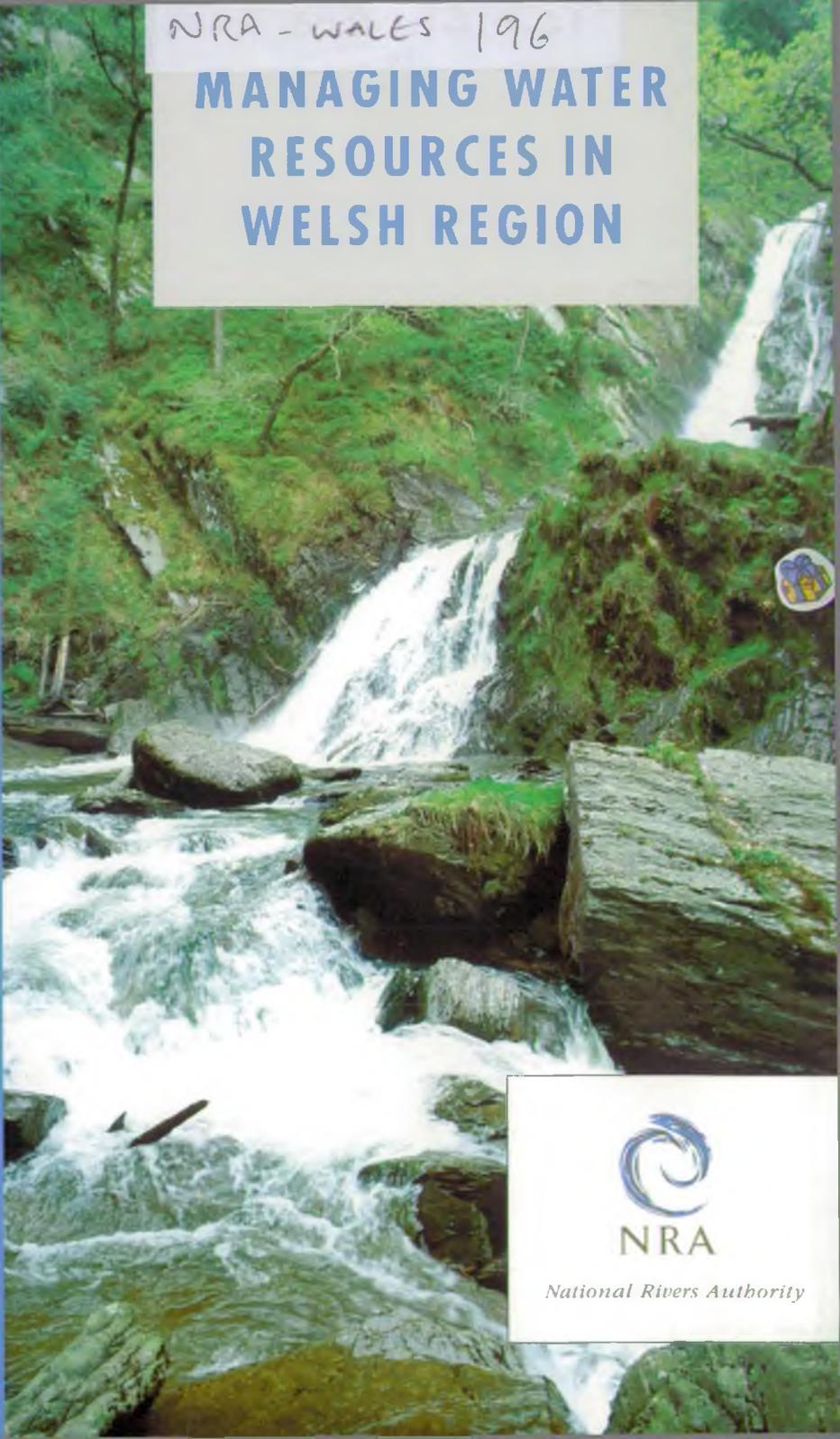


NRA - WALES 196

# MANAGING WATER RESOURCES IN WELSH REGION



**NRA**

*National Rivers Authority*



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Thanks to the National Museum  
of Wales for the illustration on  
page 1 of the Caergwrle bowl.

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### Water is vital to life.

Making the best use of this essential resource is one of the prime statutory responsibilities of the National Rivers Authority (NRA). It includes conserving water and balancing the competing needs of abstractors and of the water environment. This complex role is accomplished through:

- Continuously measuring rainfall, evaporation, river flows, and groundwater levels.
- Analysing these data to establish the availability and reliability of water resources.
- Controlling abstractions from rivers and groundwater.
- Predicting future water demands of all kinds.
- Planning environmentally sustainable works to augment water resources to reflect changing demands.



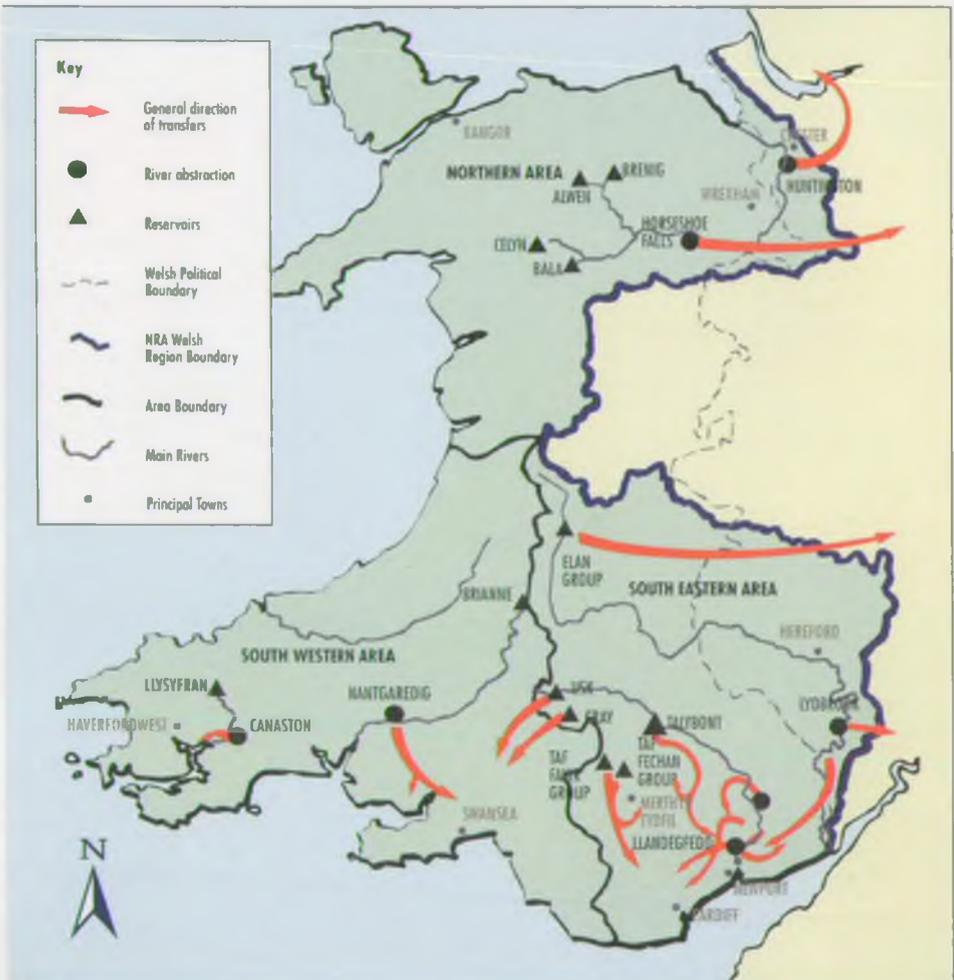
*A line drawing of the Caergurle bowl, a votive model boat made of slate and decorated with gold inlay, found in Caergurle, Clwyd.  
(9th–8th Centuries B.C.)*

## The Welsh Region

The NRA has eight Regions, covering England and Wales. Welsh Region is the fourth largest covering an area of 21,262 square km. It comprises the whole of Wales apart from that part of mid Wales which falls into the Upper

Severn catchment. It also includes those parts of the Dee and Wye catchments which lie in England. The landscape is very diverse, ranging from the distinctive mountainous areas of North Wales to the low-lying coastal areas of the Gwent levels.

### PRINCIPAL WATER RESOURCES OF THE WELSH REGION



## Water Resources of the Welsh Region

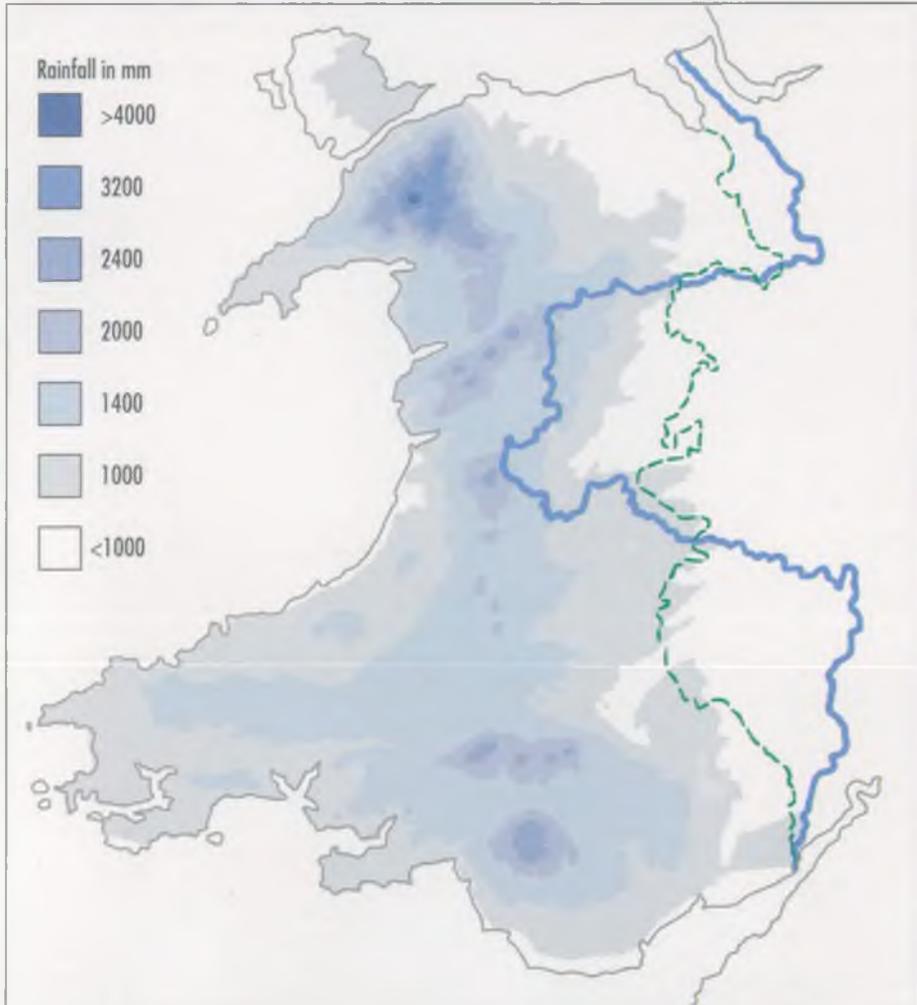
### Rainfall and Rivers

Rainfall is the sole source of fresh water. Welsh Region has more of it than any other NRA Region: over 1310 mm per year on average, compared

with 845 mm per year in the rest of England and Wales. Distribution ranges from less than 700 mm in the Welsh Borders to over 4,000 mm in Snowdonia.

Over the Region about 45% of the

### AVERAGE ANNUAL RAINFALL (1941-70)



1210 - 730 = 580 mm evaporation - ?

rainfall evaporates or is used by plants. The 730 mm per year which remains is called the "effective" rainfall. Some of this quickly finds its way to the river systems and the sea, while the remainder is delayed by infiltrating into soils and rocks, or by being stored in lakes and reservoirs. This may then be released slowly to maintain river flows during dry periods, or used to satisfy demands by industry, agriculture and the public.

### Groundwater

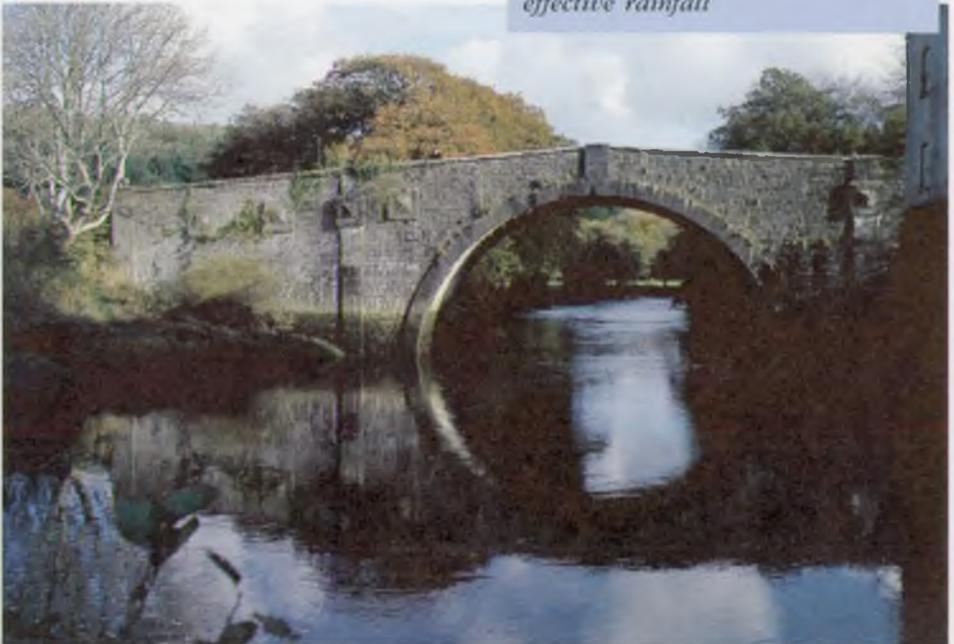
Groundwater is found throughout the Region and is important where sufficient quantities of water are held

in permeable rocks known as aquifers. The main aquifers comprise the Carboniferous Limestone, the Permo Triassic Sandstone and the Old Red Sandstone. Supplies from valley gravels are also of local significance.

### Drought

Droughts are natural phenomena caused by long periods of low rainfall. During such periods the effective rainfall in a year may be reduced by half. The proper management of water resources requires assessment of the available resource during droughts.

*River flows are maintained by the effective rainfall*



Although Wales has plentiful water resources, they are heavily utilised by man. The quantity licensed for abstraction is more than half the average effective rainfall. In drought years abstraction quantities appear to exceed the water available. However, nearly all the water used within the Region is returned to the rivers after use. This water maintains flow and keeps the aquatic environment in a healthy state. The NRA also sets conditions on licences to reduce the impact of abstractions during periods when water resources are limited.

The main needs for water are as follows:-

### **Fisheries**

The fisheries resource of the Region is extensive, diverse and valuable. Fish rely upon an adequate supply of water throughout their life cycle. Of particular importance is the effect of water flow on the migrations of salmon and sea trout. Generally, increases in river flow, known as spates, stimulate these movements and are important in enabling adult fish to negotiate obstructions.

### **Water Quality**

The Welsh Region has very good quality water in its rivers and lakes. However, in some upland areas the effects of acidification are of concern, and in the larger river valleys intensive agricultural practices can affect both surface and groundwater. Across the Region mining and other industries have left contaminated land, and current industrial activity and waste disposal pose a pollution risk. The Region's rivers and streams provide water for the dilution of effluent.

### **Conservation**

Many wildlife and landscape features which contribute to the natural beauty of Wales have developed in response to the climate and high rainfall of the Region. They rely on the continued availability of water, often of high quality and in large quantities. The rivers Wye, Usk, Dee, Tywi and Teifi harbour species such as otter, dipper, goosander, salmon, sea trout and shad; the fast flowing mountain streams in North and West Wales support fragile plant

communities dependent on a moist environment; the extensive areas of blanket and lowland bog throughout the Region are home to unique plant communities.

### **Recreation**

The Region's landscape provides the venue for the local population and tourists to enjoy a wide variety of recreational pursuits. The river Wye offers an unrivalled length of river for canoe touring, with a trip through countryside of outstanding scenic beauty. Other rivers offer white water and slalom canoeing, and on the Tryweryn these uses are enhanced through releases of water from Llyn Celyn reservoir. In addition to the extensive uses of rivers, lakes and reservoirs for angling, they are a popular choice for bankside walks and picnics.

### **Canals**

The canals of the Region provide important waterways for pleasure boating and other waterside recreational use. They are operated by British Waterways and private companies. However, the rights to take water to feed the canals predate the water resources legislation and so remain unregulated. These

uncontrolled abstractions can create problems, particularly when the rivers used to feed canals are themselves suffering from low flows.

### **Water Abstractions**

Water is abstracted from the Region's surface and groundwaters for a variety of uses. Currently there are about 4,100 licences in force, which authorise the abstraction of some 24,368 Megalitres per day (ML/d). There are also very many small unlicensed abstractions which, although important, are not significant users of water. The Region's abstractions are covered under the following categories:

**Hydro Electric Power:** About three-quarters of all the water licensed in the Region is used at 41 sites to generate electricity. No water is lost in this process, but the large changes in river flow can have a major impact on the aquatic environment and other users of the watercourse. Three of the largest schemes recirculate the water used for power generation and so limit the downstream impact.

**Agriculture:** The major agricultural abstractive uses are for spray irrigation and fish farming.

Spray irrigation often occurs when flows in rivers and streams are at their lowest and the potential impact at its greatest. Nearly all water is used by plants or evaporated away.

Fish farms account for 80% of the Region's agricultural water use.

However, nearly all water abstracted is returned after use. The Region's rivers are not ideal for this use due to the low summer flows.

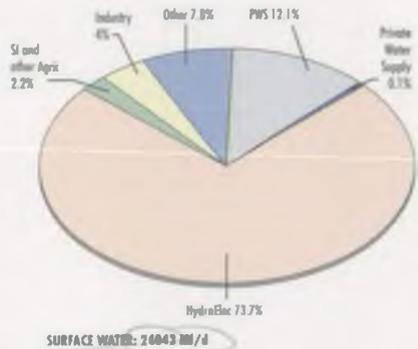
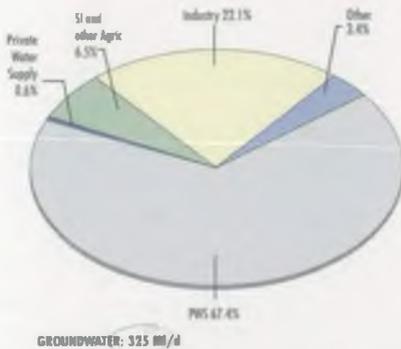
**Industry:** Direct abstraction for industrial use ranges from the low water loss mineral washing, through to high water loss evaporative cooling. Industrial use accounts for around 5%

of the Region's licensed total. Actual abstraction is well below the licensed quantities available.

**Public Water Supply:** Water Companies are licensed to abstract around 3,100 Ml/d of water to supply domestic households, commercial buildings and industry. Some 1,100 Ml/d is licensed for export from the Region. Typically about 70% of public water supply abstraction is returned to rivers via the sewerage system. However, in Welsh Region only about 30% is returned. This is due to the large volumes exported from the Region, and the high percentage of effluent discharged directly into the sea.

*water deficit means it is not returned*

### LICENSED QUANTITY IN WELSH REGION



*should be same size as 1*

Upland Wales has deep valley locations for containment of water, coupled with high rainfall. As a result many Welsh river flows are augmented by water released from reservoirs; a process known as river regulation.

The NRA has made statutory agreements with the reservoir owners, Dwr Cymru, to operate the reservoirs for the benefit of abstractors and the rivers. Agreements are now in operation on six rivers in Welsh Region:-

### Dee

The natural flows of the River Dee, during dry summer weather, would be insufficient to sustain any significant abstractions. By taking water into storage in Bala Lake, and in the reservoirs of Llyn Brenig and Llyn Celyn at times of high river flow, water may be released to supplement low natural flows when they occur. In 1994, the Dee scheme allowed the authorised abstraction of almost 830 Ml/d by four water companies and British Waterways.

In addition, a residual flow of at

least 364 Ml/d is maintained over Chester Weir in all but the most testing of droughts. This safeguards the passage of migratory fish, and limits the ingress of saline water over the weir. A further 1028 Megalitres (ML) of storage is held to:

- mitigate the effects of pollution,
- enable canoe events on the Afon Tryweryn on a number of days,
- provide fishery freshets to safeguard the grilse and spawning runs.

Bala Lake and Llyn Celyn are also used for short term retention of flood water until it can be safely released.

### Tywi

The construction of Llyn Brianne dam in 1972 provided an impoundment of 61,000 ML of water with which to regulate the River Tywi. Releases of reservoir water into the River Tywi primarily support licensed abstractions by Dwr Cymru near Llandeilo and Carmarthen. However, a further 15 Ml/d is available for allocation to other potential abstractors. Additionally, up to

9092 Ml of water can provide fishery freshet releases.

## Wye

The Elan Valley Reservoirs were originally constructed by Birmingham

Corporation to impound 99,106 Ml of water from the

Rivers Elan and Claerwen for direct supply of water to Birmingham.

Subsequent changes in operation of the scheme have enabled additional releases to be made from the reservoirs to supplement low flows in the Lower Wye. Consequently, additional abstractions are now possible at Lydbrook and Monmouth totalling 181 Ml/d. Additionally, up to 1818 Ml of water is available to provide fishery freshet releases.

## Clwyd

The Clwyd differs from the other schemes in that much of the water used to regulate river flow is taken from up to seven boreholes in the Triassic Sandstone aquifer of the Vale of Clwyd. In addition, up to 6.8 Ml/d of water can be discharged from the



*The Elan Valley reservoirs provide water to the Midlands and South Wales*

Alwen aqueduct. The river augmentation releases are required to support Dwr Cymru's abstractions of up to 13.6 Ml/d at Llannerch. A further 1 Ml/d is available for allocation to other potential abstractors. There are no specific environmental releases of water. However, releases from the artesian augmentation boreholes between early May and autumn frequently exceed downstream abstraction requirements, thereby conferring additional benefits to the river environment.

## Aled and Dwyfor

Smaller scale agreements are in force on the Aled and Dwyfor systems.

In March 1994 the NRA published "Water, Nature's Precious Resource". This milestone report (available through HMSO at £22.50) sets out a water resources strategy for England and Wales for the next 30 years. A Welsh Regional strategy, due for publication in the autumn of 1995 will build upon this foundation.

In preparing this strategy the Welsh Region of the NRA has published a consultation document "Water for Welsh Region" which is designed to invite comment on the management of water resources. This report considers the likely change in demand up to the year 2021. Over this 30-year period growth in water use is anticipated.

There is the potential for a threefold increase in hydroelectric power generation demand and doubling of spray irrigation in the Region by 2021. In practice, these demands are likely to be constrained by resource availability.

Demand for public water supply could increase above current levels by as much as 26% over the planning period. Much of this could be met by enhancement of existing licensed

sources or be deferred by improvements in demand and resource management. In some rural areas and in the Dee catchment, supplies are insufficient to meet future demands. These projected shortfalls could be met through modest schemes such as new groundwater abstractions, or through works to increase the capacity of existing reservoirs.

This consultation document is the first stage in the preparation of an environmentally sustainable water resource strategy for the Welsh Region. This strategy will build upon the detailed resource assessment and planning work already carried out and scheduled for the coming months. The comments received on this consultation document will aid the development of the strategy.

*Copies of the consultation document are available from:*  
**Water Resources Section  
National Rivers Authority  
Welsb Region  
Rivers House, St. Mellons  
CARDIFF CF3 0LT**