Institute of Freshwater Ecology

M3 Development at Winchester: botanical survey of River Itchen

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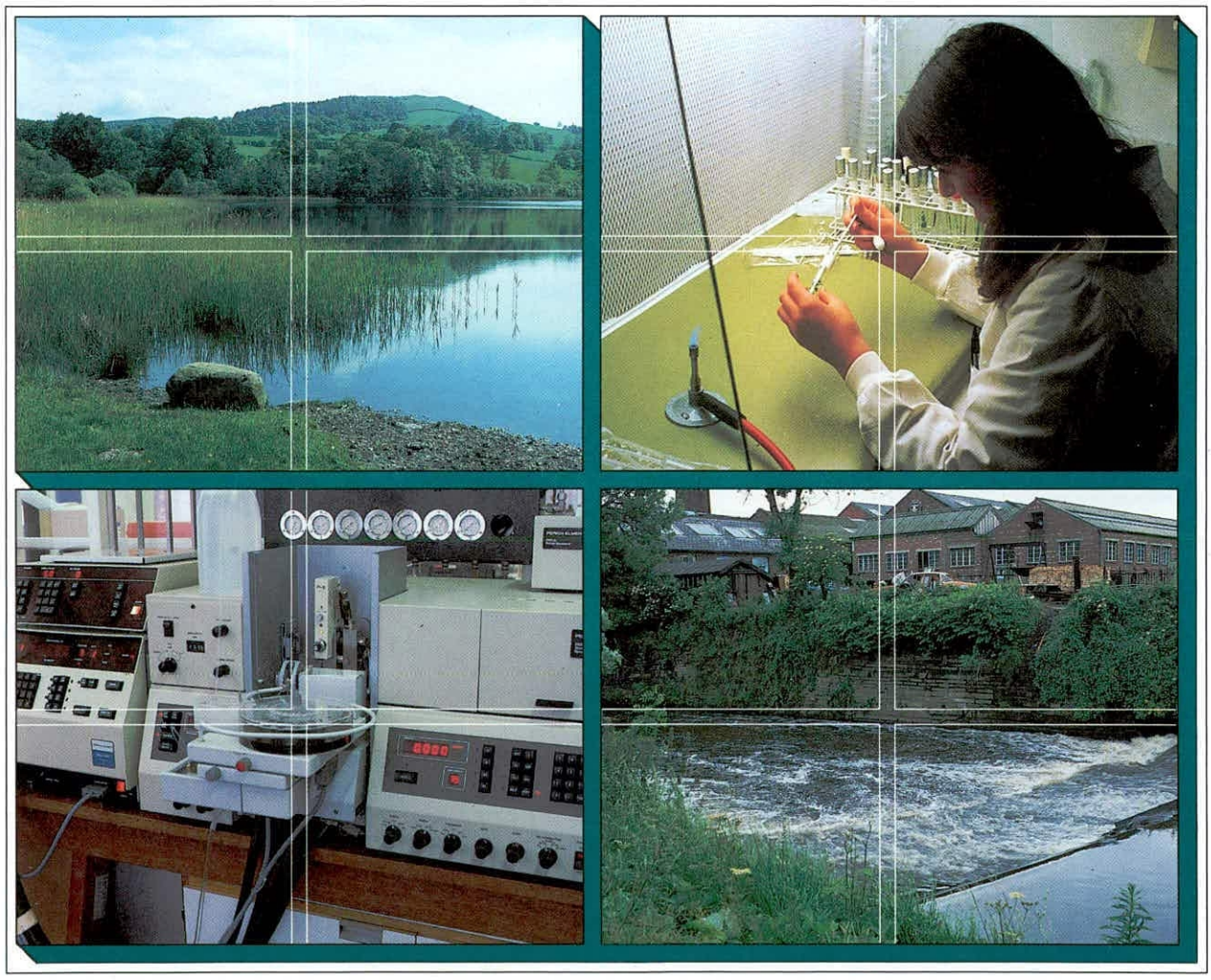

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Botanical Survey of River Itchen

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Project leader: M.G. Morris
Report date: July 1991
Report to: Mott MacDonald Civic Ltd.
Contract no.: ITE
IFE report ref.: RL/T09056j1/1
TFS project no.: T09056j1

ABSTRACT

The construction of the M3 extension to the east of St. Catherine's Hill in Hampshire requires the re-routing of the River Itchen. This report provides data on the ecological value of the river and guidelines for maintaining the taxonomic and ecological diversity and for achieving the most natural re-vegetation programme for the proposed new channel. Suggestions are also made concerning the monitoring of aquatic environmental conditions downstream of the construction work.

1. INTRODUCTION

As part of the proposed extension to the M3 motorway in Hampshire, a new Winchester by-pass is to be constructed by building the motorway to the east of St. Catherine's Hill. This work will require considerable alteration to the environment around St. Catherine's Hill, Twyford Down, and the River Itchen to the south-east of Winchester. The Institutes of Terrestrial Ecology (ITE) and Freshwater Ecology (IFE) have been contracted to assess the ecological impact this work will have, and provide guidelines for the contractors Mott MacDonald Civic Ltd. and the landscape design and environmental planning company Kelsey Associates. The IFE has primarily been involved with a stretch of the River Itchen (national grid reference SU 478267) which will need to be diverted for approximately 200 m and re-routed through an artificial channel to be excavated.

The initial involvement of the IFE was the assessment of the ecological importance of the River Itchen at the point where construction will take place and the stretch immediately downstream of this. This involved an examination of the plant species present to ascertain the dominant vegetation types, and to indicate the presence of any rare or endangered species. As a consequence of this, the IFE is able to provide guidelines for maintaining the taxonomic and ecological diversity of the river, and for achieving the most natural re-vegetation programme for the newly created channel. Suggestions are also made concerning the monitoring of the construction work to minimise the possibility of adverse effects to the fishing downstream. This report forms part of a collaborative project with the Institute of Terrestrial Ecology.

2. METHODS

A detailed map was drawn to indicate the dominant vegetation forms and their distribution in the existing natural channel of the River Itchen. Maps drawn by the contractors Mott MacDonald Civic Ltd. were used as the basis for the vegetation maps, and the precise location of the plants identified using 100 m tape measures stretched along the river bank.

The velocity of the river was measured by noting the time taken for a standard object to travel a fixed distance downstream.

The presence of rare and endangered species was ascertained by careful examination of all aquatic and riparian plants, with specimens taken back to the laboratory for later examination where required. Plant identifications were corroborated by reference to standard texts, including Haslam *et al.* (1975), Wigginton & Graham (1981), Jermy *et al.* (1982), Hubbard (1984) and Clapham *et al.* (1987).

3. RESULTS

The vegetation maps are presented as Figures 1, 2 and 3. This stretch of the River Itchen is relatively slow flowing (approximate flow rate 0.2-0.3 m s^{-1}), and the aquatic vegetation is dominated by stands of the water-starwort genus *Callitriche* L. (*C. stagnalis* Scop. or *C. platycarpa* Kütz.) and the emergent grass *Glyceria* R. Br. (*G. fluitans* (L.) R. Br. or *G. plicata* Fr.). *Ranunculus penicillatus* (Dumort.) Bab. var. *calcareus* C.D.K. Cook (water-crowfoot) was also widespread in the main channel, with *Hippuris vulgaris* L. (mare's-tail) in the sheltered margins of the river. Filamentous green algae (*Cladophora* Kütz. sp.) was found to grow on the substratum of the river: this is generally indicative of nutrient rich eutrophic waters (Haslam, 1987).

The riparian flora is dominated by stands of *Carex* L. (sedges) and various grasses, although *Iris pseudacorus* L. (yellow flag) and the introduced species *Mimulus guttatus* DC. (monkeyflower) are also common.

A detailed list of the species found at the site is given in Table 1. None of the plants present were especially rare, although the site appears to be very natural and provides a wide variety of different environmental habitats for the flora and fauna.

4. RECOMMENDATIONS

4.1 Construction of new channel

The draft plans produced by Mott MacDonald Civic Ltd. for the construction of the new channel involved the use of 'Enkamat' plastic netting laid over the artificial banks to prevent erosion. The National Rivers Authority (NRA) has suggested that this is not satisfactory, and has recommended an alternative approach using banks of natural bare chalk. Although the efficacy of these construction procedures in terms of prevention of soil erosion is not questioned, it is suggested that neither method would result in the quickest re-vegetation.

An alternative procedure would be the use of matting which has seeds incorporated in it to promote the rapid establishment of plants (*e.g.* 'Greenfix'); these geotextiles are made from biodegradable plant materials laid over a photodegradable polymer mesh which would provide the necessary protection from erosion until the plants had become established. The seeds that can be incorporated in the matting can be chosen to complement the particular environment being created. In the case of the River Itchen, it is suggested that seeds of the following plants could be used: *Carex* L. species (sedges) including *C. riparia* Curtis and *C. acutiformis* Ehrh.; *Juncus* L. species (rushes); *Glyceria maxima* (Hartm.) Holmb. (reed sweet-grass); and *Phalaris arundinacea* L. (reed-grass). These species produce close growth which would help consolidate the banks, and are also natural vegetation plants which are already found growing on the banks of the existing channel. In addition, the shorter grasses *Agrostis stolonifera* L. var. *palustris* (Huds.) Farw. (marsh bent) and *Poa trivialis* L. (rough meadow grass) grow in wet habitats and are stoloniferous and would therefore also help bind the soil of the river bank (Hubbard, 1984). Other grasses which could possibly be included in the matting are *Alopecuris geniculatus* L. (marsh fox-tail) and *Deschampsia cespitosa* (L.) Beauv. (tufted hair-grass).

Geotextile meshes (*e.g.* 'Bio-Roll') can be used for promoting the establishment of aquatic plants at the water margin by providing sheltered 'pockets' of soil (Coppin & Richards, 1990: 218-220). Species of *Carex* L. (sedges), *Juncus* L. (rushes) and *Iris pseudacorus* L. (yellow flag) are found to grow in clumps at the water margin of the existing channel, and could easily be transplanted and incorporated in the new channel using this method. Use of such a system would also create the appearance of a

more natural river bank by interrupting the artificially straight channel margins, although this might possibly result in an erosion problem if the artificial mesh is positioned badly.

Following the construction of the new channel, water will need to be fed into it from the existing river. The bed of the new channel will be of peat and gravel and not artificial matting, and will consequently be liable to erosion if fast water flows are allowed to pass through the channel before vegetation has been able to become established. Rapid water flows would result in the removal of sediment layers which would not only hinder the subsequent establishment of submerged and emergent aquatic plants that are rooted in the substratum, but would also increase the levels of suspended solids in the water to unacceptable levels, endangering fish populations *etc.* immediately downstream. It is therefore recommended that if possible the rate of transfer of the water into the new channel should be strictly regulated, and conducted over a period of several days. A policy of monitoring the aquatic environment would also help avoid these problems (see section 4.3 for further details).

4.2 Use of existing channel

The contractors Mott MacDonald have suggested that the old channel bed be filled with the peat that will become available with the construction of the new channel. An alternative, however, which would provide a greater range of habitats and hence taxonomic diversity would be the maintenance of the existing channel at a lower level relative to the surrounding meadows. This would result in a limited degree of water drainage into the disused channel and would enable the development of marsh vegetation and its complementary fauna.

4.3 Effect of construction work on the aquatic environment

The building of the M3 bridge and its accompanying slip-road and the construction of the new channel for the River Itchen will inevitably create disturbance to the aquatic environment downstream. This would be exhibited as an increase in the turbidity of the water, which might result in:

(i) the modification of habitat by the effect on biota of elevated suspended solid concentrations passing and settling downstream, increasing abrasion, clogging respiratory surfaces, and by the settlement of

suspended material affecting invertebrate feeding and fish spawning;

(ii) the reduction in dissolved oxygen brought about by the respiration of suspended organic matter as it passes downstream, which could result in fish kills (previously observed in approximately 10% of cases);

(iii) the indirect effect of the reduction in light penetration due to increased water turbidity and the subsequent reduction in photosynthetic rates of submerged macrophytes.

This is of great significance in the River Itchen because of its environmental and fisheries importance. Serious fish kills have previously been noted in approximately 10% of cases where construction work has been conducted in aquatic environments. It is recommended that the dissolved oxygen concentration and turbidity levels be monitored before and during construction work. This will provide data which will allow some feedback to moderate the work rate and reduce the potential impact on the ecosystem. This should protect the contruction company's position against possible claims for compensation.

TABLE 1. Species list.

Cladophora Kütz. sp.	Blanket-weed
Equisetum fluviatile L./*E. palustre* L.	Water or Marsh Horsetail
Ranunculus penicillatus (Dumort.) Bab. var. *calcareus* (R.W. Butcher) C.D.K. Cook [synonym: *R. penicillatus* (Dumort.) Bab. subsp. *pseudofluitans* (Syme) S.D. Webster]	Water Crowfoot
Nasturtium officinale R. Br. [synonym: *Rorippa nasturtium-aquaticum* (L.) Hayek]	Water-cress
Epilobium hirsutum L.	Great Hairy Willow-herb
Hippuris vulgaris L.	Mare's-tail
Callitriche stagnalis Scop./*C. platycarpa* Kütz.	Common or Various-leaved Water-starwort
Berula erecta (Hudson) Coville	Lesser or Narrow-leaved Water-parsnip
Oenanthe crocata L.	Hemlock Water-dropwort
Oenanthe fluviatilis (Bab.) Coleman	River Water-dropwort
Apium nodiflorum (L.) Lag.	Fool's Water-cress
Urtica dioica L.	Stinging Nettle
Myosotis scorpioides L.	Water Forget-me-not
Scrophularia auriculata L.	Water Figwort
Mimulus guttatus DC.	Monkeyflower
Veronica beccabunga L.	Brooklime
Veronica anagallis-aquatica L.	Blue Water-speedwell
Juncus L. spp.	Rushes
Iris pseudacorus L.	Yellow Iris or Yellow Flag
Lemna trisulca L.	Common Duckweed
Carex L. spp.	Sedges
Glyceria fluitans (L.) R. Br./*G. plicata* Fr.	Floating or Plicate Sweet-grass
Glyceria maxima (Hartm.) Holmberg	Reed Sweet-grass
Phalaris arundinacea L.	Reed-grass or Reed Canary-grass

FIGURE 1. Map of River Itchen at point of proposed construction. Rectangles indicate areas covered by vegetation maps (Figures 1 and 2).

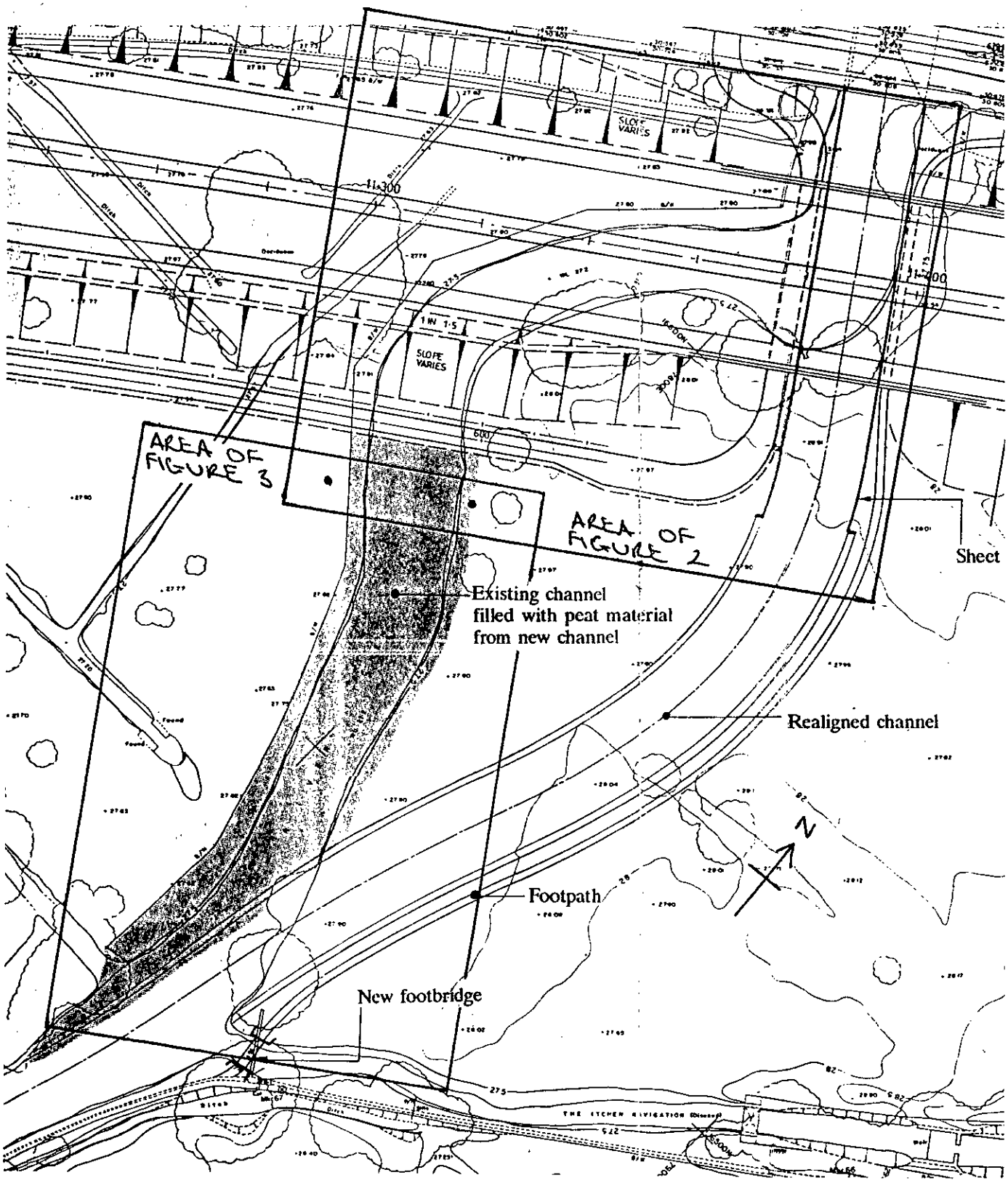


FIGURE 2. Environmental map of northern stretch of River Itchen to be diverted.

B/W fence = Barbed-wire fence

Call. = *Callitriche stagnalis/C. platycarpa*

TG&H = Terrestrial grasses and herbs

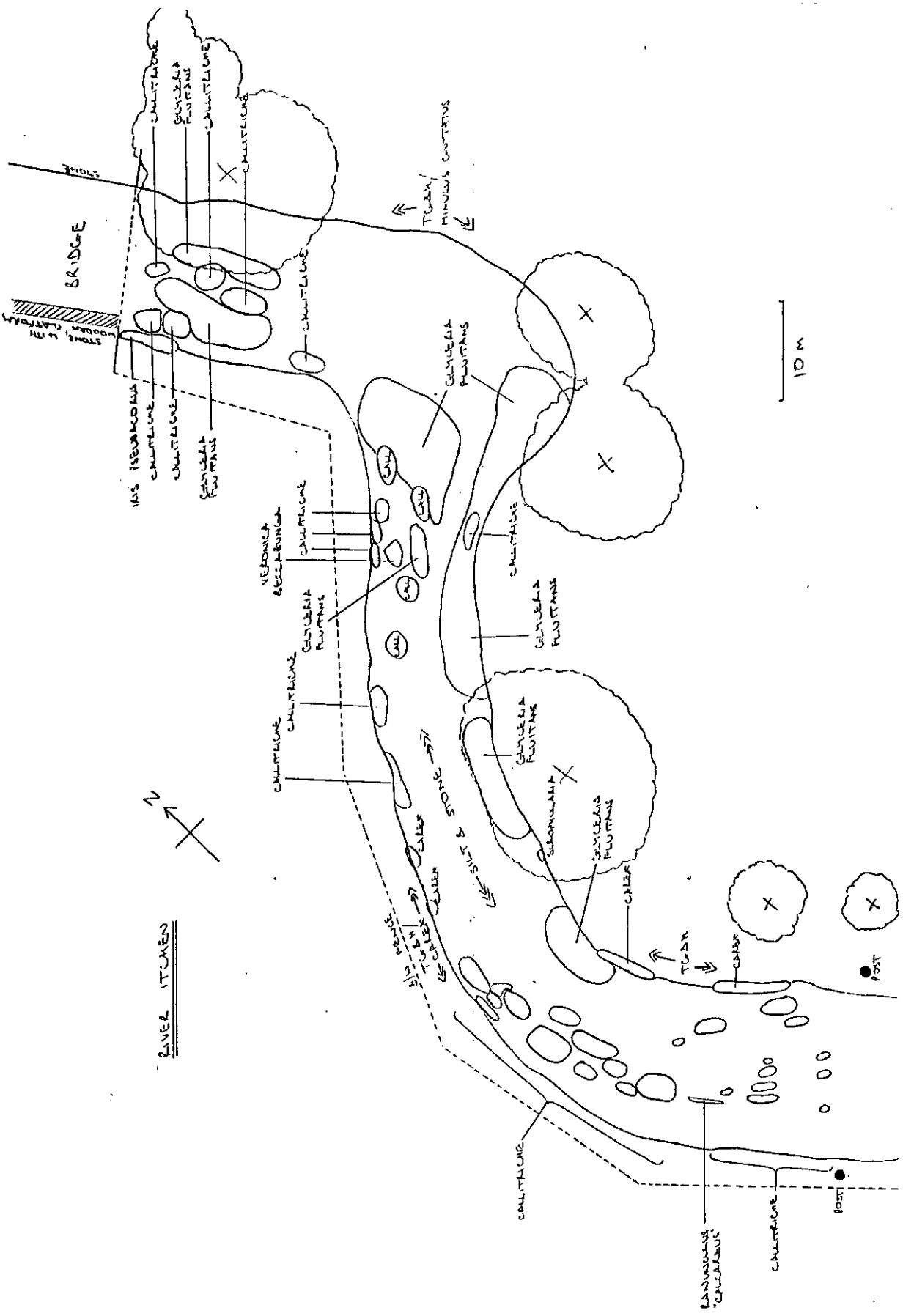


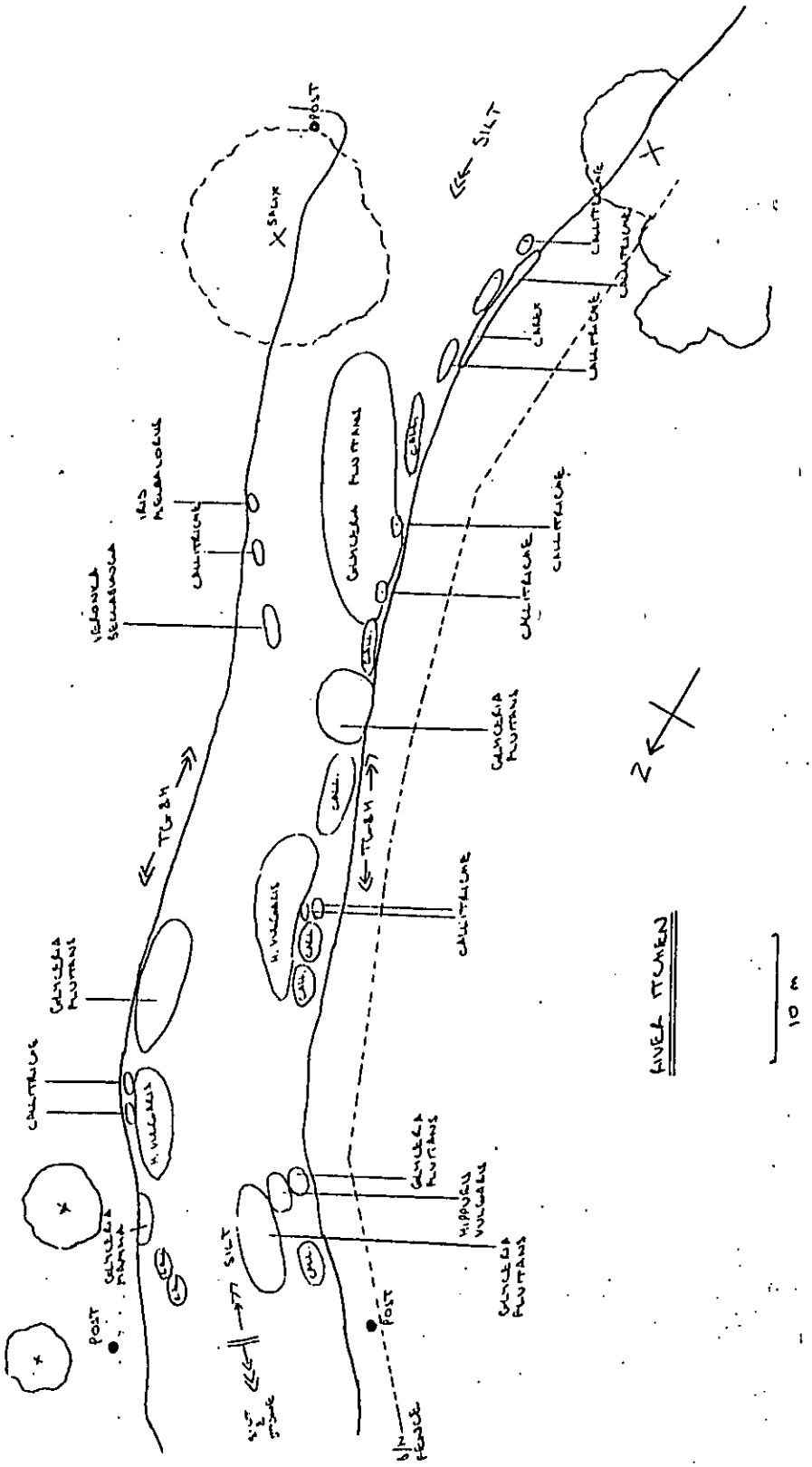
FIGURE 3. Environmental map of southern stretch of River Itchen to be diverted.

B/W fence = Barbed-wire fence

Call. = *Callitriche stagnalis/C. platycarpa*

H. vulgaris = *Hippuris vulgaris*

TG&H = Terrestrial grasses and herbs



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