EA - Anglian Water Resources

ENVIRONMENT
AGENCY

NATURALISATION OF THE ORTON FLOW RECORD

DAN CADMAN

JULY 1997

ERRATA

SEPTEMBER 1997

Derivation of factors to represent present day artificial influences (by which the Orton naturalised flow series could be denaturalised for 1997 conditions and used in yield analysis) revealed the following errors which are attributable to the naturalisation process:

1. The naturalisation uses the total public water supplied to derive effluent inputs to the system. Direct measurements of effluent were used for the years 1993 to 1996. These were not used as direct inputs, but instead were worked back into the corresponding estimate of public water supply to preserve the continuity of the method. The total effluent derived from Public Water Supply (PWS) is calculated (correctly) as described in Appendix 4 and the text. However, the working back of these data into PWS was not done correctly, nor described.

The demand for PWS varies between months. This is accommodated by applying a monthly demand factor, PWS.DEM (Appendix 3) to the annual total PWS. The resulting monthly PWS is not all converted to effluent. The proportion of supplied water that is translated to effluent also varies between months, mostly reflecting summer hosepipe use which is not returned to the sewer. This monthly variation is also represented by a monthly profile.

In this case, the profile is not read as a datafile, but remains hard coded into the program. The effluent profile ("efffac") is given on the first page of Appendix 1, four lines up from line 9999. The values of the profile are as follows:

J	F	M	A	M	J	J	A	S	O	N	D
0.95	0.95	0.95	0.9	0.9	0.85	0.85	0.8	0.85	0.9	0.95	0.95

These denote the proportion of the water supplied that is returned as effluent, They average 0.9, that is 90% of supplied water is taken to be returned as effluent.

For the years 1992 to 1996, the public water supply was calculated from effluent volumes by dividing by the average yearly effluent factor, 0.9. This is because the return as effluent of 90% of supplied water was erroneously taken as a constant rate, rather than as an average rate. The demand factor was also used at it's average proportion of 1.

As the PWS is derived from minimum recorded effluent (because it is least affected by storm run off), which in each year (1993 to 1996) was in August, it is more appropriate to use the August monthly factors in the working back from effluent total to public water supplied.

Therefore, the minimum recorded effluent is factored up to account for all catchment discharges. It is then divided by the August effluent factor to estimate the rate at which is public water supplied in August (in TCMD). The daily rate of supply in August is greater than the annual average, so it is divided by the monthly demand factor to achieve an average daily rate of supply over the whole year, in TCMD.

PWS in TCMD for the years 1993 - 1996 now becomes:

1993	1994	1995	1996
150	137	131	137

The values of 147, 134, 128 and 134 respectively are found in the datafile PWS.DAT.

This means that the contribution of effluent in 1993 - 1996 was underestimated by 3 TCMD in the July 1997 calculation. Natural flows for this period are therefore overestimated. All records, diagrams and analyses made in July 1997 for the years 1993 - 1996 inclusive are affected.

Comment:
The occurrence of the minimum effluent in August suggests that the effluent factors used are appropriate.

The method of deriving public water supply from sewage effluent makes no explicit account of leakage from supply or pipes or sewers, as this is unmeasured. Leakage would contribute to the catchment water balance by decreasing the soil moisture deficit, although some would be lost through increased evapotranspiration.

2. The monthly profile of demand for public water supply (PWSDEM.DAT) used in July 1997 was also in error. To apportion the yearly total, the sum of the factors should total twelve. In the July 1997 calculation of the series, a factor of 1.25, rather than 1.2 was used for the month of June. This takes the total of the factors to 12.05. This causes an overestimation of public water supply effluent for every June in the series. There is no corresponding underestimation in any other month, so the annual totals are also affected. The consequence of an overestimation of June effluents is a corresponding underestimation of the natural flows by the July 1997 calculation.

To indicate the scale of this error, in 1996, with a PWS of 137 TCMD, the June effluent would be calculated as 145.6, instead of 139.7 TCMD. In fact the June effluent was calculated as 142.6 TCMD because PWS was underestimated as 134 TCMD (see point 1. above). The maximum error is 7 TCMD, occurring in June 1989, the year of highest demand.

For the years 1993 - 96, when errors 1. and 2. operate, the error in June demand profile is in part counteracted by the underestimation of PWS. This gives a total underestimation of natural flows of 3 TCMD in the June values of these years, and an overestimation of 3 TCMD in all other months.

The errors 1. and 2. do affect the derived flow series, and hence the analyses performed upon them. However, they are within the errors in the series derived from other sources. It is not anticipated that these errors will significantly affect the double mass analysis. None of the negative flows observed in the derived natural series are in June nor in the last four years.

3. The Corby effluent output to file CORRECT.TCM (in Appendix 5) is the Corby effluent in units of cumec days, not TCMD. This is due to an error in the program FLOWNA6.FOR (Appendix 1). The error can be found on page 5 of Appendix 1. Two lines below line 9993, the monthly Corby effluent is calculated correctly in TCMD from corby effluent in cumec days. This line is

"ceffm = ceff(imon)*86.4/real(ndm)".

Eight lines below this, the write statement

"write(25, 9992) iyr - 1900, imon,dyear, pwsmef,ceff(imon),........."

outputs ceff(imon) instead of ceffm to the CORRECT.TCM file. The fault is confined to this term of the output file. The calculation of other terms in the naturalisation, including other terms in the CORRECT.TCM file, is not affected. The other terms in CORRECT.TCM (Appendix 5) are correct, which is why the summation of the factors in the table often vary by a small amount from the overall variation term in the final column.

correct the Corby.dat table - MG not MGD.
correct the program including update intro to include v6.

ERRATA

AUGUST 1997

Quality control of the Orton Naturalised Series by Peter Ede (Mott MacDonald, on behalf of Anglian Water) revealed two related errors in the naturalised series. For February 1992, there were only 28 days in the month, when there should have been 29. For February 1993, the "Year Mark" line (denoted YM in the file) of the output file quoted 29 days in the month rather than 28. There were only 28 days of data in the month. The same errors are also thought to be present in the Tinwell naturalised series. The source of the error was traced to the St. Andrews input file from which the year marks in the Orton series were read. This had the same errors and the fault is attributed to the output of the flow processing system (now replaced by Hydrolog) not the naturalisation process itself.

The analyses contained in this report (including the flow duration curves in Appendix 6) are based upon the uncorrected series. The errors in 2.92 and 2.93 do not cause significant errors in the intervening period. The value of the variation term and hence the final output file for February 1992 and February 1993 are changed. Data for months preceding 2.92 and following 2.93 are totally unaffected. The errors for the two months are regarded as having no significant impact upon double mass analysis, flow duration analysis or any of the negative flows.

The naturalisation procedure was repeated with the corrected St. Andrews input file. The Output files have been checked to ensure the errors have been successfully corrected. Output files included on disk give the correct (August 1997) data. The only hardcopy data included in the report which gave erroneous values were the "Components of Artificial Influence" in Appendix 5. This has been corrected with the output values using the correct data.

FURTHER ADDITIONS - AUGUST 1997

Flow duration curves were derived for the naturalised series in August 1997, subsequent to work on assessing the yield of Rutland Water. They are included here for completeness.

A directory of files is given in the Appendix 7. Files are supplied on disk on the inside cover of the document.

NATURALISATION OF THE ORTON FLOW RECORD

DANIEL CADMAN

JULY 1997

1.0 INTRODUCTION

Flow data for the river Nene at Orton is primarily required for analysis of Rutland yield, but is also used more widely as the standard naturalised series for the river Nene and in the past has been used to estimate flows to tide.

The flow series was naturalised by the Welland and Nene River Division and its predecessor authorities. The procedure was very thorough, using flows through the supply system to estimate public water supply. The naturalisation procedure was necessarily time consuming and it was discontinued in 1976, with the onset of pumping to Rutland, as flows through an increasingly complex supply system were expected to become very difficult to account for. On occasion the procedure gave obviously erroneous results, which were ascribed to imprecise reservoir storage calculations and use of dry weather flows from sewage treatment works.

Nigel Fawthrop developed an alternative method for deriving the natural flows and applied this retrospectively to the period 1941 to 1990 (inclusive). Fawthrop notes that there was scope for improving the results by more detailed estimate of some parameters than was possible at the time, but the method itself could remain, within which these detailed revisions could be made. For this reason the method was made as transparent as possible and is described in Fawthrop (1990). Particular concerns about data accuracy are noted in Fawthrop (1990), querying:

Estimates of industrial abstraction.
Wansford abstraction data, which is thought to be too high.
Monthly demand factors, which do not change with time.

Glenn Watts updated the series to the end of 1992. He and Gerry Spraggs (Anglian Water) revised the series with new, and lower estimates of public water supply to the Nene catchment. The whole data series was reworked with the new method of estimating public water supply to maintain the consistency of the record. The updated series and its method of calculation are given in Watts (1992). The sensitivity of the record to different components of artificial influence is also assessed.

2.0 ARTIFICIAL INFLUENCES IN THE NENE CATCHMENT TO ORTON

The artificial influences upon the Nene catchment are shown in Fig 1. Of these influences, losses from the catchment are:

- Net industrial direct abstraction.
- Net agricultural direct abstractions.
- Abstraction from Wansford to Rutland water.
- Abstraction from Duston Mill to Pitsford Reservoir
- Gross public water supply abstractions made within the catchment. (These are gross because the return of part of the water supplied is input separately as sewage effluent.)

Gains to the catchment are:

- Effluent from sewage treatment works. (This is the returned water from the Wansford and other PWS abstractions.)
- Effluent discharges from Corby steelworks and power station (which are supplied from Eye Brook reservoir in the Welland catchment).

There is also the effect of storage and compensation release at several small reservoirs, including Pitsford reservoir. For a given timestep, this effect can be positive or negative. In dry periods, compensation water may exceed natural inflow, in which case the adjustment to the Orton gauged record from this component is a gain. .Conversely, in wetter periods the natural inflow impounded by the dam can exceed the compensation flow, in which case water is denied to the catchment in that timestep, and the storage of reservoir inflow is a loss. The natural inflows to the reservoirs are not measured directly but are calculated from a regression relationship with total flow at St Andrews gauging station.

3.0 METHOD OF NATURALISATION

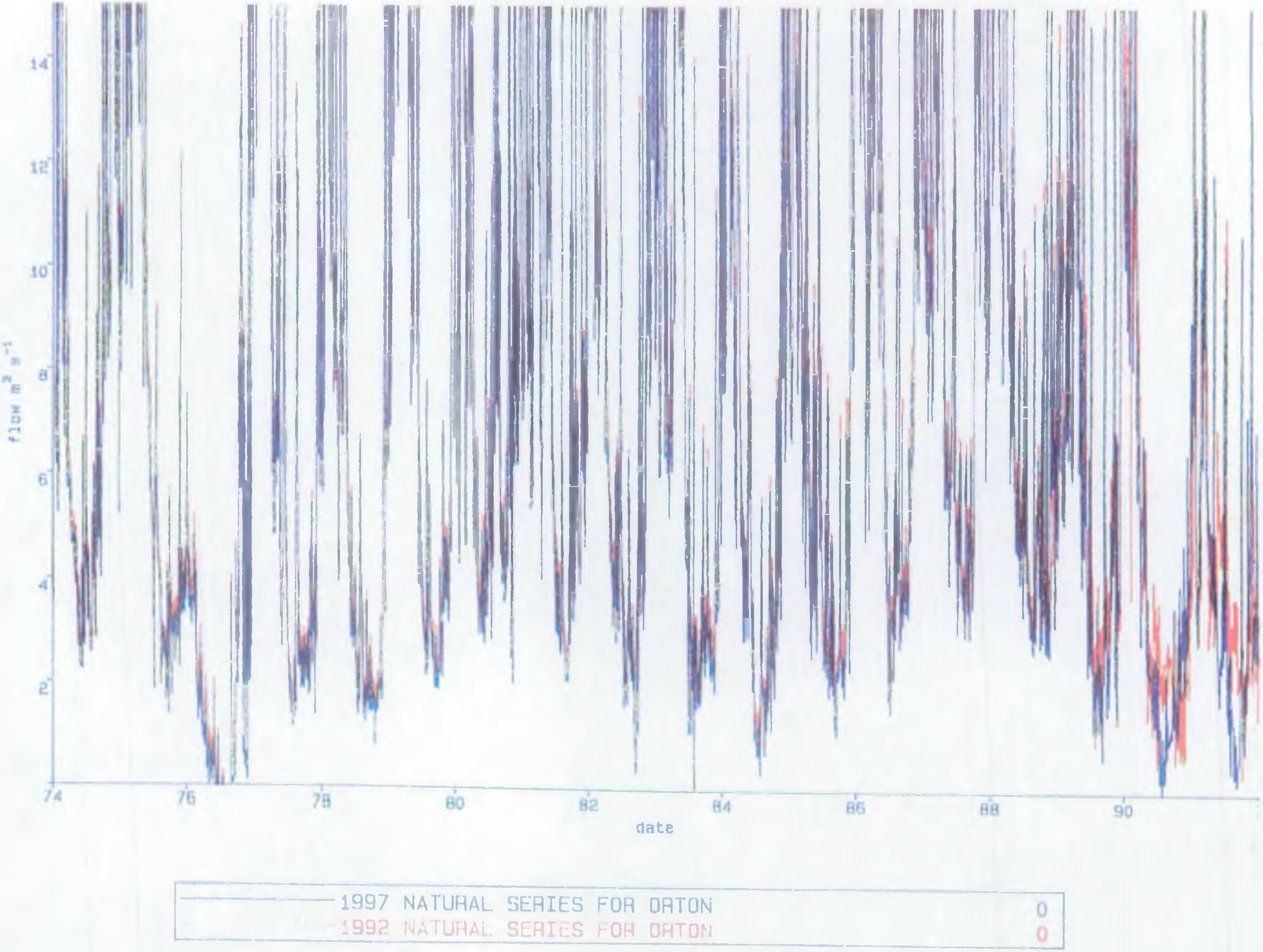
The naturalisation is by decomposition on a daily timestep. The process of naturalisation is split into two steps:

1. The calculation of a net daily adjustment by aggregating the different artificial influences upon the flow in the catchment.
2. The application of the time series of adjustments to the time series to mean daily flows at Orton.

No attempt is made to naturalise for changes in the physical character of the catchment, such as the expansion of urban centres or the Grand Union Canal.

Fig1: Artificial Influences in the Nene Catchment to Orton Gauging Station

Fig 2: Comparison of the Naturalised Series of Watts (1992) and Cadman (1997).



STEP 1 : Calculating the net artificial influence

The necessary data are available at different timesteps:

Daily data:

- Wansford abstractions 1976 - 1985 and from 1989 to date.
- Total flow at St Andrews (ie flow over the weir plus that through the bypass structure).
- Duston Mill abstractions from 1989 onwards.

Monthly data is available for:

- Abstractions from Eye Brook reservoir.
- Wansford abstractions 1985 to 1989 inclusive.

Yearly data is available for:

- Public water supply.
- Non Reservoir public water supply.
- Duston Mill abstractions to 1989 (with monthly proportion of yearly total).
- Nett industrial direct abstractions.
- Nett agricultural direct abstractions.

To calculate the net difference in flow caused by these artificial influences, it is necessary to have data on a consistent timestep. The naturalisation uses a daily timestep, so monthly data is distributed evenly across the days of the month, and yearly data is first disaggregated into monthly values. Net agricultural abstraction, Duston Mill abstractions (pre 1989), public water supply abstraction and effluent are not constant throughout the year, so disaggregation is done using a profile of monthly use to assign values to months. This profile is an estimate of typical use and is assumed to stay constant throughout the years.

Although Duston Mill abstractions have been recorded on a daily timestep since 1989, direct use of data on this timestep is appropriate. Duston is too far upstream of Orton gauging station for the effect of the abstraction to be translated into a reduction at Orton the same day. Moreover, the magnitude and timing of the effect is altered by attenuation. The daily abstractions have therefore been aggregated upwards to monthly values and averaged over each day of the month. The same is true of the effect of the small reservoirs. Again, although the data is derived in a daily timestep (from daily flow data) the net inflow to the reservoirs cannot be determined with any accuracy for such a fine temporal resolution. As with Duston data, reservoir inflows are aggregated to monthly data and distributed evenly across the days.

With the exception of the Duston Mill abstractions (for which the aggregated monthly values must be put into the appropriate data file), the manipulation of the data described above is performed by the program FLOWNA6.FOR (listed in Appendix 1). The individual artificial influences and the profiles with which the program disaggregates yearly data are read in by the program as data files. The data files used in this naturalisation are listed in Appendix 3. Attention must be paid to the format of the data files, and any missing data must be infilled.

Having manipulated the data to the necessary timestep, FLOWNA6.FOR combines the different artificial influences into one variation term which represents the daily net effect of all the artificial influences. FLOWNA6.FOR outputs the time series of adjustments in a daily timestep (file 'varn.day'), a monthly timestep ('varn.mon') and a summary of the individual components of artificial influence in the units 'cumec days' and TCMD. Cumec days are total monthly flows divided by the number of days in the month, allowing easy comparison of different influences over different months.

Step 2 : Application of the time series of adjustments to the gauged flow record

The daily timeseries of adjustments is applied to the gauged flow record by the program NATFLO2.FOR. This is listed in Appendix 2. 'Varn.day' and the gauged flow record are read as data files for the period 1941 onwards, and the application of the adjustments is a simple addition, and daily and monthly time series of naturalised flows are output. Any missing values in the gauged flow record need to be infilled prior to use in a data file.

4.0 APPLICATION OF THE METHOD, 1997

FLOWNA5.FOR was created by Watts from earlier versions to reduce the number of files opened by the program at one time. This makes no difference to the calculations. Dan Cadman adjusted the factor applied to Corby abstraction data to increase the proportion of water discharged to the Nene from Corby steelworks to 80%. (See report 'The Treatment of Direct Industrial Abstractions in the Naturalisation of the Orton Flow Record). This resulted in FLOWNA6.FOR.

The data files were updated with the following observations:

Wansford

There were two errors in the existing file Wansford file. were The data for the last two months of 1992 ~~was~~ were infilled using 1990 data as the real data was not then available. These were replaced with real data. April and May 1989 were duplicated in the file, which introduced a lag of two months into the application of Wansford abstraction data to the gauged record. This has been corrected.

PWS Effluent

The contribution of effluent for the period 1971 to 1993 has been estimated from catchment population times per capita demand in previous work. Prior to this, Fawthrop's estimates have been used. For the years 1993 to 1997 the total effluent contribution to the catchment has been estimated by Anglian Water from measured discharges. Use of actual effluent data replaces the source of data previously used in the Orton naturalisation, but does not make any changes to the method itself. The time series for 1993 onwards should thus be consistent with those of previous years.

There are 68 sewage treatment works in the Nene catchment upstream of Orton gauging station, of which the discharges of 10 (Brixworth, Broadholme, Bugbrooke, Corby, Great Billing, Islip, Long Buckby, Oundle, Raunds and Whilton) represent 91% of the effluent flow into the catchment. A 30 day running mean was fitted by Gerry Spraggs to the daily effluent flows from these treatment works to highlight the main trend to the data. The minimum flow in each year of the 30 day averaged series was assumed to have no stormwater input and was taken to represent the dry weather flow. The estimates made by Gerry Spraggs are contained in Appendix 4. The annual minima were factored to represent the inputs from the remaining 9% of the total effluent input.

Direct Industrial Abstraction, including those from Eye Brook Reservoir

The estimates of direct industrial abstraction are substantially changed from those used previously. Estimates of industrial abstraction were based upon an assumption of steadily growing demand and uncritical use of previously derived estimates. Fawthrop (1990) identifies this assumption as a potential source of error and although the term was then far from the largest in the naturalisation, the assumption of growth had increased the term to approximately half a cumec. Although this was still exceeded by other terms in the naturalisation, it merited some attention.

The abstraction returns and discharges of effluent were analysed to obtain the estimates used here. The data have been calculated for previous years and the flow series recalculated accordingly. As the analysis of returns information includes company confidential information, the detail is given in a separate report, "The Treatment of Direct Industrial Abstractions in the Naturalisation of the Orton Flow Record". This document includes the revision of the quantity of imported water from Eye Brook reservoir via Corby Steelworks, and a new licensed abstraction for Corby Power Station (completed in 1993), which had not previously figured in the naturalisation.

5.0 RESULTS

The flow series produced is compared to the previous naturalised series of Watts in Figure 2. The years 1974 to 1991 inclusive were chosen for comparison as these show the greatest differences. The two data series are out of synchronisation after May 1989 because of the errors in the Wansford data file used by Watts.

The present (1997) flow series are also lower than that produced by Glenn Watts in 1992. The difference is due to the downward revision of the industrial abstractions, the effect of increasing effluent discharged from Corby steelworks and small errors in the Corby dataset. The effect of these revisions are quantified in Table 1, with detail given in a the Working Report: "Treatment of Direct Industrial Abstractions in the Naturalisation of the Orton Flow Record ."

Aside from these differences, it is clear that the two series are consistent with one another.

A comparison of the gauged flow record at Orton and the naturalised series is given in Fig 3. The year 1995 was chosen as a recent dry year.

Double Mass Analysis

Double Mass analysis with the Tinwell naturalised series is shown on Fig 4. Data prior to 1971 are not plotted as the Tinwell series is less accurate for this period. The double mass analysis shows that there is a reasonable degree of consistency between the two series, although there are small changes in gradient around January 1977, early 1988 and early 1992 and possibly in 1995. These may be due to error in one, or both of the naturalised series or could represent real changes in the behaviour of the catchments. (Changes arising, for example, from a severe drought such as 1976, or the filling of a reservoir as large as Rutland Water, which started in 1976).

To help identify the source of these small changes, further double mass analyses were undertaken with the gauged flow at Upton gauging station, in a subcatchment of the Nene catchment, over the same period. This station was chosen because the artificial influences upon it are relatively small. However, it still cannot be described as natural, and it has different properties, particularly due to the disparity in catchment area. Therefore it is used as a pragmatic best available choice rather than an ideal comparator. Fig. 5 gives the double mass plot of Orton naturalised flow and gauged flow at Upton. The Upton series was infilled for two values in 1995.

Fig. 5 shows more marked changes than those between Orton and Tinwell. Changes in gradient again occur in January 1977, early 1988 and early 1992 and possibly in 1995, but there is also less consistency between Orton and Upton generally. The pattern shown in Figure 5 is replicated to varying degrees by double mass plots of Upton gauged flow versus Tinwell naturalised flow and Orton gauged flow. These plots are not included here as they closely resemble Fig 5. The repeat of this pattern suggests that the variation in the Upton double mass plots are not due to naturalisation errors. By implication this gives more confidence in the naturalisation when interpreting Fig 4, but this is not proof of consistency in the two naturalised series.

Fig 3: Comparison of Naturalised (Cadman, 1997)and Gauged Flows for 1995.

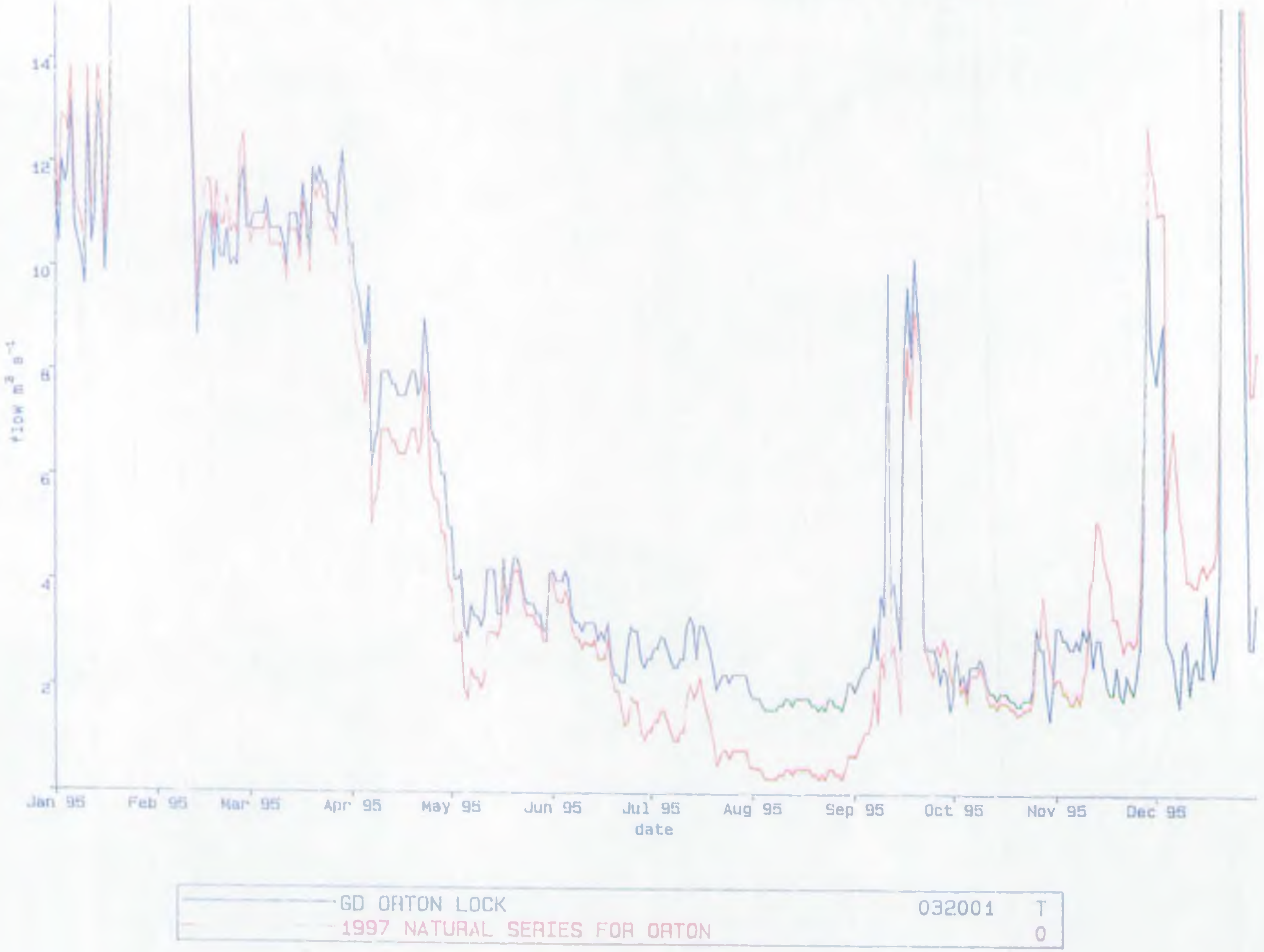


Fig 4: Orton Naturalised Flows (Cadman, 1997) vs Tinwell Naturalised Flows (Watts, 1997)

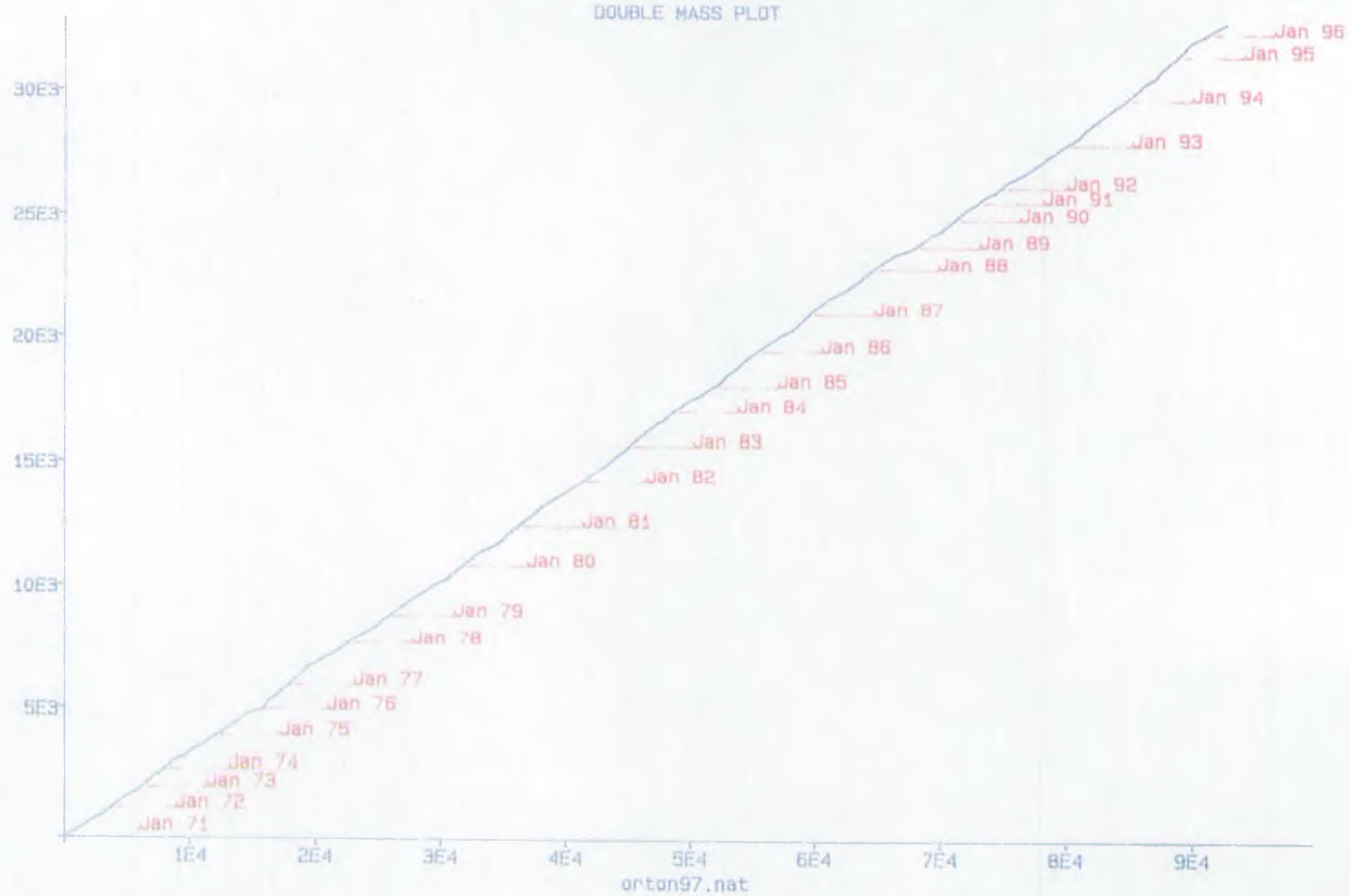


Fig 5: Orton Naturalised Flow (Cadman, 1997) vs Gauged Flow at Upton

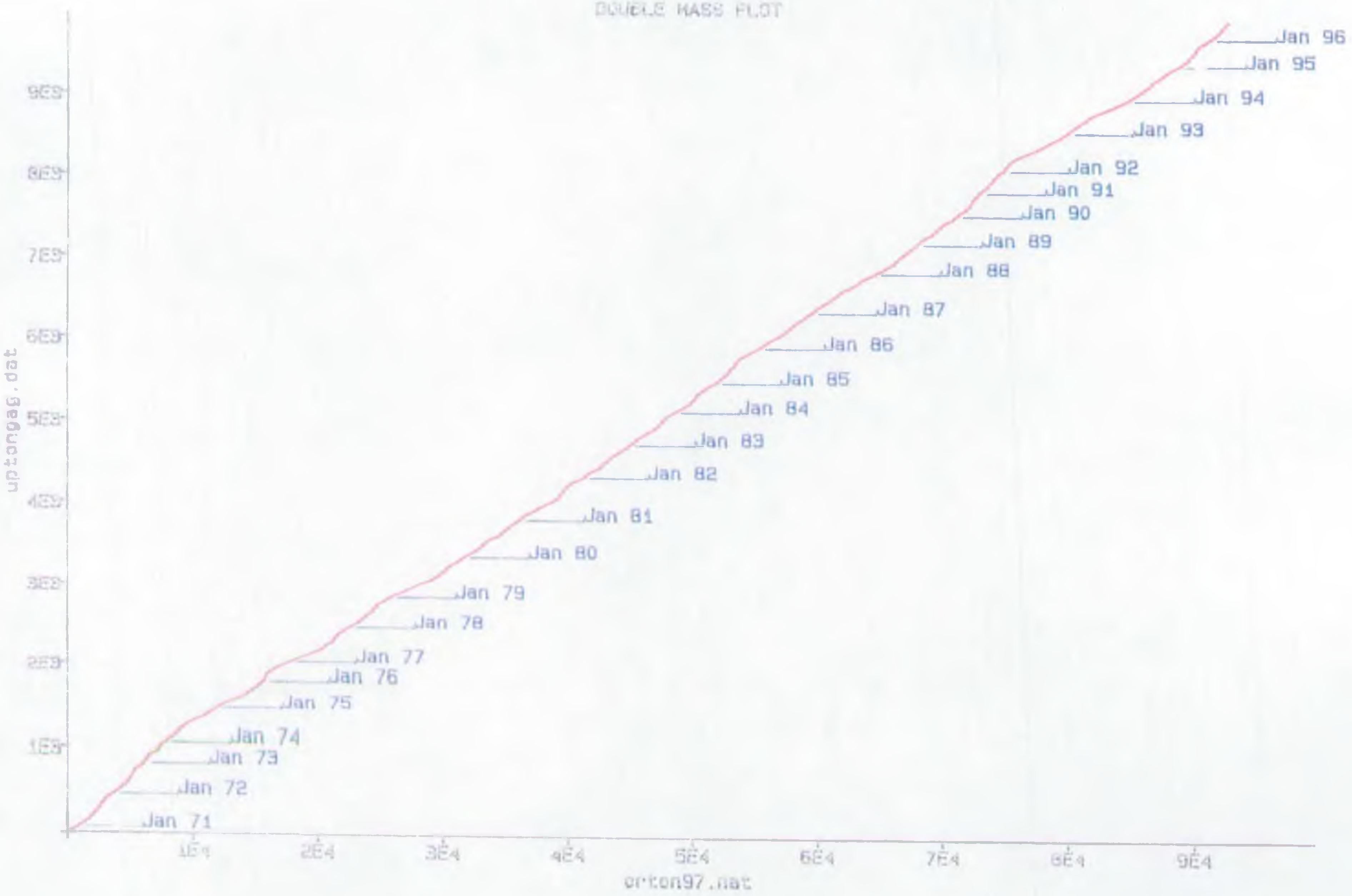
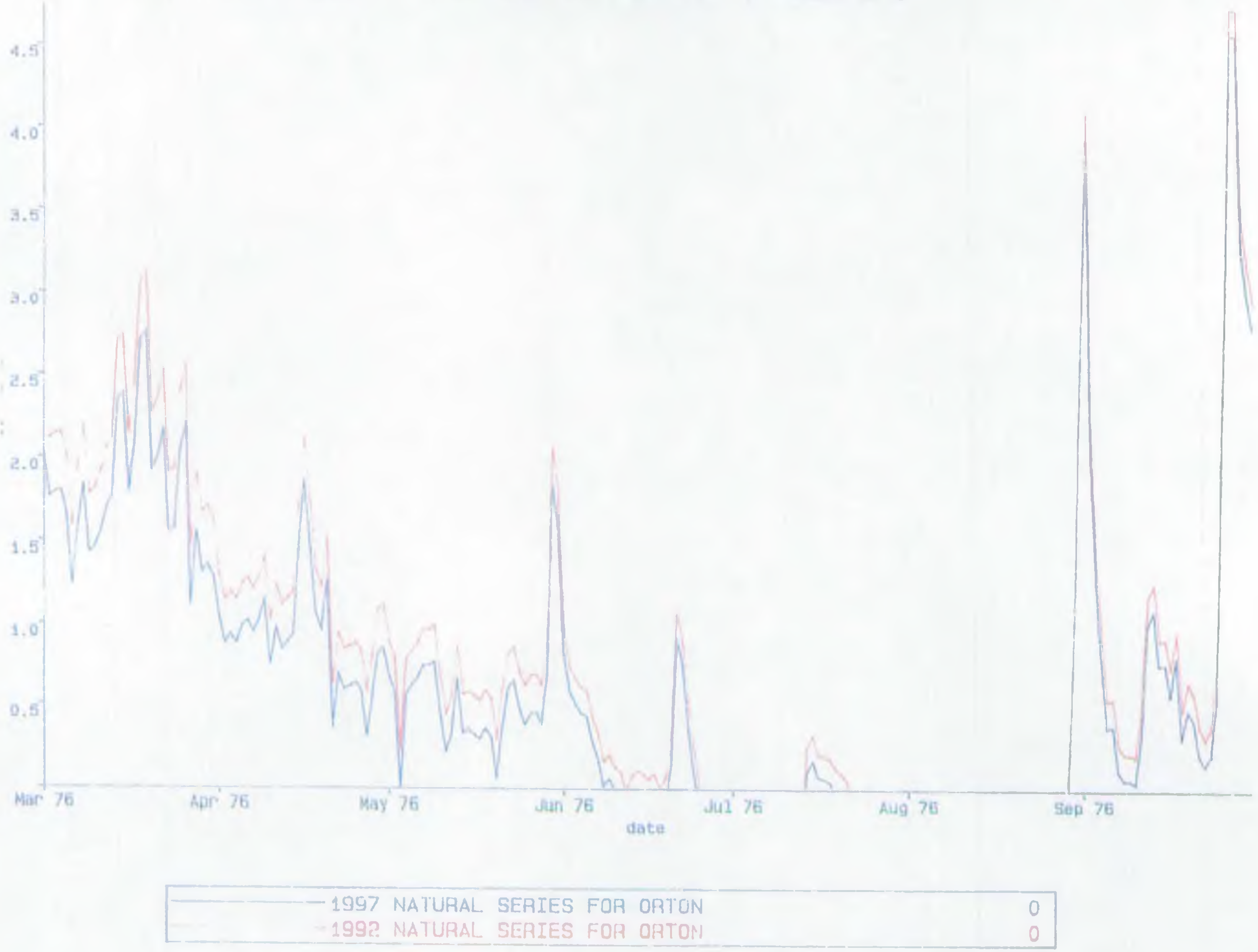


Fig 6 : Naturalised Flows of Watts (1992) and Cadman (1997), summer 1976



Negative flows

Negative flows exist in both the series generated by Watts and Cadman. These are given in Table 1. Negative flows in 1976 are too numerous to include in Table 1 and are plotted for both series in Fig 6. The reassessment of the industrial abstractions has caused changes to the magnitude of all the negative flows. The adjustment is positive in the early series and then reduces naturalised flows. The adjustments are given in Table 1. Data from 1990 also will be affected by the errors in Watts (1992) Wansford data.

Table 1 : Negative Flows in the Naturalised Flow Series, cumecs

Date	Watts	Cadman
July 30 1944	-0.035	-0.006
Aug 11 1944	-0.053	-0.007
Aug 15 1944	-0.053	-0.007
Aug 17 1944	-0.053	-0.007
July 29 1948	-0.133	-0.106
July 24 1965	-0.006	not negative
summer 1976	min. -0.653, July 12th	min. -0.798 July 12th
Aug 3 1983	not negative	-0.154
July 27 1990	not negative	-0.005

Negative flows at Orton are not possible and indicate errors in the naturalisation, or in the measurements at Orton gauging station. Negative flows are not present in the monthly flow series (Fig 7). The isolated values in years other than 1976 are on occasional days and could be explained by errors caused by averaging monthly artificial influence values to calculate a daily adjustment factor. This source of error is not present in the monthly flow series.

Periods of negative flow in 1976 are so prolonged that they cannot be explained by averaging from monthly to daily values. It is possible in such a severe drought that flow at Orton could be close to, even at, zero flow. This would suggest errors of (or over) between half and one cumec.

In a severe drought some components of artificial influence could change their behaviour. In 1976, the estimate of public water supply used in the naturalisation was reduced. This results in less input to the river system through sewage effluent. However, an error of half a cumec equates to a reduction of a third in effluent discharge, which is unlikely. Agricultural net abstractions would also be affected by drought, being initially higher than an estimate based on average use, then lower due to restrictions. However, the total licensed quantity for spray irrigation in 1996 (water from other agricultural abstractions is assumed to find its way to the river) is only 4.3 TCMD. Although this is concentrated into the summer months, and all the water used is lost, this quantity is too small to explain the errors and does not merit a more thorough investigation. When the Regional uptake factor used in microlowflows (0.59) is applied to the licensed total, the estimate of 3 TCMD loss in AGIND.DAT seems a reasonable estimate.

6.0 POSSIBLE FUTURE IMPROVEMENTS

The components of artificial influence, Fig. 8 and Appendix 4, give the relative importance of the different components throughout the time series. The naturalised flow series is equally sensitive to changes in any component of the correction factor so the larger the factor the greater its influence upon the flow. If improvements are sought, effort should be focused. Many components of artificial influence are of only marginal significance.

The most likely sources of error in the early series are errors in the estimates of public water supply (which are most likely in the record prior to 1971 due to the different basis of the estimates), reservoir inflow and non reservoir public water supply. This is at least in part due to the temporal resolution of this data. At a gauging station as complicated as Orton, there is also the likelihood of measuring error in the original gauged series.

In more recent years, large errors are only likely from:

- Wansford abstraction.
- Public Water Supply Effluent.
- Reservoir Inflow.
- Duston abstraction.
- Inaccurate measurement at Orton Gauging station.

For recent conditions in the catchment, some obvious further work might be to investigate the measurement of Wansford abstractions. This is the largest of the artificial influence components and is thought by Fawthrop (1990) to be erroneously measured. However, there was no abstraction at Wansford in July 1976, so this cannot account for all of the errors.

The benefit of applying a lag to some components of artificial influence (particularly daily Duston abstractions) or whether differences in the behaviour of the artificial influences during a severe drought could be better represented could also be investigated. The new gauging station at Wansford could also be used to improve estimates of gauged flow, and the estimate of reservoir inflow might also be refined. This last refinement could be achieved through consideration of the effect of storage as well as simply inflow, or by changing the independent variable in the regression relationship, perhaps to rainfall. (St Andrews gauging station is not independent of reservoir spill and is therefore not an ideal variable for regression, but rainfall which would not account for evaporation or any storage effects in the catchment.) However, changes to reservoir inflow are only likely to be useful for other uses of the naturalisation rather than for yield, as spills are only likely to affect high or medium flows, which have

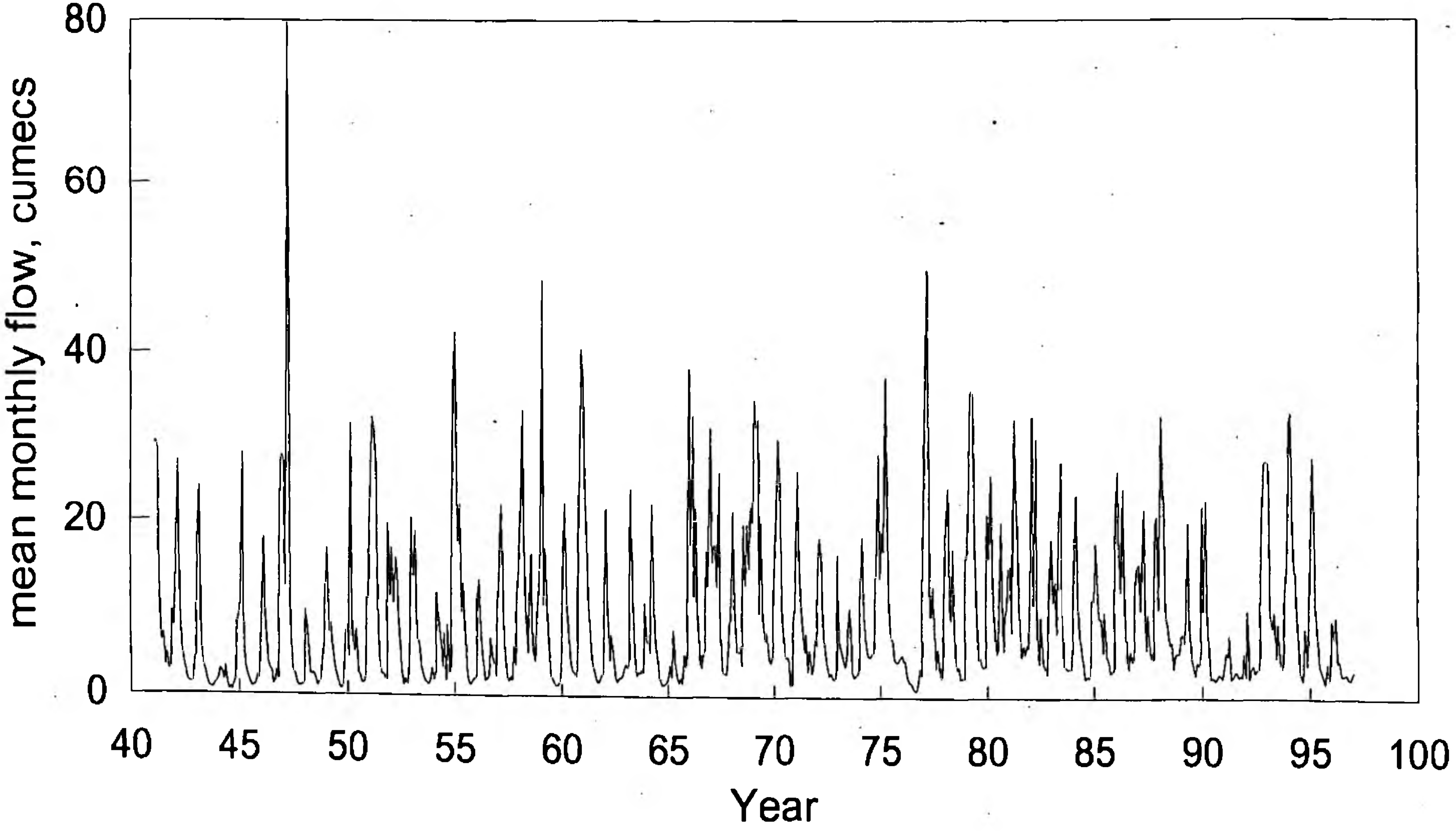
Table 1:
The nett effect of Revising Direct Industrial abstraction, changing percentage return from Corby Steelworks and corrections to "Corby.D

UNITS: TCMD

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Average over year
1941	2	1	1	1	1	1	0	0	0	0	0	1	1
1942	1	1	1	1	0	0	0	0	0	0	0	0	1
1943	0	0	0	0	0	0	-0	-0	1	1	-0	-0	0
1944	2	2	2	2	2	1	1	1	1	1	1	0	1
1945	-0	0	-0	0	0	0	0	0	0	0	0	0	0
1946	-0	0	0	1	1	1	1	1	1	1	1	0	1
1947	0	0	0	0	0	0	0	0	0	-0	0	1	0
1948	0	-0	0	0	-0	-0	-0	-0	-0	-0	-0	-1	-0
1949	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0	-0	-1	-1
1950	-1	-0	-1	0	1	1	1	1	1	-1	-1	-0	-0
1951	-1	-0	-1	-1	-1	-1	0	0	0	0	0	-1	-0
1952	-2	-1	-2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1953	-1	-1	-2	-2	-2	-1	-1	-1	-1	-1	-1	-1	-1
1954	-1	-0	-0	-0	-1	-0	-2	-1	-2	-2	-2	-2	-1
1955	-1	-1	-1	0	0	1	0	1	0	1	1	1	0
1956	0	0	0	0	-0	-0	-0	0	0	-1	-1	0	-0
1957	0	-1	-2	-2	-2	-2	-0	-0	0	-1	-0	-1	-1
1958	-2	-2	-2	-2	-2	-1	-2	-2	-2	-2	-2	-2	-2
1959	-2	-1	-2	-2	-2	-2	0	0	0	1	1	1	-1
1960	1	-2	-2	-2	-2	-2	-1	-1	-0	-0	-2	-2	-1
1961	-3	-3	-3	-3	-2	-2	-1	-1	-1	-1	-0	-1	-2
1962	-0	-2	-2	-1	-2	1	-0	-0	-0	-0	-0	-0	-1
1963	-3	-2	-2	-1	-3	-3	-3	-2	-3	-3	-1	-1	-2
1964	-0	-0	0	-1	-2	-2	-2	0	0	0	0	0	-1
1965	1	1	1	1	1	1	1	1	1	1	1	-1	1
1966	-3	-3	-4	-4	-4	-4	-4	-4	-2	-2	-2	-3	-3
1967	-4	-3	-5	-5	-5	-5	-5	-5	-5	-2	-2	-4	-4
1968	-5	-5	-6	-6	-6	-5	-5	-6	-6	-6	-6	-6	-6
1969	-7	-7	-7	-7	-7	-7	-7	-7	-7	-7	-5	-5	-7
1970	-7	-7	-8	-8	-8	-8	-8	-8	-6	-6	-6	-6	-7
1971	-7	-7	-8	-8	-9	-9	-9	-9	-9	-7	-7	-7	-8
1972	-8	-9	-10	-10	-10	-10	-10	-10	-8	-8	-8	-8	-9
1973	-9	-9	-9	-9	-9	-8	-9	-9	-9	-9	-9	-9	-9
1974	-17	-17	-18	-18	-18	-18	-17	-17	-17	-17	-18	-18	-18
1975	-21	-20	-21	-21	-21	-20	-21	-20	-19	-19	-19	-19	-20
1976	-20	-20	-19	-19	-19	-20	-19	-19	-19	-19	-20	-20	-20
1977	-21	-22	-22	-22	-21	-21	-23	-22	-23	-22	-22	-22	-22
1978	-23	-22	-23	-24	-24	-23	-24	-23	-24	-24	-23	-23	-23
1979	-24	-24	-23	-25	-25	-25	-25	-25	-25	-25	-24	-24	-24
1980	-26	-23	-23	-27	-23	-24	-25	-24	-24	-26	-24	-24	-24
1981	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27	-27
1982	-28	-28	-28	-28	-28	-28	-28	-28	-28	-28	-28	-28	-28
1983	-29	-29	-28	-29	-29	-29	-29	-29	-29	-29	-29	-29	-29
1984	-30	-30	-30	-29	-30	-30	-29	-29	-30	-29	-29	-29	-29
1985	-30	-30	-30	-30	-30	-30	-30	-30	-31	-30	-30	-30	-30
1986	-32	-32	-32	-32	-32	-32	-31	-31	-31	-31	-31	-31	-31
1987	-32	-33	-33	-32	-32	-32	-32	-32	-33	-33	-33	-33	-32
1988	-34	-33	-33	-33	-33	-33	-33	-34	-34	-34	-34	-34	-33
1989	-35	-35	-35	-35	-35	-35	-34	-34	-35	-35	-35	-34	-35
1990	-35	-35	-36	-35	-35	-35	-35	-35	-36	-36	-36	-35	-35
1991	-37	-37	-37	-36	-36	-36	-36	-36	-36	-36	-36	-36	-36
1992	-38	-38	-38	-37	-37	-38	-37	-38	-37	-37	-37	-37	-37
1993	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38	-38
1994	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39	-39
1995	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40

Fig 7

Estimated natural flows at Orton



little effect on Rutland yield.

Even if all of the magnitude of the components were accurately known, however, accounting for their quantities will not equate to an accurate representation of what would have occurred had the artificial influences not been operating. Having altered the flow in the watercourses, the artificial influences have also altered the catchment processes (such as time of travel or river - bankside interactions) which produced the recorded flow at Orton. These secondary effects of the artificial influences could have a substantial effect. The effects on times of travel within the system will cause a redistribution of flows across the timesteps and might therefore be particularly important in the daily record relative to the monthly.

Naturalisation, therefore, will always be imprecise. The errors in the series could be written off as tolerable and the estimates taken to be the best that can be economically made. The eradication of negative numbers only removes the obvious errors. Relatively small changes to some data files, within the assumptions made in their derivation, could reduce the incidence of negative numbers in the early part of the series. However, their presence is a useful reminder not to overestimate the accuracy of the series.

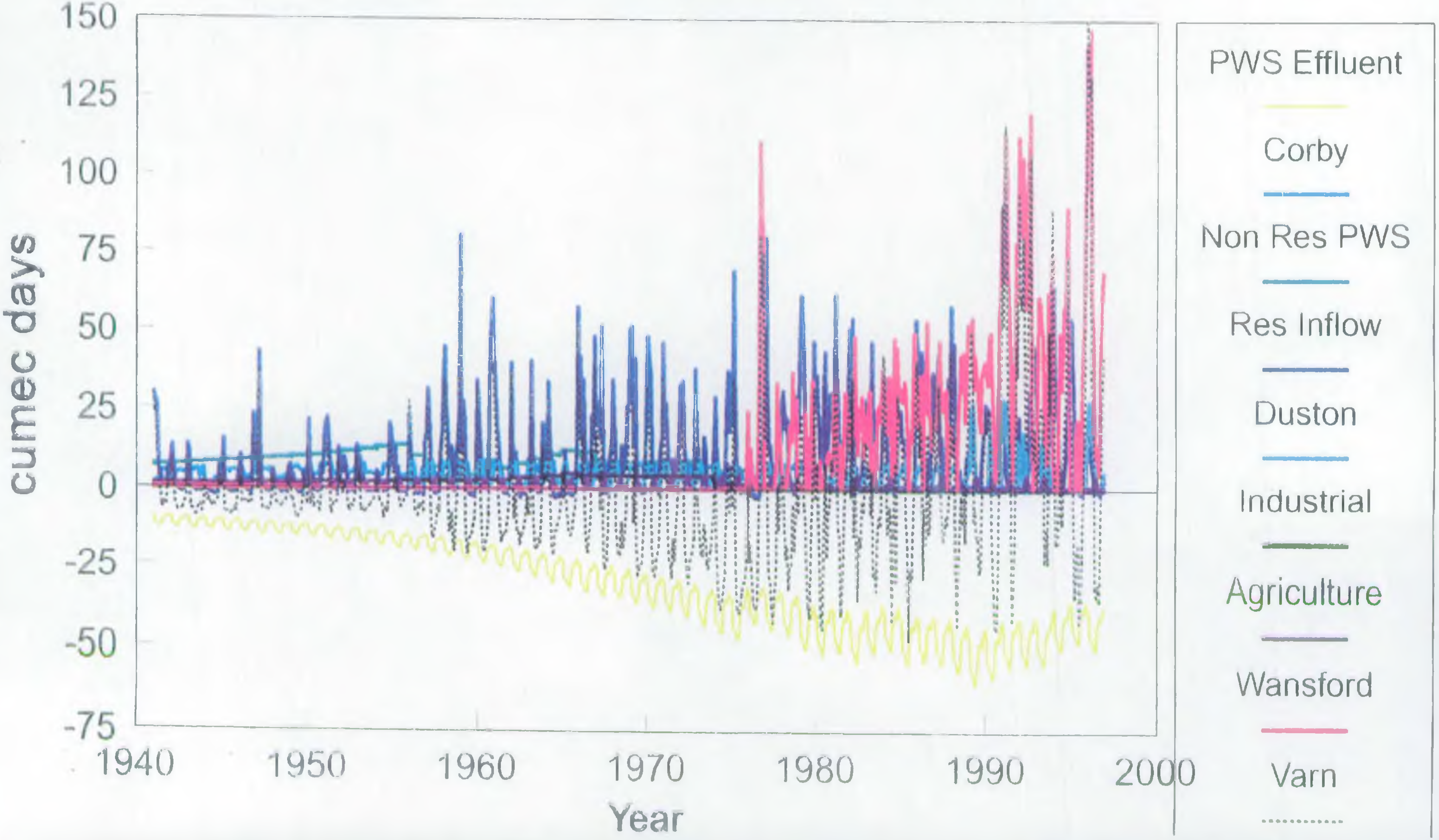
7.0 REFERENCES

Fawthrop N. 1990. Naturalisation of the Orton River Flow Record. National Rivers Authority, Anglian Region

Watts G. 1992. Naturalisation of the Orton Flow Record. National Rivers Authority, Anglian Region

Cadman D. 1997. Treatment of Direct Industrial Abstractions in the Naturalisation of the Orton Flow Record. Environment Agency, Anglian Region.

Fig 8: Artificial Influences, Orton



APPENDIX 1

LISTING OF FLOWNA6.FOR

```
c*****************************************************************
c
      program flowna
c
c*****************************************************************
c This program calculates monthly correction factors for the River      Pencil edits included 1/12/98
c Nene at Orton.
c The method used follows that of Nigel Fawthrop in "Naturalisation
c of the Orton River Flow Record" (NRA, 1989, revised July 1990).
c The major changes are to allow all data to be read from files
c (rather than hard-coded into the program) and to read the data one
c year at a time (rather than taking the whole record). This allows
c the program to be used on extended data sets when these become
c available. Reading data from files will also allow the sensitivity
c of the naturalised flow to different parameters to be assessed.
c
c Written by Glenn Watts
c
c Version 5:  23 February 1993
c
c Includes hard coded monthly effluent factors                           // modify to read from file ✓
c
c Version 4:  24 November 1992
c    uses monthly Duston abstractions 1989 onwards          ?  1969 ✓
c
c
c Version 3:  11 November 1992
c    uses daily Wansford abstractions 1975 onwards & creates
c    daily correction values
c
c Version 2:  October 1992
c    Creates daily correction values

c Version 1:  11 September 1992
c
c*****************************************************************
c
c  variables;
c     filen:    file names used for input/output
c     indabs:   industrial abstraction for year
c     indam:    industrial abstraction for month
c     nrpws:    non reservoir PWS for year
c     nrpwsm:   non reservoir PWS for month
c     mdfac:    monthly demand factor (reservoir PWS)
c     agfac:    monthly ag demand factor
c     dusfac:   monthly factor for Duston abstraction
c     wa:       daily Wansford abstraction
c     sadf:     St Andrews daily flow
c     samlt:    St Andrews monthly flow long term means
c     efffac: monthly factor for effluent ✓
c-----------------------------------------------------
      real indabs,indam,losses,nrpws,nrpwsm,mdfac(12),lday
      character*40 filen(20)
      dimension agfac(12),dusfac(12),ceff(12),wa(31),sadf(31),
     &  samlt(12),varday(31),dusab(12),efffac(12)
c
c     data efffac/3*0.95,2*0.9,2*0.85,0.8,0.85,0.9,2*0.95/             // ✓
c
c
      write(6,9999)
9999  format(2x,'This program calculates monthly correction factors',
     & ' for flow at Orton GS.',/,/,2x,
     & 'Version 1  11/9/92   Glenn Watts',/,/,/)
c
c   open file for reading other file names from. This file is called
```

```
c     'files.in' - if it does not exist the program will fail.  It must
c     contain a list of file names, one per line, for the following
c     data:
c      yearly profile of PWS demand              unit 12
c      yearly profile of Duston abstractions   unit 13
c      yearly profile of ag demand              unit 14
c      yearly data for PWS supply               unit 15
c      yearly data for reservoir factors       unit 16
c      yearly data for Duston abstractions      unit 17
c      monthly data for Duston abstractions >69 unit 18          *
c      yearly data for ag and ind abstractions unit 19
c      monthly data for Corby supply           unit 20
c      Wansford daily abs (76 onwards)          unit 21
c      St Andrews mean daily flows             unit 22
c      St Andrews long term monthly means      unit 23 <- yearly profile of effluent factors. unit 24 /
[illegible] component {c      output - monthly corrections cumec days unit 24 25 /
                      {c      output - monthly corrections TCMD       unit 25 26 /               also create insert file name EFFFAC.DAT in files.in
correction term       {c      output - daily corrections cumecs       unit 26 27 /
                      {c      output - monthly corrections each day  unit 27 28 /
c
        open(unit=11,file='files.in',status='old')
        rewind 11
c
c     nfmax = number of files
c
        nfmax=16  17 /
        do 10 i=1,nfmax
          read(11,'(a)')filen(i)
10      continue
        close(11)
        do 11 i=1,nfmax-4
          open(unit=11+i,file=filen(i),status='unknown')
          rewind (11+i)
11      continue
c
c     initialise files where there is a header;
c
        do 110 i=1,5
          read(20,*)
110     continue
        read(21,*)
        do 120 i=1,3
          read(22,*)
120     continue
c
c     read in yearly profiles for PWS, Duston, agricultural demand
c     and long term mean monthly flows for St Andrews., effluent factors /
c     These are made up of 12 values on one line of a file
c
c     variable ierr is used for determining which file has ended
c     (useful for error reporting or normal end of program)
        ierr=12
        read(12,*,end=10000,err=10000)(mdfac(i),i=1,12)
        close(unit=12)
        ierr=13
        read(13,*,end=10000,err=10000)(dusfac(i),i=1,12)
        close(unit=13)
        ierr=14
        read(14,*,end=10000,err=10000)(agfac(i),i=1,12)
        close(unit=14)
        ierr=23
        read(23,*,end=10000,err=10000)(samlt(i),i=1,12)
        close(unit=23)
                                          <- ierr = 24
                                          /  read(24, [illegible]    )(efffac(i),i=1,12)
        do 15 i=nfmax-4,nfmax                close(unit=24)
```

```
         open(unit=11+i,file=filen(i),status='unknown')
         rewind (11+i)
  15     continue
        write(25,9899)  26 ✓
  9899  format('year month decyr pws corby nonres impound ',
     &       ' duston ind ag wansford varn')
        write(26,9901)     27 ✓
  9901  format(4x,'daily variation (cumecs)')
        write(27,9902)     28 ✓
  9902  format(4x,'monthly variation (cumecs)')
        write(26,*)  27 ✓
        write(26,*)  27 ✓
        write(27,*)  28 ✓
        write(27,*)  28 ✓
 c
 c    natualisation starts from January 1941
        iyr=1941
        imon=1
 c
 c    yearly loop;
 c
 c    NOTE: no checking of input file dates is carried out - if
 c          they don't start in 1941 errors will ensue
 c          (but the program may end unexpectedly early)
 200    continue
        write(6,*)iyr                       iyr in 4 digit ✓   ↑write(6, ) to screen, FTN77 ?!!
        ierr=15
        read(15,*,end=10000,err=10000)iyear,nrpws,pws      iyear in 4 digit ✓
        ierr=16
        read(16,*,end=10000,err=10000)iyear,resfac
        if(iyr.lt.1969)then              *
          ierr=17
          read(17,*,end=10000,err=10000)iyear,dusabs
        else
          ierr=18
          read(18,*,end=10000,err=10000)iyear,(dusab(i),i=1,12)
        end if
        ierr=19
        read(19,*,end=10000,err=10000)iyear,agabs,indabs
 c
 c    all 12 months of Corby steel supply are read at the same time
 c
        ierr=20
        read(20,*,end=10000,err=10000)iyear,(ceff(i),i=1,12)
 c
 c    Corby supply converted from MG to cumec days
 c    Effluent assumed to be 80% of supply
 c
        do 250 i=1,12
          ceff(i)=ceff(i)*0.052618*0.8
 250    continue
 c
 c    daily loop
 c
 c    ndm = number of days in month
 c    iyear & imont read but not used
 c
 400    continue
        if(iyr.gt.1975)then
          ierr=21
          read(21,9998,end=10000,err=10000)iyear,imont,ndm     reads 3i5 format. iyear in 2 digit - edit for this ✓
 9998     format(3x,3i5) (2x,i4,2i3) ✓
 c                                                     if iyear ≤ 20, iyear = iyear + 2000.
 c    in the following section use of a format too short for the     if iyear ≤ 999 iyear = iyear + 1900
 c    data should read over a number of lines
```

```
c
          read(21,9997,end=10000,err=10000)(wa(n),n=1,ndm)
9997        format(4x,8f9.3)
c
c       sum the values of wa for the month
c
          wat=0.
          do 500 j=1,ndm
            wat=wat+wa(j)
500       continue
        end if
        if(iyr.lt.1976)then
          wat=0.
        end if
c
c   now read in St Andrews mean daily flows -
c   NOTE - missing values are allowed for by using the long term
c   monthly average for the whole month
c
        ierr=22
        read(22,9996,end=10000,err=10000)iyear,imont,ndm     ] FFS format, iyear is 2 digit - edit for 4 digit
9996      format(3x,3i3) (2x,i4,2i3) -
        read(22,9995,end=10000,err=10000)(sadf(n),n=1,ndm) <-- if(iyear ≤ 20) iyear = iyear +2000
                                                                if(iyear ≤ 99) iyear = iyear - 1900
9995      format(4x,8f9.3)
c
c    samf = St Andrews monthly flow
c    sadmf = St Andrews daily mean flow
        samf=0.
        samax=-1000.
        do 100 j=1,ndm
          samf=samf+sadf(j)
          samax=max(sadf(j),samf)
100     continue
        sadmf=samf/real(ndm)
c
c   If there are missing values in the month, use long term
c   average for month...
c
        if(samax.gt.990)then
          sadmf=samlt(imont)
        end if
c
c       calculate the reservoir inflows (cumec days)
c       These are calculated from the St Andrews monthly flows
c       according to a relationship derived for Pitsford.  All
c       other reservoirs are assumed to have the same inflow per
c       unit area of the catchment - the factors have been read from a
c       file.
c       Formula is different after 1956 because Pitsford became
c       operational and therefore reservoir interception is increased.
c
        resm=0.0
        if(iyr.lt.1956)then
          resm=(resfac*(-0.115+(0.38*sadmf))*real(ndm))-
     &             (0.025*real(ndm))
        else
          resm=(resfac*(-0.115+(0.38*sadmf))*real(ndm))-
     &             (0.034*real(ndm))
        end if
c
c       now calculate the monthly components of yearly figures;
c       all values converted to cumecs from TCMD by multiplying
c       by 0.011574 and then to cumec days by multiplying by the
c       number of days in the month.
c
```

```
        pwsm=pws*mdfac(imon)*0.011574*real(ndm)
c
c      pwsmef = PWS effluent - 90% of total PWS
c
        pwsmef=efffac(imon)*pwsm
        nrpwsm=nrpws*0.011574*real(ndm)
        indam=indabs*0.011574*real(ndm)
        agdam=agabs*0.011574*real(ndm)*agfac(imon)
        if(iyr.lt.1989)then                                  = ?? 1969 ✓
          dusm=dusabs*0.011574*real(ndm)*dusfac(imon)
        else
          dusm=dusab(imon)*0.011574*real(ndm)
        end if
c
c      Now all the rest can be calculated;
c
        gains=pwsmef+ceff(imon)
c
        losses=nrpwsm+resm+dusm+indam+agdam+wat
c
        varn=losses-gains
c
c      Calculate the daily variation using Wansford daily
c      data (if available) - otherwise use monthly variation
c      figure divided out over month.
        if(iyr.gt.1975)then
          gday=(pwsmef+ceff(imon))/real(ndm)
          lday=(nrpwsm+resm+dusm+indam+agdam)/(real(ndm))
            do 750 i=1,ndm
              varday(i)=lday-gday+wa(i)
750         continue
c
        else
          do 850 i=1,ndm
            varday(i)=varn/(real(ndm))
850       continue
        end if
c
c      Decimal year is calculated for plotting purposes;
c
        dyear=real(iyr)+((real(imon-1))/12.)                 iyr is 4 digit ✓
c
c      Now write output to two files in cumec days and TCMD
c      The two files are attached to units 23 and 24
c                     25 ✓                     25 ✓ 26 ✓
        write(24,9993)iyr,imon,dyear,pwsmef,ceff(imon),nrpwsm,    iyr is 4 digit ✓
     &    resm,dusm,indam,agdam,wat,varn
9993    format(2x,2(i4,1x),f8.3,1x,9(f9.3,1x))
        pwsmef=pwsmef*86.4/real(ndm)
        ceffm=ceff(imon)*86.4/real(ndm)
        nrpwsm=nrpwsm*86.4/real(ndm)
        resm=resm*86.4/real(ndm)
        dusm=dusm*86.4/real(ndm)
        indam=indam*86.4/real(ndm)
        agdam=agdam*86.4/real(ndm)
        wat=wat*86.4/real(ndm)
        varna=varn*86.4/real(ndm)
26 ✓    write(25,9992)iyr-1900,imon,dyear,pwsmef,ceff(imon),nrpwsm,
     &    resm,dusm,indam,agdam,wat,varna        ceffm ✓
9992    format(1x,2(i2,1x),f8.3,1x,9(f8.1,1x))
c          ✓ i4,1x,i3,1x      27 ✓ 28 ✓
c      Daily variations to units ~~26 & 27~~
27 ✓    write(26,9969)iyr-1900,imon,ndm
28 ✓    write(27,9969)iyr-1900,imon,ndm
9969    format(3x,3i3)
              2x,i4,2i3 ✓
```

Does not output the correct variable.
Calculation of ceffm ok, but conversion file is wrong because ceff(imon) is output and not ceffm.

iyr is 4 digit, but o/p year as 2 digit - edit f

```
          27 ✓
     write(26,9968)(varday(i),i=1,ndm)
✓ 28 write(27,9968)(varn/real(ndm),i=1,ndm)
9968   format(4x,8f9.3)
c
c      increment month and if appropriate year;
c      transfer control either to read next month or next
c      year of data.
c
        imon=imon+1
        if(imon.gt.12)then
          imon=1
          iyr=iyr+1          —— iyr is 4 digit ✓
          goto 200
        else
          goto 250
        end if
10000  write(6,9991)filen(ierr-11),imon,iyr  ——
9991   format(2x,'Reached the end of file:',2x,a40,/,
    &  2x,'in month ',i2,' year ',i4)
       do 700 i=1,nfmax
         close(i+11)
700    continue
       stop
       end
```

notes :- ndm <u>not calculated</u> anywhere - only read in from FPS type file.

APPENDIX 2

LISTING OF NATFLO2

```
c*****************************************************************
c
       program natflo
c
c*****************************************************************
c
c    natflo calculates naturalised flows from a file of real gauged
c    flow data and a file of monthly corrections.  The corrections
c    are added to the real flows.
c
c    Version 2     7 October 1992
c       uses daily corrections
c    Version 1    23 September 1992
c    written by Glenn Watts
c
c-----------------------------------------------------------
c
        dimension ortgag(31),ortnat(31),varn(31)
        character*40 file1,file2,file3,file4
        character*80 line(3),head
        write(6,*)'Flow file?'
        read(5,'(a)')file1
        open(unit=1,file=file1,status='old')
        rewind 1
        write(6,*)'Correction file?'
        read(5,'(a)')file2
        open(unit=2,file=file2,status='old')
        rewind 2
        write(6,*)'Flow output file?'
        read(5,'(a)')file3
        open(unit=3,file=file3,status='new')
        rewind 3
        write(6,*)'Monthly flow output file?'
        read(5,'(a)')file4
        open(unit=4,file=file4,status='new')
        rewind 4
c
c    read header of flow file -
c    NOTE: flow file should not contain quality indicators
c
       do 100 i=1,3
         read(1,'(a)')line(i)
100      continue
c
c    add NATURAL to top line of flow file
c
       head='NATURAL  '//line(1)
       line(1)=head
       do 150 i=1,3
         write(3,'(a)')line(i)
150      continue
c
c    Read header of correction file
c
       do 155 i=1,3
         read(2,*)
155      continue

c    First read in flow data file;
c
200      continue
       read(1,9999,end=10000,err=10000)iyr,imon,ndm
9999     format(3x,3i3)
       read(1,9998)(ortgag(n),n=1,ndm)
9998     format(4x,8f9.3)
```

HFS format, 2 digit year (= iyr) - edit for 4 digit:

2x, i4, 2i3

if(iyr ≤ 20) iyr=iyr+2000

if(iyr ≤ 99) iyr=iyr+1900

```
      if(iyr.lt.41)then
        goto 200
      end if
c
c     Read variation from variation file;  variation in cumecs
c
      read(2,9999,end=10000,err=10000)iyr,imon,ndm
      read(2,9998)(varn(n),n=1,ndm)
c
      avflow=0.
      icount=0
      dvarn=0.
c
c   only correct gauged flow if it is not a missing value
c
      do 300 i=1,ndm
        if(ortgag(i).lt.998.)then
          avflow=avflow+ortgag(i)
          icount=icount+1
          ortnat(i)=ortgag(i)+varn(i)
          dvarn=dvarn+varn(i)
        else
          ortnat(i)=ortgag(i)
        end if
300   continue
      if(icount.gt.0)then
        avflow=avflow/real(icount)
      end if
      dyear=real(iyr)+(real(imon)/12.)
      dvarn=dvarn/real(ndm)
c
c   write calculated data to appropriate files
c
      write(3,9992)iyr,imon,~~ndm~~
9992    format('YM'~~1x,3i3~~)
      write(3,9991)(ortnat(i),i=1,ndm)
9991    format('GA',2x,8f9.3)
      write(4,9990)iyr,imon,dyear,avflow,dvarn
9990    format(~~2x,2i3,f7.3~~2(1x,f9.3))
      goto 200
10000   stop
      end
```

1941 ✓

iyr is 2 digit year – edit for 4 digit ✓

iyr = 2 digit year – FFS format – edit for 4 digit ✓

✓ (if (iyr ≤ 20) iyr = iyr + 2000)
(if (iyr ≤ 999) iyr = iyr + 1900

– dyear currently 2 digit (from iyr.) – 4 digit after edit ✓

i4,2i3 ✓

] o/p FFS format, iyr is 2 digit year – 4 digit after

] iyr is 2 digit – 4 digit after edit. ✓
dyear – – – – – –

i4,i3,1x,f8.3 ✓

– ndm not calculated, read from FFS type file ∴ assume read in correctly (re leap yr

APPENDIX 3

DATA FILES INPUT TO FLOWNA6.FOR

PWSDEM.DAT
DUSDEM.DAT
AGDEM.DAT
PWS.DAT
RESFAC.DAT
DUSABS.DAT
DUSMON.DAT
AGIND.DAT
CORBY.DAT
API [illegible] - WANSDAY.DAT
API found - STANDREW.DAT
STANMON.DAT
EFFFAC.DAT ← new file added.

AGDEM.DAT
PWSDEM.DAT
DUSDEM.DAT
CORBY.DAT
AGIND.DAT
DUSMON.DAT ✓
DUSABS.DAT
PWS.DAT
RESFAC.DAT
WANSDAY.DAT

Output files

CORRECT.CUM
CORRECT.TCM
VARN.DAY
VARN.MON

0.0 0.0 0.0 0.0 2.4 4.0 4.0 1.6 0.0 0.0 0.0 0.0

AGDEM.DAT: Agricultural abstraction profile.

2.2 2.5 2.3 1.4 0.0 0.0 0.0 0.0 0.0 0.6 1.3 1.7

DUSDEM. DAT: Duston abstraction profile.

0.8 0.9 1.0 1.1 1.1 1.25 1.2 1.1 1.0 0.9 0.9 0.8

PWSDEM.DAT: Public Water Supply profile.

Erratum: The factor of 1.25 for June, PWSDEM.DAT should read 1.2. See Errata.

CORBY WATER CO.-EYE BROOK RESERVOIR-PUMPED TO SUPPLY (UNITS M.G.)

						MONTH							ANNUAL
YEAR	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
1941	0	43.02	54.56	37.71	60.41	90.35	128.1	124.26	119.09	121.58	111.35	81.83	972.26
1942	51.84	64.11	88.53	94.45	107.67	113.16	121.07	119.91	116.3	108.67	115.75	121.74	1223.2
1943	116.53	107.39	116.58	121.33	123.23	134.23	143.07	142.13	74.76	91.65	143.52	145.25	1459.67
1944	33.22	28.55	31.12	28.54	33	45.27	39.54	67.46	52.97	49.04	35.16	122.6	566.47
1945	139.14	131.97	138.32	128.77	132.56	111.31	132.16	136.36	131.92	134.21	128.15	129.92	1574.79
1946	136.49	120.95	133.68	100.8	70.95	66.85	79.61	85.04	80.84	92.14	90.34	126.18	1183.87
1947	128.92	110.4	129.99	123.51	131.95	129.23	134.86	135.62	128.4	145.68	120.47	67.26	1486.29
1948	66.17	85.88	65.93	66.31	76.23	70.7	73.72	85.28	87.48	89.54	88.26	136.12	991.62
1949	153.02	141.74	141.18	148.51	164.19	166.59	143.76	135.26	132.84	86.95	87.94	111.3	1613.28
1950	178.61	155.46	173.94	125.98	88.4	100.47	101.56	101.31	95.15	175.38	176.89	168.65	1641.8
1951	186.22	166.87	178.52	177.48	184.32	180.3	103.71	103.24	110.61	106.43	102.67	177.76	1778.13
1952	184.45	163.23	171.63	152.4	113.82	108.96	116.83	121.13	124.56	142.35	142.41	130.07	1671.84
1953	129.29	108.11	195.29	183.22	186.7	120.01	117.11	118.46	120.25	120.27	110.53	109.73	1618.97
1954	105.7	89.32	92.52	94.8	104.3	101.74	177.37	163.7	180.07	185.17	174.72	182.41	1651.82
1955	187.01	181.12	203.22	114.86	125.56	99.56	102.34	102.02	104.7	85.21	73.04	58.14	1436.78
1956	57.6	62.03	67.84	63.3	75.38	70.89	72.21	58.48	64.07	153.51	149.14	58.26	952.71
1957	59.55	138.7	206.42	205.88	210.93	172.57	87.52	79.88	65.53	104.77	100.94	102.97	1535.66
1958	201.8	173.76	193.89	182.05	189.89	111.28	195.02	177.85	189.12	194.17	184.67	175.1	2168.6
1959	183.74	167.9	185.34	187.27	188.7	189.91	64.4	55	63.64	11.57	17.82	12.37	1327.66
1960	15.22	174.52	216.52	201.38	216.88	203.65	126.49	127.41	68.33	71.02	208.42	211.84	1841.68
1961	216.55	189.49	215.73	201.96	149.51	148.81	64.9	63.36	60.38	57.04	10.64	87.39	1465.76
1962	88.64	189.98	211.03	126.06	174.59	13.33	97.01	82.18	85.6	94.02	93.76	94.75	1350.95
1963	214.91	169.44	141.66	99.67	177.66	174.98	174.41	133.22	191.16	205.54	63.68	59.66	1805.99
1964	69.72	71.41	64.7	157.46	225.1	215.37	204.1	59.59	59.5	62.42	61.52	60.1	1310.99
1965	58.61	50.63	38.53	35.21	49.71	55.09	76.2	82.93	90.48	89.6	76.99	175.26	879.24
1966	160.6	141.36	194.92	186.27	185.89	194.04	194.51	184.68	100.01	89.46	79.9	146.03	1857.67
1967	121.68	79.66	219.88	211.82	220.67	215.25	219.68	204.28	207.9	13.6	2.38	122.19	1838.99
1968	131.71	119.66	219.36	201.85	205.13	123.79	130.91	204.66	201.92	191.5	193.59	193.27	2117.35
1969	190.39	183.5	198.77	187.85	207.4	199.97	208.79	204.29	199.31	208.61	95.38	93.64	2177.9
1970	117.29	126.72	212.21	202.13	209.21	176.66	183.03	180.94	91.26	91.67	87.6	92.91	1771.63
1971	90.06	86.26	164.16	163.26	208.19	189.6	205.45	197.35	194.82	86.78	71.92	78.96	1736.81
1972	76.92	130.66	173.75	172.65	177.13	216.93	219.57	204.14	93.66	100.21	95.93	96.76	1757.56
1973	96.93	88.58	88.77	69.31	44.77	33.31	37.61	82.76	70.76	81.51	64.34	54.51	812.6
1974	52.35	86.86	158.82	153.66	142.1	134.59	93.37	89.44	96.89	85.78	123.46	161.64	1378.65
1975	171.47	160.58	178.63	172.71	176.58	168.36	174.17	141.18	88.13	91.63	91.47	86.67	1707.22
1976	56.24	64.35	33.21	21	20.75	24.21	21.38	17.62	18.16	21.32	49.8	81.34	425.73
1977	91.55	144.73	156.5	148.79	163.13	156.18	188.58	171.58	179.36	120.01	136.46	132.32	1815.8
1978	111.15	101.8	121.34	178.72	179.98	174.44	186.63	165.66	177.77	188.84	160.08	110.16	1857.18
1979	116.09	163.4	169.16	187.06	197.3	197.19	185.84	179.5	192.76	179.64	128.19	122.8	2035.57
1980	119.01	65.77	41.14	149.8	117.69	124.51	127.36	109.99	97.67	104.93	78.97	75.23	1215.84
1981	72.9	62.9	70.38	60.96	53.4	55.25	50.22	55.19	48.91	46.56	45.97	47.86	667.63
1982	52.48	51.91	67.89	57.54	49.92	49.07	56.34	50.93	59.83	50.76	41.02	48.38	633.16
1983	53.77	45.17	42.1	43.19	41.98	41.32	42.8	38.6	50.21	56.61	45.69	44.57	549.09
1984	39.22	40.14	42.65	32.86	39.08	36.56	32.84	27.97	34.59	27.97	24.01	25.68	404.16
1985	30.14	24.41	29.97	26.73	29.3	32.76	29.37	28.43	34.57	34.48	32.4	25.58	358.54
1986	35.24	35.8	41.84	36.95	35.55	35.66	29.09	28.64	31.83	29.57	30.63	31.38	402.18
1987	39.16	35.32	37.17	30.74	35.64	35.2	30.82	21.45	35.7	36.08	36.21	35.42	412.01
1988	36.59	33.23	33.54	30.16	31.24	30.57	27.11	33.81	37.3	37.24	37.92	36.81	405.86
1989	39.08	34.99	35.47	37.43	34.51	36.07	31.98	28.98	37.23	40.8	36.32	28.21	421.07
1990	29.98	30.77	36.4	29.52	29.64	32.03	24.73	29.67	39.32	43.31	37.89	28.98	392.24
1991	37.52	38.07	34.52	30.47	30.16	28.07	31.22	24.89	28.76	27.3	29.77	33.09	365.84
1992	39.37	34.54	36.08	28.16	30.8	36.95	30.36	36.08	31.02	28.6	27.94	25.74	385.61
1993	23.98	17.16	19.8	14.3	19.14	20.24	19.36	17.16	19.8	18.04	20.02	21.12	230.09
1994	21.78	18.48	22.22	17.38	17.38	19.36	16.94	17.6	17.38	17.38	17.82	16.5	220.19
1995	17.47	12.84	14.08	14.59	13.74	15.21	15.44	19.31	18.32	15.8	12.48	12.81	182.07
1996	19.38	26.16	21.57	15.64	12.92	14.93	15.21	10.44	15.25	25.12	16.04	15.87	208.53

CORBY.DAT

Corby abstractions. MGD

1941	1	4
1942	1	4
1943	1	4
1944	1	4
1945	1	4
1946	1	5
1947	1	5
1948	1	5
1949	1	5
1950	1	6
1951	1	6
1952	1	6
1953	1	6
1954	1	6
1955	1	7
1956	2	7
1957	2	7
1958	2	7
1959	2	7
1960	2	8
1961	2	8
1962	2	10
1963	2	10
1964	2	12
1965	2	14
1966	2	12
1967	2	12
1968	2	12
1969	2	12
1970	2	12
1971	2	12
1972	3	12
1973	3	12
1974	3	5
1975	3	4
1976	3	4
1977	3	4
1978	3	4
1979	3	4
1980	3	4
1981	3	2
1982	3	2
1983	3	2
1984	3	2
1985	3	2
1986	3	2
1987	3	2
1988	3	2
1989	3	2
1990	3	2
1991	3	2
1992	3	2
1993	3	2
1994	3	2
1995	3	2
1996	3	2

AGIND.DAT

Yearly agricultural and industrial abstraction totals, TCMD

Duston Monthly abstraction

	j	f	m	a	m	j	j	a	s	o	n	d
1969	0	0	0	9	0	0	0	0	0	9	0	0
1970	43	54	0	0	0	0	0	0	0	0	11	30
1971	36	0	0	0	0	0	0	0	0	22	24	54
1972	53	54	39	38	0	0	0	0	0	0	2	49
1973	37	45	26	13	13	16	8	0	0	0	0	8
1974	74	82	77	0	0	0	0	0	0	25	28	0
1975	51	25	0	0	0	0	0	0	0	0	0	0
1976	7	1	2	0	1	1	0	1	6	30	41	56
1977	12	18	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	23	30
1983	23	23	23	23	0	0	0	0	0	0	0	30
1984	63	73	0	0	0	0	0	0	0	0	19	18
1985	30	43	45	68	47	26	0	0	0	0	0	40
1986	64	0	44	22	0	0	0	0	0	0	0	7
1987	42	63	19	0	21	0	0	0	0	0	0	28
1988	4	5	3	0	0	0	0	0	0	0	0	64
1989	17	75	77	61	0	0	0	0	0	0	0	0
1990	0	0	51	45	26	0	0	0	0	0	24	48
1991	81	54	78	47	34	22	27	3	6	19	45	37
1992	0	0	51	45	26	0	0	0	0	0	24	48
1993	0	11	0	11	53	42	22	7	22	30	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	13	54
1996	79	77	52	41	24	4	3	0	0	1	16	20

DUSMON.DAT:

Monthly abstractions at Duston Mill. TCMD

1941	0.
1942	0.
1943	0.
1944	0.
1945	0.
1946	0.
1947	0.
1948	0.
1949	0.
1950	0.
1951	0.
1952	0.
1953	0.
1954	0.
1955	0.
1956	10.
1957	10.
1958	10.
1959	10.
1960	10.
1961	10.
1962	10.
1963	10.
1964	10.
1965	10.
1966	10.
1967	10.
1968	10.
1969	10.
1970	10.
1971	10.
1972	10.
1973	10.
1974	10.
1975	6.7
1976	12.2
1977	2.4
1978	0
1979	0
1980	0
1981	0
1982	9.2
1983	10.5
1984	21
1985	23.7
1986	11.5
1987	11.7
1988	12
1989	20
1990	25
1991	37
1992	37
1993	17
1994	0
1995	6
1996	26

DUSABS.DAT

Estimates of Duston Yearly Abstractions, TCMD

1941	21	33
1942	22	34
1943	23	35
1944	24	36
1945	25	37
1946	26	38
1947	27	39
1948	28	40
1949	29	41
1950	30	42
1951	32	44
1952	34	46
1953	36	48
1954	38	50
1955	40	52
1956	30	54
1957	20	56
1958	10	59
1959	13	62
1960	16	65
1961	19	68
1962	23	72
1963	27	76
1964	31	80
1965	35	84
1966	33	88
1967	25	91
1968	24	94
1969	23	98
1970	25	102
1971	27	105
1972	26	109
1973	21	115
1974	17	121
1975	18	126
1976	0	113
1977	3	118
1978	0	122
1979	16	134
1980	11	138
1981	15	137
1982	7	145
1983	4	137
1984	0	134
1985	0	146
1986	0	144
1987	0	146
1988	0	153
1989	0	163
1990	0	158
1991	0	148
1992	0	147
1993	0	147
1994	0	134
1995	0	128
1996	0	134

PWS.DAT

Public water supply data, TCMD

Year	PWS abstraction from within the Nene catchment (ie 'non reservoir PWS)	Total PWS

```
1941  0.45
1942  0.45
1943  0.45
1944  0.45
1945  0.45
1946  0.45
1947  0.45
1948  0.45
1949  0.45
1950  0.45
1951  0.45
1952  0.45
1953  0.45
1954  0.45
1955  0.45
1956  1.45
1957  1.45
1958  1.45
1959  1.45
1960  1.45
1961  1.45
1962  1.45
1963  1.45
1964  1.45
1965  1.45
1966  1.45
1967  1.45
1968  1.45
1969  1.45
1970  1.45
1971  1.45
1972  1.45
1973  1.45
1974  1.45
1975  1.45
1976  0.96
1977  1.45
1978  1.45
1979  1.38
1980  1.38
1981  1.38
1982  1.38
1983  1.31
1984  1.31
1985  1.31
1986  1.31
1987  1.31
1988  1.31
1989  1.31
1990  1.31
1991  1.31
1992  1.31
1993  1.31
1994  1.31
1995  1.31
1996  1.31
```

RESFAC.DAT

Annual reservoir inflow factors.

DAILY ABSTRACTIONS AT WANSFORD PS (CUMECS)

76	1	31					
0	0	0	0	0	0.184	1.315	2.654
1.578	0	0	1.368	1.684	2.051	1.894	1.262
1.262	0	0.368	0.337	0.473	0.505	0.408	0
0	0.717	1.779	1.789	1.341	1.105	0.484	
76	2	29					
0	0	0	0	0	0	0	0
0	0	0	0.105	0	0	0	0
0	0	0	0.105	0	0	0.447	0.421
0.421	0.5	0.473	0	0			
76	3	31					
0.452	0.473	0.473	0.421	0.452	0	0	0.526
0.437	0.5	0.5	0.526	0	0	0.015	0.789
0.789	0.842	1.039	0	0	0.894	0.631	0.421
0.526	0.878	0	0	0.342	0.405	0	
76	4	30					
0.184	0	0	0	0	0	0	0
0.842	0.421	0.421	0.158	0.342	0.158	0.763	0
0	0	0	0.763	0.263	0.310	0.408	0
0	0.562	0.355	0.368	0.5	0.579		
76	5	31					
0	0	0	0.107	0.132	0.132	0.302	0
0.053	0	0.070	0.110	0.395	0.079	0	0
0.039	0.105	0.092	0	0.145	0	0	0.237
0.263	0.289	0.252	0.21	0	0	0	
76	6	30					
0.355	0.857	0.355	0.105	0	0.026	0.158	0.013
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0		
76	7	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
76	8	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0.310	0.310	0.316	
76	9	30					
3.182	2.078	1.368	0.855	0.316	0.263	0.092	0.039
0	0	0.356	1.31	1.157	0.473	0.818	0.5
0.738	0	0.053	0.310	0.107	0.079	0.158	0.158
1.131	3.988	4.524	3.314	3.103	3.051		
76	10	31					
2.019	2.988	2.472	2.262	3.077	2.157	1.841	2.827
3.051	3.499	2.988	2.367	2.919	3.09	4.368	3.419
3.735	4.05	4.524	2.919	5.207	4.839	4.603	3.735
3.419	3.314	3.945	4.681	4.882	5.418	5.570	
76	11	30					
3.847	3.858	3.865	3.872	3.870	0	0	3.905
3.912	3.92	3.926	3.929	0	0	3.942	3.947
3.951	3.957	3.963	0	0	3.977	3.981	3.988
3.988	3.991	0	0	4.001	4.007		
76	12	31					
4.015	4.02	4.026	0	0	4.043	4.048	4.054
4.06	4.065	0	0	4.079	4.083	4.087	4.091
4.095	0	0	4.113	4.118	4.122	4.124	4.127
0	0	0	0	4.134	4.138	4.139	
77	1	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
77	2	28					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0				
77	3	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
77	4	30					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0		
77	5	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
77	6	30					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0		

77	7	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
77	8	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
77	9	30					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0.631	0.947
1.157	1.105	1.105	0.736	0.210	0.421	0	0
0	0	0	0	0.631	1.262		
77	10	31					
1.262	1.262	1.262	0.526	0	0.368	1.262	1.262
1.262	1.236	1.262	1.262	0.842	0.868	1.262	1.262
0.921	1.262	1.262	1.262	1.262	1.262	1.262	1.262
1.262	1.262	1.262	0.805	1.262	1.262	0.805	
77	11	30					
0.473	0.579	0.395	0.184	1.157	1.262	0.579	0.579
0.805	0.805	0.805	0.079	0	0.184	0.579	0.579
0.526	0.579	1.262	1.262	0.805	0.579	0.579	0.579
0.579	1.262	1.262	0.421	0.107	0.894		
77	12	31					
0.579	0.526	0.789	0.894	1.262	1.262	1.262	0.395
0	1.105	1.262	0.579	0.631	0.368	0	0
0.473	0	0	0	0	0	0	0
0.105	0.421	0.552	0.579	0.579	0.395	0	
78	1	31					
0	0.158	0	0	0	0.184	0.71	1.052
0.5	0.395	0.526	0	0	0	0	0
0	0	0	0	0	0.132	0.763	0
0	0	0	0	0.473	0.526	0.395	
78	2	28					
0.31	0.579	0.395	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0				
78	3	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
78	4	30					
0	0	0	0	0	0.526	0.894	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0		
78	5	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	1.262	1.262	1.262	0.815	0.829	
78	6	30					
0.894	0.447	0.421	0.473	0	0	0	0.368
0.579	1.262	1.262	0.631	0.579	0.526	0.526	0.395
0	0	0	0	0.21	0	0	0
0	0	0	0	0	0		
78	7	31					
0	0	0	0.184	0.631	0.631	0.631	1.262
1.262	0.395	0	0.184	0.789	1.262	1.262	0.894
1.262	0.842	0	0.276	1.262	1.262	1.262	1.262
1.262	1.262	1.052	0	0	0	0	
78	8	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.631
1.21	1.21	1.21	1.21	1.21	1.21	0.894	0
0	0.368	1.262	1.262	1.157	1.262	1.262	
78	9	30					
1.262	1.262	1.262	1.262	1.157	1.262	1.262	1.262
1.262	1.262	1.262	1.262	1.21	1.21	1.262	1.262
1.262	1.262	1.105	1.262	1.262	0.868	1.262	1.262
1.262	1.262	1.262	1.262	1.262	1.105		
78	10	31					
0	0.421	1.262	1.157	0.894	0.473	0.5	0.5
0.526	0.631	0.947	0.868	0.842	0.842	0.842	0.842
0.579	0.579	0.579	0.579	0.631	0.736	0.679	0.763
0.736	0.473	0.684	0.789	0.684	0.579	0.631	
78	11	30					
0.657	0.684	0.684	0.736	0.947	1.144	1.105	0.71
0.842	0.842	0.842	0.842	0.894	0.894	0.894	0.868
0.868	0.868	0.947	1.262	1.262	1.262	1.262	1.262
1.262	1.262	1.052	0.921	0.894	0.789		
78	12	31					
0.842	0.763	0.789	0.789	0.526	0.526	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	

```
   79       1      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   79       2      28
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0
   79       3      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   79       4      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
   79       5      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   79       6      30
    0       0       0       0       0       0       0   0.838
1.278   1.276   1.276   0.928   0.528       0       0       0
0.737   1.276   1.276   1.276   2.158   1.264   1.264   1.264
1.264   1.264   1.264   1.264   1.264   1.949
   79       7      31
2.529   2.529   2.529   1.865       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   79       8      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   79       9      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
   79      10      31
    0       0       0       0       0       0       0       0
    0       0       0   0.429   1.276   1.276   1.276   1.276
1.276   1.276   1.276   1.276   1.276   1.270   1.008   1.276
1.276   0.835   1.276   1.276   1.276   1.276   1.276
   79      11      30
1.270   1.276   1.276   1.276   1.278   1.278   1.278   1.276
1.278   1.270   1.276   1.276   1.270   1.276   1.274   1.270
1.276   1.276   1.376   1.276   1.276   1.376    0.65   1.276
1.278   0.592    0.58   0.015   0.003   0.003
   79      12      31
1.276   1.376    0.58    0.58    0.58    0.58    0.58   1.276
1.278   0.847   0.522       0       0   0.128   1.278   1.270
0.418       0       0       0       0       0       0       0
0.174   0.003   0.050       0       0       0       0
   80       1      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   80       2      29
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0   0.058   0.476       0       0
    0       0       0       0       0
   80       3      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0   0.209   1.264   1.264   0.789       0
   80       4      30
    0   0.754   1.264   1.264   1.264   1.264   1.264   1.264
0.835       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
   80       5      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   80       6      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
```

```
     0      0      0      0      0      0      0      0
     0      0      0      0      0      0      0      0
     0  0.545  1.264  0.696      0      0      0      0
     0      0      0      0      0      0      0
    81      6     30
  0.07      0      0      0      0      0      0      0
     0      0      0  0.464  0.847  0.847  0.812  0.812
 0.812  0.812  0.832  0.812  0.812  0.812  0.812  0.812
 0.812  0.812  0.815      0  0.812  0.696
    81      7     31
     0      0      0      0      0      0      0      0
     0      0      0      0      0      0      0      0
     0      0      0      0      0      0      0      0
     0      0      0      0      0      0      0
    81      8     31
     0      0      0      0      0      0      0      0
     0      0      0      0      0      0      0      0
     0      0      0      0      0      0      0      0
     0      0      0      0      0      0      0
    81      9     30
     0      0      0      0      0      0      0      0
     0  0.081  0.470  0.470  0.673  0.835   0.87  0.639
 0.128  0.812  0.812  0.812  0.812  0.394   0.58  0.812
 0.812  1.912  1.977  0.812  0.882  0.812
    81     10     31
 0.789  0.847  0.918  1.794  1.058  0.835  0.835  0.835
 0.883  1.071  2.529  2.529  0.639  0.812  0.847  0.847
 1.022  1.346  1.794  0.847  0.452  0.812  0.789  0.789
 0.905  0.835  0.882  0.882  0.812    0.9    0.9
    81     11     30
   0.8  0.812  0.824  0.817  0.883  0.812  0.824  0.824
 0.824  0.835  0.824  0.824  0.824  0.557   0.29  0.408
 0.408  0.835  0.835  0.835   0.94   1.74  1.624  0.835
 0.835  0.847  0.835   0.94   1.74  1.601
    81     12     31
 0.812  0.408  0.812  0.824  0.851   1.74  1.601  0.777
 0.464  0.418  0.418  0.777  0.888  2.529   2.32  0.777
 0.789  0.789  0.789  0.789      0      0  0.789  0.847
     0      0      0      0  0.789  0.812  0.812
```

80	7	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	
80	8	31					
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0.534	-1.114	0.371	0.418	0.418
0.418	0.418	0.418	0.418	0.418	0.418	0.348	
80	9	30					
0	0	0.07	0.418	0.418	0.418	0.418	0.418
0.383	0.383	0.383	0.336	0	0	0.07	0.383
0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383
0.383	0.383	0.383	0.383	0.464	0.58		
80	10	31					
0.406	0.182	0.522	0.527	0.522	0.812	0.383	0.383
0.383	0.638	0.406	0.478	0.522	0.789	1.102	0.487
0	0	0	0	0	0	0	0
0.174	1.264	0.51	0.383	0.07	0.464	0.406	
80	11	30					
1.264	1.264	0.567	0.383	0.383	0.383	0.348	0
0	0	0	0	0.07	0.406	0	0
0	0	0	0	0.058	0.336	0.07	0.255
0.07	0.139	0.394	0.394	1.044	1.044		
80	12	31					
0.534	0.568	0.394	0.464	0.348	0.07	0.348	0.186
0.603	0.58	0.582	0.58	1.102	1.264	0.58	0
0	0	0	0	0.058	0.406	0	0
0	0	0	0	0	0	0	
81	1	31					
0	0.186	0.603	0.394	0.07	0.336	0	0
0.129	0.603	0.582	0.568	0.478	0.557	0.129	0
0	0	0.035	0.209	0	0	0	0
0	0	0.408	0	0	0	0	
81	2	29					
0	0	0.325	0	0.151	0.51	1.264	1.264
0.829	0.394	0.174	0.394	0.51	0.829	0.478	0.464
0.829	0.829	0.603	1.348	2.529	2.529	2.529	2.529
2.529	2.529	2.529	1.74				
81	3	31					
1.102	1.102	1.102	1.102	1.102	1.102	1.102	1.102
1.102	1.102	0.522	0	0	0	0	1.18
2.529	2.529	2.529	1.74	1.264	1.264	1.264	1.264
1.264	1.264	1.264	1.264	1.264	0.408	0	
81	4	30					
0	0	0	0.058	0.383	0	0.104	0.394
0.081	0.478	0.474	0.478	0.408	0.478	0.478	0.557
0.87	0.87	0.754	0.406	0	0	0	0.151
0.754	0	0	0	0	0		
81	5	31					

```
   82       1      31
0.812   0.812   0.812   0.812    0.87   0.847   0.464   0.464
    0   0.452   0.452   0.464   0.182   0.464   0.847   0.789
0.812   0.452   0.452   0.452   0.464   0.470   0.476   0.464
0.464   0.429   0.452   0.452   0.476   0.452   0.476
   82       2      28
0.452   0.452   0.464   0.470   0.464   0.470   0.476   0.470
0.499   0.464   0.452   0.452   0.452   0.487   0.476   0.470
0.429   0.118   0.464   0.470   0.476   0.499   0.534   0.835
0.883   0.464   0.464   0.464
   82       3      31
0.464   0.476   0.882   0.470   0.452   0.476   0.464       0
    0       0   0.824   0.812   0.812   0.464   0.464       0
0.835   0.824   0.824   1.058   2.529   2.309   0.452   0.452
0.452   0.476   0.568   1.264   1.172   0.464   0.476
   82       4      30
    0   0.476   0.487   0.470   0.476   0.464   0.464   0.470
    0   0.742       0       0       0       0    0.87   0.824
0.835   0.835   0.847   0.835     0.8   0.812   0.789   0.963
0.963   0.963   0.476   0.812   0.824   0.812
   82       5      31
  0.8    1.67    1.67    1.67   1.438   1.705    1.67   1.682
1.752    1.67   1.752   2.239   2.529   1.636   1.299   1.334
1.322   2.158   1.264   1.218   1.218   1.264   1.264   1.392
1.322   1.322   0.313   1.508   2.529   2.401    1.45
   82       6      30
1.264   0.255    1.09   1.264    2.32   2.085   1.264   1.264
 2.03   2.239   1.264   1.264   1.264   1.264   1.218   1.264
1.264    1.23       0       0       0       0       0       0
    0       0       0       0       0       0
   82       7      31
    0       0   0.499   0.487    0.58    0.65   0.499    0.51
    0       0       0       0       0       0       0   0.499
0.499   0.487   0.464   0.418   1.218   0.899   0.325   0.487
0.487   0.487   0.487   0.487   0.499   0.499       0
   82       8      31
0.499   0.905   1.264   1.264   1.102   1.137   1.264   1.264
1.264   1.149   1.299   1.264   1.264   1.264   1.264   1.308
0.487   0.487   0.487   0.487   0.476   0.487       0   0.499
0.557   1.125   0.487   0.487   0.499   0.487   0.487
   82       9      30
0.499   1.148       0   0.626   1.102   1.172   1.102   1.102
1.102   1.032   0.476    0.65   0.429   0.441   0.499   0.429
0.557   0.545   0.476   0.499   0.429    1.18   1.137   1.264
1.299   1.299   1.264   0.883       0   0.848
   82      10      31
1.264   1.264   1.264   1.102   1.264   1.264   1.264   1.264
1.264   1.438   0.568       0   0.974   1.264   1.264   2.076
2.529    1.07   1.264   1.264   1.264   0.139       0       0
    0       0       0       0   0.888   0.499   1.102
   82      11      30
1.032   0.499   0.464   0.406   0.429   0.429   0.429   0.418
0.418   0.429       0       0   0.568   1.241   1.172       0
    0       0       0       0       0   1.137       0       0
    0       0       0   0.023   1.183   0.476
   82      12      31
0.464   0.452   0.418   0.557   1.241   1.032   0.545       0
1.102   0.789       0       0       0    1.09    1.09   1.102
1.079   1.299   1.985   1.902       0       0   1.079       0
    0       0       0       0   1.114       0       0
   83       1      31
    0       0       0       0   1.079   1.079   1.079   1.288
2.529   2.309   1.114       0       0       0   1.288   2.529
2.262       0       0       0       0       0       0       0
    0   0.592   0.557   0.557   1.044   2.529   1.868
   83       2      28
0.522       0       0   0.615       0       0       0   1.008
1.044   1.032       0       0       0       0       0       0
    0   0.522   0.881   1.264    1.18       0    0.58   0.568
0.522   0.673   2.386   2.308
   83       3      31
1.044       0    0.58   0.522   0.881   1.264   1.172   0.568
0.568   0.394    0.51   0.884   1.264   1.183   0.803   0.883
1.056   1.079   1.211   2.529   2.308   1.021       0   0.986
0.548   0.881   2.297    2.32   1.021   1.021   1.021
   83       4      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0   0.881       0       0       0
    0   2.085       0   0.835   2.529   0.883
   83       5      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
0.325       0       0       0       0       0       0       0
    0       0   2.401   1.508    0.22       0       0
   83       6      30
    0       0       0       0       0       0       0       0
    0   0.873   1.264   0.278       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
```

```
   83      7     31
    0      0      0      0      0      0   0.94  1.264
0.545  0.835  1.264  1.264  0.847  1.299  1.264  1.264
1.218      0      0      0      0      0      0      0
    0  0.731  1.264   1.16      0      0      0
   83      8     31
    0      0      0      0      0  0.824  1.264  1.264
1.264  1.102      0      0      0      0      0      0
    0      0  0.835  0.348      0      0      0      0
    0      0      0      0      0      0      0
   83      9     30
    0   0.29      0  0.835      0      0      0      0
    0      0  0.174  1.427  1.264   0.27  0.499  1.218
1.264  1.264  2.262  1.102  1.288  2.529  2.436  1.264
0.708  1.264  1.044  1.264  1.044  0.812
   83     10     31
0.464  0.986  1.172  1.264  1.264  0.929  0.929  0.978
0.851  1.125  1.264  1.208  1.044  2.181  2.078  2.529
1.568   0.58  0.898  1.264  1.264  0.464      0  0.418
    0      0      0      0      0      0      0
   83     11     30
    0      0  0.487  0.548  1.102  1.032  0.441  0.548
0.548  0.548  0.545  1.021  1.032  0.568   0.51  0.548
 0.51  0.545  0.898  1.087  0.522      0  0.464      0
 0.58  1.798  2.424  0.988  1.566  1.032
   83     12     31
1.032  0.673  1.264  1.183  0.522  0.478  0.478   0.51
 0.85  2.343  1.879  0.478  0.568  0.568  0.587  0.719
1.392  2.308  1.102  1.009  1.087   1.39  0.684  0.684
 0.65   0.51  0.568  0.499  0.522  1.218  2.529
   84      1     31
2.308  1.087   1.09      0  1.102  1.348  2.552   2.32
1.044  1.044  0.888  1.032  1.253      0      0      0
1.058  1.044  1.044  1.299  2.529  2.297  1.058  1.044
1.032  1.044  1.798  3.167  1.836   0.51  0.534
   84      2     29
0.545  0.522  0.587  1.264  1.183  0.418   0.51  0.522
0.534  0.673  2.529  2.158  1.032  1.032  0.929   0.87
    0      0      0  1.054  1.137  1.032  1.021  1.278
2.413  2.148  1.058  1.058  1.032
   84      3     31
1.021  1.311  2.529  2.385  1.058  1.044  1.058  1.032
0.963  2.292  2.158  0.522      0      0      0      0
    0      0  0.522  0.522   0.51  0.884  0.162      0
    0      0      0      0      0      0      0
   84      4     30
    0      0      0      0  0.418      0      0      0
    0      0      0      0      0      0      0      0
    0  0.905  1.264  1.264  1.264  1.264  1.264  1.798
1.264  2.494  2.494  2.494  0.209      0
   84      5     31
0.888  1.264  1.264  2.204  2.204  1.798  2.494   1.45
2.111  1.264  1.568  2.529  1.264  1.264  1.264  1.264
0.947  1.264  1.264  1.264  1.264  0.081  0.348      0
0.371  0.708      0      0      0  1.058  1.264
   84      6     30
2.292  2.529  2.529  0.522      0      0      0   0.94
2.181  1.473  1.308  1.264  1.264  1.264  1.264  1.264
1.264  1.264  1.021  1.044  1.264  1.264  1.264   1.16
1.264  1.264  1.264      0      0      0
   84      7     31
    0      0      0      0      0      0      0      0
    0      0      0      0      0      0      0      0
    0      0      0      0      0      0      0      0
0.058   1.16  1.264  1.264  1.264      0      0
   84      8     31
    0      0      0      0      0  0.742      0  1.949
2.529  1.531  1.264  1.264  1.264  1.264  1.102  1.264
1.264  1.264  1.264  1.264  1.264  1.264      0      0
    0      0      0  0.888  1.264  1.264  1.264
   84      9     30
1.264  1.264  1.264  1.264  2.216  1.473  1.264  1.264
1.264  1.264  1.264  1.264  1.264  1.264  1.264  1.264
1.264  2.529  2.529  2.529  2.529  2.529  2.529  2.529
2.529  2.529  2.529  0.058      0      0
   84     10     31
    0      0      0      0  1.102  2.529  2.529  0.058
    0      0      0      0      0      0      0      0
    0      0      0      0      0      0      0      0
    0      0      0      0      0      0      0
   84     11     30
    0  1.058  2.529  2.529  1.058  1.102      0  1.531
1.531  3.783  3.783  1.836  1.578  1.102  1.102  0.888
2.529  2.529  1.578   1.16   0.58  0.271  1.102  2.529
2.529  1.102   0.58   1.16  1.102  1.102
   84     12     31
2.529  2.529   0.58   0.58   0.58  0.638   0.58  1.264
1.264  1.102  1.054  1.102  1.102  0.951  2.529  2.529
 0.58   0.58   0.58   0.58   0.58  3.167  3.758      0
    0      0      0   0.58  1.264  1.264      0
```

```
   85       1      31
    0       0       0    0.58   1.204   1.204   1.056   1.056
1.102   1.056    1.16   2.529   2.529   1.056   1.102   1.102
1.578   1.102   2.529   2.529    0.58    0.58    0.58    0.58
 0.58   1.204   1.204       0       0       0       0
   85       2      28
 0.58   1.204   1.204    0.58   0.572       0    0.58   0.527
1.204   1.204   0.572       0   1.578   1.578       0   3.213
2.700   1.636   1.836   1.102   1.114    0.58   1.204   1.204
0.836   0.522    0.58    0.58
   85       3      31
 0.58   1.204   1.204       0       0   0.572   0.200   0.522
1.204   1.204   0.572    0.58    0.58    0.58   1.056   2.529
2.529   1.636    0.58   0.522       0    0.58   1.204   1.204
    0       0       0   0.883   0.888   2.529   2.529
   85       4      30
1.142   1.142   1.142   1.142   1.142   1.142   1.142   1.142
1.142   1.142   1.142   1.142   1.142   1.142   1.142   1.142
1.142   1.142   1.142   1.142   1.142   1.142   1.142   1.142
1.142   1.142   1.142   1.142   1.142   1.142
   85       5      31
0.858   0.858   0.858   0.858   0.858   0.858   0.858   0.858
0.858   0.858   0.858   0.858   0.858   0.858   0.858   0.858
0.858   0.858   0.858   0.858   0.858   0.858   0.858   0.858
0.858   0.858   0.858   0.858   0.858   0.858   0.858
   85       6      30
0.500   0.500   0.500   0.500   0.500   0.500   0.500   0.500
0.500   0.500   0.500   0.500   0.500   0.500   0.500   0.500
0.500   0.500   0.500   0.500   0.500   0.500   0.500   0.500
0.500   0.500   0.500   0.500   0.500   0.500
   85       7      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   85       8      31
0.544   0.544   0.544   0.544   0.544   0.544   0.544   0.544
0.544   0.544   0.544   0.544   0.544   0.544   0.544   0.544
0.544   0.544   0.544   0.544   0.544   0.544   0.544   0.544
0.544   0.544   0.544   0.544   0.544   0.544   0.544
   85       9      30
0.505   0.505   0.505   0.505   0.505   0.505   0.505   0.505
0.505   0.505   0.505   0.505   0.505   0.505   0.505   0.505
0.505   0.505   0.505   0.505   0.505   0.505   0.505   0.505
0.505   0.505   0.505   0.505   0.505   0.505
   85      10      31
0.836   0.836   0.836   0.836   0.836   0.836   0.836   0.836
0.836   0.836   0.836   0.836   0.836   0.836   0.836   0.836
0.836   0.836   0.836   0.836   0.836   0.836   0.836   0.836
0.836   0.836   0.836   0.836   0.836   0.836   0.836
   85      11      30
1.052   1.052   1.052   1.052   1.052   1.052   1.052   1.052
1.052   1.052   1.052   1.052   1.052   1.052   1.052   1.052
1.052   1.052   1.052   1.052   1.052   1.052   1.052   1.052
1.052   1.052   1.052   1.052   1.052   1.052
   85      12      31
0.075   0.075   0.075   0.075   0.075   0.075   0.075   0.075
0.075   0.075   0.075   0.075   0.075   0.075   0.075   0.075
0.075   0.075   0.075   0.075   0.075   0.075   0.075   0.075
0.075   0.075   0.075   0.075   0.075   0.075   0.075
   86       1      31
0.699   0.699   0.699   0.699   0.699   0.699   0.699   0.699
0.699   0.699   0.699   0.699   0.699   0.699   0.699   0.699
0.699   0.699   0.699   0.699   0.699   0.699   0.699   0.699
0.699   0.699   0.699   0.699   0.699   0.699   0.699
   86       2      28
0.703   0.703   0.703   0.703   0.703   0.703   0.703   0.703
0.703   0.703   0.703   0.703   0.703   0.703   0.703   0.703
0.703   0.703   0.703   0.703   0.703   0.703   0.703   0.703
0.703   0.703   0.703   0.703
   86       3      31
1.157   1.157   1.157   1.157   1.157   1.157   1.157   1.157
1.157   1.157   1.157   1.157   1.157   1.157   1.157   1.157
1.157   1.157   1.157   1.157   1.157   1.157   1.157   1.157
1.157   1.157   1.157   1.157   1.157   1.157   1.157
   86       4      30
0.456   0.455   0.455   0.456   0.456   0.456   0.456   0.456
0.456   0.455   0.456   0.456   0.455   0.456   0.456   0.456
0.456   0.456   0.456   0.456   0.455   0.456   0.456   0.456
0.455   0.456   0.456   0.456   0.456   0.456
   86       5      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   86       6      30
1.220   1.220   1.220   1.220   1.220   1.220   1.220   1.220
1.220   1.220   1.220   1.220   1.220   1.220   1.220   1.220
1.220   1.220   1.220   1.220   1.220   1.220   1.220   1.220
1.220   1.220   1.220   1.220   1.220   1.220
```

```
   87       3      31
0.891   0.891   0.891   0.891   0.891   0.891   0.891   0.891
0.891   0.891   0.891   0.891   0.891   0.891   0.891   0.891
0.891   0.891   0.891   0.891   0.891   0.891   0.891   0.891
0.891   0.891   0.891   0.891   0.891   0.891   0.891
   87       4      30
1.227   1.227   1.227   1.227   1.227   1.227   1.227   1.227
1.227   1.227   1.227   1.227   1.227   1.227   1.227   1.227
1.227   1.227   1.227   1.227   1.227   1.227   1.227   1.227
1.227   1.227   1.227   1.227   1.227   1.227
   87       5      31
1.516   1.516   1.516   1.516   1.516   1.516   1.516   1.516
1.516   1.516   1.516   1.516   1.516   1.516   1.516   1.516
1.516   1.516   1.516   1.516   1.516   1.516   1.516   1.516
1.516   1.516   1.516   1.516   1.516   1.516   1.516
   87       6      30
0.841   0.841   0.841   0.841   0.841   0.841   0.841   0.841
0.841   0.841   0.841   0.841   0.841   0.841   0.841   0.841
0.841   0.841   0.841   0.841   0.841   0.841   0.841   0.841
0.841   0.841   0.841   0.841   0.841   0.841
   87       7      31
0.889   0.889   0.889   0.889   0.889   0.889   0.889   0.889
0.889   0.889   0.889   0.889   0.889   0.889   0.889   0.889
0.889   0.889   0.889   0.889   0.889   0.889   0.889   0.889
0.889   0.889   0.889   0.889   0.889   0.889   0.889
   87       8      31
0.855   0.855   0.855   0.855   0.855   0.855   0.855   0.855
0.855   0.855   0.855   0.855   0.855   0.855   0.855   0.855
0.855   0.855   0.855   0.855   0.855   0.855   0.855   0.855
0.855   0.855   0.855   0.855   0.855   0.855   0.855
   87       9      30
1.057   1.057   1.057   1.057   1.057   1.057   1.057   1.057
1.057   1.057   1.057   1.057   1.057   1.057   1.057   1.057
1.057   1.057   1.057   1.057   1.057   1.057   1.057   1.057
1.057   1.057   1.057   1.057   1.057   1.057
   87      10      31
0.172   0.172   0.172   0.172   0.172   0.172   0.172   0.172
0.172   0.172   0.172   0.172   0.172   0.172   0.172   0.172
0.172   0.172   0.172   0.172   0.172   0.172   0.172   0.172
0.172   0.172   0.172   0.172   0.172   0.172   0.172
   87      11      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
   87      12      31
0.861   0.861   0.861   0.861   0.861   0.861   0.861   0.861
0.861   0.861   0.861   0.861   0.861   0.861   0.861   0.861
0.861   0.861   0.861   0.861   0.861   0.861   0.861   0.861
0.861   0.861   0.861   0.861   0.861   0.861   0.861
```

```
   86      7     31
0.982  0.982  0.982  0.982  0.982  0.982  0.982  0.982
0.982  0.982  0.982  0.982  0.982  0.982  0.982  0.982
0.982  0.982  0.982  0.982  0.982  0.982  0.982  0.982
0.982  0.982  0.982  0.982  0.982  0.982  0.982
   86      8     31
1.724  1.724  1.724  1.724  1.724  1.724  1.724  1.724
1.724  1.724  1.724  1.724  1.724  1.724  1.724  1.724
1.724  1.724  1.724  1.724  1.724  1.724  1.724  1.724
1.724  1.724  1.724  1.724  1.724  1.724  1.724
   86      9     30
0.815  0.815  0.815  0.815  0.815  0.815  0.815  0.815
0.815  0.815  0.815  0.815  0.815  0.815  0.815  0.815
0.815  0.815  0.815  0.815  0.815  0.815  0.815  0.815
0.815  0.815  0.815  0.815  0.815  0.815
   86     10     31
0.762  0.762  0.762  0.762  0.762  0.762  0.762  0.762
0.762  0.762  0.762  0.762  0.762  0.762  0.762  0.762
0.762  0.762  0.762  0.762  0.762  0.762  0.762  0.762
0.762  0.762  0.762  0.762  0.762  0.762  0.762
   86     11     30
 0.44   0.44   0.44   0.44   0.44   0.44   0.44   0.44
 0.44   0.44   0.44   0.44   0.44   0.44   0.44   0.44
 0.44   0.44   0.44   0.44   0.44   0.44   0.44   0.44
 0.44   0.44   0.44   0.44   0.44   0.44
   86     12     31
0.888  0.888  0.888  0.888  0.888  0.888  0.888  0.888
0.888  0.888  0.888  0.888  0.888  0.888  0.888  0.888
0.888  0.888  0.888  0.888  0.888  0.888  0.888  0.888
0.888  0.888  0.888  0.888  0.888  0.888  0.888
   87      1     31
 0.85   0.85   0.85   0.85   0.85   0.85   0.85   0.85
 0.85   0.85   0.85   0.85   0.85   0.85   0.85   0.85
 0.85   0.85   0.85   0.85   0.85   0.85   0.85   0.85
 0.85   0.85   0.85   0.85   0.85   0.85   0.85
   87      2     29
0.723  0.723  0.723  0.723  0.723  0.723  0.723  0.723
0.723  0.723  0.723  0.723  0.723  0.723  0.723  0.723
0.723  0.723  0.723  0.723  0.723  0.723  0.723  0.723
0.723  0.723  0.723  0.723
```

```
   88       1      31
0.649   0.649   0.649   0.649   0.649   0.649   0.649   0.649
0.649   0.649   0.649   0.649   0.649   0.649   0.649   0.649
0.649   0.649   0.649   0.649   0.649   0.649   0.649   0.649
0.649   0.649   0.649   0.649   0.649   0.649   0.649
   88       2      29
0.424   0.424   0.424   0.424   0.424   0.424   0.424   0.424
0.424   0.424   0.424   0.424   0.424   0.424   0.424   0.424
0.424   0.424   0.424   0.424   0.424   0.424   0.424   0.424
0.424   0.424   0.424   0.424   0.424
   88       3      31
0.482   0.482   0.482   0.482   0.482   0.482   0.482   0.482
0.482   0.482   0.482   0.482   0.482   0.482   0.482   0.482
0.482   0.482   0.482   0.482   0.482   0.482   0.482   0.482
0.482   0.482   0.482   0.482   0.482   0.482   0.482
   88       4      30
0.522   0.522   0.522   0.522   0.522   0.522   0.522   0.522
0.522   0.522   0.522   0.522   0.522   0.522   0.522   0.522
0.522   0.522   0.522   0.522   0.522   0.522   0.522   0.522
0.522   0.522   0.522   0.522   0.522   0.522
   88       5      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   88       6      30
0.750   0.750   0.750   0.750   0.750   0.750   0.750   0.750
0.750   0.750   0.750   0.750   0.750   0.750   0.750   0.750
0.750   0.750   0.750   0.750   0.750   0.750   0.750   0.750
0.750   0.750   0.750   0.750   0.750   0.750
   88       7      31
0.984   0.984   0.984   0.984   0.984   0.984   0.984   0.984
0.984   0.984   0.984   0.984   0.984   0.984   0.984   0.984
0.984   0.984   0.984   0.984   0.984   0.984   0.984   0.984
0.984   0.984   0.984   0.984   0.984   0.984   0.984
   88       8      31
1.377   1.377   1.377   1.377   1.377   1.377   1.377   1.377
1.377   1.377   1.377   1.377   1.377   1.377   1.377   1.377
1.377   1.377   1.377   1.377   1.377   1.377   1.377   1.377
1.377   1.377   1.377   1.377   1.377   1.377   1.377
   88       9      30
 1.06    1.06    1.06    1.06    1.06    1.06    1.06    1.06
 1.06    1.06    1.06    1.06    1.06    1.06    1.06    1.06
 1.06    1.06    1.06    1.06    1.06    1.06    1.06    1.06
 1.06    1.06    1.06    1.06    1.06    1.06
   88      10      31
1.406   1.406   1.406   1.406   1.406   1.406   1.406   1.406
```

```
1.408   1.408   1.408   1.408   1.408   1.408   1.408   1.408
1.408   1.408   1.408   1.408   1.408   1.408   1.408   1.408
1.408   1.408   1.408   1.408   1.408   1.408   1.408
   88      11      30
0.725   0.725   0.725   0.725   0.725   0.725   0.725   0.725
0.725   0.725   0.725   0.725   0.725   0.725   0.725   0.725
0.725   0.725   0.725   0.725   0.725   0.725   0.725   0.725
0.725   0.725   0.725   0.725   0.725   0.725
   88      12      31
1.148   1.148   1.148   1.148   1.148   1.148   1.148   1.148
1.148   1.148   1.148   1.148   1.148   1.148   1.148   1.148
1.148   1.148   1.148   1.148   1.148   1.148   1.148   1.148
1.148   1.148   1.148   1.148   1.148   1.148   1.148
   89       1      31
1.891   1.891   1.891   1.891   1.891   1.891   1.891   1.891
1.891   1.891   1.891   1.891   1.891   1.891   1.891   1.891
1.891   1.891   1.891   1.891   1.891   1.891   1.891   1.891
1.891   1.891   1.891   1.891   1.891   1.891   1.891
   89       2      28
1.788   1.788   1.788   1.788   1.788   1.788   1.788   1.788
1.788   1.788   1.788   1.788   1.788   1.788   1.788   1.788
1.788   1.788   1.788   1.788   1.788   1.788   1.788   1.788
1.788   1.788   1.788   1.788
   89       3      31
1.703   1.703   1.703   1.703   1.703   1.703   1.703   1.703
1.703   1.703   1.703   1.703   1.703   1.703   1.703   1.703
1.703   1.703   1.703   1.703   1.703   1.703   1.703   1.703
1.703   1.703   1.703   1.703   1.703   1.703   1.703
   89       4      30
1.961   1.961   1.961   1.961   1.961   1.961   1.961   1.961
1.961   1.961   1.961   1.961   1.961   1.961   1.961   1.961
1.961   1.961   1.961   1.961   1.705   1.705   1.705   1.705
1.705   1.705   1.705   1.141   1.141   1.141
   89       5      31
1.141   1.141   1.141   1.141   1.086   1.086   1.086   1.086
1.086   1.086   1.086   1.086   1.885   1.885   1.885   1.885
1.885   1.885   0.871   0.871   0.871   0.871   0.871   0.871
0.871   0.135   0.135   0.135   0.135   0.135   0.135
   89       6      30
0.135     1.6     1.6     1.6     1.6     1.6     1.6     1.6
1.622   1.622   1.622   1.622   1.622   1.622   1.622   1.134
1.134   1.134   1.134   1.134   1.134   1.134   1.504   1.504
1.504   1.504   1.504   1.504   1.504   1.504
```

```
   89       7      31
1.504   1.504   1.504   1.504   1.504   1.504   1.504   1.504
1.504   1.504   1.504   1.504   1.504   1.504   1.504   1.504
1.504   1.504   1.504   1.504     0.3     0.3     0.3     0.3
  0.3     0.3     0.3   1.231   1.231   1.231   1.231
   89       8      31
1.231   1.231   1.231   0.819   0.819   0.819   0.819   0.819
0.819   0.819   1.509   1.509   1.509   1.509   1.509   1.509
1.509   0.831   0.831   0.831   0.831   0.831   0.831   0.831
1.057   1.057   1.057   1.057   1.057   1.057   1.057
   89       9      30
1.057   1.057   1.057   0.841   0.841   0.841   0.841   0.383
0.383   0.383   0.383   0.383   0.383   0.383   1.044   1.044
1.044   1.044   1.044   1.044   1.044   0.678   0.678   0.678
0.678   0.678   0.678   0.678   0.721   0.721
   89      10      31
0.721   0.721   0.721   0.721   0.721   0.586   0.586   0.509
0.586   0.586   0.586   0.586   0.586   0.586   0.509   0.586
0.586   0.586   0.509   0.548   0.548   0.548   0.548   0.548
0.548   0.549   0.646   0.646   0.646   0.646   0.646
   89      11      30
0.646   0.646   1.134   1.134   1.134   1.134   1.134   1.134
1.134     1.8     1.8     1.8     1.6     1.8     1.6     1.6
1.129   1.129   1.129   1.129   1.129   1.129   1.129    1.27
 1.27    1.27    1.27    1.27    1.27    1.27
   89      12      31
1.292   1.292   1.292   1.292   1.292   1.292   1.292   1.387
1.387   1.387   1.387   1.387   1.387   1.387   1.081   1.081
1.081   1.081   1.081   1.081   1.081   1.292   1.292   1.292
1.292   1.292   1.292   1.292    1.21    1.21    1.21
   90       1      31
 1.21    1.21    1.21    1.21   1.564   1.564   1.554   1.554
1.564   1.564   1.564   1.387   1.387   1.387   1.387   1.387
1.387   1.387   1.472   1.472   1.472   1.472   1.472   1.472
1.472   0.855   0.855   0.855   0.855   0.855   0.856
   90       2      28
0.855   1.374   1.374   1.374   1.274   1.374   1.374   1.274
1.449   1.449   1.449   1.449   1.449   1.449   1.449    1.72
 1.72    1.72    1.72    1.72    1.72    1.72   0.789   0.789
0.789   0.789   0.789   0.789
   90       3      31
0.789   0.751   0.751   0.751   0.751   0.751   0.751   0.751
1.096   1.096   1.096   1.096   1.096   1.096   1.096   1.399
1.399   1.399   1.399   1.399   1.399   1.399    1.27    1.27
 1.27    1.37    1.37    1.27    1.27   0.542   0.542
   90       4      30
0.542   0.542   0.542   0.542   0.542   2.343   2.343   2.343
2.343   2.343   2.343   2.343   2.343   2.343   2.343   2.343
2.343   2.343   2.343   1.022   1.022   1.022   1.022   1.022
1.022   1.022   0.445   0.445   0.445   0.445
   90       5      31
0.445   0.445   0.445   2.118   2.118   2.118   2.118   2.118
2.118   2.118   2.329   2.329   2.329   2.329   2.329   2.329
2.329   1.223   1.223   1.223   1.223   1.223   1.223   1.223
 1.27    1.27    1.27    1.27    1.37    1.27    1.27
   90       6      30
1.253   1.253   1.253   1.253   1.253   1.253   1.253   1.292
1.292   1.292   1.292   1.292   1.292   1.292   0.854   0.854
0.854   0.854   0.854   0.854   0.854   1.292   1.292   1.292
1.292   1.292   1.292   1.292   1.247   1.247
   90       7      31
1.247   1.247   1.247   1.247   1.247   1.239   1.239   1.239
1.239   1.239   1.239   1.239   0.744   0.744   0.744   0.744
0.744   0.744   0.744       0       0       0       0       0
    0       0       0       0       0       0       0
   90       8      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
0.698   0.698   0.698   0.698   0.698   0.698   0.698       0
    0       0       0       0       0       0       0
   90       9      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0   1.029   1.029   1.029
   90      10      31
1.029   1.029   1.029   1.029    1.09    1.09    1.09    1.09
 1.09    1.09    1.09   0.142   0.142   0.142   0.142   0.142
0.142   0.142   0.631   0.631   0.631   0.631   0.631   0.631
0.631   0.631   0.631   0.631   0.631   0.631   0.631
   90      11      30
0.631   1.231   1.231   1.231   1.231   1.231   1.231   1.231
 2.05    2.05    2.05    2.05    2.05    2.05    2.05   2.906
2.906   2.906   2.906   2.906   2.906   2.906   1.734   1.734
1.734   1.734   1.734   1.734   1.734    1.27
   90      12      31
 1.27    1.27    1.27    1.27    1.27    1.27   2.578   2.578
2.578   2.576   2.578   2.578   2.578   1.022   1.022   1.022
1.022   1.022   1.022   1.022   1.496   1.496   1.496   1.496
1.496   1.496   1.496   3.717   3.717   3.717   3.717
```

```
   91      1     31
3.717  3.717  3.717   3.71   3.71   3.71   3.71   3.71
 3.71   3.71  2.583  2.583  2.583  2.583  2.583  2.583
2.583  3.267  3.267  3.267  3.267  3.267  3.267  3.267
  1.7    1.7    1.7    1.7    1.7    1.7    1.7
   91      2     28
  1.7    1.7    1.7    1.7    1.7    1.7    1.7  2.418
2.418  2.418  2.418  2.418  2.418  2.418  2.418  2.418
2.418  2.418  2.418  2.418  2.418  2.858  2.858  2.858
2.858  2.858  2.854  2.858
   91      3     31
2.515  2.515  2.515  2.515  2.515  2.521  2.515  2.913
2.913  2.913  2.913  2.913  2.913  2.913  4.745  4.745
4.745  4.745  4.745  4.745  4.745  4.213  4.213  4.213
4.213  4.213  4.213  4.213  4.213  4.213  4.213
   91      4     30
4.213  4.213  4.213  4.213  3.487  3.487  3.487  3.487
3.487  3.487  3.487  3.108  3.108  3.108  3.108  3.108
3.108  3.108  2.884  2.884  2.884  2.884  2.884  2.884
2.884  3.312  3.312  3.312  3.312  3.312
   91      5     31
3.312  3.312  2.908  2.908  2.908  2.908  2.908  2.908
2.908  2.388  2.388  2.388  2.388  2.388  2.388  2.388
2.133  2.133  2.133  2.133  2.133  2.133  2.133  1.217
1.217  1.217  1.217  1.217  1.217  1.217  1.285
   91      6     30
1.285  1.285  1.285  1.285  1.285  1.285  1.282  1.282
1.282  1.282  1.282  1.282  1.282  2.154  2.154  2.154
2.154  2.154  2.154  2.154  2.351  2.351  2.351  2.351
2.351  2.351  2.351  2.885  2.885  2.885
   91      7     31
2.885  2.885  2.885  2.885  1.387  1.387  1.387  1.387
1.387  1.387  1.387  1.052  1.052  1.052  1.052  1.052
1.052  1.052  1.005  1.005  1.005  1.005  1.005  1.005
1.005  0.975  0.975  0.975  0.975  0.975  0.975
   91      8     31
0.975      0      0      0      0      0      0      0
    0      0      0      0      0      0      0  0.331
0.331  0.331  0.331  0.331  0.331  0.331      0      0
    0      0      0      0      0      0      0
   91      9     30
    0      0      0      0      0      0      0      0
    0      0      0      0      0      0      0      0
    0      0      0      0      0      0      0      0
    0      0  3.072  3.072  3.072  3.072
   91     10     31
3.072  3.072  3.072  1.081  1.081  1.081  1.081  1.081
1.081  1.081  0.352  0.352  0.352  0.352  0.352  0.352
0.352  0.388  0.388  0.388  0.388  0.388  0.388  0.388
    0      0      0      0      0      0      0
   91     11     30
2.192  2.192  2.192  2.192  2.192  2.192  2.192  1.547
1.547  1.547  1.547  1.547  1.547  1.547  1.779  1.779
1.779  1.779  1.779  1.779  1.779  4.453  4.453  4.453
4.453  4.453  4.453  4.453  4.453  4.453
   91     12     31
1.421  1.421  1.421  1.421  1.421  1.421  1.421  1.421
1.421  1.421  1.421  1.421  1.421  1.421  1.421  1.421
1.421  1.421  1.421   3.83   3.83   3.83   3.83   3.83
 3.83   3.83  1.249  1.249  1.249  1.249  1.249
   92      1     31
1.249  1.249  2.148  2.148  2.148  2.148  2.148  2.148
2.148  5.031  5.031  5.031  5.031  5.031  5.031  5.031
4.488  4.488  4.488  4.488  4.488  4.488  4.488  3.804
3.804  3.804  3.804  2.804  3.804  3.804  3.522
   92      2     29
3.522  3.522  3.522  3.522  3.522  3.522  3.191  3.191
3.191  3.191  3.191  3.191  3.191  3.908  3.908  3.908
3.908  3.908  3.908  3.908  3.198  3.198  3.198  3.198
3.198  3.198  3.198  2.284  2.284
   92      3     31
2.284  2.284  2.284  2.284  2.284  2.351  2.351  2.351
2.351  2.351  2.351  2.351  2.548  2.548  2.548  2.548
2.548  2.548  2.548  2.805  2.805  2.805  2.805  2.805
2.805  2.805  3.487  3.487  3.487  3.487  3.487
   92      4     30
3.487  3.487  3.718  3.718  3.718  3.718  3.718  3.718
3.718  3.833  3.833  3.833  3.833  3.833  3.833  3.833
3.833  3.833  3.833  3.833  3.833  3.833  3.833  2.771
2.771  2.771  2.771  2.771  2.771  2.771
   92      5     31
2.783  2.783  2.783  2.783  2.783  2.783  2.783  3.048
3.048  3.048  3.048  3.048  3.048  3.048   1.17   1.17
 1.17   1.17   1.17   1.17   1.17  0.708  0.708  0.708
0.708  0.708  0.708  0.708  2.778  2.778  2.778
   92      6     30
2.778  2.778  2.778  2.778   3.41   3.41   3.41   3.41
 3.41   3.41   3.41  1.388  1.388  1.388  1.388  1.388
1.388  1.388  1.494  1.494  1.494  1.494  1.494  1.494
1.494  0.504  0.504  0.504  0.504  0.504
```

```
   92       7      31
0.584   0.584   2.388   2.388   2.388   2.388   2.388   2.388
2.388   2.943   2.943   2.943   2.943   2.943   2.943   2.943
4.017   4.017   4.017   4.017   4.017   4.017   4.017    3.01
 3.01    3.01    3.01    3.01    3.01    3.01   1.081
   92       8      31
1.081   1.081   1.081   1.081   1.081   1.081    3.38    3.38
 3.38    3.38    3.38    3.38    3.38   4.745   4.745   4.745
4.745   4.745   4.745   4.745   3.433   3.433   3.433   3.433
3.433   3.433   3.433   4.881   4.881   4.881   4.881
   92       9      30
4.881   4.881   4.881   4.145   4.145   4.145   4.145   4.145
4.145   4.145   2.538   2.538   2.538   2.538   2.538   2.538
2.538   4.145   4.145   4.145   4.145   4.145   4.145   4.145
4.834   4.834   4.834   4.934   4.834   4.834
   92      10      31
4.834   1.321   1.321   1.321   1.321   1.321   1.321   1.321
 1.09    1.09    1.09   0.142   0.142   0.142   0.142   0.142
0.142  -0.142   0.831   0.831   0.831   0.831   0.831   0.831
0.831   0.831   0.831   0.831   0.831   0.831   0.831
   92      11      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
   92      12      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   93       1      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   93       2      28
    0       0       0       0       0       0       0       0
    0       0       0   1.149   1.149   1.149   1.149   1.149
1.149   1.149   2.483   2.483   2.483   2.483   2.483   2.483
2.483    0.78    0.78    0.78
   93       3      31
 0.78    0.78    0.78    0.78   1.282   1.282   1.282   1.282
1.282   1.282   1.282   2.381   2.381   2.381   2.381   2.381
2.381   2.381   2.523   2.523   2.523   2.523   2.523   2.522
2.523   2.508   2.508   2.508   2.508   2.508   2.508
   93       4      30
2.508   1.981   1.981   1.981   1.981   1.981   1.981   1.981
1.981   1.981   1.981   1.981   1.981   1.981   1.981   2.441
2.441   2.441   2.441   2.441   2.441   2.441   1.353   1.353
1.353   1.353   1.353   1.353   1.353   2.523
   93       5      31
2.523   2.523   2.523   2.523   2.523   2.523   2.388   2.388
2.388   2.388   2.388   2.388   2.388   1.419   1.419   1.419
1.419   1.419   1.419   1.419   0.451   0.451   0.451   0.451
0.451   0.451   0.451    1.72    1.72    1.72    1.72
   93       6      30
 1.72    1.72    1.72    0.83    0.83    0.83    0.83    0.83
 0.83    0.83   2.411   2.411   2.411   2.411   2.411   2.411
2.411    2.28    2.28    2.28    2.28    2.28    2.28    2.28
1.218   1.218   1.218   1.218   1.218   1.218
   93       7      31
1.218   1.053       0       0       0       0       0       0
    0       0       0       0       0       0       0   0.293
0.293   0.293   0.293   0.293   0.293   0.292   1.238   1.238
1.238   1.238   1.238   1.238   1.238   0.744   0.744
   93       8      31
0.744   0.744   0.744   0.744   0.744   1.277   1.277   1.277
1.277   1.277   1.277   1.277   1.188   1.188   1.188   1.188
1.188   1.188   1.188   0.785   0.785   0.785   0.785   0.785
0.785   0.785   0.337   0.337   0.337   0.337   0.337
   93       9      30
0.337   0.337   0.337   0.337   0.337   0.738   0.738   0.738
0.738       0       0       0       0       0       0       0
0.352   0.352   0.352   0.352   0.352   0.352   0.352    0.15
 0.15    0.15    0.15    0.15    0.15    0.15
   93      10      31
1.074   1.074   1.074   1.074   1.074   1.074   1.074   1.074
 1.98    1.98    1.98    1.98    1.98    1.98    1.98   2.501
2.501   2.501   2.501   2.501   2.501   2.483   2.483   2.483
2.483   2.483   2.483   2.483   2.728   2.728   2.728
   93      11      30
2.728   2.728   2.728   2.728   1.855   1.855   1.855   1.855
1.855   1.855   1.856   1.298   1.298   1.298   1.298   1.298
1.298   1.298   0.788   0.788   0.788   0.788   0.788   0.788
0.788   1.141   1.141   1.141   1.141   1.141
   93      12      31
1.141   1.141   2.418   2.418   2.418   2.418   2.418   2.418
2.418   2.478   2.478   2.478   2.478   2.478   2.478   2.478
2.388   2.388   2.388   2.388   2.388   2.388   2.388   2.541
2.541   2.541   2.561   2.541   2.541   2.541   2.541
```

```
   84       1      31
1.255   1.255   1.255   1.255   1.255   1.255       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   84       2      28
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0
   84       3      31
    0       0       0   0.589   0.589   0.589   0.589   0.589
0.589   0.589       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   84       4      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
   84       5      31
    0       0       0       0       0   0.520   0.520   0.520
0.520   0.520   0.520   0.520   1.487   1.487   1.487   1.487
1.487   1.487   1.487   0.867   0.867   0.867   0.867   0.867
0.867   0.867   1.584   1.584   1.584   1.584   1.584
   84       6      30
1.584   1.584   2.483   2.483   2.483   2.483   2.483   2.483
2.483   2.163   2.163   2.163   2.163   2.163   2.163   2.163
 1.96    1.96    1.96    1.96    1.96    1.96    1.96       0
    0       0       0       0       0       0
   84       7      31
0.345   0.345   0.345   0.345   0.345   0.345   0.345   1.277
1.277   1.277   1.277   1.277   1.277   1.277   1.202   1.202
1.202   1.202   1.202   1.202   1.202   1.126   1.126   1.126
1.126   1.126   1.126   1.126   1.269   1.269   1.269
   84       8      31
1.269   1.269   1.269   1.269   1.045   1.045   1.045   1.045
1.045   1.045   1.045   1.344   1.344   1.344   1.344   1.344
1.344   1.344   1.052   1.056   1.048   1.049   1.051   1.051
1.088   1.389   1.389   1.389   1.389   1.389   1.389
   84       9      30
1.389   1.675   1.675   1.675   1.675   1.675   1.675   1.675
2.272   2.272   2.272   2.272   2.272   2.272   2.272   2.272
2.272   2.272   2.272   2.272   2.272   2.272   1.515   1.515
1.515   1.515   1.515   1.515   1.515   2.570
   84      10      31
2.084   2.075   2.070   3.144   2.565   2.080   2.054   2.041
2.048   2.051   1.731   1.420   0.821   1.329   2.078   2.091
1.584   0.844   0.502   1.052   1.262   1.262   1.262   1.262
1.262   1.262   1.262   2.507   2.507   2.507   2.507
   84      11      30
2.507   2.507   2.507   3.838   3.838   3.838   3.838   3.838
3.838   3.839   2.979   3.128   3.127   3.248   2.847   2.858
3.022   3.129   3.097    3.07    3.21   3.708    3.54   3.325
1.704   1.704   1.704   1.704   1.704   1.704
   84      12      31
1.704   0.875   0.001   0.001   0.947   1.558   1.829   1.837
2.225   2.238   2.242   2.199   1.931   2.339    1.83   1.838
1.107   1.197   1.197   1.107   1.052   1.042   0.488       0
    0       0   0.001   0.487   0.825   0.331   0.001
   85       1      31
0.001   0.001   0.229   0.002   0.014       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   85       2      28
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0
   85       3      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0
   85       4      30
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0
   85       5      31
    0       0       0       0       0       0       0       0
    0       0       0       0       0       0   0.743   0.994
0.989   0.989   1.003   0.982   0.983   1.003    1.01   0.987
0.982   0.986   0.981   0.989   1.021   1.025   1.389
   85       6      30
1.120   1.005   0.947   0.949   0.857   0.981   1.035   1.039
1.037   1.030   0.874   0.832   0.808   1.012   1.042   0.833
1.034   1.033   .1.02   1.012   1.020   0.917   0.583   0.001
0.001   0.001   0.001   0.001   0.001   0.001
```

```
      87       7      31
   0.001   0.001   0.001   0.001   0.001       0       0       0
       0       0   0.001   0.001   0.001   0.001   0.002   0.387
   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
   0.001   0.001   0.001   0.001   0.001   0.001   0.001
      87       8      31
   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
       0   0.001   0.001   0.001       0   0.001   0.001   0.001
   0.001   0.001   0.001   0.001   0.001   0.001       0
      87       9      30
   0.001       0   0.001   0.001   0.001   0.001   0.001   0.001
   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
   0.001   0.001   0.188    0.47   1.042   1.042   1.042   0.782
   0.619   1.471    1.74   1.738   1.728   1.768
      87      10      31
   1.284   1.061   1.068   1.037   1.042   1.046   1.073   1.046
   1.043   1.038   1.038   0.986   1.042   1.081   1.084   1.038
   1.036   1.066   1.047   1.042   1.077   1.038   1.066   1.081
   1.049   1.084   1.457   2.231   2.311   2.312   1.108
      87      11      30
   0.001   0.001   0.001   0.001   0.001   0.001   0.001   0.001
   0.001   0.449   1.788   2.827   3.291   3.134    3.12   3.136
   3.122   2.388   1.941   2.112   1.888   1.777   1.876   1.889
   1.731   1.848   2.389   2.706   4.478   4.627
      87      12      31
   3.168   2.601   2.084   2.088    3.48   4.292    3.87    3.49
   1.971   1.042   2.002   1.928   1.327   1.042   2.086    0.77
   1.292   2.083   2.083   3.106   2.428   4.784   4.384   4.862
   4.986   4.869   4.843   4.866   4.747   4.802   4.779
      88       1      31
   4.815   4.780   4.815   4.780   4.722   4.838   4.783    4.73
   4.732   4.689   4.639   4.713   4.678    4.87   4.884    4.88
   4.891    4.83   4.687   4.687   4.687   4.672   4.743   2.847
   4.372   4.488   4.488   4.437   4.418   4.421   4.447
      88       2      29
   4.413   4.366   4.138   4.143   4.132   3.819   4.006   3.877
   3.533   3.843   4.018   3.889   4.843   4.886   4.213   2.883
   4.302   3.519   4.481   4.488   2.184   3.733   3.888   4.008
   4.328   4.102   3.888   3.787   4.326
      88       3      31
   3.639   4.973   6.136   6.189   6.218   6.215   6.238   6.088
   6.228   6.228   6.246   6.243   6.248   6.231   6.215   6.216
   6.214   6.204   4.838   4.703   4.843     6.1   4.673   4.843
   4.186   3.468   3.266   1.887   3.831   6.208   6.208
      88       4      30
   3.333   1.868   3.348   3.366   3.368   3.183   2.316   2.318
   1.886     1.1     1.1     1.1   1.273   1.331   1.748   2.316
   2.869   2.384   2.484   2.488   1.887   1.888   2.211   1.736
   1.749   0.984   1.488   1.319    1.88   1.728
      88       5      31
   2.373   1.628   1.071   1.679   1.387   1.876    0.82   1.327
   1.368   1.387   1.788   2.876   2.002    2.06   1.488   1.388
   1.883   1.447   1.296   1.186   2.014   1.004   1.237   1.827
   2.186     2.9    2.87   1.736   1.888   1.877   2.173
      88       6      30
   1.882   2.215   1.701   1.676   1.157   0.388   1.168       0
       0       0       0   1.713   0.914       0       0       0
       0       0       0       0       0   0.137       0       0
       0       0       0       0       0       0
      88       7      31
       0       0       0    0.48   1.149   1.466   1.182   1.088
   0.832    0.41       0       0       0       0       0       0
       0       0       0       0       0       0       0       0
       0       0       0       0       0   0.678   2.804
      88       8      31
   0.463       0       0       0       0       0       0       0
       0       0       0   0.271   1.216   0.789       0       0
       0       0       0       0       0       0       0   1.032
   1.388   1.103   1.137    0.76       0    0.87   1.338
      88       9      30
     1.1   0.688   0.118       0       0   0.878   1.871       0
       0       0       0       0       0       0       0       0
       0       0       0       0       0       0       0       0
       0   1.302       0       0       0       0
      88      10      31
       0   0.487   1.161    1.16   1.157   1.181   1.147   1.161
   1.186   1.183   1.153   1.168   1.168   1.169   1.161    1.15
   1.188   1.168   0.873   0.784   1.238   1.088   0.483   1.111
   1.167    1.17   1.163   1.167    1.72    2.08   2.002
      88      11      30
   1.437   1.679    1.73    1.08   1.788   1.818   1.937   1.808
   2.287   2.614   1.002    1.08   0.944   1.168   1.084   0.884
   0.861   1.338   1.883   3.082   4.428   2.887   1.736   1.868
   2.384   1.784   2.861    2.88   2.488   2.321
      88      12      31
    2.36   1.574   2.136   4.488   4.433   3.384   2.188   1.878
   1.808   1.821   1.319   1.315   1.324   1.288   1.308   1.332
    1.08   1.188   1.836     3.6   4.188   4.188   2.017   1.284
   2.119   2.288   2.273   2.286   2.347   2.287   2.386
```

WANSDAY.DAT

Daily Wansford abstractions.

March 1985 to march 1989 interpolated from monthly values.

APPENDIX 4

ESTIMATES OF PUBLIC WATER SUPPLY EFFLUENT
(GERRY SPRAGGS)

ASSESSMENT OF EFFLUENTS IN THE R. NENE TO ORTON CATCHMENT

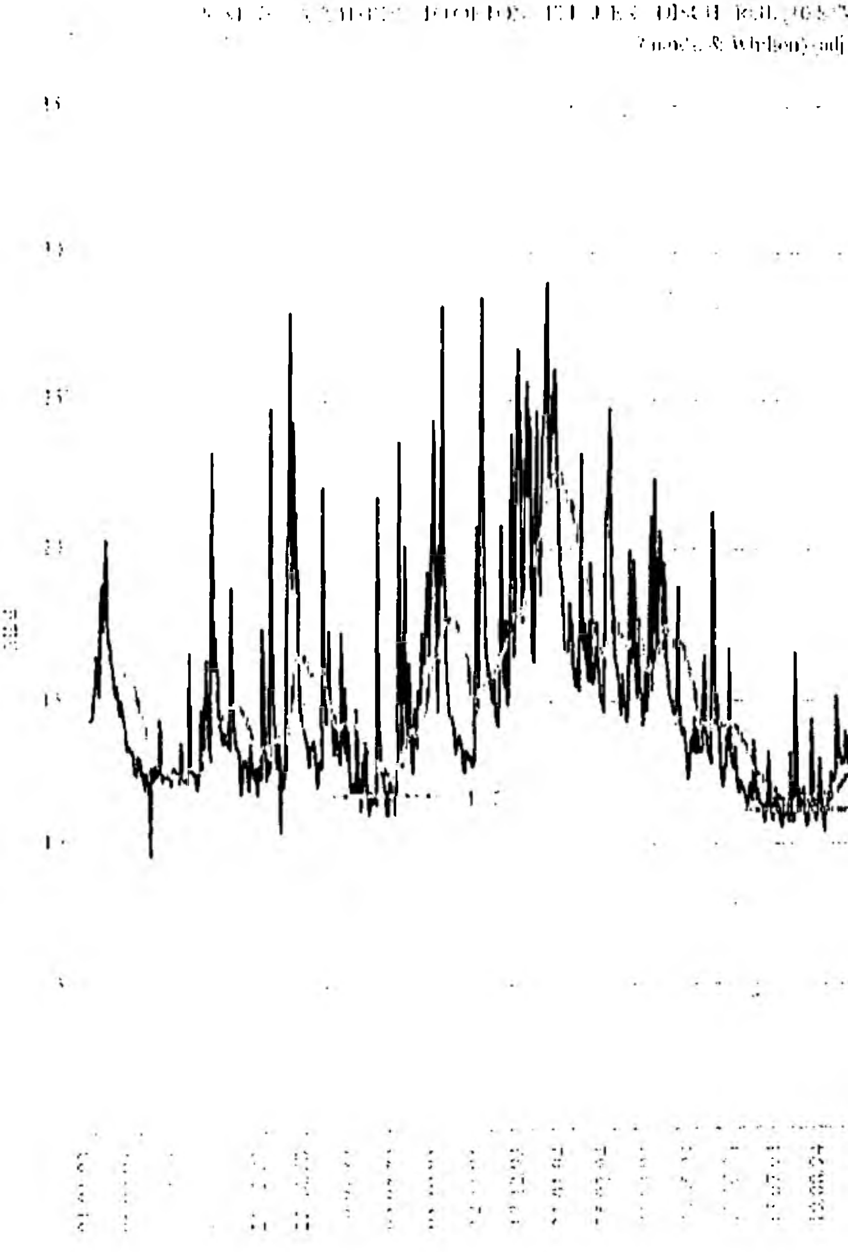
There are 68 Sewage Treatment Works (STW) discharges in the Nene catchment upstream of Orton gauging station. Of these 10 have Dry Weather Flows greater than 1Ml/d. These 10 discharges represent over 91% of the effluent flow into the catchment. Daily effluent data for these STW's are available from the telemetry archive. The 10 works are listed below.

WORKS	TERRITORY	LG_DWF	EFFECTDATE	MAIN_WATER	GRID_REF
BRIXWORTH	RTST	1200	09/18/89	R.NENE NT	SP73807130
BROADHOLME	RTST	51500	11/30/95		SP94106836
BUGBROOKE	RTST	1350	05/18/87	R.NENE NT	SP66775826
CORBY	RTST	10760	02/09/87	R.NENE NT	SP90608890
GREAT BILLING	RTST	61620	01/31/97	RIVER NENE	SP83196188
ISLIP	RTST	2400	12/23/88		SP99407960
LONG BUCKBY	RTST	1300	09/18/89	R.NENE NT	SP61306660
OUNDLE	RTST	1270	05/10/88		TL04108970
RAUNDS	RTST	2040	11/20/89	R.NENE NT	SP97937246
WHILTON	RTST	4000	02/04/87	R.NENE NT	SP62146459

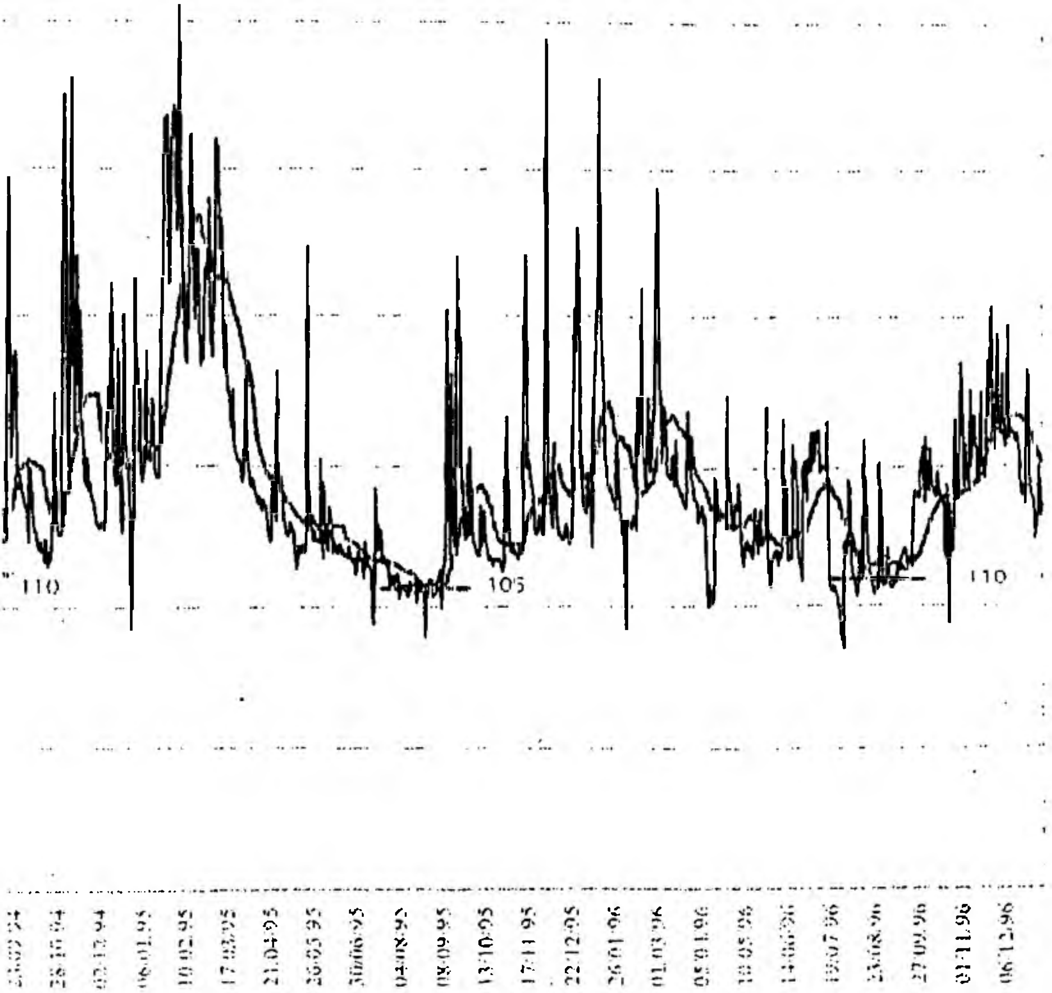
The total effluent for the 10 STWs for the period January 1993 to December 1996 is shown on the attached graph. A 30 day running mean has been fitted to the data to highlight major fluctuations. The minima for each complete year are also shown on the graph and it is assumed that these approximate to DWFs largely unaffected by rainfall. These data can be summarised as follows:

YEAR	MINUMUM Ml/d	MONTH	COMMENT
1993	120	AUGUST	
1994	110	AUGUST	
1995	105	AUG - SEPT	
1996	110	AUGUST	

OJ 16/5/97


35
30
25
20
15
10
5

ver 1 Mld : Brixworth Broadholme, Bugbrook, Corby, Gt Billing, Islip, Long Buckby, Oundle,
usted for missing and incorrect data using DWFs)



19.5.97

APPENDIX 5

COMPONENTS OF ARTIFICIAL INFLUENCE

ORTON NATURALISED FLOWS

year	mont	dec year	PWS EFF	CORB	NR PW	RES INFLOW	DUSTO	IND	AG	WANSFOR	CORRECTIO
41	1	1941	25.1	0	21	83.4	0	4	0	0	83.4
41	2	1941.083	28.2	1.8	21	81.9	0	4	0	0	73.1
41	3	1941.167	31.3	2.3	21	76	0	4	0	0	63.2
41	4	1941.25	32.7	1.6	21	37.3	0	4	0	0	25
41	5	1941.333	32.7	2.5	21	9.8	0	4	2.4	0	-2.6
41	6	1941.417	35.1	3.8	21	14.2	0	4	4	0	-2.8
41	7	1941.5	33.7	5.4	21	1.1	0	4	4	0	-18.6
41	8	1941.583	29	5.2	21	5	0	4	1.6	0	-12.1
41	9	1941.667	28	5	21	-0.6	0	4	0	0	-18.1
41	10	1941.75	26.7	5.1	21	0.8	0	4	0	0	-15.2
41	11	1941.833	28.2	4.7	21	17.6	0	4	0	0	0.9
41	12	1941.917	25.1	3.4	21	10.7	0	4	0	0	1
42	1	1942	25.8	2.2	22	26.5	0	4	0	0	28.6
42	2	1942.083	29.1	2.7	22	42	0	4	0	0	30.6
42	3	1942.167	32.3	3.7	22	22.8	0	4	0	0	6.1
42	4	1942.25	33.7	4	22	6.7	0	4	0	0	-12.5
42	5	1942.333	33.7	4.5	22	2	0	4	2.4	0	-15.9
42	6	1942.417	38.1	4.8	22	-1.2	0	4	4	0	-21
42	7	1942.5	34.7	5.1	22	-2.2	0	4	4	0	-21.1
42	8	1942.583	29.9	5	22	-2.9	0	4	1.6	0	-19.3
42	9	1942.667	28.9	4.9	22	-3.4	0	4	0	0	-20.4
42	10	1942.75	27.5	4.6	22	-3	0	4	0	0	-17.3
42	11	1942.833	29.1	4.9	22	5.1	0	4	0	0	-12
42	12	1942.917	25.8	5.1	22	4.4	0	4	0	0	-9.8
43	1	1943	26.6	4.9	23	38.9	0	4	0	0	25.6
43	2	1943.083	29.9	4.5	23	36	0	4	0	0	18.1
43	3	1943.167	33.2	4.9	23	4.3	0	4	0	0	-15.6
43	4	1943.25	34.8	5.1	23	1.9	0	4	0	0	-28.5
43	5	1943.333	34.6	5.2	23	0	0	4	2.4	0	-19.8
43	6	1943.417	37.2	5.7	23	-1.9	0	4	4	0	-24.3
43	7	1943.5	35.7	6	23	-3.3	0	4	4	0	-24.8
43	8	1943.583	30.8	6	23	-3.2	0	4	1.6	0	-27
43	9	1943.667	29.7	3.1	23	-3	0	4	0	0	-14.8
43	10	1943.75	28.3	3.9	23	-3.3	0	4	0	0	-15.4
43	11	1943.833	29.9	6	23	-2.5	0	4	0	0	-22.8
43	12	1943.917	28.8	6.1	23	-2.5	0	4	0	0	-19.1
44	1	1944	27.4	1.4	24	1.3	0	4	0	0	-1.9
44	2	1944.083	30.8	1.2	24	-0.2	0	4	0	0	-8.5
44	3	1944.167	34.2	1.3	24	-2.6	0	4	0	0	-12.5
44	4	1944.25	35.8	1.2	24	0.9	0	4	0	0	-10.2
44	5	1944.333	35.8	1.4	24	-4.6	0	4	2.4	0	-13.8
44	6	1944.417	38.2	1.9	24	-5.1	0	4	4	0	-16.9
44	7	1944.5	38.7	1.7	24	-4.8	0	4	4	0	-14
44	8	1944.583	31.7	2.8	24	-6	0	4	1.6	0	-16
44	9	1944.667	30.6	2.2	24	-5.7	0	4	0	0	-14.7
44	10	1944.75	28.2	2.1	24	-4.8	0	4	0	0	-11.7
44	11	1944.833	30.8	1.5	24	18.2	0	4	0	0	12.2
44	12	1944.917	27.4	5.2	24	12.9	0	4	0	0	-0.9
45	1	1945	28.1	5.9	25	15.8	0	4	0	0	0.4
45	2	1945.083	31.6	5.8	25	47.9	0	4	0	0	28.1
45	3	1945.167	35.1	5.8	25	1.6	0	4	0	0	-20.8
45	4	1945.25	38.6	5.4	25	0.4	0	4	0	0	-22.8
45	5	1945.333	38.8	5.6	25	-0.9	0	4	2.4	0	-21.8
45	6	1945.417	39.3	4.7	25	-3	0	4	4	0	-22.8
45	7	1945.5	37.7	5.8	25	-3.8	0	4	4	0	-24
45	8	1945.583	32.8	5.7	25	-4.5	0	4	1.6	0	-22.4
45	9	1945.667	31.4	5.8	25	-4	0	4	0	0	-22.5
45	10	1945.75	30	5.6	25	-1.3	0	4	0	0	-18
45	11	1945.833	31.6	5.4	25	-3.8	0	4	0	0	-22
45	12	1945.917	28.1	5.5	25	10.1	0	4	0	0	-4.3
46	1	1946	28.9	5.7	26	14.6	0	5	0	0	0.7
46	2	1946.083	32.5	5.1	26	32.9	0	5	0	0	15.7
46	3	1946.167	30.1	5.6	26	8.2	0	5	0	0	-12.8
46	4	1946.25	37.8	4.2	26	3.4	0	5	0	0	-19.4
46	5	1946.333	37.6	3	26	0.5	0	5	2.4	0	-12.1
46	6	1946.417	40.4	2.8	26	0.4	0	5	4	0	-19.1
46	7	1946.5	38.8	3.4	26	-2.9	0	5	4	0	-16
46	8	1946.583	33.4	3.6	26	-2.8	0	5	1.6	0	-13.6
46	9	1946.667	32.3	3.4	26	7	0	5	0	0	-4.1
46	10	1946.75	30.9	3.9	26	-2.6	0	5	0	0	-13.2
46	11	1946.833	32.5	3.8	26	67.8	0	5	0	0	55.3
46	12	1946.917	28.9	5.3	26	43.1	0	5	0	0	30.5
47	1	1947	29.6	5.4	27	42	0	5	0	0	28.2
47	2	1947.083	33.3	4.8	27	11.7	0	5	0	0	-4
47	3	1947.167	37	5.5	27	120.2	0	5	0	0	99.9
47	4	1947.25	38.6	5.2	27	30.2	0	5	0	0	17.6
47	5	1947.333	38.6	5.8	27	8.3	0	5	2.4	0	-10.4
47	6	1947.417	41.4	5.4	27	0	0	5	4	0	-21.1
47	7	1947.5	38.8	6.7	27	-1	0	5	4	0	-20.6
47	8	1947.583	34.3	6.7	27	-2.8	0	5	1.6	0	-19.3
47	9	1947.667	33.1	5.4	27	-3.2	0	5	0	0	-19.9
47	10	1947.75	31.6	6.1	27	-3.5	0	5	0	0	-20.2
47	11	1947.833	33.3	5.1	27	-3.3	0	5	0	0	-19.7
47	12	1947.917	28.6	2.8	27	-3.1	0	5	0	0	-8.6
48	1	1948	30.4	2.8	28	18.2	0	5	0	0	11.1
48	2	1948.083	34.2	3.6	28	8	0	5	0	0	-4
48	3	1948.167	38	2.8	28	-1	0	5	0	0	-13.7
48	4	1948.25	38.6	2.8	28	0.2	0	5	0	0	-14.5
48	5	1948.333	39.6	3.2	28	-0.5	0	5	2.4	0	-13.7
48	6	1948.417	42.5	3	28	-2.6	0	5	4	0	-16.7
48	7	1948.5	40.8	3.1	28	-4	0	5	4	0	-18.5
48	8	1948.583	35.2	3.6	28	-3.8	0	5	1.6	0	-14.4
48	9	1948.667	34	3.7	28	-2.8	0	5	0	0	-14.4
48	10	1948.75	32.4	3.8	28	-1.4	0	5	0	0	-11.3
48	11	1948.833	34.2	3.7	28	4.8	0	5	0	0	-7
48	12	1948.917	30.4	5.7	28	17.9	0	5	0	0	4.5
49	1	1949	31.2	6.4	29	20.8	0	5	0	0	5.7
49	2	1949.083	35.1	8	29	5.5	0	5	0	0	-13.9
49	3	1949.167	38.0	5.9	29	11.4	0	5	0	0	-10.1
49	4	1949.25	40.6	6.3	29	7.2	0	5	0	0	-17.4
49	5	1949.333	40.8	6.9	29	-0.9	0	5	2.4	0	-24.3
49	6	1949.417	43.6	7	29	-2.8	0	5	4	0	-28.5
49	7	1949.5	41.8	6.1	29	-4.2	0	5	4	0	-24.8
49	8	1949.583	36.1	5.7	29	-4.7	0	5	1.6	0	-21
49	9	1949.667	34.8	5.6	29	-4.5	0	5	0	0	-21.5
49	10	1949.75	33.2	3.7	29	0.9	0	5	0	0	-8.5
49	11	1949.833	35.1	3.7	29	11.8	0	5	0	0	0.1
49	12	1949.917	31.2	4.7	29	16	0	5	0	0	5.8
50	1	1950	31.0	7.5	30	0.7	0	6	0	0	-18.2
50	2	1950.083	35.9	6.5	30	87.1	0	6	0	0	47
50	3	1950.167	30.9	7.3	30	8.5	0	6	0	0	-15.8
50	4	1950.25	41.6	5.3	30	7.4	0	6	0	0	-13.5
50	5	1950.333	41.6	3.7	30	11.5	0	6	2.4	0	-2.1
50	6	1950.417	44.8	4.2	30	-0.8	0	6	4	0	-17.7
50	7	1950.5	42.8	4.3	30	-2	0	6	4	0	-18.8
50	8	1950.583	37	4.3	30	-3.2	0	6	1.6	0	-14.5
50	9	1950.667	35.7	4	30	-3	0	6	0	0	-14.2
50	10	1950.75	34	7.4	30	-2.2	0	6	0	0	-20.8
50	11	1950.833	35.9	7.4	30	21.3	0	6	0	0	-0.1
50	12	1950.917	31.9	7.1	30	13.7	0	6	0	0	-2.1

51	1	1951	33.4	7.8	32	46.4	0	6	0	0	29.7
51	2	1951.083	37.6	7	32	64.3	0	6	0	0	43
51	3	1951.167	41.8	7.5	32	62.3	0	6	0	0	37.5
51	4	1951.25	43.6	7.5	32	50.9	0	6	0	0	23.9
51	5	1951.333	43.6	7.8	32	25.3	0	6	2.4	0	0.5
51	6	1951.417	46.7	7.8	32	3	0	6	4	0	-23.7
51	7	1951.5	44.9	4.4	32	-1.4	0	6	4	0	-16.4
51	8	1951.583	38.7	4.3	32	-0.5	0	6	1.6	0	-11.7
51	9	1951.667	37.4	4.7	32	-1.4	0	6	0	0	-14.2
51	10	1951.75	35.6	4.5	32	-2.4	0	6	0	0	-12.6
51	11	1951.833	37.6	4.3	32	37.3	0	6	0	0	25.3
51	12	1951.917	33.4	7.5	32	17	0	6	0	0	0.7
52	1	1952	35	7.8	34	26.8	0	6	0	0	10.2
52	2	1952.083	39.3	6.9	34	14.7	0	6	0	0	-5.1
52	3	1952.167	43.7	7.2	34	27.3	0	6	0	0	3.4
52	4	1952.25	45.5	6.4	34	23.6	0	6	0	0	-0.4
52	5	1952.333	45.5	4.8	34	12.9	0	6	2.4	0	-3.6
52	6	1952.417	48.9	4.6	34	-0.1	0	6	4	0	-18.2
52	7	1952.5	46.9	4.9	34	-3	0	6	4	0	-18.6
52	8	1952.583	40.5	5.1	34	-2.3	0	6	1.6	0	-15.4
52	9	1952.667	39.1	5.2	34	-3	0	6	0	0	-17.2
52	10	1952.75	37.3	6	34	-0.1	0	6	0	0	-14
52	11	1952.833	39.3	6	34	12.8	0	6	0	0	-3.8
52	12	1952.917	35	5.5	34	38.6	0	6	0	0	28.4
53	1	1953	36.5	5.4	36	18.8	0	6	0	0	8.1
53	2	1953.083	41	4.6	36	29.9	0	6	0	0	18.8
53	3	1953.167	45.6	8.2	36	8.1	0	6	0	0	-20.4
53	4	1953.25	47.5	7.7	36	11.5	0	6	0	0	-18.2
53	5	1953.333	47.5	7.9	36	2.4	0	6	2.4	0	-22.6
53	6	1953.417	51	5.1	36	-0.9	0	6	4	0	-20.4
53	7	1953.5	49	4.9	36	-2.1	0	6	4	0	-18.8
53	8	1953.583	42.2	5	36	-3.1	0	6	1.6	0	-15.6
53	9	1953.667	40.8	5.1	36	-3.2	0	6	0	0	-16.5
53	10	1953.75	38.9	5.1	36	-2.9	0	6	0	0	-13.8
53	11	1953.833	41	4.7	36	-1.1	0	6	0	0	-13.5
53	12	1953.917	39.5	4.8	36	-2.8	0	6	0	0	-9.9
54	1	1954	38	4.4	38	-0.3	0	6	0	0	-6.7
54	2	1954.083	42.7	3.8	38	17.3	0	6	0	0	7
54	3	1954.167	47.5	3.9	38	12.7	0	6	0	0	-1.7
54	4	1954.25	48.5	4	38	5.5	0	6	0	0	-11.5
54	5	1954.333	48.5	4.4	38	1.3	0	6	2.4	0	-14
54	6	1954.417	53.1	4.3	38	2.4	0	6	4	0	-15.1
54	7	1954.5	51	7.5	38	-2.9	0	6	4	0	-28.7
54	8	1954.583	44	8.9	38	-0.5	0	6	1.6	0	-18.1
54	9	1954.667	42.5	7.6	38	-2.7	0	6	0	0	-23.1
54	10	1954.75	40.5	7.8	38	0.7	0	6	0	0	-17.5
54	11	1954.833	47.7	7.4	38	50.3	0	6	0	0	39.4
54	12	1954.917	38	7.7	38	52.8	0	6	0	0	37.4
55	1	1955	39.5	7.9	40	42.9	0	7	0	0	28.4
55	2	1955.083	44.5	7.6	40	19.7	0	7	0	0	-1.3
55	3	1955.167	49.4	8.8	40	38.3	0	7	0	0	10.1
55	4	1955.25	51.5	4.8	40	14.6	0	7	0	0	-3.8
55	5	1955.333	51.5	5.3	40	18.7	0	7	2.4	0	1.8
55	6	1955.417	55.2	4.2	40	4.8	0	7	4	0	-11.5
55	7	1955.5	53	4.3	40	-2.5	0	7	4	0	-16.5
55	8	1955.583	45.8	4.3	40	-3	0	7	1.6	0	-12.1
55	9	1955.667	44.2	4.4	40	-2.6	0	7	0	0	-12.5
55	10	1955.75	42.1	3.6	40	-2.8	0	7	0	0	-7.9
55	11	1955.833	44.5	3.1	40	-2.1	0	7	0	0	-8.4
55	12	1955.917	39.5	2.4	40	-0.4	0	7	0	0	0.2
56	1	1956	41	2.4	30	65.9	22	7	0	0	77.1
56	2	1956.083	46.2	2.6	30	35.7	25	7	0	0	43.8
56	3	1956.167	51.3	2.9	30	13.6	23	7	0	0	14.3
56	4	1956.25	53.5	2.7	30	7.3	14	7	0	0	-2.8
56	5	1956.333	53.5	3.2	30	1	0	7	4.8	0	-19.5
56	6	1956.417	57.4	3	30	-2.5	0	7	8	0	-23.5
56	7	1956.5	55.1	3	30	-5.5	0	7	8	0	-24
56	8	1956.583	47.5	2.5	30	-0.8	0	7	3.2	0	-15
56	9	1956.667	45.9	2.7	30	3.3	0	7	0	0	-13.4
56	10	1956.75	43.7	6.5	30	-0.9	6	7	0	0	-19.8
56	11	1956.833	46.2	6.3	30	-6.5	13	7	0	0	-20.8
56	12	1956.917	41	2.5	30	41.4	17	7	0	0	47.5
57	1	1957	42.6	2.5	20	49.8	22	7	0	0	49.2
57	2	1957.083	47.9	5.8	20	97.8	25	7	0	0	83.9
57	3	1957.167	53.2	8.7	20	70.5	23	7	0	0	43.1
57	4	1957.25	55.4	8.7	20	23.3	14	7	0	0	-16.1
57	5	1957.333	55.4	8.9	20	8.2	0	7	4.8	0	-42.1
57	6	1957.417	59.5	7.3	20	-0.8	0	7	8	0	-46.2
57	7	1957.5	57.1	3.7	20	-4.1	0	7	8	0	-36.4
57	8	1957.583	49.3	3.4	20	-4.9	0	7	3.2	0	-33.3
57	9	1957.667	47.8	2.8	20	13.3	0	7	0	0	-15.3
57	10	1957.75	45.4	4.4	20	4.2	6	7	0	0	-20.5
57	11	1957.833	47.9	4.2	20	35.4	13	7	0	0	15.3
57	12	1957.917	42.6	4.3	20	51.2	17	7	0	0	40.6
58	1	1958	44.8	8.5	10	96	22	7	0	0	68.5
58	2	1958.083	50.4	7.3	10	138.7	25	7	0	0	107.7
58	3	1958.167	56	8.2	10	78.7	23	7	0	0	39.9
58	4	1958.25	58.4	7.7	10	53.7	14	7	0	0	4.2
58	5	1958.333	58.4	8	10	20.3	0	7	4.8	0	-38.8
58	6	1958.417	62.7	4.7	10	14.2	0	7	8	0	-36.8
58	7	1958.5	60.2	8.2	10	37.8	0	7	8	0	-20.5
58	8	1958.583	51.9	7.5	10	-0.4	0	7	3.2	0	-52.9
58	9	1958.667	50.1	8	10	-2.1	0	7	0	0	-68.2
58	10	1958.75	47.8	8.2	10	26.6	6	7	0	0	-21
58	11	1958.833	50.4	7.8	10	44	13	7	0	0	1.1
58	12	1958.917	44.8	7.4	10	65.9	17	7	0	0	34.5
59	1	1959	47.1	7.7	13	224.8	22	7	0	0	198.1
59	2	1959.083	53	7.1	13	39.2	25	7	0	0	8.4
59	3	1959.167	59.9	7.8	13	77.5	23	7	0	0	39.9
59	4	1959.25	61.4	7.9	13	65.8	14	7	0	0	15.8
59	5	1959.333	61.4	7.8	13	18.1	0	7	4.8	0	-40.8
59	6	1959.417	65.9	8	13	-0.1	0	7	8	0	-61
59	7	1959.5	63.2	2.7	13	-4.2	0	7	8	0	-47
59	8	1959.583	54.6	2.3	13	-5.8	0	7	3.2	0	-43.8
59	9	1959.667	52.7	2.7	13	-4.7	0	7	0	0	-45.1
59	10	1959.75	60.2	0.5	13	-6.4	6	7	0	0	-31.9
59	11	1959.833	53	0.8	13	-3.8	13	7	0	0	-26
59	12	1959.917	47.1	0.5	13	18.4	17	7	0	0	6.8
60	1	1960	49.4	0.6	16	95.6	22	8	0	0	90.4
60	2	1960.083	56.6	7.3	16	72.3	25	8	0	0	43.8
60	3	1960.167	61.7	9.1	16	44.5	23	8	0	0	4.3
60	4	1960.25	64.3	8.5	16	22.4	14	8	0	0	-28.4
60	5	1960.333	64.3	9.1	16	7.2	0	8	4.8	0	-53.8
60	6	1960.417	69.1	8.6	16	1.4	0	8	8	0	-60.3
60	7	1960.5	66.3	5.3	16	1.4	0	8	8	0	-47.8
60	8	1960.583	57.2	5.4	16	-0.9	0	8	3.2	0	-45.8
60	9	1960.667	55.2	2.9	16	18.4	0	8	0	0	-21.2
60	10	1960.75	52.8	3	16	177	6	8	0	0	116
60	11	1960.833	55.8	8.8	16	151.4	13	8	0	0	107.5
60	12	1960.917	49.4	8.9	16	169.6	17	8	0	0	135.3

61	1	1961	51.7	9.1	19	112.7	22	8	0	0	84.6
61	2	1961.083	58.1	8	19	90.2	25	8	0	0	59.4
61	3	1961.167	64.6	9.1	19	55.6	23	8	0	0	15.7
61	4	1961.25	67.3	8.5	19	43.6	14	8	0	0	-7.2
61	5	1961.333	67.3	6.3	19	20.2	0	8	4.8	0	-32.8
61	6	1961.417	72.2	6.3	19	5.8	0	8	8	0	-49.5
61	7	1961.5	69.4	2.7	19	-1.6	0	8	8	0	-43.6
61	8	1961.583	59.8	2.7	19	-3.8	0	8	3.2	0	-40.9
61	9	1961.667	57.8	2.5	19	-4.7	0	8	0	0	-42.8
61	10	1961.75	55.1	2.4	19	-2.3	6	8	0	0	-31.1
61	11	1961.833	58.1	0.4	19	0.2	13	8	0	0	-19.2
61	12	1961.917	51.7	3.7	19	27.2	17	8	0	0	9.2
62	1	1962	54.7	3.7	23	111.3	22	10	0	0	101.2
62	2	1962.083	61.6	8	23	44.5	25	10	0	0	16.3
62	3	1962.167	68.4	8.9	23	10.8	23	10	0	0	-26.4
62	4	1962.25	71.3	5.3	23	34.5	14	10	0	0	-5.1
62	5	1962.333	71.3	7.3	23	16.8	0	10	4.8	0	-37.2
62	6	1962.417	76.5	0.8	23	-0.3	0	10	8	0	-37.4
62	7	1962.5	73.4	4.1	23	-7.8	0	10	8	0	-51.6
62	8	1962.583	63.4	3.5	23	-2.7	0	10	3.2	0	-39.5
62	9	1962.667	61.2	3.6	23	-4.7	0	10	0	0	-43.3
62	10	1962.75	58.3	4	23	-5	6	10	0	0	-35.4
62	11	1962.833	61.6	3.9	23	-0.2	13	10	0	0	-27.2
62	12	1962.917	54.7	4	23	10.8	17	10	0	0	-5
63	1	1963	57.8	9	27	0.1	22	10	0	0	-23.9
63	2	1963.083	65	7.1	27	1.8	25	10	0	0	-23.2
63	3	1963.167	72.2	8	27	113	23	10	0	0	84.2
63	4	1963.25	75.2	4.2	27	38.3	14	10	0	0	2
63	5	1963.333	75.2	7.5	27	17.3	0	10	4.8	0	-38.9
63	6	1963.417	80.7	7.4	27	-0.8	0	10	8	0	-57.8
63	7	1963.5	77.5	7.3	27	-1.4	0	10	8	0	-54.4
63	8	1963.583	66.9	5.6	27	-3.5	0	10	3.2	0	-45.8
63	9	1963.667	64.6	8	27	-1.2	0	10	0	0	-52
63	10	1963.75	61.6	8.7	27	-1	6	10	0	0	-43.7
63	11	1963.833	65	2.7	27	60.7	13	10	0	0	38
63	12	1963.917	57.8	2.5	27	15.6	17	10	0	0	4.8
64	1	1964	60.8	2.9	31	12.3	22	12	0	0	8.3
64	2	1964.083	68.4	3	31	17.1	25	12	0	0	7.8
64	3	1964.167	76	2.7	31	84.7	23	12	0	0	77.1
64	4	1964.25	79.2	6.6	31	52.8	14	12	0	0	11.5
64	5	1964.333	79.2	9.5	31	20.2	0	12	4.8	0	-37.6
64	6	1964.417	85	9.1	31	2.3	0	12	8	0	-57.8
64	7	1964.5	81.6	8.8	31	-6	0	12	8	0	-60.5
64	8	1964.583	70.4	2.5	31	-7.8	0	12	3.2	0	-38.8
64	9	1964.667	68	2.5	31	-7	0	12	0	0	-39.2
64	10	1964.75	64.8	2.8	31	-4.5	6	12	0	0	-27.8
64	11	1964.833	68.4	2.8	31	-7.1	13	12	0	0	-27
64	12	1964.917	60.8	2.5	31	-4.5	17	12	0	0	-12.4
65	1	1965	63.8	2.5	35	8.5	22	14	0	0	8.8
65	2	1965.083	71.8	2.1	35	-4.5	25	14	0	0	-8.9
65	3	1965.167	79.8	1.8	35	34.8	23	14	0	0	22.2
65	4	1965.25	83.2	1.5	35	12	14	14	0	0	-12.5
65	5	1965.333	83.2	2.1	35	3.3	0	14	4.8	0	-31.8
65	6	1965.417	88.2	2.3	35	-3.8	0	14	8	0	-42.7
65	7	1965.5	85.7	3.2	35	-4.8	0	14	8	0	-42.8
65	8	1965.583	73.9	3.5	35	-5.7	0	14	3.2	0	-37.1
65	9	1965.667	71.4	3.8	35	11.2	0	14	0	0	-22.2
65	10	1965.75	68	3.8	35	7.4	6	14	0	0	-16.2
65	11	1965.833	71.8	3.2	35	32.8	13	14	0	0	13.8
65	12	1965.917	63.8	7.4	35	161	17	14	0	0	142.6
66	1	1966	68.9	6.8	23	63	22	12	0	0	44.2
66	2	1966.083	75.2	8	23	129.7	25	12	0	0	106.1
66	3	1966.167	83.6	8.2	23	43.2	23	12	0	0	4.7
66	4	1966.25	87.1	7.8	33	100.5	14	12	0	0	49.8
66	5	1966.333	87.1	7.8	33	30.3	0	12	4.8	0	-19.9
66	6	1966.417	93.5	8.2	33	12.1	0	12	8	0	-52
66	7	1966.5	88.8	8.2	33	1.4	0	12	8	0	-58.2
66	8	1966.583	77.4	7.8	33	10	0	12	3.2	0	-40.9
66	9	1966.667	74.8	4.2	33	8	0	12	0	0	-34
66	10	1966.75	71.3	3.8	33	65.1	6	12	0	0	34.3
66	11	1966.833	75.2	3.4	33	46.2	13	12	0	0	10.3
66	12	1966.917	68.9	8.1	23	134.7	17	12	0	0	112.8
67	1	1967	69.2	5.1	25	68.8	22	12	0	0	32.9
67	2	1967.083	77.8	3.4	25	84.2	25	12	0	0	58.1
67	3	1967.167	86.4	0.3	25	60.6	23	12	0	0	16.4
67	4	1967.25	90.1	8.9	25	46.4	14	12	0	0	-18.3
67	5	1967.333	90.1	0.3	25	143.9	0	12	4.8	0	69.7
67	6	1967.417	98.7	0.1	25	24.1	0	12	8	0	-53.7
67	7	1967.5	92.8	0.2	25	0.8	0	12	8	0	-72.7
67	8	1967.583	88.1	8.6	25	-3.3	0	12	3.2	0	-67.1
67	9	1967.667	77.3	8.8	25	-1.2	0	12	0	0	-66.7
67	10	1967.75	73.7	0.6	25	18.2	6	12	0	0	-14.1
67	11	1967.833	77.8	0.1	25	34.3	13	12	0	0	8.2
67	12	1967.917	88.2	5.1	25	42.8	17	12	0	0	13.1
68	1	1968	71.4	5.5	24	96.6	22	12	0	0	67.7
68	2	1968.083	88.4	5	24	60	25	12	0	0	25.8
68	3	1968.167	88.3	0.2	24	22.8	23	12	0	0	-33.1
68	4	1968.25	93.1	8.5	24	14.3	14	12	0	0	-53.2
68	5	1968.333	93.1	8.6	24	17.7	0	12	4.8	0	-58.7
68	6	1968.417	98.0	5.2	24	7.8	0	12	8	0	-63.1
68	7	1968.5	96.0	5.5	24	38.6	0	12	8	0	-70.6
68	8	1968.583	82.7	8.6	24	13.8	0	12	3.2	0	-64
68	9	1968.667	70.9	8.5	24	25	0	12	0	0	-43.4
68	10	1968.75	78.1	8.1	24	34.7	6	12	0	0	-22.4
68	11	1968.833	80.4	8.1	24	75.7	13	12	0	0	20.8
68	12	1968.917	71.4	8.1	24	75.9	17	12	0	0	34.8
69	1	1969	74.5	8	23	141.5	22	12	0	0	101.7
69	2	1969.083	83.8	7.7	23	149	25	12	0	0	101.4
69	3	1969.167	93.1	8.4	23	144.1	23	12	0	0	85.7
69	4	1969.25	97	7.8	23	38.6	14	12	0	0	-32.2
69	5	1969.333	97	8.7	23	115.7	0	12	4.8	0	34.1
69	6	1969.417	104.1	8.4	23	36.7	0	12	8	0	-48.8
69	7	1969.5	100	8.8	23	4.3	0	12	8	0	-77.2
69	8	1969.583	98.2	8.8	23	2.8	0	12	3.2	0	-69.2
69	9	1969.667	93.3	8.4	23	0.5	0	12	0	0	-71.9
69	10	1969.75	79.4	8.8	23	-2.8	6	12	0	0	-65.7
69	11	1969.833	89.8	4	23	4.5	13	12	0	0	-42.8
69	12	1969.917	74.5	3.9	23	30.1	17	12	0	0	-3.4
70	1	1970	77.5	4.8	25	73.4	22	12	0	0	41.2
70	2	1970.083	87.2	5.3	25	140.2	25	12	0	0	107.5
70	3	1970.167	96.9	8.9	25	110.3	23	12	0	0	57.5
70	4	1970.25	101	8.5	25	118	14	12	0	0	33.5
70	5	1970.333	101	8.8	25	33.3	0	12	4.8	0	-50.5
70	6	1970.417	108.4	7.4	25	5.6	0	12	8	0	-79.2
70	7	1970.5	104	7.7	25	3.1	0	12	8	0	-77.4
70	8	1970.583	88.8	7.6	25	5.6	0	12	3.2	0	-85.2
70	9	1970.667	89.7	3.8	25	-0.6	0	12	0	0	-81.4
70	10	1970.75	82.6	3.9	25	-3.6	6	12	0	0	-64
70	11	1970.833	87.2	3.7	25	35.5	13	12	0	0	-12.3
70	12	1970.917	77.6	3.9	25	44.0	17	12	0	0	10.5

71	1	1971	79.8	3.8	27	129.2	22	12	0	0	90.8
71	2	1971.083	89.8	3.6	27	82.7	25	12	0	0	45.8
71	3	1971.167	89.7	6.9	27	75.8	23	12	0	0	18.8
71	4	1971.25	103.9	8.8	27	46.5	14	12	0	0	-24.2
71	5	1971.333	103.9	8.8	27	22	0	12	4.8	0	-62.6
71	6	1971.417	111.6	8	27	18.3	0	12	8	0	-69.3
71	7	1971.5	107.1	8.6	27	5.9	0	12	8	0	-78.3
71	8	1971.583	92.4	8.3	27	27.1	0	12	3.2	0	-46.2
71	9	1971.667	89.2	8.2	27	7.3	0	12	0	0	-66.6
71	10	1971.75	85	3.7	27	14.5	6	12	0	0	-35.8
71	11	1971.833	89.8	3	27	34.6	13	12	0	0	-11.9
71	12	1971.917	79.8	3.3	27	37.9	17	12	0	0	4.9
72	1	1972	82.8	3.2	26	91.9	22	12	0	0	60
72	2	1972.083	93.2	5.5	26	94	25	12	0	0	47.4
72	3	1972.167	103.5	7.3	26	95.8	23	12	0	0	32.9
72	4	1972.25	107.9	7.3	26	42.5	14	12	0	0	-34.4
72	5	1972.333	107.9	7.5	26	25.2	0	12	7.2	0	-58.3
72	6	1972.417	115.8	9.1	26	13.5	0	12	12	0	-78.7
72	7	1972.5	111.2	9.2	26	3.7	0	12	12	0	-83.2
72	8	1972.583	95.9	8.8	26	11.2	0	12	4.8	0	-85.9
72	9	1972.667	92.6	3.9	26	3.8	0	12	0	0	-62.4
72	10	1972.75	88.3	4.2	26	1.3	8	12	0	0	-54.8
72	11	1972.833	93.2	4	26	9.3	13	12	0	0	-44.5
72	12	1972.917	82.8	4.1	26	106.4	17	12	0	0	87.2
73	1	1973	87.4	4.1	21	34.7	22	12	0	0	-9.1
73	2	1973.083	98.3	3.7	21	26.4	25	12	0	0	-25.4
73	3	1973.167	109.2	3.7	21	21.5	23	12	0	0	-42.2
73	4	1973.25	113.8	2.9	21	14.8	14	12	0	0	-80.5
73	5	1973.333	113.8	1.9	21	18.5	0	12	7.2	0	-80.4
73	6	1973.417	122.2	1.4	21	48.3	0	12	12	0	-32.9
73	7	1973.5	117.3	1.6	21	37.2	0	12	12	0	-39.5
73	8	1973.583	101.2	3.5	21	5.7	0	12	4.8	0	-87.4
73	9	1973.667	87.7	3	21	0.4	0	12	0	0	-72.9
73	10	1973.75	93.1	3.4	21	4.3	6	12	0	0	-59.4
73	11	1973.833	98.3	2.7	21	3.2	13	12	0	0	-68.9
73	12	1973.917	87.4	2.3	21	8.1	17	12	0	0	-34.7
74	1	1974	92	2.2	17	48.4	22	5	0	0	-7.7
74	2	1974.083	103.5	3.7	17	90.4	25	5	0	0	22.8
74	3	1974.167	114.9	6.7	17	38.7	23	5	0	0	-61.9
74	4	1974.25	119.8	6.5	17	11	14	5	0	0	-91.4
74	5	1974.333	119.8	6	17	3.4	0	5	7.2	0	-103.8
74	6	1974.417	128.8	5.7	17	1.3	0	5	12	0	-109.8
74	7	1974.5	123.4	3.9	17	2.7	0	5	12	0	-97.6
74	8	1974.583	106.5	3.8	17	5.2	0	5	4.8	0	-85
74	9	1974.667	102.8	4.1	17	18.3	0	5	0	0	-76.3
74	10	1974.75	98	3.6	17	73.9	6	5	0	0	-8.2
74	11	1974.833	103.5	5.2	17	108.4	13	5	0	0	25
74	12	1974.917	92	8.8	17	51.6	17	5	0	0	-20.3
75	1	1975	95.8	7.2	18	94.4	22	4	0	0	22.5
75	2	1975.083	107.7	6.8	18	84	25	4	0	0	-17.6
75	3	1975.167	119.7	7.6	18	193.7	23	4	0	0	98.1
75	4	1975.25	124.7	7.3	18	95.2	14	4	0	0	-14.5
75	5	1975.333	124.7	7.4	18	27.6	0	4	7.2	0	-88.7
75	6	1975.417	133.9	7.1	18	8.4	0	4	12	0	-111.9
75	7	1975.5	129.5	7.3	18	5.4	0	4	12	0	-109.6
75	8	1975.583	110.8	5.9	18	-2.3	0	4	4.8	0	-102.9
75	9	1975.667	107.1	3.7	18	-0.3	0	4	0	0	-98.1
75	10	1975.75	102.1	3.9	18	2	6	4	0	0	-87.8
75	11	1975.833	107.7	3.9	18	-1.4	13	4	0	0	-85.2
75	12	1975.917	95.8	3.8	18	-0.5	17	4	0	0	-87.5
76	1	1976	85.9	2.4	0	-1	22	4	0	69	1.6
76	2	1976.083	96.6	2.7	0	-2.1	25	4	0	7.4	-70.4
76	3	1976.167	107.3	1.4	0	-3.7	23	4	0	38.5	-51.5
76	4	1976.25	111.9	0.9	0	-4.8	14	4	0	21.3	-79.9
76	5	1976.333	111.9	0.9	0	-4.2	0	4	7.2	8.9	-98.3
76	6	1976.417	120.1	1	0	-7	0	4	12	4.8	-109.2
76	7	1976.5	115.3	0.8	0	-4.4	0	4	12	0	-108.2
76	8	1976.583	99.4	0.7	0	-7.2	0	4	4.8	2.6	-97.2
76	9	1976.667	96	0.8	0	-5	0	4	0	98	-3.3
76	10	1976.75	91.5	0.9	0	0.4	6	4	0	309.7	226.1
76	11	1976.833	98.6	2.1	0	3.5	13	4	0	248.4	167.3
76	12	1976.917	85.9	3.4	0	43.5	17	4	0	239.1	208.1
77	1	1977	89.7	3.9	3	115	22	4	0	0	43.6
77	2	1977.083	100.9	6.1	3	247.8	25	4	0	0	159.9
77	3	1977.167	112.1	6.6	3	95.9	23	4	0	0	-4.6
77	4	1977.25	118.8	6.3	3	38.8	14	4	0	0	-77.1
77	5	1977.333	118.9	6.9	3	39.3	0	4	7.2	0	-82.5
77	6	1977.417	125.4	6.6	3	19.4	0	4	12	0	-105.9
77	7	1977.5	120.4	7.9	3	7.8	0	4	12	0	-115.7
77	8	1977.583	103.8	7.2	3	20	0	4	4.8	0	-92.2
77	9	1977.667	100.3	7.8	3	8	0	4	0	23.9	-82.1
77	10	1977.75	95.6	5.1	3	4.6	6	4	0	94	2
77	11	1977.833	100.9	5.7	3	5.1	13	4	0	64.2	-38.2
77	12	1977.917	89.7	5.6	3	40.9	17	4	0	39.1	-1.3
78	1	1978	92.7	4.7	0	75.8	22	4	0	18.2	12.3
78	2	1978.083	104.3	4.3	0	96.9	25	4	0	3.7	12
78	3	1978.167	115.9	5.1	0	65.6	23	4	0	0	-37.5
78	4	1978.25	120.8	7.5	0	55.6	14	4	0	3.5	-65.3
78	5	1978.333	120.8	7.6	0	83.8	0	4	7.2	15.1	-51.8
78	6	1978.417	129.6	7.3	0	18.3	0	4	12	24.7	-91.8
78	7	1978.5	124.4	7.9	0	4.9	0	4	12	56.8	-88.6
78	8	1978.583	107.4	7	0	6.5	0	4	4.8	42.8	-88.7
78	9	1978.667	103.7	7.5	0	1.7	0	4	0	108.8	-12.8
78	10	1978.75	98.8	7.9	0	-2.9	6	4	0	58.5	-55.3
78	11	1978.833	104.3	6.7	0	-1.1	13	4	0	82.8	-25
78	12	1978.917	92.7	4.6	0	83.3	17	4	0	11.8	10.5
79	1	1979	101.8	4.9	16	51.1	22	4	0	0	-22.3
79	2	1979.083	114.6	6.9	16	149.7	25	4	0	0	58.9
79	3	1979.167	127.3	7.1	16	172.1	23	4	0	0	67.9
79	4	1979.25	132.7	7.9	16	154.8	14	4	0	0	33.5
79	5	1979.333	132.7	8.3	16	114.6	0	4	7.2	0	-14
79	6	1979.417	142.4	8.3	16	35.8	0	4	12	71.2	-27.6
79	7	1979.5	136.7	7.8	16	10.4	0	4	12	28.7	-89.4
79	8	1979.583	117.9	7.6	16	8.8	0	4	4.8	0	-104.4
79	0	1979.667	113.9	8.1	16	0.9	0	4	0	0	-118.4
79	10	1979.75	108.5	7.6	16	1.8	6	4	0	68.8	-35
79	11	1979.833	114.6	5.4	16	7.1	13	4	0	99.7	8.7
79	12	1979.917	101.8	5.2	16	130.8	17	4	0	37.1	88.6
80	1	1980	104.9	5	11	72.4	22	4	0	0	-9.5
80	2	1980.083	118	2.8	11	108.4	25	4	0	1.6	23.9
80	3	1980.167	131.1	1.7	11	67.6	23	4	0	9.8	-20.5
80	4	1980.25	136.6	8.3	11	34.4	14	4	0	28.4	-65
80	5	1980.333	136.6	5	11	7.5	0	4	7.2	0	-120.7
80	6	1980.417	146.6	5.2	11	8.8	0	4	12	0	-124.8
80	7	1980.5	140.8	5.4	11	92.9	0	4	12	0	-35.8
80	8	1980.583	121.4	4.6	11	121.8	0	4	4.8	15.9	23
80	9	1980.667	117.3	4.1	11	21.8	0	4	0	28	-84.3
80	10	1980.75	111.8	4.4	11	50.5	6	4	0	32.8	-10.7
80	11	1980.833	118	3.3	11	57.8	13	4	0	27.8	-13.9
80	12	1980.917	104.9	3.2	11	85.4	17	4	0	24.2	27.9

81	1	1981	104.1	3.1	15	75.8	22	2	0	14.7	18.8
81	2	1981.083	117.1	2.6	15	45.3	25	2	0	93	55
81	3	1981.167	130.1	3	15	177.5	23	2	0	94.2	168.4
81	4	1981.25	135.6	2.6	15	102.5	14	2	0	23.7	14.2
81	5	1981.333	135.6	2.2	15	72.8	0	2	7.2	7	-37.8
81	6	1981.417	145.6	2.3	15	40.1	8	2	12	40.6	-42.6
81	7	1981.5	138.7	2.1	15	7.5	0	2	12	0	-109.2
81	8	1981.583	120.6	2.3	15	18.1	0	2	4.8	0	-86.1
81	9	1981.667	116.4	2.1	15	17.3	0	2	0	46.4	-41.7
81	10	1981.75	111	2	15	27.8	6	2	0	85.4	10.8
81	11	1981.833	117.1	1.8	15	27.2	13	2	0	75	8.4
81	12	1981.917	104.1	2	15	82.4	17	2	0	66.4	73
82	1	1982	110.2	2.2	7	142.5	22	2	0	46.7	100.8
82	2	1982.083	124	2.2	7	47.8	25	2	0	42	-6.8
82	3	1982.167	137.7	2.9	7	151.7	23	2	0	58.1	87.1
82	4	1982.25	143.5	2.4	7	33.6	14	2	0	49.8	-44
82	5	1982.333	143.5	2.1	7	8.8	0	2	7.2	135.1	11.8
82	6	1982.417	154.1	2.1	7	20.4	0	2	12	72.3	-48.3
82	7	1982.5	147.9	2.4	7	3	0	2	12	32.2	-98.3
82	8	1982.583	127.8	2.1	7	3.4	0	2	4.8	73.1	-43.3
82	9	1982.667	123.2	2.5	7	2.3	0	2	0	65.3	-53.8
82	10	1982.75	117.4	2.1	7	18.7	6	2	0	82.5	-9.2
82	11	1982.833	124	1.7	7	53.7	13	2	0	30.5	-22.8
82	12	1982.917	110.2	2	7	79.8	17	2	0	51.1	41
83	1	1983	104.1	2.3	4	57.1	22	2	0	66.1	40.7
83	2	1983.083	117.1	1.9	4	55.6	25	2	0	45.8	8.4
83	3	1983.167	130.1	1.8	4	37.8	23	2	0	88.8	18.1
83	4	1983.25	135.6	1.8	4	78.7	14	2	0	17.8	-24.3
83	5	1983.333	135.6	1.8	4	130.8	0	2	7.2	12.6	15.8
83	6	1983.417	145.6	1.7	4	45.6	0	2	12	8.4	-80.6
83	7	1983.5	138.7	1.8	4	11.5	0	2	12	42.2	-73
83	8	1983.583	120.6	1.6	4	4.5	0	2	4.8	18.3	-80.5
83	9	1983.667	116.4	2.1	4	5.4	0	2	0	73.4	-37.8
83	10	1983.75	111	2.4	4	4.9	6	2	0	74.9	-25.8
83	11	1983.833	117.1	1.9	4	5.5	13	2	0	82.7	-35.5
83	12	1983.917	104.1	1.9	4	34.1	17	2	0	83.8	31.5
84	1	1984	101.8	1.7	0	83.8	22	2	0	106.7	118.1
84	2	1984.083	114.8	1.7	0	105.4	25	2	0	85	87.8
84	3	1984.167	127.3	1.8	0	80.2	23	2	0	54.7	7.8
84	4	1984.25	132.7	1.4	0	28.7	14	2	0	53	-40.9
84	5	1984.333	132.7	1.6	0	12.8	0	2	7.2	100.1	-15.1
84	6	1984.417	142.4	1.5	0	11.1	0	2	12	85.9	-25.8
84	7	1984.5	138.7	1.4	0	-0.5	0	2	12	14	-113.1
84	8	1984.583	117.9	1.2	0	0	0	2	4.8	74	-40.4
84	9	1984.667	113.9	1.5	0	3.3	0	2	0	138.2	25.4
84	10	1984.75	108.5	1.2	0	4.5	6	2	0	17.3	-82
84	11	1984.833	114.8	1	0	58	13	2	0	130.4	86
84	12	1984.917	101.9	1.1	0	68.2	17	2	0	84.3	86.7
85	1	1985	111	1.3	0	70.9	22	2	0	83.7	64
85	2	1985.083	124.8	1	0	53.1	25	2	0	87.8	38.9
85	3	1985.167	138.7	1.3	0	46	23	2	0	78.2	7
85	4	1985.25	144.5	1.1	0	40	14	2	0	88.7	8.9
85	5	1985.333	144.5	1.2	0	23.4	0	2	7.2	82.8	-32.8
85	6	1985.417	156.1	1.4	0	38.8	0	2	12	51.5	-65
85	7	1985.5	148.9	1.2	0	8.1	0	2	12	0	-130.2
85	8	1985.583	128.5	1.2	0	6	0	2	4.8	47	-72
85	9	1985.667	124.1	1.5	0	0	0	2	0	43.6	-82.8
85	10	1985.75	118.3	1.5	0	4.1	6	2	0	80.9	-29.3
85	11	1985.833	124.8	1.4	0	63.6	13	2	0	142.7	42.5
85	12	1985.917	111	1.1	0	150	17	2	0	98.3	113.4
86	1	1986	108.4	1.5	0	128.8	22	2	0	80.4	100.7
86	2	1986.083	123.1	1.5	0	72.8	25	2	0	80.7	32.8
86	3	1986.167	138.8	1.8	0	78.9	23	2	0	100	80.1
86	4	1986.25	142.8	1.8	0	128	14	2	0	38.3	34.3
86	5	1986.333	142.8	1.8	0	68.7	0	2	7.2	0	-78.8
86	6	1986.417	153	1.5	0	19.9	0	2	12	108.1	-17.3
86	7	1986.5	148.8	1.2	0	2.3	0	2	12	84.8	-48.2
86	8	1986.583	128.7	1.2	0	24.7	0	2	4.8	148	80.4
86	9	1986.667	122.4	1.3	0	11.8	0	2	0	78.4	-42
86	10	1986.75	118.6	1.2	0	13.8	6	2	0	65.8	-32.4
86	11	1986.833	123.1	1.2	0	88.6	13	2	0	38	22.8
86	12	1986.917	108.4	1.2	0	103.6	17	2	0	88.4	88.8
87	1	1987	111	1.8	0	81.8	22	2	0	84.2	48.4
87	2	1987.083	124.8	1.5	0	58.4	25	2	0	82.6	19.5
87	3	1987.167	138.7	1.6	0	83.1	23	2	0	58.7	34.7
87	4	1987.25	144.5	1.3	0	123.2	14	2	0	108	87
87	5	1987.333	144.5	1.5	0	32.4	0	2	7.2	131	23.8
87	6	1987.417	156.1	1.5	0	47.7	0	2	12	72.7	-25
87	7	1987.5	148.8	1.3	0	14.2	0	2	12	78.8	-47.8
87	8	1987.583	128.5	0.9	0	8.8	0	2	4.8	73.8	-40.4
87	9	1987.667	124.1	1.5	0	8.4	0	2	0	81.2	-26.7
87	10	1987.75	118.3	1.5	0	68.3	6	2	0	14.8	-31.3
87	11	1987.833	124.8	1.5	0	102.1	13	2	0	0	-12.1
87	12	1987.917	111	1.5	0	47.7	17	2	0	57.1	8.6
88	1	1988	118.3	1.6	0	182.0	22	2	0	98.1	122.1
88	2	1988.083	130.8	1.4	0	101.8	25	2	0	98.8	30.1
88	3	1988.167	145.3	1.4	0	128.8	23	2	0	41.8	48.8
88	4	1988.25	151.5	1.3	0	42.3	14	2	0	45.1	-61.8
88	5	1988.333	151.5	1.3	0	28.8	0	2	7.2	0	-117.8
88	6	1988.417	162.6	1.3	0	14.8	0	2	12	85.8	-71.8
88	7	1988.5	158.1	1.1	0	17.8	0	2	12	85.8	-41.8
88	8	1988.583	134.6	1.4	0	8.7	0	2	4.8	119	-4.1
88	9	1988.667	130	1.8	0	7.6	0	2	0	81.8	-33.4
88	10	1988.75	123.9	1.8	0	8.4	6	2	0	121.6	7.6
88	11	1988.833	130.8	1.8	0	0	13	2	0	62.6	-48.8
88	12	1988.917	118.3	1.5	0	28.5	17	2	0	98.2	27.1
89	1	1989	123.9	1.6	0	30.0	17	2	0	148.1	87.4
89	2	1989.083	138.4	1.5	0	27.2	75	2	0	-154.5	114.8
89	3	1989.167	154.5	1.6	0	73.7	77	2	0	147.1	140.8
89	4	1989.25	161.4	1.8	0	48.4	61	2	0	157.2	100.7
89	5	1989.333	161.4	1.5	0	98.1	0	2	7.2	98.1	-27.6
89	6	1989.417	173.2	1.5	0	21.4	0	2	12	122.8	-18.4
89	7	1989.5	168.3	1.3	0	10.2	0	2	12	103.4	-42.4
89	8	1989.583	143.4	1.2	0	3.6	0	2	4.8	84.5	-42
89	9	1989.667	138.5	1.8	0	1.8	0	2	0	83.1	-78.1
89	10	1989.75	132	1.7	0	0.5	0	2	0	52.6	-72.7
89	11	1989.833	138.4	1.5	0	38.1	0	2	0	107.2	1.8
89	12	1989.917	123.9	1.2	0	63.2	0	2	0	107.6	35.5
90	1	1990	120.1	1.3	0	78.4	0	2	0	113.5	68.3
90	2	1990.083	135.1	1.3	0	77.9	0	2	0	113.4	68.2
90	3	1990.167	150.1	1.5	0	73.7	51	2	0	83.4	85.7
90	4	1990.25	156.4	1.2	0	48.4	45	2	0	140.4	73.8
90	5	1990.333	156.4	1.2	0	3.3	28	2	7.2	138.1	17.7
90	6	1990.417	167.8	1.2	0	0.6	0	2	12	102.8	-64.6
90	7	1990.5	161.2	1	0	-1.6	0	2	12	56	-86.6
90	8	1990.583	138	1.2	0	3.6	0	2	4.8	13.6	-118.8
90	9	1990.667	124.3	1.7	0	1.0	0	2	0	8.8	-128.3
90	10	1990.75	128	1.8	0	-1.6	0	2	0	58.4	-74.8
90	11	1990.833	135.1	1.8	0	1.4	24	2	0	165.2	52.8
90	12	1990.917	120.1	1.2	0	3.3	48	2	0	173.8	103.4

91	1	1991	112.5	1.6	0	37	81	2	0	250.8	253.8
91	2	1991.083	126.5	1.6	0	29.1	54	2	0	205.1	158.7
91	3	1991.167	140.6	1.5	0	73.7	78	2	0	315.9	324.9
91	4	1991.25	146.5	1.3	0	13.2	47	2	0	287.4	199.4
91	5	1991.333	146.5	1.3	0	7.1	34	2	7.2	191.4	91.6
91	6	1991.417	157.2	1.2	0	3.6	22	2	12	161.8	40.7
91	7	1991.5	151	1.3	0	5.8	27	2	12	113.2	5.3
91	8	1991.583	130.2	1	0	-1.2	3	2	4.8	9.2	-115.4
91	9	1991.667	125.8	1.2	0	1.3	6	2	0	35.4	-84.6
91	10	1991.75	119.9	1.1	0	-1.3	19	2	0	60.8	-42.8
91	11	1991.833	126.5	1.3	0	25.1	45	2	0	226.7	168.6
91	12	1991.917	112.5	1.4	0	10.3	37	2	0	167.4	100.3
92	1	1992	111.7	1.7	0	64.8	0	2	0	314.3	264.8
92	2	1992.083	125.7	1.5	0	15.7	0	2	0	289.2	176.9
92	3	1992.167	139.6	1.5	0	23.7	51	2	0	226.9	159.7
92	4	1992.25	145.5	1.2	0	28.3	45	2	0	305.4	231.8
92	5	1992.333	145.5	1.3	0	11.5	26	2	7.2	173.2	70.8
92	6	1992.417	156.2	1.6	0	17.8	0	2	12	187.4	38.5
92	7	1992.5	149.9	1.3	0	12	0	2	12	247.4	120
92	8	1992.583	129.4	1.5	0	21.2	0	2	4.8	298	192.4
92	9	1992.667	124.9	1.3	0	89.7	0	2	0	345.7	308.7
92	10	1992.75	119.1	1.2	0	87.3	0	2	0	74.3	41.1
92	11	1992.833	125.7	1.2	0	131.8	24	2	0	0	28.8
92	12	1992.917	111.7	1.1	0	120.3	48	2	0	0	55.5
93	1	1993	111.7	1	0	111.2	0	2	0	0	-1.3
93	2	1993.083	125.7	0.7	0	33.9	11	2	0	85.9	4.8
93	3	1993.167	139.6	0.8	0	18.3	0	2	0	170.9	47.3
93	4	1993.25	145.5	0.8	0	39.7	11	2	0	170	75.5
93	5	1993.333	145.5	0.8	0	11.8	53	2	7.2	144	70.1
93	6	1993.417	156.2	0.9	0	24.3	42	2	12	142.7	84.4
93	7	1993.5	149.9	0.8	0	10.2	22	2	12	40.3	-65.7
93	8	1993.583	129.4	0.7	0	4.4	7	2	4.8	78.7	-34.6
93	9	1993.667	124.9	0.8	0	13	22	2	0	23.5	-66.9
93	10	1993.75	119.1	0.8	0	53.6	30	2	0	175.4	139.9
93	11	1993.833	125.7	0.8	0	69.9	0	2	0	127.3	71.1
93	12	1993.917	111.7	0.9	0	157.2	0	2	0	205.6	250.6
94	1	1994	101.8	0.9	0	180.5	0	2	0	21	99.1
94	2	1994.083	114.6	0.8	0	124.2	0	2	0	0	9.2
94	3	1994.167	127.3	0.9	0	67.7	0	2	0	11.5	-48.7
94	4	1994.25	132.7	0.7	0	81.1	0	2	0	0	-51.7
94	5	1994.333	132.7	0.7	0	29.2	0	2	7.2	78.3	-18
94	6	1994.417	142.4	0.8	0	11.8	0	2	12	142.5	23.3
94	7	1994.5	138.7	0.7	0	4.5	0	2	12	88.8	-31.3
94	8	1994.583	117.9	0.7	0	3.6	0	2	4.8	122.1	12.5
94	9	1994.667	113.9	0.7	0	18.4	0	2	0	167.3	71.6
94	10	1994.75	108.5	0.7	0	29.8	0	2	0	153.4	74.4
94	11	1994.833	114.8	0.8	0	67.4	0	2	0	259.9	212.6
94	12	1994.917	101.8	0.7	0	84.5	0	2	0	96.3	79
95	1	1995	97.3	0.7	0	152.4	0	2	0	2.4	57.4
95	2	1995.083	109.4	0.5	0	184.4	0	2	0	0	55.3
95	3	1995.167	121.6	0.8	0	84.8	0	2	0	0	-26.4
95	4	1995.25	128.7	0.8	0	29.6	0	2	0	0	-66.9
95	5	1995.333	128.7	0.6	0	14.2	0	2	7.2	47.5	-57.5
95	6	1995.417	136	0.8	0	7.4	0	2	12	64.7	-51.8
95	7	1995.5	130.6	0.6	0	0.7	0	2	12	3	-114.7
95	8	1995.583	112.6	0.8	0	-2.8	0	2	4.8	0.1	-110.8
95	9	1995.667	108.8	0.8	0	6.8	0	2	0	39.2	-63
95	10	1995.75	103.7	0.7	0	-1.3	0	2	0	102.9	-2
95	11	1995.833	109.4	0.5	0	8.8	13	2	0	151.2	84
95	12	1995.917	97.3	0.5	0	49.2	54	2	0	267.4	273.6
96	1	1996	101.8	0.8	0	45.8	79	2	0	395.1	417.8
96	2	1996.083	114.6	1.1	0	67.3	77	2	0	348.1	374.6
96	3	1996.167	127.3	0.9	0	32.9	62	2	0	410.2	367.2
96	4	1996.25	132.7	0.7	0	22.5	41	2	0	176.8	107.7
96	5	1996.333	132.7	0.5	0	8.8	24	2	7.2	145.7	63.5
96	6	1996.417	142.4	0.6	0	0.9	4	2	12	98.4	-68.9
96	7	1996.5	138.7	0.6	0	0.2	3	2	12	27.8	-83.4
96	8	1996.583	117.9	0.4	0	-0.7	0	2	4.8	28.2	-84.9
96	9	1996.667	113.9	0.6	0	-2.9	0	2	0	14.8	-101.6
96	10	1996.75	108.5	1.1	0	-1.7	1	2	0	86	-12.2
96	11	1996.833	114.6	0.7	0	4.2	16	2	0	162.9	68.6
95	12	1996.917	101.8	0.7	0	8.4	20	2	0	192.7	119.4

CORRECT.TCMD

Components of artificial influence, TCMD

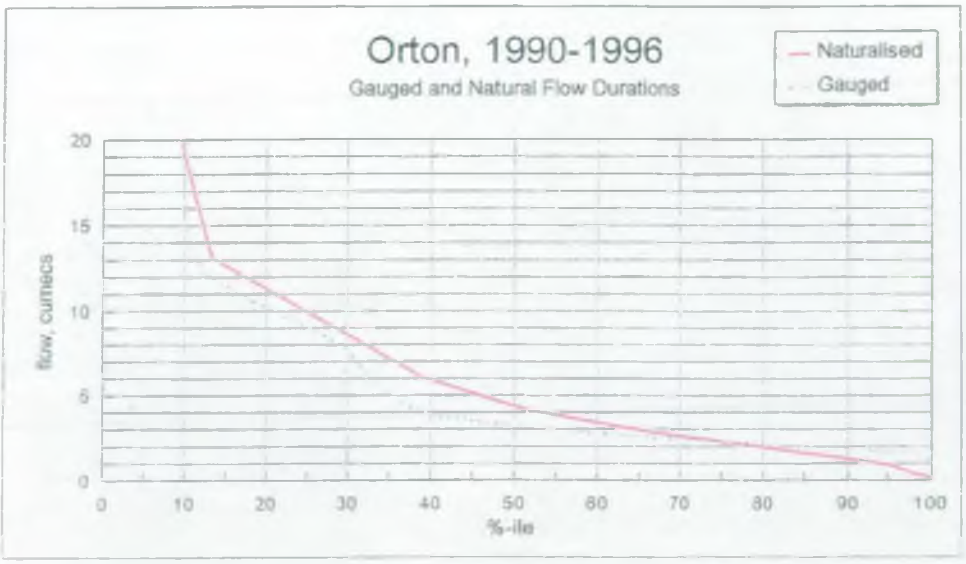
NOTE :

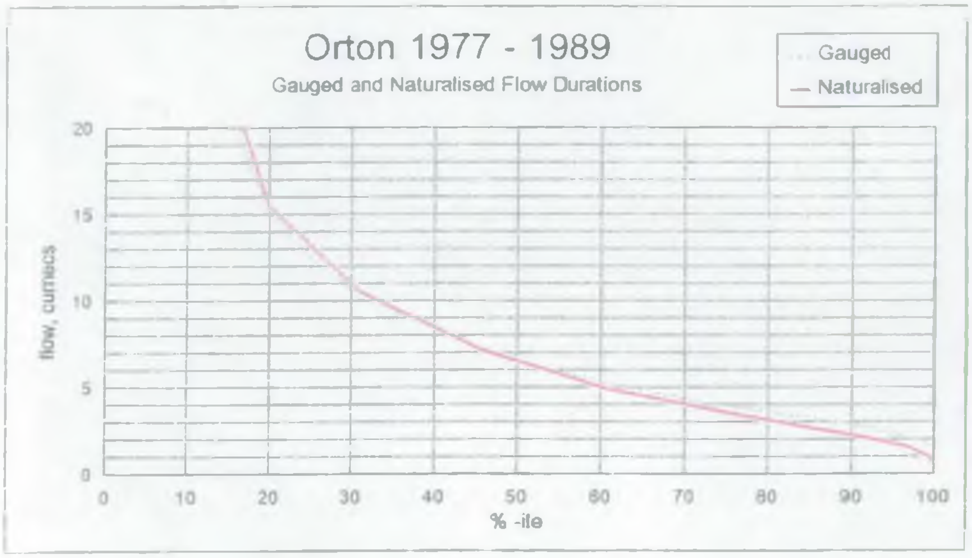
This file was altered in August 1997 to correct errors described in the Errata.
The data between 2.92 and 2.93 has been altered, though changes in values only occur in the months 2.92 and 2.

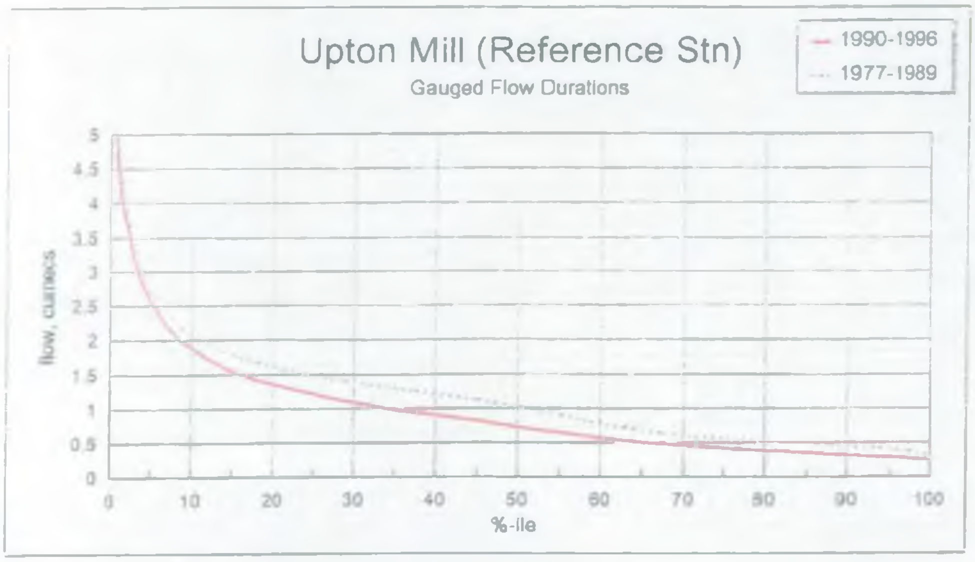
APPENDIX 6

FLOW DURATION CURVES
(AUGUST 1997)

Flow duration curves were derived for the naturalised series in August 1997, subsequent to work on assessing the yield of Rutland Water. They are included here for completeness.


Orton, 1990-1996
Gauged and Natural Flow Durations
Naturalised
Gauged
flow, cumecs
0
5
10
15
20
0
10
20
30
40
50
60
70
80
90
100
%-ile


Orton 1977 - 1989
Gauged and Naturalised Flow Durations
Gauged
Naturalised
flow, cumecs
0
5
10
15
20
0
10
20
30
40
50
60
70
80
90
100
% -ile


Upton Mill (Reference Stn)
Gauged Flow Durations
1990-1996
1977-1989
flow, cumecs
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
10
20
30
40
50
60
70
80
90
100
%-ile

APPENDIX 7

DIRECTORY OF FILES
(AUGUST 1997)

(Subdirectories are indicated by bold type, filenames by capitals.)

Gaugedat (Gauged flow data)

ORTGAG.DAT	Gauged flow at Orton.
ORTINF.DAT	ORTGAG.DAT with missing data infilled by D.Cadman using interpolation estimates.
ORTON92.NAT	Naturalised series of G.Watts 1992.
TINWELL.NAT	Tinwell naturalised series of G.Watts
UPTONINF.GAG	Gauged flow at Upton with missing data infilled by D.Cadman using interpolation estimates.

Inputfil (data files input to flowna.for)

As contained in appendices

Progs (Programmes used for the naturalisation)

.EXE .OBJ .FOR files for the natflo and Flona. programmes.
FILES.IN read by flona., is a listing of the input files to be opened.

Output

CORRECT.CUM	Monthly values of corrections for artificial influences, cumecs.
CORRECT.TCM	As Correct.Cum in tcmd.
ORTON97.NAT	The time series of naturalised daily Orton flow.
ORTMON97.NAT	Time series of naturalised monthly Orton flow.
VARN.DAY	Time series of aggregated correction due to artificial influences, daily.
VARN.MON	Time series of aggregated correction due to artificial influences, monthly.

Reports (Text and graphics for the July 1997 report.)

ORTNAT.WPD
ORTONINF.PRE
ORTNAT2.PRE
ORTONINF.PRE