Flooding Survey June 1990

River Tame Catchment

NRA
National Rivers Authority
Severn-Trent Region

RIVER CATCHMENT AREAS

Severn-Trent Region Boundary

Catchment Boundaries

Adjacent NRA Regions

1. Upper Severn **2.** Lower Severn **3.** Avon **4.** Soar
5. Lower Trent **6.** Derwent **7.** Upper Trent **8.** Tame

NRA

National Rivers Authority
Severn-Trent Region

FLOODING SURVEY

JUNE 1990

SECTION 136(1) WATER ACT 1989

(Supersedes Section 24(5) Water Act 1973

Land Drainage Survey dated January 1986)

RIVER TAME CATCHMENT

AND WEST MIDLANDS

FLOOD DEFENCE DEPARTMENT
NATIONAL RIVERS AUTHORITY
SEVERN-TRENT REGION
SAPPHIRE EAST
550 STREETSBROOK ROAD
SOLIHULL
W MIDLANDS B91 1QT

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REFERENCES

1 "Interim Report - Section 24(5) Survey" - Published by Severn-Trent Water Authority, July 1978.

2 "Flood Studies Report" Vols I-V, Natural Environmental Research Council (1975).

3 "The Benefits of Flood Alleviation" - E C Penning- Rowsell and J B Chatterton, published by Saxon House, Teakfield Ltd.

4 "Medway Letter" - Ministry of Agriculture and Fisheries (1933). Available in Wisdom's "Land Drainage", Sweet and Maxwell, London (1966).

5 DoE Circular 17/82 - "Development in Flood Risk Areas - Liaison between Planning Authorities and Water Authorities" published in 1982.

GLOSSARY OF TERMS

ADAS	- Agricultural Development and Advisory Service: part of the Ministry of Agriculture, Fisheries and Food (MAFF).
Arterial drainage	- The drainage channels conveying surface water run-off, effluent, etc. (excluding farm ditches, underdrainage and sewers) to the estuaries.
Benefit	- The return from investment in flood alleviation and land drainage improvement schemes.
Benefit area	- The geographical area in which direct benefit is obtained, usually either the maximum extent of flooding in an urban area or the land below the 'Medway Letter Line' in an agricultural area.
Catchment	- The geographical area from which rainfall will drain, by gravity, to a particular river and its tributaries.
Design flood	- The maximum flood for which the flood alleviation works will provide protection.
Discount rate	- The rate for converting all current and future benefits to present values.
Flood Q (T)	- The flood with a recurrence interval or return period of T years.
Floodplain	- The area of land adjacent to a watercourse which is inundated when the flow in the watercourse exceeds the capacity of the channel. The outer limit is usually the maximum extent of past recorded floods.
Freeboard	- See section 2.6.3.
Gross margin	- The gross output of an agricultural enterprise less the variable costs.
Intangible benefits	- The benefits that result indirectly from flood alleviation works, but which are not normally financially quantifiable. These can include freedom from anxiety, potential loss of life, cost of emergency services, etc.
Land potential	- An indication of soil profile characteristics such as structure, texture, depth, stoniness, etc which determines the ability of a soil to produce crop growth.
Main river	- The watercourses shown on the statutory 'main river maps' held by the National Rivers Authority and the Ministry of Agriculture, Fisheries and Food. The NRA has permissive powers to carry out works of maintenance and improvement on these rivers.
Mean annual flood Q	- The arithmetic average of annual maximum floods.
Normal water level	- The water level under average flow conditions.
Return Period	- The average length of time separating flood events of the same magnitude.
Underdrainage	- The drainage required in fields to ensure that the whole area drains satisfactorily to farm ditches or arterial watercourses. This may be tile drains, mole drains or subsoiling.
Variable costs	- Costs incurred in producing a crop, excluding fixed costs such as rent, rates and permanent labours. Variable costs include costs of seed, fertiliser, concentrates, vetinary costs, sprays and casual labour.

PREFACE

THE NATIONAL RIVERS AUTHORITY

The National Rivers Authority was established in September 1989 to be responsible for protecting and improving the water environment. It is an independent public body responsible for the regulatory functions formerly carried out by the water authorities, along with other important statutory duties. Its main tasks are:

- flood defence
- water quality and pollution control
- water resource management
- fisheries, conservation and recreation
- navigation

The NRA is a national body with a small central policy unit. Most of the employees work for the ten regional units which undertake day-to-day operations.

The NRA has a chairman, who along with other members is appointed by the Government - 12 by the Department of the Environment, 2 by the Ministry of Agriculture, Fisheries and Food and one by the Welsh Office. The MAFF appointees have a special responsibility for representing land drainage and fisheries interests.

SEVERN-TRENT REGION

The Severn-Trent Region is the second largest of the 10 regional units of the NRA both in size and population. It covers a diverse area of more than 8,000 square miles (21,600 sq km) and includes nearly 4,000 miles of rivers and watercourses.

The region is based upon the catchments of the Rivers Severn and Trent. The borders stretch from the Bristol Channel in the south to the Humber Estuary in the north, from Mid-Wales to the East Midlands.

The NRA is not responsible for navigation in the Severn-Trent Region. This is the responsibility of the British Waterways Board and a number of navigation trusts.

The headquarters of the NRA Severn-Trent Region is in Solihull, West Midlands. The Area organisation is catchment based with four areas of roughly equal size, achieved by dividing the Severn catchment at the confluence of the Severn and Teme and the Trent catchment at the Trent-Dove confluence. These areas are called Upper Severn, Lower Severn, Upper Trent and Lower Trent, with area offices at Shrewsbury, Tewkesbury, Burton-on-Trent and Nottingham. Within each area there are smaller sub-offices and depots.

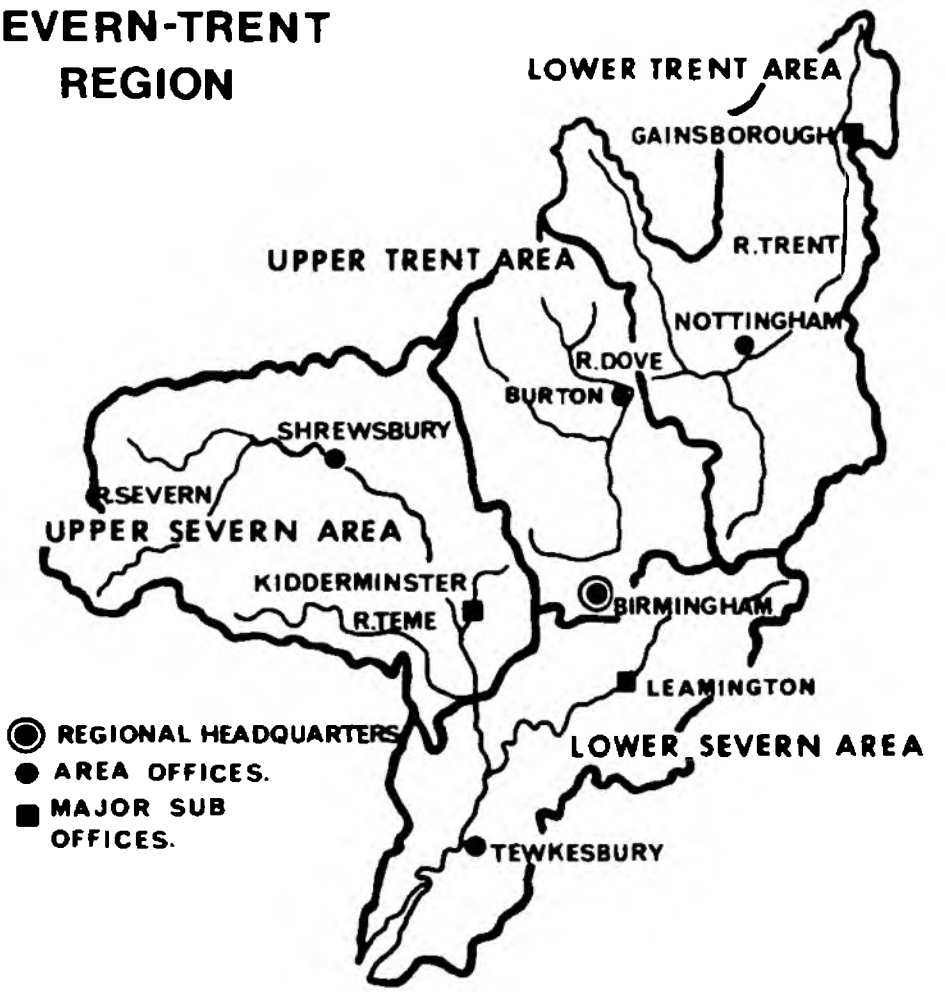
The NRA in the region works with three statutory committees which meet in public three or four times a year:-

Flood Defence Committee - This committee has 21 members appointed by the NRA, MAFF and local authorities. The committee has executive powers to discharge the NRA's flood defence and land drainage functions.

Rivers Advisory Committee - This committee is appointed by the NRA to advise on the broad framework of river basin management. It consists of representatives of local authorities, leisure groups, conservation interests, industry and agriculture and other interested parties.

Fisheries Advisory Committee - This committee has 15 members and advises the NRA on the discharge of statutory duties to maintain, develop and improve fisheries.

NRA SEVERN-TRENT REGION



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550 Streetsbrook Road
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Welshpool Road
Shelton
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Lower Severn Area Office
Southwick Park
Gloucester Road
Tewkesbury GL20 7DG
Tel: (0684) 850951

Upper Trent Area Office
The Poplars
21 Rolleston Road
Burton-on-Trent
DE13 0AY
Tel: (0283) 37191

Lower Trent Area Office
Trentside
Scarrington Road
Off Ladybay Bridge
West Bridgford
Nottingham NG2 5FA
Tel: (0602) 455722

CHAPTER 1

SUMMARY

1.0 SUMMARY

1.1 Introduction

1.1.1 This updated survey is one of eight surveys on the major river catchments in the Severn-Trent Region. Each survey provides information appertaining principally to a major catchment, extended to include the whole of the major County associated with it.

1.1.2 The primary purpose of the surveys is the identification and evaluation of flooding and land drainage problems and this summary provides information to facilitate rapid assimilation and comparison of costs, benefit/cost ratios and priority categories of these problems.

1.1.3 This survey supersedes the 1980 survey and the 1982 and 1986 revisions

1.2 Coding System

1.2.1 Every problem identified has been given a code number. The code numbers appropriate to each problem were originally classified in the "Interim Report of Survey"[1] of July 1978. That original classification remains unchanged for this Report but numbers have been added where new problems have been identified since the publication of the Interim Report. The codes applicable to catchments and County and District Councils are shown in Appendix A4 and the format of the code is as follows:

	x	xx	xxx	xx
	Catchment	County	District	Number
eg	1	83	310	27
	Upper Severn	Salop	Oswestry	Problem No.

1.3 Priority Categories

1.3.1 In order to establish a range of priorities to which an individual improvement scheme can relate, all improvement schemes have been categorised on the basis of:

(i) the size of the benefit/cost ratio
(ii) the cost of the arterial part of the improvement works (ie. excluding field drainage and ditching costs).

These categories are shown below.

Category by Benefit/Cost Ratio

CATEGORY	BENEFIT/COST RATIO	
	GREATER THAN	LESS THAN
1	2.0	
2	1.0	2.0
3		1.0

Category by Arterial Costs

CATEGORY	ARTERIAL COST (£'000)	
	GREATER THAN	LESS THAN
A	1000	
B	500	1000
C	100	500
D	50	100
E	10	50
F		10

1.4 Summary of Problem Evaluations

1.4.1 The problem evaluations which are shown in detail in Appendix A1 are summarised in Table 1. This Table shows costs, benefit/cost ratios and priority categories for every problem identified, and enables District Councils and County Councils to assimilate rapidly the total extent of improvements required in their areas and the priorities of the individual requirements within that total.

1.4.2 The page number within Appendix A1 of the evaluation of every identified problem is shown adjacent to the problem number in column 2 of Table 1.

1.4.3 It should be noted that the costs and benefits are to a December 1989 price base and that the watercourses marked * are main river or partly main river.

1.4.4 In some cases a single solution covers a number of identified problems. In these cases, the solution is detailed under the first problem number and all other relevant problem numbers are referred to it.

1.5 Summary by Priority Category

1.5.1 Tables 2 and 3 summarise, for both main river and non-main river, the numbers of problems in each category and the total cost of their associated improvement works. This summary includes only those problems in the catchment area and has been prepared primarily to provide the Ministry of Agriculture, Fisheries and Food with an overall appraisal of the total cost of improvements required throughout the Region. The total cost includes anticipated capital expenditure on current main river schemes and therefore represents a global summary of ongoing and future capital expenditure.

1.6 Identification of problems and their evaluation

1.6.1 The primary purpose of this Survey is to enable rapid identification of problems and the improvement works required to these problems. This can be done using the following system:

i) EITHER
Identify on the 1:25,000 scale maps, which accompanied the 1980 Report, the area of interest and note the code number of the benefit area or point source shown.
OR
Knowing the District or County Council in which the interest lies identify the relevant code number (see Section 1.2 of this Report and Appendix A4).

ii) Refer to the "Summary of Problem Evaluations" in Table 1 for brief details of costs, benefit/cost ratios and priority categories for the requisite watercourses in that District. All costs and benefits are at a December 1989 price base.

iii) Further information on individual schemes will be found in the detailed reports in Appendix A1. The relevant page is shown in the "Summary of Problem Evaluations".

1.6.2 The sheet numbers on the 1:25,000 scale maps in the 1980 album can be located by reference to the grid system shown on the rainfall map at the front of that album. The following diagram shows, as an example, the method for locating sheet number SK 46.

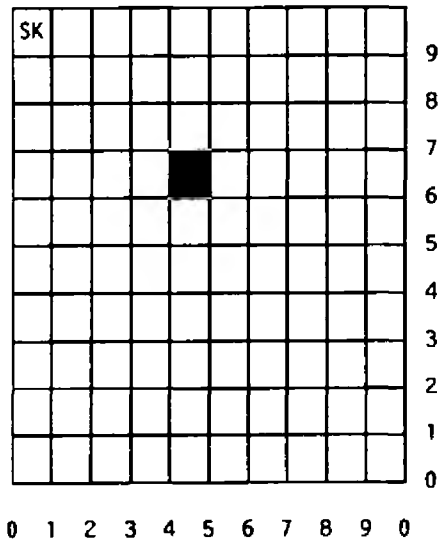

TABLE 1

SUMMARY OF PROBLEM EVALUATIONS

Note: All costs and benefits are to December 1989 price base
* Main River
\# New problems since 1986 revision

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
BROMSGROVE DISTRICT COUNCIL						
8-87-210-1	-	Hollywood Brook	SP 084 773	Problem alleviated		
8-87-210-2	-	Trib. of River Cole	SP 089 767	Problem alleviated		
NUNEATON & BEDWORTH BOROUGH COUNCIL						
8-91-110-1	-	Wem Brook	SP 374 893	Problem alleviated		
8-91-110-2	-	Un-named	SP 400 867	Problem alleviated		
8-91-110-3)						
8-91-110-4)	-	Wem Brook	SP 368 882			
8-91-110-5	1	Whittleford Brook	SP 315 919	37	0.2	3E
8-91-110-6	-	Change Brook	SP 377 930	Problem alleviated		
8-91-110-7	2	Trib. of Harrow Brook	SP 390 928			
8-91-110-8	-	Trib. of River Anker	SP 398 889	Problem alleviated		
8-91-110-9	3	Bar Pool Brook	SP 342 922			
8-91-110-10	4	#Un-named	SP 438 288			
RUGBY BOROUGH COUNCIL						
8-91-210-1	5	River Anker	SP 418 886			
8-91-210-2	6	River Anker	SP 389 912			
STRATFORD-UPON-AVON DISTRICT COUNCIL						
8-91-310-1	-	Spring Brook	SP 106 721	Problem alleviated		
NORTH WARWICKSHIRE BOROUGH COUNCIL						
8-91-510-1	7	Bourne Brook	SP 281 871	Highway problem		
8-91-510-2	8	Bourne Brook	SP 283 874	Highway problem		
8-91-510-3	9	*River Tame	SP 188 919			
8-91-510-4	10	*River Anker	SK 261 023			
8-91-510-5	11	Un-named	SK 292 067	6	0	3F
8-91-510-6	12	Langley Brook	SP 188 982	115	1.6	2C
8-91-510-7	13	Penmire Brook	SK 285 002			
8-91-510-8	14	River Bourne	SP 258 898			
8-91-510-9	15	Trib. of Bar Pool Brook	SP 320 926	Highway problem		
8-91-510-10	16	*River Bourne	SP 248 913			
8-91-510-11	17	Un-named	SP 218 883			

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
CITY OF COVENTRY COUNCIL						
3-92-110-1	18	Trib. of Canley Brook	SP 294 781			
3-92-110-2	19	River Sherbourne	SP 328 788	64	20.7	1D
3-92-110-3	20	Trib. of River Sherbourne	SP 272 798	346	0.2	3C
3-92-110-4	21	Springfield Brook	SP 337 814	1643	0	3A
3-92-110-5)						
3-92-110-6)	-	River Sowe	SP 349 834	Problem alleviated		
3-92-110-7	22	Trib. of Canley Brook	SP 306 775	14	0.1	3E
3-92-110-8	23	River Sherbourne	SP 294 821	9	0	3F
3-92-110-9	24	River Sherbourne/Pickford Brook	SP 307 803			
3-92-110-10	-	Canley/Westwood Heath/ Tocil Brooks	SP 282 769	Problem alleviated		
3-92-110-11	-	Withy Brook	SP 416 830	Problem alleviated		
3-92-110-12	-	Stoke Brook	SP 363 792	Problem alleviated		
3-92-110-13	-	Pickford Brook	SP 321 792	Problem alleviated		
3-92-110-14	-	Trib. of River Sowe	SP 360 782	Problem alleviated		
BIRMINGHAM CITY COUNCIL						
8-92-210-1	-	Bourne Brook	SO 046 832	Problem alleviated		
8-92-210-2	-	River Rea and The Bourne	SP 068 822	Problem alleviated		
8-92-210-3	25	Wood Brook	SP 035 815	29	2.7	1E
8-92-210-4	26	Griffins Brook	SP 035 812	Highway problem		
8-92-210-5	27	Bartley Brook	SO 995 818			
8-92-210-6	28	Chinn Brook	SP 088 799	10	0	3E
8-92-210-7	29	River Rea	SP 035 795	187	1.5	2C
8-92-210-8	30	River Rea	SP 023 788	294	0.4	3C
8-92-210-9	-	River Rea	included with 8-92-210-7			
8-92-210-10	-	Chad Brook	SP 043 851	Problem alleviated		
8-92-210-11	-	Merritts Brook	SP 015 802	Problem alleviated		
8-92-210-12	-	Gallows Brook	SP 037 807	Problem alleviated		
8-92-210-13	-	River Cole	SP 098 838	Problem alleviated		
8-92-210-14	32	River Cole	SP 098 813	14	0	3E
8-92-210-15)						
8-92-210-16)	-	River Rea and The Bourne	included with 8-92-210-2			
8-92-210-17	-	River Rea	included with 8-92-210-7			
8-92-210-18	-	River Rea and The Bourne	included with 8-92-210-2			
8-92-210-19	-	River Rea	included with 8-92-210-8			
8-92-210-20	-	Hatchford Brook	SP 165 858	Problem alleviated		
8-92-210-21	-	*River Cole	SP 152 880	Problem alleviated		
8-92-210-22	33	River Cole	SP 122 864			
8-92-210-23	-	*River Tame	SP 059 917	Scheme completed		
8-92-210-24	-	*River Tame	SP 082 907	Scheme completed		
8-92-210-25	-	*River Tame	SP 069 913	Scheme completed		
8-92-210-26	34	Warren Brook	SP 094 927	14	0.2	3E
8-92-210-27	-	Perry Brook	SP 070 921	Problem alleviated		

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
8-92-210-28)						
8-92-210-29)	-	Mere Green Brook	SP 120 977	Problem alleviated		
8-92-210-30	35	Plants Brook	SP 118 962	6	0	3F
8-92-210-31	-	Trib. of Langley Brook	SP 143 960	Problem alleviated		
8-92-210-32	-	None	SP 126 926	Problem alleviated		
8-92-210-33	-	Hatchford Brook	SP 158 836	Problem alleviated		
8-92-210-34	-	None	SP 126 955	Problem alleviated		
DUDLEY METROPOLITAN BOROUGH COUNCIL						
2-92-310-1	36	*River Stour/Coalbourne Bk	SO 894 850			
2-92-310-2	-	Illey Brook	SO 972 830	Problem alleviated		
2-92-310-3	-	Trib. of River Stour	SO 949 823	Problem alleviated		
2-92-310-5	37	Mousesweet Brook	SO 955 878	1067		
2-92-310-6	38	Holbeche Brook	SO 925 905			
2-92-310-7	39	Wordsley Brook	SO 907 876	577		
2-92-310-8	-	Trib. of River Stour	SO 924 849	Problem alleviated		
2-92-310-9	-	Audnam Brook	SO 896 862	Problem alleviated		
2-92-310-10	40	Stepping Stones Brook	SO 909 835			
2-92-310-11	41	Dawley Brook	SO 886 894			
2-92-310-12	42	Penn Brook	SO 908 947	6	0	3F
2-92-310-13	43	Gospel End Brook	SO 909 936			
2-92-310-14	44	Un-named	SO 898 822			
8-92-310-1	-	Parks Hall Reservoir	SO 934 929	Problem alleviated		
8-92-310-2	-	Swan Brook	SO 947 929	Problem alleviated		
8-92-310-3)						
8-92-310-4)	-	Tipton Brook	SO 940 910	Problem alleviated		
8-92-310-5)						
SANDWELL METROPOLITAN BOROUGH COUNCIL						
2-92-410-1	-	Mousesweet Brook	included with 2-92-310-5			
8-92-410-1	45	*River Tame	SO 984 876			
8-92-410-2	-	Swan Brook	SO 950 930	Problem alleviated		
8-92-410-3	-	Groveland Brook	SO 965 910	Problem alleviated		
8-92-410-4	46	Furnace Brook	SO 955 925			
8-92-410-5	-	Whiteheath Brook	SO 982 885	Problem alleviated		
8-92-410-6	47	#*River Tame	SO 991 889			
8-92-410-7	48	# Brandhall Brook	SO 988 872			
8-92-410-8	49	# Whitheath Brook	SO 984 887			
8-92-410-9	50	# Hobnail Brook	SP 004 924			
8-92-410-10	51	# Hobnail Brook	SP 003 940			
8-92-410-11	52	# Coneygre Brook	SO 957 913			
8-92-410-12	53	# Dudley Port Brookcourse	SO 967 919			
8-92-410-13	54	#*River Tame	SP 047 928			

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
SOLIHULL METROPOLITAN BOROUGH COUNCIL						
8-92-510-1	55	*River Blythe	SP 215 830			
8-92-510-2	-	*River Cole	SP 180 874	Problem alleviated		
8-92-510-3)						
8-92-510-4)	56	Low Brook and tributary	SP 173 818	92	3.8	1D
8-92-510-5	57	Trib. of River Blythe	SP 213 733	159	2.2	1C
8-92-510-6	58	Trib. of River Blythe	SP 206 762	95	2.0	2D
8-92-510-7	-	Westley Brook	SP 142 838	Problem alleviated		
WALSALL METROPOLITAN BOROUGH COUNCIL						
8-92-610-1)						
8-92-610-2)	59	Anchor Bk/Walsall Wood Bk	SK 026 013	138	3.6	1C
WOLVERHAMPTON BOROUGH COUNCIL						
2-92-710-1	-	Smestow Brook	SJ 914 005	Problem alleviated		
8-92-710-1	-	None	SO 921 968	Problem alleviated		
8-92-710-2	-	None	SO 933 965	Problem alleviated		
8-92-710-3)						
8-92-710-4)						
8-92-710-5)	-	Bilston Brook	SO 938 951	Problem alleviated		
8-92-710-6)						
8-92-710-7)						
8-92-710-8)						
HINCKLEY AND BOSWORTH BOROUGH COUNCIL						
8-93-210-1	61	Trib. of Witherley Brook	SP 327 977			
8-93-210-2)						
8-93-210-3)	-	*Sence Brook	SP 306 999	Problem alleviated		
8-93-210-4	-	Sketchley Brook	SP 426 931	Problem alleviated		
8-93-210-5	-	None	SP 428 933	Problem alleviated		
8-93-210-6	-	None	SP 428 932	Problem alleviated		
8-93-210-7	-	Harrow Brook	SP 408 936	Problem alleviated		
8-93-210-8	62	None	SP 406 927	Highway problem		
8-93-210-9	-	Sketchley Brook	SP 392 916	Problem alleviated		
8-93-210-10	-	*Sence Brook	included with 8-93-210-2			
8-93-210-11	63	Trib. of River Sence	SK 388 045			
8-93-210-12	64	None	SK 374 074	Highway problem		
8-93-210-13	65	*River Sence	SP 315 991	1738	1.2	2A
8-93-210-14	66	None	SK 370 051	Highway problem		
8-93-210-15	-	*Sence Brook	included with 8-93-210-2			
8-93-210-16	-	*River Sence	included with 8-93-210-13			
8-93-210-17	67	None	SK 339 027	Highway problem		
8-93-210-18)						
8-93-210-19)						
8-93-210-20)	-	*River Sence	included with 8-93-210-13			
8-93-210-21)						

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
8-93-210-22	68	Ashby-de-la-Zouch Canal	SK 377 060	Highway problem		
8-93-210-23	69	None	SK 394 079	Highway problem		
8-93-210-24	70	Trib. of River Sence	SK 422 045			
8-93-210-25	71	Trib. of River Sence	SK 430 054	Highway problem		
8-93-210-26	-	*River Sence	included with 8-93-210-13			
8-93-210-27	72	*Witherley Brook	SP 323 981			
8-93-210-28	73	Tweed River	SP 409 990	242	1.3	2C
8-93-210-29	-	Sunnyside Brook	SP 418 979	Problem alleviated		
8-93-210-30	-	Harrow Brook	SP 389 911	Problem alleviated		
8-93-210-31	-	Sketchley Brook	included with 8-93-210-9			
8-93-210-32	74	None	SP 436 963	1	2.2	1F
NORTH-WEST LEICESTERSHIRE DISTRICT COUNCIL						
8-93-710-1	75	River Sence	SK 395 109			
8-93-710-2	76	Blowers Brook	SK 394 121	NCB problem		
8-93-710-3	77	Trib. of River Sence	SK 407 096			
8-93-710-4	78	Trib. of River Sence	SK 411 107			
8-93-710-5	79	None	SK 432 126	Highway problem		
8-93-710-6	80	None	SK 432 108	Highway problem		
8-93-710-7	81	River Sence	SK 454 123			
8-93-710-8	82	River Sence	SK 424 124			
8-93-710-9	-	*River Sence	included with 8-93-210-13			
8-93-710-10	83	None	SK 421 121	Highway problem		
CANNOCK CHASE DISTRICT COUNCIL						
8-99-210-1	84	Un-named	SK 017 095	14	0	3E
LICHFIELD DISTRICT COUNCIL						
8-99-410-1	85	Trib. of Footherley Brook	SK 104 016			
8-99-410-2	86	*River Tame	SK 191 073			
8-99-410-3	87	None	SK 160 127	Highway problem		
8-99-410-4)						
8-99-410-5)	88	*River Tame	SK 186 140			
8-99-410-6	-	Trib. of Footherley Brook	SK 072 038	Problem alleviated		
8-99-410-7	89	*Footherley Brook	SK 108 051			
8-99-410-8	90	Crane Brook	SK 054 176			
8-99-410-12	-	Un-named	SK 193 024	Problem alleviated		
TAMWORTH BOROUGH COUNCIL						
8-99-910-1	-	Dunstall Lane W/C	SK 182 046	Problem alleviated		
8-99-910-2	-	Wilnecote Brook	SK 230 012	Problem alleviated		

TABLE 2

SUMMARY BY PRIORITY CATEGORY - TAME CATCHMENT
NON-MAIN RIVER

	A		B		C		D		E		F	
	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEME	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)
1	-	-	-	-	2	297	1	92	1	29	1	1
2	-	-	-	-	3	544	1	95	-	-	-	-
3	-	-	-	-	1	294	-	-	5	89	2	12
TOTAL	-	-	-	-	6	1,135	2	187	6	118	3	13
										TOTAL	17	1,453

TABLE 3

SUMMARY BY PRIORITY CATEGORY - TAME CATCHMENT
MAIN RIVER

	A		B		C		D		E		F	
	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEME	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	1	1,738	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	1	1,738	-	-	-	-	-	-	-	-	-	-
										TOTAL	1	1,738

CHAPTER 2

THE SURVEY

2.0 THE SURVEY

2.1 Introduction

2.1.1 The requirement for a Survey results from the Water Act 1989, which also created the National Rivers Authority. Under Section 136(1) of the above Act the National Rivers Authority has a duty to carry out from time to time, a survey of its area in relation to flood defence functions.

2.1.2 The Ministry of Agriculture, Fisheries and Food issued Guidance Notes for Water Authorities in carrying out the original Survey and, wherever possible, suggested procedures were adopted and information incorporated within the reports.

2.1.3 In carrying out the Survey the Authority was required to:

1 Consult every local authority whose area is wholly or partially included in the area of the Water Authority.

2 Have regard to structure plans and local plans under the Town and Country Planning Act 1971.

2.2 Purposes of the Survey

2.2.1 The primary purpose of the Survey is to identify and evaluate flooding problems, both for existing problems and for potential problems which may occur as a result of increased run-off from development. Information is provided which summarises the principal solutions, costs, benefits and priorities.

2.2.2 The Surveys are required by the Ministry of Agriculture, Fisheries and Food to provide a comprehensive and logical basis for long-term planning of drainage improvements and flood alleviation.

2.2.3 The Survey will be used by this Authority to ensure rational phasing of improvements on main river, and will provide a firm basis for the supervisory role exercised by the Authority over all matters relating to its flood defence functions on all watercourses throughout the region.

2.2.4 The Survey provides comprehensive information on both main river and non-main river and can, therefore, be used by all drainage authorities and drainage bodies (local authorities) for determining capital works programmes of watercourse improvements in conjunction with the Authority's own programme of works.

2.2.5 The Authority will make use of the survey in considering any changes to the main river network.

2.3 Extent of the Survey

2.3.1 The Authority exercises a general supervisory role over all matters relating to land drainage. The Survey, therefore, identifies and examines not only problems on main river but also on other watercourses having existing or potential land drainage and flood alleviation problems.

2.3.2 No limit has been fixed by the Ministry of Agriculture, Fisheries and Food for a lower order of problems which should be considered by the Survey, but it has been indicated that a "broad brush" approach is preferable to detailed investigations of a minority of large problems. This accords with the Authority's view of its own requirements and thus the lower limit has been fixed as flooding affecting a single property or inadequate arterial conditions affecting twenty hectares of agricultural land. However, where specific requests have been made to investigate problems of lesser order these have been included wherever possible.

2.3.3 The Survey has investigated those watercourses which are currently in a satisfactory condition but where future development could necessitate improvements. This has been limited to those developments which have planning permission or have been identified in Structure and Local Plans and are likely to proceed in the near future.

2.3.4 The Survey covers only those drainage inadequacies which occur on arterial watercourses. Where drainage inadequacies on agricultural land can be resolved by underdrainage alone, these have not been included within the Survey.

2.4 Procedure

2.4.1 Of the information on drainage deficiencies required for this Survey, a considerable proportion was available within this Authority. This is particularly so of the problems on main river but also applies to major problems on non-main river. There are, however, many kilometres of non-main river on which this Authority had no information and which have, in many cases, had little or no maintenance work carried out on them. In order to ensure comprehensive coverage on such watercourses, in addition to main river, all bodies having land drainage interests were asked to provide information on drainage deficiencies. These include:

1 Ministry of Agriculture, Fisheries and Food.

2 Internal Drainage Boards.

3 County Councils.

4 District Councils.

5 Parish Councils.

6 British Waterways Board.

7 National Farmers' Union.

8 Country Landowners Association.

9 British Coal.

2.4.2 In July 1978, an 'Interim Report' was circulated to local authorities and many other organisations and bodies as part of the Authority's statutory duty under Section 24 of the Water Act 1973. This Report identified all drainage deficiencies which had been notified to the Authority and provided brief details of location and type of problem.

2.4.3 The primary purpose of the Interim Report was to seek views and comments on the identified problems so that these could be taken into account in determining solutions. Provision was also made to incorporate additional problem areas in subsequent Reports to ensure their comprehensiveness. All relevant comments have, therefore, been incorporated in the problem evaluations in Appendix A1 including those of the Nature Conservancy Council, County Conservation Trusts, Countryside Commission and fisheries, navigation and many other interests, in addition to those scheduled in Section 2.4.1. Wherever possible, the costs identified for the improvement works have included the cost of making provision for all interests which have been notified.

2.4.4 Every problem identified in the Interim Report and those notified since its publication have been investigated by visiting the site and carrying out land surveys as necessary. The extent of the investigation has largely been determined by the extent of the problems and the benefits which will result. Many minor problems have, therefore, not been examined in detail because of the high cost of providing the necessary improvement works. There are also many cases where flooding cannot be attributed to inadequacies in the arterial watercourse drainage system. In these situations, the solutions to the problems are outside the scope of this Survey and have not been determined. However, an indication is given, in each case, of the cause of the problem and these have been brought to the attention of the appropriate authority (eg. Highway Authority, British Coal, etc).

2.5 Hydrological Criteria

2.5.1 The mean annual flow for all sites of major importance, for which flow records are available, have been calculated using the appropriate method formulated in the "Flood Studies Report"[2].

2.5.2 For sites of minor importance and sites having no available flow records, the mean annual flood has been calculated from catchment characteristics using the "Flood Studies Report" six parameter equation.

2.5.3 In all cases, the relationship between $Q(T)$ (the flood of return period T) and $\overline{Q}$ (the mean annual flood) has been derived from the "Flood Studies Report" regional growth curves.

2.6 Hydraulic Criteria

2.6.1 Urban flood alleviation schemes have been designed, wherever possible, to contain the 1 in 100 years flood. It is recognised that, in the final analysis, the design frequency chosen will be that which maximises the excess of benefit over cost but, within the scope of this Survey, this has not been possible other than in schemes of the very highest priority.

2.6.2 Culverts have generally been designed for the following flood return frequencies. (These standards have varied dependent upon economic or physical constraints):

1 Flooding of property and urban areas in general - 1 in 100 years.

2 All areas of high agricultural value including horticultural areas - 1 in 100 years.

3 Other agricultural areas - 1 in 25 years.

4 A combination of flooding transport systems and agricultural areas may justify a standard of up to 1 in 50 years.

2.6.3 For the Survey purposes the following criteria have been adopted:

1 In agricultural areas the pipe outfalls for field drainage systems are designed to be 150mm above normal water level. Where there is no field drainage system an average freeboard of 1,500mm between normal water level and ground level has been used. The freeboard requirements for under-drainage purposes may result in larger channel capacities than those required purely for flood alleviation purposes.

2 For the construction of floodbanks freeboard is dependent on the confidence limits of data used for design purposes, and for major floodbanks is normally 500mm. Small freeboards have been considered in appropriate cases. In all other cases, channel capacity is the design flood discharge with no additional freeboard.

2.7 Land Potential Category

2.7.1 The successful growth of crops depends on a suitable soil environment for germination, root anchorage and plant growth. Cropping systems are dependent on soil potential and similarly drainage standards can be linked to soil profile characteristics such as structure, texture, depth, stoniness and wetness. The Ministry of Agriculture, Fisheries and Food has assessed standards for field drainage and flood protection based upon the relationship between cropping and soil or land potential as indicated in Table 4. In providing these individual assessments the Ministry has pointed out that they are subjective and will need to be verified by detailed in-field investigations before any scheme can be agreed for grant aid purposes.

Table 4 Land Potential Categories

a	Land potential low (Normally pasture land)	1 in 2 years
a5	Land potential low/medium (Normally low grade arable land)	1 in 5 years
b	Land potential medium/high (Normally high grade arable land)	1 in 5/10 years
c	Land potential very high (Very high grade arable and horticultural land)	1 in 25/100 years

2.8 Improvement Costs

2.8.1 Costs of improvement schemes have been estimated on a standard unit cost basis wherever possible and appropriate in order to ensure uniformity and comparability of all schemes. The unit cost approach has been adopted for excavation of new channels, construction of floodbanks, bridges, pumping stations, culverts, revetment work, etc. It has not been possible to use unit costing for regrading and remodelling of existing channels or for channel clearance of undergrowth and trees as these are items which vary from watercourse to watercourse.

2.8.2 All costs include for design and supervision which on average is approximately 10% of the cost of the improvement works.

2.8.3 All costs are at a price base of December 1989.

2.8.4 The cost of field drainage for existing problems has been assessed by the Ministry of Agriculture, Fisheries and Food and has been included within the total cost of the improvement works. Field drainage costs for new problems have been assessed using a nomograph produced by Silsoe College for the Authority in 1984. Ditching costs have not been included unless this constitutes a significant proportion of the overall cost.

2.8.5 Wherever possible, the total cost of the improvement works includes the cost of making provision for navigation, fisheries, conservation and other interests of which the Authority has been notified.

2.9 Benefit Assessment

2.9.1 Benefit areas for urban problems have been determined largely from local knowledge of the extent and depth of past floods. These have been extrapolated where necessary to estimate the extent of floods with return periods in excess of recorded events. The stage/damage estimates and subsequent evaluation of annual average benefits have been derived from methods formulated in the manual entitled "The Benefits of Flood Alleviation: A Manual of Assessment Techniques"[3].

2.9.2 The areas which are likely to benefit in both agricultural and urban areas are shown on the overlays to the maps in the 1980 album. The locations of small areas of urban flooding and miscellaneous minor flooding problems are shown with a dot enclosed in a circle and identified with the appropriate code number. In the case of large urban flooding problems and agricultural drainage problems, the areas shown on the overlays and identified by code numbers are the areas which will benefit from drainage improvements.

2.9.3 Areas of inland agricultural land which will derive benefit from drainage operations have been defined, for the purpose of this Survey, as follows:

i) Land within an area bounded by a line 2.4m above the highest recorded flood level as defined in the "Medway Letter"[4].

ii) Where no flooding has occurred but normal water levels restrict outfall conditions for field drains, the benefit area is the area bounded by a line 2.4m above bank top level.

2.9.4 Annual average benefits for agricultural areas have been assessed by the Ministry of Agriculture, Fisheries and Food from the land potential (see Table 4) and from the potential change in gross margin which will result from improved drainage. These assessments will require verification by detailed studies if schemes are incorporated in capital programmes.

2.9.5 The maximum benefits from most agricultural improvement schemes can be achieved only if the individual farmers carry out ditching and install field drainage following the improvement to the receiving watercourses. In practise the benefits will, therefore, be phased in as field drainage is installed and due account will be taken of this phasing when individual detailed schemes are prepared.

2.9.6 If the improvement of a watercourse is an essential pre-requisite of planning permission for any housing or industrial development, such that without the improvement planning permission would not be approved, then the benefits attributable to future development by the off-site improvement of watercourse have been assessed as a proportion of the increase in the value of the land after planning permission is granted.

2.9.7 The benefits have been assessed, for both urban and agricultural problems, using a base date of December 1989. It should be appreciated that benefits, particularly in agricultural schemes, may not follow normal inflationary trends.

2.10 Test Discount Rate

2.10.1 The test discount rate which has been used for the assessment of the net present value of future costs and benefits is the Government's recommended current rate for public investment of 6%. The life of improvement schemes, other than those involving pumping stations, has been assumed as 50 years for the purpose of the net present value analysis.

2.10.2 Maintenance costs after improvements have been carried out are assumed, on average, to be of a similar order to those before. In some cases, maintenance costs will be lower whereas in others, particularly where maintenance has been neglected in the past, costs will be higher.

2.11 Benefit/Cost Ratios

2.11.1 The comparison of benefit with cost enables an assessment to be made of the worthwhileness of any proposed improvement. For the purpose of this Survey a scheme is considered as being possibly viable if the benefit to cost ratio is greater than unity. However, if an improvement scheme progresses to a capital programme it may be necessary to compare it with benefit/cost ratios for other competing schemes to enable a choice to be made.

2.11.2 The greater the excess of benefit over cost the higher the return for capital employed and, therefore, in purely economic terms, a scheme having a high benefit/cost ratio would have a higher priority than a scheme having a lower value. However, due weight must also be given to other factors such as risk to human life, amenity and environmental considerations. These factors are intangible and require a subjective assessment, in conjunction with economic factors, to determine the overall priorities of schemes.

2.12 Priority Category

2.12.1 The Survey has made no attempt to determine priorities which take into account intangible benefits; schemes have been categorised solely on the basis of tangible benefits which can be assessed in purely economic terms. It will be the responsibility of the promoting authority to determine the weight to be given to intangible benefits and, therefore, the overall priorities to be attached to schemes in its area.

2.13 Inflation Factors

2.13.1 Costs and Benefits for problems contained in the 1986 revision have been updated to a December 1989 price base as follows:

Arterial Costs - Baxter (Regional) Index

Underdrainage Costs - Retail Price Index

Agricultural Benefit - Using information supplied by Silsoe College based on changes in weighted gross margins

Urban and Road Benefits - Retail Price Index.

CHAPTER 3

GENERAL DESCRIPTION

3.0 GENERAL DESCRIPTION

3.1 Description of the Region

3.1.1 The boundary of the Severn-Trent Region of the National Rivers Authority is formed by the watersheds of the River Trent and the River Severn. The area of 21,600 sq. km extends from the Humber estuary in the north to the Severn estuary in the south, and is bounded by the Anglian, Yorkshire, North West, Welsh, Wessex and Thames Regions of the NRA. The Severn-Trent Region is divided into eight catchments the boundaries of which are the watersheds of the major sub-catchments of the River Severn and the River Trent. These catchments and the location of the region is shown in Fig.1.

3.1.2 The Severn-Trent Region of the National Rivers Authority is responsible for the two major tidal estuaries of the River Severn and the River Trent but other than these areas it has no coast line. The River Trent is tidal as far as Cromwell Lock, about eight kilometres downstream of Newark, and the River Severn is tidal as far as Gloucester.

3.1.3 The highest part of the Trent region is the Pennines in the north west where the River Derwent rises at an altitude of 630 metres. Altitude decreases across the Trent basin to the River Trent itself and then rises in the east to a height of between 60 metres and 120 metres. In the central region the catchments of the Rivers Severn and Trent are separated at the headwaters of the River Tame and the River Stour by a ridge of between 200 metres and 270 metres high.

3.1.4 The topography of the Severn basin is dominated by the Welsh Hills in the west at a maximum elevation of 830 metres and the Cotswold Hills in the south-east at an elevation of 330 metres. A prominent feature in the south-west is the Malvern Hills which rise to a height of 430 metres.

3.1.5 The average annual rainfall over the whole of the region is 775mm and this ranges from a maximum of over 2,000mm in the Welsh Hills to approximately 600mm in the Trent Valley in the rain shadow of the Pennines. The variation is largely associated with altitude. The lowlands generally have little seasonal variation but upland areas are wetter in winter than in summer. Similarly, in the upland areas, snowfall is a significant form of precipitation.

3.1.6 The geology of the region varies from the resistant Pre-Cambrian and Palaeozoic rocks in west Shropshire to the softer clays, shales and limestone bands of the Lower Lias in east Leicestershire and Warwickshire. The Pre-Cambrian and Palaeozoic rocks are characterised by the rugged landscape of Wales, the Border Counties and the carboniferous limestone formations in Derbyshire, while the more recent formations in the east have weathered to form the rolling scarps and vales typical of Leicestershire.

3.1.7 The total population of the Region is 8.3 million people with some 2.5 million in the Severn catchment and 5.8 millions in the Trent. Approximately 2.6 million people live in the West Midlands conurbation which straddles both catchments. The other major centres of population are Nottingham (280,000), Leicester (282,000), Stoke-on-Trent (250,000) and Derby (215,000). Many of these conurbations, and particularly that of the Black Country area, are situated in the vicinity of the headwaters of major rivers and have a significant effect on the river flows throughout their lengths.

3.1.8 The National Rivers Authority assumes a direct responsibility for 3,573 km of main river on which capital improvements and maintenance are carried out as necessary. Areas which have been protected from flooding, to various standards, on this length of main river total over 1,000 sq. km. Much of this area is protected by floodbanks of which the total length is 820 km, all of which is maintained on a regular basis by the Authority.

3.2 Description of the Tame Basin

3.2.1 The Tame Basin comprises the catchment of the River Tame and its major tributaries, the River Anker, Blythe, Cole and Rea and covers an area of 1,470 sq.km. The Catchment extends over a large proportion of the densely populated and industrialised area of the Black Country.

3.2.2 The basin lies in the Midland Plain within an altitude range of 50 to 270m AOD. Although the greater part of the area is a flattish plateau, the gradient of the headwaters of the Tame is steep and this, combined with extensive impervious areas of the conurbation, causes high flows of short duration shortly after the peaks of rain storms.

3.2.3 Similar, but less severe conditions apply to the upper reaches of the River Anker which receive run-off from Nuneaton and Hinckley and, to an even lesser extent, the River Sence which receives flows from Coalville.

3.2.4 A scheme to alleviate flooding on the River Tame is due for completion in 1992. The scheme comprises flood storage lakes, controlled washlands and channel improvements.

3.2.5 Flooding is controlled by three off-line storage lakes and two controlled washlands. These reduce peak flood flows in the river, thereby limiting the improvement works required to the channel itself. The storage lakes, in addition to attenuating flood flows in the river, have provided new amenity and recreational facilities.

CHAPTER 4

THE NATIONAL RIVERS AUTHORITY'S SUPERVISORY ROLE

4.0 THE NATIONAL RIVERS AUTHORITY'S SUPERVISORY ROLE

4.1 Introduction

4.1.1 Section 136(1) of the Water Act 1989 states that the National Rivers Authority shall exercise a general supervision over all matters relating to flood defence. This general supervision includes all watercourses, both main and non-main, and is exercised in part by consenting to works on or in watercourses, by the enforcement of bye-laws and by liaison with Planning Authorities responsible for development control.

4.2 Land Drainage Bye-laws

4.2.1 Section 34 of the Land Drainage Act 1976 (as amended by the Water Act 1989) allows Drainage Authorities to "make such bye-laws as they consider necessary for securing the efficient working of the drainage system in their area". Consent is required in compliance with particular bye-laws covering control of certain operations in or adjacent to rivers or the floodplain of rivers (generally confined to main rivers). Such operations include erection of fences, tree planting, disposal of rubbish, excavation affecting the bed and banks of rivers, erection of jetties or walls, etc.

4.2.2 In order to eliminate minor inconsistencies in the bye-laws inherited from the Severn and Trent River Authorities, the Severn Trent Water Authority made new bye-laws which were confirmed by the Ministry of Agriculture, Fisheries and Food on the 26 April 1979. By the provisions of the Water Act 1989 these Byelaws are now enforced by the National Rivers Authority, Severn-Trent Region. All references to Severn Trent Water Authority, STWA or Water Authority should now read National Rivers Authority.

4.3 Statutory Consents

4.3.1 It is essential that a rational and consistent approach is adopted for standards not only on main rivers but also on non-main rivers, where alterations to existing conditions can seriously affect the main river system downstream. The maximum benefits can be achieved only if all works which require consent are identified, so that a consistent standard can be attained throughout the region.

4.3.2 The issue of a Land Drainage Consent implies that, if the work is carried out in accordance with the drawings and documents submitted, there will be no detriment to land drainage operations or consequential flooding. Prior to issue of a consent Local Authorities, Internal Drainage Boards, Navigation Authorities and others are consulted as necessary.

4.3.3 A Consenting Manual has been produced for the Authority's internal use which details principles to be adopted and formalises the Authority's policy on various types of development so that consistent advice can be given to planners.

4.4 Planning Liaison and Development Control

4.4.1 In addition to exercising control over drainage works by consenting procedures, the Authority also seeks to control operations likely to adversely affect drainage interests through its planning consultation with Local Authorities. The Town & Country Planning General Development Order 1988 obliges local planning authorities to consult the NRA before determining planning applications. The majority of new developments which require land drainage improvements are identified in this way and advice is given to the planners about the effects of the proposals in relation to flooding and land drainage.

4.4.2 The Department of the Environment Circular 17/82[5] issued in 1982 emphasised the need for Planning Authorities to consult the Water Authorities in respect of development and caravan and camping sites in flood risk areas, and the effects of run-off from new developments. The National Rivers Authority must now be consulted on such matters.

4.4.3 The major floodplain areas are identified on the maps which accompanied the 1980 report. In general, the areas shown envelop those areas which have been flooded by past recorded events. They do not, therefore, relate to a particular frequency flood event.

4.4.4 Many areas within floodplains have been protected by improvement schemes which will, in general terms, consist of either channel improvements or flood embankments. These areas are also identified on the maps and the level of protection is indicated.

4.4.5 In particular, Local Authorities are advised that, for developments which are likely to increase the risk of flooding, the developer should be informed that works will be required to watercourses to remedy the situation. If these works are outside the area of the application, the developer is required to show that provision has been made to carry out the works, as conditions applicable to such works cannot be applied to planning permissions. If the developer does not make arrangements for the watercourse improvement the Planning Authority can refuse the application.

4.4.6 Where works are required to a non-main watercourse to accommodate the additional run-off from developments, the developer may carry out the work, by agreement with the riparian owners, at his own expense. If agreement is not possible he may request the Local Authority to carry out the works and reimburse the authority accordingly. In the case of main river, works will normally be carried out by the National Rivers Authority with an appropriate contribution from the developer.

4.4.7 At the present time, negotiations take place between the developer(s) and the National Rivers Authority or Local Authority into the proportion of the improvement cost of the off-site watercourse which is to be met by the developer(s).

CHAPTER 5

MAIN RIVER SYSTEM

5.0 MAIN RIVER SYSTEM

5.1 Statutory Provisions

5.1.1 The main river system is the system of watercourses identified on the statutory set of main river maps held by the National Rivers Authority and the Ministry of Agriculture, Fisheries and Food (MAFF). Main river powers extend to any structure in the bed or bank of the watercourse which controls the flow of water into or out of the watercourse. Powers for carrying out work on main river are exercisable by the National Rivers Authority and by others with the Authority's consent.

5.1.2 The main river map may be altered by the Ministry of Agriculture, Fisheries and Food at the request of the National Rivers Authority. Before doing so, the Minister must give notice of his intention and this is usually carried out by advertising in local newspapers. All objections to the proposals will be considered by the Minister.

5.1.3 In relation to watercourses which are not designated as main river the Authority has certain regulatory powers but has no powers to carry out work using Flood Defence finance.

5.1.4 A 1:250,000 scale map showing the main river system within the Severn-Trent Region as at January 1990 is available.

5.2 Principles for Main River Extension

5.2.1 The following criteria are used by the National Rivers Authority, Severn-Trent Region in deciding whether to make an application to MAFF for changing the status of a watercourse from non-main to main river.

1 Main River shall be continuous from the estuary to a suitable point (eg a bridge or other structure) where:-

(a) the population in the remainder of the upstream catchment is less than 10,000

or

(b) the average width of flood plain in the remainder of the upstream catchment is less than 300 metres per kilometre of watercourse

or

(c) there is no single community greater than 3,000 persons further upstream.

Whichever is the furthest point upstream.

2 Main river shall also extend upstream to the point of discharge of:-

(a) outfalls from sewage works with an average daily flow greater than 5 megalitres

(b) untreated water reservoirs that impound more than 1,000 megalitres

(c) the downstream outfall of an internal drainage board.

3 Where balancing storage is provided as an essential part of the system of surface water drainage, consideration should be given to extending main river up to the point of intake of such balancing storage.

4 However, a flexible approach will be adopted and consideration may also be given to extension of main river in particular circumstances (eg to receive the surface water drainage from a motorway, an embanked watercourse or to be the upstream boundary of urban areas for development control and byelaw purposes).

5.3 Local Authority Improvements

5.3.1 Where non-main watercourses accord with the above policy, and improvements are carried out by Local Authorities to standards approved by this Authority, the Authority may recommend to the Ministry of Agriculture, Fisheries and Food that the watercourses should be included as part of the main river system.

CHAPTER 6

THE LAND DRAINAGE ROLE OF LOCAL AUTHORITIES

6.0 THE LAND DRAINAGE ROLE OF LOCAL AUTHORITIES

6.1 Interaction with the National Rivers Authority's role

6.1.1 The powers available to Local Authorities (both District and County Councils) under the Land Drainage Act 1976 (as amended by the Water Act 1989) for carrying out works of maintenance and improvement on non-main rivers are complementary to those of the National Rivers Authority on main river. In almost all cases the powers are permissive, but most Councils now accept the responsibility that this implies and are prepared to carry out improvement schemes in conjunction with those of the National Rivers Authority on main river. In this way, many serious impediments to the overall drainage system are gradually being eliminated.

6.2 Powers of District Councils

6.2.1 District and Metropolitan District Councils have powers under Section 98 of the Land Drainage Act 1976 (as amended by the Water Act 1989) to carry out works on non-main river for the purpose of preventing flooding or remedying or mitigating any damage caused by flooding.

6.3 Powers of County Councils

6.3.1 County Councils have powers under Section 99 of the Land Drainage Act 1976 (as amended by the Water Act 1989) to execute land drainage schemes, at the request of owners and occupiers who will benefit from the schemes.

6.3.2 Section 100 of the Land Drainage Act 1976 (as amended by the Water Act 1989) enables County Councils to execute land drainage works compulsorily for the improvement of agricultural land, and apportion any expenses among the beneficiaries.

6.3.3 County Councils may exercise Section 98 powers by agreement with, or by default of, a District Council.

6.4 Maintenance of the Flow of Watercourses

6.4.1 Where the proper flow of water in a non-main river is impeded, both District and County Councils may, under Section 18, of the Land Drainage Act 1976 (as amended by the Water Act 1989), serve notice on the person concerned to remedy the situation.

CHAPTER 7

INTERNAL DRAINAGE BOARDS

7.0 INTERNAL DRAINAGE BOARDS

7.1 Constitution

7.1.1 Many Internal Drainage Boards were first constituted in the nineteenth century by individual Acts of Parliament. However, all Internal Drainage Boards are today constituted, or continued in being, in accordance with the provisions of the Land Drainage Act 1976 (as amended by the Water Act 1989) which defines Internal Drainage Districts as such areas as will derive benefit or avoid danger as a result of drainage operations. These areas are generally located in lowland regions where special drainage problems exist and where collective benefit will be derived from drainage operations.

7.1.2 Within the Region there are 32 Internal Districts of which 24 are in the Trent catchment and eight are in the Severn catchment. In most cases a District is administered by a Board consisting of elected members but the Sow and Penk District is administered directly by this Authority.

7.1.3 The basis for the determination of Internal Drainage District boundaries was laid down by the Minister of Agriculture and Fisheries in 1933 in a decision letter known as the "Medway Letter" [4]. This letter, which is now regarded as the authoritative pronouncement for all cases which have arisen since then, identified the area of benefit or avoidance of danger by reason of drainage operations by reference to flood contours (in relation to freshwater drainage) or tide levels (in relation to sea defence and salt water inundations).

7.2 Income

7.2.1 The income of Internal Drainage Boards is derived in the main from:

i) Drainage rates levied on land and buildings within the Drainage District.
ii) Ministry of Agriculture, Fisheries and Food grant aid for capital schemes undertaken by the Boards.
iii) Contributions, in appropriate cases, from the National Rivers Authority towards the cost incurred by the Boards in handling water flowing through the District from upland areas.

7.3 Designated Watercourses

7.3.1 The Boards are empowered under Section 6 of the Land Drainage Act 1976 (as amended by the Water Act 1989) to exercise a general supervision over all matters relating to the drainage of land within their Districts, and are empowered by Section 17 of that Act to carry out work on all non-main river watercourses within their area. In practice, most Boards designate certain watercourses in their area on which they carry out regular maintenance and other minor watercourses are left to riparian owners to maintain or improve.

7.4 Maintenance of the Flow of Watercourses

7.4.1 Where the proper flow of water is impeded, an Internal Drainage Board may serve notice under Section 18, Land Drainage Act 1976 (as amended by the Water Act 1989), on the person concerned to remedy the situation. This applies to all watercourses in the Drainage District other than main river on which notice would normally be served by the National Rivers Authority.

CHAPTER 8

FLOOD DEFENCE MAINTENANCE

8.0 FLOOD DEFENCE MAINTENANCE

8.1 Objectives

The main objectives for flood defence maintenance can be summarised as follows:

- to preserve the stability, continuity and integrity of flood defences

- to ensure the satisfactory operation of pumping stations, outfalls, sluices and other flood defence structures.

- to ensure that the river systems (channels, floodplain and washland) are capable of containing and transmitting flood waters and tidal surges up to the appropriate target return period.

- in carrying out its operations to preserve and 'further' the river environment.

8.2 Responsibility for Maintenance

The Authority is given powers under Section 17, Land Drainage Act 1976 (as amended by the Water Act 1989) to maintain watercourses designated as main river. It does not have similar powers for the maintenance of non-main rivers which are normally considered the responsibility of the riparian owners although Internal Drainage Boards, District Councils and, in certain cases County Councils have permissive powers on these watercourses.

8.3 Maintenance Programmes

An Asset Management Plan is being developed which will identify maintenance expenditure profiles which will ensure an appropriate Level of Service (LOS) for Flood Defence.

This Level of Service is expressed in terms of a target flood capacity which is calculated from an analysis of the land use benefiting from flood protection.

A major survey of Flood Defence Assets will be carried-out as part of this Asset Management Plan. Many of these assets are approaching the end of their original design life, therefore, this survey will confirm whether the current maintenance practices are adequate or not.

The Asset Management Plan will determine:-

- the target Level of Service

- the existing Level of Service

- the gap or shortfall between the target and existing Level of Service

- objective maintenance programmes appraised by cost benefit techniques. These will be further refined, following full consultation, to ensure that balanced programmes are produced which accommodate environmental interests.

The Region has recently commissioned a new Rivers Information and Maintenance System (RIMS) which assists this development of objective maintenance programmes.

In addition the Region carries out Best Operational Practice Reviews to ensure that full benefit is taken of any new developments in the industry; the resultant cost savings enable our operations to extend over more of the main river network.

Furthermore, post project appraisals are carried-out to ensure that the various models and techniques which have been developed and used are valid.

The Region also funds an annual environmental enhancement programme.

CHAPTER 9

FLOOD DEFENCE AND CONSERVATION

9.0 FLOOD DEFENCE AND CONSERVATION

9.1 Introduction

9.1.1 When carrying out improvements to watercourses due regard is taken of other interests which may be affected by such improvements. Other functions of the NRA are consulted during the detailed design phase of schemes. However, in the past, conservation interests relating to watercourses have not always received their due regard and for this reason particular emphasis has been given in this Survey to these aspects. Therefore, the problem evaluations in Appendix A1 give specific information on conservation and environmental interests where these may be affected by the suggested improvements. In addition, statutory conservation sites and County Trust Reserves are delineated on the maps which accompanied the 1980 report and scheduled in Appendix A3.

9.2 Statutory Provisions for Nature Conservation

9.2.1 Section 8(1) of the Water Act 1989 states that the National Rivers Authority has a duty to "further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological and physiographical features of special interest".

9.2.2 Guidance notes on land drainage and conservation have been circulated jointly by the Department of the Environment, MAFF and the Welsh Offices to all Water Authorities and Internal Drainage Boards in relation to duties under previous legislation. These guidelines are currently being updated to take into account the Water Act 1989.

9.2.3 The relevant functions of the Nature Conservancy Council and the Countryside Commission are given in Appendix A6.

9.2.4 The Authority's standard land drainage consent form has been amended to inform applicants of the need to comply with any duties or responsibilities for the conservation or protection of the environment (including flora and fauna).

9.3 Liaison with Conservation Interests

9.3.1 The Authority attaches great importance to liaison with conservation interests for all land drainage proposals which affect watercourses. These may be summarised as:

i) Improvement schemes identified in the 5 year capital programme for flood defence.

ii) Maintenance work on watercourses.

iii) Proposals for main river variations.

iv) Water Act 1989, Section 136(1) Flooding Survey.

9.3.2 The Authority's area staff have been issued with guidelines on the consultation which is necessary between area staff and conservation/recreation staff where works involve improvement or maintenance of rivers and watercourses.

9.3.3 The principal links between the area offices and conservation and amenity bodies are the Area Conservation and Recreation Officers.

CHAPTER 10

FLOOD WARNING SYSTEM

10.0 FLOOD WARNING SYSTEM

10.1 Investigations have shown that within the Severn-Trent Region of the National Rivers Authority considerable public benefit can accrue from accurate, reliable and well disseminated flood forecasts which provide the general public with adequate warning of flood events. The warnings can provide time for items to be moved from ground floors of residential and commercial properties, for boat owners to secure their crafts, campers and caravanners to evacuate sites, etc.

10.2 The National Rivers Authority has powers to provide and operate a flood warning system by Section 32 of the Land Drainage Act, 1976 (as amended by the Water Act 1989). The main provisions of the system which operates throughout the Region are:

i) To monitor weather conditions and flows and levels in rivers and to forecast future water levels.
ii) To provide warnings of potential floods in areas likely to be affected.
iii) To provide an advice and information service to the general public.
iv) To deploy area staff and equipment as necessary.
v) To liaise with other emergency services.

10.3 The procedure for issuing warnings is normally initiated by the Meteorological Office providing forecasts of rainfall or snowmelt. This information, together with the continual assessment of the detailed catchment situation by the interrogation of the network of rainfall and river flow and level recorders, enables the Authority to forecast and monitor the progression of floods through the river basins.

10.4 When danger areas have been assessed this information has to be passed to the public in those areas. This service is normally provided by the Police who advise the public by loudspeaker, local radio broadcasts and other appropriate methods. This system, however, cannot operate in some areas where localised storms can outpace the forecasting and warning procedure. Therefore, the service is limited to those areas where more than 4 hours warning can be given.

10.5 It is particularly difficult to provide warnings for transient groups of people such as caravanners, campers and boaters. When sites for caravans and camping are being considered the Authority will always advise planning authorities against their location in areas which are subject to periodic inundation. The protection of such sites from flooding is normally difficult, expensive and contrary to Authority policy regarding the use and management of floodplains. The joint DoE/MAFF/WO Circular 17/82 highlights this special risk problem.

10.6 Although major benefits can be attributed to a reliable flood warning system, such a system cannot, in itself, be considered as a satisfactory alternative to structural improvements which will reduce the risk of flooding. The Authority's policy is to continue to provide increased flood alleviation measures, at the same time as providing an effective flood forecasting service, which will give early warning of flooding in unprotected areas and also in the event that flood defences are likely to be overtopped.

CHAPTER 11

PROGRAMMING OF FUTURE WORK

11.0 PROGRAMMING OF FUTURE WORK

11.1 This Survey has identified and evaluated a wide range of flood defence problems throughout the Region. The responsibility for resolving the problems and financing the improvement works falls initially upon the riparian owner although drainage authorities have permissive powers to undertake works.

11.2 In many cases, the necessity for improvement is often due to increased channel flows resulting from developments in the upstream catchment, which, in recent years, have been approved by planning departments of Local Authorities. Where improvements due to development are required on main river, responsibility is normally accepted by this Authority, whereas on non-main river the responsibility is normally that of the District Council in urban areas, and the County Council in agricultural areas (other than in Drainage Districts where the Internal Drainage Board has a responsibility).

11.3 Improvement works on watercourses in individual catchments need to be co-ordinated to ensure that works in one area are compatible with those in another. This Authority is the body responsible for the co-ordination and supervision of flood defence throughout the area, and publishes annually its 5 year programme. The co-ordinating role can be carried out effectively only if all drainage bodies produce programmes of work which satisfactorily integrate to provide the maximum benefit to flood defence. This Survey provides the basis for the determination of such programmes of work.

11.4 Financing of flood defence works varies, dependent on the drainage body promoting the work. Most improvements, other than those needed as a requirement of future development, are eligible for grant aid from the Ministry of Agriculture, Fisheries and Food providing the improvement can be shown to have a satisfactory benefit/cost ratio (see Section 2.11). The sources of finance generally available to drainage bodies are indicated in Appendix A5.

11.5 In the future, the Survey will be updated at intervals of approximately three years. In order to ensure this operation is kept to a minimum in terms of manpower and financial resources, the Authority wishes to be kept informed of all improvement schemes which have been completed and of any additional problems which may be identified from time to time.

APPENDIX A1

PROBLEM DESCRIPTIONS

AND EVALUATIONS

IDENTIFICATION

Problem code number(s):	8-91-110-5
Watercourse:	Whittleford Brook (non-main river)
Location:	Galley Common (Nuneaton & Bedworth Borough Council)
OS Map reference:	SP 315 919

NATURE OF PROBLEM

Flooding occurred in July 1968 and June 1979 to a detached house and class 'C' road (not impassable). Flooding has occurred on a number of occasions at the culvert under Bucks Hill due to debris accumulation.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 25 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	37,480	
		(ii)	Field drainage	£		£37,480
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	6,260	
		(iii)	Roads/Railways	£		£6,260
(c)	**Benefit/cost ratio**					0.2
(d)	**Priority category**					3E

IMPROVEMENT WORKS

The proposed remedial works include an additional culvert under the Hickman Road/Tunnel Road junction together with regrading works downstream from this point to appoximately 500 m downstream of Park Lane. Some maintenance work will also be required under Park Lane.

Nuneaton & Bedworth Borough Council have carried out minor works to lessen the possibility of debris causing blockages.

Since the flooding of 2 properties in 1981 major improvements to the Whittleford Brook downstream of Hickman Road/Tunnel Road culvert have been undertaken. This work has improved the general situation, however, the culvert (part Highway Authority and part private) can only pass the 1 in 2 year event and subsequent flooding of residential property has occurred.

BENEFITS

As the road is not impassable to vehicles the benefits from the alleviation of flooding are small and have not been assessed.

IDENTIFICATION

Problem code number(s):	8-91-110-7
Watercourse:	Tributary of Harrow Brook (non-main river)
Location:	Long Shoot, Nuneaton (Nuneaton & Bedworth Borough Council)
OS Map reference:	SP 390 928

NATURE OF PROBLEM

A number of houses on the Long Shoot are affected. Flooding of gardens to 140-160 Long Shoot and water to threshold level at 148 occurred on 31 December 1981.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The problem is due to:

(a) properties being low relative to road and adjacent fields

(b) ditch behind the houses being badly maintained and inadequately piped in parts.

(c) very shallow surface water sewerage system.

The outfall of the system was improved as a result of works carried out to Harrow Brook by Hinckley and Bosworth Borough Council. Some of the householders are now attending to the ditch, but the problem remains. Nuneaton & Bedworth Borough Council have no proposals for remedial work.

IDENTIFICATION

Problem code number(s):	8-91-110-9
Watercourse:	Bar Pool Brook (non-main river)
Location:	Nuneaton & Bedworth (Nuneaton Borough Council)
OS Map reference:	SP 342 922

NATURE OF PROBLEM

In 1983, a 1 in 3/4 year flood made Queen Elizabeth Road impassable to traffic aand inundated several gardens. The problem was caused by the blockage of an inadequate culvert which outfalls to the Coventry Canal.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The cost of the remedial scheme would be very high (far in excess of the value of the property affected). Therefore, no scheme is programmed, although ameliorative works will be undertaken as and when development in the catchment takes place.

CONSERVATION

The Barpool Valley and adjacent Bucks Hill clay pit are important wildlife areas especially for willow scrub and wetland areas - where many warblers occur. Any proposed maintenance should not be allowed to interfere or disrupt the ecology of this area.

IDENTIFICATION

Problem code number(s):	8-91-110-7
Watercourse:	Tributary of Harrow Brook (non-main river)
Location:	Long Shoot, Nuneaton (Nuneaton & Bedworth Borough Council)
OS Map reference:	SP 390 928

NATURE OF PROBLEM

A number of houses on the Long Shoot are affected. Flooding of gardens to 140-160 Long Shoot and water to threshold level at 148 occurred on 31 December 1981.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The problem is due to:

(a) properties being low relative to road and adjacent fields

(b) ditch behind the houses being badly maintained and inadequately piped in parts.

(c) very shallow surface water sewerage system.

The outfall of the system was improved as a result of works carried out to Harrow Brook by Hinckley and Bosworth Borough Council. Some of the householders are now attending to the ditch, but the problem remains. Nuneaton & Bedworth Borough Council have no proposals for remedial work.

IDENTIFICATION

Problem code number(s):	8-91-210-1
Watercourse:	River Anker (non-main river)
Location:	Wolvey (Rugby Borough Council)
OS Map reference:	SP 418 886 to SP 428 872

NATURE OF PROBLEM

Farmland adjoining the river suffers from inadequate arterial drainage.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Warwickshire County Land Agent is considering a scheme.

IDENTIFICATION

Problem code number(s):	8-91-110-10
Watercourse:	Un-named (non-main river)
Location:	Bulkington (Nuneaton & Bedworth Borough Council)
OS Map reference:	SP 438 288

NATURE OF PROBLEM

Deficiencies in a piped-in ditch or watercourse discharging into Ashby Canal causes flooding in gardens etc.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-91-510-1
Watercourse:	Bourne Brook (non-main river)
Location:	Fillongley (North Warwickshire Borough Council)
OS Map reference:	SP 281 871

NATURE OF PROBLEM

Flooding has occurred to a class 'C' road and a public house twice in the last 10 to 15 years and was caused by the blockage of the inlet screen to a culverted section of the Brook. The screen is now regularly maintained and, in addition, the culvert was cleaned out by Warwickshire County Council Highways Division. No flooding has occurred in recent years and no further work can be recommended. Flooding occurs regularly in the centre of Fillongley. The last event was on 31 December 1981 affecting the Post Office. Flooding is attributable to debris collection on an inadequately designed inlet screen and the possible inadequate capacity of the culvert.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Warwickshire County Council as Highway Authority carried out maintenance and cleaning out work of the culvert adjacent to the Post Office and there has been no recurrence of flooding there. They are monitoring the situation.

IDENTIFICATION

Problem code number(s):	8-91-210-Z
Watercourse:	River Anker/Tributary from Stretton Baskerville (non-main river)
Location:	Stretton Baskerville (Rugby and Nuneaton & Bedworth Borough Councils)
OS Map reference:	SP 389 912 to SP 419 918

NATURE OF PROBLEM

Some 88 ha of agricultural land on the River Anker and 62 ha on the Stretton Baskerville tributary suffer from inadequate arterial drainage.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Warwickshire County Land Agent carried out a Section 99 scheme from head of main river at Paul's Ford on the River Anker to 1.65 km upstream as far as the Stretton Baskerville tributary. It was completed in 1983 and mained in 1985. This has alleviated the problem on the River Anker and has provided a good outfall facility for the Stretton Baskerville tributary. No work is proposed or has been carried out by Rugby Borough Council. The flow in the watercourse is being increased by development in Sketchley Lane which is in the area of Hinckley & Bosworth Borough Council. The developer of the latest phase of this industrial estate has installed storm water balancing facilities as an alternative to off-site watercourse improvements.

IDENTIFICATION

Problem code number(s):	8-91-510-3
Watercourse:	River Tame (main river)
Location:	Water Orton (North Warwickshire Borough Council)
OS Map reference:	SP 188 919

NATURE OF PROBLEM

Flooding occurred twice in 1960 and again in 1968 to Minworth Water Reclamation Works and a class 'B' road. This area is within the normal floodplain of the River Tame but a higher standard of protection was provided by the Trent River Authority when an improvement scheme was carried out on the Tame to provide for flows up to 113 cumecs between Curdworth Bridge and Parkhall Farm.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£		
	(ii)	Field drainage	£		£
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£

(c) **Benefit/cost ratio**

(d) **Priority category**

COMMENT

A feasibility exercise has been carried out by the Authority and capital works are programmed to commence in 1991.

IDENTIFICATION

Problem code number(s):	8-91-510-2
Watercourse:	Bourne Brook (non-main river)
Location:	Fillongley (North Warwickshire Borough Council)
OS Map reference:	SP 283 874

NATURE OF PROBLEM

Flooding occurs to a class 'C' road and results from surface water run-off from the highway. Works to watercourses will not alleviate the problem and the solution is, therefore, outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-91-510-4
Watercourse:	River Anker (main river)
Location:	Polesworth (North Warwickshire Borough Council)
OS Map reference:	SK 261 023

NATURE OF PROBLEM

When the River Anker overtops its banks a class 'B' road floods for periods of about two hours. The flooding occurs to washland only and this is essential in order not to exacerbate flooding downstream. Maintenance work on the river has been carried out and this will alleviate the incidence of flooding to a limited extent.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-91-510-5
Watercourse:	Un-named (non-main river)
Location:	Austrey (North Warwickshire Borough Council)
OS Map reference:	SK 292 067

NATURE OF PROBLEM

Gardens are flooded approximately twice a year and a class 'C' road is also flooded but not to such a depth that it is impassable to vehicles.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in 50 years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	5,770	
		(ii)	Field drainage	£		£5,770
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£
(c)	**Benefit/cost ratio**					0
(d)	**Priority category**					3F

IMPROVEMENT WORKS

Resectioning works to a small watercourse will provide alleviation.

IDENTIFICATION

Problem code number(s):	8-91-510-6
Watercourse:	Langley Brook (non-main river)
Location:	Middleton (North Warwickshire District Council)
OS Map reference:	SP 188 982 to SP 148 955

NATURE OF PROBLEM

Inadequate outfalls for field drainage to the Langley Brook result in poor drainage of 115 ha of agricultural land.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	5 years
	(ii)	Structures	1 in	25 years
(c) **Land potential category**				a5

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	115,320	
	(ii)	Field drainage	£	105,090	£220,410
(b) **Present value of benefits**	(i)	Agriculture	£	344,510	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£344,510
(c) **Benefit/cost ratio**					1.6
(d) **Priority category**					2C

IMPROVEMENT WORKS

It is recommended that the channel should be enlarged and regraded over a length of 5 km to provide a maximum design discharge of 7 cumecs. Two new box culverts will be required where the minor roads from Middleton cross the Brook.

FISHERIES

The Fisheries Office should be noitified prior to the commencement of any works.

IDENTIFICATION

Problem code number(s):	8-91-510-7
Watercourse:	Penmire Brook (non-main river)
Location:	Grendon (North Warwickshire District Council)
OS Map reference:	SK 285 002

NATURE OF PROBLEM

Minor highway flooding and flooding of a school playground occurs approximately twice per year.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Penmire Brook at Grendon has a complex drainage system involving a canal feeder, two road crossings, two rail crossings and a canal crossing. Maintenance work is required at these structures together with some structural repair work. The existing flooding situation will be improved by clearance of these structures. At present it is difficult to survey the structures and, therefore, their maximum capacity is uncertain.

The Warwickshire County Land Agent's proposed scheme was not proceeded with due to lack of co-operation from riparian owners. The possible contribution from British Coal failed to materialise as they abandoned proposals for "The Orchard" opencast site. North Warwickshire District Council are monitoring the situation.

IDENTIFICATION

Problem code number(s):	8-91-510-8
Watercourse:	River Bourne (non-main river)
Location:	Fillongley (North Warwickshire District Council)
OS Map reference:	SP 258 898 to SP 273 888

NATURE OF PROBLEM

A limited area of grade two farmland is subject to flooding and inadequate arterial drainage.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Warwickshire County Land Agents are considering a possible scheme despite the low benefits attributable.

IDENTIFICATION

Problem code number(s):	8-91-510-9
Watercourse:	Un-named Tributary of Bar Pool Brook (non-main river)
Location:	Plough Hill, Nuneaton (North Warwickshire District Council)
OS Map reference:	SP 320 926

NATURE OF PROBLEM

13 and 15 Plough Hill Road were flooded to 0.6 m in December and July 1981. Flooding is caused by an undersized culvert.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The Highway Authority carried out maintenance work on their culvert and no flooding has occurred since. North Warwickshire District Council are monitoring the situation.

IDENTIFICATION

Problem code number(s):	8-91-510-10
Watercourse:	River Bourne (main river)
Location:	Furnace End (North Warwickshire District Council)
OS Map reference:	SP 248 913

NATURE OF PROBLEM

Mill Garage premises, a road and adjoining farmland flooded on 31 December 1981.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

COMMENT

The flooding at Mill Garage premises on 31 December 1981 was not considered to be attributable to lack of channel capacity on the River Bourne downstream of Furnace End, but due to channel inadequacy of the upstream section which is non-main river.

The problem has been partially alleviated by improvements to the B4114 Road Bridge.

IDENTIFICATION

Problem code number(s):	8-91-510-11
Watercourse:	Un-named watercourse (non-main river)
Location:	Duke End, Maxstoke Hill Farm (North Warwickshire District Council)
OS Map reference:	SP 218 883

NATURE OF PROBLEM

Farmland adjoining the River Blythe is permanently waterlogged upstream of Duke Bridge.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

Approximately 50 ha of pasture land upstream of Duke Bridge has a field drainage system drained via a carrier drain crossing the Blythe by two syphons and outfalling downstream of Duke Bridge weir. The Authority's River Blythe Capital Improvement Scheme from Castle Farm to the M6 (completed 1982) has provided an outfall for the 50 ha of pasture land upstream of Duke Bridge and there is now an opportunity for a riparian owners' voluntary scheme to be undertaken.

IDENTIFICATION

Problem code number(s):	3-92-110-1
Watercourse:	Tributary of Canley Brook (non-main river)
Location:	Templar Avenue, Coventry (City of Coventry Council)
OS Map reference:	SP 294 781

NATURE OF PROBLEM

A pharmaceutical warehouse flooded regularly from 1974-1976 for periods up to 12 hours as the warehouse was built on an existing culverted watercourse to wrong levels. The riparian owner has since kept the watercourse free from debris and no recent flooding has been reported. No further works are proposed.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	3-92-110-2
Watercourse:	River Sherbourne (non-main river)
Location:	Coventry City Centre (City of Coventry Council)
OS Map reference:	SP 328 788 to SP 342 788

NATURE OF PROBLEM

Shops, commercial premises and roads are at risk from flooding. The degree of risk has not been determined but extensive flooding occurred in 1900. Some improvements to the River Sherbourne have been made since then.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£ 63,500		
		(ii)	Field drainage	£		£63,500
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£ 1,277,250		
		(iii)	Roads/Railways	£ 41,920		£1,319,170
(c)	**Benefit/cost ratio**					20.7
(d)	**Priority category**					10

IMPROVEMENT WORKS

The City of Coventry Council have carried out a survey into the capacity and condition of the culverted and open channel sections of the River Sherbourne through the City Centre. The survey covered existing protection levels to houses, shops and industrial premises.

Costs based on a balancing pond at Four Pounds Avenue.

IDENTIFICATION

Problem code number(s):	3-92-110-3
Watercourse:	Un-named Tributary of River Sherbourne (non-main river)
Location:	Broad Lane, Hockley Lane (City of Coventry Council)
OS Map reference:	SP 272 798

NATURE OF PROBLEM

A petrol filling station and adjacent roads are subject to annual flooding for periods up to six hours. The maximum recorded flood is estimated to have a 25 year recurrence interval. The City Council have carried out a feasibility study.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 5 years (Storm frequency)	
	(ii)	Structures	1 in years	
(b) **Agricultural**	(i)	Channel	1 in years	
	(ii)	Structures	1 in years	
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	345,950	
	(ii)	Field drainage	£		£345,950
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	15,010	
	(iii)	Roads/Railways	£	45,040	£60,050
(c) **Benefit/cost ratio**					0.2
(d) **Priority category**					3C

IMPROVEMENT WORKS

The recommended improvement is to culvert the entire length of the watercourse (300m) to a 1 in 5 year storm frequency standard. It is proposed that the works are carried out as part of the Hawkehurst Moor Deep Mine project.

IDENTIFICATION

Problem code number(s):	3-92-110-4
Watercourse:	Springfield Brook (non-main river)
Location:	Coventry (City of Coventry Council)
OS Map reference:	SP 337 814

NATURE OF PROBLEM

Two houses flood on average every three years, four houses and a church on average every five years and a factory on average every 25 years. The City Council have carried out a feasibility study of the problem. Recent flooding has occurred in 1968 and 1972 for a maximum duration of 12 hours.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in years
	(ii)	Structures	1 in 5 years (Storm frequency)
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	1,643,250	
	(ii)	Field drainage	£		£1,643,250
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	15,010	
	(iii)	Roads/Railways	£		£15,010
(c) **Benefit/cost ratio**					0
(d) **Priority category**					3A

IMPROVEMENT WORKS

The recommended improvement is to reconstruct the existing culverted watercourse in a 1.5m diameter tunnel. Associated surface water sewerage will cost a further £230,000. Flooding of the factory and the church will be relieved by the sewerage improvements.

IDENTIFICATION

Problem code number(s):	3-92-110-7
Watercourse:	Un-named Tributary of Canley Brook (non-main river)
Location:	Canley (City of Coventry Council)
OS Map reference:	SP 306 775

NATURE OF PROBLEM

A 'C' class road and three gardens flood on average every five years for periods up to four hours due to blockage of the road culvert.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in 50 years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	14,410	
		(ii)	Field drainage	£		£14,410
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	1,260	
		(iii)	Roads/Railways	£	negligible	£1,260
(c)	**Benefit/cost ratio**					0.1
(d)	**Priority category**					3E

IMPROVEMENT WORKS

The suggested improvement is to construct 20m of new culvert to divert the watercourse into Canley Brook, thus by-passing the existing road culvert providing a design discharge of six cumecs. A more expensive alternative proposal involves building a larger culvert beneath the road.

IDENTIFICATION

Problem code number(s):	3-92-110-8
Watercourse:	River Sherbourne (non-main river)
Location:	Washbrook Lane (City of Coventry Council)
OS Map reference:	SP 294 821

NATURE OF PROBLEM

A 'C' class road flooded in 1968, 1970 and 1975 for periods up to four hours due to both inadequate highway drainage and overtopping of the River Sherbourne.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in 10 years
		(ii)	Structures	1 in 25 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£ 8,650	
		(ii)	Field drainage	£	£8,650
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£negligible	£negligible
(c)	**Benefit/cost ratio**				0
(d)	**Priority category**				3F

IMPROVEMENT WORKS

Approximately 100m of watercouse requires re-sectioning, and a culvert beneath the entry to 'Stone House' requires replacement to provide a channel design capacity of 3.4 cumecs.

IDENTIFICATION

Problem code number(s):	3-92-110-9
Watercourse:	River Sherbourne/Pickford Brook (non-main river)
Location:	Allesley (City of Coventry Council)
OS Map reference:	SP 307 803

NATURE OF PROBLEM

Approximately five ha of agricultural land suffer from inadequate arterial drainage and have flooded five times since 1968 for periods up to 48 hours. The land is within the floodplain of the River Sherbourne and improvements cannot be recommended as this could worsen conditions in other parts of the catchment.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-92-210-3
Watercourse:	Wood Brook (non-main river)
Location:	Bournville (Birmingham City Council)
OS Map reference:	SP 035 815

NATURE OF PROBLEM

Flooding occurs to the A38 road where the brook passes under the road in a culvert.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in 50	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	28,830	
		(ii)	Field drainage	£		£28,830
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£	77,570	£77,570
(c)	**Benefit/cost ratio**					2.7
(d)	**Priority category**					1E

IMPROVEMENT WORKS

The recommended improvement requires the replacement of the culvert with a new culvert having a capacity of 1 in 50 years (3 cumecs).

The undersized culvert under the A38 is a Highway Authority responsibility. Birmingham City Council have monitored this culvert after heavy rainfall and no further flooding has been evident. No improvement works are planned.

BENEFITS

Traffic delays have been estimated at 1 hour every 5 years.

CONSERVATION

Woodbrook Pool and grounds are of particular interest for nature conservation and water levels should not be altered.

IDENTIFICATION

Problem code number(s):	8-92-210-4
Watercourse:	Griffins Brook (non-main river)
Location:	Bournville (Birmingham City Council)
OS Map reference:	SP 035 812

NATURE OF PROBLEM

Cob Lane, an unclassified road under which the brook flows, floods 2 or 3 times a year but it does not become impassable to traffic. There are convenient alternative routes and negligible traffic disruption occurs. The culvert is heavily silted and this restriction causes flooding of the adjacent upstream open parkland. Flooding of cottages downstream of the culvert is prevented by sandbagging.

Flooding occurred in Cob Lane to a depth of 0.8 m on 30/31 December 1981.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

No improvements are planned by Birmingham City Council other than maintenance work to desilt the channel.

As only marginal benefits would accrue from improvements to the road culvert, no improvements are planned by the Highway Authority.

IDENTIFICATION

Problem code number(s):	8-92-210-5
Watercourse:	Bartley Brook (non-main river)
Location:	Frankley (Birmingham City Council)
OS Map reference:	SO 995 818

NATURE OF PROBLEM

Flooding occurs on a class 'C' road and a public open space from an 18" culvert on the Bartley Brook adjacent to Hasbury Road.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The flooding problem results from the blockage of the culvert by debris. The culvert is of adequate size and the problem can only be alleviated by channel maintenance, particularly during storms.

IDENTIFICATION

Problem code number(s):	8-92-210-6
Watercourse:	Chinn Brook (non-main river)
Location:	Yardley Wood (Birmingham City Council)
OS Map reference:	SP 088 799

NATURE OF PROBLEM

In September 1976, between 9 and 12 gardens in Stoneyford Grove were flooded for between one and two hours.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in 50 years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	10,100	
		(ii)	Field drainage	£		£10,100
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£
(c)	**Benefit/cost ratio**					0
(d)	**Priority category**					3E

IMPROVEMENT WORKS

The channel, for a distance of approximately 400 m downstream of Yardley Wood Road, requires cleaning out and widening to provide increased capacity.

BENEFITS

Negligible direct damage is caused by the flooding but considerable inconvenience and distress is experienced by the residents.

IDENTIFICATION

Problem code number(s):	8-92-210-7/9/17
Watercourse:	River Rea (non-main river)
Location:	Kings Norton (Birmingham City Council)
OS Map reference:	SP 035 795 to SP 056 806

NATURE OF PROBLEM

Major highway flooding occurs at Pershore Road South on two or three occasions a year and at Popes Lane six to eight times a year. The flooding lasts for a duration of between one and two hours.

A garage and factory were flooded to 0.75 m on 30 December 1981. Pershore Road South was flooded to a depth of 1 m and Popes Lane to 1.3 m.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 50 years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	187,390	
	(ii)	Field drainage	£		£187,390
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£	282,740	£282,740
(c) **Benefit/cost ratio**					1.5
(d) **Priority category**					2C

IMPROVEMENT WORKS

Following removal of the British Waterways Board weir at Lifford no further flooding has occurred in this area. However, the overall River Rea (Fordhouse Lane to Longbridge) land drainage assessment by Birmingham City Engineer's Department involves monitoring flood levels in this area, and the need for improvement works will be reviewed in the future.

Popes Lane is not a public highway and the bridge is owned by British Waterways Board who propose to reconstruct it. No buildings are affected by flooding and the effect on traffic is minimal.

Pershore Road South - A flood storage reservoir is to be developed upstream at Wychall which will limit 50 year flood flows to the capacity of the culvert. Maintenance of the culvert will maximise the capacity. Channel improvements are proposed for a later section of River Rea Improvement Scheme (Section 9).

Tunnel Lane - Work was carried out in 1987-88 to improve the channel capacity and to replace two restrictive bridges.

BENEFITS

Major delays result from road flooding at both locations and there are no convenient diversion routes.

CONSERVATION

Wychall Reservoir and the Rea from SP 036 793 to SP 045 793 are important nature conservation sites. Kingfishers breed on the river banks.

IDENTIFICATION

Problem code number(s):	8-92-210-8/19
Watercourse:	River Rea (non-main river)
Location:	Northfield (Birmingham City Council)
OS Map reference:	SP 023 788

NATURE OF PROBLEM

Severe flooding has occurred for the last 25 years to properties in Station Road on six to nine occasions. A post office, six terraced houses and two industrial premises have been affected. Flooding results from restrictions at Colleys Lane and West Heath Road bridges and a private access footbridge.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 50 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	294,060	
	(ii)	Field drainage	£		£294,060
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	112,590	
	(iii)	Roads/Railways	£		£112,590
(c) **Benefit/cost ratio**					0.4
(d) **Priority category**					3C

IMPROVEMENT WORKS

The recommended improvements require enlargement of the channel and reconstruction of the restricting bridges.

Birmingham City Council propose to commence works in 1992/3, as part of the River Rea Improvement Scheme (Section 8), to increase channel capacity.

BENEFITS

Highway flooding causes little traffic delay and, therefore, the benefits attributable to its alleviation are minimal.

IDENTIFICATION

Problem code number(s):	8-92-210-14
Watercourse:	River Cole (non-main river)
Location:	Billesley (Birmingham City Council)
OS Map reference:	SP 098 813

NATURE OF PROBLEM

Every 5 or 6 years the level of the River Cole is such that surface water outfalls are submerged causing highway flooding at the junction of Coleside Avenue and Brook Lane. Some highway flooding occurred on 30 December 1981 at Robin Hood Lane.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 30 years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	14,410	
	(ii)	Field drainage	£		£14,410
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£	negligible	£negligible
(c) **Benefit/cost ratio**					0
(d) **Priority category**					3E

IMPROVEMENT WORKS

Localised lowering of water levels can be achieved by channel regrading work over a length of approximately 200 m on both sides of Brook Lane Bridge. Dredging of the bridge holes and the channel immediately adjacent was carried out in 1988/89.

BENEFITS

There is a convenient diversion route which results in little traffic delay. Therefore, improvement works will provide minimal benefits.

CONSERVATION

All work on this section should be carried out with care as Kingfishers breed on the banks.

IDENTIFICATION

Problem code number(s):	8-92-210-22
Watercourse:	River Cole (non-main river)
Location:	Yardley (Birmingham City Council)
OS Map reference:	SP 122 864

NATURE OF PROBLEM

Flooding occurs two or three times a year for periods up to 4 hours to a class 'C' road. The road becomes impassable to vehicles for floods in excess of the 1 in 25 years event. The flooding results from normal floodplain inundation and highway run-off.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

There is a convenient diversion route for traffic and, therefore, the benefits from improvement works will be negligible. No works can be recommended.

Work to the highway drainage system has improved the situation.

IDENTIFICATION

Problem code number(s):	8-92-210-26
Watercourse:	Warren Brook (non-main river)
Location:	Witton (Birmingham City Council)
OS Map reference:	SP 094 927

NATURE OF PROBLEM

Flooding of Perry Common Road was alleviated in 1976 by an improvement scheme carried out by the City Council which cleared out the culvert under Perry Common Road and the downstream channel. Further improvement will be required to provide a 1 in 50 years standard of protection.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 50 years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	14,410	
	(ii)	Field drainage	£		£14,410
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£	3,250	£3,250
(c) **Benefit/cost ratio**					0.2
(d) **Priority category**					3E

IMPROVEMENT WORKS

The recommended improvement requires the extension of the overflow facility from Upper Witton Boating Lake to the lower lake. This could be done by installing two box culverts under the embankment between the two lakes. No improvement works are programmed.

IDENTIFICATION

Problem code number(s):	8-92-210-30
Watercourse:	Plants Brook (non-main river)
Location:	Driffold (Birmingham City Council)
OS Map reference:	SP 118 962

NATURE OF PROBLEM

The Brook, between Clifton Road and the railway, does not appear to be in its original geographical location with the result that when it overtops its banks flood water flows into the natural valley line crossing Garrard Gardens. In addition to the road, flooding also occurs to gardens and a garage site. Flooding has occurred five times since 1970.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in 30 years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	5,770	
		(ii)	Field drainage	£		£5,770
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£negligible
(c)	**Benefit/cost ratio**					0
(d)	**Priority category**					3F

IMPROVEMENT WORKS

The recommended solution is to deepen the open channel section of the brook and use the excavated material to form a flood bank on the left bank of the channel. The solution is based on a nominal 450 mm deepening with pioneer clearance work and this will enable the removal of silt in the Clifton Road culvert.

No significant flooding has occurred since the brook was culverted between the railway and The Parade in the early 1970's. No improvements are programmed, but this will be reviewed when the proposed redevelopment of the area between The Parade and Lower Queen Street is underway.

BENEFITS

The flooding causes minimal direct damage but if improvement works are not undertaken it is likely that flooding of property will occur in the future.

CONSERVATION

This area is near Sutton Park SSSI. Plants Brook is identified as being of particular nature conservation interest.

IDENTIFICATION

Problem code number(s):	2-92-310-1
Watercourse:	River Stour (main river) and Coalbournbrook (non-main river)
Location:	Wollaston (Dudley Metropolitan Borough Council)
OS Map reference:	SO 894 850 to SO 888 859

NATURE OF PROBLEM

The River Stour in flood submerges the outlet from Coalbournbrook seriously reducing the capacity of the culvert. No serious storms have been experienced since the re-culverting of Coalbournbrook but the Fish Junction on the A491 and A461 is considered vulnerable until the level of the main river can be reduced.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

The removal of two obstructions downstream of the Coalbournbrook confluence would lower the River Stour water level and help to alleviate flooding. The removal of one of these, the weir at Bellsmill, which has a drop of one metre, could be effected easily. The other obstruction is the culvert beneath the Stourbridge canal. The restriction to flow caused by this obstruction could be mitigated by deepening the Stour in this reach and underpinning the canal structure.

In addition, the construction of a balancing device on the Coalbournbrook at SO 910 855 is being considered.

The costs would be extremely high in relation to the low benefits and no works are therefore proposed.

IDENTIFICATION

Problem code number(s):	2-92-310-5 and 2-92-410-1
Watercourse:	Mousesweet Brook (non-main river)
Location:	Netherton/Dudley (Dudley Metropolitan Borough Council and Sandwell Metropolitan Borough Council)
OS Map reference:	SO 955 878 to SO 935 856

NATURE OF PROBLEM

The inadequate capacity of Mousesweet Brook and its associated culverts, particularly around Bannister Street, causes the extensive flooding of 25 properties, especially in Hickman Avenue, and roads notably Bowling Green Road and Lynbrook Close. Many of the culverts are collapsed or in a very poor state of repair. It has been established that, in the vicinity of Lynbrook Close, the status of the pipeline and open channel is that of surface water sewer and not watercourse.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£ 1,066,670	
	(ii)	Field drainage	£	£1,066,670
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£ not estimated
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

Dudley MBC have provided balancing at Bumble Hole and a new culvert on the Mousesweet Brook west of Newton Street. Downstream of Newton Street there are a number of undersized culverted sections, some of which are in Sandwell MBC area. These various restrictions are being monitored by Dudley MBC following heavy rainfall and their degree of effectiveness will determine the priority for possible future improvement.

IDENTIFICATION

Problem code number(s):	2-92-310-6
Watercourse:	Holbeche Brook (non-main river)
Location:	Himley and Gornal (Dudley Metropolitan Borough Council)
OS Map reference:	SO 925 905 to SO 883 906

NATURE OF PROBLEM

Pasture, rough grazing and two properties flood on a 1 in 5 year (approx) basis. Smithy Lane and other roads in the vicinity flood several times per annum.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Improvement works are planned for completion in the current financial year to abandon the drop shaft at Hunts Mill Farm. This will enable stabilisation of the watercourse embankment to the west, replacement of a defective culvert and the extension of the flood meadow to accommodate future development upstream.

There is a need to address the main valley culvert from Coopers Bank to Cinder Road.

This Brook is considered to be of high priority for establishment of hydraulic regime requirements.

IDENTIFICATION

Problem code number(s):	2-92-310-7
Watercourse:	Wordsley Brook (non-main river)
Location:	Brierley Hill (Dudley Metropolitan Borough Council)
OS Map reference:	SO 907 876 to SO 893 868

NATURE OF PROBLEM

After heavy rainfall, land and one property adjacent to the watercourse flood for several days. Watery Lane floods several times per annum.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	576,580	
		(ii)	Field drainage	£		£576,580
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£ _____
(c)	**Benefit/cost ratio**					
(d)	**Priority category**					

IMPROVEMENT WORKS

Originally the watercourse passed through The Leys Slag Works via a 20 m deep culvert which has collapsed. The water now finds its way out by seeping through the slag into the inadequate watercourse downstream.

The Dudley MBC scheme to replace the existing culvert and an alternative scheme to divert the major flows to the canal and provide a smaller, shallower culvert at a higher level has been ruled out.

Part of the problem within this catchment is the need to establish responsibility for the mines drainage culverts which form a vital component in the drainage area.

Counsels opinion is being sought in respect of the mines drainage culverts and the need to establish an appropriate operating regime is considered to be of high priority.

IDENTIFICATION

Problem code number(s):	2-92-310-10
Watercourse:	Stepping Stones Brook (non-main river)
Location:	Old Swinford (Dudley Metropolitan Borough Council)
OS Map reference:	SO 909 835

NATURE OF PROBLEM

The culvert system on the Stepping Stones Brook under Brook Road and beyond is inadequate causing frequent flooding of the road (often impassable) and gardens adjoining the brook. In July 1968 a house immediately upstream of the road was flooded for a period of less than 12 hours.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Metropolitan Borough Council proposes to raise the banks of the brook around the road culvert to permit surcharge and increase the culvert capacity. These works will alleviate the house flooding but may make the road flooding worse. A complete solution requires the uprating of the system downstream. Limited bank raising has been carried out alleviating the problem slightly.

BENEFITS

The costs involved in completing these works would be very high and not justifiable in relation to the small amount of tangible benefit.

IDENTIFICATION

Problem code number(s):	2-92-310-11
Watercourse:	Dawley Brook (non-main river)
Location:	Kingswinford (Dudley Metropolitan Borough Council)
OS Map reference:	SO 886 894

NATURE OF PROBLEM

Land to the rear of housing and industrial development and the Wolverhampton Road flooded in September 1976 for less than 12 hours.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The box culvert beneath the road appears to be adequate. Its efficiency is impaired by the small impounding weirs upstream and the poorly designed grid fitted to the culvert. The weirs require removal or lowering but as they are believed to contain services the works would be expensive and not justifiable solely on the tangible benefits of alleviating the minor flooding at this site.

COMMENT

Brief inspection of the brook to its confluence with the Smestow Brook indicated that the channel and culvert capacity provided elsewhere is often far below that provided at the problem site.

The Metropolitan Borough Council's Dawley Brook Drainage Schemes are now complete. Consideration of conditions outside the Borough from Swindon Road to Smestow Brook should now be made.

IDENTIFICATION

Problem code number(s):	2-92-310-12 and 2-99-610-9
Watercourse:	Penn Brook (non-main river)
Location:	N W Sedgley (Dudley Metropolitan Borough Council)
OS Map reference:	SO 908 947

NATURE OF PROBLEM

Inadequate watercourse adversely affecting surface water outfalls from adjacent development.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in 100 years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	6,350	
		(ii)	Field drainage	£		£6,350
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£ low
(c)	**Benefit/cost ratio**					
(d)	**Priority category**					3F

IMPROVEMENT WORKS

Tree clearance and watercourse resectioning required alongside development and for at least 300 m downstream to sewage works.

IDENTIFICATION

Problem code number(s):	2-92-310-13 and 2-99-610-10
Watercourse:	Gospel End Brook (non-main river)
Location:	W Sedgley (Dudley Metropolitan Borough Council)
OS Map reference:	SO 909 936

NATURE OF PROBLEM

Inadequate watercourse adversely affecting surface water outfalls from adjacent development and highways, causing surface flooding. Dudley Metropolitan Borough Council cannot contemplate improvements to pipe drainage systems until the watercourse is improved.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	100 years
	(ii)	Structures	1 in	100 years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£not assessed
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£not assessed
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

Combined surface water sewerage/highway drainage/land drainage works are required. The receiving watercourse and its culverts are considerably undersized. A detailed investigation is required. A solution may comprise channel and culvert works on the upstream section, together with a balancing structure, to avoid continuing such improvements for a long distance downstream.

IDENTIFICATION

Problem code number(s):	2-92-310-14
Watercourse:	Un-named (non-main river)
Location:	Stourbridge Golf Course (Dudley Metropolitan Borough Council)
OS Map reference:	SO 898 822

NATURE OF PROBLEM

An inadequate culvert on the Golf Course causes short duration overland flow at times of heavy rainfall. Further development in the catchment would aggravate the problem.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

No works are proposed unless significant development in the catchment is planned. Any future developments need to take into account the need to re-culvert (to an acceptable standard) the section of watercourse that runs through the golf course.

IDENTIFICATION

Problem code number(s):	8-92-410-1
Watercourse:	River Tame (main river)
Location:	Oldbury (Sandwell Metropolitan Borough Council)
OS Map reference:	SO 984 876

NATURE OF PROBLEM

Flooding occurred in September 1972 and July 1973 to eight houses and a Class 'B' road. Extensive flooding occurred on 31 December 1981 including flooding of the highway to a depth of 1 m. The decorative timber manufacturers - BGN (Boards) suffered £25,000 damages.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	50 years
		(ii)	Structures	1 in	50 years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The problem was alleviated to a limited extent in July 1977 when maintenance was carried out to the channel and two restricting culverts were removed at the rear of Park Lane. The Authority's River Tame Improvement Scheme (Oldbury Arm Improvement Part 4 Section 10) has been completed and should alleviate the flooding problem.

IDENTIFICATION

Problem code number(s):	8-92-410-4
Watercourse:	Furnace Brook (non-main river)
Location:	Tipton (Sandwell Metropolitan Borough Council)
OS Map reference:	SO 955 925

NATURE OF PROBLEM

Houses and the carriageway in Wood Street are prone to flooding.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Metropolitan Borough Council have designed a scheme to improve the undersized culvert but the work is not yet programmed.

IDENTIFICATION

Problem code number(s):	8-92-410-6
Watercourse:	River Tame (main river)
Location:	Park Lane, Oldbury (Sandwell Metropolitan Borough Council)
OS Map reference:	SO 991 889

NATURE OF PROBLEM

Flooding of Class'B' highway to a depth of one metre has occurred thus closing the road. This has occurred on a number of occassions during the past 10 years.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years

(c) **Land potential category** .

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The National Rivers Authority has a relief scheme in preparation, but has not completed work on the section which floods. (See 8-92-410-1.)

IDENTIFICATION

Problem code number(s):	8-92-410-7
Watercourse:	Brandhall Brook (non-main river)
Location:	Penncricket Lane, Oldbury (Sandwell Metropolitan Borough Council)
OS Map Reference:	SO 988 872

NATURE OF PROBLEM

Flooding of Class'B' highway caused bvy culvert being of inadequate capacity. This culvert is in poor condition and has suffered a number of collapses.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in.	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

A scheme is proposed for dualling part of the culvert and reconstructing the section in poor condition to a larger size.

IDENTIFICATION

Problem code number(s):	8-92-410-8
Watercourse:	Whitheath Brook (non-main river)
Location:	Birchley Park, Oldbury (Sandwell Metropolitan Borough Council)
OS Map reference:	SO 984 887

NATURE OF PROBLEM

Flooding of Parkland and Class 'A' Trunk Road due to undersized culvert.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£166,000
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Relay culvert to larger size.

IDENTIFICATION

Problem code number(s):	8-92-410-9
Watercourse:	Hobnail Brook (non-main river)
Location:	Lyndon to Church Lane, West Bromwich (Sandwell Metropolitan Borough Council)
OS Map reference:	SP 004 924

NATURE OF PROBLEM

Flooding occurs in two houses and the rear gardens of 8 houses in minor roads.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in		years
	(ii)	Structures	1 in		years
(b) **Agricultural**	(i)	Channel	1 in		years
	(ii)	Structures	1 in		years
(c) **Land potential category**					

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	120,000	
	(ii)	Field drainage	£		£120,000
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£
(c) **Benefit/cost ratio**					
(d) **Priority category**					

IMPROVEMENT WORKS

A Scheme is in preparation in accordance with the results of a recent Drainage Area Study.

IDENTIFICATION

Problem code number(s):	8-92-410-10
Watercourse:	Hobnail Brook, West Bromwich (non-main river)
Location:	Millfields Pool (Sandwell Metropolitan Borough Council)
OS Map reference:	SP 003 940

NATURE OF PROBLEM

The water level of the pool causes surcharging of surface water sewers discharging into it and consequently causes flooding from the sewers.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	250,000	
	(ii)	Field drainage	£		£250,000
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

Reconstruct outlet levels to pool and other improvements to the pool.

IDENTIFICATION

Problem code number(s):	8-92-410-11
Watercourse:	Coneygre Brook (non-main river)
Location:	Coneygre Foundry Site, Tipton (Sandwell Metropolitan Borough Council)
OS Map reference:	SO 957 913

NATURE OF PROBLEM

A collapsed culvert causes the flooding of derelict land and a factory on an industrial estate is subject to flooding due to the inadequate capacity of a culvert.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The collapsed culvert is being repaired by the riparian owner prior to redevelopment. Details of the inadequate culvert will be supplied by current Drainage Area Study analysis.

IDENTIFICATION

Problem code number(s):	8-92-410-12
Watercourse:	Dudley Port Brookcourse (non-main river)
Location:	Dudley Port, Tipton (Sandwell Metropolitan Borough Council)
OS Map reference:	SO 967 919

NATURE OF PROBLEM

An ancient brick culvert beneath a canal, railway and Class 'A' road is known to have backfall. It is silted and in poor structural condition where it can be inspected.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in		years
	(ii)	Structures	1 in		years
(b) **Agricultural**	(i)	Channel	1 in		years
	(ii)	Structures	1 in		years
(c) **Land potential category**					

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	97,000	
	(ii)	Field drainage	£		£97,000
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£
(c) **Benefit/cost ratio**					
(d) **Priority category**					

IMPROVEMENT WORKS

No scheme is proposed at present.

IDENTIFICATION

Problem code number(s):	8-92-410-13
Watercourse:	River Tame (main river)
Location:	Hamstead (Sandwell Metropolitan Borough Council)
OS Map reference:	SP 047 928

NATURE OF PROBLEM

Flooding occurred on 23rd August 1987, inundating the gardens of 8 houses and closing a 'B' class highway and adjacent railway line. Floodwater came from the River Tame which overflowed its banks here before overflowing the weir at the Sandwell Valley Balancing Lakes.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The N.R.A. are proposing to construct flood defence works on the River Tame at Hamstead in 1990/91 which should alleviate the problem.

IDENTIFICATION

Problem code number(s):	8-92-510-1
Watercourse:	River Blythe (main river)
Location:	Stone Bridge (Solihull Metropolitan Borough Council)
OS Map reference:	SP 215 830

NATURE OF PROBLEM

Flooding occurs to agricultural land in the floodplain of the River Blythe and also to the A452 road. The flooding lasts for approximately 4 hours and has been recorded in July 1968 and June 1973.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	5 years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

The original STWA Land Drainage Improvement Scheme on the River Blythe was to extend from Coleshill to Earlswood. However, following discussions with the Nature Conservancy Council, who indicated the importance of the River Blythe from a conservancy viewpoint (Blythe is designated as a SSSI), the extent of the works was reduced. The modified scheme was completed in 1984.

CONSERVATION

This is an important river site designated as a SSSI.

FISHERIES

A fishery input is essential to determine the value and extent of the fisheries interest and for the whole length affected by the Blythe Improvement Scheme.

IDENTIFICATION

Problem code number(s):	8-92-510-3/4
Watercourse:	Low Brook and tributary (non-main river)
Location:	Bickenhill (Solihull Metropolitan Borough Council)
OS Map reference:	SP 173 818 to SP 178 828

NATURE OF PROBLEM

Regular flooding occurs to farmland affecting 170 ha.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 5 years
		(ii)	Structures	1 in 25 years
(c)	**Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	92,250	
		(ii)	Field drainage	£	92,580	£184,830
(b)	**Present value of benefits**	(i)	Agriculture	£	649,580	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£649,580
(c)	**Benefit/cost ratio**					3.8
(d)	**Priority category**					1D

IMPROVEMENT WORKS

The Low Brook and its tributary require improvement to a 5 year standard over approximately 5 km to gain the optimum benefit from the land. The design capacities of the Low Brook and its tributary are 1.35 cumecs and 0.7 cumecs respectively which would enable an increase in gross margin to be achieved. To accommodate the increased peak flows from the action area Phase IV, the Metropolitan Borough Council have constructed an off-line balancing meadow.

DEVELOPMENT

No allowance has been made in the design flows for the future upstream developments in the action areas of Elmdon Heath, Lugtrout Lane and Wherretts Well Lane. The existing Low Brook can accommodate the increased flows from Phases I and II.

CONSERVATION

The benefit area is adjacent to a British Trust for Ornithology registered site.

IDENTIFICATION

Problem code number(s):	8-92-510-5
Watercourse:	Un-named tributary of River Blythe (non-main river)
Location:	Balsall (Solihull Metropolitan Borough Council)
OS Map reference:	SP 213 773 to SP 242 738

NATURE OF PROBLEM

Regular flooding occurs to farmland, over a length of approximately 6 km, affecting 270 ha of land.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in 5	years
	(ii)	Structures	1 in 25	years
(c) **Land potential category**			b	

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	158,560	
	(ii)	Field drainage	£	212,680	£371,240
(b) **Present value of benefits**	(i)	Agriculture	£	800,150	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£800,150
(c) **Benefit/cost ratio**					2.2
(d) **Priority category**					1C

IMPROVEMENT WORKS

The proposed works require enlargement of the watercourse to provide design capacities varying between 3.9 cumecs and 2.3 cumecs over the improved length. Four road crossings require new box culverts and a fifth will require underpinning.

STWA completed a capital improvement scheme on the River Blythe in 1984 which provided an outfall for this tributary of the Blythe.

FISHERIES

Consultation is important before the commencement of any remedial works.

IDENTIFICATION

Problem code number(s):	8-92-510-6
Watercourse:	Un-named tributary of River Blythe (non-main river)
Location:	Temple Balsall (Solihull Metropolitan Borough Council)
OS Map reference:	SP 206 762 to SP 216 724

NATURE OF PROBLEM

Regular flooding occurs to farmland, over a length of approximately 4.5 km, affecting 140 ha of land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 5 years
		(ii)	Structures	1 in 25 years
(c)	**Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	95,140	
		(ii)	Field drainage	£	115,100	£210,240
(b)	**Present value of benefits**	(i)	Agriculture	£	413,970	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£413,970
(c)	**Benefit/cost ratio**					2.0
(d)	**Priority category**					20

IMPROVEMENT WORKS

The proposed works require enlargement of the watercourse to provide a design capacity of 4 cumecs. Two road crossings require new box culverts and three small footbridges will be replaced with short culverts.

CONSERVATION

There are important meadows downstream of SP 212 753.

FISHERIES

Consultation is important before the commencement of any remedial works.

IDENTIFICATION

Problem code number(s):	8-92-610-1/2
Watercourse:	Anchor Brook/Walsall Wood Brook (non-main river)
Location:	Walsall Wood (Walsall Metropolitan Borough Council)
OS Map reference:	SK 026 013 to SK 040 027

NATURE OF PROBLEM

Flooding occurs approximately every 6 months to 6 houses, a timber yard and farmland. The houses which flood are on Lichfield Road and the flooding results from a bridge of inadequate capacity at the timber yard. Generally the whole watercourse is undersized and this affects the drainage of 120 ha of agricultural land. There are culvert restrictions at Lichfield Road and Stubbers Green Road and normal water levels are also raised by the 'Swag' pool.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 50 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 2 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	138,380	
	(ii)	Field drainage	£	60,050	£198,430
(b) **Present value of benefits**	(i)	Agriculture	£	630,670	
	(ii)	Buildings	£	75,060	
	(iii)	Roads/Railways	£		£705,730
(c) **Benefit/cost ratio**					3.6
(d) **Priority category**					1C

IMPROVEMENT WORKS

The flooding risk to the Timberyard and 6 houses and most of the farm land has now been drastically reduced due to the completion of new culverting works between the Ford Brook Confluence and Lichfield Road.

The watercourse upstream of this improvement still remains relatively undersized with culvert restrictions at Stubbers Green Road, and raised water levels due to the Swag Pool, but is unlikely to promote a major flooding risk to property.

Anchor Brook is now improved through the Timberyard and across Lichfield Road by the construction of a 2.4/2.7 x 1.2m Box Culvert from the confluence with the improved Ford Brook, through to the East side of Lichfield Road. This work was carried out by the Developer of the East of Shelfield Development under a Section 52 Agreement and completed in September 1987. The sole outfall to the estate for surface water is located relatively close to the new intake structure for the Anchor Brook. The culvert was designed to take 12 cumecs capacity.

Ford Brook Stage 3 improvements were completed in 1986. It is anticipated that further development discharging to the Anchor Brook in the Stubbers Green Road area at the Aldridge end will be controlled by on-site balancing areas.

CONSERVATION

The valley is of nature conservation value as it is a "green finger" within an urban area.

IDENTIFICATION

Problem code number(s): 8-93-210-1
Watercourse: Tributary of Witherley Brook (non-main river)
Location: Witherley (Hinckley and Bosworth Borough Council)
OS Map reference:

NATURE OF PROBLEM

The junction of Riverside, Hunts Lane and Mythe Lane was flooded to a maximum depth of 1.2 m in March 1977 but no properties were affected. The water flows onto the road as a result of the inadequate capacity and/or blocking of the culvert under Atterton Road in Witherley.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

High water levels occur in the watercourse as a result of backing up from the River Anker, and until improvements are carried out on the Anker, to lower water levels only, limited works are possible on this watercourse. It is, therefore, recommended that the construction of a small headwall at the entrance to the culvert will allow the culvert to surcharge and reduce the incidence of road flooding.

BENEFITS

There is a convenient diversion and the benefits from improvements are, therefore, negligible.

IDENTIFICATION

Problem code number(s):	8-93-210-8
Watercourse:	None
Location:	Hinckley (Hinckley and Bosworth Borough Council)
OS Map reference:	SP 406 927

NATURE OF PROBLEM

A 50 m length of the A5 road is reported to have flooded to a depth of 450 mm in 1955. The problem relates to inadequate highway drainage and does not involve arterial drainage and is, therefore, outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-93-210-11
Watercourse:	Tributary of River Sence (non-main river)
Location:	Carlton (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 388 045

NATURE OF PROBLEM

The minor road from Carlton to Bilstone floods where it crosses under the railway approximately 1 km south-west of Carlton. The road flooded to a depth of 450 mm in March 1977 and December 1978. The watercourse has inadequate capacity for flood flows and flooding of agricultural land occurs.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The benefits from the alleviation of flooding of the road are small as the road is of minor importance and there is a suitable diversion. The benefits therefore, do not warrant any extensive work on watercourse improvement or road alterations and it is recommended that work is confined to maintenance of the watercourse. Further investigations may be necessary to determine the extent of the flooding to agricultural land.

IDENTIFICATION

Problem code number(s):	8-93-210-12
Watercourse:	None
Location:	Shackerstone (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 374 074

NATURE OF PROBLEM

Flooding occurs to the Shackerstone to Heather Road over a length of 150 m and to a depth of 200 mm.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Clearance of the roadside ditch and the culvert to which it discharges would alleviate the problem. As the solution relates to highway drainage, it is outside the scope of this Survey.

IDENTIFICATION

Problem code number(s):	8-93-210-13/16/18/19/20/21/26, 8-93-710-9
Watercourse:	River Sence (main river)
Location:	Ratcliffe Culey to Heather (Hinckley and Bosworth Borough Council and North-West Leicestershire District Council)
OS Map reference:	SP 315 991 to SK 397 115

NATURE OF PROBLEM

The major problem is flooding of agricultural land and roads and inadequate freeboard for agricultural drainage on certain reaches which affects approximately 760 ha. The problem is exacerbated by the high water levels maintained by weirs for fishing purposes and weirs associated with five mills. Flooding occurs annually along some sections of the river and once flooded the land is under water for several days.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	1,738,390	
	(ii)	Field drainage	£	778,150	£2,516,540
(b) **Present value of benefits**	(i)	Agriculture	£	2,972,780	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£2,972,780
(c) **Benefit/cost ratio**					1.2
(d) **Priority category**					2A

IMPROVEMENT WORKS

The recommended solution is the regrading and widening of the river from the Odstone/Newton Burgoland road bridge to the confluence with the River Anker to provide a design capacity of 38.8 cumecs. Five access bridges will require replacement and 12 will need to be underpinned. All the weirs will require to be demolished and replaced at a lower level. The improvement scheme could be extended upstream of Heather to include problem 8-93-710-9 (floodplain flooding) but it is considered that the benefits of this section of the improvements are insufficient to justify the cost and this has not been included.

SUBSIDENCE

Upstream of Heather the river enters a mining area and owing to workings and subsidence the course is ill-defined.

FISHERIES

Consultation is essential before any works are considered.

IDENTIFICATION

Problem code number(s):	8-93-210-14
Watercourse:	None
Location:	Congerstone (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 370 051

NATURE OF PROBLEM

The minor road between Congerstone and Carlton floods to the west of Ashby-de-la-Zouch canal where the road goes through a dip. Prolonged rainfall fills the roadside ditches and floods the road and surrounding land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The flooding is independent of water levels in the nearby River Sence and is caused by inadequate road drainage. The problem could be alleviated by raising the level of the road but the detailed solution is outside the scope of this Survey.

FISHERIES

Consultation is essential before any works are considered.

IDENTIFICATION

Problem code number(s):	8-93-210-17
Watercourse:	None
Location:	Sheepy (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 339 027

NATURE OF PROBLEM

The minor road from Sheepy Magna to Bilstone floods near Rye Hills. The problem results from inadequate road gullies and highway drains and is, therefore, outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-93-210-22
Watercourse:	Ashby-de-la-Zouch Canal
Location:	Shackerstone (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 377 060

NATURE OF PROBLEM

The minor road between Congerstone and Barton-in-the-Beans floods to the east of Bates Wharf Bridge over the Ashby-de-la-Zouch canal. The problem results from either inadequate road drainage or overflow from the canal.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The problem does not originate from the flooding of a watercourse and is, therefore, outside the scope of this Survey. However, it is considered that the problem could be alleviated by raising the road level or, if the problem is due to overtopping of the canal bank, raising the bank to provide adequate freeboard.

IDENTIFICATION

Problem code number(s):	8-93-210-23
Watercourse:	None
Location:	Odstone (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 394 079

NATURE OF PROBLEM

Flooding to a depth of 450 mm occurs to the minor road from Odstone to Ibstock at the edge of the village of Odstone.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

The flooding results from surface water drainage which collects in a pond and, at times of heavy rainfall, overflows the road. An overflow from the pond to a hillside to the north-west would alleviate the problem. As this is primarily a road drainage problem, the detailed solution is outside the scope of this Survey.

IDENTIFICATION

Problem code number(s):	8-93-210-24
Watercourse:	Tributary of River Sence (non-main river)
Location:	Osbaston (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 422 045

NATURE OF PROBLEM

Flooding occurs to a minor road between the A447 and Osbaston and surrounding land also floods. In March 1977 the road was flooded to a depth of 450 mm over a length of approximately 150 m.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The flooding could be alleviated by maintenance of the channel, raising of the road and enlargement of the culvert under the minor road. As there is another convenient road access to Osbaston, the benefits of this work will be small and have not been quantified.

IDENTIFICATION

Problem code number(s):	8-93-210-25
Watercourse:	Un-named tributary of River Sence (non-main river)
Location:	Barlestone (Hinckley and Bosworth Borough Council)
OS Map reference:	SK 430 054

NATURE OF PROBLEM

The Newbold Road last flooded in 1960 due to the blockage of a culvert. Downstream of this point, the watercourse has been culverted and resectioned by a developer and the culvert has since been kept clear by local residents.

In February/March 1977, approximately 0.25 ha of allotments upstream of the roadway were flooded to a depth of 150-300 mm. Inadequate highway drainage also allows surface water from the road to run onto adjacent gardens.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The road flooding which occurred from the watercourse has now been solved and the remaining problem of allotment and garden flooding is as a result of inadequate highway drainage and, therefore, is outside the scope of this Survey.

IDENTIFICATION

Problem code number(s):	8-93-210-27
Watercourse:	Witherley Brook (main river)
Location:	Witherley (Hinckley and Bosworth Borough Council)
OS Map reference:	SP 323 981 to SP 329 976

NATURE OF PROBLEM

Flooding occurs to the floodplain of the Witherley Brook for durations of 24 hours; the last occasion being March 1977. However, land drainage is adequate and no improvements in existing production or change in land use is anticipated if any improvement scheme was implemented. Improvement works are, therefore, not recommended.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-93-210-28
Watercourse:	Tweed River (non-main river)
Location:	Dadlington (Hinckley and Bosworth Borough Council)
OS Map reference:	SP 409 990 to SP 439 964

NATURE OF PROBLEM

The river overflows its banks on frequent occasions flooding agricultural and urban land and roads. In February 1979 ten houses were flooded in Barwell as a result of a silted-up culvert. Flooding of agricultural land results, in the main, from increased flows caused by recent development in Barwell. There is also insufficient freeboard for agricultural drainage over most of its length.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 2 years
		(ii)	Structures	1 in 25 years
(c)	**Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	242,160	
		(ii)	Field drainage	£	112,590	£354,750
(b)	**Present value of benefits**	(i)	Agriculture	£	405,630	
		(ii)	Buildings	£	42,540	
		(iii)	Roads/Railways	£		£448,170
(c)	**Benefit/cost ratio**					1.3
(d)	**Priority category**					2C

IMPROVEMENT WORKS

The recommended solution is the lowering of the bed level of the brook upstream of the Ashby-de-la-Zouch Canal culvert. This will require the reconstruction of culverts under three major roads. The reconstruction of the culvert in Barwell will be a major contribution to the relief of flooding in Mill Street. The scheme will cater for a design flow of 4 cumecs.

FISHERIES

Consultation is required before any works are considered.

COMMENT

The downstream Sence Brook has undergone heavy maintenance which has reduced water levels and improved the outfall from Tweed River.

Hinckley & Bosworth Borough Council will, in 1990, improve the Tweed River from the Sunnyside Brook confluence (SP 418 979) to the junction with Sence Brook (SP 409 990).

IDENTIFICATION

Problem code number(s):	8-93-210-32
Watercourse:	None
Location:	Barwell (Hinckley and Bosworth Borough Council)
OS Map reference:	SP 436 963

NATURE OF PROBLEM

Flooding occurred in 1974 and 1979 to a cottage, the main street in Barwell and non-productive land. The land to the south of the road drains to a badly overgrown ditch which has a completely blocked culvert under a track. As a result, water collects to a depth of 150 mm in the vicinity of the cottage, which is the lowest part of the area.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	1,440	
	(ii)	Field drainage	£		£1,440
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	3,130	
	(iii)	Roads/Railways	£		£3,130
(c) **Benefit/cost ratio**					2.2
(d) **Priority category**					1F

IMPROVEMENT WORKS

The problem can be alleviated by clearing the culvert and the ditch. A small embankment between the pipe inlet and the garden of the cottage will raise the standard of protection.

IDENTIFICATION

Problem code number(s): 8-93-710-1
Watercourse: River Sence (non-main river)
Location: Heather (North-West Leicestershire District Council)
OS Map reference: SK 395 109

NATURE OF PROBLEM

The B591 road between Heather and Ibstock has flooded at the crossing with the River Sence. There is also flooding of a 6 ha meadow to a depth of 150-200 mm.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years	
	(ii)	Structures	1 in	years	
(b) **Agricultural**	(i)	Channel	1 in	years	
	(ii)	Structures	1 in	years	
(c) **Land potential category**					

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The area to the north of the B591 road is a British Coal opencast site and, prior to the site being opened up, the road bridge over the River Sence was rebuilt in conjunction with the County Council. Other than minor gully problems, flooding has not occurred since.

The flooding of meadow land is considered in problem number 8-93-710-9 (8-93-210-13).

IDENTIFICATION

Problem code number(s):	8-93-710-2
Watercourse:	Blowers Brook (non-main river)
Location:	Heather (North-West Leicestershire District Council)
OS Map reference:	SK 394 121

NATURE OF PROBLEM

In 1977 the minor road from Heather to Ravenstone flooded at its crossing with the Blowers Brook. The culvert under the road is inadequate for flood flows.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The British Coal opencast mining site has necessitated the temporary diversion of the Blowers Brook. It is thought that the flooding in 1977 resulted from the inadequacy of pumps which British Coal were using to pump water from the Brook into the River Sence. The problem will be alleviated when the site is reinstated by British Coal on completion of mining.

IDENTIFICATION

Problem code number(s):	8-93-710-3
Watercourse:	Tributary of River Sence (non-main river)
Location:	Ibstock (North-West Leicestershire District Council)
OS Map reference:	SK 407 096

NATURE OF PROBLEM

Flooding is reported on the minor road which runs parallel to the A447 through Overton at the point where the road crosses the tributary of the River Sence. This problem is on the edge of the area affected by mining subsidence and this has resulted in a non-uniform gradient. The watercourse is badly maintained and this causes poor drainage to a small area of agricultural land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The brook requires regrading to a point downstream of the A447 and this involves the lowering of bridge inverts on the A447 and the minor road concerned. As this work cannot be justified by the available benefits it is recommended that maintenance work only should be carried out to reduce the frequency of flooding. The comprehensive solution may be possible with a contribution from British Coal.

IDENTIFICATION

Problem code number(s):	8-93-710-4
Watercourse:	Un-named tributary of River Sence (non-main river)
Location:	Ibstock (North-West Leicestershire District Council)
OS Map reference:	SK 411 107

NATURE OF PROBLEM

Spring Road floods from the adjacent watercourse due to blockage of a trash grid by silt and debris. The grid forms the entry to a 200 m long culvert and the blockage causes a 300 mm head loss across the grid at normal flow.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Maintenance and removal of silt and debris from the trash grid and upstream channel will alleviate the problem.

IDENTIFICATION

Problem code number(s):	8-93-710-5
Watercourse:	None
Location:	Hugglescote (North-West Leicestershire District Council)
OS Map reference:	SK 432 126

NATURE OF PROBLEM

Flooding occurs from the Hugglescote to Bardon Road to a depth of 150 mm where it crosses the tributary of the River Sence immediately to the west of the railway embankment. The road is 2 to 3 m above the level of the Brook and the culvert under the road is adequate for flood flows.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The road flooding results from surface water drainage from the road itself and can be alleviated by the installation of road drains. The detailed solution is outside the scope of this Survey.

IDENTIFICATION

Problem code number(s):	8-93-710-6
Watercourse:	None
Location:	Whitehill (North-West Leicestershire District Council)
OS Map reference:	SK 432 108

NATURE OF PROBLEM

The B585 road floods just south of the village of Whitehill where it crosses a slight dip in the land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

It is considered that flooding occurs due to run-off from the surrounding land. This could be alleviated by the installation of a culvert under the road at this point but the detailed solution is outside the scope of this Survey.

IDENTIFICATION

Problem code number(s): 8-93-710-7
Watercourse: River Sence (non-main river)
Location: Bardon (North-West Leicestershire District Council)
OS Map reference: SK 454 123

NATURE OF PROBLEM

The A50 road between the M1 and Coalville floods where it crosses the River Sence. The river runs parallel to the road for about 100 m and is crossed by a barbed wire and corrugated iron fence. The flooding is likely to be caused by the restriction of flood flows by the fence.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The fence requires removal or raising above flood levels.

IDENTIFICATION

Problem code number(s): 8-93-710-8
Watercourse: River Sence (non-main river)
Location: Hugglescote (North-West Leicestershire District Council)
OS Map reference: SK 424 124

NATURE OF PROBLEM

The B585 road floods occasionally at its crossing with the River Sence at Hugglescote but is not impassable to traffic.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years	
	(ii)	Structures	1 in	years	
(b) **Agricultural**	(i)	Channel	1 in	years	
	(ii)	Structures	1 in	years	
(c) **Land potential category**					

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

The cutting back of the branches downstream of the bridge and the general maintenance of the channel will alleviate the problem.

IDENTIFICATION

Problem code number(s):	8-93-710-10
Watercourse:	None
Location:	Donington le Heath (North-West Leicestershire District Council)
OS Map reference:	SK 421 121

NATURE OF PROBLEM

The minor road between Donington and Ibstock floods due to direct run-off from fields. The installation of road drains would alleviate this problem but this is a highway drainage problem and is outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-99-210-1
Watercourse:	Un-named (non-main river)
Location:	Norton Canes (Cannock Chase District Council)
OS Map reference:	SK 017 095

NATURE OF PROBLEM

A low lying portion of the Hednesford Road floods when the watercourse comes out of bank.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	2 years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	14,410	
	(ii)	Field drainage	£		£14,410
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£
(c) **Benefit/cost ratio**					0
(d) **Priority category**					3E

IMPROVEMENT WORKS

The recommended improvement is the clearance and regrading of the watercourse downstream of the road.

BENEFITS

As the road does not become impassable the benefits from alleviation of flooding are negligible.

IDENTIFICATION

Problem code number(s):	8-99-410-1
Watercourse:	Un-named tributary of the Footherley Brook (non-main river)
Location:	Shenstone (Lichfield District Council)
OS Map reference:	SK 104 016

NATURE OF PROBLEM

Flooding of farmland occurs periodically and affects 73 ha of agricultural land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Ministry of Agriculture, Fisheries and Food has stated that the area will benefit from underdrainage works but no work is required to the arterial watercourse. The problem, therefore, is outside the scope of this Survey.

IDENTIFICATION

Problem code number(s):	8-99-410-2
Watercourse:	River Tame (main river)
Location:	Wigginton (Lichfield District Council)
OS Map reference:	SK 191 073

NATURE OF PROBLEM

Flooding of a minor road occurs during severe floods. The flooding results from normal floodplain inundation from the River Tame and the benefits from alleviation will not justify improvement works.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-99-410-3
Watercourse:	None
Location:	Alrewas (Lichfield District Council)
OS Map reference:	SK 160 127

NATURE OF PROBLEM

A problem has been recorded at the point where the Coventry Canal crosses the A38 road. There is no watercourse in this area and the problem is, therefore, outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-99-410-4/5
Watercourse:	River Tame (main river)
Location:	Elford (Lichfield District Council)
OS Map reference:	SK 186 140 and SK 191 106

NATURE OF PROBLEM

During times of severe floodplain flooding, flooding of two roads occurs. As the flooding is so infrequent the benefits from alleviation will be small and no improvements can, therefore, be recommended.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	8-99-410-7
Watercourse:	Footherley Brook (main river)
Location:	Shenstone (Lichfield District Council)
OS Map reference:	SK 108 051 to SK 105 008

NATURE OF PROBLEM

Commercial premises off Lynn Lane and farmland adjoining the Footherley Brook, adjacent to Little Aston Water Reclamation Works, flood periodically.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Contributions from the developers of residential development at Hill Hook were made available for the Staffordshire County Land Agent to improve 3 sections of the Footherley Brook between Shenstone and Hill Hook which were considered inadequate for the increased surface water run-off from the Hill Hook Development. The Staffordshire County Land Agent completed 2 of the sections but the remaining section at Shenstone had to be postponed due to complications caused by a 24" South Staffordshire Waterworks Company water main in the bed of the Footherley Brook.

IDENTIFICATION

Problem code number(s):	8-99-410-8
Watercourse:	Crane Brook (non-main river)
Location:	Hammerwich (Lichfield District Council)
OS Map reference:	SK 054 176 to SK 103 056

NATURE OF PROBLEM

Various reaches have inadequate outfall facility and flood flow capacity.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The possible residential development at "The Triangle" Hammerwich which would have required improvement to the Course Brook is not now proceeding. The minor inadequacies on the Crane Brook in this area for existing flows still exist.

APPENDIX A2

SCHEDULE OF MAIN RIVER

SCHEDULE OF MAIN RIVERS IN THE UPPER SEVERN AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
ACRE BROOK	R Severn confluence to upstream face of outfall structure	SJ 316 160	SJ 315 159	0.28	1
ADFORTON BROOK	Wigmore Main Drain confluence to a point upstream of Green Lane Bridge, Adforton	SO 420 706	SO 415 704	0.48	2
ALLCOCKS BROOK	Wigmore Main Drain confluence to Allcocks Bridge	SO 420 706	SO 425 693	1.45	2
BACK BROOK	R Roden confluence to Stang's Plantation	SJ 514 286	SJ 484 291	3.70	1
BAILEY BROOK	R Tern confluence to Hoarstone Lane Bridge	SJ 629 315	SJ 610 337	4.67	1
BELE BROOK	R Severn confluence to Wern Bridge	SJ 283 158	SJ 253 137	4.14	1
BLACK BROOK	Smestow Brook confluence to the A454 road bridge	SO 839 959	SO 836 967	1.00	2
BROMLEY BROOK	R Perry confluence to Bagley-Shade Oak road bridge	SJ 399 252	SJ 410 274	3.70	1
BUCKLEY FARM BROOK	R Severn confluence to upstream face of Buckley Farm outfall	SJ 363 166	SJ 364 167	0.20	1
RIVER CAMLAD	R Severn confluence to Snead Bridge	SJ 209 006	SO 320 918	29.23	1
RIVER CERIST	R Severn confluence to Van road bridge (B4518)	SO 025 915	SN 915 874	9.50	1
RIVER CLYWEDOG	R Severn confluence to Clywedog Dam	SN 954 848	SN 913 869	5.31	1
COMMISSION DRAIN	R Tern confluence to Kynnersley road bridge	SJ 615 149	SJ 650 176	5.25	1
RIVER CORVE	R Teme confluence to Beam Bridge	SO 506 750	SO 532 882	22.85	2
CRIGGION BROOK	R Severn confluence to upstream face of outfall structure	SJ 314 161	SJ 313 161	0.04	1
CRUCKTON BROOK	Rea Brook confluence to upstream of confluence with right bank tributary	SJ 432 098	SJ 428 102	0.70	1
DUNKETT BROOK	R Severn confluence to upstream face of Dunkett outfall	SJ 356 170	SJ 357 174	0.40	1
RIVER EIRTH	R Tanat confluence to 250m upstream of B4391 bridge at Llangynog	SJ 055 260	SJ 051 263	0.56	1
ELMBRIDGE BROOK	R Salwarpe confluence to road bridge near Cooksey Green	SO 885 629	SO 894 696	8.69	2
RIVER GARNO	R Severn confluence to Wig Bridge	SO 027 917	SO 017 926	1.50	1
GUILSFIELD BROOK	Bele Brook confluence to Lower Varchoel Farm	SJ 253 137	SJ 236 126	2.30	1
GWYFER BROOK	R Severn confluence to upstream face of outfall structure	SJ 292 166	SJ 291 166	0.07	1
HADLEY BROOK	R Salwarpe confluence to the B4192 road bridge	SO 869 620	SO 869 713	14.64	2
HEN AFON	R Vyrnwy confluence to outfall structure	SJ 155 127	SJ 153 128	0.26	1
HOO BROOK	R Stour confluence to A448	SO 829 746	SO 847 755	2.25	2
HURLEY BROOK	Commission Drain confluence to overflow structure on Northern Interceptor sewer	SJ 641 159	SJ 653 151	1.17	1
KYRE BROOK	R Tame confluence to confluence with a minor watercourse downstream of Splash Bridge	SO 599 685	SO 602 672	1.88	2
LAUGHERN BROOK	R Teme confluence to the Worcester - Martley road bridge near Kenswick Manor	SO 834 526	SO 796 580	12.71	2
LONCO BROOK	R Meese confluence to Whitleyford Bridge	SJ 737 217	SJ 746 238	4.83	1
RIVER MEESE	R Tern confluence to Aqualate Mere	SJ 638 208	SJ 765 208	22.60	1
RIVER MORDA	R Vyrnwy confluence to Newbridge road bridge	SJ 293 207	SJ 304 254	14.80	1
RIVER ONNY	R Teme confluence to confluence of Quinny Brook	SO 485 766	SO 436 843	12.34	2
OSWESTRY BROOK	R Morda confluence to the major surface water outfalls at Oswestry	SJ 316 238	(SJ 302 290) (SJ 300 284)	7.40	1

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SCHEDULE OF MAIN RIVERS IN THE UPPER SEVERN AREA (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
PENTRE BROOK	R Vyrnwy confluence to downstream face of road culvert at Pentre	SJ 166 137	SJ 151 135	1.74	1
RIVER PERRY	R Severn confluence to Hillyards Plantation	SJ 440 166	SJ 315 334	30.09	1
POTFORD BROOK	R Tern confluence to the downstream face of A442 culvert	SJ 638 208	SJ 634 223	2.30	1
REA BROOK	R Severn confluence to Marton Pool	SJ 496 123	SJ 298 028	37.65	1
RIVER REA	R Teme confluence to the A4117 road bridge at Cleobury Mortimer	SO 636 686	SO 680 763	18.02	2
RIVER RED STRINE	R Strine confluence to Humber Brook confluence	SJ 644 174	SJ 685 165	5.31	1
RIVER RODEN	R Tern confluence to Blackhurstford Bridge	SJ 593 124	SJ 462 334	43.44	1
RIVER SALWARPE	R Severn confleunce to Upton Warren Bridge	SO 841 601	SO 933 674	23.01	2
RIVER SEVERN	R Teme confluence to R Clywedog confluence	SO 850 521	SN 954 848	218.00	1 + 2
SLEAP BROOK	R Roden confluence to bridge on minor road from Brandwood to Noneley	SJ 505 281	SJ 471 271	4.30	1
SMESTOW BROOK	R Stour confluence to the upstream face of the canal culvert	SO 863 855	SJ 898 006	25.27	2
SOULTON BROOK	R Roden confluence to Creamery Bridge	SJ 545 294	SJ 541 337	5.15	1
RIVER STOUR	R Severn confluence to the downstream end of Overend Tunnel, Cradley	SO 812 708	SO 949 851	41.79	2
STRINE BROOK	Soulton Brook confluence to road bridge at Steel Heath	SJ 550 308	SJ 554 363	6.35	1
RIVER STRINE	R Tern confluence to downstream face of canal culvert	SJ 629 176	SJ 752 200	15.00	1
RIVER TANAT	R Vyrnwy confluence to 300m downstream of Llangynog bridge	SJ 243 207	SJ 055 260	26.00	1
RIVER TEME	R Severn confluence to sewage works outfall at Knighton	SO 850 521	SO 301 724	107.07	2
RIVER TERN	R Severn confluence to Walkmill Bridge, Market Drayton	SJ 553 091	SJ 672 335	45.21	1
TETCHILL AND NEWNES BROOK	R Perry confluence to upstream face of culvert at Dudleston Heath	SJ 380 296	SJ 365 363	10.70	1
RIVER TRANNON	R Cerist confluence to the B4569 road bridge at Trefeglwys	SO 012 910	SN 969 903	5.52	1
RIVER VYRNWY	R Severn confluence to downstream end of the Vyrnwy dam spillway	SJ 328 159	SJ 019 192	66.06	1
WALL BROOK	R Strine confluence to syphon at junction of Kynnersley Drive and Shropshire Union Canal	SJ 675 181	SJ 687 165	2.14	1
WEIR BROOK	R Severn confluence to upstream face of outfall structure	SJ 345 169	SJ 344 169	0.05	1
WEIR BROOK (new cut)	R Severn confluence to upstream face of outfall structure	SJ 345 171	SJ 344 171	0.04	1
WERN-DDU BROOK	R Vyrnwy confluence to the Melverley IDB outfall on the B4398	SJ 283 202	SJ 282 206	0.56	1
WIGMORE MAIN DRAIN	R Teme confluence to the head of the drain	SO 431 717	SO 415 696	3.22	2
RIVER WORFE	R Severn confluence to Broad Bridge, Stapleford	SO 725 952	SO 762 982	15.14	1
WORTHEN BROOK	Rea brook confluence to the Ford at Worthen	SJ 334 042	SJ 327 045	0.80	1
TOTAL				960.83	

SCHEDULE OF MAIN RIVERS IN THE LOWER SEVERN AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
RIVER ALNE	R Arrow confluence to Botley Mill Farm Bridge	SP 093 573	SP 144 684	22.69	3
RIVER ARROW	R Avon confluence to Coventry Highway Bridge, Redditch	SP 083 507	SO 055 680	25.00	3
RIVER AVON	R Severn confluence to road bridge at Welford	SO 888 331	SP 645 808	180.94	3
BADSEY BROOK	R Avon confluence to A44 road bridge, Wickhamford	SP 050 454	SP 065 413	6.27	3
BIRDINGBURY BROOK	R Leam confluence to upstream face of culvert on Birdingbury-Offchurch Road	SP 418 685	SP 427 677	1.40	3
BOW BROOK	R Avon confluence to Shell Ford, Himbleton	SP 919 426	SO 951 596	25.90	3
BRETFORTON BROOK	Badsey Brook confluence to Stoneford Barn	SP 066 443	SP 097 426	4.32	3
RIVER CAM	Gloucester and Sharpness Canal to Lower Cam	SO 739 051	SO 752 002	7.15	2
CAPEHALL BROOK	Wicksters Brook confluence to upstream face of M5 Motorway culvert	SO 756 048	SO 762 038	1.45	2
CAREYS BROOK	R Severn confluence to upstream face of A4021 road bridge	SO 849 506	SO 834 507	2.50	2
CARRANT BROOK	R Avon confluence to Aston on Carrant road bridge	SO 895 334	(SO 940 349) (SO 940 348)	8.10	3
RIVER CHELT	R Severn confluence to railway bridge, Cheltenham	SO 848 262	SO 936 232	14.81	2
CLAYCOTON BROOK	R Avon confluence to unnamed tributary flowing from Elkington	SP 564 778	SP 607 754	8.20	3
CLIFTON BROOK	R Avon confluence to Clifton road bridge	SP 515 775	SP 521 759	0.90	3
COLLIERS BROOK	R Leadon confluence to upstream face of the A417 road bridge	SO 776 235	SO 799 260	4.00	2
DEAN BROOK	R Swilgate confluence to the A435 road bridge	SO 911 283	SO 955 286	4.83	2
DEERHURST PARISH DRAIN	R Severn confluence to the drain head	SO 846 264	SO 878 271	3.22	2
RIVER DENE	R Avon confluence to Wellesbourne Mill	SP 258 563	SP 284 544	4.83	3
DIMORE BROOK	R Severn confluence to upstream face of the A38 road bridge	SO 794 150	SO 807 131	2.94	2
DOVERTE BROOK	R Little Avon confluence to upstream face of the B4509 road bridge at Berkeley	ST 677 992	ST 684 990	0.84	2
ELL BROOK	R Leadon confluence to upstream face of Ell Bridge, Newent	SO 774 245	SO 721 264	6.80	2
RIVER FROME	R Severn confluence to bridge on Frampton Mansell - Trillis road	SO 751 106	SO 929 030	34.59	2
GLYNCH BROOK	R Leadon confluence to upstream face of Berry Bridge, Staunton	SO 771 275	SO 783 294	4.00	2
HASFIELD DRAIN	R Severn confluence to upstream face of B4213 road culvert	SO 844 270	SO 842 281	1.58	2
HATHERLEY BROOK	R Severn confluence to upstream face of Arle Bridge	SO 826 210	SO 914 218	11.53	2
HORSBERE BROOK	R Severn confluence to upstream face of Brockworth road bridge	SO 828 209	SO 892 169	9.84	2
RIVER ISBOURNE	R Avon confluence to Wormington Bridge	SP 031 431	SP 037 364	9.07	3
RIVER ITCHEN	R Leam confluence to R Stowe confluence	SP 406 690	SP 406 620	12.55	3
RIVER LEADON	R Severn confluence to England's Bridge near Bosbury	SO 817 199	SO 692 440	39.00	2
RIVER LEAM	R Avon confluence to road bridge on Grandborough-Woolscott road	SP 301 657	SP 495 672	39.09	3
LEIGH BROOK	R Chelt confluence to Knight's Bridge	SO 853 259	SO 893 268	5.40	2

SCHEDULE OF MAIN RIVERS IN THE LOWER SEVERN AREA - (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
LEIGH PARISH DRAIN	R Chelt confluence to approx 300m downstream of footbridge on Coombe Hill Canal (disused)	SO 851 261	SO 877 270	3.38	2
RIVER LITTLE AVON	R Severn confluence to upstream face of railway bridge	SO 661 006	ST 728 902	20.04	2
LITTLETON BROOK	Bretforton Brook confluence to tributary upstream of North Littleton	SP 073 443	SP 084 478	4.34	3
LONGDON BROOK	R Severn confluence to confluence with Berry Meadow Brook	SO 868 362	SO 810 335	9.87	2
MARCHFONT BROOK	R Avon confluence to Clifford Chambers - Long Marston road bridge	SP 159 521	SP 169 513	1.61	3
MILL AVON	R Severn confluence to downstream face of Abbey Mill sluice	SO 879 317	SO 892 330	1.80	2
MILLHOLME BROOK	R Leam confluence to downstream side of bridge on road running SW from Grandborough	SP 460 681	SP 483 659	4.02	3
MYTHE BROOK	R Severn confluence to upstream face of Bow Bridge	SO 886 342	SO 879 364	2.69	2
NOLEHAM BROOK	R Avon confluence to access bridge at Pitchell Farm, south of Broad Marston	SP 117 514	SP 145 454	9.81	3
NORMANS BROOK	Hatherley Brook confluence to railway bridge at Churchdown	SO 874 222	SO 895 204	3.38	2
PIDDLE BROOK	R Avon confluence to the A442 at Grafton Flyford	SO 954 465	SO 964 555	14.48	3
RED BROOK	R Leadon confluence to upstream face of road bridge at Taynton	SO 776 222	SO 751 231	4.12	2
RIVER SEVERN	Avonmouth (East bank) and Beachley Point (West Bank) to R Teme confluence	(ST 513 798) (ST 550 903)	SO 850 521	130.00	1 + 2
SHELL BROOK	Shell Ford to Brandon Brook confluence	SO 951 596	SO 006 602	6.40	3
RIVER SHERBOURNE	R Sowe confluence to Whitley Bridge	SP 346 757	SP 349 771	2.74	3
SHORN BROOK	Gloucester and Sharpness Canal to minor road at Hardwicke	SO 791 128	SO 794 125	0.40	2
SHOTTERY BROOK	R Avon confluence to upstream face of culvert under the Stratford-on-Avon canal	SP 184 535	SP 187 560	3.00	3
RIVER SOWE	R Avon confluence to Longford Bridge (A444)	SP 324 724	SP 349 832	24.94	3
STOCK GREEN BROOK	Shell Brook confluence to downstream face of road culvert in Stock Green	SO 956 599	SO 981 587	3.15	3
RIVER STOUR	R Avon confluence to Mitford Bridge	SP 183 534	SP 263 371	36.42	3
RIVER STOWE	R Itchen confluence to Daventry road bridge, Southam	SP 406 620	SP 423 619	2.48	3
STROUD WATER	R Frome confluence to Wall Bridge culvert, Stroud	SO 831 047	SO 848 051	1.77	2
RIVER SWIFT	R Avon confluence to Lutterworth water reclamation works outfall	SP 505 768	SP 541 835	11.50	3
RIVER SWILGATE	Mill Avon confluence to Stoke Orchard Bridge	SO 887 323	SO 914 281	7.00	2
TIBBERTON BROOK	Red Brook confluence to upstream face of Wynford Bridge	SO 756 231	SO 752 226	0.68	2
TIRLE BROOK	R Swilgate confluence to Aston Cross Bridge	SO 897 325	SO 942 336	5.95	2
WHADDON BROOK	Gloucester and Sharpness Canal to downstream end of culvert, Lower Tuffley	SO 815 157	SO 824 146	1.40	2
WHITSUN BROOK	Piddle Brook confluence to Bishampton - Abberton road bridge	SO 962 510	SO 991 522	4.40	3

SCHEDULE OF MAIN RIVERS IN THE LOWER SEVERN AREA – (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
WICKSTERS BROOK	R Cam confluence to upstream face of M5 Motorway culvert	SO 742 049	SO 766 049	2.85	2
WITHY BROOK	R Sowe confluence to B4029	SP 385 802	SP 410 827	4.00	3
WOTTON BROOK	Horsbere Brook confluence to Cole Bridge, Gloucester	SO 833 210	SO 847 191	2.57	2
TOTAL				834.93	

SCHEDULE OF MAIN RIVERS IN THE UPPER TRENT AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
RIVER ANKER	R Tame confluence to Stretton Baskerville Brook confluence	SK 206 038	SP 403 909	38.34	8
BELL BROOK	R Penk confluence to Pillaton Bridge	SJ 923 145	SJ 940 130	2.41	7
BENTLEY (BRADBOURNE) BROOK	R Dove confluence to Woodeaves Mill Bridge	SK 160 462	SK 185 503	6.44	6
RIVER BLITHE	R Trent confluence to north of Blythe Bridge	SK 114 176	SJ 951 416	39.00	7
RIVER BLYTHE	R Tame confluence to Earlswood Reservoir	SP 212 916	SP 114 742	40.47	8
BOURNE BROOK	R Tame confluence to Footherley Brook confluence	(SK 210 017) (SK 209 016)	SK 108 051	18.83	8
RIVER BOURNE	R Tame confluence to Furnace End Bridge	SP 216 916	SP 248 912	4.10	8
BRAMCOTE BROOK	R Anker confluence to downstream face of M42 culverts	SK 264 040	(SK 276 056) (SK 279 061)	3.85	8
CHURCH EATON BROOK	R Penk confluence to Mitton Manor Farm	SJ 916 142	SJ 889 148	3.68	7
RIVER CHURNET	R Dove confluence to Tittesworth Reservoir	SK 102 375	SJ 994 586	40.50	6
RIVER COLE	R Blythe confluence to Cole Ford, near Shard End	SP 212 912	SP 143 885	14.11	8
COLESHILL HALL BROOK	R Cole confluence to the M42 outfall	SP 190 882	SP 195 877	1.00	8
COMBERFORD BROOK	R Tame confluence to field boundary upstream of footbridge north-west of Wigginton	SK 190 075	SK 204 072	1.80	8
CURBOROUGH BROOK	R Trent confluence to Curborough reclamation works outfall	SK 166 155	SK 127 129	5.70	7
DARLASTON BROOK	R Tame confluence to downstream face of Murdoch Road culvert	SO 981 982	SO 961 967	2.85	8
DOLEY BROOK	Church Eaton Brook confluence to Norbury Park, north-west of Gnossall	SJ 892 150	SJ 808 225	13.68	7
RIVER DOVE	R Trent confluence to Okeover Bridge	SK 280 261	SK 164 481	54.86	6
ENDON BROOK	R Churnet confluence to flood wall 40m above railway culvert	SJ 968 534	SJ 928 531	5.82	6
FEATHERSTONE BROOK	R Penk confluence to Cat and Kittens Lane, Featherstone	SJ 905 066	SJ 923 050	2.90	7
FOOTHERLEY BROOK	Bourne Brook confluence to Blake Street Culvert	SK 108 051	SK 105 008	5.95	8
FORS BROOK	R Blithe confleunce to downstream face of the footbridge, Forsbrook	SJ 960 406	SJ 965 417	1.36	7
FOSTON BROOK	R Dove confluence to Boylestone	SK 195 299	SK 179 359	8.45	6
GILWISKAW BROOK	R Meese confluence to near Nook Farm, Ashby-de-la-Zouch	SK 336 101	SK 359 155	6.91	7
GROVELAND BROOK	R Tame confluence to manhole 80m north of Tividale Road	SO 974 916	SO 964 908	1.50	8
HARROW BROOK	R Anker confluence to downstream face of Brodick Road Bridge	SP 389 911	SP 409 938	4.15	8
HATCHFORD BROOK	Kingshurst Brook confluence to the downstream face of Eastern Bridge	SP 167 860	SP 166 860	0.60	8
HENMORE BROOK	R Dove confluence to Carsington Reservoir	SK 160 447	SK 244 504	13.53	6
HILTON BROOK	R Dove confluence to Longford	SK 265 274	SK 219 369	13.52	6
HOLLYWELL BROOK	R Blythe confluence to M42 outfall	SP 214 839	SP 199 836	1.75	8
HORTON BROOK	Endon Brook confluence to A53 road bridge	SJ 936 540	SJ 934 541	0.41	6
KINGSHURST BROOK	R Cole confluence to Hatchford Brook confluence	SP 179 874	SP 167 860	1.50	8
KINGSTON BROOK	R Penk confluence to upstream face of A513 road bridge	SJ 946 229	SJ 939 242	1.45	7
LEASOW BROOK	R Tame confluence to Birmingham & Fazeley Canal	SK 189 082	SK 178 077	1.30	8

SCHEDULE OF MAIN RIVERS IN THE UPPER TRENT AREA – (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
LONGNOR BROOK	Wheaton Aston Brook confluence to Station Road, Wheaton Aston	SJ 869 141	SJ 855 124	2.05	7
LOW BROOK	Kingshurst Brook confluence to downstream face of railway culvert	SP 172 864	SP 179 846	2.00	8
MARE BROOK	R Tame confluence to upstream face of A38(T) road culvert	SK 174 115	SK 141 096	4.80	8
MARSTON BROOK	Wheaton Aston Brook confluence to Birchmoor Lane	SJ 845 141	SJ 827 143	1.98	7
RIVER MEASE	R Trent confluence to Gilwiskaw Brook confluence	SK 196 147	SK 336 101	25.57	7
MEECE BROOK	R Sow confluence to Swinchurch Brook confluence	SJ 874 282	SJ 823 363	16.94	7
MOAT BROOK	R Penk confluence to 200m above Wood Road, Codsall	SJ 890 037	SJ 859 037	4.30	7
MOTTY MEADOWS BROOK	Wheaton Aston Brook confluence to Wrestlers Wood	SJ 845 141	SJ 825 133	1.60	7
NUNEATON FLOOD RELIEF CHANNEL	R Anker confluence to inlet from the R Anker	SP 365 927	SP 379 917	1.80	8
OTMERTON BROOK	R Penk confluence to railway bridge near Lyne Hill	SJ 922 144	SJ 923 129	1.61	7
RIVER PENK	R Sow confluence to Pendeford Mill Lane bridge	SJ 946 229	SJ 891 036	26.87	7
PICKNALL BROOK	R Dove confluence to confluence 260m downstream of Loxley Lane	SJ 116 319	SK 066 326	6.31	6
RAVENSHAW BROOK	R Blythe confluence to M42 outfall	SP 178 792	SP 173 789	0.80	8
RISING BROOK	R Penk confluence to A449 culvert	SJ 936 212	SJ 920 214	2.60	7
ROLLESTON BROOK	Tutbury Mill Fleam confluence to 200m upstream of Bushton Bridge	SK 242 282	SK 206 262	4.41	6
SAREDON BROOK	R Penk confluence to Golly Brook confluence	SJ 903 075	SJ 972 087	8.35	7
SCOTCH BROOK	R Trent confluence to downstream face of canal culvert	SJ 902 334	SJ 902 337	0.26	7
SENCE BROOK	R Sence confluence to confluence of R Tweed and Stapleton Brook	SP 326 999	SP 409 989	12.47	8
RIVER SENCE	R Anker confluence to B591 at Heather	SP 315 991	SK 394 109	20.33	8
SHADOW BROOK	R Blythe confluence to M42 outfall	SP 216 825	SP 192 809	3.00	8
SKETCHLEY BROOK.	Harrow Brook confluence to downstream face of Brookfield Road Bridge	SP 392 916	SP 421 928	3.50	8
RIVER SOW	R Trent confluence to Pershall	SJ 995 226	SJ 818 297	28.83	7
SWAN BROOK	Tipton Brook confluence to downstream face of manhole adjacent Birmingham New Road	SO 963 927	SO 947 918	3.00	8
RIVER TAME	R Trent confluence to Ashes Road, Oldbury and downstream face of James Bridge, Willenhall	SK 192 149	(SO 985 875) (SO 976 987)	87.72	8
TATENHILL BROOK	R Trent confluence to SK 220 203	SK 227 209	SK 220 203	1.00	7
RIVER TEAN	R Dove confluence to footbridge near Noah's Ark Farm	(SK 102 355) (SK 106 344)	SK 062 360	7.80	6
TIPTON BROOK	R Tame confluence to Swan Brook confluence	SO 979 935	SO 963 927	1.90	8
RIVER TRENT	R Dove confluence to footbridge at Stoke-on-Trent	SK 280 261	SJ 901 513	87.00	5 + 7
TUTBURY MILL FLEAM	R Dove confluence to sluice at Dove confluence	SK 249 284	SK 204 294	6.40	6
WHEATON ASTON BROOK	Church Eaton Brook confluence to Motty Meadows Brook confluence	SJ 889 148	SJ 845 141	4.30	7

SCHEDULE OF MAIN RIVERS IN THE UPPER TRENT AREA - (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
WITHERLEY BROOK	R Anker confluence to upstream face of Chapel Lane road bridge	SP 323 981	SP 328 976	0.80	8
WYRLEY BROOK	Golly Brook confluence to Charrington Drive	SJ 972 087	SJ 986 078	1.85	7
TOTAL				744.87	

SCHEDULE OF MAIN RIVERS IN THE LOWER TRENT AREA (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
RATCLIFFE-ON-SOAR POWER STATION DRAIN	R Soar confluence to upstream face of railway culvert	SK 491 298	SK 497 296	0.70	4
RATCLIFFE-ON-SOAR VILLAGE DRAIN	R Soar confluence to upstream face of railway culvert	SK 493 289	SK 497 285	1.29	4
REPTON BROOK	R Trent confluence to Lawn Bridge	SK 317 285	SK 313 252	4.50	7
ROTHLEY BROOK	R Soar confluence to the A50	SK 592 132	SK 542 070	11.26	4
RIVER RYTON	R Idle confluence to Bracebridge, Worksop	SK 658 921	SK 585 790	28.96	5
SAUNDBY BECK	R Trent confluence to Laneham IDD boundary	SK 807 881	SK 790 879	1.74	5
RIVER SENCE	R Soar confluence to Great Glen	SP 552 985	SP 656 981	19.31	4
SILEBY BROOK	R Soar confluence to Sileby Village	SK 591 148	SK 602 150	1.00	4
SNOW SEWER	R Trent confluence to Snow Sewer pumping station	SK 813 994	SK 731 986	9.01	5
RIVER SOAR	R Trent confluence to footbridge upstream of Sharnford	SK 494 309	SP 463 909	75.73	4
SOOBRIDGE DRAIN	Middle Beck confluence to upstream face of railway culvert	SK 805 508	SK 816 528	2.53	5
SOUTH LEVEL ENGINE DRAIN	Keadby pumping station to Bull Hassocks pumping station	SE 835 113	SE 731 017	17.25	5
SOUTH LEVEL ENGINE SOAK DRAIN	South Idle Drain to north of Aucklands Farm	SE 735 040	SE 738 034	2.00	5
SOUTH SOAK DRAIN	Keadby pumping station to Thorne	SE 835 113	SE 681 132	16.57	5
RIVER TORNE	R Trent confluence to the A60 at Styrrup Carr	SE 836 113	SE 588 906	39.42	5
RIVER TORNE SOAK DRAIN (CANDY FARM)	Ring Drain confluence to Blaxton Banks	SE 704 037	SE 673 028	3.94	5
RIVER TORNE SOAK DRAIN (TUNNEL PITS)	Southern side of Syphon under R Torne into Tunnel Pits pumping station to Wroot Common	SE 735 040	SE 717 040	2.20	5
RIVER TRENT	R Humber confluence to R Dove confluence	SE 863 235	SK 280 261	193.00	5 + 7
TUNNEL PITS SUCTION DRAIN	Tunnel Pits pumping station to North Idle Drain at East Ring Drain	SE 735 040	SE 736 044	0.55	5
TWYFORD BROOK	Queniborough Brook confluence to the Dairy Farm	SK 643 131	SK 736 094	15.89	4
WATERTON DRAIN	Woodhouse Sewer confluence to Diggin Dyke confluence	SE 662 066	SE 662 064	0.21	5
WENSLEY BROOK	R Derwent confluence to upstream face of Oldfield Lane Bridge	SK 270 621	SK 269 619	0.13	6
WHETSTONE BROOK	R Soar confluence to Bottom End Bridge, Countesthorpe	SP 548 974	SP 558 969	1.34	4
WILNE DRAIN	R Derwent outfall to 230m north-east of Beech cottage	SK 452 314	SK 440 307	1.59	6
WOODCARR SUCTION DRAIN	Woodcarr pumping station to junction with Woodcarr Small Drain	SE 753 088	SE 754 088	0.06	5
WOODHOUSE SEWER	Hatfield Waste Drain to Green Lane, Waterton Carr	SE 685 082	SE 660 066	3.22	5
RIVER WREAKE	R Soar confluence to Stapleford Park	SK 596 127	SK 815 187	40.42	4
RIVER WYE	R Derwent confluence to the A6 upstream of Ashford-in-the-Water	SK 260 655	SK 179 698	17.29	6
TOTAL				1,032.40	

SCHEDULE OF MAIN RIVERS IN THE LOWER TRENT AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
ALFRETON BROOK	R Amber confluence to Fordbridge Lane	SK 387 564	SK 440 577	6.84	6
RIVER AMBER	R Derwent confluence to Ogston Reservoir	SK 347 515	SK 380 598	16.03	6
BAR BROOK	R Derwent confluence to tributary confluence 60m upstream of Derwent Valley Aqueduct, near Baslow	SK 256 712	SK 262 725	1.77	6
BARROW DRAIN	Main Drain confluence to SK 350 302	SK 368 303	SK 350 302	1.80	6
BENTLEY BROOK	R Derwent confluence to stilling pond south of Lumsdale	SK 300 598	SK 312 605	1.78	6
RIVER BIAM	Downstream confluence with R Soar to upstream confluence with R Soar	SK 579 028	SK 577 024	0.48	4
BLACK BROOK	R Soar confluence to Grace Dieu Brook	SK 521 220	SK 487 209	5.15	4
BOTTESFORD BECK	R Trent confluence to Emanuel Bridge	SE 837 061	SE 925 084	9.98	5
BOTTLE BROOK	R Derwent confluence to Smithy Houses (North) & Bottlebrook Houses (South)	SK 359 407	(SK 386 471) (SK 389 460)	9.00	6
BROUGHTON ASTLEY BROOK	R Soar confluence to surface water outlet from Harborough DC housing development	SP 520 963	SP 528 923	5.00	4
BURTON BROOK	R Sence confluence to Burton Overy	SP 654 974	SP 675 980	2.41	4
CANDY FARM SUCTION DRAIN	Candy Farm pumping station to Hatfield Chase IDB Boundary	SE 698 031	SE 698 037	0.60	5
CASTLE DONINGTON BROOK	R Trent confluence to outfall of surface water sewer	SK 455 300	(SK 449 284) (SK 448 277)	3.33	7
CHADDESDEN BROOK	R Derwent confluence to Lees Brook confluence	SK 375 358	SK 384 372	1.83	6
COSBY BROOK	R Soar confluence to Cambridge Road, Cosby	SP 536 970	SP 547 952	3.22	4
CUTTLE BROOK	R Trent confluence to Sinfin Moor	SK 377 281	SK 370 302	2.41	6
RIVER DERWENT	R Trent confluence to outfall from Ladybower Reservoir	SK 459 308	SK 199 853	88.78	6
RIVER DEVON	R Trent confluence to Knipton reservoir	SK 790 533	SK 818 309	32.94	5
DIGGIN DYKE	Waterton Drain confluence to balancing area	SE 662 064	SE 657 050	2.03	5
DOVER BECK	R Trent confluence to Lowdham Mill (downstream limit of control structures)	SK 695 451	(SK 666 474) (SK 666 473)	5.20	5
RIVER EAU	R Trent confluence to Dunstall Beck	SE 837 033	SK 891 940	16.41	5
RIVER ECCLESBOURNE	R Derwent confluence to weir upstream of Windley Bridge	SK 350 432	SK 319 447	5.28	6
EGGINTON BROOK	R Trent confluence to Radbourne Brook, Etwall	SK 285 269	SK 264 336	9.36	6
EMINSONS DYKE	R Eau confluence to Messingham Catchwater Drain confluence	SE 879 026	SE 884 027	0.50	5
RIVER EREWASH	R Trent confluence to downstream face of B6018 road bridge, Kirkby-in-Ashfield	SK 514 330	SK 485 548	39.66	5
FAIRHAM BROOK	R Trent confluence to surface water outfall from new development on left bank	SK 560 366	SK 556 328	4.60	5
FOSSE DYKE	R Trent confluence to Torksey road bridge	SK 834 781	SK 838 781	0.32	5
GRASSTHORPE BECK	R Trent confluence to downstream end of control structure at Grassthorpe Mill	SK 816 673	SK 792 676	3.12	5
GREAT CATCHWATER DRAIN	Ravensfleet pumping station to the A159 at Wharton	SK 800 960	SK 839 934	6.40	5
RIVER GREET	R Trent confluence to outfall at Lower Kirklington Road, Southwell	SK 743 515	SK 705 547	6.80	5
GREYTHORNE DYKE	R Trent confluence to upstream of Wilford Road	SK 575 375	SK 572 368	0.81	5
HALLOUGHTON DUMBLE DRAIN	Marlock Dyke confluence to Southwell reclamation works	SK 737 523	SK 726 526	1.37	5

SCHEDULE OF MAIN RIVERS IN THE LOWER TRENT AREA – (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
HARWORTH DYKE	R Torne confluence to major surface water outfall from Harworth	SK 606 926	SK 614 916	1.50	5
HATFIELD WASTE DRAIN	Keadby pumping station to Woodhouse Sewer, Hatfield Woodhouse	SE 835 113	SE 685 082	17.70	5
HERMITAGE BROOK	R Soar confluence to railway and Moor Lane	SE 544 215	(SK 553 196) (SK 551 194)	3.30	4
RIVER IDLE	R Trent confluence to Twyford Bridge, Gamston	SK 790 947	SK 699 752	48.75	5
KILBY BROOK	R Sence confluence to downstream face of Kilby Road culvert	SP 616 963	SP 618 955	1.00	4
LANEHAM BECK	R Trent confluence to Askham Drain	SK 815 770	SK 774 740	5.60	5
LEAS BROOK	R Meden confluence to surface water outfall at Mansfield Woodhouse	SK 555 672	SK 547 642	3.60	5
RIVER LEEN	R Trent confluence to Linby Mill, Papplewick	SK 566 381	SK 546 510	17.52	5
LEES BROOK	Chaddesden Brook confluence to minor watercourse confluence	SK 384 372	SK 387 373	0.35	6
LOW BANK SUCTION) DRAIN/ANCHOR DRAIN)	Low Bank pumping station to the M180	SE 739 086	SE 729 090	1.06	5
LUBBESTHORPE BROOK	R Soar confluence to downstream face of Meridian Park culvert	SK 564 007	SK 552 008	1.43	4
MAIN DRAIN	Osmaston Drain confluence to outfall from balancing pond, Sinfin Moor	SJ 370 302	SK 348 309	2.30	6
MARLOCK DYKE	R Greet confluence to Halloughton Dumble Drain confluence	SK 741 518	SK 737 523	0.76	5
RIVER MAUN	R Idle confluence to King's Mill reservoir	SK 701 754	SK 519 597	32.61	5
MEADOW DRAIN	Osmaston Drain confluence to southern boundary of golf course, Sinfin	SK 363 312	SK 356 315	0.95	6
RIVER MEDEN	R Maun confluence to Newbound Mill Bridge, Pleasley	SK 703 751	SK 496 633	29.50	5
MESSINGHAM CATCHWATER DRAIN	Bottesford Beck confluence to the Messingham IDD boundary	SE 878 060	SE 884 027	3.50	5
MIDDLE BECK	R Devon confluence to upstream face of railway culvert	SK 785 514	SK 805 508	2.27	5
MILTON BROOK	R Trent confluence to overspill weir at Foremark reservoir	SK 340 273	SK 329 245	4.80	7
NETHERGATE BROOK	Fairham Brook confluence to downstream face of A453 culvert	SK 564 345	SK 548 348	1.70	5
NORTH ENGINE DRAIN	Keadby pumping station to Dirtness pumping station	SE 835 113	SE 747 096	9.01	5
NORTH SOAK DRAIN	Keadby pumping station to Wike Well Bridge, Thorne	SE 835 113	SE 696 121	13.68	5
OCK BROOK	R Derwent confluence to upstream face of Hawthorn Avenue bridge, Borrowash	SK 420 338	SK 422 349	1.44	6
OLDCOATES DYKE	R Ryton confluence to the A60 at Oldcoates	SK 630 872	(SK 588 885) (SK 588 884)	5.79	5
OSMASTON DRAIN	Cuttle brook confluence to culvert under disused railway line	SK 370 302	SK 364 316	1.66	6
OUSE DYKE	R Trent confluence to downstream end of Netherfield railway culvert	SK 648 420	SK 629 411	3.50	5
RIVER POULTER	R Idle confluence to weir upstream of the A614	SK 699 752	SK 646 754	7.24	5
QUENIBOROUGH BROOK	R Wreake confluence to St Mary's Church Bridge	SK 628 133	SK 653 120	3.56	4

SUMMARY OF MAIN RIVER - JANUARY 1990

AREA	LENGTH (KM)
Upper Severn	960.83
Lower Severn	834.93
Upper Trent	744.87
Lower Trent	1,032.40
TOTAL	3,573.03

SEC24/35

APPENDIX A3

CONSERVATION SITES

SSSI - Site of Special Scientific Interest
NNR - National Nature Reserve
LNR - Local Nature Reserve
CTR - County Trust Reserve

CONSERVATION SITES IN THE RIVER TAME CATCHMENT AND WEST MIDLANDS AT APRIL 1990

SITE NAME	STATUS	NATIONAL GRID REFERENCE	DESCRIPTION
Alvecote Pools	SSSI	SK 249 050	Area of freshwater pools and marshland of great biological interest.
Ashby Canal	SSSI	SK 346 099	Diverse water community.
Bardon Hill	SSSI	SK 461 130	Remnant of Charnwood Forest Heaths.
Bardon Hill Quarry	SSSI	SK 459 133	Geological interest.
Bentley Park Wood	SSSI	SP 289 955	Oak wood providing habitat for some uncommon plant species.
Birch Hill	SSSI	SK 478 137	Geological interest.
Boon's Quarry	SSSI	SP 330 947	Geological interest.
Bromsgrove Road Cutting	SSSI	SO 971 835	Geological interest.
Chasewater Heaths	SSSI	SK 039 080	Wet and dry heathland communities.
Clows Wood and New Fallings Coppice	SSSI	SP 102 740	Important resort for waterfowl and floristically rich woodland.
Clayhanger	SSSI	SK 034 045	Wetland site.
Coleshill and Bannerley Pools	SSSI	SP 200 860	Artificial pool and rare wooded peat bog.
Daw End Railway Cutting	SSSI	SK 035 002	Geological interest.
Edgbaston Pool	SSSI/LNR	SP 054 841	Refuge for variety of fauna and flora and good educational resource.
Fens Pools	SSSI	SO 920 886	Series of pools with wide range of habitats.
Hay Head Quarry	SSSI	SP 048 987	Geological interest.
Herald Way Marsh	SSSI	SP 380 769	Range of wetlands containing assemblage of rare invertebrates.
Hoar Park Wood	SSSI	SP 265 933	Ancient woodland.
Illey Pastures	SSSI	SO 977 812	Species rich unimproved natural grassland.
Illing's Trenches	SSSI	SP 324 943	Geological interest.
Kendall's Meadow	SSSI	SP 394 981	A traditionally managed hay meadow.
Ketley Claypit	SSSI	SO 898 888	Geological interest.
Kingsbury Wood	SSSI	SP 233 976	Oak-hazel woodland. Important wildlife habitats.
Middleton Pool	SSSI	SP 190 983	Important refuge for wildfowl.
Monkspath Meadow	SSSI	SP 145 763	Species rich unimproved hay meadow.
Moseley Bog	SSSI	SP 094 821	Mixed deciduous woodland on floor of old mill pond.
Newton Burgoland Marshes	SSSI	SK 381 084	Neutral alluvial grassland and marsh.
River Blythe	SSSI	SP 109 729 TO SP 212 916	Diverse river with clear succession of plant communities.
Sheepy Fields	SSSI	SK 332 025	Neutral grassland with hay meadow plant communities.
Stubbers Green Bog	SSSI	SK 046 016	Species rich swamp.
Sutton Park	SSSI	SP 098 974	Diverse biological habitat.
Swan Pool & The Swag	SSSI	SK 040 019	Two pools important for bird life.
Tilehill Wood	SSSI/LNR	SP 279 790	Woodland with botanical, entomological and ornithological interest.
Turner's Hill	SSSI	SO 909 918	Good geological exposures.
Webster's Claypit	SSSI	SP 340 805	Geological site.
Whitacre Heath	SSSI/CTR	SP 208 928	Ornithological interest.
Windmill Naps Wood	SSSI	SP 093 724	Ancient semi-natural woodland.
Woodlands Quarry	SSSI	SP 325 947	Fossiliferous site.

APPENDIX A4

CODING SYSTEM

CODING SYSTEM

	x	xx	xxx	xx
	CATCHMENT	COUNTY	DISTRICT	NUMBER
eg	6	98	510	23
	Derwent	Derbyshire	High Peak	Problem No.

CATCHMENT	Code
UPPER SEVERN	1
LOWER SEVERN	2
AVON	3
SOAR	4
LOWER TRENT	5
DERWENT	6
UPPER TRENT	7
TAME	8

County/District Councils	County Code	District Code
AVON COUNTY COUNCIL		
Bristol	82	310
Northavon	82	410
SHROPSHIRE COUNTY COUNCIL		
Bridgnorth	83	110
North Shropshire	83	210
Oswestry	83	310
South Shropshire	83	410
Shrewsbury and Atcham	83	510
Telford Development Corporation	83	610
Wrekin	83	710
CLWYD COUNTY COUNCIL		
Glyndwr	84	110
Wrexham Maelor	84	210
GWYNEDD COUNTY COUNCIL		
Meirionnydd	85	110
POWYS COUNTY COUNCIL		
Mid Wales Development Corporation	86	110
Montgomery	86	210
Radnor	86	310

HEREFORD AND WORCESTER COUNTY COUNCIL		
Leominster	87	110
Bromsgrove	87	210
Malvern Hills	87	310
Redditch	87	410
Redditch Development Corporation	87	510
South Herefordshire	87	610
Worcester	87	710
Wychavon	87	810
Wyre Forest	87	910
GLOUCESTERSHIRE COUNTY COUNCIL		
Cheltenham	88	110
Forest of Dean	88	210
Gloucester	88	310
Stroud	88	410
Tewkesbury	88	510
Cotswold	88	610
OXFORDSHIRE COUNTY COUNCIL		
Cherwell	89	110
NORTHAMPTONSHIRE COUNTY COUNCIL		
Daventry	90	110
WARWICKSHIRE COUNTY COUNCIL		
Nuneaton & Bedworth	91	110
Rugby	91	210
Stratford-upon-Avon	91	310
Warwick	91	410
North Warwickshire	91	510
WEST MIDLANDS		
Coventry	92	110
Birmingham	92	210
Dudley	92	310
Sandwell	92	410
Solihull	92	510
Walsall	92	610
Wolverhampton	92	710
LEICESTERSHIRE COUNTY COUNCIL		
Blaby	93	110
Hinckley and Bosworth	93	210
Charnwood	93	310
Harborough	93	410
Leicester	93	510
Melton	93	610
North West Leicestershire	93	710
Oadby and Wigston	93	810
Rutland	93	910

NOTTINGHAMSHIRE COUNTY COUNCIL		
Ashfield	94	110
Bassetlaw	94	210
Broxtowe	94	310
Gedling	94	410
Mansfield	94	510
Newark and Sherwood	94	610
Nottingham	94	710
Rushcliffe	94	810
LINCOLNSHIRE COUNTY COUNCIL		
North Kesteven	95	110
South Kesteven	95	210
West Lindsey	95	310
HUMBERSIDE COUNTY COUNCIL		
Boothferry	96	110
Glanford	96	210
Scunthorpe	96	310
SOUTH YORKSHIRE		
Doncaster	97	110
Rotherham	97	210
Sheffield	97	310
DERBYSHIRE COUNTY COUNCIL		
Bolsover	98	110
Erewash	98	210
Amber Valley	98	310
Derby	98	410
High Peak	98	510
North East Derbyshire	98	610
Derbyshire Dales	98	710
South Derbyshire	98	810
Chesterfield	98	910
STAFFORDSHIRE COUNTY COUNCIL		
Staffordshire Moorlands	99	110
Cannock Chase	99	210
East Staffordshire	99	310
Lichfield	99	410
Newcastle under Lyme	99	510
South Staffordshire	99	610
Stafford	99	710
Stoke on Trent	99	810
Tamworth	99	910

APPENDIX A5

SOURCES OF FINANCE

1 Levy on County Councils, Metropolitan District Councils and Internal Drainage Boards

The Authority's flood defence and land drainage revenue income derives in the main from contributions from County Councils, Metropolitan District Councils and Internal Drainage Boards collected by a regional levy. The total amount required to be collected is apportioned between the Councils on the basis of relevant population (for Community Charge purposes) after taking into account the amounts to be raised from Internal Drainage Boards. The amount paid by Councils for flood defence levies is reimbursed in full by the Department of the Environment the following year through the revenue support grant for local authorities. Internal Drainage Boards' contributions to the National Rivers Authority expenditure are assessed on the basis of the benefit which the Boards derive as a result of the Authority's operations.

2 Loans

The Authority's flood defence capital expenditure is self-financed and loans will be sought in exceptional circumstances only, to deal with unforeseen emergencies.

3 General and Special Drainage Charges

General drainage charges are a means by which revenue, to meet land drainage expenditure, can be raised on agricultural land which lies outside Internal Drainage Districts. The Land Drainage Act (as amended by the Water Act 1989) prescribes a procedure designed to secure that the amount of the charge shall be as near as practicable equivalent to what would be paid in respect of the chargeable land if the land were rated.

Special drainage charges can be levied on specified areas outside Internal Drainage Districts where it appears to the Authority that drainage works on any watercourses in that area should be carried out in the interests of agriculture.

Because of the limits which are statutorily imposed, General and Special charges would provide only a small addition to current income. The Authority has, therefore, decided that, in view of the high adminstrative costs, such charges would not be justified at present.

4 Grant Aid to the National Rivers Authority

(a) Section 90 of the Land Drainage Act 1976 (as amended by the Water Act 1989) enables grants to be paid by the Ministry of Agriculture, Fisheries and Food in respect of approved land drainage schemes for the improvement of existing works or the construction of new works. In the Severn-Trent Region grant is currently paid at 15% of qualifying expenditure. A supplement of 20% may also be payable for tidal defence schemes.

(b) Grants are available under Section 92 of the Land Drainage Act 1976 (as amended by the Water Act 1989) for providing apparatus for carrying out engineering operations for the installation of flood warning systems.

5 Grant Aid to Local Authorities and Internal Drainage Boards

By virtue of Section 91, Land Drainage Act 1976 (as amended by the Water Act 1989) grants are payable by the Ministry of Agriculture, Fisheries and Food to Internal Drainage Boards and County, Metropolitan and District Councils in respect of expenditure incurred on drainage schemes carried out under Sections 17, 22, 98, 99

and 100 of the Land Drainage Act 1976 (as amended by the Water Act 1989). Such grants are available in respect of expenditure on approved land drainage schemes for the improvement of existing works and for the construction of new works, and, in the case of Internal Drainage Boards, on works (other than routine maintenance) on the rebuilding or repair of any bridge maintained by a Board.

The Authority must be consulted, as required by Section 98(8) of the Land Drainage Act 1976 (as amended by the Water Act 1989), before such schemes are submitted to the Ministry.

Grant aid is currently payable up to a maximum of 26% of the cost of the scheme for Internal Drainage Boards and Local Authorities. A supplement of 20% may also be payable for tidal defence schemes.

6 European Regional Development Fund

Certain areas within the region, principally the West Midlands, have been designated as intermediate areas and schemes which are designed to serve those areas by the provision of infrastructure for industry/commerce may be eligible for grant aid from the European Regional Development Fund.

APPENDIX A6

CONSERVATION

1 **CONSERVATION DUTIES UNDER THE WATER ACT 1989**

The following excerpts from the Water Act 1989 define the NRA's statutory conservation duties, as relating to flood defence/land drainage operations.

8. (1) It shall be the duty of each of the following, that is to say, the Secretary of State, the Minister, the Director and every relevant body, in formulating or considering any proposals relating to the functions of any relevant body or, as the case may be, that body:-

a) so far as may be consistent with the purposes of any enactment relating to the functions of that body and, in the case of the Secretary of State and the Director, with their duties under section 7 above, so to exercise any power conferred on him or it with respect to the proposals as to further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological and physiographical features of special interest;

b) to have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural or historic interest; and

c) to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora, fauna, features, buildings, sites or objects.

(2) Subject to subsection (1) above, it shall be the duty of each of the following, that is to say, the Secretary of State, the Minister, the Director and every relevant body, in formulating or considering any proposals relating to the functions of a relevant body or, as the case may be, that body:-

a) to have regard to the desirability of preserving for the public any freedom of access to areas of woodland, mountains, moor, heath, down, cliff or foreshore and other places of natural beauty;

b) to have regard to the desirability of maintaining the availability to the public of any facility for visiting or inspecting any building, site or object of archaeological, architectural or historic interest; and

c) to take into account any effect which the proposals would have on any such freedom of access or on the availability of any such facility.

9. (1) Where the Nature Conservancy Council are of the opinion that any area of land:-

a) is of special interest by reason of its flora, fauna or geological or physiographical features; and

b) may at any time be affected by schemes, works, operations or activities of a relevant body or by an authorisation given by the Authority,

the Council shall notify the fact that the land is of special interest for that reason to every relevant body whose works, operations or activities may affect the land or, as the case may be, to the Authority.

(2) Where a National Park authority or the Broads Authority is of the opinion that any area of land in a National Park or in the Broads:-

a) is land in relation to which the matters for the purposes of which section 8 above has effect are of particular importance; and

b) may at any time be affected by schemes, works, operations or activities of a relevant body or by an authorisation given by the Authority, the National Park authority or Broads Authority shall notify the fact that land is such land, and the reasons why those matters are of particular importance in relation to the land, to every relevant body whose works, operations or activities may affect the land or, as the case may be, to the Authority.

(3) Where a relevant body has received a notification under subsection (1) or (2) above with respect to any land, that body shall consult the notifying body before carrying out, or (in the case of the Authority) carrying out or authorising, any works, operations or activities which appear to that relevant body to be likely:-

a) to destroy or damage any of the flora, fauna, or geological or physiographical features by reason of which the land is of special interest; or

b) significantly to prejudice anything the importance of which is one of the reasons why the matters mentioned in subsection (2) above are of particular importance in relation to that land.

(4) Subsection (3) above shall not apply in relation to anything done in an emergency where particulars of what is done and of the emergency are notified to the Nature Conservancy Council, the National Park authority in question or, as the case may be, the Broads Authority as soon as practicable after that thing is done.

2 RELEVANT FUNCTIONS OF THE NATURE CONSERVANCY COUNCIL

1 The Nature Conservancy Council was established by the Nature Conservancy Council Act 1973 for the purposes of nature conservation and fostering the understanding thereof. The major functions prescribed by the Act are:-

i) the establishment, maintenance and management of nature reserves in Great Britain;

ii) the provision of advice to Ministers on the development and implementation of policies for or affecting nature conservation in Great Britain;

iii) the provision of advice and dissemination of knowledge about nature conservation;

iv) the commissioning or support of relevant research.

2 The NCC also inherited a number of powers and duties formerly exercised by the Nature Conservancy among which are:-

i) a duty to notify land of special interest (SSSIs) to local planning authorities (Section 23 of the National Park and Access to the Countryside Act 1949 now superseded by Section 28 of the Wildlife and Countryside Act 1981 - see below);

ii) power to enter into agreements to conserve SSSIs (Section 15 of the Countryside Act 1968);

iii) powers of entry for survey in connection with acquisition of land (Section 108 of the 1949 Act).

3 The Town and Country Planning General Development Order 1977 obliges local planning authorities to consult the NCC before granting planning permission for development in an SSSI.

4 The Wildlife and Countryside Act 1981 placed a number of additional duties on the NCC, some of which replace similar duties in earlier legislation, including:

i) duty to notify internal drainage boards and the NRA of land of special interest and to advise those bodies when consulted on their proposals affecting such sites. (Section 48);

ii) duty to notify land of special interest (SSSIs) not only to local planning authorities but also to every owner or occupier and to the Secretary of State, specifying the nature of the scientific interest and any operations likely to damage the interest (Section 28);

iii) duty to offer a management agreement where the NCC has objected to a farm capital grant and it is subsequently refused by agriculture ministers on nature conservation grounds (Section 32).

3 RELEVANT FUNCTIONS OF COUNTRYSIDE COMMISSION

1 Under Section 2 of the Countryside Act 1968, the Countryside Commission has the statutory duty of keeping under review all matters relating to the provision and improvement of facilities for the enjoyment of the countryside, the conservation and enhancement of the natural beauty and amenity of the countryside, and the need to secure public access to the countryside for the purposes of open-air recreation. It is required to consult with such local planning authorities and other bodies as appear to the Commission to have an interest in those matters, and to encourage, assist, concert or promote the implementation of any proposals with respect to those matters made by any person or body, being proposals which the Commission consider to be suitable. The Commission is also required to advise any Minister having functions under the Countryside Act 1968, or any other Minister or any public body, on such matters relating to the countryside as he or they may refer to the Commission, or as the Commission may think fit.

2 Under Section 9 of the Local Government Act, 1974, the Commission, in accordance with arrangements approved by the Secretary of State and the Treasury, may give financial assistance by way of grant or loan, to any person in respect of expenditure incurred by him in doing anything which, in the opinion of the Commission, is conducive to the attainment of any of the purposes of the Countryside Act 1968 or the National Parks and Access to the Countryside Act 1949.

NRA

National Rivers Authority
Severn-Trent Region