

**Lower Nene - Options for Resources**

**Current Water Management Practice**

**Product LNOR-1**

**National Rivers Authority  
Anglian Region**

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**Author:** Glenn Watts

**Checked:** Andrew Turner

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## Summary

This report identifies current water management practice in the Lower Nene catchment. It covers the Nene between Wansford and the tidal limit at Dog-in-a-Doublet Sluice. Demands for water include irrigation in the North Level, navigation and irrigation in the Middle Level and the Nene Washlands SSSI and Ramsar site. The Nene is a navigation throughout its lower reaches.

Water resource problems occur in the Lower Nene during dry summers, when demand often exceeds available supply. The existing procedures for determining actions were agreed in 1992 and involve a weekly exchange of faxes between NRA Northern and Central Areas. The procedure was used during June and July 1995; scope for improvement has been identified, particularly in the estimation of losses of water from the river channel.

## Authors

This report was compiled by:

Roger Enstone	Water Quality, Spalding
Debbie Jones	Water Resources, Brampton
Fola Ogunyoye	Flood Defence, Spalding
Kevin Rutterford	Water Quality, Brampton
David Watling	Water Resources, Lincoln
Glenn Watts	Water Resources, Peterborough

# **1 Introduction**

In June 1994 the National Rivers Authority issued the Lower Nene Catchment Management Plan. The Catchment Management Plan was formulated following a seven month public consultation period. It identifies the water related issues in the catchment, and includes an action plan to resolve them. Issue 1(i) of the Lower Nene Catchment Management Plan requires "a multi-disciplinary project team to be set up to review current policy and determine medium to long term water allocation policy for the Lower Nene." The team has been established and a plan for the investigation of the water resource issues of the Lower Nene has been developed. The first phase of this involves documenting current water management practice in the Lower Nene catchment. Subsequent phases will identify the water-dependent environment and consult with interested parties to establish their views on the issues of the catchment. This project is investigating issues related to water resources and water allocation. There are many water-related issues in the Lower Nene which can not be solved by the allocation of water resources, and these will not be addressed in this project.

This report is the first report of the Lower Nene Options for Resources project. It details current water management practice in the Lower Nene catchment.



## 2 The Lower Nene catchment

The Catchment Management Plan defines the Lower Nene catchment as that part of the Nene catchment downstream of Wansford (fig. 1). Issues of the Nene above Wansford are covered by the Upper Nene Catchment Management Plan (published in August 1994). Between Wansford and Peterborough the river meanders through a wide flood plain. Downstream of Peterborough the Nene is a wide, embanked channel above the level of the surrounding Fens. The catchment is predominantly agricultural, with intensive arable farming as well as livestock in the Fens downstream of Peterborough. The tidal limit of the main river is at Dog-in-a-Doublet Sluice, 9 km downstream of Peterborough. A lock at Stanground on the outskirts of Peterborough passes water to the Middle Level, where the water provides a navigation in the old course of the Nene and is also used for irrigation. A pipe at Dog-in-a-Doublet Sluice allows water to pass into the Thorney River and the North Level. Other demands for water include the Nene Washlands which are a Site of Special Scientific Interest (SSSI) and an internationally important wading bird site identified under the Ramsar convention. The Nene is a navigation throughout the length from Wansford (and above) to the sea at Sutton Bridge. Industrial and domestic sewage effluents are discharged into the Nene at various locations throughout its length. Legal consents for these discharges have been set with dilutions based on historic flows. It is important that these historic dilutions are not compromised by water resource development. However, this does not mean that additional water should be made available for effluent dilution. 'Water Resources in Anglia', the NRA's water resources strategy for the Region, states that "we will not usually allocate water specifically to the dilution of effluents but rather we will set effluent consent conditions according to the anticipated regime of dilution flows". The Nene is also an eel and coarse fishery and in 1994 a fish pass was installed at Dog-in-a-Doublet Sluice to allow the passage of migrating fish.

Water resource problems occur in the Lower Nene during dry summers. The basic problem is that demand exceeds available water. Demands include a need to retain navigation levels both in the Nene and the Middle Level, agricultural, irrigation and industrial demands, the need to maintain effluent dilution, and the need for water for conservation purposes in the Nene Washlands. These demands will be considered in the second report of this project. The current report examines the way that the Lower Nene is managed at present. Particular attention is paid to practices invoked during dry summers. The report covers the Lower Nene itself to the tidal limit at Dog-in-a-Doublet, and those parts of the North and Middle Levels affected by transfers from the Nene. The tidal Nene is excluded from this project because the water resources regime of the Lower Nene has little impact on the tidal Nene. However, for completeness some details of the water quality of the tidal Nene have been included.



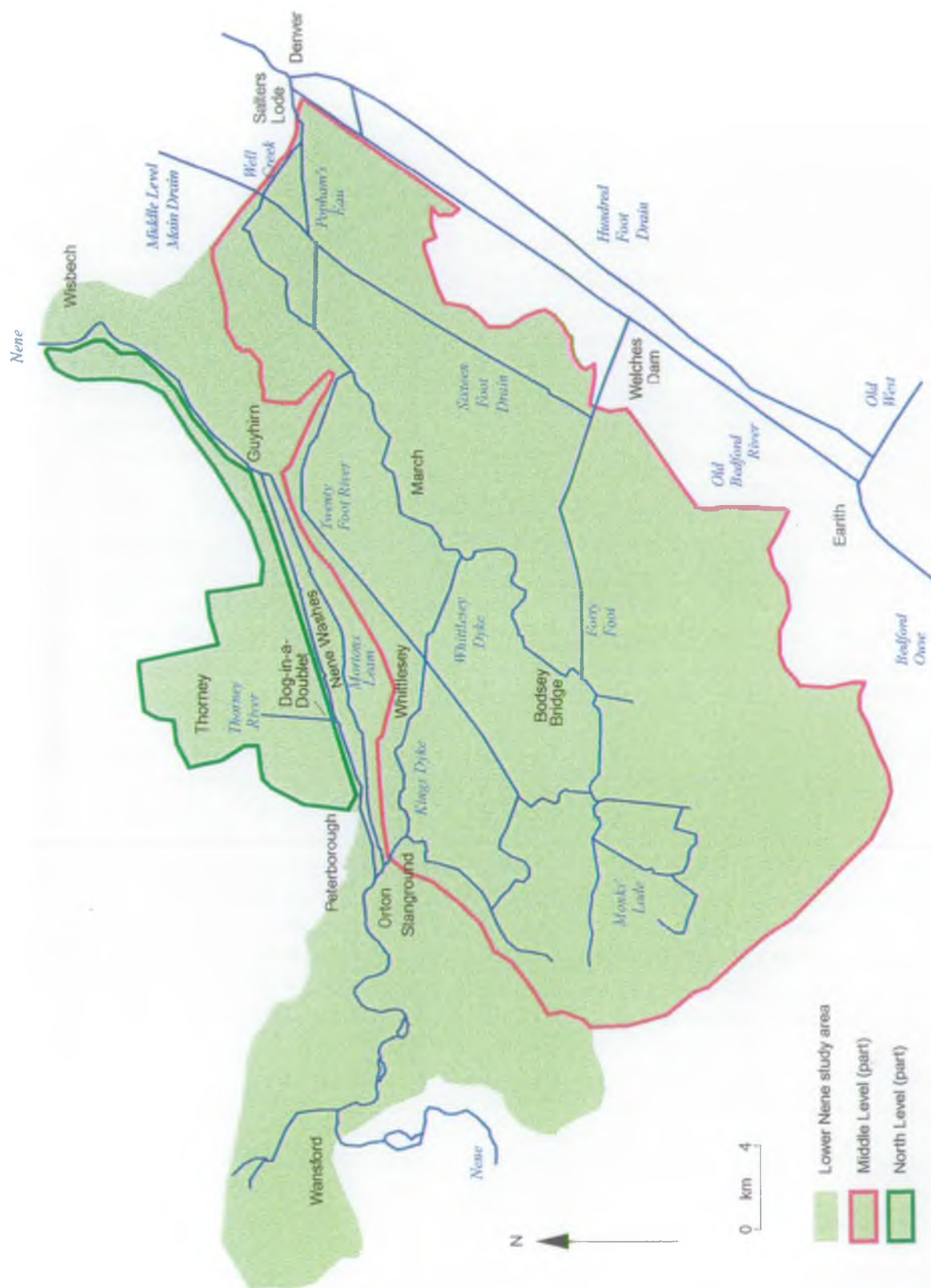


Figure 1: Area covered by Lower Nene water resources project



### **3 Flows and level management in the Lower Nene**

#### **3.1 The Nene**

##### **3.1.1 Wansford**

Wansford is the upstream limit of this project. Since 1976 Anglian Water has abstracted water from the Nene at Wansford to fill Rutland Water. This abstraction is the largest in the entire Nene catchment (and the Anglian Region of the NRA); the maximum abstraction is 546 thousand cubic metres per day (tcmd) with the existing pumps, although the licence allows up to 764 tcmd to be abstracted by the addition of two more pumps. The Anglian Water abstraction must not cause flows at Orton gauging station to fall below 136 tcmd (30 million gallons per day, or  $1.57 \text{ m}^3 \text{ s}^{-1}$ ). The Orton gauging station is not especially accurate and is about 10 km downstream of the abstraction point. A new ultrasonic gauging station has been constructed just upstream of the abstraction point at Wansford; this started to function in the summer of 1995 and will allow better control of the abstraction. It should be noted that flow at Orton may fall below the 136 tcmd "hands off" flow during dry summers.

##### **3.1.2 Wansford to Orton**

Between Wansford and Water Newton the river is maintained at an average retention level of 8.2 m Above Ordnance Datum (Newlyn) (AODN) by a locking pen with two automatic sluices and a weir about 0.5 km upstream of the Water Newton lock. A lock and automatic sluice at Alwalton maintains an average retention level of 6.6 m AODN between Water Newton and Alwalton. The next structure downstream, Orton Lock, controls the upstream river level to 4.4 to 4.6 m AODN. All of these structures are controlled by the National Rivers Authority. Levels are shown schematically in fig. 2.

##### **3.1.3 Orton to Dog-in-a-Doublet Sluice**

There are outflows into the tidal Nene through the Dog-in-a-Doublet Sluice and fish pass. There are also outflows to the Stanground Backwater (and hence to the Middle Level) and to the North Level system. The Dog-in-a-Doublet Sluice and the control on flow into the North Level system are manned by an NRA lock keeper.

The Dog in Doublet structure (the tidal limit on the River Nene) controls the river levels upstream through Peterborough as far as Orton river gauging station. Level is also influenced by the volume of flow into the Stanground backwater which feeds the Kings Dyke (Middle Level system) and the Nene Washes (via the Mortons Leam).

The normal retention level upstream of the Dog-in-a-Doublet Sluice is 3.0 m AODN. A minimum of 2.9 m AODN is required to maintain navigation and an effective fish pass (the fish pass was built to a design level of 2.9 m AODN to ensure fish migration). This level

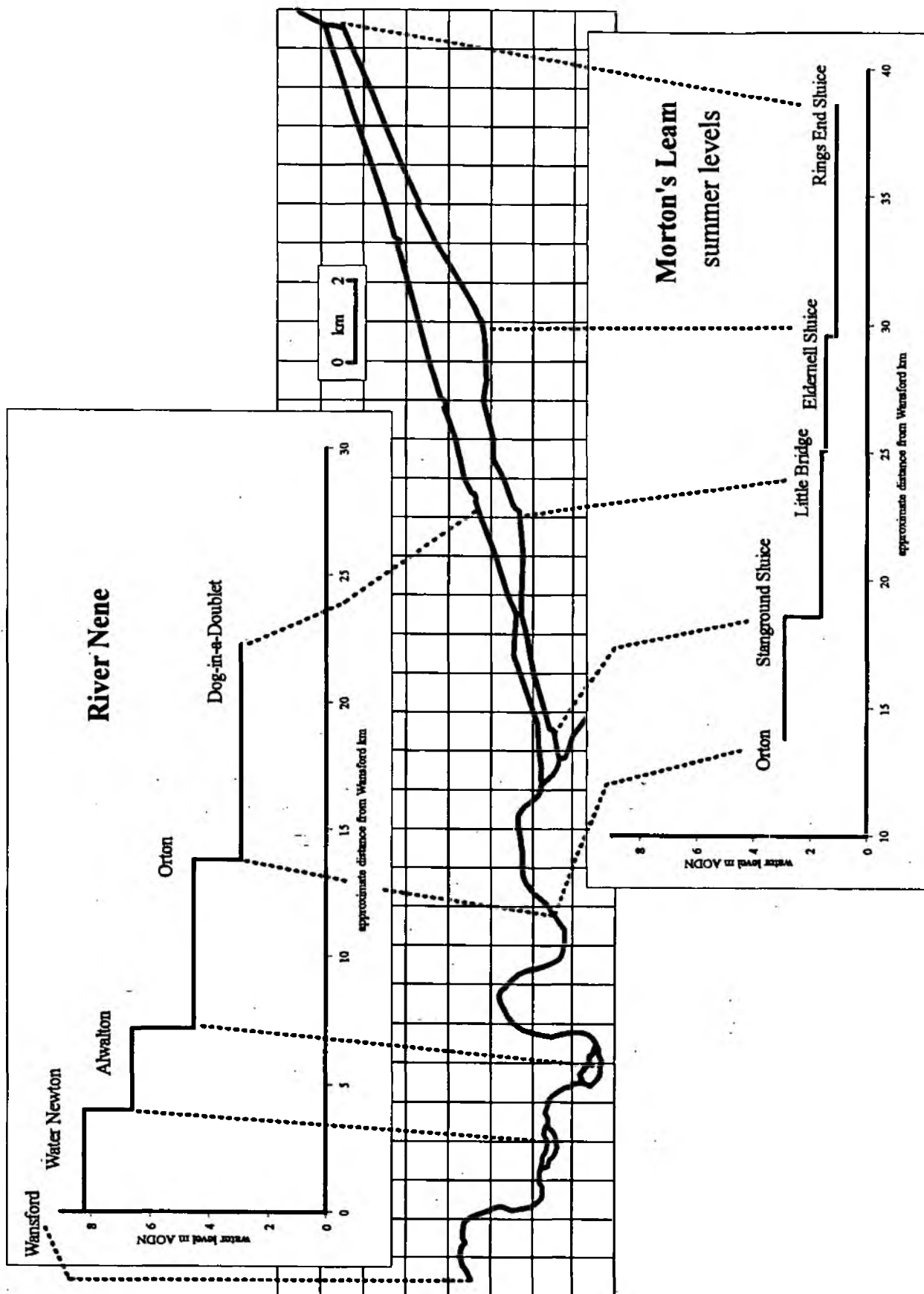


Figure 2: Water levels in the Nene

of 2.9 m AODN is the summer target; in winter the level is sometimes kept at 2.6 m AODN to provide additional capacity for flood storage.

Section 8 of the Anglian Water Authority Act 1977 gives the NRA the powers to maintain the river at levels that prevailed in the nine months immediately preceding 8 December 1975; this is the source of the target level of 2.9 m AODN.

#### 3.1.4 Stanground Backwater

The Stanground Backwater is a short stretch of river leading from the Nene near Stanground (fig. 3). Water flows from the Stanground Backwater into the Kings Dyke and the Middle Level system through the Stanground Lock. Stanground Lock is controlled by the Middle Level Commissioners. Water also flows from the Stanground Backwater to the Mortons Leam through Stanground Sluice. This Sluice is controlled by the NRA and will automatically discharge water to flood the Washes when a level of 3.7 m AODN occurs in the Stanground Backwater. The extent of gate opening is dependent on water level.

During dry summers, the transfer to the Middle Level is the greatest demand on the water resources of the Lower Nene.

#### 3.1.5 Mortons Leam

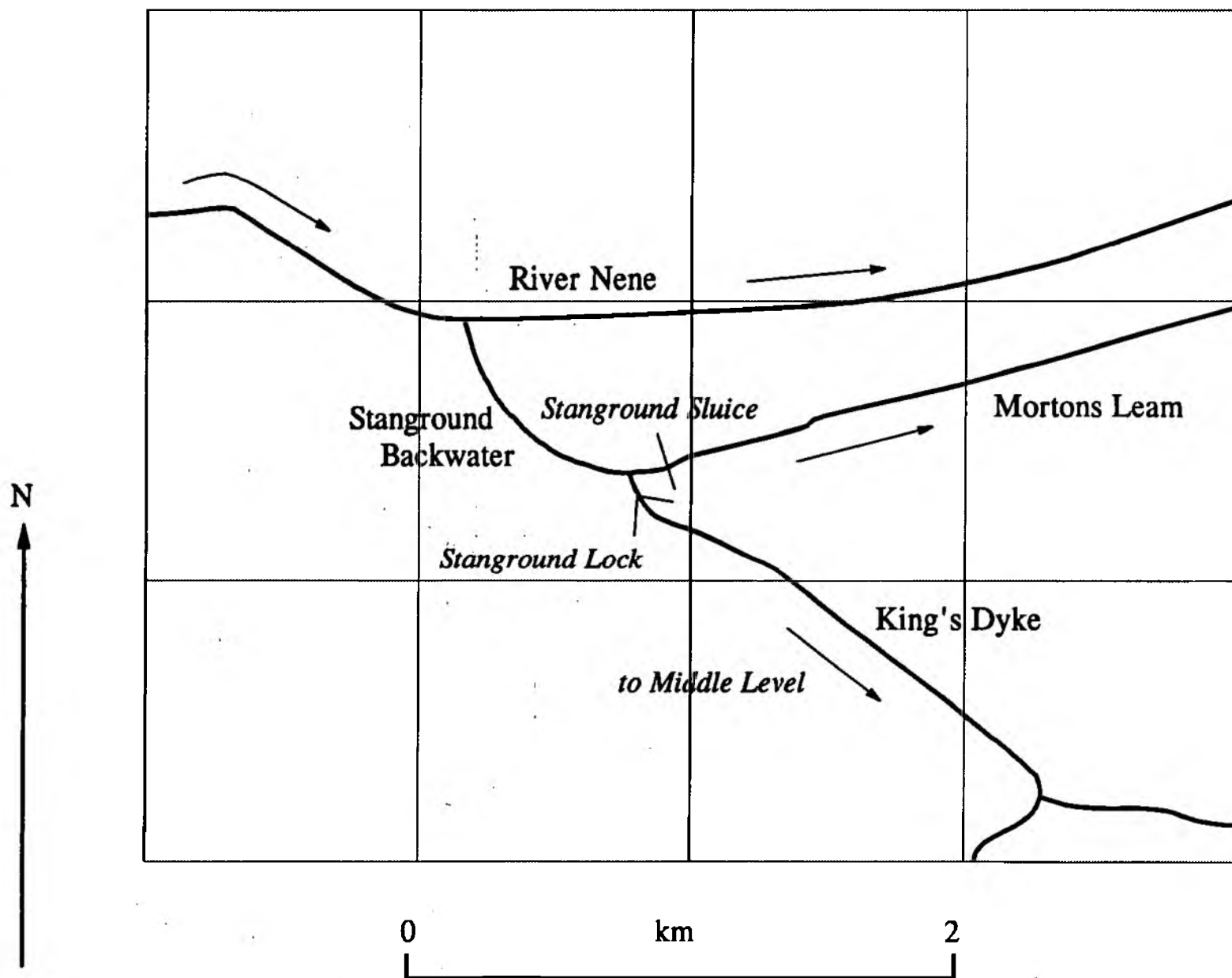
Mortons Leam is a flood relief channel which also provides water to the Nene Washes. The level in the Leam is controlled by the volume of inflow through Stanground Sluice and by outflow to the tidal Nene through Rings End Sluice at Guyhirn. The required level in Mortons Leam is determined by the Nene Washland Commissioners; the NRA ensures that this level is maintained provided that sufficient water is available.

The current operating levels for Mortons Leam are given in Table 1.

SEASON	OPERATING LEVELS (AODN)		
	Stanground Sluice to Little Bridge Weir	Little Bridge Weir to Eldernell Sluice	Eldernell Sluice to Rings End Sluice
<b>WINTER</b> (November - April)	1.0	1.0	1.0
<b>SUMMER</b> (May - October)	1.60 - 1.65	1.45 - 1.50	1.1

Table 1: Current operating levels in Mortons Leam.

Figure 3: Stanground Backwater



### 3.2 Middle Level

The Middle Level system consists of high level and low level drains. The high level drains are controlled by the Middle Level Commissioners. During winter the low level system is pumped out into the high level system to minimise flooding. In summer the high level drains feed water into the low level drains; this water maintains water tables and is also used for spray irrigation.

Flow into the Middle Level drains can occur from the Nene at Stanground, the Forty Foot River at Welches Dam Lock, transfer from the River Delph under the Counter Drain to the Forty Foot River (the Middle Level Transfer Scheme), and from the Tidal Ouse through Salters Lode Sluice and Well Creek (fig. 4). The transfer from the Nene provides most water.

The Middle Level system is essentially a series of interconnected ponds; thus flow is dependent on the management strategy adopted. Relative levels at each control structure govern flow in the system. Maintenance of the retention level within the Middle Level is undertaken on a day to day basis by transfer of water from Stanground and pumping out to the tidal Ouse at St Germans and other intermediate pumping stations. The transfer is under the control of the Middle Level Commissioners. There is no licence for the transfer at Stanground; the lock itself constrains the volume to 120 tcmd as measured at the Stanground Lock gauging station (136 tcmd measured at the new and more accurate ultrasonic gauging station). The 1848 Middle Level Act empowers the Middle Level Commissioners to take water from the Nene at Stanground for the purpose of maintaining a depth of water in specified sections of the Middle Level system. This applies except where "failure of water shall arise through drought". Reductions in the transfer rate may be requested from the Middle Level Commissioners by the NRA.

### 3.3 North Level

The North Level Internal Drainage Board obtain water from the Nene through a "slacker" incorporated in the Dog-in-a-Doublet Sluice structure. "Slacker" is the term used to describe a structure for transferring water from a high level water course to one at a lower level; slackers are common in the Fens. In the case of the North Level the slacker was incorporated into the Dog-in-a-Doublet structure when it was built in 1935. Its purpose is to provide a fresh water supply to the Thorney River. Water from the Nene feeds a relatively small part of the North Level system, extending a few kilometres north of Thorney. The rate of transfer is controlled by the size of the pipe in the structure; this is said to allow a maximum flow rate of about 10 tcmd. The North Level IDB control the water levels within the IDB area.

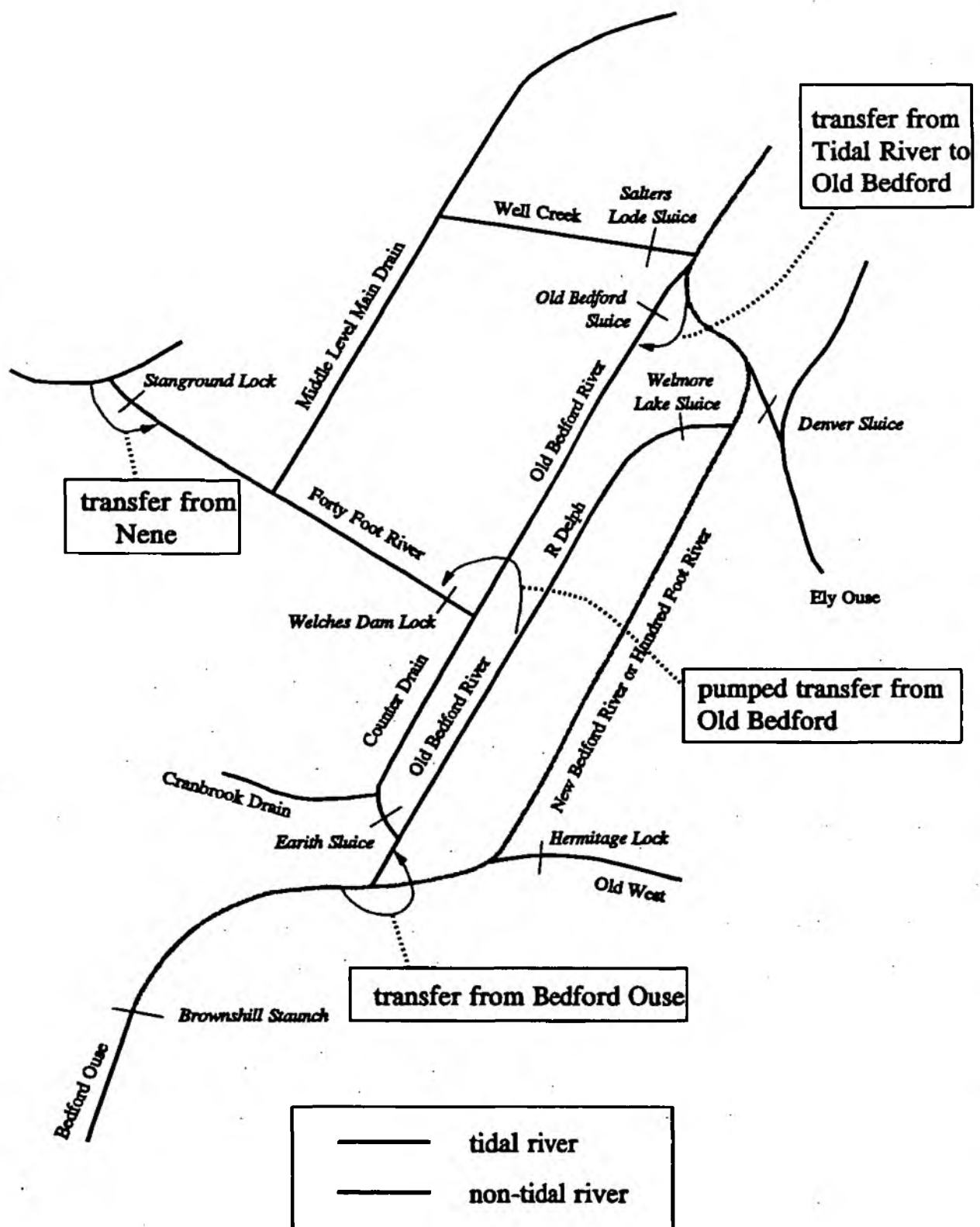


Figure 4: Sources of supply to the Middle Level

### 3.4 Nene flows

Flows in the Nene are measured at Orton gauging station, where the record starts in 1941. Orton is the control point for Anglian Water's Wansford abstraction, which ceases at an Orton flow of 136 tcmd ( $1.57 \text{ m}^3 \text{ s}^{-1}$ ). Flow can of course fall below this naturally in dry summers. There are few licensed abstractions between Wansford and Orton. A total of 517 thousand cubic metres per annum (tcma) is licensed for spray irrigation; although this abstraction will principally occur during the summer the total licensed volume is so small that it will have only a very limited impact on Nene flows. The only major abstraction licence between Wansford and Orton is held by Pedigree Petfoods in Peterborough. The licence authorises a maximum abstraction of 2050 tcma, of which 2000 tcma is for non-evaporative cooling and must be returned to the river. This licence has never been used and has not had an impact on historic flows in the Nene.

A plot of the minimum monthly flow for each year since 1941 demonstrates that there has been an upward trend in the lowest flows gauged at Orton (fig. 5). During the drought of the early 1990s the minimum monthly flow was much higher than the worst years in the 1940s, 1950s and 1960s. Even in 1976 the driest month had more flow than in 1944. This increase in summer flows in the Nene is real and is explained by the increase in the discharge of treated effluents to the Nene from towns such as Northampton and Wellingborough. The volume of effluent discharge is fairly constant throughout the year, and therefore represents a valuable source of additional water for the catchment during the summer. This is water which would not have been available to the catchment at any time in the past. Current Anglian Water demand forecasts suggest that this trend of increasing effluent has ceased, and effluent volumes will not rise further; indeed, no upward trend is apparent after 1976. While the Nene is recognised as a eutrophic sensitive zone, summer river water quality in the Peterborough area presents no problems. There is significantly more water in the Lower Nene catchment during dry summers now than there would have been under equivalent climatic conditions in the past.

Flows to the Middle Level are measured at Stanground Lock. The gauging station at the Lock operated from 1969 to 1992, when it was replaced with an ultrasonic gauge a few hundred metres downstream of the Lock. The hydrograph (fig. 6) shows that after about 1976 flows to the Middle Level were regulated more carefully, with higher summer transfers. When the monthly transfer is expressed as a proportion of the monthly Orton flow (fig. 7) it can be seen that since 1989 a high proportion of the summer Orton flow has been transferred to the Middle Level; in July 1990 74% of Orton flow was transferred. This should be seen in the context of the increases in summer flows that have occurred since 1941.



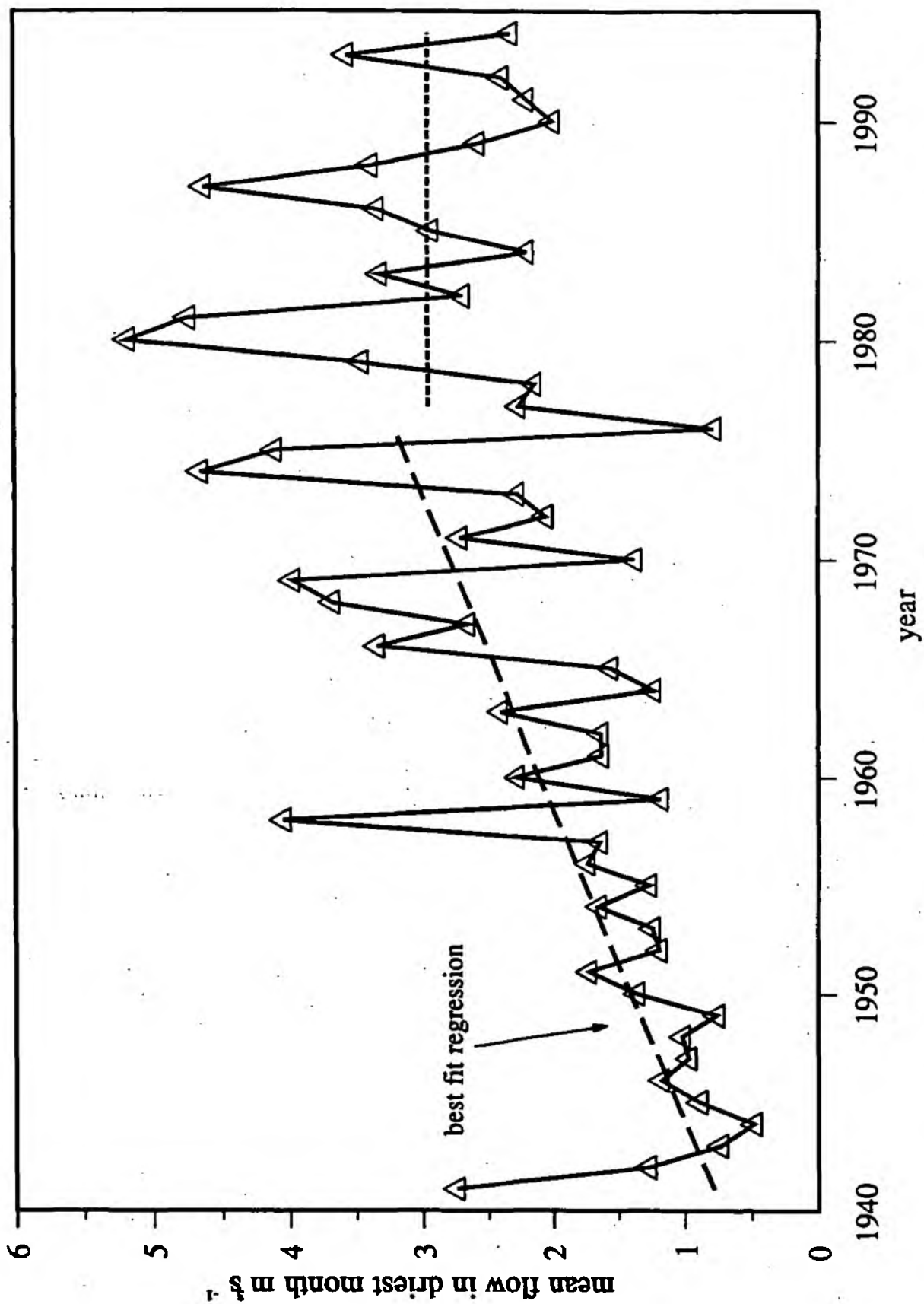


Figure 5: Orton flow in driest month

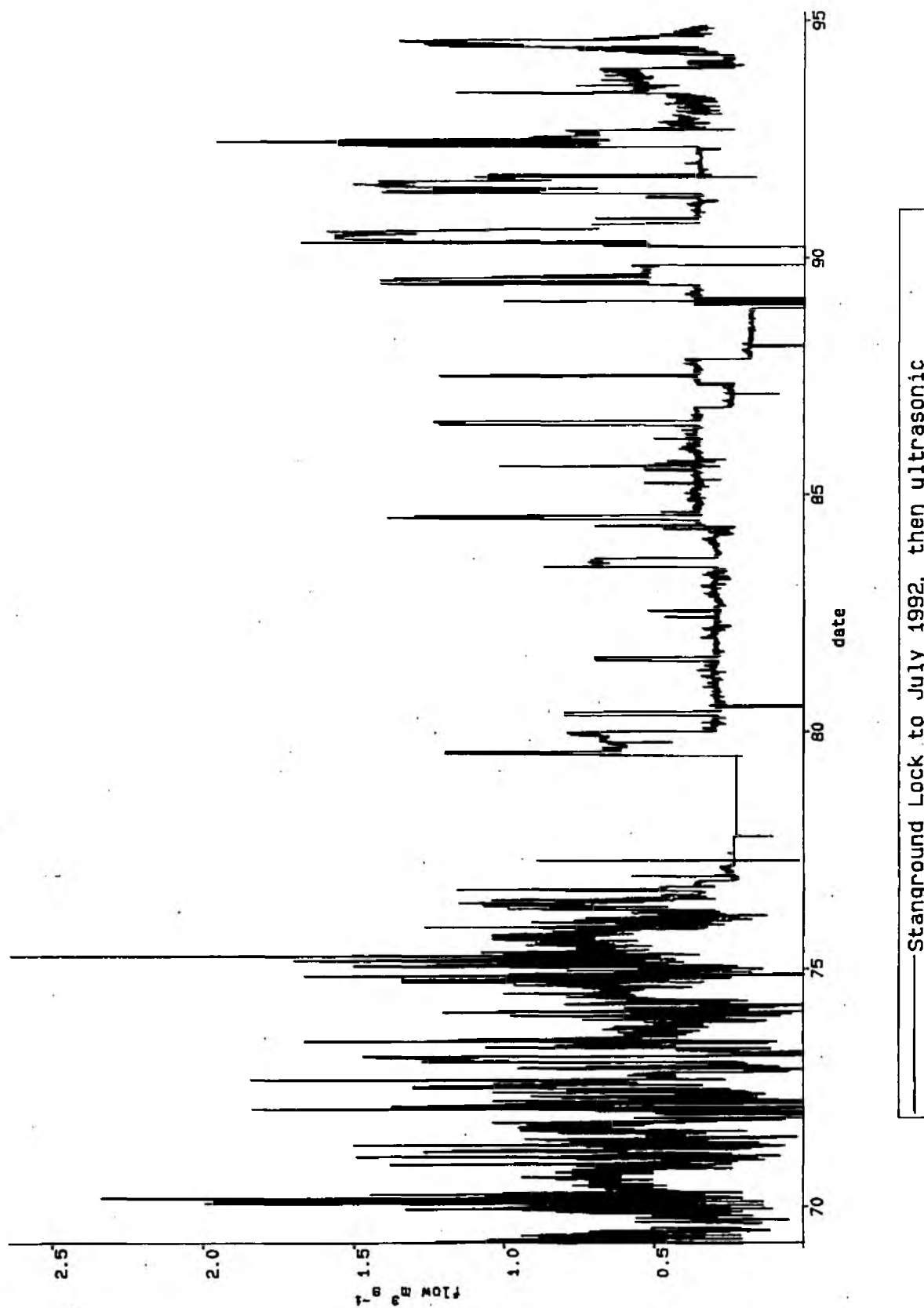


Figure 6: Flows at Stanground Lock

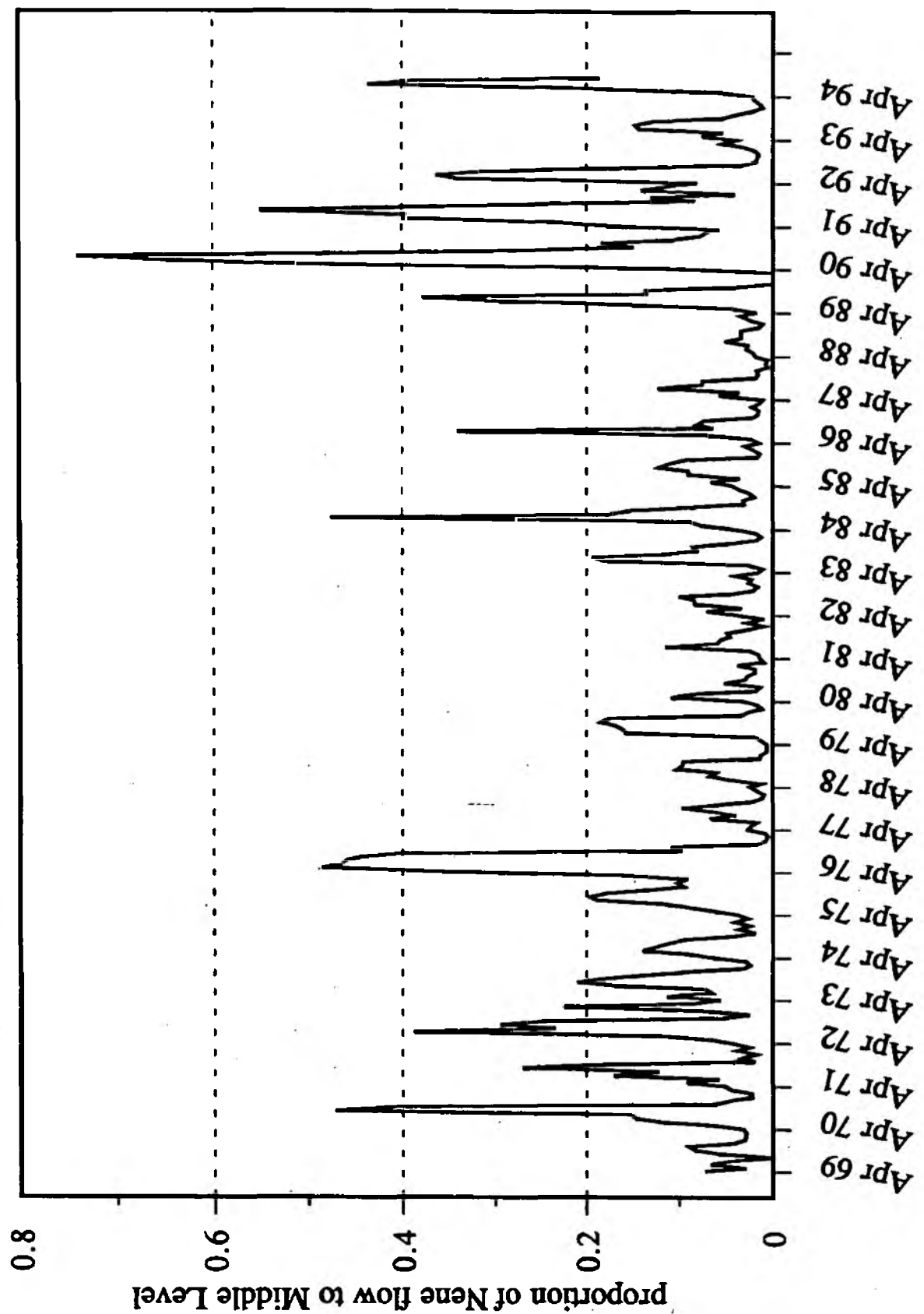


Figure 7: Proportion of Orton monthly flow passing through Stanground Lock

## **4 Water quality**

### **4.1 The Lower Nene**

The water quality target for the Lower Nene is River Ecosystem Class 3. The Lower Nene met this target in 1994. The Lower Nene has been designated as a Eutrophic Sensitive Area under the Urban Wastewater Treatment Directive. This means that phosphate must be removed from the effluent from certain water company sewage treatment works. However, there are no water resource implications for such action.

### **4.2 The tidal Nene**

The quality of water in the stretch of river immediately below the Dog-in-a-Doublet Sluice can be very poor. In the summer of 1992, 80,000 eels died in the 200 m stretch downstream of Dog-in-a-Doublet Sluice. The main cause of these problems is the discharge from Flag Fen sewage treatment works. This flows for 5 km along the Counter Drain North, before entering the Nene immediately downstream of Dog-in-a-Doublet Sluice. The quality of the discharge from Flag Fen is scheduled for improvement by Anglian Water in AMP2; these improvements must be completed before the year 2000 and should solve quality problems downstream of Dog-in-a-Doublet Sluice. The fish pass, which was completed in 1994, is helping to ameliorate the problem by providing a small feed of fresh water to the pool immediately below the Sluice. This serves as a useful haven for fish when water quality problems occur. However, its impact is localised.

Quality problems in the rest of the tidal Nene are less serious than those immediately downstream of the Dog-in-a-Doublet Sluice. The tidal channel has little flushing during summer months; instead a slug of water is moved up and down the channel as the tide goes in and out. There is very little mixing with water from the Wash itself.

While in theory it would be possible to improve the quality of the tidal Nene by dilution with fresh water, the volume required would be much more than is available. Investment at Flag Fen treatment works is the key to improving the quality of the tidal Nene.

### **4.2 Mortons Leam**

There are no recorded water quality problems in Mortons Leam, indicating that Nene water is of acceptable quality.

### **4.3 The Middle Level**

Water transferred from the Lower Nene to the Middle Level system affects water quality in two ways. First, the quality of the water transferred may directly affect the quality in King's Dyke. Secondly, the quantity of water transferred and the pattern of transfer may influence

the dilution and dispersion of effluents. The quality of water transferred has a relatively localised effect as natural self-purification, surface water discharges and effluent discharges alter the quality. In any case, the quality of the water transferred from the Lower Nene is acceptable, especially during the summer. The main impact of Lower Nene water on Middle Level water quality is to provide dilution for effluents discharged into the Middle Level system. This is especially important for King's Dyke and Whittlesey Dyke.

King's Dyke complied with its objectives in 1994 but had not in previous years. At present water quality objectives are not met in Whittlesey Dyke. It is believed that this results from the impact of Whittlesey sewage treatment works discharge, which causes low dissolved oxygen levels and elevated ammonia levels. This is being addressed separately from the current project. In addition to this problem there have also been a number of intermittent problems associated with sewage discharge into the King's Dyke. The major cause of concern has been the operation of the Anglian Water Thistle Drive pumping station emergency overflow near Stanground Sluice. This discharge has in the past caused fish mortalities in King's Dyke as a result of de-oxygenation following operation of the outfall. The storm overflow at Whittlesey sewage treatment works is also considered to be problematical although it has not been associated with any Category 1 pollution incidents. We understand that investment is in hand to overcome both of these problems.

The main implication for water resources is that it is necessary to ensure that the flows which were used for the assessment of discharge consent conditions are maintained.

## 5 Managing the allocation of water resources

In dry summers, abstraction and slacker demand plus the transfer to the Middle Level can exceed the river flow at Orton. Under these circumstances, if there is no control or management of abstraction, then level will fall in this section of river as the storage is depleted. This has the effect of compromising the navigation level on the Nene and lowering river level through Peterborough. In the summer of 1991 the Nene fell approximately 0.45m (18") as demand for water exceeded river flow. The river flow through the Dog-in-a-Doublet structure is effectively zero under these circumstances. If the level at Dog-in-a-Doublet drops below 2.5 m AODN, flow through the fish pass ceases.

### 5.1 Current practice

The potential for demand for water to exceed available river flow is recognised and procedures have been in use since the drought of the early 1990s to monitor and notify water users of water availability. An indication of the frequency of potential problems is given in fig. 8. This shows the mean monthly flow at Orton from 1984 and the approximate current demand from the Lower Nene. This has been calculated approximately assuming 136 tcmd for the Middle Level, 10 tcmd for the North Level, 15 tcmd for Mortons Leam, and a 25 tcmd flow to the tidal Nene at Dog-in-a-Doublet. It can be seen that with these demands there would have been cause for concern in the summers of 1984, 1989, 1990, 1991, 1992 and 1994. The use of monthly averages in this plot disguises the fact that more serious water shortages may occur over periods of a few days. However, the general indication is valid. The precise level of demands in the Lower Nene catchment will be examined more carefully in a future report.

In order to maintain the navigation level on the Nene and allocate water (under limited availability) a management plan was agreed at a meeting in Thorney on 7 May 1992 between all local water users. The parties represented were:

NRA  
Nene Washland Commissioners  
North Level IDB  
Middle Level Commissioners  
RSPB  
English Nature

The management plan was intended to be effective for the summer of 1992. In the event the allocation of water was not tested as there was sufficient rainfall and river flow to meet water needs without restriction. The management plan is detailed in Appendix 1. It attempts to allocate water to the Nene Washes during times of low flow while at the same time allowing water for the North Level and understanding the needs of other water users. No changes to this plan have been made since 1992. During June and July 1995 the plan was implemented, although it seems that a revision of the method for flow estimation may be necessary. In particular losses from the channel of the Nene need to be quantified.

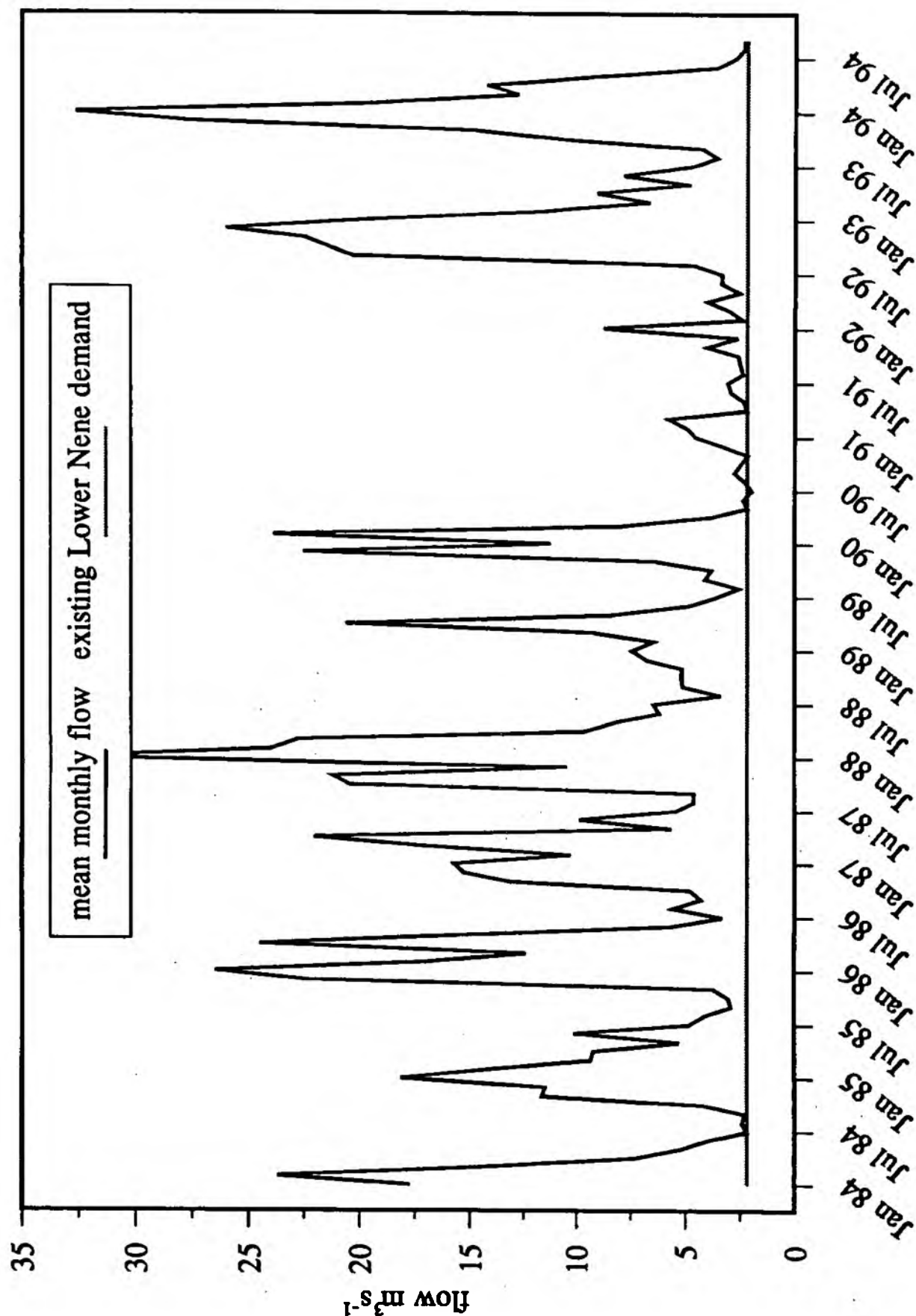


Figure 8: Orton flows and Lower Nene demands



In 1994 a new fish pass was constructed at Dog-in-a-Doublet to provide a passage for migratory fish. This structure was commissioned in June 1994 and allows a small river flow to pass; level and flow details are given in Appendix 3. Until Flag Fen sewage treatment works discharge is improved, the flow through the fish pass will continue to provide a pool of fresh water which acts as a valuable refuge for fish.

## **5.2 Monitoring and procedures**

River flows and river levels are monitored from the telemetry system by Northern Area's hydrology staff in Lincoln.

Daily monitoring commences after the start of May if the soil moisture deficit for MORECS squares 127 and 128 (the Middle Level) exceeds 25 mm. This occurs during the irrigation period when demand for river water peaks. Sites monitored are:

- River Nene at Orton (Nene river flow)
- Stanground (flow into Middle Level system)
- upstream level at Dog in Doublet (level only)

Procedures will be modified to incorporate the flows measured by the new ultrasonic gauging station at Wansford

From examination of current flow and level information the following procedures and actions are carried out:

- 1 On Thursday each week Northern Area compile a weekly forecast of "available water" for transfer through Stanground Lock by the Middle Level Commissioners.
- 2 This forecast is faxed to Central Area NRA and the NRA Spalding office.
- 3 The forecast takes account of:
  - current and forecast Orton flows,
  - 10 tcmd allocation to North Level IDB
  - 15 tcmd allocation for Nene Washes via Mortons Leam
  - 25 tcmd flow at Dog-in-a-Doublet
  - navigation level on the River Nene
  - water quality requirements of the Catchment Office
- 4 Central Area liaise with MLC about implementation of the forecast with respect to abstraction through Stanground to the Middle Level.
- 5 Central Area confirm implementation with Northern area.
- 6 The weekly forecast can be over-ridden in the following circumstances:
  - a) If Dog-in-a-Doublet level is less than 3.0 m AODN and reducing by more than 0.03 m per day, the Sluice Keeper informs Northern Area. Northern Area and Central Area liaise to set the reduction in the Middle Level abstraction. Central Area contact the Middle Level Commissioners and inform them.

- b) If Dog-in-a-Doublet level is greater than 3.1 m AODN, the Dog-in-a-Doublet Sluice Keeper informs the Middle Level Commissioners that additional water is available. The Middle Level Commissioners inform Central Area by fax of any changes which result.
- c) If Dog-in-a-Doublet level is less than 2.9 m AODN the Sluice Keeper informs either Central or Northern Area. The area contact requests the Middle Level Commissioners to reduce the Stanground abstraction immediately to 50 tcmd. Central Area and Northern Area liaise to discuss future transfer quantities and Central Area inform the Middle Level Commissioners of the new requirement.

The procedures and specimen fax are shown in Appendix 2.

## **6 Conclusions**

Current operating practice in the Lower Nene attempts to balance different demands and requirements. Flood defence and navigation require specific levels to be retained and sluices are operated for these purposes. Demands for water resources place pressure on the system in dry summers. Existing procedures try to reduce Middle Level abstractions in order to supply more water to the Nene Washlands and to retain navigation levels in the Nene. However, the details of the existing procedure for calculating available water for the Middle Level need revision. An assessment of low flow management procedures should help to ensure that all interested parties understand the conflicting demands of the system.



## **Appendix 1: Management plan for 1992**

In 1992 the NRA had three main concerns:

- 1 That uncontrolled discharge of water to the Nene Washes could not be accepted in a drought period.
- 2 That the importance of the Nene Washes as an SSSI must be recognised and that the Nene Washes should be allocated a supply of water in circumstances when there was a severe resource shortfall.
- 3 That the legitimate water use interests in the Lower Wash (mainly agricultural) must be addressed in 1992.

The NRA suggested to the RSPB that some control structures should be considered to enable water flow from the Morton's Leam to be controlled. The RSPB agreed that this could be considered in principle and that further discussions should take place.

The NRA proposals were:

- 1 To allocate a minimum constant flow of 15 tcmd into Morton's Leam in 1992 to meet RSPB and English Nature needs. The RSPB and English Nature gave general agreement to this, although the RSPB hoped that the NRA could be flexible if problems occurred.
- 2 To allocate a minimum of 5 tcmd to the North Level. North Level IDB felt that nearer 10 tcmd may be necessary at times; this was accepted.
- 3 To seek restrictions on spray irrigation demand from the Lower Nene if the supply to RSPB or English Nature was threatened (given the need to maintain minimum levels in the Nene for water quality and navigation). This was generally agreed.
- 4 To seek to maintain agreed water levels in Morton's Leam. This was welcomed.
- 5 To consider physical restrictions at Gravel Dyke, a slacker from the Nene to Morton's Leam. The Nene Washland Commissioners agreed to let the NRA control this transfer.
- 6 To request the Middle Level to take measures to restrict abstraction (if necessary). The Middle Level Commissioners agreed to operate the system as carefully as possible.
- 7 To consider the installation of controllable off-takes from the Morton's Leam especially in the Middle Wash section.

## Appendix 2: Operational procedures

### MIDDLE LEVEL TRANSFER AT STANGROUND

#### OPERATIONAL RULES

TARGET LEVELS/FLOWS	
Retention Level in Nene u/s Dog-in-a-Doublet	3.0 m ODN
Minimum level in Nene u/s Dog-in-a-Doublet	2.9 m ODN
MRF at Dog-in-a-Doublet	25 tcmd
MRF at Orton Lock	136 tcmd

TELEMETRY MONITORING	
Stanground Abstraction (Ultrasonic)	STANGS \ R13 FLW
U/S Level Dog-in-a-Doublet Sluice	DOGIDS \ R11 LVL

#### BEFORE THE 1ST MAY

- 1 Northern Area to forecast future available resources in Nene (Good, Fair, Poor) and liaise with Central Area.
- 2 Central Area to meet with Middle Level Commissioners (MLC). Discuss arrangements for coming summer including NRA & MLC Contacts.

#### AFTER THE 1ST MAY WHEN SOIL MOISTURE DEFICIT >25 mm

- 1 Level in Nene u/s of Dog-in-a-Doublet to be maintained at 3.0 m ODN.
- 2 Initiate 'Weekly Forecast Fax' (see over) from Northern Area to Central Area. Central Area to forward to MLC.
- 3 Dog-in-a-Doublet Sluice Keeper to be informed of Northern and Central Area's contact for the season.
- 4 MLC to be informed by Central Area that Nene is now being 'actively managed'.

#### OVERRIDES

- 1 If level in Nene u/s of Dog-in-a-Doublet < 3.0 m ODN and reducing by >0.03 m per day Dog-in-a-Doublet Sluice Keeper to inform ..... at Northern Area. Northern Area and Central Area liaise to set reduction in MLC abstraction. Central Area to contact MLC. Especial care to be taken regarding effect abstraction over weekend.
- 2 If level >3.1 m ODN Dog-in-a-Doublet Sluice Keeper to contact MLC directly that the resources are available to increase abstraction at Stanground. MLC to fax Central Area with any changes which result.
- 3 If level <2.9 m ODN Dog-in-a-Doublet to inform either Central or Northern Area Contact. Area Contact to request MLC for immediate reduction to 50 tcmd. Central Area and Northern Area liaise to discuss future transfer quantities and Central Area to inform MLC of new requirement.

WEEKLY FORECAST  
MIDDLE LEVEL TRANSFER AT STANGROUND

Week Commencing 25/8/94

PREVIOUS WEEK: w/c 24/8/94

Flow at Nene Gauging Station (Orton Lock)	<u>190</u>	tcmd
Level u/s of Dog-in-a-Doublet Sluice	<u>3.0</u>	MODN
Transfer through Stanground	<u>60</u>	tcmd

Actions taken during week: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

FORECAST (TCMD) w/c 25/8/94

Flow in Nene	<u>160</u>	
North Level Requirement	<u>10</u>	(10 min)
Nene Washes Requirement	<u>15</u>	(15 min)
Flow to Tide	<u>25</u>	(25 min)
Change in Storage	_____	
Available for Transfer to Middle Level Commissioners	<u>110</u>	

Circulate

From: Northern Area      Signed D. Gray      Date 25/8/94  
To: Central Area      Signed \_\_\_\_\_      Date \_\_\_\_\_  
To: Middle Level Commissioners (0354 59619)



### Appendix 3: Level to flow relationship for Dog-in-a-Doublet fish pass

#### DOG-IN-DOUBLET FISH PASS.

Head v. Discharge relationship from calculations.

Level m (ODN)	head m	FLOW.	
		cumecs	tcmd.
2.5	0	0	0
2.7	0.2	0.042	3.64
2.75	0.25	0.060	5.15
2.8	0.3	0.079	6.83
2.9	0.4	0.123	10.66
3.0	0.5	0.174	15.07
3.1	0.6	0.231	19.98
3.2	0.7	0.294	25.38

Check gauging carried out in 1994 at 2.83 m ODN gave 9.9 tcmd flow.