THE ROLE OF THE NATIONAL RIVERS AUTHORITY IN DROUGHTS

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Abstract

The National Rivers Authority (NRA) came into being on the 10th July 1989, and formally took up its full duties on the 1st September 1989.

In the U.K. the Autumn of 1989 was a period of drought which in some parts of the country continued during the Winter, resulting in significant potential problems for water resources in general and for public water supply in specific areas. This was at a time when the arrangements under the Water Act 1989 were still very new.

This paper explains the role of the NRA in water resource planning in England and Wales with specific reference to the experiences gained during the Summers of 1989 and 1990.

1. INTRODUCTION

1.1 The Water Act 1989 fundamentally reorganised the Water Industry in England and Wales. Before considering the experiences gained during the drought of 1989 and 1990, it is necessary to gain an understanding of the current arrangements and of how the Water Resource and Water Supply functions are organised and carried out.

History

1.2 In 1973, the water industry in England and Wales was reorganised by the setting up of the ten regional water authorities. These were based on river basin catchment areas and were responsible for water supply, sewerage and sewage treatment, resource planning, pollution control, fisheries, land drainage and flood defence, water recreation conservation and navigation on some rivers. In fact all aspects of the water cycle.

1.3 In addition to the water authorities, there were 29 statutory water companies responsible for water supply in their areas.

The Water Act 1989

1.4 On 6th July 1989, the Water Act 1989 was enacted. This act transferred the functions relating to water supply, (except where carried out by Statutory Water Companies), sewerage and sewage treatment to ten Water Services Companies in the private sector. On the same date, the other functions, previously carried out by the Water Authorities, were transferred to the National Rivers Authority (NRA); a new public body. A fundamental element of the change was to separate the regulator and the regulated - commonly expressed as separating the gamekeeper and the poacher.

1.5 The Water Act also established the Secretary of State, the Director General of Water Services and the NRA as the principal regulators of the industry. The responsibilities of the Secretary of State include the regulation of drinking water quality; those of the Director General include economic regulation, and those of the NRA include the management of water resources, the control of pollution as well as flood defences, fisheries, recreation, conservation and navigation.

1.6 Both the Secretary of State and the Director General have a primary duty to exercise to secure that:-

- water and sewerage functions are properly carried out in England and Wales, and
- undertakers are able to finance the proper carrying out of these functions.

1.7 In addition, the Secretary of State, the Director General, the water undertakers and the NRA all have environmental and recreational duties.

1.8 From the above, it is clear that the regulatory arrangements are fairly complex. Figure 1 presents a schematic representation of this arrangement.

1.9 Before considering the role and experiences of the NRA specific to water resources and water supply during 1989 and 1990, alongside the duties of the Water Undertakers and others, the following section provides information on the NRA, to clarify where Water Resources fits into its overall activities.

2. THE N.R.A.

Duties

2.1 The NRA has been charged with statutory duties and powers in relation to water resources, pollution control, flood defence, fisheries, recreation, conservation and navigation, along with various other support functions.

2.2 The NRA's sponsor department is the Department of the Environment. It also has strong links with the Ministry of Agriculture, Fisheries and Food and the Welsh Office.

Organisation and Management

2.3 The NRA has a Head Office in London and ten Regions covering England and Wales.

The Head Office houses the Chairman, Chief Executive and five Directors, who report to the Chief Executive, with responsibilities for Technical, Scientific, Corporate Affairs, Personnel and Finance.

2.4 The vast majority, over 6,000 of the NRA's staff are based in 10 Regions (see Map 1), and are primarily concerned with the implementation of the NRA's policies and functions. Within each Region there is a Regional Headquarters and various Divisional, Area or Local Offices, along with laboratories, workshops, depots and other operational facilities.

Each Region is managed by a Regional General Manager, who reports to the Chief Executive.

2.5 A schematic diagram of the organisation and management of the NRA is presented in Fig.2.

Mission Statement and Aims

2.6 Early on the NRA developed a Mission Statement and related aims. These were:-

Mission Statement

2.7 The National Rivers Authority will protect and improve the water environment. This will be achieved through effective management of water resources and by substantial reductions in pollution. The Authority aims to provide effective defence for people and property against flooding from rivers and the sea. In discharging its duties it will operate openly and balance the interests of all who benefit from the use of rivers, groundwaters, estuaries and coastal waters. The Authority will be businesslike, efficient and caring towards its employees.

Aims

1. To achieve a continued improvement in the quality of rivers, estuaries an coastal waters, through the control of water pollution.

2. To assess, manage, plan and conserve water resources and to maintain and improve the quality of water for all those who use it.

3. To provide effective defence for people and property against flooding from rivers and the sea.

4. To provide adequate arrangements for flood forecasting and warning.

5. To maintain, improve and develop fisheries.

6. To develop the amenity and recreational potential of waters and lands under NRA control.

7. To conserve and enhance wildlife, landscape and archaeological features associated with waters under NRA control.

8. To improve and maintain inland waterways and their facilities for use by the public where the NRA is the navigation authority.

9. To ensure that dischargers pay the costs of the consequences of their discharges, and as far as possible to recover the costs of water environment improvements from those who benefit.

10. To improve public understanding of the water environment and the NRA's work.

11. To improve efficiency in the exercise of the NRA's functions and to provide challenge and opportunity for employees and show concern for their welfare.

To encapsulate the comprehensive range of duties and aims in a simple statement the phrase "GUARDIANS OF THE WATER ENVIRONMENT" was adopted.

2.8 The duties and powers for the various functions are many and varied. The Mission Statement and the aims reflect the key elements. The following sections summarise the water resources function of the NRA, and related support functions, and some of the key tasks ahead.

Water Resources

2.9 The implementation of the Water Act 1989 has provided the opportunity to take a fresh look at the Water resources management and planning from the viewpoint of environmental protection whilst ensuring adequate supplies.

2.10 The prime responsibility for development of adequate supplies rests with the water companies but the NRA has a duty to ensure that water resources are managed and operated properly. Schedule 1 lists the duties and powers of the NRA in relation to Water Resources.

2.11 A key issue is the establishment of a consistent water resources policy throughout the NRA as a whole. This need has arisen due to additional powers resulting from the Water Act 1989, and also due to the 10 Regions inheriting different procedures and policies relating to water resources management. Included amongst the issues requiring a consistent approach are:

- abstraction licensing policy and procedure
- aquifer protection policy
- abstraction charges scheme

2.12 Whilst recognising the important role the NRA plays in the provision of water for abstraction, it is also required to balance these legitimate demands against others such as flows to estuaries to enable migatory fish passage, as well as protect inland and underground waters from over use.

2.13 Provision of water resources to meet future demands for domestic, industrial and agriculture supplies will involve the Authority in detailed liaison with existing and potential water users, to ensure that balanced plans are developed. Water resources planning is closely linked with water quality planning and development of close relationships between these two functions is essential.

2.14 The principal mechanism for management of the water environment is the granting or otherwise of abstraction licences.

2.15 Sections 131 and 132 of the Water Act 1989 refer to drought orders which enable water companies and/or the NRA to authorise actions necessary to provide additional water for supply during drought or indeed reduce abstractions for the protection of the environment. The NRA is a statutory consultee on all drought order applications, determined by the Secretary of State. The main role of the NRA in these consultations is to ensure a balance of water supply and environmental protection interests is achieved.

Finance

2.16 The total annual expenditure of the NRA is around £300m with some £60m being spent on water resources, this being funded totally by income from abstraction charges.

Manpower

2.17 The total manpower of the NRA is around 6,700 with some 500 being employed on water resources.

2.18 The above has given a brief background to the NRA, and briefly described its role in water resources.

Powers and Duties relating to Water Resources Act 1963

2.19 Although it has been amended by subsequent legislation, the 1963 Water Resources Act is the most important piece of legislation affecting the water resources activities of the NRA. The Act, as amended, is concerned with:-

- Assessment of water resources and related matters.
- General provisions as to abstraction of water.
- Control of impounding.
- Determination, variation and revocation of abstraction licences.
- Enforcement of restrictions and protected rights.
- Charges for licences to abstract or impound water.

3. Planning of Water Resource

3.1 Historically water resources in England and Wales have been developed on a first come first served basis, through a system of licensing which is now the responsibility of the NRA to administer.

3.2 The method for assessing whether an application is granted takes into account the rights of downstream abstractors, the quantity of water required to meet downstream water quality objectives and the quantity of water required to meet aquatic environmental standards at and below the

point where the application applies.

3.3 Some 50,000 abstraction and impounding licences exist throughout England and Wales, whereby on average about 35 million cubic metres of water is abstracted daily of which 20% is obtained from groundwaters, although this varies from 1% to 74% between NRA regions. Abstraction for potable supply amounts to about 10% of the average natural runoff.

3.4 In granting a licence to abstract from surface waters it is common practice to specify a condition, within the licence, which prevents abstraction when river level or flow is low. The cutoff level is often referred to as a prescribed level or flow and its magnitude is assessed according to the downstream needs. Even if such a condition is not specified, the granting of a licence to abstract water does not give any guarantee that the licensed quantity will be available for abstraction.

3.5 The development of storage to meet supplies during low flow periods has been common practice for public water supplies and other sectors are increasingly investing in the construction of reservoirs especially in relation to spray irrigation for high value crops.

3.6 At first sight the degree of abstraction might suggest that there is no difficulty associated with the acquisition of additional water resources. However this is not the case because the concentration of demand coincides with the lowest rainfall areas and because the variability of river flow and the degree of reservoir storage means that in most years most of the winter runoff drains to the sea.

3.7 Table 1 gives a breakdown of actual abstractions according to purpose of use which shows the dominant use for public water supply.

3.8 Development of water resources for public water supply is undertaken principally by the water companies. They have a duty to ensure an efficient and economical system of water supply in their area and the Secretary of State and Director General of Water Services are required to protect the interest of customers of the utilities in respect of the quality of service they receive.

3.9 The NRA plays an active role in planning water resource developments primarily because of its duty to ensure the proper use of resources, to conserve augment and redistribute water resources and to protect the water environment.

3.10 Protection of the water environment is fundamental to the aims and objectives of the NRA. In relation to water resources planning the NRA is intent upon ensuring that water companies have developed adequate water resources systems to avoid emergency overdrawing of surface and groundwater resources during dry periods.

Table 1 - Abstraction from surface and groundwaters - England and Wales
(units are $1000m^3$/day)

NRA region	Water Supply	Agriculture		Industry		Total quantity abstracted	Percentage of total abstractions that were from groundwater
		Spray irrigation	Other	Central Electricity Generating Board	Other		
Anglian	1757	57	15	3	270	2102	50
Northumbria	891	-	-	-	71	962	11
North West	1857	2	5	77	705	2646	16
Severn Trent	2556	26	8	3290	500	6380	18
Southern	1156	7	11	-	144	1318	74
South West	531	3	31	44	56	665	15
Thames	3934	6	13	113	184	4250	42
Welsh	2449	13	15	7479	301	10257	1
Wessex	772	8	11	-	101	892	47
Yorkshire	1694	11	5	781	362	2853	11
England and Wales	17597	133	114	11787	2694	32325	20

(Note: Based on statistics for 1988 produced by the Department of the Environment)

3.11 Special regard has to be given to abstractions for public water supply above other abstraction purposes. Inadequate public water supply systems during dry periods would not only impact upon the availability of abstractions for other users but would necessitate the need for emergency abstractions which may be unacceptable to the water environment.

3.12 The water industry in England and Wales experienced an exceptional drought during 1976 which was more severe than most supply systems were designed to accomodate in some areas (commonly 1 in 50 year return period). It was neccessary to restrict consumption by the use of stand pipes in many areas. Since 1976 some £3300 million has been invested by the water industry in improving water supply systems of which about £500 million has been invested in the supply of water resources.

3.13 One of the lessons learned from the 1976 drought was the need to operate water resource systems in an integrated way in order to maximise the use of available resources and to achieve flexibility in the way that they can be operated. Much of the expenditure since 1976 has been invested in schemes to improve integrated resource operation.

3.14 Where topographic and hydrologic conditions have been favourable, advantage has been taken of developing different types of sources to feed large demand centres. Supplies to many are met from a combination of direct supply reservoirs, river regulating reservoirs, which sustain lowland abstractions and groundwater abstractions either directly from boreholes or to augment river flows. There are two main advantages in such combined resources. Firstly they are likely to have differing responses to a given drought. For example, many groundwater resources have large storage capacities and can sustain abstractions for long periods of time which are significantly in excess of their average reliable output. Secondly, the different types of sources respond differently to efffective rainfall. Typically upland reservoirs and downstream abstractions can respond to short periods of rainfall during a drought and provide significant additional resources. Also during recovery from a drought, the most stressed sources can be rested due to the faster recovery rate of other sources.

3.15 One of the penalties of flexible resource operation can be the need to provide sufficient transmission and treatment capacity to meet peak demands from each of the resource components. However, these additional costs may be offset by maximising the use of low cost, high quality sources which can suply more than their individual reliable yields for most of the time. Also, where river abstraction schemes have been supported by river augmentation from groudwater development, the river serves as the transmission route, and additional capacity is avoided. Such schemes also benefit the water environment by augmenting river flows during times of low flow.

3.16 Due to the integrated roles played by the NRA and the water companies it is necessary to work together in the preparation of plans for water resource development. Although the NRA will not normally be the promoter or developer of a water resources scheme it must satisfy itself that proposals make efficient use of water resources in terms of impact on the water environment.

3.17 Because the water companies are privately owned and are motivated to provide adequate returns to their shareholders it is possible that schemes preferred by utilities may not be the ones preferred by the NRA to meet its environmental obligations.

3.18 There are some broad objectives that the NRA applies in the development of water resources plans.

i) There is evidence that groundwater abstraction from a number of aquifers is unacceptably reducing rivers flows and much greater attention will be given to these effects than has been given in the past.

ii) Special attention will be paid to the integrated development of diverse source types (such as regulating reservoirs, groundwater schemes and direct supply schemes) to achieve flexible source operation in drought.

iii) Piecemeal resource developments will be discouraged and efforts will be made to develop and share resources between water companies and other users.

iv) As demand increases in the South and East of England there is an increasing likelihood that bulk transfers of raw water will be needed in these areas. The NRA will require as much as possible of bulk water movements to be transmitted via the river system in order that the river environment may benefit.

v) In the development of water resources schemes, the NRA will seek opportunities to obtain benefits for the water environment, such as freshet releases, recreational opportunities or flexible compensation water arrangements.

3.19 It may be necessary for the NRA to undertake feasibility studies to explore options not being considered by the water companies. This is particularly likely in the context of large scale developments which would provide additional resources for a number of potential uses.

3.20 There are two main routes whereby the NRA can exert its influence upon proposals which it finds unacceptable. Firstly, the NRA can refuse an application for an abstraction or impounding licence associated with a proposed scheme. If the applicant appeals against the decision then it is up to the Secretary of State to resolve the matter. Secondly the NRA can be an objector at a planning enquiry into a proposed scheme which would be resolved by the Minister.

3.21 Agricultural abstractions have been increasing in recent years, especially for spray irrigation. Although some agricultural abstractions have benefited from schemes developed for public water supply purposes they are mostly dependant upon direct river or groundwater abstractions rather than being met from large scale resource development schemes. These requirements for abstraction are considered on a first come, first served basis and their applications are determined according to the ability of the source to meet the abstraction demand.

3.22 Industrial abstraction has declined in recent years due to the move away from water intensive industries. Some large scale water resources schemes have been developed to provide reliable water supplies such as for the electricity and steel industry but many rely on direct river and groundwater abstractions.

3.23 Development of future resources for agriculture and industry is a potential role of the NRA through development of river-to-river transfer, strategic reservoirs or river augmentation schemes.

4. <u>Drought Management</u>

4.1 Under its general role to balance the need of the water environment with demands of abstractors the NRA has a difficult task to see that the correct balance is reached during times of drought.

4.2 During such periods the policy of the NRA is to attempt to share any shortage as equitably as possible but bearing in mind the special regard for water supply abstraction requirements.

4.3 The primary mechanism available to vary abstractions and compensation water releases during drought periods is to apply to the Secretary of State for a drought order, which can be granted only when an exceptional shortage of rain has resulted in, or threatens, a serious deficiency of supplies of water.

4.4 Generally, drought orders directly affecting the availability of water resources are of the following form:

- reduction in compensation water required from reservoirs to conserve storage for water abstraction;

- reduction in residual flows required to pass below the point of abstraction to enable additional quantities to be abstracted;

- authorisation of abstraction rate in excess of permitted quantity;

- authorisation of abstraction at otherwise unlicensed locations;

- restriction in licensed abstraction rate to conserve water for other purposes.

4.5 Application for such drought orders may be made by the NRA or water companies. Further drought order powers are also available to water utilities relating to progressing more severe measures aimed at reducing consumption by its customers. These include:-

- Restrictions on the non-essential use of water such as washing buildings, water for fountains and vehicle washing;

- Pressure reductions to ration and share out supplies between customers;

- Rota cuts restricting supplies to supply areas for a portion of each day;

- Standpipes or water tanker supplies.

Drought orders can also be sought to modify the quality of discharges if necessary to protect the river system.

4.6 Through its resource planning role, the NRA expects water utilities to take account of the form, magnitude and frequency of drought orders in evaluating the performance of its systems. In addition it is considered necessary to account for the way in which the system would be operated during a drought, such as taking account of the introduction of various levels of restriction to curtail demand. In general, effective resource planning should restrict the need for drought orders to events of severity greater than the design standard.

4.7 Evaluation of such operational yields is not common practise throughout England and Wales and it is suspected that when such approaches are applied to existing systems it will be necessary to reduce the reliable yields of a number of source works.

4.8 Apart from the use of drought orders, the NRA has powers to reduce or ban licensed abstraction of water for spray irrigation from surface waters or from groundwaters which affect the flow in surface waters. These powers are invoked to conserve water resources within the environment or to enable a sharing of limited water resources with other abstractors.

The Drought of 1989/90

4.9 Like much of Europe, England and Wales has been suffering a severe drought during 1989 and 1990. The problem began in the late Autumn of 1988 when several months of exceptionally low rainfall occurred. This resulted in significantly lower groundwater recharge than normal and left many groundwater sources at a depressed level at the beginning of the 1989 summer. Likewise some reservoirs were not yet refilled.

The Summer of 1989 continued to be dry resulting in substantial drawdown of reservoir storage, groundwater levels and river flows. Although the winter of 1989/90 was not severely dry, aquifer recharge suffered due to initially high soil moisture deficits and much of the rainfall was of high intensity which resulted in storm runoff and some arose late in the winter when soil moisture deficits were already building up.

4.10 It is difficult to generalise on the severity of the drought period in broad terms due to the differing responses of storage reservoirs, groundwaters and river flows to rainfall. However using rainfall statistics as a broad measure, Table 2 shows estimates of the return period of rainfall for successive periods during the drought. Comparisons have been made with the prolonged drought of 1975/76 and for most resources the impact has not been so severe to date.

4.11 The area which has resulted in the most severe problems is the Eastern side of England, mostly within the Yorkshire, Anglian and Southern regions of the NRA. These areas are heavily dependent upon abstractions from Chalk aquifers which in turn also provide base flow in watercourses draining from these areas.

4.12 Upon the formation of the NRA in September 1989 resources were already in a depressed state and especially in the eastern Chalk problem areas, concern was being expressed regarding their recharge potential during the coming winter.

4.13 The Autumn and earlier Winter resources were generally sufficient to meet immediate demands, but by January 1990 the NRA commenced a National review of the water situation. During the Winter period monthly reviews were prepared covering England and Wales, which indicated areas at risk in the future if defined deficiencies of rainfall occurred up to the end of April. The reviews also identified contingency measures which would be undertaken if an inadequate resource position resulted by the beginning of the Summer.

4.14 In order to undertake the review of potential problem areas and the means to resolve them, the NRA formed close links with water undertakers, and other interested bodies.

4.15 By early Summer 1990 it became clear that the Chalk groundwater resources in the East of the country had not recovered to sufficient levels to avoid problems during the Summer months and as the intensity of the drought continued further areas of England and Wales began to experience increasing difficulties.

4.16 Throughout the Summer national reviews of the situation were compiled twice monthly and were used to brief government departments, specific external interested parties and were also used as a basis for responding to intensive media enquiries.

TABLE 2

Rainfall return period estimates during 1989 and 1990

(Figures show return period range in years).

	Nov 88 to Apr 89	May 89 to Sept 89	Oct 89 to March 90	April 90 to August 90
England and Wales	2 to 5	40 to 50	5 to 10	20 to 50
Northwest	2 to 5	30 to 40	2 to 5	20 to 50
Northumbria	40 to 60	50 to 80	2	10 to 20
Severn trent	5 to 10	40 to 50	10 to 20	80 to 120
Yorkshire	10 to 20	25 to 35	2 to 5	20
Anglia	5 to 10	10 to 20	2 to 5	50
Thames	5	30	5 to 10	80 to 120
Southern	10	70 to 100	2 to 5	20 to 50
Wessex	2 to 5	20 to 30	10 to 20	20 to 50
Southwest	2 to 5	30 to 40	5 to 10	10
Welsh	2 to 5	70 to 100	2 to 5	20 to 50

4.17 During the drought it has been the policy of the NRA not to support applications for drought orders which impact upon the water environment unless the water company applying for the orders was prepared to imposed restrictions on its customers to reduce consumption normally through the banning of the use of hosepipes or garden sprinklers. The logic applied to this policy was that it is unreasonable to reduce the water that would normally be available to the water environment unless the abstraction of water by the water company is reduced by the imposition of such a ban. In general the water companies have been sympathetic to this policy.

4.18 By the end of August 1990 some 25 drought orders had been made and hosepipe or sprinkler bans were in force for 39% of the population. The extent of the measures is shown in Map 1. By this time, river flow rates in the East and South East were typically between 20% and 50% of average for the time of year and groundwater levels in the Chalk aquifers were up to 10 metres below those normally experienced in August, and some were recorded at their lowest recorded level.

4.19 Even 50, in general terms the impact of the drought on supplies through the mains system has not been too dramatic. Following the so called "Great Drought" of 1976 water undertakers have spent considerable sums of money to augment their water resources and to interconnect supply systems. There appear to be no plans to impose greater restrictions on public water supplies than existed in September 1990, although wet weather in 1990 Autumn and 1990/91 Winter will be required to avoid problems next year for many of the surface reservoir and groundwater fed systems.

4.20 However, the impact on direct abstractions has been greater. Many abstractions with prescribed flow conditions have been required to cease due to the flow conditions contained in their licences. In particular this has affected abstractions from rivers for spray irrigation in areas of the Midlands and the South and the East of the country. In particular it was necessary for the NRA to ban all river abstractions for spray irrigation in parts of East Anglia to prevent a river becoming "septic" due to particularly low flows.

4.21 Active measures have been taken to augment river flows where necessary. The NRA operates some river regulation schemes and close liaison has been necessary to match release quantities to abstraction and in river requirements. Groundwaters are also used to augment river flows and these have been operated, where necessary, to satisfy environmental and abstraction requirements.

4.22 During the Autumn of 1990 the NRA concern not only relates to the monitoring of resource recovery but also to close liaison with abstractors to ensure that recovery is maximised and that contingency measures are planned in the eventuality that winter rainfall is inadequate.

5. Experiences Gained and Lessons Learned.

5.1 The NRA was established during the 1989/90 drought at a time when policies, practices and procedures were at an early stage of development. However the majority of staff were recruited from the previous regional water authorities and were therefore familiar with the situation and measures required to tackle future scenarios.

5.2 One of the most important aspects of management of the drought is the development of close liaison with all interested parties. It is not possible to contemplate standing committees representing all interests due to the large number of people involved. Approaches have varied between regions ranging from informal contacts to more formal committees. The differing forms of liaison are partly dictated by the severity of the drought in different regions although there may be some benefit in pre-planning liaison arrangements to cope with future droughts.

5.3 Central government have taken a close interest in drought developments and have high lighted the need to collect consistent information across England and Wales as efficiently as possible, and the NRA has been the agency compiling situation reports covering the water companies, other abstractors and the water environment. Drought reports have been produced for a variety of purposes, using different data sets and to different reporting dates and there would appear to be the opportunity to develop a system based on common information which can be more effective in meeting a variety of needs. This would be greatly facilitated by pre-planning a representative monitoring network of reservoir level, river flow, groundwater level and water quality information which would meet reporting requirements and for which statistical information would have been derived in advance so that the "present" situation could be rapidly assessed. Clearly a computer based system would be most-appropriate.

5.4 Drought management relies heavily upon an assessment of the future situation should certain hydrological events occur. Although use has been made of modelling to make future predictions there is scope for much greater use of models for drought management purposes. In some cases, such as groundwater models, they were often not developed with drought management in mind and the assumed aquifer characteristics may not be appropriate for drought prediction, or they may be too detailed for the job.

5.5 Assessment of the impact of drought orders upon the water environment is a difficult area and where as the NRA is conscious of the needs of water abstractors it must also protect the needs of water environments. There are no objective methods available for striking the right balance between the two needs and at the present time assessments are based on local knowledge and experience. The NRA is undertaking research into this area but it is difficult to envisage a methodology which would totally reduce

this conflict of interest. However a way forward would be to pre-evaluate possible drought orders which would impact on the water environment so that the urgent needs to evaluate measures to secure additional resources can be expedited efficiently.

5.6 Media interest in the drought has been intense and in many instances has exaggerated the severity of the drought. To some extent the NRA has been re-active to the media and those regions that have acted in a pro-active way appear to have had greater success in portraying the true situation.

5.7 The drought has generated comment and interest in possible future developments such as the:-

- construction of a national water grid to connect the wetter parts of the country to the dryer parts.
- supply of water by ship from sources with spare capacity.
- use of dual portable/non portable supply networks.

These ideas are not new and have been discounted by the industry as being uneconomic. Suggestions have been made that the extent to which we use water is a squandering of this precious resource. Although the NRA is intent upon securing the wise use of water it does not envisage a radical change in the way in which water is used.

6. CONCLUSIONS

6.1 The reorganisation of the water industry in 1989 has resulted in the establishment of a framework which cradles the requirements of public water, industry and agriculture to be balanced against those of the water environment, not only in terms of abstractions but also discharges.

6.2 Planning of future water resource strategies will be a cooperative exercise between the NRA and the water users.

6.3 Over recent decades, considerable sums of money have been spent to achieve robust and flexible water resource schemes to withstand droughts. Flexibility has been achieved by the cross connection of supply systems and by the conjunctive use of sources which have different responses to a given drought.

6.4 The 1989/90 drought has been particularly severe in the eastern part of England and has had greatest impact on direct abstractors from rivers and on water supply abstractors from chalk aquifers.

6.5 The short term impact of the drought upon the water environment has not been dramatic. Higher than normal temperatures tend to enhance the natural ability of rivers for self purification, and also aids the treatment process prior to the discharge of effluents to the water environment. Where impact has been observed typically it has been:-

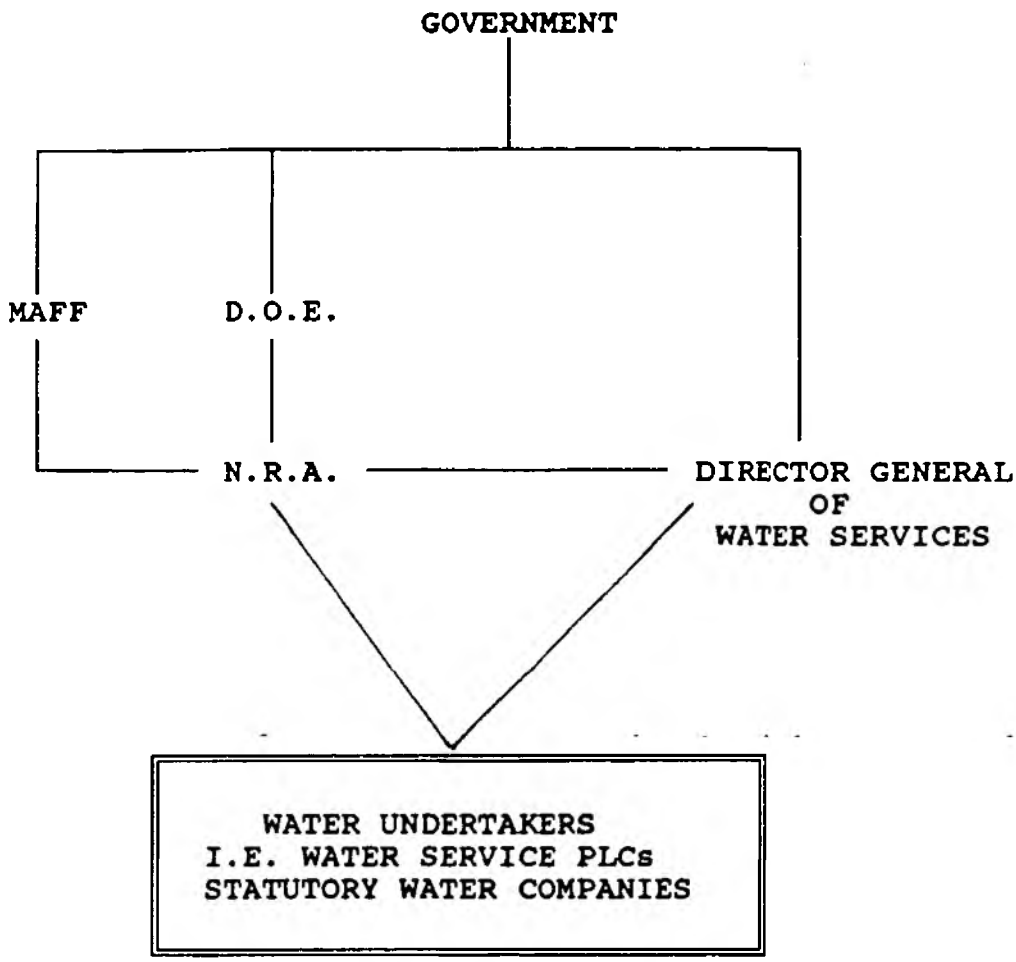
- detraction of usual amenity due to low flows
- fish kills due to oxygen depletion
- loss of recreational use such as fishing and boating

6.6 The long term environmental implications of drought are difficult to quantify. There are many instances where the river is said to be in a much 'worse' state than ever before, but unfortunately the relationships between water quantity/quality and flora and fuana are not usually sufficiently well understood to objectively link causes to effects. This is an area that the NRA has included in its research and development programme.

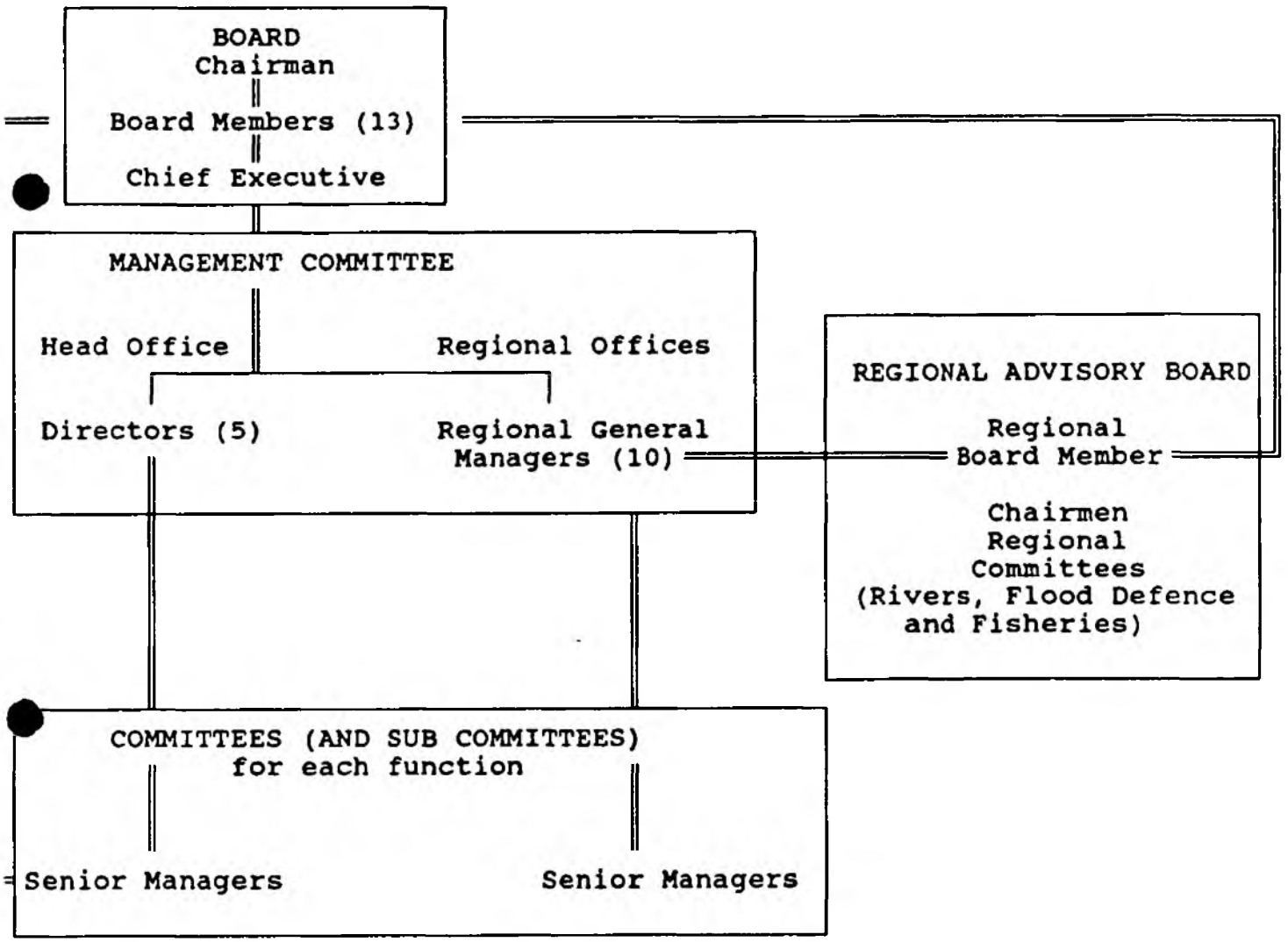
6.7 All the above lead to the fundamental need for appropriate resource planning which provides sufficient water for legitimate use during design drought periods whilst at the same time ensuring the water environment is provided. A long and diffult task ahead in many areas, but an essential one if we are to avoid hasty reactive measures by not having planned ahead sufficiently.

6.8 The need for a strong execution of the NRA's role in water resource planning has been amply demonstrated by the drought of 1989/90.

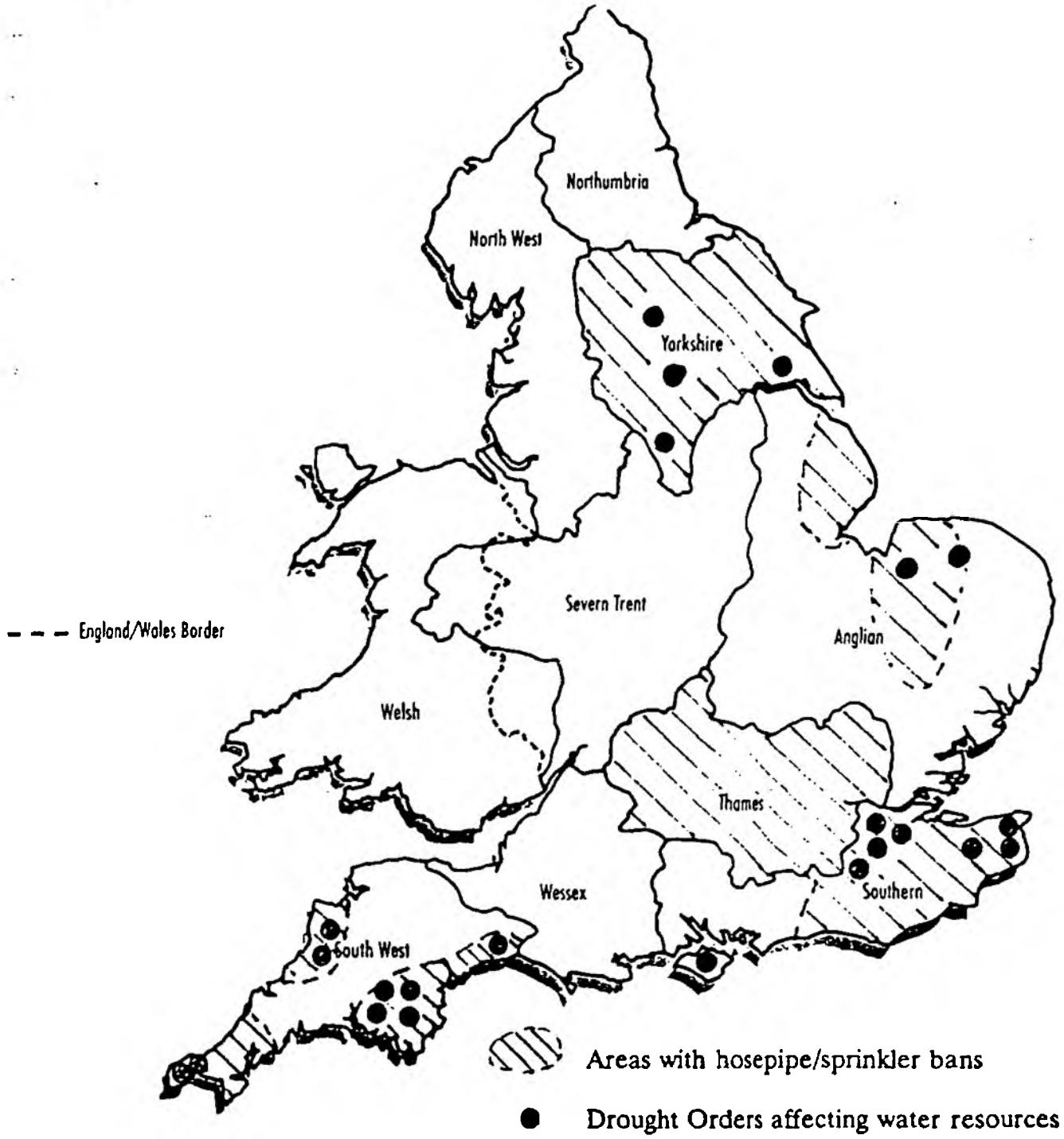
FIGURE 1 - REGULATORY FRAMEWORK



GURE 2 - THE ORGANISATION AND MANAGEMENT OF THE NRA



MAP 1. LOCATION OF NRA REGIONS AND
EXTENT OF DROUGHT MEASURES-30 AUGUST 1990



SCHEDULE 1

Statutory Duties and Powers

Duties - Under Water Act 1989

S.103(3) To make maps of the fresh-water limit of relevant rivers and watercourses available to the public.

S.125(1) To undertake measures to conserve, redistribute or augment water resources and to secure the proper use of water resources in England and Wales.

S.7(6) To have regard to the duties imposed on any water or sewerage undertaker likely to be affected by the Authority's powers.

S.126(1) To make arrangements, where reasonably practical, with water undertakers for securing the proper management and operation of water resources and associated works used in connection with the carrying out of their functions. The Authority is required to send a copy of such arrangements to the Secretary of State.

S.127(2) If directed by the Secretary of State, to consider whether a minimum acceptable flow for a particular inland water ought to be determined or reviewed.

S.129(8) To bring the provisions of an abstraction charges scheme, which is in force to the attention of persons likely to be affected by them.

S.130(1) To provide water undertakers with information which they reasonably request in connection with their functions and which is in the possession of the Authority.

S.130(6) To provide reasonable facilities to all persons for the inspection of specified records kept by the Authority and for the taking of copies of such records.

S.143(2a) To collate and publish information from which assessments can be made of actual and prospective demand for water and the availability of water resources.

Powers - Under Water Act 1989

S.129 The Authority may require payment for abstraction licences in accordance with its scheme of charges. Schemes made by the Authority following the period ending two years after the transfer date will require approval by the Secretary of State following a

period in which the proposals have been published in the form of a notice.

S.131/132 To apply to the Secretary of State for a drought order to be made containing specific provisions relating to conservation or augmentation of water resources which are required due to an exceptional shortage of rain. Such provisions include suspension or variation of consent conditions and abstraction licences together with provision for securing additional resources. Provisions apply when the exceptional shortage of rain is accompanied by a situation likely to impair the economic or social well being of persons in the area.

S.111 To apply to the Secretary of State to designate areas as water protection zones within which specified activities may be restricted or prohibited for the purposes of preventing or controlling pollution of controlled waters.

S.112 To apply to the relevant Minister to designate nitrate sensitive areas within which provisions are made to prevent or control the entry of nitrate into controlled waters.

S.127(1) To submit a draft statement to the Secretary of State to determine, amend or replace a minimum acceptable flow following consultation with specified bodies and individuals.

S.130(5) To charge, in specified instances, for the use of facilities in connection with the provision of information.