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**NATIONAL RIVERS AUTHORITY
(ANGLIAN REGION)**

**MARKET DEEPING DEFENCES
ENVIRONMENTAL APPRAISAL REPORT
NOVEMBER 1993**

 **POSFORD
DUVIVIER
ENVIRONMENT**

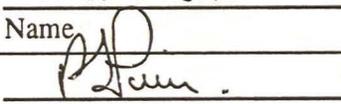
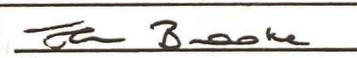


NATIONAL RIVERS AUTHORITY
(ANGLIAN REGION)

MARKET DEEPING DEFENCES
ENVIRONMENTAL APPRAISAL REPORT

NOVEMBER 1993

FINAL REPORT

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MARKET DEEPING DEFENCES

ENVIRONMENTAL APPRAISAL

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SECTION 1 INTRODUCTION**1.1 Background to the Study**

1.1.1 Flood defences along the River Welland through the Deepings (Market Deeping, Deeping Gate and Deeping St James) are the responsibility of the National Rivers Authority (Anglian Region). The existing defences currently provide protection against a flood event with a return period of 1 in 20 years. However, with the proposed restoration of the Greatford Cut, and the resulting increase in water flow from the River Glen to the River Welland, the standard of protection will be reduced to 1 in 15 years. Failure of the existing sluice gates at High and Low Locks through deterioration of the supporting structures, will further reduce the standard of protection to 1 in 10 years.

1.1.2 Concerns that the defences did not provide the NRA's adopted target standard of 100 years led to the consideration of improvements to the existing defences, and restoration works to the lock structures. Posford Duvivier's river engineers were therefore appointed to investigate options to provide an improved standard of defence.

1.2 Project History

1.2.1 In 1991, the National Rivers Authority (Anglian Region) commissioned Posford Duvivier to carry out an investigation into the current situation and future need for flood protection structures on the River Welland through Market Deeping. The results of this work, providing preliminary designs for flood defence measures in the study area, were reported in the Detailed Appraisal Report to the NRA (Posford Duvivier, 1993a). During this work, consultations were undertaken with a number of interested parties.

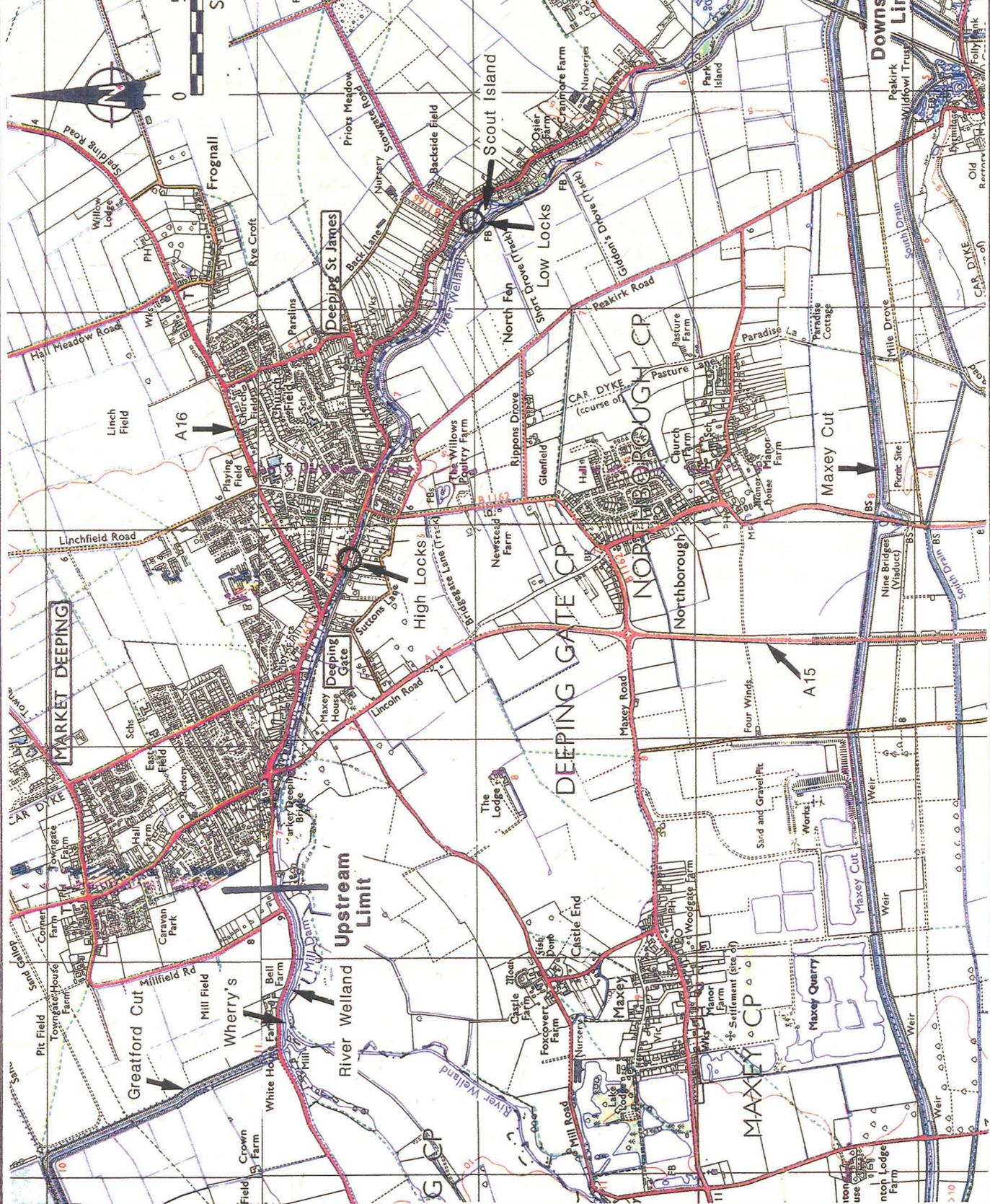
1.2.2 Posford Duvivier were also commissioned, in 1992, to conduct further studies inspecting and reporting on the condition of the river control structures at High and Low Locks on the River Welland. The Condition Report was submitted to the NRA in March 1993 (Posford Duvivier, 1993b).

1.3 The Environmental Appraisal

1.3.1 Posford Duvivier Environment were commissioned in September 1993 to carry out an environmental appraisal of the proposed flood defence works as described in the Detailed Appraisal Report (Posford Duvivier, 1993a). The environmental appraisal enables environmental considerations to be incorporated into the design, construction and operation of the river defence works. Its purpose is to identify any significant impacts of the proposals, to ensure that potential adverse impacts are identified and mitigated against, and finally to suggest opportunities for environmental enhancement in its widest sense. These objectives are broadly in line with the NRA's duty, under the Water Resources Act 1991, to "maintain and where practicable enhance the environment" (HMSO, 1991).

- 1.3.2 The environmental appraisal of the flood defence proposals at Market Deeping has been carried out in broad accordance with Statutory Instrument 1217, the Land Drainage Improvement Works (Assessment of Environmental Effects) Regulations 1988. Although the appraisal and report have been carried out and structured using a methodology similar to that recommended for an Environmental Assessment, however, this report does not represent an Environmental Statement.
- 1.3.3 No potentially significant environmental impacts were identified during this appraisal process. If potentially significant impacts had been identified, it may have been necessary to prepare a full Environmental Statement.
- 1.4 **Report Structure**
- 1.4.1 Section 2 of the environmental appraisal report describes the engineering background to the current problem and outlines the proposed works along the River Welland. A detailed account of the works can be found in the Detailed Appraisal Report (Posford Duvivier, 1993a). Section 3 then gives a baseline description of the environment of the River Welland along the stretch likely to be influenced by the proposed works. Section 4 provides an appraisal of the potential impacts on the environment as a result of either the construction or operation of the flood defence works and the lock restoration. Finally, Section 5 presents a summary of potentially important impacts, describes opportunities to enhance the environment, and suggests future liaison requirements during project works.
- 1.5 **The Study Area**
- 1.5.1 The initial study commissioned by the NRA (Posford Duvivier, 1993a) was to examine flood protection along the River Welland from Deeping Mill, Market Deeping downstream to the confluence with Maxey Cut. The stretch of river is illustrated in Figure 1.5. This section of the River Welland flows through areas of Market Deeping, Deeping Gate and Deeping St James.
- 1.5.2 The study corridor shown on Figure 1.5 has generally been adopted for the environmental appraisal. However, if issues of concern are identified, they have been investigated beyond the study boundary. The landward extent of the study corridor varies but, with the majority of work being the improvement of existing flood defence structures, it is mainly restricted to river bank.

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<p>PROJECT</p> <p>MARKET DEEPING FLOOD DEFENCES</p>	<p>TITLE</p> <p>STUDY CORRIDOR</p>	<p>POSFORD DUVIVIER ENVIRONMENT</p>	<p>DATE OCT '93</p> <p>SCALE As shown</p> <p>DRAWN J.R.</p> <p>CHKD LP</p> <p>Figure 1.5</p>
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SECTION 2 FLOOD DEFENCE PROPOSALS**2.1 Description of the Problem****2.1.1 Existing Defences**

The defences considered in the Detailed Appraisal Report (Posford Duvivier 1993a) extend from Mill House sluice (OS Ref TF 134 099) approximately 500 metres upstream of Market Deeping Bridge, through Market Deeping, Deeping Gate and Deeping St James downstream to the confluence of the River Welland and Maxey Cut (OS Ref TF 177 074). Within this stretch of the River Welland there are river control structures at High Locks (OS Ref TF 148 096) and Low Locks (OS Ref TF 164 090).

2.1.2 In outline the existing defences in this area comprise:-

- | | | |
|------------------------------|---|---|
| Left bank down to High Locks | - | An ad-hoc defence comprising stone, brick and concrete walls together with earth banks. The defences are generally located within private gardens or commercial premises. |
| Left bank below High Locks | - | Typically earth banks. Between High Locks and OS Ref TF 170 083 the defences are generally located within gardens. |
| Right bank | - | Generally earth banks except for lengths of concrete wall either side of High Locks. |
| High Locks | - | Two weirs and a vertical sluice gate located at OS Ref TF 148 096 |
| Low Locks - North | - | A weir and vertical sluice gate located at OS Ref TF 164 090 |
| Low Locks - South | - | A vertical sluice gate located at OS Ref TF 164 090. |

2.1.3 Without the existing defences, extensive flooding would regularly occur within Market Deeping, Deeping Gate and Deeping St James and the surrounding agricultural land.

2.1.4 Existing Defence Standards

The existing defences currently provide a 20 year standard of defence for the study area. With the restoration of the Greatford Cut and the failure of the sluice gates at High Locks and Low Locks - North through continuing deterioration of the supporting structures, the standard of defence will reduce to 10 years. This would then result in 1600 metres of defence being overtopped and more than 400 houses, 40 retail premises and 5 offices being damaged by flood water during a 1/100 year event.

2.1.5 Definition of the Problem

The existing defences do not provide the 100 year target standard of flood protection adopted by the NRA for Market Deeping and improvements to the existing defences and structures at High and Low Locks are therefore required.

2.2 Improvement Options

2.2.1 The following options were considered during the preparation of the Detailed Appraisal Report (Posford Duvivier, 1993a):-

- Option 1 Do nothing
- Option 2 Sustain
- Option 3 Restore High and Low Locks and improve defences
- Option 4 Do nothing to High and Low Locks but improve defences
- Option 5 Restore High and Low Locks but do nothing to defences
- Option 6 Remove High and Low Locks.

2.2.2 Options 1, 2 and 5 were rejected by the NRA as they would not provide the required standard of protection. Options 4 and 6 were rejected as a result of unacceptable adverse environmental impacts because they would not ensure the long term preservation of the historic structures at High and Low Locks.

2.2.3 Option 3, involving the restoration of the locks and the improvement of 880 metres of existing defences, has therefore been adopted as the recommended option. It provides a cost-effective solution to the improvement of the existing defences and, as will be indicated by the appraisal in this report, incorporates the following environmental benefits:-

- ensures the preservation of the lock structures (See Sections 3.7.3 and 4.7.5)
- maintains the existing appearance and amenity value of the river through continuing operation of the sluice gates
- reduces disruption to local residents.

2.3 Proposed Improvement Works

2.3.1 The improvement works proposed under Option 3 are discussed below. The location of the works is shown on Drawings Nos. 1 and 2 in Appendix G.

2.3.2 Defences

Considerable lengths of the defences are located within the residential areas of Market Deeping, Deeping St James and Deeping Gate, in the rear gardens of properties and in Conservation Areas. It is therefore important that the proposed improvement works are both in keeping with the existing environment and minimise disruption to residents. To achieve this, it was initially concluded that works should be carefully designed in terms of construction and materials used, and materials and plant should be delivered to site by water. The recommendations in this environmental appraisal examine many of these issues in greater detail.

2.3.3 Given the constraints and opportunities identified in this and earlier studies, the following types of construction have been adopted for improvements to the existing defences:-

i) **Double Skin Planking**

Double skin planking, is generally proposed for river banks or earth bunds where there is insufficient space to raise the bank using imported fill. It would also be used where raising the bank would result in extensive damage to gardens.

In addition, it is proposed that the bank supporting the concrete wall between Ch 23240 and Ch 23010 (right bank) would be stabilised using a double skin planking system. This method of construction would overcome the problem of restricted access for plant and materials and minimise impacts on the environment and disruption to local residents.

ii) **Brick or Stone Walls**

Brick or stone would be used to:

- raise existing walls
- extend existing walls
- reinforce existing walls
- provide new walls
- raise steps and gaps.

The choice of brick and/or stone construction would be dictated by environmental considerations.

iii) **Raising Banks**

Where space and environmental considerations permit, existing river banks or earth bunds would be raised using imported fill.

iv) **Other Works**

In addition to the improvement methods described above the following specific works are proposed:

- reconstruction of the headwall at Ch 23540 (right bank)
- make up and asphalt footpath from Eastgate to Low Locks to prevent further erosion of the bank by pedestrians
- fix toe plate to footbridge at High Locks and close to concrete walls on left bank.

2.3.4

Locks

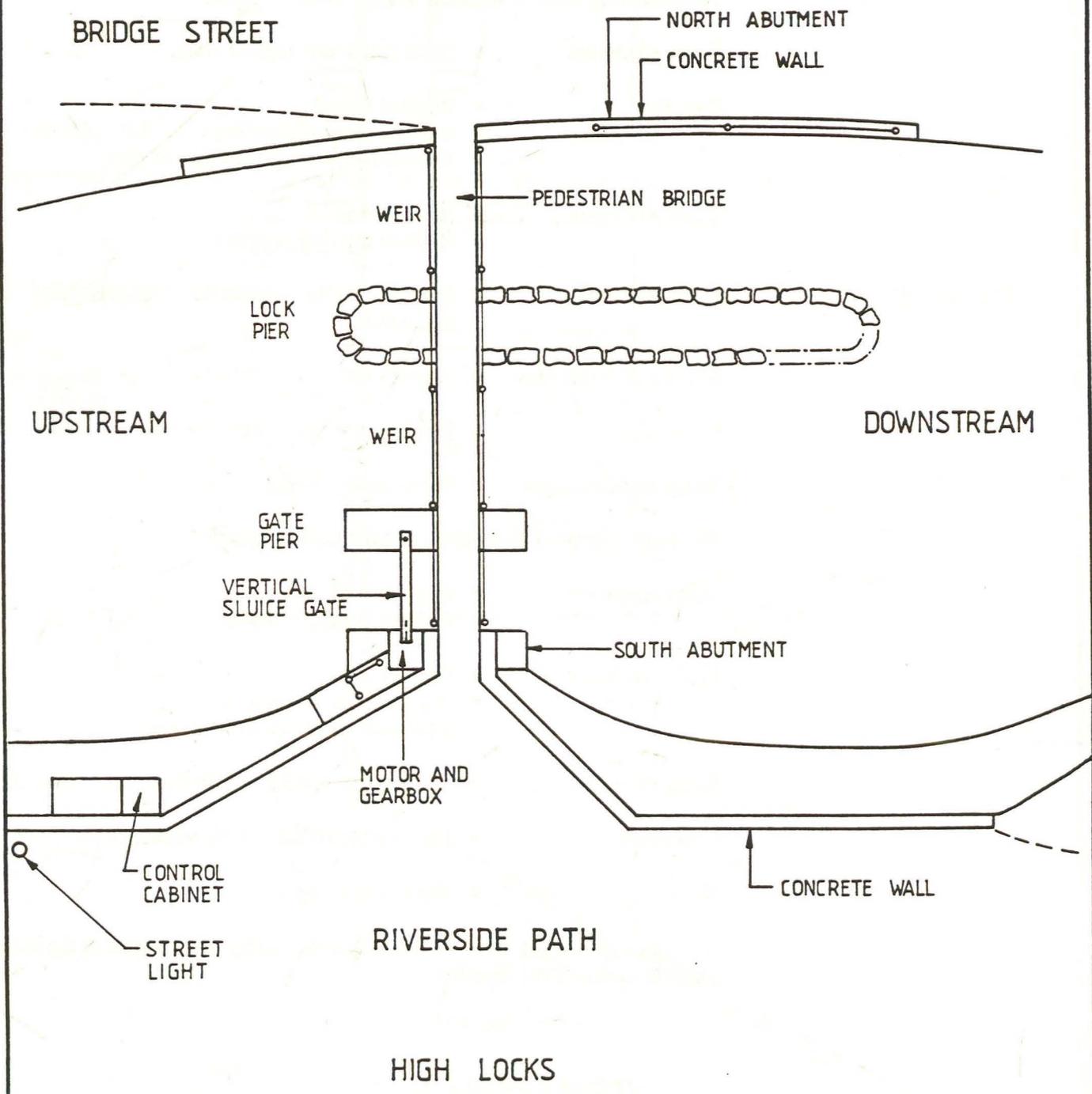
The work required to restore the structures at High and Low Locks is outlined below. Further details are available in the Condition Report on these structures (Posford Duvivier, 1993b).

i) **High Locks**

High locks comprise two weirs and a vertical sluice gate. The sluice gate operates between the gate pier and south abutment. Figure 2.3.4a illustrates the layout of the lock.

The following works are required at High Locks:

- | | |
|----------------------------|--|
| North Abutment | ■ Grub out roots and repoint walls. |
| Lock Pier | ■ Grub out roots and repoint walls.
■ Replace missing brickwork.
■ Reconstruct downstream end of pier. |
| Gate Pier | ■ Grub out roots and repoint walls.
■ Replace cracked/missing masonry.
■ Reconstruct downstream end of abutment. |
| South Abutment | ■ Grub out roots and repoint walls.
■ Replace cracked/missing masonry.
■ Reconstruct downstream end of abutment. |
| Scour protection | ■ Provides protection downstream of structures. |
| Footbridge and weir guides | ■ Painting and minor safety works. |
| Sluice and structures | ■ Minor safety works. |



PROJECT	TITLE		DATE NOV. '93	SCALE N.T.S.
MARKET DEEPING FLOOD DEFENCES	HIGH LOCKS		DRAWN D.R.	CHKD LP
			Figure 2.3.4 (a)	

ii) Low Locks

There are two sets of river control structures at Low Locks. Low Locks - North comprises a weir and vertical sluice gate and Low Locks - South only a vertical sluice gate. Figures 2.3.4b and 2.3.4c illustrate the layout of Low Locks - North and South.

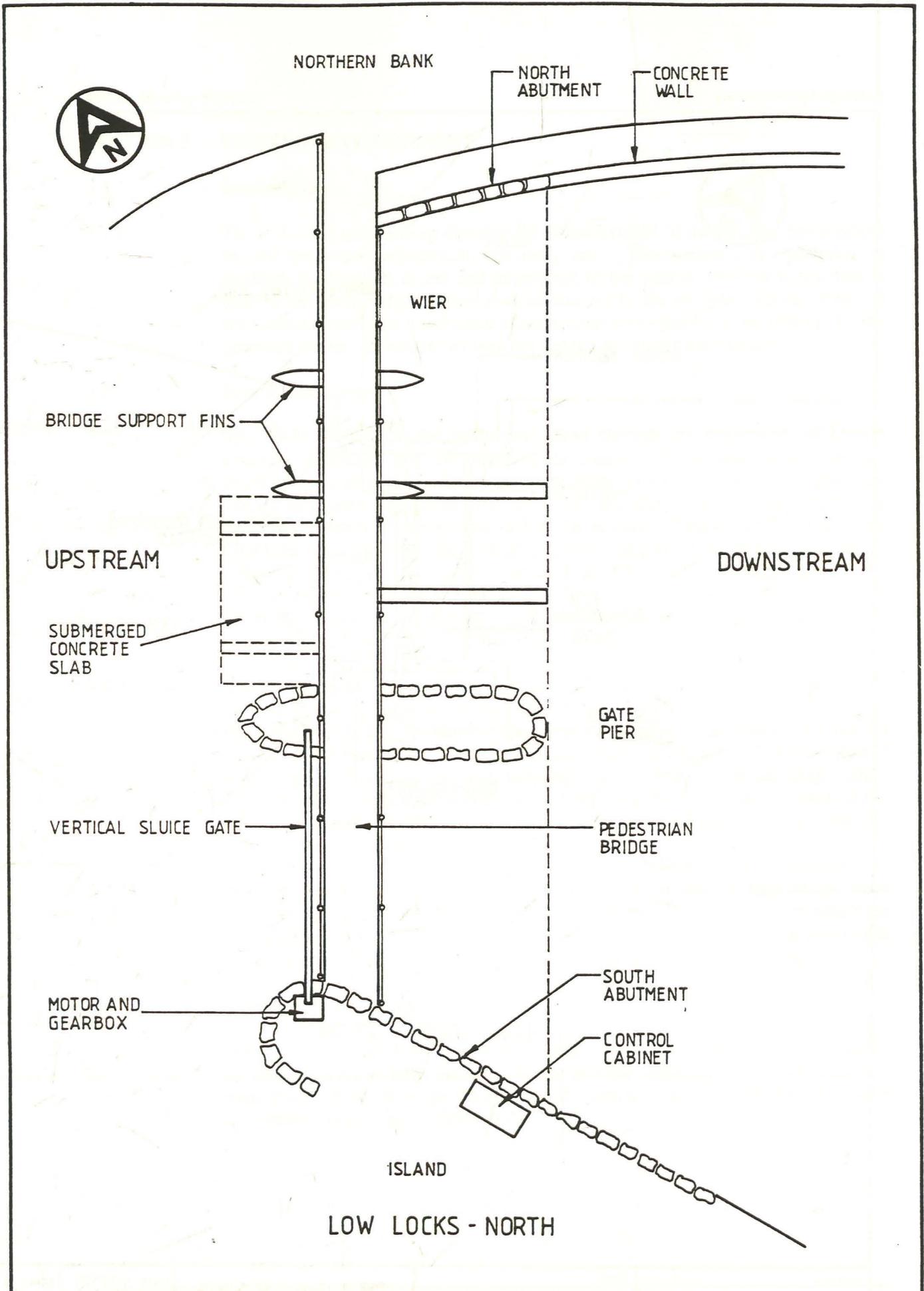
The following work is required at Low Locks - North:

- | | |
|-----------------------|---|
| North Abutment | ■ Grout crack and repoint wall. |
| Gate Pier | ■ Repoint walls.
■ Replace missing masonry.
■ Reconstruct downstream end of pier. |
| South Abutment | ■ Repoint walls.
■ Replace missing masonry. |
| Scour Protection | ■ Provide scour protection downstream of structures. |
| North and South Fins | ■ Repair cracks. |
| Footbridge | ■ Painting and minor safety work. |
| Sluice and structures | ■ Minor safety works. |

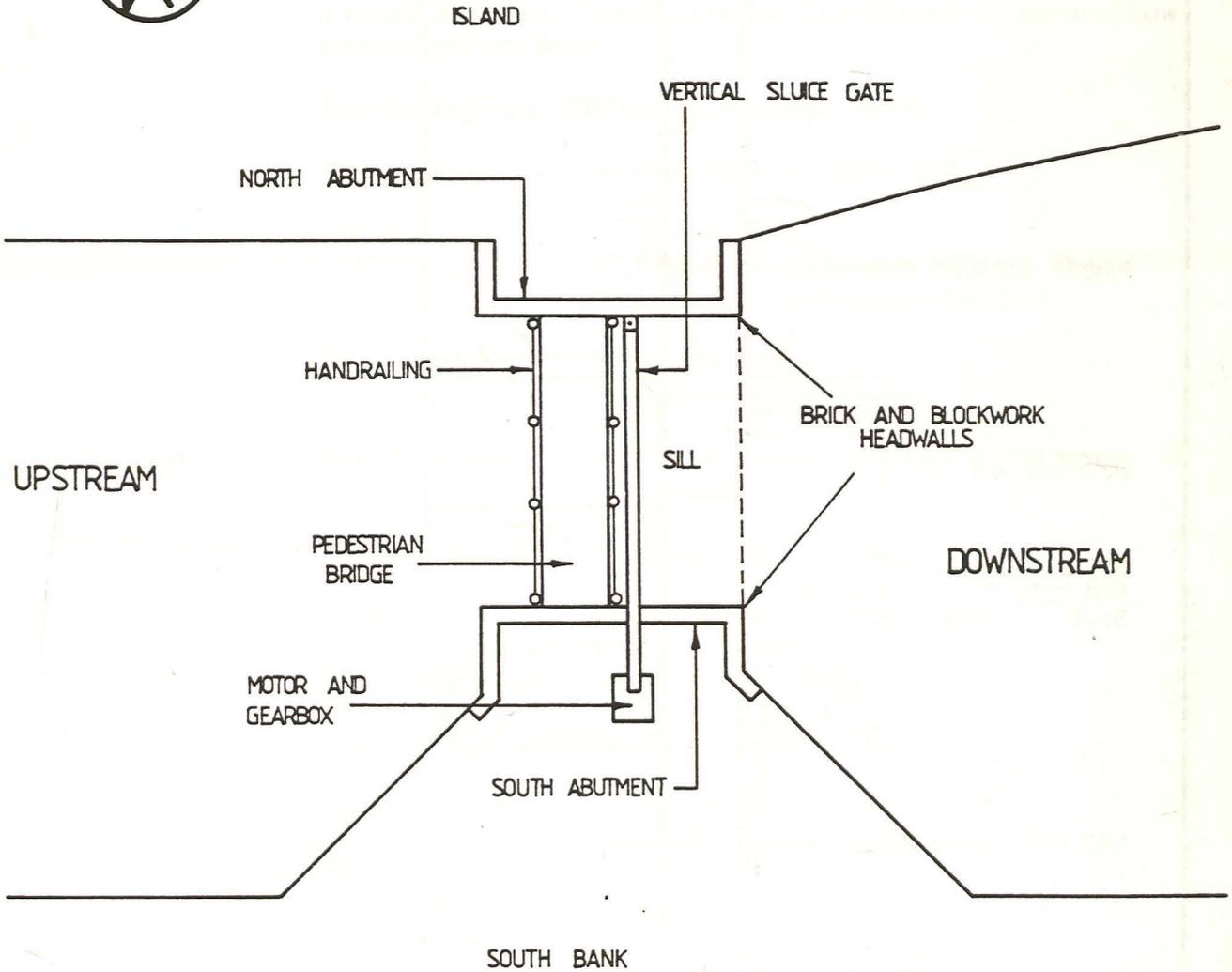
The following work is required at Low Locks - South:

- | | |
|------------------|---|
| North Abutment | ■ Repoint wall.
■ Replace concrete coping. |
| South Abutment | ■ Repoint wall.
■ Replace concrete coping.
■ Construct sheet pile cut-off wall. |
| Scour Protection | ■ Provide scour protection downstream of structure. |
| Footbridge | ■ Painting and minor safety works. |
| Sluice | ■ Minor safety works. |

No work is envisaged at the former lock immediately downstream of the sluice gates at Low Locks - South.



PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE LOW LOCKS - NORTH		DATE NOV. '93	SCALE N.T.S.
			DRAWN D.R.	CHKD <i>JP</i>
			Figure 2.3.4 (b)	



LOW LOCKS - SOUTH

PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE LOW LOCKS - SOUTH		DATE NOV. '93	SCALE N.T.S.
			DRAWN D.R.	CHKD <i>LD</i>
			Figure 2.3.4 (c)	

SECTION 3 EXISTING ENVIRONMENT**3.1 Introduction**

3.1.1 The following sub-sections describe the characteristics of the existing environment in, and sometimes adjacent to, the study area. This review was undertaken to establish the location, extent and importance of the various interests in the area in order to determine which factors may be affected by the proposed works. Where it was demonstrated that a particular characteristic was unlikely to be affected by the proposed works, the parameter was not subject to further investigation.

3.2 Human Settlement

3.2.1 The River Welland in the study area flows through the settlements of Market Deeping, Deeping Gate and Deeping St James. These three townships are collectively known as the Deepings. The study area is illustrated on Figure 1.5. With a combined population of over 10,000, the Deepings is an important local centre for a range of commercial and social activities (SKDC, 1992). Originally established as a centre for the agricultural community and developing as a focus for communications, the settlements expanded in the 1970's and 1980's as a result of the New Town development in Peterborough approximately 13km to the south. The Deepings is now an important satellite residential area for people working in Peterborough, Stamford and further afield.

3.2.2 The Deepings is situated at the cross-roads of two important transport routes. The A15 running roughly north to south (the main Peterborough to Sleaford road) and the A16 (Stamford to Spalding) converge at the roundabout adjacent to the market place in Market Deeping. Considerable congestion has resulted from the amount of traffic using this location, and proposals for a bypass are currently under consideration. The proposed route of the bypass leaves the A15 to the south of the Deepings, crosses the River Welland and skirts Market Deeping to the west and north, joining the A16 in the north east.

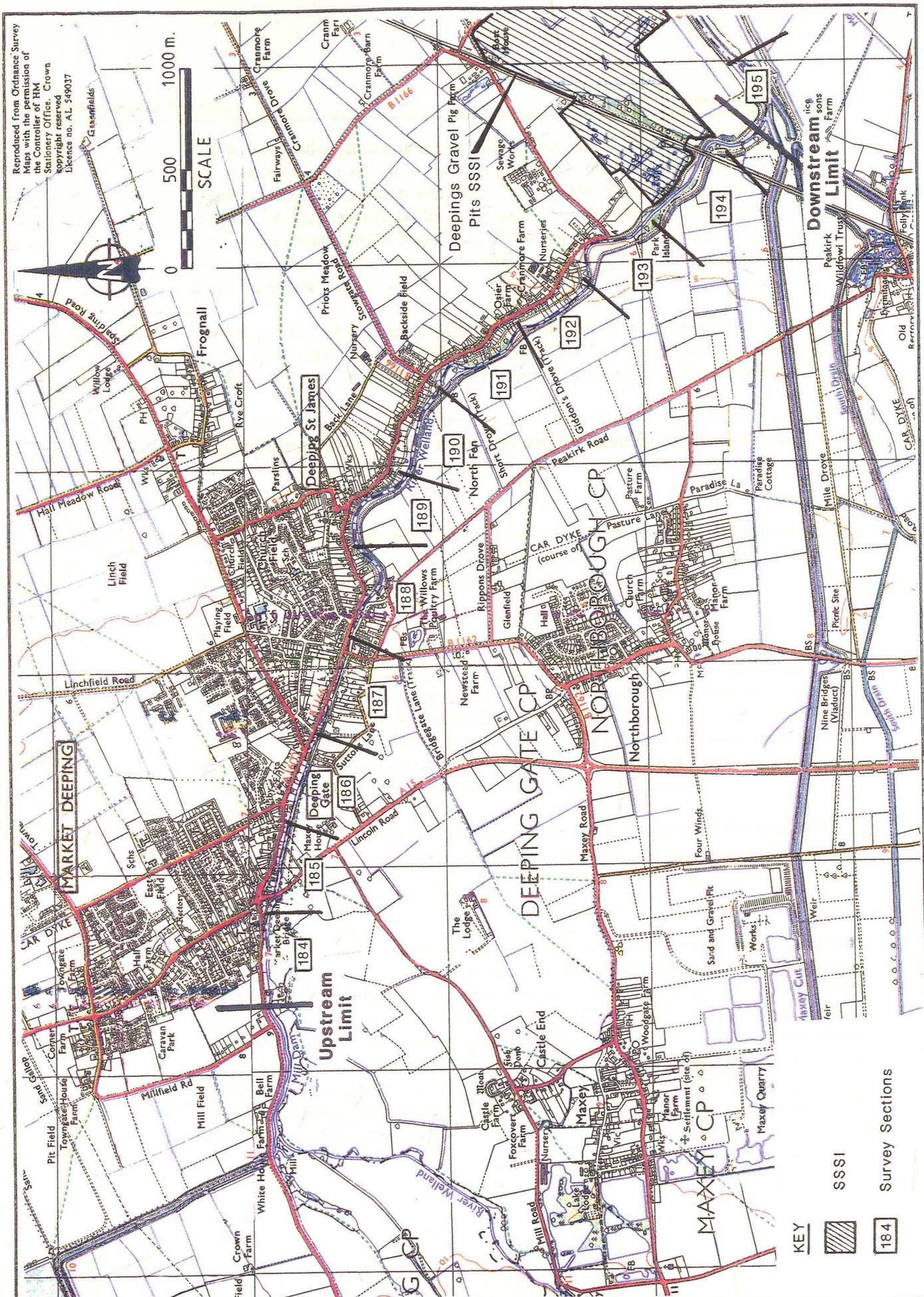
3.2.3 The area surrounding the Deepings is mainly good quality agricultural land, producing a range of arable crops. The area of southern Lincolnshire in which the Deepings is situated is also an important source of sand and gravel. The south bank of the river is in Cambridgeshire, again providing rich agricultural land.

3.3 Drainage and Geology

3.3.1 Although the region has a low annual rainfall, the groundwater levels, the quantity of water flowing through the area and the shallow gradients ensure that without a managed system of drainage, the area would return to an environment consistent with its former fenland edge location (LCC, 1993).

- 3.3.2 Major floods have been recorded in the Deepings area in 1877, 1880, 1912 and 1939 with the last occurrence of severe flooding in 1947. Following this latter event, the Maxey Cut was built to divert peak flows in the River Welland away from Market Deeping. Hives Bank was also built at this time providing an earth mound as a flood defence along the north side of the river.
- 3.3.3 The last major re-organisation to the Welland/Glen catchment was undertaken in 1957 with the construction of the Greatford Cut. This channel transfers flows from the River Glen into the River Welland joining the Welland about 1km upstream of Market Deeping (Posford Duvivier 1993a). Since 1957, various factors have led to a reduction in the capacity of the Greatford Cut. The absence of serious flood events from the Deepings in recent years may be partly due to the reduced capacity of the Greatford Cut.
- 3.3.4 The Market Deeping area is underlain by beds of Oxford Clay and rocks of the Kellaway Series. Material has been laid down upon this as outwashings from the River Glen and Welland. This material forms the basis of the sand and gravel deposits exploited in the area. A variety of loamy and peaty soil types have developed from the weathering of this base which, when drained, form the basis of good agricultural land.
- 3.4 **Water Quality**
- 3.4.1 The stretch of the River Welland flowing through the Deepings has been regularly monitored for physico-chemical water quality parameters. There are no substantial sewage discharges along this stretch of river.
- 3.4.2 A 1979 report on the status of the river fishery concluded that the chemical quality of the river was excellent (AWA, 1979). This was based on water quality standards established under the former National Water Council's (NWC) classification scheme for dissolved oxygen, biochemical oxygen demand (BOD) and ammonia. The NWC classes range from 1a/1b "Good quality" to 4 "Bad quality" and are based on quality criteria. Under this classification, successive fishery surveys have concluded that the chemical quality of this stretch of river falls into class 1b, and that the water quality is good (Anglian Water, 1984; NRA, 1993b).
- 3.4.3 Water quality data (1991-1993) was collected from the Water Resources Act register for a wide range of physico-chemical parameters. The data demonstrated that the river is well oxygenated and capable of supporting a healthy aquatic ecosystem. The nutrient (nitrogen and phosphorus) status is relatively high and is likely to be one cause of the dense growth of macroalgae and duckweed found in the river adjacent to both High and Low Locks.
- 3.5 **The Natural Environment**
- 3.5.1 Data Collection
- The REDS data (River Environmental Database System) developed by NRA provided the River Corridor Survey (RCS) data for the section of the River Welland included within the study area (see Figure 3.5).

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KEY

- SSSI
- Survey Sections

<p>PROJECT</p> <p>MARKET DEEPING FLOOD DEFENCES</p>	<p>TITLE</p> <p>RIVER CORRIDOR SURVEY SECTIONS & SSSI DESIGNATION</p>	<p>POSFORD DUVIER ENVIRONMENT</p>	<p>DATE OCT. '93</p> <p>SCALE As shown</p> <p>DRAWN J.R.</p> <p>CHKD </p>
			<p>Figure 3.5</p>

- 3.5.2 The river corridor survey provides information on 500 metre sections of the river. An annotated map of the section is produced, recording the aquatic, bank and adjacent land zones together with their characteristic plant communities and physical features. A cross-section of the river includes information on the river width and depth, bank heights, berm width, etc. Finally, a summary description of each 500m section is produced to accompany the maps, together with ornithological and botanical species lists.
- 3.5.3 For the purpose of the study, river corridor survey data was reviewed for sections WELL 184 to 190. Sections WELL 191 to 195 do not have a complete data set and, therefore, only the ornithological and botanical species list could be reviewed.
- 3.5.4 Bedfordshire and Cambridgeshire Wildlife Trust's draft list of rare species in Cambridgeshire was consulted to identify any rare plant species occurring within the study area. The Red Data book on bird's in Britain (Batten et al, 1990) was used to identify any rare bird species.
- 3.5.5 Finally ecological notes made during a site visit in 1991 were used to determine the characteristics of the river corridor (especially in sections WELL 191 to 195 where the REDS annotated maps were not available).
- 3.5.6 Existing Environment
- The majority of the river length from sections WELL 184 to 190 flows through the Deepings. The adjacent landuse on the north bank is dominated by houses and gardens while roads and/or commercial properties border the river along other stretches. A mixture of semi-improved pasture, hay meadow and houses and gardens border the river corridor on the south side. Overall, the corridor provides a relatively natural habitat within a largely urban and agricultural landscape.
- 3.5.7 The river banks vary from half a metre to three metres in height. The steeper banks are dominated by false oat grass (*Arrhenatherum elatius*), perennial rye grass (*Lolium perenne*), cock's foot (*Dactylis glomerata*), nettle (*Urtica dioica*) and common cleavers (*Galium aparine*).
- 3.5.8 The river banks have numerous trees and shrubs situated within agricultural land and/or private gardens. Species include willow (*Salix spp*), hawthorn (*Crataegus monogyna*), ash (*Fraxinus excelsior*), alder (*Alnus spp*), and sycamore (*Acer pseudoplatenus*), along with various ornamental species. The vegetated fringe is continuous in areas and sparse in others. The fringe species include watercress (*Nasturtium officinale*), water forget-me-not (*Myosotis scorpioides*), water crowfoot (*Ranunculus aquatilis*), brooklime *Veronica beccabunga*), common club-rush (*Scirpus lacustris*) and branched bur-reed (*Sparganium erectum*). Reed sweet grass (*Glyceria maxima*) dominates the fringe.

- 3.5.9 The channel contains aquatic species including rigid hornwort (*Ceratophyllum demersum*), common duckweed (*Lemna minor*) and yellow water lily (*Nuphar lutea*). The average species richness of the flora is approximately sixty species per 500m stretch, with extremes ranging from forty two to seventy four species. The average species richness of birds is eighteen per 500 metre section, with an average of fifteen holding breeding territories in the river corridor. The main habitats for birds include the trees and shrubs along with the river fringe. Discussions with local groups confirm that kingfishers (a protected species under the Wildlife and Countryside Act, 1981) are regularly seen along the river.
- 3.5.10 Through sections 191 to 195 the surrounding settlement is reduced as the river leaves Deeping St James. The river corridor is bordered on the north bank by a small area of planted willow (*Salix spp*). The south bank is bordered by a line of mature willows (*Salix spp*) and unmanaged grassland with scrub. Sections 193 to 195 are bordered by semi-improved grassland. The river has a faster flow along this section than through the Deepings, and exhibits wider fringes. Species richness of the flora ranged from sixty five to over a hundred species with an average of ninety species. The average species richness of birds is twenty five. A number of gadwall, a Red Data Book Species of bird, were recorded.
- 3.5.11 Nature Conservation Designations
- English Nature and Lincolnshire Trust for Nature Conservation were both consulted over the nature conservation interest within the study area. A Site of Special Scientific Interest is present adjacent to the River Welland at Grid Reference TF180 082 (see Figure 3.5). Deeping Gravel Pits SSSI is important for its ornithological interest. The habitats vary from extensive areas of open water through to marginal aquatic and fen vegetation. Willow shrub grading into oak and ash woodland is also present. The site is important in supporting a heronry of national importance and numerous overwintering wildfowl species, including widgeon, pintail, goldeneye, mallard, teal and goosander. The site is also used by gadwall, great crested grebe, shoveller, tufted duck and kingfisher. Appendix E includes a copy of the SSSI citation.
- 3.6 **Landscape**
- 3.6.1 The River Welland through the study area provides an attractive river landscape, comprising several areas of differing character, both open and closed, rural and built up. Reed beds or grassy banks and stone buildings and walls are characteristic of the landscape. There are several points of interest on the river (e.g. High Locks, Deeping Gate Bridge and Low Locks) which are examined in greater detail in Section 3.7. There is generally good public access to these sites and to other stretches of the river.
- 3.6.2 The characteristics of the existing landscape are considered in greater detail in the full landscape assessment included as Appendix A.

3.7 The Built Environment

- 3.7.1 Although an important market town, the Deepings appears to have been overshadowed to some extent by its larger neighbours, until the cutting of the Stamford Canal in the 17th century (see Section 3.7.3). The River Welland and the Canal have been central in the development of the built environment of the Deepings. Many of the Post-Medieval listed buildings in the Deepings were directly concerned with either the Canal or the river and its traffic. Wharves, boat houses, jetties, merchant's houses, inns etc. would all have been present in previous times and many of the surviving structures form the Conservation Areas described below. Section 3.8 describes the archaeological evidence supporting early settlement in the Deepings area.
- 3.7.2 The historic quality of the built environment in the Deepings area is indicated by the coverage of the Conservation Areas designated by the appropriate local authority. The areas are shown on Drawing Nos. 1 and 2 in Appendix G. The designation of the historic cores of Market Deeping, Deeping St James and Deeping Gate as Conservation Areas (PCC, 1992; SKDC, 1992) recognises the built environment as being of particular interest and enhances the ability of the appropriate District Council to influence development. Tree Preservation Orders also cover areas of tree cover and occasional trees.
- 3.7.3 Stamford Canal and the Lock Structures
- Appendix D provides a detailed description of the Canal and the lock structures which has been compiled using the results of work undertaken by the Archaeology Section of Lincolnshire County Council, contributions from other interested parties, and research carried out by Posford Duvivier Environment. Only a summary is presented here.
- 3.7.4 The River Welland was navigable to Stamford during the Middle Ages but the construction of several water mills began to cause problems for commercial traffic in the late 16th Century. As a result, improvements were made to the navigation route including the construction of the Stamford Canal and incorporating the construction of locks on the River Welland through the Deepings. Although the exact construction date is uncertain, the Welland Navigation was certainly in use some years before 1673. The coming of the railway forced the canal into disuse in the 1860s, after which it was auctioned off.
- 3.7.5 There are only three surviving lock structures from this canal and they are located at West Deeping, Low Locks, and High Locks Deeping St. James. Appearing to be of masonry construction throughout, the latter structure provides the best preserved example.

- 3.7.6 The construction of the Exeter Canal predates that of the Stamford Canal, but as a result of extensive refurbishment to the former, the Deeping Locks may represent the oldest remaining navigation pound locks in Britain. They are therefore potentially of national significance. Although the lock structures remain undesignated as either listed or scheduled sites, this may reflect the lack of attention which has been focused upon them. The lock structures are currently being considered by the Department of the Environment as a candidate for listing (personal communication, SKDC, 1993).
- 3.8 **Archaeology**
- 3.8.1 As part of the environmental appraisal, the Archaeology Section of Lincolnshire County Council (LCC) were asked to make investigations into the importance of the study area in archaeological and heritage terms. The following text draws heavily on their report, whilst incorporating information from other investigations and consultations carried out by Posford Duvivier Environment. Drawing Nos. 1 and 2 in Appendix G identify many of the sites mentioned here.
- 3.8.2 A series of factors appear to have combined to ensure that people have established dwellings in the Deepings area from the earliest times. Its Fenland edge location, position on a long-established transport route (River Welland), location at the lowest fordable point on the river, and the productive soils of the area have made it a popular settlement site.
- 3.8.3 There is extensive cropmark evidence to indicate a major concentration of prehistoric settlement, ritual and funerary monuments, and also of Roman settlement and occupation in the area. The gravel terraces of the River Welland have been recognised as being of importance for these features for many years. Market Deeping itself has cropmark evidence of settlement, funerary and possibly ritual activity in the west of the study area.
- 3.8.4 Fieldwork for the Fenland Survey undertaken to the north and east of the study area identified prehistoric settlement remains at a number of locations (SMR Nos. 34057, 34058, 34059, 34060, 34064, 34066 and 34068). More isolated finds of prehistoric objects are scattered widely in the study area. Settlements and occupation appears to have continued to the Roman period, perhaps with a surge of activity in the Bronze Age.
- 3.8.5 The Roman period saw further expansion of settlement and farming activity across large areas of the Fens, illustrated by the considerable level of Roman workings currently under excavation in the area (for example Flag Fen). In Priors Meadow, south of Frognall, Deeping St James, a focus of dense Roman settlement covering about nine hectares has been identified (SMR Nos. 00179, 33448, 33456, 33463). Dispersed farmsteads and possibly small manufacturing sites appear to make up the rest of the Roman sites in the area.

3.8.6 The Roman Car Dyke (SMR No. 34753) crosses the study area on its passage from Witham (near Lincoln) to the Nene (near Peterborough). The dyke is obscured by settlement in the Deepings and only re-appears south of the Welland. There has been considerable discussion on the purpose of this structure but it is now generally agreed to be a catchwater drain. There is a similar feature in the east of the study area (SMR No. 34069) which is also thought to be of Roman origin and is considered to be either an artificial structure to control the rivers or a drainage feature.

3.8.7 It appears likely that Saxon settlement in the area was located around Towngate and St Guthlac's church in the west of the study area. The written history dates from Norman times with the Domesday Book referring to the parish of East Deeping (thought to be Market Deeping). Market Deeping is thought to be older than nearby Deeping St James which was possibly a planned creation of the late 11th or early 12th centuries.

3.8.8 The Deepings appears to have been overshadowed to some extent by its larger Medieval neighbours, Stamford, Crowland and Peterborough and it was not until the construction of the Stamford Canal in the 17th Century that the Deepings villages were able to prosper.

3.8.9 Archaeological Importance and Potential of the River Banks

The desktop study carried out by the LCC Archaeology Section suggests that the prehistoric and Roman settlement was centred away from the river on the free draining gravel fans, silt ridges and artificial mounds. However, this apparent distribution may be due to the masking of earlier riverside occupation sites by the modern settlements, rather than any avoidance of the Welland flood plain.

3.8.10 In summary, therefore, although the area has a long-running history of settlement, there are known sites of archaeological significance adjacent to the river in the study area.

3.9 The Planning Context

3.9.1 Local Authority Jurisdiction

The River Welland, on its course through Market Deeping, Deeping Gate and Deeping St James, marks the boundary between Lincolnshire to the north and Cambridgeshire to the south. This also results in a split responsibility between district authorities, with South Kesteven District Council to the north and Peterborough City Council to the south. Deeping Gate is within the Peterborough City Council area and Cambridgeshire, whereas Market Deeping and Deeping St James are in South Kesteven District and Lincolnshire.

3.9.2 Relevant Planning Documents

The large number of local authorities with responsibility in the area confuses the situation regarding planning policy documents. The following documents are of relevance to the project:

- Peterborough Local Plan (Deposit, 1992).
- South Kesteven Local Plan (Deposit Draft, April 1992).
- Cambridgeshire Structure Plan Review (Consultation Draft 1992).
- Lincolnshire Structure Plan.
- Baston - Langtoft - West Deeping Countryside Management Plan (1992).

3.9.3 Planning Considerations

Under the Water Resources Act 1991 (HMSO, 1991), the NRA have power to ensure the provision of adequate flood defences. However, formal planning permission is not necessarily required from the local authorities. Also in the Water Resource Act, the NRA have responsibilities for the environment similar to those required of "developers" under the planning system.

3.10 Recreation and Amenity

3.10.1 The role of the River Welland in the study area as a resource for recreation and amenity is outlined in this section. Angling, however, is addressed in Section 3.11.

3.10.2 The River Welland provides an important recreational and open space resource for both visitors and locals alike, penetrating into the heart of the Deepings. Its continuing role is recognised by the concern for its maintenance shown by two important local residents' groups: Welland Watch Group and Deepings Heritage.

3.10.3 In the first half of the 19th Century water-based activities (shooting and water-sports) were of prime importance but, partly as a result of the development of alternative facilities in the locality, these activities have declined. Currently the main uses of the river area are for informal recreation (for example, walking, picnicking, bird watching, and other nature conservation activities). These activities are dependent on both the river and the existence of the public Rights of Way network, consisting of footpaths, bridleways and byways. Drawing Nos. 1 and 2 in Appendix G illustrate these routes in the Deepings area. The Cambridgeshire County Council, with assistance from local organisations and volunteers, is committed to the establishment, development and maintenance of the footpath network in an effort to provide "barrier free" access to the countryside.

3.10.4 An important user group of the river is the local Scout group. Using Scout Island (see Figure 1.5) during the summer as a camping base, the Scouts are involved in water-based recreation (eg. canoeing) and carry out maintenance and restoration work on the banks.

- 3.11 **Angling**
- 3.11.1 Angling represents the main year-round recreational use of the River Welland through the Deepings study area. Although eels have been taken from the river to supplement incomes in the past, fishing is now for sport and recreation only.
- 3.11.2 Although previously in separate ownerships, the Deeping St James Angling Club (DAC) acquired the fishing rights and are now sole owners (though a Several Order) of the fishing rights between Kennulphs Stone (beyond the confluence of Maxey Cut and the River Welland) and Wherry's (see Figure 1.5). A thriving and popular club, the DAC obtained the rights of fishing in order to secure the resource for local fishermen. The club also hold rental agreements covering considerable lengths of the river bank to ensure access to the river. The Welland at Market Deeping is an important chub (*Leuciscus cephalus*) and roach (*Rutilus rutilus*) fishery, also producing pike (*Esox lucius*), tench (*Tinca tinca*) and dace (*Leuciscus leuciscus*). The river is well known for its chub fishing with fish up to 2.5 kg being caught. The angling club regularly carry out stocking exercises upstream of High Locks. The south bank is particularly important for angling because access is more readily available to the river's edge.
- 3.11.3 Matches, involving both local and visiting groups, are an important part of the angling year as well as the primary source of revenue for the DAC. Visiting angling clubs pay a fee for the rental of a particular stretch of river and bank. Although such bookings are taken well in advance, "late" bookings are usual depending on how well the river is "fishing" at a particular time.
- 3.11.4 The National Rivers Authority plays a prominent role in the management of the fisheries resource as stated in its recently prepared Fisheries Strategy: "In the broadest sense, the NRA's primary aim for fisheries is to maintain, improve and develop fish stocks, the basic fish resource, in order to optimise the social and economic benefits from their sustainable exploitation" (NRA, 1993a).
- 3.11.5 The NRA carry out population surveys of the fishery, the most recent taking place in April - June 1993. This survey noted concern over a decline in the dace population, although not particularly in the Deepings area. The decline is thought to be a reflection of the deterioration of environmental factors such as low flows and the siltation of spawning beds (NRA, 1993b).
- 3.11.6 The physical and environmental features of the river are of paramount importance to the maintenance of fish populations. Reproduction, feeding, growth and protection are the four essential biological processes for fish populations. The provision of suitable environments in which these activities may take place is crucial.
- 3.11.7 Gravelly sections of the river are used by chub and many other species as a suitable spawning substrate. Egg incubation is then governed by the stability of the substrate, oxygen supply and water velocity. Riparian and aquatic vegetation provide conditions for invertebrates and other food sources which are important to fish. Similarly, the cover provided by bankside vegetation and channel obstacles provides important resting areas, shade and protection. Areas of slack velocity similarly play an important role in fish growth and survival.

3.11.8 Fish populations are at their most vulnerable during spawning periods. Table 3.11.8 shows the basic period of spawning for the major species.

Table 3.11.8 Fish Spawning Times

Species	Spawning Time
Dace	March - July
Chub	May - June
Pike	March - May
Roach	April - June
Rudd	April - June
Tench	May - August

(Source: Lewis and Williams, 1984)

3.11.9 Essentially, the diversity of the river channel and the bankside vegetation are important contributors to the maintenance of river fish populations, and the success of the fishery in this area suggests a prosperous existing environment in this sense.

SECTION 4 ENVIRONMENTAL APPRAISAL**4.1 Introduction**

4.1.1 The following sub-sections give a brief description of the environmental impacts considered; provide a preliminary assessment of their significance and, where necessary, suggest mitigation measures whereby the impact's significance may be reduced. Possibilities for environmental enhancement are suggested, but further detail is given in Section 5.2

4.1.2 Following the description of the existing environmental parameters described in Section 3, and comparing these factors with the proposed flood defence works described in Section 2, it is possible to identify areas of overlap or potential conflict. Drawing Nos. 1 and 2 in Appendix G should be used with this Section.

4.2 Human Settlement

4.2.1 The proposed flood defence works are not anticipated to have any adverse impacts on the settlements making up the Deepings. Given that they improve the standard of flood defence, they will provide a positive impact.

4.2.2 Although the materials and plant will be brought into the Deepings by road, they will be moved locally to the site by river. This should minimise disruption to local residents.

4.2.3 The use of local contractors for the work should contribute to co-operation between the NRA, contractor and the local population, thus minimising the level of disruption to the local community.

4.2.4 During the works to improve the flood defences it is likely that the contractor will need to establish a temporary site or compound for the storage of equipment and materials at some locations. When considering the locations and appearance of this site, the following factors should be borne in mind:-

- any site must be returned to its pre-works condition
- footpath disruption must be minimised, and if significant albeit temporary changes are necessary they should be well publicised (see Section 4.10.5 for further requirements relating to footpath provision)
- although the site will be temporary, full consideration must nevertheless be given to its visual appearance (ie the site must be kept tidy)
- safety considerations for members of the local community as well as for people working on the site must be adequately addressed.

Most, if not all of these concerns are, however, considered in the NRA's contract documentation.

4.3 Drainage and Geology

- 4.3.1 The proposed works will have no impact on the area's drainage or geology except by enhancing flood protection. However, the improved level of flood defence in the Deepings will enable the proposed restoration of the Greatford Cut to proceed without adverse consequences for the settlements. Potential changes in water level in the River Welland as a result of restoration works to the Greatford Cut have not been considered further in this appraisal.

4.4 Water Quality

- 4.4.1 The construction of new defences along the banks of the River Welland could potentially have an impact on the river water quality. Debris, construction materials and waste products from construction plant could be (accidentally) released into the aquatic environment if suitable care is not taken during the construction phase.
- 4.4.2 There are some sites where the proposed work will take place very close to the river itself. Some of this work, such as at sites 4 and 27, may involve the demolition of the existing defence. Construction at these sites and others (including sites 5, 17, 26 and 27) all require work next to the river. New defences may comprise dwarf walls or the use of double planking set into a bund. In such cases waste or construction materials, or even waste from the plant, may find its way into the water, albeit accidentally.
- 4.4.3 As described in Section 3.12, the physico-chemical and aesthetic quality of the River Welland is good. Any inputs of waste or construction materials during the building of the proposed defences would be detrimental to the aquatic environment. The input of materials such as masonry would not be expected to have a significant environmental impact, assuming such debris can be recovered. However, of potentially greater significance would be the spillage of materials such as cement and fuels from construction machinery.
- 4.4.4 Care should be taken at all times to ensure that no waste or construction materials are accidentally allowed to enter the river. If this were to happen, where possible, the materials should be recovered immediately. The importance of good working practice should be stressed throughout the construction phase.
- ### 4.5 The Natural Environment
- 4.5.1 The investigations into the existing natural environment in the study area, (described in Section 3.5) did not identify any sites of exceptional nature conservation importance likely to be adversely impacted by the proposals.
- 4.5.2 Deeping Gravel Pits SSSI may receive an indirect benefit from the proposed works in that flood protection for the nearby sewage works will be improved. With the current standard of protection, the flooding of the sewage works is a possibility. Given the local topography, a sudden influx of sewage into the SSSI, resulting in an increased level of nutrients, could be a possibility in the event of flooding. Increased nutrients could lead to excessive growth, causing competitive species to dominate with a subsequent loss of species richness.

4.5.3 Although no major adverse impacts were identified as a result of the proposed works, there are a number of potential impacts which may have a bearing on the nature conservation interests of the river area. These are briefly outlined below.

4.5.4 Damage to Emergent/fringing Vegetation

Sections 3.5 and 3.11.6 outlined the importance of marginal vegetation to a variety of wildlife including fish, invertebrates and birds. Long-term damage to these features should be avoided. As described in Section 2.3.2, in order to minimise disruption to local residents, materials would be delivered to site by water. This may create instances where damage to riverside vegetation is unavoidable. In such cases, in the interests of both the property owner and wider nature conservation concerns, the vegetation must be re-established to its pre-works extent and, where possible extended. If reedbed damage is minor, natural re-establishment will occur. However, if severe damage occurs the reeds may need to be re-established by planting. The NRA Conservation Office will be able to advise on specific techniques for re-establishment of reeds on a site specific and individual damage basis.

4.5.5 Re-establishment of Reed Beds

At sites 26 and 29, the clearance and re-establishment of emergent vegetation is a necessary part of the proposed works. In order to avoid a long-term potentially significant impact, it is imperative that the reed beds are effectively replaced.

4.5.6 At site 26 the proposed works involve the repair of cracks in the existing 100m section of concrete flood wall, and the re-establishment of the river bank to improve the wall's stability.

4.5.7 In implementing these proposals the objectives should be clearly established: to provide a river bank which gives stability to the wall and secondly to provide a basis on which reeds and other vegetation can be established whilst attempting to minimise the change to water levels necessary during construction.

4.5.8 During the initial consideration of bank reconstruction methods a two tier structure was suggested with reeds establishing at both levels on a base of earth fill. The earth would fill the gaps between two sets of planks driven into the river bed. Reeds are unlikely to be able to colonise the upper tier of the new bank because the site would be too dry. A suitable conservation seed mix should be used here, and natural regeneration encouraged where possible. It is important to ensure that an amenity grass area is not created which may encourage use of and, therefore, damage to the upper tier of the artificial bank.

4.5.9 It is suggested that fibre rolls may provide an alternative method of meeting the objectives. Fibre rolls are made of coconut fibres compressed into a roll and contained by a large mesh netting. They are often used in conjunction with stone rolls. The stone rolls (designed to prevent scour) are staked into the channel side while the fibre rolls (designed to provide bank protection) are staked behind at the bank side. The rolls are designed to protect the plants, and once the plants become established and have spread and bound into the existing banks the rolls disintegrate, usually after about five years.

The advantages of using fibre rolls include:

- encourages the establishment of marginal vegetation
- allows continuity of a riverbank habitat whilst enabling diversity
- habitat enhancement for fish and invertebrates
- relatively easy to handle and place.

However, in this situation fibre rolls, on their own, would not give the wall the required stability.

4.5.10

Assuming that the planks and posts which provide support for the new bank can be placed using hand piling equipment, there will be no need for any lowering of water levels during the works. The requirement to use fibre rolls may therefore be reduced so long as nature conservation concerns are satisfied with the results. Therefore the use of wooden planks and earth fill for the construction of the two-tier bank is suggested. On the lower tier a fibre roll may be used to "seal in" the earth fill and encourage the establishment of reeds. When the roll disintegrates the reeds may be well enough established to bind the earth fill in place. The upper tier may require the use of a conservation seed mix.

4.5.11

Site 29 raises many of the above concerns. Detailed discussions are required between the NRA Engineering group and NRA Conservation, firstly to establish the objectives for this stretch of work, and then to ensure nature conservation protection and/or enhancement issues are duly considered.

4.5.12

Damage to Trees

There are a number of sites where works are proposed in areas of trees. Of particular concern here is Site 21, where the construction of the concrete footing for the wall may interfere with the nearby tree roots. This site is located in a private garden so discussions with the owner, and the Peterborough City Council if necessary, may successfully resolve the potential issue.

4.5.13

Disruption to Birds

Stretches of river where there are wide fringes of emergent vegetation and areas of scrub may be important for birds. However, so long as damage is kept to a minimum and any lost areas are re-established, impacts are likely to be insignificant. Noise or other disruption would only temporarily displace birds. The most sensitive periods for birds is during the breeding season, (ie. March/April to August/September). The proposed NRA works are scheduled to be undertaken between February and June.

- 4.5.14 The February to June programme may result in disruption to nesting birds in areas of reeds which are programmed for lifting, storage and replanting. Although the information available does not suggest that the reeds are particularly important for breeding birds, care must be taken to minimise this potential impact. If a nesting site is observed in a section where works are to be undertaken, appropriate measures to minimise disturbance should be taken by the contractor in consultation with the NRA Conservation section. However, in the long term, there is likely to be a net benefit to reed nesting bird species along this stretch of the River Welland as a result of the re-establishment and possible enhancement of the reed beds.
- 4.5.15 The presence of kingfishers along the river has been confirmed by regular sightings. However, there is no evidence of breeding sites and the absence of vertical (ie eroding) banks suggests this is unlikely.
- 4.5.16 Consequences of Raising Existing Flood Banks
- In locations where existing flood banks are raised there will be a need for both new fill material and for methods of retaining and re-creating the existing vegetation of the site. Site 22 involves perhaps the longest stretch of bank raising and a number of points should be considered. The most appropriate method for the raising of bank would involve the removal of the turf and topsoil and its storage nearby; the addition of fill material; and the respreading of removed material on the surface of the fill. In the majority of cases this would ensure the natural recolonisation of the flood bank and minimise the need for any reseeded. Natural regeneration may take a few seasons before being able to withstand trampling pressure and the site would, therefore, require protective fencing for the duration. This should not, however, restrict access along the top of the riverbank.
- 4.5.17 Habitat Creation Opportunity at Source of Fill
- A number of the proposed works use imported fill. To avoid adverse impacts, the source of the material must be carefully considered. It may be possible to identify a site where the obtaining of material will result in the creation of wildlife habitats (eg borrow pits).
- 4.6 **Landscape**
- 4.6.1 The impact of the proposed works on the existing landscape in the study area is not generally considered to be significant. The proposed works are comprised mostly of low walls constructed in materials designed to complement the existing landscape. Although work is proposed in Conservation Areas, close attention has been paid to the design to ensure that any changes are consistent with the spirit of the planning requirements.
- 4.6.2 The proposed mitigation measures, which concentrate on the detailed construction and appearance of each item of work, are provided in the full landscape appraisal included as Appendix A to this report.

4.6.2

In summary, the possible measures of mitigation and enhancement include:-

- (i) Sites 2, 3 and 4 involve the construction of two new walls (sites 2 and 4) either side of an existing wall (site 3). All of these works are located within the Market Deeping Conservation Area. Sites 3 and 4 are also in the property of listed sites. The landscape assessment identifies the lack of a unifying element along this frontage. The proposed works are of differing heights and site 2 of different material. The appearance of this section of works would be improved if the material in the new walls matched those used in the existing wall at site 3. Unless the residents of site 2 object to the top of the wall projecting above the sill of their patio door, the height of the walls should all be the same. At site 3, stone piers should be built to support gate at its new height, with stone blocks to match those existing.
- (ii) The works at site 21, although outside of any designated Conservation Area, require sympathetic treatment particularly in view of the fact they are visible from both Market Deeping Bridge and the pub garden. Consequently the wall should match the wall on the opposite bank being a natural and local stone, regular coursed rubble wall with recessed mortar pointed joints. The coping should be concrete slabs. The steps must match the wall with stone risers and concrete slabs treads. The footings of the proposed wall should not damage the trees which form an important visual aspect of the stretch.
- (iii) As recommended in the Detailed Appraisal Report, the new wall extending the existing structure at site 7 should match the latter.
- (iv) The raising of the stone wall around the sluice at site 8 should be carried out ensuring the stonework matches that existing.
- (v) The dwarf brick wall at site 9 should be constructed of a stock brick, being more weathered in appearance, in keeping with the character of the section, and the colour complementing the adjacent brickwork. To prevent the wall being hit by car bumpers, the structure should be at least 600mm from the existing kerb.
- (vi) The proposed wall at sites 12 and 13 stretches across two untidy properties in a row of otherwise well maintained back gardens. The height and stonework of the wall should match that existing downstream which is visually more prominent than the wall the other side. The planting of reedbeds in this location would soften the walls' appearance.
- (vii) Sites 24 and 25 are located immediately adjacent to a listed building frontage and therefore particular care must be taken in this location. The wall should reflect very closely the material of the cottages in order to maintain their association with the banks. A natural stone wall (ie. regular coarsed rubble wall with flush joints and appropriate coping) should ensure this continued association. It is suggested that, to avoid creating a feeling of confinement for footpath users, the wall should be set back slightly and the footpath widened in front of the buildings.

- (viii) Following the construction of a new wall at sites 26 and 27, the footpath will require improvement and would benefit from a new wearing course over the full width. The new wall would blend into the area more quickly if the surface of the concrete was brushed to roughen it and create a habitat more conducive to lichen growth.
- (ix) High Locks (site 31), which is within the Conservation Areas of both Deeping Gate and Deeping St James, provides a focal point for the village community and is of potentially national significance in terms of its heritage value. The general restoration and cleaning works proposed will generally enhance the location's appearance. Further enhancement could be achieved by the provision of information boards detailing the history of the locks and Deeping Gate Bridge; the replacing of railings on the road side; and the gentle roughening of the new walls to assist the re-colonisation of vegetation.
- (x) The works raising the existing bank at site 22 should be graded to a smooth and free flowing cross section and should be seeded with a suitable hard wearing grass mix if reseeding is necessary.
- (xi) The path making up site 16 links Low Locks to the main road through Deeping St James. The proposals will improve the existing route by improving the surface, providing easier access to the locks. A sign at the roadside would further enhance the benefits to the local community of the works. The removal and replacement of the dead trees with appropriate species would be beneficial as would the re-setting of the timber barrier at the entrance.
- (xii) The sluice at site 20 is close to a point where cars park and appears to be used as a point of access to the bank. To ensure that erosion does not take place on the proposed stretch to be raised, erosion resistant material and methods should be used. "Enkamat", a "geotextile", or quarry waste may serve this purpose.
- (xiii) The design of the steps at site 30 should match the original steps as closely as possible. The original facing materials might be reused if possible.

4.7 The Built Environment

4.7.1 By improving the defence against flooding, the proposed works will provide a beneficial impact to the built environment. Although no severe flooding has been experienced in the Deepings since 1947, this situation cannot be expected to continue unless the proposed works are implemented (see Section 2.1.4).

4.7.2 Perhaps the main built environment concern in respect of the proposed works is the occurrence in Conservation Areas. Of the 32 proposed work sites, 15 will be undertaken in the Conservation Areas of Market Deeping, Deeping St James or Deeping Gate. However, a range of measures have been suggested and are detailed in Section 4.6.2. These have been developed to ensure neither the structures or aesthetics of sites adversely impacts upon the area.

4.7.3 There are no works proposed to Deeping Gate Bridge which is a Scheduled Ancient Monument.

4.7.4 Sites 3, 4, 15, 24 and 25, 26, 29 and 30 involve works to river banks adjacent to properties identified as Listed Buildings or Buildings of Local Historic Interest. Extreme care should be taken in these locations to ensure that neither the aesthetic nor the structural value of these properties is adversely impacted by the proposals. Assuming that the recommendations included in the previous section and in Table B1 are adopted, it is believed no detrimental impacts will occur, indeed there may well be opportunities for enhancements in the built environment.

4.7.5 The Lock Structures

Section 2.3.4 describes the works proposed to the structures at High Locks and Low Locks. Section 3.7.3 outlines the potential national significance of the structures.

4.7.6 The proposed works to the structures at High Locks will result in the following impacts:

i) Preservation of structures

The proposed works will ensure High Lock's survival as a monument of potentially national significance.

ii) Aesthetic improvement

Given the general restoration, cleaning works and provision of interpretation boards, the works will result in an improved visual appearance. The removal of roots and unnecessary vegetation will also improve the areas.

iii) Retention of river water level

The improvement of the stability of the structures will ensure the locks future as water control structures and therefore maintain water levels and velocities in the river.

iv) Improved safety

The structures are regularly used by pedestrians and the works will enhance their safety.

Given the NRA's dual objectives of maintaining the lock's function as water level control points and achieving environmental improvements, it is difficult to distinguish between mitigation and enhancement. However, Section 5.2 outlines possible additional enhancement measures.

4.7.7 Low Locks comprise two sets of structures. Low Locks - North comprises a weir and vertical gate, and Low Locks - South a vertical sluice gate and the remains of the downstream lock gates. There is no work envisaged at the site of the old downstream lock gate at Low Locks - South (See Figure 4.7.7. The proposals can be expected to result in the following positive impacts:

i) Preservation of structures

The restoration works will ensure the locks survival as a monument of potentially national importance (with the exception of the downstream lock gate at Low Locks - South).

ii) Aesthetic improvement

The repointing of walls, replacement of missing masonry and painting will improve the appearance of the lock site.

iii) Retention of water level

The restoration of the locks will allow continuing control of water levels.

iv) Improved safety

Safety works will improve the stability and safety for members of the public using the area.

The downstream lock gate at Low Locks - South, is in a fragile condition. Although no works are proposed at this site at this stage, any future proposals must be carefully considered in light of its condition.

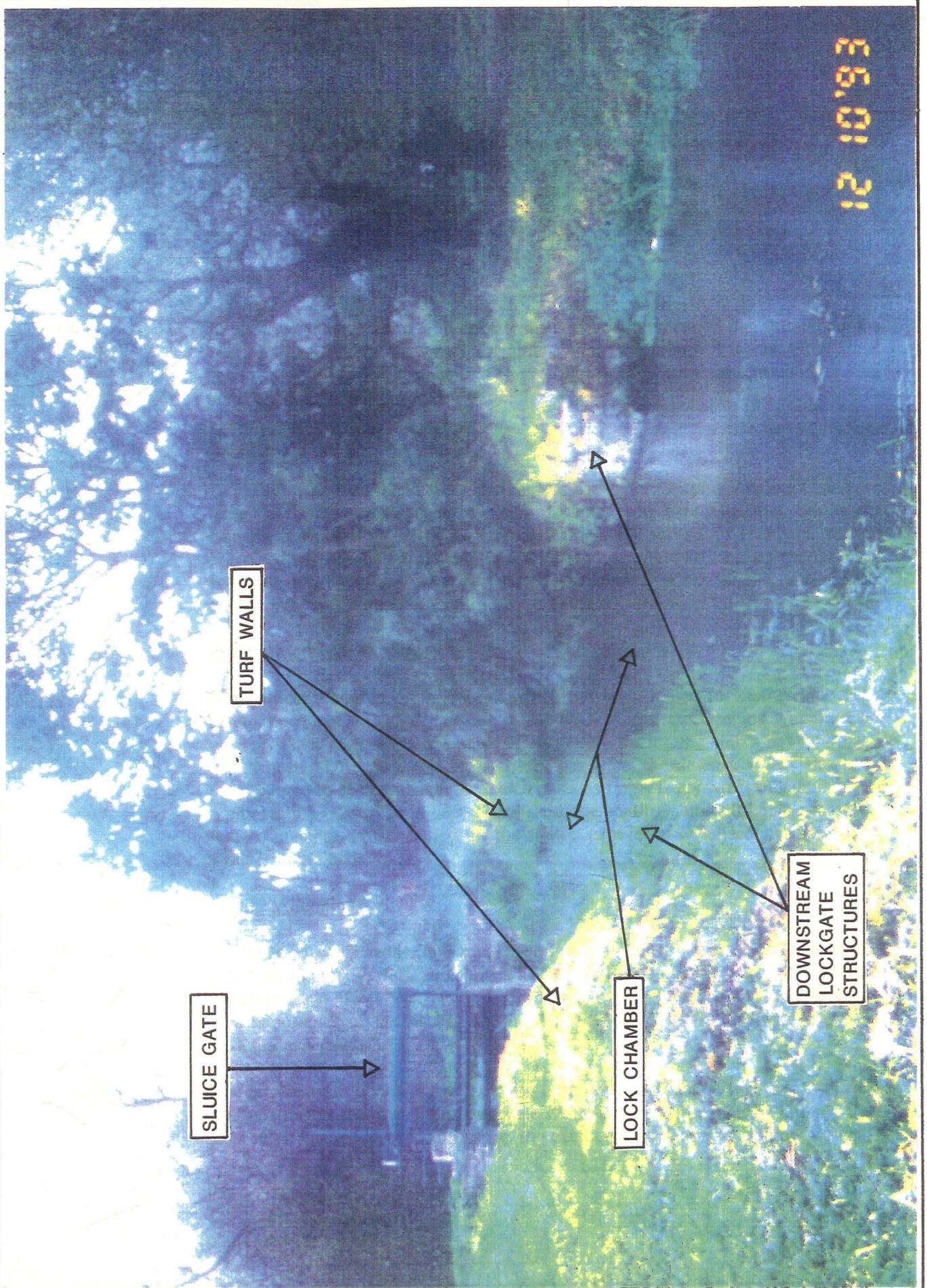
4.7.8. On the basis of the work proposed, it does not appear there will be any significant adverse impacts to the lock structures. However, given the potential national significance of the sites, sympathetic enhancement opportunities should also be investigated. To this end it is recommended that an industrial archaeologist should be asked to conduct a first phase survey of the sites. This would provide verification of the lock's origin but, more importantly, would provide detailed advice to the NRA and the contractor on the materials and methods to be used in the works.

4.8 Archaeology

4.8.1 Where earthworks are proposed as part of any "development" (including flood defence schemes) there is always the potential for an archaeological impact to occur. Guidance from the government, in the form of PPG 16 Archaeology and Planning, recognises this fact. Therefore, any scheme where works have an impact on known or suspected archaeological remains usually requires a programme of fieldwork to assess the effects and the nature of the archaeological environment to be impacted.

- 4.8.2 However, in this case, the modest nature of the proposed works means that there will be little direct effect on known archaeological interests in the area. Work undertaken by Lincolnshire County Council, Archaeology Section, supports this view (LCC, 1993). For the south side of the river, the County Archaeologist for Cambridgeshire has concluded that there will not be any significant archaeological impact from the proposed works.
- 4.8.3 In some instances, fill material will be used (for example, site 22). It is assumed that this will not be obtained from sites of known archaeological importance, otherwise a "watching brief" will be necessary.
- 4.8.4 In the event of any apparent "discovery" being made in the flood banks for which little information is available, the contact name for the appropriate authority is provided in the Appendix C. Consideration of potential impacts on other aspects of the historic environment is given in Section 4.7.
- 4.9 **The Planning Context**
- The location of a number of the proposed works in Conservation Areas could potentially lead to conflict with planning considerations. However, the measures proposed elsewhere in this report (see Section 4.6.2) ensure there will be no significant conflict.
- 4.10 **Recreation and Amenity**
- 4.10.1 The informal recreation in the study area (for example walking and picnicking), is based on the River Welland and the Rights of Way network in the locality. Angling is considered in the following Section.
- 4.10.2 There have been a number of efforts by local interest groups and authorities to improve the basic provision of footpaths for informal recreation. Stiles have been built and a notice board erected to facilitate and indeed encourage the use of walkways in the Deepings area. An opportunity for recreational enhancement centred on the locks structures has been identified earlier in this report.
- 4.10.3 There are unlikely to be any significant adverse impacts on recreation as a result of the proposed works. The vast majority of the use of the river itself (excluding angling, but including, for example, canoeing) occurs during the summer months. Informal recreation on the river banks would also be expected to peak during the summer months. The proposed works are likely to have been completed by June, so the overlap will be relatively small.
- 4.10.4 Although there are unlikely to be any significant impacts as a result of the proposed works, a number of points should nevertheless be considered in order to minimise any disruption to recreational users.

12 10 '93



PROJECT
MARKET DEEPING
FLOOD DEFENCES

TITLE
LOW LOCKS SOUTH :
LOCK CHAMBER
FROM THE S.E.
(Source: LCC:1993)



DATE OCT. 93

SCALE —

DRAWN J.R.

CHKD

Figure 4.7.7

- 4.10.5 Works are proposed for a number of sites either on or adjacent to public footpaths. It is likely that some short term disruption will be experienced by users of these paths. Alternative access and routes should be provided where topography and vegetation allow. A diversion route may require permission from the landowner and will need to be adequately signposted. If a diversion route is not possible, a temporary closure order will be required under the Highways Act 1980.
- 4.11 **Angling**
- 4.11.1 Angling is the largest single riverine recreational activity, continuing throughout the year. During discussions with local groups about the proposed works, three broad headings were identified, under which potential impacts were best grouped: access; matches; and habitat changes.
- 4.11.2 Access
- To ensure fishermen retain access to the river banks, the Deeping Angling Club have rented a number of stretches of bank. Concern was expressed that, during the construction phase of the flood defences, access to sections of riverbank will be prevented. Examination of the proposals show that there will be no restriction of access to the banks. If footpath access is disrupted at any points, an adequate appropriate path should be identified.
- 4.11.3 Fishing Matches
- If a particular stretch of river bank which has been leased to another club for a match, becomes unfishable because of the NRA works, the Deeping Angling Club not only stand to lose the revenue, but also risk reducing the club's reputation as a match host. To ensure this impact does not arise, the defence works should be programmed to accommodate the match dates as far as is known at this time. Once a programme of works has been established, the angling club will be able to ensure that no matches are scheduled for the stretch of river at or adjacent to that where work is being undertaken.
- 4.11.5 Habitat Alterations
- Works to a river channel and bank have the potential to adversely impact angling activities indirectly, through changes to fish habitats which may in turn alter local conditions and effect "catchability", or damage overall fish populations themselves. The importance of the fishery and its dependence on the river environment was outlined in Section 3.11.
- 4.11.6 The occurrence of diverse substrate types is an important feature for fish. The works will not change the diversity of substrate types in the river channel. Similarly there will be no change to bed profiles (ie. the occurrence of deep and shallow water).

- 4.11.7 Vegetation cover (both emergent and bankside) provides an important resource for fish both for shelter and breeding, and as a source of food. The importance of maintaining these features, re-establishing them if damaged, and extending such sites where possible is important for fish and wider wildlife issues and has been considered elsewhere. Generally speaking, the removal of vegetation cover will adversely affect fish, whilst its maintenance or improvement would be beneficial.
- 4.11.8 Water quality has an important bearing both on the presence of fish, and the level of enjoyment received by the angler. Section 4.4, demonstrates that there are no such problems anticipated except in the event of accidental spillage. Procedures in the case of accidental spillage should be consistent with NRA procedure.
- 4.11.9 Management of the water quantity in rivers is a critical consideration in fisheries management. Sustained periods of low flow in rivers may have adverse effect on fish in a number of ways, both chemical and physical. There is a possibility that, in order to allow the improvement of the flood defence works (particularly at sites 26 and 29 where piling is being considered), water levels will need to be reduced. Although at these locations lowering by 0.15m or 0.30m may not make a significant difference to water levels, higher upstream where water levels are significantly lower, the consequences may be important. At the time of writing, the method of construction or re-establishment of the river-bank environment is uncertain, but it is useful at this point to establish the requirements for further consultation prior to the works. In order to work out a suitable method of construction, and identify necessary mitigation measures, liaison should be established and maintained between all intended parties: National Rivers Authority (Engineering, Fisheries, and Conservation sections), the Contractor and the Deeping St James Angling Club.
- 4.11.10 However, at this stage it is envisaged that the timber piles would be driven using hand held equipment from a small floating pontoon. In which case the operation would not require a reduction in water levels during construction.
- 4.11.11 Significant disruption to critical periods of fish development could cause problems for overall populations. However, disruption to areas of reeds during the spawning season would only be temporary and at isolated locations. With the re-establishment and enhancement of reedbeds there are unlikely to be any significant long term impacts.

SECTION 5 CONCLUSIONS AND RECOMMENDATIONS**5.1 Environmental Impacts**

5.1.1 The nature of the flood defence works on the river banks is relatively small scale and, provided that the recommendations contained in the Detailed Appraisal Report (Posford Duvivier, 1993) and in this document are implemented, there are unlikely to be any significant environmental problems. The main potential impacts identified by the appraisal process are given below:-

5.1.2 Conservation Areas

Improvement measures must be designed and constructed using materials and methods consistent with their location in a designated Conservation Area. The location and appearance of any site compounds must comply with the recommendations elsewhere in this report.

5.1.3 Lock Structures

The proposed works must be designed to preserve and enhance the structures. An industrial archaeologist should be appointed to consider, in detail, the materials and methods. Such an investigation should consider all the lock remains, not just those at which works are proposed.

5.1.4 Nature Conservation

The removal of or damage to vegetation and the need for its successful re-establishment is the main concern identified in this report. Provided the recommendations in this report are implemented, however, no significant long-term adverse impacts are anticipated.

5.1.5 Fisheries

Anglers will not be denied access to the river banks for any significant periods. Discussions about the least damaging method to allow piling (if necessary) to take place should be developed including NRA, fisheries and contractor. There should be no adverse impacts on fisheries interests, assuming that the suggestions in respect of nature conservation (vegetation, etc) are implemented.

5.2 Opportunities for Environmental Enhancement

5.2.1 The summary table in Appendix B shows specific steps required at each site, some of which represent enhancement, others which are necessary to ensure the maintenance of the existing value of the location. A number of particularly important enhancement opportunities in the study area are briefly described below.

5.2.2. The Lock Structures

The need for works to the locks themselves, presents an opportunity to enhance a feature which is central to the local community. In association with the restoration works undertaken by the NRA, minor enhancement works should also be undertaken. It is acknowledged that enhancement of this general nature is not be the sole responsibility of the NRA, but it may be possible to consider a joint effort involving the local authorities, English Heritage and other local interest groups.

Appendix A shows sketches indicating the type of measures which may be taken at High Locks in order to enhance the structure's role in the community environment. Timber framed information boards would improve the "visit experience" by allowing appreciation and interpretation of the structures.

5.2.3. Fisheries Habitats

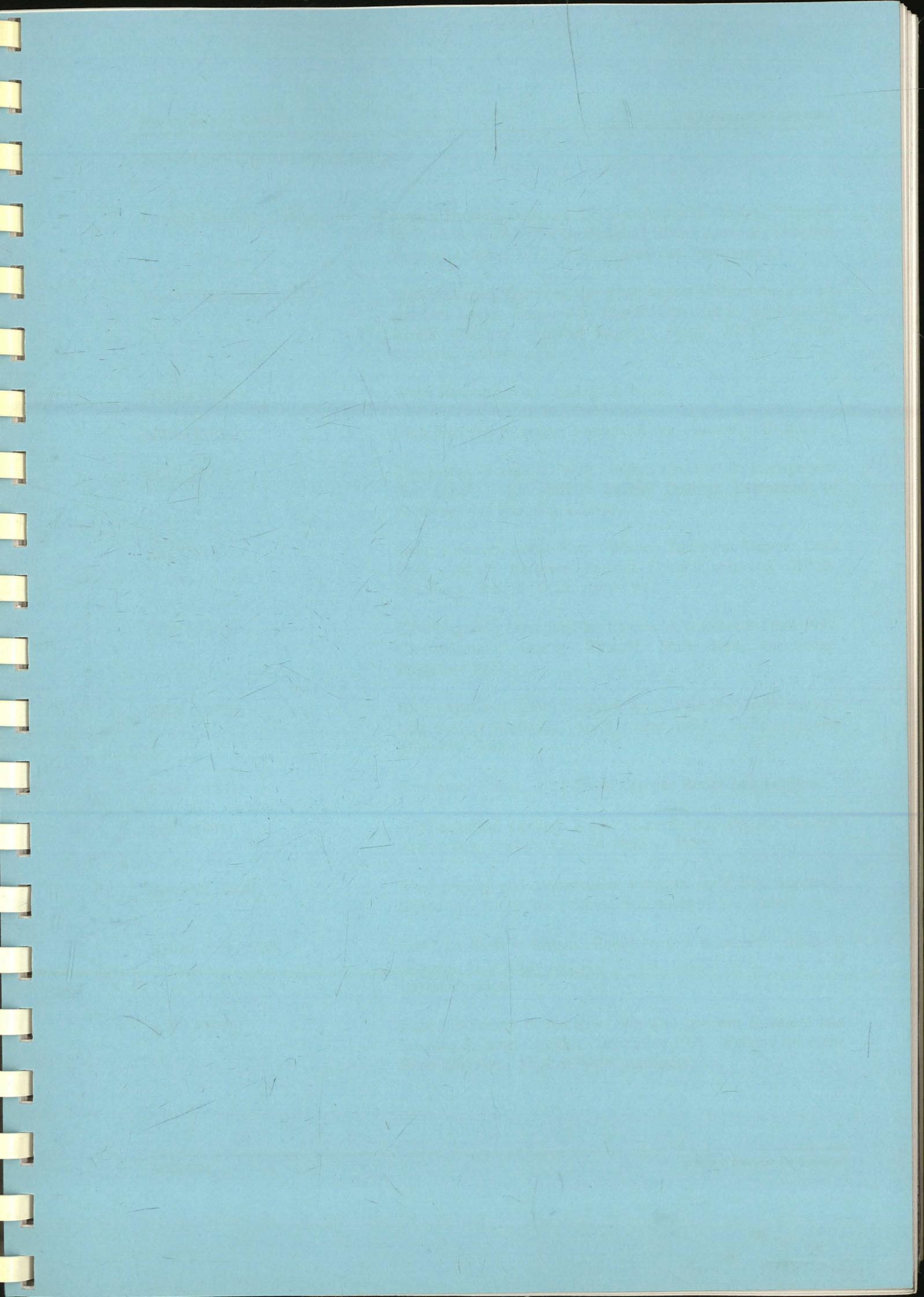
A variety of measures can be taken along rivers to enhance the habitats for the fish resource. Measures for fishery enhancement range from the maintenance of aquatic vegetation to the provision of artificial bed obstacles, but the main criteria is cost. For the stretch of the River Welland within the study area, the current state of the fishery indicates that specific enhancement measures are not a necessity. However, a number of the measures proposed (eg. vegetation replacement and extension) are likely to enhance the fishery.

5.3 Liaison Requirements

5.3.1 In order to ensure that the construction works are undertaken in sympathy with the environmental concerns in the area, a number of requirements for future liaison are recommended. The type of communication or liaison entered into will be dependant on the requirements of the groups themselves. Certain groups may expect continued consultation, but more commonly the agencies will need to be kept informed of progress, adherence to programme, etc. Table 5.3.1 summarises the liaison suggested at this stage.

Table 5.3.1 Liaison Requirements

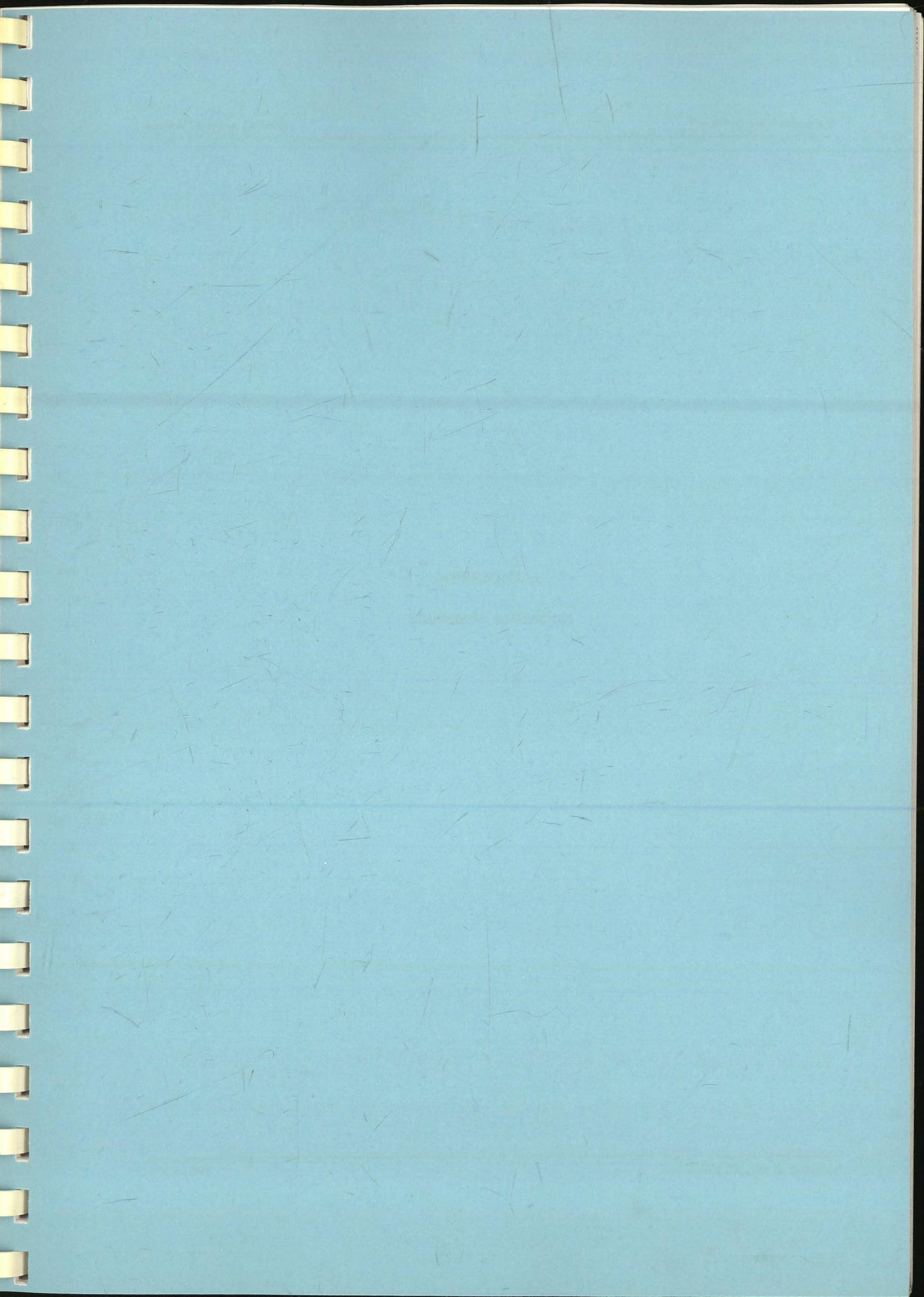
GROUP	INTEREST	COMMUNICATION MEDIA
Local Community (Welland Watch, Deepings Heritage, etc)	General disruption, footpath re-routing, programme of works	Consultation. Temporary notice boards.
Residential property owners	General disruption, noise, etc.	Consultation. House visits. Letter drops.
Deeping Angling Club	Water level changes	Consultation.
Community Archaeologist County Archaeologists	Archaeology	Consultation. Reporting of 'finds'.



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APPENDIX A

Landscape Assessment

Market Deeping Flood Defences

Landscape Appraisal

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For Posford Duvivier Environment
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Peterborough PE3 8DW

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1.0 **INTRODUCTION**

1.1 This landscape assessment forms part of an overall environmental appraisal of proposals to upgrade existing flood defences to a stretch of the River Welland, which is being carried out by Posford Duvivier Environment for the NRA. The stretch of river runs through Market Deeping and Deeping St. James in south Lincolnshire and the proposals comprise improvements at a number of locations along the river. The main environmental appraisal report outlines the background information to the proposals, and the location and extent of the study area.

1.2 This report assesses the impact of the works on the landscape and comprises:

- i. An assessment of the existing landscape character and sites of interest within the study area.
- ii. An assessment of the impact and significance of the proposed works on the existing landscape, with suggested mitigation measures to offset any adverse impacts.
- iii. Suggestions for enhancement of the existing landscape where appropriate.

1.3 The landscape assessment has been carried out to the methods and procedures provided by the National Rivers authority. (Conservation Technical Handbook No. 2. River Landscape Assessment, Methods and procedures. NRA 1993).

2.0 EXISTING LANDSCAPE

2.1 SITE CONTEXT

Market Deeping is situated north west of Peterborough on the border between Lincolnshire and Cambridgeshire, in the fertile, agricultural landscape of the fens. The town lies on the northern banks of the River Welland, which forms the county boundary.

Market Deeping is a historic market town, built up along the northern banks of the River Welland, merging with the village of Deeping St. James on its downstream side. The town is surrounded by the drains, dykes and cuts that are a familiar part of the fen landscape, and several flooded gravel pits, making water and its associated landscape and vegetation, a dominant characteristic of this area.

There are three Conservation Areas in the Deepings, containing a number of listed buildings, buildings of local historic interest and protected frontages (See Fig. 1 and Drawing No.s 1 and 2 in the back of the report). The River Welland passes through all three Conservation Areas.

2.2 THE RIVER WELLAND

The river is an integral part of Market Deeping, running parallel to the High Street on the southern edge of the town. It is a fairly straight river, once navigable and linked to the Stamford Canal upstream. There are a number of areas of varying landscape character along the river. Running close to the edge of the town, it passes through a mixture of urban and rural settings, commercial and residential, sometimes to the rear and sometimes to the front of the properties, and through both pastoral and arable fields. It is at times enclosed, and at times open allowing views and access to its banks from the town. Section 3 of this report breaks the river down into the different character areas (See Fig. 2), giving a more detailed description of the character and views within each section.

Characteristics of this stretch of the river include reed margins, which run along both banks for most of its length. Buildings and structures are mostly stone, with later ones of brick. Against the banks of the river through built up areas, dwarf walls of stone, brick or concrete are common, usually matching the material of the adjacent buildings. Grassed bunds set back from the banks are a common flood defence alongside open areas and within private gardens that back onto the river.

It is an attractive area, and one in which the character and characteristics outlined above should generally be conserved.

2.3 POINTS OF INTEREST (See Fig. 1)

2.3.1 High and Low Locks

High and Low Locks are historic lock structures, legacies of the Stamford Canal, which was operational around the 17th and 18th centuries. It has been suggested that they may be among the oldest, if not the oldest, conventional locks in the country. They certainly have value as historic and landscape features.

The locks have very different characters. High Locks is an open area in the centre of the town within the conservation area, and is a popular place for fishing and just for sitting by the river, with grassy banks and seats nearby.

Low locks, further downstream in Deeping St. James, is a secluded spot, away from the road and surrounded by mature trees. Despite the locks suffering from graffiti, this is an attractive, quiet place, with pleasant views of the river.

2.3.2 Deeping Gate Bridge

This bridge and adjacent medieval chapel, are within the conservation area just downstream from High Locks. Both the bridge and the chapel are scheduled ancient monuments. The open, grassy banks here allow good views of both Deeping Gate Bridge and of High Locks.

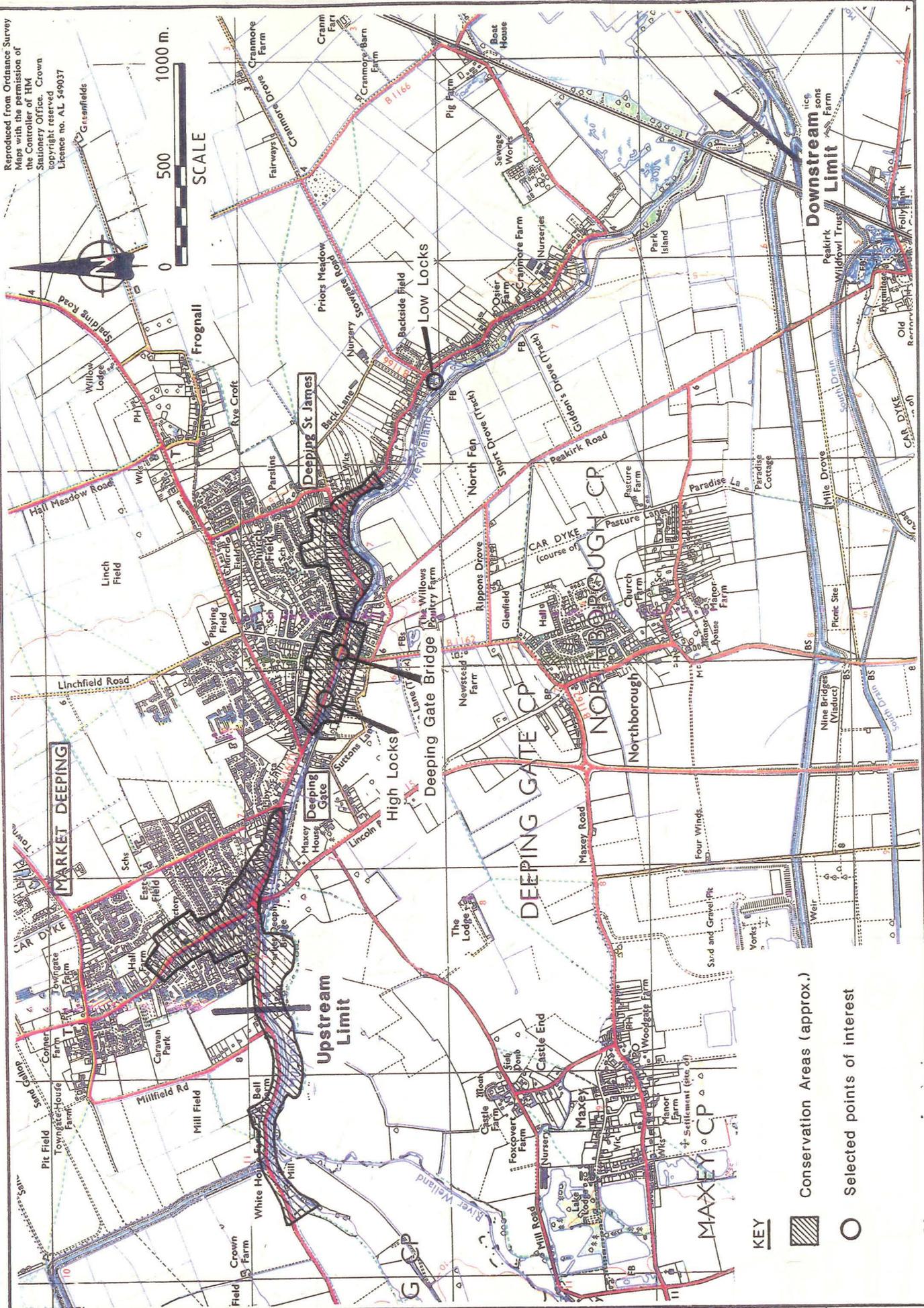
2.3.3 Deeping Gravel Pits

Towards the downstream limit of the study area, beyond the built up area, the river passes by Deeping Gravel Pits, which are a Site of Special Scientific Interest (SSSI).

2.4 RECREATION AND AMENITY

Much use is made of water for recreation in this area, with footpaths following the course of rivers and flooded gravel pits used for leisure pursuits. A public footpath follows much of the course of the River Welland, continuing through Market Deeping on its southern bank until it reaches Deeping St. James, passing High Locks and Deeping Gate Bridge. Although it does not continue as far as Low Locks, there is a footpath link connecting the locks to the main road through Deeping St. James. There are a number of open areas with seats and grassy banks for sitting by the river, and spots that are popular for fishing, particularly High Locks.

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KEY

 Conservation Areas (approx.)

 Selected points of interest

PROJECT
**MARKET DEEPING
FLOOD DEFENCES**

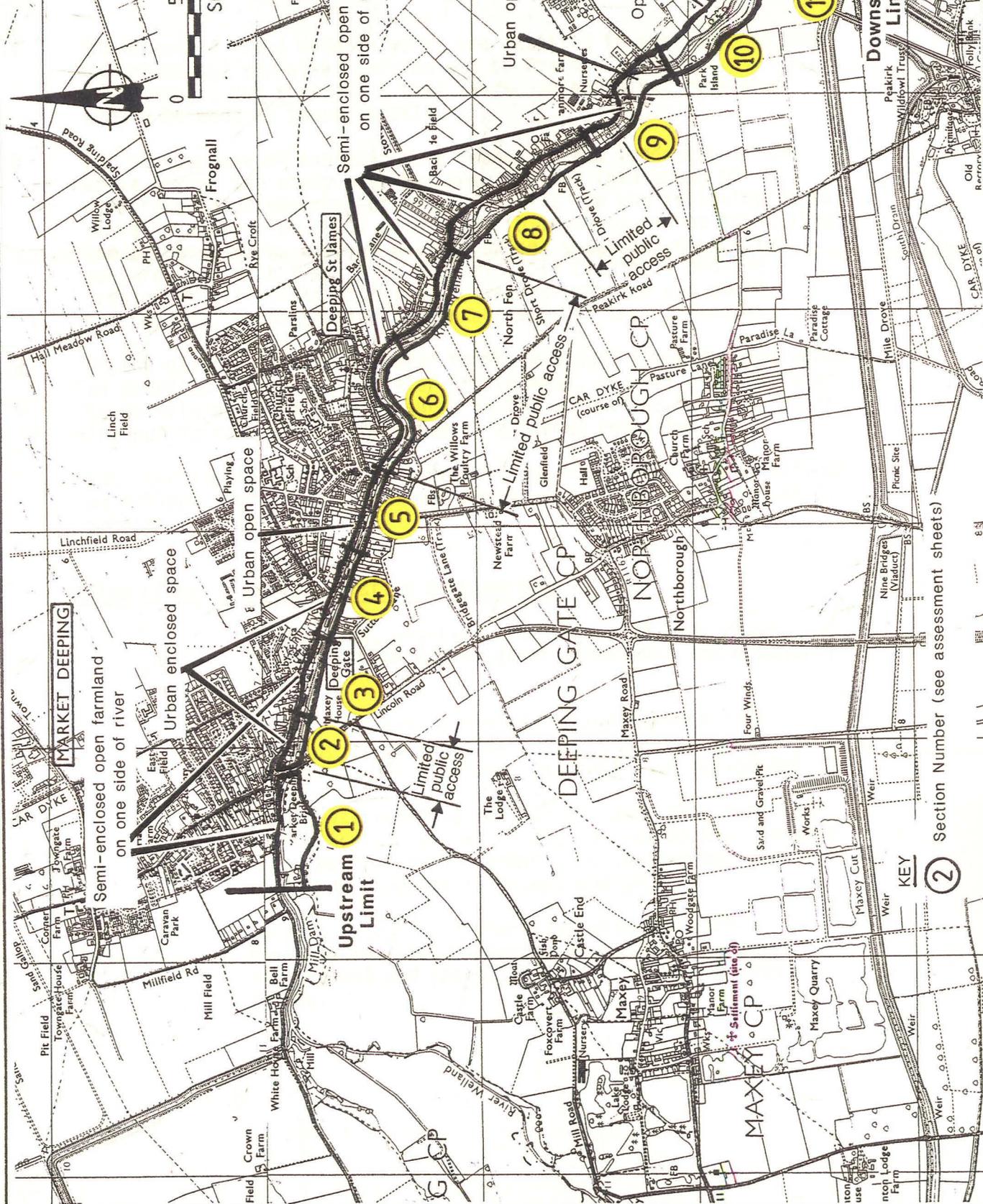
TITLE
SITE CONTEXT

**POSFORD
DUVIVIER
ENVIRONMENT**

DATE OCT. '93
DRAWN J.R.
SCALE As shown
CHKD

Figure 1

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Section Number (see assessment sheets)

KEY ②

PROJECT

MARKET DEEPING
FLOOD DEFENCES

TITLE

LANDSCAPE
ASSESSMENT
LANDSCAPE
CHARACTER AREAS

**POSFORD
DUVIVIER
ENVIRONMENT**

DATE OCT. '93

SCALE As shown

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CHKD *[Signature]*

Figure 2

3.0 LANDSCAPE APPRAISAL

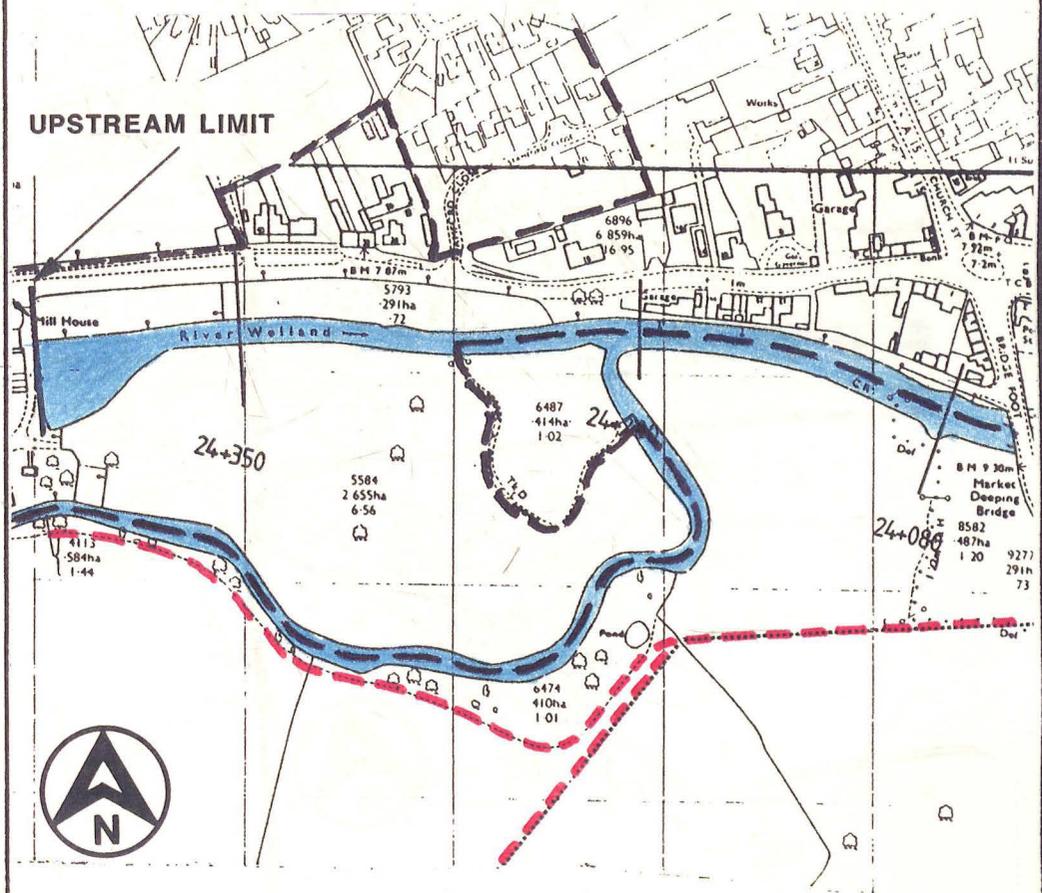
- 3.1 The proposed flood defence works are detailed in section 2 of the environmental appraisal carried out by Posford Duvivier Environment, and throughout this landscape appraisal reference should be made to those details.
- 3.2 For the purpose of assessing the impact on the landscape of the above works, the study area has been divided into areas of differing landscape character (See Fig. 2). On the following pages there is a description of each area, followed by tables scheduling the proposed works with an evaluation and suggested mitigation measures for each item. The appendices in Section 4 provide greater detail of the mitigation measures proposed and where appropriate, opportunities for enhancement of the landscape.
- 3.3 On the plans, the numbers refer to the proposed flood defence works as detailed by Posford Duvivier Environment, and the letters refer to details of mitigation measures in the appendices to this report. The public footpath is indicated by a dashed red line.

Each section has been given a broad value class from 1 - 4, defined as follows (Ref: River Landscape Assessment, Technical Handbook 2, published by the NRA).

<u>Value class</u>	<u>Characteristics of Landscape</u>
1	Very strong, positive character with many valued features which are of great importance and essential to conserve.
2	Strong, positive character though perhaps some evidence of degradation. Should generally be conserved, but may need restoration or management.
3	Some positive character but evidence that this has generally been eroded. These landscapes will benefit from restoration of landscape character but may also have some capacity to accept change.
4	Largely negative in character with few strong positive features, offering significant scope for enhancement and potentially able to accommodate change.

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THERE ARE NO FLOOD DEFENCE WORKS
 PROPOSED IN THIS SECTION



--- CONSERVATION AREA

PROJECT
**MARKET DEEPING
 FLOOD DEFENCES**

TITLE
LANDSCAPE ASSESSMENT

SECTION
1

**POSFORD
 DUVIVIER
 ENVIRONMENT**

DATE OCT. 93 SCALE N.T.S.
 DRAWN S.C. CHKD *SP*

VALUE CLASS 3

Description

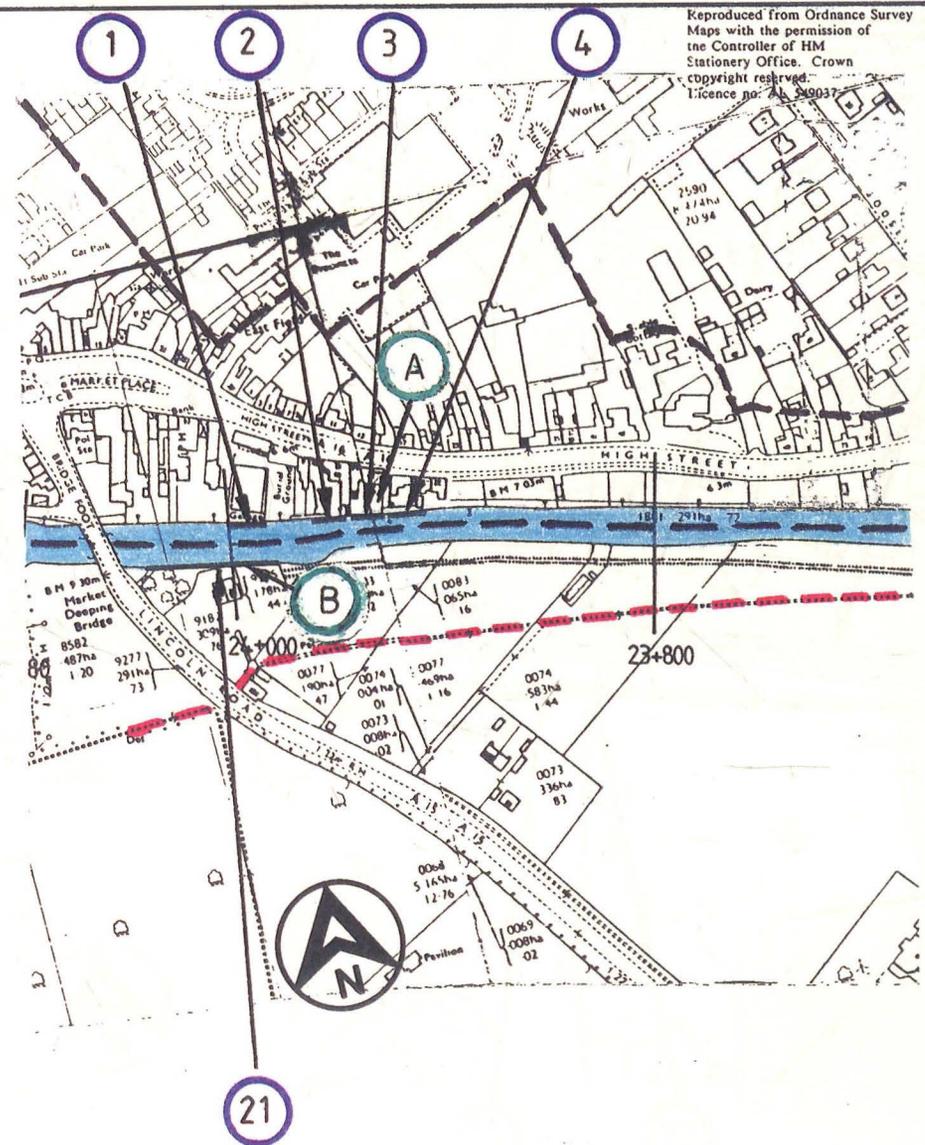
This section is enclosed on both sides by private land, on the north side by the rear of the residential and commercial properties that face Market Deeping High Street, and on the south side by residential properties and fields used for grazing horses. There is an attractive view of the river from Market Deeping Bridge and the adjacent pub garden, but otherwise this section is mostly inaccessible to the public. The public footpath crosses the paddocks to the south away from the waters edge, from where the rear view of the properties on the north bank can be seen. With their mixture of styles, materials and colour, they present a haphazard and untidy scene.

Proposed Works

Evaluation

Mitigation

1 Dwarf concrete block wall	Very little impact as wall is low and not visible from footpath or bridge.	None required
2 Dwarf concrete block wall	These 3 sites are adjacent to each other, with only site 3 having an existing good quality stone wall. Those proposed either side are of differing heights and (site 2) of a different material, where already a unifying element is lacking.	The appearance of this section will be improved if the material in the new walls matched those used in the existing wall at site 3. Unless the residents of site 2 object to the top of the wall projecting above the sill of their patio door, the height of the walls should all be the same (See Appendix A).
3 Reinforce existing stone wall and raise steps and gate		
4 New stone wall	Site 3 - the proposal to raise the steps will leave the gate protruding above the top of the wall.	Site 3 - Piers to match the existing stone wall should be built to support the gate (See Appendix A).
21 Dwarf stone wall	This is an attractive stretch of the river, with mature trees on both banks, and visible from Market Deeping Bridge and the pub garden - requires sympathetic treatment.	Wall should match the wall on the opposite bank ie. a natural stone regular coursed wall with a flat coping. Steps over the wall should correspond (See Appendix B).



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PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE LANDSCAPE ASSESSMENT	SECTION 2	POSFORD DUVIVIER ENVIRONMENT	DATE OCT. 93	SCALE N.T.S.
				DRAWN S.C.	CHKD <i>SP</i>

VALUE CLASS 2

Description

This section is more open than the previous one. Pasture fields to the south create a pleasant, rural feel with the footpath now meeting the river and following the bank for the next 1/2 mile. The north side has some residential and commercial properties backing onto it, but opens out frequently allowing views to and from the river, and occasional access from Market Deeping High Street, where in one place seats have been provided overlooking the river.

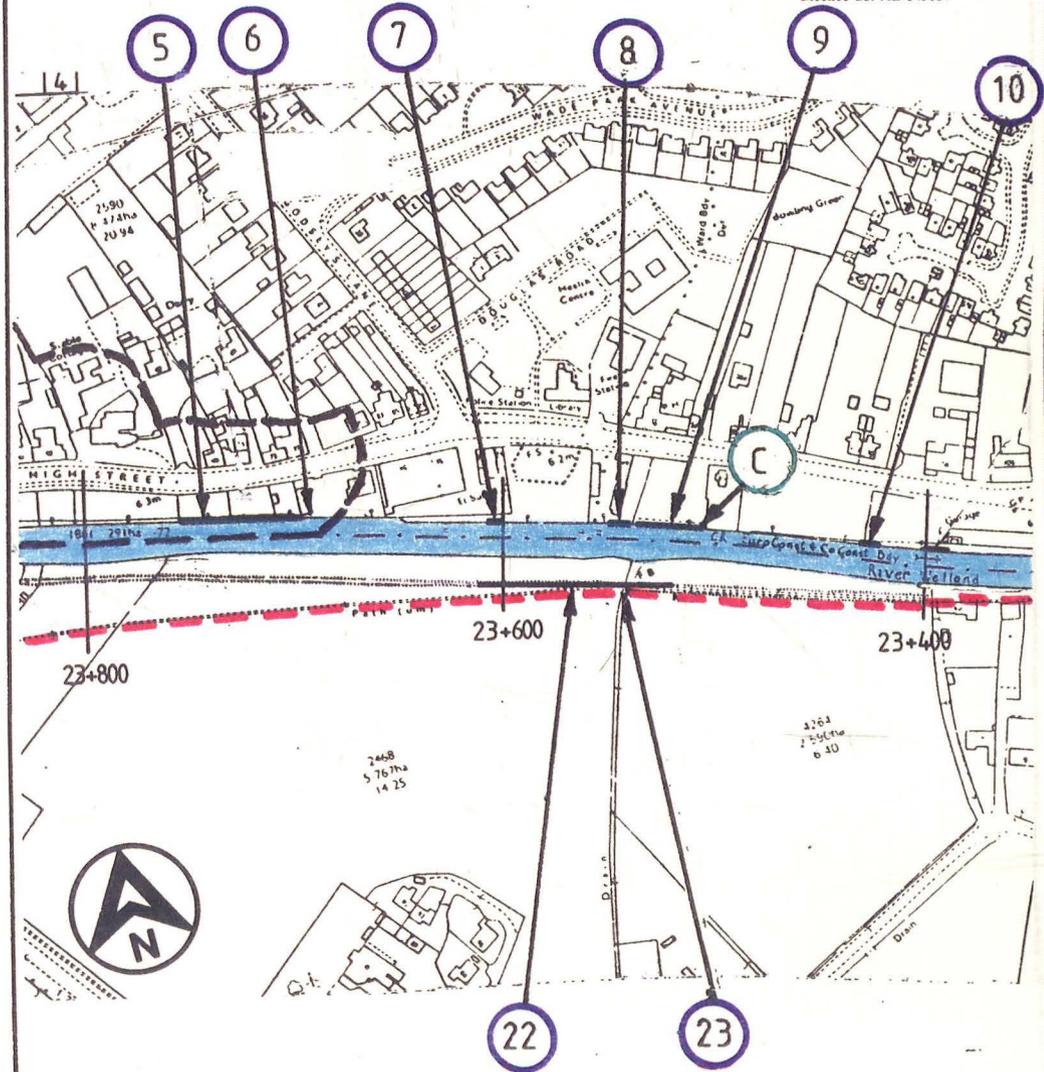
Proposed Works

Evaluation

Mitigation

5 Double skin planking	Planking will be no higher than the existing bund, so the pleasant views in both directions will be retained. The existing reed beds will soften the new hard edge viewed from the footpath.	Minimise disturbance to existing vegetation.
6 Install flap Valve	No visual impact	None required
7 Extend existing brickwall	This is a short extension of an existing wall which is low and visually unobtrusive. No visual impact.	Brickwork to match existing.
8 Raise stone wall around sluice	Existing sluice is stone. Raising the stonework will have no detrimental visual impact, and offers the chance to level out the top which is currently uneven.	Stonework to match existing
9 Dwarf brick wall	This runs along the back of a car park with an open grass bank to the river, so will be fairly prominent. It could have a positive impact, obscuring the tarmac seen from the footpath, whilst retaining the views either way.	A stock brick would have a softer, more weathered appearance, in keeping with the character of this section. The colour should complement the adjacent brickwork. The wall should be at least 600mm from the existing kerb to prevent it from being hit by car bumpers (See Appendix C).

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PROJECT

**MARKET DEEPING
FLOOD DEFENCES**

TITLE

LANDSCAPE ASSESSMENT

SECTION

3

**POSFORD
DUVIVIER
ENVIRONMENT**

DATE OCT. 93

SCALE N.T.S.

DRAWN S.C.

CHKD

10 Close gap in
brick wall

This is a short extension
to an existing wall which is
unobtrusive. No visual
impact.

Brickwork to match
existing.

22 Raise existing
earth bank

A raised bank (approximately
300mm) already exists across
these fields so there is
little visual impact in
raising it a further
200mm.

Bank to be graded to
smooth and free flowing
contours and overseeded
with a suitable hard
wearing grass mix.

23 Reconstruct sluice No visual impact
with flap valve

None required.

PROJECT

MARKET DEEPING
FLOOD DEFENCES

TITLE

LANDSCAPE ASSESSMENT

SECTION

3

(CONT.)

 POSFORD
DUVIVIER
ENVIRONMENT

DATE OCT. 93

SCALE

DRAWN

CHKD *LP*

VALUE CLASS 2

Description

The character of the landscape again becomes enclosed, with mainly residential properties on both sides. The narrow footpath continues along the southern bank between stone cottages and the well-maintained river bank, then opens out briefly past a pasture field and closes again past high boundary walls of the adjacent properties. The footpath is narrow and fairly confined throughout this section.

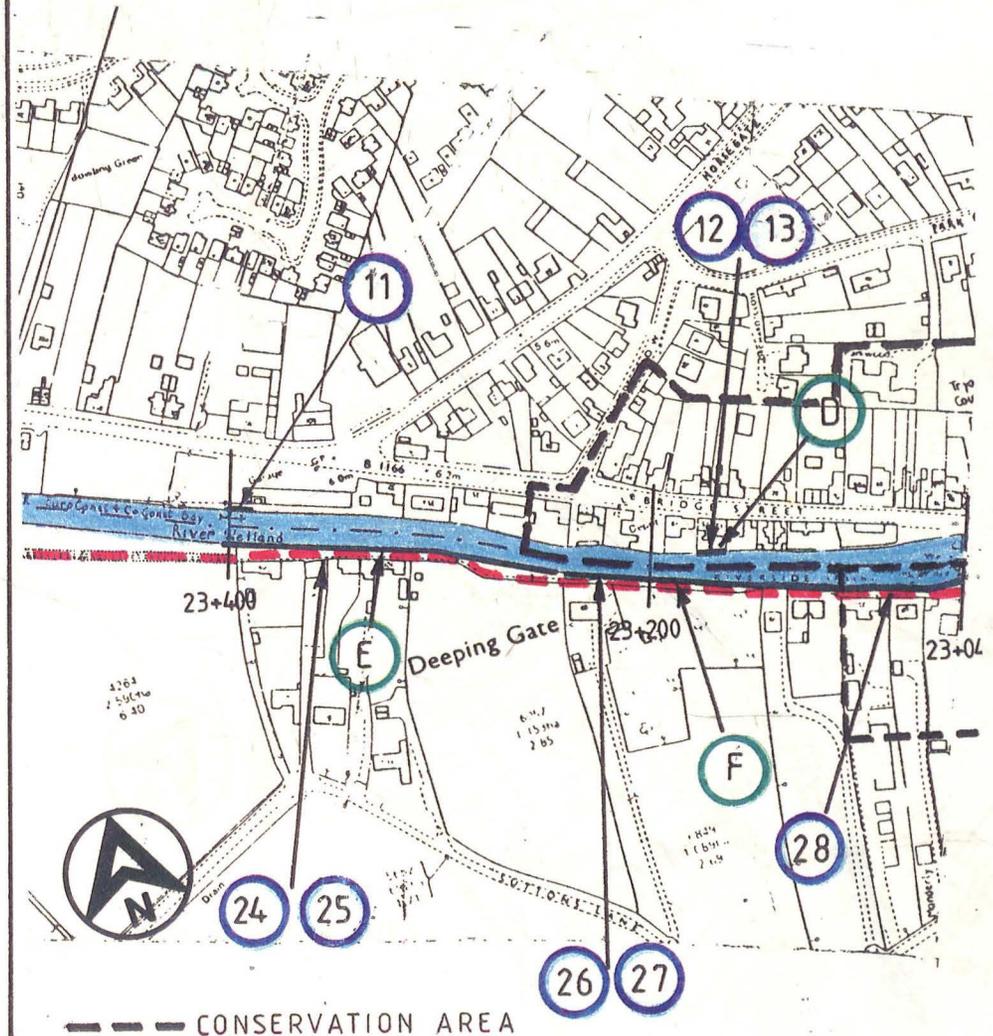
Proposed Works

Evaluation

Mitigation

11 Replace existing wall with brick wall	This is a short extension to an existing wall which is unobtrusive. No visual impact.	None required.
12 & 13 Dwarf stone wall	This stretches across two untidy properties in a row of otherwise well maintained back gardens. There are stone walls either side. It will improve the appearance of these properties and the overall view of this stretch of the river.	Reed beds should be re-established in front of the new wall, to soften it and avoid an otherwise continuous hard edge. Heights of the wall should tie in with adjacent walls (See Appendix D).
24 & 25 Dwarf stone wall set into existing bund	This stretch of the bank is well maintained by the residents whose doors open directly onto the narrow footpath. The wall here should reflect very closely the material of the cottages in order to maintain their association with the banks, and should avoid creating a feeling of confinement for footpath users.	Natural regular coursed stone wall to match the buildings. The wall should be set back slightly and the footpath widened in front of the buildings (See Appendix E).
26 & 27 Re-establish bank and repair wall. Demolish and reconstruct failed wall	Re-establishing reed beds would improve this section of the river, replacing an overgrown, untidy bank and maintaining the continuity of the reed margins. Reconstructing the concrete wall will have an initial impact, but should quickly age and blend with the old.	Following construction of the new section of wall, the footpath will require making good, and would benefit from a new wearing course over the full width of the path (See Appendix F).
28 Add concrete cill to gap in flood walls.	This will have no detrimental visual impact.	None required.

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PROJECT

**MARKET DEEPING
FLOOD DEFENCES**

TITLE

LANDSCAPE ASSESSMENT

SECTION

4

**POSFORD
DUVIVIER
ENVIRONMENT**

DATE OCT. 93

SCALE N.T.S.

DRAWN S.C.

CHKD *JP*

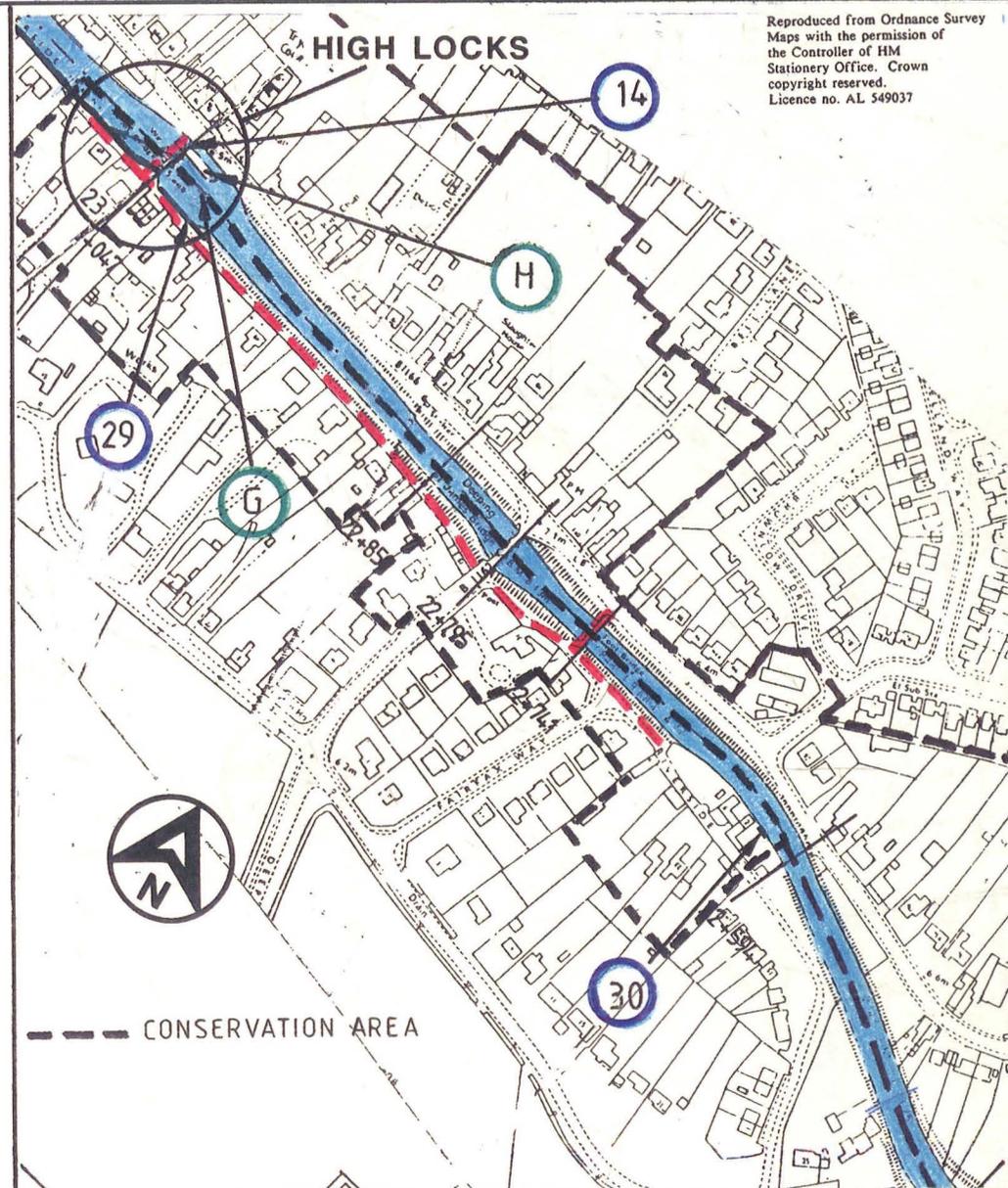
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VALUE CLASS 1

Description

This section opens out, with grassy banks along both sides of the river for most of its length, providing the most popular points of access to the river. This is an attractive stretch, and the whole of the southern bank is within Deeping Gate conservation area. Two major points of interest, High Locks and Deeping Gate Bridge, feature here and there are good views of both, though there are no signs or information relating to either. The area is popular for fishing and for sitting by the river.

<u>Proposed Works</u>	<u>Evaluation</u>	<u>Mitigation</u>
HIGH LOCKS		
14 Fix toe plates to footbridge	No visual impact	None required
29 Re-establish bank in front of wall and repair cracks	This will enhance the area, continuing the reed margins and softening the edge where there is currently no vegetation	None required
31 Restoration of structures, provision of scour protection and safety works	There is an opportunity here for further enhancement of High Locks. If these are as old as suggested, see section 2.3.1, then some form of interpretation should be provided in addition to improving the overall appearance.	Further investigation into the history of the locks. Provision of a sign and information board, detailing the history of the locks and of Deeping Gate Bridge. Replace railings on road side (See Appendices G/H)
30 Raise steps	This work is within private property. There will be no impact on the general landscape.	As required by residents.



PROJECT

**MARKET DEEPING
 FLOOD DEFENCES**

TITLE

LANDSCAPE ASSESSMENT

SECTION

5

**POSFORD
 DUVIVIER
 ENVIRONMENT**

DATE OCT. 93

SCALE N.T.S.

DRAWN S.C.

CHKD *JP*

Description

VALUE CLASS 2

At this point the public footpath ends and there is no longer public access along the river. The river is flanked by private gardens on its northern side, and by arable fields on its southern side.

Proposed Works

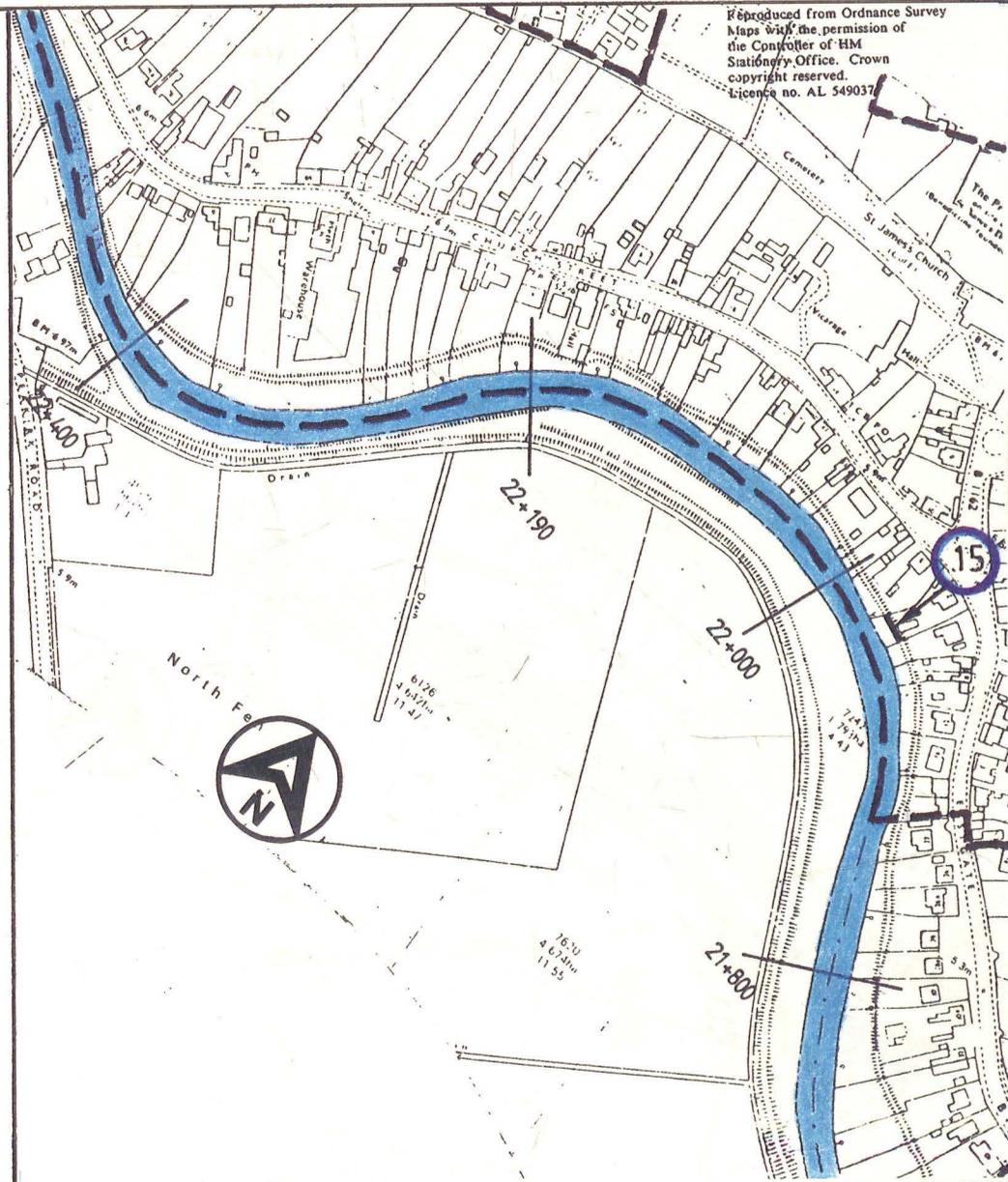
Evaluation

Mitigation

15 Double skin planking

This work is within private property. There will be no impact on the general landscape.

As required by residents.



PROJECT

**MARKET DEEPING
FLOOD DEFENCES**

TITLE

LANDSCAPE ASSESSMENT

SECTION

6

**POSFORD
DUVIVIER
ENVIRONMENT**

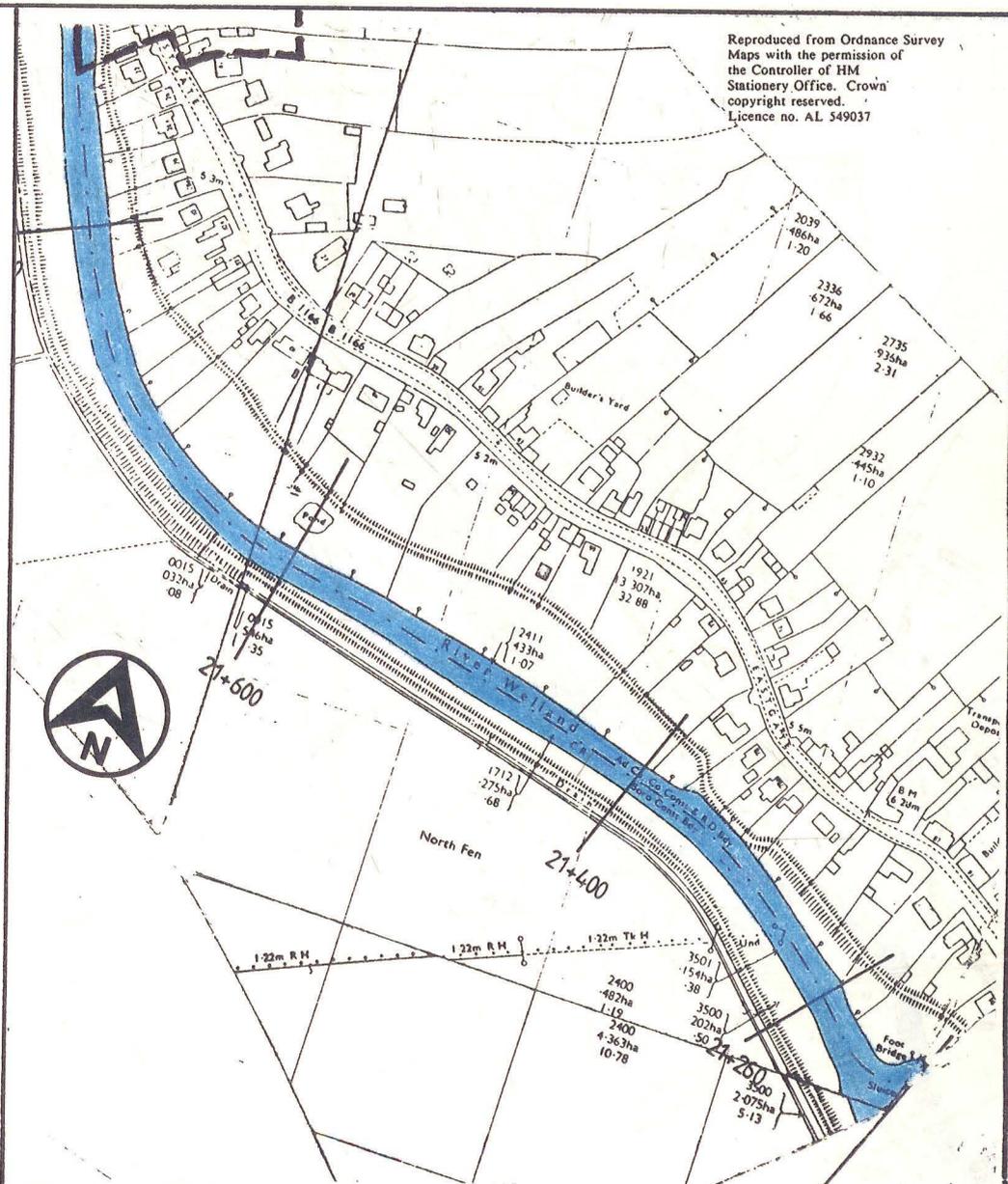
DATE OCT. 93

SCALE N.T.S.

DRAWN S.C.

CHKD

THERE ARE NO FLOOD DEFENCE WORKS
PROPOSED IN THIS SECTION



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<p>PROJECT MARKET DEEPING FLOOD DEFENCES</p>	<p>TITLE LANDSCAPE ASSESSMENT</p>	<p>SECTION 7</p>	<p>POSFORD DUVIVIER ENVIRONMENT</p>	<p>DATE OCT. 93 DRAWN S.C.</p>	<p>SCALE N.T.S. CHKD JP</p>
---	--	-----------------------------	--	--	---

Description

The dominant feature in this section is Low Locks. This is a pleasant, secluded area set back from the road behind houses and surrounded by mature trees, with an attractive view of the river upstream. The locks suffer from some graffiti. A footpath links the area to the main road through Deeping St. James, but like High Locks, there are no signs or information boards provided. The rest of this section, like the previous two, is flanked by private gardens on the northern bank and arable fields to the south.

Proposed Works

16 Make up and asphalt path

32 Restoration of structures, provision of scour protection and safety works

Evaluation

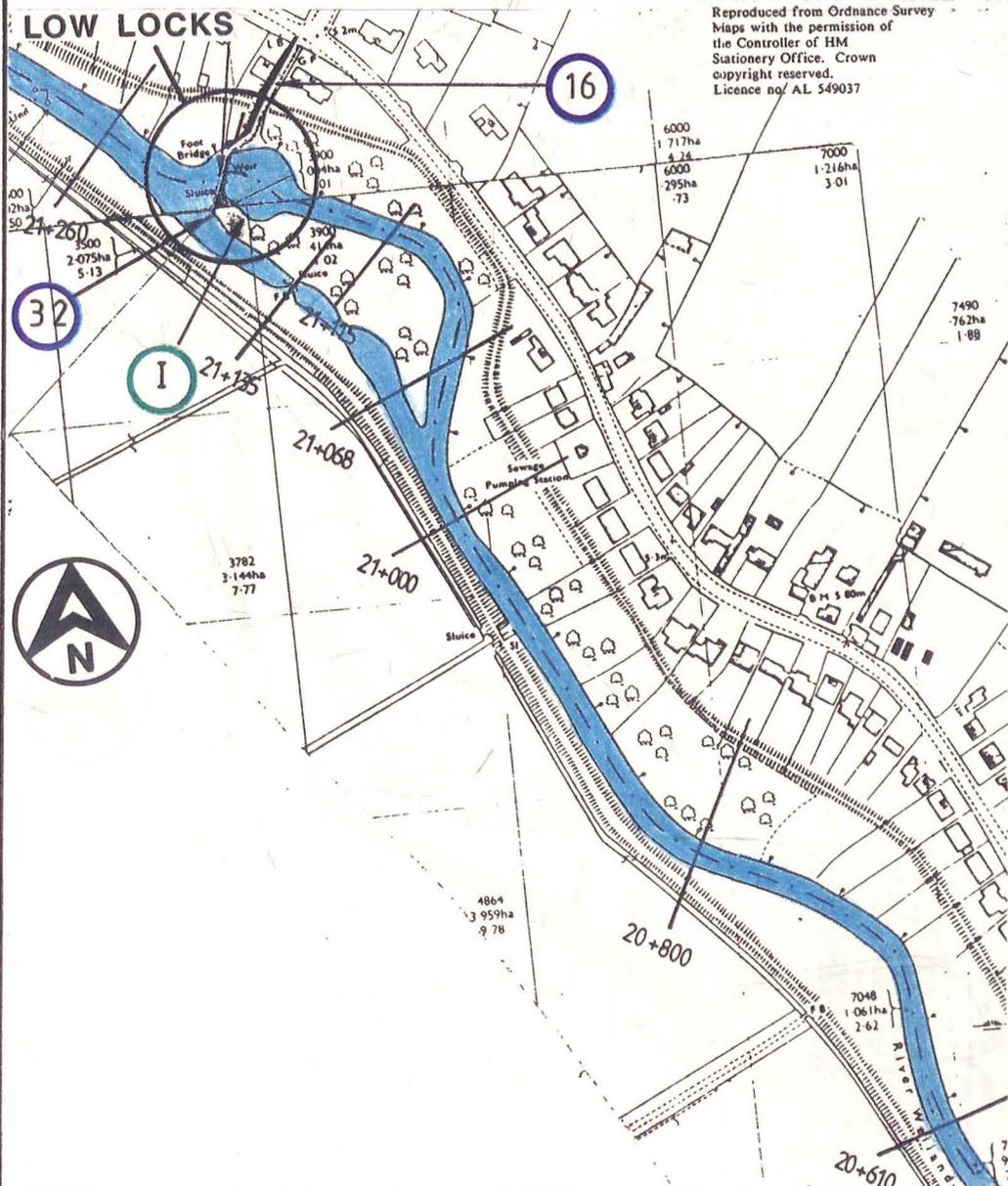
This path links Low Locks to the main road through Deeping St. James. The proposals will improve the surface, providing an easier, smoother access to Low Locks. There is no sign at the roadway to indicate the presence of the locks.

Like High Locks, see section 5, this is an historic area offering the opportunity for further enhancement. It would also benefit from some form of interpretation in addition to general improvement works.

Mitigation

Provision of a sign at the roadside indicating Low Locks. Reset timber barrier at the entrance. Remove dead Elms (5 No.) and replace with appropriate tree species ie. *Crataegus monogyna* -(Hawthorn)
Sorbus aucuparia -(Rowan)

Further investigation into the history of the locks. Provide an information board. Repaint metalwork and rebuild section of wall (See Appendix I).



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PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE LANDSCAPE ASSESSMENT	SECTION 8	POSFORD DUVIVIER ENVIRONMENT	DATE OCT. 93	SCALE N.T.S.
				DRAWN S.C.	CHKD LP

Description

As the houses become fewer and fewer, the river again comes close to the road and is open and accessible, becoming progressively more rural in character. This is a quieter, residential area. There is a green by the river, but otherwise no features of particular interest and no public footpath.

Proposed Works

Evaluation

Mitigation

- 17 Double skin Planking
- 18 Double skin planking
- 19 Raise bank

Sites 17, 18 and 19 are within private property. There will be no impact on the general landscape.

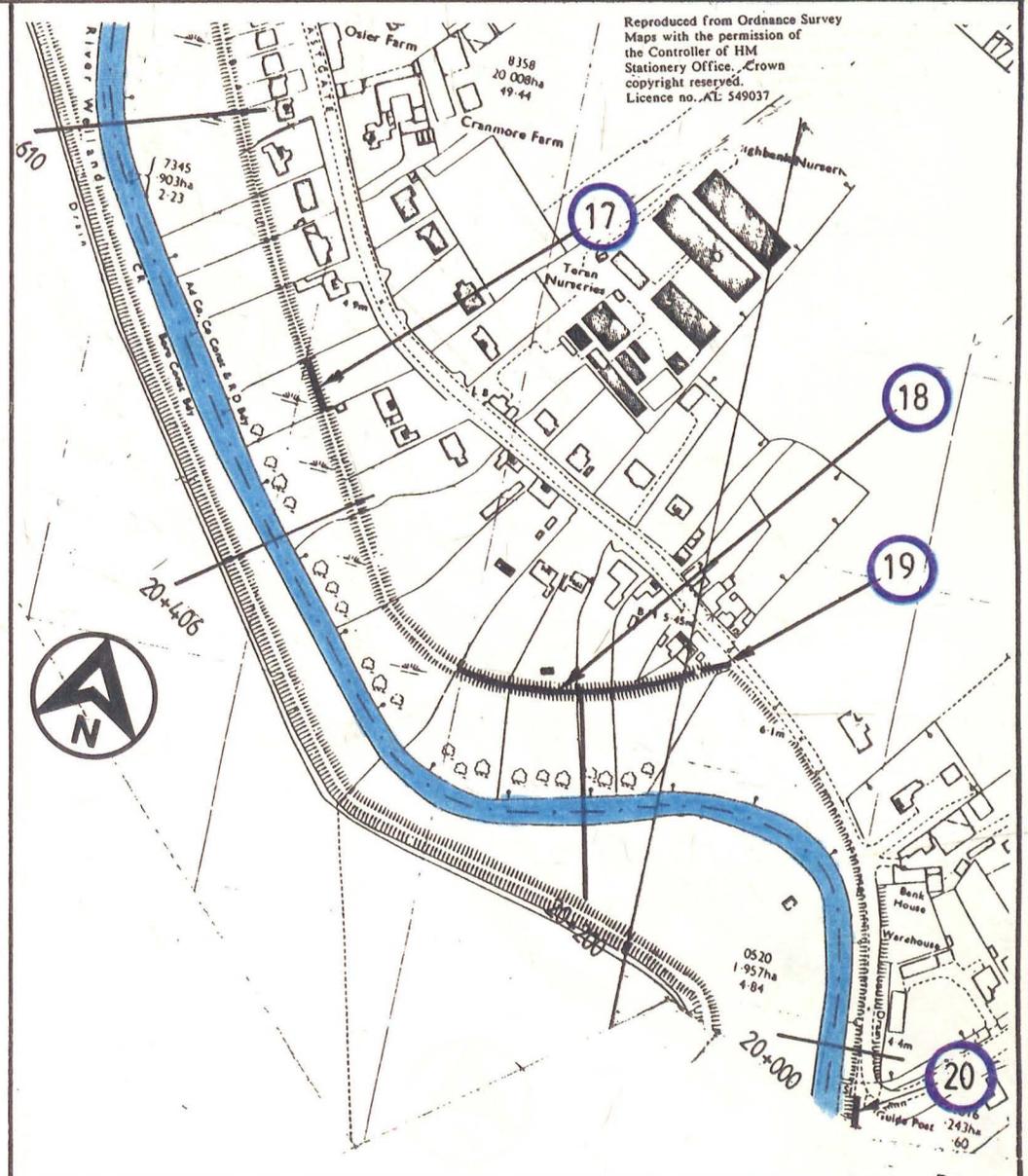
As required by the residents.

Site 19 - There are many mature trees and shrubs close to this bank, and care should be taken not to raise the ground level around the base of the trunks.

- 20 Raise bank

This is over a sluice, close to a point where cars park at the beginning of a track following the river downstream. The sluice appears to be used as a point of access to the bank, and material added here may be susceptible to erosion.

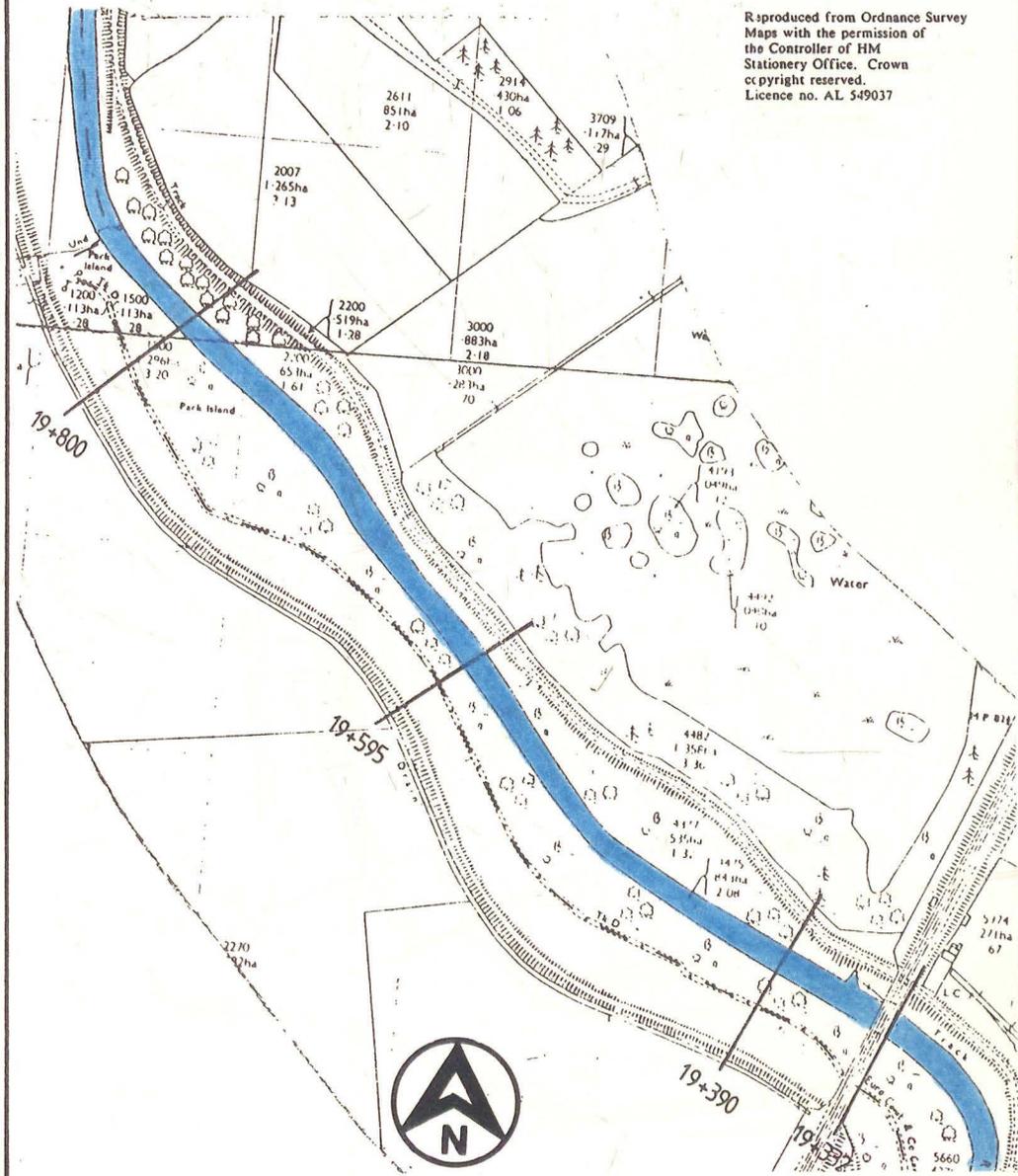
Material should be well compacted and overseeded. Bank protection, ie. 'Enkamet' or 'Geotextile' would help to prevent erosion.



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PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE LANDSCAPE ASSESSMENT	SECTION 9	POSFORD DUVIVIER ENVIRONMENT	DATE OCT. 93	SCALE N.T.S.
				DRAWN S.C.	CHKD <i>JP</i>

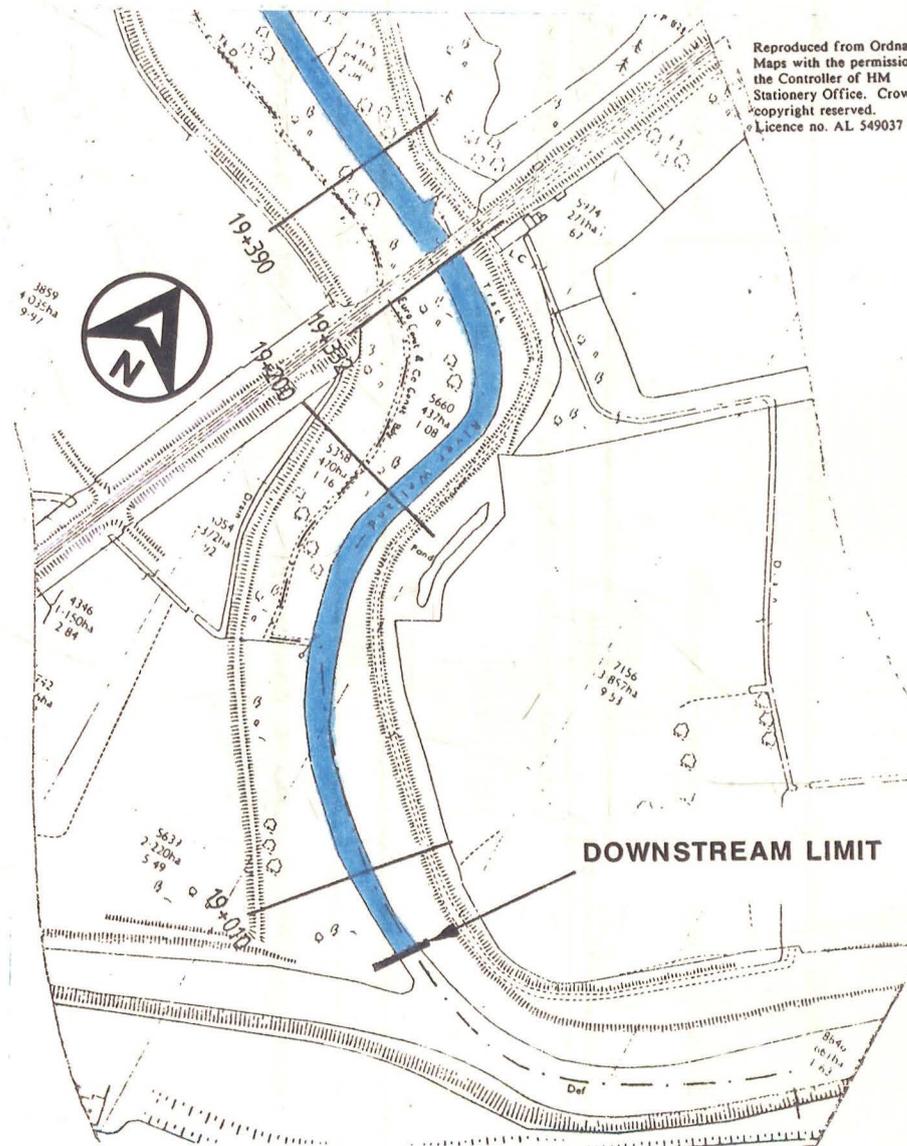
THERE ARE NO FLOOD DEFENCE WORKS
PROPOSED IN THIS SECTION



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<p>PROJECT</p> <p>MARKET DEEPING FLOOD DEFENCES</p>	<p>TITLE</p> <p>LANDSCAPE ASSESSMENT</p>	<p>SECTION</p> <p>10</p>	<p>POSFORD DUVIVIER ENVIRONMENT</p>	<p>DATE OCT. 93</p> <p>DRAWN S.C.</p>	<p>SCALE N.T.S.</p> <p>CHKD <i>SP</i></p>
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THERE ARE NO FLOOD DEFENCE WORKS
PROPOSED IN THIS SECTION



PROJECT

**MARKET DEEPING
FLOOD DEFENCES**

TITLE

LANDSCAPE ASSESSMENT

SECTION

11

**POSFORD
DUVIVIER
ENVIRONMENT**

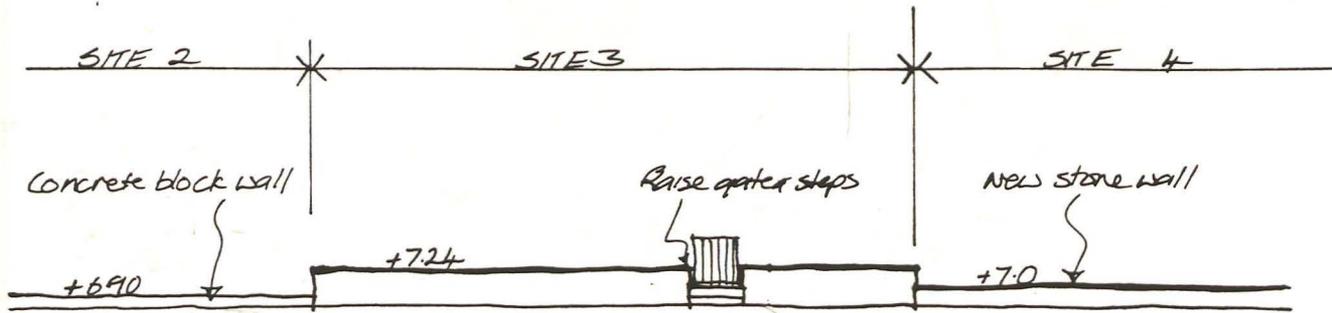
DATE OCT. 93

SCALE N.T.S.

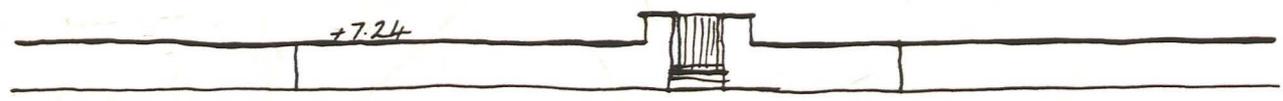
DRAWN S.C.

CHKD

SP

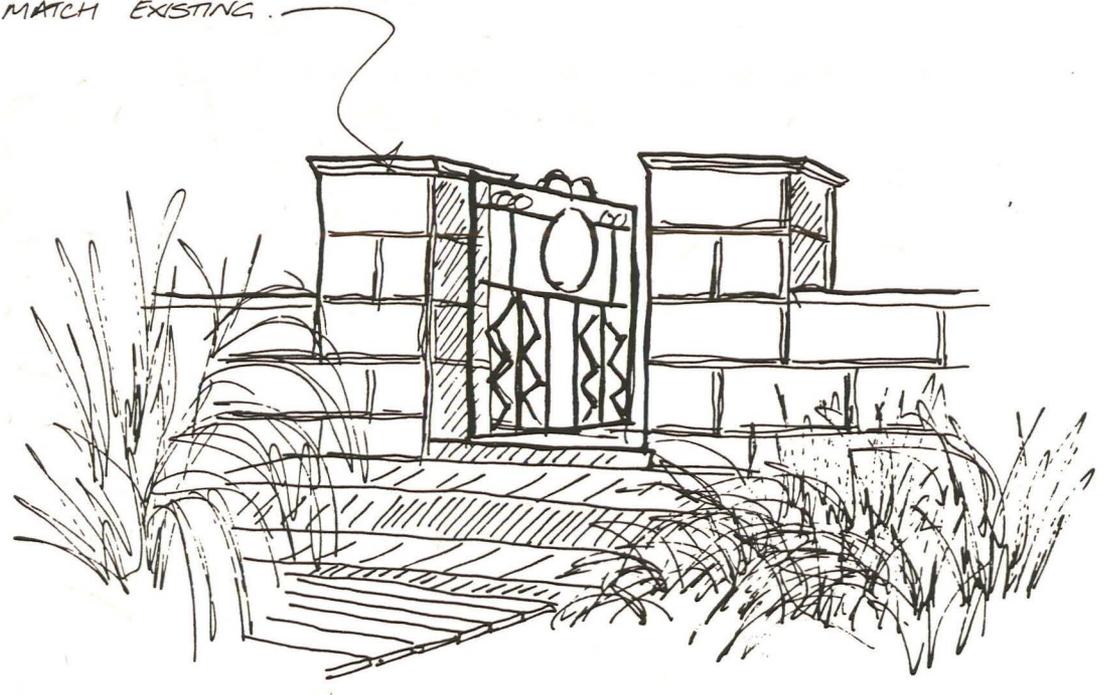


1. PROPOSED NEW WALLS (LYTH PROPOSED HEIGHTS SHOWN)



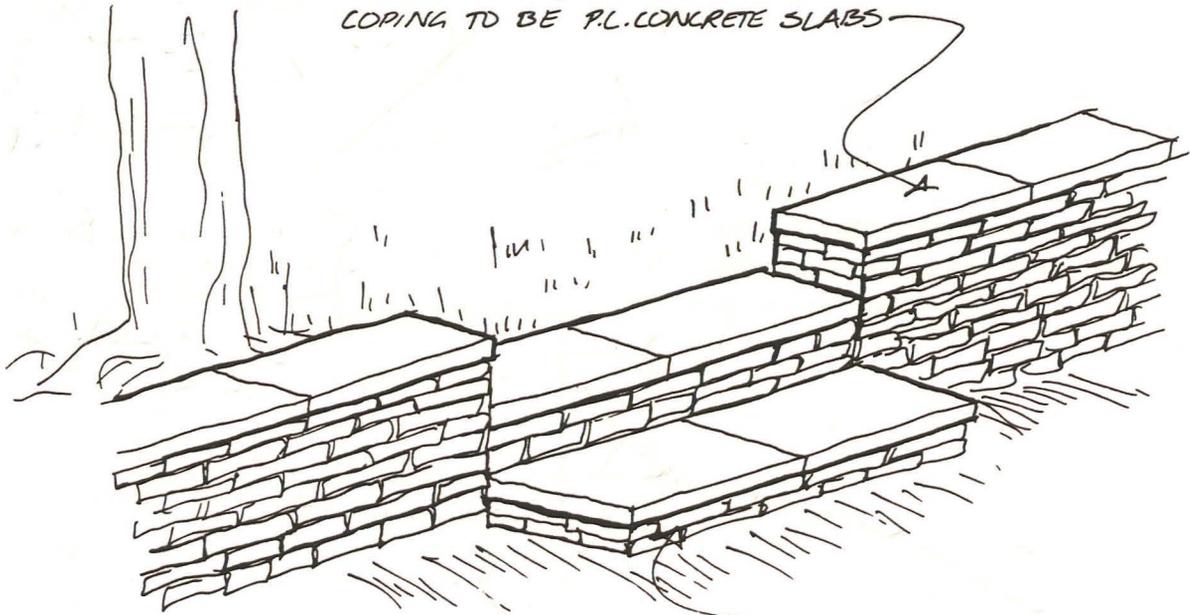
2. ALTERNATIVE - MATERIAL, COPING AND HEIGHTS OF WALLS TO MATCH SITE 3.
 - SITE 3 TO HAVE PIERS SUPPORTING GATE.

STONE PIERS BUILT TO SUPPORT GATE AT ITS NEW HEIGHT. STONE BLOCKS TO MATCH EXISTING.



PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE POSSIBLE ENHANCEMENT TOP: SITES 2,3 & 4 BOTTOM: SITE 3		DATE NOV. '93	SCALE N.T.S.
			DRAWN S.A.	CHKD LP
			Appendix A	

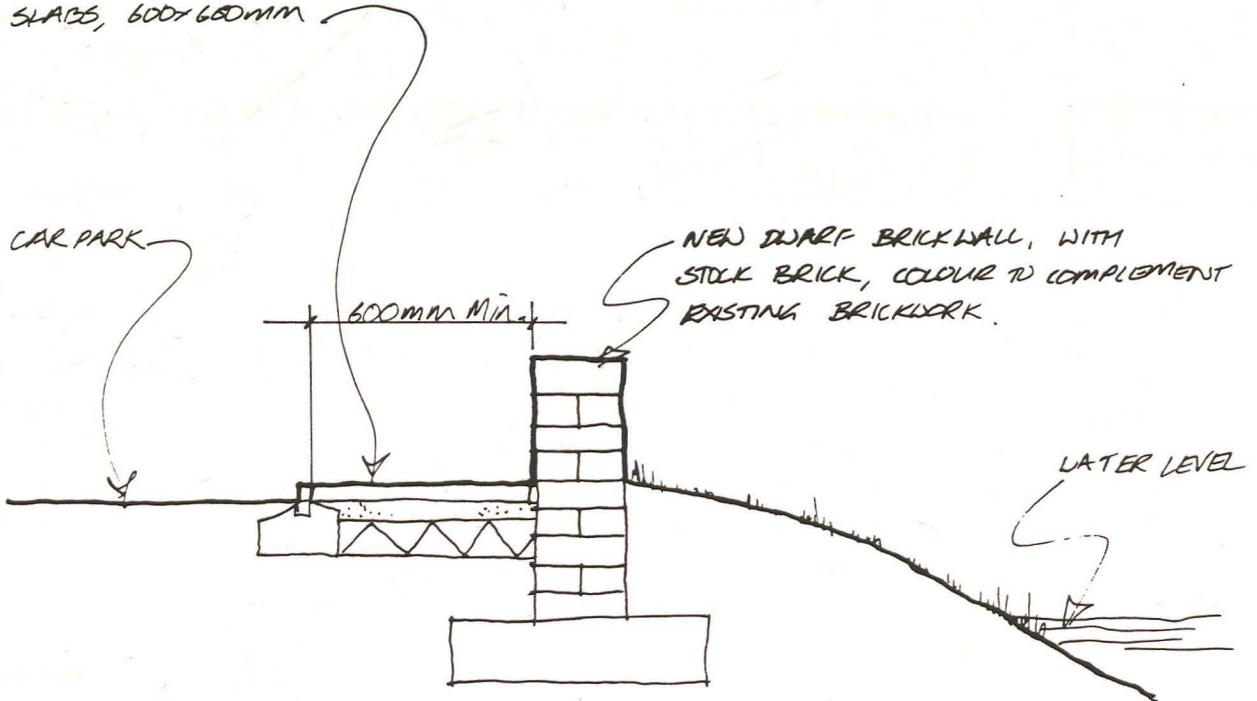
NATURAL STONE, REGULAR COURSED
RUBBLE WALL, WITH RECESSED MORTAR
POINTED JOINTS, USING LOCAL STONE.
COPING TO BE P.C. CONCRETE SLABS



STEPS TO MATCH WALL WITH STONE RISERS
AND P.C. CONCRETE SLAB TREADS

PROJECT	TITLE	POSFORD DUVIVIER ENVIRONMENT	DATE NOV. '93	SCALE N.T.S.
MARKET DEEPING FLOOD DEFENCES	POSSIBLE ENHANCEMENT SITE 21		DRAWN S.A.	CHKD <i>SP</i>
			Appendix B	

600MM MINIMUM DISTANCE FROM EXISTING KERB,
 WITH IND. ROW OF NATURAL P.C. CONCRETE PAVING
 SLABS, 600x600MM



PROJECT

MARKET DEEPING
 FLOOD DEFENCES

TITLE

POSSIBLE ENHANCEMENT
 SITE 9

**POSFORD
 DUVIVIER
 ENVIRONMENT**

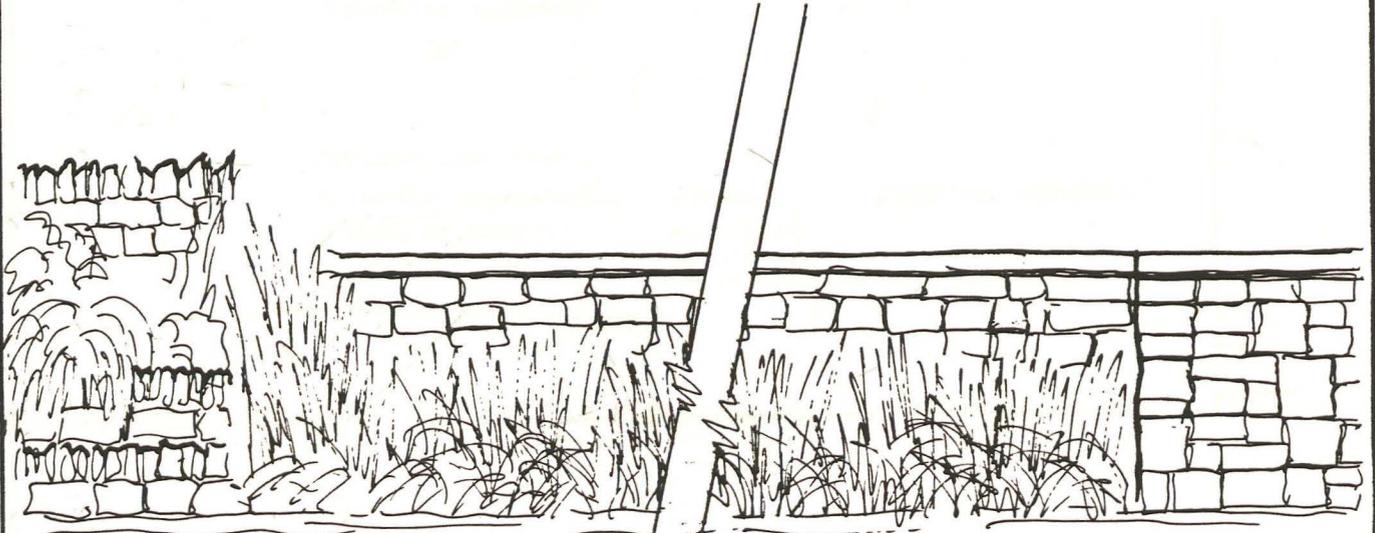
DATE NOV. '93

SCALE N.T.S.

DRAWN S.A.

CHKD JP

Appendix C



1.
 ADJACENT WALL
 NATURAL LOOKING
 AND SOFTENED BY
 PLANTING VARIOUS
 HEIGHTS

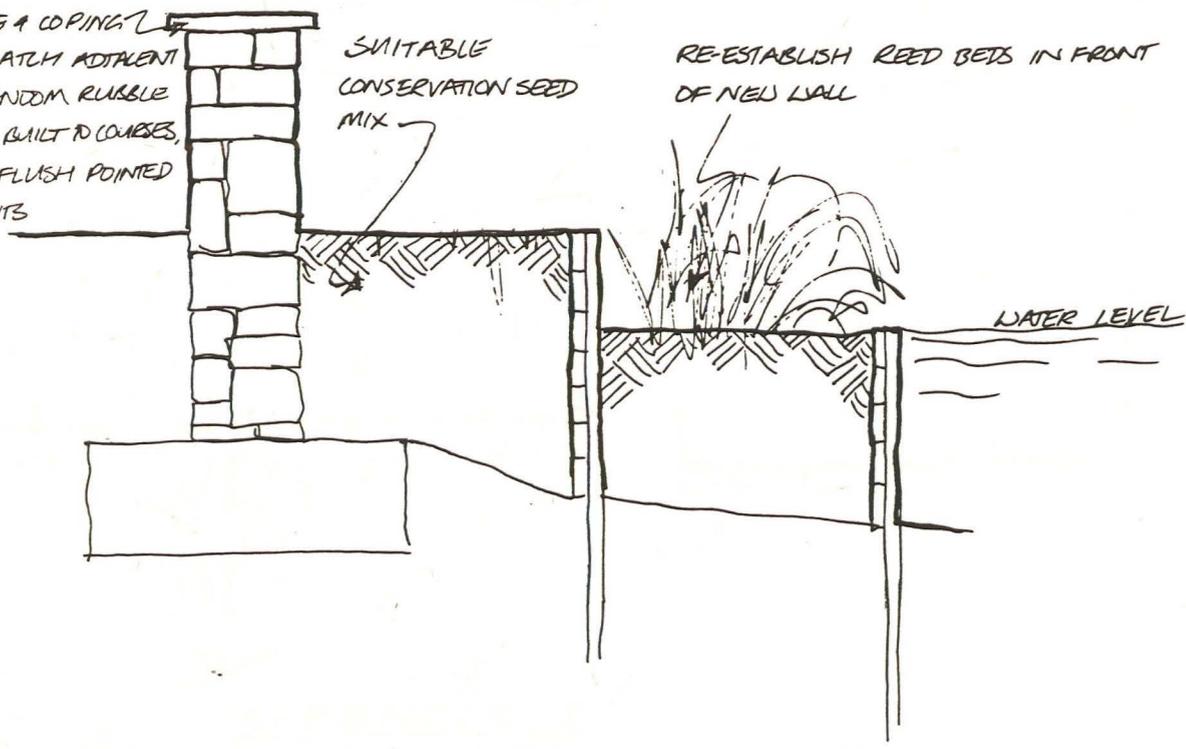
NEW WALL TO MATCH HEIGHT AND STONEDORK
 OF 2, WHICH IS VISUALLY THE MORE PROMINENT
 OF THE ADJACENT WALLS. RE-ESTABLISH REED
 BEDS TO SOFTEN WALL & TO DISGUISE JUNCTION
 WITH 1.

2.
 ADJACENT WALL
 CLEAN, STRAIGHT
 LINES, NO
 VEGETATION.

STONE & COPING
 TO MATCH ADJACENT
 IE. RANDOM RUBBLE
 WALL BUILT TO COURSES,
 WITH FLUSH POINTED
 JOINTS

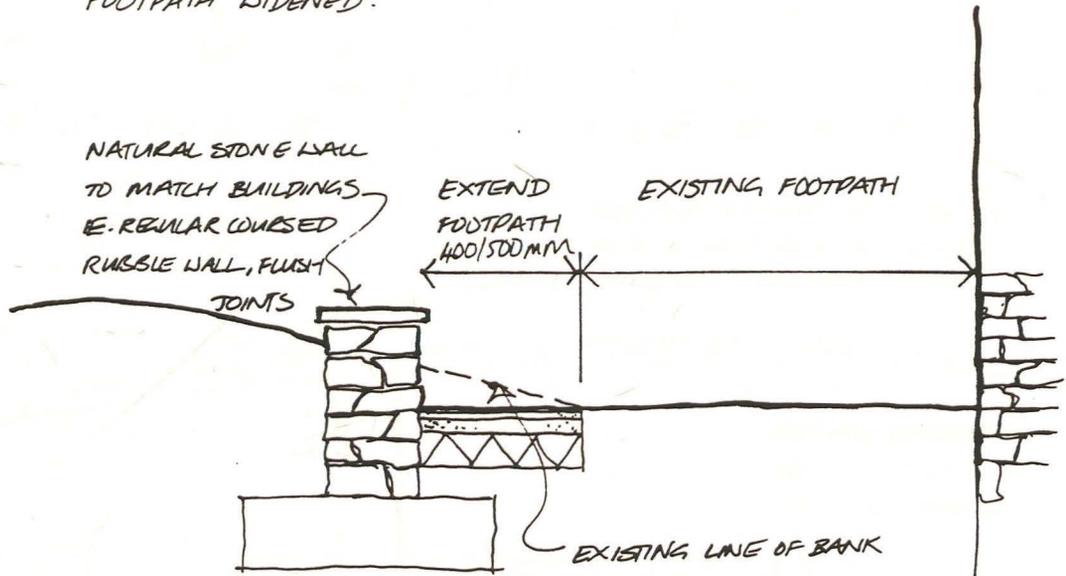
SUITABLE
 CONSERVATION SEED
 MIX

RE-ESTABLISH REED BEDS IN FRONT
 OF NEW WALL



PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE POSSIBLE ENHANCEMENT SITE 12 & 13		DATE NOV. '93 DRAWN S.A.	SCALE N.T.S. CHKD JP
			Appendix D	

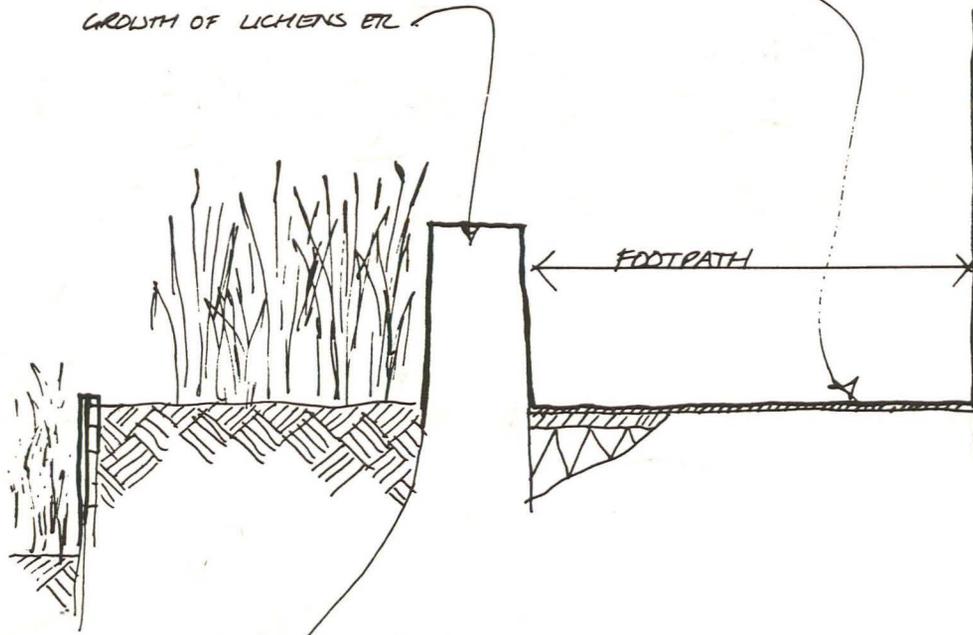
NEW DWARF WALL SET APPROX. 450MM
FROM EDGE OF EXISTING PATH.
FOOTPATH WIDENED.



APPENDIX E.

BRUSH SURFACE OF CONCRETE
WITH A SOFT BRUSH, 30MM.
AFTER LAYING, TO ROUGHEN
SURFACE AND ENCOURAGE
GROWTH OF LICHENS ETC

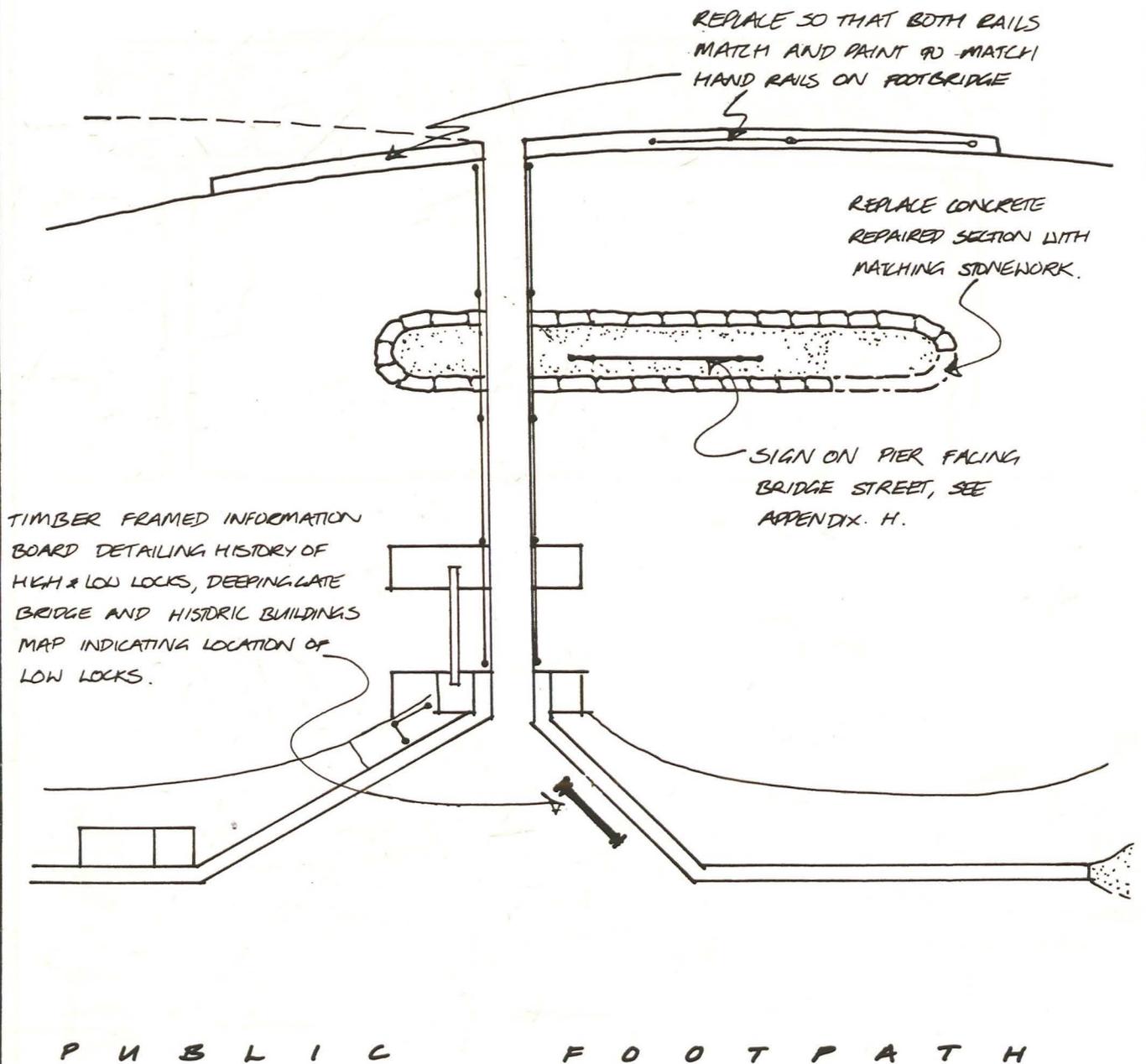
MAKE UP LEVELS AFTER CONSTRUCTION
OF WALL AND APPLY NEW 10MM
WEARING COURSE OVER WHOLE WIDTH
OF FOOTPATH.



APPENDIX F.

PROJECT MARKET DEEPING FLOOD DEFENCES	TITLE POSSIBLE ENHANCEMENT TOP: SITE 24 & 25 BOTTOM: SITE 26 & 27		DATE NOV. '93	SCALE N.T.S.
			DRAWN S.A.	CHKD LP
	Appendix E and F			

B R I D G E S T R E E T

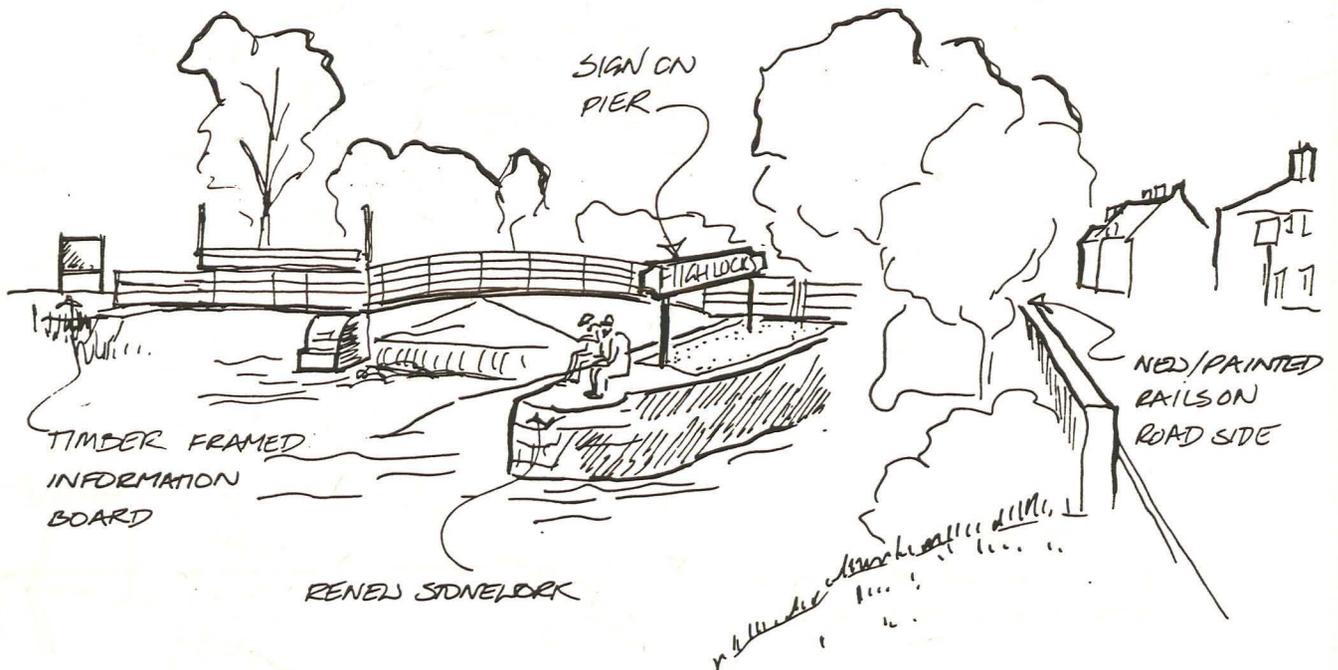


P U B L I C F O O T P A T H

<p>PROJECT</p> <p>MARKET DEEPING FLOOD DEFENCES</p>	<p>TITLE</p> <p>POSSIBLE ENHANCEMENT HIGH LOCKS I</p>		<p>DATE NOV. '93</p> <p>DRAWN S.A.</p>	<p>SCALE N.T.S.</p> <p>CHKD LP</p> <p>Appendix G</p>
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TRADITIONAL STYLE SIGN ON GRASSED PIER
FACING BRIDGE STREET

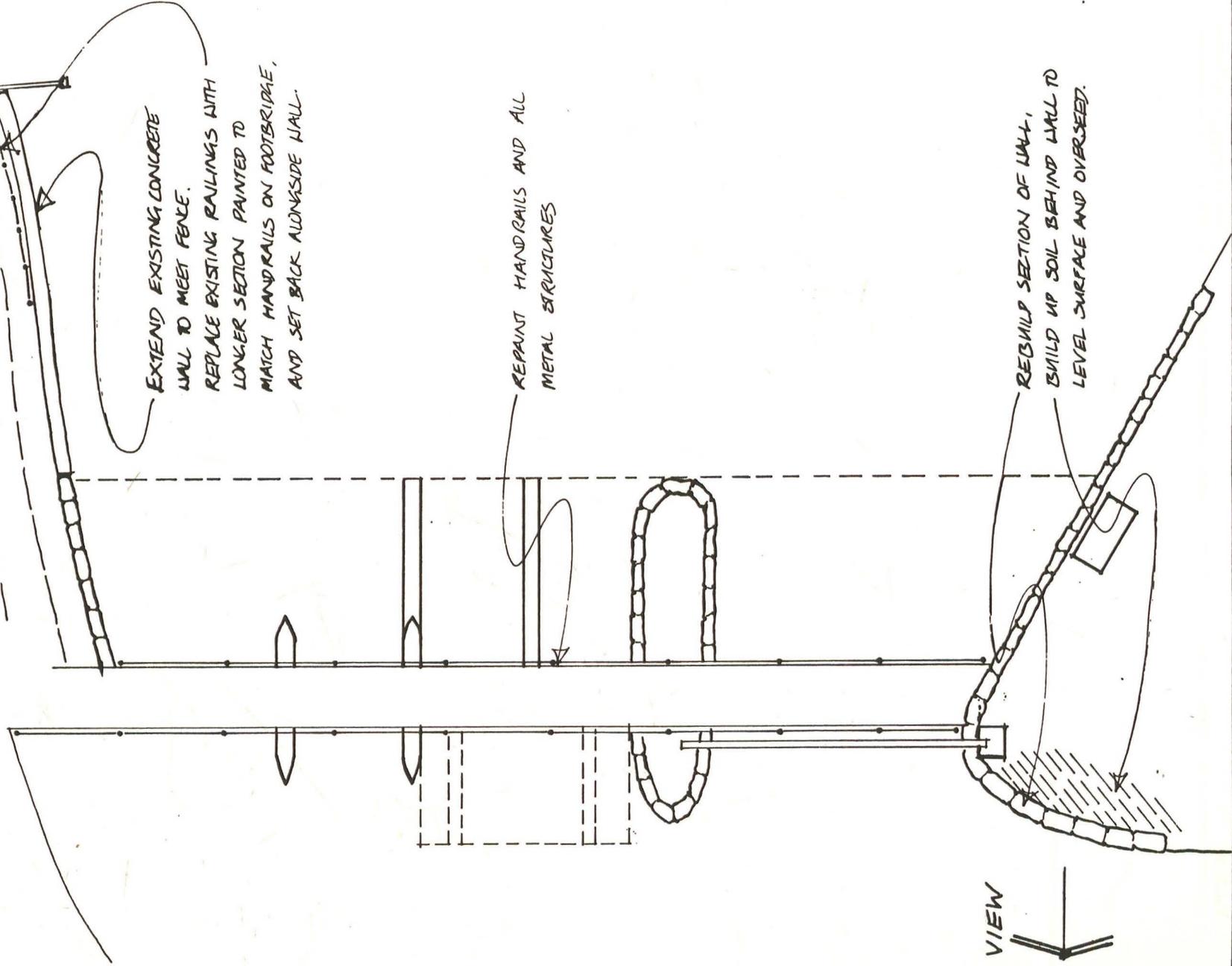
(CAST IRON / STEEL SIGN, WITH LETTERING IN RELIEF,
PAINTED GREEN TO MATCH RAILINGS. LETTERING PEEKED OUT
IN WHITE)



<p>PROJECT</p> <p>MARKET DEEPING FLOOD DEFENCES</p>	<p>TITLE</p> <p>POSSIBLE ENHANCEMENT HIGH LOCKS II</p>	 <p>POSFORD DUVIVIER ENVIRONMENT</p>	<p>DATE NOV.'93</p>	<p>SCALE N.T.S.</p>
		<p>DRAWN S.A.</p>	<p>CHKD <i>LP</i></p>	
		<p>Appendix H</p>		

FOOTPATH TO DEEPING ST. JAMES

TIMBER FRAMED INFORMATION BOARD
DETAILING HISTORY OF LOCKS, + MAP
SHOWING LOCATION OF HIGH + LOW LOCKS



EXTEND EXISTING CONCRETE
WALL TO MEET FENCE.
REPLACE EXISTING RAILINGS WITH
LONGER SECTION PAINTED TO
MATCH HANDRAILS ON FOOTBRIDGE,
AND SET BACK ALONGSIDE WALL.

REPAINT HANDRAILS AND ALL
METAL STRUCTURES

VIEW

REBUILD SECTION OF WALL,
BUILD UP SOIL BEHIND WALL TO
LEVEL SURFACE AND OVERSEED.

PROJECT

MARKET DEEPING
FLOOD DEFENCES

TITLE

POSSIBLE ENHANCEMENT
LOW LOCKS

**POSFORD
DUVIVIER
ENVIRONMENT**

DATE NOV '93 SCALE N.T.S.

DRAWN S.A. CHKD JP

Appendix I

APPENDIX B
Summary Table

APPENDIX B: SUMMARY TABLE-POSSIBLE ENHANCEMENT OPPORTUNITIES AND RECOMMENDATIONS

B1 INTRODUCTION

The brief for this environmental appraisal instructed, among other things, that:

"Mitigation measures must be explored in detail, particularly with regard to the type of wall construction"

and that

"Enhancement opportunities must also be explored in detail, in particular, enhancement of High and Low Locks."

Table B1 provides a summary of the mitigation measures and enhancement opportunities which have been discussed in the main report.

B2 ASSUMPTIONS

When using the table the following points should be borne in mind:

- opinions of the private landowners have not been considered in this appraisal, but are paramount where works are proposed in private gardens. The NRA have undertaken the consultations with the individual landowners.
- all enhancement opportunities are "possible" and Posford Duvivier Environment are not maintaining that they must be carried out. The Table is a basis for discussion.
- a number of the measures suggested are beyond the direct responsibility of the National Rivers Authority under their flood defence duties. Consultation, co-operation and perhaps funding from other bodies will be required.

LEFT BANK				
SITE NO.	PROPOSED IMPROVEMENT WORKS	RELEVANT ENVIRONMENTAL DESIGNATIONS	OTHER ENVIRONMENTAL CONSIDERATIONS	POSSIBLE ENHANCEMENT AND RECOMMENDATIONS
1	Block wall along workshop (20m).	MDCA	Reed species	Minimise damage to emergent vegetation with replanting if damage occurs. Ensure no damage to tree roots.
2	Dwarf wall along building face (20m).	MDCA	Reed species.	Dwarf wall to be tied into existing wall*. Minimise damage to emergent vegetation with replanting if damage occurs.
3	Reinforce existing stone wall; raise steps through.	MDCA Listed building property.	-	Reinforcement with stone to match existing stonework*. Piers to support gate and match existing wall (see sketch in Appendix A).
4	Remove existing rubble wall; provide new stone wall (20m).	MDCA Listed building property.	-	New wall tied into existing boundary wall.
5	Double skin planking set into existing bund (60m).	MDCA	Marginal vegetation.	Minimise disturbance to existing vegetation.
6	Install flap valve on drain.	MDCA	-	None.
7	Extend existing brick wall, seal joints in existing wall (3m)	-	-	New wall to match existing wall*.
8	Raise stone wall around existing sluice (10m).	-	Marginal vegetation.	Stonework to match existing (see sketch in Appendix A)*.
9	Dwarf brick wall along bankside edge of car park (35m).	-	-	Tie into new stonework*. Stock brick in keeping with character of section. Wall at least 600mm from existing kerb (see sketch in Appendix A).

SITE NO.	PROPOSED IMPROVEMENT WORKS	RELEVANT ENVIRONMENTAL DESIGNATIONS	OTHER ENVIRONMENTAL CONSIDERATIONS	POSSIBLE ENHANCEMENT AND RECOMMENDATIONS
10	Close gap in brick wall (5m).	-	-	Tie new wall into old wall*.
11	Demolish poor concrete wall; provide new brickwall (15m).	-	Marginal vegetation.	New brick wall to match existing wall*.
12/13	Dwarf stone wall along frontage (14m).	DSJCA	Marginal vegetation.	New wall tying into boundary walls at either end*. Avoid damage to marginal vegetation. Material and height should match adjacent walls (see sketch in Appendix A). Re-establishment of reedbeds in front to soften visual impact (see sketch in Appendix A).
14	Fix toe plates to footbridge and close to concrete walls at bank.	DSJCA	-	None.
15	Double skin planking set into existing bank (15m).	DSJCA Listed building property.	-	Great care must be taken to avoid damage to structure or setting.
16	Make up and asphalt footpath crossing Hives Bank (100m).	-	-	Roadway sign to indicate presence of locks. Reset timber barrier at entrance. Remove dead elms and plant new trees.
17	Double skin planking set into existing bank (20).	-	-	None.
18	Double skin planking set into existing bank (90).	-	-	None.
19	Raise ground generally downstream of Hives Bank (20m).	-	-	Ensure use of "clean" fill and bank to be sensitively seeded in keeping with current species composition. Avoid damage to trees during works (eg. raising ground level around trees may cause damage).

SITE NO.	PROPOSED IMPROVEMENT WORKS	RELEVANT ENVIRONMENTAL DESIGNATIONS	OTHER ENVIRONMENTAL CONSIDERATIONS	POSSIBLE ENHANCEMENT AND RECOMMENDATIONS
20	Raise bank using quarry waste (15m).	-	Sluice apparently used as access to bank.	Material should be erosion resistant. Use of 'Emkamat', geotextile or quarry waste.
RIGHT BANK				
21	Dwarf stone wall along frontage (70m).	-	Attractive stretch of river, highly visible.	Care to ensure concrete wall footings do not damage tree roots. Wall should match wall on opposite bank (ie. natural stone and flat coping). Steps to correspond (see sketch in Appendix A).
22	Raise existing earth bank (90m).	-	Fishermens access.	Care with use of soil conditioners and reseeding. Hard wearing grass mix if reseeding to occur. Perhaps use of natural regeneration. Ensure appropriate source of fill material. Bank to be graded to smooth and free flowing contours. Ensure access to riverbank during construction and regeneration if necessary.
23	Reconstruct sluice with flap valve.	-	-	None.
24/25	Dwarf stone wall set into existing bund on riverside of footpath (160m).	Listed building frontage.	Footpath.	Natural regular coarse stone wall to match nearby listed cottages. Sensitive coping. Avoid obstruction to footpath. Possible footpath widening (see sketch in Appendix A).
26	Re-establish bank in front of concrete flood wall to sustain wall stability. Repair cracks in concrete flood wall (100m).	DGCA (part). Building of local historic interest.	Footpath.	Sensitive repair of wall cracks. Avoid obstruction to footpath. Liaison with DAC if construction requires dropping water levels. Appropriate source of fill material. Use of fibre rolls. New wearing course for footpath (see sketch in Appendix A).

SITE NO.	PROPOSED IMPROVEMENT WORKS	RELEVANT ENVIRONMENTAL DESIGNATIONS	OTHER ENVIRONMENTAL CONSIDERATIONS	POSSIBLE ENHANCEMENT AND RECOMMENDATIONS
27	Demolish failed length of concrete flood wall and reconstruct (40m).	DGCA (part)	Footpath. Emergent vegetation.	Wall constructed to match existing wall. Minimise footpath obstruction. Ensure all debris from demolition is removed from site. Minimise damage to vegetation and ensure re-establishment if damage occurs.
28	Add concrete cill to gap in flood wall (2m).	DGCA	Footpath.	Cill to match existing wall.
29	Re-establish bank in front of concrete flood wall, to sustain wall stability. Also repair cracks in concrete wall (35m).	DGCA. Buildings of local historic interest.	Footpath.	Sensitive repair of wall cracks. Avoid obstruction to footpath. Liaison with DAC if construction requires dropping of water levels. Sensitive source for earth fill. Use of fibre rolls.
30	Raise steps leading from house to riverside (2.).	DGCA Buildings of local historic interest.		Design and material of steps to match original steps*.
LOCKS				
31	Restoration of structures, provision of scour protection and safety works.	DGCA/DSJCA SMR 34763.		Ensure works are consistent with historical significance of structures. Avoid intrusion on street scene. Provide interpretation/information boards (see sketch in Appendix A). Repaint metalwork (see sketch in Appendix A). Roughen new walls to assist re-colonisation of vegetation. Allow survey of structures by qualified industrial archaeologist prior to works. Agree construction methods and materials with industrial archaeologist (see sketch in Appendix A).

SITE NO.	PROPOSED IMPROVEMENT WORKS	RELEVANT ENVIRONMENTAL DESIGNATIONS	OTHER ENVIRONMENTAL CONSIDERATIONS	POSSIBLE ENHANCEMENT AND RECOMMENDATIONS
32	Restoration of structures, provision of scour protection and safety works.	SMR 34764.		Allow survey of structures by qualified industrial archaeologist prior to works. Agree construction methods and materials with industrial archaeologist (see sketch in Appendix A).

Notes:

- MDCA - Market Deeping Conservation Area
- DSJCA - Deeping St. James Conservation Area
- DGCA - Deeping Gate Conservation Area
- DAC - Deeping St. James Angling Club
- SMR123 - Lincolnshire Sites and Monuments Record and Number.
- * - Contained in Detailed Appraisal Report

APPENDIX C

Consultee List

APPENDIX C: CONSULTEE/CONTACT LIST

<u>Organisation</u>	<u>Name/Position</u>	<u>Type of Consultation</u>
ARCHAEOLOGY AND HERITAGE		
Cambridgeshire County Council (Archaeology Section)	Tony Hurley/County Archaeologist	Letter
Lincolnshire County Council (Archaeology Section)	Steve Catney/County Archaeologist	Letter
South Kesteven District Council	Ruth Waller/Community Archaeologist	Letter
Peterborough City Council (Planning Services)	Jon Burgess/Senior Conservation Officer	Letter
Fenland Archaeological Trust (Flag Fen)	Francis Pryor/Director	Letter
Cambridge Archaeological Unit (University of Cambridge)	Chris Evans	Letter
Deepings Heritage	A.J. Garton	Meeting
English Heritage (East Midlands Conservation Group)	Chris Alexander P. Walker/District Inspector	Letter
Society for Lincolnshire History and Archaeology (Industrial Archaeology Committee)	Neil Wright	(Involved in archaeological study)
NATURE CONSERVATION		
English Nature (East Region)	John Shackles	Letter
RSPB (East Midlands)	John Sharpe/Conservation Officer	Letter
Lincolnshire and South Humberside Trust for Nature Conservation	Mark Crick/Conservation Officer	Letter
OTHERS		
Countryside Commission (Eastern Region Office)	Judith Feline/Senior Countryside Officer	Letter
Welland Watch Group	Peter Hilton/Chairman	Meeting
Deeping St James Angling Club	David Bailey/Secretary	Meeting
Peterborough District Angling Association	P Doel/Secretary	Letter
Market Deeping Town Council	J Kemp/Clerk	Letter
Deeping St James Parish Council	R Jones/Clerk	Letter

The following groups and individuals were also contacted during the study:-

National Rivers Authority	C. Randall (Fisheries) G. Coster (Water Quality)
Lincolnshire County Council	J. Watson (Ecologist) H. Edwards (Recreational Services Department)
Cambridgeshire County Council	A. Hodges, (Transportation Department)

APPENDIX D

The Stamford Canal/Welland Navigation

APPENDIX D: THE STAMFORD CANAL/WELLAND NAVIGATION**D1 Introduction**

D1.1 During the initial consultations undertaken in 1992 as part of Posford Duvivier's Detailed Appraisal Report (Posford Duvivier, 1993a), concern was expressed by interested parties about the proposed works to the lock structures (High and Low Locks) on the River Welland. Consequently, during the Environmental Appraisal, Posford Duvivier Environment commissioned the Archaeology Section of Lincolnshire County Council to make detailed investigations into the significance of the structures, along with other sites of potential historical or archaeological significance in the study area. A number of other interested individuals have also contributed to the work and are acknowledged elsewhere in this report. Overall, the problem was a lack of archive material on the lock structures themselves, and the following text has been prepared drawing heavily on work carried out by Lincolnshire County Council, but incorporating additional information when available.

D2 Outline History of the Stamford Canal (Welland Navigation)

D2.1 The River Welland was navigable to Stamford during the Middle Ages but by the 16th Century, the construction of a number of water mills between Stamford and the Deepings and along other stretches had begun to adversely affect river traffic. The consequent effects on commerce prompted local merchants and the civic authorities to petition members of Parliament for permission to construct a canal. A Canal Act was obtained but work appears not to have been systematically carried out until after 1620 when James I, in 1623, approved the proposals and authorised the charging of a toll at each lock. Funding problems were encountered by the Corporation charged with the cutting of the canal, but in 1664 Daniel Wigmore took responsibility for the work. The canal appears to have been completed sometime in the 1660's. The exact opening date of the canal is not known but it was certainly in use some years before 1673.

D2.2 The Canal was over 6¾ miles in length, running from just east of the weir at Hudd's Mill in Stamford to just west of Market Deeping at Tongue Head. There were 12 locks along the canal, with additional structures on the River Welland at Upper and Lower Locks in Deeping St James. The route of the canal is recorded in the Lincolnshire SMR (No. 34762) and the eastern end is shown on Drawing No. 1 in Appendix G and referenced in Appendix F.

D2.3 The extension of the Midland Railway to Stamford in 1846 and the arrival of the Great Northern Railway in 1856 effectively finished the canal, which by then was in poor condition. The last barge travelled up to Stamford in April 1863 and in 1865 the canal was auctioned, in Stamford. Disputes over property titles hindered the sale but by 1868 much of the canal had been disposed of.

D3 High and Low Locks

D3.1 Investigations by the Archaeology Section of Lincolnshire County Council were unable to identify any documentary evidence for the construction dates of the High and Low Locks, but they would appear to have been an integral part of the Welland Navigation scheme described above. The report states: "Both locks appear on the first edition 1" Ordnance Survey map of 1824, which also shows the canal as a functional watercourse with the position of all its locks indicated. Deeping Low Lock and Deeping High Lock (known as Briggin Lock) were lots 22 and 23 respectively in the 1865 auction catalogue for the sale of Stamford Canal (LAO SW 5/23/7-8), although an undated draft of a letter objecting to the proposed sale indicates a local belief that both of the Deeping Locks were built before the canal (LAO SW 5/23/6). The High Locks seem to have become the responsibility of the people of Deeping St. James by 1867 when a committee was formed for the purpose of carrying out repairs (LAO SW S/23/10)".

D4 Archaeological Significance of the Welland Navigation and Deeping Locks

D4.1 The Stamford Canal was the longest locked canal in the country when it was constructed and only the second post-Roman canal to have been built in Britain. The first canal in Britain to use pound locks was the Exeter Canal. John Trew constructed the original Exeter canal between 1564 and 1566 a distance of 3110 yards, in order to improve navigation on the river Exe up to Exeter. Various and extensive works were carried out on the canal during the 17th, 18th and 19th Centuries. So, although the Exeter Canal was cut before the Stamford Canal, all the lock structures on the former have been rebuilt at some time and those now in existence date from either the 18th or 19th Centuries. In contrast there is no clear evidence that the Stamford Canal was ever refurbished. "This must make the surviving remains [of the Stamford Canal] of considerable national importance." (LCC, 1993).

D4.2 All but one of the locks along the Stamford Canal seem to have been "turf locks" constructed of sloping turf-faced sides with stone-faced structures only at the lock gates. The status of the three surviving locks (West Deeping, High Locks and Low Locks) is briefly outlined below:

- D4.3
- | | | |
|-------------------|---|--|
| West Deeping | - | located in a private garden but still recognisable as a turf lock. |
| Deeping Low Lock | - | has been constructed for use as a sluice utilising the masonry structures. |
| Deeping High Lock | - | built as a masonry lock throughout, it is the best preserved of the surviving locks. The stonework appears to be that of the original lock dating from the 17th Century, although the construction date cannot be verified without a detailed survey of the masonry. |

D4.4 In a summary of the locks' significance, the report states:

"The Deeping Locks possibly represent the oldest remaining canal navigation pound locks in the country and are therefore potentially of national importance. It is also possible (in the absence of surviving flash locks) that they are the oldest surviving locks in Britain" (LCC, 1993).

D5 High and Low Locks as Protected Structures

- D5.1 That the lock structures remain unlisted, may not be an indication of their importance but rather may reflect the fact that their significance has not yet been fully considered. Consultations indicated that both High and Low Locks are currently in the early stages of the process potentially leading to their being listed as historic buildings by the Department of the Environment (personal communication, SKDC 1993).
- D5.2 Consultation with English Heritage (personal communication, District Inspector, 1993) did not identify any intention for the structures to be designated as scheduled ancient monuments. However, such a process is ordinarily initiated by the County Archaeologist and it may well be that the first stage is now taken, partly as a result of the interest in the structures generated from the NRA's proposals.
- D5.3 English Heritage is currently undertaking a wide ranging review of historic sites in England (The Monuments Protection Programme or MPP) as a result of which many more sites are being afforded statutory protection. The MPP has yet to examine the study area but in view of the information provided here such protection appears distinctly possible. Consequently, every attention must be paid to the conservation and indeed restoration of the structures.
- D5.4 Listed building control is a special form of control applicable to buildings of special architectural or historic interest. This control is intended to prevent the unrestricted demolition, alteration or extension of the listed building without the express consent of the local planning authority or the Secretary of State. The control extends to cover any works for the demolition of a listed building, or for its alteration or extension in any manner likely to affect its character as a building of special architectural or historic interest.

APPENDIX E

SSSI Citation

COUNTY: LINCOLNSHIRE

SITE NAME: DEEPING GRAVEL PITS

DISTRICT: SOUTH KESTEVEN

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

Local Planning Authority: South Kesteven District Council

National Grid Reference: TF 180 082 Area: 55.9 (ha) 138.1 (ac)

Ordnance Survey Sheet 1:50,000: 142 1:10,000: TF 10 NE

Date Notified (Under 1949 Act): 1968 Date of Last Revision:

Date Notified (Under 1981 Act): 1986 Date of Last Revision:

Other Information:

The boundary of this site has been modified at renotification by partial deletions.

Description and Reasons for Notification:

The variety of habitats present and the undisturbed nature of the area make Deeping Gravel Pits an extremely important ornithological site. The pits support a heronry of national importance, being the largest in Lincolnshire with over seventy occupied nests. The diversity of the wintering wildfowl species and the breeding bird community are of regional importance.

Breeding birds include gadwall, great crested grebe, shoveler, tufted duck, heron and kingfisher. The extensive areas of open water support wide variety of wildfowl in winter, including wigeon, pintail, goldeneye, mallard, teal and goosander, as well as water-rail and bearded tit. The site is remarkable in being an inland breeding locality for cormorant.

Aquatic and fen vegetation occur around the open-water margin, characterised by common reed Phragmites australis, lesser bulrush Typha angustifolia, common clubrush Schoenoplectus lacustris, yellow water-lily Nuphar lutea and yellow iris Iris pseudacorus. Elsewhere, there is much willow scrub Salix spp, grading into pedunculate oak Quercus robur and ash Fraxinus excelsior woodland. The water is nutrient-rich and is dominated by Nuttall's waterweed Elodea nuttallii with small amounts of spiked water-milfoil Myriophyllum spicatum and stonewort Chara sp.

7 March 198

DEEPING GRAVEL PITS

LINCOLNSHIRE

TF 180 082

7 March 1986



NATURE CONSERVANCY COUNCIL

Site boundary thus 

Scale 1:10 000

0 Metres

600

0 Yards

600

Based on the Ordnance Survey 1:10 000 map with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved 1986/2

18

Peakir

Thorney Road

Three Acres

APPENDIX F

**Summary of Lincolnshire Sites
and Monuments Record**

APPENDIX F: SUMMARY OF LINCOLNSHIRE SITES AND MONUMENTS RECORD (See Drawings 1 and 2)

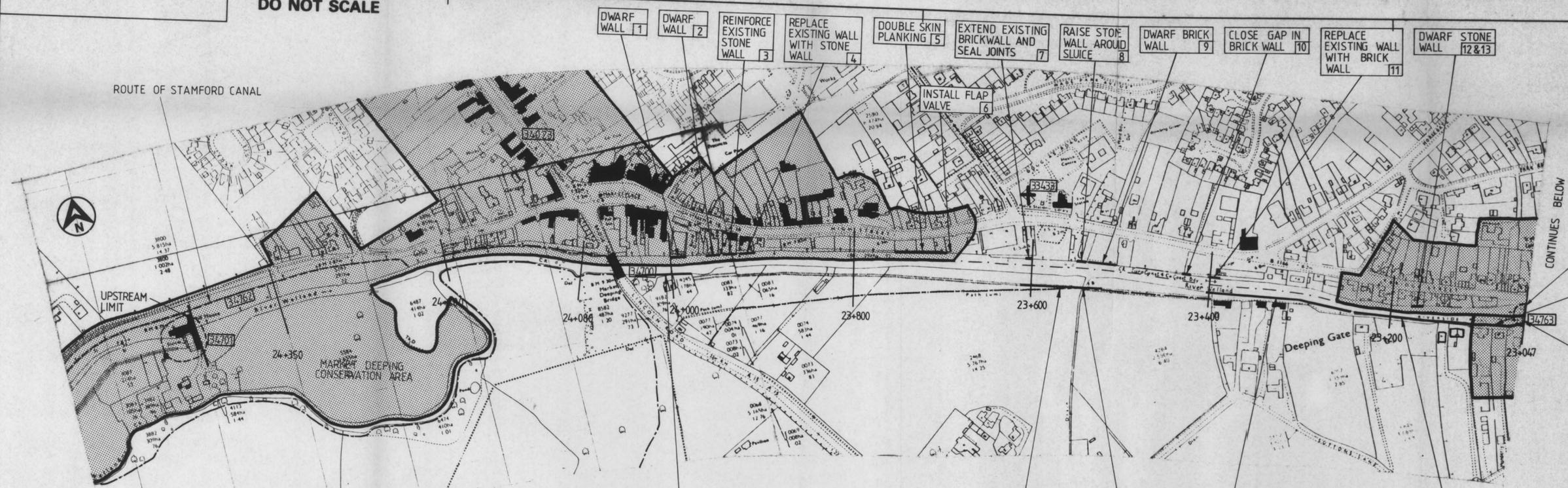
SMR No.	BRIEF DESCRIPTION	STATUS
00069	Remains of Medieval market cross.	Scheduled Grade I Listed Building.
00151	Deeping Gate Bridge, 1651.	Scheduled Grade II* Listed Building.
34762	Stamford Canal.	-
34701	18th Century buildings and site of watermill.	Grade II Listed Building.
34023	Scotney Almshouse, 1877.	Grade II Listed Building.
34700	Market Deeping Bridge, 1841.	Grade II Listed Building.
34753	Roman Car Dyke.	-
33433	Medieval pottery found, 1973.	-
34763	Deeping High Locks.	-
33443	Former site of mound - possibly a barrow.	-
33460	Elizabethan coin hoard found, 1968.	-
33435	Site of Benedictine priory founded 1139.	-
33457	17th Century building remains found, 1971.	-
33458	Medieval building remains found, 1971.	-
33442	St. James' Church.	Grade I Listed Building
34764	Deeping Low Locks.	-

APPENDIX G
Drawings 1 and 2

Drawing No

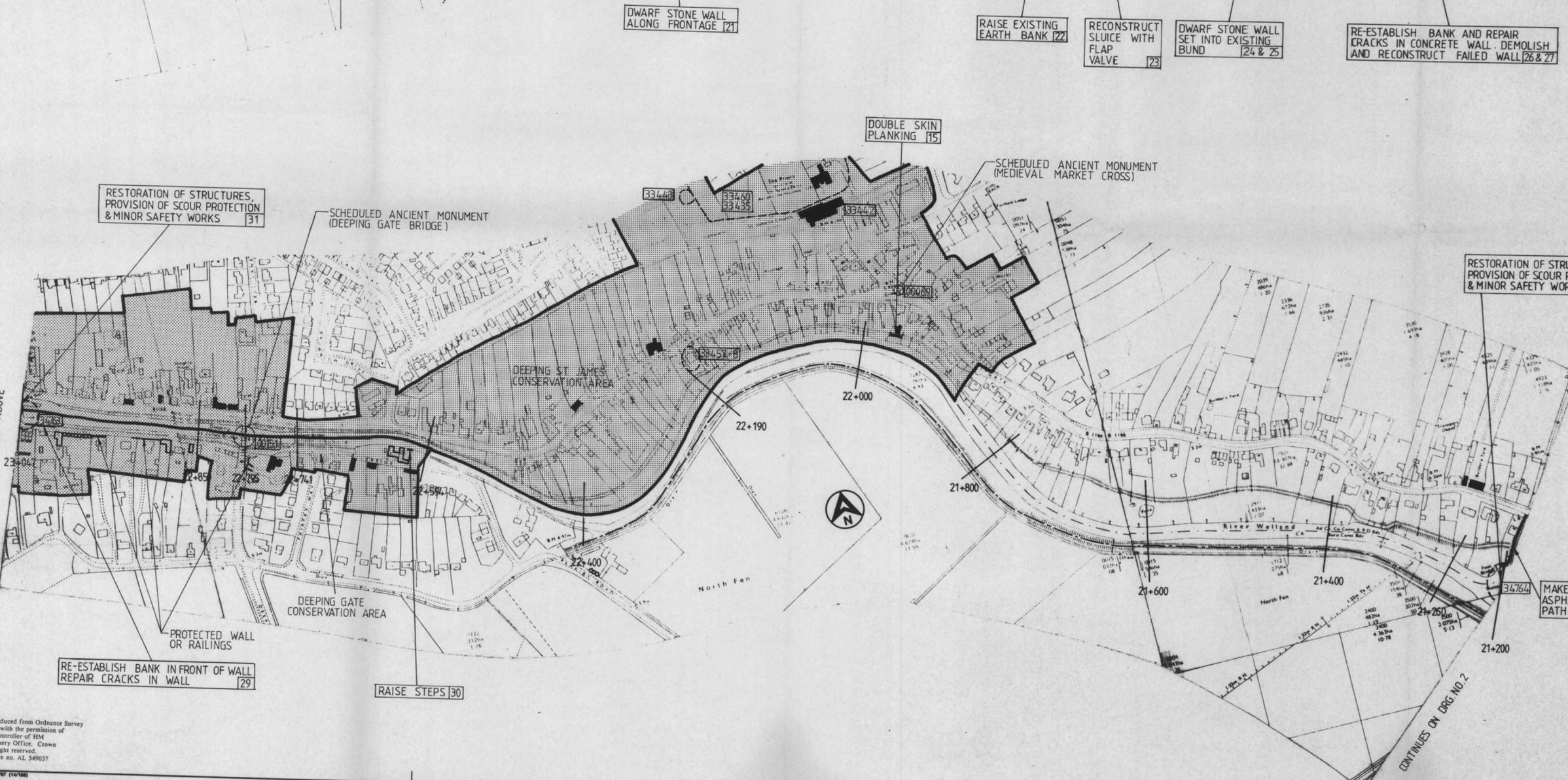
DO NOT SCALE

- Notes
- SEE SECTION 2 FOR FURTHER DETAILS OF IMPROVEMENT WORKS
 - DWARF WALL 1 - DESCRIPTION OF IMPROVEMENT WORKS
SITE NO.
 - DENOTES CHAINAGE
23+800



- CONTINUES BELOW
- DEEPING HIGH LOCKS
- ADD CONCRETE CILL TO GAP IN FLOOD WALLS 28
- FIX TOE PLATES TO FOOTBRIDGE AND CLOSE TO CONCRETE WALLS AT BANK 14

- KEY:
- LISTED BUILDING
 - ARCHAEOLOGICAL SITE
 - FIND SPOT
 - LINC'S SMR NUMBER (SEE APPENDIX G)
 - PROTECTED TREE OR HEDGED FRONTAGE
 - BUILDINGS OF LOCAL HISTORIC INTEREST
 - FOOTPATHS (FOR ILLUSTRATION ONLY)
 - CONSERVATION AREA



RESTORATION OF STRUCTURES, PROVISION OF SCOUR PROTECTION & MINOR SAFETY WORKS 31

SCHEDULED ANCIENT MONUMENT (DEEPING GATE BRIDGE)

DOUBLE SKIN PLANKING 15

SCHEDULED ANCIENT MONUMENT (MEDIEVAL MARKET CROSS)

RESTORATION OF STRUCTURES, PROVISION OF SCOUR PROTECTION & MINOR SAFETY WORKS 32

DEEPING ST JAMES CONSERVATION AREA

DEEPING GATE CONSERVATION AREA

PROTECTED WALL OR RAILINGS

RE-ESTABLISH BANK IN FRONT OF WALL REPAIR CRACKS IN WALL 29

RAISE STEPS 30

MAKE UP AND ASPHALT PATH 16

A	25	ROUTE OF STAMFORD CANAL LABELLED	AK	AK
	33	REPORT ISSUE	MO	AK
Rev	Date	Description	By	Chkd App
Revisions / Status				

MARKET DEEPING FLOOD DEFENCES

ENVIRONMENTAL APPRAISAL (ACCOMPANIES ENVIRONMENTAL APPRAISAL REPORT NOVEMBER 1993)

National Rivers Authority
NRA
Anglian Region

SELECTED ENVIRONMENTAL INTERESTS

Consulting Engineers
POSFORD DUVIVIER
Head Office
PETERBOROUGH

Drawn	MO		
Date	NOV 93		
Scale	1:2500	Client Ref	51560
Drawing No.	1	Code	Revision
			A

PD Job No. 7111
© POSFORD DUVIVIER

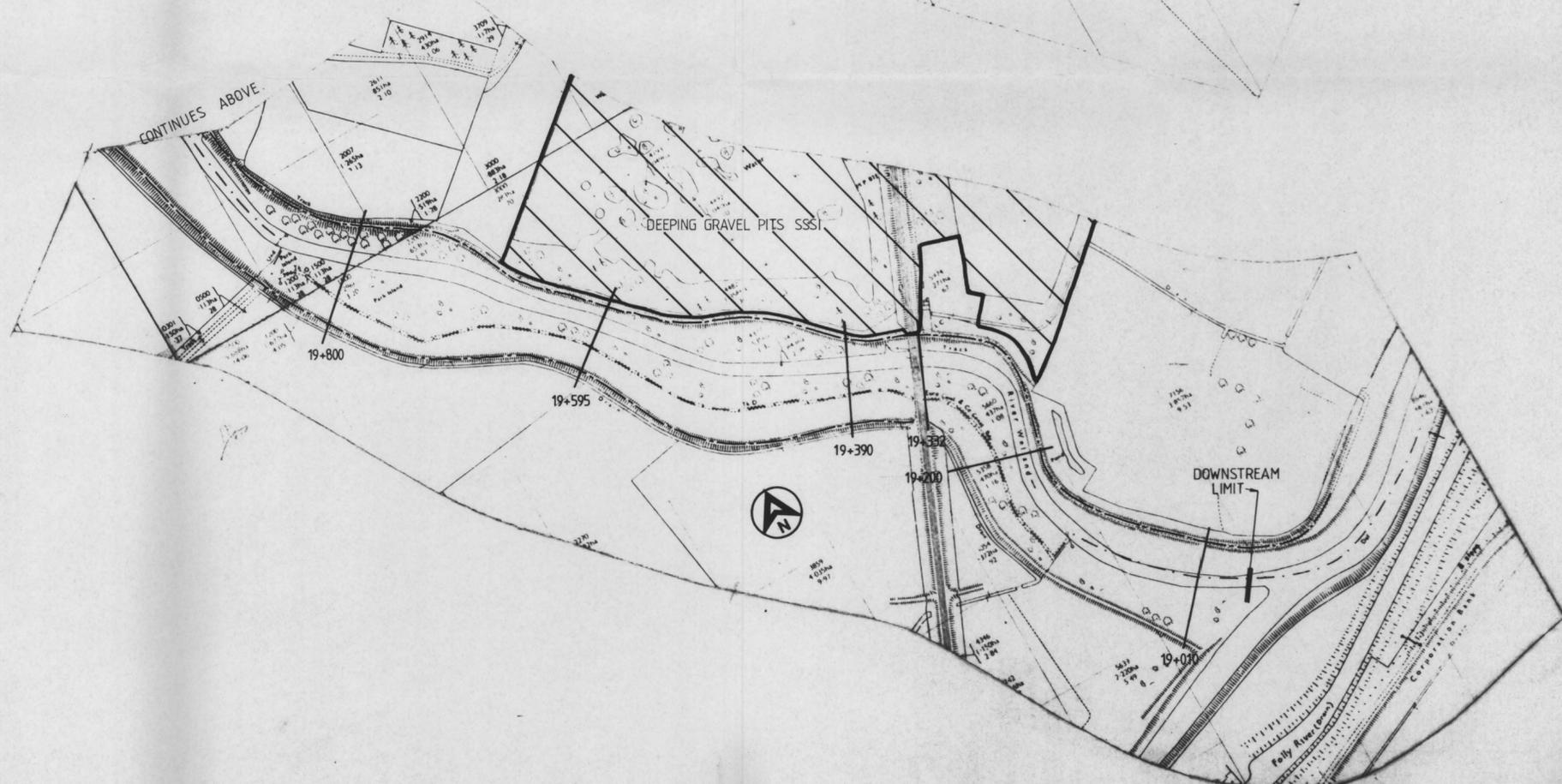
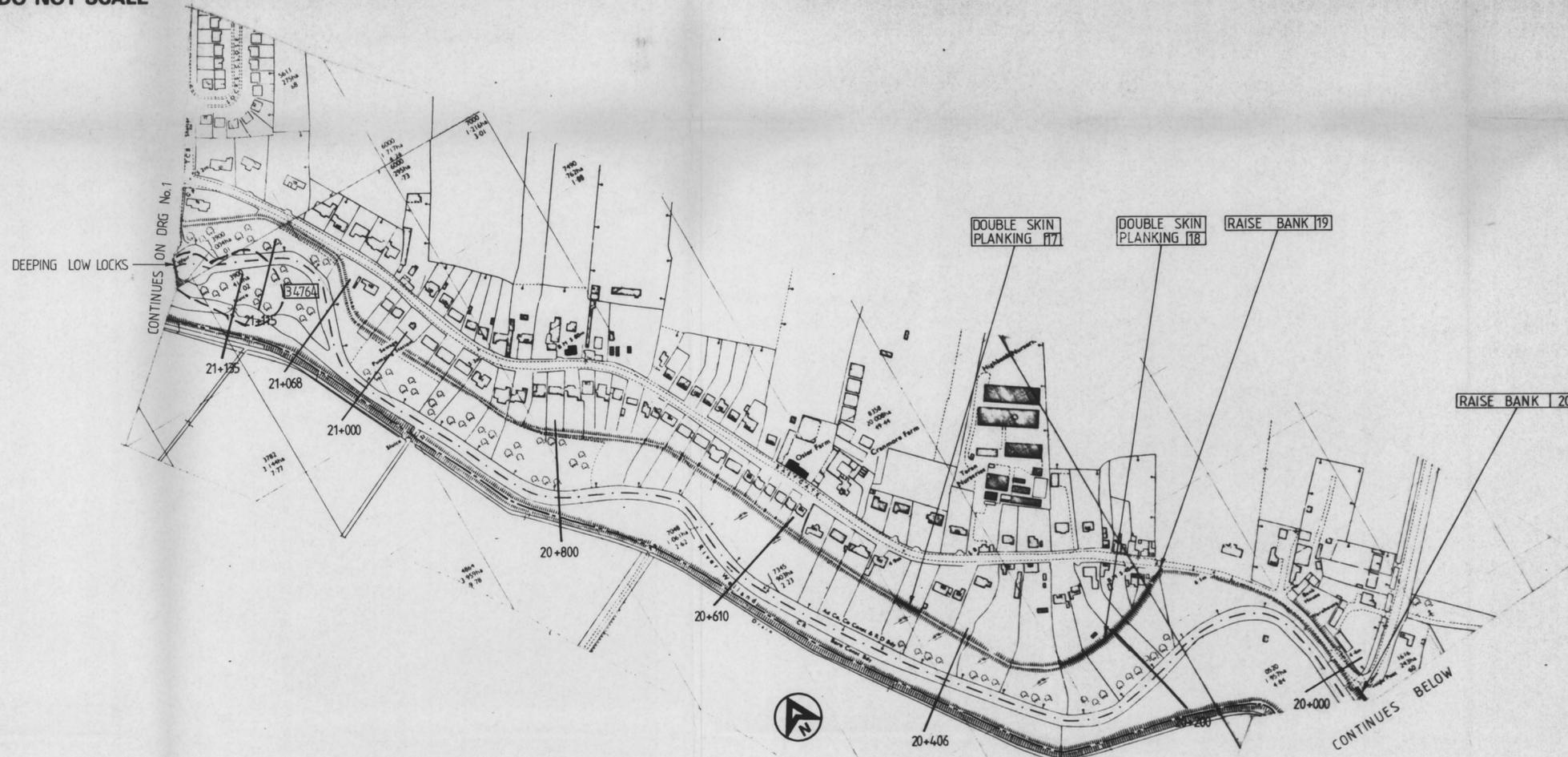
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DO NOT SCALE

Notes

- 1. SEE SECTION 2 FOR FURTHER DETAILS OF IMPROVEMENT WORKS.
- 2. DWARF WALL [1] DESCRIPTION OF IMPROVEMENT WORKS SITE NO.
- 3. | DENOTES CHAINAGE

28+800



KEY :

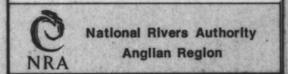
- [Symbol] LISTED BUILDING
- [Symbol] ARCHAEOLOGICAL SITE
- [12345] LINC'S SMR NUMBER (SEE APPENDIX G)
- [Symbol] FOOTPATHS (FOR ILLUSTRATION ONLY)

Rev	Date	Description	By	Crtd	App

REPORT ISSUE

MARKET DEEPING
FLOOD DEFENCES

ENVIRONMENTAL APPRAISAL
(ACCOMPANIES ENVIRONMENTAL
APPRAISAL REPORT
NOVEMBER 1993)



SELECTED ENVIRONMENTAL INTERESTS

Consulting Engineers		Head Office	
POSFORD DUVVIER		PETERBOROUGH	
Client	M.O		
Date	NOV '93		
Scale	1:2500	Client Ref.	51560
Drawing No.			