

NRA Thames 104

Project Summary

COLN RIVER LEVELS STUDY



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ENVIRONMENT AGENCY

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commissioned by



NRA

National Rivers Authority
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ENVIRONMENT AGENCY



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Project Summary

COLN RIVER LEVELS STUDY

PROJECT BRIEF

This project was commissioned in response to public concerns that the character of the river had changed over the last 30 years and, in particular, that river levels had reduced. The study was divided into two stages.

Stage One considered the evidence for change in catchment characteristics with regard to the following parameters:

- | | |
|--------------------------------|---------------|
| Groundwater levels | Water quality |
| Surface flows and river levels | Flora & fauna |

Each parameter was considered with regard to historical evidence, local information and perceptions, and factual data analyses.

Stage Two considered each of the possible causes of catchment change as below:

- | | |
|--|------------------|
| Meteorological variation | River management |
| Groundwater abstraction | Land management |
| Effluent discharges and pollutant inputs | |

RIVER COLN

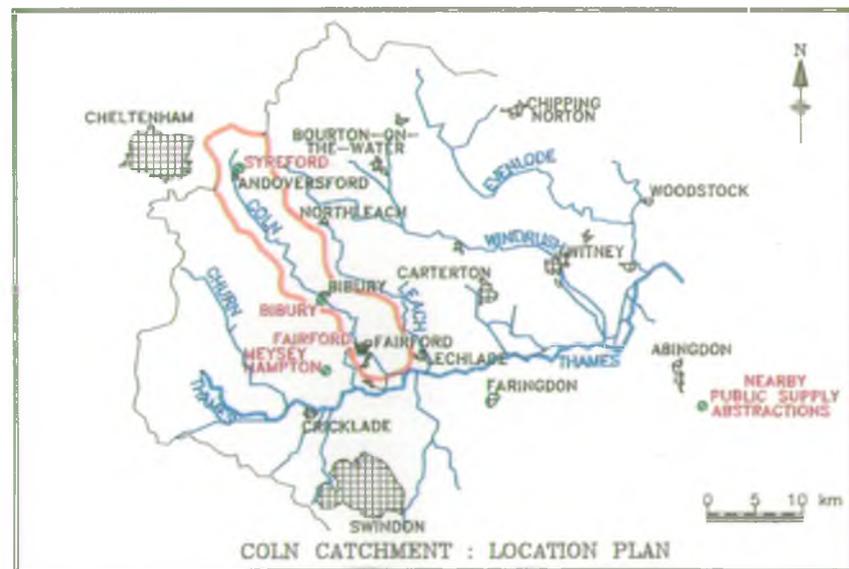
The project considers the Coln catchment as far down as Lechlade, a total area of 150 km². The Coln is one of five northern Cotswold streams, with very similar characteristics, flowing southwards into the upper Thames. The catchment is steep sided with a wide valley base and is largely rural in nature.

The geology of the catchment consists of the Great Oolite and Inferior Oolite limestone aquifers with intervening and overlying clay layers. The entire sequence dips gently from north to south.

Public concerns have focussed on the central reach of the river, from Fossebridge down to Bibury, and relate largely to reduced river levels, loss of submerged river weed (e.g. *Ranunculus*) and increased siltation of the river bed. These same issues have also been highlighted by angling interests along the river downstream of Bibury. These bodies have also noted the lack of natural recruitment of brown trout along this reach. There has been relatively little concern expressed on the upstream river reach above Fossebridge.



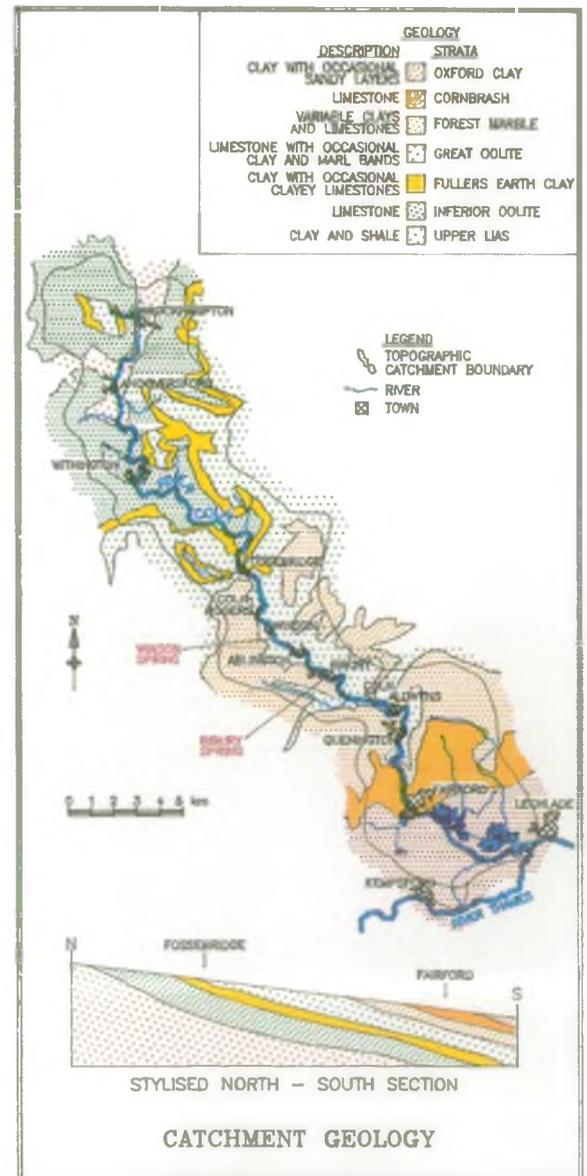
Quenington - unimproved pasture land in the wide valley base - October 1991



STAGE ONE - CHANGES IN CATCHMENT CHARACTERISTICS

GROUNDWATER LEVELS

The variation in groundwater levels at individual borehole sites and the groundwater level distribution throughout the study area were considered. Groundwater levels appear to have remained fairly consistent with time over most of the catchment area. However, there appears to be a reduction in Great Oolite groundwater levels of 2 to 6 metres in the south west of the catchment, related to abstraction at Meysey Hampton. This effect does not appear to have extended to affect river flows on the Coln.



SURFACE FLOWS

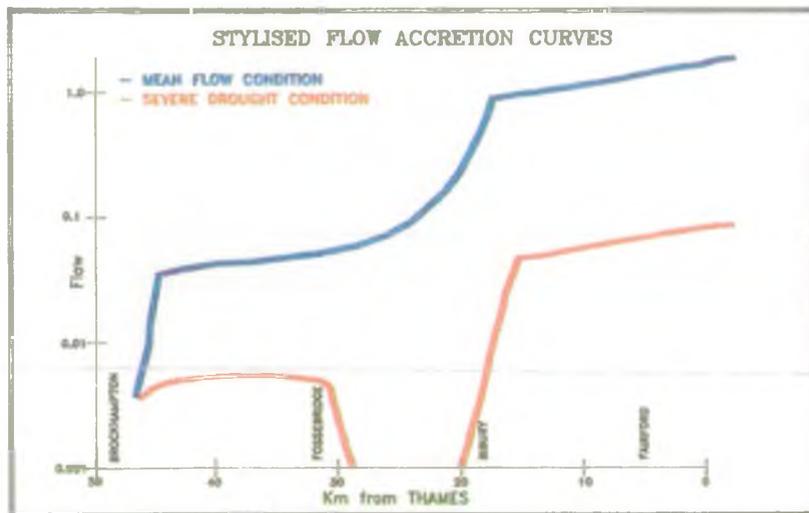
The river can be divided into three main reaches on the basis of the surface flow characteristics. Stylised flow accretion curves for both average and extreme drought conditions illustrate the nature of these reaches.

The upper reach extends downstream to Fossebridge and is fed by a combination of surface runoff and groundwater baseflow from springs mainly from the Inferior Oolite aquifer.

The central reach is from Fossebridge to Ablington and is fed by major spring outflows from the Great Oolite aquifer. There is a large increase in flows along this reach under normal conditions. However, during extreme drought conditions these springs may fail, from North to South, as the underlying aquifer is drained. This occurred in 1976, but also in 1890, indicating that it may be a completely natural phenomenon. In 1976, flow re-appeared at the main spring at Bibury.

Flows along the lower reach, from Bibury, are controlled largely by springflows at Bibury and from upstream.

The relationship between rainfall and surface flow to Bibury gauge indicates no significant changes in the flow regime over the period from 1964 when records start.



WATER QUALITY

Water quality is not a significant issue. The entire reach was of 1A standard in the 1990 National Water Quality Survey. Reductions in dissolved oxygen in 1991 reduced the river to 1B standard at times. This is considered to be due to lower flows and consequent reduction in oxygenation. Increased silt build up in the river bed in recent years is considered to be due to reduced flushing flows rather than increased silt loadings.

Some public concern has been expressed regarding the 'milky' nature of the river at various locations. This same feature was noted in the nineteenth century and appears to be largely a natural phenomenon.

FLORA & FAUNA

The major change in river character over the last few years has been the loss of submerged in-stream vegetation and corresponding increase in emergent and encroaching weed and blanket weed. The movement to the surface of mats of blanket weed is a more recent feature which detracts from the appearance of the river. Siltation of the river bed has a further detrimental effect on submerged weed growth. Loss of submerged weed and increased siltation has also led to a reduction in the natural reproduction of brown trout. Most of the trout population are artificially stocked.

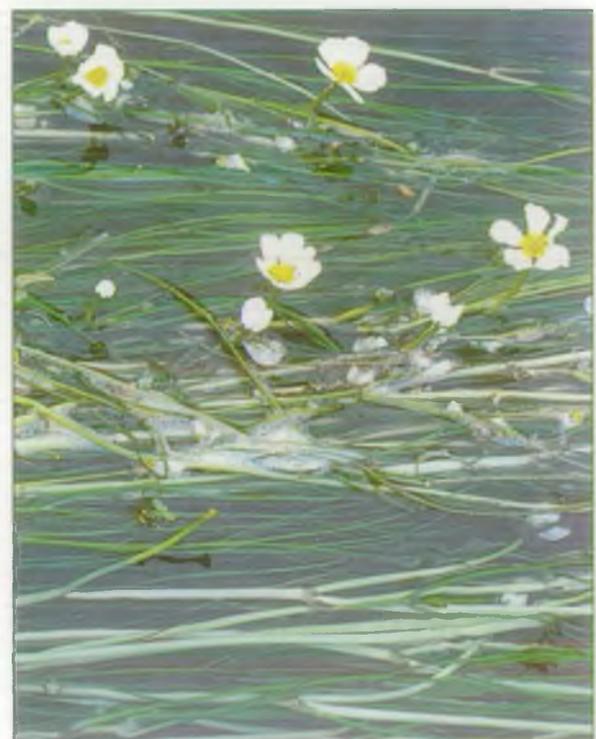
STAGE TWO - CAUSES OF CHANGE

METEOROLOGY

The rainfall and percolation record over the last 70 years was analysed. Extended periods of reduced rainfall over the winter period results in a muted groundwater level response and reduced spring flows during the following spring and summer.



Bibury - low river levels, encroaching weed, blanket weed, siltation and 'milky' water. All the current issues of concern are illustrated here - May 1992.



Flowering Ranunculus - a common submerged weed

The Great Oolite aquifer can drain a large proportion of its available storage following a single dry winter period, as was shown when the river dried between Fossebridge and Winson in the summer of 1976.

The recent drought period (1988 to 1991) has not had as severe an impact on surface flows as 1976, but several years of reduced flow have had a cumulative impact on the in-stream flora, reducing growth of submerged weed with progressive replacement by emergent and blanket weed. The drought is considered to have reduced mean flows by a third. Loss of submerged weed may result in a halving of river level for a given flow thus giving the impression of an even larger reduction in flow.

GROUNDWATER ABSTRACTION

One of the main public concerns at the start of the Project was that reduced river levels were being caused by groundwater abstraction, for public supply outside the Coln catchment. Actual abstraction has increased steadily over the last 25 to 30 years.

Two methods of analysing the effects on river flows were tried but produced conflicting results. One method showed a small reduction in flows at Bibury amounting to less than one fifth of the reduction due to the drought. The other method showed no impact and in fact indicated a small improvement in flow rate in relation to rainfall.

EFFLUENT DISCHARGE

Discharges from sewage treatment works are all very minor. There is no significant impact on the river of effluent discharge and the water quality of the River Coln is generally of a very high standard.

RIVER MANAGEMENT

Mills and water meadows used to be present along much of the River Coln, indicating a high level of management over the last couple of hundred years. The mills and water meadows are no longer in use and the present river flow regime is largely natural. The main remaining effect of this period occurs where the mill leat and the natural watercourse are both still flowing and there is consequently a loss of flow to the natural river channel.

Contemporary river management practices consist of weed cutting and occasional dredging and are generally carried out in a sympathetic manner with no detriment to the river.

LAND MANAGEMENT

Farming policies have changed a number of times over the last 100 years or so with both arable and stock farming being dominant at different times. Since the last war both the uplands and valley slopes have been developed for arable crops. Nitrate concentrations have increased in both surface and groundwaters but remain well within the designated limits. In general, land management is not considered to have had a significant impact upon the river. Bank trampling by livestock has been observed to introduce significant silt loads to the river.

SUMMARY

The river is most dramatically affected by severe one year droughts, which can lead to the central reach drying completely. This appears to be a natural feature. The recent drought has reduced river flows significantly and increased the build up of silt. These factors have resulted in large scale losses of submerged weed, which has had a detrimental effect on river ecology and further reduced river levels by up to a half.

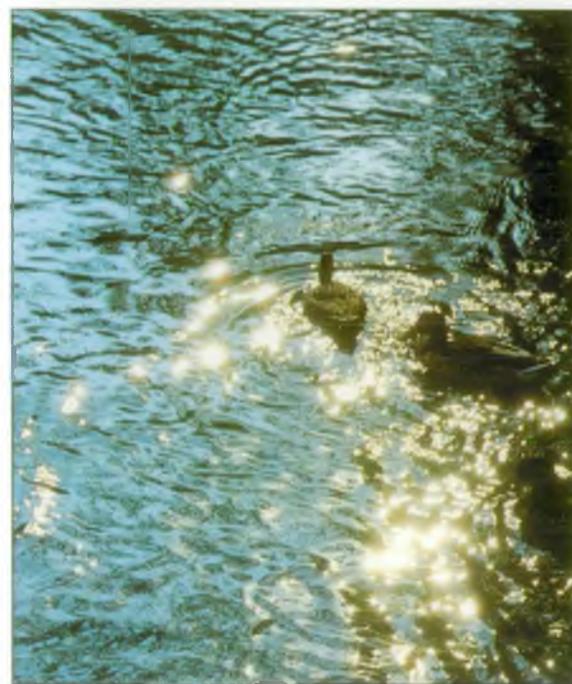
The changes in river character reported by the general public are supported by the available data but are identified as being largely natural, although groundwater abstraction does have a minor contributory effect to river flow reduction.

THE NATIONAL RIVERS AUTHORITY

Established on 1 September 1989, the NRA is an independent public body charged with safeguarding and improving the natural water environment. It is responsible for flood defence, regulating the quality of rivers and groundwaters, managing water resources by balancing the needs of various water users, protecting and improving fish stocks and promoting water based recreation of all kinds. The NRA is committed to improving wildlife habitats and conserving the natural environment in all its undertakes.



*Coln St Aldwyn - junction of natural channel and mill stream
- May 1992*



Ducklife is a pleasant feature of the reach through Bibury

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