

CONFIRMED  
MARCH 1992

# Code of practice for the identification of potentially contaminated land and its investigation

UDC 631.47 + .002.637:[(083.75) + .001.2 + .001.3]

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Royal Society of Chemistry  
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United Kingdom Atomic Energy Authority  
University of Liverpool

This Draft for Development, having been prepared under the direction of the Environment and Pollution Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 March 1988

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The following BSI references relate to the work on this Draft for Development:  
Committee reference EPC/47  
Draft for comment 83/55992 DC

ISBN 0 580 16527 2

## Amendments issued since publication

| Amd. No. | Date of issue | Comments |
|----------|---------------|----------|
|          |               |          |
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## Foreword

This Draft for Development has been prepared under the direction of the Environment and Pollution Standards Committee. It provides guidance on the identification and investigation of sites where contamination may exist and where hazards from undesirable substances may occur.

It has been assumed in the drafting of this Draft for Development that the execution of its provisions is entrusted to appropriately qualified and experienced people. This Draft for Development calls for the use of procedures that may be hazardous or injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage. In particular, attention is drawn to the provisions of the Health and Safety at Work etc. Act 1974. Essential safety precautions are presented in detail in the appendix.

The complete code will be of interest and use to all persons engaged in the identification and investigation of contaminated land. However clauses **0** to **3** are of particular relevance to planners and developers, whereas clauses **4** to **11** are more relevant to contractors and consultants.

**This publication is not to be regarded as a British Standard.**

It is being issued in the Draft for Development series of publications and is of a provisional nature because there is at present insufficient experience in the UK of the application of the type of guidance given in this code of practice. Over recent years the redevelopment of former industrial land has increased significantly and a number of major site investigations have been carried out. Knowledge on the optimum and most efficacious means of carrying out these investigations has therefore recently been growing considerably. Nevertheless the subject is still relatively new and is continuing to develop. Accordingly this code of practice should be applied on a provisional basis only, so that information and experience of its practical application may be obtained.

A review of this Draft for Development will be carried out not later than two years after its publication. Notification of the start of the review period, with a request for the submission of comments from users of this Draft for Development, will be made in an announcement in the appropriate issue of *BSI News*.

According to the replies received, the responsible BSI Committee will judge whether the Draft for Development can be converted into a British Standard or what other action should be taken.

Observations which it is considered should receive attention before the official call for comments will be welcomed.

These should be sent to the Secretary of BSI Technical Committee EPC/47 at the BSI Head Office at the address shown at the foot of the back cover.

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 28, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

## 0 Introduction

The suitability of land for the construction of buildings, engineering works or any other purpose is assessed from information on those of its properties that may affect the design or continued performance of the proposed structures: such information is obtained from geotechnical site investigations undertaken in accordance with BS 5930.

The presence in the ground of materials such as toxic, radioactive or other harmful substances may be a hazard to public health and affect the design and performance of structures. These materials may be injurious to the health of people present on the site, may cause damage to buildings or to essential site services such as water mains, drains, sewers, gas and electricity supplies, or give rise to other hazards.

The site history can show whether a site is contaminated or not. Knowledge of the history of a site is therefore essential before deciding whether further investigation of a site is needed and, if it is, in assisting in designing suitable programmes of sampling and analysis. The purpose of this Draft for Development is to provide guidance on the principles of how potentially contaminated sites should be investigated in the most cost-effective manner, starting with the acquisition of information on the site history. It therefore complements BS 5930, though the two types of investigation (geotechnical and chemical) need not be undertaken separately: usually it is advantageous to undertake them together.

In practice, there are considerable difficulties in establishing whether a site is contaminated or not, and in deciding whether contamination presents any risk for redevelopment or re-use of the land. All types of previously used land are likely to show some signs of contamination, but certain types of site, of which the following are examples, are particularly likely to have been contaminated by their past or present uses:

- asbestos works [1];
- chemical works;
- docks and railway land, especially large sidings and depots;
- gasworks, other coal carbonization plants and ancillary by-products works [2];
- landfills and other waste disposal sites [3];
- metal mines, smelters, foundries, iron and steel works, metal finishing;
- munitions production and testing sites;
- oil refineries, petroleum storage and distribution sites;

- paper and printing works;
- plants and heavy engineering installations, e.g. shipbuilding and shipbreaking;
- installations involving the processing of radioactive materials. (Sites which may be radioactive are subject to special regulations and it is imperative that they are treated with special care.);
- scrap yards [4];
- sewage works and farms [5];
- tanneries;
- industries making or using wood preservatives.

For each site the range of contaminants and the variations in their concentrations will be different and consequently the significance of the hazards which they pose will also differ from site to site. There is therefore no single “best method” for investigating a contaminated site. It is usually preferable to begin by identifying the principal hazards and the contaminants which give rise to them before the site investigation is designed or carried out. If investigations are not designed on this basis, at least two serious difficulties may arise: either there will be a tendency to specify and carry out comprehensive investigations for contaminants and hazards which in reality are unimportant or, conversely, failure to undertake an adequate investigation will result in insufficient information being available to assess the important hazards of the site with respect to the proposed uses.

The **principal** hazards, namely those that determine whether or not a site is suitable for a proposed use, fall into two categories as follows:

- a) those that may affect the integrity of buildings, building materials and site services; and
- b) those that may adversely affect the health of the site users or occupiers, or that of plants or animals.

The hazards that may be encountered affect a variety of targets. It is important when assessing the need for an investigation, the scope of the investigation, and the results, to take appropriate expert advice from a range of disciplines.

A complete site investigation may involve several stages. Those set out in the following list are based on the need to distinguish the main hazards to which users of the site would be subject from the less important ones in order to obtain the most appropriate information and then to assess it properly.

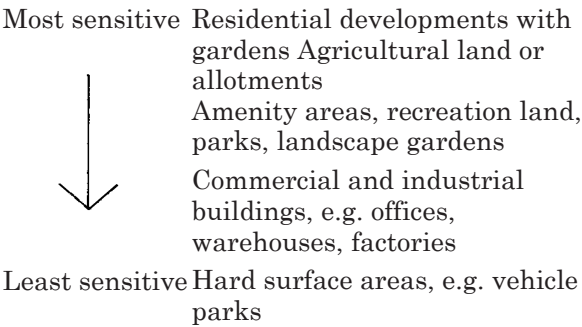
- a) Identification of **potentially** contaminated sites. The site history indicates the likelihood of finding contaminants that might affect decisions on future land uses.

- b) Examination of the intended use, where known, of a site. This provides an initial check on the possible significance of contamination with respect to use.
- c) Identification of the principal hazards likely to affect the suitability of the land for that use. An assessment of their importance assists in deciding whether that use is practicable or needs modifying. If the intended use of the site is not already known, examination of the site will be necessary for the potential hazards for a variety of uses (see 8.1).
- d) Identification of the contaminants that would give rise to those hazards referred to in c).
- e) Determination of the nature, concentration and distribution of these contaminants.
- f) Evaluation of the results of the investigation. This allows an assessment of the hazards to be made and consideration given to how they could be removed or reduced.
- g) Assessment of the suitability of the site for the intended use. This is to determine whether by changing the proposed use the significance of the contamination would be substantially reduced.
- h) Consideration of what remedial treatment is practicable and future monitoring requirements. This influences the final use of the site.

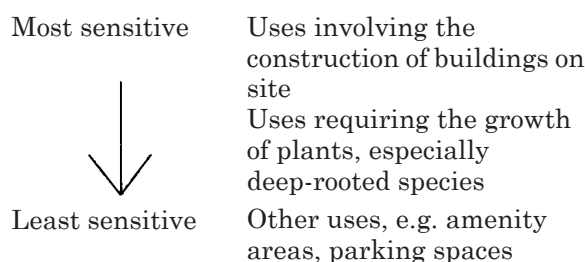
This Draft for Development is concerned primarily with a), d) and e); b) and c) are briefly mentioned, but f), g) and h) are not discussed.

The presence of contaminants on a site does not necessarily mean that a hazard exists, or that it is essential for action to be taken. Many contaminated sites would present no hazards to their users or occupiers because the uses are “tolerant” of the contamination. For example, high concentrations of metals present fewer risks to industrial or commercial development, although attention may still have to be paid to landscaped areas, protection of water supplies, and potential aggressivity to building materials. So long as the present use continues, it is unlikely that anything is necessary except to ensure that there is no existing hazard and the activities on the site do not increase the contamination. Whenever any form of construction or work involving disturbance of the ground is to be carried out, including reclamation of land for agricultural or recreational purposes and installation of building services, it is important to check whether the land is contaminated by carrying out the procedures described in clause 4 and, if necessary, clauses 5 to 8. The significance of the contamination can then be determined before deciding on the new use. Normally, the optimum solution will be achieved by choosing the form of development which is most tolerant of the contaminants present.

For contaminants that could adversely affect human health or the growth of plants and animals, an approximate order of sensitivity is as follows:



Where the hazards produced by the contaminants affect the integrity of buildings or building services, the relative sensitivities are different. For example, if the principal hazard of the site is the emission of flammable gases, the order of sensitivity may then be:



“Sensitivity scales” of this type can help to decide whether or not an investigation is needed. They can also suggest which contaminants should be included in the investigation.

## 1 Scope

This Draft for Development provides guidance on the investigation of sites where hazards from toxic, flammable, aggressive or other undesirable substances may occur. For convenience, such sites are referred to by the general description “contaminated land”. Chemical contamination is, most often, man-made, though the principles and methods used for investigation are normally applicable to contamination of natural origin.

The guidance given in this Draft for Development is limited to:

- a) identifying sites where contamination may occur and where an investigation may be needed (clauses 0 to 3);
- b) methods and sources for the collection of relevant historical and current information and site reconnaissance (clause 4);
- c) the design of sampling programmes and analytical work (clauses 5 and 6);
- d) collection and examination of samples (clauses 7 and 8);
- e) reporting and assessment of results (clauses 9 to 11).

For detailed guidance on the interpretation of results and on the decisions and actions that follow from a site investigation, users of this Draft for Development are referred to other sources of information (see, for example, clause 10).

**NOTE** The titles of the publications referred to in this Draft for Development are listed on the inside back cover. In addition, a bibliography is presented (see Appendix B). References to bibliographical items in the main text are indicated by the use of square brackets.

## 2 Definitions

For the purposes of this Draft for Development the following definitions apply.

### 2.1

#### **potentially contaminated land**

land that, because of its nature or former uses, may contain substances that could give rise to hazards likely to affect a proposed form of development

### 2.2

#### **identification (preliminary investigation)**

the sequence of activities, principally the collection and examination of information from records and site reconnaissance, that leads to the conclusion that a site is potentially contaminated and will therefore require further investigation

### 2.3

#### **site investigation**

the planned and managed sequence of activities carried out to determine the nature and distribution of contaminants on and below the surface of a site that has been identified as potentially contaminated. These activities comprise identification of the principal hazards; design of sampling and analysis programmes; collection and analysis of samples; and reporting of results for further assessment

**NOTE** The expression is used elsewhere to include geotechnical investigations for civil engineering purposes (as in BS 5930) or in a narrower sense to refer to the exploration of the ground.

## 3 Objectives and strategy

The aim of the investigation is to gather the information needed to assess the significance of the contamination of the site. This may require that the investigation be specially designed to meet one or more of the following objectives:

- a) to identify and assess the hazards to those working on the site, and to subsequent users or occupiers, to building materials, to the environment, including adjacent land, and to surface and ground water;
- b) to determine if any immediate action is needed or whether any action may be necessary in the future;
- c) to provide the information needed to design protection against any hazards;
- d) to identify those materials that may need to be removed to licensed waste disposal sites;
- e) to provide a reference against which the performance of remedial actions may be measured;
- f) to enable the relative advantages and disadvantages of different sites to be compared.

To decide whether any investigation is necessary, a step-wise approach should be followed, e.g. as shown in Figure 1, which sets out the main decisions to be taken. A preliminary investigation is nearly always necessary unless sufficient information is already available (see clause 4). Should the information obtained from the preliminary investigation indicate that substances which could produce hazards were used, made, deposited or stored on the site, then the site should be regarded as potentially contaminated and further investigation undertaken to establish the nature of the contamination (see clauses 5 to 8).

## 4 Preliminary investigation

### 4.1 Introduction

A preliminary investigation should always be carried out before any sampling or analysis is specified or undertaken unless the information is already available. Existing information may be sufficient to show that a site is contaminated. The aims of a preliminary investigation are:

- a) to check the likelihood of finding contamination that may affect the suitability of the site for a specific use or any proposed future use, and, if possible, to indicate its nature and extent;
- b) to identify whether any special procedures and precautions may need to be taken during operations on the site itself;
- c) to provide the information from which an effective investigation of the site could be designed, should this be necessary.

In a preliminary investigation there are two main stages, namely:

- 1) the collection and examination of information on the site history from published maps, plans and photographs, and existing site records and enquiries. From such information it is often possible to deduce the types of contaminant that may be present and their distribution; and
- 2) a site reconnaissance or inspection by visiting the site. An inspection should not be carried out before the available historical information about the site has been collected and examined, unless this is made necessary by the imminent demolition or clearance of the site.

Information relevant to a preliminary investigation includes:

- i) the history of the site, details of its owners, occupiers and uses;
- ii) the processes used, including their locations, raw materials, products, waste residues and methods of disposal;

iii) the layout of the site above and below ground at each stage of development, including roadways, storage areas and other hard-cover areas, and the presence of any extant buildings, pits and services, e.g. gas, water, electricity, drains and sewers;

iv) the presence of waste disposal tips, abandoned pits and quarries, with or without standing water;

v) mining history including shafts and roadways (worked seams);

vi) information on geology and hydrogeology, including the presence of groundwater and surface water.

**NOTE** Since the engineering properties of the ground usually affect the design and costs of development, a geotechnical investigation is also normally required (see BS 5930). Information on the past use and potential contamination of the site may also be of relevance to such an investigation.

### 4.2 Information on site history

Prior to the site reconnaissance, as much information about the site as possible should be gathered from the sources listed in Table 1 and Table 2, ensuring that information is collected on all the topics listed in 4.1. Reference should be made to Appendix E of BS 5930:1981 for details of sources of information in areas of mining, quarrying and waste disposal. All the information gathered should then be collated and assessed prior to commencement of the site reconnaissance. It is important that the information collected is adequate to allow a detailed and safe reconnaissance to be carried out.

### 4.3 Site reconnaissance

**4.3.1 Access.** No site should be entered unless permission has been obtained from the land owner or occupier.

**4.3.2 Preparations.** Maps, plans and aerial photographs should be consulted before the visit and a detailed course of action prepared.

**4.3.3 Safety.** Throughout the visit, and particularly when the site contains underground chambers, tunnels or mine workings, it is essential that care should be taken to avoid danger from unstable structures, dangerous substances or gases together with any other hazards present or thought to exist on the site (see Appendix A).

### 4.3.4 General procedure

**4.3.4.1** A route should be selected based upon the maps and plans, and the whole site should be traversed, preferably on foot. Any areas of discoloured soil, polluted water, blighted vegetation or significant odours should be noted.

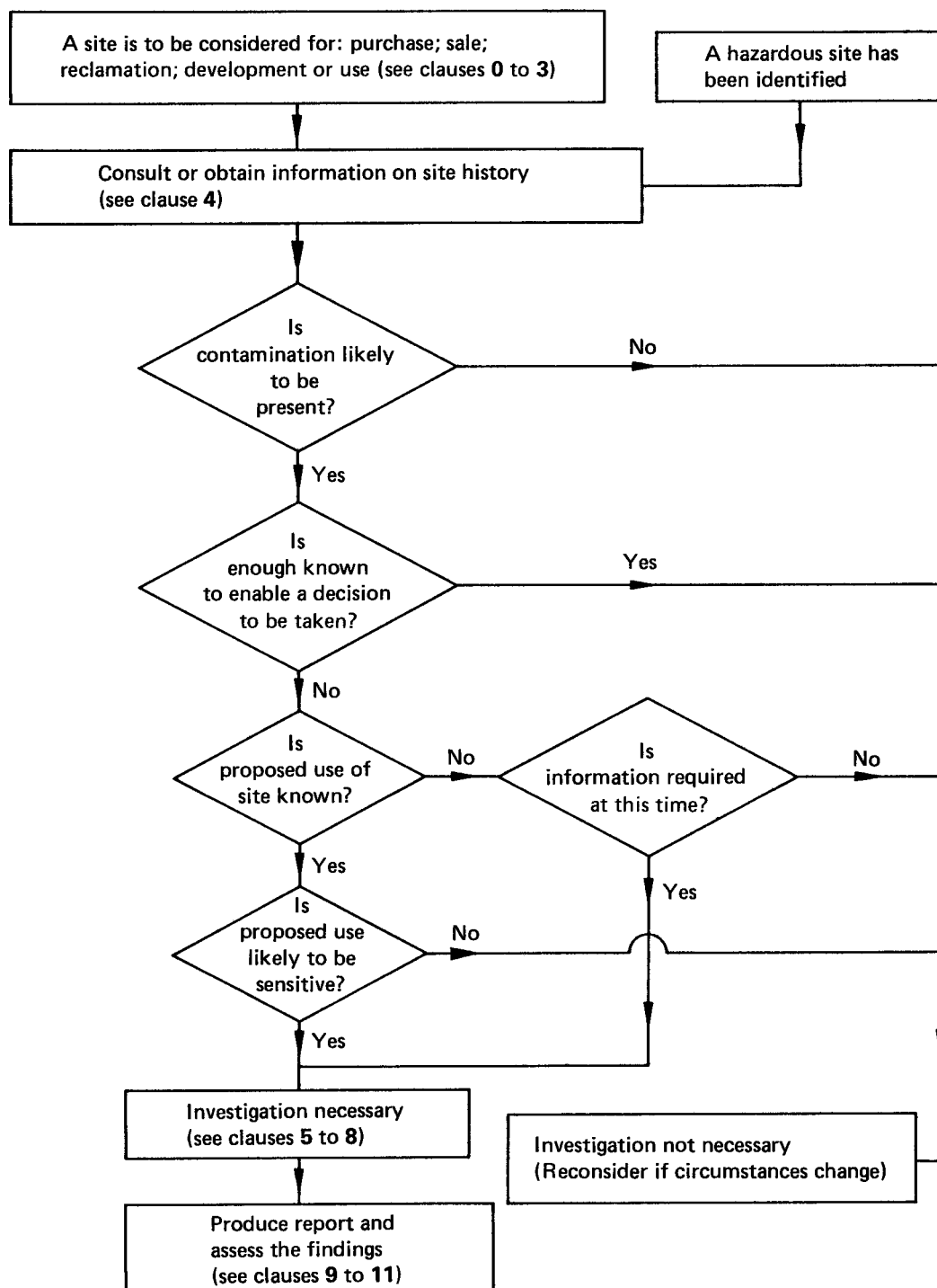


Figure 1 — Determination of need for site investigation

**4.3.4.2** Any differences between the present conditions and the information obtained from the site history should be looked for and noted, for example, changes in the positions of boundaries, buildings, roads and power transmission lines.

**4.3.4.3** All structures above and below ground, including foundations, tanks and pits should be inspected and recorded. The presence of any fill material, made ground and materials such as slag, ashes, asbestos, scrap and industrial or chemical waste should be noted and recorded, as well as any signs of settlement, subsidence and disturbed ground. The locations of overhead power and telephone lines, and underground services, e.g. gas, water, electricity, drains and sewers, should be determined and it should be established whether they are still in use.

**4.3.4.4** Adequate access to the site should be ensured, and the uses of adjacent premises noted. The likelihood of these being affected by further stages of investigation or subsequent development of the site should be considered.

**4.3.4.5** Areas suitable for temporary use during the investigation for depots, offices, sample storage and mobile laboratories should be identified.

**4.3.4.6** A suitable water supply should be located.

**4.3.4.7** The locations of the nearest telephone and emergency services should be recorded.

**4.3.4.8** Where relevant, the depths of any standing water, and direction and rate of flow in rivers, streams or canals should be noted, together with their flood levels and any tidal fluctuations.

**4.3.4.9** The locations of covered shafts or sub-surface features which may be relevant, including activities on adjoining land that may have contaminated the site, should be identified and recorded.

**4.3.5** *On-site sampling and testing.* Samples of solids or liquids should be collected and tested in order to identify any hazards that may affect later stages of the investigation. Portable instruments may suffice to detect and measure some contaminants, e.g. emissions of flammable or toxic gases. However, care is needed in selecting and using portable instruments and in interpreting the results they give. Negative results, (i.e. when the instrument fails to detect the contaminant), should not be taken as conclusive proof that there is no hazard: even a positive result may not provide sufficient quantitative information for a reliable assessment.

**4.3.6** *Report.* A report of the preliminary investigation detailing findings and conclusions should be prepared (see **9.1**).

## 5 Planning for on-site investigation

### 5.1 Introduction

The information from the preliminary investigation should be used to design the site investigation and in particular to identify any necessary safety precautions for the investigation.

### 5.2 Environmental protection and information (see also Appendix A)

It is imperative that investigations are planned and carried out in such a way as to avoid creating a nuisance or hazard to neighbouring residents or occupants. The safety of site personnel and investigatory staff is discussed in clause **6**.

Local and statutory authorities should be informed so that they can deal with enquiries from residents, users or occupiers of adjacent sites.

Access to the site, both for normal purposes and for emergency use, should be clearly identified and maintained during the investigation.

It is essential that the site is kept secure during the investigation. Trial pits should be backfilled and sealed after completion of sampling and, if at all possible, by the end of the same working day. Open excavations should be temporarily fenced if they have to be left unattended overnight or at other times. Boreholes should be backfilled and capped off on completion of sampling or monitoring (see **6.4.2.5** and **6.4.3.3** for extended testing requirements for some contaminants). When carrying out investigations in areas of mining, quarrying or waste disposal, careful consideration should be given to the possibility of subsidence (see appendix E of BS 5930:1981).

### 5.3 Preparation of site for investigation

**5.3.1** *Demolition and clearance.* Before trial pits or boreholes can be constructed, it is sometimes necessary to remove part or all of any buildings or structures remaining on the site. Care should be taken to avoid spreading contamination during site clearance works. All demolition should, as far as is practicable, be carried out in accordance with BS 6187. Some buildings may require special procedures to reduce the hazards before the site is cleared, e.g. hazards from asbestos, radioactive substances and biological organisms. Where the site history shows that these are likely to be present, the engagement of specialist decontamination or demolition contractors is recommended.

**Table 1 — Readily accessible documented information for the preliminary investigation of contaminated sites**

| Type of information                | Principal characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sources                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maps, plans and chart</b>       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                      |
| Ordnance survey topographical maps | <p><b>Large scale maps</b></p> <p>a. 1 : 1 250 scale (50.668 in to one mile); cover major urban areas in Great Britain.</p> <p>b. 1 : 2 500 scale (25.344 in to one mile) from 1 853; cover the remainder of Great Britain, apart from areas of mountain and moorland.</p> <p>c. 1 : 10 560 scale (6 in to one mile) from 1 840; cover the whole of Great Britain, but are being replaced by maps at the 1 : 10 000 scale.</p> <p><b>Small-scale maps</b></p> <p>a. 1 : 25 000 scale: The first series covered the whole of Great Britain except the Scottish Highlands and Islands. The second series, which includes the Scottish Highlands and Islands, is gradually replacing the first.</p> <p>b. 1 : 50 000 scale, first and second series; these maps have replaced 1 in to one mile (1: 63 360) maps.</p> <p>c. 1 : 250 000 scale; the series popularly known as “quarter-inch” maps.</p> <p>d. 1 : 625 000 scale; specialist maps on this scale are available on such subjects as route planning, administrative areas, archaeology and geology.</p> | <p>Early maps, early editions of OS maps and plans are available for reference at the location listed as notes 1, 2 and 3 at the end of table</p> <p>Local and national libraries; British Library Map Library; County Record Offices.</p> <p>All types of printed maps and plans are listed in the British Museum Catalogue [6] which may be consulted in university and other large libraries.</p> |
| OS special maps, plans and books   | <p>a. Geological maps for the British Geological Survey (note 4); mostly small scale (1 : 63 360 or 1 : 50 000) in solid and drift editions.</p> <p>b. Soil survey maps for The Soil Survey of England and Wales (note 5), and The Survey of Scotland (note 6).</p> <p>c. Archaeological and historical maps and texts.</p> <p>d. Professional papers, Gazetteer, place names on maps of Scotland and Wales</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Catalogues of OS maps and publications, and information about services and copyright, are available from the Ordnance Survey (notes 7 to 11).</p>                                                                                                                                                                                                                                                 |