

HATFIELD CHASE

Water Level Management Plan



Interim Statement

Consultation Report

June 1995

FOREWORD

In 1994 the Ministry of Agriculture, Fisheries and Food launched Water Level Management Plans as a means of controlling water levels in rivers and drainage systems that affect Sites of Special Scientific Interest. The plans will form a basis of understanding for all those using or managing such waters.

The National Rivers Authority is preparing the plan for the Hatfield Chase pumped drainage system, which surrounds Hatfield Moors SSSI. This plan is being written with the full co-operation of the several Internal Drainage Boards that operate in the area.

This consultation report is the first stage in the preparation of the plan. It provides a framework for consultation and seeks a commitment from those concerned in the management of water levels in the area.

We look forward to receiving comments and contributions from interested organisations and individuals. These will be used to produce the final plan, balancing the conflicting demands for water.

April 1995

ENVIRONMENT AGENCY



059118

CONTENTS PAGE

Section	Page Numbers
Introduction	1
Maps	2
Consultees	3
Summary of Interests	4 - 9
Objectives	10 - 11
Operating Procedures	12 - 16
Programme for changes	17
Unresolved differences	18
Strategic Objectives	19
Appendix I - NRA Maintenance Works	20 -21
Appendix II - NRA Pumping Stations	22
Appendix III - IDB Maintenance Activities	23
Appendix IV - IDB Pumping Stations	24 - 25
Appendix V - SSSI information	26
Appendix VI - Past conservation initiatives	27

HATFIELD CHASE WATER LEVEL MANAGEMENT PLAN

Introduction

Water Level Management Plans provide a means by which the water level requirements for conservation, agriculture, fisheries, industry, flood defence and water quality can be balanced and integrated.

The 'Conservation Guidelines for Drainage Authorities' (MAFF/DOE/Welsh Office 1991) states that plans should be produced where water levels are managed, with priority being given to Sites of Special Scientific Interest.

The Hatfield Chase area would once have been a large area of bog and fen, below sea level, which supported a wide variety of plants and animals. The history of this area has been one of increasing use, and over the centuries it has been embanked and drained to create conditions suitable for agriculture and settlement. Despite the conversion of peat moor to arable land the drainage from the land retains water quality characteristics of the peat lands. The demand for water for agricultural use in the area is high.

The pumped drainage system surrounds Hatfield Moors SSSI, a raised peat mire, which has been milled for peat for several years. There is concern over the restoration of the mire, through loss of water from the pumped drainage system and the lowered water table of the Doncaster Groundwater Unit. Sensitive management of the drainage system may have a beneficial effect on the mire, but it is considered that the main problem is the lowered groundwater.

Lowland wetland habitat still exists in the pumped drainage system and the low lying peat areas contain archaeological remains. Sensitive water level and land management practices are essential if the conservation interest is to be maintained, enhanced or restored. This would contribute to the sustainable management of wetland habitat.

There are informal agreements for water levels at present, but as these may be open to misunderstanding or misinterpretation it is essential that a formal plan is adopted.

The area of the plan covers the River Tame catchment from Auckley downstream together with the Internal Drainage Board areas that discharge into the system and eventually are pumped to the River Trent at Keadby. (See Figure I). Most of the land covered in the plan is below sea level.

The purpose of the plan is to develop integrated and sustainable water level management arrangements to balance the needs of conservation, agriculture, recreation, industry, flood defence and water quality with the agreement of all interested parties. The plan will establish requirements for these needs and agree operational arrangements, whilst taking opportunities as they arise to secure such arrangements, taking into account current or future demands for water needs.

MAPS

The maps contained in this plan show:-

1. The pumped drainage area on A3 maps extracted from 1:50,000 OS monochrome maps.
2. The Internal Drainage Districts within the Plan area
3. Main River and Pumping Stations
4. Conservation and Archaeological sites
5. Sub Catchments showing IDB watercourses and structures on A3 maps extracted from 1:25,000 OS monochrome maps showing drain names, flow direction.
6. Licenced abstractions
7. Main consented discharges, chemical and biological classification of watercourses.
8. The Moor Drain and associated drainage pattern for Hatfield Moors

LIST OF CONSULTEES

English Nature	A partner to the plan
Grantham Brundell & Farran	Engineers and Clerks to several IDBs in the area
Hatfield Chase IDB	A drainage board in the area
Ashfields & Westmoor IDB	" "
Finningley IDB	" "
West Axholme IDB	" "
Tween Bridge IDB	" "
Althorpe IDB	" "
Armthorpe IDB	" "
Crowle IDB	" "
National Farmers Union	To represent the views of the farmers
M.A.F.F.	Promoter of the plans
R.S.P.B.	To advise on bird habitat
Yorkshire Wildlife Trust	County conservation advisors
Lincs & S.Humberside Trust	" "
Countryside Commission	General countryside matters
Country Landowners Assoc.	To represent views of landowners
English Heritage	Government body for SAMs, archaeology & listed buildings.
Farming & Wildlife Advisory Group.	Conservation advisors to farmers
Tilcon Gravels	Gravel extraction
Tarmac Roadstone	"
Severn Trent Water	Discharges from sewage works
Yorkshire Water Services	Public water supply (Doncaster Groundwater Unit)
Humberside County Council	Footpaths, Mineral Extraction, Archaeology, Education as above plus Planning
Doncaster MBC	Planning
Boothferry Borough Council	Peat milling
Levingtons	Local businesses
DTi	NRA tenants on River Torne (Candy Farm to Pilfrey Bridge)
Doncaster & District A.C.	NRA tenants on River Torne (Torne Bridge to Candy Farm)
Barnsley & District A.C.	NRA tenants on Three Rivers (Pilfrey Bridge end)
Worksop & District A.C.	NRA tenants on Three Rivers (Keadby end)
Sheffield & District A.C.	e.g. Lindholme Fishery, Tyrham Hall Fishery
Fishery owners	Tyrham Hall
Recreation owners	e.g. Wroot
Parish Councils	
Forestry Authority	
Individual landowners	

Consultees should identify interests, evaluate interest and water level requirements, determine common aims and consider possible enhancements.

SUMMARY OF INTERESTS

Drainage and Flood Defence

The history of drainage in Isle of Axholme dates back to the 17th century and has involved river diversion, the excavation of new drains and the construction of floodbanks. More recently the increased ability to pump water by steam driven, diesel and now, in most cases, electric pumps, at the pumping stations has increased the drainage ability of the area. The whole of the area is now dependant on pumping and is divided into drainage areas controlled by pumping stations (see Figure 1). The pumping stations discharge to main river and the water is eventually pumped or gravity fed to the River Trent at Keadby.

Recent refurbishment at Keadby, Candy Farm, Bull Hassocks and Tunnel Pits North Pumping Stations, involving full automation of pumps, will enable water levels in drains to be controlled within a narrower band than at present. A new station was also built at Tunnel Pits South.

The River Torme is the main carrier watercourse. The main rivers in the plan area are primarily wide drainage channels but the River Torme has a natural upland catchment, which drains the Doncaster area, and has several pumped inputs in its lower reaches. Each main river has embankments to protect the surrounding low level agricultural land

The NRA has powers under the Water Resources Act 1991 to maintain the statutorily-defined main rivers which provide the high level carrier network. This provides capacity to carry flood flows and freeboard for drainage of outfalls. The Authority has a duty under Water Resources Act 1991 to further the conservation and enhancement of the environment. All operations undertaken in the watercourses of the drainage area are subject to an environmental assessment.

There are seasonal variations in the water levels in the drains. In winter the levels are controlled by pumping and there is generally water in all the drain system. In summer levels are held at the main pumping stations to allow abstraction to take place for irrigation. In some cases the drains at the head of a pumped catchment area are dry in summer

Locations of NRA Main Rivers and pumping stations are shown on Figure 3

Internal Drainage Boards were established to secure the drainage of the lowland area. Drainage, as defined in the Land Drainage Act 1991, includes flood defence, irrigation, other than spray irrigation and warping.

These IDBs exercise a general supervision of matters relating to drainage of land within a district which shall derive benefit, or avoid danger, as a result of drainage operations. Each IDB interprets the definition in the 1991 Act in a broadly similar way.

The following Internal Drainage Boards operate within the drainage area.

Hatfield Chase IDB, Finningley IDB, Armthorpe IDB, Ashfield & West Moor IDB, Tween Bridge IDB, West Axholme IDB, Althorpe IDB. Locations of the districts are given in Figure 2

All Boards maintain channels and manage water levels to provide flood protection for residential and industrial properties and to provide drainage for agriculture.

For areas which rely on pump drainage there are two levels at which the pumps are set, relating to summer or winter flows. (see appendices for pumping levels)

All IDB pumping stations discharging to Keadby are on automatic level control. (There are some manually controlled IDB pumps discharging directly to the River Trent outside this plan area). There is no direct link between operation of the IDB pumps and the NRA pumps. When IDB pump discharges raise levels in drains feeding NRA pumps, the latter operate in response.

In order to convey water to pumping stations the IDBs have, over the years, adopted watercourses. Some old IDBs, such as Hatfield Chase, own whole watercourses whilst others are exercising their permissive powers to maintain the watercourses, mainly those providing drainage to two or more ratepayers or an urban area.

IDBs operate under the Land Drainage Acts of 1991 and 1994 and in exercising their land drainage functions, each Board has a duty to further the conservation and enhancement of the natural environment through the drainage district. In addition there are special responsibilities relating to SSSIs, which require the Board to consult with English Nature before undertaking any work which could be a potentially damaging operation e.g. lowering water levels.

Conservation

The catchment area is low lying, with considerable importance for nature conservation. The extensive network of drains forms a significant wetland resource. The drainage system surrounds Hatfield Moors SSSI. Within the catchment there are also Epworth Turbary, Haxey Turbary, Belshaw, Crowle Borrow Pits and Thorne, Crowle and Goole Moors SSSIs, as well as several SINCS. Details of the interest of the SSSIs is given in Appendix V

Lowland raised mire is a very scarce resource in Britain and every effort is made to conserve component species and provide conditions for restoration such mires. The wetland aspect is of prime importance and both the drainage of the moors and the underlying groundwater table require investigation in the case of Hatfield Moors.

SINCS in the area are also dependent on water levels. Finningley Gravel Pits, formerly an SSSI, for its wetland interest is now mainly dry woodland; Blaxton Common and Blaxton Carr-side both have suffered damage through loss of water. SSSIs and SINCS are marked on Figure 4

There is a need to keep an average of 400mm of standing water in drains to ensure the growth of some of the rarer species. Plants are particularly vulnerable in spring when a period of drought can prevent successful emergence. Low water levels in winter can expose roots to frost damage.

Survey work in 1986 (Wade & Wingfield) ascertained that the drains supported varied aquatic plant communities and work in 1990 (Bignall) identified sensitive drains. These are being re-surveyed in 1994. (see Appendix VI)

Maintaining water in the ditch system should enable aquatic invertebrates to survive and there is evidence to link plant diversity to invertebrate diversity, so levels suitable for plants should maintain invertebrate interest.

Variations in water levels should not affect the small number birds found in the drainage system, mainly duck, moorhens and herons. Shallow flooded fields would be of great benefit to wading and wintering birds, but there is seldom flooding in the area as the drainage system enables high flows to be transported in the high level drains to evacuate by pumping into the River Trent.

Further work in the area could identify areas that may be isolated hydrologically and could be flooded in winter for this purpose.

Archaeology

Hatfield Chase lies within an area more broadly defined by the Humber Wetlands Project (based at the University of Hull and sponsored by English Heritage) as the Humberhead Levels. Archaeological finds and sites in the Humberhead Levels provide evidence of human use of the area from Palaeolithic to Post-Medieval periods. Many of these items of archaeological interest will depend upon the maintenance of an appropriate water regime for their preservation.

The drainage and land use history of the Humberhead Levels is described in "Wetland Heritage" by R Van de Noort and P.Davies, published by the Humber Wetlands Project in 1993. This document also highlights areas of existing or potential high archaeological importance, several of which lie within the general area of Hatfield Chase.

There is an Ancient Monument at Thorne.

Recreation

The catchment area has numerous public rights of way and bridleways.

The Rivers Torne and Three Rivers are formally fished by a number of angling clubs. The Keadby & Stainforth Canal is also fished but although it is in the catchment area it is not

affected by the pumped drainage system. The canal is used by pleasure boats travelling to Sheffield Basin, and as an alternative route from the River Trent to the River Ouse, avoiding Trent Falls.

Fishing takes place at a number of stillwaters in the area, the majority of which are unaffected by the drainage system. It is possible that the lowering of the regional groundwater table may have an effect on some of these stillwaters.

Bird watching is known to take place at Armthorpe Balancing Reservoir and Lindholme Lakes.

Jet Ski-ing takes place on Tyrham Hall Lake.

Agriculture

Much of the land within the catchment boundary is in agricultural production with a high proportion of Grade 1 and 2 land. Most of the land is in arable crops with a significant proportion of potatoes, sugar beet and horticultural crops.

All of the land is low lying and the agricultural productivity depends on a good standard of arterial drainage and a plentiful supply of water for irrigation.

During the Summer months, surface water resources in the Hatfield Chase area are intensively used for the irrigation of crops. An indication of the increased demand for water for spray irrigation is the recent applications for 24 new licences and 11 applications for increases to existing licences. A 100mm drop in level at Bull Hassocks has, on occasion, occurred overnight in summer due to abstractions. The total daily licensed abstraction from the Bull Hassocks catchment could be pumped by a 1 cumec pump in 5 hours.

The system now supports 99 spray irrigation licences which can abstract up to 91 megalitres per day (Ml/d).

Abstractors/Water Resource

There is extensive groundwater pumping for public water supply from the Doncaster Groundwater Unit. There has been a lowering of the groundwater levels in recent years caused by drought conditions and increased demand for water. A study is currently being undertaken by NRA and Yorkshire Water Services to examine levels and the relationship between the drainage system and the regional groundwater levels.

The lowered levels may be having an effect on Hatfield Moors SSSI combined with the draining of the moors for peat cutting..

There is a need to examine the water balance for the drainage area; the natural input of water from the River Torne, the licenced abstractions, the outflow at Keadby Pumping Station to the River Trent and the interaction of the pumped drainage system and the regional groundwater levels.

Water Quality

It is the aim of NRA to maintain and improve the quality of controlled waters. Watercourses are classified according to existing quality and are given targets/objectives relating to their uses. Quality objectives are not currently statutory, but when they are, under the Water Resources Act 1991, it will be the duty of the NRA to achieve them. Figure 7 shows chemical and biological quality of the classified watercourses in the plan area. Major consented discharges are also shown.

Consents specify quality limits which must be met by the discharger. The limits are calculated by the use of computer modelling and take account of flow and quality of both the effluent and the receiving watercourse which provides dilution. It is important that sufficient dilution is available to prevent polluted water building up at the outfall. This is particularly relevant to the pumped watercourses in the plan area as flows are variable, difficult to measure and are low during periods of dry weather. Consents inherited by Severn Trent Water Ltd are treated as assets and are difficult to tighten the conditions. Such consents may not have taken account of prevailing flow regimes in the receiving watercourses, and in dry weather a plug of polluted water can collect at the consented outfall. When pumped this could cause damage downstream to flora and fauna. This situation can be compounded by over abstraction upstream of the discharge which reduces dilution. Such events can cause watercourses to fail to meet quality objectives and this is to be avoided when the objectives become statutory. The discharge of sewage effluent to a static waterbody creates eutrophic conditions leading to excessive weed growth.

Drainage from the land within the plan area has a water quality characteristic of the rich peat deposits which underlie much of the agricultural land and the moors. Humic and fulvic acids from the peat reduce the pH of water in the ground which mobilises metals. The metals tend to precipitate out in the higher pH conditions and can blanket the bed of the watercourse. This usually occurs in winter months and could be related to NRA and IDB pumping operations.

Invertebrates and plant life within the watercourses are affected by the blanketing and by the toxicity from metals such as aluminium, which can occur at high levels. Drainage from land also contains ammonia which lowers the overall quality of watercourses in the area, more than would be expected of a rural area.

Commercial/Industrial

There are several small Industrial estates requiring protection which depend on the drainage system to evacuate surface water and prevent flooding.

Mineral Extraction

Gravel extraction takes place at several sites within the area, the majority of which are worked dry, necessitating dewatering. The resultant pumped water is discharged to the drainage system. (Locations are shown in Figure 8)

Peat Extraction

Whilst the drainage regime of the area is obviously critical to the conservation interest, the significance of peat cutting on the raised mire should not be overlooked. Peat extraction on a small scale for domestic fuel had taken place in the area prior to the large scale drainage of the 17th and 18th Centuries. Commercial exploitation of peatland sites only began in the 19th Century when peat was cut to provide litter for animal stables. Since the last war, cutting has continued at an ever-increasing rate to service the horticulture market. The main sites for commercial extraction have been Thorne, Goole, Crowle and Hatfield Moors.

In a natural state peat bogs are able to retain large quantities of water, which then drains slowly into the drainage system. Damaged bogs, such as Thorne and Hatfield Moors, retain less water and drain more quickly through the deep drains dug by the commercial operators to enable milling to take place.

If peat cutting were to cease and drainage of the bogs stopped the effect of the Hatfield Chase drainage system, particularly the water fed into the system from Moor Drain, on the water level in the peat on the moors would need to be assessed. Work has been undertaken in Holland on the effect of a drainage system surrounding a raised peat mire.

Transport/Road/Rail

The M180 crosses the drainage area and all motorway drainage is dependent on the drainage system.

The Keadby and Stainforth Canal crosses to the north and although there may be seepage there is no direct overflow into the drainage system.

The Grimsby to Doncaster railways line runs east to west across the plan area, north of the Keadby Stainforth Canal, crossing the River Trent at Keadby.

Fisheries

Fisheries survey work is undertaken on main rivers and the canal by the NRA. Fish stocks are moderate to good dominated by roach and bream. Other species include eels, perch, pike, tench and gudgeon

The stillwaters in the area support good fisheries, maintained privately, for both coarse and trout fishing.

OBJECTIVES

The general objectives should:-

Determine the required water level which fulfils the aims of interest groups i.e. consultees.

Relate aims to practical limitations of the drainage infrastructure

Assess whether current practices meet the aims

Consider restrictions that water resource and water quality requirements may place on water level management practices and maintenance operations

Specific objectives are:-

Conservation

Water Levels should be maintained at as high a level as is compatible with other uses

Maximum length of drain should hold the water for maximum time. The heads of the drains should be kept wet.

The maximum length of drain should contain a depth of not less than 500mm. The system as a whole should contain a variety of water depth from very shallow to around 1.5m.

Water levels should be maintained at as constant a level as is practical

Flood Defence - NRA

To protect people and property from flooding

To ensure effective and efficient operation of the pumping stations

To ensure the river system is capable of containing and transmitting flood waters.

To preserve the stability and integrity of flood defences.

To manage water levels to allow adequate discharge of IDB outfalls

Drainage - Internal Drainage Boards

To provide flood defence for 1:10 return period floods for agricultural property and to a higher degree for industrial and residential property.

To provide adequate drainage to agricultural land to provide adequate water for crop growth whilst allowing harvesting machinery on the land

To retain water in summer to enable spray irrigation by agreement of land occupiers

To undertake all operations with due regard to conservation and implementing new or alternative methods in areas which may benefit the environment without prejudicing the previous three objectives.

Water Resources

Water Resources aim to ensure the reasonable demands of all abstractors in the Isle of Axholme system can be met as far as possible, while ensuring that no detrimental effects to the environment or other uses occur.

To ensure that water levels in the drains are kept as high as possible during the irrigation season, such as is compatible with other users.

To ensure that water resources are distributed such that optimal use can be made of them, especially in sub-catchments that have a high irrigation demand.

Water Quality

To ensure water quality is consistent with users of the water and satisfies relevant legislation

To take measures to improve water quality in watercourses that do not meet their quality objectives.

To maintain or improve quality by ensuring provision of dilution water to ameliorate the effects of consented discharges by controlling abstraction and maintaining pass forward flows at pumping stations where practicable.

To limit pollution of watercourses from drainage from land associated with water level management.

OPERATING PROCEDURES

Current practice

NRA

To protect the surrounding low level agricultural land embankments have been constructed along main river and maintenance works to these embankments and watercourse channels are therefore undertaken to ensure that flood defences are effective and there is sufficient channel capacity to carry flood flows.

These maintenance activities are listed in Appendix I

The following details apply only to the NRA pumps; IDB pumping is isolated from NRA pumping.

The average ground level in the Hatfield Chase area is approximately 0.5 m AOD. Although the catchment area for each pumping station is defined, there are no physical barriers within the drainage system for Hatfield. Hence all pumping stations operate at about the same level. Typically a duty pump will start when the water level in the drain rises to -0.5m OD and will stop when the level falls to -1.0m OD.

The NRA pumping stations discharge into a system of highland drains which then gravitate to Keadby before being pumped (when necessary) into the River Trent. The flood level in the River Torne at Candy Farm is 2.85m OD and the flood level in the River Trent at Keadby is 6.0m OD. Levels in the main drains are maintained at a level which allows free discharge from the field drains.

During the first 5 minutes of pump operation at a pumping station the level may drop by up to 0.3 metres. However, it could be several hours before any change in level is detected at the upstream end of the drain which could be several kilometres away. Ditch gradients vary between 1 in 4000 and 1 in 10,000.

The target summer and winter levels for each pumping station are shown in Appendix II. Remedial action is required when anticipated or actual levels vary from these e.g. increase pumping, decrease abstraction. The greater efficiency of the pumps enables the drain levels to remain constant as flood water is removed more quickly, thus encouraging the establishment of marginal vegetation.

The NRA monitored water levels in the Bull Hassocks catchment during 1992. Levels were monitored at Bull Hassocks pumping station, Upper Snell Drain, Twelve Foot Drain, Monkham Drain, South Idle Drain and Misson Bank Drain. At each of these sites daily gauge board readings were taken and plotted. At some sites continuous level recorders have also been installed.

Comparison of the plotted levels showed, in general, that levels in the drains responded to changes in level at Bull Hassocks PS when penstocks were operated. An exception was Monkham Drain where higher levels were initially retained by a sand bar until it was removed.

The target summer water level at Bull Hassocks PS is -0.45m OD with a minimum level of -0.6m OD. Higher levels would cause drainage problems for low lying land near to the Bull Hassocks PS

In the 1992/93 winter, water levels in the drains were typically 0.2 metres above levels at Bull Hassocks PS. Winter levels in drains were approximately 0.2 metres below summer levels. Backfeeding water at some pumping stations takes place to support abstractions for irrigation when sufficient water is available.

Internal Drainage Boards

Details of sub catchments, showing watercourses, direction of flow and pumping stations will be shown in Figures 5 (one map for each IDB)

Several of the Boards in the catchment area have pumping stations and the summer and winter pumping levels are given in Appendix IV. The summer levels are not set to a determined level throughout the period but are varied to take account of particular cropping regimes in the catchment. Both are set to maintain water levels for farming operations whilst still retaining enough storage capacity (freeboard) to prevent flooding throughout the catchment in a storm event.

Tween Bridge Internal Drainage Board

Elmhirst District comprises 1705ha and is served by Elmhirst Pumping Station, in which there are three Archimedean Screw type pumps, each of 600 litres per second capacity. The duty pump cuts in at - 1.8m, and stops at - 2.4m. Two main drains flow to the Pumping Station, Boating Dyke Drain from the South and Leonards Drain from the North, and subsidiary drains feed into these. In addition to the agricultural land, there is a built up area to the North West side, which includes parts of Moorends and Thorne. The flow from Elmhirst Pumping Station is discharged into Thorne Waste Drain, which runs in a South Easterly direction to the New Zealand Pumping Station, owned and operated by the NRA. As well as taking the discharge from Elmhirst and some side flow into the Thorne Waste Drain, this also caters for that from the remainder of the town area of Thorne. The latter flow is conducted to the Pumping Station via the North Soak, into which the pump discharges to flow by gravity to the Trent at Keadby.

Medge Hall District is served by the pumping installation at Medge Hall, which is run by the NRA on the Board's behalf, and caters for 600 ha approximately. The main drain leading to the pump is Crook-a-Moor Drain, into which there are a number of subsidiary drains:

Lovers Ground, Proctors New Cut, Blackburn New Cut, Dole Road, Middle Moor Drains. At the Pumping Station there are two vertical axial flow pumps each delivering 240 lisees.

Ealand District is composed of 204 ha and served by four drains, three of which (Godknow Common, Nettle Common and Wood and Ealand Common Drains) discharge directly into the North Soak.

Corporation of the Level of Hatfield Chase Internal Drainage Board

The Internal Drainage District administered by the Board is 7970 hectares of which 1008 ha are non agricultural. There are 135 km of adopted watercourse. The District all but surrounds the Hatfield Moors Site of Special Scientific Interest.

The Board owns and operates six pumping stations and operates three others on behalf of British Coal Corporation. A number of the stations (three) discharge directly into main river. The remainder discharge into Board watercourses which are then pumped to main river by NRA pumping stations.

Pumping stations operated by the Board are given in Appendix IV

Armthorpe Internal Drainage Board

The Armthorpe Internal Drainage District is 1151 hectares of which 491 ha are non agricultural. There are 5.8 km of adopted watercourse

There are no pumping stations within this district and all watercourses discharge by gravity outfall into either the Corporation of the Level of Hatfield Chase Internal Drainage District or the NRA Waterton Farm Pumping Station.

Ashfields and West Moor Internal Drainage Board

The Internal Drainage District administered by the Board is 3408 hectares in total area with 1258 ha being non agricultural. There are 48.18 km of adopted watercourses.

The Board owns and operates one pumping station and operates four others on behalf of British Coal Corporation. One of these stations (Wykewell Pumping Station) discharges directly into the Sheffield and South Yorkshire Navigation whilst the remainder discharge into Board maintained watercourses. A large amount of the water generated by the system is discharged by gravity into the Corporation of the Level of Hatfield Chase Internal Drainage District.

Pumping stations operated by the Board are shown in Appendix IV

Finningley Internal Drainage Board

The Internal Drainage District administered by the Board is 4520 hectares in total area with 1639 hectares being non agricultural. There are 39.92 km of adopted watercourse

The Board owns and operates three pumping stations and one on behalf of British Coal Corporation. The Park Drain station discharges on the northern boundary into main river and does not enter the Hatfield Chase area. The remaining three stations discharge into the River Idle which is main river and does not flow into Hatfield Chase. The north western part of the District drains by gravity flow into the southern part of the Corporation of the Level of Hatfield Chase Internal Drainage District. These waters flow to the NRA Bull Hassocks Pumping Station and are then pumped to South Engine Drain.

West Axholme Internal Drainage Board

The Internal Drainage District administered by the Board is some 4899 hectares in total area. The District borders with the Corporation of the Level of Hatfield Chase Internal Drainage District to the west, Finningley Internal Drainage District to the south, South Axholme and West Butterwick Internal Drainage Districts to the east and Althorpe Internal Drainage District to the north. Within the district lie the settlements of Epworth, Westwoodside and Haxey.

The Board operates three pumping stations. Two of these stations discharges directly into the River Trent and are thus outside the plan area, only Greenholme P.S. discharges into main river draining to Keadby Pumping Station.

The stations all have electric duty pumps which are controlled by automatic switches. The three stations operated by the Board in the plan area have electric main pumps.

Althorpe Internal Drainage Board

The Internal Drainage District administered by the Board is some 223 hectares in total area. The District is bordered by Three Rivers to the north, The River Trent to the east and West Axholme Internal Drainage District to the south. One eighth of the water is discharged into the River Trent whilst the remaining seven eighths go to Keadby Pumping Station via Three Rivers.

Crowle Internal Drainage Board

The Internal Drainage District administered by the Board is only partly in the drainage area, and this is pumped into North Soak Drain. The Old River Drain Pumping Station is a small automatic station with one submersible pump. There is no gravity discharge. In the event of breakdown water is allowed to flow in the opposite direction towards the Paupers Drain system, and to the River Trent at Amcotts.

Peat Industry

A plan of Hatfield Moors drainage is shown in Figure 8. 60% of water from the moors enters the pumped drainage system via the Moors Drain which surrounds the moors. At Tunnel Pits 60% of the moors drainage comes into East Ring Drain by means of a slide valve and is then pumped into the River Torne. 30% of moors drainage enters Hatfield Waste Drain to the north. Both these outlets have water in all year round. The other 10% enters at points A, also Hatfield Waste Drains, and D, via a drain to Candy Farm and again to the River Torne. Both these outlets are dry most of the time and operate only when the main outlets back up.

Water Resources

The system supports 99 spray irrigation licences which can abstract up to 91 megalitres a day (ML/d). This compares with a dry weather flow in the River Torne at Auckley of 30 ML/d. Approximately 30 of these licences have conditions which restrict abstraction if either Keadby levels or River Torne flows at Auckley fall below defined thresholds.

The prescribed flow on the River Torne, which triggers abstraction restrictions, is set for water quality (there are 3 - 4 sewage discharges within the catchment) and fisheries purposes. There are four levels, relating to flows at Auckley, at which increasingly strict restrictions come into play. These are 4° - 24 ML/d; 3° - 22 ML/d; 2° - 20 ML/d; and 1° - 17.3 ML/d.

Increased demand for irrigation in the area has recently led to 24 applications for new licences and 11 applications for increases to existing licences

Backfeeding water at pumping stations to support irrigation abstractions from drains is a possibility and in future may be managed by a licence or by operational rules. Currently only the NRA pumping stations Bull Hassocks, Tunnel Pits, Dirtiness and Candy Farm have the facilities to backfeed water. At present no IDB pumping station has these facilities.

Backfeeding of water at pumping stations downstream of effluent discharges should be avoided where it would lead to water quality deterioration.

There are still various uncertainties over the high level system - it is not known how much leaks from the bottom, or goes out by gravity at Keadby. There is a need to do careful measurements and refine the modelling, and then extend this to the low level systems.

The input of water from the Moors Drain, draining the peat milling areas, is unknown.

Figure 6 shows the licenced abstractions. It should be noted that there are multiple licences at some locations.

PROGRAMME FOR CHANGES

There is a need to collect more data in the catchment in order to write a final management plan.

The work undertaken in the Bull Hassocks area, collecting water level data from six points using gauge boards, will be continued through 1995. It may then be possible to write a plan for a part of the catchment area, based on each pumped area.

The modelling of both the Doncaster Ground Water Unit, and the surface water within the catchment will enable the Authority to determine any change in licencing policy. Data loggers are to be installed on several abstraction meters to measure actual amounts taken.

Methods of measuring backfeeding also needs to be investigated during the coming year.

Biological surveys of the drains identified as having conservation value have been completed in 1994 and the results show that the interest is still present in some of the drains but some have declined. Interestingly, other drains of interest were located in spot checks in the area.

A bed level survey of the IDB drains in the Bull Hassocks catchment showed that several drains were not capable of holding water when the levels at Bull Hassocks were -0.45m. Remedial work such as dredging to lower bed levels, or installing structures such as stop boards to retain water need to be examined.

Collect information on the effect of pumping regimes on the quality of land drainage with a view to reducing the pollution load where practicable.

Assess the impact of the very low summer flows experienced within the Hatfield Waste Drain catchment.

When these further studies are complete the data obtained might indicate that a programme of changes may be needed. Any subsequently agreed changes will have to be programmed accordingly.

UNRESOLVED DIFFERENCES

Any unresolved differences which arise during the consultation period will be considered by the operating parties prior to the production of a final plan. Those that cannot be satisfied will be highlighted and will need to be considered by the Minister of Agriculture, Fisheries and Food.

STRATEGIC OBJECTIVES

The objectives outlined previously are of a specific nature to the management of the water levels. In addition there will be strategic objectives relating to the overall area and future work.

The strategic objectives will be set to maintain the existing status quo of operations. Variations to these can be made when new information or new opportunities arise e.g. as pumping requirements change.

Objectives that fall in this category may be identified at the consultation stage

Objectives so far identified are:-

Contingency Measures

Contingency measures relating to drought and flood conditions relate to the target water levels. Remedial action will be required when anticipated or actual values are out of line with the target. These have already been covered in both flood defence and water resources.

Monitoring

Records of pumping station operations are held by the NRA and gauge boards exists at a number of locations.

The NRA monitored water levels in the Bull Hassocks catchment during 1992. Levels were monitored at Bull Hassocks pumping station, Upper Snell Drain, Twelve Foot Drain, Monkham Drain, South Idle Drain and Misson Bank Drain. At each of these sites daily gauge board readings were taken and plotted. At some sites continuous level recorders have also been installed.

Timescale of plan

The contents of the plan will be reviewed every 3 years or earlier with the prior agreement of NRA, IDB, EN and MAFF

APPENDIX I

NRA Maintenance Works

Present maintenance works can be summarised as follows:

Grass Mowing

Grass cover protects earth floodbanks and channel batters from erosion by high floodwater velocities. It is therefore essential, particularly on floodbanks, to maintain the grass in good condition with a short top growth and dense root growth below. Both bank settlement and vermin infestations can be readily spotted as a result of regular mowing or grazing. In the past major breaches and extensive flooding have resulted from uncontrolled vermin activity. Where possible controlled grazing of floodbanks is permitted. A cutting regime of 3 times/annum has been adopted. Heavy vegetation on channel batters can also significantly reduce the capacity of smaller watercourses and mowing is carried out on such channels once per year.

Floodbank Repair and Maintenance

Damage due to rutting by transport and settlement and erosion damage also requires repair work to be carried out. Where necessity demands, stone surface access tracks have to be provided over floodbanks.

Weed Control

Aquatic weed control is often necessary in watercourses with slack bed gradients where it can become exceedingly dense, seriously impede flow and cause water levels to be excessively high. Weeds can also cause serious blockage problems at pumping stations. Where possible, weed boats or excavators fitted with weed cutting buckets are used; alternatively chemical control or, as a last resort, hand cutting methods are employed. In critical channels, surface weeds on the channel batters, as well as obstructing flow, can also cause bank instability by preventing grass growth. Where the weed growth cannot be controlled by mowing an approved herbicide is applied. Weed control is managed such that water quality is protected.

Tree and Bush Trimming

Overhanging trees, branches and bushes within a watercourse channel accumulate floating debris which can seriously impede flood flows. It is not unknown for minor obstructions to develop into blockages which could cause extensive local flooding, affecting valuable crops or property. Trimming is therefore usually carried out once every three years.

Dredging

Siltation problems usually occur in watercourses with slack channel bed gradients or overwide channels. Siltation raises bed levels, reducing the available drainage free board and the channel capacity. Silt is removed by dredging using a dragline or hydraulic excavator on a ten year cycle.

Revetment Maintenance

Revetment protecting the banks of watercourses can become damaged by erosion or the public and if left unchecked can result in extensive local failure. Repairs to existing revetment are therefore essential. The construction of new revetment is restricted to protecting banks adjacent to flood defences, where stability is threatened.

Pest Control

Rabbits, moles and rats can seriously weaken the integrity of floodbanks due to their burrowing habits. Their activity therefore has to be controlled by the use of specialist pest control operators.

Routine Patrols, Inspections and Surveys

Routine surveillance of the catchment area with particular reference to the integrity of the flood defences and the carrying capacity of the main river system is carried out.

Pumping and Pumping Stations

Routine operation of pumping stations is carried out to maintain freeboard levels for land drainage and to evacuate flood waters. The electrically powered pumping stations are automatically operated

APPENDIX II

NRA PUMPING STATIONS - OPERATING LEVELS all to Ordnance Datum

STATION	Duty Pump	WINTER		SUMMER	
		Start	Stop	Start	Stop
Belton Grange	No. 1	-0.25	-0.60	0.00	-0.20
Bull Hassocks	No. 1	-0.70	-1.20	-0.40	-0.70
	No. 2	-0.60	-1.40	-0.30	-1.20
	No. 3	-0.50	-1.50	-0.20	-1.60
	No. 4	-0.40	-1.60	-0.10	-1.40
Candy Farm	No. 1	-0.75	-1.25	-0.45	-0.60
	No. 2	-0.60	-1.10	-0.40	-1.25
	No. 3	-0.45	-1.20	-0.35	-1.25
Dirtness	No. 1	-0.60	-1.10	-0.05	-0.40
	No. 2	-0.30	-1.10	+0.05	-0.30
Goodcop	No. 1	+0.20	-0.15	+0.20	0.00
	No. 2	+0.35	+0.15	as	as
	No. 3	+0.45	+0.30	winter	winter
	No. 4	+0.50	+0.40		
Keadby	No. 1	+0.45	+0.10	+0.60	+0.45
	Nos 2 3,4,5,6	on rising level			
Low Bank	No. 1	-1.00	-1.50	-0.30	-0.60
	No. 2	-0.60	-1.00	off	off
	No. 3	-0.30	-0.60		
New Zealand	No. 1	-1.30	-1.70	as winter	
	No. 2	-1.15	-1.70		
	No. 3	-1.00	-1.70		
Tunnel Pits	No. 1	-0.95	-1.20	off	off
	No. 2	-0.80	-1.10		
	No. 3	-0.60	-0.85	-0.45	-0.60
	No. 4	-0.45	-0.60		
Waterton Farm	No. 1	+2.40	+1.95	off +3.05	off +2.80
	No. 2	+2.60	+2.15		
	No. 3	+3.05	+2.80		
Woodcarr	No. 1	+0.20	-0.20	as winter	
	No. 2	+0.45	+0.20		
	No. 3	+0.70	+0.50		

APPENDIX III

IDB Maintenance activities

Whilst the seven IDBs in the catchment are totally independent of each other, they do all share similar maintenance regimes. These have been listed below, with particular reference to an IDB if works are different.

Grass Mowing

This is undertaken on the drain banks and within any pumping station compound. The drain banks are mown using a tractor mounted flail between the end of July and December in any year. Where possible, mowing will not commence until late August when crops are harvested. July mowing is undertaken in specific areas where the drain is a major watercourse and provision of machinery is minimal. The majority of drains are mown on one full bank and half of the opposite bank, for conservation reasons.

Weed Cutting

Almost all IDB maintained watercourses are subject to weedcutting, either using an excavator mounted weedcutting basket or by hand using a fork. West Axholme does not weedcut often, preferring sludging. The operation is undertaken during the same time as mowing, following crop removal. Where circumstances permit, partial removal of weed is undertaken, for conservation purposes. This is, however, a rare situation as most drains are at minimum size.

Sludging

Except in the areas of sandy soils, this is a rare activity, as the weedcutting operations remove small amounts of silt annually. On sandy soils it may be necessary to sludge up to four times per year due to topsoil blows. It is for this reason that West Axholme IDB prefers to utilise sludging in preference to weedcutting. Spoil from sludging is deposited within the Boards access width.

Pumping Station maintenance

Each station is visited at least once a week to have working hours read and general maintenance undertaken by the pump attendant. In wet weather more frequent visits are made to rake the screens and check for signs of breakdown. The pumps are inspected annually by a mechanical engineer and at specified intervals are overhauled. All the stations are electrical.

Patrols

All IDB maintained watercourses are patrolled by staff on a regular basis to check for obstructions to flow e.g. logs, bank slips. Remedial work is undertaken as required. These patrols also identify areas which may benefit from sludging.

APPENDIX IV

Pumping stations operated by the Boards are listed below

Hatfield Chase

Site Name	Type	Capacity	Discharge point	Levels	
				Winter	Summer
Blaxton	CS	2 x 0.9	Main river	+ 1.5m	+ 1.5m
Franklins	axial	1 x 0.2	IDB drain	+ 1.0m	+ 1.3m
South Thorne Bank	axial	1 x 0.2	IDB drain	+ 0.81m*	+ 1.11m*
Cadmans	axial	1 x 0.25	IDB drain	+ 0.7m	+ 1.0m
Kilham Farm	axial	1 x 0.2	Main river	+ 1.0m	+ 1.0m
Torne Bridge	axial	1 x 0.2	Main river	+ 1.0m	+ 1.0m
High Levels Nth	axial	n/a	IDB drain	+ 2.25m	+ 2.25m
High Levels Sth	CS	n/a	IDB drain	+ 2.45m	+ 2.45m
West Moor	screw	2 x 0.15			

NOTES:

The levels given are the current norm but are subject to change at any time as a result of adverse weather or a change in circumstances. Levels are not set to OD Newlyn (subject to check levelling to be carried out)

Pump type CS = centrifugal submersible

axial = axial flow type

screw = archimedean screw type

West Axholme IDB

Levels for Greenholme Pumping Station are not available.

Ashfields and West Moor Internal Drainage Board

Site Name	Type	Capacity	Discharge point	Levels	
				Winter	Summer
Wykewell Kirton Lane	screw axial	3 x 0.943 2 x 0.15 1 x 0.2	Canal IDB drain	- 3.0m + 1.0m	- 3.0m + 1.0m
Pissy Beds Cuckoo Lane	CS axial	2 x 0.125 1 x 0.135 1 x 0.375	IDB drain IDB drain	- 0.8m - 0.1m	- 0.8m - 0.1m
Sandall Grange	CS	2 x 0.15	IDB drain	+ 4.1m	+ 4.1m

NOTES

The levels given are the current norm but are subject to change at any time as a result of adverse weather or a change in circumstances. Levels are not set to OD Newlyn (subject to check levelling to be carried out)

Pump types - see Hatfield Chase sheet

Tween Bridge Internal Drainage Board

Site Name	Pump	Type	Winter Levels		Summer levels	
			start	stop	start	stop
Medge Hall	No 1	Axial	-0.70	-0.85	off	off
	No.2	Axial	-0.55	-0.70	-0.55	-0.70
Elmhirst	No. 1	Screw	-1.80	-2.40		
	No. 2	Screw	-1.70	-2.15		

NOTES

The levels given are the current norm but are subject to change at any time as a result of adverse weather or a change in circumstances. Levels are not set to OD Newlyn (subject to check levelling to be carried out)

Pump types - see Hatfield Chase sheet

APPENDIX V

Details of the SSSIs are given below:-

Hatfield Moor SSSI (SE 700060)

Hatfield Moor is a large raised mire, mainly cut-over for peat extraction but with some areas of possibly uncut, but partially drained, surface. The site has been extensively cleared for peat milling and the uncleared areas are largely overgrown with birch. The site, however, retains an outstanding invertebrate fauna, an international important nightjar population and areas of rare mire vegetation. The site is proposed as a Special Protection Area under the EC Birds Directive and as a site under the Ramsar convention.

Thorne, Crowle and Goole Moors SSSI (SE730150 (small area only within plan area)

This site forms the largest single area of lowland raised mire in England. Although much of the surface has been damaged by peat cutting, traditional methods of peat extraction have ensured sufficient continuity for the retention of areas of mire vegetation. The site is also important for its invertebrate assemblage and internationally important for its nightjar population. The site is proposed (as Hatfield Moor as SPA and Ramsar site)

Haxey Turbarv SSSI (SE748018)

This site is a relict mire which has been extensively dug for peat. Now largely colonised by birch, recent management has opened up areas to allow the regrowth of mire species. The site also has a fen influence and has records of some rare fenland species.

Epworth Turbarv SSSI (SE755040)

Epworth Turbarv is another relict peatland. The peat has been partially covered by blown sand and in the past was cut extensively for fuel. The site has partly dried out and has been colonised by birch, but recent management is clearing the site and attempting to raise the water table on the site to re-establish wet heath habitats. The site also has some fen vegetation and remnants of mire vegetation.

Belshaw (SE768059)

This site forms part of a disused railway and supports a colony yellow rattle which is nationally rare. Neutral grassland and damp areas containing common reed and meadowsweet make up the majority of the site.

Crowle Borrow Pits (SE790105)

Two sites lie either side of the disused railway embankment and include a variety of habitats including alder carr, scrub, fen and open water. Several locally uncommon plants are found on the site

APPENDIX VI

Past Conservation Initiatives

The importance of the area for conservation and the effect of changing water levels on the biology of the watercourses, was identified by the NRA and its predecessor, Severn Trent Water Authority and various studies have been carried out since 1986 to determine relative values of the watercourses and the surrounding landscape. The reports that were generated by these studies are listed below:-

The loss of drainage channels from the Hatfield Chase area 1908-1986 (M.Wingfield 1987)

The aquatic flora of Hatfield Chase, recommendations for botanical conservation (M. Wade and M. Wingfield 1987)

Recommendations for the conservation of the rarer aquatic plants of Hatfield Chase (M. Wade and M. Wingfield 1988)

Hatfield Chase, developing a countryside management plan (Loughborough University 1988)

A survey of the aquatic invertebrates of Hatfield Chase (F.Malard 1989)

Factors affecting the distribution of the aquatic invertebrates in Hatfield Chase (F.Malard 1990).

The nature conservation management of ditches on Hatfield Chase (M.Bignall 1991)
A re-survey of important drains was undertaken in 1994 (M.Bignall)

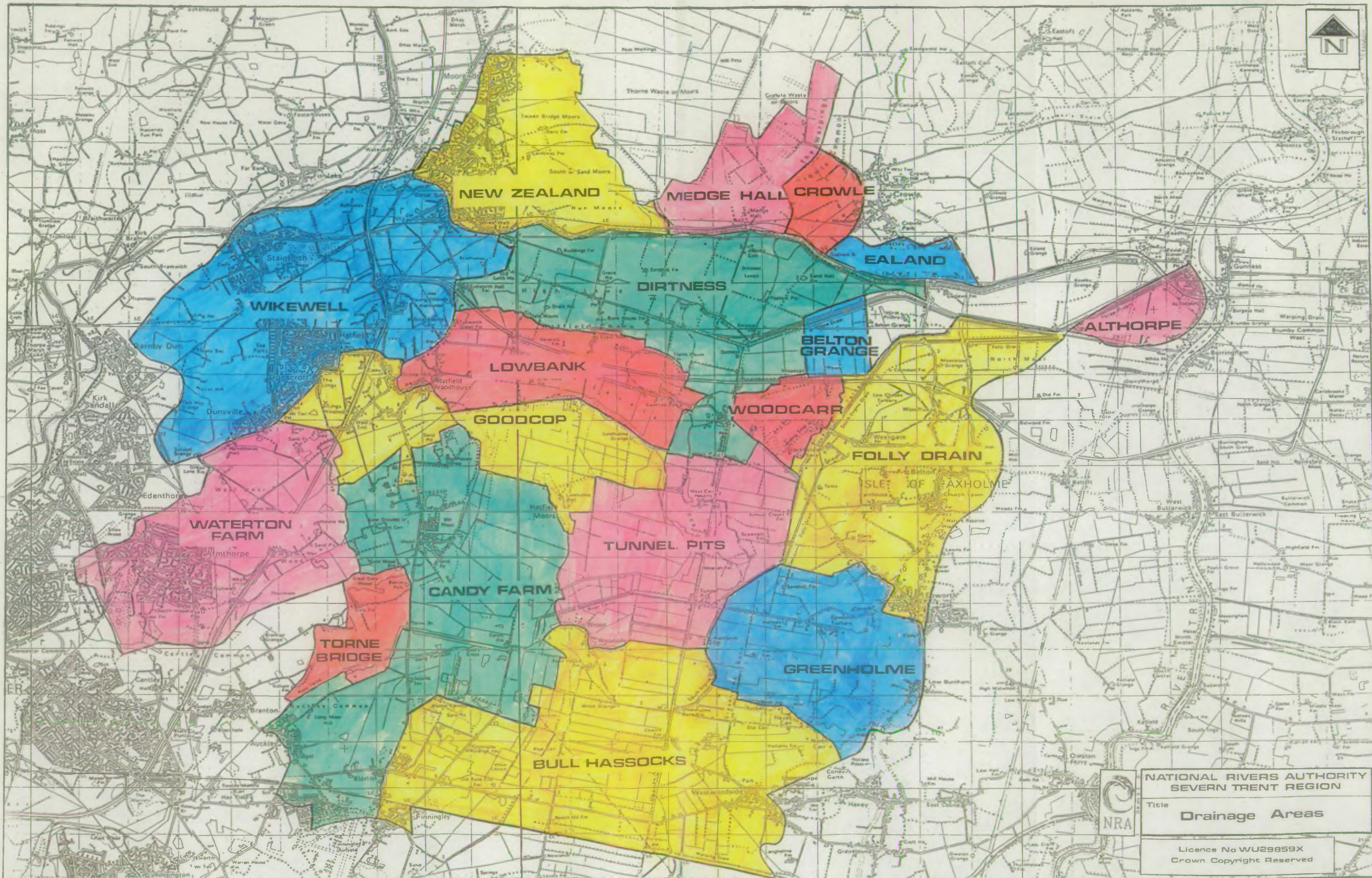
A joint report of Yorkshire Water Services and NRA was published in 1994 looking at the Doncaster Groundwater Units and effects on wetland sites in the area.

In addition there has been habitat improvements carried out in the form of over-widened drains and new ponds. An extensive tree planting scheme was undertaken in 1986/7 involving 14 landowners, 26,000 trees and shrubs, almost all planted alongside watercourses.

In 1988 the Hatfield Chase Management Group was set up involving STWA, Hatfield Chase IDB, Doncaster MBC, Boothferry BC, Humberside CC, NCC, FWAG to co-ordinate conservation initiatives.

In 1992 landscaping works were carried out on the River Torme, Medge Hall, South Soak Drain, Keadby PS, Bull Hassocks PS, New Zealand PS, Tunnel Pits PS and Candy Farm PS. A feasibility study into an interpretive centre at Bull Hassocks was undertaken. A management plan was prepared for Torme Wood, and this will be rewritten in 1995 to a new methodology.

FIGURE 1

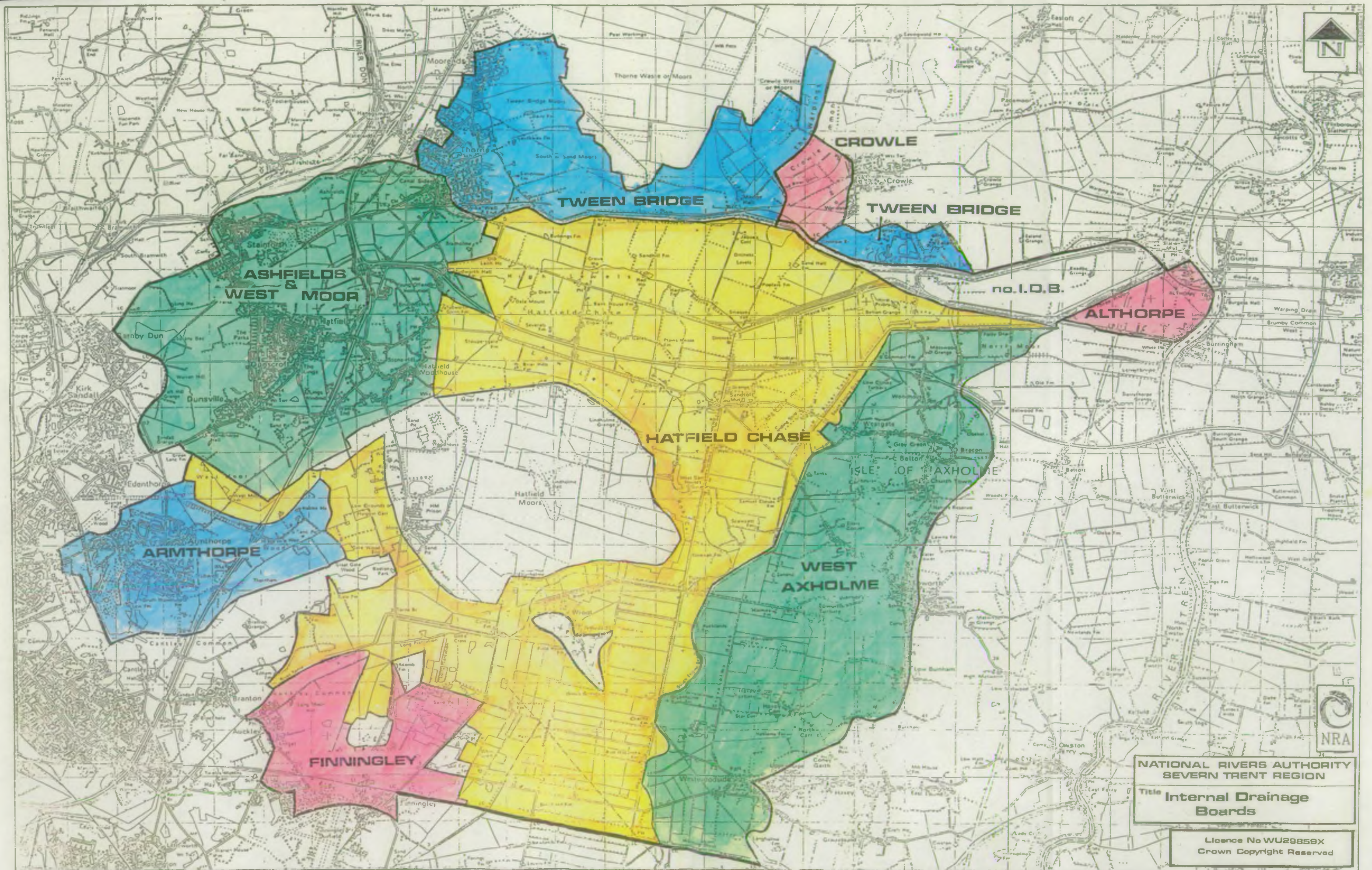


NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION

Title
Drainage Areas

Licence No WU29859X
Crown Copyright Reserved

FIGURE 2



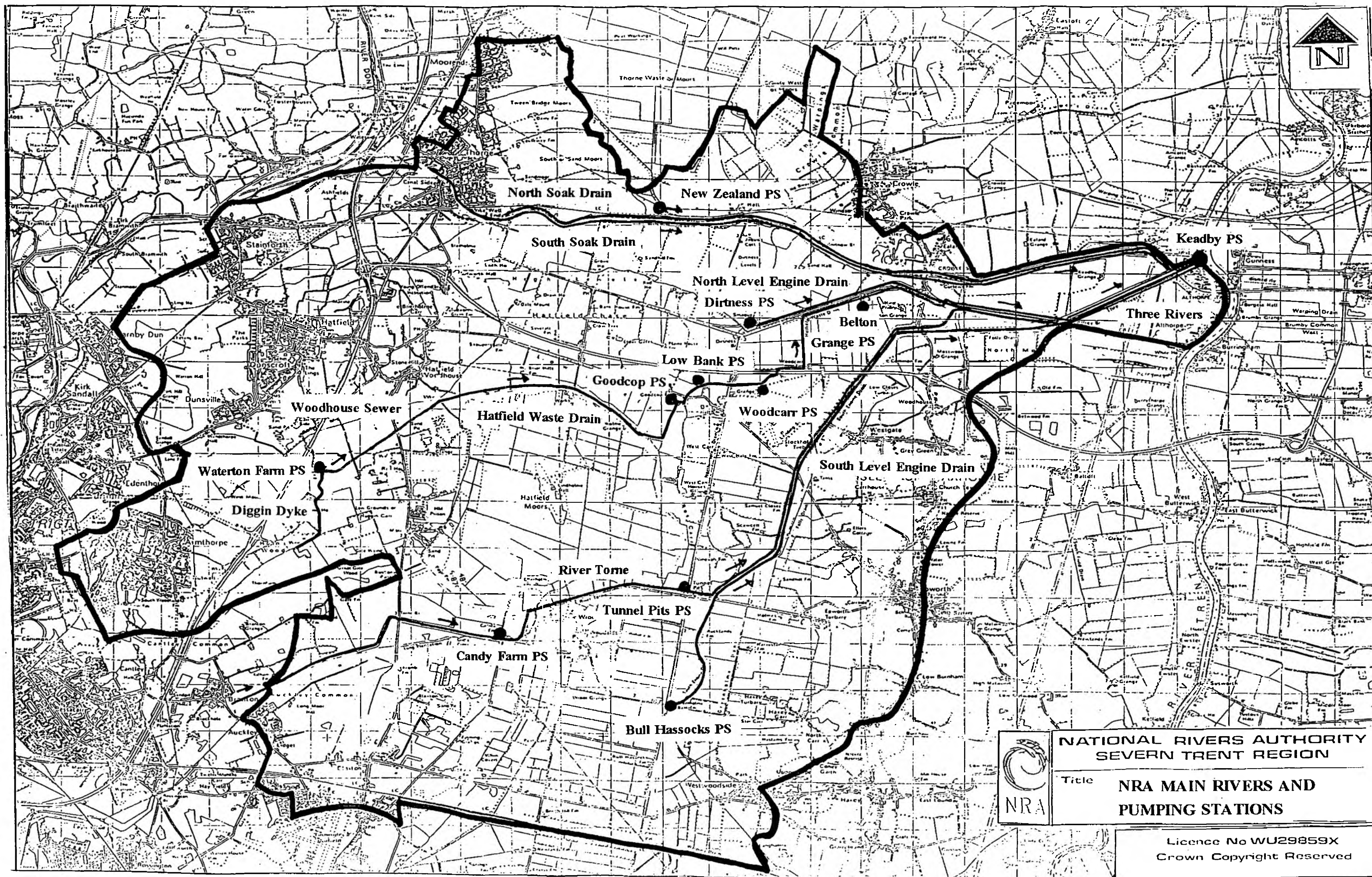
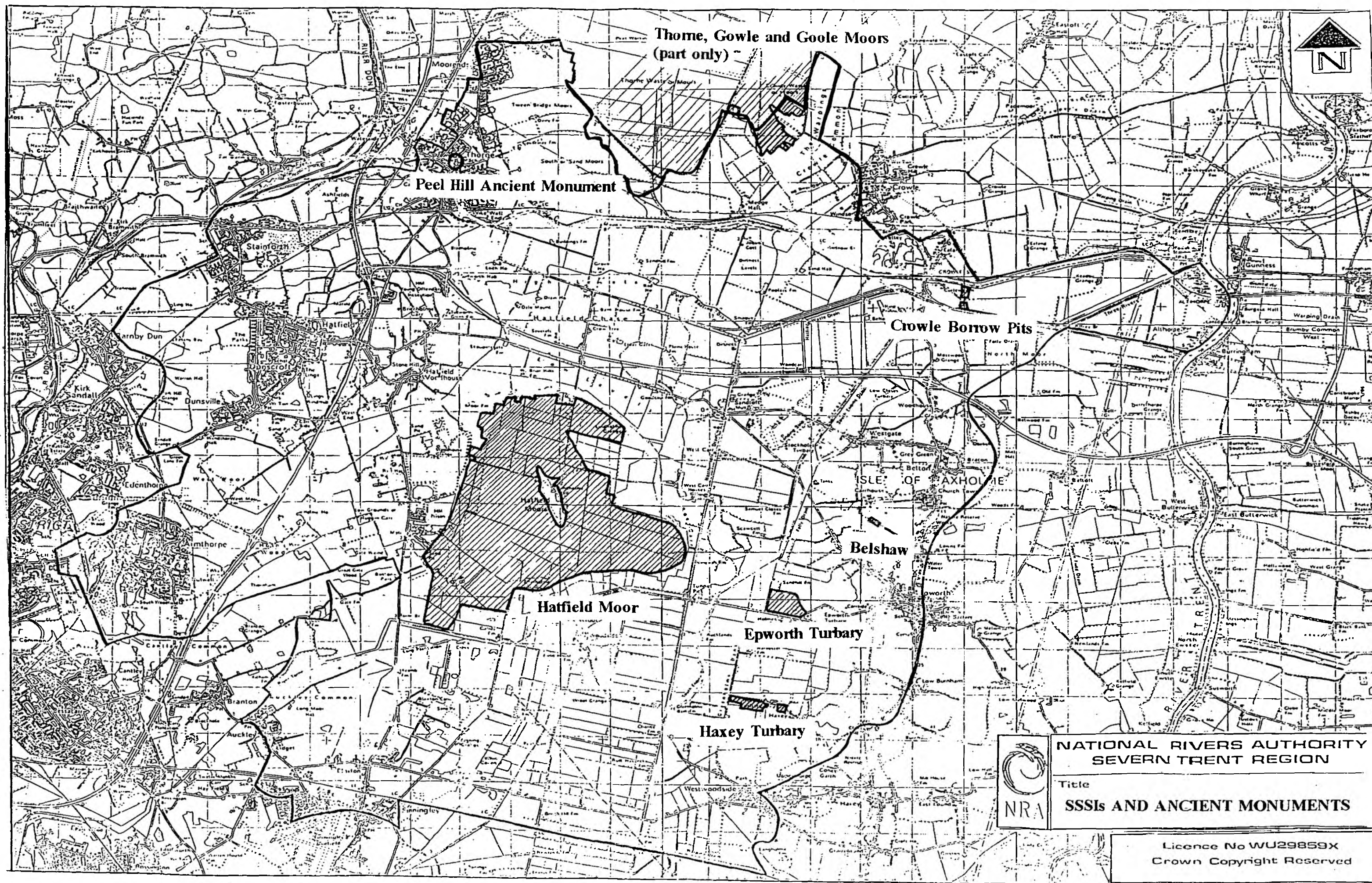
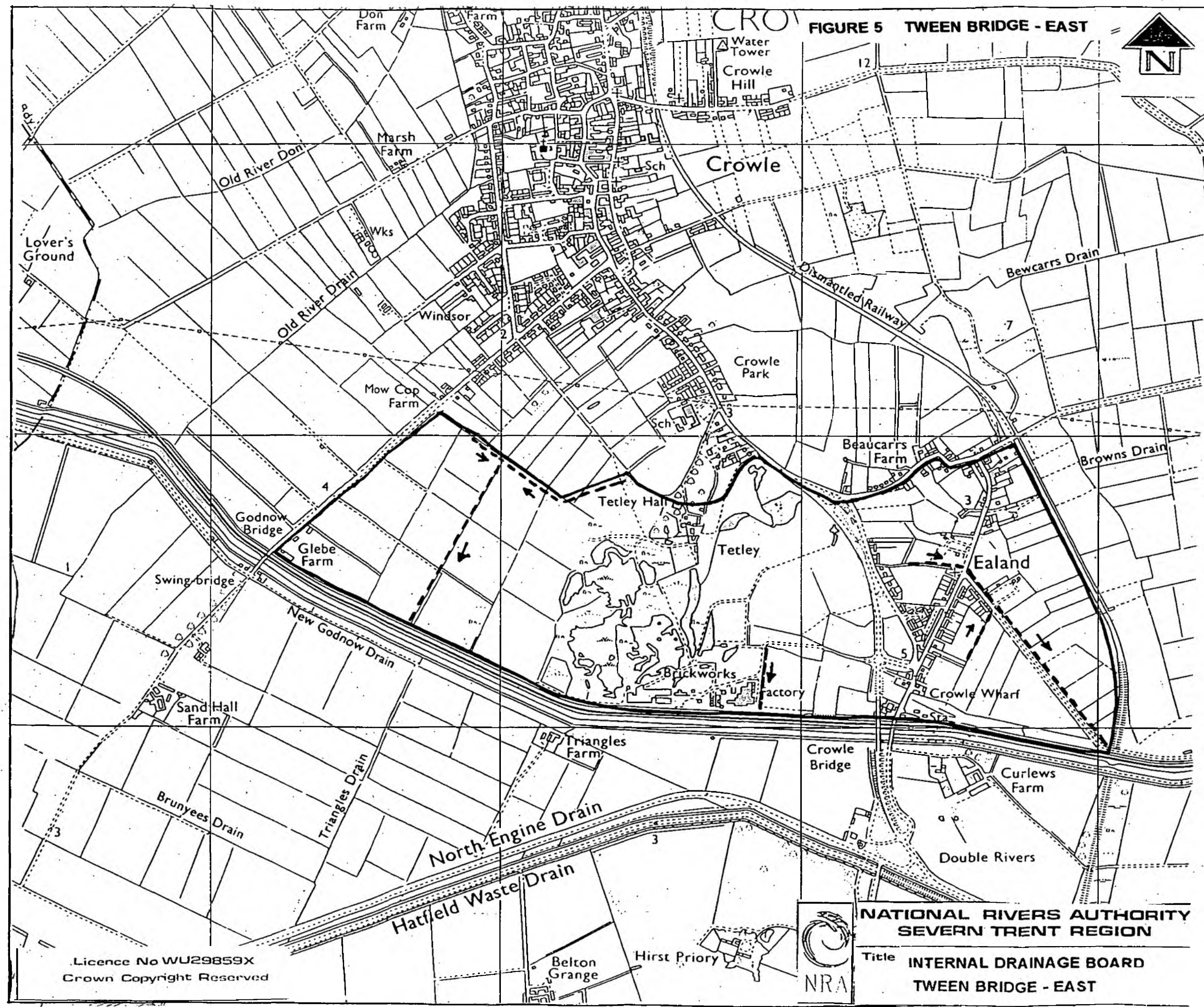


FIGURE 4





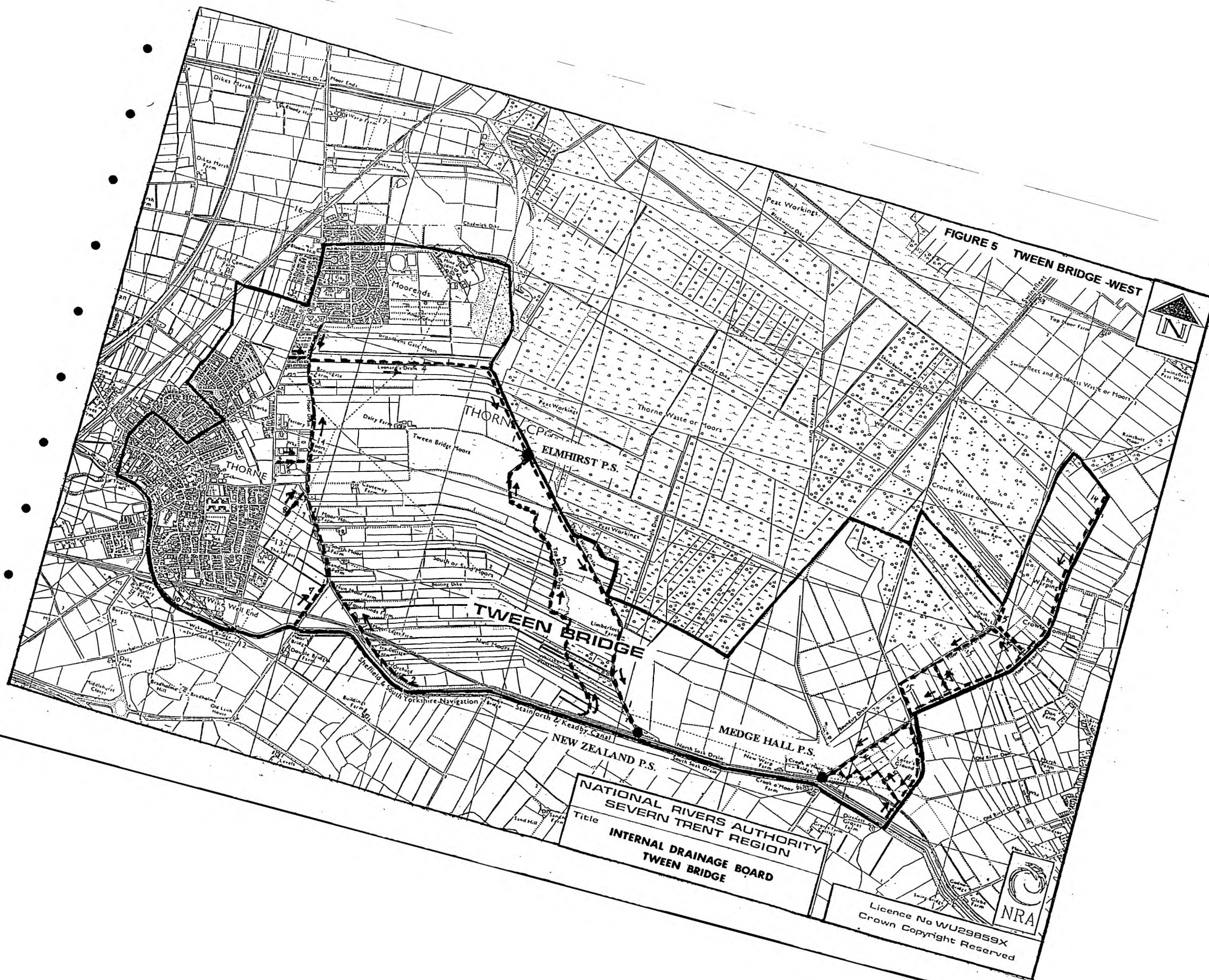
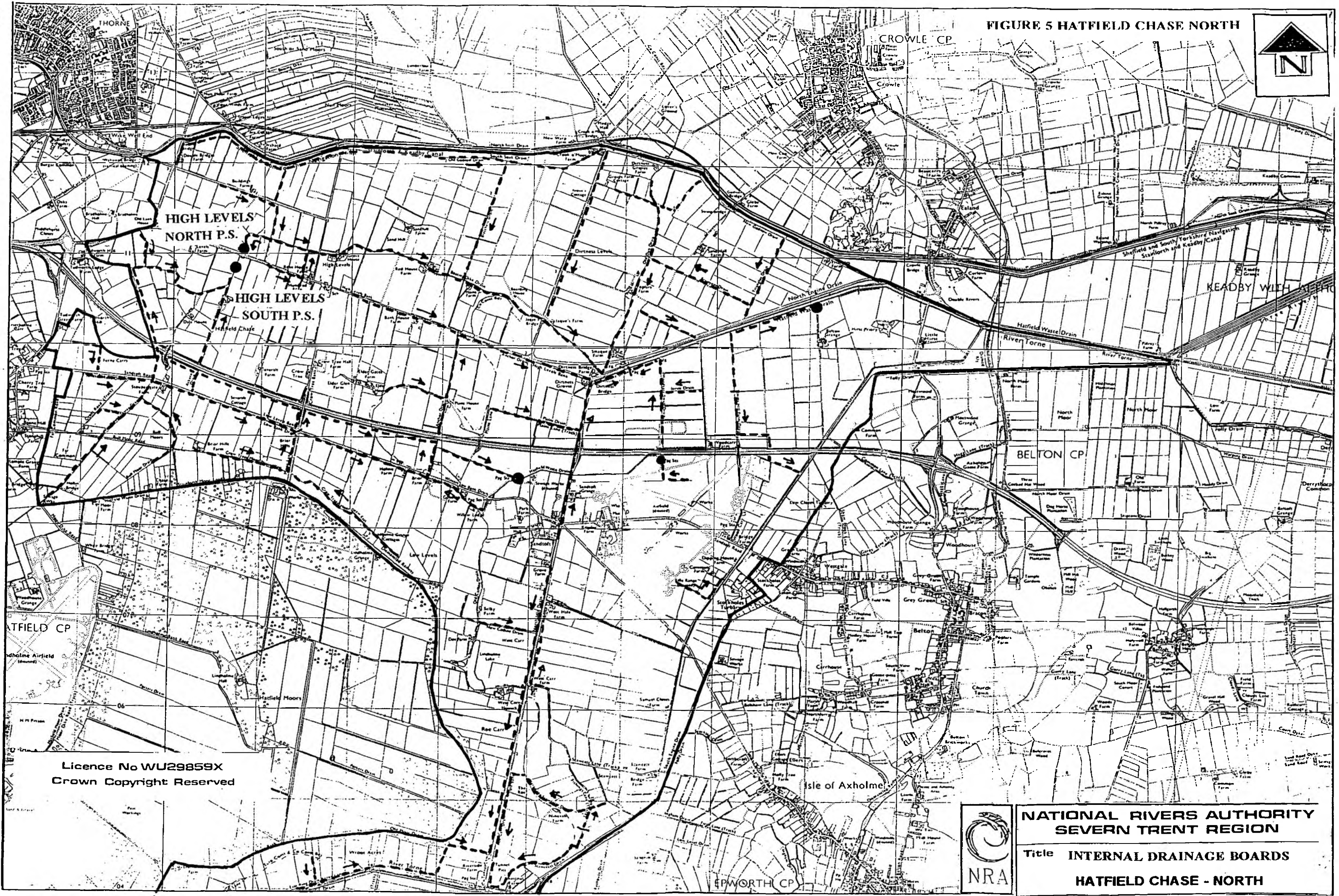


FIGURE 5 HATFIELD CHASE NORTH



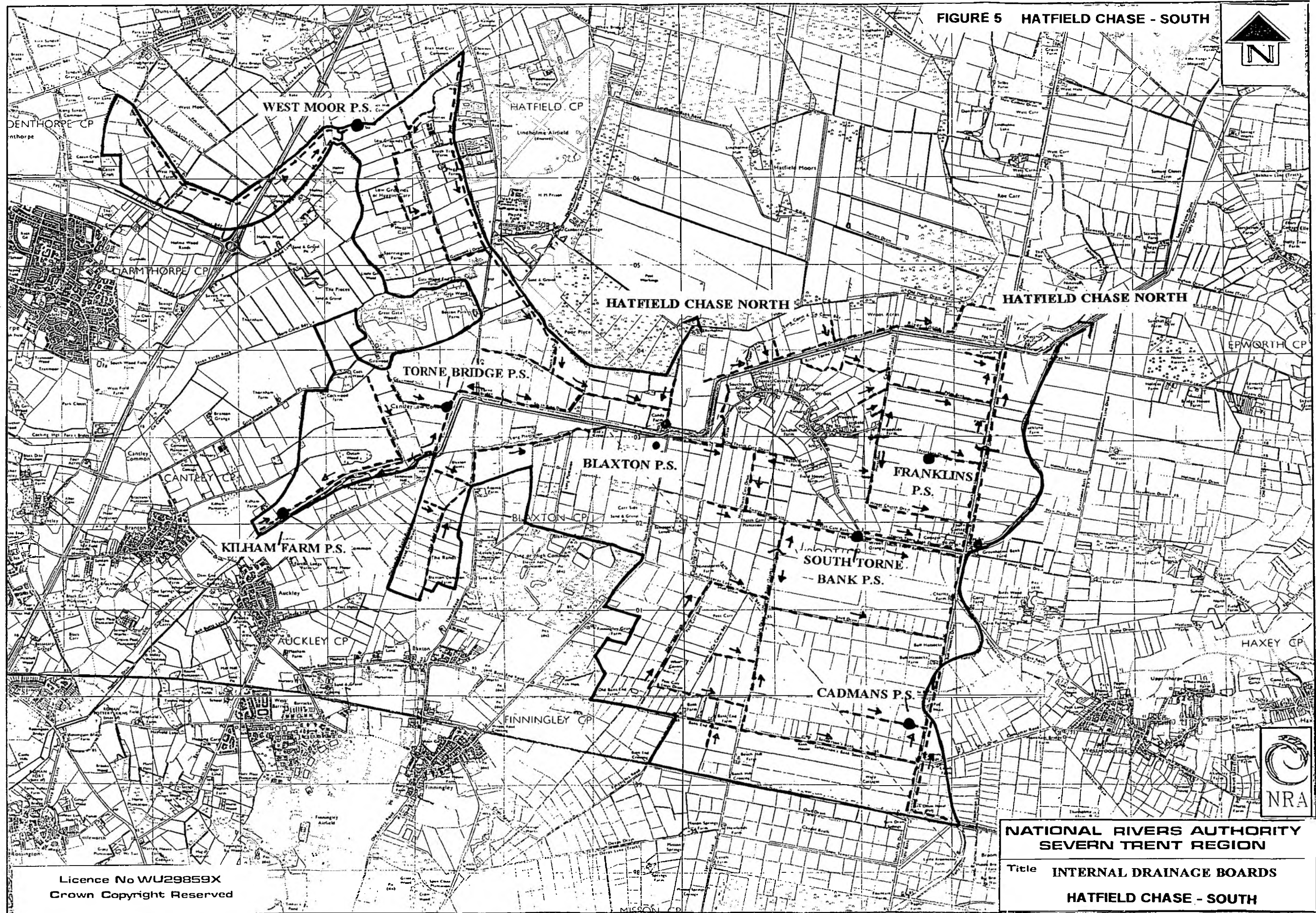
Licence No WU29859X
Crown Copyright Reserved



**NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION**

Title **INTERNAL DRAINAGE BOARDS
HATFIELD CHASE - NORTH**

FIGURE 5 HATFIELD CHASE - SOUTH



Licence No WU29859X
Crown Copyright Reserved

**NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION**
Title **INTERNAL DRAINAGE BOARDS
HATFIELD CHASE - SOUTH**



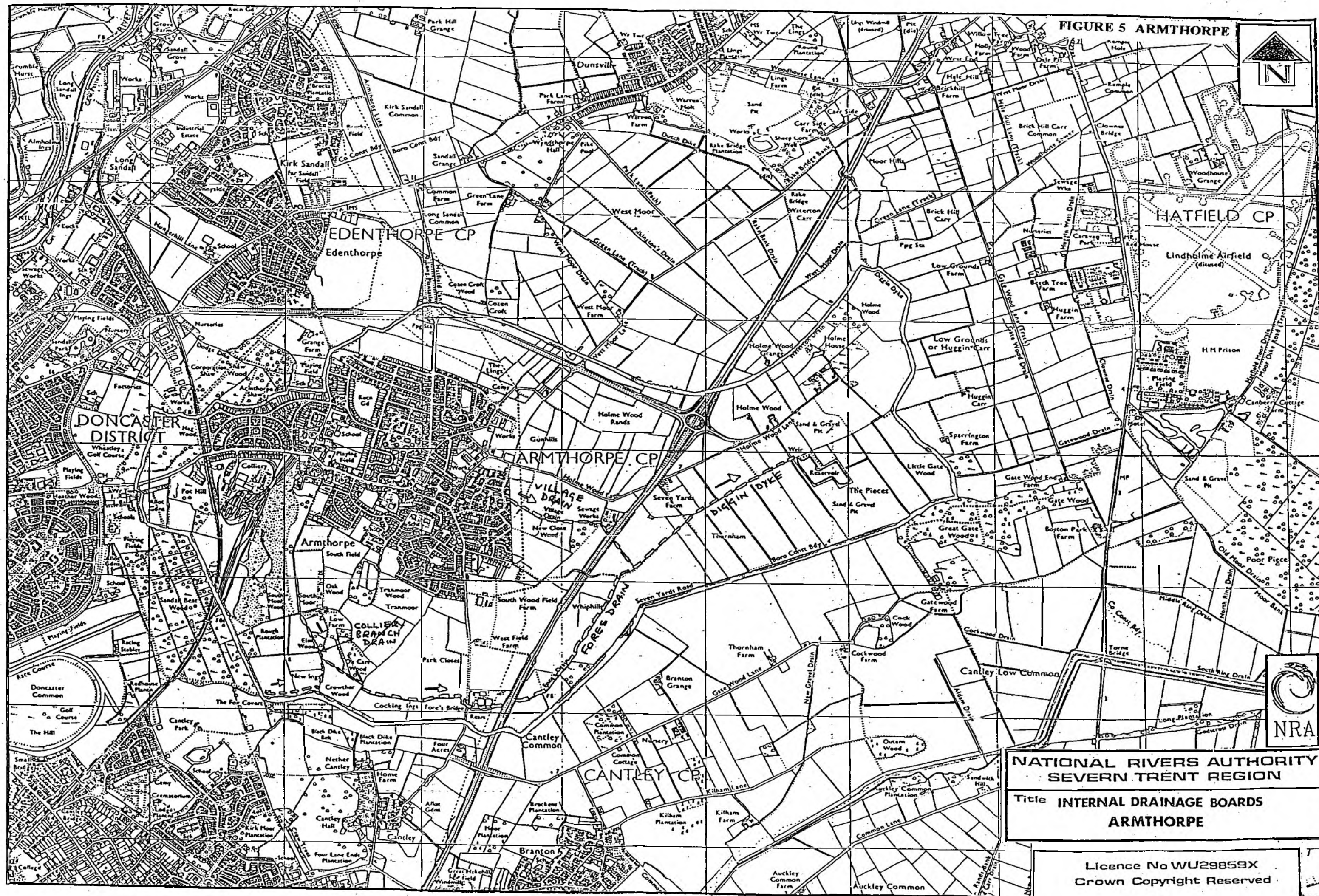
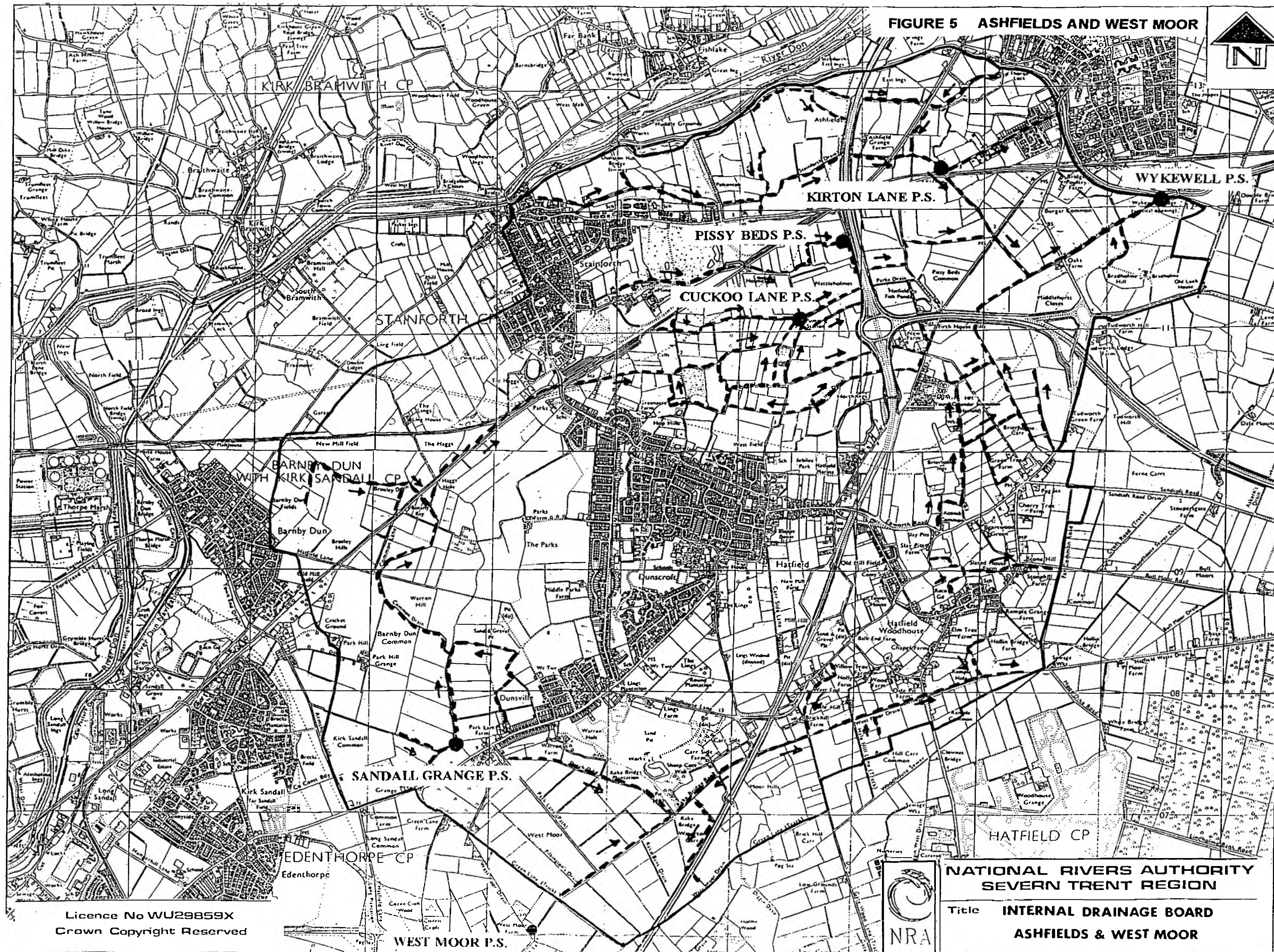


FIGURE 5 ASHFIELDS AND WEST MOOR



Licence No WU29859X
Crown Copyright Reserved

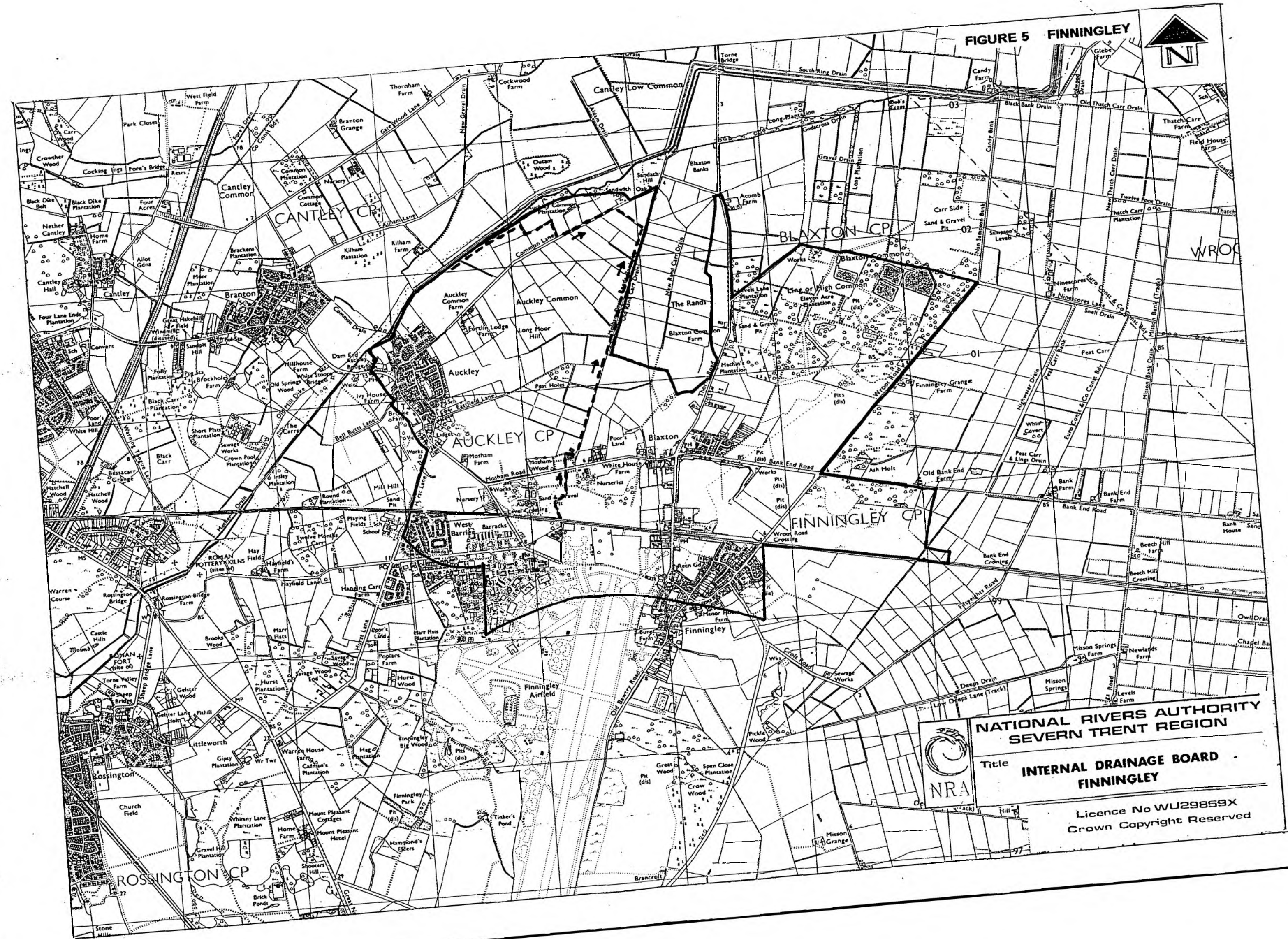
WEST MOOR P.S.



NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION

Title INTERNAL DRAINAGE BOARD
ASHFIELDS & WEST MOOR

FIGURE 5 FINNINGLEY



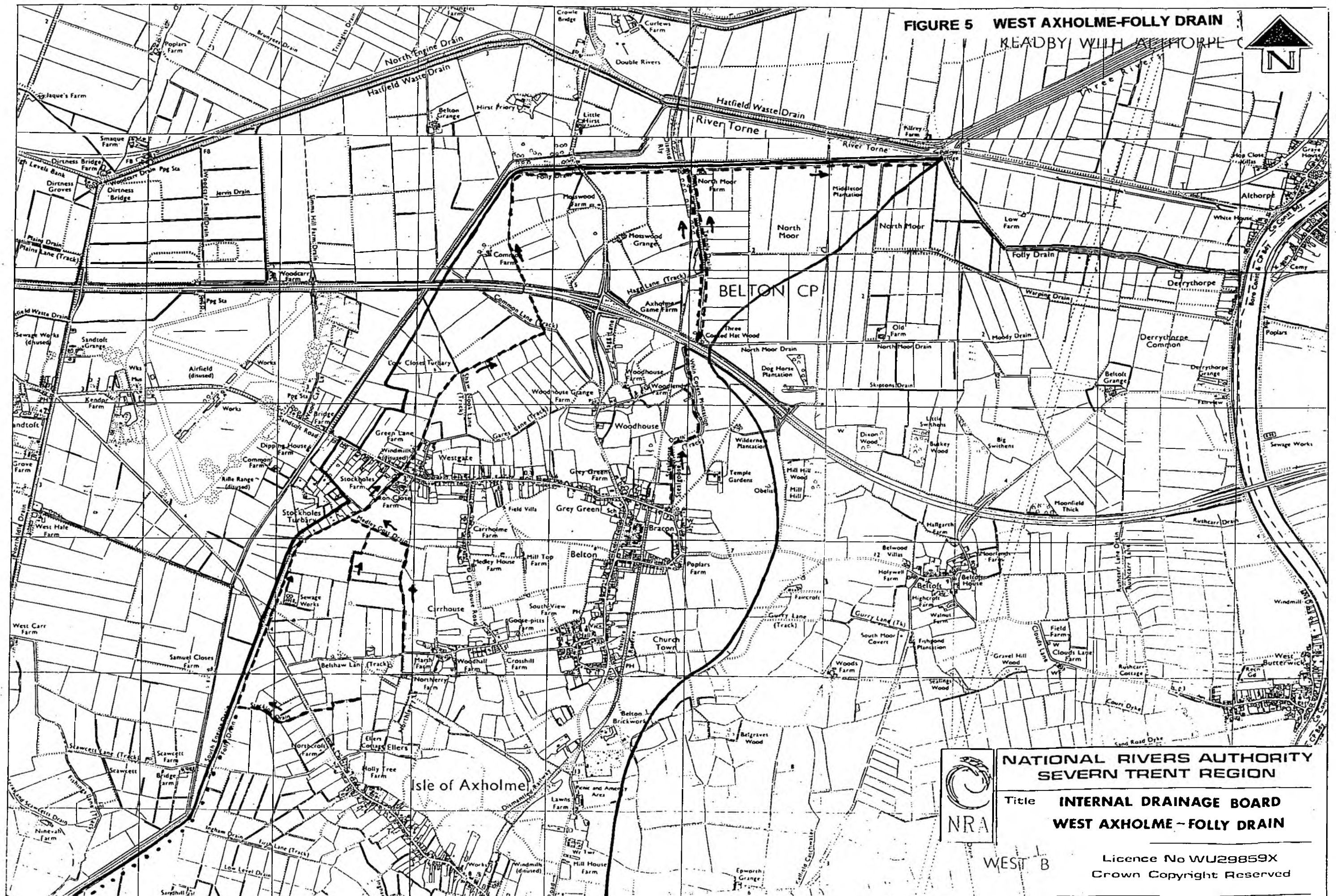
NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION

Title
**INTERNAL DRAINAGE BOARD
FINNINGLEY**

Licence No WU29859X
Crown Copyright Reserved

FIGURE 5 WEST AXHOLME-FOLLY DRAIN

READY BY WITH ALTHORPE



NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION

Title **INTERNAL DRAINAGE BOARD
WEST AXHOLME - FOLLY DRAIN**

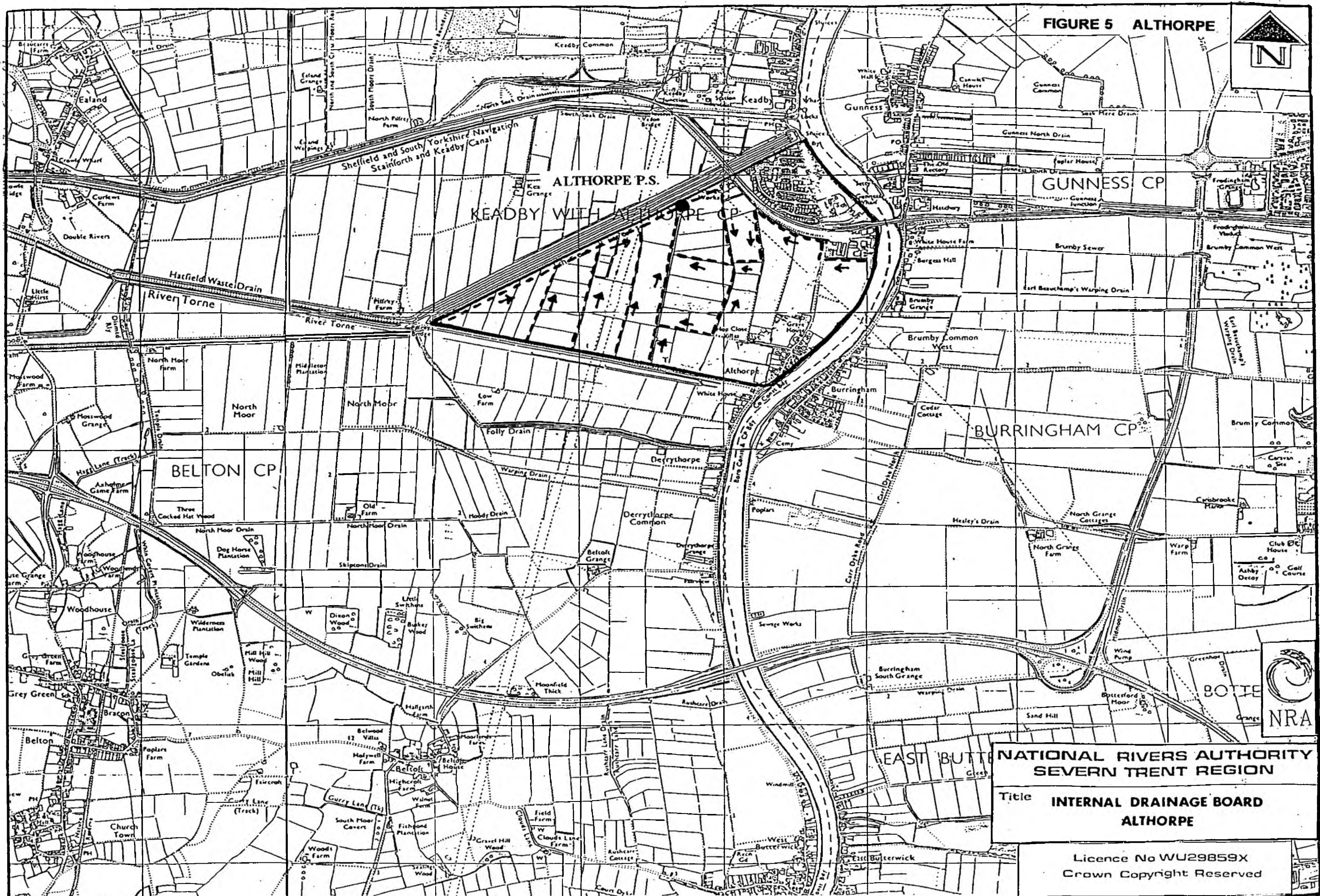
WEST B

Licence No WU29859X
Crown Copyright Reserved

FIGURE 5 WEST AXHOLME-GREENHOLME



NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION
Title
INTERNAL DRAINAGE BOARDS
WEST AXHOLME - GREENHOLME
Licence No WU29859X
Crown Copyright Reserved



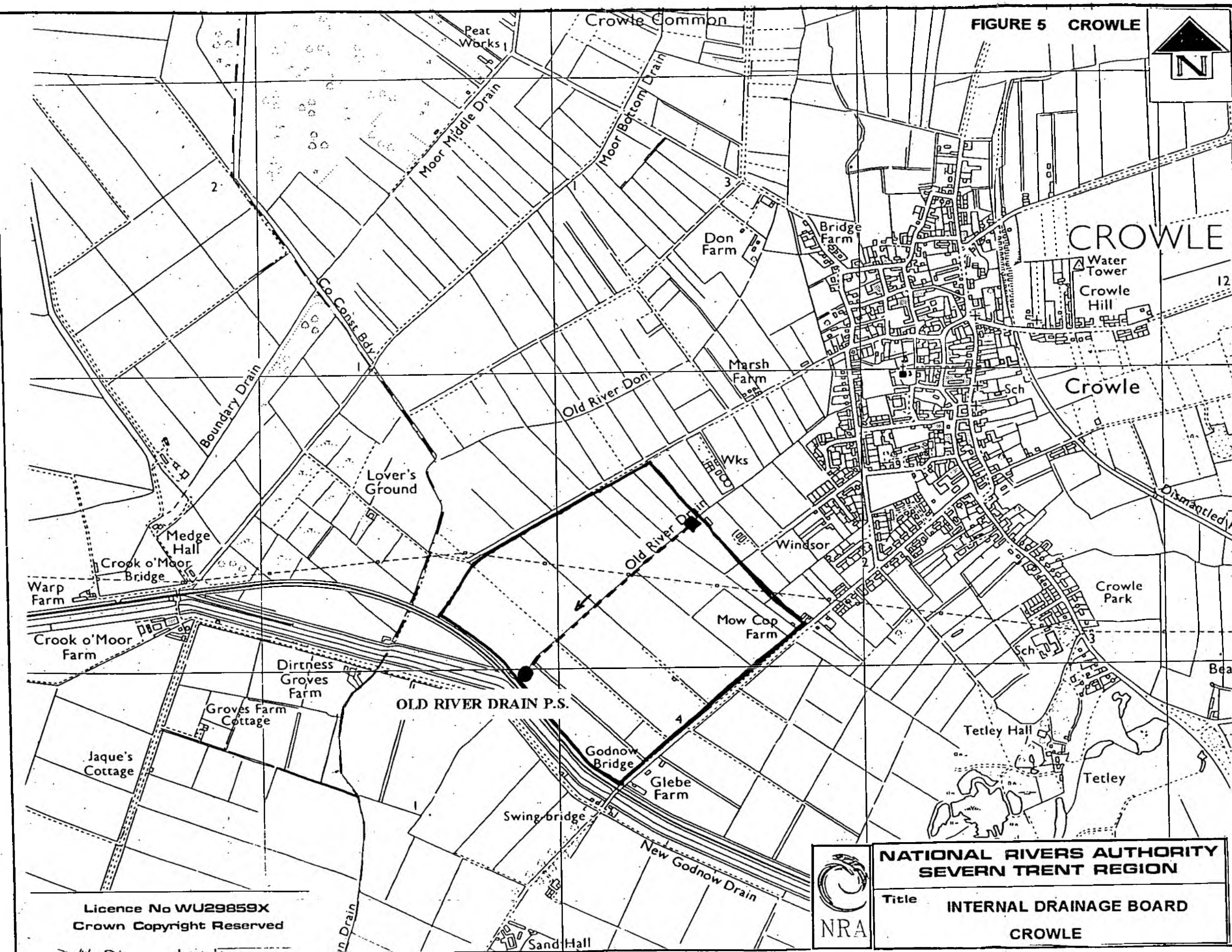


FIGURE 6

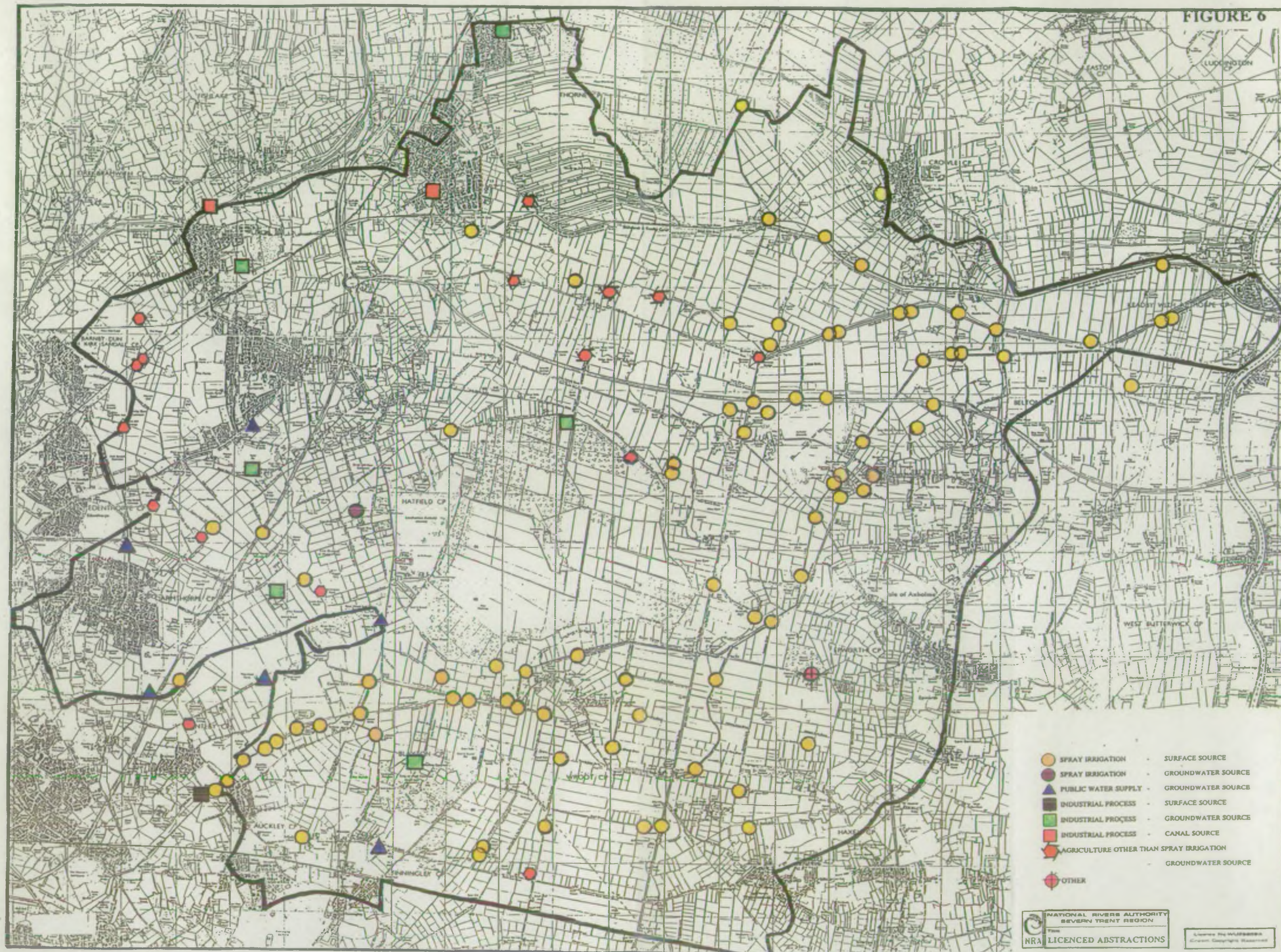
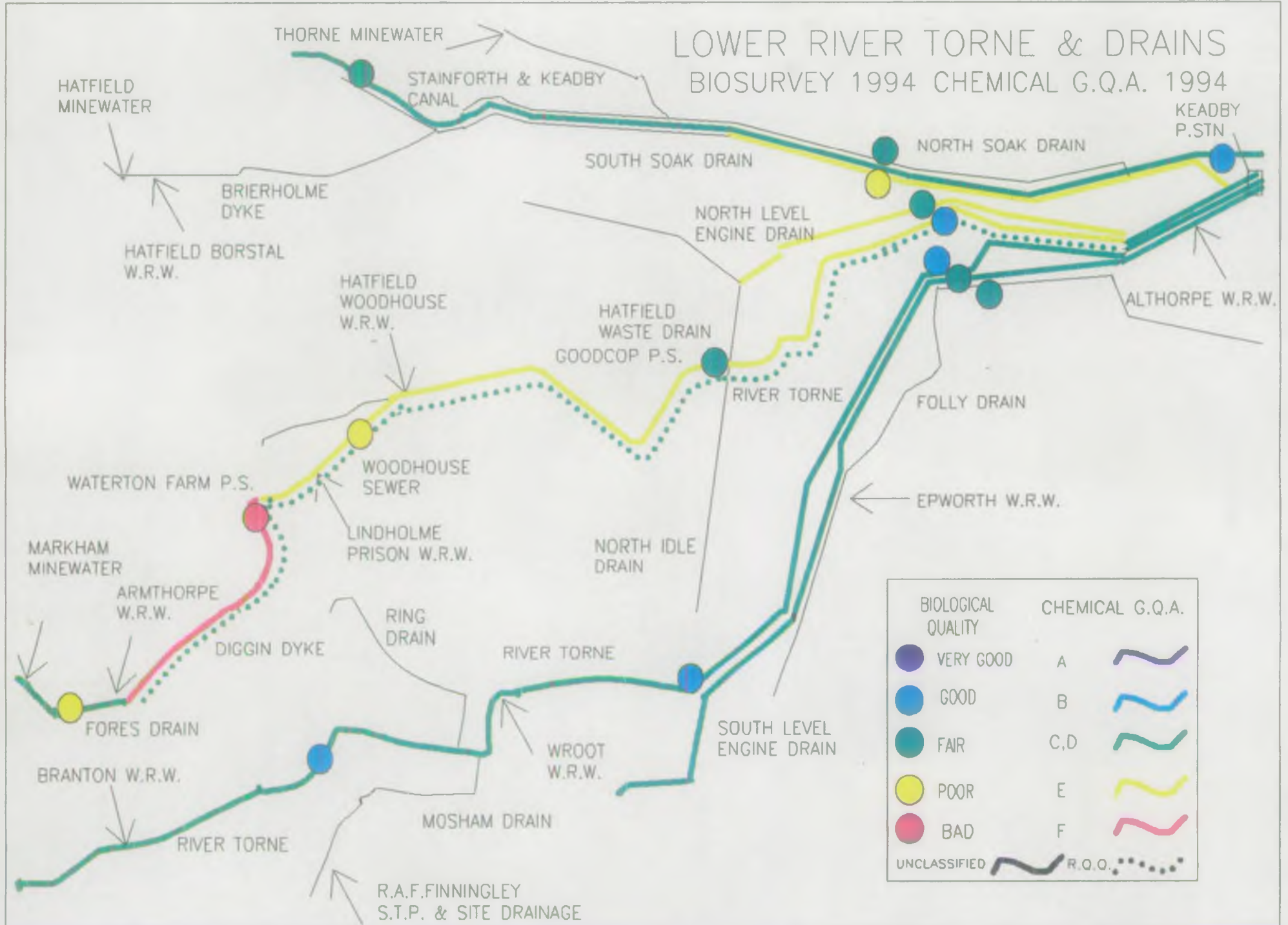


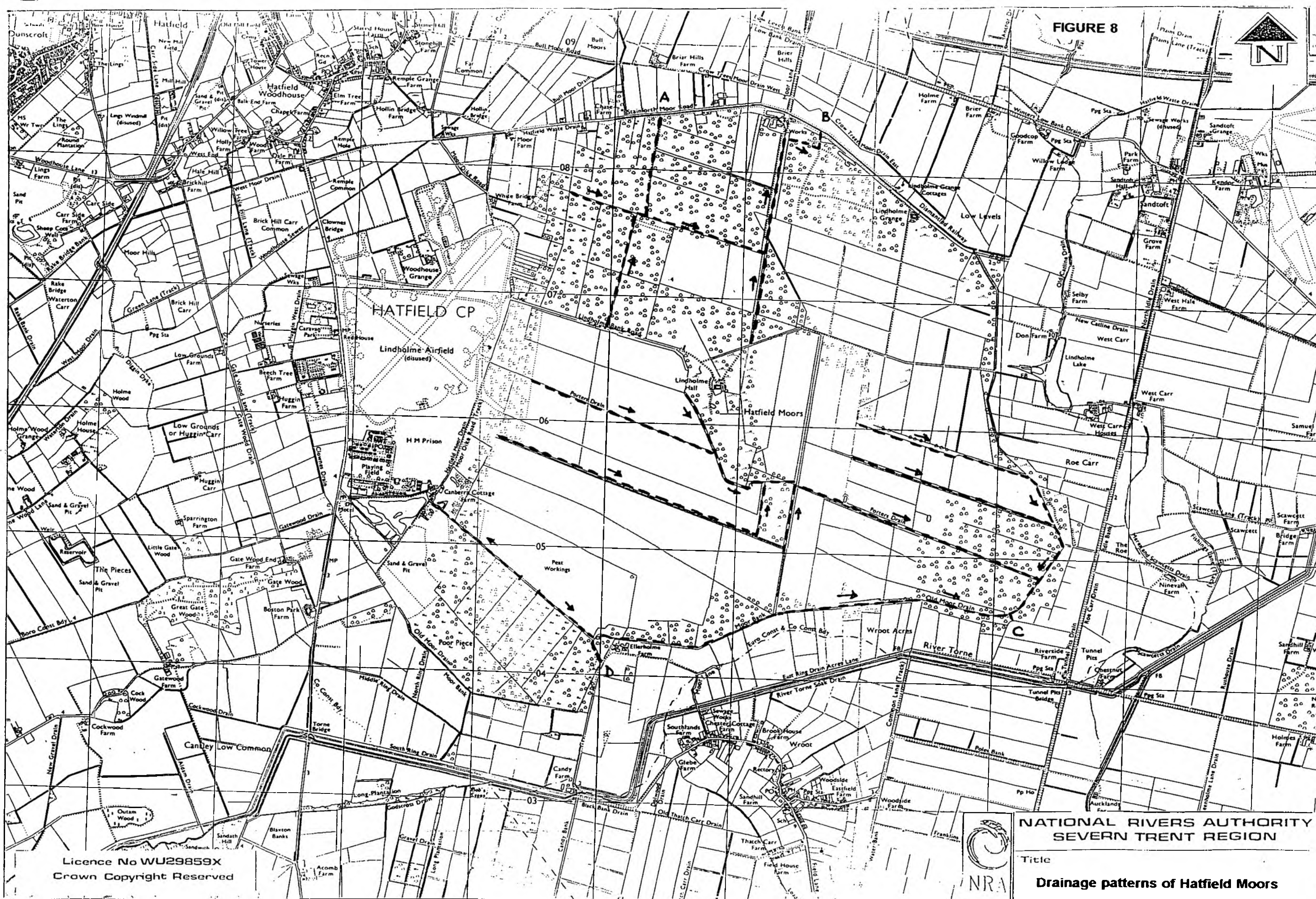
FIGURE 7

LOWER RIVER TORNE & DRAINS BIOSURVEY 1994 CHEMICAL G.Q.A. 1994



BIOLOGICAL QUALITY		CHEMICAL G.Q.A.	
VERY GOOD	GOOD	A	B
FAIR	POOR	C,D	E
BAD	UNCLASSIFIED	F	R.Q.Q.

FIGURE 8



Licence No WU29859X
Crown Copyright Reserved



NATIONAL RIVERS AUTHORITY
SEVERN TRENT REGION

Title

Drainage patterns of Hatfield Moors