEY OF CANADA DISCHARGE RECORDS FROM MAGNETIC TAPE

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PREFACE

This document describes a computer procedure for retrieval of Water Survey of Canada discharge records from magnetic tape. The programs were designed to provide economical retrievals of discharge records on a routine basis. The programs described are written in Fortran 4G for implementation on an MTS (Michigan Terminal System) facility. As such, it may not be possible to implement these directly at non-MTS facilities.

INTRODUCTION

Many of the studies conducted by Water Quality Branch, Pacific & Yukon Region involve the use of Water Survey of Canada discharge records. Until recently, it has been most practical to transfer the published records into machine readable form as required. The demand has, however, increased to the point where this practice is no longer economical.

Water Survey of Canada will provide users with data in a variety of formats (Inland Waters Directorate, 1973). Of those which are available, we chose to obtain daily discharges on magnetic tape (format 67-002). For the readers information a description of the format of the card images is given in Appendix I.

For British Columbia and the Yukon Territory two 2400 foot magnetic tapes are required to hold all available discharge records through 1977. The total number of data records contained on the two tapes is in excess of 500,000 card images.

Our requirements for discharge data are normally for a relatively large number of stations for relatively short durations (i.e. 1 to 2 years). During the year, various requirements for discharge data are encountered. Hence, linear searches of the tape for each record required would not be an economical proposition.

At this point we felt that we needed a program or series of programs which would accomplish the following:

1) minimize the need for linear searching of the tapes

2) economize on tape mountings

3) be easily applied by a user with limited knowledge through:

   a) simple input and run commands

b) being as "automatic" as possible.

Two programs have been developed which accomplish the desired objectives. The first program mounts and reads tapes creating a pseudo table of contents for a tape. The second program performs the actual retrieval using simple input format. Running of both programs requires minimal knowledge beyond the input formats and the run commands.

IMPLEMENTATION

These programs are written in FORTRAN 4G for use under MTS (Michigan Terminal System) on an Amdahl 470 V/6 Model II at the University of British Columbia. They should be readily portable to other MTS facilities, however, they may not be directly compatible with non-MTS installations. Some details regarding adaptation to other facilities are given at the end of this document.

PROGRAMS

Two programs are required to accomplish the desired objective. The first program is used to produce a "pseudo table of contents" for each tape. This program will be referred to as WSC.TABLE. The second program (WSC.RETRIEVE) performs the actual retrieval of Water Survey of Canada records.

1. WSC.TABLE

This program produces a "pseudo table of contents" for each of the tapes. Each tape is done independently. Each time a new set of tapes is received, running of this program will be required to produce a new table of contents which is stored in a file for use by WSC.RETRIEVE.

The program locates the first occurence on the tape of the station which appears as the n*5000 record. The output table of contents is the STATION NUMBER, YEAR, and record number on tape. This allows WSC.RETRIEVE to perform a table search for the interval on the tape that the desired records appear in. In other words the tape can be positioned to within a maximum of 5000 records from the ones desired. This means that less than 1% of the total card images on the tape must be examined.

Under MTS the running of the program can be invoked by:

```
$RUN WSC.TABLE 3 = TAPE-TABLE 6  =  ERROR MESSAGES
                              5  =  TAPE-RACK NUMBER
```

A listing of WSC.TABLE is given in TABLE 1.

TABLE 1

```
C                                                                       C
C     WSC.TABLE IS A PROGRAM TO SET UP A SUMMARY TABLE FOR DISCHARGE    C
C   DATA TAPES.  EACH LINE OF THE TABLE CONTAINS THE STATION NAME,      C
C   STARTING YEAR AND TAPE RECORD NUMBER.  THE RECORDS IN THE TABLE     C
C   CORRESPOND TO THE FIRST RECORD ON THE TAPE AND ALL RECORDS THAT     C
C   ARE FIRST OCCURRENCES OF THE STATIONS FOUND AT MULTIPLES OF 5000.   C
C   I.E. IF THE STATION NAME AT RECORD 5000 IS '08AB034 ' AND THE FIRST C
C   OCCURRENCE OF THE STATION IS IN 1956 AT RECORD 4865, THE TABLE EN-  C     C
C   TRY WOULD BE   '08AB034 956   4856'.  NOTE THAT THE STARTING YEAR   C
C   IS ONLY THE LAST THREE DIGITS OF THE YEAR.                          C
C                                                                       C
      REAL*8 STAT,STA,S1,S2
      INTEGER*2 MOUNT1(18)
C                                                                       C
C     MOUNT1 CONTAINS TAPE MOUNTING INFORMATION USED IN THE 'CALL       C
C   MOUNT' STATEMENT.                                                   C
C                                                                       C
      DATA MOUNT1/34,'  ','  ','  ',' *','T*',' R','IN','G=','IN',' F','
     1MT','=F','B(','32','00',',8','0)'/
      INC=5000
      ISNC=128
C                                                                       C
C     THE RACK NUMBER OF THE TAPE IS READ IN.                           C
C                                                                       C
      READ(5,1) (MOUNT1(I),I=2,4)
1     FORMAT(3A2)
      CALL MOUNT(MOUNT1,698)
      CALL FTNCMD('ASSIGN 2=*T*',12)
      NREC=0
      NS=0
C                                                                       C
C     INFORMATION FOR THE FIRST RECORD IS WRITTEN IN THE TABLE.         C
C                                                                       C
      READ(2,2) STAT,IYR
2     FORMAT(1X,A7,I3)
      BACKSPACE 2
      WRITE(3,4) STAT,IYR
4     FORMAT(A7,I3,'       1')
C                                                                       C
C     THE TAPE IS SKIPPED 4999 RECORDS AHEAD.  THE STATION IS READ IN   C
C   AND THE TAPE IS BACK-SKIPPED 128 RECORDS AT A TIME UNTIL A DIFFER-  C
C   ENT STATION IS ENCOUNTERED.  A BINARY SEARCH IS EXECUTED, SKIPPING  C
C   FORWARD OR BACKWARD BY POWERS OF 2 UNTIL THE FIRST OCCURRENCE OF    C
C   THE STATION IS FOUND.  THE INFORMATION IS THEN ENTERED IN THE TABLE.C
C                                                                       C
100   CALL SKIP(0,(INC-1),2,699)
      NS=NS+1
      NREC=INC+NREC
      READ(2,2) STAT
3     CALL SKIP(0,-(ISNC+1),2,699)
      NREC=NREC-ISNC
      READ(2,2) STA
      IF(STAT.EQ.STA) GO TO 3
      NSKIP=ISNC
5     NSKIP=NSKIP/2
      IF(NSKIP.EQ.0) NREC=NREC-1
      IF(NSKIP.EQ.0) JYR=KYR
      IF(NSKIP.EQ.0) GO TO 6
```

TABLE 1 (Continued)

```
      NREC=NREC+NSKIP
      CALL SKIP(0,(NSKIP-2),2,&99)
      READ(2,2) S1,KYR
      READ(2,2) S2,JYR
      IF((S1.NE.STAT).AND.(S2.NE.STAT)) NSKIP=IABS(NSKIP)
      IF((S1.NE.STAT).AND.(S2.NE.STAT)) GO TO 5
      IF((S1.EQ.STAT).AND.(S2.EQ.STAT)) NSKIP=-IABS(NSKIP)
      IF((S1.EQ.STAT).AND.(S2.EQ.STAT)) GO TO 5
6     WRITE(3,8) S2,JYR,NREC
8     FORMAT(A7,I3,I7)
      NSK=NS*INC-NREC
      NREC=NS*INC
      CALL SKIP(0,NSK,2,&99)
      GO TO 100
99    STOP
98    WRITE(6,97)
97    FORMAT('0','******** MOUNT UNSUCCESSFUL *********')
      STOP
      END
```

2. WSC.RETRIEVE

A listing of this program is given in TABLE 2. WSC.RETRIEVE assigns all but two logical units automatically. These are units 5 and 7. Unit 5 is to be assigned to the file containing the stations to be retrieved (defaults to user input on MTS) and Unit 7 to the file where the retrieved data is to go.

Output on Unit 7 is in the same format as described in Appendix 1. The input read from Unit 5 is in format A7, I3, I2. These are the WATER SURVEY OF CANADA STATION number (A7) (e.g. 07AB008), the last three digits of the year (e.g. 977 for 1977) and the number of years to be retrieved (e.g. 01 for 1 year). The stations being retrieved are sorted into alphabetical order by the program. This means that the order that stations occur in the output to unit seven may not occur in the same order as requested. This sorting is done to reduce the repositioning of the tape.

Error messages are written to unit 6.

The first data statement in the program is:

```
DATA TAPE1/'07EA001 ','08MH134 '/,TAPE2/'08NA001 ','10MB003 '/
```

These are respectively the first and last stations on each of the two tapes. These are found on the printout which accompanies the tapes from Water Survey. These data are used by the program to decide which tapes are required to be mounted. If all the desired retrievals occur on one tape only that tape will be mounted. Only in the case where retrievals are required from both tapes are both tapes mounted.

The processing done by this program can be summarized as follows:

A. Stations to be retrieved are read in
B. Stations are sorted into ascending sequence

C. The tape(s) required are mounted

D. The approximate location of the current station is found in the table (FROM WSC.TABLE)

E. The tape is advanced to the position found in D

F. Card images are read serially until the station number and year desired are encountered

G. Records are read from tape and written to logical unit 7 until the number of years desired are retrieved or until a new station is encountered

H. The process D through G is repreated for all stations in the input list.

Operating under MTS the object program is invoked by:

```
$RUN  WSC.RETRIEVE  5 = INPUT-FILE  7 = RETRIEVED RECORDS
```

Appendix 2 shows output of a sample run of this program.

TABLE 2

```
C                                                                       C
C     WSC.RETRIEVE IS A FORTRAN PROGRAM TO SEARCH FOR AND RETRIEVE      C
C   DISCHARGE DATA FROM EITHER OR BOTH OF THE DATA TAPES ( SEE ACCOM-   C
C   PANYING DOCUMENTATION FOR FURTHER INFORMATION ON THE TAPES AND      C
C   THIS PROGRAM ).                                                     C
C                                                                       C
      REAL*8 STAT(100),TAPE1(2),TAPE2(2),TABS(100),DUMMY
      INTEGER*2 MOUNT1(18),MOUNT2(18),YEAR(100),NYR(100)
      LOGICAL T1,T2
      INTEGER REC(100),TABYR(100)
      COMMON NRECNC
C                                                                       C
C     AS OF JANUARY, 1979, THE FIRST AND LAST STATION NAMES ARE         C
C   'C7EA001 ' AND 'C8MA134 ' FOR THE FIRST TAPE AND '08NA001 ' AND     C
C   '10MB003 ' FOR THE SECOND TAPE.  THESE MUST BE ALTERED IN THE       C
C   'DATA' STATEMENT WHEN THE TAPES ARE UPDATED.  THE OTHER 'DATA'      C
C   STATEMENTS SET UP THE CHARACTER STRINGS FOR USE IN THE 'CALL        C
C   MOUNT' COMMANDS BELOW.                                              C
C                                                                       C
      DATA TAPE1/'07EA001 ','08MH134 '/,TAPE2/'08NA001 ','10MB003 '/
      DATA MOUNT2/34,'RA','00','23',' *','T*',' R','IN','G=','IN',' F'
     1,'MT','=F','B(','32','00',',8','0)'/
      DATA MOUNT1/34,'RA','00','21',' *','S*',' R','IN','G=','IN',' F'
     1,'MT','=F','B(','32','00',',8','0)'/
      CALL FTNCMD('ASSIGN 1=TAPE1TABLE',19)
C                                                                       C
C     UNIT 1 IS ASSIGNED TO DISK FILE 'TAPE1TABLE', UNIT 2 TO FILE      C
C   'TAPE2TABLE'.  THESE FILES ARE TABLE SUMMARIES OF THE DATA TAPES    C
C   PRODUCED BY THE PROGRAM 'WSC.TABLE'.                                C
C                                                                       C
      CALL FTNCMD('ASSIGN 2=TAPE2TABLE',19)
      T1=.FALSE.
      T2=.FALSE.
      INDEX=1
      NRECNC=0
      NS=0
C                                                                       C
C     USER INPUT IS READ IN ON UNIT 5.  'STAT', STATION NAMES; 'YEAR',  C
C   STARTING YEAR OF THE RECORDS WANTED; AND 'NYR', NUMBER OF CONSEC-   C
C   UTIVE YEARS.  THE STATIONS NAMES MUST BE 7 CHARACTERS  ( EG.        C
C   'C7EA001' ), THE STARTING YEAR IS 3 DIGITS - 1977 MUST BE INDIC-    C
C   ATED AS '977' AND THE NUMBER OF YEARS MUST BE LESS THAN 99.         C
C                                                                       C
100   READ(5,1,END=2) STAT(NS+1),YEAR(NS+1),NYR(NS+1)
1     FORMAT(A7,I3,I2)
C                                                                       C
C     STATION NAMES ARE CHECKED TO SEE IF THEY ARE BETWEEN THE FIRST    C
C   AND LAST RECORDS ON THE TAPE.  IF SO, THE FLAG FOR THE APPROPRIATE C
C   TAPE IS SET.  IF NOT, AN ERROR MESSAGE IS WRITTEN AND THAT STA-     C
C   TION IS IGNORED.                                                    C
C                                                                       C
      IF((STAT(NS+1).GT.TAPE1(1)).OR.(STAT(NS+1).LT.TAPE2(2))) CALL ERRM
     1ES(1,STAT(NS+1),&100)
      IF((STAT(NS+1).LE.TAPE1(1)).AND.(STAT(NS+1).GE.TAPE1(2)))T1=.TRUE.
      IF(.NOT.T1) T2=.TRUE.
      NS=NS+1
      GO TO 100
2     IF(NS.EQ.0) CALL ERRMES(2,DUMMY,&96)
```

TABLE 2 (Continued)

```
      CALL SORTS(STAT,YEAR,NYR,NS)
C                                                                       C
C     THE STATION NAMES ARE SORTED INTO ALPHABETHICAL ORDER.  THE TAPE C
C  ( OR TAPES) IS MOUNTED AND SUBROUTINE 'FINDR' IS CALLED TO POSITI  C
C  ON THE TAPE AND READ THE DESIRED RECORDS.
C                                                                       C
      I=1
      IF(.NOT.T1) GO TO 98
C                                                                       C
C     TAPE 1 IS MOUNTED AND ITS TAPETABLE READ IN BY SUBROUTINE READT. C
C                                                                       C
      CALL MOUNT(MOUNT1,&101)
      CALL FTNCMD('ASSIGN 3=*S*',12)
      CALL READT(1,TABS,TABYR,REC,NTAB)
4     IF(STAT(I).LT.TAPE1(2)) GO TO 98
      IF(I.GT.NS) GO TO 96
      CALL FINDR(TABS,TABYR,REC,STAT(I),YEAR(I),NYR(I),INDEX,3)
      I=I+1
      GO TO 4
C                                                                       C
C     TAPE 2 IS MOUNTED AND ITS TAPETABLE READ IN BY SUBROUTINE READT. C
C                                                                       C
98    CALL MOUNT(MOUNT2,&101)
      CALL FTNCMD('ASSIGN 4=*T*',12)
      CALL READT(2,TABS,TABYR,REC,NTAB)
      INDEX=1
      NRECNO=0
5     IF(I.GT.NS) GO TO 96
      CALL FINDR(TABS,TABYR,REC,STAT(I),YEAR(I),NYR(I),INDEX,4)
      I=I+1
      GO TO 5
96    STOP
101   CALL ERRMES(3,DUM,&96)
      END
C
C
C
C
C
C                                                                       C
C     SUBROUTINE FINDR SEARCHES THE TAPETABLE TO FIND THE PAIR OF STA- C
C  TION NAMES BETWEEN WHICH THE STATION IS LOCATED.  THE TABLE EN-    C
C  TRIES ARE THE FIRST OCCURRENCES OF THOSE STATIONS LOCATED 5000     C
C  RECORDS APART ON THE TAPE.                                         C
C     WHEN THE INTERVAL IS FOUND THE TAPE IS SKIPPED TO THE LOCATION  C
C  OF THE FIRST STATION OF THE PAIR ( WHICH IS LESS THAN THE WANTED   C
C  STATION ).  THE TAPE IS READ UNTIL THE CORRECT STATION NAME AND    C
C  YEAR ARE FOUND.                                                    C
C                                                                       C
      SUBROUTINE FINDR(S,YR,R,ST,YEAR,NY,INDEX,IC)
      INTEGER R(100),YR(100),DIS
      INTEGER*2 YEAR,NY
      REAL*8 S(1),ST,STAT,DISCH(8)
      COMMON NRECNO
      JNDEX=INDEX
2     IF(ST.GE.S(INDEX)) GO TO 1
      IF(INDEX.LT.10) WRITE(6,143) S(INDEX),YR(INDEX),INDEX
      INDEX=INDEX+1
```

TABLE 2 (Continued)

```
      GO TO 2
1     INDEX=INDEX-1
      NREC=5000*(INDEX-JNDEX)-MOD(NRECNO,5000)
      IF(ST.EQ.S(INDEX+1)) INDEX=INDEX+1
      IF(ST.EQ.S(INDEX)) NREC=R(INDEX)-NRECNO-1
      NRECNO=NRECNO+NREC
      WRITE(6,143) ST,YEAR,INDEX
143   FORMAT(' ',A8,2I5)
      WRITE(6,144) NREC,NRECNO,INDEX
144   FORMAT('0',3I10)
      CALL SKIP(C,NREC,IO,&7)
      NRECSK=0
3     FORMAT(1X,A7,I3,I2,8A8,A2)
4     READ(IO,3) STAT,IYR
      NRECSK=NRECSK+1
      IF((STAT.EQ.ST).AND.(YEAR.EQ.IYR)) GO TO 10
      IF(STAT.GT.S(INDEX+1)) GO TO 4
      WRITE(6,5) ST
5     FORMAT('1','STATION CODED: ',A7,'  IS NOT ON TAPE')
10    BACKSPACE IO
      NRECSK=NRECSK-1
      WRITE(6,143) STAT,YEAR,NY
C                                                                       C
C    THE TAPE IS READ UNTIL ALL THE RECORDS REQUESTED HAVE BEEN FOUND.C
C  THE DISCHARGE DATA IS WRITTEN OUT ( ON UNIT 7 ) AS IT IS READ IN.  C
C                                                                       C
11    READ(IO,3) STAT,IYR,MON,DISCH,DIS
      IF(STAT.NE.ST) GO TO 100
      IF(IYR.EQ.(YEAR+NY)) GO TO 100
      NRECSK=NRECSK+1
      WRITE(7,6) ST,IYR,MON,DISCH,DIS
6     FORMAT(A7,I3,I2,8A8,A2)
      GO TO 11
C                                                                       C
C    'NRECNO' IS THE TOTAL NUMBER OF RECORDS THAT HAVE BEEN SKIPPED    C
C    ON THE TAPE AT ANY ONE TIME.                                       C
C                                                                      *C
100   NRECNO=NRECNO+NRECSK
      RETURN
7     WRITE(6,8) ST
    8 FORMAT('-',5X,'END OF FILE REACHED DURING TAPE SKIP - STATION: ',A
     17,'  IS NOT ON THE TAPE')
      STOP
      END
C
C
C
C
C
C                                                                       C
C    SUBROUTINE READT READS THE TAPETABLES COMPILED BY WSC.TABLE.      C
C  STATION NAMES, STARTING YEARS AND THE RECORD NUMBER ON THE TAPE     C
C  ARE READ AND STORED IN ARRAYS 'TABS', 'TABYR' AND 'REC'.            C
C                                                                       C
      SUBROUTINE READT(IO,TABS,TABYR,REC,NTAB)
      REAL*8 TABS(100)
      INTEGER TABYR(100),REC(100)
      COMMON NRECNO
```

TABLE 2 (Continued)

```
      I=0
7     READ(IC,6,END=97) TABS(I+1),TABYR(I+1),REC(I+1)
6     FORMAT(A7,I3,I7)
      I=I+1
      GO TO 7
97    NTAB=I
      RETURN
      END
C
C
C
C
C
C                                                                       C
C     SUBROUTINE ERRMES IS CALLED WHENEVER ONE OF THREE ERRORS OCCUR    C
C   IN THE ABOVE ROUTINES.                                              C
C                                                                       C
      SUBROUTINE ERRMES(J,S,*)
      REAL*8 S
      COMMON NRECNO
      IF(J.EQ.1) WRITE(6,1) S
1     FORMAT('C',//5X,'STATION  ',A7,'  IS NOT ON EITHER TAPE'//)
      IF(J.EQ.2) WRITE(6,2)
2     FORMAT('C',//5X,'THERE ARE NO STATIONS READ IN'//)
      IF(J.EQ.3) WRITE(6,3)
    3 FORMAT(////5X,' THE TAPE CANNOT BE MOUNTED - THERE IS EITHER AN ER
     1ROR IN THE MOUNT COMMAND'/5X,' OR ALL THE TAPE DRIVES ARE IN USE'/
     2/)
      RETURN 1
      END
C
C
C
C
C
C                                                                       C
C     SUBROUTINE SORTS IS A ROUTINE TO SORT THE INPUT STATIONS AND      C
C   THEIR ACCOMPANYING YEARS AND DURATIONS INTO ALPHABETICAL ORDER.     C
C   THE STATIONS ARE SORTED BY A BUBBLE SORT, AND THE INDICES OF THE    C
C   SORT ARE STORED IN ARRAY 'IND'.  AFTER THE STATIONS ARE IN ORDER    C
C   ARRAYS 'YEAR' AND 'NYR' ARE REORDERED ACCORDING TO 'IND'.  IF THE   C
C   STATIONS WERE IN ORDER INITIALLY, 'YEAR' AND 'NYR' ARE NOT CHANGED.C
C                                                                       C
      SUBROUTINE SORTS(STAT,YEAR,NYR,NS)
      REAL*8 STAT(100),DUM
      INTEGER*2 YEAR(100),NYR(100),IND(100),DY(100),DN(100)
      DO 3 I=1,NS
3     IND(I)=I
      IS=0
2     IC=0
      DO 1 I=2,NS
      IF(STAT(I).LT.STAT(I-1)) GO TO 1
      DUM=STAT(I)
      STAT(I)=STAT(I-1)
      STAT(I-1)=DUM
      J=IND(I)
      IND(I)=IND(I-1)
      IND(I-1)=J
```

TABLE 2 (Continued)

```
      IC=1
      IS=1
1     CONTINUE
      IF(IC.EQ.1) GO TO 2
      IF(IS.EQ.0) GO TO 5
      DO 6 I=1,NS
      DY(I)=YEAR(I)
6     DN(I)=NYR(I)
      DO 4 I=1,NS
      NYR(I)=DN(IND(I))
4     YEAR(I)=DY(IND(I))
5     RETURN
      END
```

LOGICAL UNIT ASSIGNMENT

For the information of the user the logical units assigned in the program, with the manner of assignments and information located at each are:

WSC.TABLE

UNIT 2	TAPE BEING READ	ASSIGNED VIA FTNCMD
UNIT 3	OUTPUT TABLE OF CONTENTS	ASSIGNED BY USER
UNIT 5	TAPE RACKNUMBER	DEFAULT OR USER ASSIGNED
UNIT 6	ERROR MESSAGES	DEFAULT OR USER ASSIGNED

WSC.RETRIEVE

UNIT 1	TABLE OF CONTENTS TAPE 1	ASSIGNED VIA FTNCMD
UNIT 2	TABLE OF CONTENTS TAPE 2	ASSIGNED VIA FTNCMD
UNIT 3	TAPE 1	ASSIGNED VIA FTNCMD
UNIT 4	TAPE 2	ASSIGNED VIA FTNCMD
UNIT 5	STATIONS TO BE RETRIEVED	DEFAULT OR USER ASSIGNED
UNIT 6	ERROR MESSAGES	DEFAULT OR USER ASSIGNED
UNIT 7	RETRIEVED RECORDS	USER ASSIGNED

Under MTS unit 5 defaults to the input stream and unit 6 defaults to the output stream. These will differ depending upon whether the task originates at a terminal or in a batch stream.

PORTABILITY

Both programs are written in FORTRAN 4G and may not be directly compatible with other facilities. In particular the following details are believed to be specific to the system wherein the programs reside.

1) use of system subroutine FTNCMD which provides an entry point to FORTRAN I/O LANGUAGE MONITOR. This is used in both programs to automatically assign logical units to particular files and devices. This serves to reduce the complexity of the run statements.

2) use of system subroutine MOUNT. This is used to mount the required tapes from the program.

3) use of system subroutine SKIP. This is used to position magnetic tape.

4) logical unit defaults may be different. As the programs are implemented unit 5 defaults to user input and 6 default to program output and system messages.

5) read statements contain "END=". This may not be available at other installations.

6) some routines and functions obtained from the system library may have different implementations.

7) the programs contain INTEGER*2 declarations. This may not be permissable at other facilities.

Some changes to the programs may be required to overcome these possible incompatibilities.

We will provide copies of these programs to interested parties.

REFERENCES

Inland Waters Directorate 1973. Description of CARD and Tape formats for supplying data to users. Water Resources Branch, Ottawa.

APPENDIX 1

Water Survey of Canada card format 67-002 (Daily discharges)

We request these data be written on magnetic tape, in EBCDIC on 9 track tape at 1600 bpi. These tapes are unlabelled and have a field length of 80 and a blocking factor of 40. (The data to December 1977 consists, for British Columbia and the Yukon of 14,170 station-years or 510,000 card images).

The first record on tape is the first data record (card image) and the last data record (card image) is followed by an 80-character "end-of-data" record containing 9's in all 80 columns except columns 4-5 which are z's and by padding records (if necessary) also containing 9's in all columns except columns 4-5 which are z's. The last tape block is followed by an end-of-file mark. Unless otherwise specified the data will be supplied as unblocked card images on tape. A blocking factor of 9 is suggested since this will accommodate machines of any word-length.

Format Description

Col. 1	type of data and units, coded as follows: 1 for mean discharges in cfs
Col. 2-8	station number, e.g. 08AA023
Col. 9-11	year, e.g. "968" for 1968
Col. 12-13	month, e.g. "b7" for July
Col. 14	time interval, coded as follows: 1 for daily figures from day 1 to day 10 2 for daily figures from day 11 to day 20 3 for daily figures from day 21 to day 31
Col. 15-80	eleven 6-digit data fields.

Description of Data

Each data field has six positions. Discharges are punched right justified with a decimal point if necessary. A negative value is entered with a minus sign just to the left of the most significant figure. The data fields are in Fortran F-type format; discharges are read as F6.0.

The data shown on the card applies to the first data field (Col. 15-20). The successive fields are for consecutive days or months depending on the interval (Col. 14) used. The value "-99999" is entered whenever a figure is missing in a field that would normally contain a figure.

Daily Figures

Three cards per month are required. The first card (1 in Col. 14) contains 10 days from day 1 to 10; Col. 75-78 are not used; the number of days in the month, e.g. "30" for November, is punched in Col. 79-80. The second card (2 in Col. 14) contains 10 days from day 11 to 20; Col. 75-80 are not used. The third card (3 in Col. 14) contains 11 days from day 21 to 31; however, the figure "-11111" is punched in the appropriate field for days that do not apply to the month in question, e.g. 30 and 31 for February 1968.

APPENDIX 2

The following pages show output from WSC.RETRIEVE. The first output shown is that directed to logical unit 6 and shows the stations in the order in which they are attempted to be retrieved. This output also contains any error messages which are generated. In this case we attempted to retrieve data from a fictional station, and received the error message which corresponds to the condition.

Also shown is a listing of the retrieved data which was written to logical unit 7.

APPENDIX 2

```
$R -LOAD 7=WSC.TEST


EXECUTION BEGINS    14:09:30
*S* (RA0021): MOUNTED ON T422
07EA001    960     1
07EF001    917     2
07FD002    944     3
08CC001    962     4
08DB001    929     5
08EC004    961     6
08EE008    960     7
08EG001    928     8
08FB002    947     9
08MF005    976    50

    244294     244294          50
08MF005    976     1
*T* (RA0023): MOUNTED ON T423
08NA001    912     1
08NA011    912     2
08NA045    944     3
08NB005    944     4
08ND002    912     5
08ND013    963     6
08NE008    952     7
08NE039    929     8
08NE058    975     8

     35000      35000           8
08NE058    975     3
08NE039    929     8
08NE072    947     9
09BC001    978    41

    161087     200000          41


STATION CODED: 09BC001   IS NOT ON TAPE
09BC002    978     1
09EB001    976    43

       5107     210000          43
09EB001    976     2
EXECUTION TERMINATED    14:19:32   T=11.413   RC=0     $12.56
T=11.522 DR=150
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APPENDIX 2 (Continued)

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08MFCC5976 12 32300 34800 36400 35900 34800 38000 41400 42500 42300 40500
08MFCC5976 13 38500 39000 40900 42500 42000 41500 45600 44500 45100 44800 4380
C8MFCC5976 21 42200 4C400 40400 39500 38100 36400 36300 35400 36800 37400     2
08MFCC5976 22 37000 36400 36700 36500 35200 35600 37900 37900 36400 35700
C8MFCC5976 23 35200 34800 35700 35600 35200 34500 34400 33300 30400-11111-1111
08MFCC5976 31 29400 28800 28100 28100 27700 27700 29400 31500 32700 33400     3
C8MFCC5976 32 33200 32300 32200 32100 31800 31400 31900 33500 34100 33400
08MFCC5976 33 34100 33400 33000 36000 36000 34500 36000 35400 36000 36800 3790
C8MFCC5976 41 37300 36500 36200 36100 37500 39400 41000 43200 46800 52600     3
C8MFCC5976 42 62400 7240C 835CC 97000110001170001170001110001080001C4000
08MFCC5976 43102C0001010001010001010001C10C01C1C001050001C0000112000120000-1111
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08MFCC5976 53262C0C2510002420002350002340002350002480002520002440002390002350C
C8MFCC5976 61224000220000214C0213000213000209000205000205000203000211000     3
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08MFCC5976 633CECCC3250003320CC3240C0307000291000282000283000282000275000-1111
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C8MFCC5976 72304C0C3C300029500C284000276C0271000267000261000261000264000
C8MFCC5976 73264C0C2560002500002500002450002360002320002310002320002300002600
C8MFCC5976 8122C0002120002160002210002300002340002410002410002460002520000     3
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08MFCC5976 8323E0002440002480002500002380002260002180002120002070002030002040C
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08MFCC5976103 84000 8060C 78100 75400 74400 72300 71300 72100 69700 72400 7690
C8MFCC5976111 7780C 76900 74700 72600 72000 69800 69000 67000 65400 64600     3
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08MFCC5976123 5E10C 59700 60900 5950C 56800 61400 59900 5700C 54000 51800 5070
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08NEC58975 21 85400 85900 99100102000 99900103000102000 97800 98500 9920C     2
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C8NEC58975 23 96600 90300 901CC 935CC 954C0 93000 92400 91200-11111-11111-1111
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C8NEC58975 33 87100 8760C 84900 87100 88200 84500 81900 82300 77200 7630C 7500
08NEC58975 41 7370C 72800 74000 713CC 70700 73500 72300 69800 67000 68900     3
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C8NEC58975 73 8770C 9070C 90500 8670C 88000 80100 79100 89100122000143000157000
C8NEC58975 811450C011C000103000110000115000110000104000 9720C 89900 8470C     3
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APPENDIX 2 (Continued)

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08NEC58975 91 81C00 71000 77400 731CC 70100 62200 58600 5890C 64100 65400    3
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C8NE058975 93 57900 54700 53100 53100 54500 58800 5910C 5870C 62400 6340C-1111
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08NE058975103 654CC 6C800 59CC0 675C0 66000 76500 85400 83700 80500 86100 8700
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08NE058976 21104000 98900 990001020001010C0 994001000001070001190001280000    2
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APPENDIX 2 (Continued)

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C8NE058977 73 88300 94900 9630C 953CC 983C0 9520C 975CC 96200 95800 9750C 9960
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C8NEC58977 83 85E00 89700 86500 8650C 92500 95800 94200 9330C 89400 8160C 7530
08NE058977 91 77100 76800 71700 7370C 831C0 87400 85800 8290C 81900 80900    3
C8NEC58977 92 8C40C 78800 80100 80300 83500 82300 817CC 80400 73800 731CC
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C8NE058977111 7580C 77000 77600 8150C 82500 78400 77500 82400 83200 820CC    3
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09EB001976 13 18900 1890C 18800 1870C 187C0 1870C 1880C 18800 18900 18900 1870
C9EB0C1976 21 1E6CC 18500 183C0 18200 18100 18100 18000 18000 18000 1800C    2
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09EB0C1976 23 17400 17400 17500 17700 17800 17800 178C0 1780C 17700-11111-1111
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C9EBCC1976 911CCC0C 9E4CC 967CC 95000 935C0 92200 90100 88700 87200 86400    3
09EBC01976 92 86C00 8450C 841CC 8400C 838C0 8300C 825CC 82000 81800 8050C
C9EBCC1976 93 8C2CC 7950C 79000 775C0 760C0 75000 74000 7350C 73000 725CC-1111
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APPENDIX 2 (Continued)

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09EB0C1976123 22500 22300 22300 22400 22800 22800 22400 22200 22000 21900 2180
09EB001977 11 21500 21300 21100 21100 21100 21200 21800 22000 22100 22200     3
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C9EB0C1977 13 22500 22500 22200 22100 22000 22000 22100 22300 22800 22900 2280
C9EB0C1977 21 22300 22100 22000 22000 22000 22000 22000 21800 21100 20900     2
C9EB001977 22 20800 20800 20800 20600 20200 20000 19800 19800 19900 20000
09EB001977 23 20100 20200 20200 20200 20200 20300 20500 20500-11111-11111-1111
C9EB0C1977 31 20000 19500 19000 18800 18500 18300 18300 18300 18400 18500     3
09EB001977 32 18600 18500 18200 18100 18200 18300 18300 18300 18200 18000
09EB0C1977 33 18000 18000 18000 18100 18100 18000 18000 17800 17700 17600 1760
C9EB001977 41 17700 17800 18000 18100 18500 18800 18800 18800 18700 18800     3
C9EB0C1977 42 18900 18800 18800 18800 19000 19000 19000 19000 19100 19200
C9EB0C1977 43 19500 20100 20600 21000 22000 23000 24000 25000 26500 27800-1111
09EB0C1977 51 29000 30000 30000 28800 28400 25000 32000 42000 60000 90000     3
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C9EB0C1977 93 79800 80400 82800 86100 86900 86700 87900 89800 91200 91200-1111
C9EB0C19771C1 90300 87500 84200 81100 78900 77300 75400 72900 70300 67800     3
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C9EB001977113 26000 25500 25200 25200 25100 25100 25100 25200 25200 25200-1111
C9EB001977121 25200 25100 24800 24300 24000 23800 23800 23500 23500 23500     3
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