

ENVIRONMENTAL PROTECTION



National Rivers Authority

South West Region

CATCHMENT INVENTORIES: A SUMMARY REPORT

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Author: A. M. Burrows

GORDON H BIELBY BSc
Regional General Manager

C V M Davies
Environmental Protection
Manager

CATCHMENT INVENTORIES: A SUMMARY REPORT

A.M.BURROWS
Assistant Catchment Planner
Freshwater Investigations Team
NRA South West Region
Manley House
Exeter
FWI/90/005



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1.0 EXECUTIVE SUMMARY

The House of Commons Select Committee made recommendations that detailed inventories of hazardous chemicals be undertaken as soon as possible with the objective of setting up a National Emergency Centre. These recommendations were supported by the Government, since implementation of protection zones would improve protection of water use, in particular potable water abstractions and provide a consistent approach to catchment management.

The control of chemical storage and prescribed practices, by regulations, under COPA S31(4) & (5) were replaced by clauses 111 and 112 of the 1989 Water Act. They reinforce the requirement to undertake site inspections for the reasons of determining risks and potential pollution problems, by using agreed powers for information and entry, to assist in the control of hazardous chemicals, especially within zones of a particularly sensitive or vulnerable nature.

To determine risks and prevent pollution, a pilot catchment inventory was undertaken by the Freshwater Investigations Team (FWIT), of the Upper River Fowey Catchment (15B) from its source at Buttern Hill (SX 172 813) to the tidal limit at Lostwithiel (SX 106 598) (Fig 1). This included:

- i) inventories of hazardous chemicals;
- ii) farm campaign data;
- iii) times of travel for a range of flows;
- iv) risk assessment; and
- v) the development of a relational database system using ORACLE.

A total number of 200 sites have been recorded on the database, although the number of sites visited exceeded 200. The recorded sites consisted of 117 farms, 15 industrial premises, 5 SWW PLC sewage treatment works (STWs), 1 water treatment works (WTWs), 5 timber supplies/treatment plants, 15 other miscellaneous premises and 42 bridging points for the A38(T) and A30(T) roads and railway.

Manpower requirements totalled 118 days, with the greatest percentage of time being taken up by site visits.

The risk posed to Restormel and Trekievesteps intake from a possible pollution event is high. Times of travel for low flow conditions (DMF = 0.55 cumecs at Restormel) only totalled 24hrs 24mins from Palmersbridge (SX 193 776) to the intake at Restormel WTWs. A chemical spillage along the A38(T) would give even less time before the Restormel intake had to be closed.

Implications to SWW plc include the consideration of bank side storage for a maximum of 7 days, as recommended by the DoE. Further investigations should also be considered with regards to the ECC Park Plant to Moorswater clay line; times of travel for med and high flows; road and rail freight; and drainage into Colliford Lake from the A30(T) road.

2.0 INTRODUCTION

2.1 Requirements for Catchment Inventories

Catchment inventories requires information to be collected on hazardous chemicals stored in a catchment. This involves visits to all sites considered to pose a potential risk to the river system, but especially potable water abstractions. It requires that the information should be made readily available to aid the control of pollution should an incident occur and for aiding Catchment Management Policy (CMP).

2.2 Constitution of Catchment Inventories

The study was initially conceived to encompass the following categories:

Site Inventories

The constitution of catchment inventories was decided by the FWIT and the Pollution sections. Essentially, it was agreed that the inventory should contain information pertaining to all hazardous chemicals stored or used regularly at a site, its drainage, treatments, names, addresses and telephone numbers of contacts, discharges, consent conditions and farm campaign data. (This information is specified within the Data Dictionary (Appendix 1).)

Sites targeted for study included farms, industries, STWs, WIWs, British Rail, Cornwall Highways and other miscellaneous premises. Bridging points for the railway and the A30 and A38 trunk roads were also identified to establish where pollutants may enter the river system.

Risk Assessment

Certain sites because of their proximity to the river; their distance from potable water supply abstractions; their chemical storage capacity; and their treatments of certain chemicals, may pose a greater potential risk to the river water quality and ultimately the abstraction points. All sites were assigned a risk factor of between 1 (low) and 5 (high), reflecting each sites pollution potential.

Database Developments

With the help of the SWNRA Data and Information and outside contracted labour from Exeter University, a database was developed to store all of the information collected, so that it can be made readily available should a pollution incident occur or if general information concerning the catchment is required.

Times of Travel

Times of travel for low, medium and high flow conditions were indicated as being important information to be included within the inventory. Times of travel for low flow have been calculated by the FWIT, but as yet extreme meteorological events have delayed further studies for medium and high

flows. This report will be written by the Investigations Officer.

3.0 POWEY PILOT STUDY

3.1 Requirement for the Pilot Study

Agreement was reached between the Pollution Inspectorate and the FWIT that the FWIT would develop a system for catchment inventories, which they would test on a catchment and present to the Pollution Section, who would develop and use the system from then on. This included the development of a questionnaire; the development of the database; instructions on the use of the database; and manpower requirements.

3.2 Selection of the Fowey Catchment (Fig 2)

The River Fowey Catchment (15B) was selected for study by the SWNRA's Pollution and Freshwater Investigation Sections, primarily because of its particularly sensitive public water supply abstraction at Restormel WTWs (SX 097 626) with its relatively short storage capacity of 4 hours, which serves a population of approximately 220,000 and the intake at Trekievesteps (SX 227 698), supplying St Cleer WTWs. Secondary, was its value as a sport fishery, especially since it has a designated EQO for supporting Salmonid fish. A final consideration was its value as a public amenity, as many angling clubs have rights of access to the river for game fishing.

3.3 Catchment Characteristics

Catchment Area

The Upper Fowey Catchment drains an area of 256km². Rising in the north on Bodmin Moor, which receives an annual rainfall average of between 1600 and 1800mm, the Fowey then flows in a southerly direction towards Redgate where upon it changes directions and flows in a westerly direction onto Bodmin paralleling the A38 for much of its length. At Bodmin Road Bridge (SX 112 644) it begins to flow south entering the Fowey Estuary at its freshwater limit at Lostwithiel Bridge (SX 106 598).

Geology, Pedology and Land-use (Fig 3)

Land-use in the catchment is affected by the geology and overlying pedology of the area. In the north of the catchment, the geology consists of a granite intrusion, which is overlain by peaty soils. It's this area which is dominated by beef and sheep farming of low intensity and mineral extraction for china clay.

The southern half of the catchment, away from Bodmin Moor, is underlain by Brown Earths and Devonian geology. It is well drained and is associated with dairy and arable farming and small nurseries growing mainly herbaceous plants and flowers.

Both the northern and southern halves of the catchment are also used for forestry, especially the middle reaches of the Fowey between Doublebois and

Lanhydrock. A number of other areas are designated SSSIs.

Infrastructure (Fig 4)

The A30(T) to the north and the A38(T) to the south are the main roads which pass through the catchment and generally define its upper and lower boundaries respectively. The A30(T) runs perpendicular to the river system, whereas the A38 runs parallel to the River Fowey between Doublebois and Bodmin Road Bridge.

The main British Rail line between London Paddington and Penzance runs to the south of the catchment along the left bank of the River Fowey, posing a potential risk to the river system.

Water Quality

Routine monitoring of the River Fowey and its tributaries have shown achievement of their RQOs of 1B for the years 1984 to 1988 inclusive. Certain stretches of the Fowey and its tributaries have a water quality superior to their RQOs (Table 1), indicating its value as a potable supply and salmonid fishery.

3.4 Sources of Information

Initial contact was made through Peter Collett (formerly Pollution Control Planner, West), who identified a number of sites within the Fowey catchment which required inventories to be undertaken (Table 2). Other sources of information included:

- Aerial video
- Aerial photographs
- Yellow pages telephone directory
- O.S. maps
- Cornwall Business Directory
- MAFF
- NFU
- Local knowledge
- Cornwall Highways Department
- Cornish Place Names Directory
- NRA wardens
- Duchy of Cornwall
- English China Clays

The majority of the information came from using the OS maps and Yellow Pages. These two sources accounted for approximately 70% of the names and addresses identified.

3.5 Collecting and Recording the Information (Appendix 2)

Data was collected by visiting each site individually, after initial contact was made via the phone, establishing the nature of the premises.

The information was recorded on questionnaires designed especially for catchment inventories, by the Assistant Catchment Planner, using 'FREELANCE', a IBM micro based drawing package.

The questionnaires were developed to be used on all varieties of premises to allow for easy data collection and transferal onto the database. The questionnaires consist of a general site form for collecting information on addresses, activity, drainage and comments; a chemical form for use with individual chemicals; and a treatment form to record the types of treatment, consent conditions and discharge points.

3.6 Times of Travel

Times of travel were required for low, medium and high flow conditions, for the Fowey River system (15B). Unfortunately, only low flow data was collected due to the extreme meteorological conditions experienced during 1989. Flow conditions were as follows:

<u>River</u>	<u>Gauging Station</u>	<u>NGR</u>	<u>Average DMF*</u>
Fowey	Restormel	SX 098 624	0.55 cumecs
Warleggan	Trengoffe	SX 159 674	0.139 cumecs
St Neot	Craigshill Wood	SX 184 662	0.68 cumecs

* Average DMF =
$$\frac{\text{DMF}}{\text{nos. of days taken to do time travel survey}}$$

Reaches boundaries were governed by their physical characteristics ie. abstraction points, discharges, weirs, turbulent zones and river confluences. These were identified on a 1:25,000 map and were used to determine the river reaches to be investigated as part of the time and travel survey.

Travel times for reach lengths were determined by using either rhodamine dye or orange run tests. The latter approach was adopted along sensitive stretches used for FWS.

3.6.1 Times of Travel Results

A summary of travel times for low flow conditions for selected stretches are shown in Table 3. A full report has been written by the Investigations Officer, and will be made available when completed.

Figure 5 shows the times of travel from specific key points along the river system respectively to Restormel WTWs.

4.0 USE OF CATCHMENT INVENTORY DATABASE

4.1 Database Development Aims and Objectives

The specification (19/4/89) given to Exeter University was as follows:

- i) to provide advise on all aspects of data processing for the study;
- ii) to take account of the SWNRA requirement for a Geographical Information System (GIS) when providing advice on data collection and when specifying, designing, programming and implementing data processing systems;
- iii) to design, program and implement a system to process catchment inventory data based on an IBM personal computer using a relational database ORACLE;
- iv) to consider the future use of the system including:
 - a) the portability of the software from a single-user PS/2 DOS to a multi-user DEC-VAX operating environment, and
 - b) the provision of an interface, possibly to the existing GMP river mapping software package, for the generation of hydrological references;
- v) to provide a short training course, for a maximum of 6 SWNRA staff, on the use and the maintenance of the system;
- vi) to provide maintenance of the software; and
- vii) to provide sections i) to vi) inclusive for the use with a single river catchment;

The objective was to develop a system for holding and manipulating detailed information pertaining to catchment inventories, to be used on any future catchment that may be studied by the Pollution Inspectorate.

The ORACLE database was written with the objective of allowing general information to be made available to all SWNRA staff, updating to take place and inputting of new data to be undertaken. With this in mind, the database for catchment inventories has be written to allow different levels of access.

4.2 Data Manipulation (Appendix 3)

There are two routes which can be followed within the database. These are accessed by going through the POLLUTION or the POLL UPDATE menus. The former allows the user limited access to the database i.e. QUERY mode only. The latter allows all three levels of access, INPUT, UPDATE and QUERY. Query allows the user to view the information held on the database but does not allow the user to change, delete or add to it. Access to the INPUT and UPDATE modes, where the data can be altered, will only be allowed if the correct username and password are entered (ie. similar to the TP system on

the DEC).

4.3 Reports Available (Appendix 4)

Once the data has been stored and validated on the database, it can then be manipulated to produce specific reports. These can be produced by either:

- i) running pre written REPORT programs, via the POLLUTION menu by selecting:

Site	- summary of site information
Chemical	- summary of chemicals for a given site
Treatment	- summary of treatments for a given site
Chem Locs	- report on sites storing a specific chemical
Farm	- activity and livestock for a given site

- ii) by writing specific REPORT programs eg. slurry.prg, which may produce a list of all farms with metal slurry stores > 100,000 gals, which are built above ground, via the POLL_UPDATE menu.

Alternatively, data can be accessed by using the QUERY mode within the POLLUTION menu. This will pull all the information, with respect to the form accessed, from the database and display it on the screen, similar to the screens used for entering the data.

All the REPORT programs are written in SQL*PLUS a programming language used for use with the ORACLE database. User manuals for SQL*PLUS can be obtained from Data & Information.

4.4 Geographical Mapping Package

All data pertaining to a site can be plotted on a map using the Geographical Information Package, as long as each site can be linked to a grid reference. Examples of the maps can be seen in appendix 4.

4.5 Risk Assessment

Subjective assessments were made of the potential risk posed to the river system for each site visited. A score was given between 1 (low risk) to 5 (high risk) and was dependant on a number of interrelated determinants. The determinants included:

- volume of chemicals stored (including slurry, fuel, pesticides, herbicides, etc);
- type of storage for chemicals;
- treatment for chemicals;
- drainage from site;
- distance of site from watercourse; and
- distance from Restormel or Trekievesteps FWS intakes.
- Daily Mean Flow (DMF) conditions.

The risk posed to the river system was then evaluated by assessing each of the above determinants individually and collectively. Unfortunately, a subjective approach was taken, hence the risks for each site are not compatible.

Certain guidelines were followed especially with regards to the containment of slurry. All sites with slurry tanks/lagoons greater than 100,000 gallons above ground were automatically given a risk of 3 or more. The whole length of the A30 and A38 was given a risk of 3 or more because of its capacity to carry large volumes of chemicals along their lengths.

4.6 Expert System using SQL*PLUS

To alleviate the subjectiveness of risk assessment, an 'Expert Systems' approach should be adopted. Expert systems enable experiential knowledge as well as parametric data to be used in the analysis of a problem. By using an expert system specifically written for catchment inventories, it would be possible to objectively assess the potential risk posed by a site to the river system, by using the data collected and stored on the database. Sites could then be continually and automatically reassessed each time new data is collected pertaining to a specific site. The program to calculate risk could be written in SQL*PLUS. This would make the risk assessments between each site and each catchment more compatible.

4.7 Expert systems an aid to policy decision making

Catchment Management policies could be produced in catchments which are identified as having a high risk through the use of an expert system. Expansion of the expert system could incorporate factors of non-compliance, political sensitivity, public awareness, etc. This would highlight the problem catchments and would aid Catchment Management Policy.

4.8 System Backup

Full system backup will be provided by Data & Information, including program faults and general help facilities.

5.0 RESULTS

Farm Campaign

A total of 117 farms were visited as part of catchment inventories, of which 2 were red, 14 green and 101 blue. However, the number of red and green farms may have been higher if it was not for the drought experienced during the survey.

Discharges

A total of 15 consented and 28 non-consented discharges to watercourses were identified, along with 1 consented discharge to sewer from St Merryn Meat, Bodmin.

Chemical Storage

Details on the amounts of chemicals stored in the catchment have calculated by using SQL*PLUS. Total amounts of specific chemicals are as follows:

Liquid slurry (cow and pig)	1,600,000 gallons
Silage liquor	111,512 gallons
Sheep dips	8,280 gallons
Pesticides/herbicides	2,736 gallons
Pesticides/herbicides	12,616 Kg
Fuel (diesel, oil, petrol)	132,275 gallons
Largest slurry store	200,000 gallons
Number of slurry stores	
> 100,000 gallons	4

Largest fuel tank	12,000 gallons
Largest volume at one site (West Country Oils)	43,240 gallons

Number of fuel tanks	
> 500 gallons	55

Number of fuel tanks	
> 1000 gallons	26

Number of different chemicals identified within the catchment	230 (+/- 10%)
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Red list substances have yet to be identified because of the time constraints put on the project. However, the chemicals can be pulled from the database and compared to those held on Ecdin, a database of chemicals in Denmark. Direct links to the database are available through Data & Information.

Suppliers

Major agricultural suppliers within the catchment include:

- Avon Farmers, Liskeard
- Cornwall Farmers, Liskeard
- Monro Horticulture Ltd, Penzance
- North Cornwall Tractors, Liskeard

Major fuel suppliers include:

- West Country Oils, St Austell
- Fuelserv, Bodmin
- Mitchell & Webber Ltd, Falmouth
- Chugg John Oils, Launceston
- Watson Petroleum, Falmouth

Livestock

The Fowey Catchment contains the following numbers of livestock:

Sheep	15,042
Beef cattle	6,804
Dairy cattle	2,108
Followers & sucklers	1,298
Deer	250
Pigs	164

6.0 PROBLEMS ENCOUNTERED

6.1 Sources of Information

The original number of site was underestimated and finding a complete list of farms for a single catchment is very difficult. MAFF were consulted with regards to this information, but unfortunately, their records are parish and not catchment based. A magnetic tape was acquired from MAFF pertaining to the 1984 parish records, but the software and hardware was not available at the SWNRA to enable it to be downloaded into a readable form.

The NFU were consulted in order to provide us with a list of farmers within the Fowey Catchment. Unfortunately, they were reluctant to send information on individuals and stated that not all farmers were members of the NFU.

6.2 Inventory Visits

To avoid unnecessary loss of time when conducting site inventories, visits were arranged by phone. This was especially important for farms, since

- i) some farm buildings had been converted to holiday cottages;
- ii) farm land had been sold of to another farmer;
- iii) some farms were not lived on by the farmer;
- iv) farmers were too busy to assist with the inventory; and
- v) much of the inventory was conducted under drought conditions, which is reflected in the farm campaign data; and
- vi) there was a lot of ignorance as to who and what the NRA is and does.
- vii) many farmers attended livestock markets on a number of days during the week.

The inventory mostly lies with the completion of the farm visits. Industrial sites were much easy to arrange because there were people on site throughout the working day, making the whole process of inventory visits much easier.

6.3 Collecting Chemical Data

The transient use of pesticides and herbicides in the catchment made it difficult to assess the amounts of chemicals used within the study area.

Guidelines on the collection of data should be written to aid the persons involved in catchment inventories to decide what should and should not be included. The recording of chemicals and storage has proved difficult. Some chemicals are far more toxic than others and may pose a risk to the river system even if in small quantities and its the identification of these highly toxic pollutants that poses the problem.

6.4 Time Lost for Inventory Visits

The total number of days made available to the Assistant Catchment Planner (ACP) for Catchment Inventory visits was limited due to the nature of the pilot study. Because the database was being developed in parallel to the collection of the inventory information, field time was lost. The following gives a breakdown for the times the ACP was unavailable for fieldwork:

Time allocated to:	Days Taken Up
Whole Inventory	152
Questionnaire development	5
Meetings	20
Holidays	4
Flexidays	7
Database Developments	16
Data Entry	20
Pollution Investigations	15
Total nos. of days lost	87
Days available for site visits	65

6.5 Questionnaires

Although the questionnaires used were for general use for all sites, they were still difficult to use under certain circumstances, especially when multiple treatments were used on farms.

6.6 Database

Data entry proved a problem, because the database written for catchment inventories had a number of small errors, delaying the imputing process. Such problems could only be corrected by the person who wrote the program, hence the imputing stage was a major time consumer.

6.6.1 Validation

At present there appears to be no easy way of validating the data that has been input. Although the database has a number of logical instructions to avoid any serious errors being entered, there have been occasions when data has been entered incorrectly. This depends to a certain extent on the knowledge the person has about catchment inventories. Serious errors on the questionnaires should be identified by the user.

6.7 Updating the Database

This will prove to be the greatest problem, since all sites will have to be continually updated to effectively operate CMP. To achieve this, it will be necessary to produce a small form which can be automatically sent out to all addresses after a certain preset time period has elapsed since the last inventory visit. This could be achieved by producing a report via the POLLUTION menu, which corresponds to the site in need of updating.

Updating the information stored on the database could be achieved by linking the data, held within the database pertaining to the first visit, to a pre-written program (in SQL*PLUS), which will automatically prompt the user to send out a letter to the site owner, each time the database is accessed.

The data received from the owner will only prove useful if:

- a) the form sent out is not too complicated;
- b) the owner is honest enough to write down all details;
- c) the information provided by the owner is in an imputable format, to be used with the database.

The report summaries accessed via the POLLUTION menu could be used as a means of updating the database. By sending these forms out to the sites, the relevant person could change the information on the forms.

7.0 CONCLUSIONS

The Fowey Catchment offered a good introduction to catchment inventories because of its simplistic nature.

A number of high risk areas were identified. These included the bridging points along the A30(T) and A38(T) roads and railway line; the Park Plant to Moorswater clay pipe line; the oil storage depot at Doublebois; and a number of dairy farms with slurry lagoons > 100,000 gallons above ground level. All site pose a potential risk to Restormel and Trekievesteps intake, especially since travel times under low flow conditions are relatively fast. The extent of the risk under medium and high flow conditions has yet to be determined, but will inevitably increase the risk to both intakes.

Farming activity within the catchment can be divided into predominantly beef and sheep farming in the north, on Bodmin Moor and dairy farming along the lower reaches of the river. It is unfortunate that more intensive farming appears to take place closes to the intake at Restormel coupled with timber treatment.

8.0 RECOMMENDATIONS and ACTIONS

1. Its of chemicals stored within the catchment will be passed to the Tidal Waters Offficer to be examined for presence of 'Red List' substances.

- Action by Water Quality Planner
2. All 32 NRA SW catchments should be studied as part of catchment inventories. Priority should be given to those catchments identified a having a particularly sensitive and vulnerable nature.
3. Catchments for inventory assessment should not be to large; they should be divided into smaller manageable areas, allowing a more structured approached to be adopted. They should also be chosen, so that travelling time is reduced to a minimum, thus making optimum resources. Preference should be given to assigning local staff to undertake these assessments.
4. Prior to an inventory, firm commitments should be made with regards to manpower allocations from other sections. This will allow for a more accurate assessment of the time to undertake a study, allowing deadlines to be met.

- Action by Pollution Controller
5. One person should be responsible for managing the database to validate and verify the data.

- Action by Pollution Controller

6. Staff undertaking inventory work should be familiar with and understand the relevant practices required for the storage and handling of hazardous chemicals.
7. The forms used for recording the information should be easy to complete. They should not be too complicated, yet they should be capable of recording the information accurately, and in a manner that is easily transferable to the database. The existing forms are a good basis for commencement.
 - Action by Water Quality Planner
8. Formal letters and actions required for improvements should follow up any site found to pose a risk to the river water quality and its designated uses.
 - Action by Pollution Controller
9. A consistent approach to planning should be adopted.
 - Action by Pollution Controller
10. Provision for acquiring the software and hardware to unload the MAFF parish records should be investigated. This would decrease the time used on finding sources of information, especially as all land owned over 3 hectares is covered on this register.
 - Action by Water Quality Planner
11. The database should be made a multi-user area, with 3 levels of access, to allow optimum use of the database and its contents. Links to a GIS should be considered.
 - Action by Water Quality Planner
12. The attention of SWWS Ltd should be drawn to the vulnerability of its intake from the close proximity of several large slurry stores, the A30(T) and A38(T) roads and railway bridging points across the River Fowey and the position of a large oil depot at Doublebois.
 - Action by Pollution Controller
13. The NRA should investigate the possible pollution risk from the A30 and A38 roads, the clay pipe line from Park Plant to Moorswater Industrial Estate and the possible risk to Colliford Lake from a chemical spillage along the A30.
 - Action by Pollution Controller

14. All PIs should be made familiar with the database in case details are required in an emergency.
- Action by Pollution Controller and Water Quality Planner
15. All aspects of catchment inventories should be taken from the Freshwater Investigations Team and handed over to the appropriate section as soon as possible, in order to begin inventories on other catchments with the region.
- Action by Pollution Controller and Water Quality Planner
16. An expert system approach to risk assessment should be developed to evaluate the possible adoption of a protection zone.
- Action by Pollution Controller and Water Quality Planner
17. The Pollution Inspectorate should decide if the Fowey is to be subjected to zone control policies and what these policies should be.
- Action by Pollution Controller

FIGURES

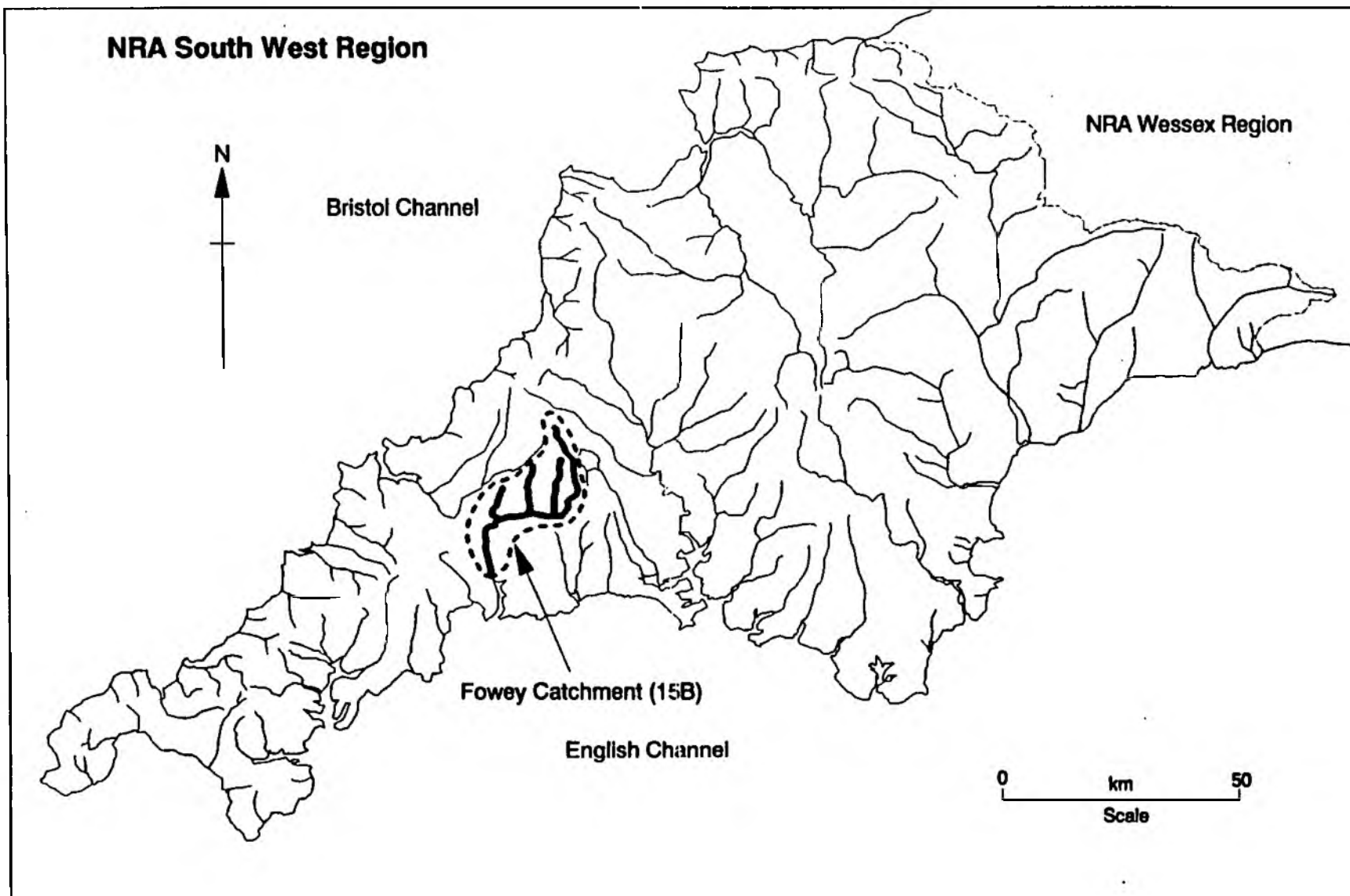


Fig. 1. Location of the Fowey Catchment (15B)

Fig. 2. Major Abstractions and Discharges

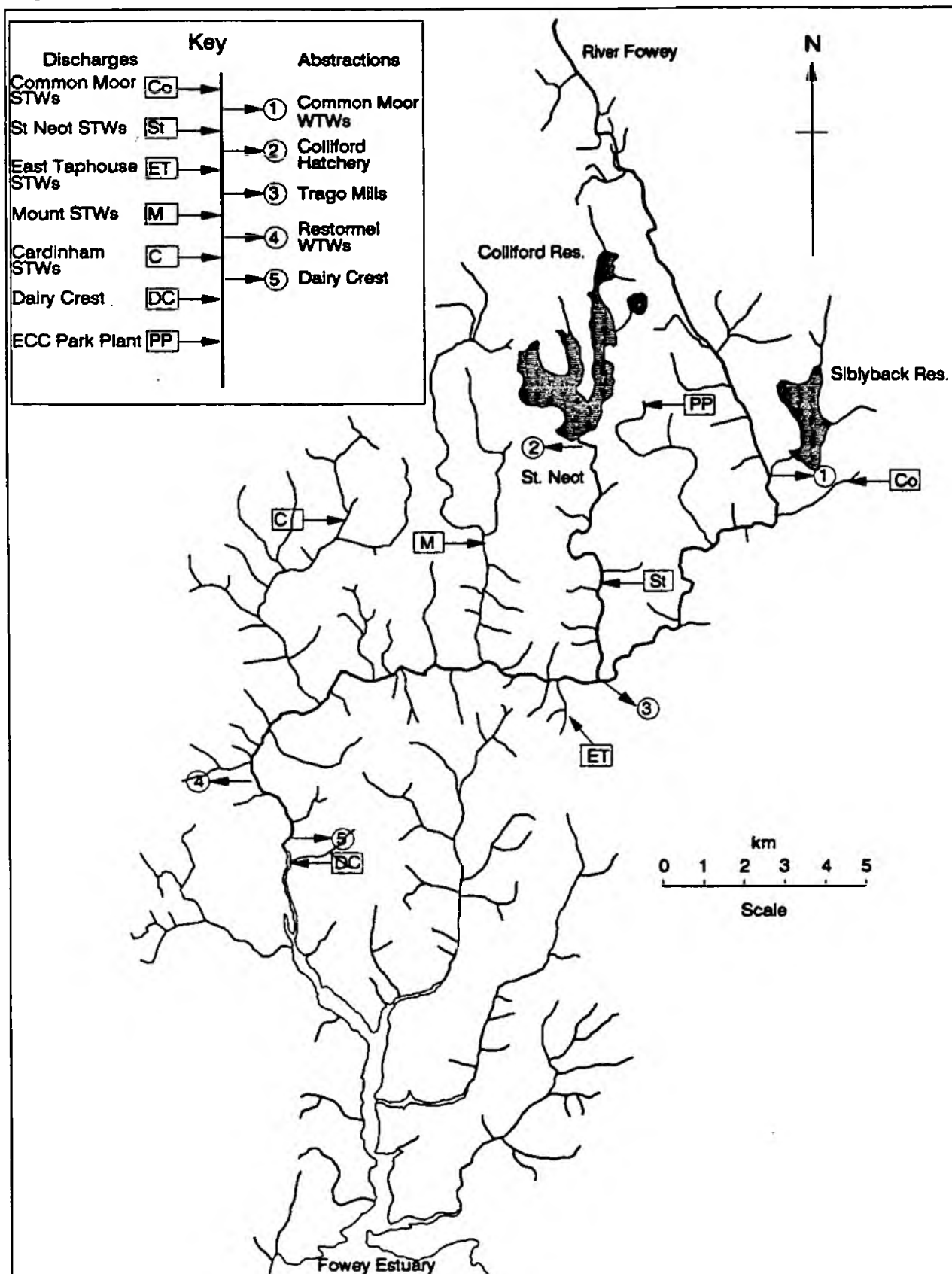


Fig. 3. Geology, Land Use and Pedology

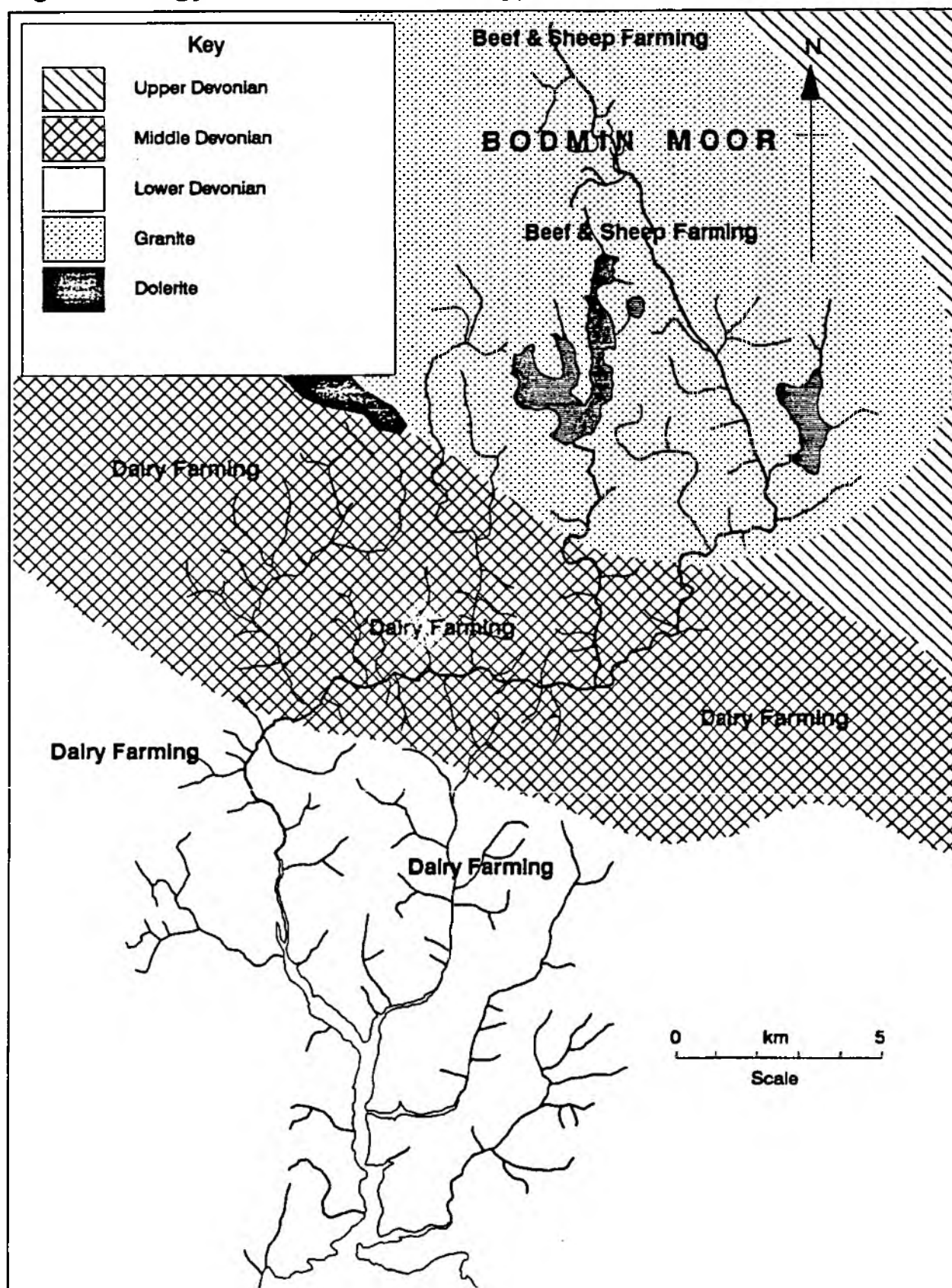


Fig. 4. Infrastructure

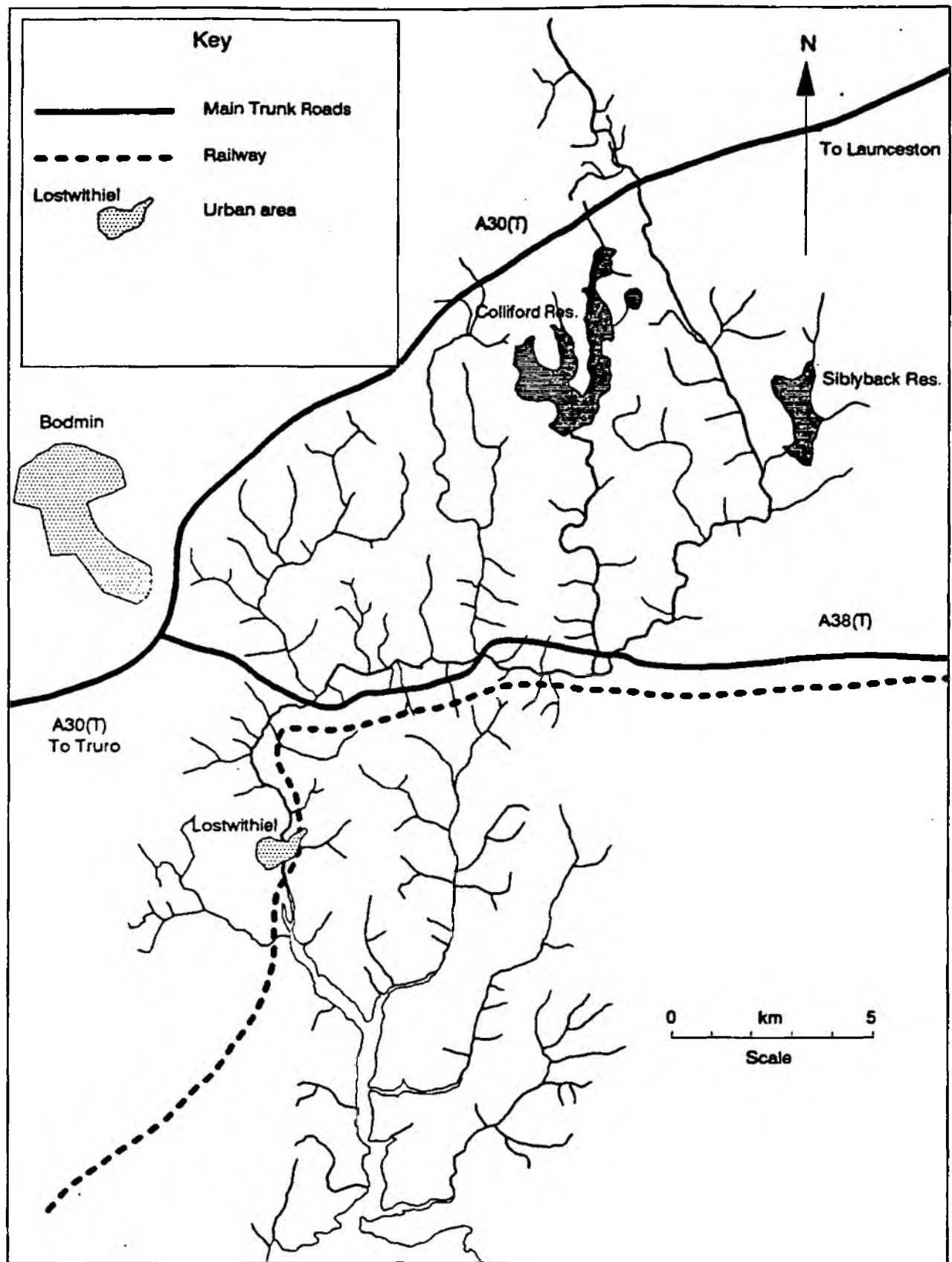
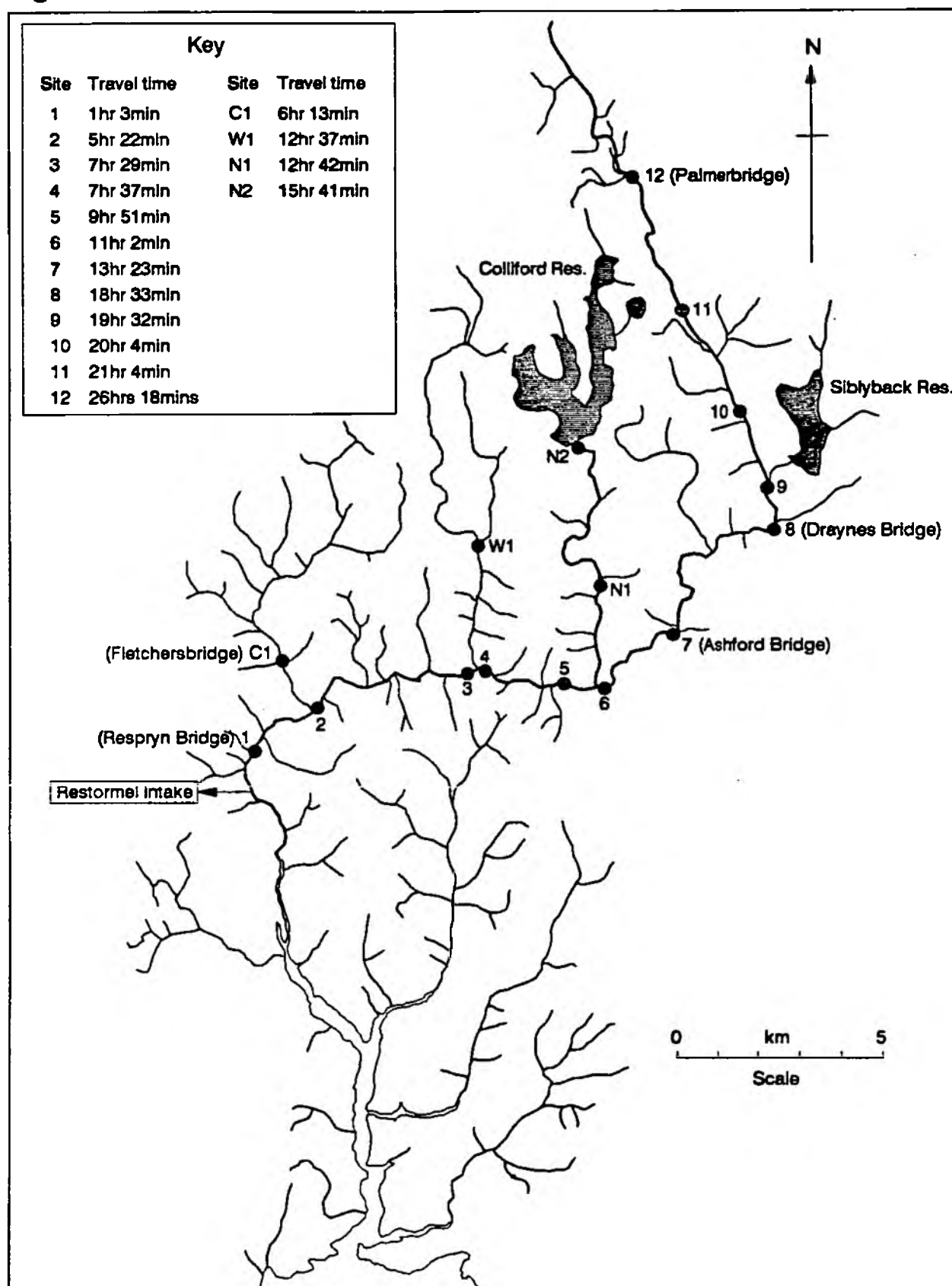


Fig. 5. Times of travel from Restormel Water Treatment Works



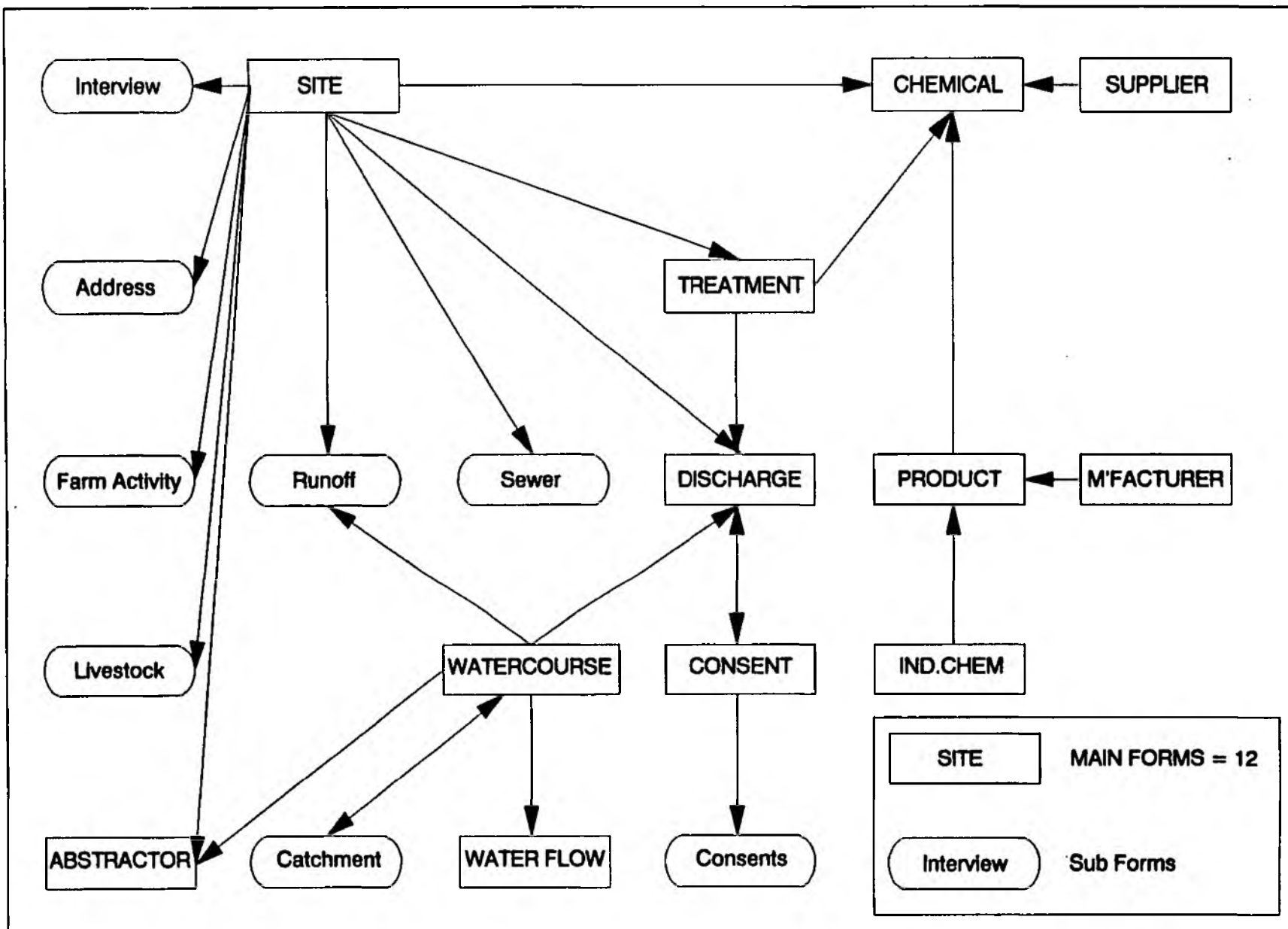


Fig. 6. Relational diagram for entry forms

TABLES

Table 1 Fowey Catchment (15B) Years Exceeding RQOs

<u>River Fowey</u>	<u>N.G.R.</u>	<u>RQ YEARS EXCEEDING RQO</u>
Restormel	SX 108 613	1A 1985 1986 1987 1988
Bodmin Road Bridge	SX 111 644	1A 1985 1986 1987 1988
Bodithiel Bridge	SX 176 648	1A 1985
Treverbyn Bridge	SX 206 674	1A 1985 1986 1987
Draynes Bridge	SX 228 689	1A 1985 1987
Lamelgate	SX 223 708	1A 1985 1986
Harrowbridge	SX 207 744	1A 1985 1986 1987 1988
<u>River Warleggan</u>		
Panter's Bridge	SX 159 680	1A 1985 1986 1987 1988
<u>St Neot River</u>		
Twowatersfoot	SX 185 649	1A 1985 1986
Trevenna	SX 183 687	1A 1986 1987 1988
<u>Trenant Stream</u>		
Trenant Bridge	SX 209 683	1A 1986 1987 1988
Wortha Trenant Stream	SX 206 698	1A 1986 1987 1988
<u>Siblyback Stream</u>		
Trekievesteps Bridge	SX 228 699	1A 1985 1987

The RQO for the Fowey Catchment (15B) is class 1B.

Table 2 Information from P. Collett (Pollution Control Planner West)

SWWA Sewage Treatment Works	-	5
Private Sewage Treatment Works	-	0
Fish Farms	-	2
Industrial Premises with consented discharges	-	5
Estimated number of Farms	-	80
Industrial Units without consented discharges	-	30
Timber Treatment Plants	-	2
Retail Shopping Centres	-	1
Water Treatment Works	-	1
Dam & Pump Works	-	3
Airport	-	1
Riding Stables	-	3
Motor Garages	-	1
Oil Storage Depot	-	1
Holiday & Tourist Centres	-	4
<hr/>		
Total Number of Sites	-	139

Table 3 Times of Travel for Selected Stretches for Low Flow Conditions

<u>River</u>	<u>From Site</u>	<u>To Site</u>	<u>DMF*</u>	<u>Time hr/mins</u>
Fowey	Palmersbridge A30 (SX 193 776)	Restormel Bridge (SX 107 605)	0.55	29hrs 30mins
Fowey	Palmersbridge A30 (SX 193 776)	Trekievesteps (SX 225 701)	0.55	6hrs 41mins
St Neot	Colliford Lake (SX 182 707)	250m upstream of Fowey (SX 185 645)	0.68	4hrs 39mins
Cardinham Water	Fletchersbridge (SX 104 658)	Confluence with Fowey (SX 112 644)	no data	3hrs 10mins
Warleggan	Panthersbridge (SX 159 680)	Confluence with Fowey (SX 155 656)	0.139	4hrs 35mins

* DMF is the average DMF for the time of travel survey in cumecs.

APPENDICES

Appendix 1

The Data Dictionary

TNAME	CNAME	COLTYP	WIDTH	NULLS
ADDRESS	REFERENCE	CHAR	12	NOT NULL
	NAME	CHAR	20	NOT NULL
	TOWN	CHAR	20	NOT NULL
	POSTCODE	CHAR	10	NULL
	TEL_NO_NOS	NUMBER	10	NULL
	TEL_NO_EXTN	NUMBER	6	NULL
	TEL_NO_STD	NUMBER	10	NULL
	COUNTY	CHAR	10	NULL
	ADDRESS	CHAR	100	NOT NULL
	ROLE	CHAR	7	NOT NULL
CATCHMENT	NAME	CHAR	30	NULL
	NUMBER_CODE	CHAR	10	NULL
	TYPE	CHAR	30	NULL
CHEMICAL_PRODUCT	CAS	CHAR	15	NOT NULL
	MANUFACTURER_ID	CHAR	10	NULL
	TRADE_NAME	CHAR	30	NOT NULL
CHEMICAL_STORE	SITE_REFERENCE	CHAR	12	NOT NULL
	CHEMICAL_TYPE	CHAR	30	NOT NULL
	UNIT	CHAR	4	NULL
	LAGOON_TYPE	CHAR	15	NULL
	LINING_TYPE	CHAR	15	NULL
	ABOVE_GROUND	CHAR	1	NULL
	QTY_UNBUNDLED	NUMBER	9	NULL
	PERCENT_UNBUNDLED	NUMBER	3	NULL
	CONTAINER_COUNT	NUMBER	3	NULL
	PLANT_NUMBER	NUMBER	2	NULL
	TREATED	CHAR	1	NULL
	BUNDLING_TYPE	CHAR	15	NULL
	CONTAINER_TYPE	CHAR	15	NULL
	SUPPLIER_ID	CHAR	10	NULL
	PHYSICAL_STATE	CHAR	1	NULL
	MAX_QTY	NUMBER	9	NULL
	TRADE_NAME	CHAR	30	NULL
CHEM_SITES (VIEW)	REFERENCE	CHAR	12	NULL
	COMMENTS	CHAR	200	NULL
	TRADE	CHAR	30	NULL
	NGR	CHAR	12	NULL
	NAME	CHAR	40	NULL

TNAME	CNAME	COLTYP	WIDTH	NULLS
CONSENT	CONSENT_NUMBER	CHAR	15	NOT NULL
	SITE_REFERENCE	CHAR	12	NULL
	VOLUME	NUMBER	10	NULL
..				
CONSENT_DETAIL	CONSENT_NUMBER	CHAR	15	NOT NULL
	UNIT	CHAR	5	NULL
	CONCENTRATION	NUMBER	8	NULL
CONSENT_DETAIL	STANDARD	CHAR	10	NULL
DISCHARGE	SITE_REFERENCE	CHAR	12	NULL
	CONSENT_NUMBER	CHAR	15	NULL
	HR_STW_SOAK	CHAR	50	NULL
	PLANT_NUMBER	NUMBER	2	NULL
	NGR	CHAR	12	NULL
	URN	CHAR	12	NULL
	CONSENTED	CHAR	1	NULL
FARM_ACTIVITY	REFERENCE	CHAR	12	NOT NULL
	ACTIVITY	CHAR	15	NULL
FARM_LIVESTOCK	REFERENCE	CHAR	12	NOT NULL
	NOS_ANIMALS	NUMBER	6	NULL
	ANIMAL	CHAR	15	NOT NULL
INDUSTRIAL_CHEMICAL	NAME	CHAR	30	NOT NULL
	CAS	CHAR	15	NOT NULL
	MELTING_POINT	NUMBER	8	NULL
	COMMENTS	CHAR	200	NULL
	TOXICITY_OTHERS	CHAR	200	NULL
	SNARL_1DAY	NUMBER	10	NULL
	SNARL_3DAY	NUMBER	10	NULL
	SNARL_5DAY	NUMBER	10	NULL
	SNARL_TASTE	NUMBER	10	NULL
	SOLUBILITY	CHAR	100	NULL
	SPECIFIC_GRAVITY	NUMBER	7	NULL
	MOLECULAR_WEIGHT	NUMBER	7	NULL
	BOILING_POINT	NUMBER	8	NULL
	BREAKDOWN_PRODUCTS	CHAR	200	NULL
	SNARL_ODOUR	NUMBER	10	NULL
	TOXICITY_MAMMALS	CHAR	200	NULL
	TOXICITY_FISH	CHAR	200	NULL
	TOXICITY_BIRDS	CHAR	200	NULL
	LD50	CHAR	15	NULL
	RTEC	CHAR	15	NULL
	FORMULA	CHAR	40	NOT NULL

TNAME	CNAME	COLTYP	WIDTH	NULLS
SUPPLIER	SUPP_ID	CHAR	10	NOT NULL
	TOWN	CHAR	20	NOT NULL
	ADDRESS	CHAR	40	NOT NULL
	NAME	CHAR	50	NOT NULL
	COUNTY	CHAR	10	NULL
	COMMENTS	CHAR	100	NULL
	CONTACT_NAME	CHAR	30	NULL
	POSTCODE	CHAR	10	NULL
	TEL_NO_EXTN	NUMBER	6	NULL
	TEL_NO_NOS	NUMBER	10	NULL
	TEL_NO_STD	NUMBER	10	NULL
TREATMENT_PLANT	SITE_REFERENCE	CHAR	12	NOT NULL
	NGR	CHAR	12	NOT NULL
	COMPLEX_KIND	CHAR	1	NULL
	CONSENT_NUMBER	CHAR	15	NULL
	TREATMENT_DETAIL	CHAR	20	NOT NULL
	TREATMENT_TYPE	CHAR	1	NOT NULL
	PLANT_NUMBER	NUMBER	2	NOT NULL
WATERCOURSE	NAME	CHAR	30	NULL
	DIST	CHAR	8	NULL
	IX	NUMBER	2	NULL
	HR	CHAR	50	NOT NULL
WATER_ABTRACTOR	HR	CHAR	50	NOT NULL
	TREATMENT_TYPE	CHAR	3	NOT NULL
	SITE_REFERENCE	CHAR	12	NOT NULL
	USAGE_CODE	CHAR	3	NOT NULL
	NGR	CHAR	12	NOT NULL
	QUANTITY_LICENCED	NUMBER	6	NULL
WATER_FLOW	HR	CHAR	50	NOT NULL
	SITE_REFERENCE	NUMBER	12	NOT NULL
	TO_KM	NUMBER	4	NULL
	LOW_FLOW_TIME	NUMBER	3	NULL
	MED_FLOW_TIME	NUMBER	3	NULL
	HIGH_FLOW_TIME	NUMBER	3	NULL
	NGR	CHAR	12	NOT NULL

TNAME	CNAME	COLTYP	WIDTH	NULLS
INTERVIEW	QUESTIONNAIRE_NUMBER	NUMBER	6	NOT NULL
	REFERENCE	CHAR	12	NOT NULL
	DATE_OF_INVENTORY	CHAR	8	NOT NULL
	FINISH_TIME	NUMBER	5	NOT NULL
	START_TIME	NUMBER	5	NOT NULL
	INITS_OF_INTERVIEWER	CHAR	5	NOT NULL
	ACTION_REQUIRED	CHAR	1	NULL
	PASSED_TO	CHAR	20	NULL
	VISIT_NUMBER	NUMBER	2	NULL
	VIDEO	CHAR	1	NULL
MANUFACTURER	MAN_ID	CHAR	10	NOT NULL
	ADDRESS	CHAR	40	NOT NULL
	NAME	CHAR	50	NOT NULL
	TOWN	CHAR	20	NOT NULL
	TEL_NO_NOS	NUMBER	10	NULL
	TEL_NO_EXTN	NUMBER	6	NULL
	CONTACT_NAME	CHAR	30	NULL
	COMMENTS	CHAR	100	NULL
	TEL_NO_STD	NUMBER	10	NULL
	POSTCODE	CHAR	10	NULL
RUNOFF	SITE_REFERENCE	CHAR	12	NOT NULL
	HR	CHAR	50	NOT NULL
SEWER	SITE_REFERENCE	CHAR	12	NULL
	DESTINATION_NAME	CHAR	40	NULL
	DESTINATION_CODE	CHAR	12	NULL
SITE	REFERENCE	CHAR	12	NOT NULL
	TYPE_OF_PREMISES	CHAR	1	NOT NULL
	BUSINESS_CODE	CHAR	5	NOT NULL
	RISK_FACTOR	NUMBER	1	NOT NULL
	NAME	CHAR	40	NOT NULL
	PARISH_CENTROID	CHAR	12	NULL
	FARM_POLLUTION	CHAR	1	NULL
	COMMENTS	CHAR	200	NULL
	WATERCOURSES	NUMBER	2	NULL
	LAND	NUMBER	2	NULL
	SOAKAWAYS	NUMBER	2	NULL
	TREATMENTS	NUMBER	2	NULL
	RUNOFFS	NUMBER	2	NULL
	SEWERS	NUMBER	2	NULL
	DESCRIPTION_OF_PREMISES	CHAR	80	NULL
	NGR_OF_SITE	CHAR	12	NULL

Appendix 2

FARM/INDUSTRIAL/OTHER PREMISES

REFERENCE NUMBER? 15B/P/.....
QUESTIONNAIRE NUMBER?
NAME OF INTERVIEWER?
DATE OF INVENTORY?
START TIME (24 hours)?
FINISH TIME (24 hours)?

SITE DETAILS

NGR of site?
Site name.....
Farmers/managers name.....
Site address.....
.....
town.....county.....postcode.....
Tel no. STD.....Nos.....Ext.....

Contact information: is it different from above?

Contact name.....
Contact address.....
.....
town.....county.....postcode.....
Tel no. STD.....No.....Ext.....

Owner information: is it different than above?

Owner's name.....
Owner's address.....
.....
town.....county.....postcode.....
Owner's tel. no. STD.....No.....Ext.....

RISK FACTOR?
1 2 3 4 5
low risk high risk

FARM POLLUTION
BLUE ☐ GREEN ☐ RED ☐

FARM ONLY

↓

What type of premises is it?

farm ☐
 industry ☐
 STWs ☐

WTWs ☐
 Other ☐

Description of premises

.....

.....

.....

Business code

not farm

↓ farm

What types of farming are undertaken?

dairy ☐
 arable ☐
 beef ☐
 pigs ☐
 battery chickens ☐
 market garden crops ☐
 sheep ☐
 other (specify)..... ☐

Are any other activities undertaken on this farm?

yes

What types of activities?

activity 1.....

activity 2.....

activity 3.....

activity 4.....

no

How many different types of animals are kept?

dairy
 beef
 pigs

chickens
 sheep
 followers

others (specify).....

How many surface water destinations are there?

watercourse =
 sewers =
 land =

soakaway =
 treatment =

other 1
 to watercourse 2
 3 to sewer

other 1

watercourse 2

sewer 3

NGR.....	River.....	Consented	yes	<input type="checkbox"/>	no	<input type="checkbox"/>
NGR.....	River.....	Consented	yes	<input type="checkbox"/>	no	<input type="checkbox"/>
NGR.....	River.....	Consented	yes	<input type="checkbox"/>	no	<input type="checkbox"/>
NGR.....	River.....	Consented	yes	<input type="checkbox"/>	no	<input type="checkbox"/>

to sewer also

Does it go to a STWs?
yes ☐ no ☐

no

Does it go to a surface water drain?
yes ☐ no ☐

yes

no

Name of STWs.....
STWs code.....

NGR.....

Are any chemicals stored/used on site?
(include silage liquor and slurry)
yes ☐ no ☐

yes

no

GO TO CHEMICALS QUESTIONNAIRE

END OF INVENTORY

Is any immediate action required? yes ☐ no ☐

Remedial measures undertaken?.....

.....

.....

Passed on to

Was a video taken? yes ☐ no ☐

Comments.....

.....

.....

CHEMICALS QUESTIONNAIRE

REFERENCE NUMBER? 158/P/.....

Chemical number? of

Type of chemical/substance to be investigated?

fertilizer ☐
pesticide/herbicide ☐
detergent/disinfectant ☐
silage liquor ☐
slurry ☐
fuel (diesel, oil, petrol) ☐
sheep dip ☐

other (specify).....

Please state the trade of the chemical?

Physical state of chemical?

solid ☐ liquid ☐ gas ☐

If solid, state max weight stored.....kg

If liquid, state max volume stored.....lts

(or equivalent in gallons?.....gals)

If gas, state max volume stored?.....m3

If quantity unknown, state dimensions of unit?

length (m)
depth (m)
width (m)

volume (m3)
or litres x1000

What is the chemical contained in?

metal drums ☐
plastic drums ☐
plastic bags ☐
lagoon ☐
other (specify)..... ☐

not lagoon

Type of lagoon?

concrete ☐
metal ☐
earth ☐
weeping wall ☐

lagoon

Is it lined? yes ☐ no ☐

yes

What type of lining is used?

Is it above ground level?

yes ☐ no ☐

yes

What type of bunding is used?

metal ☐
concrete ☐
plastic ☐
earth bund ☐
other (specify)..... ☐
none ☐

How much of the chemical is not banded?

either %
or.....kg/lts/m3 (del. as appropriate)

How many containers are used?

number =

bunding = 000%

Supplier's name and address?

town.....county.....postcode.....

Tel No. STD.....Nos.....Ext.....

Manufactures name and address?

town.....county.....postcode.....

Tel No. STD.....Nos.....Ext.....

Is the chemical treated? yes ☐ no ☐

yes

Are there other chemicals? yes ☐ no ☐

no

GO TO TREATMENT QUESTIONNAIRE

Treatment plant number

GO TO CHEMICALS QUESTIONNAIRES

END OF INVENTORY

TREATMENT QUESTIONNAIRE
REFERENCE NUMBER? 15B/P/.....

Treatment plant number
NGR of treatment plant

Type of treatment undertaken?
simplistic ☐ complex ☐

If simplistic: type of treatment?
barrier ditch ☐
blind ditch ☐
open ditch ☐
soakaway ☐
low rate irrigation ☐
high rate irrigation ☐
tanker ☐
sewer ☐
land ☐
other (specify).....

If complex: type of treatment? (mark appropriate boxes)
primary ☐ secondary ☐ tertiary ☐
septic tank ☐ percolating filter ☐ grass plot ☐
primary tank ☐ activated sludge ☐ lagoon ☐
S/O operating ☐ rotating discs ☐ soakaway ☐
other ☐

Does the treatment have a direct link to a watercourse? yes ☐ no ☐

If to a watercourse: state NGR and name of river?
NGR River.....

Is the discharge consented? yes ☐ no ☐

Consent number?.....
Volume.....m /day
Standards? BOD.....mg/l
S.S.....mg/l
NH4.....mg/l
other (1).....
other (2).....

NGR of consented discharge?
NGR River.....

END OF TREATMENT QUESTIONNAIRE

Are there any (other) chemicals stored on site?
yes ☐ no ☐

GO TO CHEMICALS QUESTIONNAIRE

END OF INVENTORY

Appendix 3

POLLUTION menu

FORMS

- | | | |
|-----|--------------|--|
| 1) | Site | - Query on site information only |
| 2) | Chemical | - Query on chemical store information |
| 3) | Treatment | - Query on treatment plant information |
| 4) | Consent | - Query on consent information |
| 5) | Product | - Query on chemical product information |
| 6) | Supplier | - Query on supplier information |
| 7) | Manufacturer | - Query on manufacturer information |
| 8) | Ind.Chem | - Query on industrial chemical (CAS) information |
| 9) | Site Chems | - List chemicals at a given site |
| 10) | Chem Sites | - List sites which store a given trade chemical |
| 11) | Upstream | - List all sites, upstream of a pollution incident, which store a given chemical |
| 12) | Downstream | - List all water abstractors downstream of a pollution incident |

REPORTS

- | | | |
|----|-----------|--|
| 1) | Site | - Report site summary information |
| 2) | Chemical | - Report on chemicals for a given site |
| 3) | Treatment | - Report on treatment plants by site |
| 4) | Chem Locs | - Report on sites storing a given chemical |
| 5) | Farm | - Report on activities and livestock by site |

POLL_UPDATE menu

FORMS

- | | | |
|-----|--------------|--|
| 1) | Site | - Enter details of a new site information |
| 2) | Chemical | - Enter details of a new chemical stored at a site |
| 3) | Treatment | - Enter details of a new treatment plant at a site |
| 4) | Consent | - Enter details of a consent |
| 5) | Product | - Enter new details of a chemical product |
| 6) | Supplier | - Enter new details of a chemical supplier |
| 7) | Manufacturer | - Enter details of a new chemical manufacturer |
| 8) | Ind.Chem | - Enter details of a new industrial chemical |
| 9) | Watercourse | - Enter details of a new watercourse |
| 10) | Abstractor | - Enter new details of a water abstractor |
| 11) | Discharge | - (QUERY only): inspect discharge information |
| 12) | Water Flow | - Enter details of a new flow monitoring station |

Appendix 4

CHEMICAL SUMMARY REPORT

Site Reference: 15B/P/C10002

Mgr Of Site: SX 196 664
 Site Name: PDLVENTON FARM
 Risk Factor: 3

Chemical Type:	Trade Name:	Max Qty	Cont Type	Bund Type	Supplier Name	Treat Type	Coapr Kind
COW SLURRY		150000	LASDON	NONE		S	
SILASE LIQUOR		2025	LASDON			S	
DETERGENT/DISINFEC	DEOSAN D60	25	PLASTIC DR	NONE	NORTH CORNWALL TRACTOR	S	
DETERGENT/DISINFEC	BLU GUARD	40	PLASTIC BA	NONE	NORTH CORNWALL TRACTOR	S	
DETERGENT/DISINFEC	SANATANK	5	PLASTIC DR	NONE	NORTH CORNWALL TRACTOR	S	
DETERGENT/DISINFEC	JODRON	20	PLASTIC DR	NONE	NORTH CORNWALL TRACTOR	S	
PESTICIDE/HERBICID	NORTON	5	METAL DRUM	NONE	NORTH CORNWALL TRACTOR	S	
PESTICIDE/HERBICID	ISO-CORNU	10	PLASTIC DR	NONE	NORTH CORNWALL TRACTOR	S	
FUEL	DIESEL	500	LASDON		WATSON PETROLEUM	S	
FUEL	DIL	294	METAL DRUM	NONE	WATSON PETROLEUM	S	

09-JAN-90

SQL>
ORDER S.REFERENCE

ERROR at line 8: ORA-0924: missing KEYWORD

SQL> EDIT
Wrote file afiedt.buf

```
1  SELECT DISTINCT C.MAX_QTY,C.UNIT,C.CHEMICAL_TYPE,S.REFERENCE
2  FROM CHEMICAL_STORE C, SITE S
3  WHERE S.REFERENCE = C.SITE_REFERENCE
4  AND
5  UNIT LIKE '%GALS%'
6  AND
7  CHEMICAL_TYPE LIKE '%SLURRY%'
8* ORDER BY S.REFERENCE
SQL> /
```

MAX_QTY	UNIT	CHEMICAL_TYPE	REFERENCE
150000	GALS	COW SLURRY	15B/F/C10002
15859	GALS	COW SLURRY	15B/F/C10011
60000	GALS	COW SLURRY	15B/F/C10011
19823	GALS	COW SLURRY	15B/F/C10019
52863	GALS	COW SLURRY	15B/F/C10019
26432	GALS	FIG SLURRY	15B/F/C10019
30837	GALS	COW SLURRY	15B/F/C10020
10000	GALS	COW SLURRY	15B/F/C10021
20000	GALS	COW SLURRY	15B/F/C10029
47974	GALS	COW SLURRY	15B/F/C10029
34692	GALS	COW SLURRY	15B/F/C10037
25000	GALS	COW SLURRY	15B/F/C10038
12885	GALS	COW SLURRY	15B/F/C10039
150000	GALS	COW SLURRY	15B/F/C10042
120000	GALS	COW SLURRY	15B/F/C10050
30000	GALS	COW SLURRY	15B/F/C10076
35000	GALS	COW SLURRY	15B/F/C10077
33039	GALS	COW SLURRY	15B/F/C10082
17621	GALS	COW SLURRY	15B/F/C10086
33040	GALS	COW SLURRY	15B/F/C10087
9912	GALS	COW SLURRY	15B/F/C10089
33040	GALS	COW SLURRY	15B/F/C10092

MAX_QTY	UNIT	CHEMICAL_TYPE	REFERENCE
99119	GALS	COW SLURRY	15B/F/C10093
18061	GALS	COW SLURRY	15B/F/C10098
151686	GALS	COW SLURRY	15B/F/C10101
71365	GALS	COW SLURRY	15B/F/C10108
200000	GALS	COW SLURRY	15B/F/C10114
25000	GALS	COW SLURRY	15B/F/C10118
22000	GALS	COW SLURRY	15B/F/C10128
35242	GALS	COW SLURRY	15B/F/C10144
2800	GALS	COW SLURRY	15B/F/C10153
2300	GALS	COW SLURRY	15B/F/C10154

1595590 TOTAL COW SLURRY

```

SQL> def xrep7.sql
1 select distinct s.nbr of site,s.reference,term pollution,s.risk_factor,s.type of premises
2 from site s
3 where risk_factor > 2
4 and
5 type_of_premises like '%F%'
6 order by s.reference
SQL>

```

NBR OF SITE	REFERENCE	F RISK_FACTOR	T
-------------	-----------	---------------	---

SX 196	664	15B/F/CI0002	B
SX 163	663	15B/F/CI0011	B
SX 139	674	15B/F/CI0019	G
SX 206	692	15B/F/CI0037	B
SX 126	636	15B/F/CI0038	B
SX 151	638	15B/F/CI0042	B
SX 190	694	15B/F/CI0050	G
SX 207	644	15B/F/CI0060	G
SX 217	723	15B/F/CI0081	G
SX 106	613	15B/F/CI0090	R
SX 145	690	15B/F/CI0098	B
SX 112	623	15B/F/CI0101	G
SX 067	619	15B/F/CI0112	G
SX 078	626	15B/F/CI0114	G
SX 080	633	15B/F/CI0128	G
SX 089	683	15B/F/CI0144	R
SX 189	674	15B/F/CI0153	G

17 records selected.

SQL> spool off

Catchment Inventory - Sheep Dip Locations

