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Baseline survey of the Sor Brook upstream and downstream of the Bodicote source during a natural low flow period

A Report for Thames Water Utilities Ltd

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Summary

This report describes the results of a rapid baseline survey of an 8km length of the Sor Brook, between Wykham Mill and its confluence with the River Cherwell.

The aim of the study was to gather baseline data needed for the planning of a detailed programme of monitoring to investigate the effects of low flows on the river.

Physical features of the river

The Sor Brook is a small lowland river with a catchment area of approximately 106 km^2. Within the study area, the river is highly regulated with weirs every 0.5-1km. Approximately 85% of the river is ponded-up and overdeepened. Well-developed riffle-pool and run sequences occupy less than 10% of the channel length.

Water quality

Water quality in the Sor Brook is GQA Class B (good quality). Records indicate that, historically, total oxidised nitrogen (TON) concentrations have been rising in the Brook since the late 1970s (7.5mg/l in 1979 to 11 mg/l in 1995). Low flows in 1995 appeared to have no effect on TON concentrations.

Phosphate levels have fallen in the Brook since 1990. Low flows appeared to have no effect on phosphate concentrations in 1995. There is, however, evidence of nutrient enrichment in many parts of the Brook and low flows may have exacerbated these effects (for example, by promoting extensive growths of filamentous algae).

In a 24hr survey of dissolved oxygen concentrations undertaken at the end of August 1995, dissolved oxygen (DO) levels were lower downstream of Bodicote than upstream, and the river had occasional episodes of low DO concentrations (50%-60% saturation).

BMWP EQIs and ASPT EQIs were higher in September 1995 than at any other time in the previous 5 years. At least in the short term, low flows did not appear to be reducing invertebrate diversity or affecting the occurrence of taxa sensitive to organic pollution.

Ecological quality

The wetland plant community in the Sor Brook was of moderate conservation value. No nationally uncommon plant species were recorded but nine local species were found. The present data suggests that low flows are not likely to have a *highly* adverse affect on the plant community. However, changes in the diversity of the aquatic plant community, as a result of increased eutrophication, are possible.

The invertebrate community was less species-rich than other similar rivers in Oxfordshire with a community of low to moderate conservation value. Six nationally notable invertebrate species were recorded (with a maximum of 2 per reach). Four of these are species which also occur in ponds; only one species (White-legged damselfly) is exclusively riverine and therefore more likely to be affected by low flow conditions. It seems unlikely that the conservation value of the invertebrate community will be *severely* affected by low flows.

A fisheries survey was not undertaken because the warm weather increased the risk of stress to fish to unacceptable limits. However, the Sor Brook upstream of Wykham is regarded as "a good trout stream" and, in the current study, a single brown trout was observed upstream of Bodicote at Upper Mill, during the course of other work. The

NRA plan to complete a fisheries survey of relevant lengths of the Brook in autumn 1995.

Evidence from water quality monitoring at Adderbury indicates that during the lowest flow period of summer 1995, dissolved oxygen (DO) concentrations and water temperatures reached critical stress levels for brown trout. Thus, if trout *are* present, there is evidence that low flows could have a detrimental effect on the population. It was not possible, however, to assess whether, in 1995, these adverse DO and temperature conditions were localised or widespread throughout the length of the Brook.

Constraints on a future monitoring programme

There are two main difficulties which currently constrain the design of a monitoring programme to assess the impacts of low flows on the Sor Brook.

(i) During the 1995 low flow period it was only possible to monitor the Brook during and after the drought. There is, therefore, *no pre-drought baseline* with which to compare drought impacts.

(ii) Pumping at Bodicote was halted in August 1995. Thus, during the period of *lowest* flows, the Sor Brook probably experienced similar low flow impacts both up *and* downstream of the abstraction point. This prohibits the use of an upstream control against which a low flow could be compared downstream of Bodicote.

Because of these constraints *it is not possible to use the 1995 low flow event to adequately model the effects of greater abstraction from the river.*

Pre-impact survey data *could*, however, be collected during 1995/1996 in order to provide a baseline for a future low flow event.

Future steps

The presence or absence of brown trout in the Sor Brook may be critical to the success of a TWUL application for changes in the Bodicote pumping station abstraction limit. It is therefore suggested that further monitoring is not undertaken until the results of the NRA fisheries survey are available this autumn.

A recommended design for a controlled study of the impacts of low flows on the Sor Brook, based on the results of this survey, is given.

Contents

1. Background

1.1 Introduction

In late summer 1995 potential water shortages in the Banbury area led Thames Water to consider the need to apply for a change in the existing abstraction licence for the Sor Brook at Bodicote, near Banbury (Oxfordshire). At present, Thames Water is only licenced to abstract at flows above the existing "lower flow constraint" of 14Ml/d (equal to NRAs estimate of 5th percentile flow).

Conditions during summer 1995, with exceptionally low rainfall and naturally low flows in the Sor Brook, provided the opportunity to investigate the effects of low flows on the ecology of the river. It was intended that this investigation would enable Thames Water to assess the impact of a natural low flow event on the river and use this information, if appropriate, as the basis of a case to the NRA for the sustainability of a lower flow constraint in the future.

Thames Water specified that the study should consider the effects of a natural low flow event on:

- river geomorphology
- river flow characteristics
- water quality
- aquatic vegetation
- aquatic invertebrates
- fish populations.

The National Rivers Authority also requested that the study should include River Habitat Survey to NRA methodology.

1.2 Design of the ecological study to investigate the effects of low flows

In advice given to Thames Water, Pond Action recommended that the low flow study should be developed in two stages:

(i) a rapid baseline study to provide information necessary to plan a detailed ecological study

(ii) a detailed programme of survey work over at least 12 months, to begin in autumn 1995.

The rapid baseline survey was necessary because existing information (particularly that held by NRA) was not adequate to assess which lengths of the Sor Brook should be monitored and which key indicators/target species should be used for assessing the impact of low flows.

This report describes the results of the rapid baseline survey.

1.3 The rapid baseline study

1.3.1 Objectives

The objectives of the rapid baseline study were to:

- provide information needed to design the detailed monitoring programme and recommend locations for monitoring sites.
- identify key species and environmental factors which could be used to assess the impacts of low flows.

1.3.2 The approach taken for the baseline study

The baseline study had two main components:

- collecting and interpreting existing data (mainly information held by the NRA - there is little other relevant data available about the Sor Brook).
- field surveys to obtain data needed for the design of a detailed ecological study.

Baseline information was collected for the river from 2km upstream of the abstraction point at Bodicote to the confluence with the Cherwell. For the baseline study, the river was divided into 16 length of 0.5 - 1km (see Figure 1).

Survey work was undertaken between 23 August and 18 September 1995.

A description of the methods used in the survey is given under the relevant subject headings.

Figure 1. Survey and monitoring stations on the Sor Brook.

KEY

- River Habitat Survey reach
- NRA monitoring site (water chemistry at both sites; aquatic invertebrates only downstream of Adderbury)
- Dissolved oxygen 25 hour diurnal variation study: riffle sites
- Dissolved oxygen 24 hour diurnal variation study: pool sites
- BS — Bodicote source works (Thames Water)
- GS — Bodicote gauging station (NRA TR)
- 10 — Reach numbers for vegetation and aquatic invertebrate survey

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2. River morphology

A review of existing information and a fluvial audit were undertaken in order to provide baseline information about the morphology of the Sor Brook.

2.1 Review of existing NRA data

There is little existing NRA information on the morphology of the Sor Brook. A limited amount of data is held for a survey of a 500m reach of the river in Adderbury, but this was not relevant to the present study.

2.2 Methods

2.2.1 Fluvial audit of the lower reaches of the Sor Brook

A fluvial audit of the Sor Brook was undertaken, with a detailed field survey of the lower reaches between Wykham Mill (ca. 2km upstream of the Bodicote abstraction point) and the Cherwell confluence.

The fluvial audit broadly followed the methods used by the NRA. However, there was insufficient time available within the study to undertake the detailed review of historical data (e.g. old maps and old aerial photographs) normally recommended by the NRA.

The main objective of the fluvial audit was to characterise the morphology of the river (is it a depositional or erosional river, highly modified or little modified, for example) and summarise the main factors influencing channel morphology (such as overdeepening or inputs of sediments from urban areas). Fluvial auditing provides the basis for management decisions about river morphology.

The fluvial audit was based on desk study of existing geological and topographical maps and a field survey of the main morphological features of the channel.

2.2.2 River Habitat Survey

A standard River Habitat Survey (RHS), using NRA methodology, was undertaken in alternate reaches of the river. Figure 1 shows the location of RHS survey sites. Data from the RHS is presented in Appendix 4.

2.3 Results

2.3.1 Catchment characteristics

The Sor Brook is a small lowland stream, with a catchment of approximately 106km^2. The stream drains the north-western edge of the Cotswolds, before flowing south-east across a Lias clay vale to join the River Cherwell 2km south of King's Sutton.

2.3.2 Geology and topography

The catchment of the Sor Brook is dominated by Lias clays and mudstones with rarer limestone horizons. Catchment altititude averages 100-200m ASL.

The headwaters of the Sor Brook rise, partly as springs, below the base of the Jussassic limestones of the Cotswold escarpment. In its upper reaches, the Brook runs across Lower Lias clays, but it predominantly drains Middle Lias mudstones and siltstones in the surrounding catchment. In its middle reaches, between Shutford and Adderbury, the Brook runs directly over Middle Lias strata and drains both Middle and Upper Lias siltstones in the surrounds. Below Adderbury, the Brook and its immediate catchment area revert to Lower Lias stata, dominated by clay but with occasional indurated limestone horizons which locally outcrop in the stream bed.

2.3.3 Land Use

Land use in the catchment is dominated by agriculture, with little urban development. Within the study area, land immediately adjacent to the Sor Brook is dominated by permanent pasture, with grazing by cattle, sheep and horses. A small proportion of the stream (less than 5%) borders arable land, and through the village of Adderbury the stream runs past gardens and public paths. In its lowest reaches the Brook passes through a large golf course.

Most of the channel is unshaded, but isolated willow and alder are common. Occasionally one or both banks are tree-lined for lengths of 200 meters or so, most notably in the Adderbury area.

2.3.4 Hydrology

The headwaters of the Sor Brook rise, often as springs, below the base of the Cotswold escarpment near Edgehill in Warwickshire. A modest baseflow is sustained by small springs which arise from the Upper, Middle and Lower Lias strata along the length of the Sor. However the catchment is predominantly underlain by clays and mudstones and the main watersource for the Brook is surface runoff draining these relatively impermeable strata. The rapid catchment responce to both high rainfall and drought, gives the Brook a typically 'flashy' character.

The licensed abstraction point at Bodicote is one of four in the Cherwell catchment at which more than 1Ml/d may be abstracted.

Three small sewage treatment works discharge into the Sor Brook.

Hydrological data is discussed in more detail in Section 3 below.

2.3.5 Stream morphology and flow

The Sor Brook is a highly regulated stream with water flow controlled by a series of mills and weirs. These impoundments are closely spaced occurring, on average, every 0.5km to 1km. The series of mills and weirs gives the stream a characteristic pattern

of water flow, depth and bed-form. Immediately above each structure the stream is deep and ponded with water typically 1m to 2m deep. Water depth gradually reduces upstream of the impoundments, so that towards the base of the next mill or weir the stream often retains a short stretch with riffle-pool or shallow gravel run development.

Although water levels are principally controlled by impoundments, high levels are also maintained by the presence of extensive emergent and submerged macrophyte beds which fill the channel in many reaches.

At three mills on the Sor Brook, an artificial mill leat carries the main water flow. The lowest leat runs through Adderbury, with an active side-channel (along the original stream course) taking the overflow. The others, at Bodicote Mill and Upper Grove Mill, both lie above the Thames Water intake at Bodicote. At Bodicote Mill the side channel is thickly vegetated and only semi-permanent, with parts almost dry at the time of the survey. At Upper Grove Mill, 0.5 km above Bodicote, the side channel is directed along a series of field boundaries which may or may not represent the old course of the stream.

In its lowest reach, a kilometre above its confluence with the R. Cherwell, the Brook is embanked to prevent flooding of adjacent farmland.

Because of the extensive lengths of pooled and deepened channel, most water flow is laminar and particularly, where flow is impeded by exentensive stands of macrophytes, slow flowing. Turbulent water flow predominantly occurs along the relatively restricted lengths of riffles and at weirs.

2.3.6 Channel morphology

For most of its length in the study area the banks of the Sor Brook are composed of consolidated alluvium with a high clay and silt content. The cohesive nature of the bank material enables the maintenance of steep banks and, where unmodified, a sinuous course with little planform instability. Bank heights vary considerably; they are typically lowest (0.3m - 0.5m) above impoundments, but increase in height upstream (1.5m - 2m) to the base of next weir or mill. Lower banks are heavily cattle poached in some sections.

The channel bed material is predomonantly clay, mudstone or siltstone. In the lower reaches of the river below Adderbury, more resistant limestone horizons occasionally outcrop, creating riffles, runs and low natural weirs.

As noted in the previous section, most of the channel (c. 85%) is ponded and over-deepened. Well-developed riffle-pool and shallow run sequences are limited to less than 10% of the stream, and many owe their existence to the presence of man-made features such as bridges, weirs and mills. The most extensive lengths of riffles occur in the lower part of the stream at Nell Bridge Farm (adjacent to the golf course), above the A4260 roadbridge below Adderbury and at Lower Grove Mill below the new NRA monitoring station at Bodicote. Gravel riffles at this latter site were, in part, established when the gauging station was constructed as a channel enhancement. Above the Thames Water intake at Bodicote very few riffle sequences are present, with only three short lengths evident, each less than 200m in length. These are (i) below Bodicote Mill House (ii) at Upper Grove Mill and (iii) below the footings of the Banbury Road bridge near Wykham Mill at the top of the study area.

The most widespread in-channel feature are consolidated side-channel sediment bars (berms) which extend along most of the ponded lengths. They typically fill 15%-40% of the channel, but in some parts of the stream, particularly the middle sections between weirs where water depths are moderate (0.5m-1m), there may be very extensive development of both marginal and mid channel bars, filling 50%-90% of

the channel. Most marginal and mid-channel bars are consolidated and well vegetated by tall emergents, particularly *Sparganium erectum.*

2.3.7 Sediment type and transport

The dominant sediment load of the Sor Brook is clay and silt. At the time of the survey, a silt layer covered the bed in most areas, but the depth of sediment varied considerably. It was often 1m+ deep in the ponded reaches above weirs, but typically 0.1m to 0.5m deep in middle sections, thinning upstream as the water shallowed towards the next weir. Grain size also increased upstream towards the base of weirs. The bed sediments associated with riffles were typically coarse gravel rock clasts, but locally there were sands composed of both rock and clay clasts. Large cobbles and blocks were associated with the footings of bridges and weirs, and around the urban areas of Adderbury.

At the time of the survey, very fine silt also covered, or formed part of, the coarser bed sediments in all but the shallowest and fastest flowing riffles and runs. The field evidence of extensive berms, silted riffles and the lack of actively eroding banks indicates that the contemporary stream is essentially depositional rather than erosional (*sensu* Brookes).

2.3.8 Evidence of the effect of low flows on channel geomorphology

The geomorphological survey was undertaken on 23 and 25 August 1995, at the time of minimum summer water levels. A number of factors suggest that the stream was affected by low flows at this time. These include:

(i) thin layers of very fine unconsolidated silt covering the stream bed throughout the non-riffle areas.

(ii) areas of locally bare, unvegetated mud exposed at the edges of marginal bars and the channel edge, suggesting a recent drop in water level. This was most evident in the lower reaches between Adderbury and the R. Cherwell.

(ii) a number of very shallow gravel runs, with *maximum* water depths less than 0.15m and unvegetated gravel beds exposed above water level. The shallowest sections were two runs, both downstream of Bodicote, at Nell Bridge Farm and Lower Grove Mill. Almost all the aquatic macrophytes associated with gravel riffles remained submerged however.

Nutrient enrichment was also evident in many reaches. In particular:

(i) *Cladophora* was present in all reaches, and was particularly common below the A4260 roadbridge at Adderbury, where it locally covered up to 30% of the stream surface.

(ii) In the upper part of the Brook, above Bodicote, many actively growing submerged macrophyte beds were covered in extensive growths of epiphytic algae.

Nutrient pollution may also have been responsible for:

(i) Reaches with anomalously reduced submerged macrophyte diversity, in the upper part of the study area, especially downstream of Wykham Mill.

iv) Chlorosis of marginal herbs growing in shallow water, which was particularly apparent below the A4260 roadbridge at Adderbury.

Appendix 3 gives details of the geomorphological features of the river.

3. Hydrology

3.1 River flow data

3.1.1 Data available

Flow and water level data for the Sor Brook is available from 1962 up to October 1995. However, most of this record is from the former Adderbury gauging station (SP474346) covering the years 1962-1988, with detailed data apparently available only from 1966).

Water level data is available from the Bodicote gauging station (SP464368) from 1993, but continuous recording of discharge did not start until May 1995.

The following data is available from Bodicote:

1993: September-December	(Stage)
1994: January-October	(Stage)
1995: May-October	(Stage & Discharge)

Occasional measurements were also made in 1992 at Horley (SP422434), North Newington (SP424393) and Adderbury (right & left channels).

3.2 Results

3.2.1 Bodicote flow data

Summer 1995 water levels at Bodicote were approximately 50% below those of 1994 (see Figure 2), the only year for which there is directly comparable data (see Table 1 and Figure 2).

3.2.2 Abstraction on the Sor Brook

TWUL is currently obtaining information on the detailed pattern of abstraction on the Sor Brook. However, abstraction is thought to have started shortly after gauging began at Adderbury (in 1962) and continued until the mid-1980s.

No abstraction occurred then until 1995 when the new source works came into operation. Abstraction was scheduled to start in April but probably did not begin until late July. Abstraction continued for a short time during August until the river reached the flow constraint.

3.2.3 The pattern of discharge at Bodicote during summer 1995

The mean daily discharge at Bodicote for the period May-September 1995 is shown in Figure 3.

Flows fell below 14 Ml/d on 9 August and remained below this level until 7 September. Although flows rose following storms in early and mid September, by the end of the month flows had dropped again below 14Ml/d.

Table 1. **Monthly maximum and minimum water levels (stage) at Bodicote gauging station**

Year	Minimum water level (Stage, Metres)	Maximum water level (Stage, Metres)
1993	0.181 (September)	0.585 (October)
1994	0.136 (October)	0.683 (January)
1995	0.055 (August)	0.151 (May)

Figure 2. **Water levels at Bodicote gauging station: 1993-1995.**

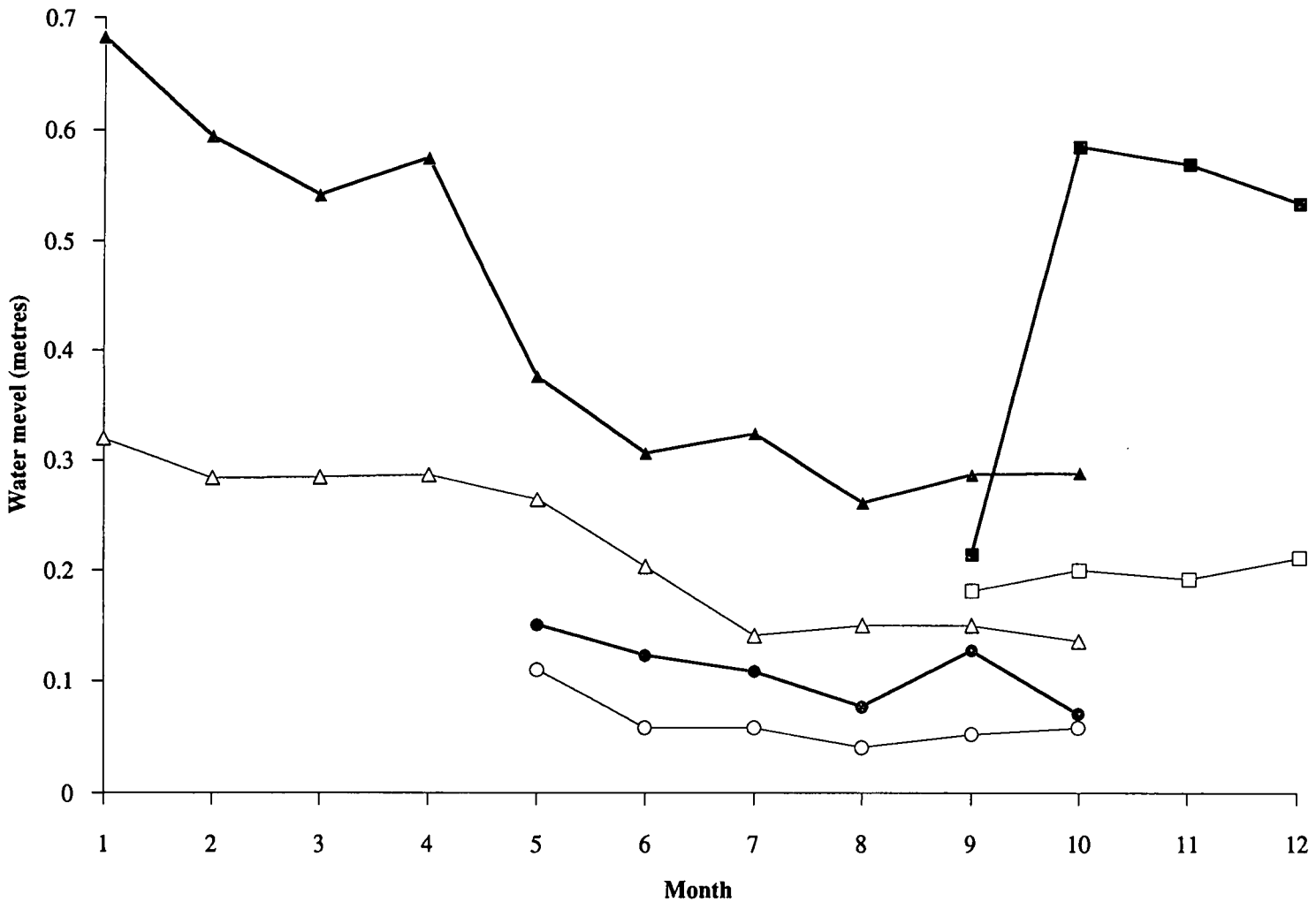
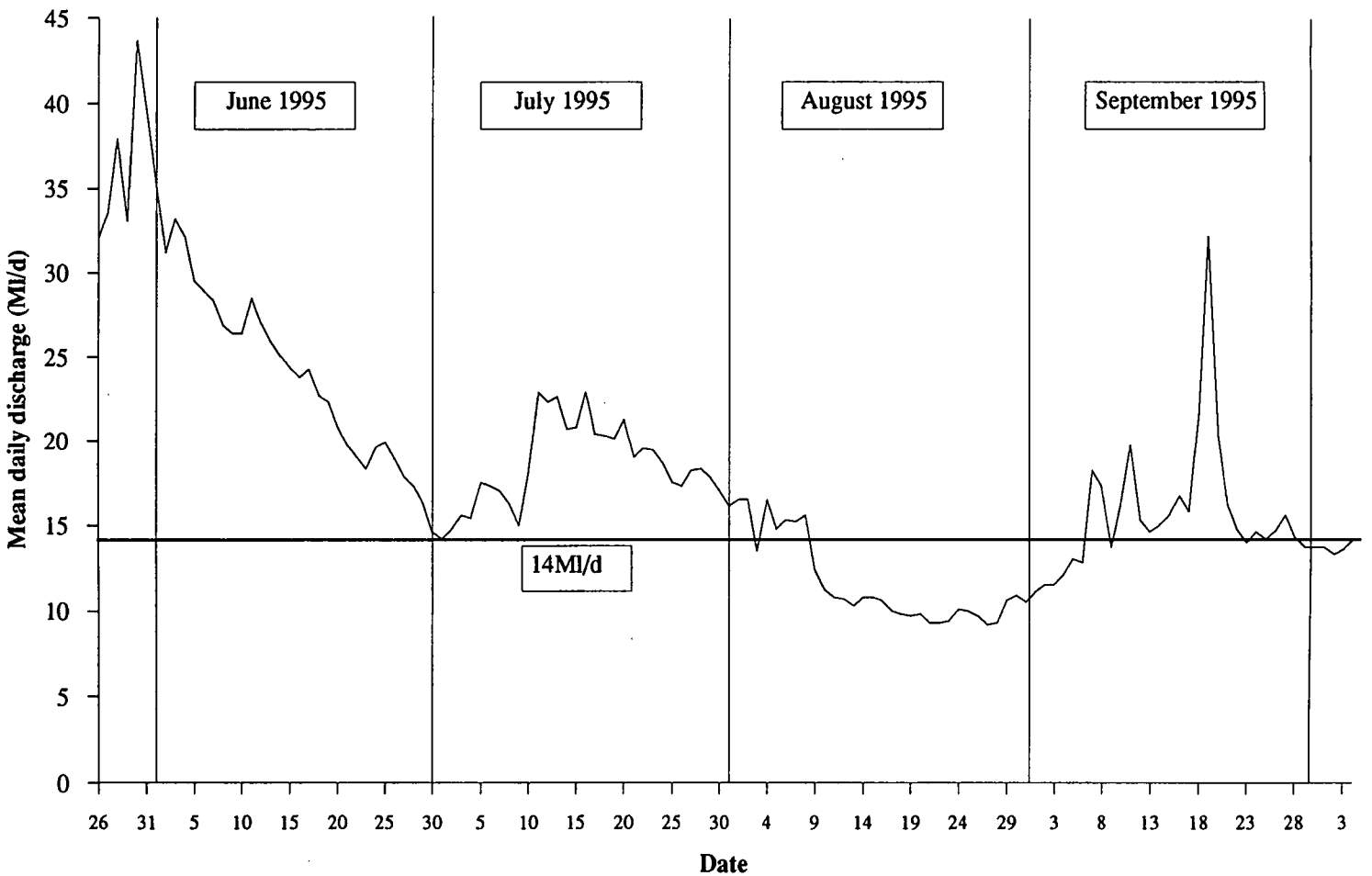


Figure 3. Mean daily discharge in the Sor Brook, May 1995 - September 1995



4. Water quality

4.1 Methods

4.1.1 NRA data available

Chemical water quality

NRA chemical water quality data is available for two sites on the Sor Brook: Bodicote (SP459372) from 1979-1983 and 1989-1995 and the former Adderbury gauging station (SP474346) from 1986-1995. A full list of determinands measured is given in Appendix 3.

As the NRA record of water quality sampling provided a good baseline no additional chemical sampling was undertaken in this study.

Biological water quality

NRA invertebrate survey data for the assessment of bioligcal water quality has been reviewed.

NRA has one biological monitoring station on the Sor Brook, also at the former Adderbury gauging station. Data is available from March 1990 and consists of records of macroinvertebrate families used to calculate Biological Monitoring Working Party (BMWP) scores. The data is analysed in conjunction with the Institute of Freshwater Ecology RIVPACS computer programme.

Family level invertebrate data is used to calculate BMWP and Average Scores per Taxon (ASPTs). These values are then compared with predicted BMWP and ASPT values derived from the RIVPACS computer programme. RIVPACS predicts the invertebrate fauna and the scores which would be expected in relatively unpolluted rivers. RIVPACS uses simple physical data (such as river width and water depth), which should not be affected by water pollution, as the basis for these predictions.

NRA is currently developing a system for describing the relationship between observed and predicted values, called Ecological Quality Indices (EQIs). EQIs are the ratio of the observed BMWP or ASPT score divided by the predicted score. In a river relatively unaffected by pollution, EQIs will be close to 1.00. Table 4 shows the bands of EQIs currently being used by NRA to summarise the results of biological monitoring. This system is currently under development and the bands may change in the near future.

4.1.2 Diurnal fluctuations in dissolved oxygen concentrations

Under some conditions diurnal flucuations in dissolved oxygen concentrations can be sufficiently severe to stress or injure fish. Short term oxygen concentrations probably also affect invertebrates, but far less is known about this phenomenon. An important potential impact of low flows is, therefore, reduced nightime dissolved oxygen concentrations. This problem is likely to be especially important for brown trout for which the minimum tolerable dissolved oxygen concentration is 5mg/l[1].

NRA does not routinely undertake intensive studies of dissolved oxygen concentrations. For this study a 24 hour study of dissolved oxygen concentrations was

[1]Moss, B. (1988). *Ecology of freshwaters. Man and medium.* Blackwell Scientific Publications, Oxford.

made at four locations along the Sor Brook, two upstream of Bodicote source and two below (see Figure 1).

Measurements were made with a Clandon YSI 54A dissolved oxygen meter.

4.2 Results

4.2.1 Chemical water quality at Bodicote

Water quality in the Sor Brook at Bodicote is within Grade B of the NRA General Quality Assessment scheme and class RE2 of the River Ecosystem Classification (see Appendix 3). This indicates that the river is of "very good quality, suitable for all fish species".

Annual averages for the main determinands measured at Adderbury and Bodicote are given in Table 2. The results indicate that the Sor Brook is fairly typical of many small rural rivers in lowland Britain. Annual averages for most determinands are very similar to those in the River Cole, on the Wiltshire/Oxfordshire border, which is being used by the River Restoration Project as a typical example of lowland rivers in central southern England.

Dissolved oxygen and BOD

Dissolved oxygen levels in the Sor Brook at the two NRA monitoring sites are generally fairly high, with averages just below 100% saturation (see Figure 4). However, there are occasional periods with low dissolved oxygen concentrations.

For example, on 3 August 1995 the NRA measured dissolved oxygen saturation at Adderbury as 61%, with only 5.5mg/l of oxygen. This is close to the level which is unsuitable for brown trout. The water temperature on this date (19.8C) was also close to the lethal limit for brown trout.

Total oxidised nitrogen (nitrate and nitrite)

Total oxidised nitrogen (TON), which is mostly nitrate, shows a typical pattern of seasonal variation with concentrations highest in winter (probably due to leaching from the land) and lower during the summer (see Figure 5).

From the available evidence there is no indication that the low flows of 1995 produced any unsual features in TON concentrations. However, values in 1995 are higher than the average over the previous 5 years, but this is almost certainly because TON values have been increasing generally in the Sor Brook (see Figure 6).

Phosphate (measured as orthophosphate P)

Orthophosphate P concentrations are high in summer and low in winter. This pattern is also typical of rivers like the Sor Brook and concentrations in 1995 do not appear to be particularly affected by the low flows.

Orthophosphate P values are, however, lower in 1995 than the 1990-1994 average, reflecting a general trend for phosphate to decrease during this period (see Figure 6).

Table 2. **Comparison of water quality in the Sor Brook with the River Cole EU LIFE demonstration site at Coleshill, Oxfordshire.**

Determinand	Sor Brook at Adderbury 1979-1983, 1989-1995		Sor Brook at Bodicote 1979-1983, 1989-1995		River Cole at Coleshill (Oxon) 1990-1993	
	Average	Range	Average	Range	Average	Range
pH	7.9	7.2 - 8.5	8.0	7.1 - 8.6	7.9	7.4 - 8.4
Suspended solids (mg/l)	17.9	8.5 - 27.2	23.0	0.8 - 226	15.4	2.5 - 72.4
BOD (mg/l)	0.9	0.8 - 5.4	1.3	0.5 - 10.7	1.5	1.0 - 5.1
DO (%)	91.2	45 - 136	92.0	11.7 - 137.0	92.1	69 - 118
Unionised ammonia (mg/l)	<0.001	0 - 0.018	0	0 - 0.023	-	-
Total oxidised nitrogen (mg/l)	9.3	5.7 - 14.9	7.95	0.10 - 15.30	6.32	2.10 -17.90
Chloride (mg/l)	33.7	4 - 54	27.8	17.0 - 55.0	43.3	19.0 - 83.0
Alkalinity as CaC03 (mg/l)	184.9	53 - 254	175	<0.01 - 235	186	128 - 242
Copper (mg/l)	2 µg/l	1 - 2 µg/l	0.001	<0.01 - <0.1	0.001	<0.005 - 0.006
Zinc (mg/l)	0 µg/l	<2.0 µg/l	0.017	<0.01 - <0.1	0.009	<0.008 - 0.091

4.2.2 Trends in chemical water quality in the Sor Brook

Trends in five key determinands in the Sor Brook at Bodicote were analysed using NRA data (see Table 3).

There has been little change in dissolved oxygen concentrations or BOD since monitoring began in 1979 (see Figure 4).

Total oxidised nitrogen (TON) concentrations have increased since 1979 from around 7.5mg/l to around 11mg/l. Average annual phosphate concentrations (measured as orthophosphate P) have decreased after a peak in 1990 and are now close to the values measured in the early 1980s (Figure 5). Ammoniacal nitrogen concentrations have remained fairly constant, except for two high years (1982 and 1983) and do not show any long-term trends in the period for which data is available.

4.2.3 Diurnal fluctation in dissolved oxygen concentrations

Figure 7 shows the results of the monitoring of dissolved oxygen concentrations at 4 locations on the Sor Brook over a 24 hour period on 31 August - 1 September 1995.

The river was less saturaterd with oxygen at the two sites downstream of Bodicote (in the centre of Adderbury and at the A4260 road bridge) compared to Wykham Mill and Bodicote Mill.

At all sites oxygen saturations were generally lower at the beginning of the 24 hours surveyed than at the end (Figure 8). This may have been the result of heavy rain on the day when the survey was started, washing sediments and organic matter into the river.

All sites showed some tendency for oxygen saturation to drop in the night (lowest oxygen levels are arounf dawn). However, diurnal changes were not large.

The lowest oxygen saturations were in the mill channel in the centre of Adderbury were the water was only 60% saturated at 7.00am (Figure 8).

Table 3. Annual average concentrations of BOD, dissolved oxygen, ammoniacal nitrogen, total oxidised nitrogen and phosphate for the Sor Brook at Bodicote.

Year	BOD mg/l	DO %	Ammoniacal nitrogen mg/l	Total oxidised nitrogen mg/l	Orthophosphate as P mg/l
79	1.5	89.7	0.05	7.5	0.09
80	1.9	90.9	0.06	7.5	0.07
81	1.8	77.6	0.06	8.1	0.10
82	1.7	95.7	0.14	8.4	0.10
83	3.7	93.3	0.16	8.5	0.09
89	1.0	93.7	0.05	6.5	
90	1.4	99.9	0.06	7.7	0.27
91	2.1	96.4	0.05	7.5	0.20
92	2.0	88.4	0.06	10.5	0.17
93	2.0	90.5	0.05	9.9	0.12
94	1.8	97.9	0.05	10.8	0.13
95	1.8	99.0	0.07	11.2	0.12

Figure 4. **Dissolved oxygen concentrations and BOD values at Bodicote: 1979-1995**

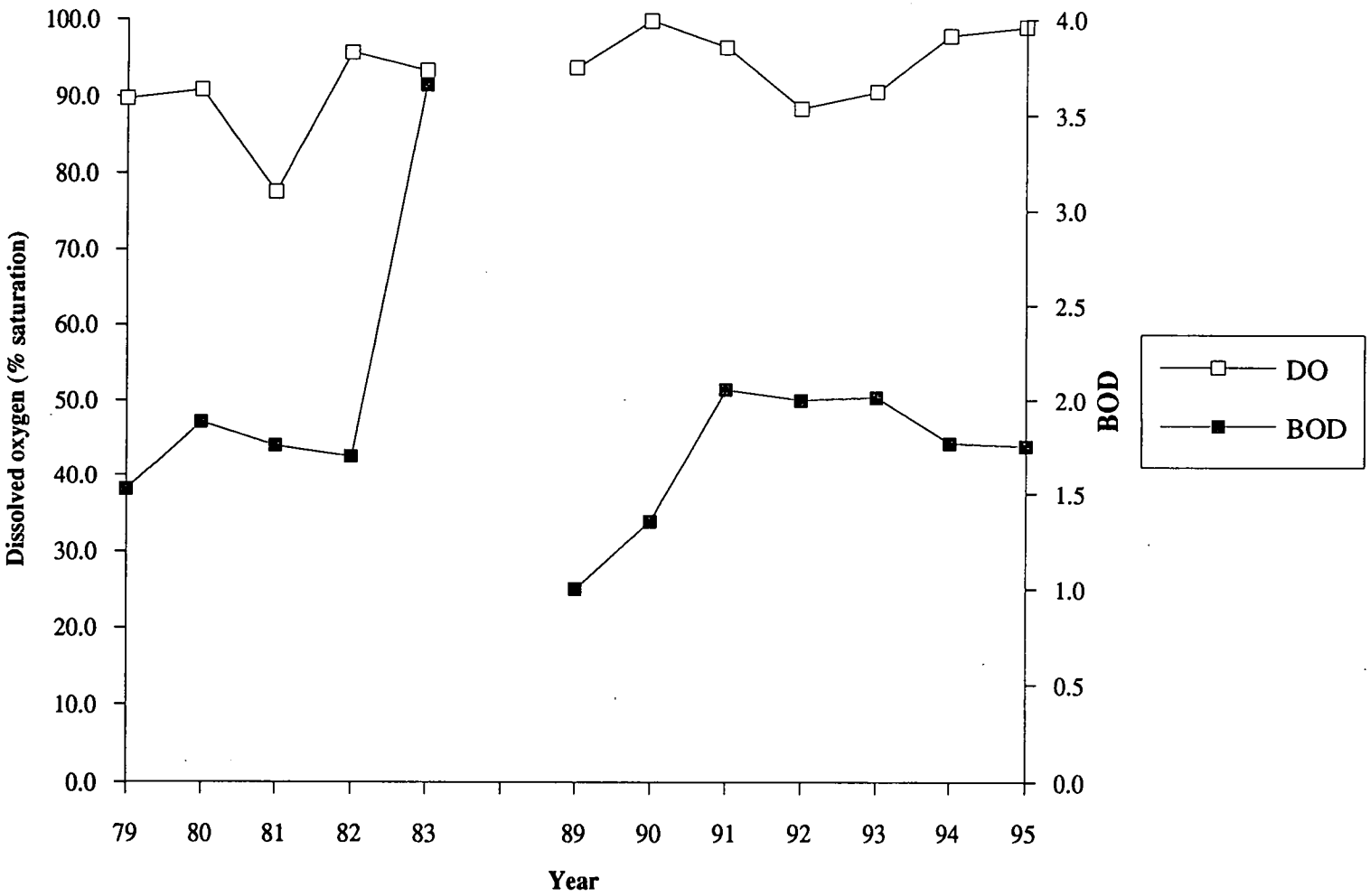


Figure 5. **Total oxidised nitrogen, ammoniacal nitrogen and phosphate concentrations at Bodicote: 1979-1995**

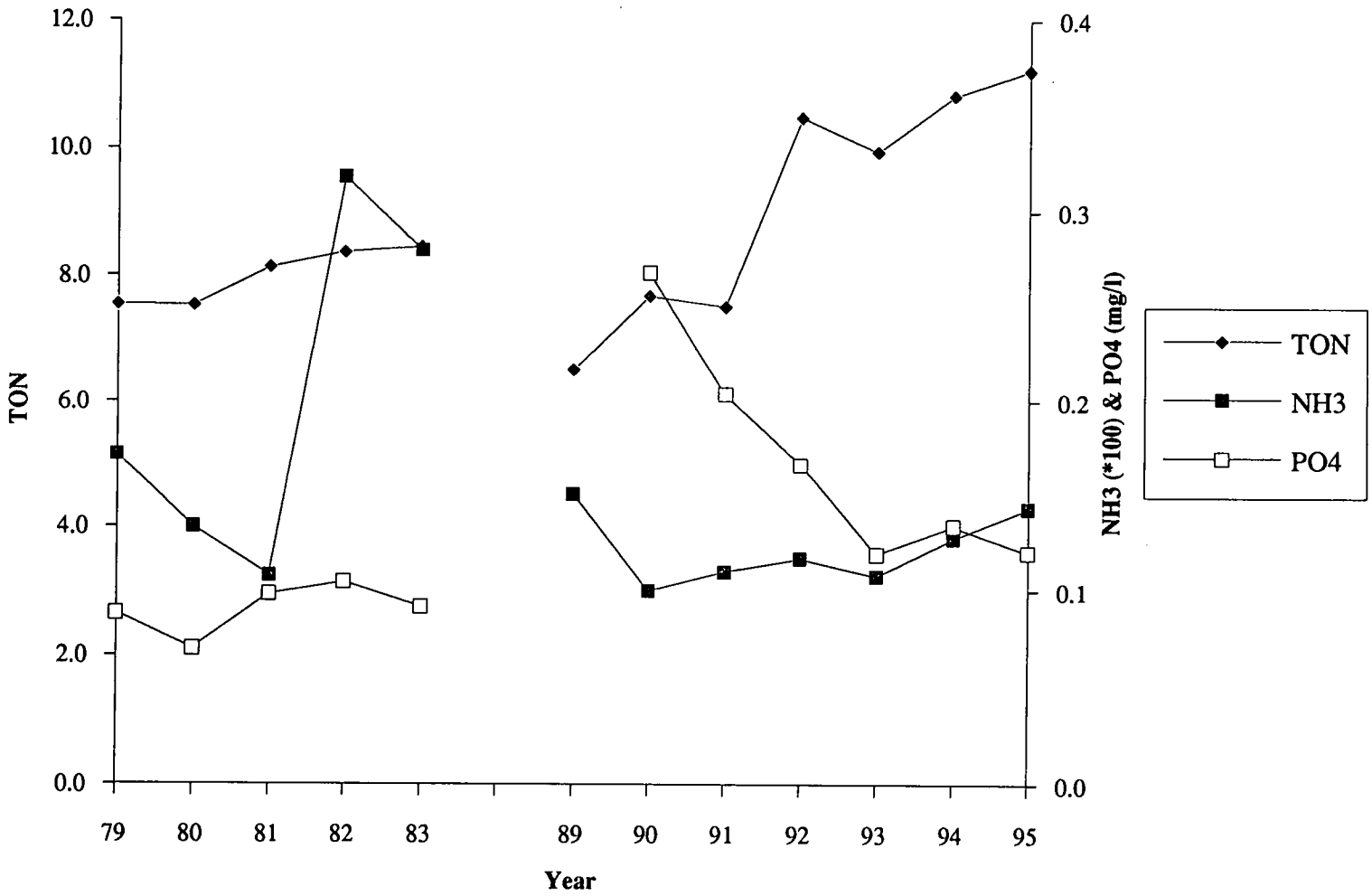
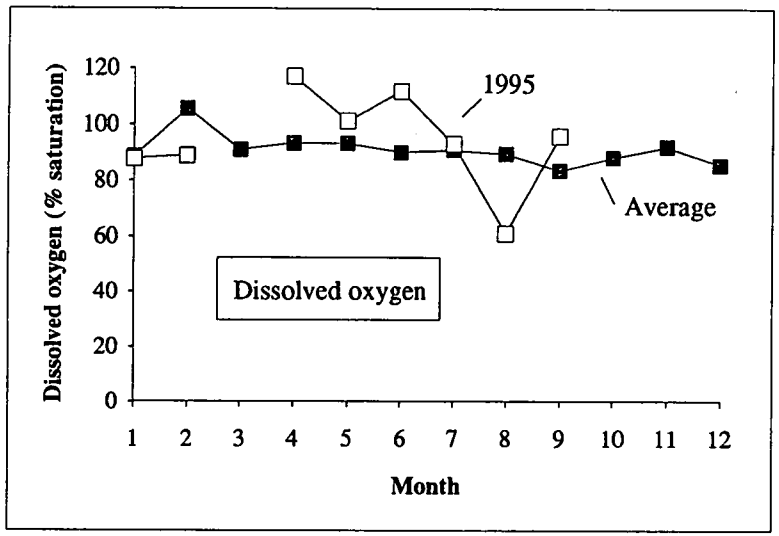
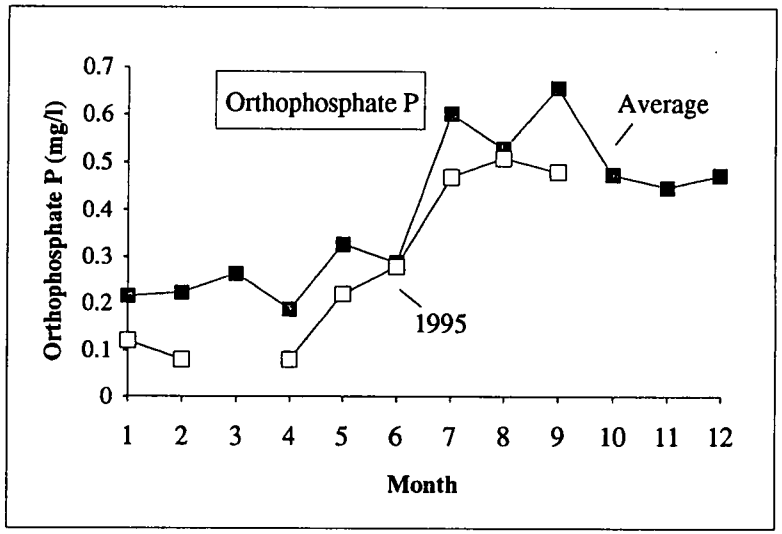


Figure 6. **Seasonal variation in dissolved oxygen, orthophosphate P and total oxidised nitrogen: 1995 concentrations compared to the long-term average**





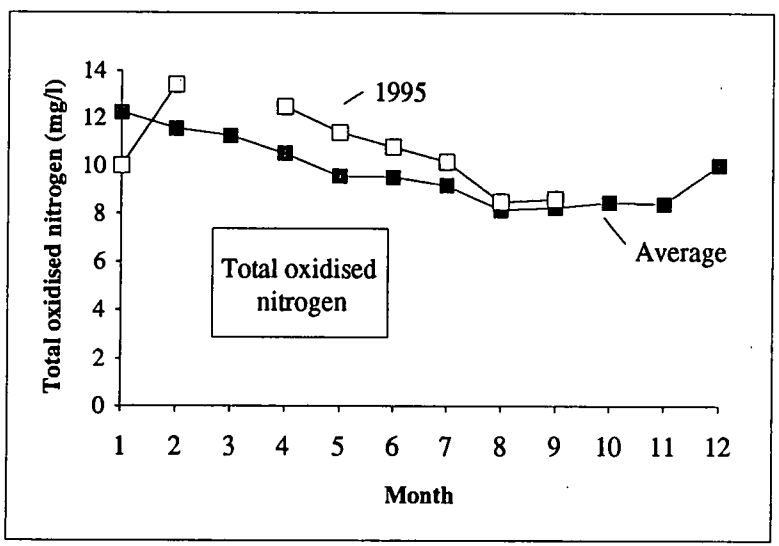


Figure 7. **Average dissolved oxygen saturations over 24 hours at four sites on the Sor Brook (31 August - 1 September 1995)**

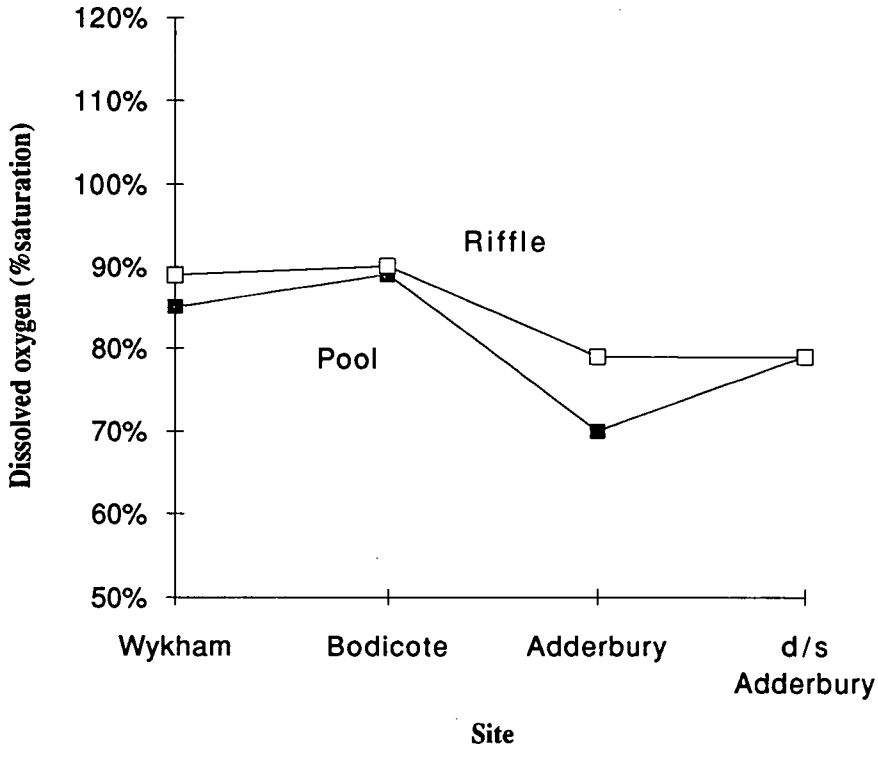
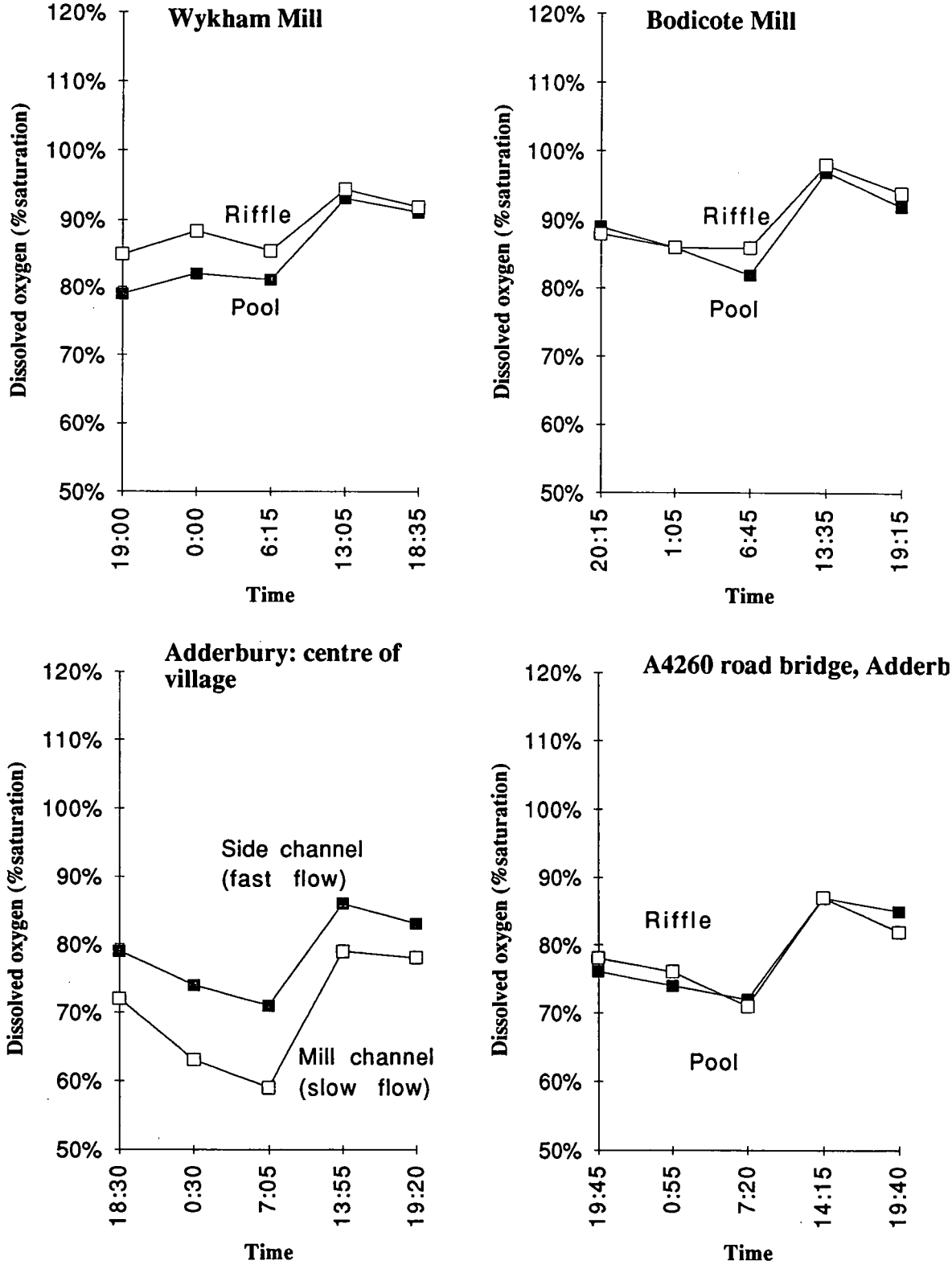


Figure 8. **Diurnal variation in dissolved oxygen saturation at four sites on the Sor Brook**



4.2.4 Biological water quality monitoring of the Sor Brook

Trends in biological water quality over the last five years

NRA biological water quality data is summarised in Figure 9. BMWP EQI and ASPT EQI were both higher in September 1995 than at any other time in the last 5 years. There also appears to have been a general increase in both BMWP EQI and ASPT EQI since 1991.

This trend, although apparently clear, must be treated with some caution, however, because at only one point did the BMWP EQI and ASPT EQI drop from Band A into Band B (Summer 1991) (see EQI bands in Table 4).

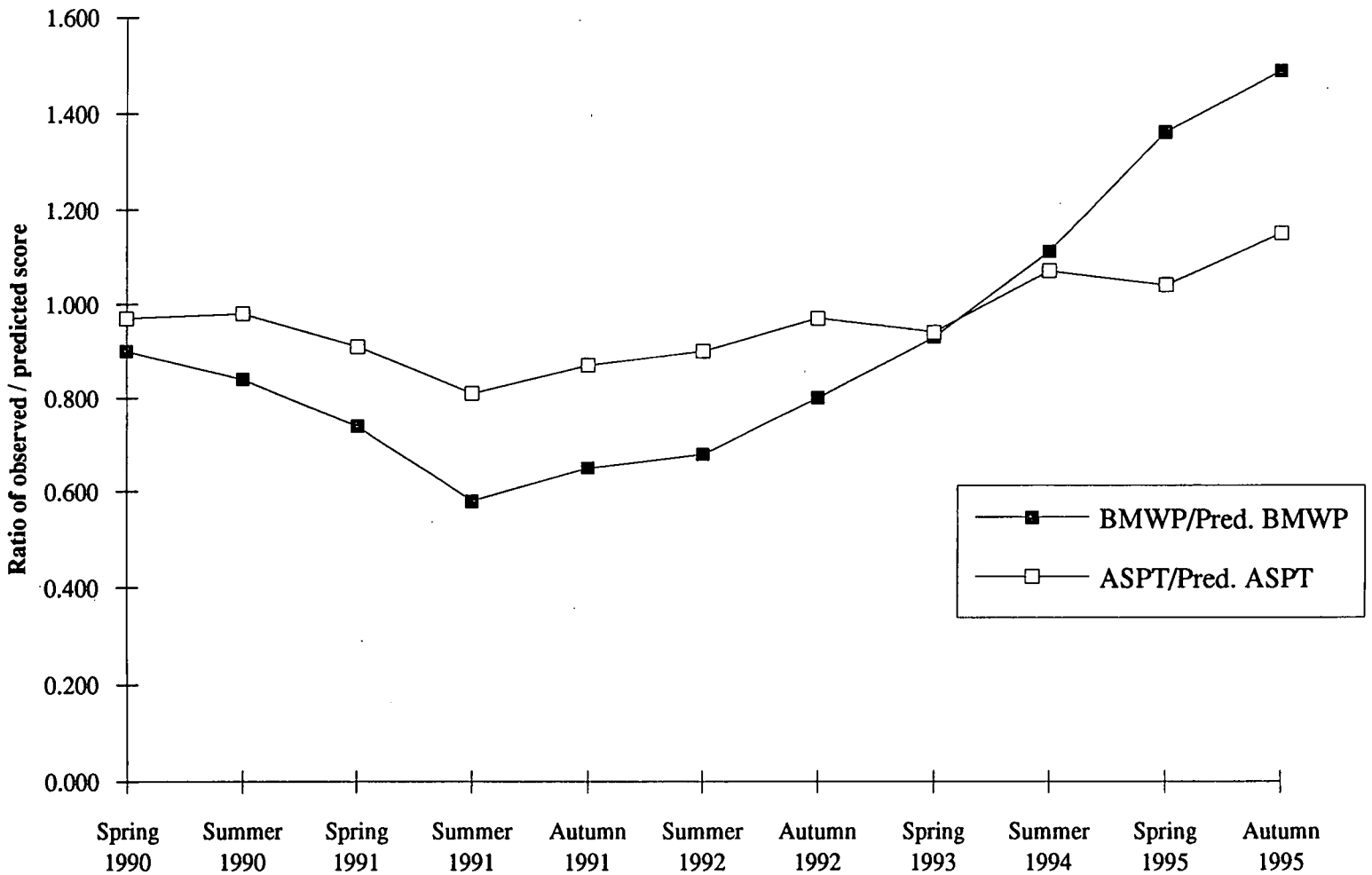
The impact of low flows

The highest BMWP scores and ASPTs recorded by the NRA at Adderbury (and therefore the best water quality, in terms of this method of assessment) coincided with the period of lowest flow. The autumn 1995 sample was, in fact, collected on 5 September 1995, just after the period of lowest flow. Clearly there is no way of knowing whether this is a causal relationship but it does suggest that, at least in the short-term, invertebrate communities at the monitoring site used by the NRA were little affected by the low flow.

Table 4 Band ranges for single season EQIs

Index	Band	Value
ASPT	A	>=0.84
	B	0.68-0.83
	C	0.52-0.67
	D	<0.51
BMWP	A	>=0.62
	B	0.24-0.61
	C	<=0.23
	D	No band

Figure 9. Biological water quality in the Sor Brook: 1990-1995



5. Aquatic vegetation

5.1 Methods

5.1.1 NRA data

NRA river corridor surveys have been undertaken on the Sor Brook. However, TWUL did not require this information to be reviewed.

5.1.2 Work undertaken as part of the baseline study

A full wetland plant list was prepared for each 0.5-1km stretch of river (see Figure 1). The wetland plant list is based on the standard Pond Action wetland plant list. Surveys were undertaken between 23 and 25 August 1995.

5.2 Results

5.2.1 Plant species richness

The number of wetland plant species recorded from individual 0.5-1km lengths ranged from 24 to 40, a moderate to good diversity of species. A full list of the wetland plants recorded is given in Table 5.

The number of specifically *aquatic* macrophytes (ie submerged and floating species) varied between 7 and 13 in each reach. Overall, there seemed to be no consistent trends in aquatic species richness up- or downstream, of the Bodicote source, and no evidence that species richness changed markedly below Bodicote. The most species-poor reach was above Bodicote, near to the top of the study area at Wykham Mill, where aquatic macrophyte diversity declined suddenly with loss of *Myriophyllum spicatum* and *Potamogeton crispus*, and dominance by *Potamogeton pectinatus*. The cause of this decrease in diversity was not clear, but may have been due to nutrient enrichment or biocide application on the adjacent intensively managed grasslands.

5.2.2 Plant abundance

Wetland plant abundance varied. There was typically low abundance above weirs where water was deep or where the channel was locally shaded. In other areas a mixture of emergent and aquatic vegetation usually filled 35% to 100% of the channel. *Sparganium erectum* was the most common species. *Saggititaria sagittifolia*, *Apium nodiflorum* and *Nuphar lutea* were also locally common in the middle reaches between Bodicote and Adderbury. *Ranunculus penicillatus* was particularly abundant in shallows, and on some riffles and runs, but was not recorded above Bodicote. Stands of *Myriophyllum spicatum*, *Potamogeton pectinatus* and, locally, *Potamogeton crispus* were often abundant in deeper water, particularly in the sections between Adderbury and Bodicote and between Upper Grove Mill and Wykham Mill.

No very uncommon species were recorded during the survey (i.e. Nationally Scarce or rarer) but nine local plant species were found. Local species are defined here as plants recorded from less than 600 (i.e. one third) of 10 km grid squares in Britain. Most of these local plants are aquatic species.

When classified using the Species Rarity Score and Index system developed by Pond Action for assessing the conservation value of comunities, most reaches classified as of moderate value (on a four point scale low, moderate, high and very high). One site in the Adderbury area had a low value (see Tables 6 and 7).

Table 5 **Wetland plants recorded in the lower reaches of the Sor Brook**

Species name	Reach number															
Note: Aquatic species are emboldened	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Agrostis stolonifera	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Alisma plantago-aquatica	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Angelica sylvestris	-	-	+	-	+	+	+	-	-	+	+	+	+	+	-	-
Apium nodiflorum	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+
Barbarea vulgaris	+	-	+	-	-	-	+	+	+	-	+	+	-	+	+	+
Butomus umbellatus	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Callitriche sp*	+	-	-	+	-	+	+	+	+	+	+	+	+	-	-	+
Carex paniculata	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Carex riparia	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	-
Cirsium palustris	+	-	+	-	-	+	-	-	-	-	-	-	-	-	+	+
Cyperus longulus (garden plant)	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Deschampsia caespitosa	-	-	-	+	-	-	-	-	-	+	-	+	-	+	-	-
Elodea canadensis	+	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+
Epilobium hirsutum	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Epilobium obscurum	+	-	-	-	-	-	+	+	-	-	-	+	-	+	-	+
Epilobium parviflorum	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	+
Equisetum palustre	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+
Filipendula ulmaria	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Galium palustre	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
Glyceria fluitans	-	-	-	-	+	+	-	-	+	+	+	-	+	+	-	+
Glyceria maxima	+	-	-	+	+	+	+	+	-	-	-	-	-	+	-	-
Hypericum tetrapterum	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+
Iris pseudacorus	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-
Juncus articulatus	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Juncus effusus	-	-	+	-	+	+	-	-	+	+	-	-	+	-	-	-
Juncus inflexus	-	-	-	-	+	+	-	-	+	+	-	-	+	-	-	-
Lemna minor	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lycopus europaeus	+	-	-	-	-	+	+	-	+	+	+	-	+	-	-	+
Lythrum salicaria	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
Mentha aquatica	+	-	-	+	+	+	+	-	+	+	+	+	+	-	-	+
Mimulus guttatus	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Myriophyllum spicatum	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
Myosotis scorpioides	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Myosoton aquaticum	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+
Nasturtium officinale	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+	+
Nuphar lutea	-	-	+	+	+	+	+	+	+	+	-	-	+	+	-	-
Petasites hybridus	-	-	-	-	-	-	-	+	-	-	-	-	+	+	-	-
Phalaris arundinacea	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Phragmites australis	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polygonum amphibium	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-
Potamogeton crispus	+	-	-	-	-	-	-	-	-	-	+	+	+	-	-	+
Potamogeton pectinatus	+	+	+	+	-	+	-	-	-	+	+	+	+	-	+	+
Ranunculus sceleratus	+	-	-	-	-	-	-	-	+	-	-	-	+	+	+	-
Ranunculus penicillatus	-	+	+	+	-	+	+	+	-	-	-	-	-	-	-	-
Rumex hydrolapathum	+	+	+	+	-	-	-	-	-	+	-	-	-	-	-	-
Saggittaria sagittifolia	+	+	+	+	+	+	+	-	-	+	+	+	+	+	-	-
Schoenoplectus lacustris	+	+	+	+	+	-	+	-	+	+	+	+	+	+	+	-
Scrophularia auriculata	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Scutellaria galericulata	+	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Solanum dulcamara	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sparganium erectum	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sparganium emersum	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Stachys palustris	+	+	+	+	+	+	+	+	+	+	+	-	+	-	-	-
Symphytum x uplandicum	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Typha latifolia	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Veronica anagallis-aquatica	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Veronica beccabunga	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Veronica catenata	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Zannichellia palustris	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fontinalis antipyretica	+	+	+	+	-	-	+	+	-	-	+	+	+	+	-	+
Entromorpha sp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Filamentous algae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
TOTAL MARGINAL SPECIES	13	10	11	11	9	12	11	10	9	11	13	11	13	10	7	10
TOTAL AQUATIC SPECIES	27	14	20	21	19	22	24	21	24	22	21	22	23	22	17	21
TOTAL SPECIES	40	24	31	32	28	34	35	31	33	33	34	33	36	32	24	31
REGIONAL SCORE	40	25	32	33	28	35	36	32	33	33	34	33	36	32	24	31
REGIONAL INDEX	1	1.04	1.03	1.03	1	1.03	1.03	1.03	1	1	1	1	1	1	1	1
NATIONAL SCORE	45	28	34	37	28	39	38	34	36	36	38	37	41	33	26	35
NATIONAL INDEX	1.13	1.17	1.1	1.16	1	1.15	1.09	1.1	1.09	1.09	1.12	1.12	1.14	1.03	1.08	1.13

* In the absence of any fruiting plants it was not possible to confidently determine the species of Callitriche present. However, leaf morphology characteristics alone suggests that the dominant was probably *Callitriche obtusangula.*

Table 6. **Species Rarity Index: grouping of sites according to nature conservation value of their wetland plant communities**

Species Rarity Index	Conservation value of the plant community
>1.5	Very high
1.20 - 1.49	High
1.01 - 1.19	Moderate
1.00	Low

Note: In sites with very low numbers of species, the presence of one or two local or, especially, Notable species may have a disproportionate effect on NCI's: for this reason, therefore, one should use caution in the interpretation of the NCI's of such sites (particularly where the number of species recorded is less than 16).

Table 7. **Species Rarity Score (SRS) and Species Rarity Index (SRI) values for wetland plant communities in reaches 1-16 of the Sor Brook**

Length	SRS	SRI	Nature conservation value
1	45	1.13	Moderate
2	28	1.17	Moderate
3	34	1.1	Moderate
4	37	1.16	Moderate
5	28	1	Low
6	39	1.15	Moderate
7	38	1.09	Moderate
8	34	1.1	Moderate
9	36	1.09	Moderate
10	36	1.09	Moderate
11	38	1.12	Moderate
12	37	1.12	Moderate
13	41	1.14	Moderate
14	33	1.03	Moderate
15	26	1.08	Moderate
16	35	1.13	Moderate

6. Aquatic macroinvertebrates

6.1 Methods

6.1.1 NRA data

NRA macroinvertebrate data is reviewed in Section 3.

6.1.2 Work undertaken as part of the baseline study

A 'bankside' survey was undertaken to generate a species list for each 0.5-1km reaches of the river. The survey reaches are shown in Figure 1.

The objective of the survey was to identify reaches with communities or species of ecological/conservation importance.

During bankside surveys each reach was surveyed for a standard length of time noting all macroinvertebrate species found. The objective of the survey was to obtain good species lists, collected with comparable effort from each reach.

Invertebrates were searched for by kick and sweep sampling. Stones, firmly-rooted vegetation, tree roots and similar substrates which could not easily be disturbed with a hand net, were searched to ensure that leeches, limpets and any other firmly-attached animals were collected. Net samples were field sorted in large white trays. Macroinvertebrates were identified in the field or retained for laboratory identification where necessary. Each length was surveyed for 30 minutes by two surveyors giving a total of one hour per reach.

Surveys were carried out on 26 August 1995 (reaches 1 to 8) and 28 August 1995 (reaches 9 to 16).

6.2 Results

6.2.1 Species richness

Numbers of macroinvertebrate species recorded in individual lengths varied between 30 (length 10) and 51 (length 5). This was generally lower than has been recorded in other streams in the Upper Thames during surveys undertaken by Pond Action. For example, the Hinksey Stream in Oxford, surveyed using the same field search methods in 1989, supported between 51 and 76 species in each reach.

A full list of species, showing the lengths in which each was recorded, is given in Appendix 4.

There was no obvious pattern in the invertebrate species richness of reaches up or downstream of the Bodicote source works (see Table 8).

Table 8. Sor Brook: summary of macroinvertebrate species richness and rarity in the Sor Brook

Length	No. of species	Notable species	Local species
1	42	1	0
2	36	2	0
3	45	2	0
4	50	0	0
5	51	0	0
6	48	1	1
7	40	0	0
8	40	0	0
9	37	1	0
11	30	1	0
11	43	1	0
12	39	0	0
13	49	0	1
14	43	2	1
15	34	0	1
16	32	0	0

6.2.2 Species of conservation and ecological importance

Uncommon species

Six Nationally Notable B[1] species was recorded (species occurring in less than 100 10km squares nationally). These were the White-legged Damselfly, *Platycnemis pennipes*, a whirligig beetle *Gyrinus urinator*; and four other water beetles *Cercyon convexiusculus*, *Haliplus laminatus*, *Hydroglyphus pusillus* and *Peltodytes caesus*. In addition, three 'local' species[1] were recorded: the lesser water boatman *Micronecta scholtzi*, the water beetle *Haliplus obliquus*, and the caddis fly *Phryganea grandis* (known as the Great Red Sedge or Murragh). Brief notes on each of these species are given in Table 9.

Of the six Nationally Notable species recorded, four were water beetles which are found in ponds as well as rivers. It seems unlikely that these species will be greatly affected by low flows. The whirligig beetle *Gyrinus urinator* is almost entirely restricted to rivers, and the White-legged Damselfly (*Platycnemis pennipes*) completely so, suggesting that these two species are more likely to be affected by changes in flow regime.

When classified using the Species Rarity Index developed by Pond Action for assessing the conservation value of aquatic comunities, all sites were of either low or moderate value, although two reaches (2 and 14) was on the moderate/high value borderline (see Table 11).

[1] See Appendix 5 for explanation of these terms.

Table 9. Notes on Nationally Notable and local macroinvertebrate species recorded in the Sor Brook (26 and 28 August 1995)

Nationally Notable B species

***Platycnemis pennipes* (ODONATA: Platycnemididae). The White-legged Damselfly. Lengths 1, 2 and 3.**
Nationally Notable B. Locally common where it occurs in southern England and the Midlands, though it is said to be apparently 'susceptible to even slight pollution' (Hammond). It breeds in weedy streams, rivers and seepages bordering streams, the adults having a noticeable preference for sites where there is abundant vegetation. (Ball, 1986; Hammond and Gardner, 1983; d'Aguilar, Dommanget and Préchac, 1986.)

***Cercyon convexiusculus* (COLEOPTERA: Hydrophilidae). A water scavenger beetle. Length 9.**
Nationally Notable B. All of the aquatic *Cercyons* are either rare (Red Data Book 3) or Nationally Notable, but *convexiusculus* is perhaps less uncommon than most. Its distribution is scattered throughout Britain, excluding northern Scotland, but is mainly in Eastern England. (Hyman and Parsons, 1992; Foster, 1987; Friday, 1988.)

***Gyrinus urinator* (COLEOPTERA: Gyrinidae). A whirligig beetle. Lengths 2 and 3.**
Nationally Notable B. A scarce species, almost completely limited to the south - mainly the extreme south coast of England - but there are a few scattered records in North Wales, Cheshire and Yorkshire. The nearest record on the 'official' distribution map appears to be in Hampshire; however, Pond Action have now recorded this species from several locations in Oxfordshire (including the River Cole and Pinkhill Meadow). It may therefore be less scarce in the south of England than had previously been thought; or it may be increasing its range. A species of lowland running water. (Hyman and Parsons, 1992; Foster, 1985; Pond Action, 1995; Friday, 1988.)

***Haliplus laminatus* (COLEOPTERA: Haliplidae). A haliplid water beetle. Lengths 11 and 14.**
Nationally Notable B. A scarce species, apparently now limited to the south-eastern half of England. Before 1950, there were records for the north, central England and Wales, but the post-1950 distribution map shows, as Foster comments, an apparent sharp decline throughout the west of its range. A species of canals, rivers and silt ponds. (Hyman and Parsons, 1992; Foster, 1981; Friday, 1988.)

***Hydroglyphus pusillus* (COLEOPTERA: Dytiscidae). A diving beetle. Length 14.**
Nationally Notable B. Found in the south of England and the Midlands. Its preferred habitat is said to be 'heath pools, mossy ditches, and new, man-made ponds'. However, this species is commoner than is suggested by the published literature, especially in Oxfordshire, and may be increasing. It is often one of the earliest colonisers to arrive in new ponds, and has recently been recorded in a much wider variety of water body types, including rivers, streams and ditches, as well as lakes and ponds. It appears, at present, almost ubiquitous in Oxfordshire. (Foster, 1981; Friday, 1988; Pond Action, 1994 and pers. obs.)

***Peltodytes caesus* (COLEOPTERA: Haliplidae). A haliplid water beetle. Length 6.**
Nationally Notable B. Considered to be a declining fenland species, but 'it is still common where it occurs'. (It is locally common in Oxfordshire.) Its range has drastically receded since 1950, however, to a few locations in the south and east of England. A beetle of fenland drains and quarry ponds. (Hyman and Parsons, 1992; Foster, 1981; Pond Action, 1994 and pers. obs.)

Local species

***Micronecta scholtzi* (HEMIPTERA: Corixidae). A lesser water boatman. Lengths 13 and 14 (immature specimens, probably of this species, were found in other reaches).**
Local. Locally common, but limited in range to the south of England and the Midlands. Found in both rivers and lakes at low altitudes, where it prefers sparse plant cover and a clean gravel or sand substratum. (Savage, 1989; Fitter and Manuel, 1986.).

***Phryganea grandis* (TRICHOPTERA: Phryganeidae). A caddis fly (known as the Great Red Sedge or Murragh). Length 6.**
Local. This species is believed to merit a local status, although it has been recorded from sites scattered throughout Britain. The 'general paucity of records' that exists is thought to be perhaps due to 'its fairly short flying period and a most elusive larva'. A species of weedy ponds, lakes, canals and very slowly flowing rivers. (Wallace, 1991.)

***Haliplus obliquus* (COLEOPTERA: Haliplidae). A haliplid water beetle.**
Local. Widespread but local, ocurring throughout Britain except in the Scottish Highlands. Usually found in permanent base-rich waters, its preferred habitat is said to be ponds or ditches where the aquatic vegetation includes *Chara* sp. (stonewort), with which it appears to be associated (although it is not known whether the preference, if any, is for particular *Chara* species or all charophytes). The Sor Brook, therefore, may seem an unlikely habitat for this species, but it has also been recorded from the River Cole.

Category definitions.
Nationally Notable B = Scarce: recorded in Britain from only 31 - 100 10-km squares of the National Grid.
Local = Species not scarce enough to be categorised as 'Notable', but usually either (a) confined to certain limited geographical areas where they may, however, be present in large numbers; (b) of widespread distribution, but present only in small numbers where they occur; or (c) restricted to a very specialised habitat of which, however, they may be a common component.
Note: References throughout to 'Britain' are to mainland Britain, and do not include Ireland.

6.2.3 The Atlantic Stream Crayfish (*Austropotamobius pallipes*)

The Sor Brook is a potential site for the native Atlantic Stream Crayfish. This species has recently suffered a rapid and widespread decline in Britain as a result of the 'crayfish plague', a fungal disease carried by introduced non-native crayfish, especially the American Signal Crayfish. As a result of this decline, the native crayfish is now given partial protection under the provisons of the Wildlife and Countryside Act.

No crayfish were recorded in the Sor Brook in the course of the study. However, two sources of information indicate that crayfish (almost certainly the native species) were, until recently, found in the river.

1. The farmer at Upper Mill reported that, until 'a few years ago' he regularly trapped large numbers of crayfish in the stream but during recent trapping no crayfish were caught.

2. Until 1992, crayfish were found at Adderbury by NRA staff in the course of routine invertebrate monitoring. Although the NRA biologists did not record which species was present, it seems very likely that these were native crayfish. Since 1992, no crayfish have been recorded.

Taken together, this evidence suggests that crayfish plague has now eliminated the native population of crayfish which previously occurred in the study area.

Table 10. **Species Rarity Index: grouping of sites according to nature conservation value of their macroinvertebrate communities**

Species Rarity Index values	Conservation value of macroinvertebrate community
>1.5	Very high
1.20 - 1.49	High
1.01 - 1.19	Moderate
1.00	Low

Note: In sites with very low numbers of species, the presence of one or two local or, especially, Notable species may have a disproportionate effect on NCI's: for this reason, therefore, one should use caution in the interpretation of the NCI's of such sites (particularly where the number of species recorded is less than 16).

Table 11. **Species Rarity Score (SRS) and Species Rarity Index (SRI) values for invertebrate communities in reaches 1-16 of the Sor Brook**

Length	SRS	SRI	Nature conservation value
1	45	1.07	Moderate
2	42	1.16	Moderate/High
3	51	1.13	Moderate
4	50	1	Low
5	51	1	Low
6	52	1.08	Moderate
7	40	1	Low
8	40	1	Low
9	40	1.08	Moderate
10	30	1	Low
11	46	1.07	Moderate
12	39	1	Low
13	50	1.02	Moderate
14	50	1.16	Moderate/High
15	35	1.03	Moderate
16	32	1	Low
Sor Brook as a whole:	**138**	**1.18**	**Moderate**

7. Fisheries

7.1 NRA data

The NRA is currently (1995 field season) surveying the fish populations of the Sor Brook. At the time of the present survey NRA staff had completed surveys at three sites upstream of Wykham Mill and had postponed further work downstream until the end of the summer to avoid stress to fish.

In informal discussions, NRA staff noted that the Sor Brook was 'a good trout stream' in its upper reaches in the Horley area.

7.2 Observations made during the present study

As the study was being undertaken in a period of low flow and warm weather, it was not possible to undertake fish surveys. However, a specific effort was made to record species of likely interest during the course of other survey work.

The most significant observation was of a single, approximately 1/2lb, brown trout at Upper Mill above Bodicote. At present this is the only information available to indicate that trout occur on the Sor Brook in the area covered by this study.

7.3 EC Fisheries Directive

The NRA has recommended the Sor Brook from Wytham Mill to the Cherwell for designation as a cyprinid water under the EC Fisheries Directive.

8. Overall assessment of the Sor Brook

8.1 Key species and environmental features of the Sor Brook

A summary of the key features of the Sor Brook is given in Table 12. NRA guidance notes on the environmental assessment of points of large abstraction, including a checklist of potential impacts, have been referred to in the preparation of this section.

8.1.1 River morphology and sediment loads

River morphology

Most low flow impacts on the morphology of the Sor Brook are unlikely to be regarded as critically damaging. It is widely acknowledged that streams will, over time, adjust their morphology to equilibrate with any new flow regime. It is quite likely that the Sor Brook underwent some morphological adjustment in the 1970s and 1980s when water was abstracted at Adderbury, particularly as rates of abstraction were probably relatively high. Since that time the stream has probably been readjusting to the higher summer flows which are presumed to have resulted following the closure of the Adderbury source. It would be difficult, therefore, to argue that a partial reversion to pre-1980s summer flows would be generally damaging.

Sediment deposition

One of the most frequent effects of low flows is the deposition of a layer of fine silt over the channel. It is unlikely that such an impact would be significant in *ponded* sections of the Sor Brook since these reaches are already silty.

However, there *is* the potential for adverse effects from siltation of gravel riffles and shallow runs. Siltation of gravels could potentially have a detrimental effect on gravel-bed invertebrates and fish which spawn and feed in these areas. The most important of the potential effects of siltation would be any adverse effects on the spawning success of brown trout, if that these occur in the study area.

Overall, low flows occurring early in the year (January-July), would be the most likely to have adverse effects, particularly since this coincides with fish spawning periods. Low flows late in the year would probably be less important, since the fine sediments would be rapidly removed by high winter flows.

8.1.2 Water quality

Temperature and dissolved oxygen

The temperature and dissolved oxygen regimes of the river are key environmental parameters. Evidence from water quality monitoring at Adderbury indicates that during the lowest flow period of summer 1995, DO concentrations and water temperature reached levels which would be critical for brown trout. It was not possible, however, to predict whether these adverse condition were localised or common throughout the length of the Brook.

At present the dissolved oxygen regime does not appear to be significantly affecting invertebrate populations.

Nutrient pollution

Nutrient concentrations in the river, and reduced dilution due to low flows, have the potential to be key environmental issues. However, both nitrate (as total oxidised nitrogen) and phosphate (as orthophosphate P) appear to be undergoing long-term trends in the Sor Brook unrelated to low flow events. There was little evidence of increased nutrient concentrations in late summer/autumn 1995 as a result of low flows. However, a more detailed programme of sampling might reveal such a trend.

As will be noted below, nutrient pollution could influence the abundance of aquatic plants. Significant changes in the vegetation structure of the river could, in turn, have a variety of knock-on effects. For example, loss of aquatic plants could lead to (i) less water being held back in summer (ii) changes to the dissolved oxygen regime and (iii) less habitat for fish and invertebrates.

8.1.3 Wetland plants

The plant community of the Sor Brook is predominantly composed of species with relatively low sensitivity to low flow events. However the submerged plant community may be vulnerable to some effects associated with low flows.

There are three main aspects of low flows with the potential to adversely affect wetland plant communities (i) low water levels (ii) reduction in flow velocities and (iii) reduction in the dilution of pollutants, resulting in a net increase in pollutant concentrations. The potential for these three factors to affect plant communities in the Sor Brook is outlined below.

Plant species intolerant of low water levels

Most species of plant recorded in the Sor Brook are unlikely to be affected by low water levels. Marginal plants are likely to quickly readjust to any new water level regime. Amongst the submerged species, only those found growing in very shallow water (e.g. *Myriophyllum spicatum*, *Potamogeton crispus* and *Ranunculus penicillatus*) are likely to be vulnerable to drying-down of the river channel. All of these species would be at least moderately tolerant to complete loss of water from the channel (Pond Action, unpublished information). Of the three, *Ranunculus penicillatus* is the most likely to be affected.

Plant species sensitive to slow flows

All the marginal and aquatic plants recorded are species tolerant of still or very slowly flowing water. They are therefore unlikely to be impacted by any reduction in flow alone.

Plant species sensitive to increases in nutrient, or other pollutant, concentrations

Increases in nutrients, or other pollutants, (caused by a reduction in dilution) are likely to be the most critical sources of adverse impacts resulting from low flow. Significant impacts are likely to be restricted to the relatively few submerged species, such as *Myriophyllum spicatum*, *Potamogeton crispus* and *Ranunculus pennicellatus*. However, communities could potentially be affected in terms of both (i) a reduction of species richness and (ii) a decrease in species abundance.

In addition eutrophication has the potential to increase the abundance of other, less desirable, macrophytes such as algae or duckweed.

8.1.4 Invertebrates

Low flows have the potential to impact aquatic invertebrate communities through a number of processes. These include changes in flow rate, changes in the dissolved oxygen regime and changes to habitat quality (e.g. siltation of gravels or reductions in aquatic plant abundance).

A number of invertebrate families sensitive to organic pollution (and low dissolved oxygen concentrations) occur in the river which might be lost if flows were reduced. However, at present there is relatively little evidence from BMWP scores that invertebrate communities were damaged by low flows in summer 1995.

Loss of invertebrate species of particular conservation interest is also a key environmental issue. However, most of the notable species recorded from the Brook are also found in ponds and only one notable species, the White-legged damselfly, is exclusively associated with rivers. Most uncommon species seem likely, therefore, to be little affected by low flow events.

8.1.5 Fish

A fisheries survey was not undertaken as part of the current study because in the hot weather there was a high risk of causing excessive stress to fish. However, one brown trout was seen during the study, upstream of Bodicote at Upper Mill, and it is therefore quite possible that trout will be present downstream of the Bodicote pumping station.

Changes to the population of this brown trout would be a key environmental issue influencing the viability of increased water abstraction at Bodicote. Dissolved oxygen concentrations and water temperature at Adderbury during the lowest flow period in 1995 were both at the critical stress limits for trout. This suggests that, if trout occur in this area, similar low flow events caused by abstraction at Bodicote could have adverse impacts on the any population.

If trout are present in the Sor Brook below Bodicote It will be important to determine whether the Adderbury DO and temperature readings were unusual for the Brook, or whether large sections of the stream would be vulnerable to oxygen and temperature stress at periods of low flow.

With the designation of the river as an EU Cyprinid fishery changes to in the populations of coarse fish species could also be important. However, at present detailed fisheries information is not available from the study area.

The approach that needs to be taken to fish populations cannot be finalised until fisheries survey work on the lower reaches of the Sor Brook has been completed (the NRA expects to complete its fisheries survey of the river this autumn). Options for the monitoring that would be required, depending on whether brown trout occur in the river, are given in Section 9.

Table 12. **A summary of the physical, chemical and biological features of the Sor Brook.**

Feature	Comments
Physical features of the river	• Catchment area: approximately 106 km^2. • Weirs occur every 0.5-1km between Wykham and the Cherwell confluence. • Approximately 85% of the river in the study areas is ponded-up and overdeepened. • Well-developed riffle-pool and run sequences occupy less than 10% of the channel length. • The most widespread channel features are consolidated channel-edge sediment bars.
Hydrology	• Gauging at Adderbury took place between 1962 and 1988. • Water level measurements started Bodicote in 1993; discharge measurements started in 1995). • Flows were less than 14Ml/d from 9 August - 7 September 1995.
Water quality	• NRA monitors water quality routinely at Bodicote and Adderbury. • The river is GQA Class B ("very good quality, suitable for all fish species"). • Dissolved oxygen concentration were lower downstream of Bodicote than upstream during a 24hr survey at the end of August 1995. There river has occasional episodes of low dissolved oxygen concentrations (50%-60% saturation). • Total oxidised nitrogen concentrations have risen from about 7.5mg/l in 1979 to 11 mg/l in 1995. Concentrations are higher in winter than summer. Low flows in 1995 appeared to have no effect on TON concentrations. • Phosphate concentrations have fallen since 1990 in the river. Low flows appeared to have no effect on phosphate concentrations in 1995. • There is evidence of nutrient enrichment in many areas; low flows may have exacerbated the effects (for example, extensive growths of filamentous algae). • BMWP EQIs and ASPT EQIs were higher in September 1995 than at any other time in the previous 5 years. • Low flows did not appear to be reducing invertebrate diversity or affecting organic pollution sensitive taxa, at least in the short term.
Ecological quality	• The wetland plant community is of moderate conservation value. No nationally uncommon plant species were recorded; nine local species were found. Low flows are unlikely to have a *highly* adverse affect on the plant community, however changes in community diversity through eutrophication effects are possible. • The invertebrate community was less species-rich than other similar rivers in Oxfordshire; the community was of low to moderate conservation value. • Six nationally notable invertebrate species were recorded (with a maximum of 2 per reach). Four of these also occur in ponds; only one species (White-legged damselfly) is exclusively riverine. The value of the invertebrate communities does not seem likely to be *heavily* damaged by low flows. • Native crayfish were probably present in the study area in 1992, but are now extinct between Wykham Mill and the Cherwell, almost certainly because of crayfish plague. • The Sor Brook upstream of Wykham is "a good trout stream". One brown trout was seen during the study, upstream of Bodicote (at Upper Mill). Fish surveys were not undertaken because of the warm weather and the risk of stressing fish. • Low dissolved oxygen concentrations and high water temperatures could place brown trout occurring in the study reach under stress.

9. Requirements of a detailed monitoring programme

9.1 Objectives of the monitoring programme

Major objectives of the baseline study of the Sor Brook were to:

- provide information needed to design a detailed monitoring programme.
- identify key species and environmental factors which could form the basis of the detailed monitoring programme.
- recommend the location of appropriate monitoring sites.

This section discusses the factors influencing choice of suitable key species, groups and features and broadly indicates methods which would be appropriate for monitoring low flow effects in the Sor Brook.

Ideal indicator parameters/monitoring methods are those which:

- are sensitive to low flows
- are receptive to estimation of 'acceptable levels of change' (technically, what change can we be confident of statistically?).
- are monitored for long enough to ensure that any medium-term (12-18 months) changes which may occur can be detected.
- are sufficiently robust to enable TWUL to present a clear case to the NRA describing the effects of any increased abstraction.

9.2 Some important constraints on the design of a monitoring programme to detect low flow impacts

The are two main difficulties which currently confound the design of a monitoring programme which uses 1995 low flow conditions in the Sor Brook to provide an analogy for the likely impacts of higher abstraction rates at Bodicote.

(i) During the 1995 low flow period it has only been possible to monitor the Sor Brook during and after the drought. There is, therefore, *no pre-drought baseline.* In effect this means that when the stream was monitored at the minimum flow point in August 1995, adverse effects, such as loss of key species, could potentially *have already occurred.* It is therefore not possible to judge the full effect of the drought by comparing before and after surveys.

(ii) Pumping at Bodicote was halted in August 1995. Thus, during the periods of *lowest* flows, the Sor Brook may have been undergoing relatively similar low flow impacts both up *and* downstream of the abstraction point. For the 1995 low flow event this, in effect, prohibits the use of an upstream control against which any change downstream of Bodicote could be compared.

The main effect of these constraints is that *it would not be advisable to use the 1995 low flow event to model the effect of greater abstraction from the Brook.*

However, it is now possible to:

- Identify environmental factors and species/communities which have the potential to constrain a TWUL application to the NRA for a change in the abstraction conditions at Bodicote.
- Identify key groups/features which are suitable for monitoring low flow impacts on the Sor Brook
- Identify suitable methodologies for a monitoring programme, and the location at which monitoring should be undertaken.

These points are discussed below, for each of the main monitoring areas in turn.

A summary of the recommended methods is given in Table 13.

9.3 Fish

Fish, particularly brown trout, are likely to be a critical group in any monitoring programme in the Sor Brook (see Section 8). NRA fisheries surveys in autumn 1995 should indicate whether trout are present in the lower reaches of the Brook below Bodicote.

Depending on the results from this fisheries survey, two monitoring options are possible:

(i) If trout *are* recorded in the Sor Brook below Bodicote in good numbers this suggests either (i) that the 1995 low flow had no significant impact or (ii) that fish were affected by low flows but quickly recolonised from upstream of Wykham Mill. The objective of monitoring under these circumstances would be to determine whether the physical conditions during 1995 were unusual (i.e. whether dissolved oxygen concentrations were exceptionally low and water temperatures exceptionally high). This would be done by resurveying DO and water temperature in summer 1996. It would also be important to monitor more sites than 1995 in order to find out how widely areas with low DOs and high temperatures were distributed.

(ii) If trout are *not* recorded in the study area, or are recorded in unusually low abundance, this could indicate that the populations were impacted by low flows (without a pre-low flow study there is no way of knowing for sure, however). In this situation further surveys would be needed in 1996 to look for recolonisation (and, by implication, indications of potentially adverse effects of abstraction). Ideally the NRA should carry out this work to ensure consistency and high survey quality.

9.4 Aquatic macroinvertebrates

Two aspects of the aquatic macroinvertebrate community could potentially be used for low flow monitoring.

(i) Key species, such as uncommon invertebrates or species sensitive to low flows.

(ii) Whole community changes.

9.4.1 Key invertebrate species

No rare (i.e. Red Data Book) species requiring special protection were recorded in the course of the survey. Of the six Nationally Notable species recorded, four were water beetles which are frequently encountered in ponds, as well as rivers. Only the White-legged Damselfly (*Platycnemis pennipes*) is a specifically riverine animal, and therefore likely to be vulnerable to changes in flow regime or water chemistry resulting from low flows. Unfortunately, the White-legged Damselfly was recorded only in the lowest three reaches of the Sor Brook, just above its confluence with the R. Cherwell. This in effect prohibits its use as a key indicator, since, without a control reach above Bodicote, it would not be possible to suggest that any abundance changes identified by monitoring were due to abstraction related low flows.

Other more common species known to be sensitive to flow/oxygen concentrations could also be used as low flow indicators (e.g. the mayfly *Ephemerella ignita*). However these taxa could most easily be monitored as part of a programme of community analysis using BMWP/RIVPACS methods (see below).

9.4.2 Community change

Community change can be measured in a number of different ways, including (i) multivariate analysis (e.g. CANOCO) which could be used to compare differences in gross community change (ii) conservation scores/indices, such as those used in this report which could be used to identify changes in community diversity and rarity (iii) BMWP/RIVPACS methods which are sensitive to water quality changes.

Of these, the most relevant to the aims of the monitoring project is the BMWP system, because it relates directly to oxygen stress in the stream. This method also has the benefit that the NRA already collect BMWP data from the Brook, providing a valuable historical data set against which to study future trends.

9.4.3 Recommended invertebrate monitoring methods

If further monitoring of the invertebrate community is appropriate, it is recommended that standard BMWP monitoring is used to compare the reaches upstream and downstream of the Bodicote abstraction point. The level of any change in scores which would be acceptable in a future study would require discussion with the NRA. However mean deviations of 10%-20% from upstream control areas or non-low flow conditions, would probably be undesirable.

BMWP samples would need to be taken at least bi-monthly through the year, with three stations above Bodicote and three below (including the NRA sampling point). Where possible, areas with both riffles and ponded water should be included at each sampling point.

Suitable sampling locations are:

Above Bodicote: (i) ca.200m below A361 road bridge (ii) ca.300m above Upper Grove Mill (iii) below Bodicote Mill House.

Below Bodicote: (i) ca.250m below Bodicote gauging station (ii) Adderbury ca.150m above A4260 road bridge (iii) ca.1.5km-2km above the R. Cherwell confluence.

9.5 Wetland macrophytes

9.5.1 Potential impact factors

The broad methodologies outlined for aquatic invertebrates above, also apply to monitoring the wetland plant communities.

No nationally notable or rare plant species were recorded during the survey but, of the nine local species, six were aquatic plants (i.e. submerged or floating-leaved species) which might be vulnerable to changes in the aquatic environment.

As noted in the Section 8, the adverse effect of low flows on the plant communities are largely threefold:

(i) Plant species intolerant of low water levels. Most wetland plants species recorded in the Sor Brook are unlikely to be affected by low water levels. Even amongst the potentially most vulnerable species, submerged plants growing in shallow water, the three species which are actually likely to experience low water levels are all plants which are at least moderately tolerant to drought. Of the three, *Ranunculus penicillatus* could *potentially* be the most affected, but this species is restricted to lengths below Adderbury, and is therefore not suitable for single species monitoring since there is no control population above Bodicote.

(ii) Plant species sensitive to slow flows. All marginal and aquatic plants recorded are species tolerant of still or very slowly flowing water. They are therefore unlikely to be affected by any reduction in flow alone and monitoring is therefore not appropriate.

(iii) Species sensitive to increases in nutrient or other pollutant concentrations. Increases in nutrient or other forms of pollution has the potential for adverse impacts on the diversity of the submerged plant community in the Sor Brook, and could potentially result in greater abundances of less desirable species such as algae or duckweed.

Consideration of the points above suggests that the likely impacts from low flows would be best measured at community level rather than by monitoring individual species. the following method is suggested.

9.5.2 Plant monitoring methods

It is recommended that potential impacts on the Sor Brook plant communities are assessed using a method which monitors the abundance and species-richness of aquatic species.

It is suggested that monitoring is undertaken using fixed 10m-band transects across the stream. Within these, the percentage cover of all aquatic species should be estimated. It is recommended that monitoring is undertaken at six stations along the Brook, three upstream and three downstream of Bodicote. The locations for invertebrate monitoring would be adequate for this. At each station, duplicate (3+) fixed 10m transects bands should be monitored.

The level of change which would be acceptable between downstream and control reaches, could be in the order of 20%-30% changes in abundance, and perhaps no more than loss of one species (on average) from impact reaches.

9.6 Morphology and sediment deposition

As noted in the Section 8, stream morphology is not a critical parameter likely to be adversely impacted by low flows.

It is possible, however, that low flow velocities could cause siltation of gravels with a detrimental effect on invertebrates and some fish species. Gravel siltation would be particularly significant were it to adversely affect the spawning success of fish, particularly brown trout.

If it is anticipated that abstraction at Bodicote would be likely to cause low flows during the fish spawning season (January-July), it is recommended that siltation of riffle areas is directly monitored by dry/wet weighting.

Riffles and runs occupy a small proportion of the river (about 10% of the study area). Monitoring would aim to determine whether deposition of silt, which already occurs to some extent, became significantly worse as a result of low flows.

9.7 Water chemistry

The critical water quality parameters for the Sor Brook are those linked with eutrophication and oxygenation i.e. dissolved oxygen (DO) concentrations, temperature, nitrate, orthophosphate P and ammonia.

In order to undertake an effective baseline monitoring programme which could detect the future impacts due to low flow conditions, monthly samples would be recommended at plant and invertebrate monitoring stations.

If brown trout are recorded in the lower reaches of the Brook below Bodicote, it would be valuable to undertake a DO/temperature survey along the length of the Brook. This would help to establish a DO profile for the stream, which could be used to indicate whether future low flow events would be likely to lead to extensive deoxygenation or merely localised problems.

9.8 Recommended rational for future monitoring of the Sor Brook

Lack of a pre-low flow baseline or upstream control reach means that it is not possible to be confident that changes in the river following the 1995 low flow will mirror changes that might result from an artificially induced low flow event. This is because (i) both the upstream and downstream reaches experienced similar impacts *i.e. the upstream reach was not, in fact, a control) (ii) there is no pre-flow data for the river downstream of Bodicote (excluding routine NRA data which is not adequate for a detailed controlled study of a low flow event).

Monitoring during autumn 1995 and continuing into 1996 *could* be undertaken, and would provide interesting data from which hypotheses could be generated. However, the results could not be conclusive. It is therefore suggested that monitoring to this end would not be cost effective.

Although it is not possible to adequately measure the effect of the 1995 low flow on the Brook, it is now possible to set up an effective monitoring programme to measure the effects of low-flow events on the Brook. It *would* be viable, for example, to use the detailed monitoring programme to establish a true pre-impact baseline of the Brook, to provide data which *could* be used to assess low flow impacts in future

years. The monitoring methods described above provide the basis for such monitoring.

The effect of low flows could be assessed either by waiting for another drought year with which to compare 'before' and 'after' results. Alternatively low flows could be artificially induced, if the NRA are agreeable, by pumping large at Bodicote. The effects of low flow could then be assessed under properly controlled conditions by comparing upstream (control) and downstream (impact) sections.

This stated, it should be noted that, if the NRA fisheries surveys indicate that brown trout are present in the Brook downstream of Bodicote, this may limit the potential for greater abstractions from the Brook. This fact may, in itself, be sufficient for TWUL to decide not to proceed with an application for a change in the current abstraction conditions.

The following protocol provides an aid to making decisions about the a future monitoring programme in the Sor Brook.

1. It is suggested that TWUL wait for the NRA fisheries survey results before proceeding with any monitoring.

2. If brown trout *are* present below Bodicote, TWUL should consider (possibly in consultation with NRA) whether this would automatically rule out any changes to the current abstraction regime. In addition, further dissolved oxygen and temperature measurements could be made to establish whether low flow deoxygenation events (such as that experienced at Adderbury) are likely to be localised or extensive under expected low flow conditions.

3. If the NRA survey indicates that trout are *not* currently present in the lower part of the Brook below Bodicote, then additional fisheries surveys should be undertaken in 1996 to make sure of their absence, before proceeding with any further monitoring work on the stream. This step may not be necessary if NRA fisheries staff are confident that the lower reaches of the Sor Brook are unsuitable for brown trout.

If brown trout are known to be absent from the Brook, a baseline, pre-impact survey, in the form outlined above, could be established in order to assess the impact of future natural or induced low flows.

Table 13. **Recommended monitoring to detect future low flow impacts in the Sor Brook**

Parameter	Recommended monitoring method
Aquatic invertebrates	Use BMWP scores to identify community level impacts.
Wetland plants	Monitor 10m stream transects, recording aquatic plant species (i.e. submerged and floating plants) and their abundance.
Fish	Methodology dependant on NRA survey results.
Geomorphology and sediments	Monitor silt content of gravels at riffle and run areas if low flows are likely to occur early in the year (causing siltation of valuable fish or invertebrate gravel habitats).
Water chemistry	Critical variables are dissolved oxygen, temperature, orthophosphate P and nitrate. Depending on NRA fisheries survey results, it may be necessary to monitor DO and temperature

Appendices

Appendix 1 General Quality Assessment and Water Quality Objectives

The NRA uses two principal schemes for the reporting and management of river water quality; the General Quality Assessment (GQA) scheme and the statutory Water Quality Objectives (WQO) scheme introduced by The Surface Waters Regulations 1994. The latter is not yet formally established and is therefore applied on a non-statutory basis.

The GQA for chemical grading of rivers and canals comprises six-tiered grades defined by standards for DO, BOD and total ammonia, with Grade B described as good water quality.

The WQO scheme establishes quality targets based upon the uses to which a river stretch may be put. The standards defining the five-tiered River Ecosystem (RE) use classes include DO, BOD and total ammonia. The target established by the NRA for the Sor Brook is RE2 (water of good quality suitable for all fish species) by 1994.

Water Quality	Grade / Class	DO % 10 Percentile	BOD mg/l 90 Percentile	Ammonia mg N/l 90 Percentile
Good	B / RE2	70	4.0	0.25

Appendix 2 List of determinands analysed by NRA for water quality assessment

Note that the full list of determinands applies only to samples from Bodicote between 1979 and 1983

Determinand	
pH Value	*
Conductivity	
Colour	
Turbidity	
Solids, Suspended 105 C	
BOD 5 Day using ATU	*
COD	
Temperature (FIELD)	*
Dissolved Oxygen (FIELD)	*
Ammoniacal Nitrogen	*
Ammonia, Un-ionised as N	*
Nitrogen, Total Oxidised	*
Chloride as Cl	*
Sulphate as SO4	
Orthophosphate as P	*
Syndets, anionic	
Hardness, Total as CaCo3	
Alkalinity as CaCo3	
Chromium	
Zinc	
Nickel	
Copper	
Cadmium	
Lead	
Boron	
Iron	
Manganese	
Cyanide, Total	
Fluoride	
Phenols	
HCH, gamma	
Dieldrin	
HCH, alpha	
HCH, delta	
DDE	
DDT	
PCBs	
Coliforms	
E.Coli	
Silicate, Reactive	
* Adderbury (1979-1995); Bodicote (1989-1995)	

Appendix 3. Sor Brook geomorpholog: summary of information about each length

Reach 1/2	Junction with the R. Cherwell to footpath footbridge - lowest 0.7km.
Land Use	Grazing, overgrown setaside becoming golf-course westward and upstream.
River morphology:	Overdeepened and overwidened with marginal embankments.
Bank structure and type	Banks steep and consolidated alluvium.
Channel features	Riffles very rare and largely associated with the footings of the footbridge. Side bars and vegetation with tall emergents, but a limited number of vegetated point-bars and mid stream bars.
Channel base material	Cohesive base: alternations of solid clay and sediment (0.05-0.03m deep) vegetated with aquatic macrophytes, silt becoming deeper upstream.
Sediment type and depth	Gravel coarse sand and clay clasts (2cm) and silt, becomming finer and more silty upstream.
Water depth average	0.4 - 0.5m
Water depth maximum	0.6m
Water depth minimum	0.3m
Water width	4m
Bankfull depth	1.8m to brashline. 2m to top of bank
Bankfull width	8m
Trees	Isolated scattered trees
Evidence of low flow	Some lower bank margins and marginal sediment bars are muddy and bare of vegetation, suggesting unusually low water levels.

Reach 2/3	Footpath footbridge to first riffle section west of Nell Bridge Farm.
Land Use	Golf-course, grazing, arable (rape, maize, hay).
River morphology:	Nothing in particular, probably over deepened and widened.
Bank structure and type	Banks typically steep and composed of consolidated alluvium.
Channel features	Rather pooled above the bridge with riffles rather uncommon. Extensive silty side bars and mid-stream bars covered in tall emergent vegetation (particularly *Sparganium erectum*) often filling the channel and controlling and inhibiting water flow.
Channel base material	Bed: alternations of solid clay and hard indurate bedrock locally forming shallows and low natural weirs.
Sediment type and depth	Variable, sometimes little, but often heavy sedimentation - ca. 0.3m deep.
Water depth average	0.6m
Water depth maximum	0.8m
Water depth minimum	0.3m
Water width	ca.4-5m
Bankfull depth	? to brashline. 2m to top of bank
Bankfull width	ca. 10m
Trees	Occasional clumps, and locally semi-continuous.
Evidence of low flow	Extensive sedimentation in the form of vegetated mid and side bars.

Reach 3/4	Nell Bridge Farm to weir 0.2km downstream of Park Farm
Land Use	Golf-course, grazing, arable.
River Morphology:	
Bank Structure And Type:	Banks fairly steep, though often lower than in downstream reaches. Composed of consolidated alluvium.
Channel Features	A section of gravely riffles pools and particularly shallow runs, though locally with some deeper sections. Occasional natural weirs. Some mid-stream bars covered in tall emergent vegetation.
Channel Base Material	Bed: alternations of hard indurate bedrock (locally forming low natural weirs), gravels and clay with some silty pools.
Sediment Type And Depth	Heterogeneous, varies from silt to medium grained gravel. (10-20mm diameter max.) Clasts of rock and mud.
Water Depth	Average 0.4m, but some very shallow runs with maximum water depth of <0.15m. Pools often 1m+ deep.
Water Width	5m
Bankfull Depth	1m to brashline. ca 1.8m to bank top.
Bankfull Width	4-7m
Trees	Occasional clumps.
Evidence of low flow	Very shallow riffles.

Reach 5 and 6	Weir 0.2km downtream of Park Farm to A4260 road bridge.
Land Use	Pasture, local farm buildings
River generally	Major weir at bottom of the reach and to others above, 0.5km apart. Banks locally reinforced.
Bank structure and type	Banks low and locally poached by cattle.
Channel features	Deep and ponded by the weirs. Semi-continuous side bars filling 20% - 50% of the channel.
Channel base material	Clay. .
Sediment type and depth	Soft silt often deep (generally >0.4m)
Water depth	1m - 2m+
Water width	ca. 6-7m
Bankfull depth	ca 0.4m to bank top.
Bankfull width	ca. 10-12m
Trees	Varied isolated downstream to clumps and locally semi-continuous on one bank upstream.
Evidence of low flow	Nutrient enrichment evident from locally extensive entromorpha growth at the surface in some parts.

Reach 7/8	A4260 road bridge to mill at Adderbury
Land Use	Grazing.
River generally	2 weirs and a sewage inlet.
Bank structure and type	Banks fairly steep, but relatively low. Composed of consolidated alluvium.
Channel features	A section of gravely riffles and pools with occasional shallow runs. Occasional mid-stream and side bars covered in tall emergent vegetation. Locally deeper above the embankment weir.
Channel base material	Bed: medium and coarse grained gravels with some sand and layers of very fine silt (<20mm deep)
Sediment type and depth	as above
Water depth	Average 0.3 - 0.45m, but locally ca. 0.1 - 0.6m deep. Pools often 1.5m deep.
Water width	5m
Bankfull depth	1m to bank top.
Bankfull width	6m
Trees	Occasional clumps.
Evidence of low flow	Nutrient enrichment evident from algae and thin layers (always <20mm) of very fine sediments covering gravels and macrophytes.

Reach 8	Mill at Adderbury to north Adderbury
Land Use	Urban, woodland.
River morphology	Two channels: a mill leat and active side channel, both ca. 1km long
Bank structure and type	Banks for both the Mill leat and side channel are fairly steep, but relatively low. The mill leat is partially reinforced with stone or sheet piling. Other banks are of consolidated alluvium.
Channel features	The side channel is relatively shallow and narrow with little bottom sediment and some gravely riffles and pools. Occasional mid-stream. The Mill leat is very silty with deep sediment.
Channel base material	Bed: mud/clay
Sediment type and depth	Fine sediment in the Mill leat, often deep (c0.5m+). The side channel has sands and gravels with little fine sediment (locally 0.1m maximum). However both the leat and side channel commonly have large cobbles of stone and brick and other debris presumably derived from its urban setting within Adderbury.
Leat water depth	Average 0.5m, Maximum 1.2m, Minimum 0.4m.
Leat water width	4m
Leat bankfull depth	0.4 to bank top.
Leat bankfull width	4.5m
Side channel water depth	Average 0.25m, Maximum 0.4m, Minimum 0.1m.
Side channel water width	3m
Side channel bankfull depth	1m to bank top.
Side channel bankfull width	4.5m
Trees	Semi continuous on one or both banks.
Evidence of low flow	Perched roots and occasional exposed muddy side bars in the side channel. Fine sediments covering the cobbles of the leat, and to a lesser extent the side channel.

Reach 9, 10, 11/12	North Adderbury to Lower Grove Mill
Land Use	Cattle grazed pastures
River morphology	nothing much, but over deepened by the weir below.
Bank structure and type	Meandering plan-form. Banks typically steep and composed of consolidated alluvium. Banks low, gentle and well and poached by cattle towards the bottom (downstream part) of the section, becomming steeper towards the upstream end.
Channel features	consistently deep and pooled, shallowing to give deep 'riffle-pool' sequences only towards the very top of the section. Extensive silty side bars and mid-stream bars covered in tall emergent and wetland herb vegetation (particularly *Sparganium erectum* and *Saggitaria*). These typically fill 25%-85% of the channel and help to control and inhibit water flow. Point bars moderately well developed too
Channel base material	Bed: mostly clay, but the bed sometimes appears to be finely gravely.
Sediment type and depth	Variable, sometimes little, but often thick deposits of fine sediment - ca. 0.3m deep. the gravels evident at the top of the reach are rather silty.
Water depth	Average 1.1m; maximum 1.4+m; minimum 0.8m.
Water width	ca.4-6m
Bankfull depth	0.8m to top of bank
Bankfull width	?ca. 5-10m
Trees	Isolated with occasional clumps. Some regularly spaced pollards.
Evidence of low flow	Extensive sedimentation in the form of vegetated mid and side bars.
Reach 12 and 13	Lower Grove Mill to Upper Grove Mill
Land Use	Arable, grazing, locally urban.
River morphology	Weirs and mills. A section of with weirs and mills every kilometre or so. This gives deep pooled sections immediately upstream of the weir which very gradually shallow to give one or two riffles riffle-pool/run sequences at the top of the reach. The Bodicote Mill House has a small semi-permanent, and densely vegetated side channel which was almost dry at the time of the survey. Also receives a culverted inflow (stream?) below the NRA monitoring station.
Bank structure and type	Banks fairly steep and high. Composed of consolidated alluvium.
Channel features	Pooled areas often have vegetated marginal bars, and occasional mid-stream bars. The riffle -pool areas have Some marginal and point-bars covered in wetland vegetation.
Channel base material	Bed: varied: solid rock- clay?
Sediment type and depth	Heterogeneous, varies from silt in the pooled sections (average 0.15-0.3m depth) to fine to medium grained gravel (some clean stony gravels, some with a high proportion of clay clasts). (<10-30mm diameter). Occasionally coarse and rocky as part of footing for bridge (<40mm). Sediment
Water depth	Average 1m in pooled sections but shallowing to 0.2m in riffle/run sections
Water width	4-5.5m
Bankfull depth	1-1.5m
Bankfull width	7-12m
Trees	Very varied, from isolated to semi-continuous.
Evidence of low flow	Thin layers of very fine sediment.

Reach 14, 15 and 16	Upper Grove Mill to Banbury Road Bridge at Wykham Mill
Land Use	Grazing, locally wooded, arable, urban.
River generally	Mill leat for the lowest 0.25km above the mill, but the stream is over deepened/ponded above this. It only begins to shallow towards the road bridge at the upstream end.
Bank structure and type	Meandering plan-form. Banks typically steep and becomming higher towards the upstream end. Composed of consolidated alluvium.
Channel features	Consistently deep and pooled, shallowing to give deep 'riffle-pool' sequences only towards the very top of the section. Extensive silty side bars and a few mid-stream bars with tall emergent vegetation (particularly *Sparganium erectum*). These typically fill 15%-50% of the channel. Submerged macrophyte beds are very abundant, generally occupying ca. 50% of the channel in the middle and upper reaches. Macrophyte growth must help to control and inhibit water flow. Point bars moderately well developed.
Channel base material	Bed: mostly clay, but the bed sometimes appears to be finely gravely.
Sediment type and depth	Variable, sometimes little, but often deposits of very fine unconsolidated sediment - ca. 0.3m deep. Towards the top of the reach silty coarse sand and fine gravel are evident on riffles.
Water depth Average	0.5m-0.6m
Maximum	1.4+m
Minimum	0.2m
Water width	ca.3-4m
Bankfull depth	1-2m to top of bank
Bankfull width	ca. 7-9m
Trees	Semi continuous on the southern bank of the mill leat, but mostly isolated with occasional clumps.
Evidence of low flow	Sedimentation in the form of vegetated mid and side bars. Fine silt covering the bottom and both silt and algae covering growing submerged macrophyte beds.often deposits of very fine unconsolidated sediment - ca. 0.3m deep.

Appendix 4 River Habitat Survey: raw data sheets

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

Reference network site number: PA Q2

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP 487341 River: SOR BROOK

Date 19/9/1995 Time: 12.00 Surveyor name NIALL GRIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....
[Heavy rain overnight]

Bed of river visible? No ☐ partially ☑ entirely ☐ *(tick one box)*

Duplicate photographs: general character? No ☐ Yes ☑ *(tick one box)* 32 33

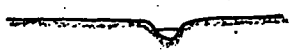
Site surveyed from: left bank ☑ right bank ☐ channel ☑ *(tick as appropriate)*

PREDOMINANT VALLEY FORM *(tick one box only)*


☑ shallow vee


☐ terraced valley floor


☐ deep vee


☐ symmetrical floodplain


☐ gorge


☐ asymmetrical floodplain


☐ concave/bowl

NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use 1/1 then indicate total number)*

Riffles 1	Unvegetated point bars 1
Pools 1	Vegetated point bars 1

Spot check 1 is at: upstream end ☒ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	SU	EA	EA	EA	SA	SA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	RS	RS	RS	RS	RS	RS	NO	RS	RS	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	NO	NO	NO	VS	VS	NO	NO	NO
CHANNEL										
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	GP	SI	SI	GP	SI	SI	GP	GP	GP	SI
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	SM	NP	NP	SM	NP	NP	SM	SM	SM	SM
Channel modification(s) NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
RIGHT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	RS	RS	RS	RS	RS	RS	RS	NO	NO	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose one from BL, CP, MH, SC, RP, WL, OW, IG, N, SU golf course

LAND USE WITHIN 5m OF BANKTOP (L)	SU	SU	SU	SC	SU	SU	SU	SC	SC	SC
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	S	U	U	U	S	S	S
LEFT BANK FACE *(structure)* B/U/S/C	S	S	S	S	S	S	S	S	S	S
RIGHT BANK FACE *(structure)* B/U/S/C	S	U	S	S	S	S	S	S	S	S
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	U	U	U	U	U	U	U
LAND USE WITHIN 5m OF BANK TOP (R)	IG	IG	IG	IG	SU	SU	SU	SC	SU	SC

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present)*

NONE *(tick as appropriate)*										
Liverworts/mosses/lichens										
Emergent broad-leaved herbs Epilobium sp	✓			✓	✓	✓	✓	✓	✓	✓
Emergent reeds/sedges/rushes Sparganium, Phalaris, Scirpus	✓	E	E	✓	E	E	✓	✓	E	✓
Floating-leaved (rooted)										
Free-floating Lemna	✓	✓	✓		✓		✓	✓		✓
Amphibious ?, Water Dock										
Submerged broad-leaved										
Submerged fine/linear-leaved Potamogeton sp			✓	✓			✓	✓		
Filamentous algae										

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓)

Alisma
Sparganium

II LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*			Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		✓
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*		✓
Scrub *(SC)*	✓		Tilled land *(TL)*		
Rough pasture *(RP)*			Suburban/urban development *(SU)* GOLF COURSE	E	E

I BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut			Resectioned	E	E
Vertical + toe			Reinforced - whole bank	✓	
Steep (>45°)	✓	✓	Reinforced - top only		
Toe			Reinforced - toe only		
Composite			Artificial two-stage		
Use this space to draw profile if different from above, after ticking predetermined box			Poached		
			Embanked		
			Set-back embankments		

I EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

	Left	Right
None	☐	☐
Isolated/scattered	☐	☐
Regularly spaced, single	☐	☐
Occasional clumps	☑	☑
Semi-continuous	☐	☐
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☑	☐
Overhanging boughs	☐	☑	☐
Exposed bankside roots	☑	☐	☐
Underwater tree roots	☐	☑	☐
Fallen trees	☑	☐	☐
Coarse woody debris	☐	☑	☐

EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E
Waterfall(s) *~free-fall*	☑	☐	☐
Cascades(s) *~chute*	☑	☐	☐
Step/pool sequence	☑	☐	☐
Rapid(s) *~whitewater*	☑	☐	☐
Ripple-pool sequence	☑	☐	☐
Run(s) *~disturbed, rippled*	☑	☐	☐
Boil(s) *~upwellings*	☐	☑	☐
Glide(s) *~smooth, no eddies*	☐	☐	☑

	None	Present	E
Marginal deadwater *~slack*	☐	☐	☑
Exposed bedrock	☑	☐	☐
Exposed boulders	☑	☐	☐
Unvegetated mid-channel bars	☑	☐	☐
Vegetated mid-channel bars	☑	☐	☐
Mature island(s)	☑	☐	☐
Unvegetated side bars	☑	☐	☐
Vegetated side bars	☐	☑	☐

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK				RIGHT BANK	
Banktop height (m)	1.2	Banktop width (m)	7.5	Banktop height (m)	1.2
Embanked height (m)	—	Water width (m)	6.5	*Embanked height (m)*	—
		Water depth (m)	0.8		

If trashline lower than banktop break in slope, indicate: height (m) 1.0 width(m) 2.0

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurement is: riffle ☐ run or glide ☑ other ☐ *(tick one box)* *Slope (IFE only)*

M ARTIFICIAL FEATURES *(Use 1|1 Indicate total number, tick "none" where appropriate)*

None ☐ Number of Culverts= Weirs= Outfalls= Fords =

Footbridges = 1 Roadbridges = Other=

Is water level controlled by weir/dam downstream? No ☑ Part of site ☐ Most/whole of site ☐

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging ☐ mowing ☐ Other ? State .....

weed-cutting ☐ enhancement ☑ Tree planting in golf course (banks)

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☑	Bog	☐	Other (state) .....
Braided/side channels	☐	Natural open water	☐	Carr	☐	
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☐	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☐ YES ☑

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State —

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Sluggish channel - SM + NP

Plants of note: — choked with weed + marginal veg (E)

Major conservation features: BL Plantation at lower end (LHS)

Major impacts: RS banks

Incidental observations (animals etc):

Kingfisher.

Symphytum, Aruhna sp (mints).

S DISEASED ALDERS *(Tick one box)*

None ☐ Present ☑ Extensive ☐ Other diseased trees? State .....

SEND COMPLETED FORM TO HUGH DAWSON, IFE, RIVER LABORATORY, EAST STOKE, WAREHAM, BH20 6BB

P-49428.TL

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

7 *Reference network site number:* PA 04

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP 481 346 River: SOR BROOK

Date 19/9/1995 Time: 10:30 Surveyor name NIALL GRIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....
[Heavy rain overnight]

Bed of river visible? No ☐ partially ☑ entirely ☐ *(tick one box)*

Duplicate photographs: general character? No ☐ Yes ☑ *(tick one box)* 30 31

Site surveyed from: left bank ☐ right bank ☑ channel ☑ *(tick as appropriate)*

C PREDOMINANT VALLEY FORM *(tick one box only)*


☑ shallow vee


☐ deep vee


☐ gorge


☐ concave/bowl


☐ terraced valley floor


☐ symmetrical floodplain


☐ asymmetrical floodplain

D NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use 1/1 then indicate total number)*

Riffles	6	Unvegetated point bars	\
Pools	4	Vegetated point bars	\

Spot check 1 is at: upstream end ☑ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL (RR)	BW	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	RI	RS	RS	RS	RS	NO	NO	NO	NO	NO
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	VS	NO	NO	VS	NO	NO	NO	VS	NO
CHANNEL										
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	CO	GP	GP	GP	GP	GP	GP	SI	GP	GP
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	BW	UW	SM	SM	UW	SM	SM	SM	RP	RP
Channel modification(s) NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
RIGHT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	BE	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	NO	NO	NO	NO	PC/RS	RS	RS/BM	RS	RS	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	SC	EC	VS	NO	NO	NO	NO	NO

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose one from BL, CP, MH, SC, RP, WL, OW, IG, TL, SU — FOOTPATH/GRASS

	1	2	3	4	5	6	7	8	9	10
LAND USE WITHIN 5m OF BANKTOP (L)	IG	IG	IG	IG	IG	BL	TL	RP	RP	RP
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	U	U	S	S	S	U	U
LEFT BANK FACE *(structure)* B/U/S/C	S	S	S	B	S	C	S	U	S	S
RIGHT BANK FACE *(structure)* B/U/S/C	S	S	S	S	S	S	S	S	S	S
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	S	S	U	S	U	U	U	U	U	U
LAND USE WITHIN 5m OF BANK TOP (R)	BL	BL	IG	IG	IG	IG	IG	IG	IG	IG

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present)*

NONE *(tick as appropriate)*											
Liverworts/mosses/lichens	✓	✓									✓
Emergent broad-leaved herbs Epilobium sp	✓					✓			✓		✓
Emergent reeds/sedges/rushes Scirpus, Phalaris, Glyceria max Sparganium.	✓	✓			E		✓	E	E	✓	E
Floating-leaved (rooted)											
Free-floating Lemna sp					✓						✓
Amphibious Myosotis	✓										✓
Submerged broad-leaved											
Submerged fine/linear-leaved Potamogeton sp Ranunculus		✓	E	✓	✓	✓		✓		✓	E
Filamentous algae		✓	✓	✓	✓	✓	✓			✓	✓

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓) ↑

LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*	✓	✓	Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*	E	E
Scrub *(SC)*			Tilled land *(TL)*		
Rough pasture *(RP)*			Suburban/urban development *(SU)*		

BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut		✓	Resectioned	E	E
Vertical + toe		✓	Reinforced - whole bank	✓	✓
Steep (>45°)	✓	✓	Reinforced - top only		
Ledge			Reinforced - toe only		
Composite			Artificial two-stage		
Use this space to draw profile if different from above, after ticking predetermined box			Poached		✓
			Embanked		
			Set-back embankments		

EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

	Left	Right
None	☐	☐
Isolated/scattered	☐	☐
Regularly spaced, single	☐	☐
Occasional clumps	☐	✓
Semi-continuous	✓	☐
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☐	✓
Overhanging boughs	☐	☐	✓
Exposed bankside roots	☐	✓	☐
Underwater tree roots	☐	☐	✓
Fallen trees	✓	☐	☐
Coarse woody debris	☐	✓	☐

EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E
Waterfall(s) *~free-fall*	✓	☐	☐
Cascades(s) *~chute* (WIER)	☐	✓	☐
Step/pool sequence	✓	☐	☐
Rapid(s) *~whitewater*	☐	✓	☐
Riffle-pool sequence	☐	☐	✓
Run(s) *~disturbed, rippled*	☐	✓	☐
Boil(s) *~upwellings*	☐	✓	☐
Glide(s) *~smooth, no eddies*	☐	☐	✓

	None	Present	E
Marginal deadwater *~slack*	☐	✓	☐
Exposed bedrock	☐	✓	☐
Exposed boulders	✓	☐	☐
Unvegetated mid-channel bars	✓	☐	☐
Vegetated mid-channel bars	✓	☐	☐
Mature island(s)	✓	☐	☐
Unvegetated side bars	✓	☐	☐
Vegetated side bars	☐	☐	✓

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK		Banktop width (m)	10.0	RIGHT BANK	
Banktop height (m)	2.0	Water width (m)	6.0	Banktop height (m)	2.0
Embanked height (m)	\	Water depth (m)	0.3	*Embanked height (m)*	\

If trashline lower than banktop break in slope, indicate: height (m) 0.75 width(m) 6.5

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurement is: riffle ☑ run or glide ☐ other ☐ *(tick one box)* **Slope (IFE only)**

M ARTIFICIAL FEATURES *(Use |1| Indicate total number, tick "none" where appropriate)*

None ☐ Number of Culverts= Weirs=1 Outfalls= Fords =

Footbridges =1 Roadbridges = Other=

Is water level controlled by weir/dam downstream? No ☑ Part of site ☐ Most/whole of site ☐

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging	☐	mowing	☐	Other ? State	\
weed-cutting	☐	enhancement	☐		

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☐	Bog	☐	Other (state) \
~~Braided~~/side channels	☑	Natural open water	☐	Carr	☐	DRY CHANNEL from old spring on RHS, with wet pools (temporary)
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☑	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☑ YES ☐

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State \

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Sinuous channel, more RF / Pool + GP substrate.

Plants of note: Steep banks, but good marginal veg.

Major conservation features: BL woodland on RHB (mature)

Major impacts: RS banks.

Incidental observations (animals etc):

Kingfisher
Heron
Pike remains (c. 5lb)

S DISEASED ALDERS *(Tick one box)*

None ☐ Present ☑ Extensive ☐ Other diseased trees? State

SEND COMPLETED FORM TO HUGH DAWSON, IFE, RIVER LABORATORY, EAST STOKE, WAREHAM, BH20 6BB

P-49428.TL

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

Reference network site number: PA 06

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP 477352 River: SOR BROOK

Date 18/9/1995 Time: 2.00 Surveyor name NIALL GRIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....

Bed of river visible? No ☐ partially ☐ entirely ☑ *(tick one box)*

Duplicate photographs: general character? No ☐ Yes ☑ *(tick one box)* 28 29

Site surveyed from: left bank ☐ right bank ☑ channel ☑ *(tick as appropriate)*

PREDOMINANT VALLEY FORM *(tick one box only)*

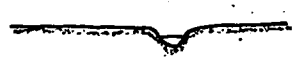

☑ shallow vee


☐ deep vee


☐ gorge


☐ concave/bowl


☐ terraced valley floor


☐ symmetrical floodplain


☐ asymmetrical floodplain

NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use 𝍸 then indicate total number)*

Riffles	𝍸	Unvegetated point bars	𝍸
Pools	𝍸	Vegetated point bars	𝍸

Spot check 1 is at: upstream end ☒ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	NO	NO	NO	NO	PC	PC	PC	NO	NO	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	VS	NO	SC	VS	NO	NO	VS	VS	VS	NO
CHANNEL	(+SI)								WEED	
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	GP	GP	SI	SI	SI	SI	SI	CL	SI	SI
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	RP	SM	NP	NP	SM	NP	SM	SM	SM	SM
Channel modification(s) NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	TR	NO	NO	NO	NO	NO	NO	NO	NO	NO
RIGHT BANK					DRESSING					
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	NO	RS/PC	NO	NO	PC	PC	PC	RS	RS	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	VS	NO	NO	NO	NO	NO	NO	NO

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose one from BL, CP, MH, SC, RP, WL, OW, IG, TL, SU

LAND USE WITHIN 5m OF BANKTOP (L)	SC	IG	IG	IG	IG	IG	IG	IG	IG	IG
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	S	U	S	U	U	U	U	S	U	U
LEFT BANK FACE *(structure)* B/U/S/C	S	S	C	S	U	U	S	S	S	S
RIGHT BANK FACE *(structure)* B/U/S/C	C	U	S	S	U	U	U	U	U	S
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	S	U	U	U	U	U	U	U	U	U
LAND USE WITHIN 5m OF BANK TOP (R)	SC	IG	IG	IG	IG	IG	IG	IG	IG	IG

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present)*

NONE *(tick as appropriate)*											
Liverworts/mosses/lichens	✓		✓								✓
Emergent broad-leaved herbs Epilobium sp. Apium	✓	✓	✓			✓	✓		✓		✓
Emergent reeds/sedges/rushes Sparganium Glyceria Phalaris Iris	E	E	✓	✓	✓	E	✓	✓	✓	✓	E
Floating-leaved (rooted)											
Free-floating Lemna sp.				✓	✓	✓					✓
Amphibious											
Submerged broad-leaved											
Submerged fine/linear-leaved Potamog. sp Myriophyll	E	E	✓	✓	✓	✓	✓	✓	✓	✓	✓
Filamentous algae	✓	✓	✓	✓	✓	✓	✓	E	✓	✓	E

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓) ↑

RB = 1
LB = 1
Chara (+ fungus)

1 LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*			Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*	E	E
Scrub *(SC)*			Tilled land *(TL)*		
Rough pasture *(RP)*			Suburban/urban development *(SU)*		

2 BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut	✓	✓	Resectioned	✓	E
Vertical + toe			Reinforced - whole bank	✓	✓
Steep (>45°)	E	E	Reinforced - top only		
Gentle			Reinforced - toe only		
Composite			Artificial two-stage		
Use this space to draw profile if different from above, after ticking predetermined box			Poached	E	E
			Embanked		
			Set-back embankments		

3 EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

	Left	Right
None	☐	☐
Isolated/scattered	☐	☐
Regularly spaced, single	☐	☐
Occasional clumps	☑	☑
Semi-continuous	☐	☐
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☑	☐
Overhanging boughs	☐	☑	☐
Exposed bankside roots	☑	☐	☐
Underwater tree roots	☐	☑	☐
Fallen trees	☐	☑	☐
Coarse woody debris	☐	☑	☐

4 EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E
Waterfall(s) *~free-fall*	☑	☐	☐
Cascades(s) *~chute* (WIER)	☐	☑	☐
Step/pool sequence	☑	☐	☐
Rapid(s) *~whitewater*	☑	☐	☐
Riffle-pool sequence	☑	☐	☐
Run(s) *~disturbed, rippled*	☑	☐	☐
Boil(s) *~upwellings*	☑	☐	☐
Glide(s) *~smooth, no eddies*	☐	☐	☑

	None	Present	E
Marginal deadwater *~slack*	☐	☐	☑
Exposed bedrock (CLAY)	☐	☑	☐
Exposed boulders	☑	☐	☐
Unvegetated mid-channel bars	☑	☐	☐
Vegetated mid-channel bars	☑	☐	☐
Mature island(s)	☑	☐	☐
Unvegetated side bars	☑	☐	☐
Vegetated side bars	☐	☐	☑

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK				RIGHT BANK	
Banktop height (m)	0.3	Water width (m)	7.0	Banktop height (m)	0.2
Embanked height (m)	—	Water depth (m)	0.5	*Embanked height (m)*	—

Banktop width (m): 8.0

If trashline lower than banktop break in slope, indicate: height (m) — width(m) —

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurement is: riffle ☐ run or glide ☑ other ☐ *(tick one box)* **Slope (IFE only)**

M ARTIFICIAL FEATURES *(Use 1 Indicate total number, tick "none" where appropriate)*

None ☐ Number of Culverts= Weirs=1 Outfalls= Fords =

Footbridges =1 Roadbridges =1 Other=

Is water level controlled by weir/dam downstream? No ☐ . Part of site ☑ Most/whole of site ☐

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging ☑ small-scale clearance of reeds mowing ☐ Other ? State .....

weed-cutting ☐ enhancement ☐

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☐	Bog	☐	Other (state) .....
~~Braided~~/side channels	☑	Natural open water	☐	Carr	☐	
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☑	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☐ YES ☑

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State .....

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Sluggish channel - mostly silt (GP at top)

Plants of note: Abundant channel macrophyte.

Major conservation features: Small BL plantations on RHS.

Major impacts: RS / dredging. Weir near bottom section.

Incidental observations (animals etc): Club.

S DISEASED ALDERS *(Tick one box)*

None ☑ Present ☐ Extensive ☐ Other diseased trees? State .....

SEND COMPLETED FORM TO HUGH DAWSON, IFE, RIVER LABORATORY, EAST STOKE, WAREHAM, BH20 6BB

P-49428.TL

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

5 *Reference network site number:* PA 08

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP 469354 River: SOR BROOK

Date 18/9/1995 Time: 12.45 Surveyor name NIALL SCIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....

Bed of river visible? No ☐ partially ☑ entirely ☐ *(tick one box)*

Duplicate photographs: general character? No ☐ Yes ☑ *(tick one box)* 27

Site surveyed from: left bank ☐ right bank ☑ channel ☐ *(tick as appropriate)*

PREDOMINANT VALLEY FORM *(tick one box only)*


☑ shallow vee

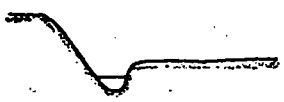

☐ deep vee


☐ gorge


☐ concave/bowl


☐ terraced valley floor


☐ symmetrical floodplain


☐ asymmetrical floodplain

NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use 1/1 then indicate total number)*

Riffles 1	Unvegetated point bars 1
Pools 1	Vegetated point bars 1

NRA RIVER HABITAT SURVEY 1995: TEN SPOT CHECKS

Spot check 1 is at: upstream end ☑ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	SC	SC	NO	NO	SC	NO	NO	NO	NO	NO
CHANNEL					NVC = 3 CHAN.					
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	SI	GP	SI	SI	SI	GP	GP	GP	GP	GP
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	NP	SM	SM	SM	SM	SM	SM	SM	SM	SM
Channel modification(s) ? NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	NO	NO	NO	NO	NO	NO	NO	NO	TR	NO
RIGHT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	SP	EA	EA	SP	EA	EA	WP	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	NO	NO	RI	NO	NO	RI	NO	NO	RI	NO
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	SC	NO	SC	NO	NO	NO	SC	NO	NO

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose one from BL, CP, MH, SC, RP, WL, OW, IG, TL, SU = GDN

	1	2	3	4	5	6	7	8	9	10
LAND USE WITHIN 5m OF BANKTOP (L)	SU	SU	BL	BL	SU	BL	SU	SU	BL	SU
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	S	S	C	C	S	C	S	U	C	S
LEFT BANK FACE *(structure)* B/U/S/C	U	S	S	U	S	S	C	S	S	S
RIGHT BANK FACE *(structure)* B/U/S/C	U	U	S	U	S	B	S	S	B	S
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	S	S	S	B	B	B	B	S
LAND USE WITHIN 5m OF BANK TOP (R)	SU	SU	BL	BL	BL	SU	SU	SU	SU	SU

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present))*

NONE *(tick as appropriate)*									✓	
Liverworts/mosses/lichens	✓	✓	✓	✓	✓					✓
Emergent broad-leaved herbs Epilobium sp							✓			
Emergent reeds/sedges/rushes Sagg Horia			✓			✓				✓
Floating-leaved (rooted) Nuphar	✓	✓	✓							
Free-floating										
Amphibious ? Water Dock										✓
Submerged broad-leaved Nuphar Callitriche Elodea	✓	E	E			✓		✓		✓
Submerged fine/linear-leaved Potamog. Myriophyll.		✓	✓		✓	E		✓		E
Filamentous algae		E				E	E	E		✓

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓) ↑

P-49428.TL Rb = 11
Rb = 1 Minnows

↑ SIDE CHANNEL

LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*	E		Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*		
Scrub *(SC)*			Tilled land *(TL)*		
Tough pasture *(RP)*			Suburban/urban development *(SU)*	E	E

BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut	E	E	Resectioned		
Vertical + toe			Reinforced - whole bank	✓	E
Steep (>45°)	E	E	Reinforced - top only		
Mole			Reinforced - toe only		
Composite			Artificial two-stage		
Use this space to draw profile if different from above, after ticking predetermined box			Poached		
			Embanked		
			Set-back embankments		

EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

	Left	Right
None	☐	☐
Isolated/scattered	☐	☐
Regularly spaced, single	☐	☐
Occasional clumps	☐	☑
Semi-continuous	☑	☐
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☐	☑
Overhanging boughs	☐	☐	☑
Exposed bankside roots	☑	☐	☐
Underwater tree roots	☐	☐	☑
Fallen trees	☐	☑	☐
Coarse woody debris	☐	☑	☐

EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E		None	Present	E
Waterfall(s) *~free-fall*	☑	☐	☐	Marginal deadwater *~slack*	☐	☐	☑
Cascades(s) *~chute*	☑	☐	☐	Exposed bedrock	☑	☐	☐
Step/pool sequence	☑	☐	☐	Exposed boulders	☑	☐	☐
Rapid(s) *~whitewater*	☑	☐	☐	Unvegetated mid-channel bars	☑	☐	☐
Riffle-pool sequence	☑	☐	☐	Vegetated mid-channel bars	☑	☐	☐
Run(s) *~disturbed, rippled*	☑	☐	☐	Mature island(s)	☑	☐	☐
Pool(s) *~upwellings*	☑	☐	☐	Unvegetated side bars	☑	☐	☐
Glide(s) *~smooth, no eddies*	☐	☐	☑	Vegetated side bars	☑	☐	☐

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK		Banktop width (m)	6·0	RIGHT BANK	
Banktop height (m)	0·75	Water width (m)	5·5	Banktop height (m)	0·75
Embanked height (m)	—	Water depth (m)	0·4	*Embanked height (m)*	—

If trashline lower than banktop break in slope, indicate: height (m) 0·5 width(m) 5·5

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurement is: riffle ☐ run or glide ☑ other ☐ *(tick one box)* **Slope (IFE only)**

M ARTIFICIAL FEATURES *(Use 44 Indicate total number, tick "none" where appropriate)*

None ☐ Number of Culverts= Weirs= 1 Outfalls= Fords =

Footbridges = 2 Roadbridges = 1 Other=

Is water level controlled by weir/dam downstream? No ☐ Part of site ☑ Most/whole of site ☐

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging ☐ mowing ☐ Other ? State —

weed-cutting ☐ enhancement ☐

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☐	Bog	☐	Other (state) .....
~~Braided~~/side channels	☑	Natural open water	☐	Carr	☐	
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☑	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☑ YES ☐

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ ?Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State .....

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Change in character – more SM + SP

Plants of note: — Straight channel, uniform features.

Major conservation features: — BL woodland LHB.

Major impacts: Modified channel, with original stream as side channel.

Incidental observations (animals etc): RS/RI banks – Urban section

(*) Side channel = more features RF/Pool, woody debris etc

S DISEASED ALDERS *(Tick one box)*

None ☑ Present ☐ Extensive ☐ Other diseased trees? State .....

SEND COMPLETED FORM TO HUGH DAWSON, IFE, RIVER LABORATORY, EAST STOKE, WAREHAM, BH20 6BB

P-49428.TL

Mill at U/S end (+ pond).

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

4 *Reference network site number:* PA-10

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP 463361 River: SOR BROOK

Date 18/9./1995 Time: 11:00 Surveyor name NIALL GRIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....

Bed of river visible? No ☐ partially ☑ entirely ☐ *(tick one box)*

Duplicate photographs: general character? No ☐ Yes ☑ *(tick one box)* 25 56

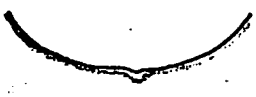
Site surveyed from: left bank ☑ right bank ☐ channel ☐ *(tick as appropriate)*

PREDOMINANT VALLEY FORM *(tick one box only)*

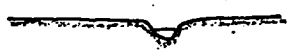

☑ shallow vee


☐ deep vee


☐ gorge


☐ concave/bowl


☐ terraced valley floor


☐ symmetrical floodplain


☐ asymmetrical floodplain

NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use 卌 then indicate total number)*

Riffles 卌	Unvegetated point bars 卌
Pools 卌	Vegetated point bars 卌

Spot check 1 is at: upstream end ☑ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	PC/RS	PC/RS	PC/RS	RS	RS/RC	RS/RC	RS/RC	RS/RC	RS/RC	RS/RC
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CHANNEL										
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	NP	NP	SM	SM	SM	SM	NP	NF	NP	NP
Channel modification(s) NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
RIGHT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	RS	RS	RS/RC	RS/RC	RS/RC	PC	RS	RS	NO	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose one from BL, CP, MH, SC, RP, WL, OW, HG, TL, SU

LAND USE WITHIN 5m OF BANKTOP (L)	HG	HG	HG	HG	HG	HG	HG	HG	HG	HG
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	U	U	U	U	U	U	U
LEFT BANK FACE *(structure)* B/U/S/C	S	S	S	U	S	S	U	S	U	U
RIGHT BANK FACE *(structure)* B/U/S/C	S	S	U	U	U	S	S	S	U	U
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	U	U	U	U	U	U	U
LAND USE WITHIN 5m OF BANK TOP (R)	HG	HG	HG	HG	HG	HG	HG	HG	HG	HG

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present)*

NONE *(tick as appropriate)*										
Liverworts/mosses/lichens										
Emergent broad-leaved herbs Apium		✓	✓		✓		E		✓	
Emergent reeds/sedges/rushes Phalaris Sparganium Sagittaria	E	E	E	E	E	E	✓	E	E	E
Floating-leaved (rooted) Nuphar	✓					✓				
Free-floating Lemna sp	✓	✓							✓	
Amphibious Myosotis Veronica b	✓	✓	✓	✓	E	✓		✓		
Submerged broad-leaved Elodea			E	E	✓		E		✓	
Submerged fine/linear-leaved Potamog sp	✓				✓				✓	
Filamentous algae			✓		✓	✓	✓		E	

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓)

LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*			Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*	E	E
Scrub *(SC)*			Tilled land *(TL)*		
Rough pasture *(RP)*			Suburban/urban development *(SU)*		

BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut			Resectioned	E	E
Vertical + toe			Reinforced - whole bank		
Steep (>45°)	✓	✓	Reinforced - top only		
Toe			Reinforced - toe only		
Composite			Artificial two-stage		
Use this space to draw profile if different from above, after ticking predetermined box			Poached	E	E
			Embanked		
			Set-back embankments		

EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

Mostly pollarded willows

	Left	Right
None	☐	☐
Isolated/scattered	☑	☑
Regularly spaced, single	☐	☐
Occasional clumps	☐	☐
Semi-continuous	☐	☐
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☑	☐
Overhanging boughs	☐	☑	☐
Exposed bankside roots	☑	☐	☐
Underwater tree roots	☐	☑	☐
Fallen trees	☑	☐	☐
Coarse woody debris	☐	☑	☐

EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E
Waterfall(s) *~free-fall*	☑	☐	☐
Cascades(s) *~chute*	☑	☐	☐
Step/pool sequence	☑	☐	☐
Rapid(s) *~whitewater*	☑	☐	☐
Ruffle-pool sequence	☑	☐	☐
Run(s) *~disturbed, rippled*	☑	☐	☐
Boil(s) *~upwellings*	☑	☐	☐
Glide(s) *~smooth, no eddies*	☐	☐	☑

	None	Present	E
Marginal deadwater *~slack*	☐	☐	☑
Exposed bedrock	☐	☐	☐
Exposed boulders	☑	☐	☐
Unvegetated mid-channel bars	☑	☐	☐
Vegetated mid-channel bars	☑	☐	☐
Mature island(s)	☑	☐	☐
Unvegetated side bars	☑	☐	☐
Vegetated side bars	☑	☐	☐

NB: Channel choked;
areas of Sparganium / Sagittaria
Previously widened - now recovering (ie. narrowing)
= long vegetated side / berm.

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK		Banktop width (m)	5.75	RIGHT BANK	
Banktop height (m)	0.75	Water width (m)	4.25	Banktop height (m)	0.7
Embanked height (m)	—	Water depth (m)	1.25	*Embanked height (m)*	—

If trashline lower than banktop break in slope, indicate: height (m) 0.5 width(m) 5.5

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurement is: riffle ☐ run or glide ☑ other ☐ *(tick one box)* **Slope (IFE only)**

M ARTIFICIAL FEATURES *(Use* |H| *Indicate total number, tick "none" where appropriate)*

None ☑ Number of Culverts= Weirs= Outfalls= Fords =

Footbridges = Roadbridges = Other=

Is water level controlled by weir/dam downstream? No ☑ . Part of site ☐ Most/whole of site ☐

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging ☐ mowing ☐ Other ? State Tree felling/... Clearing

weed-cutting ☐ enhancement ☐

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☐	Bog	☐	Other (state) .....
Braided/side channels	☐	Natural open water	☐	Carr	☐	
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☐	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☐ YES ☑

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State .....

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Meandering channel, which has extensive BM / Marginal vegetation. Silty substr. Smooth flow inbetween veg.

Plants of note:

Major conservation features: > Channel widened in past, now recovering.

Major impacts: RS banks + extensive poaching.

Incidental observations (animals etc): Sympetrum sp. Minnows.

S DISEASED ALDERS *(Tick one box)*

None ☐ Present ☑ (Dead) Extensive ☐ Other diseased trees? State .....

SEND COMPLETED FORM TO HUGH DAWSON, IFE, RIVER LABORATORY, EAST STOKE, WAREHAM, BH20 6BB

P-49428.TL

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

3 *Reference network site number:* PA 12

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP 462369 River: SOR BROOK

Date 14/9/1995 Time: 17.00 Surveyor name NIALL GRIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....

Bed of river visible? No ☐ partially ☐ entirely ☑ *(tick one box)*

Duplicate photographs: general character? No ☐ Yes ☑ *(tick one box)* 23 24

Site surveyed from: left bank ☑ right bank ☑ channel ☐ *(tick as appropriate)*

PREDOMINANT VALLEY FORM *(tick one box only)*


☑ shallow vee


☐ terraced valley floor


☐ deep vee


☐ symmetrical floodplain


☐ gorge


☐ asymmetrical floodplain


☐ concave/bowl

NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use |||| then indicate total number)*

Riffles	2	Unvegetated point bars	\
Pools	2	Vegetated point bars	\

NRA RIVER HABITAT SURVEY 1995: TEN SPOT CHECKS

Spot check 1 is at: upstream end ☑ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	CC	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	RS	NO	RI	RS	RS	NO	NO	RS	NO	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	SC	NO	NO	NO	NO	NO	NO	NO	NO
CHANNEL	SI									
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	GP	SI	SI	SI	SI	SI	SI	SI	GP	GP
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	SM	NP	SM	SM	SM	NP	SM	SM	UW	UW
Channel modification(s) NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	TR	NO	NO	NO	NO	NO	TR	NO	NO	NO (TP)
RIGHT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	BR	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	NO	PC/RS	RS	NO	NO	NO	NO	NO	RI	NO
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose one from BL, CP, MH, SC, RP, WL, OW, IG, TL, SU

LAND USE WITHIN 5m OF BANKTOP (L)	SU	TL	TL	TL	TL	TL	TL	TL	TL	TL
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	B	B	B	B	U	U	U	U
LEFT BANK FACE *(structure)* B/U/S/C	S	S	B	U	U	S	S	U	S	S
RIGHT BANK FACE *(structure)* B/U/S/C	S	S	S	S	S	S	S	S	C	S
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	S	S	C	C	C	B	C
LAND USE WITHIN 5m OF BANK TOP (R)	IG	IG	IG	BL	BL	BL	BL	SU	SU	SU

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present))*

NONE *(tick as appropriate)*				✓							✓
Liverworts/mosses/lichens			✓					✓	✓		✓
Emergent broad-leaved herbs Epilobium sp.		✓	✓			✓	✓		✓	✓	✓
Emergent reeds/sedges/rushes Sparganium erectum.	✓	✓			✓			✓	✓		✓
Floating-leaved (rooted)											
Free-floating Lemna sp.		✓				✓		✓			✓
Amphibious Myosotis, Veronica b. Mentha aq.	✓								✓	✓	✓
Submerged broad-leaved											
Submerged fine/linear-leaved Potamog sp. Ranunculus	✓	✓	✓		✓	✓					✓
Filamentous algae								✓	E	✓	✓

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓) ↑

II LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*		E	Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*		✓
Scrub *(SC)*			Tilled land *(TL)*	E	
Rough pasture *(RP)*			Suburban/urban development *(SU)*	✓	✓

I BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut			Resectioned	E	✓
Vertical + toe			Reinforced - whole bank	✓	✓
Steep (>45°)	✓	✓	Reinforced - top only		
Mle			Reinforced - toe only		
Composite			Artificial two-stage		
			Poached		✓
			Embanked		
			Set-back embankments		

Use this space to draw profile if different from above, after ticking predetermined box

I EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

	Left	Right
None	☐	☐
Isolated/scattered	☐	☐
Regularly spaced, single	☐	☐
Occasional clumps	☑	☐
Semi-continuous	☐	☑
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☐	☑
Overhanging boughs	☐	☐	☑
Exposed bankside roots	☑	☐	☐
Underwater tree roots	☐	☐	☑
Fallen trees	☐	☑	☐
Coarse woody debris	☐	☑	☐

EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E
Waterfall(s) *~free-fall*	☑	☐	☐
Cascades(s) *~chute*	☑	☐	☐
Step/pool sequence	☑	☐	☐
Rapid(s) *~whitewater*	☐	☑	☐
Riffle ~~pool sequence~~	☐	☑	☐
Run(s) *~disturbed, rippled*	☐	☑	☐
Boil(s) *~upwellings*	☐	☑	☐
Glide(s) *~smooth, no eddies* (SLOW)	☐	☐	☑

	None	Present	E
Marginal deadwater *~slack*	☐	☑	☐
Exposed bedrock	☑	☐	☐
Exposed boulders	☑	☐	☐
Unvegetated mid-channel bars	☑	☐	☐
Vegetated mid-channel bars	☑	☐	☐
Mature island(s)	☑	☐	☐
Unvegetated side bars	☑	☐	☐
Vegetated side bars	☑	☐	☐

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK		Banktop width (m)	7.5	RIGHT BANK	
Banktop height (m)	2.0	Water width (m)	5.0	Banktop height (m)	2.0
Embanked height (m)	\	Water depth (m)	0.2	*Embanked height (m)*	\

If trashline lower than banktop break in slope, indicate: height (m) 0.75 width(m) 6.0

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurement is: riffle ☑ run or glide ☐ other ☐ *(tick one box)* **Slope (IFE only)**

M ARTIFICIAL FEATURES *(Use |||| Indicate total number, tick "none" where appropriate)*

None ☐ Number of Culverts= Weirs= 1 Outfalls= 2 Fords =

Footbridges = Roadbridges = 1 Other=

Is water level controlled by weir/dam downstream? No ☐ Part of site ☑ Most/whole of site ☐

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging ☐ mowing ☐ ✓ Other ? State Gauging. Weir.

weed-cutting ☐ enhancement ☐ (+) R1/RS Banks.

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☐	Bog	☐	Other (state) .....
Braided/side channels	☐	Natural open water	☐	Carr	☐	
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☑	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☑ YES ☐

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State \

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Predominantly slow flowing (sluggish) channel. Silt. More uniform in character. >More varied below weir.

Plants of note: \

Major conservation features: BL woodland strip along (RHS).

Major impacts: Pumping sta, outfalls, + Gauging wier. RS banks.

Incidental observations (animals etc): Trash in channel. Roach.

S DISEASED ALDERS *(Tick one box)*

None ☑ Present ☐ Extensive ☐ Other diseased trees? State .....

SEND COMPLETED FORM TO HUGH DAWSON, IFE, RIVER LABORATORY, EAST STOKE, WAREHAM, BH20 6BB

P49428.TL

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

2 *Reference network site number:* PA 14

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP 451372 River: SOR BROOK

Date 14/9/1995 Time: 15:00 Surveyor name NIALL GRIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....

Bed of river visible? No ☐ partially ☐ entirely ☑ *(tick one box)*

Duplicate photographs: general character? No ☑ Yes ☐ *(tick one box)* 22

Site surveyed from: left bank ☑ right bank ☐ channel ☑ *(tick as appropriate)*

PREDOMINANT VALLEY FORM *(tick one box only)*


☑ shallow vee


☐ terraced valley floor


☐ deep vee


☐ symmetrical floodplain


☐ gorge


☐ asymmetrical floodplain


☐ concave/bowl

NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use 1/1 then indicate total number)*

Riffles	2	Unvegetated point bars	1
Pools	3	Vegetated point bars	1

Spot check 1 is at: upstream end ☑ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	BR	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	PC/BM	PC/BM	PC/RS	RS	NO	NO	EM	EM	RI	NO
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	NO	NO	SC	SC	NO	NO	NO	VS
CHANNEL										
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	SI	SI	SI	SI	SI	SI	SI	SI	GP	GP
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	SM	NP	SM	NP	SM	SM	SM	SM	SM	RP
Channel modification(s) NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	RS	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
RIGHT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	RS	RS	NO	NO	NO	NO	NO	NO	RS	NO
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	VS	NO	SC	NO	NO	SC	SC	NO	VS

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose ~~one from~~ BL, CP, MH, SC, RP, WL, OW, IG, TL, SU — SILTY →

	1	2	3	4	5	6	7	8	9	10
LAND USE WITHIN 5m OF BANKTOP (L)	IG	IG	IG	IG	IG	IG	SC	SU	SU	IG
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	U	S	U	S	U	B	U
LEFT BANK FACE *(structure)* B/U/S/C	S	U	U	U	S	U	U	S	B	S
RIGHT BANK FACE *(structure)* B/U/S/C	U	S	S	S	S	S	S	S	S	S
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	S	S	S	C	C	U	S	U
LAND USE WITHIN 5m OF BANK TOP (R)	IG	IG	SC	BL	SC	BL	BL	BL	SU	IG

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present)*

NONE *(tick as appropriate)*						✓	✓				✓
Liverworts/mosses/lichens				✓					✓		✓
Emergent broad-leaved herbs Butterbur, Epilobium sp	✓		✓		✓			✓			✓
Emergent reeds/sedges/rushes Glyceria, Sparganium, Rushes	✓	E	✓	✓						✓	✓
Floating-leaved (rooted)											
Free-floating Lemna sp		✓									✓
Amphibious Veronica b, Myosotis	✓	✓		✓						✓	✓
Submerged broad-leaved Mlphar								✓			✓
Submerged fine/linear-leaved Potamogeton sp.	E	E	✓					✓	✓		E
Filamentous algae			✓						✓	E	✓

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓) ↑

Trout 1/2lb

H LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*	✓	E	Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*	E	✓
Scrub *(SC)*		✓	Tilled land *(TL)*		
Rough pasture *(RP)*			Suburban/urban development *(SU)*	✓	✓

I BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut	✓	✓	Resectioned	E	✓
Vertical + toe			Reinforced - whole bank	✓	✓
Steep (>45°)	✓	E	Reinforced - top only		
[illegible]			Reinforced - toe only		
Composite			Artificial two-stage		
Use this space to draw profile if different from above, after ticking predetermined box			Poached	✓	
			Embanked	✓	
			Set-back embankments		

J EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

	Left	Right
None	☐	☐
Isolated/scattered	☐	☐
Regularly spaced, single	☐	☐
Occasional clumps	☑	☐
Semi-continuous	☐	☑
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☐	☑
Overhanging boughs	☐	☐	☑
Exposed bankside roots	☑	☐	☐
Underwater tree roots	☐	☐	☑
Fallen trees	☑	☐	☐
Coarse woody debris	☐	☑	☐

K EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E
Waterfall(s) *~free-fall* (MILL)	☐	☑	☐
ascades(s) *~chute* (MILL)	☐	☑	☐
Step/pool sequence	☑	☐	☐
apid(s) *~whitewater*	☐	☑	☐
iffle-~~pool~~sequence	☐	☑	☐
n(s) *~disturbed, rippled*	☐	☑	☐
il(s) *~upwellings*	☐	☑	☐
Glide(s) *~smooth, no eddies*	☐	☐	☑

	None	Present	E
Marginal deadwater *~slack*	☐	☑	☐
Exposed bedrock	☑	☐	☐
Exposed boulders	☑	☐	☐
Unvegetated mid-channel bars	☑	☐	☐
Vegetated mid-channel bars (1)	☐	☑	☐
Mature island(s)	☑	☐	☐
Unvegetated side bars	☑	☐	☐
Vegetated side bars (see below)	☐	☑	☐

NOTE: channel previously widened, now naturally recovering (ie narrowing) = VS/BM, extensive side channel & Sparganium erect, acting as a berm.

(AT TOP END OF SURVEY REACH)

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK		Banktop width (m)	6.0	RIGHT BANK	
Banktop height (m)	1.0	Water width (m)	4.0	Banktop height (m)	1.0
Embanked height (m)	—	Water depth (m)	0.2	*Embanked height (m)*	—

If trashline lower than banktop break in slope, indicate: height (m) — width(m) —

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurement is: riffle ☑ run or glide ☐ other ☐ *(tick one box)* **Slope (IFE only)**

M ARTIFICIAL FEATURES *(Use |/| Indicate total number, tick "none" where appropriate)*

None ☐ Number of Culverts= Weirs=1 Outfalls= Fords =
Footbridges =1 Roadbridges = Other= PIPE OVER RIVER

Is water level controlled by weir/dam downstream? No ☐ Part of site ☐ Most/whole of site ☑

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging ☑ small area near hatch mowing ☐ Other ? State Light maintenance of bank by pipe over river

weed-cutting ☐ enhancement ☐

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☐	Bog	☐	Other (state) Scrub marshlike veg. between main channel & side channel.
Braided/side channels	☑	Natural open water	☐	Carr	☐	
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☑	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☑ YES ☐

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State .....

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Modified channel - predominantly silt. Slow flow.

Plants of note: — Side channel + mill: GP + fastes below mill.

Major conservation features: Woodland + open area of Scrub/Rough ground (RHB).

Major impacts: Top end = RS/Widened in past, now recovering (LE: narrowing [BM]

Incidental observations (animals etc):

Pike + Trout.

S DISEASED ALDERS *(Tick one box)*

None ☑ Present ☐ Extensive ☐ Other diseased trees? State .....

SEND COMPLETED FORM TO HUGH DAWSON, IFE, RIVER LABORATORY, EAST STOKE, WAREHAM, BH20 6BB

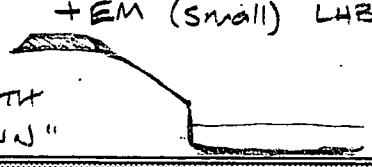
H LAND USE WITHIN 50m OF BANKTOP *Use E (≥ 33% banklength) or ✓ if present*

	L	R		L	R
Broadleaf/mixed woodland *(BL)*			Wetland (eg bog, marsh, fen) *(WL)*		
Coniferous plantation *(CP)*			Open water *(OW)*		
Moorland/heath *(MH)*			Improved/semi-improved grass *(IG)*	E	E
Scrub *(SC)* WITHIN MEANDER POINTS	✓	✓	Tilled land *(TL)*		✓
Rough pasture *(RP)*			Suburban/urban development *(SU)*		

I BANK PROFILES *Use E (≥ 33% banklength) or ✓ if present*

Natural/unmodified	L	R	Artificial/modified	L	R
Vertical/undercut	✓	E	Resectioned (see Diag.)	E	E
Vertical + toe			Reinforced - whole bank		
Steep (>45°)			Reinforced - top only		
Gentle			Reinforced - toe only		
Composite			Artificial two-stage		
			Poached	✓	
			Embanked		
			Set-back embankments		

Use this space to draw profile if different from above, after ticking predetermined box



RS BANKS, WITH "CUTTING DOWN"

J EXTENT OF TREES AND ASSOCIATED FEATURES

TREES *(Tick one box per bank)*

	Left	Right
None	☐	☐
Isolated/scattered	☑	☐
Regularly spaced, single	☐	☐
Occasional clumps	☐	☑
Semi-continuous	☐	☐
Continuous	☐	☐

ASSOCIATED FEATURES *(Tick one box per feature)*

E ≥33%	None	Present	E
Shading of channel	☐	☑	☐
Overhanging boughs	☐	☑	☐
Exposed bankside roots	☑	☐	☐
Underwater tree roots	☐	☑	☐
Fallen trees	☐	☑	☐
Coarse woody debris	☐	☑	☐

K EXTENT OF CHANNEL FEATURES *(Tick one box per feature)*

	None	Present	E
Waterfall(s) *~free-fall*	☑	☐	☐
Cascades(s) *~chute*	☑	☐	☐
Step/pool sequence	☑	☐	☐
Rapid(s) *~whitewater*	☐	☑	☐
Riffle-~~pool sequence~~	☐	☑	☐
Run(s) *~disturbed, rippled*	☐	☑	☐
Boil(s) *~upwellings*	☐	☐	☑
Glide(s) *~smooth, no eddies*	☐	☐	☑

	None	Present	E
Marginal deadwater *~slack*	☐	☐	☑
Exposed bedrock (CLAY)	☐	☑	☐
Exposed boulders	☑	☐	☐
Unvegetated mid-channel bars	☑	☐	☐
Vegetated mid-channel bars	☑	☐	☐
Mature island(s)	☑	☐	☐
Unvegetated side bars	☑	☐	☐
Vegetated side bars	☐	☑	☐

NOTES Pollarded willows, Alder, Hawthorne.

L CHANNEL DIMENSIONS to be measured at one site on a straight uniform section, preferably across a riffle

LEFT BANK		Banktop width (m)	9.0	RIGHT BANK	
Banktop height (m)	2.0	Water width (m)	6.0	Banktop height (m)	2.8
Embanked height (m)	\	Water depth (m)	0.1	*Embanked height (m)*	\

If trashline lower than banktop break in slope, indicate: height (m) 0.5 width(m) 6.5

Bed material at site is: consolidated (compact) ☐ unconsolidated (loose) ☑ unknown ☐

Location of measuremont is: riffle ☑ run or glide ☐ other ☐ *(tick one box)* *Slope (IFE only)*

M ARTIFICIAL FEATURES *(Use |/// Indicate total number, tick "none" where appropriate)*

None ☐ Number of Culverts= Weirs= Outfalls= Fords =

Footbridges = Roadbridges = 1 Other=

Is water level controlled by weir/dam downstream? No ☒ . Part of site ☐ Most/whole of site ☐

N EVIDENCE OF RECENT MANAGEMENT *(Tick appropriate box)*

dredging ☐ mowing ☐ Other ? State .....

weed-cutting ☐ enhancement ☐

O FEATURES OF SPECIAL INTEREST *(Tick appropriate box(es))*

CHANNEL		FLOODPLAIN (50m corridor)				
Waterfalls > 5m high	☐	Artificial open water	☐	Bog	☐	Other (state) .....
Braided/side channels	☐	Natural open water	☐	Carr	☐	
Debris dams	☐	Water meadow	☐	Marsh	☐	
Leafy debris	☒	Fen	☐	Flush	☐	

P CHOKED CHANNEL *(Tick one box)*

Is 33% or more of the channel choked with vegetation? NO ☒ YES ☐

Q NOTABLE NUISANCE PLANT SPECIES *Use ✓ or E*

Giant Hogweed ☐ Himalayan Balsam ☐ Japanese Knotweed ☐ Other ? State .....

R BRIEF DESCRIPTION *(Use prompts and key words as appropriate)*

Descriptive sentence: Meandering channel, mostly Silt + some clay.

Plants of note: \ Slow flow: Mostly SM, some rans. (GP at top end)

Major conservation features: \ Good variety channel macrophytes

Major impacts: RS in past / Steep banks. (+ Small EM LHB)

Incidental observations (animals etc):

Sympetrum SD + Aeshna SD

Heron Kingfisher + ? Snipe

S DISEASED ALDERS *(Tick one box)*

None ☒ Present ☐ Extensive ☐ Other diseased trees? State .....

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P-49428.TL

A BACKGROUND MAP-BASED INFORMATION

Altitude(m)	Slope (m/km)	Flow category (1-10)
Solid geology code	Drift geology code	Planform category
Distance from source(km)	Significant tributary ?	Navigation ?

B FIELD SURVEY DETAILS

Reference network site number: PA16

Mid-section grid reference of network site if different from designated location:

COMPLETE THE FOLLOWING FOR ALL SITES

Grid Reference: SP438373 River: SOR BROOK

Date 14/9/1995 Time: 13.00 Surveyor name NIALL GRIEVE

Adverse conditions affecting survey? No ☑ Yes ☐ *If yes, state* .....

Bed of river visible? No ☐ partially ☐ entirely ☑ *(tick one box)*

Duplicate photographs: general character? No ☐ Yes ☑ *(tick one box)* 20 21

Site surveyed from: left bank ☐ right bank ☑ channel ☑ *(tick as appropriate)*

PREDOMINANT VALLEY FORM *(tick one box only)*


☑ shallow vee


☐ deep vee


☐ gorge


☐ concave/bowl


☐ terraced valley floor


☐ symmetrical floodplain


☐ asymmetrical floodplain

NUMBER OF RIFFLES, POOLS AND POINT BARS *(Use 𝍸 then indicate total number)*

Riffles 1	Unvegetated point bars 1
Pools 4	Vegetated point bars 1

Spot check 1 is at: upstream end ☑ downstream end ☐ of site *(Tick one box)*

E PHYSICAL ATTRIBUTES *(to be assessed across channel within a 1m wide zone)*

	1	2	3	4	5	6	7	8	9	10
LEFT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	PC	NO	RS	RS	RS	RS	NO	RS	RS	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	SC	VP	VS	NO	NO	SC	VS	NO	NO
CHANNEL								(4S)		
Channel substrate *(one)* NV,BE,BO,CO,GP,SA,SI,CL,AR	GP	SI	SI	CL	SI	CL	SI	GP	SI	GP
Flow type *(one)* FF,CH,BW,UW,CF,RP,UP,SM,NP,NO	UN	SM	SM	SM	SM	SM	SM	RP	NP	SM (UP)
Channel modification(s) NK,NO,RS,RI,DA,FO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel feature(s) NO,RO,MB,VB,MI,TR	TR	NO	NO	NO	NO	NO	NO	NO	NO	NO
RIGHT BANK										
Bank material *(one)* BE,BO,CO,GS,EA,PE,CL	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
Bank modification(s) NO,RS,RI,PC,BM,EM	NO	NO	NO	NO	NO	NO	NO	NO	RS	RS
Bank feature(s) NK,NO,EC,SC,PB,VP,SB,VS	NO	NO	SC	SC	SC	SC	SC	SC	NO	NO (+RS)

F BANKTOP LAND USE AND VEGETATION STRUCTURE *(to be assessed over a 10m wide transect)*

Land use: choose one from BL, CP, MH, SC, RP, WL, OW, IG, TL, SU

LAND USE WITHIN 5m OF BANKTOP (L)	IG	IG	RP	IG	IG	RP	RP	IG	SC	SC
LEFT BANK-TOP *(structure within 1m)* B/U/S/C	U	U	U	U	U	U	U	U	S	S
LEFT BANK FACE *(structure)* B/U/S/C	U	S	S	S	S	S	S	U	S	S
RIGHT BANK FACE *(structure)* B/U/S/C	S	S	S	S	S	S	U	S	S	U
RIGHT BANK-TOP *(structure within 1m)* B/U/S/C	S	U	U	U	U	U	U	U	U	U
LAND USE WITHIN 5m OF BANK TOP (R)	IG	IG	IG	IG	IG	IG	IG	IG	TL	SC

G CHANNEL VEGETATION TYPES *(fill in relevant boxes with one entry: use E (≥ 33% area) or ✓ (present)*

NONE *(tick as appropriate)*										
Liverworts/mosses/lichens	✓	✓	✓			✓			✓	✓
Emergent broad-leaved herbs Apium Epilobium	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Emergent reeds/sedges/rushes Sparganium Phalaris			✓	✓				E	✓	✓
Floating-leaved (rooted)										
Free-floating Lemna sp.						✓	✓		✓	
Amphibious Myosotis Mentha aq Veronica b.	✓	✓	✓		✓			✓		✓
Submerged broad-leaved										
Submerged fine/linear-leaved Pot m sp Sparganium		✓	✓	✓	E	E	✓	E	✓	✓
Filamentous algae	✓		✓				✓			

Use end 'catch-all' column for types not occurring in spot checks as well as overall assessment over 500m (use E or ✓)

Appendix 5 Macroinvertebrate species recorded from the Sor Brook (26 and 28 August 1995)

(⌘ indicates a Nationally Notable species; † indicates a 'local' species.)

Length	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Hirudinea																
Erpobdella octoculata	-	+	-	+	-	-	-	-	+	-	-	-	-	-	-	+
Glossiphonia complanata	+	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+
Haemopis sanguisuga	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Helobdella stagnalis	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Piscicola geometra	-	+	+	-	+	+	+	+	-	-	+	-	-	-	-	+
Theromyzon tessulatum	-	-	+	+	+	+	-	-	+	+	+	-	-	-	-	-
Gastropoda																
Acroloxus lacustris	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
Ancylus fluviatilis	+	-	-	+	+	+	+	+	-	-	-	-	+	-	-	+
Anisus vortex	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
Armiger crista	-	-	-	-	+	+	-	-	+	+	-	-	-	+	+	-
Bathyomphalus contortus	-	+	+	-	-	+	-	-	+	-	-	-	+	-	-	-
Bithynia tentaculata	+	+	+	+	+	+	-	+	+	-	-	+	+	-	-	-
Gyraulus albus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Hippeutis complanatus	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
Lymnaea auricularia	-	-	-	-	-	+	-	-	-	-	+	-	-	+	-	-
Lymnaea palustris	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Lymnaea peregra	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lymnaea stagnalis	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	+
Lymnaea truncatula	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Physa acuta	+	-	+	+	+	+	-	+	-	+	+	+	+	-	-	-
Physa fontinalis	-	-	+	-	+	-	-	-	+	-	-	+	+	-	-	-
Planorbis carinatus	+	+	+	+	+	+	-	+	+	-	+	-	+	-	+	-
Potamopyrgus jenkinsi	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Theodoxus fluviatilis	-	+	-	+	+	-	-	-	-	-	-	-	+	-	-	-
Valvata cristata	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Valvata piscinalis	+	+	+	+	+	+	-	-	+	-	+	+	+	-	-	+
Bivalvia																
Anodonta anatina	-	-	-	-	-	-	+	+	-	-	+	-	-	-	-	-
Anodonta sp. (juvenile)	-	-	-	-	-	-	-	-	-	-	-	-	(+)	-	(+)	-
Sphaerium corneum	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Unio pictorum	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Crustacea																
Asellus meridianus	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Crangonyx pseudogracilis	+	-	-	-	-	+	-	-	-	-	+	-	+	+	-	-
Gammarus pulex	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ephemeroptera																
Baetis buceratus	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	+
Baetis fuscatus	+	-	-	+	+	-	+	-	-	-	-	+	-	-	-	+
Baetis rhodani	-	-	+	+	+	-	+	-	-	-	+	+	+	+	+	+
Baetis scambus	-	-	-	-	-	-	+	-	-	-	-	+	+	-	-	-
Baetis vernus	-	-	+	-	-	-	-	+	-	-	-	+	+	-	-	+
Centroptilum luteolum	-	-	+	+	+	+	+	+	-	+	+	+	+	+	+	-
Centroptilum pennulatum	+	-	+	-	+	+	-	-	-	-	-	-	+	-	-	-
Cloeon dipterum	-	-	-	-	-	+	-	+	-	-	+	-	-	+	+	-

Appendix 5 Macroinvertebrate species recorded from the Sor Brook (26 and 28 August 1995)

Length	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Ephemeroptera (continued)																
Ephemera danica	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-
Ephemera vulgata	+	+	+	+	+	-	+	-	-	-	+	-	+	+	+	-
Ephemerella ignita	+	+	+	+	+	-	+	-	+	+	+	+	+	-	+	+
Habrophlebia fusca	-	+	-	-	-	-	-	+	-	-	+	-	-	-	+	+
Procloeon bifidum	+	+	+	-	+	-	-	-	-	-	-	-	+	-	+	-
Odonata																
Aeshna grandis	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Calopteryx splendens	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ischnura elegans	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Platycnemis pennipes⌘	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Plecoptera																
Leuctra fusca	-	+	-	+	+	-	+	-	-	-	-	+	+	+	-	+
Leuctra geniculata	+	-	+	+	-	-	+	-	-	-	-	+	-	-	-	-
Hemiptera																
Corixa punctata	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Gerris lacustris	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-
Hesperocorixa sahlbergi	-	-	-	+	-	-	-	+	-	-	-	-	-	+	-	-
Hydrometra stagnorum	-	+	+	+	-	-	-	+	-	+	+	+	-	-	-	-
Micronecta scholtzi†	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
Nepa cinerea	+	+	-	-	-	+	-	-	-	-	-	-	+	+	-	+
Notonecta glauca	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-
Notonecta maculata	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-
Notonecta marmorea	-	-	-	+	-	+	-	+	+	-	-	-	+	+	-	-
Plea leachi	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Sigara distincta	-	-	-	-	-	+	-	+	-	-	-	-	+	-	-	-
Sigara dorsalis	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-
Sigara falleni	-	-	-	-	-	+	-	-	+	-	+	+	-	+	-	-
Sigara fossarum	-	-	-	-	+	+	-	+	+	-	+	+	-	+	+	-
Velia caprai	+	-	-	+	-	+	-	-	-	-	-	-	+	-	+	+
Megaloptera																
Sialis lutaria	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+
Trichoptera																
Anabolia nervosa	-	-	-	-	-	-	+	-	+	-	+	-	-	+	-	-
Athripsodes albifrons	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Athripsodes cinereus	-	+	+	+	-	-	+	+	-	+	-	+	+	-	+	+
Brachycentrus subnubilus	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ceraclea nigronervosa	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Chaetopteryx villosa	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Goera pilosa	-	+	+	+	-	-	+	+	-	-	-	+	-	-	-	-
Halesus radiatus	-	-	+	-	+	-	+	-	-	-	+	-	-	+	-	-
Hydropsyche angustipennis	-	-	-	-	+	-	+	-	-	-	-	-	-	-	+	-
Hydropsyche contubernalis	-	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-
Hydropsyche pellucidula	+	+	+	+	+	-	+	-	-	-	-	-	-	-	+	+
(Hydroptila sp.)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Lype phaeopa	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-