



National Rivers Authority

River Darent



A Strategy for the Enhancement of the River Darent, Kent

Final Report
October 1992



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RIVER DARENT

A strategy for the enhancement of the
River Darent, Kent

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'THE DAILY TELEGRAPH'

Tuesday 16 June 1992

A STRATEGY FOR THE ENHANCEMENT OF THE RIVER DARENT

1 BRIEF AND BACKGROUND

The dried-up Darent is, of all the British rivers suffering from low flows, the most notorious cause célèbre and also the principal flagship for the NRA's concerted effort to tackle the difficult problems of overabstraction. These issues can now be seen to have replaced the old issue of land drainage as the major controversy concerning the environmental health of our rivers in the 1990s.

While the waters of the Darent have reduced with every passing year, the flow of reports on the matter has in no way diminished. Residents in the valley, ably represented by DRIPS (Darent River Preservation Society), have with some justification, however, sighed at the arrival of yet another group of consultants, setting about yet another report. The justification for this one is a major change of circumstances since Halcrow's report of 1987, together with a real concern to produce at least some environmental improvements on the ground, starting in the winter of 1992/93, in tandem with the much slower process of actually improving flows in the Darent Valley.

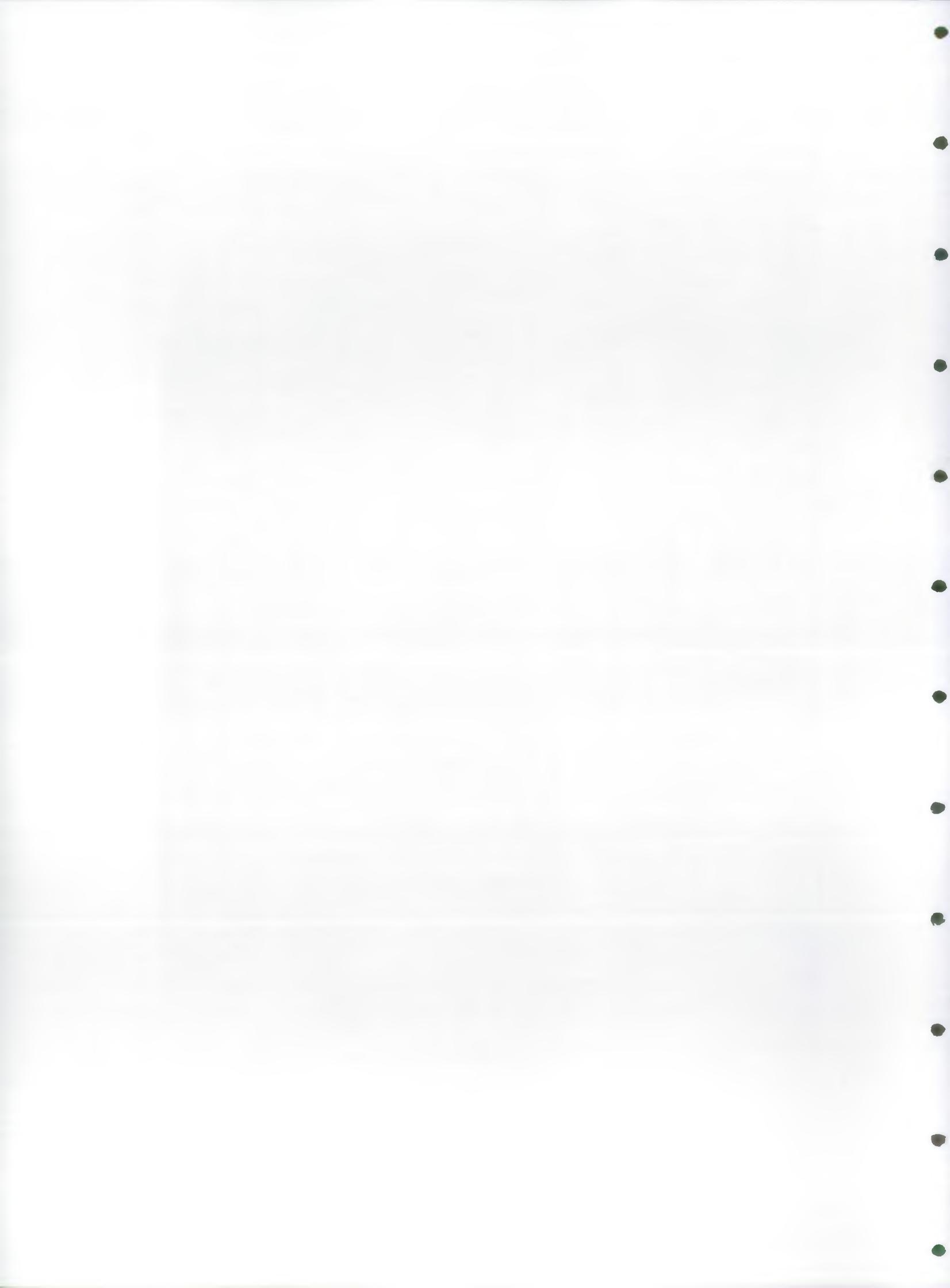
In 1992, National Rivers Authority (Southern Region) commissioned the landscape/ecological team at Mott MacDonald to liaise with residents and pressure groups in the valley, produce a broad corridor survey of the river from source to mouth and identify potential areas where landscape and habitat could be restored or enhanced. This report is parallel to detailed hydrological investigations also being prepared on the Darent by Groundwater Development Consultants of the Mott MacDonald Group.

Halcrow's May 1987 report on the River Darent for Thames Water Authority, includes an extensive section on landscape and recreation in the Darent Valley together with an excellent section on ecology written by Nigel Holmes. There also exists a series of botanical surveys of bridge points on the Darent made by Sylvia Haslam in 1969, 1971, 1972, 1974, 1977, 1979, 1983 and 1986 (see Appendix 4). It seems wasteful to reinvent the wheel as far as data gathering is concerned and so this report is designed to be complementary to other existing material.

Halcrow's report only covered the reach of the Darent downstream from Otford, while the whole of the Darent and its main river tributaries are here considered. Furthermore, the situation has been changed since 1987 by the emergence of the NRA, with a more open attitude to the option of reduced abstraction. This is bound to influence some of our conclusions, for example, an excessive length of lining can now be seen as an unsatisfactory substitute for the proper restoration of flows.



There is no point in carrying out localised enhancements on the River Darent unless the problem of low flows is also addressed. This is especially bad on the lower reaches of the river. Algal bloom in Dartford Park (above) and a dry bed at South Darent (below).



Our brief is fundamentally seen as no substitute to the restoration of adequate flows, for which reduction of abstraction is now openly accepted as a very important potential solution. Without this fundamental premise the authorities would always have been left open to charges of dodging the issue, and environmental enhancements proposed in this report seen as mere cosmetics. There is no way that any environmentalist can wave a magic wand and restore the riverine habitats of the Darent without restoring an adequate level of flow.

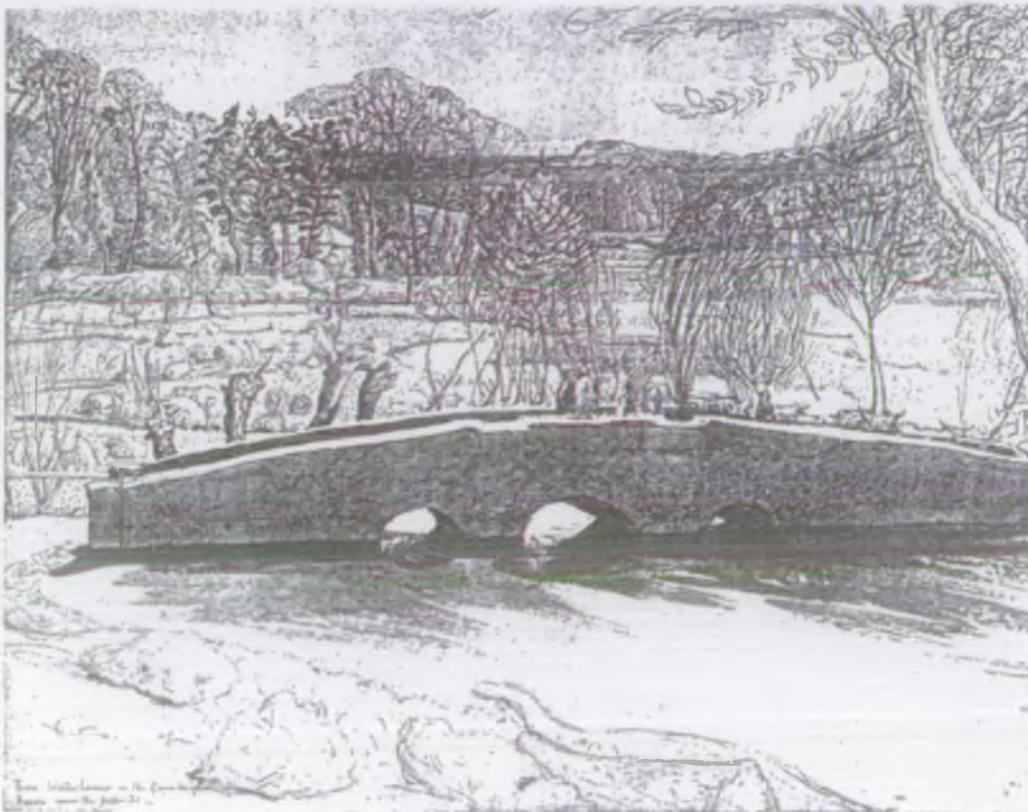
As far as this report is concerned therefore, Lord Crickhowell's statement of 15 June 1992, was extremely timely. In his statement, the NRA, gave Thames Water Utilities until 1 September 1992 to vary its abstraction licences for the Darent to 70% of the currently authorised 90 MI/d of water that they are allowed to take. 'If agreement on timetables cannot be reached', he said, 'the NRA will act unilaterally to vary abstraction licences downwards or revoke them completely'.

Against this background, the enhancements proposed in this report are not a substitute for water restoration but a sensible part of the overall wise management of the river. The brief for this study was to identify possible enhancement measures within the river corridor in order to modify the effects of low flows, and to improve landscape and ecological quality which has been impoverished by past drainage and other forms of management. Justification for the proposed enhancements can be summarised as follows:

- (i) Starting in the winter of 1992/93 with four sites where the river environment is especially degraded, the proposed enhancement will give 'on the ground' results ahead of full-scale restoration of river flows. Priority sites such as that at Horton Kirby, may also have some influence over the setting up of targets for reduced abstraction on specific reaches of the river.
- (ii) Once the low flows problem in the Darent have been resolved, the enhancements will remain as an additional bonus, created by taking the opportunity at the time when there was a focus of interest on the Darent and its problems.
- (iii) The environmental degradation of the River Darent is not confined to that of low flows. Heavy land drainage management in the past, intensive farming up to its margins, vandalism and neglect of historical structures, inadequate footpath access in a few places, unsympathetic engineering structures and ugly barbed-wire fencing all contribute to a reduction in landscape and ecological quality. The NRA has a duty to enhance the river environment and therefore the upgrading of the River Darent landscape can be seen as a legitimate part of its brief in addition to the restoration of water levels.

- (iv) It is a good time to assess the larger scale sites under consideration such as the Dartford Marshes and the Shoreham water meadows, in relation to wider planning issues which might usefully be dovetailed with good river management and also strategies which may include water storage as part of the restoration of flows. It is also possible that such proposals may be the springboard for more ambitious long term schemes eligible for grant aid, as part of overall conservation strategies for the valley, part of which is already within the North Downs Area of Outstanding Natural Beauty and may qualify for Countryside Stewardship payments under the category of waterside landscapes.

- (v) All the enhancements proposed will still cost considerably less than the major proposals recommended by Halcrow and yet will not involve the difficulties inherent in such large-scale artificial solutions as extensive bed-lining or the pumping of dilute sewage effluent.



The bridge at Shoreham The three arches and the lower half of the parapet (above) are still recognisable as the bridge in Samuel Palmer's 1828 watercolour (below) beyond which the sheep grazed watermeadows can be made out. The surviving remnant of those meadows may prove useful in boosting flows in Shoreham Village.



2 SCOPE AND STATUS OF REPORT

2.1 Design of Detailed Proposals

Outline sketches and detailed descriptions of the proposals are submitted although some sites such as the Shoreham Watermeadows and Dartford Marshes are so large and complex that it has only been possible to identify potential at this stage. Landowners have also been contacted in most cases to establish whether schemes are broadly feasible with the exceptions of Thames Water and landowners on the Dartford Marshes.

The intention of this study was not to produce designs in a finalised format for use as construction drawings. Accurate topographical surveys are not available at this stage to produce designs. Drawings are therefore in the form of detailed sketches, not accurately scaled, which give a reasonable impression of the schemes.

Exact positions of services have not been located and final construction details concerning brick walls, weirs and liner are yet to be decided.

In addition, an order of costs has been submitted for each scheme (see Appendix 1). For accurate final costings detailed surveys at the sites would be required. Liaison with a consultancy team within NRA, Thames Region, which is engaged on construction details and costings for weirs, has begun and should continue.

2.2 Liaison

Mott MacDonald has liaised with Trevor Carman of the flood alleviation section within the NRA, Sevenoaks District Council, Dartford District Council, Darent River Preservation Society (DRIPS), numerous fishermen and representatives of angling groups, and many individual landowners within the valley. An especially valuable contact has been Michael Mansell-Moullin, hydrological adviser to DRIPS. A list of important contacts with addresses and telephone numbers is in the appendix.

Having walked the river from source to mouth a clear picture of attitudes in the valley emerges. There is a common concern about the low flows in the Darent, but a far from common approach to how the water resource should be managed along the particular local reaches. The Darent Valley is the scenario of 'Manon des Sources' writ large: as the water becomes scarcer, conflicts develop among the competing groups as to who is to benefit from it, echoing the wider conflict between the NRA and Thames Water Utilities. Conservationists argue with farmers; leading members of DRIPS campaign for priority attention to be given to the wealthy mid-valley section at Shoreham where they live; the fishermen use river water in attempting to ensure the well-being of their lakes. In this situation the NRA will never be able to please everybody and the role of liaison increasingly becomes that of referee.

2.3 Corridor Survey and Environmentally Acceptable Flows

In addition to the master plan at AO (Appendix 7) size and detailed sketches of specific proposals at A4 and A3 size, within the text, six plans at 1 : 10 000 (Appendix 8) record the detailed observations made when walking the river from Westerham to Dartford. These plans are not definitive corridor surveys following a strict NCC methodology but they do indicate significant riverine habitat as well as particular species in many areas. They also indicate amenity/conservation potential with many points in addition to those singled out for specific mention on the master plan.

The landscape and ecological information will assist in assessing environmentally acceptable flows. Michael Mansell-Moullin's useful paper on this subject is also included in Appendix 6. The implication of this paper is that yet more work will need to be done to establish Ecologically Acceptable Flows for each reach of the river. It is clear that specialist techniques such as the analysis of invertebrate sampling at fixed points are too narrow a criterion to use in isolation. Commonsense and simple visual assessment may establish some practical ground rules. Visual quality and adjacent wetland systems are two important considerations, a good example of the latter being the workable restoration potential of the Shoreham water meadows.

2.4 Who Benefits From the Enhancements?

A question which is likely to be raised is 'who are the enhancements for?'. In many cases the answer will be self evident. The beauty and ecological richness of the river will be improved for the benefit of walkers on the Darent way footpath, visitors to the Dartford Park and even motorists driving past the entrance to Squerryes. Wherever possible areas which have public access have been given priority for enhancement. However, it has always been axiomatic that river enhancement does not have to be justified in terms of the number of people who regularly set eyes on it. Thus riverbank planting upstream of Shoreham may reduce algal bloom by shading the channel and creating a buffer against adjacent arable land adjacent pastureland, so benefiting fishing as well as extending the river corridor habitat. Similarly the pond at Park Farm, Westerham will benefit dragonflies, birds and plants, and the fact that there is no regular public access may even improve the value of the site as a nature reserve.

2.5 Grant Aid

This report has shown that many people are already working on piecemeal enhancements on the Darent Valley, notably the Northwest Kent Countryside Project and the Kent Thameside Groundwork Trust (see list of organisations in Appendix). The NRA is already engaged on enhancement at Otford. Angling groups have been establishing weirs on the river for a number of years and various individual landowners are also considering local projects.



Botanical Specialities of the Darent Wood club rush, *Scirpus sylvaticus* (top) is a major feature of the upper reaches around Westerham. The lowest reaches support abundant flowering rush, *Butomus umbellatus*, (middle right), while riverside pastures are full of lesser stitchwort, *Stellaria graminea* (middle left). Town hall clock, *Adoxa moschatellina* (bottom) is an indicator of ancient woodland, clinging to riverbanks at Lullingstone and Farningham.



A strategy for the enhancement of the entire river can help to pull all these initiatives together and also as a launching pad for grant aid on a more ambitious scale than has hitherto been achieved. The Countryside Stewardship Schemes which include a specific component on Waterside Landscape (see Appendix 11), offer grants for ponds, pollarding and clearance of eyesores, with up to £400 to individual landowners for the construction of a weir and £225 per hectare per annum for the restoration of watermeadows.

In addition to funds from the NRA, money may be available from Sevenoaks District Council, which gives generously for environmental enhancement grants and covers approximately two-thirds of the Darent Valley, and perhaps also from Kent County Council.

On a smaller scale, village societies, angling groups, and parish councils may be prepared to offer various forms of help if not funds and charitable organisation such as the Kent based Iris Darnton Fund may be worth approaching for money.

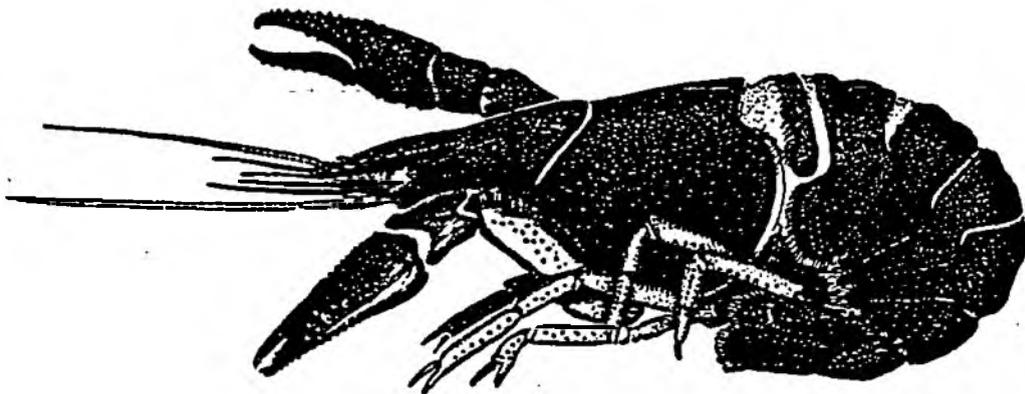
Finally while it is hoped that the first few projects will be achieved in the next 12 months, the entire shopping list together with other similar schemes which are bound to be suggested, may only be completed over a 10 to 20 year period, by which time full scale ESA designation and a far larger panoply of grants may well be in place.

3 LANDSCAPE AND ECOLOGICAL BACKGROUND TO THE VALLEY

3.1 The River Channel and Margins

Geology dictates the three most striking character zones of the Darent, the upper reaches are fed from both the Greensand and the Chalk, the middle section cuts through the Chalk of the North Downs and the lowest reaches flow through the salt marshes of the Thames. Within these categories, however, there are many subdivisions, and controversy has raged over whether the Darent is a classic Chalk stream. Consensus of evidence seems to indicate that it never could have been a true Chalk stream in the same category as the Itchen or the Test.

The upper reaches of the Darent still support fine beds of water crowfoot *Ranunculus aquatilis* at Brasted, but there appears to be some reduction of this where it was previously recorded as abundant in the Otford/Shoreham area. The same reaches no longer support wild British crayfish *Astacus astacus*, though this is due principally to the introduction of American species carrying the crayfish plague rather than because of low flows. Crayfish are still reported as present near Westerham and investigation would be worthwhile.



Crayfish were once abundant on the River Darent but are now reduced to the uppermost reaches.

Locally the typical fast running clear character of the Darent can vary within its upper reaches, and this again may not be entirely due to low flows. Thus the stream is dark, silty, and heavily shaded where it runs through woods at the back of Sundridge, and also winds more sluggishly in the central reach between Otford and Shoreham at the back of Filston Hall.

Below Farningham the river has been catastrophically affected by low flows, with a dry bed for much of the year, particularly in the last four years. When flows were regular, surveys as far back as 1969 indicated species typical of relatively slow silty conditions, such as *Glyceria* and *Sparganium erectum* in the Darent/Horton Kirby area. Flowering rush, *Butomus umbellatus* is still a feature of this area, standing up in the dry river bed. In fact, flowering rush should not be present in a true chalk stream, and as the flows become siltier and slower it gains a competitive advantage.

Nature is remarkably adaptable, and while low flows are far from desirable it is interesting to note the changes which have arisen from these new conditions. Dr Thirlaway, writing on the Darent, has noted the increase of *Oenanthe fluviatilis* in Chalk streams as they become more nutrient-rich. As the lower Darent has been converted to a chain of ponds in the summer, the frog population has boomed, and preying upon them has been an explosion of grass snakes.

However, some less attractive features are sure indications of increasing pollution, concentrated by low flows. *Enteromorpha* has been present since 1990, while the variety of *Cladophora* (blanket weed) now evident on the middle and lower reaches of the Darent is an indicator of pollution. This pollution may be worsened by leaching from garages and cow units, and was almost certainly accelerated by the construction of the motorway.

Nonetheless, walking the river has dispelled a number of misconceptions frequently repeated by residents in the valley, such as the belief that the minnows have all gone and so the kingfisher has not been seen since the 1950s. At all reaches between Westerham and South Darent we have seen kingfishers on almost every visit. Water crowfoot still flourishes at Brasted.

3.2 The Historical Character of the Darent Valley

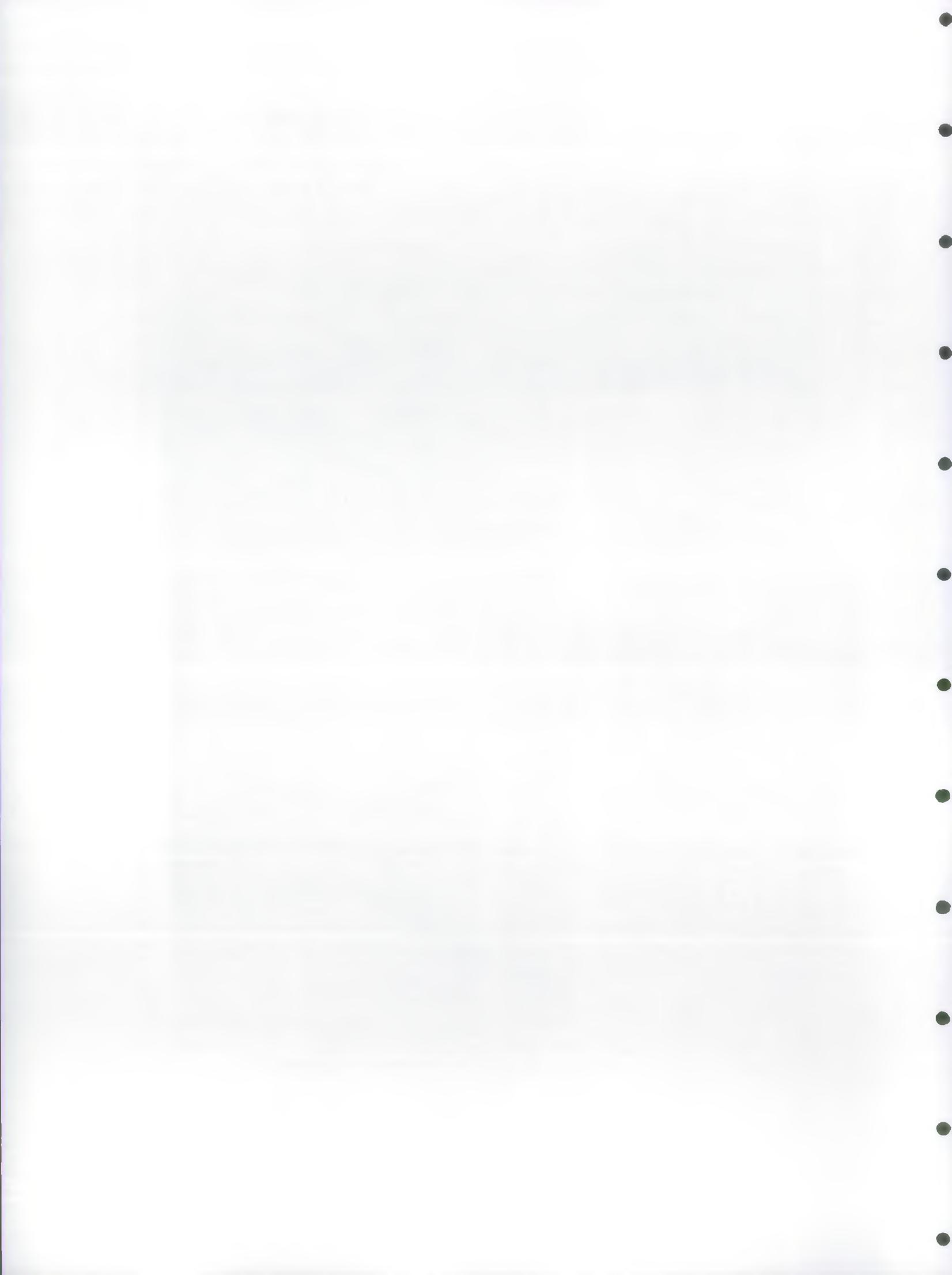
Considering that it is so close to London, local pressure groups and planning controls have preserved the Darent Valley so that it retains a remarkable balance between the landscape and traditional village settlements, farms and watermills. This is the valley of Samuel Palmer who is to the Darent as John Constable is to the Stour, and the importance of a healthy river in this landscape setting cannot be underestimated.

From the Anglo-Saxon period the river was elaborately engineered, diverted and split in order to drive watermills, the first record being for one near Otford called 'Hylentum' (mill settlement) sold by King Ceolwulf in 822. By the time of the Domesday Book the manor of Otford, (which included the valley bottom at Shoreham) supported eight mills while Darent had five and there were mills at Lullingstone, Eynsford, Horton Kirby, Fawkham and Farningham, the latter still boasting what must be one of the finest watermills in England, now sadly depleted of water.

Water meadows appear in the drawings of Samuel Palmer, and the remarkably intact structures north of Filston Hall are the remnants of a system which extended from the bridge at Shoreham as far as Otford. The legendary clarity of streams such as the Darent probably owed much to the way in



The relationship between the Darent and its historic structures and buildings is important. Mill weirs (above) and water meadow structures still survive. Provided flows are maintained, the river sets off to perfection the shingled spires of its village churches just as it did in Samuel Palmer's day (below).

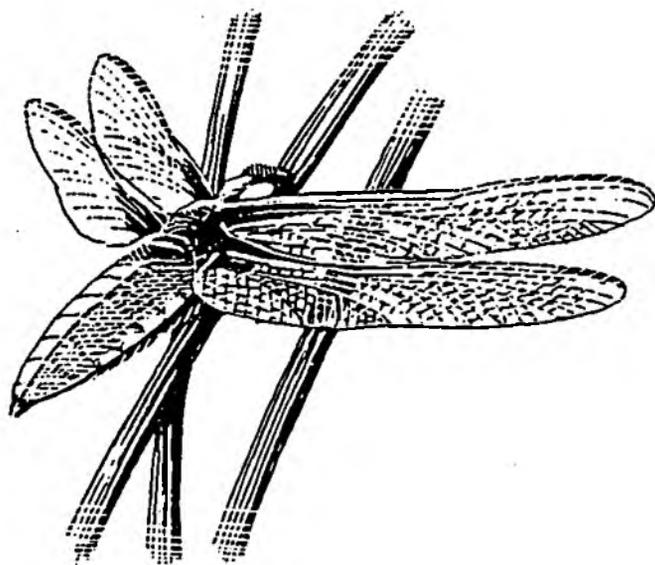


which water meadows skimmed off the sediment load, (although the sudden return of accumulated sediment when the water meadow hatches are open is regarded as harmful to trout fisheries on the Dorset Piddle). The increasing move to restore such features is yet another reason why restoration of adequate water-levels is highly desirable.

3.3 Off-site Gravel Pits

One of the oldest residents of the valley, has maintained that the River Darent is still there: it has simply been converted into fishing lakes. He has a point. Although all the lakes have outlets most of them pick up springs which used to feed the river. In addition to the problem of evapotranspiration, the fine-tuning of lake levels is not closely supervised by anybody other than the fishermen, who have understandable vested interests. In August 1992 the Darent lakes at Parsonage Lane were evidently receiving water while there was less evidence of equal quantities flowing out of the lakes on the eastern side. The north-eastern lake has never been seen to be low, while the adjacent river is often empty. Many of these lakes lie across areas which were known previously to support spring-fed cressbeds, and it is reasonable to assume that these springs now feed directly into some of the lakes.

Having said this, when flows were adequate in the past there was enough water for the river and for the lakes and there is no doubt that the lakes are now an ever more crucial wetland habitat to which the riverine species have retreated as the Darent itself dries up. Compared with many valleys suffering from low flows, the Darent valley does in fact remain remarkably rich in aquatic wildlife. The Bradbourne lakes are famous as an SSSI and nature reserve. Marley Lake has fine populations of dragonflies including *Aeshna grandis* and *Libellula quadrimaculata*. The Darent Lakes support greenshank on passage, breeding kingfisher and, perhaps most remarkable of all, in the south-east lake a large colony of bladderwort, *Utricularia vulgaris* which may be a survivor from the old ditch system of the lower Darent valley.



The broad-bodied chaser dragonfly, *Libellula quadrimaculata*, is found on the Marley Lakes



Riverside Gravel Pits at Lullingstone Castle (above) and Bradbourne Lake (below) are typical of the wealth of offsite water bodies in the Darent Valley. These lakes have become a kind of wetland substitute for the river itself, both as a resource for wildlife and as a sink for some of the surviving valley springs.



4 TECHNIQUES/PRINCIPLES ADDRESSED UNDER ENHANCEMENT PROPOSALS

4.1 Weirs

Sandbag weirs constructed at Eynsford by the NRA and elsewhere by local fishermen, have undeniably helped retain a reasonable depth of water in the river at some locations. It is true that they reduce the natural pool-riffle sequence of the river, but this ceases to be such an issue in the emergency of critical water shortage. Mill structures dominating the river for the past 1 000 years and only drastically reduced this century would have created a fundamentally impounded river. The NRA fisheries office has said that weirs are desirable, and the Flood Alleviation Section has also generally approved of weirs provided that they are low enough to be drowned out in flood conditions. By increasing depth of water weirs may, however, also increase the rate of depletion of river flow, further depleting flows to downstream reaches.

In the circumstances, use of weirs is recommended as a partial short term solution in some areas. The question of design and consequent cost remains open, especially while the detailed report on weirs by NRA Thames Region, is still in preparation. It is, however, worth noting that as they may not be permanent features and that in the public eye, the restoration of water may be more important than the elegance of individual weirs, rather more numerous cheap weirs may be more desirable than a few magnificent ones. The cost range is enormous. Fishermen in the River Piddle construct weirs for £200, while a weir which really satisfies a civil engineer may cost upward of £10 000. The latter is surely an excessive sum and an overdesign of what is appropriate to the Darent (see Appendix on costs).

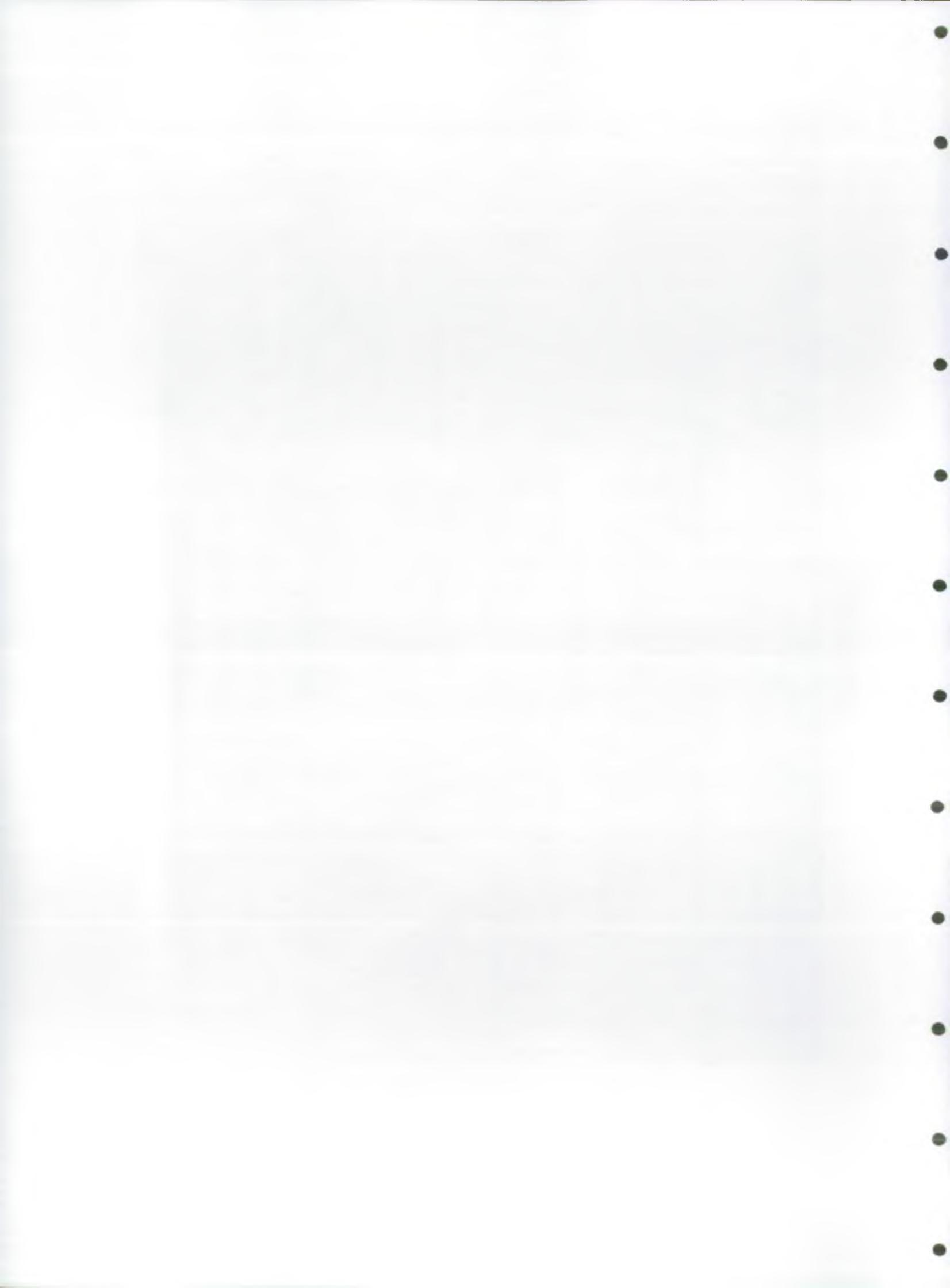
4.2 Narrowing the River with Deflectors

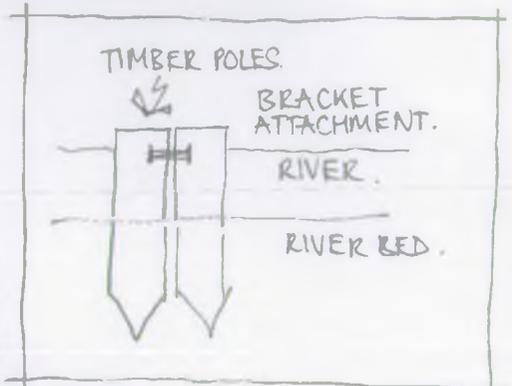
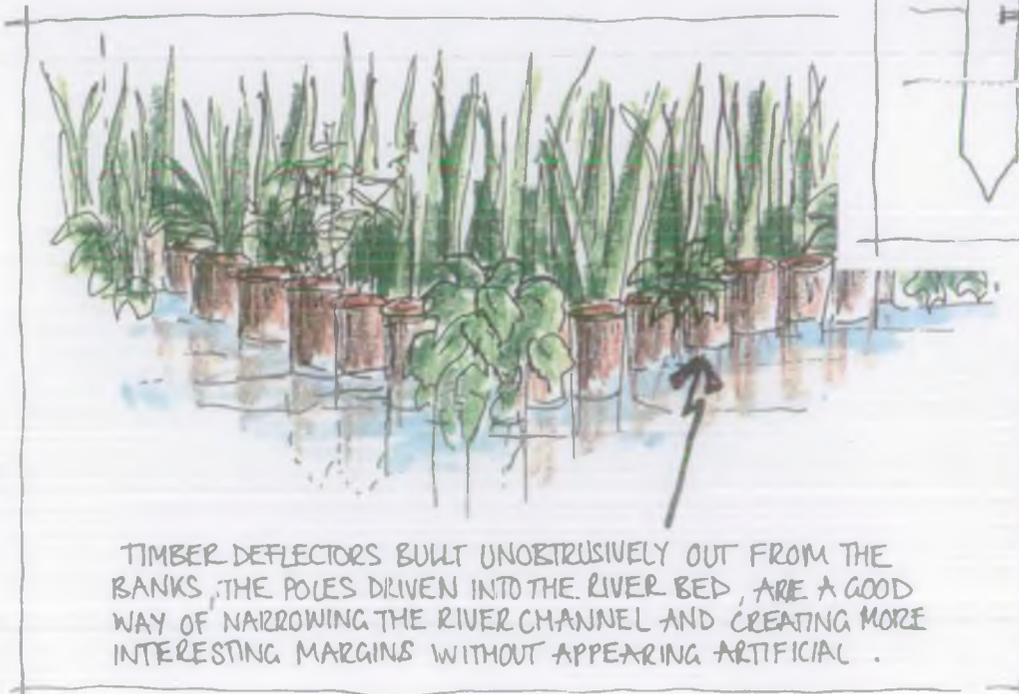
Where flows have been reduced, vegetation has invaded the channel in some places, thereby naturally creating a concentration of flow in the channel. A classic example of this may be seen immediately downstream of the M20, north of Farningham. There may well be opportunities to mimic this natural tendency, by driving in timber posts at angles to the flow and establishing such vigorous stream bed plants as butterbur, *Petastites hybridus*, which is already native on the River Darent. This may be especially worthwhile where the river appears genuinely overwide as at the field centre downstream of Horton Kirby.

However, a word of warning should also be issued. DRIPS has rightly expressed concern that ever narrowing the river can be a dubious way of disguising the lack of flow. When the Darent is flowing satisfactorily but only over half or even a quarter of its previous width, it will have been reduced from a river to a mere stream especially in its lower reaches, and this is unsatisfactory.



Weirs have proved a useful strategy in raising water levels and more are recommended. Many have been constructed by fishermen, like these upstream of Shoreham (above), while the NRA sandbag weirs at Eynsford (below) are even a training ground for budding engineers.





TIMBER DEFLECTORS BUILT UNOBTUSIVELY OUT FROM THE BANKS, THE POLES DRIVEN INTO THE RIVER BED, ARE A GOOD WAY OF NARROWING THE RIVER CHANNEL AND CREATING MORE INTERESTING MARGINS WITHOUT APPEARING ARTIFICIAL.

Timber deflectors can be used to mimic natural rafts of vegetation (above). Poles driven into the river bed can create spits of vegetation that can also form a narrowing of the channel.



4.3 Lining

Halcrow recommended lining the bed of the River Darent as a major part of its strategy. This is now felt to be an undesirable solution to the real issue of improving flows. We have inspected the lined reach of the Gussage Brook in Dorset, where there are no mature trees or built structures close to the watercourse. It is also possible to see a lined reach of the Darent, which was instigated as part of reinstatement following gravel abstraction downstream of Darenth. This reach was created by tracking in 30 cm of chalk, over which there was laid 30 cm of puddled clay and then gravel and flints. Driving cattle along the bed increased the effect of puddling. While the flows over this reach are totally inadequate, this appears to be a consequence of lack of water flowing down from further upstream, rather than any failure in the lining, although monitoring here may be sensible. There is now an exceptionally rich aquatic margin along this channel which was only created in 1989.

The practical difficulties of tying the edges of the lining into the river bank where there are existing trees and also historical structures which may be unstable are compounded with enormous cost. There is also the 'un-naturalness' of the treatment for a mobile river with pool and riffle sequence. The regular nature of the lined rivers mentioned above may, however, have more to do with the unnecessarily crude channels which were excavated rather than being an inevitable consequence of lining. Current trials being carried out on lining the River Misbourne by NRA (Thames Region) may lead to further useful information on the techniques and costs of river lining.

While a general presumption is made here against lining, it is recommended in a few exceptional and relatively small areas. Upstream of Horton Kirby, for example the water leaks through a large hole in the bed. Leakage has increased with the successive periods of low flow. It is obviously wise to seal such vulnerable areas. Another area where the river is known to leak through the bed is under the M20 downstream of Farningham where motorway pile driving may have opened up huge cracks in the bed. In addition, the main sewer pipe laid recently is, of course, on a bed of gravel, presumably without concrete collars, and quantities of water are able to flow down the gravel bed to the pipe.

In conjunction with weirs and water restoration in key localised areas it is also desirable to line the bed if immediate results are to be achieved. The artificial nature of the banks as at Westminster Mills, Horton Kirby, make the choice of lining much more appropriate in this area.

4.4 Fencing and Planting

Partly because of its urban-rural fringe character, farming in the valley has never created the large scale landscape destruction evident in East Anglia and in some parts of Kent. Horse-grazing has retained some relatively species-rich meadows, as in the centre of Brasted and in the semi-improved pastures south of Shoreham.

Nonetheless, intensive agriculture has combined with the problem of low flows to produce a further decline in environmental quality in some places. Fertilisers for arable land have boosted algal growth already encouraged by low flows. Elsewhere trampling by sheep which never used to wade far into the river when it was deeper, have widened the channel therefore creating even shallower flows.

For this reason, fencing and planting is especially desirable in some reaches of the Darent in order to reinforce the river corridor. Elsewhere planting to conceal existing ugly fencing as well as improve the ecological value of the river is recommended.

4.5 Offsite Pools and Pools Within the Channel

New ponds are strongly recommended throughout the report, but a word of caution is advocated about excavations which may possibly break through gravel pans and other natural seals and so worsen the problem of low flows on the Darent. Simple trials under the direction of hydrologists should be carried out before major excavations are commenced. The problem of evaporation from large new offsite waterbodies should also been addressed by hydrologists but it is hoped that this should not be an overwhelming problem, if restoration of adequate flows is being undertaken in tandem.

4.6 Public Access to River Darent

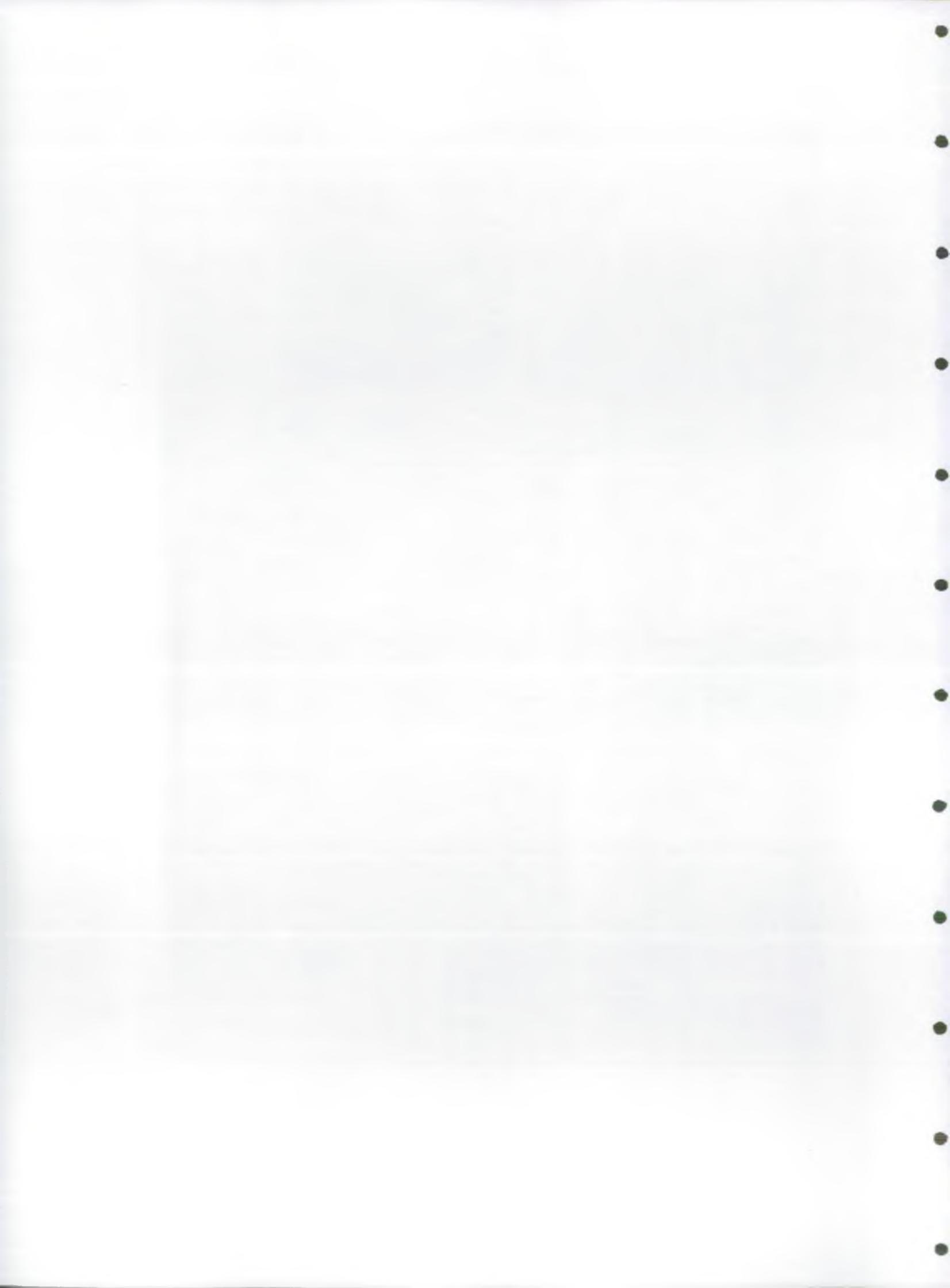
The accessibility of the River Darent to Greater London creates its own problems but is also a major reason for the expenditure of public money on its wise management. The Darent Valley path which was recently opened, remains a major responsibility of the North-West Kent countryside project. Contributions to its general improvements are included under the general river enhancement recommendations below.

Local village access to the riverside is a general problem in the south of England which has often been understated. As private housing expands from the old historical centres, private gardens with desirable riverside frontages enclose the common river bank which the older generations in the village remember as taking for granted as a place where they could swim, swing from ropes or fish for tiddlers. This is one of the attractive features of the Darent at Westerham, where the footpath goes along the back of the village, winding beside the river among meadows where cattle wade hock-deep in buttercups. Large reaches in Brasted, Sundridge and Shoreham on the other hand are fenced off by private gardens, and of course when the river bed dries up and becomes a path, the barbed wire increases. At Horton Kirby and South Darenth a serious vandal problem has increased with accessibility down the bed of the river.

Where appropriate and possible, our recommendations include improved public access and the general democratisation of the river alongside its ecological enhancement. This is bound to be controversial since there will always be a lobby of immediate residents who will want other people kept away from the meadows which they overlook.



Access to the river is an important part of the justification for landscape enhancements. The Darent Valley Path (above) takes visitors beneath the major roads, while the river is also an important amenity for local householders.



4.7 Education and Community Involvement

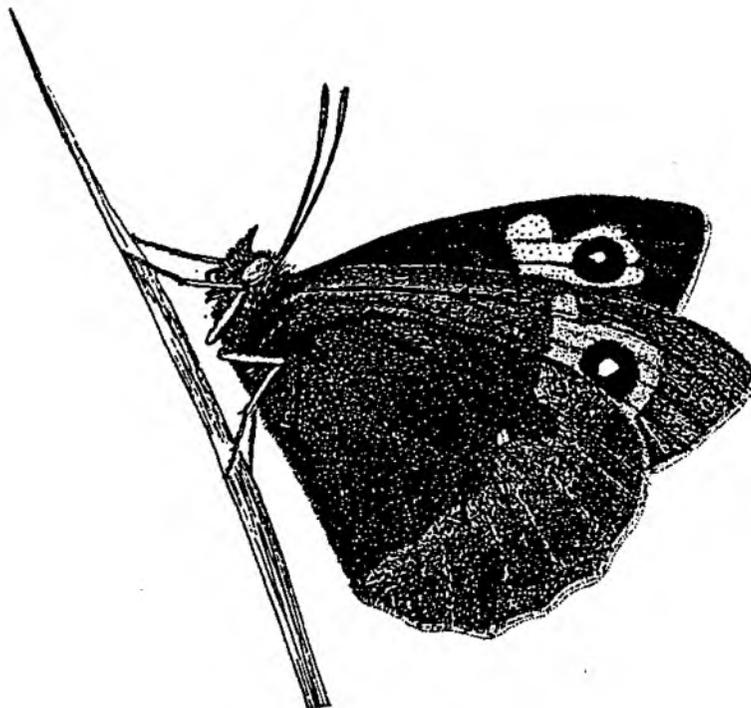
All efforts to help the River Darent will fail without close involvement of the community and so we especially value our contacts with DRIPS which must be among the most well organised and articulate of all pressure groups dealing with the problems of low flows. This report is intended as a draft for comments rather than a statement of what is good for the Darent Valley. Opportunities for survey and monitoring have already been identified at the request of some DRIPS members and in addition a survey of existing crayfish populations with the long term aim of reintroduction to the middle reaches of the river is recommended as a project for close public involvement.

Schools have been picked out as especially important areas for enhancement proposals, one of which is already underway, involving the Antony Roper School, and the Flood Alleviation Section of the NRA. Current 'River Watch packs' being drawn up for use in geography and biology classes at all levels are incorporating guidelines for low flow studies. A major summer holiday project for local schools in 1992 is entitled 'Is the River Darent Dying?', and the potential for this report to lead to further initiatives between schools and the NRA is considerable.

Individual landowners are already considering carrying out their area enhancement projects on the Darent (see Sections 5.15 and 5.35 below) and there is already a precedent for this in the case of weirs constructed at Franks Hall, and weirs installed by the Park Farm Trout Fishery at Otford. Both in the case of fisheries management, and ecological enhancements, the potential of well managed sections of the river being set up as 'demonstration reaches' should be considered. An 'audit' of some of these proposals, so that before and after surveys can demonstrate the benefits of these schemes, is also a consideration, although post project appraisals have been known to lead to an excess of bureaucracy. There are too many river surveys, locked away in filing cabinets, which have used up money which could be more usefully spent on further on-site enhancement on the ground.

4.8 Archaeology

There is a wealth of archaeological interest in the valley and all proposals should first be cleared with archaeological offices in the appropriate councils.



The meadow brown butterfly, *Mariola jurtina*, is abundant throughout the Darent valley.

5 SUGGESTED ENHANCEMENTS/CASE STUDIES

These are taken from north to south; ie working upstream. Locations referred to are shown on Drawing Nr 70223LAIB (Appendix 7). Section numbers correspond to references on map.

5.1 Dartford Marshes

No specific enhancements are suggested here but it is important to identify the environmental issues on the Dartford Marshes in order to dovetail any future proposals which may involve water storage or augmentation for the Darent with other current proposals concerning the area.

The Dartford Marshes are perhaps the single most important wetland system adjacent to the River Darent and also one of the most threatened. They comprise one of the largest blocks of surviving Thames-side grazing marsh, which has everywhere been much reduced. Many dykes are remarkably clean with a rich flora of branched bur reed, flowering rush, arrowhead, starwort and common reed. Lapwing, heron, redshank and snipe are evident.

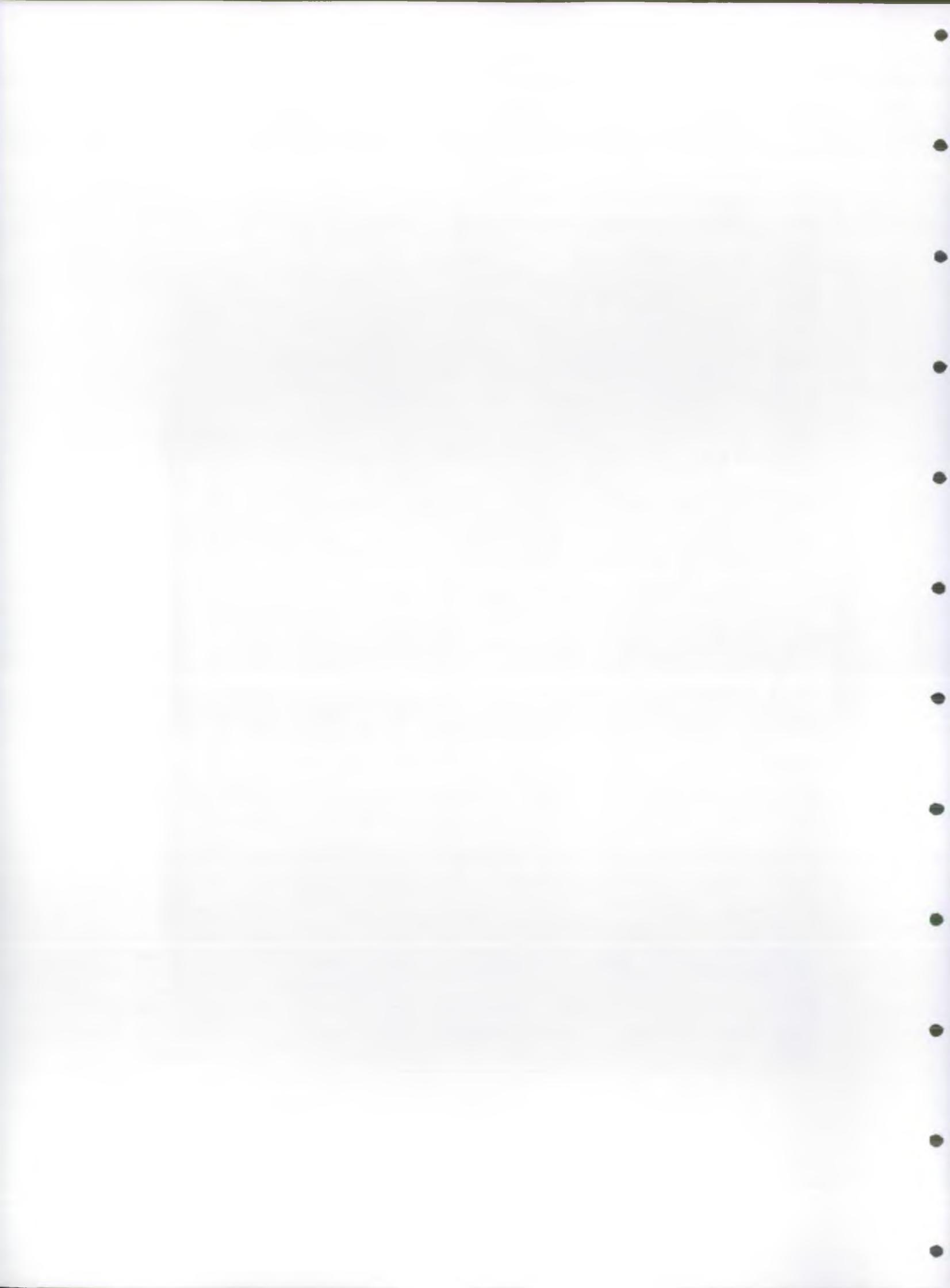
While the Darent itself is tidal up to Dartford, the Joyce Green brook which is also a main river, appears to be largely freshwater. The Littlebrook Lakes which belong to Dartford District Council and lie immediately west of Dartford Bridge and are managed for sailing and nature conservation are fed by clean sweet water from the aquifer within the local gravels.

The overall structure plan for the area is currently going through public enquiries. If these proceedings are successful the area will gain the status of a Local Nature Reserve (LNR) and an SSSI (Site of Nature Conservation Interest). This will not, however, have the strength of an SSSI and will not automatically preclude the possibility of gravel working for which it is designated in the County Mineral Plan. Amey Road Company owns the majority of the land immediately east of the Darent. In addition, there are pressures from Wellcome which wishes to develop the most southern section of marsh, which it owns, and from the Thames Polytechnic whose plans to expand its campus on the eastern side include a large ornamental lake.

While there may be some salinity problems, the NRA's proposals should in no way erode the principle upheld by Kent Trust for Nature Conservation (KTNC) that grazing marsh is ecologically and historically the most appropriate use for the area. If the creation of large water bodies does become more likely however, then the opportunities for water storage in order to boost flows in the Darent should at least be considered. The now-disused sewer pipe remains in place and may therefore provide an economic conduit for the pumping of water up the valley as far as Shoreham and beyond.



Two major areas of wetland landscape beside the Darent deserve special studies of their own: the Dartford marshes (above) and the Shoreham Watermeadows (below).



Furthermore water bodies which are drawn down in the autumn exposing muddy sides are a major attraction for wading birds. Top up pools of the Darent could complement other nature conservation interests on the marshes. It may be that even now some water could be drawn off the Littlebrook Lakes to the benefit of the Darent, subject to negotiations with Dartford District Council. Major Schemes involving storage are being considered as river support options within the main Darent catchment investigation.

5.2 Crayford Marshes

The majority of this area is landfill and therefore presents little potential but the northern area may be worth exploring in the context of Section 5.1 above. Furthermore, excessive groundwater in the Crayford area is creating problems for the Flood Alleviation Section of the NRA and subject to water quality this may be worth considering in relation to the depleted resources of the Darent.

5.3 Dartford Park

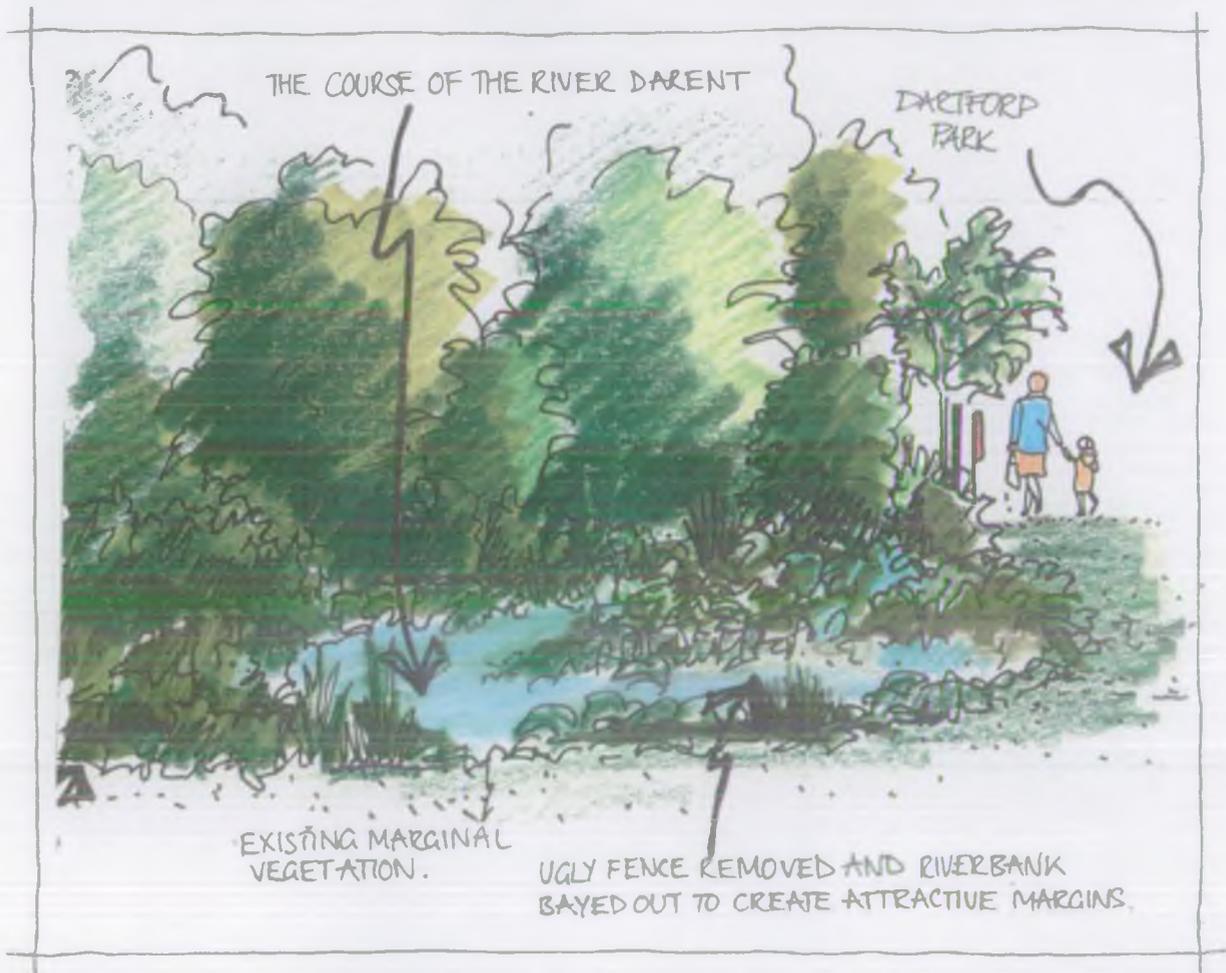
5.3.1 Overview

The river flows through Dartford Park, which is very popular and well-kept. At the downstream end of the park reach, flows are very low and affected by algal bloom. At the upstream end the channel is attractive with luxurious branched bur reed, flowering rush and evident kingfishers. It is possible that flows might be increased if less water were sent down the flood relief channel which flows through Wellcome's land on the east side of the valley bottom. The difficulties with this are:

- (i) the water level, at the point where the two branches split, is set so that at very low flows it goes through the park anyway;
- (ii) the relief channel is also of nature conservation interest with quantities of flowering rush although it does receive heavy management from the Flood Alleviation Section of the NRA.
- (iii) Wellcome is very keen to keep and if possible increase water in the flood relief channel for its amenity benefit.

Nonetheless, if there were a choice it would seem desirable to send most water down the most publicly visible channel which incidentally would also benefit Wellcome at the downstream section.

Within Dartford Park there are three main environmental issues, all of which are supported by the Dartford District Council which owns the park.



Removing the unnecessary fencing, and baying out the river in this area will greatly improve its amenity value within Dartford Park



5.3.2 Thames Water Pump Station

This station pumps water back into the river at the southern boundary of the park with the Wellcome land. Some of the walls across the water area in front of the pumps have been vandalised and the whole area is a dangerous eyesore. Children manoeuvre past the coils of barbed wire and walk along in front of the pumps. What could be one of the nicest riverside corners of the park, with the very pretty Wellcome bridge beyond is dominated by ineffective stalag-style fencing, ugly walls and a bank between the riverside and the public.

Assuming that Thames Water Utilities is unlikely to take on the environmental improvement of its pump station, on the parkland adjacent to the station planting could soften the effect of walls and fencing, the raised bank could be pulled back and a weir upstream of the pump station could aerate the algae-dominated waters of the river.

5.3.3 Raised Banks and Access to River in Dartford

When the Southern Water Authority carried out the land drainage scheme in Dartford in the 1970s a raised bank was put up beside the river creating a steep slope and severing the relationship between river and park. This was done despite objections from Dartford District Council.

There is now an opportunity to pull back this bank in places and create a wider bay in the river, impounded by a downstream weir. Planting back from the river would also be desirable since as with many parks, the sterile expanses of mown grass come right down to the river reducing the corridor effect.

An especially good place for such a proposal is where a fence, in addition to the bank, severs access to the stream. This fence was originally erected to provide a safety barrier between the river and a now-vanished paddling pool. Its removal would be a bonus and the bend of the river just here means that the creation of a river bay would fit the natural hydrological regime.

5.3.4 Footpath Link through River Tunnel

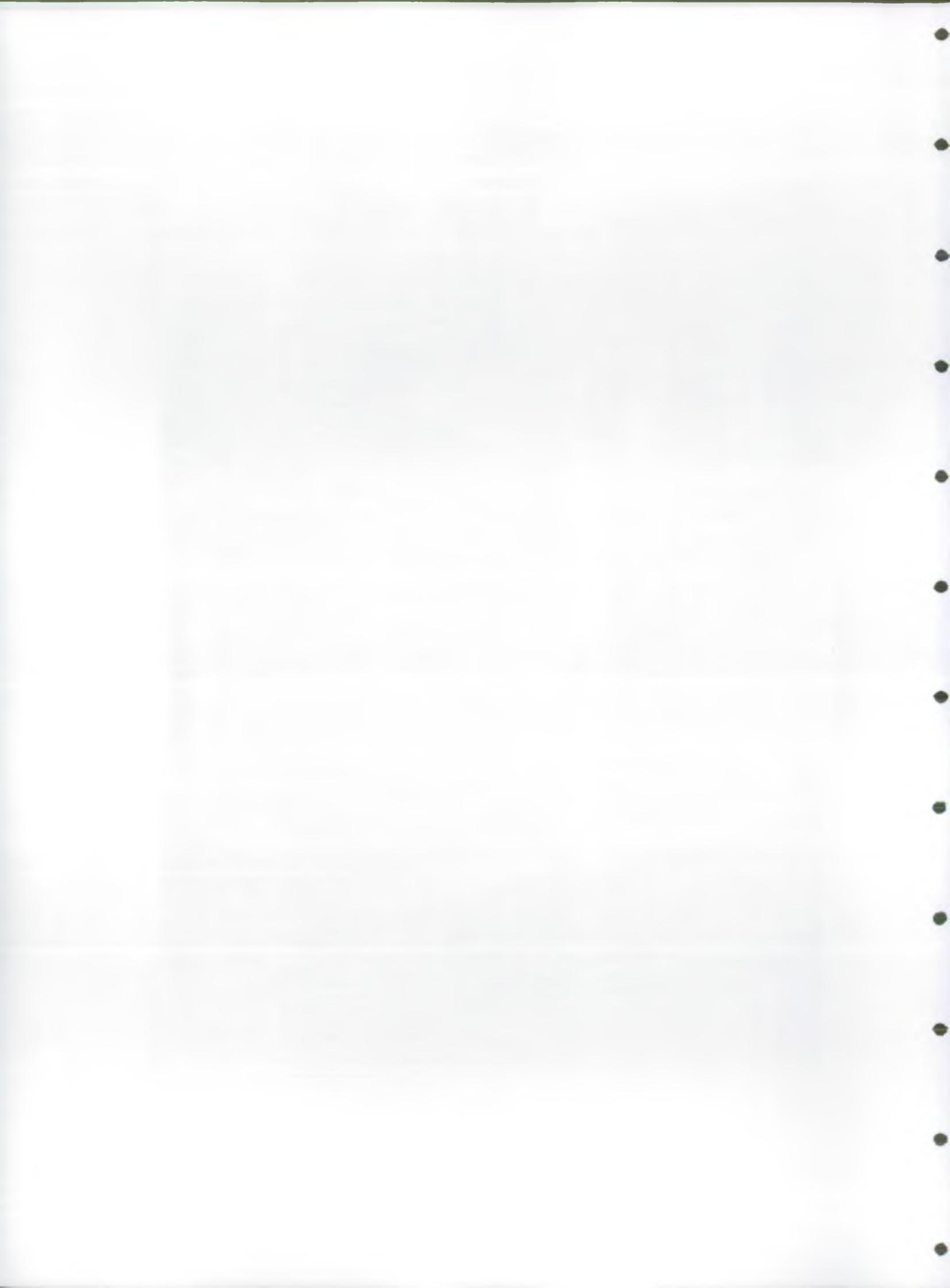
This relatively inexpensive suggestion has long been mooted by the District Council but money has never been available for it.

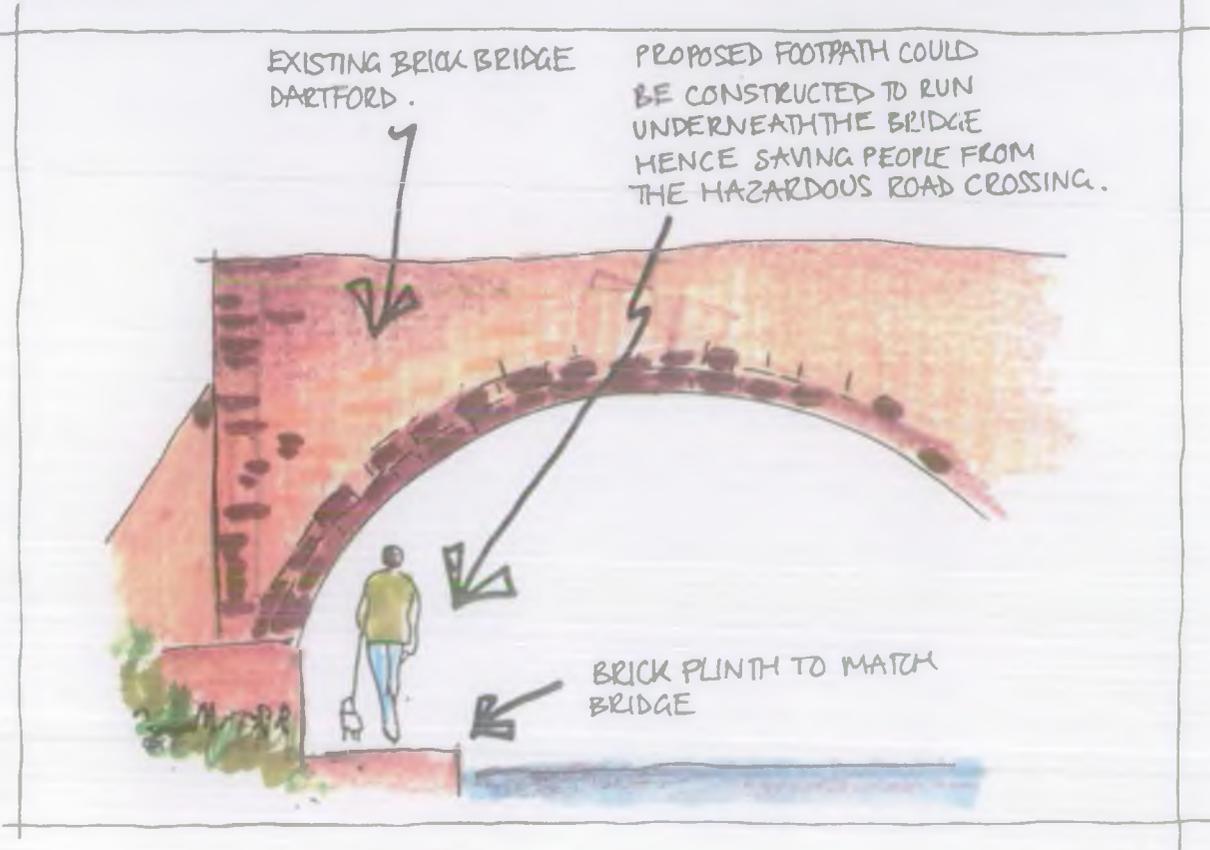
The present Darent Valley Path ascends the steep bank of the A225 and makes a dangerous and inconvenient crossing of the busy trunk road before descending again to the comparative tranquillity of the Brooklands Lakes. If a pad of concrete were set out along inside edge of the nearer bridge tunnel, much simpler and pleasanter access would link the Brooklands Lakes with the park. The existing series of stepping stones at the upstream mouth of the tunnel shows how easily this could be achieved.



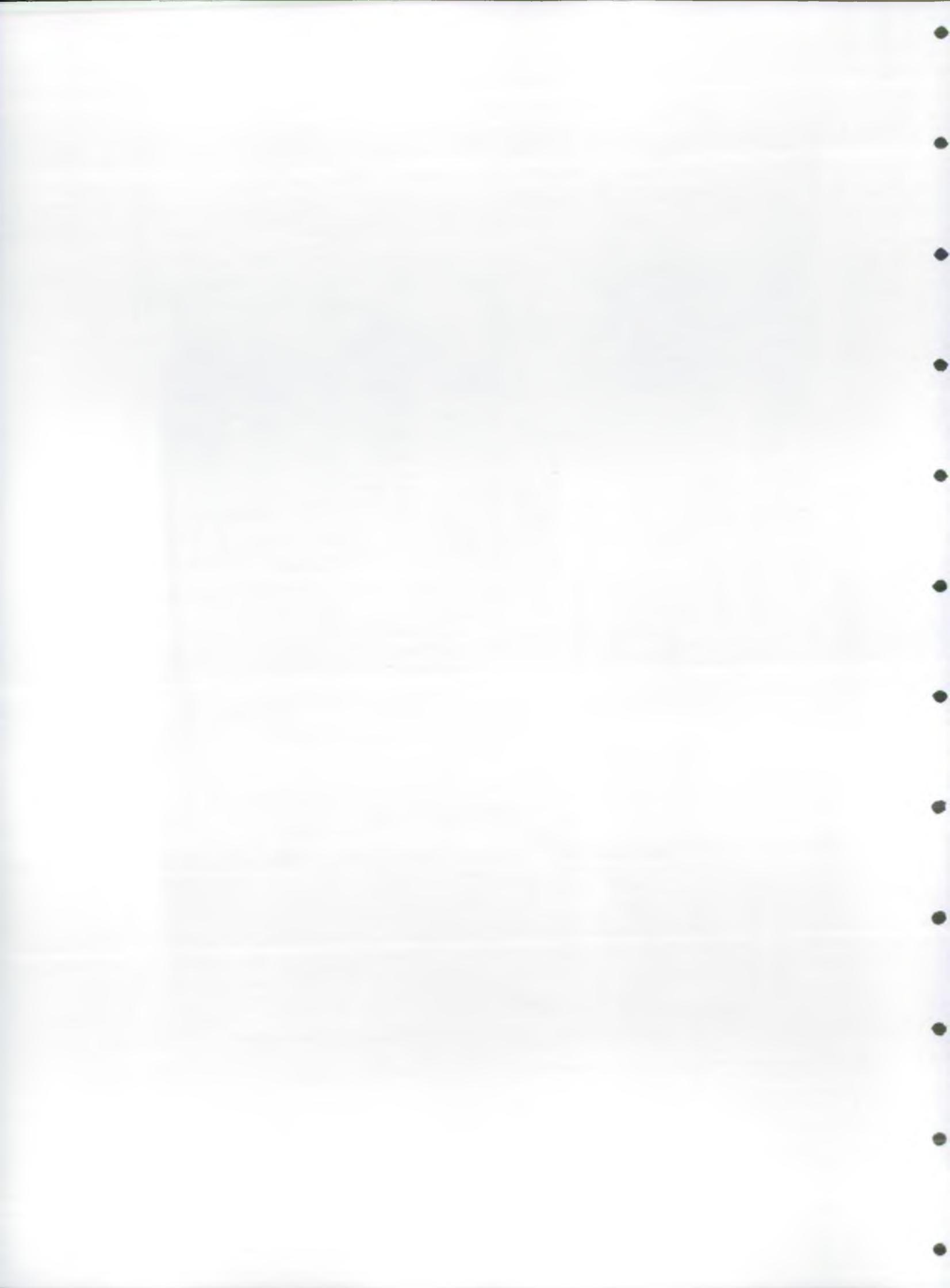
The visual quality of the river is downgraded by eyesores, such as the dangerous and ugly pumping station at Dartford (above), and by barbed wire barricades as here beside the Darent Valley Path at Horton Kirby (below)

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Between Brooklands lakes and Dartford Park an ideal opportunity for riverside enhancements would be to construct a footpath link beneath the bridge preventing the need to cross the road (above).



Nonetheless careful thought would have to be given to safety factors, flooding considerations, and headroom clearance for walkers. It is assumed that the level of the platform and stepping stones would be drowned out whenever there were relatively high flows, thereby necessitating diversion back to the present route of the footpath.

5.4 Wellcome Institute Recreational Club, Acacia Hall

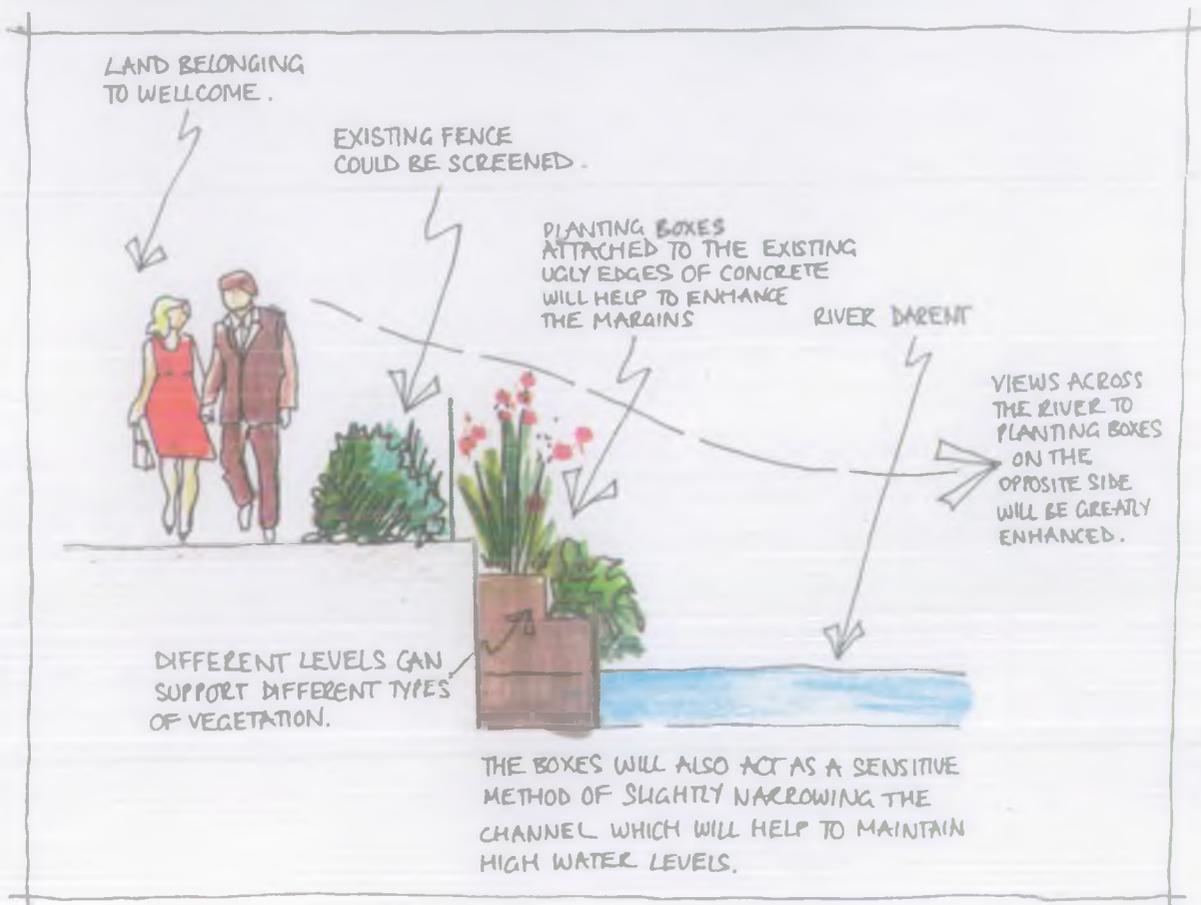
The reach of the river adjacent to Acacia Hall where the Wellcome Institute runs its recreational club, was given a concrete section when the 1970s land drainage scheme was carried out. Consequently, despite some five weeping willows on the left bank, the effective establishment of wild flowers in the right bank and a very attractive white painted bridge, the state of the channel lets down what would otherwise be a very attractive scene and one that is much visited. Algal blooms are also severe here.

Aquatic planting boxes are recommended to break up the severe concrete edge. These could be constructed at intervals and established with common reed, *Phragmites australis* which may reduce the nutrient load and consequently the algal bloom on this reach. These boxes may have to be built of concrete keyed into the concrete bed, but since this area is 600 mm to 1 000 mm deep in silt it may be just possible to establish the reed without the planting boxes. Establishing trailing plants above the concrete plants in the left bank is also a possibility. A weir may also be possible but account will need to be taken of the regular inundation from the pump station immediately upstream. A long-term strategy to tackle the problem of unpleasant black silt coming from this pumping station should also be considered and the proposals suggested under Section 5.3.2 will also benefit the Wellcome area.

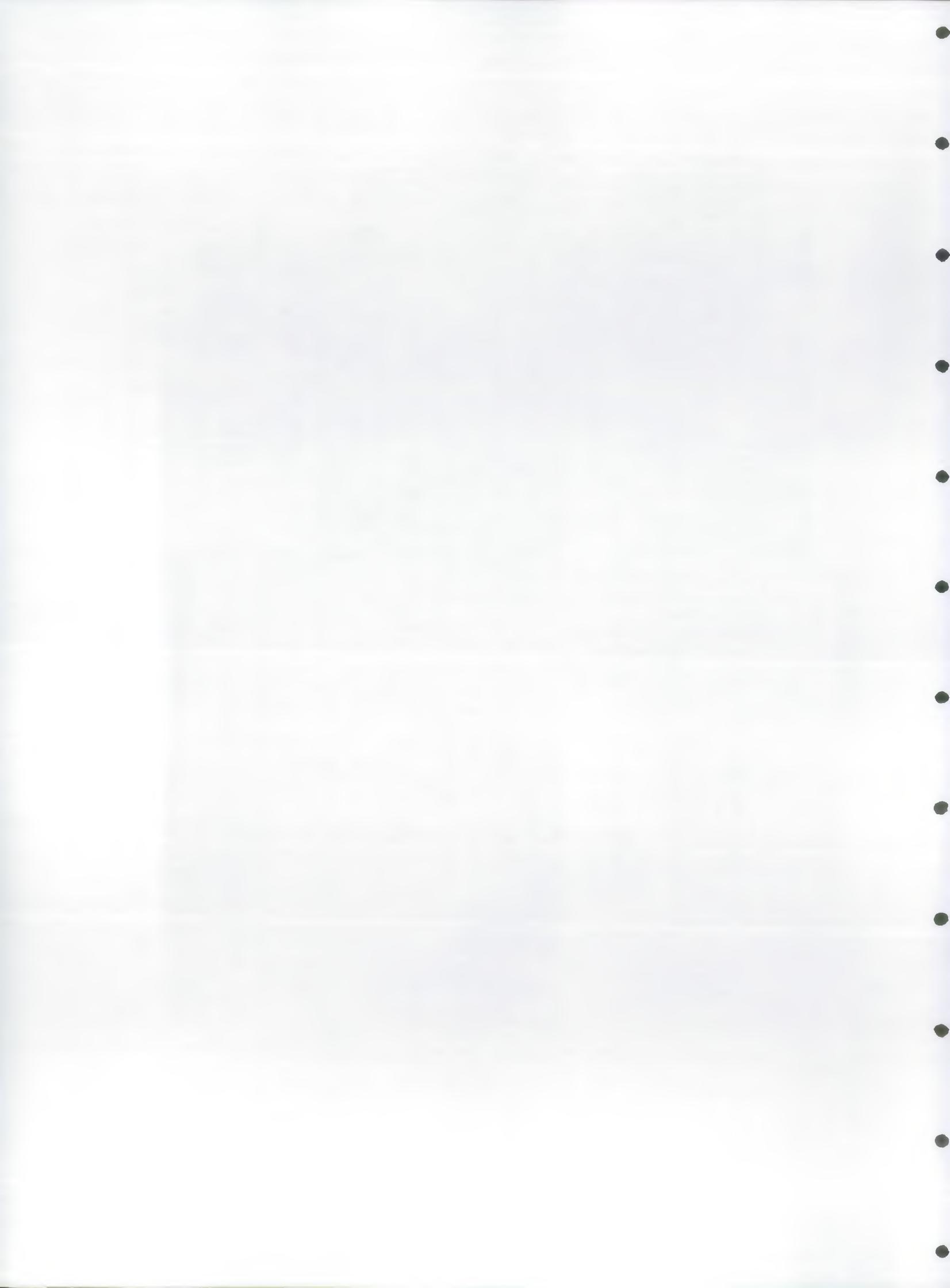
The Wellcome Institute has given broad support to these suggestions.

5.5 Brooklands Lakes and Powder Mill Lane

These lakes excavated in the 1920s and run by the Dartford and District Angling Preservation Society with a relatively open membership, are immensely popular with 50 000 to 60 000 angling visits a year. They have margins of *Glyceria* and large colonies of yellow water lily, *Nuphar lutea*. Levels have recently dropped but have benefited from topping up from the Thames Water pumping station beside the lakes. However local people have noticed some dropping of water levels in the adjacent valley, when 'pumping to waste' takes place from this pumping station. A debate between the fishermen and the owner of Brookland House who has inherited legal rights concerning the mill weir is continuing. No specific enhancements are recommended on the lakes.

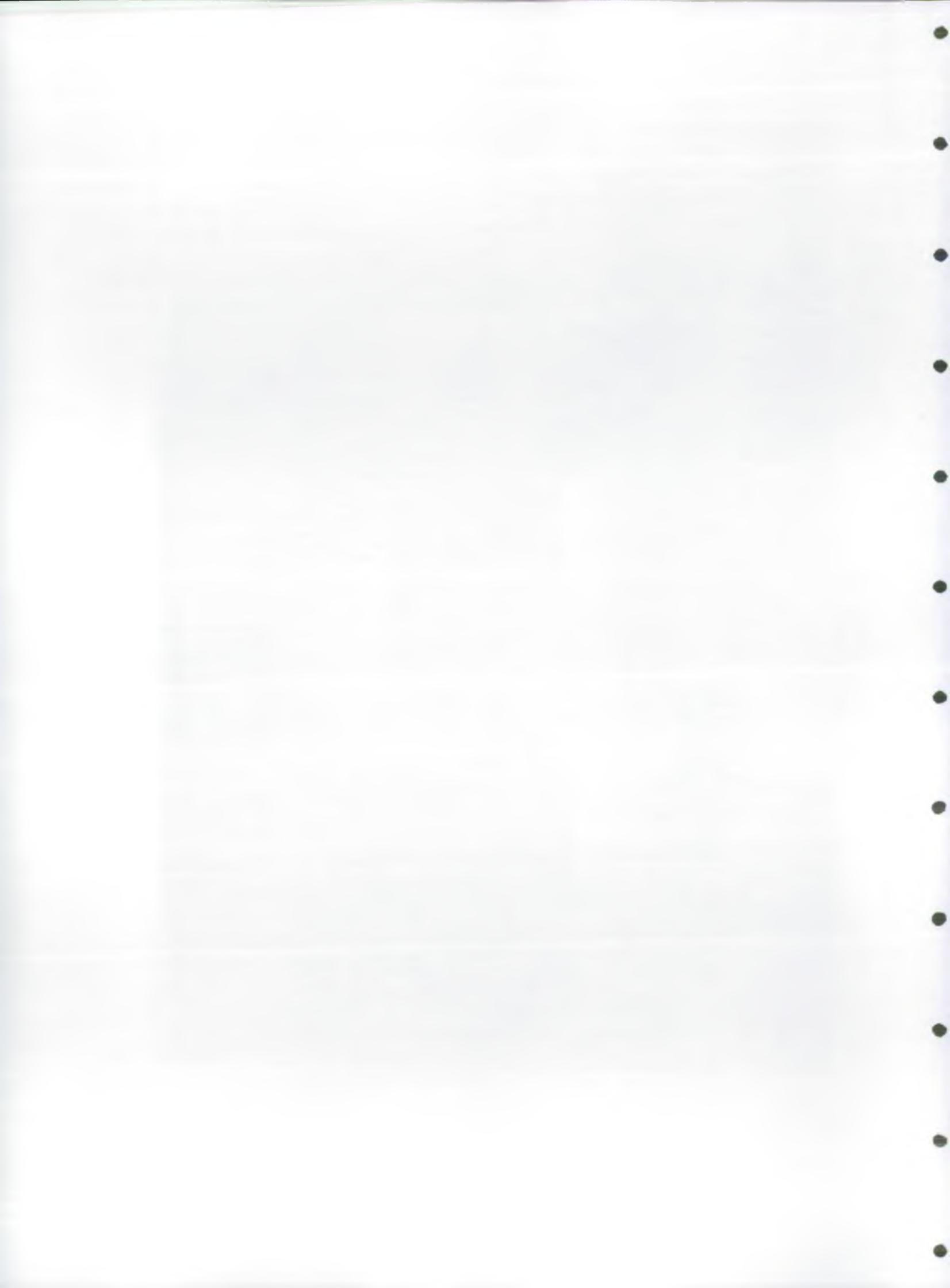


The river, as it runs through Wellcome's land, is channelled by ugly concrete sides. These could be greatly enhanced by the construction of planting boxes along the riverbank.





Parsonage Lane The St Johns Arm, looking upstream from the bridge (above) and downstream towards the bridge (below). This is one of the saddest and most visible reaches of the river, with generally less flow than shown in recent years. A weir, local lining, excavation of the left bank to create an extended pool and the piping down of a reliable upstream spring are recommended.



Upstream of the Brooklands Lakes and the bridge at Powder Mill Lane, are the remains of the eighteenth century gunpowder mills excavated by archeologists in the mid 1980s and now fast disappearing under nettle, wild clematis and a luxuriant growth of deadly nightshade, *Atropa belladonna*. The recolonising vegetation is attractive and should not be tidied up too vigorously but there is no doubt that some tactful repairs and interpretation may discourage the increasing vandalism, and thought might also be given to the restoration of the surviving system of penstocks and sluices. The Kent Thames-side Groundwater Trust is currently taking this up as a project and is seeking further funds to boost its own contribution to the work.

5.6 Darent Lakes, Parsonage Lane

These lakes which are spring fed both on the eastern and western sides are exceptionally attractive and rich in wildlife (see Section 3.3 above). They belong to Ready Mix Concrete (RMC) and are run as a fishery by Leisure Sport.

The river here is split into two channels, the main Darent flowing down the centre of the valley and what is known as the St John's arm flowing down the western side of the valley. Both branches are very adversely affected by low flows, the effects possibly being more severe in St John's arm.

An enhancement is recommended immediately upstream of the Parsonage Road bridge on the St Johns arm. The right bank here is rough land and could be excavated to create a wide pool. A weir could be established just downstream of the bridge and lining over the very short reach which is seen by many people may be necessary. On-site trials are recommended before the expense of lining is decided upon. At present there is a steady inflow of water from the cressbeds at St John's Jerusalem into the south-east lake. This water then flows out of the lake system and into the St John's arm less than half a mile upstream of the Parsonage Road bridge. However it soon disappears down cracks in the bed of the stream, and so is reduced to a very sluggish trickle by the time it reaches the road bridge. If it were piped through this short section which is seldom seen by people, then a reliable and clean source of water would be available for the feature at the Parsonage Lane bridge.

The local representative of Leisure Sport has approved this proposal in principle and is happy to send details through to RMC for final approval. This is considered a priority enhancement for possible implementation in the winter of 1992/93.

5.7 Weirs in South Darent

Downstream of South Darent are several home-made weirs which help to retain water in this very severely affected section of channel parallel to the fishing lakes. These could usefully be made more secure and permanent.

In South Darenth itself is an especially desirable location for a weir, where the stream runs beside the road in the village near an attractive small nineteenth century mill. This weir is another priority enhancement proposed for the winter of 1992/93.

5.8 The Moat of St John's Jerusalem

St John's Jerusalem is a twelfth century Commandery of the Order of St John of Jerusalem, with a contemporary moat, formed on one side by river. The moat is all now entirely dry. In the eighteenth century the house was extended by Edward Hasted the author of the definitive 'History and Topographical Survey of the County of Kent', and brickwalls and bridges for the moat may date from his time. Relics of a wetland system within the moat still support sedge, *Carex riparia* and branched bur-reed *Sparganium erectum*, while sedge warblers are present.

The house and adjacent land belong to the National Trust which plans regular public opening and further development of the estate, and has also produced a detailed ecological survey of its ownership (see Appendix 9). While it is anxious to avoid excavation within the curtilage of the moat and the inner area owing to archaeological considerations, the National Trust is very keen to see restoration of water to the moat. This enhancement would have the combined benefits of improvement to ecology, amenity and a feature of major historical interest. In addition, standing water in the moat would be entirely appropriate, in contrast to those enhancements which suggest standing water in key sections of the previously flowing stream as a short-term emergency measure.

A major question concerning this proposal is the extent of lining needed. The branch of the moat furthest from the Darent on the eastern side of the house is believed to be the most porous and it may be that only local patching will be necessary. If the whole moat requires lining then with a length of approximately 600 m and a width of 8 m the lining alone will cost about £80 000 (see Appendix 1) which makes this one of the most expensive proposals.

One possibility worth considering is to use the spring taking the flow from below the cress beds farmed by the National Trust's tenant, Mr Ward. The spring is understood to provide a reasonably permanent discharge. At present, from the cress beds, this water goes straight into the Darent Lakes (see Section 5.6 below) and it is essential that, after recirculation through the St John's area, it should continue to do so. It is also fundamental that such water would not be taken until after it had gone through the cress beds. It would at least seem worthwhile to look at the possibility of pumping and piping this water up to St John's and then sending it back through the moat, under the bridge which carries the heavily used footpath and thence into the lakes.



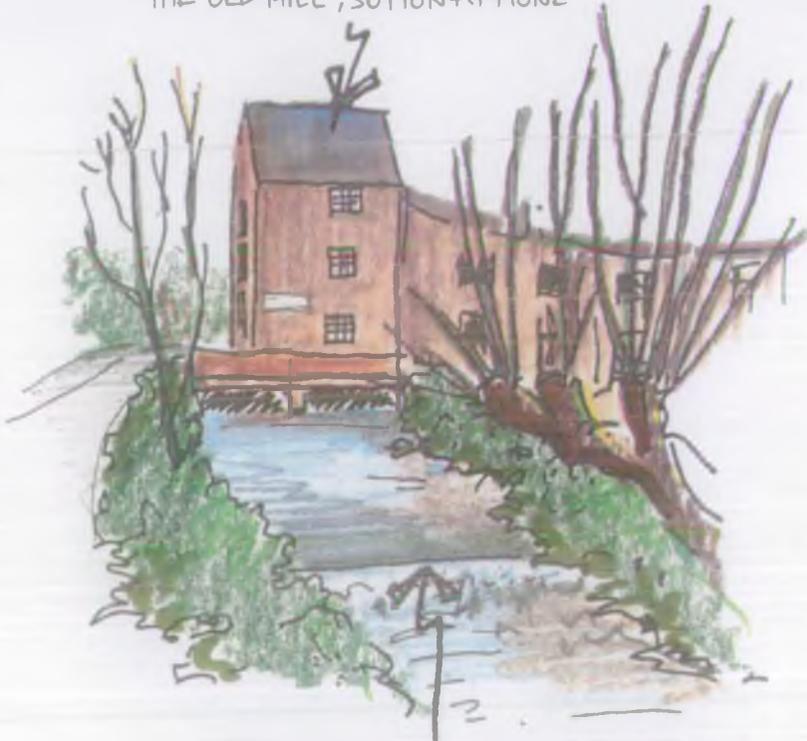
Two twelfth century monuments beside the Darent, Eynsford Castle (above) and St Johns Jerusalem (below) present enhancement possibilities, subject to minimal disturbance of archaeologically significant areas. The National Trust has said that it would welcome the restoration of the moat at St Johns.

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THE OLD MILL, SUTTON-AT-HONE



PROPOSED LOCATION FOR INSTALLATION
OF A WEIR TO HOLD BACK THE WATER IN
THIS ATTRACTIVE LOCATION.

The installation of a weir would hold back the water and make this stretch of the river through Sutton-at-Hone more attractive.



5.9 Crossing Point by Field Centre south of Horton Kirby

This small section of river which suffers from acute low flows, is also somewhat overwide and could be narrowed by the establishment of butterbur, *Petastites hybridus* near the concrete crossing since this plant already occurs nearby. The concrete crossing itself is very dominant and could perhaps be softened by scrub planting at its edges. There is some dispute here between the fishing lakes and the NRA over the setting of water levels in relation to the lake inlet. The land is owned by the Dartford Anglers Club which has agreed in principle to these suggestions.

5.10 Westminster Mills, Horton Kirby

Of all the dried up locations on the River Darent this is perhaps the saddest sight of all. The bridge across the river leading to the recreation ground is a popular access point to the river and the mill pond below the Victorian weir was always a popular beauty spot. The village children believed it to be bottomless. Now the whole bed is cracked and dry except after a heavy thunderstorm when a puddle below the weir acts for a week or so as a fishes graveyard. Coachloads of schoolchildren from London still occasionally appear here with their jamjars and fishing nets because of the link with the field centre. The paving stones for stream dipping are now set in a waste of gravel.

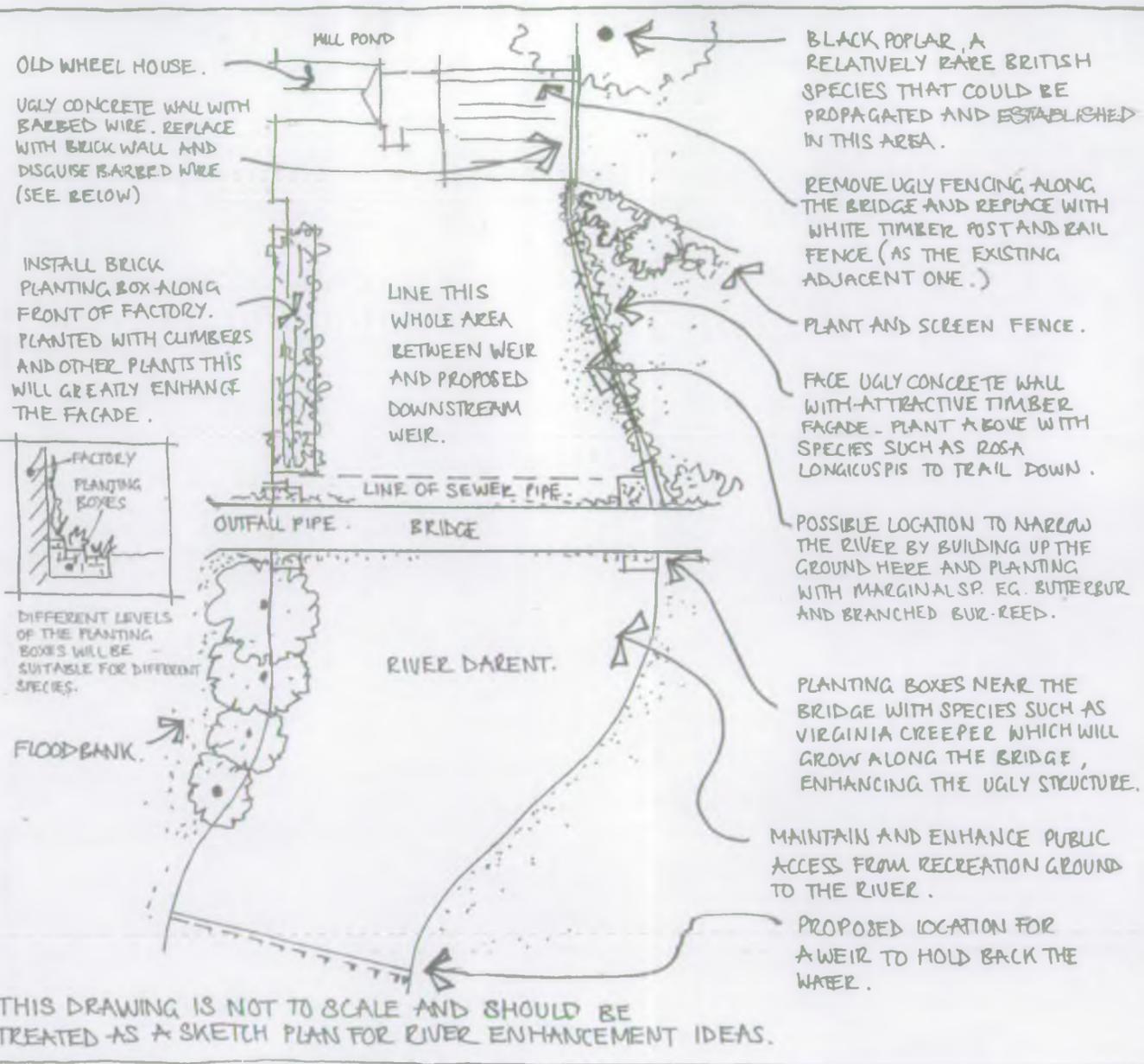
The whole area has declined in other ways as well. The once pretty bridge visible in photographs taken at the turn of the century has been replaced by an ugly structure of mass concrete. While the back of the mill retains some of the character of the Napoleonic era, (one of Nelson's flag lieutenants at Trafalgar lived at nearby Kirby Hall), the northern block of buildings was put up in the 1950s and constructed of very coarse brick.

The mill weir itself has been patched, with suburban railings replacing part of the original rail. Vandalism has become worse with the dry stream bed allowing easy access up the face of the weir. A mass of warning signs, loops of barbed wire and rusting corrugated sheeting complete the effect and the owner has had to coat all surfaces with slimy vandal-proof paint. This is where the television and the national papers go when they want horror shots of the Darent, the most recent spread featuring in TODAY, 22 July 1992 (Appendix 2).

Westminster Mill is on the site of a mill recorded in Domesday book. In the nineteenth century it was a cornmill. During the last war it made armaments for Vickers and since then bootlaces for Woolworths, and telephone cables. It is now abandoned though still belonging to Alcatel which has recently spent £10 000 to prevent the weir collapsing and which awaits a turn-up in the economy before deciding what to do with the building. Alcatel also owns land on the other side of the stream where there is a fine though slightly burned specimen of the rare black poplar, *Populus nigra*. Recent efforts to tidy up this area have led to a notable reduction in vandalism. The upstream millpond has been extended by the Flood Alleviation Section of the NRA. It has profuse algal growth and a large grass snake population. Native plants still clinging to the damp brickwork of the turbine house, (where the turbine which once supplied electricity for Queen Victoria's visit to Franks Hall still survives) include hemlock water dropwort, greater celandine, and black horehound.



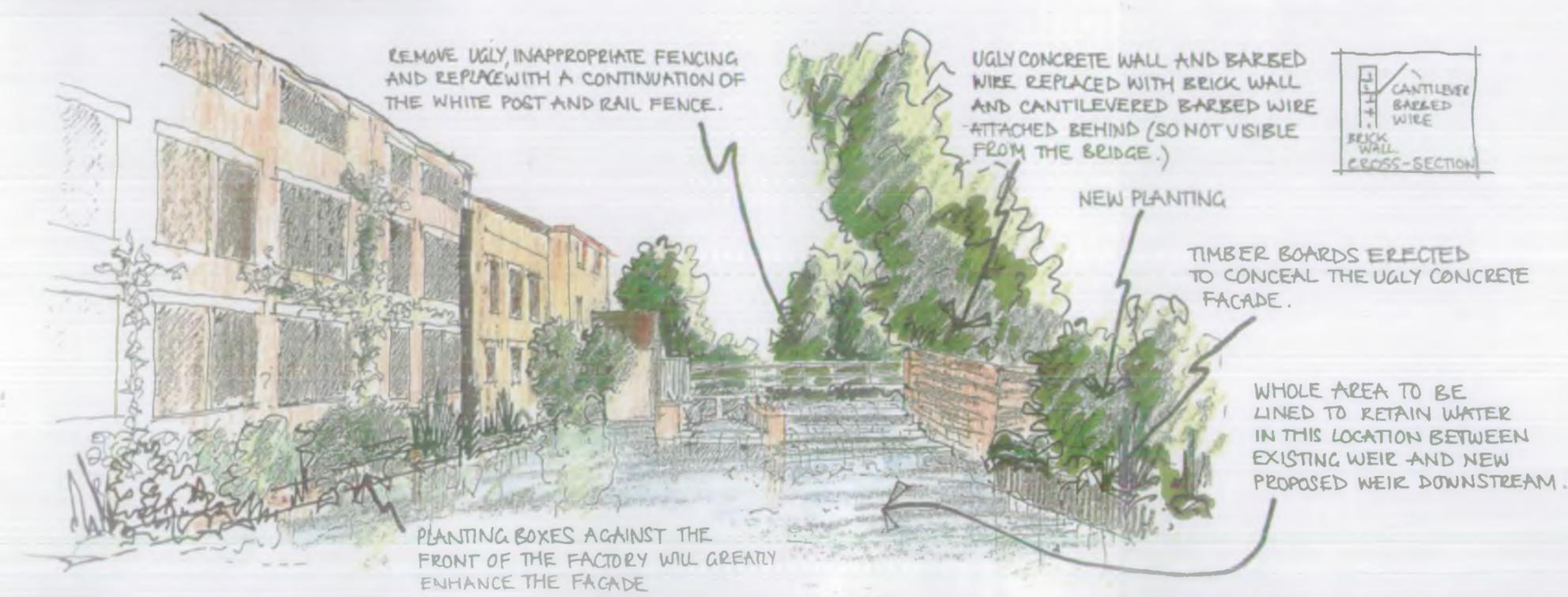
THE UGLY CONCRETE EDGE (ABOVE) WOULD LOOK FAR MORE ATTRACTIVE IF FACED WITH TIMBER BOARDS (BELOW)



Horton Kirby mill around 1915, functioning then as a shoe-lace factory. (Walter Millen)



HORTON KIRBY MILL TODAY (1992) THE RIVER DRY, THE FACTORY STANDING EMPTY AND THE OLD BRIDGE NOW REPLACED WITH AN UGLY CONCRETE STRUCTURE.



WESTMINSTER MILLS - HORTON KIRBY.



Suggested enhancements are shown in plan and include provision of a weir downstream of the bridge, possible lining of the bed back to the main mill weir, and reinstatement of rails and other details on the mill weir. (A full structural restoration of the mill weir would be a large-scale job but not recommended in the short term although a cost estimate for this more ambitious restoration is also included in the cost estimate in the appendix below.) Further suggestions are a replacement of the ugly concrete left bank with a secure brick wall by the mill weir, and traditional timber boarding below that. A brick walled planting box alongside the 1950s wing of the mill, set above flood level, would allow Virginia creeper, the luxuriant white rose *Rosa longicuspis* and willow bushes such as *Salix rosmarinifolia* and *Salix alba sericea* to soften the impact of the mill wall. Virginia creeper might also be established on the face of the concrete bridge if brick planters were constructed. Care will be needed to avoid the surface water outfall just upstream of the bridge on the right bank and also the sewer which apparently crosses the bed upstream of the bridge. A low embankment downstream of the bridge on the right bank may be needed so that high flows boosted by the weir do not flood the adjacent field in winter.

A source of extra water should be explored for this scheme. A reduction in abstraction at the pumping station immediately upstream in Horton Kirby is very likely to benefit flows at the weir and this should be pursued as a priority. In addition, the sealing of the existing swallow-hole upstream (see Section 5.13) would be beneficial. The local agent for the landowner of this site has been approached and has given his warm support. This proposal is recommended as the principal flagship of the NRA enhancement programme and it is hoped work will commence on it in the winter of 1992/93.

5.11 Garden of the Fighting Cocks Public House, Horton Kirby

A new weir, scooped out margins and planting could all be considered as potential enhancements in this area where the amenity value of the river is very important. The landlord would be especially interested in turning the existing inlet at the upstream boundary of his land into a wide pond. Part of the ground here lies at a lower level than the existing river bed and would probably fill with water very easily.

5.12 Rough Land beside Recreation Ground, Horton Kirby

A lined pond could perhaps be created in this area as a habitat improvement although care should be taken not to disturb possible Roman remains.

5.13 Swallow-hole Upstream of Horton Kirby

This large natural bay is also believed to be a swallow-hole down which waters of the Darent disappear to re-emerge well downstream of Horton Kirby. It is strongly suggested that this is sealed as soon as possible, subject to investigation outlined below. At the same time a small weir could be built downstream of the bay and planting could be established on the right bank in front of the ugly and dominant barbed wire fence. The Darent Valley Path is along the left bank of the river at this point.

Before sealing it may be wise to carry out a general investigation of this reach to check for other porous areas of the river bed. The fact that this bay is always one of the last spots on this reach to hold water may mean that it is not the worst section of bed. There is general consensus that the river does get lost very quickly through the bed, somewhere on this reach. Another area which should be checked and possibly sealed is the river below the M20, downstream of Farningham where pile driving for the motorway may have cracked the bed.

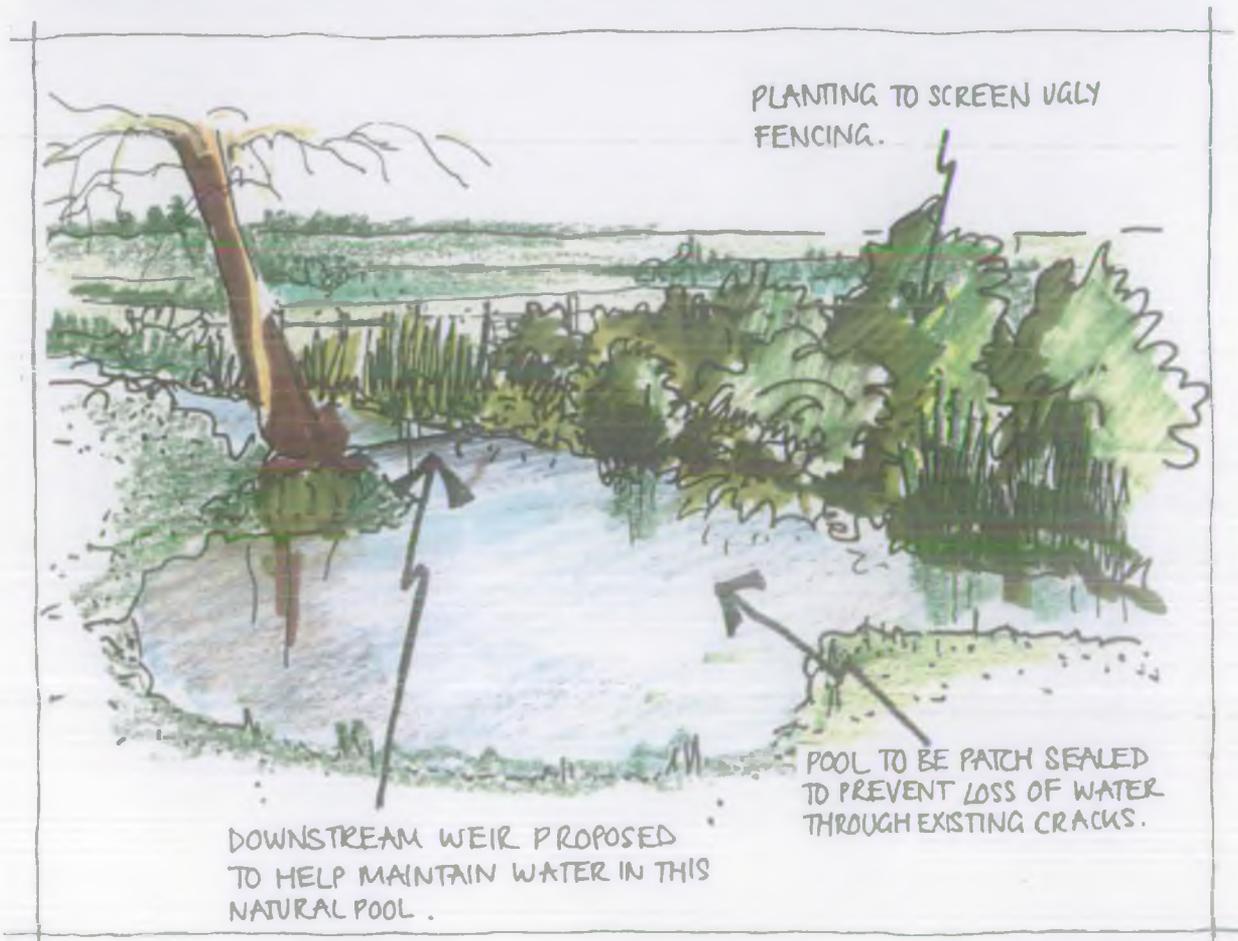
5.14 Planting between River and Pumping Station, Upstream of Horton Kirby

There is a 3 m gap between the ugly barbed wire fence and the right bank of the river. This is opposite the continuous Darent Valley Path on the left bank and so very visible. Planting of blackthorn and other native species would screen the fence, and increase the ecological value of the river corridor. Maintenance access for the river could continue on the left side. This proposal may have to be relatively long term, since the landowner is Thames Water Utilities, which has recently erected this fence very close to the river and enclosed a very large area of wasteland for its pump station on the inside. It would be very desirable to plant up much of the land within the grounds of the pump station which is at present a waste of docks and thistles.

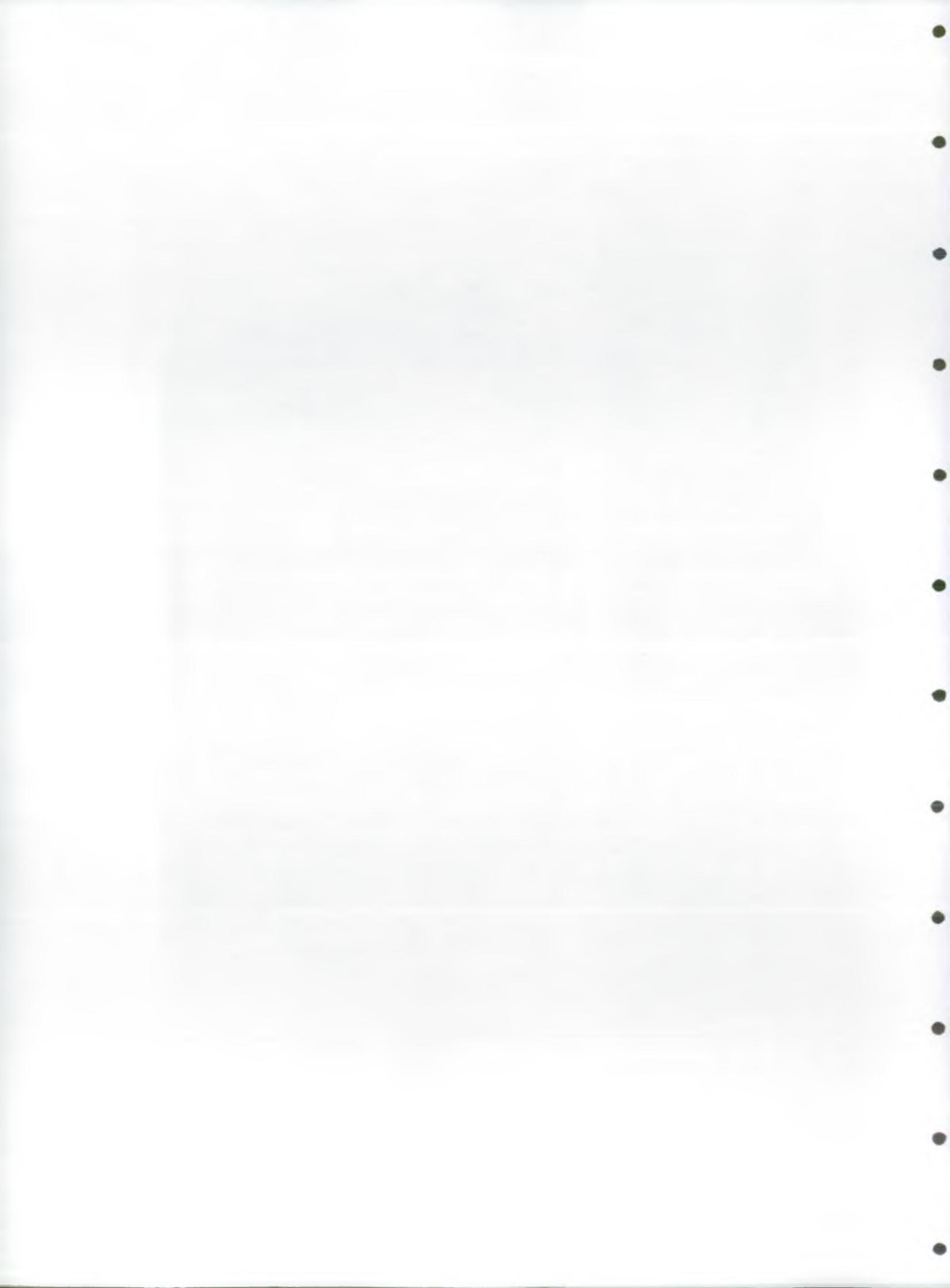
5.15 Weir Downstream of Franks Road Bridge

Attractive weirs immediately below Franks Hall have been installed by the landowner, in addition to the two Victorian rock weirs in the grounds. All these weirs are a notable feature as well as helping to retain water in the river.

It is suggested that a similar weir is installed downstream of the road bridge where the river bed is frequently dry but nonetheless a popular place which is easy of access. This site is beside the public footpath. The landowner, Mr Westacott is keen to establish weirs on this reach of the river himself and should be approached by the local NRA conservation office which can also alert him to the £400 grant available to landowners from the Countryside Commission specifically for erecting weirs. Mr Westacott also owns the land resulted in Section 5.13 above, and he is similarly keen to construct a weir there.



Upstream of Horton Kirby planting to screen the ugly fence, the installation of a weir, and patch sealing of the river bed will all help to enhance this naturally created pool.



5.16 The Bridge at Farningham

The land opposite the Red Lion Inn between the road bridge in Farningham and the historic cattle gate is one of the most obvious 'honey pots' of the whole river where many people gather. However, while flows are often too low here, there generally is some flow of water, compared with drier downstream reaches near Horton Kirby.

Nonetheless, because of the great amenity value of this location it is an important site for consideration. A weir could be constructed downstream of the cattle gate although some temporary weir structures have already been established. Liners might also be considered if flows prove very inadequate although great caution should be exercised in relation to the footings of the listed historic structure of the cattle gate and the bridge. Marginal aquatics such as yellow iris could easily be established here.

5.17 Farningham Mill

This superb building, completed in its present form around 1790, is one of the jewels of the Darent valley. Lack of water has left the millpond, upstream of the mill, slimy and exposed but never as regularly dry as the Horton Kirby millpond. The landowner has expressed interest in anything which could be done but local enhancement is hardly going to deal with the problem here as compared with restoration of flows. However, patching of leaks in the mill weir should be considered. Also much of the water goes through the eastern arm rather than the Darent itself and sill adjustment may be worth considering, subject to pressure from those benefiting on the eastern arm.

5.18 Reach Upstream of Farningham

This fairly open area could benefit from tree planting and sensitive channel narrowing where it is overwide in a few places. Public opinion has suggested that a footpath link would be very popular here, but extensive negotiations with landowners would of course be necessary and this is beyond the scope of the NRA. This reach includes some very attractive gravelly stretches with large colonies of monkey flower and brooklime.

5.19 Damp Field near Eynsford Paper Mill Development

The river is highly embanked here in order to provide a considerable head of water to Eynsford Paper Mill, now converted to housing. The Darent leaks out of the steep bank constructed for the mill race, as the water seeps down to its original natural route at the bottom of the valley to the west. As a result the damp field is a good habitat for snipe and grey wagtail, which are evident. One option would be to rationalise these damp spots into a pond which would have the additional benefit of providing an educational facility to the nearby Eynsford school, if access were allowed on special occasions.

However the land is good pasture and our impression is that the landowner, Mr Alexander of Eynsford, would prefer that the leaks were patched. Furthermore the NRA is already excavating a pond for the Antony Roper School under direction of Trevor Carman and Robert Pilcher.

5.20 Eynsford Castle

Standing beside the river and once entirely moated, the twelfth century castle makes a fine sight. This is a potential site for enhancement, which could comprise shallower slopes to the river and the creation of a reedy margin. At present the site, though accessible to visitors is fairly dull with mown grass to the waters edge. Clearly disturbance to any area of archaeological importance would need to be avoided. English Heritage has suggested that we write to them about the matter and so discussion is ongoing.

5.21 Eynsford Village

This is an outstandingly popular area and on a sunny day is thronged with people paddling, pond dipping and picnicking.

The weirs, installed by the NRA, have been an undoubted success and further work on them is being carried out by consultants based with NRA (Thames Region). When these are redesigned it may be worth considering aquatic planting boxes constructed with timber boards to break up the severe concrete line of the left bank. These could be established with flowering rush and branched bur reed which are already in the channel and would achieve the effect of stream narrowing and therefore deepening flows. Care will need to be taken, however, to leave plenty of space for people who like to sit on the concrete sill and dangle their legs over the edge, as well as gaining access to the river from this point. The landowner who owns this reach has made no objection to these proposals in principle.

5.22 Lullingstone Castle Wetlands

An attractive wetland area of alder carr and reed swamp lies adjacent to the left bank of the River Darent immediately downstream of Lullingstone Castle. As a habitat this is increased in value by its proximity to the historic deer park of Lullingstone which has been extensively researched. This is also one of the wildest and more attractive reaches of the entire river.

No particular enhancement is proposed here but the importance of keeping this wetland system damp is stressed in connection with the general guidelines for Environmentally Acceptable Flows.

5.23 Footpath and Fence Improvements at Lullingstone Lakes

The Darent Valley Path follows the river to the west of the Lullingstone Lakes, an important trout fishery. At one point the path runs hard against the Lullingstone estate boundary and a massive barricade of fencing has been put up to minimise intrusion. The result is one of the worst examples of barbed wire and stalag-style fencing on the long distance path.

It is suggested that the path is set back from the fence and planting of such species as blackthorn and hawthorn are established in front of it. This will reinforce the boundary for the estate as well as increasing the privacy, whilst at the same time reducing the intrusive effect on the footpath.

The agents for Lullingstone estate have been approached and have not yet expressed objection. Once the landowner is in agreement, the Kent County Council will need to formalise a diversion order for the footpath.

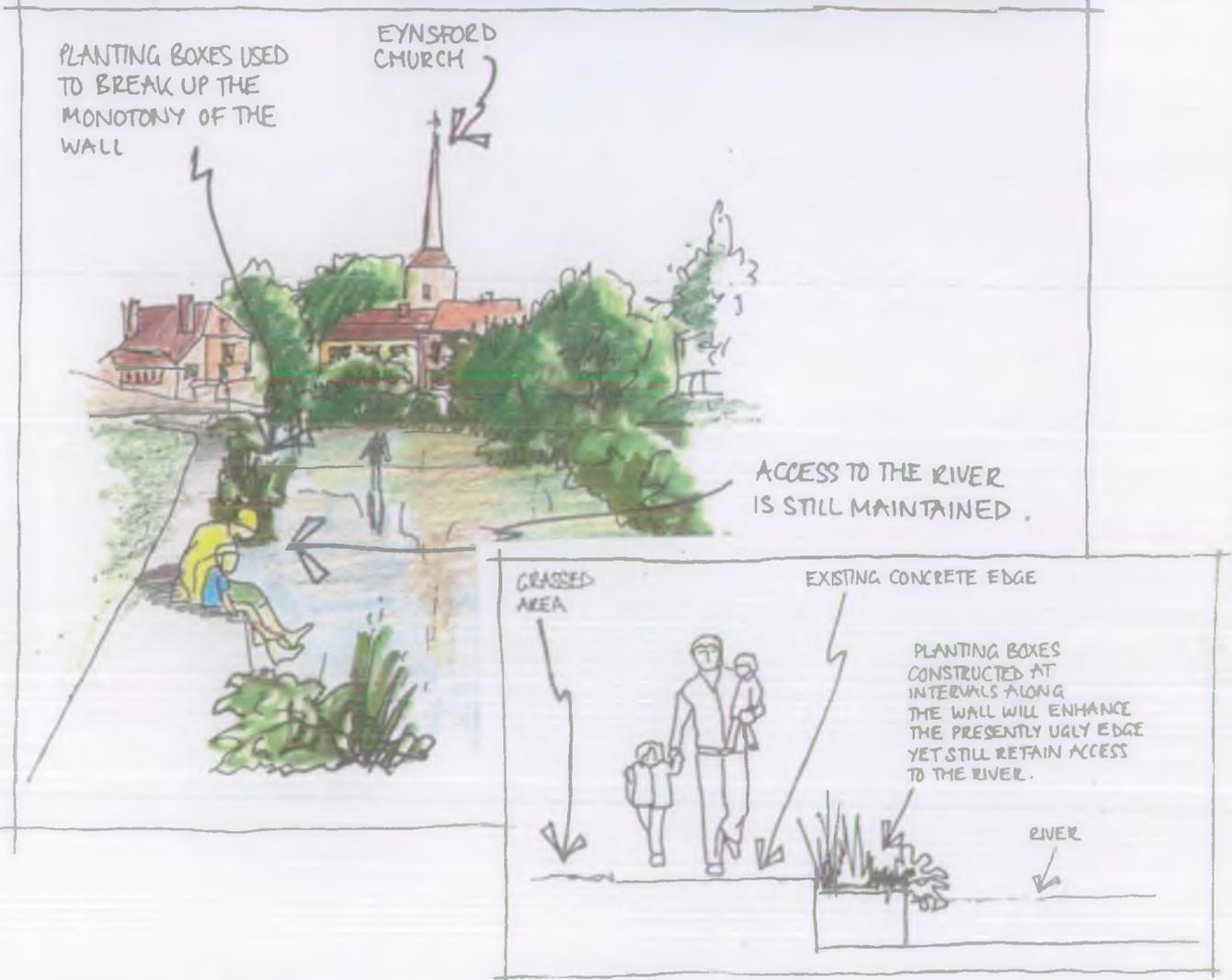
5.24 Shoreham Bridge

The centre of Shoreham is a well known beauty spot and important access point for the river. While water levels are lower than they should be, some flow is generally maintained with the exception of the western arm of the split stream which occasionally goes dry upstream of the bridge. Given that the scale of the problem is not as great as in some areas and that the pool and riffle sequence is a valuable feature, enhancements are not especially recommended here although a low weir might be considered on the western arm. Flows in this stretch may be boosted by water meadow proposals (see Section 5.25 below) and the long-term re-introduction of the crayfish would be another major goal.

5.25 Shoreham Water Meadows

Following their introduction in the sixteenth century water meadows were the last word in sophisticated farming technology alongside many southern English rivers including the River Darent. Water was 'floated' along brim-full channels, as described by Thomas Hardy 'on a plan so rectangular that on a fine day they looked like silver grid irons'. This warmed up the land for the early bite, thereby allowing heavy stocking of sheep.

In the past greenshank, redshank and dunlin were recorded on these water meadows and they were also recorded on the flood meadow south of Otford. Snipe still occur and lady's smock *Cardamine pratensis* together with kingcup, *Caltha palustris* are still an attractive sight here in the spring. What is most remarkable is that the stone-lined channels, sluices, and even the hydraulic ram all still survive in remarkably good condition.

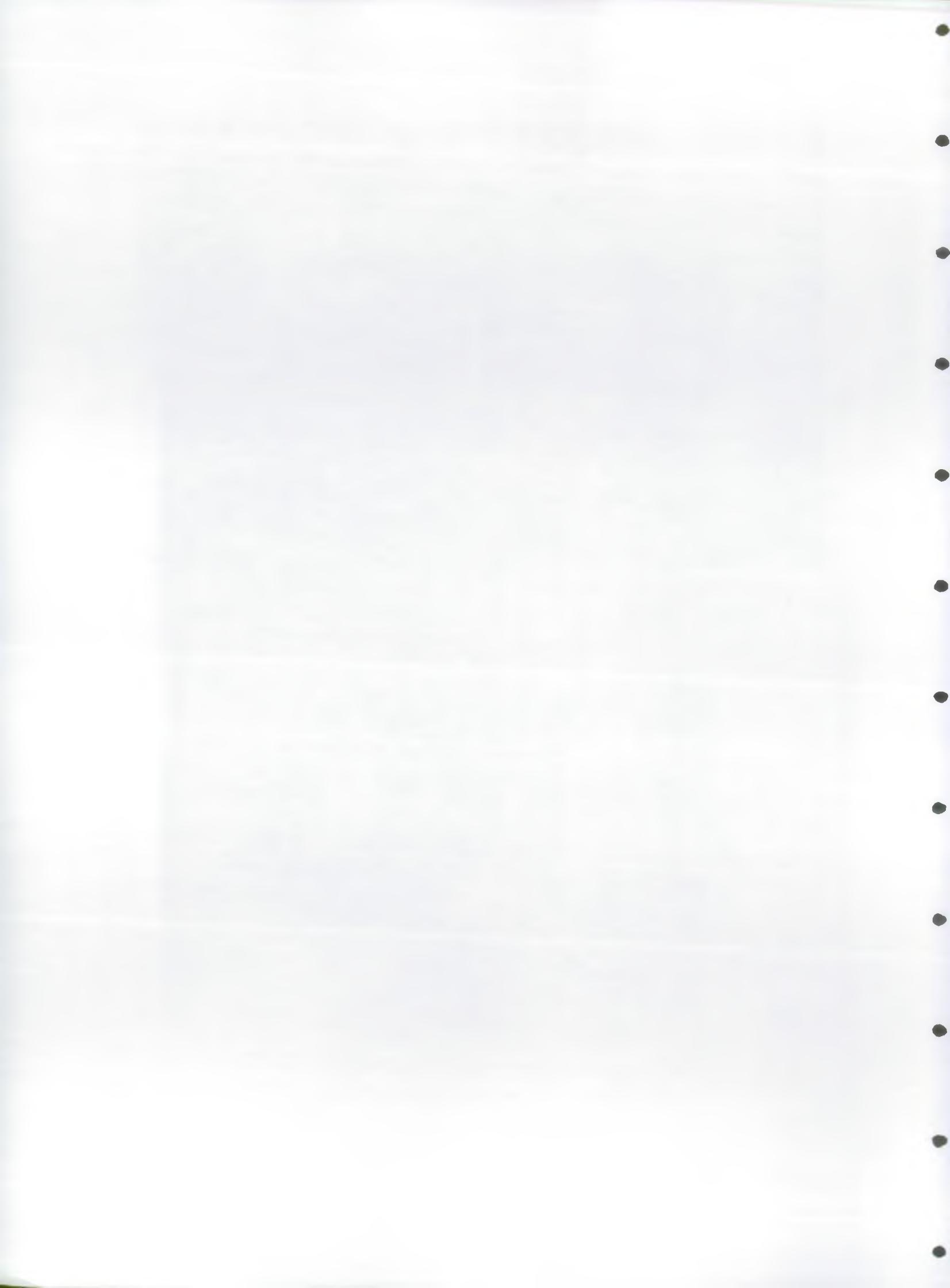


As the river passes through Eynsford an ugly concrete margin could be greatly enhanced by the construction of planting boxes at intervals along this stretch. The construction of weirs here has already helped to hold back water.





The Darent Valley Footpath could be made far more attractive as it approaches Lullingstone Castle by moving the path and planting a thicket of blackthorn to screen the existing unsightly security fence (above).



Countryside Stewardship schemes have piloted the restoration of similar water meadow systems in recent years, especially on the River Meon in Hampshire where the horse-grazing land-use is similar to that at Shoreham. This would seem a golden opportunity to explore. The landowner is J Clubb, the gravel extractor, who originally bought the land for mineral extraction but was denied planning permission. He lets it out to the Mr Dinnis of Filston Farm who has no overall objection to the idea although at present the £65/acre payments fall a little short of making the stewardship scheme an entirely attractive idea. Mr Dinnis grazes horses on it and this use is compatible with water meadow management which must involve grazing. Indeed the Shoreham meadows were historically used for draught horses. Another important meadow in this group belongs to Mr Wright of Home Farm, Shoreham who also grazes horses and has an agreement with the Kent Trust for Nature Conservation (KTNC) for the management of the meadow.

A problem would be the head of water upstream of Shoreham needed to drive the system but in the early spring this may not be a particular problem over this relatively well-watered reach. There may also be considerable benefits in storing the water and saturating the meadows. The water might then be released naturally to the Darent in Shoreham in the early summer. An additional pool which helped store water could of course be a further conservation feature as well as being popular with the landowner as a source of gravel, but this may be resisted by the Shoreham Society.

5.26 Filston Farm Moat and Cricket Bat Willows

This is another of the many historic moats in the Darent Valley, but fortunately the levels have not dropped as they have at St John's Jerusalem. Nonetheless, some monitoring would be advisable. The nearby cricket bat willow plantation will need to be kept damp if the willows are to make good straight stems and this is another factor to consider in relation to Environmentally Acceptable Flows in this area. No specific enhancements are recommended here.

5.27 Riverside Planting on Filston Farm

This sinuous rather silty reach of river is slightly atypical of the central reaches of the Darent. Algal bloom is especially bad, compounded by low flows and the fact that extensive arable farming has removed most shrub and woodland cover on the left bank which is generally exposed to bright sunlight and high nitrogen input, especially evident from the nettle-dominated river banks. The right bank already supports a reasonable tree cover notably of alder.

Planting on the left bank is therefore recommended and the owner has indicated a general willingness to edge his fields with a new straight boundary which would create quite generous tree-planted areas within the deep loops of the river. A Forestry Commission grant for management may offer particular cash incentives to the farmer for tree planting and the planting of cricket bat willows, which have a ready market with Newburys in Robertsbridge, is another popular idea.

Deepening of pools and further weir structures might also improve the fishing in this area. The local fishermen have already established some effective weirs.

5.28 Timber Deflector Downstream of Otford

This reach has some good stands of water crowfoot. Given the low flow problems and the fisheries interests, timber deflectors in areas where cattle have created a slightly overwide channel could be a potential improvement.

5.29 Pond Scheme in School Field

A riverside field at the back of the school in Otford is owned by Kent County Council and would be an ideal site for a pond or artificial meander loop because of the school involvement (see Section 4.7 above). The field is rough grazing and quite damp in places.

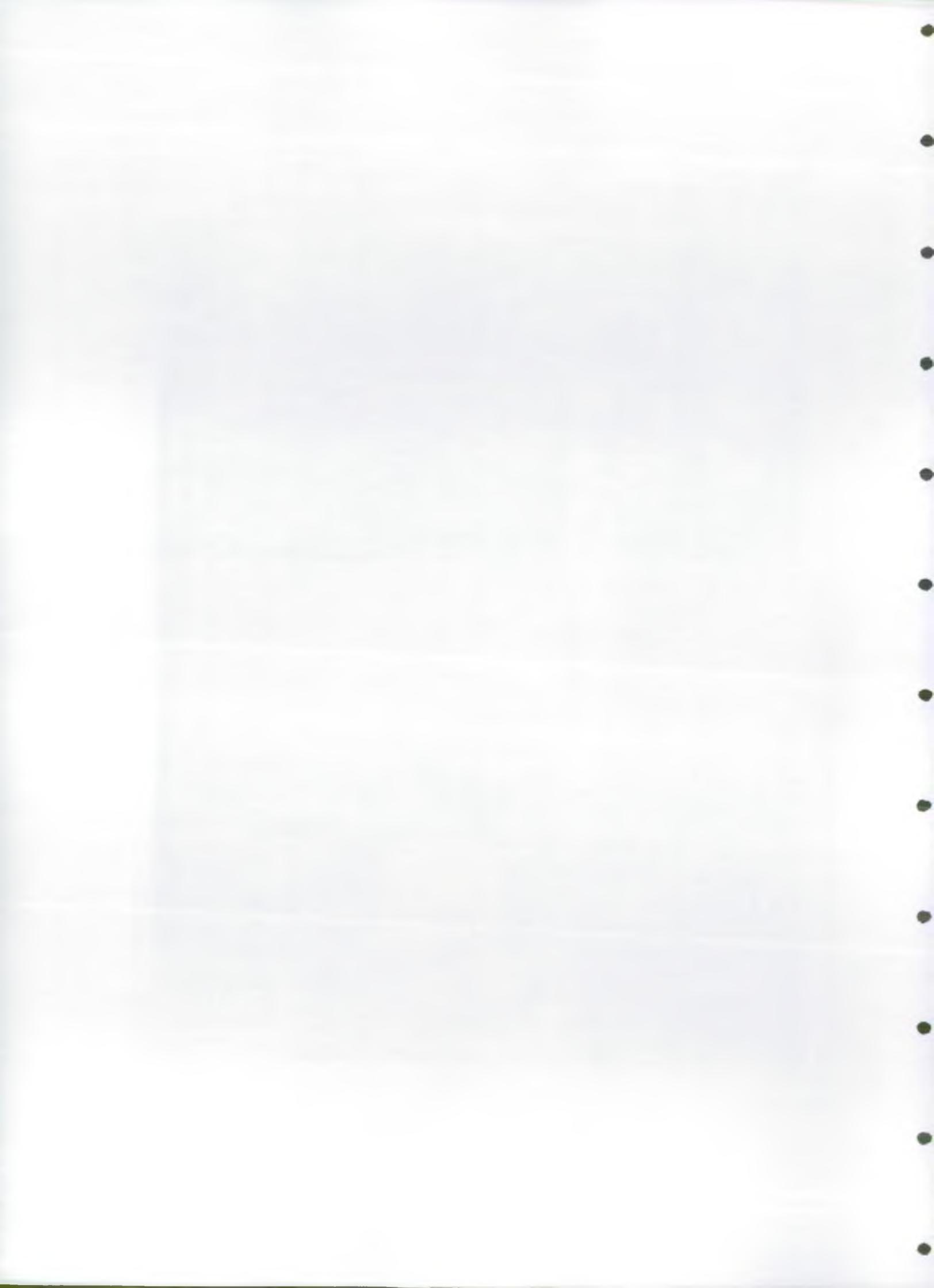
5.30 Sheep-grazed Pasture on Bartram Farm between Bradbourne Lakes and Otford

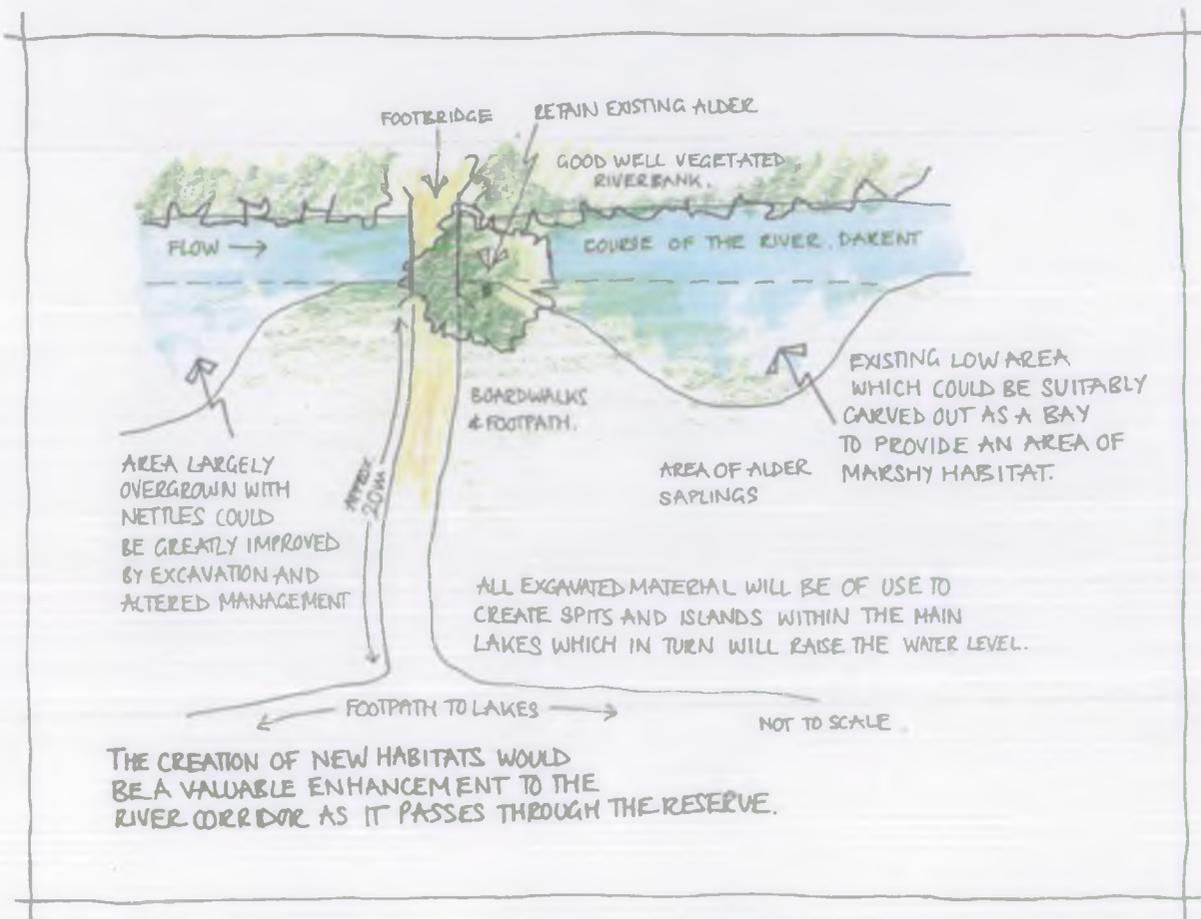
This is one of the few traditionally sheep-grazed sections of the valley, the meadows between Otford and the M26 having been damp pasture of ornithological interest 20 years ago. The area south of the M26 is especially bare of trees and as the flows in the Darent become ever lower the sheep have trampled the banks and so widened the channel through which the water is spread even more shallowly. Smelly black algae are also a feature of this section, exacerbated by the shallow water. Fenced tree planting is recommended over this reach, and the landowner has welcomed the idea in principle and has suggested that cricket bat willows would be especially popular.

Much of the flow in this reach of the Darent has been reduced because the outlet from the Bradbourne Lakes (see Section 5.31 below) is such that all the surplus lake water is conveyed under the landfill site rather than into the true arm of the River Darent. This means that water from the spring-fed Bradbourne Lakes reaches the river about 1 km downstream of the lakes via a featureless ditch at the eastern side of the valley. The outflow is notably black and polluted when it emerges from the landfill. Furthermore the pipe coming out of the landfill has been observed as being submerged by a larger flow of water seeping out of the landfill itself. The landowner over this reach has said he would be very happy to see the lakes' outflow go directly into the Darent rather than through the subsidiary channel. In addition, the owner of the lakes is happy to accept a rerouting of the outfall (see Section 5.31 below).

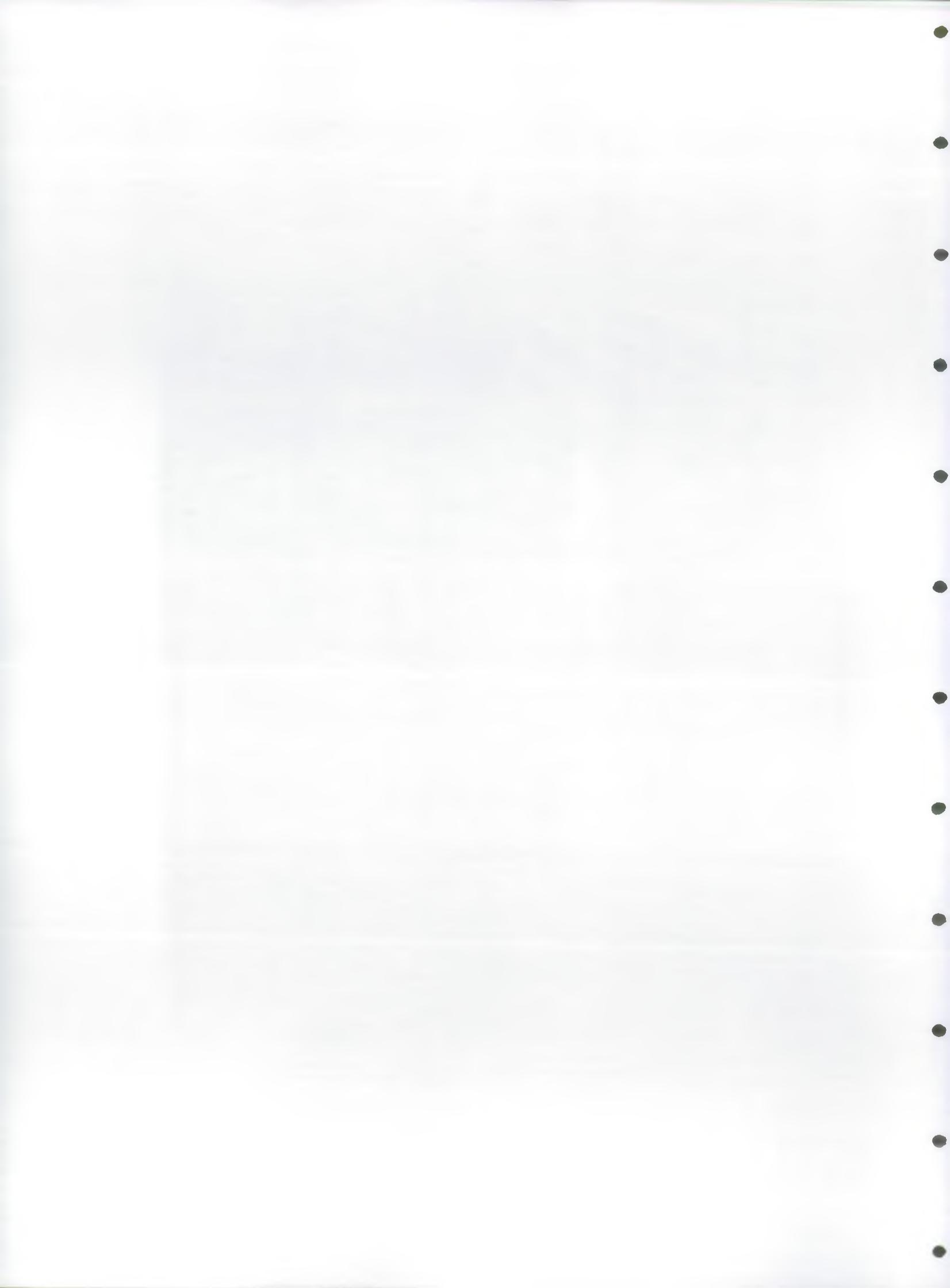


Intensive agriculture has eroded the river corridor upstream of Shoreham (above) and upstream of Otford (below). In the top example arable cultivation leads to nutrient enrichment of the Darent which compounds with low flow to increase algal bloom. In the bottom example sheep grazing tramples, and so widens, the channel thus causing low flows to spread even more shallowly over an extended river bed. Tree planting is proposed in both areas.





As the river passes through Sevenoaks Wildfowl Reserve valuable enhancements could include creating bays and using the excavated material to make more interesting margins on the main lakes.



The area is also crossed by the Bubblestone Brook which flows down into the Darent from the east, parallel to the further side of the M26. This brook is totally dry in the summer and it should be investigated further as part of the total Darent catchment along with the Honeypot stream. Much of the water for the Bubblestone Brook has seeped down into the motorway drains. The massively oversized river engineering in association with the M26 has also affected the lower reach of the Bubblestone Brook.

A new gravel pit being excavated at Great Oaks Farm just north of Sevenoaks would also be worth considering in relation to top-up flows.

5.31 Sevenoaks Wildfowl Reserve, Bradbourne Lakes

This is a 135 acre SSSI famous chiefly as an early example of habitat creation for wildfowl being the imaginative adaptation of a gravel pit, pioneered by Jeffrey Harrison in the 1950s. The first excavation had been made in 1935 and mineral extraction was completed in 1980. The site is leased from Redland and run by an independent charity, the Jeffrey Harrison Memorial Trust, with income from visitors and fishermen.

The site is an important reserve for wildfowl with large numbers of mallard, tufted duck, pochard and gadwall together with many waders on passage, and snipe and jack snipe throughout the winter. Great crested grebes are an attractive feature of the lakes and have increased to five breeding pairs since shallowly flooded islands overgrown with willows have been created for them. These make ideal breeding platforms for the grebes since they are too wet for the aggressive Canada geese and graylag geese.

The warden in charge of the reserve has expressed considerable interest in potential enhancements notably at the north-west corner of the reserve where the River Darent flows past the lakes. In one reach upstream of the footpath and footbridge, an area of approximately 20 m x 40 m, which currently consists of bramble and nettle, could be excavated to a depth of 1.5 m, thus creating a marshy area beside the river. This would develop into a fine reed bed if *Phragmites* was established. It would be a notable attraction for reed warblers and sedge warblers which are already present elsewhere on the site. The spoil could be transported to the lake which is only 20 m away for relatively low cost, and there created into a damp spur or else a shallowly flooded island for the grebes.

Immediately downstream of the footpath and footbridge a small meadow could be created beside the river in conjunction with a weir which would raise levels locally. This would enhance the existing wetland area where kingcups and purple loosestrife already flourish and reed-buntings are abundant.

A major issue which would usefully tie in with a strategy to restore waters to the Darent is the fact the periodic lowering of the lakes, especially in late summer and autumn, would create muddy sides attractive to waders on passage and therefore be a major enhancement to the habitat of the reserve. Subject to careful negotiation with the Bromley Angling Club, which leases the fishing from the Jeffrey Harrison Memorial Trust and would probably require bunds, spurs and jetties, lowering the water level by a possible depth of 1.5 to 2.0 m would be welcomed in principle by the Trust. Lowering would need to be done after the grebes and other birds had finished breeding in July. Redesigning the outfall to give proper control with a penstock would be a welcome improvement in itself and could be tied in with the major improvement of diverting the outfall directly to the Darent rather than through the landfill (see Section 5.30 above). This would need to be combined with a control to keep the flooded wood damp at north-western corner of the reserve. A detailed level survey would be needed as a prerequisite for this scheme but in theory a 2 m drop in water level could be achieved. The lake is approximately 1.5 km long by 0.5 km wide. As a source of water for the river this could be especially valuable if combined with a strategy of topping up from Marley Lake and Sundridge Lake (see Section 5.32 below).

5.32 Conservation Pond Downstream of Railway Arches

Between the Bradbourne Lakes and the railway line at Riverhead, rough land on the left bank of the river could make a good site for a conservation pond. The landowner has not made any objections in principle.

5.33 Marley Lakes and the Sundridge Lakes

The large Marley Lakes which is the most important sailing lake in the valley belongs to Marley which originally used the sand in the manufacture of their tiles. The most easterly end has been filled by Marley with a view to the creation of waterside offices/housing but they lease out the main part of the lake to the Chipstead Sailing Club, and the Holmesdale Angling Society. As well as being an attractive site for birds, with a well developed woodland fringe, the lake is a fine dragonfly site with large populations of *Aeshna grandis* and *Libellula quadrimaculata*. An attractive small reed bed already exists at the eastern end of the lake.

The lake has been considered as a possible source of top-up water for the River Darent and a useful plan from the Halcrow report (Appendix 11) has been appended with the additional suggestion that to bund and impound the north-eastern inlet creek as a small isolated lake would be a more attractive option than creating a reed bed area which would anyway be difficult on the steep sides. Further work is needed however to establish the feasibility of this proposal, notably a detailed level survey and further negotiation with the fishermen and sailors. The sailors would need a draught of at least 1.1 m depth and the fishermen require adequate spurs and jetties to get out to the water's edge in periods

of drawdown. The most ingenious suggestion recently mooted is the sinking of large air balloons which would displace water without lowering levels and this would also seem worth investigating despite numerous practical problems. The lake is said to be extremely deep. Marley has said that it is prepared to look at more detailed plans with an open mind, subject to agreement with fishermen and sailors.

The Sundridge Lakes, immediately upstream of the A21, belong to a landowner in Brasted (see Section 5.34 below) who has said that he has an open mind about proposals. The lakes are used for fishing only and have valuable adjacent wetlands.

5.34 Sundridge Pumping Station

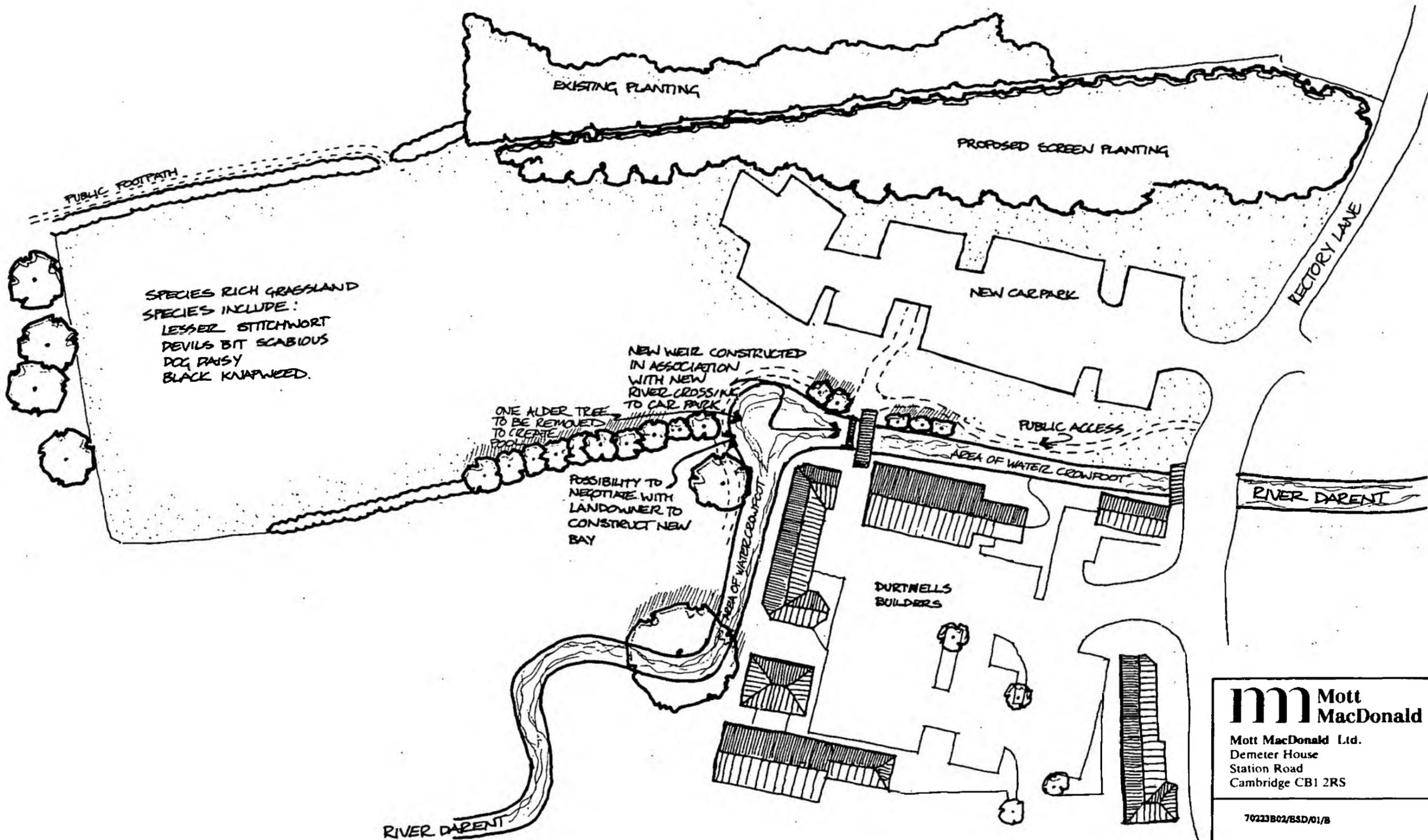
Land adjacent to the Thames Water pumping station, especially on the left bank of the Darent presents interesting conservation potential. If 1 m of land was stripped off (with possibly some gravel winning benefits which would cover costs) a fine reed bed could be developed on this land, which is currently rough grassland of little conservation interest with poplars which may be harvested in a few years' time. At present, the grassland is dominated by dock, thistle, nettle and coltsfoot, although there is also some meadowsweet and the goldfinches evidently enjoy the thistle.

It would be desirable to develop some access through the meadow on the left bank (opposite the pumping station), as this is presently one of the most impassable sections on the Darent.

5.35 Moorcocks Meadow, Brasted

The meadow immediately upstream of Rectory Lane road bridge at the back of Brasted offers an interesting, though potentially controversial, opportunity for enhancement. Public access to the riverside in Brasted is notably limited and John Durnell, the landowner of the riverside meadows immediately adjacent to the road is, in fact, eager to develop public access to these meadows together with conservation enhancement in return for a concession which allows him weekday car parking for his offices across the river. Although this would be within the Green Belt, Sevenoaks District Council planners are not automatically against this. The structure plan does indeed itemise the need for some extra car parking in Brasted. (The public would be able to use the car park at weekends.) However, a lobby of residents immediately to the north of the site has opposed these proposals within the parish council. By moving the car parking back from the river (see plan) it is suggested that river access would be improved, and a new millpond could be created on the bend of the river between the main areas of crowfoot. This could be impounded by a weir and solid planting could screen the parking from residents to the north.

The meadow immediately to the west of this field also belongs to Mr Durnell. He is prepared to make this accessible to the public as well as managing it for conservation which would involve grazing or mowing and avoiding sprays. The meadow is one of the more interesting species-rich meadows beside the upper Darent and species include:



SPECIES RICH GRASSLAND
SPECIES INCLUDE:
LESSER STITCHWORT
DEVILS BIT SCABIOUS
DOG RAISY
BLACK KNAPWEED.

NEW WEIR CONSTRUCTED
IN ASSOCIATION
WITH NEW
RIVER CROSSING
TO CAR PARK

ONE ALDER TREE
TO BE REMOVED
TO CREATE
POOL

POSSIBILITY TO
NEGOTIATE WITH
LANDOWNER TO
CONSTRUCT NEW
BAY

AREA OF WATER CEDWFOOT

DURTNELLS
BUILDERS

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70223B02/ESD/01/B

MOORCOCKS MEADOWS -

BRASTED

Date AUG 92	Drawn DS	Checked JRP	Approved JRP	Scale NTS
Drawing No. 70223/SK SECTION 5.35				Rev.

Lesser stitchwort	<i>Stellaria graminea</i>
Meadow buttercup	<i>Ranunculus acris</i>
Devils bit scabious	<i>Succisa pratensis</i>
Dog daisy	<i>Leucanthemum vulgare</i>
Sedge	<i>Carex sp</i>
Black knapweed	<i>Centaurea nigra</i>

The creation of a pond, although this may need lining, could be another attractive feature.

5.36 Pond Site at Park Farm

The river at Park Farm is an especially attractive reach with a pronounced pool and riffle sequence, clean gravel supporting some crowfoot and large alder trees along its banks. There is one notable gap in the alder trees near the western boundary of Park Farm and this would make an attractive site for an on-site pond and weir system. Crayfish may well still be present here, dragonflies such as *Libellula quadrimaculata* are likely to colonise it and conditions are not impossible for trout.

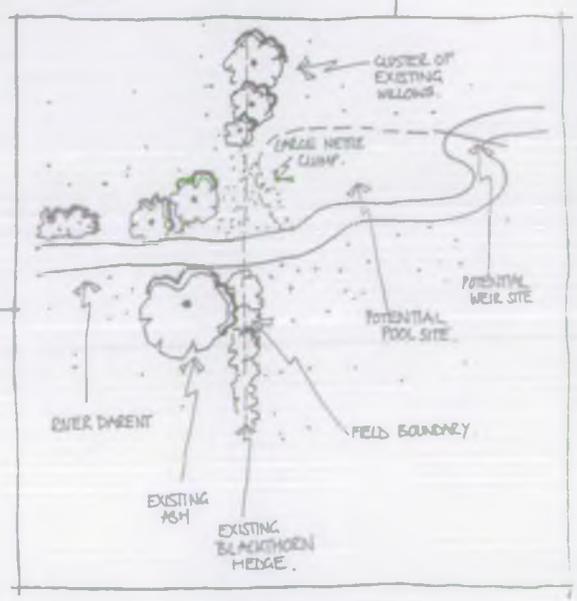
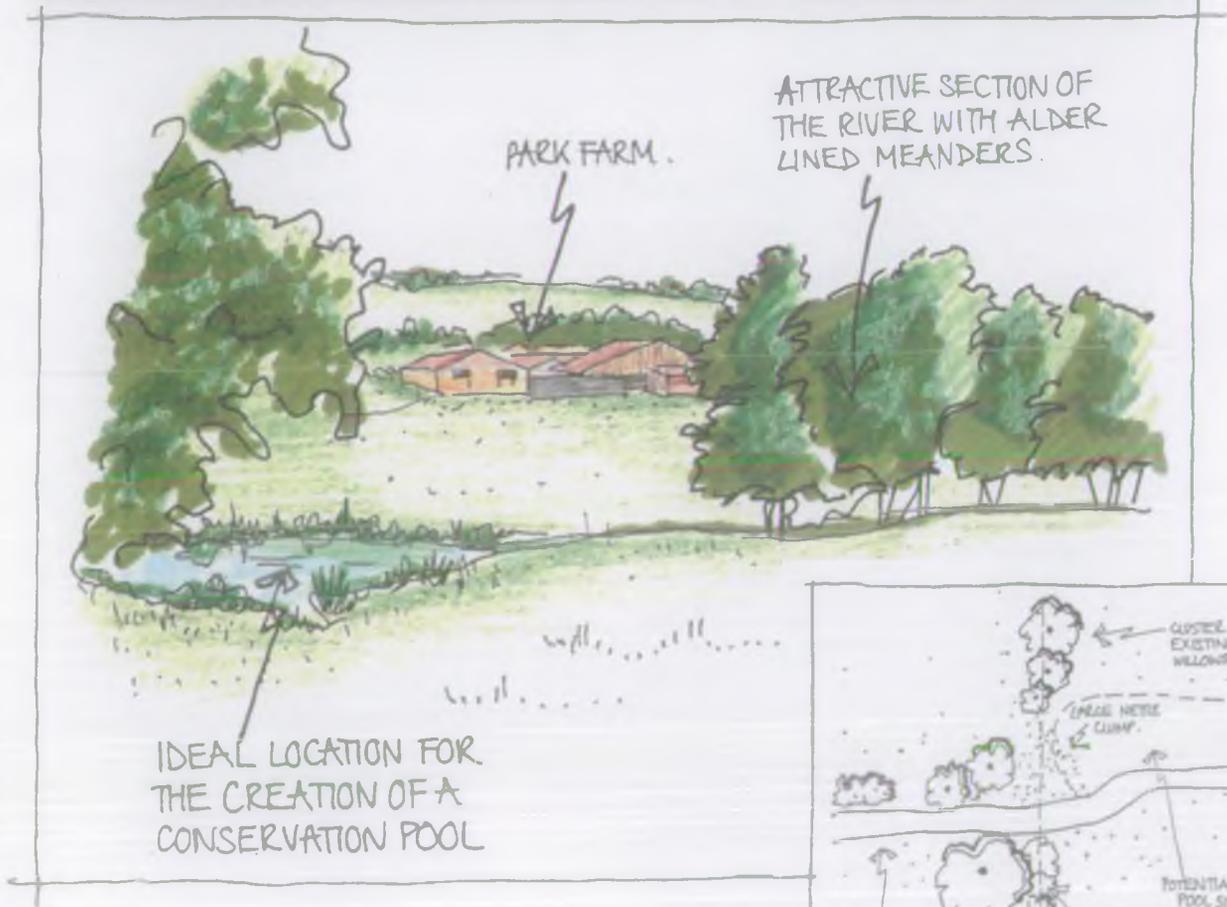
The pond would not be on a public footpath and its value would be entirely for nature conservation. Care will be needed to avoid the mains pipe in this area and associated planting to tie into the hedge systems would be beneficial. The tenant farmer has expressed support subject to clearing it with the Chevening Estate. Some planting and river widening might also be achieved immediately upstream of the hedge boundary where the owner is Mr Warde of Squerryes (see 5.38 below).

5.37 Riverside Car Park, Westerham

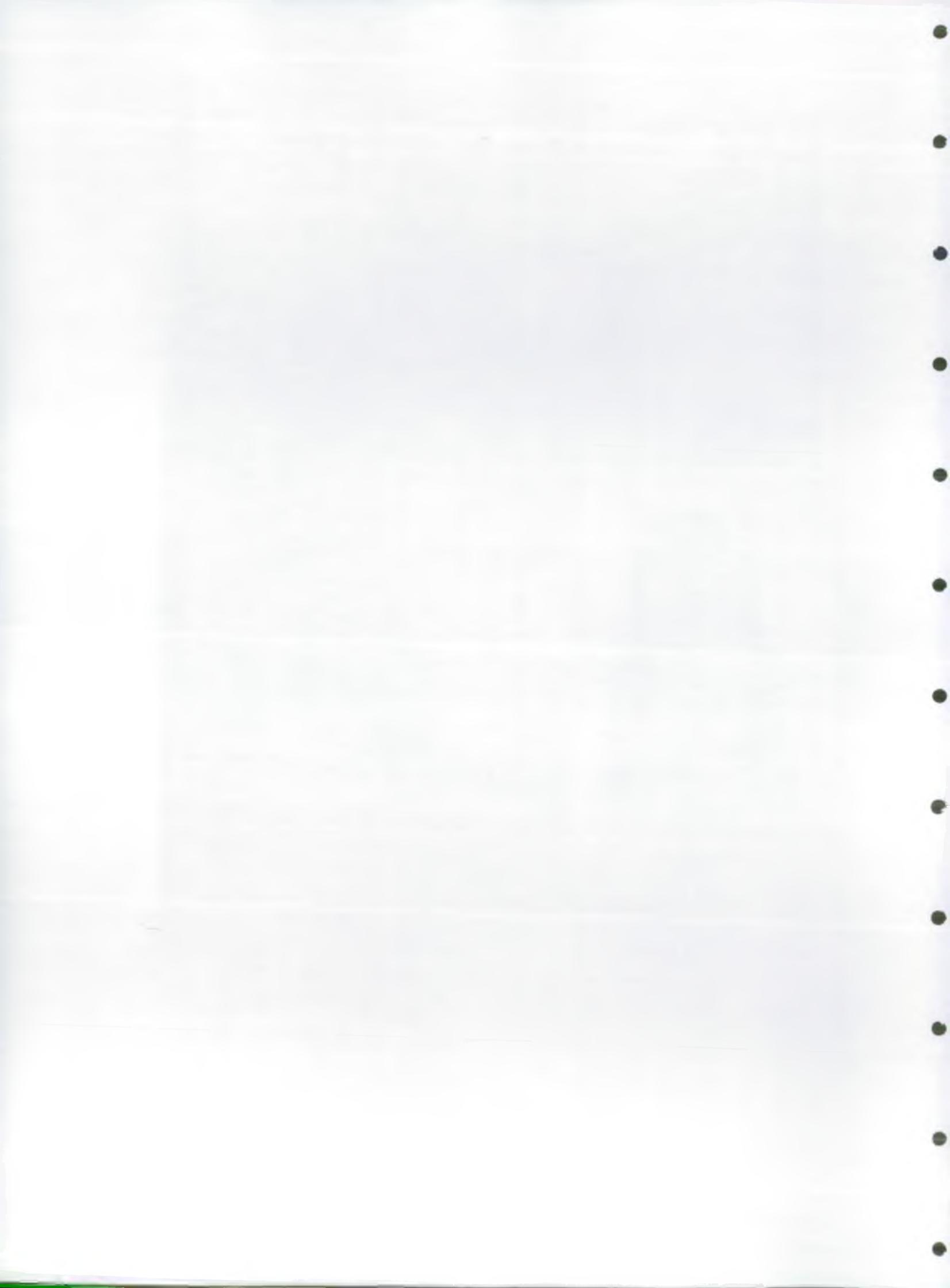
This car park, recently established by Sevenoaks District Council, is an important departure point for the Darent Valley Path but the river itself is virtually invisible owing to the way it cuts down steeply at the back of a fenced and weedy bank on the north side of the car park. Excavation of a shallow slope here would give access to the river and, on the other side which also has public access, a wide bay impounded by a weir could also be created within the King George V Playing Fields. Sevenoaks District Council has welcomed this proposal and Westerham Parish Council has no objection to landscape enhancement works along the river, but has expressed reservations regarding the specific area where these should take place, preferring land to the south side of the hedge at the western end of the field.

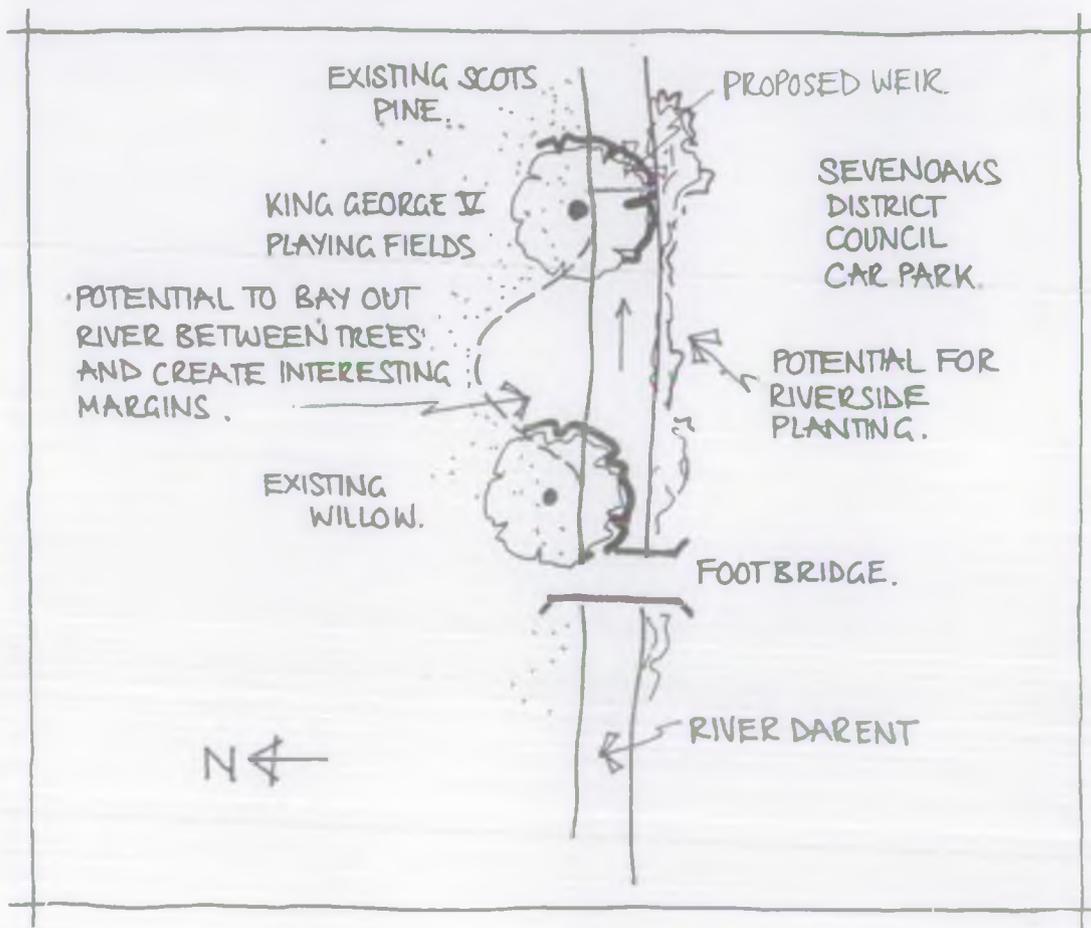
5.38 Squerryes Court Entrance

Squerryes Court house and grounds are open to the public. At the entrance to Squerryes Court is an attractive lodge house framing the distant views of the mature parkland. However, on the left of the entrance gate the foreground is encumbered by an untidy collection of barbed wire fences beyond which is a trampled morass created by cattle and a concrete hump put up as a local flood bank.

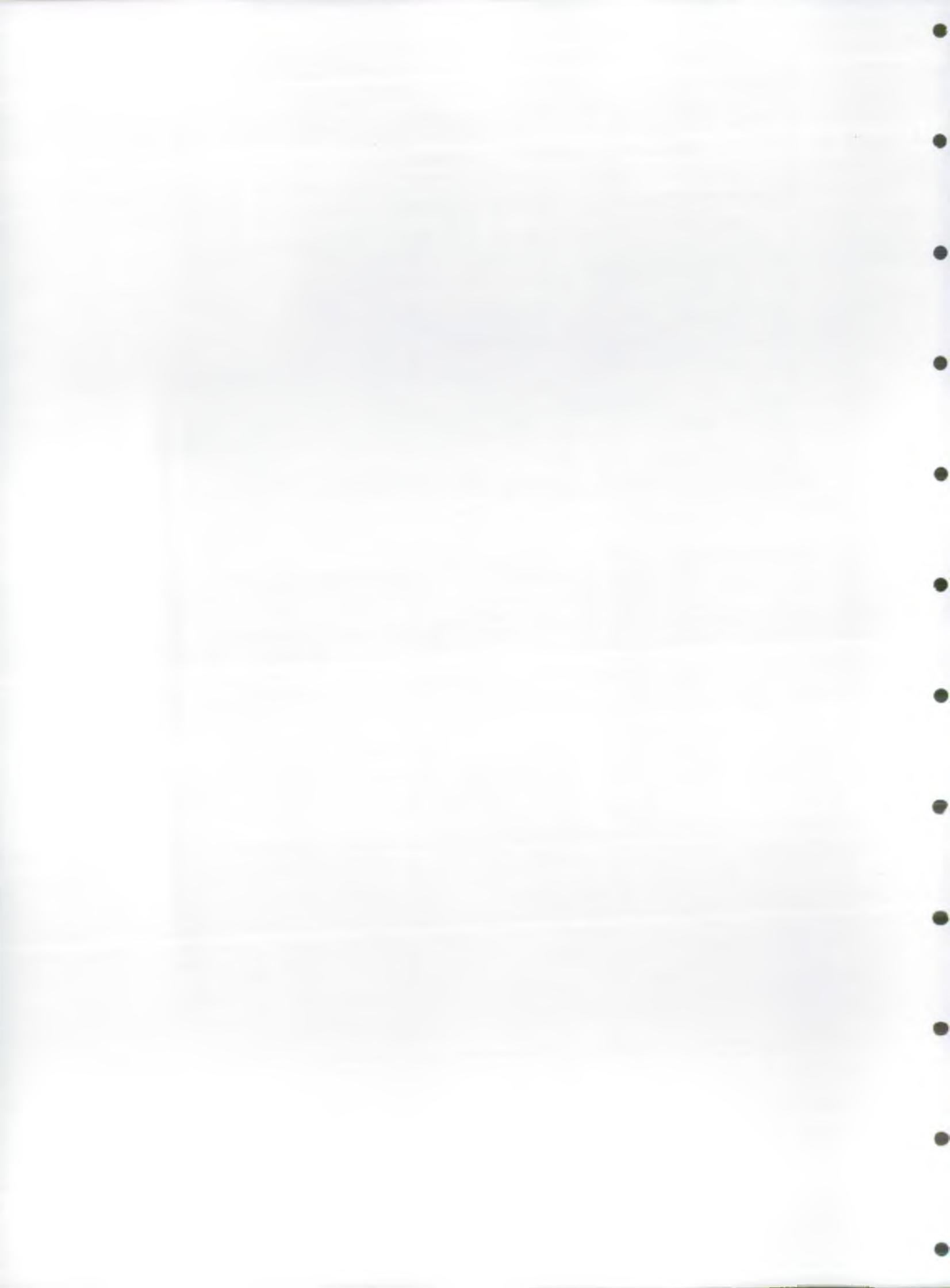


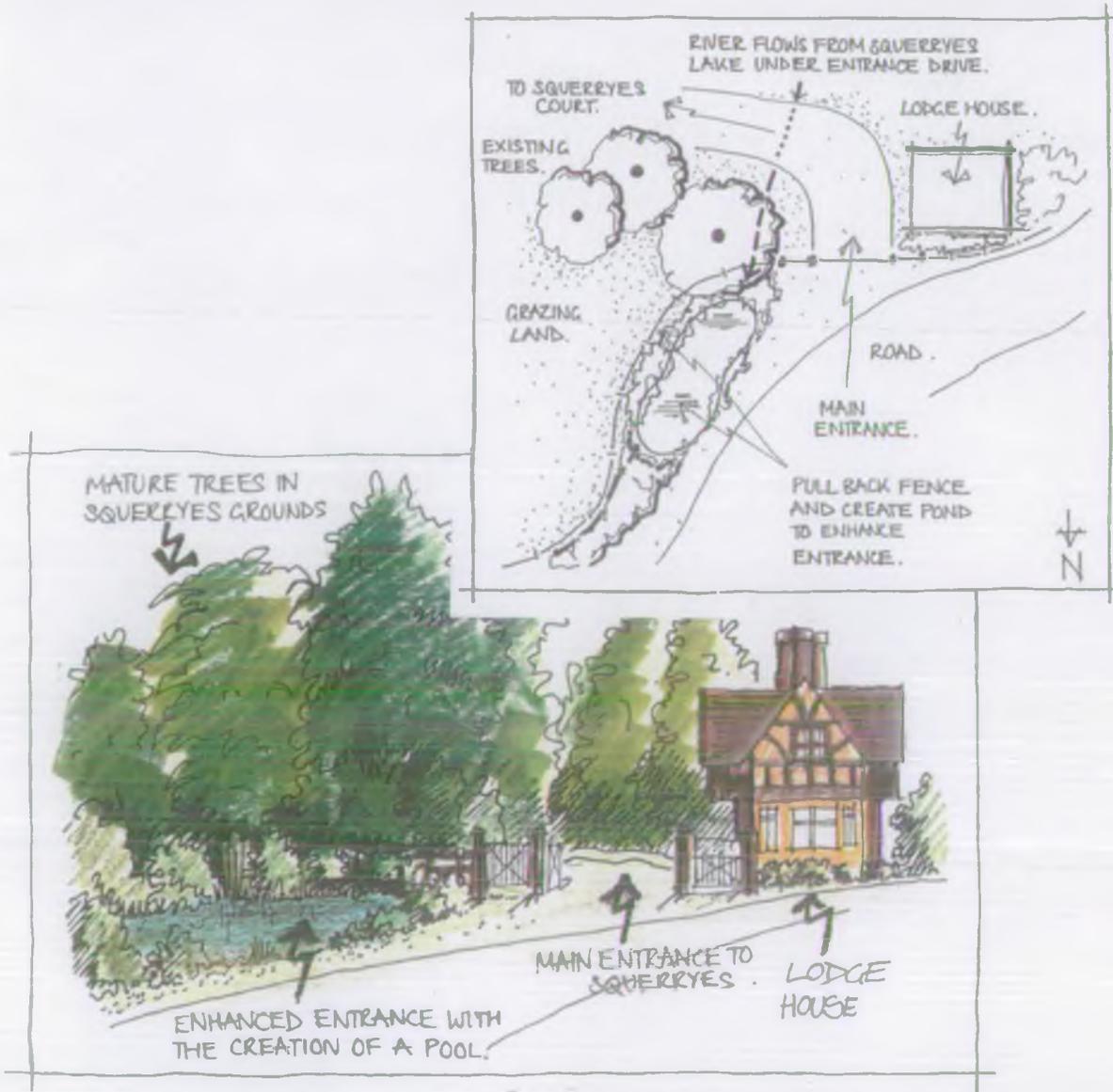
The land belonging to Park Farm here is an ideal location for the creation of a pool on conservation grounds.



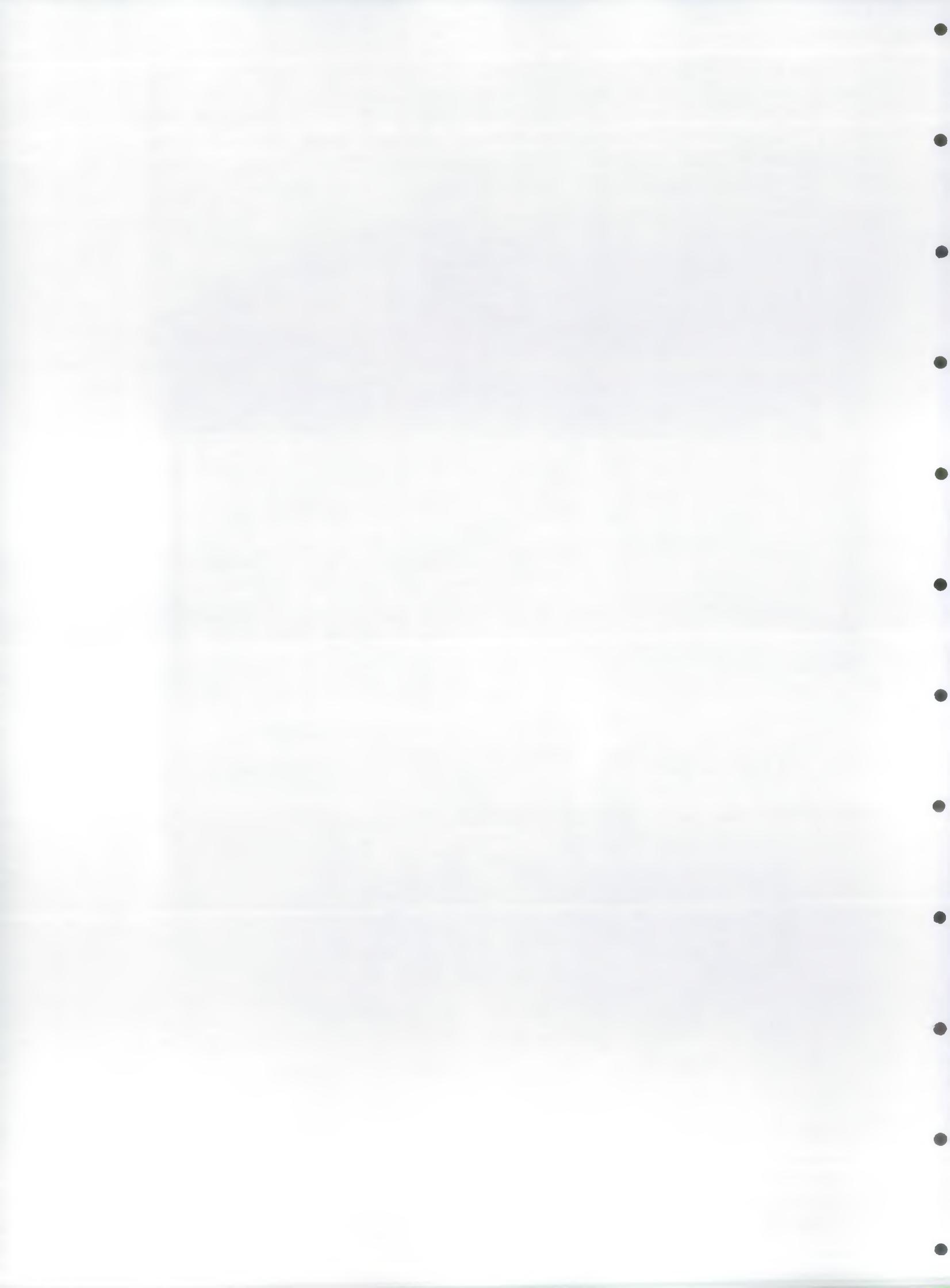


This bland stretch of the river, as it runs between the car park and King George's Playing Fields outside Westerham, would greatly benefit from riverside enhancements such as the creation of a bay and associated weir. The Darent lies to the immediate left of the photograph which demonstrates the lack of relationship between river and car park. The bed of docks in the foreground could be regraded, so that it slopes to the water, and then sown with grass.





The entrance to Squerrys Court could be greatly enhanced by planting and the creation of a pool, in association with proposed land drainage schemes.



It is suggested that the foreground fence is replaced by a marker rail denoting private property. Beyond this a pool could be excavated to act as a moat and an attractive feature. A low retaining weir could be established at the downstream end. Planting could then be established beyond the pool, with the stark fence behind that. The local rarity, wood club rush, *Scirpus sylvaticus* would establish easily in the pool margins together with yellow flag iris.

The access track for cattle could easily be diverted a few metres further south with a new fenced drinker immediately downstream of that. As flood alleviation is proposed for this area and, if it was thought appropriate, this feature could be incorporated into the alleviation scheme, a principle which has been accepted by the Flood Alleviation Section of the NRA.

The landowner has given his agreement in principle but has also suggested that he would like dredging to be carried out on the round pond at the north-eastern corner of the estate. This reasonable request arises because the pond is heavily silted and fast filling up with sprouting willow trees which fell in during the 1987 gale.

6 CONCLUSION

It is recommended that the NRA commence the strategy for enhancements with work on the ground if possible in the winter of 1992 - 1993, at Horton Kirby, Parsonage Lane and Sutton at Hone. This will involve detailed survey design. Design work on the weirs at Eynsford is already proceeding. Wherever possible initial approaches have been made to all landowners affected by proposed enhancements, and to date every single proposal has been positively received.

As a total package however, the ambitious programme laid down in this report has little chance of being achieved unless a person or persons take over the responsibility of co-ordinating a strategy for the enhancement of the River Darent. Exactly who is to do this and how it is to be paid for are political matters beyond the scope of this report and should be decided following a meeting of all interested parties. However, the section on grant aid (2.5) and appendix (10) of key organisations in this document may be helpful. The North West Kent Countryside Project, the Kent Thameside Groundwork Trust, and the Leigh based conservation unit of the NRA are already involved in conservation work in the Darent and clearly have very important roles to play. There does seem to be a need for a single River Darent officer, (who might also cover such rivers as the Cray) with adequate budgets attached and a clear brief covering the river from source to mouth. The neighbouring example of the Medway River Project is a role model which should be closely considered.

Provided that the momentum of the restoration of acceptable flows is also kept up then the realisation on the ground of this enhancement strategy will convert the River Darent from being one of the most notorious watercourses in the country to a model of enlightened conservation management.

APPENDIX 1

RIVER DARENT ENHANCEMENT COSTS

RIVER DARENT ENHANCEMENTS - COSTS

Numbers refer to landscape enhancement proposals drawing.

* Priorities

3 DARTFORD PARK

Widening of river channel and grading 100 m x 6 m	£3 000
Planting 500 m ²	£2 000
Total	£5 000

*4 WELLCOME RECREATIONAL AREA

Timber Planting Boxes 20 m on either side of river	£1 000
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6 PARSONAGE LANE BRIDGE

River widening excavation 20 m long 4 m wide 1 m deep	£1 000
Weir	£10 000
Total	£11 000

9 LANDSCAPING IN ASSOCIATION WITH CONCRETE CROSSING

Landscaping	£1 000
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*10 HORTON KIRBY BOOTLACE FACTORY

Weirs x 2	£20 000
Lining of River 40 m x 8 m = 320 m ²	£8 000
(Restoration of Upper Weir	£20 000)
Flood Elevation Bank	£2 000
40 m ² of brick facing @ (say) £10 per m ²	£400
Tree Planting 60 m ²	£300
Total Including Upper Weir	£50 700
(Excluding Upper Weir	£30 700)

11 PUB GARDEN, HORTON KIRBY

Weir £10 000

Pond 10 m x 8 m x 1 m maximum depth £500

Total £10 500

12 POND IN ROUGH LAND, HORTON KIRBY

Pond 15 m x 10 m x 1 m = Excavation 150 m³ £400

Grading 50 m x 2 m = 100 m² £100

Total £500

13 UPSTREAM OF HORTON KIRBY

Weir £10 000

14 BESIDE FENCE, UPSTREAM OF HORTON KIRBY

Planting 150 m² £750

***15 WEIR AT ROADBRIDGE DOWNSTREAM OF FRANKS**

Weir £10 000

***16 BY THE RED LION, FARNINGHAM**

Weir £10 000

Lining of 20 m x 6 m = 180 m² £4 000

Total £14 000

17 MILL WEIR RESTORATION OF FARNINGHAM

Reinstatement of mill weir £40 000

18 UPSTREAM OF FARNINGHAM

Planting 40 m x 5 m = 200 m² £1 000

19 POND SITE DOWNSTREAM OF EYNSFORD

Excavation of Pond 25 m x 15 m ²	£1 000
Planting 10 m x 10 m = 100 m ²	£500
Total	£1 500

20 EYNSFORD CASTLE

Excavation of Bay	£1 500
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***23 LULLINGSTONE CASTLE, RIVERSIDE ENHANCEMENT**

Planting 20 m x 10 m = 200 m ²	£1 000
20 m length of footpath	£300
Total	£1 300

27 PLANTING BUFFER BETWEEN ARABLE LAND AND RIVER

500 m x 5 m planting 2 500 m ²	£12 500
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28 WEIRS DOWNSTREAM OF OTFORD

Weir	£10 000
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***29 POND ON KENT COUNTY COUNCIL LAND BESIDE SCHOOL**

Pond Excavation 25 m x 15 m	£1 000
Planting 400 m ²	£2 000
Total	£3 000

30 PLANTING ON LANDFILL UPSTREAM OF OTFORD

Planting	£12 500
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***31 BRADBOURNE LAKES NATURE RESERVE ENHANCEMENTS**

Excavations 30 m x 10 m x 2 m	£1 500
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32 POND ON PRIVATE LAND, RIVER HEAD

Pool 10 m x 15 m = 150 m³

Total **£500**

33 THAMES WATER AUTHORITY PUMP STATION SITE

Excavation of Large Pond 30 m x 20 m x 1.5 m = 900 m³

Total **£2 100**

34 OPPOSITE NEW OFFICE DEVELOPMENTS, BRASTED

Bay **£1 500**

35 AT THE BACK OF HOUSES, BRASTED

Pond **£600**

***36 PARK FARM**

Pond **£1 500**

Planting **£2 000**

Total **£3 500**

37 ENHANCEMENTS AT DISTRICT COUNCIL CAR PARK, WESTERHAM

Bay **£1 500**

Regrading 20 m x 4 m = 80 m² **£100**

Total **£1 600**

38 ENHANCEMENT AT ENTRANCE OF SQUERRYES

Removal of fence 10 m **£50**

Pond **£200**

Total **£250**

GRAND TOTAL (including priority schemes) **£209 300**

Priority Schemes only **£89 000**

LARGE DEVELOPMENTS

8 RESTORATION OF MOAT ST JOHN'S JERUSALEM

Lining of moat 600 m length 8 m wide	£85 000
Pump and pipes	£50 000
Total	£135 000

25 WATER MEADOW RESTORATION, SHOREHAM (GRANT AIDED)

Total	£200 000
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GRAND TOTAL £335 000

CONTINGENCIES 20 000

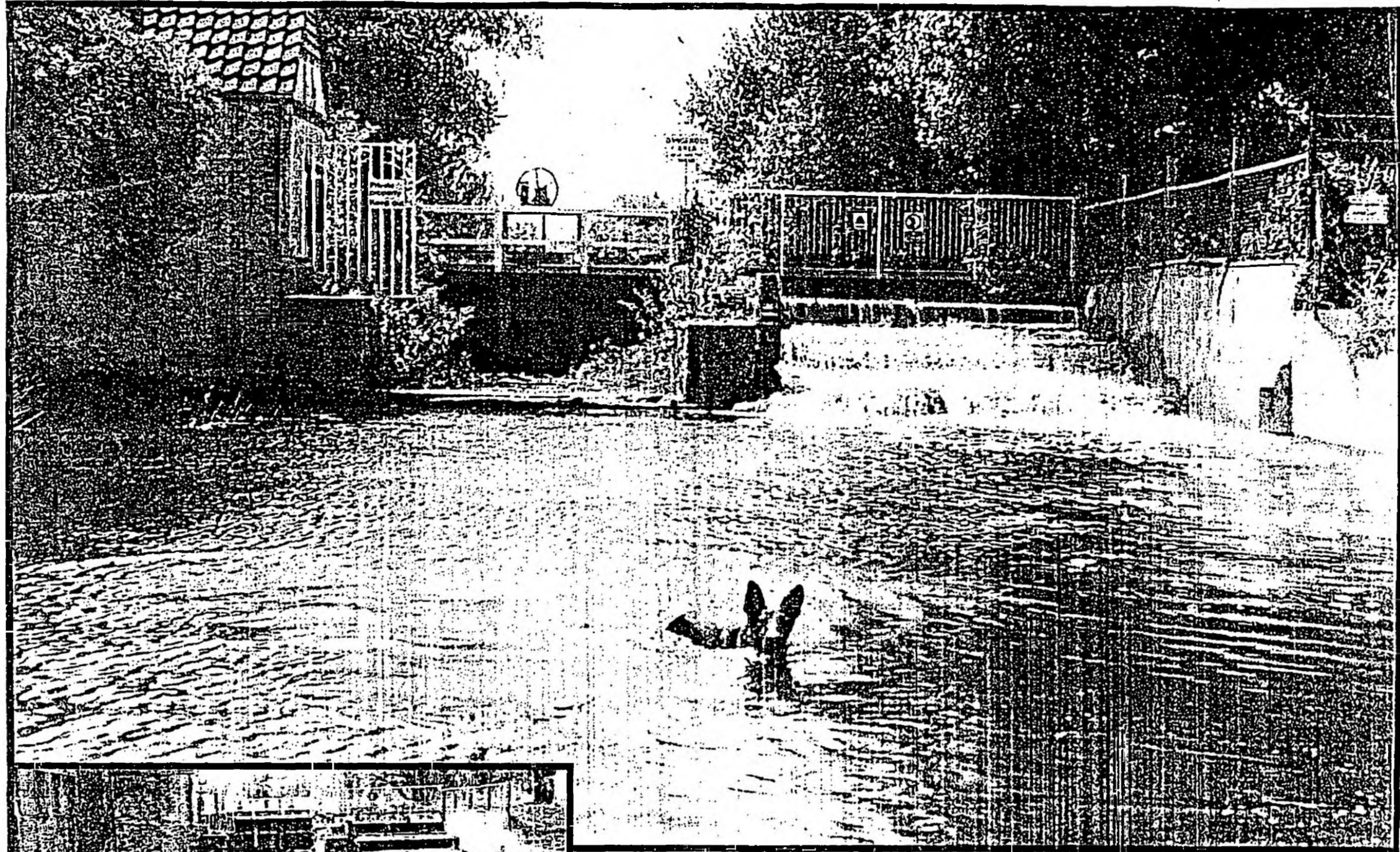
TOTAL INCLUDING CONTINGENCIES £355 000

Contingencies added due to uncertain nature of some of the costings.

APPENDIX 2

NATIONAL PRESS CUTTINGS

PARCHED RIVER IS TAKEN BY STORM



Storms have left the parched Darent, left, in full flow again, above Picture: ALISDAIR MACDONALD

BEAUTIFUL water flows freely again in one of Britain's drought-hit rivers which, just two days ago, contained nothing but grass.

Torrential storms which swept the country have brought life back to the River Darent, which runs through the heart of the Kent countryside.

The Darent dried up totally when it fell victim to the worst drought this century.

But yesterday, as the thunderstorms left homeowners mopping up, villagers in Kent were celebrating as the river became home to shoals of sticklebacks which darted through

the unexpected 6ft of water and *Sorta* the alsation romped in it.

The Darent flows through some of the most beautiful villages in England and has inspired poets and painters.

The National Rivers Authority blamed the parched river on Thames Water which siphoned 20 million gallons a day. It ordered the company to reduce its intake when the river was in full flow again.

Weathermen have warned that more thunderstorms are on the way.

But hopes that the downpours would end shortages across the south and east of England were dashed.

"We need lots more of the same," said a Water Services Association spokesman.

The overnight storms on Monday brought flash-flooding which caused disruption for commuters. Rail services were delayed by signalling problems, some roads in Kent and Suffolk were closed by flooding, and motorists were warned to beware of slippery conditions. Houses were damaged by lightning which triggered thousands of automatic fire alarms.

TODAY
WEDNESDAY
22 JULY 92

It's winter and the waters of the Darent should be fast and full. But, as Nicholas Schoon reports, our increasing need for water has drained it dry

A lively river struggles for survival

You might expect a river to be at its fullest and fastest in midwinter, especially after a few days of heavy rain.

Yet as the Darent nears the Thames estuary in Kent, it dwindles to a sluggish trickle, then disappears altogether for a stretch.

Last summer it dried up completely for several miles between Farningham village and Dartford. The bottom was sun-hardened mud and stone, with the occasional shallow pool containing a hopeless pike, gills heaving as it awaited death in the still, warm water.

The long drought was partly to blame. But the underlying cause of the Darent's decline from an idyllic chalk stream to its present sorry state is a chain of bore hole pumping stations alongside it, providing water for 200,000 people on London's south-east fringe.

Thames Water is licensed to pump an average 72,000 cubic metres a day from its riverside boreholes, with a peak summer rate of 92,000 cubic metres a day.

The licence bears no relation to what the river can stand. In the past Thames Water and its predecessors extracted only a small amount of the water they were entitled to take, but in the past 20 years this has grown to 80 per cent of that figure. As living standards rose, so did the demand for water — more dishwashers, more garden sprinklers — especially in dry summers.

The Darent is fed from waterlogged chalk that floors its valley rather than surface run-off. As more water was pumped from the boreholes, the groundwater dropped and the river dried.

This is happening to rivers on porous rocks all over England, from the Pang in Berkshire to the Piddle in Dorset. The National Rivers Authority (NRA) has drawn up a list of 40 rivers damaged by over-abstraction of water from the aquifers beneath.

The Darent, however, is "the classic worst case" of what is going wrong, says Peter Herbertson, water resources manager for the NRA's Southern Region.

Thames Water admits its bore holes are to blame, and worries about its public image. The Darent, with its lakes and gravel pits, runs along London's eastern Green Belt and is loved by tens of thousands of anglers and walkers.

A riverside path was opened last summer, just before the river dried out for miles, allowing people to walk along the bed instead. One of those who did so was Lord Crickhowell, a former Welsh Secretary and the NRA's chairman, who described the river as devastated by over-abstraction.

Derrick Allwood, secretary of the Darent River Preservation Society (DRPS), has lived beside the Darent in Shoreham for 40 years. He used to fly fish for wild trout in the Darent, but



Decline and fall: the dried-up Darent at Horton Kirby Mill in Kent... "It has deteriorated abominably; it is sad to see a pristine chalk stream so close to London go this way. The flow is half what it used to be"

Photographic: Brian Harris

gave up early in the Seventies as the flow dwindled and the fish disappeared.

"It has deteriorated abominably in my time; it's sad to see a pristine chalk stream so close to London go this way," says Mr Allwood, a retired company secretary. "The flow where I live is half what it used to be 25 years ago."

The flow tapers farther down the river as the water leaks through its bed. The spongy water meadows on either side have largely gone and sediment and rushes are invading the river bed.

Thames Water's abstraction licences date back to the Water Resources Act of 1963, which attempted to bring legal order to what was largely a free-for-all.

By and large, it gave those who were already taking water, such as the old water boards, a licence to continue

while setting a limit on the rate of extraction. But these limits were determined mainly by what the extractors said they needed, rather than what the river and groundwater could supply.

The licences were inherited by the 10 water authorities set up in 1974, then by the privatised water companies that replaced them in 1989. The NRA has the power to revoke licences and reduce limits, but it would have to pay the compensation needed for the extractor to find and develop another supply.

The authority has little idea of what these costs would be, and is even less certain about whether it could afford them, since its funding is largely in the lap of the Government.

So it will attempt persuasion rather than compulsion, negotiating for compromises that will restore the damaged rivers to a reasonable flow, maintain

drinking water supplies and minimise costs. Thames Water and the NRA's Southern Region are about to start pioneering negotiations about the Darent.

Bryan Connerton, Thames' groundwater manager, says: "If the NRA drastically reduced our licences overnight, we couldn't supply local households through the summer, so a heavy-handed approach isn't on."

The low flows are environmentally unacceptable, he says. "We don't want this problem forever, and we're sure there is a happy half-way house."

In 1986, Thames Water commissioned a report from consulting engineers on what could be done to alleviate low flows. In those pre-privatisation days it was both water supplier and environmental regulator — poacher and gamekeeper — so it was looking for

low-cost solutions that avoided drastical

reducing abstractions from the Darent Valley and bringing in water from elsewhere.

One of the proposals was to sink bore holes into the less porous Greensands rock near the river's source and use water from there to boost the flow in summer. The most expensive measure, at £1m, was to line a mile of river bed at the driest, leakiest part with compressed chalk. This would slow the leakage of water into the rocks below.

Plastic or butyl linings — as found under garden ponds — could be used, although they look unattractive and can tear. Compressed chalk and butyl have been tried on a mile of the Guseage stream, a tributary of the River Allen near Wimborne, Dorset. They appear to work.

To the NRA and environmentalists, however, linings are a classic example

of a "sticking plaster" solution — an attempt to patch up a problem without addressing the cause. The NRA has hired its own consultants, as has DRPS, which will try to follow the negotiations and chivy both sides.

One large potential water source for the Darent catchment is the sewage of Sevenoaks, sited at the river's head. It is piped down the valley in a trunk sewer, collecting wastes from the villages on the way before decanting into the Long Reach sewage works at Dartford. The treated effluent is then released into the Thames estuary.

Were Sevenoaks's sewage treated to a high standard at the head of the river, the treated effluent could then go into the Darent, boosting its flow year-round. Thames Water rejects this, say-

ing a sewage works that produced sufficiently clean, consistent effluent would be too expensive.

Mr Connerton says Thames and the NRA agree that any long-term solution would almost certainly involve reducing the rate of abstraction and bringing in new supplies for some of the homes that rely solely on the Darent Valley. And that is likely to cost considerably more than the modest measures proposed in the first consultants' report.

Thames will want to pass on these costs to consumers, but it is unsure whether it will be able to — that depends on the industry's economic regulator, the Director-General of Water Services. The NRA might be willing to meet some of these costs, but it, too, is unsure it will have the funds.

Meanwhile, the Darent will remain a trickle of its former self.



Supply companies are ordered to reduce abstraction or face a total ban

Water curb to save dying rivers

By Toby Moore

Environment Correspondent

WATER companies have been ordered to reduce what they take from 20 drying rivers or risk losing their permits in moves reflecting the increasing gravity of the drought in parts of England.

The National Rivers Authority says excessive water is being siphoned from rivers flowing as far afield as Dorset, Shropshire, Worcestershire, Yorkshire and Nottinghamshire, and is demanding reductions.

In its first such ultimatum since being set up in 1989, the authority has told Thames Water to cut by nearly half the amount drained from the River Darent, which flows through Kent and supplies 500,000 people. A two-mile stretch of the river near Horton Kirby has dried out.

Water companies drawing from the other 19 rivers face similar cut-backs over the coming months in an effort to avert a crisis that could see vast stretches turned into mud.

The authority says that some of the country's most famous water courses are literally drying to death and excessive abstraction is compounding any problems caused by low winter rains.

Their list includes the Pang, in Berkshire, Wallop Brook, in Hampshire, and the Misbourne, running through the Chilterns in Buckinghamshire. Others on the crisis list are the Wharfe, near Otley, in West Yorkshire.

The authority has begun assessing the state of a further 20 rivers in the Anglian, Severn Trent and Yorkshire region and in rain-rich Wales.

It is angered by the modest priority it thinks water companies are giving to low and, in some cases, disappearing flows, the devastating consequences for wildlife, especially fish, and the complex ecology of wetlands.

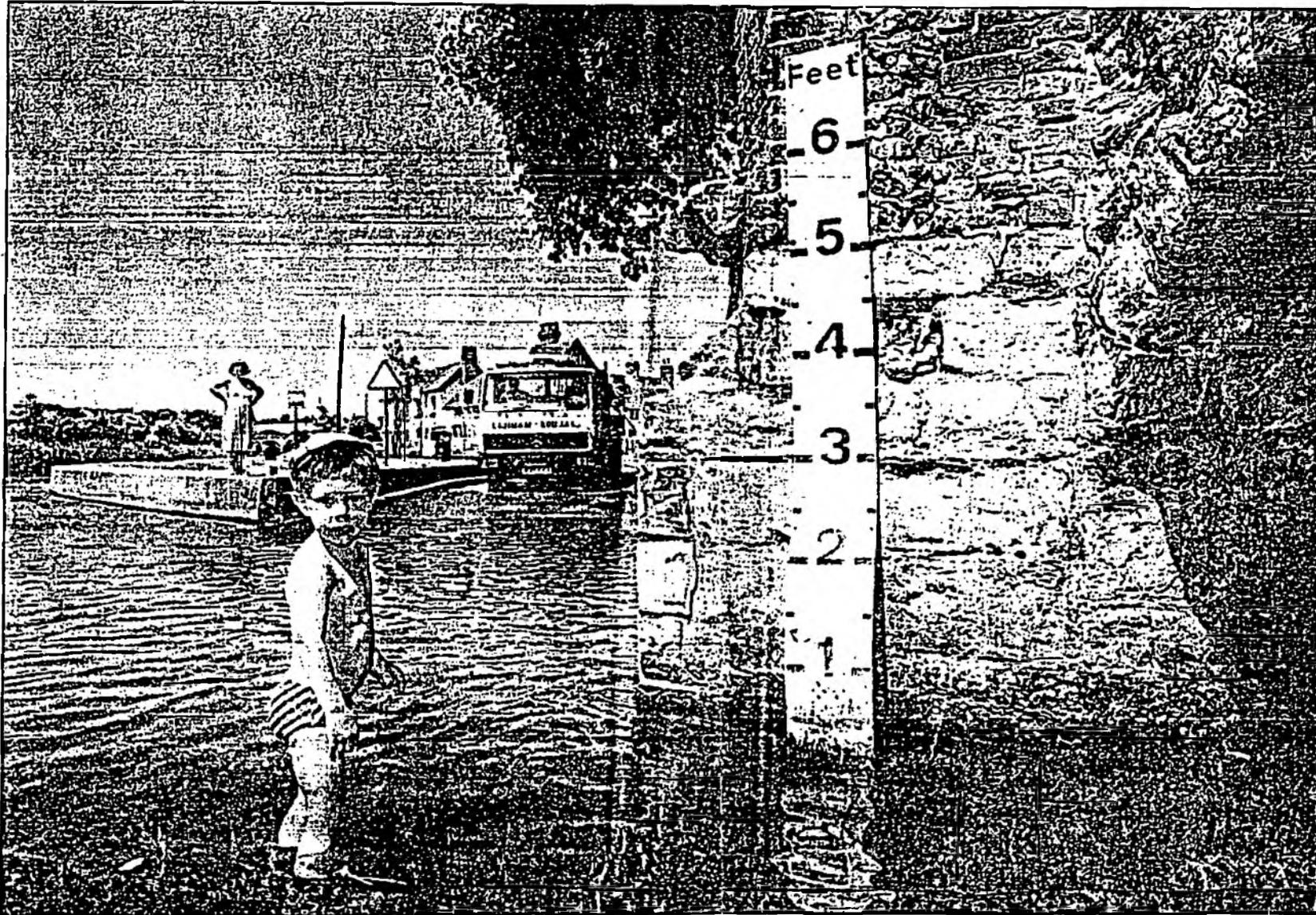
It believes water companies are wrongly blaming the drought for problems principally caused by inefficient piping systems through which 25 per cent of water leaks before it even reaches the taps. It points out that seven of the 20 rivers on its second list of priorities are in Wales.

The ultimatum to Thames Water is the first time the authority has threatened to withdraw a licence and amounts to a test case of its powers after four consecutive years of drought. Expressions of good will were not being translated into enough action, said Lord Crickhowell, authority chairman.

"The public and the NRA are not prepared to wait a minute longer than is absolutely necessary to restore these long-suffering rivers to their former healthy flows," he said.

Companies taking from the top 20 priority rivers suffering chronically low flows must come up with firm plans to reduce the amount they abstract or face revocation of their licences.

"We will insist on agreed timetables then we will not hesitate to vary or revoke existing licences where we are not satisfied. We have



The River Darent at Eynsford, Kent — Thames Water has been told again to cut down on the water it abstracts

Picture: JAMES FRASER

legal powers to do that in order to protect the environment and other users of water."

In setting timetables Lord Crickhowell said the authority would take account of the need to find alternative water sources. But water companies also needed to take action on leaks. "Before any new sources are developed, it is essential that water companies make sure they are doing all they can to reduce leakage and carry out effective demand management."

"The NRA supports selective domestic metering, with an appropriate tariff, in areas where water resources are stressed."

"Where it can be shown that proper attention is not given to the control of leakage, or where appro-

appropriate consideration has not been given to the introduction of selective metering, the NRA will not grant licences for new sources," he said.

The water companies are using licences granted in the 1960s. The 1963 Water Resources Act allowed the old water boards legally to abstract whatever they had taken in the past as a matter of right.

The rivers authority has untested powers to revoke or amend licences to take water from rivers. A water company has the right to appeal against the decision and this can go to a public inquiry.

Lord Crickhowell admitted that the legal waters were murky. Companies which lose or have their licences altered are entitled to compensation to finance the provision of

alternatives. Privately, the authority is itching for a water company to challenge its alterations to an abstraction licence so it can find out how much compensation might be necessary and highlight the anomaly that any money paid to a water company would currently come from the taxpayer.

Lord Crickhowell said he was sure the legislation to privatise the water authorities was not intended to "fill one pocket from another", with the consumer paying both for the water and the compensation.

Water companies view the authority's public threats as sabre-rattling in advance of Government plans to bring environmental watchdogs together in a single agency. They point out that they have always been

open to voluntary agreements to limit abstraction. A spokesman for Thames Water said they were "puzzled" by the tone of the demands, particularly as the company had already reduced its use of the Darent to the 14 million gallons a day the authority has said it should be limited to from Sept 1, in recognition of the problem.

"We've also spent £500,000 on the Pang and voluntarily cut back from taking three million gallons a day to taking one million," he said.

The rivers authority, which recently published a consultation paper laying out the options for ensuring enough water reached the south of the country, is now moving towards a grid system using existing rivers and canals

Navy to destroy nuclear arsenal

By Peter Almond
Defence Correspondent

THE ROYAL NAVY is to scrap all its nuclear weapons except the Trident ballistic nuclear deterrent, Mr Rifkind, Defence Secretary, said yesterday. It will therefore no longer have the means or capability of dropping tactical nuclear bombs or depth charges.

In a statement on naval nuclear weapons that went substantially further than any moves announced by the US, Russia, France or China, Mr Rifkind said all such weapons had been removed from Navy ships and would be destroyed at the Aldermaston nuclear weapons establishment.

The Navy had about 30 free-fall nuclear bombs and 30 nuclear depth charges.

Mr Rifkind said there was no special reason for the timing of his announcement, but it might have a beneficial effect when President Yeltsin of Russia meets President Bush in Washington today.

The two hope to sign an agreement to cut strategic nuclear weapons far beyond what was agreed in the Start treaty.

Britain and the US, following Nato policy, announced last September that, while keeping tactical nuclear weapons, their navies would no longer carry them. Mr Rifkind said: "The Government has now decided that this residual capability is no longer needed."

"Royal Navy ships and aircraft, and RAF maritime patrol aircraft, will therefore no longer have the capability to deploy tactical nuclear weapons. The United Kingdom's sub-strategic nuclear capability will consist of RAF dual-capable aircraft with the WE177 free-fall bomb."

While 50 per cent of the US tactical nuclear weapons are to be destroyed, the rest will remain in storage, and training in their use will presumably continue.

Tebbit has more bomb surgery

Mr Norman Tebbit, former Tory Party chairman, will undergo further surgery today at the Mount Vernon hospital in Northwood, north-west London, for the injuries he suffered in the 1984 Brighton bombing.

Mr Tebbit, 60, who was made a peer in the Dissolution Honours, suffered huge injuries to his left side in the bombing, which paralysed his wife from the neck down.



APPENDIX 3

NEW SCIENTIST CRAYFISH ARTICLE

The lethal harvest of crayfish plague

After more than a century devastating Europe's freshwater crayfish, a killer fungus has found its way to Britain. It may now be too late to save the country's native crayfish

Peter Marren

AT ONE TIME, Lake Hjalmar in Sweden held enough crayfish to furnish the tables of homes, bars and restaurants throughout Europe. These abundant delicacies were the celebrated "noble crayfish", *Astacus astacus*, the largest of Europe's four freshwater species. To the many Scandinavians who ate them by the bucketful, they were the most delicious of all the crayfish. But while Hjalmar's rich harvest showed no signs of exhaustion, late in the 19th century native stocks in other parts of Europe suddenly declined as the result of a severe and mysterious disease.

The "crayfish plague" originated in northern Italy in the 1860s. It ravaged north through France and Germany, reaching Finland and the Russian Steppes by the turn of the century. Everywhere it struck, the plague left a melancholy imprint of tiny corpses, washed ashore, and failing fishing businesses. In 1908, the plague spread into Sweden and Lake Hjalmar, apparently after some infected crayfish from Poland had been dumped in a waterway in Stockholm. The effect was immediate and devastating. Rotting crayfish littered the banks and the clear waters of the lake grew turbid and weedy. Where once they caught five million crayfish each year, it was soon difficult to find any living crayfish. The plague was as lethal as its cause was baffling. Sweden's trade in crayfish collapsed almost overnight. The families who had fished the lake for centuries could no longer make a living. *Astacus astacus* ultimately found a place in the *Red Data Book* (1983) of the International Union for the Conservation of Nature and Natural Resources (IUCN). The IUCN describes the species as globally rare and endangered in parts of its European range where once it was abundant.

The mystery of crayfish plague was finally resolved in 1935. Then, scientists isolated a fungus from the bodies of infected animals and identified it as *Aphanomyces astaci*. The cause of the disease had escaped detection for so long because the tell-tale woolly puffs of fungal threads (hyphae) that appear between the abdominal segments are found only on freshly dead crayfish. For a long time, it proved very difficult to grow the parasitic fungus in the laboratory.

The fungus is endemic in North America. Its natural hosts, signal crayfish, *Pacifastacus leniusculus*, and related species, have a thicker carapace than the European species and are more resistant to the fungus. The European species show no resistance. The fungal hyphae grow through the shell of the crayfish to invade the animal's muscles. Infected crayfish behave peculiarly. Normally nocturnal, they suddenly begin to wander about the stream in broad daylight, sometimes leaving the water altogether. In the early stages of infection, the crayfish appear "dazed" and disorientated; they stagger about on trembling limbs with an odd upright gait, described as "walking on stilts". Later, the dying animals are found lying on their backs; there are dark melanised spots on their carapace and the white fungal hyphae appear through the soft tissue between their abdominal segments. In time, perhaps, natural selection might produce European strains as resistant to the plague as their American cousins. Time, unfortunately, may not be on the side of the European species of freshwater crayfish, for they are also very vulnerable to the pollution of waterways by industrial effluent and runoff from farmland.

No one knows for certain how the crayfish plague travelled from the New World to the Old. Circumstantial evidence suggests that it was introduced with American crayfish brought to Europe as a food species in the 19th century. The

American signal crayfish, which is native to Western Canada and the northwestern US, is an ideal crayfish to farm for food. It is larger than the European species, it is relatively easy to culture, it grows and reproduces more rapidly, and it reaches sexual maturity at an earlier age. To most palates, it tastes just as delicious as the noble crayfish. Moreover, it thrives in the waters of northern Europe, where temperatures are similar to those of its native pools and streams. And, of course, the signal crayfish is resistant to the plague fungus and, therefore, can be used to restock infected waters.

Unfortunately, a large proportion of the American population carries the fungus so widespread stocking of signal crayfish helps to spread the crayfish plague. Professor Soderhall, of the Institute of Physiological Botany in Uppsala, Sweden, estimates that 60 per cent of signal crayfish carry the disease in their native haunts. It was for this reason, and because restocking natural waters was not as successful as was first hoped, that the Simontorps Akvatiska Avels-Laboratorium, an industrial hatchery, was established in Sweden in 1970 for the culture of the signal crayfish. Soon it produced half a million juvenile crayfish each year for export to agencies elsewhere in Europe. The "astaculturalists" at Simontorp claim that their stock is free from disease. Swedish scientists, however, challenged the claim and were quick to point out that the veterinary certificate attached to all consignments of juvenile crayfish from Simontorp, is worth very little as there is no easy way of detecting the early stages of fungal infection—or, for that matter, viral or bacterial diseases.

The plague reaches Britain

Britain's erstwhile lack of interest in crayfish as a food industry kept British waters free of the plague. The native British crayfish, *Austropotamobius pallipes*, is known as the Atlantic stream or white-clawed crayfish or simply as the crayfish. It is more common and widespread than is generally supposed; it lives in ponds, lakes, reservoirs, streams and rivers throughout England, Ireland and lowland Wales, wherever the water is sufficiently clean, well-oxygenated and alkaline. Despite its relative abundance, we know little about it. It is largely nocturnal, leaving the dark holes where it lurks during the day to scavenge along the bed of the pond or stream.

Crayfish are easily caught in traps baited with fish offal. In a few parts of the country people still collect them for "crayfish suppers". Anglers regard them as excellent bait for chub. In Europe, the Atlantic stream crayfish is regarded as a rather local species found mainly in upland rivers and, like the noble crayfish, it is listed in the *Red Data Book* as rare. It is probable that the crayfish in England and Ireland are a significant proportion of the world population.

Extinctions of the native crayfish locally are nothing new. The animal is sensitive to pollution and to the over-enrichment of waters from sewage and fertilisers. It has probably disappeared from a great many ponds and streams as a result. New gravel pits provide a congenial habitat for it and probably offset some of the losses. Until 1981, there were no proven cases of crayfish plague in Britain. Then, a fisherman, who rented a stretch of bank on the Bristol Avon near Malmesbury in Wiltshire, was struck by the apparent demise of an animal familiar to him and reported it to the Wessex Water Authority. The authority investigated and found large numbers of dead crayfish in the Bristol Avon. Tests ruled out

pollution as the cause. Scientists suspected plague, but it was not until two years later, when healthy animals confined in cages in infected areas of the river contracted the plague, that scientists at the research laboratories run by the Ministry of Agriculture, Fisheries and Food (MAFF) in Weymouth identified the fungus (*Journal of Fish Diseases*, vol 7, p 401). The crayfish plague, which had been active in Europe for well over a century, had finally reached Britain.

Soon there were fresh outbreaks. In the same year as the mass mortality in the Bristol Avon, large numbers of dead crayfish were found in the River Lea in Hertfordshire and neighbouring rivers. In 1983, there was an outbreak in the River Wey, near Godalming in Surrey, and in the summer of 1984 the Hampshire Avon became infected. Investigations by the Wessex Water Authority revealed thousands of dead animals in the Avon, downstream of a new crayfish farm established near Lake in Wiltshire, as far south as the borders of the New Forest, where the river became too deep and turbid for examination. By this time, crayfish had probably disappeared from the Rivers Lodden, Lyde, Gade and parts of the Kennet. Anecdotal information from landowners, anglers and naturalists suggests that many other rivers in the south of England no longer support native crayfish. The plague is not responsible for all mass mortalities of crayfish, however. A section of the River Blythe near Birmingham, in which large numbers of dead animals turned up in the summer of 1984, showed no signs of the disease when tested with healthy animals. But there is enough evidence to show that crayfish plague is widespread in Britain.

As in Europe, no one knows exactly how the plague came to Britain. But recent outbreaks followed the establishment of commercial crayfish farms throughout the country. Britain's first industrial crayfish hatchery was set up at Riversdale Farm, Dorset, in 1976 and was stocked with signal crayfish imported from Simontorp in Sweden. As Simontorp's sole agent in Britain, Riversdale was initially the only supplier from whom would-be breeders could obtain stock. The company set up a marketing service for crayfish farmers, the British Crayfish Marketing Association (BCMA). "Don't feel THE PINCH! With efficient marketing there can be profits for the taking in any healthy lake, pond or gravel pit on your land," it proclaimed. A small crayfish farm has considerable advantages to landowners: with the right kind of water, they can keep breeding stock out of doors with a minimum outlay and low maintenance costs; a market is virtually guaranteed, with crayfish retailing at about £12 per kilogram. No licences or planning permission are normally required to stock related ponds. Until very recently, almost the only legal requirement was for the would-be farmer to "take all reasonable steps" to prevent animals from escaping. Such a proviso is quite meaningless for, as one crayfish farmer put it: "If the crayfish don't like their environment, they leave!"



The signal crayfish is the ideal species for commercial farming. It is resistant to the plague but it also carries it



A healthy Atlantic stream crayfish scavenges a dead stickleback. Dead crayfish (above) from the Hampshire Avon, collected after the mass mortality in 1984



The enterprise has been hugely successful. In its first full year, Riversdale Farm supplied juvenile crayfish to 25 sites throughout the country, including the biology departments of the universities of Nottingham and Stirling and the City of London Polytechnic. The original stock reached maturity in 1980; by 1983, at least 250 farms had received "implantations" of juveniles and were attempting to establish their own self-generating stocks. A growing number now possess sexually mature stock. Home-grown animals can be sold more cheaply than imports, and current market forces favour a further expansion of the industry. Although there is no direct evidence to link the British outbreak of plague with commercial farming, it is highly likely that the signal crayfish imported from Sweden brought the disease to British waters (*Aquaculture and Fisheries Management*, vol 16, p 203).

Little hope for native crayfish

The ecological implications of crayfish plague in British waters are potentially serious. The native species will probably disappear over large parts of its range, especially in flowing water and in lakes with large catchment areas. It has a better chance of survival in enclosed bodies of water with small catchments which can be protected from contamination. The sudden demise of crayfish may have direct and indirect effects on the freshwater environment. Crayfish are food for large carnivorous fish, particularly trout, chub and pike. The loss of a valuable food supply is likely to result in reduced fish stocks and slower growth. Crayfish are important grazers as well as scavengers. Many Swedish lakes and waterways became overgrown with water weeds after the mass mortalities of *Astacus astacus* in the early years of the century. Overgrown rivers are not suitable for game fish. Conversely, in some circumstances, large numbers of signal crayfish introduced into small pools can cause a rapid decline of aquatic vegetation and the disappearance of shelter and suitable spawning areas for fish.

If the signal crayfish becomes established in the wild, the problems will be greater still. Although the Atlantic stream crayfish is widely distributed in England and Ireland, in Europe it is restricted to upland waters, which suggests that it may be a poor competitor with other species of crayfish. The male signal crayfish is sexually more aggressive than the male of Britain's native species; competition and interbreeding could produce a proportion of sterile hybrids. And, of course, a permanent breeding population of signal crayfish also means a permanent source of spores of the plague fungus. There is even a possibility that signal crayfish might carry



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Spore cysts of the plague fungus, *Aphanomyces astaci*, on the surface of a crayfish which died from the disease. A clump of cultured spore cysts (right) are about to be discharged. In the wild they would be swept away to infect another crayfish

viral diseases of fish. Although scientists at MAFF think that it is probable, their Irish counterparts take the idea very seriously and operate a total ban on imports of live crayfish for precisely this reason. All this may seem rather a high price to pay for a home crayfish industry, particularly when no one has investigated the market potential of the native species.

The circumstances that permitted the spread of the plague are worth noting. First, Britain has no legal requirement for certification that imported crayfish are free of disease. Although the Simontorp stock does bear a certificate, most scientists agree that it is practically impossible to guarantee that any commercial stock is completely free of disease. Moreover, there is currently nothing to stop someone importing live signal crayfish directly from the US, as at least one operator has done. Even scientists from the MAFF doubt whether disease-free signal crayfish are available from any commercial source. In reply to a question in the House of Lords in November 1983, the agriculture minister, Lord Belstead, admitted that: "imported signal crayfish frequently

carry the disease, crayfish plague, which is capable of killing the native crayfish."

According to the scientists at the MAFF, the disease does not cause significant mortality until three to five years after its introduction. This is exactly the time between the establishment of the first commercial farm and the first recorded outbreak of crayfish plague in British waters. Secondly, there are no statutory controls on the establishment of crayfish farms. In legal terms, crayfish are "fish", and as fish farming is technically an agricultural activity, crayfish farms do not normally require planning permission. Under the Salmon and Freshwater Fisheries Act 1975, water authorities are empowered only to control introduction into open bodies of water. Fish farms do not come into this category, even when a watercourse passes through them. Under the Wildlife and Countryside Act 1981, only introduction into the wild requires a licence from the Nature Conservancy Council (NCC). Again, fish farms do not come into this category. Indeed, the MAFF's current tendency is to relax the restrictions on fish farming. The ministry is even supporting a move to permit extraction of gravel in quarries of up to two hectares, without the prior need for planning permission, in order to make fish farming still more profitable. If this move goes ahead, it might encourage a rash of small-scale excavation suitable for stocking signal crayfish.

Signal crayfish are occasionally found in the wild. There were at least two deliberate introductions before the Wildlife and Countryside Act made it illegal. Signal crayfish can walk short distances overland: it would not be difficult for them to escape from a farm where the only barrier to freedom might be crumpled large-mesh chicken wire. The spread of the plague may not rely solely on escaped crayfish viable fungus spores can probably escape in effluent water or can spread by the movement of contaminated water, equipment or fish, even when the actual carriers of the disease are secure. Contaminated water does not fall within the scope of the Pollution Act and no one has yet developed adequate means to overcome this problem.

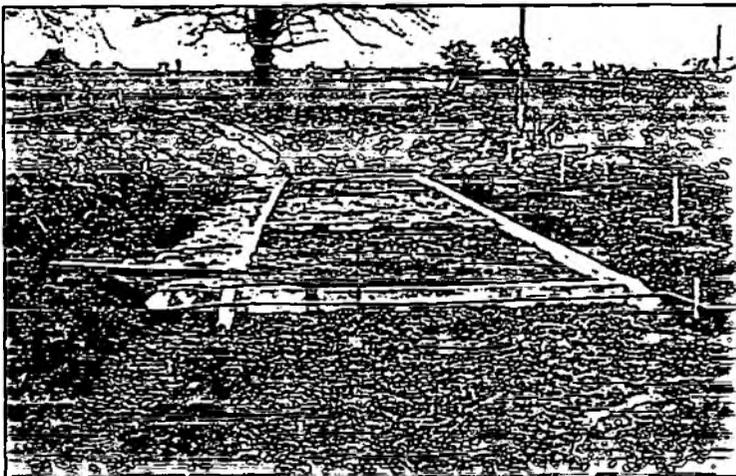
Until 1980, even the MAFF had no powers to impose controls on crayfish farms. The Minister for Agriculture could not ban imports nor impose controls on the movement of crayfish within Britain. For that matter, he did not even have the power to obtain information about existing farms. When, in the late 1970s, both the NCC and the Wessex Water Authority voiced their concern over the introduction of signal crayfish to Britain and the consequent risks of introducing the plague fungus, the MAFF could reply only that as a policy it "did not encourage" the import of foreign crayfish and that when consulted it recommended various safeguards to prevent escapes. Apparently, prospective crayfish farmers seldom consulted the MAFF and, in any case, contrary to its



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Infection is very difficult to diagnose. Muscles in the abdomen appear white rather than the normal bluish colour. Brown melanised patches appear where the crayfish tissues try to surround some of the invading fungal threads



Wessex Water Authority

Crayfish farms are cheap and easy to run and profits are high

...the MAFF did initially encourage crayfish farming in Britain by providing funds for the BCMA.

Since that time, the MAFF has conducted a comprehensive review of legislation on fish diseases, which has resulted in three new acts of parliament:

- *The Import of Live Fish (England and Wales) Act 1980* gave a minister the power to ban or license the import or release of foreign crayfish and also the power to impose restricted "no-go" areas in which no foreign crayfish be kept.

- *The Animal Health Act 1981* empowered the minister to prevent the introduction or importation of any animal in order to prevent the spread of disease.

- *The Diseases of Fish Act 1983* gave the minister the power to obtain information about the location and activities of any crayfish farm. An order has at last been made, which became effective on 1 December 1985, requiring all fish-farming businesses to register with fisheries departments, giving details of the location, stocks and holding facilities of each farm.

Together, these three acts provide the minister with adequate powers to take immediate action to prevent or contain the spread of crayfish plague in Britain. The ministry, however, has, until very recently, been reluctant to use any of them. In answer to a question by the Earl of Onslow in the House of Lords in April 1984, Lord Belstead replied that no controls to prohibit imports were in force and that it was now too late for such efforts to be successful. "Moreover, the necessary imposition of restrictions on all imports of live crayfish, including those for the table, and of controls on their movements throughout England and Wales, would be highly disruptive to trade and extremely onerous to enforce." Nevertheless, the 1985 order does require a farmer to keep records of all movements of live crayfish to and from the farm. These records are open to inspection by an authorised official.

Sadly, this is almost certainly a case of too little, too late. The MAFF is probably right when it claims that statutory

controls would now be ineffective in limiting the spread of crayfish plague. An unknown but increasing number of farms are now producing sexually mature stock and selling juveniles for the home market, rendering import controls irrelevant.

One possible course of action is to draw up a Code of Guidance for the design of crayfish farms in Britain, with the cooperation of the BCMA. Unfortunately, some suppliers and breeders now work independently from the marketing association. Another course is to enforce "no-go areas" for crayfish farms in sensitive catchments where healthy stocks of native crayfish are known to live. This approach requires the willingness of the MAFF to use its powers to impose area-restricted orders, which could be a cumbersome procedure. A third, fail-safe course of action is to try to breed strains of native crayfish that are resistant to the fungus. The resistant animals could be used to restock infected waters. The Thames Water Authority is investigating this possibility. Little else can be done but to monitor the spread of the plague and compile a list of enclosed waters that contain native crayfish. Local angling clubs and conservation societies could help water authorities in this task. They could report to the local water authority or the MAFF any finds of large numbers of dead crayfish or the absence of crayfish where only recently they were plentiful.

It is too early to assess the ecological impact of crayfish plague in Britain. It is probably too late to do very much to control it, except in very limited areas. The complete absence of legal restraints on crayfish farming made the introduction of the plague inevitable in one of the last European countries to have escaped its effects. It is a salutary warning against complacency over Britain's laws to protect wildlife. □

Peter Marren is a writer and editor in the public affairs branch of the Nature Conservancy Council.

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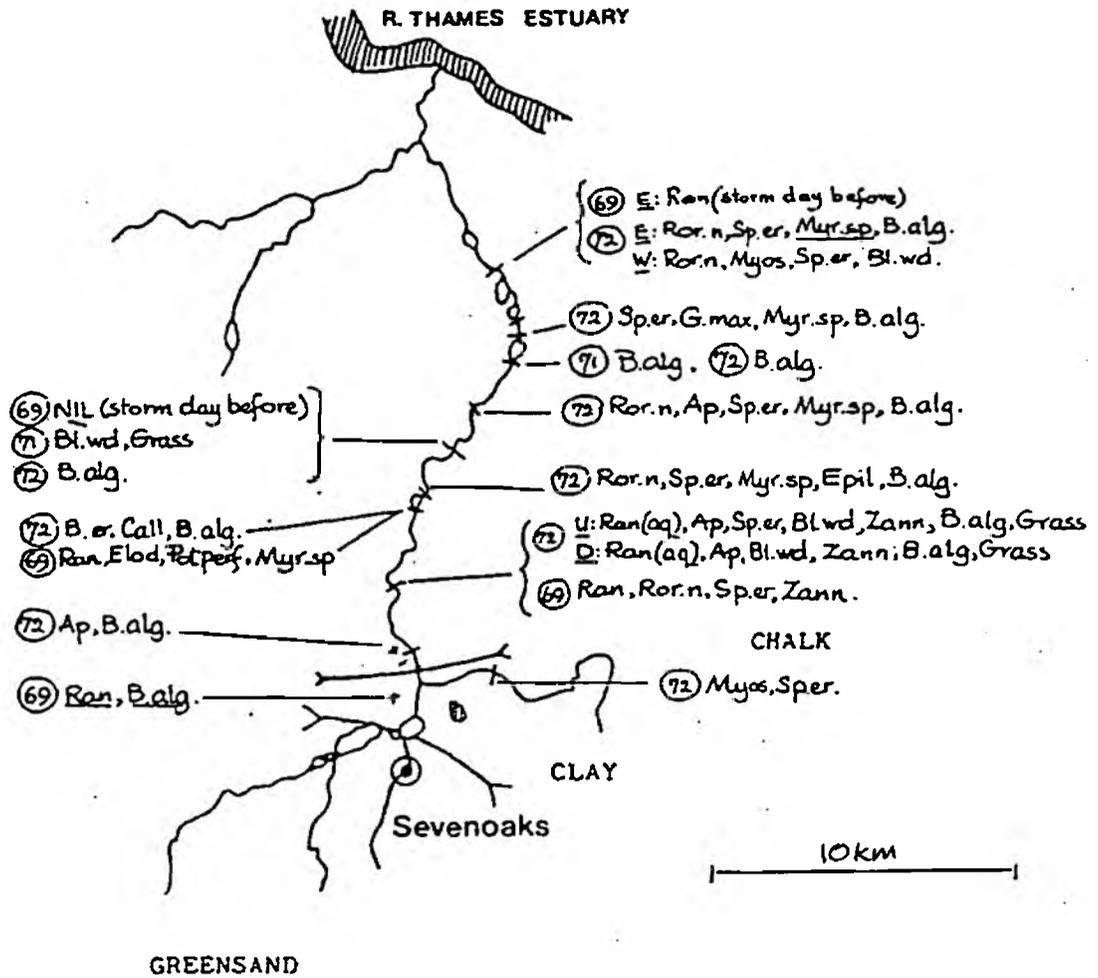
APPENDIX 4

S M HASLAM ECOLOGICAL SURVEYS OF RIVER DARENT 1969 - 1986

KEY FOR USE WITH DR S M HASLAM'S RIVER SURVEY MAPS

Ap	-	<i>Apium nodiflorum</i> - fool's watercress
Bl wd	-	<i>Cladophora</i> - blanket weed
But	-	<i>Butomus umbellatus</i> - flowering rush
Call	-	<i>Callitriche</i> ssp - common starwort
Elod	-	<i>Elodea canadensis</i> - Canadian pondweed
Epil	-	<i>Epilobium hirsutum</i> - great willow herb
G max	-	<i>Glyceria maxima</i> - reed sweet-grass
Iris	-	<i>Iris pseudacorus</i> - yellow iris
Ment	-	<i>Mentha aquatica</i> - water mint
Myos	-	<i>Myosotis scorpioides</i> - water forget me not
Myr sp	-	<i>Myriophyllum spicatum</i> - spiked water milfoil
Phal	-	<i>Phalaris arundinacea</i> - reed canary grass
Pot nat	-	<i>Potamogeton natans</i> - broadleaved pondweed
Pot perf	-	<i>Potamogeton perfoliatus</i> - perfoliate pondweed
Ran	-	<i>Ranunculus</i> c.f. <i>aquatilis</i> - water crowfoot
Ran (trich)	-	<i>Ranunculus trichophyllus</i> - thread-leaved water crowfoot
Ror n	-	<i>Rorippa nasturtium</i> - <i>Aquaticum</i> agg (<i>Nasturtium officinale</i> agg)
Sper	-	<i>Sparganium erectum</i> - branched burreed
Ver a	-	<i>Veronica anagallis-aquatica</i> agg - water speedwell
Ver b	-	<i>Veronica beccabunga</i> - brook lime
Zann	-	<i>Zannichellia palustris</i> - horned pondweed

RIVER DARENT 1969, 1971, 1972

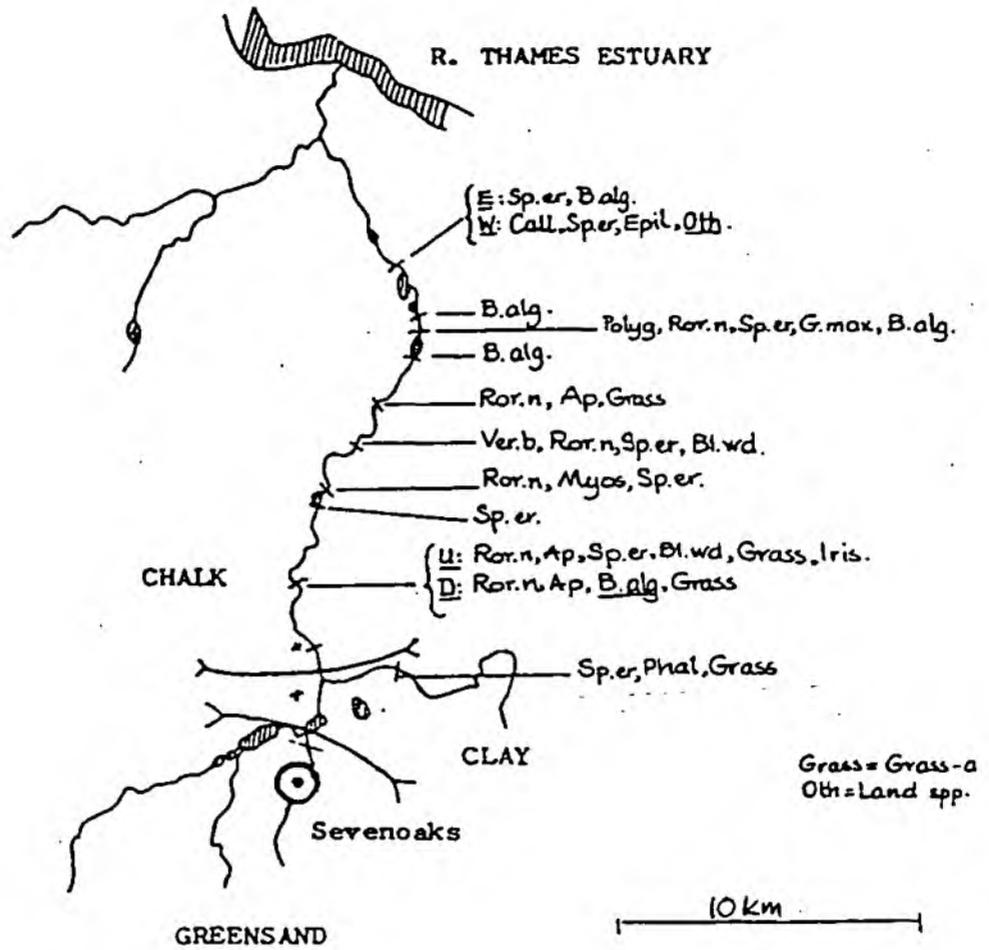


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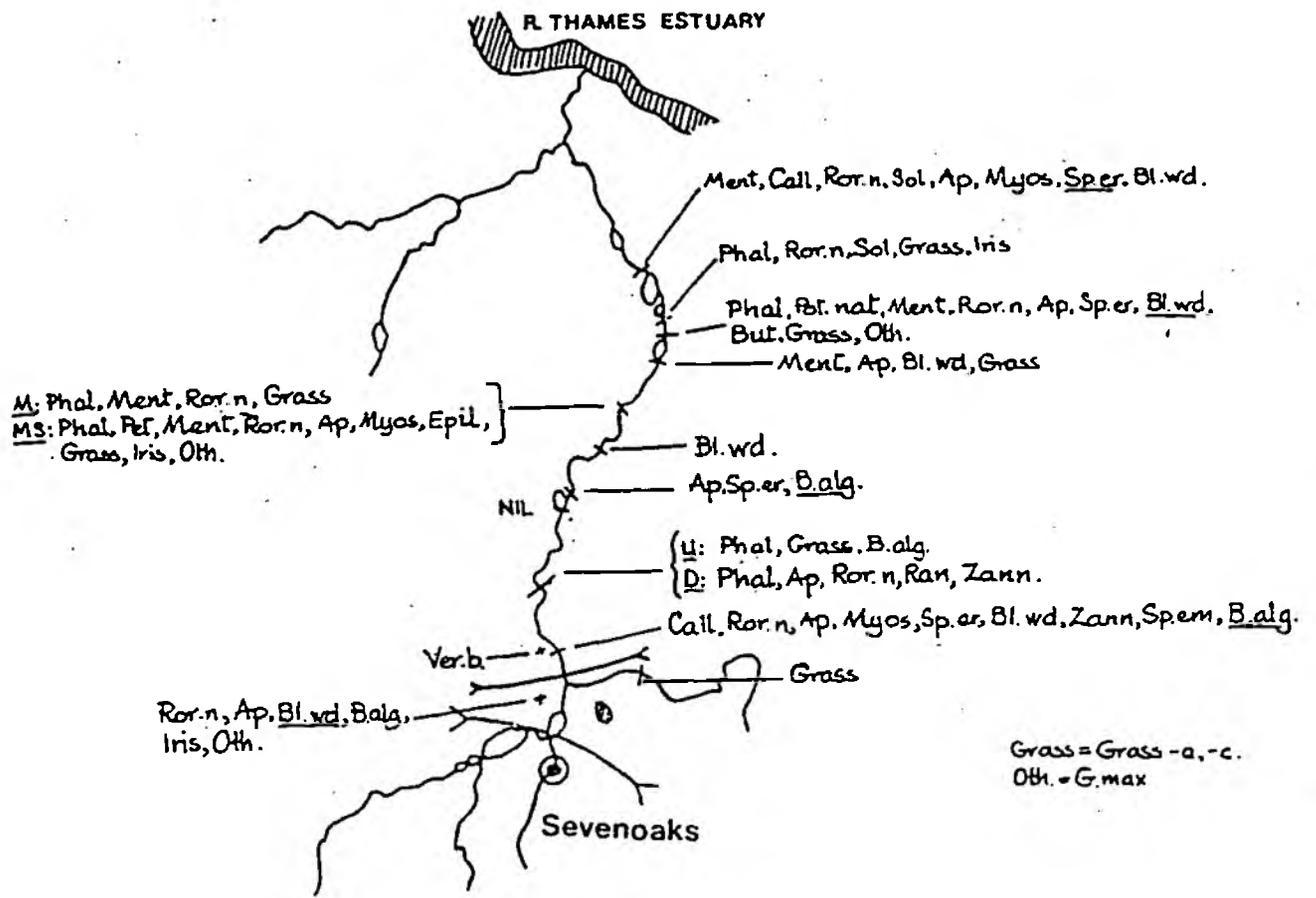
1969 SURVEY

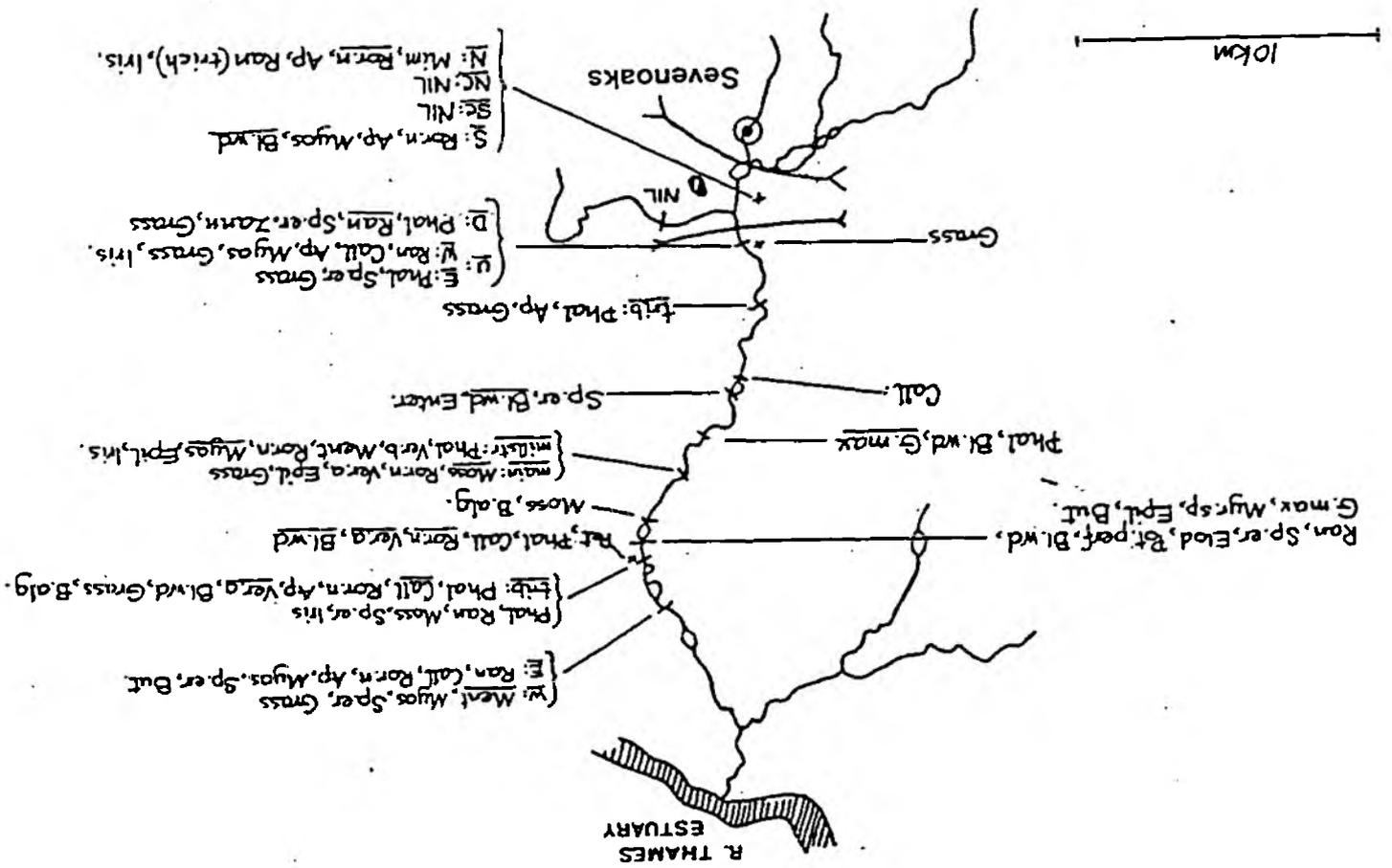
- 1 Storm flow, turbid, deep water. No short water supported plants seen.
- 2 Mentha, mysotis and veronica spp were not recorded.

RIVER DARENT 1974



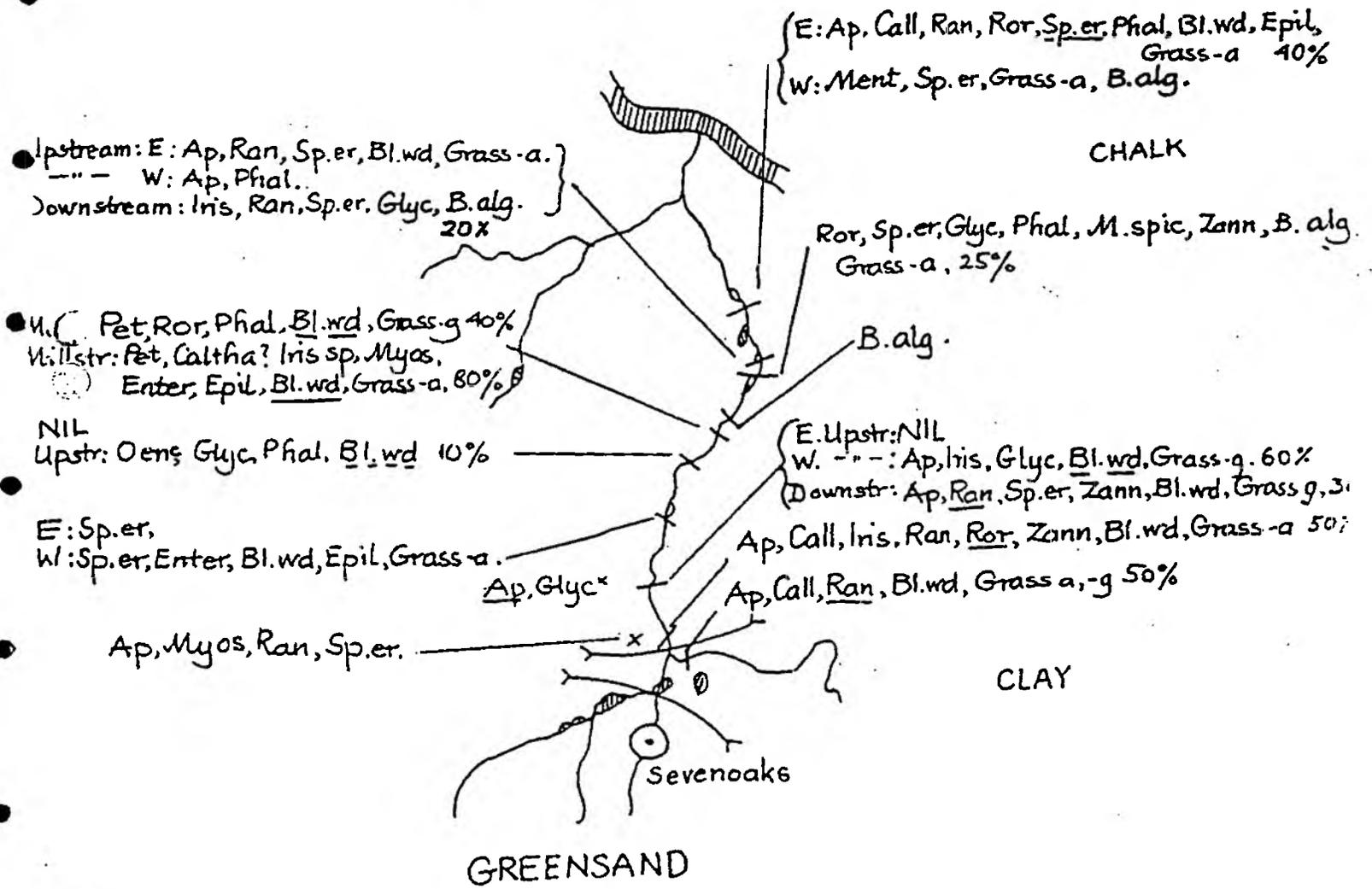
RIVER DARENT 1977





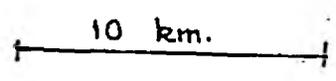
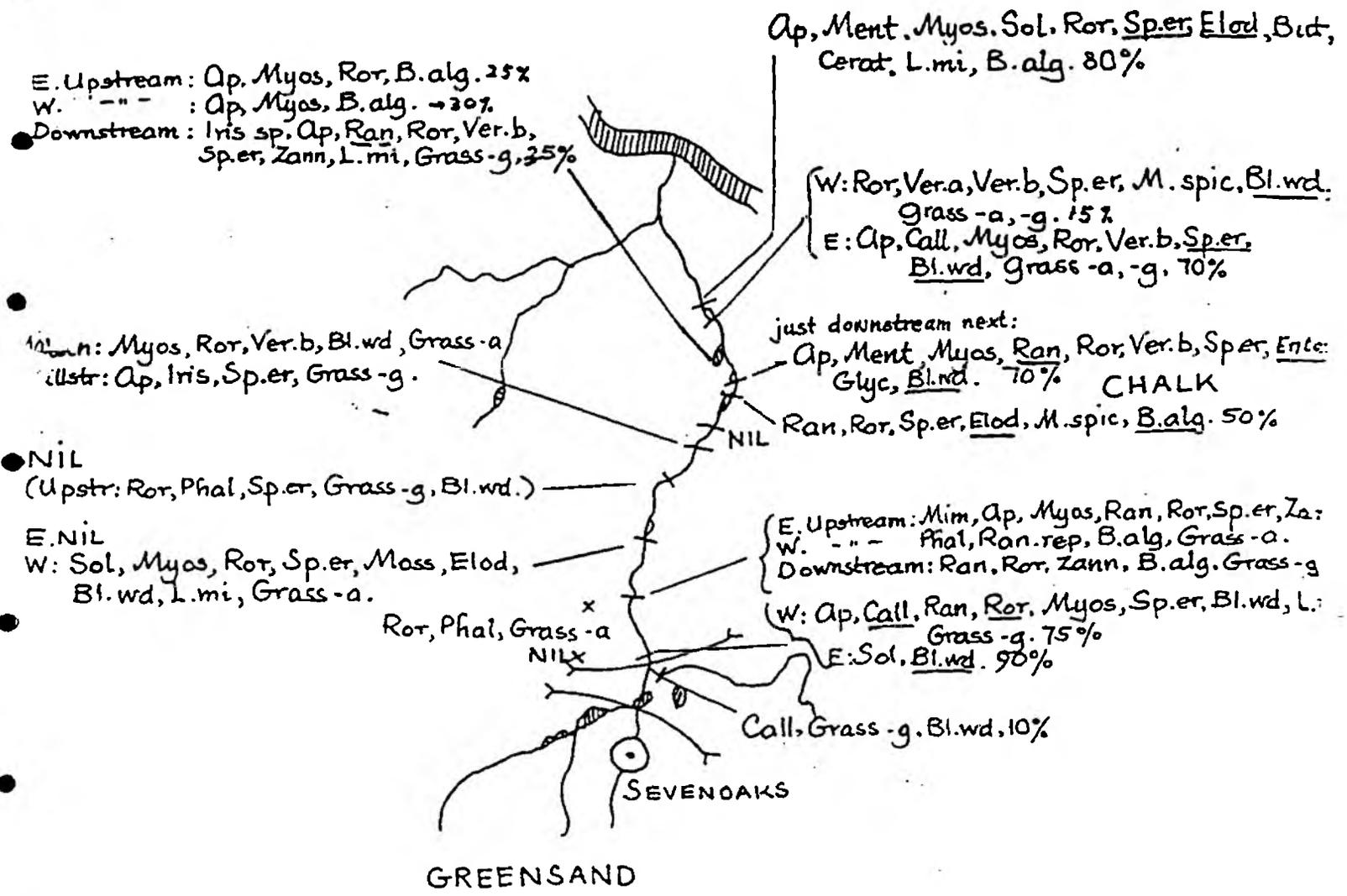
RIVER DARENT 1979

RIVER DARENT 1983



10 km

RIVER DARENT 1986



APPENDIX 5

NRA NEWS RELEASE



National Rivers Authority

N E W S R E L E A S E

72

15 June 1992

TOUGH NEW ACTION ON LOW FLOW RIVERS

The National Rivers Authority is stepping up its action to deal with the problem of low flows caused by water companies taking too much water from rivers and groundwater resources, starting with the River Darent in Kent.

Urgent discussions are to be held with water companies to seek agreement on timetables for action to restore the flows to these rivers in the shortest practical timescales, otherwise the companies face having their licences to abstract water 'varied' so that they cannot take as much, or taken away altogether.

This action will give impetus to the work that has already been done to identify solutions for the 40 worst affected rivers, and the progress that has been made in some areas in implementing remedial schemes.

Commenting today, NRA Chairman Lord Crickhowell said:

"The public and the NRA are not prepared to wait a minute longer than is absolutely necessary to restore these long suffering rivers to their former healthy flows.

"A great deal of work has already been done with the water companies to tackle this problem, but what I want to see now are firm target dates set to complete whatever action is required for each of the 40 rivers most affected by excessive abstraction of water. If agreement on timetables cannot be reached, the NRA will act unilaterally to vary abstraction licences downwards, or revoke them completely."

He said that following a recent meeting of the NRA board, firm action had just been taken in the case of the River Darent in Kent - one of the most visible casualties of excessive abstraction - and to make the NRA's position clear to other water companies where urgent remedies are required.

The NRA has given Thames Water Utilities until 1 September this year to commit the company to varying its abstraction licences for the Darent to 70 per cent of the currently authorised 90 megalitres of water a day that they are allowed to take. If they fail to do so, the NRA will take action itself to vary the licences.

As part of a stepped approach, the NRA is also seeking agreement by 31 March 1993 from the company for a further reduction of 15 megalitres a day by the end of 1995 at the latest, as part of an action plan for the Darent which could lead to even greater reductions.

In a letter to the company, the NRA states that if agreement cannot be reached "the Darent licences will be replaced with a time-limited licence of a duration considered by the NRA to be sufficient for Thames Water Utilities to introduce alternative supplies."

The Darent is not the only case. In other regions, too, where discussions have been taking place with water companies with the object of reducing abstractions, the same clear message has been given that the NRA requires firm timetables for action and is prepared to vary or revoke licences.

Lord Crickhowell said that he welcomed the fact that real progress has been made in talks with Wessex Water on reducing abstractions at Alton Pancras in Dorset, on the River Piddle; and with Southern Water to reduce abstractions from the Wallop Brook in Hampshire.

Where reducing or stopping abstractions means water companies having to seek alternative sources of supply, this will be taken fully into account in the setting of timetables for action. Lord Crickhowell said the NRA understood well the potential practical difficulties that this could cause water companies, but added:

"As water companies plan their capital programmes and discuss them with the Office of Water Services (OFWAT), I believe that they will find it helpful to know the NRA's priorities and requirements.

"Before any new sources are developed, it is essential that water companies make sure that they are doing all they can to reduce leakage and to carry out effective demand management. The NRA supports selective domestic metering, with an appropriate tariff, in areas where water resources are stressed.

"Where it can be shown that proper attention is not given to the control of leakage, or where appropriate consideration has not been given to the introduction of selective metering, the NRA will not grant licences for new sources."

NOTE TO EDITORS

The NRA began urgent investigations in February last year (News Release 13) into the extent and cause of low flows in the following 'top 20' priority rivers:

RIVER

Hiz
Hoffer Brook
Slea
Upper Waveney

NRA REGION

Anglian
Anglian
Anglian
Anglian

Dover Beck
Worfe
Battlefield Brook
Misbourne
Ver
Pang
Wey
Letcombe Brook
Darent
Wallop Brook
Piddle
Allen
Wey
Wharfe
Lowther

Severn Trent
Severn Trent
Severn Trent
Thames
Thames
Thames
Thames
Thames
Southern
Southern
Wessex
Wessex
Wessex
Yorkshire (two locations)
North West

Investigations began in May 1991 (News Release 33) on an additional 20 waters:

River Glen
East Rushton SSSI
River Mun
River Deben
Black Ditch
Rufford Lake
Leomansley Brook
Black Brook
Little Stour
Bourne Rivulet
River Meon
River Hamble
River Frome
River Garren
River Gamber
River Monmow
River Alun
Afon Clywedog
Cefni Reservoir
River Derwent

Anglian
Anglian
Anglian
Anglian
Anglian
Severn Trent
Severn Trent
Severn Trent
Southern
Southern
Southern
Southern
Southern
Welsh
Welsh
Welsh
Welsh
Welsh
Welsh
Welsh
Yorkshire

Press Enquiries: 071-820 0101

APPENDIX 6

**DARENT RIVER PRESERVATION SOCIETY NOTES ON
ECOLOGICALLY ACCEPTABLE FLOWS**

Darent River Preservation Society

Notes on the river flows needed to maintain ecologically acceptable conditions

Introduction

1. During the NRA, Southern Region's proposed studies (1990) of the River Darent the need to reduce public water supply (PWS) groundwater abstractions within the basin and to replace them by other sources, both inside and outside the basin will be examined. Among the questions requiring answers will be:-

"At what times of year and what reductions in abstractions would be of greatest benefit to the river" and "what flows at various points down the river from its source are needed to provide ecologically acceptable conditions"? Proposals for providing a) a method to answer these questions and b) operational guidelines for reducing abstractions according to the prevailing conditions throughout the year are made in this Note. The proposals are intended to replace the simple concept of single, "target flows" proposed by Halcrows (1988) as these are considered unsatisfactory. The ideas proposed will need to be developed further.

Ecologically Acceptable Flows

2. The proposal is to define, for specific short reaches of the river, annual curves showing the minimum flows needed to provide ecologically acceptable conditions. This leads to the concept of Ecologically Acceptable Flows (EAF's). A series of curves (say 10-12) each for a specific location down the length of a river would together represent the main conditions and water needs throughout a Chalk stream. Initially, uncertainties will mean that each "curve" is a "band", which can be narrowed in the light of experience (Figure attached.) The ecological acceptability will be based on estimates of the minimum flow requirements of the various aspects which together determine the river's local, ecological character including:-

- i. flora
- ii. fauna (invertebrate)
- iii. fish life
- iv. fishing
- v. amenity value, wildlife
- vi. water quality, including sediment transport
- vii. possibly others

River levels/depths are only partly related to flows; being affected also by plant growth, river management, hatch operations and locally by pool-riffle sequences, etc. However, because of the rapid and frequent changes in depths along a river, initially they will probably have to be represented by flows.

3. An annual curve of EAF's in a particular reach will be defined by different aspects of the river ecology at different times of year e.g. during one period the need to maintain a specific pattern of flora may define the EAF; at another time fishing needs may be predominant. Once the controlling aspect at any particular period is assessed, then efforts to define that aspect's flow needs more precisely can be attempted. This is likely to require specific fieldwork and analysis.

4. Exceptional natural events and stresses will always occur in a river and it would be wrong to allow fully for these when estimating EAF's. The concept of an acceptable frequency of flows falling below the EAF by a specified amount should be introduced. In determining these values the ecological consequences of such shortages should be taken into account. An example might be that "during the first two weeks in May a 20% shortfall below the EAF is allowable once in 15 years, on average."
5. Variations in the climate from year to year cause river conditions to be advanced or delayed compared with average conditions. A method to take some account of this may be needed.
6. There will undoubtedly be considerable difficulties in estimating EAF's and initially they may be relatively crude. However, such attempts seem essential, not only for the present River Darent problems but also for many other Chalk Rivers. I suspect that the existing knowledge can provide useful first estimates, particularly if supplemented by limited, specific fieldwork.
7. The preparation of curves of EAF's will require contributions from a variety of scientists, other specialists and those with local knowledge of the river.

EAF's for the River Darent

8. An appreciable amount of data, surveys and knowledge of the river's characteristics and conditions are available. These should be used to derive the first EAF's. While some of the river's features have been studied, there appears to be scope to integrate the results more fully and, in particular to relate them to prevailing flows. Therefore the first effort should be to derive, from existing data, preliminary EAF's related to each individual aspect (para. 2). The results of these first studies will be needed in May 1990 if supplementary fieldwork is to be carried out during the most important periods in 1990 and if the estimates are to be used in the forthcoming water resources planning studies.
9. Which reaches have a) the most critical river flow and ecological conditions and b) could benefit most from reductions in groundwater abstractions? These reaches are those which should be studied first and EAF's for them derived. The NRA will wish to consider this and will be assisted by the information in the Halcrow Reports. I suggest that DRFS could make useful contributions to this planning. The first reaches for which EAF's are derived should be related to FWS abstraction sites e.g.

a) FWS source "x"

- i. Greatest influence - (zone of greatest influence of pumping on the river)
- ii. Required flow hydrograph - (location where flow record required for relating to ecological characteristics in the EAF reach)
- iii. Suggested EAF study reach - (to be decided in each case)

10. Suggested characteristics of an EAF reach include:-

- a) length: say 100 m.
- b) to include at least one pool and riffle sequence.

11. Suggested field measurements in each of the initial EAF reaches in 1990:-

- a) continuous, reliable record of local river flows (see para. 9.a.ii above). This is likely to require additional hydrometric measurements.
- b) river level staff gauges installed in one pool and one riffle in each reach and observed as often as practical
- c) regular (fortnightly?) water sampling for chemical and suspended solids analyses. More frequent sampling during floods, pollution incidents etc.
- d) regular (monthly, and fortnightly during critical ecological periods) river flora surveys
- e) other measurements which the initial analyses (para. 6) show to be essential.

Some local riparian owners or others may be prepared to assist by making further observations (to be agreed with the NRA) in the critical areas.

Summary

- 12. a) the concept of deriving Ecologically Acceptable Flows (EAF's) is proposed. These are needed to assist in assessing the impact on river conditions of groundwater abstractions and to optimise the timing and quantities of reduced abstractions.
- b) suggestions are made to derive first estimates of EAF's for a few zones in the River Darent in critical or representative locations
- c) first estimates of EAF's are needed by about May 1990 to provide immediate guidance for water resources planning studies
- d) proposals are made for frequent observations during 1990 of selected aspects of the river's ecological character in order to improve the first estimates of EAF's.
- e) depending on the results of these initial proposals, the approach should be refined and extended to the whole River Darent basin.

M. Mansell-Moullin

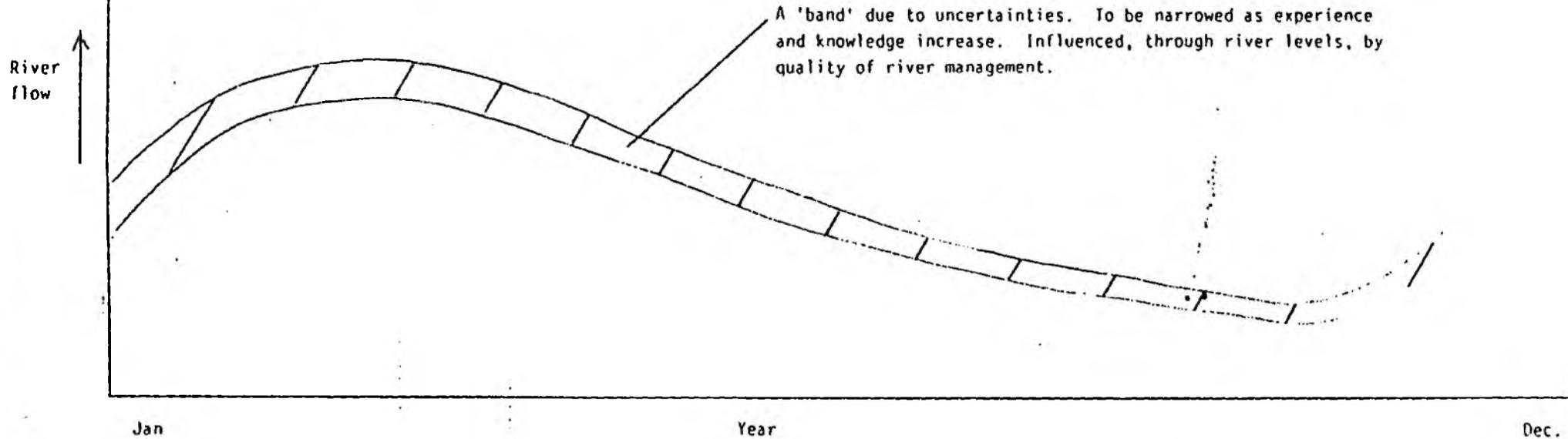
7 February 1990

Attached.

Figure. Ecologically Acceptable Flow Curve

River: _____

River reach: _____



Notes

1. The curve is for a specific river reach representative of local river conditions. A series of curves (10-12) might represent the main conditions throughout a particular Chalk stream. Each curve could form the basis for public water supply or other operations, including abstractions and river regulation, and licencing.
2. The curve is derived from curves of each aspect affecting the river's ecology and is based on the controlling curve on any particular date.
3. The prime aspects include a) river fauna (invertebrates) b) river flora c) fish population d) fishing e) river water quality, sediment load f) river levels g) amenities, wildlife
4. The curve should be related to a stated, acceptable flow frequency and degree of shortages e.g. a 20% shortage in flow is acceptable once in 15 years, on average.

MMM 2/90

ECOLOGICALLY ACCEPTABLE FLOW CURVE

APPENDIX 7

**MOTT MACDONALD LANDSCAPE ENHANCEMENT PROPOSALS
-MASTER PLAN 70223LA1/B**

APPENDIX 8

**MOTT MACDONALD LANDSCAPE ASSESSMENT AND CORRIDOR SURVEY
DRAWINGS 70223/LA/A1 TO A6**

APPENDIX 9

ECOLOGICAL SURVEY OF ST JOHN'S JERUSALEM

3. Floodplain Pastures

These are situated on the flat floor of the Darent Valley, where the course of the calcareous river has been modified to accommodate feeder and outflow channels for the garden moat, and also for the construction of a series of deep, steep-sided, canal-like structures formerly managed as water-cress beds.

The area probably once supported wetland vegetation, but a fall in the water-table of nearly 5 metres, caused by gravel extraction both up and down the valley, will have caused a significant drying-out, with springs ceasing to flow. However, there is still significant water flow in the ditches and other water-courses.

The water-cress beds, which are an interesting historical feature, still contain large quantities of water-cress (Nasturtium officinale), but also support good quantities of a small number of other common emergent plants such as brooklime (Veronica beccabunga), fool's water-cress (Apium nodiflorum), reed sweet-grass (Glyceria maxima) and floating sweet-grass (Glyceria ?fluitans). Other water-courses support a greater diversity of common emergent plants, although where stock have access this is generally not well-developed. Species additionally recorded include water-plantain (Alisma plantago-aquatica), great willowherb (Epilobium hirsutum) and celery-leaved buttercup (Ranunculus sceleratus). In addition, Hemsley (1977) noted a patch of common reed (Phragmites communis) at the location marked on Map III. Only a limited variety of invertebrates were found in association, sweep-netting revealing Lymnaea sp. snails, various spiders, ephydriids and other flies, the snail-killing fly Tetanocera robusta, and nitidulid beetles.

Alder and ash, including old specimens, line the water-courses marking the north and east property boundaries, and also occur elsewhere along water-courses. These trees are useful to birdlife and to common invertebrates, and should preferably be perpetuated.

The floodplain pastures have unfortunately lost their former value as marshland and now contain a dry flora. They are however of value as permanent alluvial grasslands in an area where most of this habitat type has been lost to gravel extraction. They are semi-improved, but two areas, which have been graded G2* (see Map III), contain open sward neutral to acid grassland which is herb-rich and contains a good diversity of herb species, including common knapweed (Centaurea nigra), lady's bedstraw (Galium verum), common bird's-foot-trefoil, creeping cinquefoil (Potentilla reptans), lesser stitchwort (Stellaria graminea), mouse-ear hawkweed (Hieracium pilosella), germander speedwell and thyme-leaved speedwell (Veronica serpyllifolia). Field woodrush (Luzula campestris) was also frequent in these areas, together with a large number of grass species - Holcus mollis, Phleum pratense, Lolium perenne, Festuca and Anthoxanthum odoratum are predominant.

*Enclosed grasslands are graded on a scale G1 to G4, where G1 is a herb- and species-rich sward and G4 is agriculturally improved, herb-poor grassland. Although of low botanical interest G3 and G4 may, in some cases, be of zoological value.

Other pastures, graded G3, were less diverse, generally lacking most of the more notable plants - lady's bedstraw, knapweed, field woodrush for instance. Overall the grasslands appear to be more diverse and species-rich than indicated by Hemsley's 1987 assessment (NT files). The latter was based on a winter survey when much of the species content of the grassland would not have been evident.

Grazing limits the value of these grasslands for invertebrates and very few species were found. The grazed pasture is, however, probably of value to feeding and resting birds - particularly wetland species disturbed from the adjacent gravel-pits. Clumps of scrub in the southern riverside field are of value for small birds such as yellowhammer, blue tit and chaffinch.

Management Implications

The grasslands are well worth protecting from agricultural improvement and should preferably be managed by stock-grazing without the use of fertilisers, herbicides or pesticides, although light dressings of traditional manure would be acceptable if this has been part of the management practice. The fields should not be ploughed or re-seeded. Good water quality should be maintained within the water-courses and any dredging should be of only short sections at a time, allowing one side to recover before the other is cut. Current tree-cover marginal to water-courses should be maintained by appropriate coppicing, pollarding or replacement planting.

The area overlies gravel deposits of great financial value and the biological interests of the area are not of sufficient merit to forego exploitation of the gravel-beds: they are to a large extent re-creatable. If the area is to be worked for gravel, strong consideration should be given to restoring at least part of the area to a lake with fringing wetland areas and reed-beds to be managed as a nature reserve.

4. St. John's Jerusalem

No information is currently available on whether or not the house is used by bats as a roost. All bats are protected by law under the Wildlife & Countryside Act 1981 and it is highly desirable that the Trust is aware of any bat interests, particularly when planning any roof repair and maintenance work.

5. Other Biological Information

There is an unconfirmed record for the very rare marsh sow-thistle (Sonchus palustris) for the property (Maidstone Museum records). No location is given. This seems highly unlikely as the plant is only known in the county from along the Medway.

6. Public Access

There is no conflict between biological interests and public access on the property.

MAP II

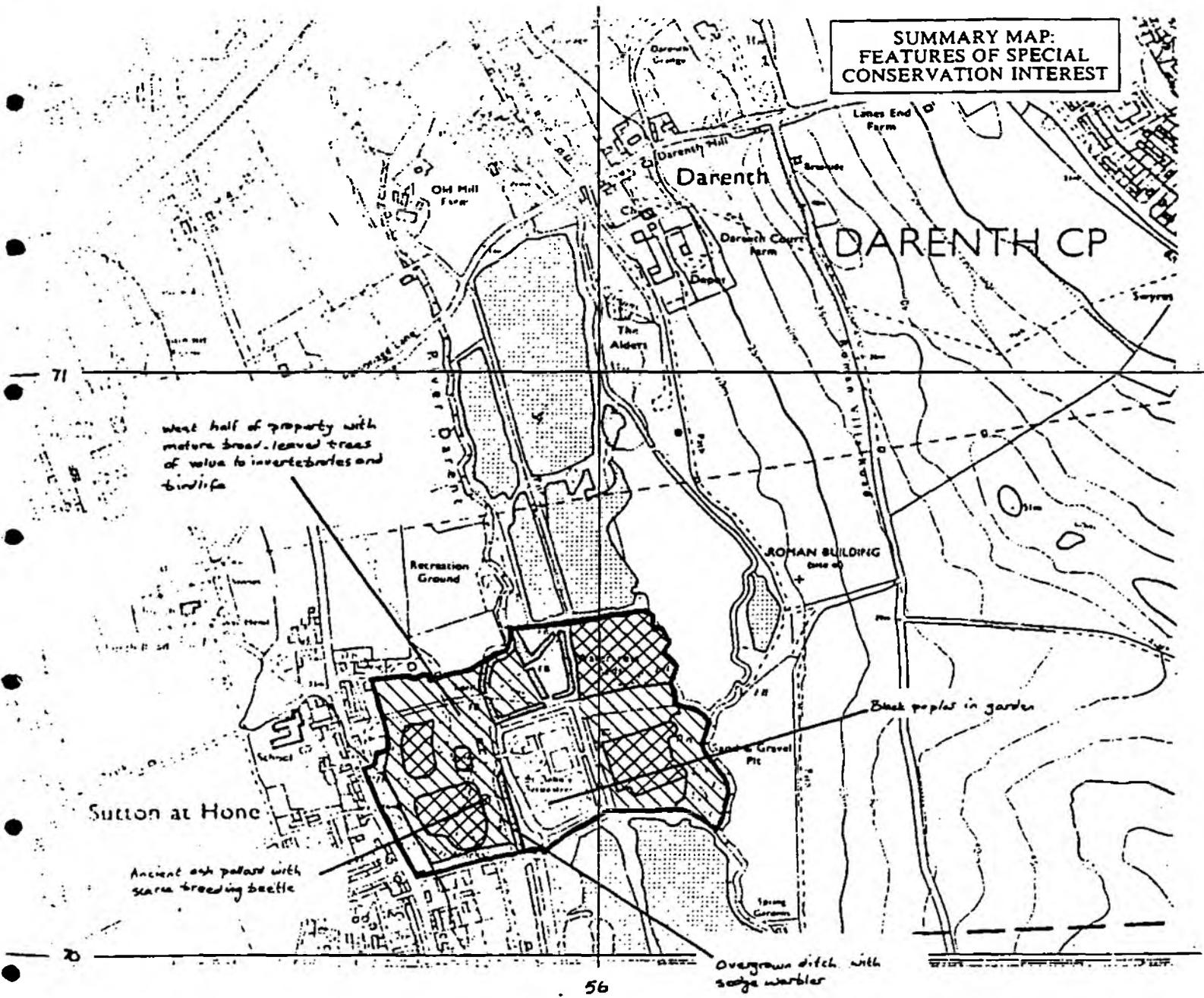
The National Trust
ST. JOHN'S JERUSALEM
Kent

TQ 558703

1:10,000

1987

SUMMARY MAP:
FEATURES OF SPECIAL
CONSERVATION INTEREST



KEY	
	Best areas of grassland
	Other permanent grassland
	Water courses of minor interest

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MAP III

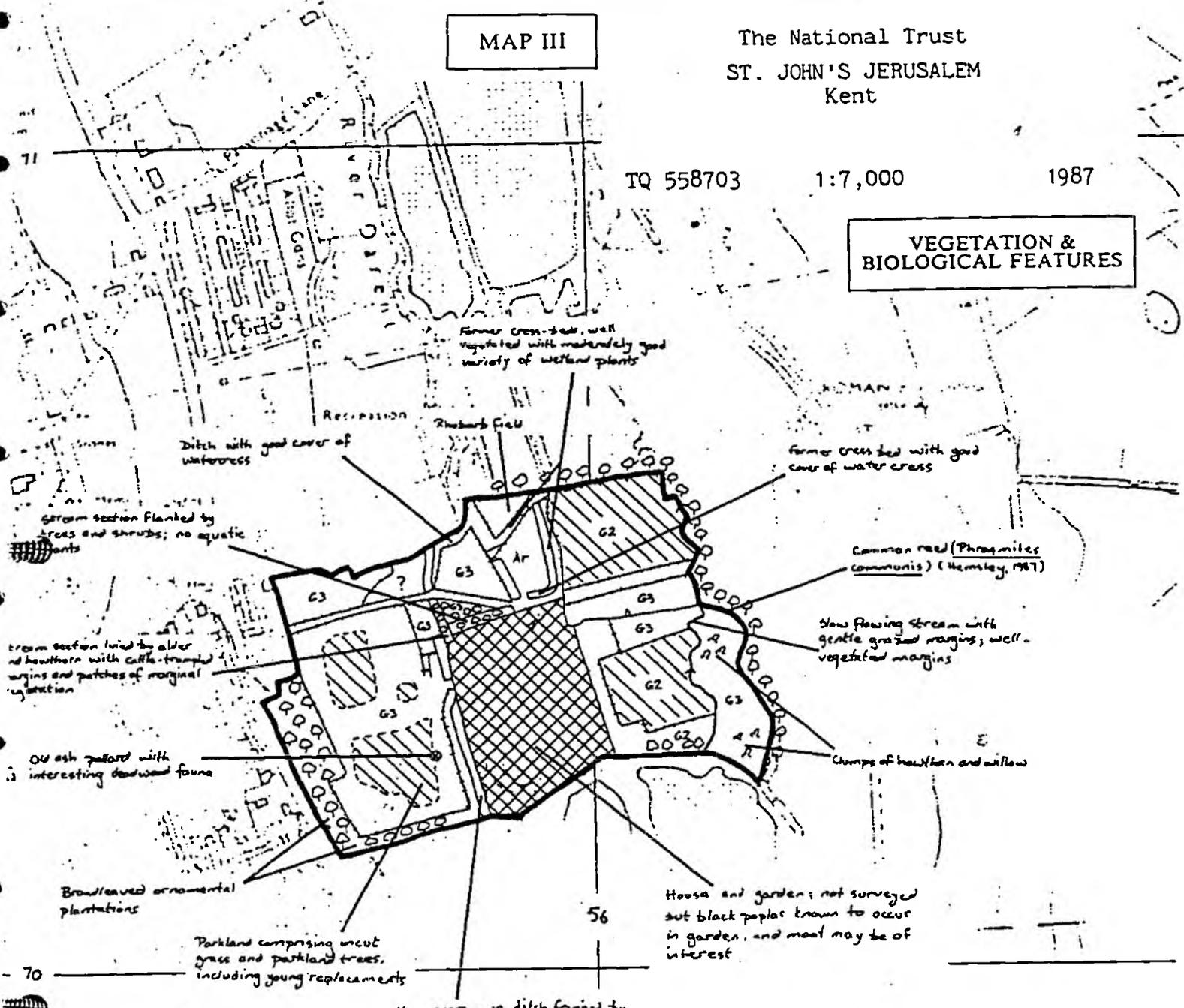
The National Trust
ST. JOHN'S JERUSALEM
Kent

TQ 558703

1:7,000

1987

VEGETATION & BIOLOGICAL FEATURES



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KEY		
	Broadleaved woodland	Ar Arable
	Scrub	— Fence
	Best areas of grassland	h Hedge
G1-G4	Enclosed grassland graded on a scale 1-4 where G1 is species-rich unimproved and G4 is species-poor improved	
		? Feature not surveyed

APPENDIX 10

USEFUL CONTACTS

ORGANISATIONS AND CONTACTS

BRASTED PARISH COUNCIL

DEAN, Nick
Chairman

0732 70777

SKINNER, Mr A F
Clerk
30 Homestead Road
Bickley, Kent BR2 8BA

081 467 4986

CHIPSTEAD SAILING CLUB

KING, Mr D
Chipstead
Nr Sevenoaks
Kent

0959 524611

DARTFORD DISTRICT COUNCIL

DAVIS, Eric
Civic Centre
Home Gardens
Dartford, Kent DA1 1DR

0322 343434

DRIPS, DARENT RIVER PRESERVATION SOCIETY

ALBAN-DAVIES, Mr
Chairman
Trout Beck
Otford
Sevenoaks
Kent TN14 5PH

0959 525439

Consulting Hydrologist to DRIPS
MANSELL-MOULLIN, Michael
Old Hatch
Lower Farm Road
Effingham
Surrey KT24 5JL

0372 52672

KENT THAMES-SIDE GROUNDWORK TRUST

WILLIAMS, Catherine

Projects Manager

Manorgate House

Priory Road

Dartford

DAI 2BJ

0322 28772

LINTEL, Mark

Land Use Consultant

The Quadrangle

c/o Home Ward Farm

Shoreham

Kent

0959 524251

MEDWAY RIVER PROJECT

SMITH, Brian

3 Lock Cottages

Lock Lane

Sandling

Maidstone, Kent

ME14 3AU

0622 683695

NORTH WEST KENT COUNTRYSIDE PROJECT

TUSTIAN, Charles and BARTON, Rosie

Countryside Project Centre

Mead Crescent

Mead Road

Dartford

DA1 2SH

0322 294727

OTFORD PARISH COUNCIL

DERBY, Mrs

0959 524808 office

522869 home

OTFORD PRIMARY SCHOOL

LINN, Mrs - Headmistress

High Street

Oxford

Sevenoaks

TN14 5PJ

0959 523145

SEVENOAKS DISTRICT COUNCIL

GAYNOR, Mr A J - Planner

HIGGINGS, Mike - Conservation Officer

Argyle Road

Sevenoaks TN13 1HG

0732 741222

WARD, Sarah

Court Lodge

Horton Kirby

0322 865356

WESTERHAM PARISH COUNCIL

EVANS, Mrs D

Clerk

Russell House

Market Square

Westerham TN16 1RB

0959 562147

FISHERIES/ANGLING

DARENT VALLEY TROUT FISHERIES

REECE, John

Farnborough

Kent

0689 851888

DARENTH LAKES

DAVIS, Tom - Local Agent

081 697 4708

LEISURE SPORT AC (Fishing Club) - Headquarters

47 Church Street

Staines

0784 61831

DARENTH OTTERS ANGLING & PRESERVATION SOCIETY

MONK, Bob

26 Berkeley Crescent

Dartford

Kent DA1 1NH

0322 227989

DARTFORD & DISTRICT ANGLING AND PRESERVATION SOCIETY

WILLIAMS, Alan

Martigues

17 High Road

Wilmington

Kent DA2 7EQ

0322 220567

HOMESDALE ANGLING SOCIETY

JONES, Mr T S

4 Shoreham Lane

Riverhead

Sevenoaks

Kent TN13 3DT

0732 453658

KINGFISHERS ANGLING AND PRESERVATION SOCIETY

CRAWLEY, Mick
Swanley

0322 667726

THOMAS, Mr D M
23 Everest Drive
Rochester
Kent NE3 9AN

MARLEY LAKES
VANSTONE, Mr A
Powell Tolner Associates - Consulting Engineers
Beverly House
132 High Street
Chesham, Bucks

0494 77271

PARK FARM TROUT FISHERY
WICKENS, John
23 Broughton Road
Otford
Kent TN14 5LY

09592 3793 home
09592 3542 office

PRESTON FLY FISHERS
MONTGOMERIE, Mrs Shirley
Preston Farm
Shoreham

09592 20290

RIVER DARENT LANDOWNERS/AGENTS

ALEXANDER, James

Home Farm

Eynsford

0322 862128 office

8662237 home

ALEXANDER, William

Castle Farm

Eynsford

Farningham

0322 862128

ARCHER, Nigel (landlord)

The Fighting Cocks Public House

Horton Kirby

0322 862299

BOWERS, Mr

Rye Street Farm

Rye Street

BRAY, Mr - Agent for:

Franks Hall

Horton Kirby

Kent DA4 9LL

0322 222222

CLUBB, Mr James (Shoreham Watermeadow)

J Clubb Ltd

Church Hill

Wilmington

Kent DA2 7DZ

0322 225431

DIMENT, Michael (agent for Geoffrey Day: owner of Westminster Mills, Horton Kirby)

Development Director

Cablenet ALCATEL

Tandy House

Felxtow Road

Abby Wood

London SE2 9AA

081 310 7036

DINNIS, John (Shoreham watermeadow and land between Shoreham and Otford)
Filstone Farm
Filstone Lane
Shoreham 0959 522015

DURTNELL John
Rectory Lane
Brasted
TN16 1JR 0959 564165

EDGAR, G R & Son
Park Farm
Brasted 0959 563601

EYNSFORD CASTLE
English Heritage
Peter Mills
Room 403, Keysign House
429 Oxford Street
London 071 973 3000

FRENCH, Mrs
Poundsley House
Langford Bridges 0959 462501

HEAD, Mr George (agent for Marley for Coombe Bank Lake)
Coombe Bank Lodge
Westerham 0959 564328

HEARTDYKE, Mr
Lullingstone Castle 0322 2114

Agent: Mr A McElwee
36 Earls Street
Maidstone
Kent 0622 661313

MARLEY Plc
BAKER, Peter
River Head
Nr Sevenoaks

0732 455255

ST JOHN'S JERUSALEM

National Trust
MAYELL, Miss Caroline (Agent)
Scotney Castle
Lamberhurst
Kent

0892 890110

Tenant Farmers
Ward, Mr F (Junior)
Ward, Mr F (Senior)

0322 220495

0322 863167

SEAWARD, Mr
Brasted House
Brasted
Nr Westerham
Kent

0959 563736

SEVENOAKS WILDFOWL RESERVE

TYLER, John
Warden
Bradbourne Vale Road
Sevenoaks
Kent TN13 3DH

0732 456407

VIZARD, Mr Ken (land between Bradbourne lake and Otford)
Bartram House
Bartram Farm
Old Otford Road
Sevenoaks

0732 454487

WARDE, Mr John
Squerryes Court Estate Offices
Westerham
Kent

0959 562345

THE WELLCOME FOUNDATION LTD
Temple Hill
Dartford DA1 5AH

0322 223488 x 2501

BRIDGMAN, A E - Estates Manager
WEBB, Mr - Lock Keeper

WESTACOTT, Mr Charlie (landowner downstream of Franks)
43 Lullingstone Avenue
Swanley

0322 663875

WRIGHT, Mr (Shoreham watermeadow)
Home Farm
Shoreham
Kent

0959 522138

NATIONAL RIVERS AUTHORITY, SOUTHERN REGION ADDRESSES

NRA Southern Region Headquarters

Guildbourne House

Chatsworth Road

Worthing

Sussex BN11 1LD

0903 820692

Peter Herbertson

Simon Taylor

NRA Southern Region

Medway House

Powdermill Lane

Leigh

Tonbridge

Kent TN11 9AS

0732 838858

Steve Oaks - Resource

John Cave - Fisheries

Robert Pilcher - Conservation

John Margame - Conservation HQ

NRA Gravesend Office

0474 325072

Trevor Carmen - Land Drainage (correspondence to Leigh Office)

NRA Thames Region

Howard House

10/11 Albert Embankments

London SE1 7TG

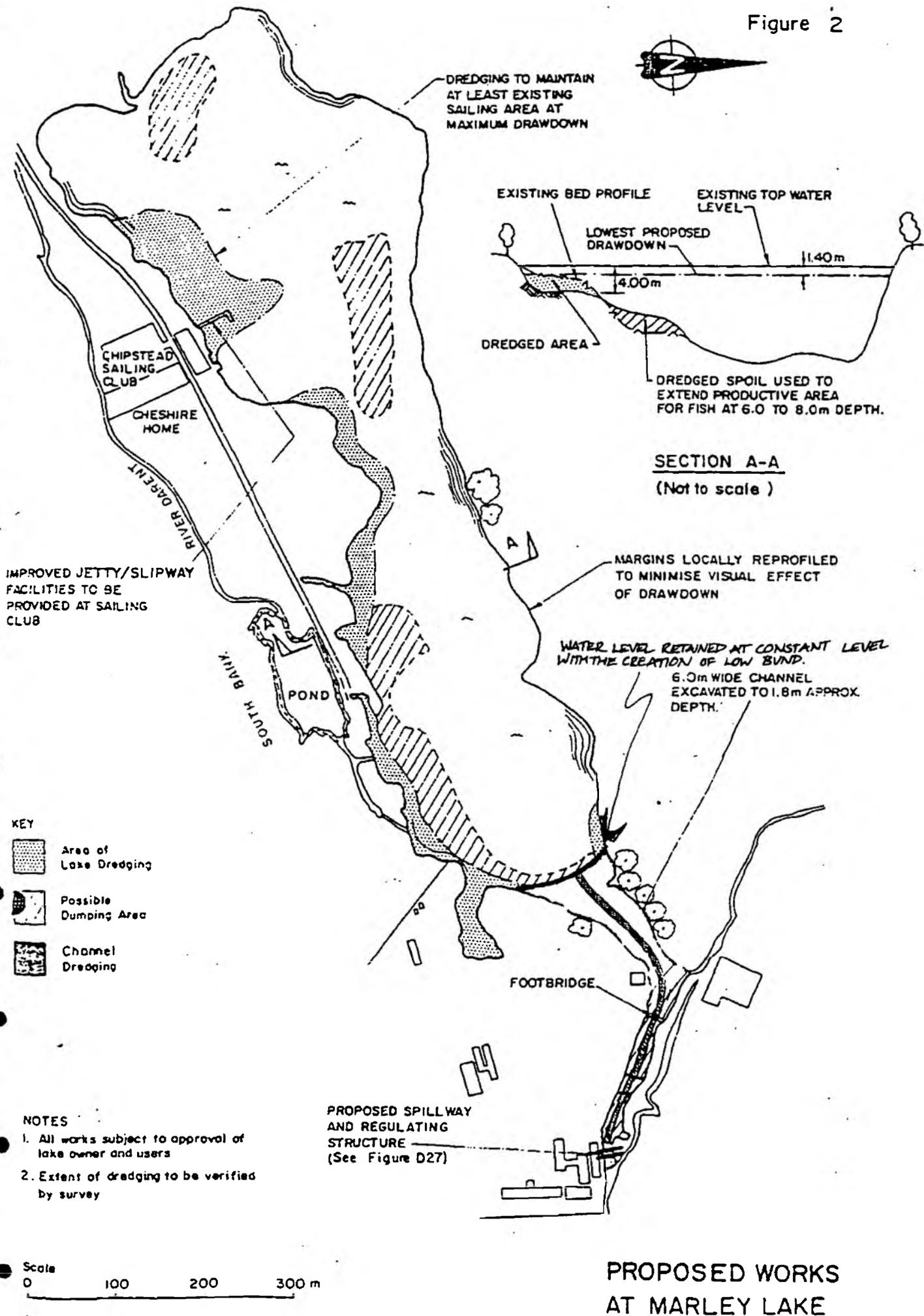
071 735 9993

Pat Campbell - Carrying out assessment of weirs at Eynsford

APPENDIX 11

**HALCROW'S - PROPOSED WORKS AT MARLEY LAKE
WITH SUGGESTED MODIFICATIONS**

Figure 2



APPENDIX 12

COUNTRYSIDE STEWARDSHIP - GRANTS

WATERSIDE LANDSCAPES

Landscape management leaflet

This leaflet contains guidelines for the management of waterside landscapes under Countryside Stewardship and describes the payments available. It supplements the scheme handbook. Please ensure that you read the handbook before making an application.

The Countryside Commission works to conserve the beauty
of the English countryside and to help people enjoy it.

What waterside landscapes are included?

River valley land affected by the flood plain, areas adjoining lakes and canals, and other wetlands.

What makes waterside landscapes special?

England contains an intricate network of waterside landscapes including rivers, grazing marshes, water meadows, brooks, lakes, ponds, canals and drainage dykes. The distinctive and often restful character of these areas make them attractive to walkers and other visitors.

Historically, flood plains have been important to the rural economy. Rich fertile silts encouraged farming while reedbeds and withy beds supplied essential building materials. Where traditional forms of management continue, they support important wildlife habitats such as herb-rich hay meadows, grazing marshes that provide nesting sites for birds, and unpolluted ditches and dykes rich in aquatic plants.

Objectives

Countryside Stewardship aims to:

- support and reintroduce traditional management to sustain and extend meadows and pasture and the wildlife they support;
- restore and protect characteristic waterside features;
- create and improve opportunities for people to enjoy the landscape and its wildlife.

Choosing the right land

The Countryside Commission wishes to attract land that has most potential for environmental improvement and public benefit. Land with the following characteristics is particularly suitable:

- existing areas of traditionally managed waterside land, including water meadows, grazing marshes and hay meadows;
- waterside land where the reintroduction of grazing or hay making would be beneficial, or where invasive scrub threatens the character of the landscape and its wildlife;
- arable land and grass leys in areas of high scenic value;
- selected arable land and grass leys that would link fragmented remnants of existing pastures and meadows;
- historical landscapes, particularly those rich in archaeological and historical remains;
- land that offers opportunities for people to enjoy the landscape through new access, existing rights of way, or by visibly enhancing the landscape.

Other waterside features

An additional annual payment is available for establishing or restoring the following waterside features.

Reedbeds: the objective is to encourage natural regeneration of reeds, or to plant the native common reed (*Phragmites australis*) in winter or early spring on damp, but not waterlogged soils. Once established, the bed should be cut in winter on a rotation of two–four years and cuttings removed. Where practical, cutting should be staggered to give an uneven age structure. During the establishment period it may be necessary to exclude livestock.

Carr or fen: the objective is to encourage the establishment of areas of wet vegetation including sedges, reed, rushes and iris. You should choose areas that lie wet throughout most of the year, and allow natural regeneration to occur. Once established, the area should be cut during late summer or autumn once every three–four years. Where practical, cutting should be staggered to give an uneven age structure.

Willow or alder carr: small areas of willow or alder enhance the landscape and its wildlife. You should choose land that lies wet, and plant native willow or alder saplings. Avoid planting close to river or dyke banks. There is a capital payment for tree planting.

Note: a capital payment is available for pollarding.

Access

Payments are available for the creation of new access to all, or a selected part, of your agreement land, or to assist visitor management in areas under pressure. Payments are not available for maintaining existing rights of way.

Make all land chosen for access available to the public for walking and quiet countryside enjoyment at no charge. This provision may include horseriding and pedal cycling, although care should be taken to avoid conflict between riders and walkers. In all cases ground cover must be maintained and any damage repaired.

The emphasis is on quiet enjoyment of the landscape and its wildlife. Organised games or sports, camping or overnight stays, lighting fires, visitors carrying firearms, or the use of motorised vehicles (except where necessary in managing the land), should not be allowed. If you wish, you may require dogs to be kept on a lead.

You will be allowing people onto your land on a concessionary basis only and no new permanent rights of way will be created. The agreement will not restrict or otherwise affect existing public rights of way over the land.

All land available for access should be clearly marked with signs and waymarked where appropriate. All signs and waymarks must be of a type approved by the Countryside Commission.

Signs are important in making people aware of the concessionary nature and availability of access. Payments are available for posts, signs and waymarks. Advice will be provided on the form of words to be used on the signs.

Land may be closed to the public for up to 10 days in each year (but not on public holidays). If land is closed, notices must be posted on the land for at least four weeks in advance.

This provision is primarily intended for occasional rough shooting and pest control. Where appropriate the Commission may use its discretion to allow land to be closed for longer periods for lambing, or during the nesting season to avoid disturbing nesting birds.

The availability of access to the land may be publicised by the Countryside Commission.

Publicity will be limited to achieving levels of use appropriate to the area.

Management options and payments

Code		£/ha
R1	Tier 1: management of existing permanent grassland.	£70/annum
R2	Tier 2: re-creation of traditional waterside landscapes on arable land or ley grassland. PLUS:	£225/annum
A	On land made available for public access.	£50/annum
Supplementary payments on:		
r	Tier 1 land for initial work needed to establish or reintroduce grazing;	£40 first-year payment
r	Tier 2 land for additional work to help re-create traditional waterside grassland.	£40 first-year payment
W	The creation of waterside features such as reedbeds, fens and carr.	£40/annum

Capital payments for landscape improvements and other capital works needed in support of your proposals are summarised on page seven of the handbook, and full details are given in leaflet CS 7.

Special projects

Exceptionally, there may be opportunities that are outside the scope of the normal management guidelines. The Countryside Commission is able to consider these under the provision described on page five of the scheme handbook.

**COUNTRYSIDE
COMMISSION**

John Dower House
Crescent Place, Cheltenham
Gloucestershire GL50 3RA
Telephone: 0242 521381
Fax: 0242 584270

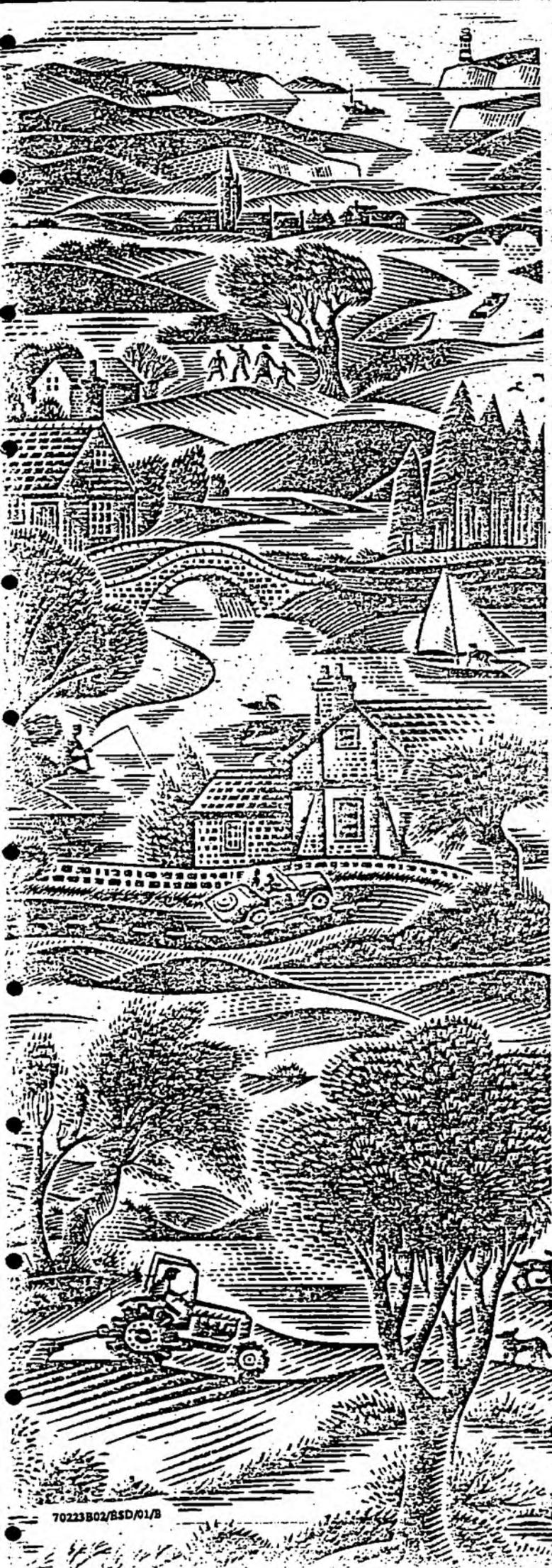
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CS 4

70223B02/ESD/01/B



CS 4

HANDBOOK FOR COUNTRYSIDE STEWARDSHIP



The Countryside Commission works to conserve the beauty of the English countryside and to help people enjoy it.

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COUNTRYSIDE STEWARDSHIP

Countryside Stewardship is an initiative of the Countryside Commission being undertaken in collaboration with English Nature and English Heritage, at the invitation of the Department of the Environment and with the support of the Ministry of Agriculture, Fisheries & Food.

**COUNTRYSIDE
COMMISSION**



**ENGLISH
NATURE**



English Heritage

Introduction

Countryside Stewardship is a pilot scheme run by the Countryside Commission to show that conservation and public enjoyment of the countryside can be combined with commercial farming and land management through a national system of incentives and agreements.

Please read this handbook and the relevant, accompanying leaflets carefully before committing yourself to any expenditure. You should keep them for future reference.

Where does Countryside Stewardship apply?

Countryside Stewardship operates in England. Initially it applies to five distinct landscapes and their wildlife habitats. The scheme targets key areas where it is most needed and is not confined to specially designated areas.

The five English landscapes targeted are:

- Chalk and limestone grassland (see leaflet CS 2)
- Lowland heath (see leaflet CS 3)
- Waterside landscapes (see leaflet CS 4)
- Coastal land (see leaflet CS 5)
- Uplands (see leaflet CS 6)

The Countryside Commission's objectives for each landscape are described in the five individual leaflets.

What does the scheme aim to do?

The qualities for which the five landscapes are valued were created by traditional management practices. Countryside Stewardship encourages positive conservation management to sustain or return to these practices, or to adopt practical modern equivalents.

The scheme combines the following four elements.

- **Landscape** – developments in agriculture have improved productivity but have tended to impose uniformity. Countryside Stewardship offers opportunities to restore characteristic qualities and features to our diverse landscape.
- **Wildlife** – all five landscapes support an important, and sometimes unique wildlife. The scheme offers opportunities to improve and restore typical habitats.
- **History** – the five landscapes all contain important historical and archaeological remains, and can provide glimpses of an ancient countryside and the activities of those who lived there. The scheme offers opportunities to protect and maintain important sites.
- **Access** – the scheme will create opportunities for people to enjoy the landscapes through the sensitive provision of new access, help in managing land under visitor pressure, and through existing rights of way.

How Countryside Stewardship works

Countryside Stewardship is a voluntary scheme. It contains a range of measures for each landscape. If you manage suitable land, you are invited to choose a combination of these measures and propose a 10-year agreement. The measures and accompanying payments are summarised on pages six and seven.

The scheme is discretionary and the Countryside Commission will accept proposals that offer the most potential for environmental improvement and public benefit.

Scheme framework

For each landscape there are two or three management tiers with accompanying annual payments. There are guidelines to follow for each tier. They outline the management needed to conserve and re-create the targeted landscapes. The guidelines vary to suit the individual qualities of these landscapes, and are described in the landscape management leaflets.

Additionally, payments are offered for allowing access, and for special measures or capital works where needed to restore and conserve the landscape. These are either paid as part of your annual payment, or are offered as one-off capital payments.

How long will an agreement last?

As environmental improvement is long term, all Countryside Stewardship agreements run for 10 years. However, some management elements may be for a shorter period within this.

Flexibility

The Countryside Commission is concerned to achieve results and will not impose set guidelines where alternative local practices and traditions are more appropriate. The guidelines are applied flexibly and suitable adjustments may be agreed at the outset provided they will achieve the desired conservation and recreational benefits.

Advice

Countryside Stewardship is run from the Countryside Commission's regional offices. Addresses are given on the back cover. There are specially appointed advisers based at each office. They will welcome an early opportunity to visit and discuss the scheme with you.

Making an application

Who can apply?

Anyone who is responsible for managing suitable land and able to enter a 10-year agreement may apply. The scheme is open to farmers (including tenant farmers), estate owners, voluntary bodies and local authorities. No specific farming or income criteria are applied.

If you are a tenant you must notify your landlord using form CS 9. In some cases you may need your landlord's consent. Please see page three for further details.

Where you do not hold sufficient interest in the land to apply independently, an occupier and landowner may make a joint application. Examples include share farming agreements, and land let on a licence.

When can I apply?

In 1991 the Countryside Commission will invite applications between 25 June and 31 October, and in subsequent years between 1 May and 30 September.

How do I apply?

Applications must be made on form CS 8, and must always be accompanied by an appropriately marked Ordnance Survey map as described on page eight.

Please note: you are not accepted into Countryside Stewardship until you sign a formal offer of agreement.

Where do I send my application?

Applications should be sent to your Countryside Commission regional office. Addresses are given on the back cover.

Is there a maximum or minimum area that can be entered?

There are no upper or lower limits to the area of land that can be proposed for Countryside Stewardship. However, small fragments of land are unlikely to satisfy the scheme's objectives and may not be accepted in isolation.

What about capital works?

Capital payments are available for capital works and landscape improvements to support a proposal. These payments are listed on page seven, and full details are given in leaflet CS 7, 'Guidelines for capital works'.

Your application should detail capital works needed, and should specify the year(s) when the work will be carried out. Access works, fencing and water supply must be completed in the first year. However, bracken control, scrub management and landscape improvements, such as hedge planting and the renovation of stone walls, may be phased over the agreement period.

What happens after I apply?

Your application will be acknowledged. Normally, you will be contacted by your adviser to discuss the proposals.

After any necessary discussion, the Countryside Commission will consider the proposal and, if accepted, you will receive a formal agreement offer for your acceptance.

Will my proposal be altered?

The Countryside Commission may ask you to increase or reduce the area of land, or change the proposed management of it. You will be contacted by your adviser to discuss any changes. If you do not wish to proceed, you may withdraw your application.

Please note: participation in Countryside Stewardship is at the Countryside Commission's discretion.

When can I start work?

You must not carry out any work in connection with your application until you receive and sign a formal agreement document.

Payment

Summaries of annual and capital payments appear on pages six and seven. Full details are given in the landscape booklets and leaflet CS 7.

When will I be paid?

Annual payments: your annual payment will be made in arrears after the end of each agreement year, which runs from 1 October to 30 September. You must submit a claim for your annual payment no later than 30 November in the year it is due. A special form, CS 10, will be sent to you in good time.

Capital items: there is a standard payment for each item that you claim, irrespective of the actual cost. Claims for payment should be made after completion of the work during the agreement year in which the work is approved. A site visit by Countryside Commission staff may be necessary before payment can be made.

Will payments be reviewed?

All payments will be reviewed every three years on a fixed cycle. The first review will be in 1994 and the second in 1997. Any adjustments will be made to payments due on 1 October in the year of the review, and to new agreements starting from this date. Payments are not index-linked and will not be increased automatically.

General rules and conditions

You will be asked to allow Countryside Commission staff to visit the holding to inspect the land during the course of your agreement.

What records will I be required to keep?

You should keep proper records to show that the management guidelines have been followed. These records must include: receipted invoices for capital items, dates of operations such as grass cutting, tree planting, and (if applicable) dates and reasons for the closure of access land.

Can I withdraw from the agreement?

Under normal circumstances you will be expected to fulfil your contractual obligations for the full 10 years of your agreement.

However, there may be circumstances where this is not possible for reasons beyond your control, for example, where a tenant is served with an incontestable notice to quit, or where agreement land becomes subject to a Compulsory Purchase Order. Under these circumstances the Countryside Commission may amend or terminate your agreement.

If justified on grounds of economic hardship or good farm or estate management, the Countryside Commission will consider a written application to terminate an agreement at any time without penalty. Appropriate documentation in support of the case should be submitted. Completed capital works should continue to be maintained for the agreed period.

Can I add land to an agreement?

You may apply for a new 10-year agreement on additional land in subsequent years.

Can I make changes to an agreement?

Where additional work would be beneficial, you may apply to your regional office to extend the scope of your agreement.

If you feel that there are other exceptional circumstances that require alterations to the content of the agreement, you should contact your adviser to discuss the changes. You must not implement such changes until they are agreed with the Countryside Commission.

What happens if agreement land is sold, transferred or let?

If you sell, transfer or let land that is subject to a Countryside Stewardship agreement, the new occupier may take on the agreement and receive subsequent payments. You should inform the new occupier that an agreement exists before the transfer, and contact your adviser. The Countryside Commission will normally encourage the transfer of your agreement.

If the new occupier does not wish to continue the agreement you may be liable to repay a proportion of payments already received.

In all cases, you must notify the Countryside Commission of an intended change of occupation on agreement land at least one month before the change.

What happens on common land?

The Countryside Commission welcomes applications on suitable common land. However, all those with an interest in the common must agree to the application, or the application must be made by a management committee with sufficient authority to enter into an agreement.

What are the arrangements on tenanted land?

It is important that tenants discuss an application with their landlord. Countryside Commission advisers are available to assist.

If you are a tenant you must notify your landlord and complete sections 1, 2 and 3 of form CS 9.

You may need your landlord's consent or you may wish to make a joint application. For example, where you propose access or heathland restoration on arable land. In these cases, you should also complete section 4 of form CS 9, and your landlord should then sign the form.

It is your responsibility to ensure that you do not contravene the terms of your tenancy agreement. If you are in any doubt about how the agreement may be affected by Countryside Stewardship, you should discuss your proposals with your landlord and reach agreement before proceeding.

Would management under the scheme require planning permission from my local authority?

Most Countryside Stewardship applications will not require planning or other local authority approvals because they involve normal agricultural operations. Exceptionally, some recreational proposals may require a consent, for example, where a new vehicular access is to be created to a public highway. It is an applicant's responsibility to ensure that all necessary local authority consents are obtained.

What if the land I wish to enter is a Site of Special Scientific Interest or a National Nature Reserve?

Proposals for these areas require special procedures.

If land proposed for Countryside Stewardship is within an Site of Special Scientific Interest (SSSI) or National Nature Reserve, you must notify your local English Nature office before applying to the Countryside Commission. You should send them an outline of what you intend, together with a clear map identifying your proposals. You should give English Nature one month to respond before sending your application to the Countryside Commission.

English Nature is closely involved with Countryside Stewardship and supports it. However, they may occasionally wish to highlight special wildlife considerations that the Countryside Commission would take account of when considering an agreement. If English Nature wish to offer advice they will do so within a month. This should accompany your application to the Countryside Commission.

National Rivers Authority

The National Rivers Authority (NRA) supports Countryside Stewardship.

Where changes in the management of water levels are proposed as part of an agreement, you will need prior NRA or Internal Drainage Board (IDB) consent or agreement. This is a requirement of Land Drainage legislation, associated bye-laws, and of the legislation governing IDBs. These cover any works (including tree planting) that might impede flood flows in watercourses, impinge on immediately adjacent land, or on flood plains. Diverting water also requires consent.

You should therefore contact your regional NRA office at an early stage for advice on these matters.

Protection of other land on the holding

Where only part of a landscape type on your holding is entered into the scheme, the Countryside Commission expects that the remainder is managed in sympathy with the scheme's objectives. In extreme circumstances, where the management is not compatible, the Countryside Commission may terminate your agreement.

Other activities and uses on agreement land

If you propose to carry out activities such as those listed below, you should consult your adviser at least one month before you start.

- Erect a new building or substantially alter an existing building.
- Construct a new road or yard.
- Use the land for camping or caravanning.
- Establish a commercial shoot, or use the land as a clay pigeon shooting ground.
- Allow motor sport.

Countryside Stewardship is not a planning control. However, the Countryside Commission needs to consider whether such proposals are compatible with the purpose of an agreement.

Public rights of way

A well maintained public rights of way system is important for people to enjoy the countryside. Responsibility for the maintenance of public rights of way lies partly with the occupier and partly with the local highway authority.

Countryside Stewardship agreements are conditional on participants fulfilling their legal obligations to ensure that public rights of way are unobstructed over the whole land holding. The Countryside Commission is also urging local highway authorities to invest further in maintaining rights of way.

Will I have legal liability if someone who comes onto my land is injured?

Possibly. You should check that you have a public liability insurance policy and that such a risk is covered by it.

Other grant schemes

You may not apply for, or claim, other public funding for management and work carried out under Countryside Stewardship. Other organisations may choose to offer funds for specialist management on agreement land in addition to, and outside the scope of, Countryside Stewardship. You must inform the Countryside Commission of such additional proposals.

Land already subject to funding for environmental management will not usually qualify for Countryside Stewardship. Examples include land under a management agreement with English Nature on a Site of Special Scientific Interest, and land receiving payments under the Ministry of Agriculture's Nitrate Sensitive Area Schemes.

Exceptionally, Countryside Stewardship may add to the benefits of other agreements. The Countryside Commission will consider an application to do this after consulting the other funding body.

MAFF's Environmentally Sensitive Area (ESA) schemes offer management agreements targeted to the environmental needs of specially designated areas. Countryside Stewardship will not be available where funding is available from MAFF. However, at its discretion, and in discussion with the MAFF Project Officer, the Countryside Commission may offer elements of Countryside Stewardship within an ESA that are not covered by the ESA scheme, for example, access.

You may not claim payments for the same capital items under both the Farm and Conservation Grant Scheme and Countryside Stewardship. Where you hold a MAFF Development or Improvement plan, you should discuss the implications of a Countryside Stewardship agreement with your MAFF Divisional Office before applying.

Suitable land that is exempted from inheritance tax and capital gains tax is eligible for consideration under Countryside Stewardship. Your adviser can explain any special requirements.

Set-aside land under the MAFF scheme does not qualify for Countryside Stewardship, but you may apply on other suitable non-set-aside land on your holding.

Special projects

Exceptionally, there may be opportunities for the five targeted landscapes that are outside the scope of the normal management guidelines. There is a provision for these. Examples include the restoration of traditional water meadows, and the provision of concessionary alternative routes to relieve pressure on eroded sections of a National Trail.

You will find it helpful to discuss your ideas with your adviser at an early stage.

How do I apply?

You should select suitable land and prepare a 10-year management plan listing the individual operations. A 1:10,000 or 1:10,560 (6 inches to a mile) scale map of the land should accompany your application.

Your plan should clearly describe the objectives of the project, and specify details such as soil type, the source and type of grass-seed mixes, the type and timing of operations, water levels to be maintained, etc.

How much will I be paid?

There is no set payment. You should propose an annual payment based on the work proposed in your management plan, and detail separately the cost of any capital items.

The Countryside Commission will discuss the plan and proposed annual payment with you to reach a mutually acceptable agreement. Acceptance is discretionary.

Summary of annual payments

Chalk and limestone grassland

Code		£/ha/annum
CL1	Tier 1: improved management of existing chalk and limestone grassland.	£50
CL2	Tier 2: re-creation of chalk and limestone grassland on arable land or ley grassland.	£210
	PLUS:	
A	On land made available for access.	£50
First-year supplementary payments on:		
r	Tier 1 land for initial work needed to establish or re-grazing;	£40 first-year payment
r	Tier 2 land for additional work to help recreate chalk and limestone grassland.	£40 first-year payment

Lowland heath

Code		£/ha/annum
H1	Tier 1: management of existing lowland heath.	£50
H2	Tier 2: re-creation of lowland heath on arable land or ley grassland.	£250
	PLUS:	
A	On land made available for access.	£50
r	Supplementary payments on Tier 1 or Tier 2 land for special measures to regenerate heathland vegetation.	£50 for 5 years

Waterside landscapes

Code		£/ha/annum
R1	Tier 1: management of existing permanent grasslands.	£70
R2	Tier 2: re-creation of waterside landscapes on arable land or ley grassland.	£225
	PLUS:	
A	On land made available for access.	£50
First-year supplementary payments on:		
r	Tier 1 land for initial work needed to establish or reintroduce traditional management;	£40 first-year payment
r	Tier 2 land for additional work to help re-create waterside landscapes.	£40 first-year payment
W	The restoration or creation of waterside features such as reedbeds and fen.	£40

Coastal land

Code		£/ha/annum
C1	Tier 1: management of salt marsh.	£20
C2	Tier 2: management of coastal vegetation on cliff tops, sand dunes and other coastal areas not subject to tidal flooding.	£50
C3	Tier 3: re-creation of coastal vegetation on arable land and ley grassland.	£225
	PLUS:	
A	land made available for access.	£50
First-year supplementary payments on:		
r	Tier 1 and Tier 2 land for initial works needed to establish or reintroduce grazing;	£40 first-year payment
r	Tier 3 land for additional work to help re-create coastal landscapes.	£40 first-year payment
C	The restoration or creation of coastal features such as reedbeds and carr.	£40

Capital payments

Uplands

Code		£/ha /annum
U1	Tier 1: regeneration of suppressed heather on enclosed moorland.	£15 PLUS: £50 for first 5 years
U2	Tier 2: regeneration of heather moor on agriculturally improved land.	£50 PLUS: £50 for first 5 years
U3	Tier 3: restoration and management of traditional pastures or hay meadows.	£50 PLUS:
A	On enclosed land made available for access.	£50
r	Supplementary payment for initial work on Tier 3 land to establish or reintroduce beneficial management.	£40 first-year payment

Scrub management	scattered scrub	£100/ha
	dense scrub (more than 50 per cent ground cover)	£250/ha
Pond:	restoration	£2/m ²
	creation	£4/m ²
Creation of scrapes		£1.40/m ²
Sluice for water level control:	soil bund	£40
	timber	£140
	concrete	£400
Stone wall:	repair	£7.50/m
	restoration	£15/m
Top wiring of stone wall		£0.60/m
Hedge banks:	repair	£10/m
	restoration	£25/m
Tree and shrub planting		£0.65/plant
Tree guards:	rabbit guard	£0.20/guard
	tube	£0.50/guard
Pollarding		£17.50/tree
Coppicing bankside trees		£12.50/tree
Hedge planting		£1.75/m
Hedge laying		£2/m
Hedge coppicing		£1.50/m
Bracken control:	chemical	£85/ha
	mechanical	£50/ha
Clearance of eyesores		£120
Field gate		£125
Bridle gate		£100
Stile		£30
Post for sign or waymark		£4
Sign		£4
Waymark		£1
Bench		£30
Assistance with the cost of technical advice or Management plan preparation		£125

The following payments are available only where they are essential to achieve good environmental management.

Fencing:	post and wire	£0.80/m
	sheep fencing	£1.20/m
	rabbit netting	£0.40/m
Water:	supply	£0.40/m
	trough	£25

What information must I show on the application map?

Your application will not be accepted unless you include a properly marked 1:10,000 or 1:10,560 (6 inches to 1 mile) scale Ordnance Survey map of the land you propose for Countryside Stewardship.

The map should show the following information:

- name of holding in top left corner;
- boundaries of holding (marked in black);
- areas to be entered into Countryside Stewardship (outlined in red);
- any rights of way that occur on application land - mark as black dotted lines and indicate the following if known:
 - fp (footpath)
 - bw (bridleway)
- the landscape management options that you wish to choose shown against the land where you wish them to apply, using the following codes:

Chalk and limestone grassland

CL1 (Tier 1)
CL2 (Tier 2)

Lowland heath

H1 (Tier 1)
H2 (Tier 2)

Waterside landscapes

R1 (Tier 1)
R2 (Tier 2)
W (Restoration or creation of waterside features)

Coastal land

C1 (Tier 1)
C2 (Tier 2)
C3 (Tier 3)
C (Restoration or creation of coastal features)

Uplands

U1 (Tier 1)
U2 (Tier 2)
U3 (Tier 3)

Supplements

To the codes you should add the following symbols on land in any of the five landscapes where you are applying for:

- A (Access).
- r (First year restoration supplement or, on heathland, regeneration of heathland vegetation)

An illustrated example of how you should complete an application map is shown opposite.

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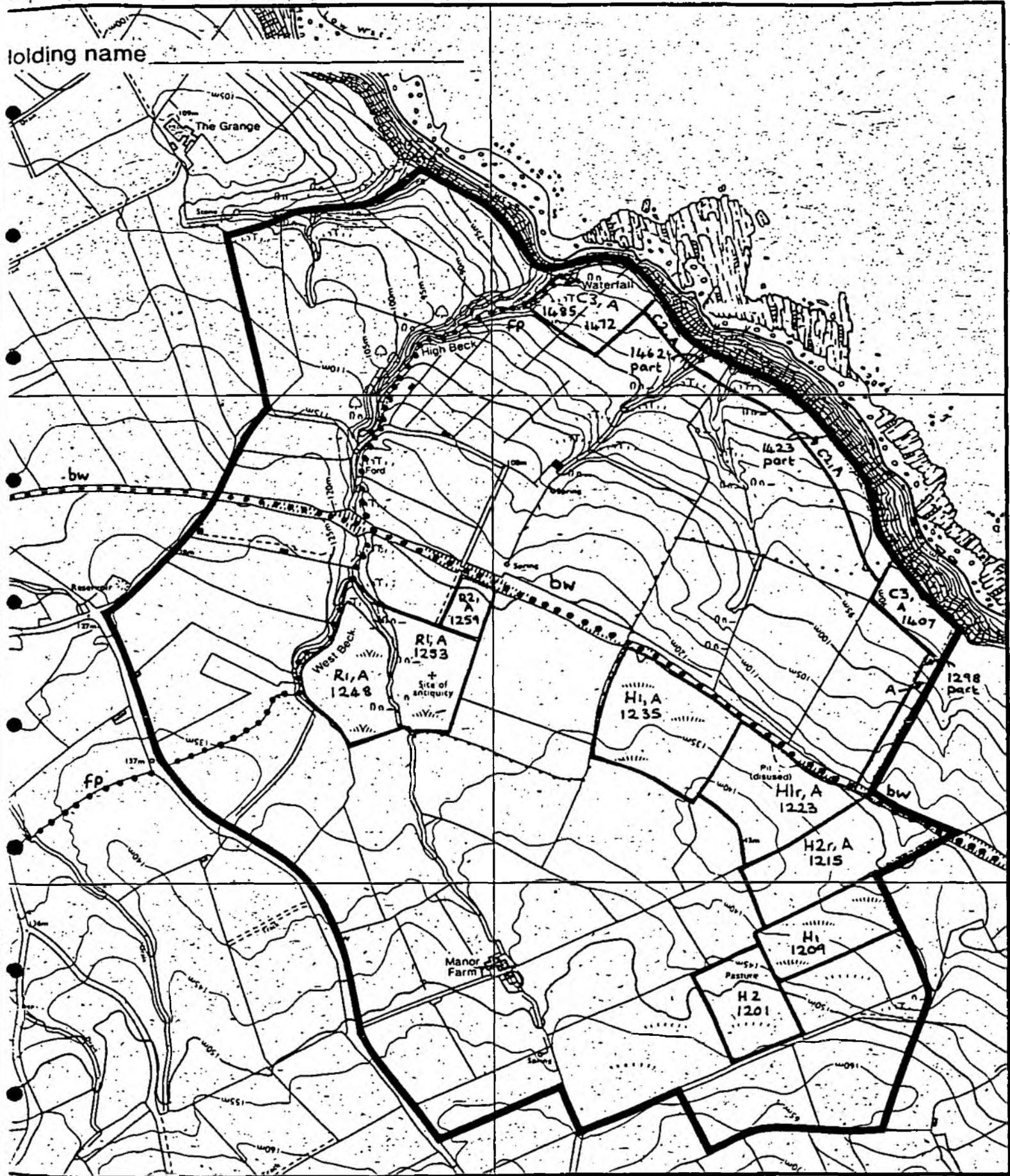


Countryside Stewardship proposals map

EXAMPLE ONLY

(features and designations are for illustrative purposes only)

Holding name _____



-  Boundary of farm holding
-  Approximate boundary of land to be entered into the Scheme
-  Rights of way if known
-  FP Footpath
-  BW Bridleway

NOTES

Your proposals map must be on a 1:10,000 scale Ordnance Survey (OS) map. If you need further information on where to obtain the relevant map you should contact:
 Ordnance Survey, Romsey Road, Maybush
 Southampton, SO9 4DH. Telephone (0703) 792000.

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Not all the management options shown on this example map need necessarily be present on the land you wish to enter into the scheme.

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