

EVALUATING ALTERNATIVES FOR RESHAPING EXCAVATED LAND:
A STUDY OF THE BEDFORDSHIRE BRICKFIELDS

by

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PREFACE

This thesis evaluates the reclamation of land excavated by surface mining for clay and the opportunities for improvement. The study was centered around the Marston Vale in Bedfordshire because of the derelict condition of the excavated areas of the Oxford clay mineral working. I would therefore first like to thank Stephen Sunderland, who initially pointed out the problem of the derelict claypits to me. The research that formed the starting point for the study was a detailed examination of the practices and policies of the London Brick Company and the Bedfordshire County Council. I am grateful to Stuart Meier, Nigel Rayne, David Szymanski and John Briggs from the London Brick Company for making their time and the necessary information available to me. Especially valuable has been the assistance given to me by the county planning officers -- Stuart Smith and Richard Köller -- from Bedfordshire. I appreciated the encouragement from Elizabeth Street that began the initial writing of the thesis.

Over a long period, many people have contributed to my efforts in many different ways. I would like to thank my thesis committee, Tom Musiak, Tony Barnes, and especially Robert Melnick, who pushed, prodded and encouraged me continuously. Katie Blesener edited the text into a readable end-product and Jeanette Ochs typed the manuscript into a finished product. Most of all, I thank my husband, Stephen, for his patience, understanding and encouragement.

CHAPTER ONE - INTRODUCTION

The introductory chapter is divided into three parts. The first part discusses the changing countryside of Great Britain due to industry. One industrial use of the land is mineral extraction, which has given rise to the problem of reshaping the land after extraction. This section briefly discusses trends and philosophies on the changing landscape and the role of landscape architects in this transition. Secondly, is background information on Great Britain, including land-use, the surface mineral industry and planning legislation. Finally this chapter includes a brief account of the approach of the thesis.

1.1 Philosophies

Change in the countryside is not a new phenomenon. The countryside is not a static background but, like all landscapes, has always and will continue to be in a state of change. Man lives in his environment and he changes it as his needs change.

The first men living in Great Britain were hunters and food-gatherers and their impact on the natural environment was marginal in the thousands of years of their existence. Later man progressed to farming and the environment changed from forests to an open landscape of crops and grassland, enduring for many centuries. The countryside has now changed from agricultural use to industrial use and, inevitably, this

change must produce a new landscape. Modern man is no longer a farmer and agriculture is now one industry among many.

Great Britain was one of the earliest countries to experience industrialization. New demands on the land continued to grow as the population increased. The Industrial Revolution created change in Great Britain during the nineteenth century -- cities spread and farming declined in its importance. Industrial people became urban creatures. Britain changed from a rural to an urban society and new developments in farming transformed the countryside. The urban population now outnumbers the rural. New farming techniques have increased productivity but caused changes in the countryside, since small fields had to be made large to adapt to the machinery. Our new industrial farming methods simply cannot be accommodated by the old agricultural countryside.

Minerals must be considered as part of the national heritage of the country. The land must be disturbed for man to survive. For example, coal is required as an energy resource to supplement reserves from forests. In addition, buildings are constructed of materials extracted from the land such as clay, gravel, rocks, and sand. Mineral resource development occurs in a cyclical fashion, from discovery to exploitation to decline. England is a highly-industrialized society with high living standards and the minerals must be utilized to survive and to grow.

It is not the resources that are lacking, but the ability to use them constructively. Humans misuse their resources

and their landscape. The modern world of agriculture and industry is not destroying the English countryside; it is altering the old field-pattern and covering the countryside with human-made intrusions.

Modern people still believe they can move from one resource to another as each is used up but, eventually, they must plan to reshape the land. In this thesis, reclamation and reshaping are used interchangeably to describe the activities which seek to upgrade damaged land or to re-create land that has been destroyed and to bring it back to beneficial use. As Nan Fairbrother points out, the choice then is not between old and new but between good and bad. (Fairbrother, 1970)

The dereliction can be reshaped; what is lacking are the updated traditions that must be created for this new industrial condition. But the proper shaping will depend first on understanding the operation of extraction and its effect on the physical environment. The old cannot be preserved but it can be created in the new. The need to reshape land is now widely accepted in Great Britain, and is given a measure of priority by the government agencies.

Industrial people must live in an environment suited to industrial use and it is the role of the landscape architect to consciously create this environment. New industrial landscapes must be consciously achieved no matter what final land-use is adopted following reclamation -- it must be planned. There is no tradition for industrial landscapes: previously, the opportunity has not existed to reshape the landscape.

A landscape should be planned on the broad stable framework relating to the surrounding environment.

It is unlikely that demands for minerals will decline in the future. Natural conflicts exist between mineral extraction with its impact on existing land uses and the threat it imposes on the environment. It is the responsibility of the landscape architect to allievate these conflicts.

Landscape architects have been instrumental in making progress in the field of landscape reclamation. Landscape architects are doing work in many of the extractive industries researching new land-planning and design techniques, revegetation of excavated areas, designing landforms, and biological and soil aspects. But, the process should include a collaboration of skills with engineers, ecologists, biologists and other professionals. In the harmonious integration of such new developments, landscape architects are invaluable.

The next section of this chapter is a brief outline of the situation of Great Britain including land-uses, the mineral industry and the planning legislation.

1.2 Background of Great Britain

Great Britain consists of the countries of England, Wales and Scotland and this together with Northern Ireland makes up the United Kingdom. The total land surface of the United Kingdom is 59.6 million acres, and Great Britain covers all but 1.7 million acres of this total. (See Map 1.1)

Map 1.1



Of the 59.6 million acres of land surface in the United Kingdom, 47.3 million acres (79.4%) are in agricultural use; 4.6 million acres (7.7%) are devoted to urban development; 4.4 million acres (7.4%) to woodland and forestry; and miscellaneous uses (including mineral workings) make-up the remainder (5.5%) of the land (See Appendix 2). The population of the UK is 55,870,000, putting the average density at one person per acre of land surface. The population is concentrated in the urban areas. Farming is the largest single land-use and it supplies about one-half of the total food supplies of the UK.

The quality of agricultural land is classified according to various grades by the Ministry of Agriculture, Fisheries, and Food (MAFF). Description of the grades are as follows:

Grade 1: Land with minor or no physical limitations to agricultural use.

Grade 2: Land with some minor limitations for agricultural use which excludes it from Grade 1, particularly in soil texture, depth or drainage.

Grade 3: Land with moderate limitations due to soil, relief or climate, or some combination of these factors.

Grade 4: Land with severe limitations due to adverse soil, relief or climate, or a combination of these factors.

Grade 5: Land of little agricultural value with very severe limitations due to adverse soil, relief or climate, or a combination of these factors.

(MAFF, 1966). Land classified as Grade 1 or 2 is designated as an Agricultural Priority Area (AWA) and is barred from other uses. The grade of the land after mineral extraction falls below the agricultural classification, although minerals contained in this land are crucial to Britain's industrial economy.

The highly developed industrial economy cannot exist without mining of surface minerals. A modern way of life and standard of living can only be maintained by making use of the mineral resources. (Chapter four will give a broader outline of the mineral industry.) There is, however, a growing concern for the quality of the environment and the mineral workings are often regarded as one of the more unacceptable scars on the landscape. Unfortunately, the minerals can only be worked where they exist. The British government and its County Councils are acting on this conflict between the desire for a strong industrial economy and a quality environment.

1.2.1 Planning Legislation

Britain was the first nation to begin a program of legislation for environmental planning, largely because it was the first to feel the harmful side effects of industrialization and urbanization. (Gilg, 1978) The roots of Town and Country Planning in Britain grew out of rapid environmental and

social changes which have occurred in the last two hundred years. The legislation was largely due to the rapid increase in population between 1800 and 1900, and the transformation of Britain from a predominately agricultural society to an industrial one early in the nineteenth century. Widespread concern about land-use, including the loss of good agricultural land to suburban development, lead to discussions of land-use planning in the 1930's. The concern was stimulated by the 1939-45 war, and formal planning was established by the 1947 Town and Country Planning Act.

In 1947, the passing of the Town and Country Planning Act 1947 marked the beginning of the present system of land-use planning. The Act gave the British what was then the most advanced system in the world, and it worked through: (1) development plans drawn up by local authorities showing proposed land-uses of each area; and (2) the requirement of planning permissions for all intended developments. The Act was divided into three major areas of concern: development control; development plans; and the financial implications of settlement and compensation. (Gilg, 1978) Land-owners no longer had the right to develop or change the use of the land. The 1947 Act also clearly placed responsibility of the control of minerals on the local authority. This Act amounted to the nationalization of development so that overall land control could be managed for the betterment of the population. The main concepts are:

1. Preparation of a development plan. Each local planning authority was required to prepare a development plan to show the optimum use that could be made of land in their area over a period of 20 years.
2. Compensation. The Act provided for compensation to be paid to those landowners whose land was used for development, based on existing use value.
3. Loss of development value. The landowner who lost potential value of his property because of loss of development rights was to receive compensation through a fund set up by the government.
4. Local authority development. Planning authorities were given powers to undertake development and compulsory acquisition of land for planning purposes.
5. Planning permission. The Act required permission to be obtained from the local planning authority (with few exceptions) before development was carried out.
6. Central Land Board. A board was set up to levy development charges for the developer to pay the State if he was successful in obtaining permission to develop. These charges were later abolished for development in the 1953 Act, returning development value to the landowner. (Williams, 1981)

The aspects of the Act concerned with development and associated site works provided planners with an effective means of control over developers.

Throughout the 1950's the development control and development plan sections of the legislation stayed as they were originally written, but the financial arrangement sections of the Act were continuously amended by a number of new Acts. These changes were consolidated in 1962, in the Town and Country Planning Act 1962. It defined the types of development; gave the local authorities the power to revoke or modify planning permission; made provisions for compensation to be paid to any person on refusal of planning permission of certain

developments; and gave the local authority the powers to buy land for development. The 1962 Act remained the principal act for nearly a decade.

The first major revision of the entire 1947 Act was not made, however, until 1968, when in the Town and Country Planning Act 1968, the old-style development plan was replaced by structure plans and local plans. The Development Plans were basically land-use maps showing the type of development that was acceptable in a certain place. Although they had a large effect in directing new development, the plans did not accommodate rapid changes. The Structure Plans, which were written by planning authorities in each county, contained an examination of social, economic, and physical situations for each area. The Structure Plans were basically sets of policy statements, with land-use diagrams (not maps) as an illustrative background. The main issues concentrated on:

- (a) the integration of land-use and transport planning,
- (b) measures for improving the environment,
- (c) the relationship with regional planning,
- (d) the resources likely to be available for carrying out the plan,

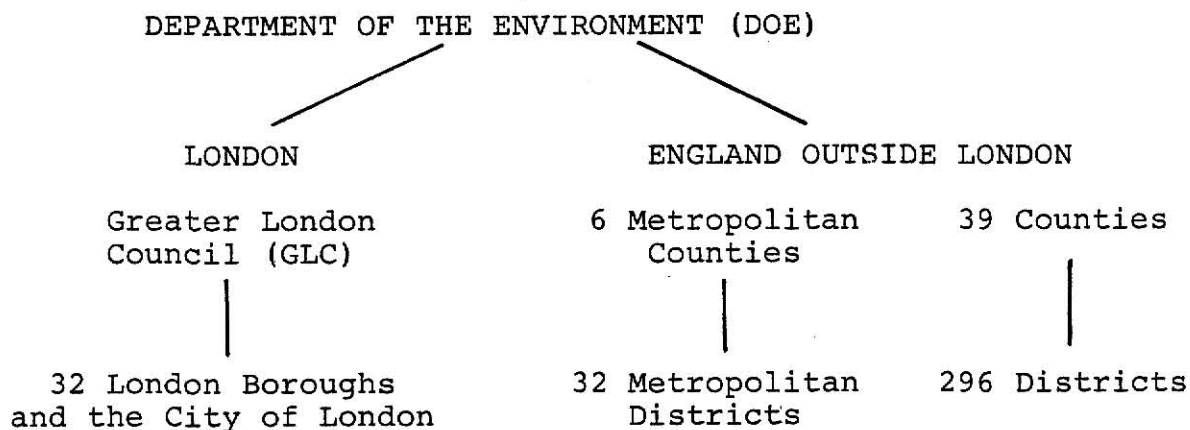
(Blacksell, 1981).

The 1968 Act was amended in the Town and Country Planning Act 1971, but the essentials of the Act remained unchanged. Under the 1971 Act, which is still operating today, the Structure Plans for the countryside are prepared by individual counties and are based on a survey of matters likely to affect the development of the County.

The survey is used to provide a number of alternative solutions to the county's problems. Consultations with the public take place and a preferred plan is worked out. The plan is then submitted for approval to the Secretary of State of the Environment. (See Dia. 1.1.) The Secretary is a Cabinet Member appointed by the Prime Minister and is the head of the Department of the Environment (DOE)

Dia. 1.1

STRUCTURE OF GOVERNMENT FOR COUNTY POLICIES



The importance of structure planning to mining is that it requires local authorities to integrate mineral planning with other important strategic matters. When planning permission is granted for development, the Council can attach constraints, in the form of conditions, upon the developer. Planning conditions allow a local planning authority to impose conditions "as they think fit", subject to the general requirements of the law and relating to planning matters. (Williams, 1981) These constraints must serve some purpose and must not

be wholly unreasonable.

The Town and Country Planning (Minerals) Act 1981 is the most recent of the planning acts. The 1981 Act implements the main recommendations of the Stevens Committee Report published in 1976. Two of the main provisions are:

1. planning authorities will be under a duty to review mineral working sites and to consider whether or not new conditions should be imposed.
2. when a planning authority imposes a restoration condition in relation to mineral working, they will also be entitled to impose an after-care condition for up to 5 years.

(Everall, 1982).

The implications of this Act cannot be assessed at this early date but it shows that the government is attempting to balance environmental considerations between the developers and the needs of the public.

In addition to the Town and Country Planning Acts, there has been legislation designed to deal with the problems of the minning of specific minerals. A committee was set up in 1939 to consider the Restoration of Land Affected by Iron Ore Working. Undoubtedly, the most significant provision of the Mineral Working Act 1957 was that a levy was charged for the extraction of ironstone. The revenue was paid into the Ironstone Restoration Fund. This money could be used by the developer for financing reclamation work of land damaged by opencast ironstone working.

Similarly, under the provisions of the Open Cast Coal Act 1958, there are specific clauses which deal with the

reclamation of land and also with the need to have due regard for matters of amenity and natural beauty. However, open cast-coal operations are not subject to normal planning controls possessed by local authorities, due to the 1948 Coal Nationalization Act providing for state ownership of coal resources, and instead, operators must answer to the Secretary for Energy.

Financing has been the crucial issue surrounding the backlog of derelict land. For many county authorities, the financial burden of embarking upon land reclamation is prohibitive. The National Parks Act of 1949 made some provisions for government assistance to be given for reclamation, but it only applies to a relatively small area of the country and excludes the vast majority of badly affected areas.

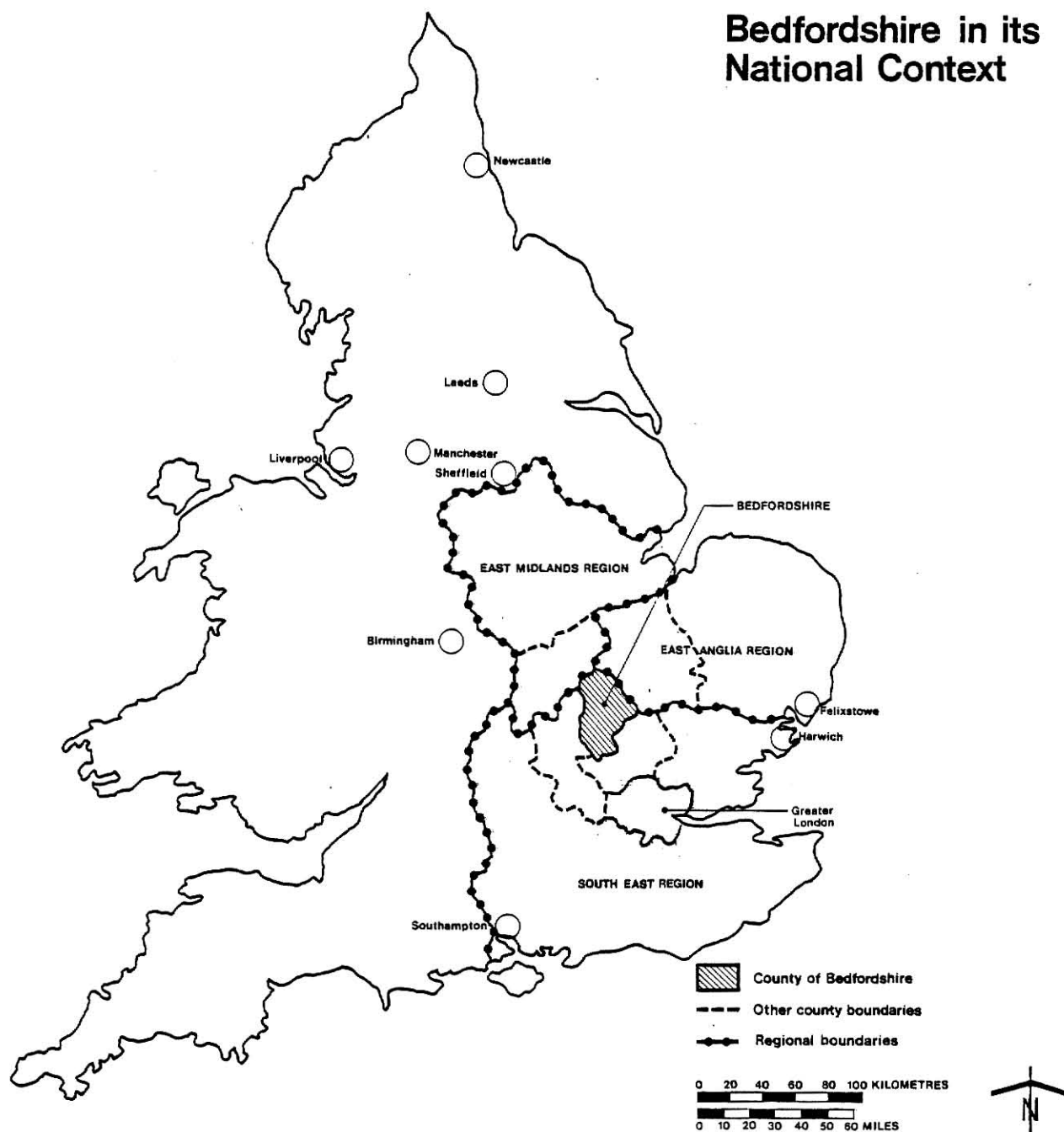
As far as new mineral operations are concerned, it is generally accepted that derelict land problems should and can be avoided by attaching appropriate landscaping and aftercare conditions when granting planning permission.

The next part of this chapter describes the case study site of the brickfields in the Marston Vale and the approach to the thesis.

1.3 Approach

The Marston Vale in Bedfordshire, England, contains one of the richest mining areas in Britain, where, from huge pits, clay is extracted and turned into bricks. (See Maps 1.2, 1.3) Extensive areas of land have been excavated and left with no one totally

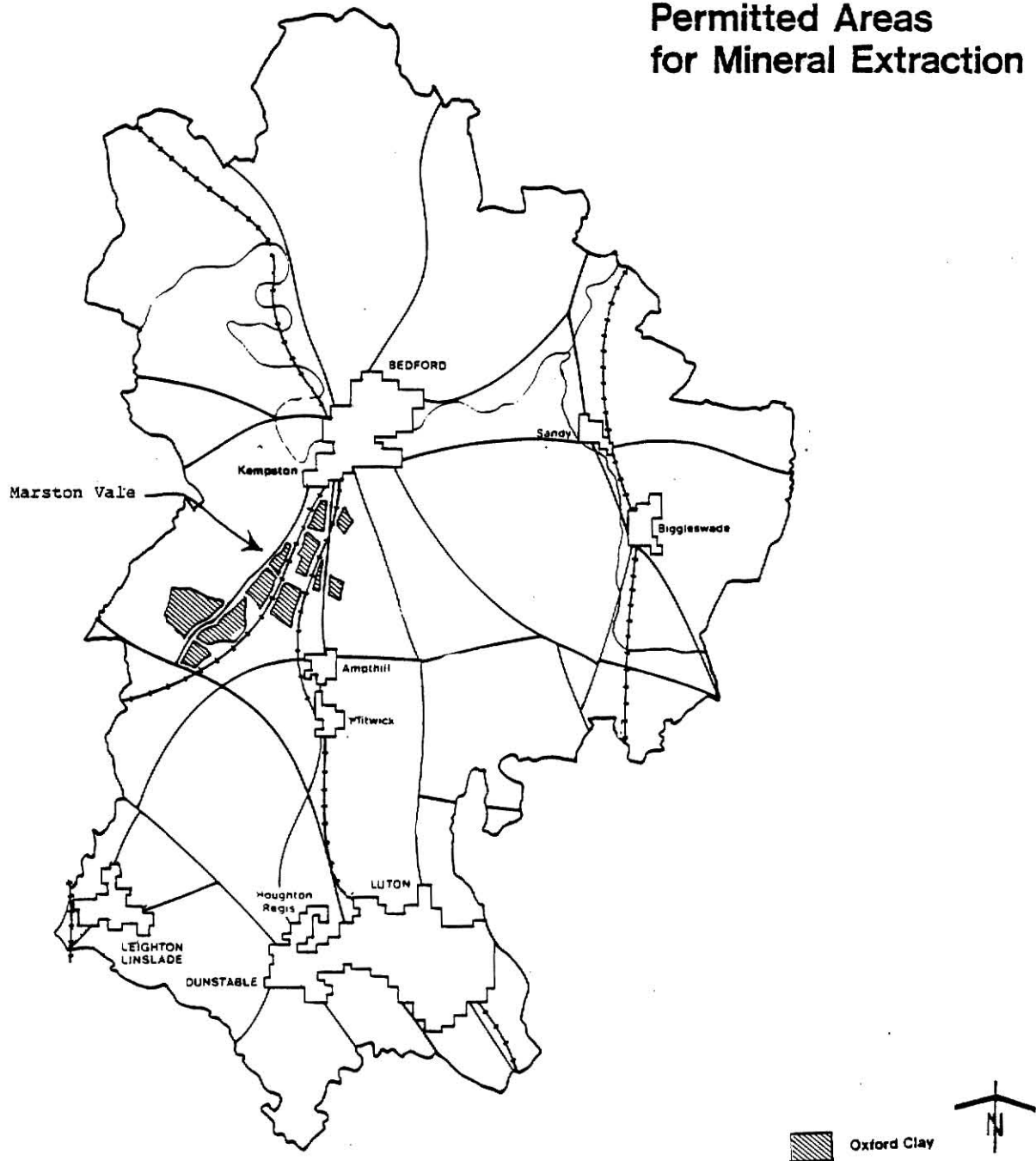
Bedfordshire in its National Context



Source:

Bedfordshire County Structure Plan: Report of Survey -
Consultation Draft. January 1976

Permitted Areas for Mineral Extraction



Source: Bedfordshire County Structure Plan: Report of Survey -
Consultation Draft 1976

willing to accept the responsibility of financing their reclamation. Much of the damaged land was inherited from the period before the introduction of planning legislation. The purpose of this study is: (1) to compare and evaluate the methods of reclamation procedures used in the Marston Vale; (2) to analyze the alternatives for after-use with the needs of the County; and (3) to arrive at a recommendation for the best solution to reshape the land.

The methodology begins with a review of current and related literature. The two major areas of literature considered are general reclamation and British planning policies. Literature discussed under the general reclamation section includes publications specifically relating to the brickfields of the Marston Vale, current literature in the field of reclamation, and books on conservation of the natural resources. The section on British planning policies covers publication on general planning legislation and specific material published by Bedfordshire County Council. This literature outlines surveys of the county leading to the policies developed for the Structure Plan.

From here it is necessary to understand the Marston Vale and the brick industry. A description of the brick industry, the physical appearance of the Marston Vale and the individual excavations is included; and the current planning permissions are discussed.

To evaluate the methods of reclamation of the clay pits, it is necessary to understand the mining procedures of the

the clay extraction. A brief description of the reclamation methods is given, which leads to an examination of the alternative after-uses of the claypits and a discussion of the goals of the parties directly influencing the reclamation proposals. Finally, the alternatives are evaluated using the policies of the agencies while taking into consideration other factors such as local needs, costs of reshaping and conservation of natural resources.

The next chapter is a review of related literature, examining the broad topic of reclamation and identifying voids in existing literature.

CHAPTER TWO - LITERATURE REVIEW

Land reclamation literature has become increasingly prevalent in both the U.S. and in Britain. Most of the literature on reclamation of surface mined lands discusses coal and sand and gravel. Little literature exists specifically on clay extraction or on renovation of clay pits, and an even smaller amount is to be found on the brickfields of the Marston Vale.

The literature presented in this chapter is divided into two sections. The purpose of the first section is to look at the literature, (1) directly related to the Bedfordshire brickfields, (2) on general reclamation applicable to the problem, and (3) in the related field of conservation. The second section is divided into two parts, (1) County Council publications outlining the policies for the brickfields and (2) literature on planning legislation.

Presented in the chapter is the background information related to the problem through discussion of reclamation, conservation, and planning legislation and various viewpoints on the problem of the dereliction of the Marston Vale brickfields. This review of the literature helps show how this present research fits into the overall picture.

2.1 Reclamation

In the past twenty years, much has been written on the

subject of reclaiming land damaged by surface mineral extraction in the USA and Great Britain. However, the majority of the literature is too broad or too technical to be of much relevance to this thesis. The literature on clay extraction, the subject of this section, is especially limited.

Although reclamation has been an important issue in Great Britain, particularly since the passing of the Town and Country Planning Act 1947, the bulk of publications began to appear in the early to mid-sixties, continuing through the mid-seventies. These books are oriented toward philosophies and problems of mineral extraction rather than technical information on procedures of reclamation.

2.1.1 Clay Extraction - Marston Vale

Six publications include Oxford clay extractions in their discussions on derelict land. One publisher, the Civic Trust, is an independent agency whose objective is to improve the appearance of town and country. The Civic Trust's Derelict Land (1964; 3rd impression 1967), is the outcome of a special study of industrial dereliction and reclamation possibilities. The section on "Bedfordshire -- Brick Clay" describes alternatives for reclaiming the clay pits including filling with water, refuse, or pulverised fuel ash, and suggests that the impervious nature of Oxford clay makes it impractical to reclaim to an elevation lower than the surrounding land.

Cowley (1967), Bedfordshire County Council's planning

officer, published an appraisal of the brickfields which also described alternatives for reclaiming the claypits. He examines filling the pits with refuse from London, colliery spoil, and pulverised fuel ash, which are the only materials produced in sufficient quantity to fill the pits. Barr (1969), in his analysis of Britain's industrial wasteland, feels that the claypits will never be reclaimed because: (1) the problem of finding fill material is insurmountable and (2) the reclamation conditions are ambiguous, making it difficult to enforce reclamation. More recently, Wallwork (1974) suggests that the history of reclamation proposals since the 1960's illustrates the complexity of finding an adequate solution to the problem of filling the Oxford Claypits. He also emphasizes that the absence of filling material will make it necessary to adopt a new reclamation strategy. (See Chapter Seven for recommendations.) Wallwork also suggests that the practice of tipping overburden in irregular mounds (creating a moonscape) upon the pit floor be stopped and, instead, be evenly spread over the floor of the pit. Bulger (1975; reprinted 1981) updates the reclamation schemes, pointing out that the refuse from London scheme was approved in 1973 and expected to begin in 1975. A subsidiary company, London Brick Development, was formed to assist local authorities with refuse problems. The refuse from London was to be carried by special trains twice daily to the worked-out Bedfordshire brick pits, but, according to Bulger, this scheme in itself would not be enough to solve the problem. Blunden (1975) agrees that the major

problem of reclamation of the Bedfordshire brickfields is the vastness of the pits and the scarcity of fill materials. Much like Wallwork, Blunden emphasizes the need to stop the tipping of the overburden and topsoil on the floor of the pits but suggests concentrating the overburden at the edge sloping inwards and covering the fill with topsoil.

Cowley (1967) is concerned with the implications the planning permission has had on the solution of reclaiming the claypits. Cowley outlines the reclamation conditions and points out the disagreement in the interpretation between the Brick Company and the County Council. The crucial wording is:

"... with any other suitable filling material available at reasonable times on reasonable terms shall be deposited within the excavated area ...".

Cowley interprets the terms to mean the Brick Companies should not have to pay an inordinate price for filling materials but understands the Brick Companies to construe it to mean that they may charge for tipping in their pits but the charge must not be unreasonably high. Barr and Bugler question the 'morality' of making a profit from self-inflicted dereliction. On the other hand, Wallwork and Blunden point out that there is no reason the process should not be profitable, as long as the solution is satisfactory.

The publications on the brickfields are valuable because they point out problems, and a need for solutions, but offer very little in the way of suggestions to solve the problem. There has been little published on the dereliction problem of the brickfields in Marston Vale in the last several years, with

the exception of the reports published by the County Council, which will be discussed later in this chapter.

2.1.2 Technical

Many articles and books have been written in the USA and Great Britain on the technical aspects of reclamation; but they do not relate the practice to clay extraction. Hackett (1977), Lovejoy (ed. 1979), and Bradshaw and Chadwick (1980), are a few of the more recent publications from Great Britain. Hackett's (1977) book is the result of a two volume report on landscape reclamation research developed at the University of Newcastle and is a collection of technical papers. The book chapters are organized to develop a procedure of reclamation practices from administrative procedures, survey, design, land-form design and grading, soils, revegetation and financial contracts. Lovejoy's (1979) book is a collection of technical papers on general scope of landscape architecture, showing the relevance of the techniques and philosophy of land centered design. It contains one chapter by Tandy related directly to derelict land and techniques for reclamation. Bradshaw and Chadwick (1980) have published an excellent, detailed, account of problems and techniques of reclamation of derelict land. Bradshaw and Chadwick, a botanist and biologist respectively, have taken a scientific approach to land reclamation. They lean heavily on an understanding of the ecological factors which effect plant growth and include comprehensive chapters on soil problems.

An older publication, but still of great value, is by Oxenham (1966). His book, which broadly surveys the subject of reclamation, is of value as a handbook on the technical details of how to do the job of land renewal. Also of importance is the publication from the American Society of Landscape Architects (1978) "Creating Land for Tomorrow". It is a well presented, concise guide to land reclamation with examples drawn from the coal mining industry. It includes information on mining and mining equipment and relates the information to planning processes, legal requirements, and visual analysis. While all of these publications include technical information on reclamation, some of which can be applied to clay extraction, they do not relate directly to the problem of mining clay.

Industry Publications

By far, some of the most detailed and constructive research has been in conjunction with the mining industries themselves. Particularly notable are the four research projects from the University of Illinois, sponsored by the National Sand and Gravel Association in USA. The projects began in 1963 and continued through 1968 and covers simultaneous excavation and rehabilitation, land use selection, operating procedures for progressive rehabilitation, and site planning. Another of these publications is one by Haywood (1974) which was sponsored by the British Quarry & Slag Federation. It includes

general information on extraction, relationships between planners, the public and the industry, site evaluation, and detailed recommendations. The Sand and Gravel Association of Great Britain has also printed several publications related to land renovation, including New Lands for Old (1971). The coal industry in Great Britain and the USA have provided a long list of valuable reclamation discussions and information. All of these studies are important to the reclamation field and often have some common features, but do not relate specifically to the unique problem presented by the vast impermeable pits left after the extraction of the Oxford clay.

Journals and Articles

Derelict land and land reclamation are dealt with quite frequently in Landscape Design, formerly the Journal of the Institute of Landscape Architects. A particularly valuable discussion was "Gravel Extraction - Why Always The Wet Answer" by L. Tartaglia - Kershaw (February 1980). Landscape Architecture also has frequent articles including the July 1981 issue 'New Landscapes' with several articles relating to land reclamation and 'The Big Hole: Planning A Quarry's Re-use' by McKenzie, S. & R. (Jan. 1979).

The amount of material pertaining to reclamation is extensive. The publications from Great Britain tend to center on land reclamation after the extraction procedure has been completed whereas the attitude in the USA is one that examines the problem before extraction even begins.

2.1.3 Conservation

In recent years, several significant books have been published concerning the future of the English countryside, three of which have been particularly valuable. Nan Fairbrother (1970) outlines the history of and the changes caused by a new society. To Fairbrother, the solution is to achieve good landscapes by deliberately designing new settings to suit new land-uses and re-creating the beauty of the old in the new ones. More recently, Shoard (1980) stresses the need now to save the English Countryside. Although this book and the one by Fairbrother are concerned with the impact new technology has had on the countryside, Shoard (1980) stresses the effect of the agricultural change and the forces destroying the rural environment. Green (1980) critically examines the root of the conservation problem, outlining the development of the modern farming landscape, looking at management of natural resources -- renewable and nonrenewable -- along with private enterprise or public agencies.

Fairbrother (1970) and Shoard (1980) make realistic assessments of the changing landscape and present plans of action. Shoard (1980) proposes a major reorganization of the administration that affects the planning of the countryside. Fairbrother (1970) presents plans for designing a better landscape, rather than proposing radical changes within the government system. Green (1980) presents a case for the need of change in policies to develop a balance between agriculture and conservation rather than developing a proposal for the changes.

Other publications appeared in the years between 1970-80. The Countryside Review Committee began its work in 1974, reviewing the state of the countryside and the pressures on it. The purpose of the committee was to examine the governmental policies for the impact upon the countryside. Discussion papers published from 1977-79 include: "Rural Committees"; "The Countryside - Problems and Policies"; "Leisure and the Countryside"; and "Conservation and the Countryside Heritage".

A particularly noteworthy book is by Hoskins (1970). He wrote about the development of the English village in a broad historical perspective. His book led to a series of books on the English landscape including The Bedfordshire and Huntingdonshire Landscape by Peter Bigmore (1979). Best (1981) concludes that, presently, there is no real land problem in Britain in his researched appraisal of land-use structure and change. Mabey (1980) examines the British ecology movement and looks at realistic proposals for nature conservation; and finally, Newby (1979) investigates social changes in rural England.

Although conservation publications are not directly related to reclamation of mined-out land, they are important because they are concerned with the changes in the country, one of which is mineral extraction.

2.2 British Policy

The most recent publications relating specifically to the brickfields of the Marston Vale and the problem of reclamation

appear in the form of booklets and reports published by Bedfordshire County Council. The Oxford Clay Subject Plan - Consultation Draft by Griffin (May 1982), was prepared to apply the policies contained within the County Structure Plan. The County Structure Plan (as discussed in the previous chapter) is a written plan formulating the County Council's policy and general proposals in respect to future development of the County over the next fifteen years or so. It has three main functions: (1) provide guidance to development agencies; (2) interpret national and regional policies; and (3) provide a framework and statutory basis for local plans. The Structure Plan, prepared in 1977 and approved in 1980, sets out the general strategy to be adopted with respect to mineral extraction, and contains policies for each significant mineral found in the County. Chapter Six discusses in more detail the policies adopted by the County Council. In 1978, the County published the report, 'Bedfordshire Minerals: Appraisal and Issues', which is the first stage of the Subject Plan. It represents the information upon which the Subject Plan is based and draws attention to the issues which the County Council feels require resolution through the Subject Plan. The Subject Plan is produced in two stages: (1) presentation of the 'Appraisal and Issues' report, followed by public consultation; and (2) publication of a draft policies and proposal report. The draft will now be followed by public consultation and then be prepared as the final Subject Plan. The Subject Plan is concerned with the detailed treatment of

the brickfields of the Marston Vale and formulates policies and proposals for extraction and reclamation. The Subject Plan provides accounts of the Oxford Clay resources and further clay extraction, reclamation and after-use, affects on the landscape and wildlife, and concerns about pollution. All these reports have been extremely beneficial in understanding the needs of the public, progress, and the reasons that the action has been taken. Other helpful reports included Landscape and Wildlife - Wildlife Technical Volume, Landscape and Wildlife - Landscape Technical Volume, and the Report of the Survey.

Planning Legislation

Publications on planning legislation in England have been beneficial in understanding the trend in reclamation policies. Recently, Roberts and Shaw (1982) produced a study that attempts to identify a more rational and coordinated approach to planning for mineral development, assessing the needs for change and the form the change should take. Blacksell's and Gilg's (1981) publication assesses the impact of the policies and plans that guide the change in the rural countryside and note that co-ordinated decision-making is lacking in the process. Gilg's (1978) study fills a gap in the literature available on the overall coverage of the conflicts between countryside powers, examining the planning agencies and focusing on the British countryside in planning for all aspects.

A brief and clear discussion of land reclamation as part of the overall planning policies can be found in Town and Country Planning in Britain by J.B. Cullingworth (Seventh edition 1979). For publications that give concise accounts of the history, principles and practice of planning in Great Britain, Williams (1981) and Ardill (1974) are suitable.

The publications of the Bedfordshire County Council relating to the brickfields of the Marston Vale help to understand the problems and solutions being sought in reclaiming the land of the area. With the aid of the planning legislation books it is easier to understand the procedures involved, as the planning authorities have been given clear responsibility for the control of mineral extractions.

2.3 Conclusions

The early trends on reclamation literature were directed to recognizing that industrial dereliction existed and to identifying specific problem industries but without providing solutions. Later literature discussed research and developed solutions to problems in each of the individual industries such as strip mining of coal, or sand and gravel. Recent literature is devoted to general reclamation practices and problems such as grading and revegetation but generally does not examine how these improved practices can be used for a specific mineral industry.

The attitude towards the claypits in the Marston Vale has changed very little. The County Council is still searching

for the most beneficial solution but still struggling with the attitude of the Brick Company's desire to make a profit out of the problem of their dereliction.

What is needed is analysis that links the different problems and the solution for an area such as the claypits of the Marston Vale and studies how the solutions are applicable to other areas.

CHAPTER THREE - THE MARSTON VALE

3.1 Introduction

This chapter first gives a brief outline of the surface mining industry in Great Britain narrowing to the Bedfordshire brickfield of the Marston Vale. A brief history of brickmaking from the Oxford clay deposits is given, followed by a description of the Marston Vale and the surrounding agricultural land and the individual claypits. Finally, the new planning permissions relating to the Marston Vale are outlined.

3.1.1 Surface Mining

All forms of mineral extraction carried out in excavations open to the sky are termed surface mining or open-cast mining. These workings are generally described as quarries, pits, or mines. 'Quarry' normally refers to an open excavation for non-metalliferous hard rock. 'Pit' is used to describe open workings in soft deposits, such as clay, sands and gravels. 'Mine' is used to describe excavations working fossil fuels and metalliferous ores. The deposits themselves range from shallow widespread beds, through solid and often deep formations with little overburden to extensive areas with large amounts of overburden and small mineral deposits.

S.H. Beaver, in 1966, designated a system of classification of surface mining. The categories and examples are listed below:

1. Shallow Workings.

Excavations working thin mineral deposits (6m or less) with little or no overburden and not reaching the water table. (Most dry sand and gravel pits and all peat diggings fall into this category. In earlier periods of development opencast workings for ironstone, coal and clay were also of this type.)

2. Deep Working with a high ratio of overburden to mineral.

Excavations working thin to moderate mineral deposits (20m or less) with overburden reaching thickness of 30-35m (opencast mining of coal and ironstone).

3. Deep working with little overburden and thick mineral deposits.

Excavations working thick mineral deposits with varying amounts of overburden. The following sub-types are identifiable:

- a) working 'soft' material which normally can be excavated without blasting (brick and china clays);
- b) working 'hard' material which normally has to be blasted before excavation (slate, limestone, chalk);
- c) working fossil fuels (brown coal or lignite);
- d) working metalliferous ores, which may be either 'soft' or 'hard' and, unlike most examples in a) and b) above, may also be worked by deep mining techniques in other localities (metalliferous ores).

4. Surface working below the water table.

Surface working of deposits taken from below the water table (but excluding off-shore dredging):

- a) 'pure' workings (sand and gravel);
- b) 'residual' workings (gold).

(Wallwork, 1974)

The different types of mineral workings are as varied as their environmental after effects. The different types of

mineral workings may have some features in common, but each requires separate considerations in relation to reclamation. Shallow workings can generally be reclaimed to something that resembles their previous conditions creating little long term problems. Deep workings with a high ratio of overburden to mineral such as opencast coal mining produce no real long term dereliction; the topsoil and overburden are removed, the mineral extracted, the overburden is replaced, subsoil and topsoil respread and the site is reclaimed. Deep workings with little overburden and thick mineral deposits such as brick clays, china clays, sandstone or limestone are the basis for extreme forms of dereliction. This thesis is limited to the examination of dereliction left by the extraction of brick clay mining in the Marston Vale of Bedfordshire.

The next section is a brief history of brickmaking, followed by a description of the Marston Vale.

3.1.2 History of Brickmaking in Bedfordshire

One of the oldest activities of semi-civilized man is brickmaking - the first bricks being made from sun-dried clay. The history of brickmaking in Britain begins with the Romans as the first great brickmakers but the art disappeared after they left. Brickmaking was re-introduced in the thirteenth century as timber for building became scarcer, and received a further boost in 1666 after the Great Fire of London. (Cox, 1969) Until the mid-nineteenth century, the

manufacturing of bricks was primarily carried out on or near the site where the bricks were actually required. The process was slow and tedious; the clay was dug in the autumn and piled in the winter, turned occasionally to break it down. In the spring it was wetted, stirred and worked into a pliable lump to be handshaped into raw bricks and then fired. With the nineteenth century came the railway which brought about the growth of Bedfordshire as a major center for brickmaking. Britain's largest brickmaker is headquartered in Bedfordshire, making it one of the most important brickmaking centers in the country.

Bedfordshire was turned into a major brickmaking center after a revolutionary brickmaking technique was introduced within the industry. In 1881, at the little village of Fletton near Peterborough, Huntingdonshire, the revolution began when the first kiln containing bricks made of Oxford clay was fired. A deposit averaging 45-50 feet of shale-like, grey-green clay known as 'knotts' was found beneath the 10 to 40 feet of top calow. The characteristics of the Oxford clay are:

1. A 20 percent moisture content allows the clay to be crushed into granular form, which could be pressed into a brick and fired immediately without curing.
2. The knotts contain 10 per cent of a carbonaceous material which assists during firing acting as a built-in fuel and reducing the fuel consumption by two-thirds.
3. The lime content can be maintained constant providing precisely the correct amount required to prevent bricks cracking during firing.
4. There are few impurities in the clay.

(Cowley, 1978)

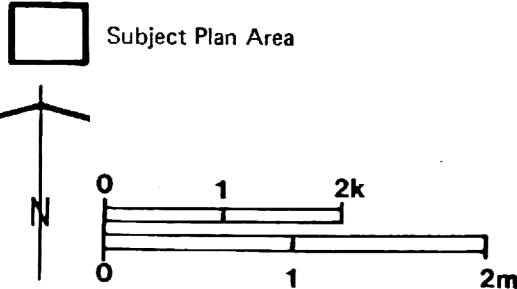
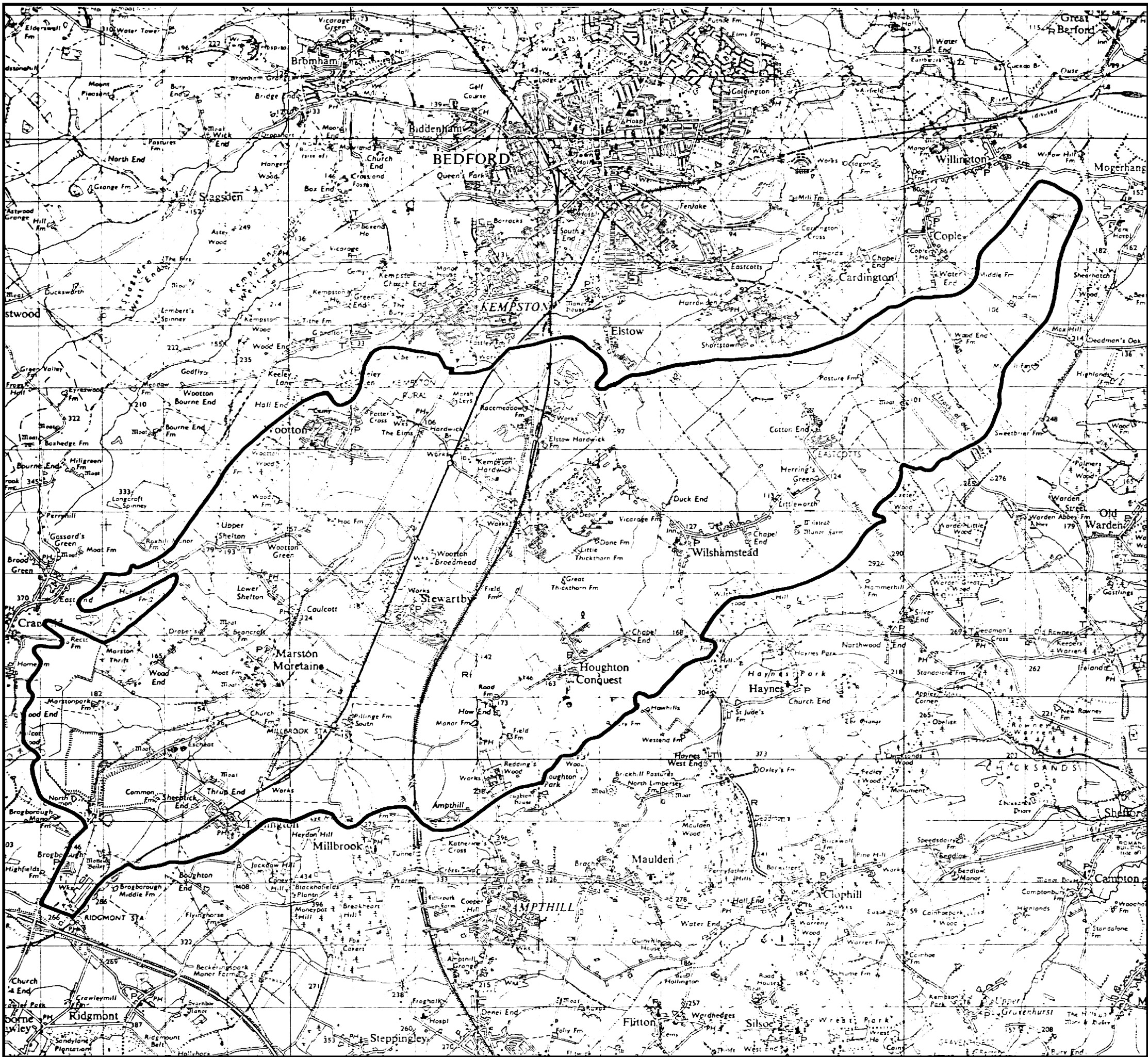
Due to the success of the brickworks in Fletton, exploitation of other exposures of Oxford clay by other manufacturers soon followed. One of the largest exposures of Oxford clay occurs in a valley in central Bedfordshire, stretching south-westwards from Bedford and is variously known as the Vale of Bedford, Marston Valley, Marston Vale, or 'the Brickwork Valley' (see Map 3.1); the Oxford clay formation on which it is based lies diagonally across England from Dorset in the south, north-eastwards to East Yorkshire in the north.

The year 1897, marks the beginning of the Bedfordshire brickworks; B.J. Forder & Sons opened the first two works at Wootton Phillinge and Elstow. The Forder brickworks grew successfully and the company absorbed other companies during the 1920's brick production slump. Finally, it was absorbed into a much larger company which in 1936 named itself the London Brick Company Limited (LBC). The London Brick Company has continued to grow over the years; in 1969 Marston Valley Brick Company Ltd., LBC's chief rival, was taken over by the LBC and in 1971, LBC purchased Redland (Fletton) Ltd. the last Fletton brickworks, giving the company all of the local clay brickworks. The Bedfordshire brickworks manufactures about 45-50 per cent of the national Fletton production and about 20 per cent of all bricks made in Britain.

3.2 The Brick Valley

The Bedfordshire Brickfield is located southwest of

Source: Oxford Clay Subject Plan.
1982



Bedford in a valley, the Marston Vale, that stretches for about 8 miles to the M1 Motorway which is the busiest major highway in England. The character of the area is basically rural but the brickmaking activities dominate the landscape with tall chimneys and gaping holes of current and derelict clay workings. The Marston Vale constitutes what is generally accepted as the bleakest landscape in Bedfordshire. (See plates 1,2). The brickmaking activities are concentrated in an elongated core extending the full length of the area beginning in the north from Kempton Hardwick to Brogborough in the south. There are fourteen areas with past or present permission for extraction of the clay. About 1700 acres have been excavated since 1900. Over half of this excavated area, 1060 acres, is unrestored. There are about 1600 acres with future planning permission for excavation. Current permitted reserves are sufficient to serve the adjacent brickworks for up to forty years.

The core of brickmaking activities are flanked on either side by continuous stretches of agricultural land. The flat plain ends abruptly under the Greensand Ridge to the southeast, creating a distinct change in height and open views over the Vale. The next section is a description of the agriculture in the Marston Vale which characterizes the area as rural.

3.2.1 Agriculture in the Valley

The Vale of Bedford is an area of low lying, gently



Plate 1: The Brickworks dominate the Vale



Plate 2: Derelict Pit - Brogborough 2

undulating Oxford clays. The flat farmland consists mainly of Grade 3 or 4 land (see Chapter 1) according to the Agricultural Land Classification System, with a small area of Grade 2 but beyond the extent of the workable Oxford clay deposit. The majority of the soils are from the Rowsham association, a group of non-calcareous gley (waterlogged) soils formed on the Ampthill and Oxford clays and include gravelly drifts.

The Rowsham series is formed in a layer of clayey drift containing some sand and stones, often having a narrow gravelly seam 18-36 inches deep overlying the Oxford clay. The surface horizon consists of a dark brown clay loam or sandy clay loam while the subsoil consists of an olive or greyish brown clay loam to clay with distinct fine ochreous mottling. This is followed by a discontinuous layer of gravelly sandy clay loam overlying gleyed clay. These heavy soils suffer from waterlogging in the winter and crack severely in periods of drought. The main crops are winter wheat and barley with some oil seed rape, although they have traditionally been used for grassland. For the best use of the land, artificial drainage is essential. (Hodgson, 1976)

The remainder of the area belongs to the Milton association, largely of gleyed brown earths of variable thickness. Drainage also tends to be imperfect much like the Rowsham association; but they are level yet easily drained by ditches and are very useful arable soils with favorable texture and structure.

Despite the drainage problems, the reserve of the moisture held by the underlying clay and the horizon above the soils are valuable because they counteract the low rainfall of only 22 inches per year. Good yields of cereal crops can be obtained on this land.

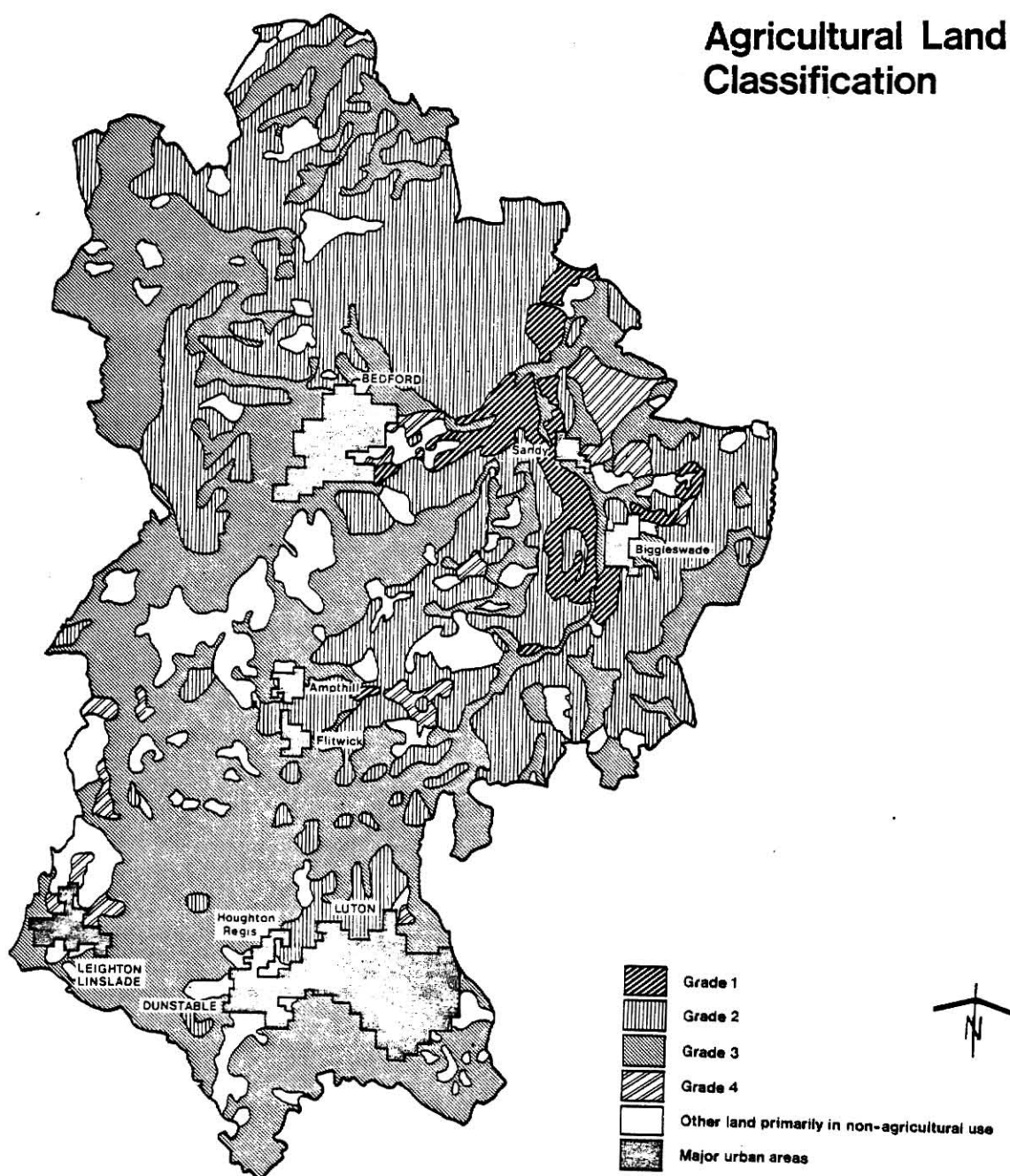
The agricultural land in the Marston Vale is at best only of average quality and not of significant importance as the higher grade areas which make-up the majority of the land of Bedfordshire. The land taken by the clay extraction is not a loss of the most valuable agricultural use in Bedfordshire. Following is a description of the condition of each of the permitted areas for clay extraction. (See Map 3.2)

3.2.2 The Brickfields

The majority of the excavated areas in the Marston Vale was either worked before World War II without planning permission or the permissions were granted over 20 years ago. The worked and permitted areas are listed below and the current condition outlined. (See Map 3.3)

Elstow (55) comprises a total of 94 hectares (ha.). Of this, 62 ha. have been worked leaving 31 ha. remaining with planning permission for clay extraction representing 4.1 million cubic meters void space. Of the worked area, 35 ha. are in the ownership of the County Council. Approximately 20 ha. are currently operated as a landfill site which accepted 50,000 tons of domestic, industrial and commercial waste in 1979 and is estimated to be filled to ground level in 1982.

Agricultural Land Classification



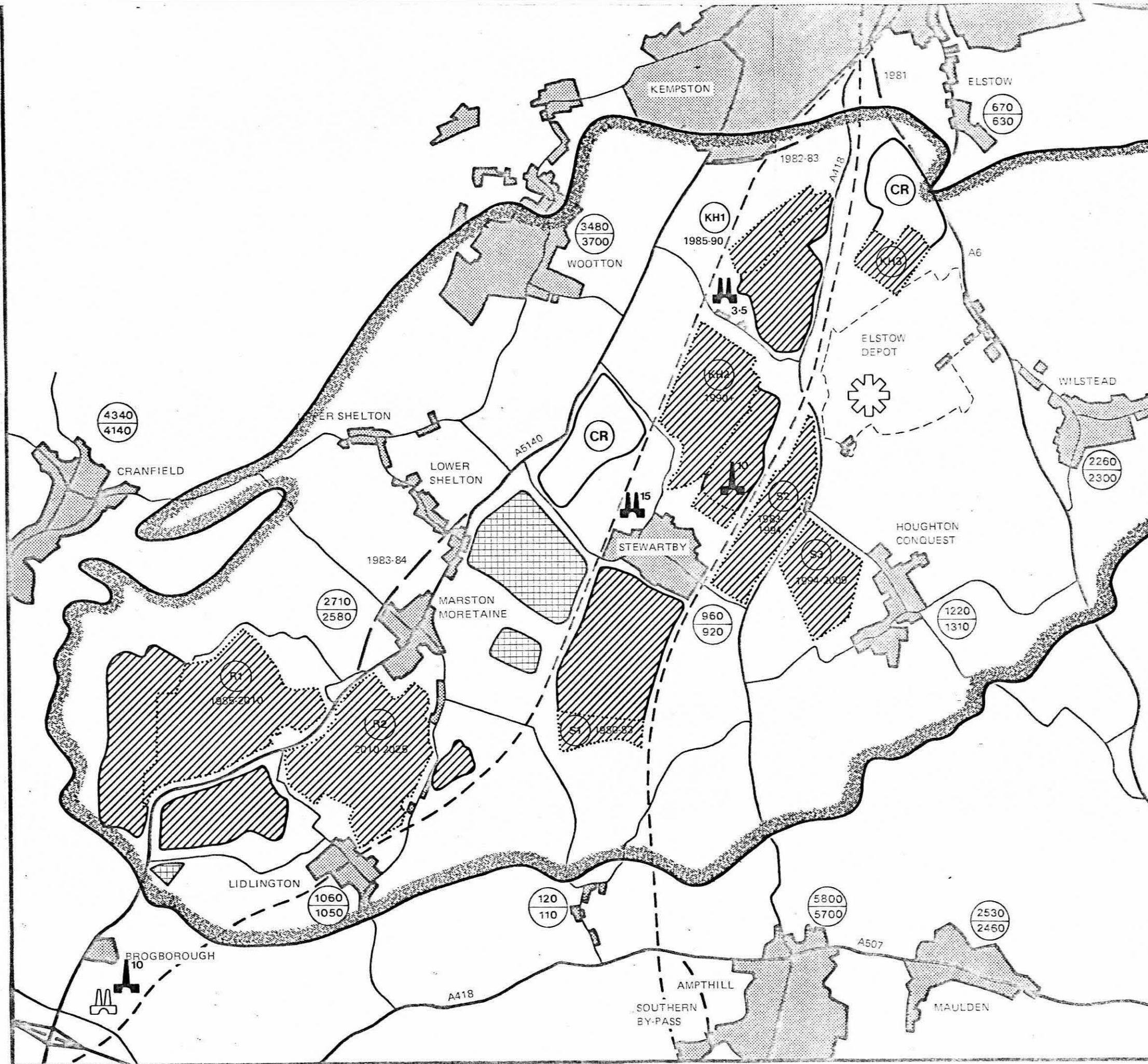
Source: Bedfordshire County Structure Plan: Report of Survey - Consultation Draft. January 1976

Oxford Clay

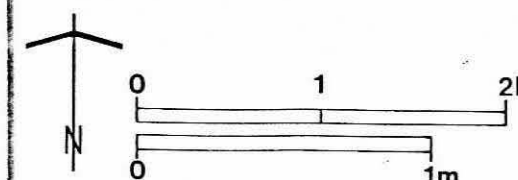
Longterm Framework

Map 3.3

Source: Oxford Clay Subject Plan.
1982



- Future working areas
- (1 and 2) Ridgmont reserves
- (1, 2 and 3) Stewartby reserves
- (1, 2 and 3) Kempston Hardwick reserves
- Areas requiring restoration (existing and future)
- Restoration taking place
- Restored
- Permitted sites for new brickworks (capacity in million bricks/week)
- Existing brickworks (capacity in million bricks/week)
- Disused works
- Extent of Oxford Clay deposit
- Possible site for power station
- Built up area
- Existing (1981) population
Forecast (1991) population
- Strategic highway network
- Proposed highway improvements (with start dates)
- Main roads, other than strategic
- Other roads
- Railway



The remaining 15 ha. are being sought as an extension to the existing landfill site and it is estimated that it will take 15 years to fill. The remaining 28 ha. are subject to a planning agreement with the LBC allowing the filling by domestic, industrial and commercial refuse provided it is brought in by rail. No refuse has so far been brought in under these terms.

Kempton Hardwick (63, 64, 65), of which 80 ha. (6.9 million cubic meters) of the permitted 67 ha. have been worked. The remaining reserve representing 2.5 m.cu.m. of void space. A lagoon in the southern portion of the pit, 26 ha., is currently used for sailing and angling. The remaining 54 ha. are of a relatively shallow nature and are partially waterfilled but unrestored.

Coronation (66) is a permitted area covering 167 ha. of which 58 ha. representing 6.9 m. cu. m. of void space have been worked, leaving 109 ha. unworked with estimated 11.5 m. cu. m. potential void space. No restoration has been carried out in this pit, which has a 'moonscape' formation from the dumping of the overburden, and is partly flooded.

Quest (67) was granted permission in 1980 for an area of 84 ha. with an estimated void capacity of 12.9 m. cu. m. An area of topsoil has been stripped and removal of the first cut of callow will begin summer 1982 in preparation for extraction which is scheduled to begin summer 1984, as Rookery is exhausted.

Rookery (80) is the current working pit for Stewartby

works; approximately 121 ha. of the permitted 166 ha. have been worked. Rookery is one of the deepest pits in the Vale and the current void capacity is estimated at 25 m. cu. m.

'L' Field (61, 62) has a permission covering 77 ha. of which 70 ha. have been worked. Excavation of the pit ceased in 1960 leaving a void space of 11.5 m. cu. m. In 1979 this pit started to be filled with domestic waste brought in by rail with between 800 and 1,200 tonnes (metric 1000 kg per tonne) disposed of each day. It is expected to be filled to ground level in 20 years. Older planning agreements allow for household, industrial and commercial waste to be disposed; and also an area of 23.8 ha. for dumping of certain notifiable (hazardous) waste (1978). The reclamation scheme provides for the reclaimed site to be used for agriculture. (See Plate 3)

Stewartby Lake (60), a worked out area which covers 100 ha., is flooded. The lake is used for recreation and is considered to be reclaimed. (See Plate 4)

Marston Moretaine (76) has a permitted area which consists of 124 ha. of which only 13 ha. have been worked. The rest is unlikely to be worked because of a shell layer in the clay. The worked area is flooded and is used for angling and fish breeding. Backfilling for agricultural use in the long term may be desirable, according to the County Council, if it can be demonstrated that it is in the interest of agriculture.

Houghton Conquest (81), after a modification of the planning permission, has been reduced to 59 ha. with a void capacity of 12.5 m. cu. m. Excavation is not expected to



Plate 3: 'L' Field - Landfill Site



Plate 4: Stewartby Lake

begin before 1991 and if an alternative area for clay extraction is found, the existing permission will be revoked.

Lidlington (78) permission consists of a 19 ha. worked area, 7 ha. of which have been backfilled to ground level with railway waste but have not been topsoiled. The remaining area is flooded to a shallow depth and is now a habitat for many types of birdlife. The site has been proposed as a reception terminal for colliery spoil and it is viewed by the County Council that it be backfilled to ground level as soon as possible.

Brogborough 1 (74) has a permitted area which totals 125 ha., of which 91 ha. have been worked. The total area was allowed to flood and is considered an attractive part of the landscape; the area contains a colony of a very rare and attractive flowering plant species that grow in only four other localities in Britain. The pit will be retained as a water feature unless it is demonstrated that it is essential for colliery waste disposal.

Brogborough 2 (73) is the largest single permitted area in the Vale, with 363 ha. The worked area consists of 194 ha. with an additional 160 ha. likely to be excavated. Existing void space is 23.14 m. cu. m. with eventual capacity of 46.44 m. cu. m. No restoration has taken place but it is proposed to be filled with colliery spoil.

Ridgmont (90, 91) has a permission extending to 92 ha., of which 5 ha. have been worked; the remainder is unlikely to ever be worked. Some tipping has occurred but the void space

has not been filled and no further proposals have been made.

Thrupp End/Estacheat (77, 75) is presently unworked but permission is for 177 ha. with an estimated void capacity of 14.9 m. cu. m. It is not expected to be worked until 2010. It has been recommended that the worked out area be filled with colliery waste.

The final section of this chapter outlines the recent planning permissions and the implications of the permissions.

3.3 Planning Permission

Early planning permission in the years after the Town and County Planning Act 1947, were designated for individual pits. New planning permissions granted for the Marston Vale in 1980 and 1981 are different. They divide the Vale into northern and southern areas to serve the proposed new works in each area. In 1977, London Brick Company announced its intention to build two new brickworks in the next 15 years in the Marston Vale. (Griffin 1982) Permissions for clay extraction in Bedfordshire exist to allow brickmaking to continue for another 30-40 years at current rates. The London Brick Company estimates the current permitted reserves are sufficient to serve the two major works at Stewartby and Ridgmont for about 30 and 40 years respectively. (See Table 3.1)

Table 3.1 Permitted Clay Reserves

WORKS	RESERVE	AREA OF RESERVE (ha)	VOLUME OF CLAY (m.cu.m.)	ANTICIPATED LIFE
Ridgmont	Brogborough	160	23.3	25
	Thrupp End/Estcheat	158	14.9	15
Stewartby	Rookery South	33	4.4	6
	Quest (Field Farm)	84	12.9	11
	Houghton Conquest	59	12.5	15
Kempston Hardwick	Kempston Hardwick	33	2.5	5
	Coronation	109	11.5	23
	Elstow	31	4.1	8

Source: Oxford Clay Subject Plan; Griffin 1982

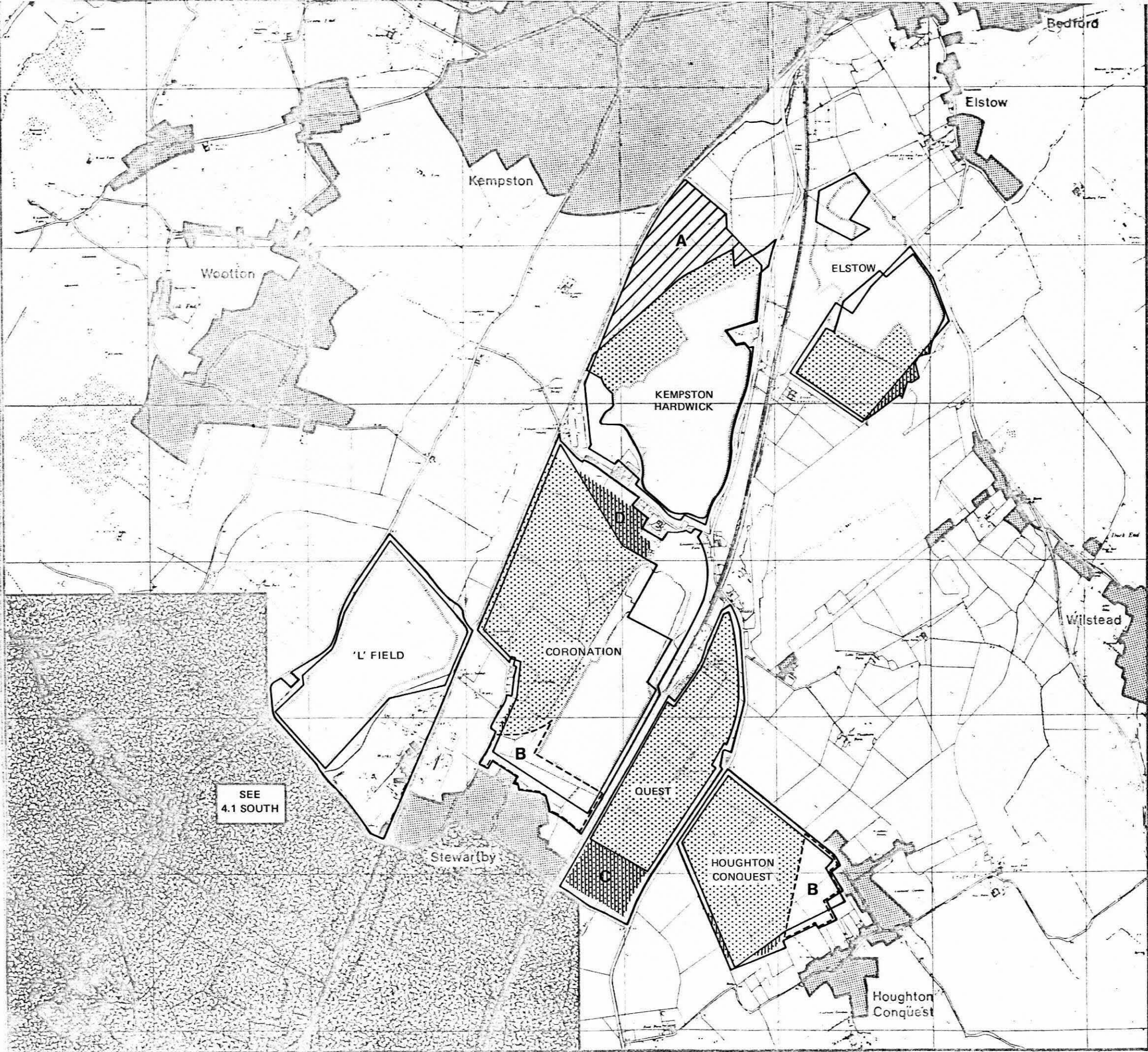
The northern part of the Vale is designated as Marston Vale North and is made up of the clay reserves which serve the Stewartby Works (Rookery, Quest, and Houghton Conquest) along with the reserves at Coronation, Kempston Hardwick and Elstow. In July 1980, the County Council granted permission for the northern Vale with conditions that included the new works must be capable of removing the pollutants. Permissions were also granted with the conditions requiring submission of detailed drawings of the development. (See Map 3.4)

Marston Vale South (see Map 3.5) consists of the proposed new

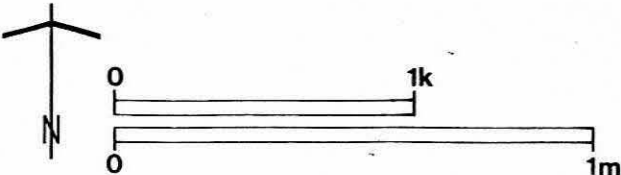
Oxford Clay
Permissions for
Clay Extractions

49
Map 3.4
North

Source: Oxford Clay Subject Plan.
1982



- Original permitted areas (granted 1947-1960)
- New permitted areas (granted 1980)
- Future extraction areas
- Areas of uneconomic deposit
- Settlement stand off areas
- Minor extensions to original permitted areas









Oxford Clay Permissions for Clay Extractions

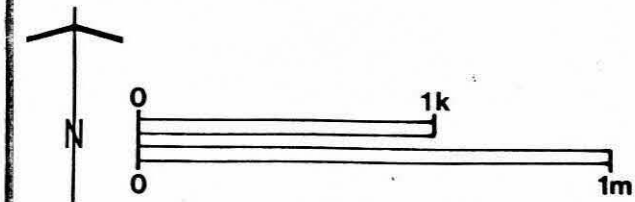
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Map 3.5
South

Source: Oxford Clay Subject Plan.
1982



-  Original permitted areas (granted 1947-1960)
-  New permitted areas (granted 1980)
-  Future extraction areas
-  Areas of uneconomic deposit
-  Settlement stand off areas
-  Minor extensions to original permitted areas



Ridgmont Works and the clay reserves from Brogborough No. 2, Thrupp End and Escheat which will serve the works. In March 1981, the County Council granted permissions for the southern Vale with conditions that were not as stringent as those for the northern area in regard to pollution control on the new brickworks. The permission came into effect in October 1981.

The planning permissions are essentially the same for each area and provide the following:

- (a) New Clay Working Boundaries. Consists largely of boundary changes of the permitted areas to avoid clay extraction close to villages near the reserves.
- (b) New Conditions for Working and Restoration. Essentially a comprehensive set of conditions has been developed relating to the exhausted, partly worked and the future clay workings to which the new planning permissions are subject. The conditions require comprehensive plans of the entire excavation process with landscaping proposals and plans for restoration of the pits. "The conditions require for future approval, schemes relating to detailed working, restoration, landscaping and noise control. As far as working and restoration matters are concerned, schemes are required both in respect of existing and proposed excavation area, giving the County Council the opportunity to consider not only the detailed phasing of extraction but also the future levels and after-use of each site on an individual basis." (Griffin, 1982)

(See Appendix 3 for comprehensive conditions.)

- (c) Appearance of the Vale. This covers the planning application for each of the new works, proposing demolition of outmoded buildings as well as landscaping, and substantial planting and screening of clay workings. (Griffin, 1982)

The planning agreement for the northern part of the Vale no longer exists because the LBC was unable to implement the permission for rebuilding Stewartby Works. The Company gave

notice that it did not intend to proceed with the construction of the new brickworks due to the stringent conditions requiring that the kilns' design be capable of removing all of the pollutants. According to the County Council, the LBC has indicated its acceptance of the new planning permissions for clay extraction because it has already started to implement the clay extraction of a new area. It appears that the LBC will voluntarily comply with the draft permissions in developing its proposals.

3.4 Summary

In this chapter, there has been a description of the character of the Marston Vale including an outline of the individual worked and permitted areas of the clay reserves. The most recent planning permissions have been briefly examined with a general outline of the conditions attached to the permission. The next chapter will describe the current methods of extraction to aid in understanding the cause of the dereliction and examine the methods of reclamation.

CHAPTER FOUR - EXCAVATION AND RESTORATION

The purpose of this chapter is to describe the excavation method to better enable the understanding of the cause of the dereliction. The first section is a brief description of the actual mining methods in progress in the Marston Vale in Spring 1982. Second is a brief description of the disposal of the overburden. Finally there is a description of the methods used to reclaim the claypits.

4.1 Mining Methods as Seen at Stewartby (Plates 5-10)

The area of land is worked by tenant farmers until extraction procedures begin, at which time a portion of the land is prepared for stripping of the topsoil. The area for the first cut is fenced off to protect the farmer who continues to farm the remaining land until the next cut is needed for the extraction of the clay. The topsoil removal, as seen at Quest Pit, was done by a contractor using an elevated scraper and road-going vehicles. The operation takes place once a year (or as needed for about two weeks) during the summer, generally stripping about nine inches deep across a band of about 64 meters along the width of the pit, removing about 7,000 cubic meters of soil. The expense of the operation is approximately 50 pence (\$1.00) per cubic meter depending on the distance to be moved. The topsoil is stored for later use as a screen bank in a ten-meter strip as part of the pit



Plate 5: Agricultural Land before clay extraction



Plate 6: Topsoil stripped



Plate 5: Agricultural Land before clay extraction



Plate 8: Dragline digging clay



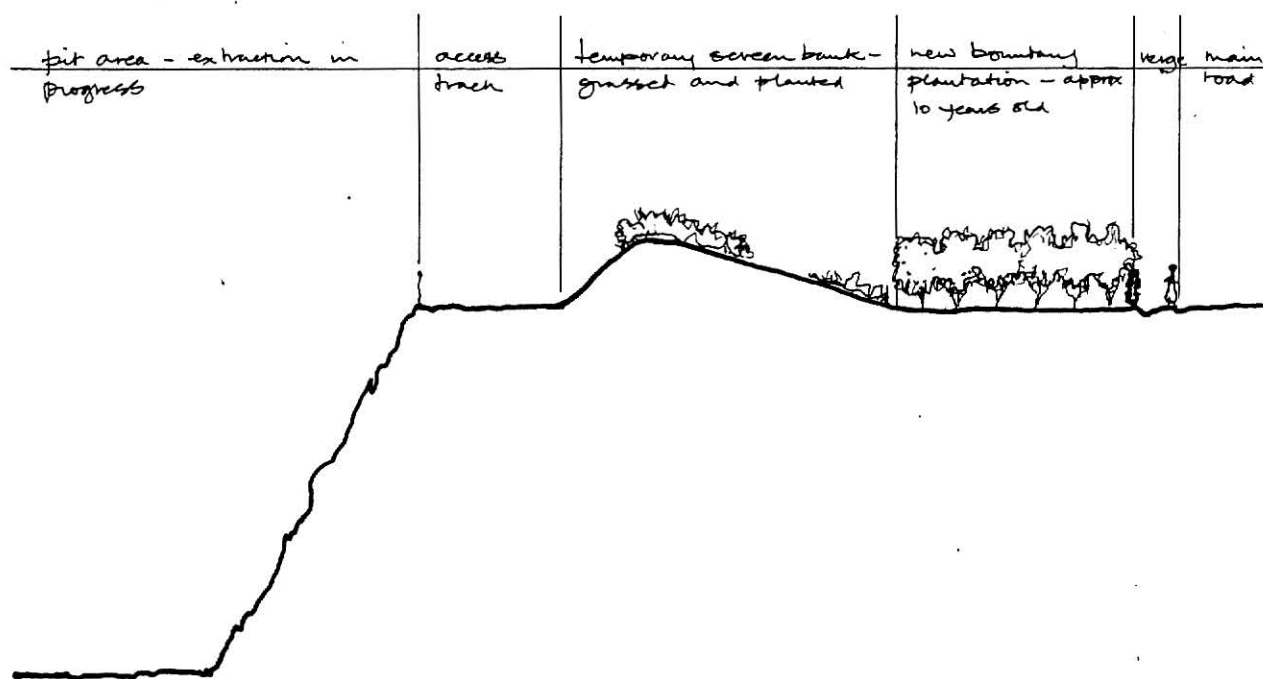
Plate 9: Conveyor taking clay to brickworks



Plate 10: Excavated area of pit - 'Moonscape'

margin. The pit margin is a standard thirty-meter strip (planted ten years before work begins); a ten-meter-wide screen bank made from topsoil stripped from the site; and a ten meter access road.

Figure 4.1



Typical section through perimeter screen bank

Dwg no : 79/1/5

Source: London Brick Company Estate Department

The second step is the removal of the overlying clay - brown clay known as callow - using a walking dragline excavator with a six cubic yard bucket. Generally, the callow removal is about two years ahead of the digging of the clay; removal at Rookery Pit has been completed, and work on the callow is

scheduled to commence at Quest in summer 1982. After the calow is removed, what is known as blue clay is occasionally found; this also has to be stripped off and dumped. The final procedure in the mining method is the removal of the Oxford clay or knotts. After the calow has been removed, the knotts is laid bare and walking drag-line excavators are employed in digging the clay. At the present time two drag-line excavators are working. The first cut, called a 'Y' cut, is a very slow process because the drag-line must cut down whereas the other cuts begin at the base of the pit and drag up to the top. Each cut is worked along the face of the pit and proceeds along the entire width (See Plate 8).

Rookery Pit has a face of between 14-23 meters in depth on a strip of approximately 34m wide for the knotts, cut on a base of 55m of exposed knotts. Rookery is supplying 100% of the clay into Stewartby works with approximately 24,000 cu. meters per week during full production, which fluctuates depending on the number of bricks needed for output. (D. Szymanski 1982) In June 1985, Quest Pit will be supplying 30-40 percent into Stewartby and should be at 100 percent production in 1987 coinciding with the completion of excavation at Rookery.

The drag-lines feed hoppers which transfer clay to a conveyor belt, dropping it onto vibrating metal bars known as a grizzly. The larger lumps are carried to the kibbler for breaking down at which time pieces of rock are separated and discarded. The grizzly allows the smaller lumps to fall through onto a belt which takes them to the brick works.

4.2 Disposal of the Overburden

The callow, once it has been excavated and fed into the hopper, is placed on a separate conveyor belt from the knotts and travels around Rookery Pit to a suitable worked out portion for disposal. In Rookery Pit, water at a maximum rate of 1800 liters per minute, was pumped along with the callow to enable it to flow freely as a liquid slurry where it was disposed in the center of the pit. The addition of water to the callow during disposal has created problems because the callow can become unstable and may slide.

Once the overburden has been excavated in Quest Pit, it will be transferred by conveyor to Rookery where it will join onto an existing conveyor and be disposed of in the north-eastern corner of the pit. It is estimated that 7,000 cubic meters of callow will be removed per week from Quest, operating one eight hour shift per day based on the rate of approximately 14,000 cubic meters per week from Rookery working two shifts per day.

In the past, the overburden along with soil and subsoil, was either fed onto a conveyor and returned at a convenient spot to a worked out portion of the pit or fed on a mobile gantry stacker which has a conveyor belt cantilevered from a loading hopper. The stacker drops the callow into rows of conical mounds on the pit floor well clear of the working face, creating huge pimples often referred to as 'moonscapes'. The blue clay was either disposed of with the callow or simply

thrown onto the pit floor to be dealt with by the mechanical plant.

The drag-line has been used in Rookery and will be used in Quest to remove the callow. An alternative method used on some pits is an elevated scraper which would allow for easier placement of the material. One cost analysis done by the engineering department of the LBC showed that it is to be less costly to use the elevated scraper but it is felt that further studies would show the drag-line method equally cost effective depending entirely on the individual site conditions.

This portion of the chapter has shown the mining procedure and the disposal of the overburden which has caused the dereliction and unsightly appearance in the worked out areas of the clay pits. The final section will give a brief description of the methods used to reshape the derelict clay pits.

4.3 Reclamation

Because of the vast size of the clay workings and generally unsatisfactory condition of the majority of worked areas, the question of reclamation has been a long-standing cause for concern. There has been relatively limited progress made in achieving reclamation and an increase in the amount of derelict land. The clay pits have an overwhelming impact on the landscape and settlement of the Vale and there is the prospect of further deterioration as workings continue over the next 30-40 years. More and more landscape features, trees and hedgerows are lost as the workings proceed. There are three

basic ways in which clay workings can be reclaimed: by flooding, by landfill or by reclaiming at a reduced level. Following is a brief description of how each of these is achieved. (See Map 4.1)

4.3.1 Water Reclamation

Water reclamation by flooding the excavations has often been regarded as the easiest and cheapest method of returning the land to a usable and visually acceptable state. The strata beneath the clay pits is impermeable, therefore, there is little percolation of water from the water table into the base of the pit. Little spring water rises in the area and drainage is concerned only with surface run-off from the area itself; the excess water is carried away by a small stream known as the Great Brook. The Great Brook and other drainage channels have been realigned because of the working of the clay.

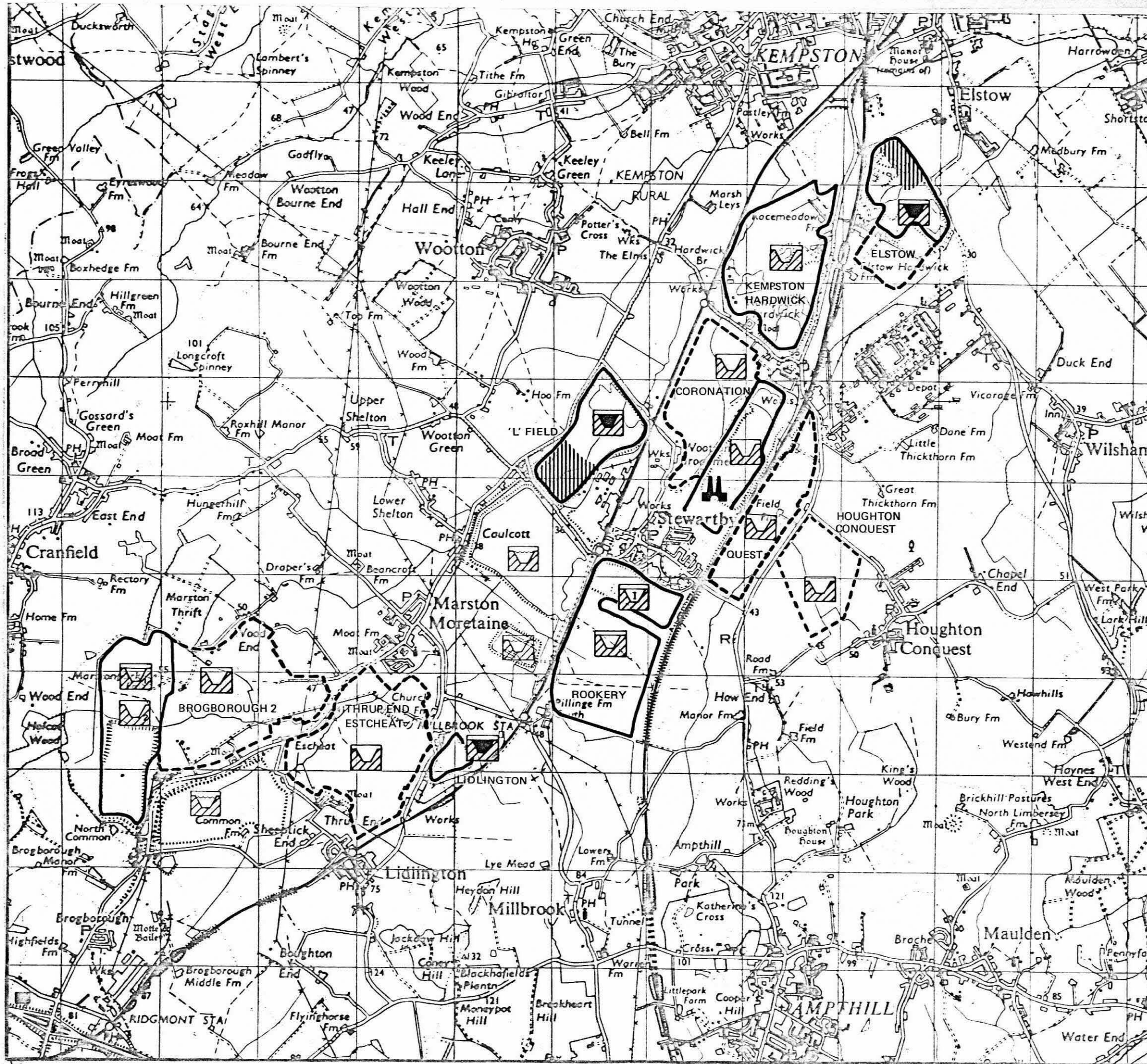
The flooding of the excavations thus far has been accomplished by allowing the natural watercourse to flow into the pit and maintaining the level by a balancing outlet. Some of the flooding can be attributed to local rainfall, run-off and the interruption of land drains which result in the collection of water in the pit's bottom. Information is unavailable on the actual water content in the individual sites due to the lack of accurate survey data. (Rayner, 1982) (Discussed in more detail in Section 5.2.2.)











Oxford Clay Restoration Strategy

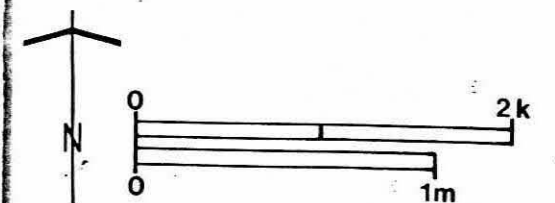
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Map 4.1

Source: Oxford Clay Subject Plan.
1982



-  Worked areas
-  Future working areas
-  Priority Fill
-  Fill if available domestic waste acceptable
-  Fill if available inert fill only
-  Low level restoration
-  Indicates preference for restoration method
-  Area undergoing restoration by filling
-  New brickworks site
-  Retain as existing



Although the lake areas were not planned for amenity purposes in the recreational sense, they are considered now to be attractive landscape features which also provide habitats for wildlife. The County Council considers water reclamation to provide a limited range of use: wildlife conservation and recreation; and support the LBC in its efforts to secure reclamation by landfill methods. (Griffin, 1982)

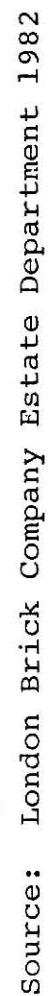
4.3.2 Landfill

The County Council acknowledges that landfill is the best form of reclamation for the clay pits and supports the LBC in its efforts to fill the pits. It is felt that reclamation by landfill could enable the land's after-use to be agricultural, and both the MAFF and Bedfordshire County Council policies 'aim to minimize the overall loss of productive or potentially productive agriculture land to other forms of development'. (Griffin, 1982)

Landfilling entails the backfilling of the excavation to ground level or to a suitable sloped level to give improved drainage or topographical relief. The sloped level is referred to as surcharged. Fill material suitable for landfill includes domestic and industrial waste as well as inert material such as colliery spoil. LBC created the London Brick Landfill Limited (LBL), formerly London Brick Development, in order to reclaim some of the clay pits.

The procedure used by the LBL in reclaiming the clay pits is laid down in the Section 52 Agreement with Bedfordshire County Council. The majority of the waste materials is transported by rail at a rate of 1400 tonnes of waste per day from London. The transportation by rail is encouraged as it relieves the impact of the transporting waste by road. Household, commercial and industrial wastes--solid and liquid--are used to fill the site. Because of the impermeable nature of the excavation, they are classified as containment sites and the management of surface water and leachates is extremely important. Notifiable (hazardous) wastes can be deposited provided that the pH and the phenol content are regulated. They must be deposited under a cap at an intermediate level below the top and 2m below the interface of the Oxford clay and weathered Oxford clay. New trenches are constructed each day in previously laid refuse terraces where the liquids are disposed. (See Fig. 4.2)

The refuse is laid in terraces of not more than 2m depth, the width of the face varying according to the rate of input each day. The layers are sloped to drain off as quickly as possible. Ditches are constructed to keep surface water separate from leachate. The leachate is pumped back into the refuse mass while surface water is pumped away. Following is a description of the procedure used by the LBL for land-filling the excavations.



Procedure

1. Consultations with relevant agencies and interested parties such as the MAFF, the Water Authority and the County Council.

2. Final reclamation plans including landscape design, planting, drainage, etc.

3. Refuse is deposited and spread in terraces 2m depth along width of excavation; the higher the rate of deposit, the wider the terrace and easier for vehicles to move about. The vehicle used to place the refuse is a Caterpillar 816 Compactor. Each layer is consolidated by the compactor to reduce voids and uneven settlement and left for 3 months before a new layer is placed. The excavation is filled to the intermediate level, capped and watched for two years. The final two layers should be free of large objects which might emerge as settlement occurs. Settlement is the major concern of the operation.

4. Final capping is placed during dry periods to avoid panning. An agricultural subsoiler is used to avoid soil compaction. The final depth of overburden layer is dependent on availability and requirements but the deeper the layer of overburden, the better the final results. Final capping consists of layer of overburden, subsoil layer and topsoil, placed approximately 2 months before leveling and seeding to allow for settlement. Typical final capping consists of "approximately 0.3m (12 inches) of clay cover,

followed by 0.6m (24 inches) of old sewage from dried out sludge, and compiled with approximately 0.15m (6 inches) topsoil from a classification grade 3 source." (Rayne, 1981)

5. Aftercare initially minimizes disturbances to avoid bringing unwanted material to the surface and to stabilize soil. Therefore, a program of establishment of grassland is recommended because the root system will bind the soil and build up organic matter, helping stabilize the soil.

6. The procedure may take as long as 20 years for complete reclamation of an individual working.
(Rayne, 1981)

The recent decision of the DOE to allow the mining of coal in the Vale of Belvoir has brought about a revival of the proposal of transporting colliery spoil by rail to the Bedfordshire Brickfields. The estimated amount of colliery spoil that could be available annually from the Vale of Belvoir would be sufficient to make substantial progress in the reclamation of the Brickfields, although the spoil would not become available before 1991. The County Council is in full support of proposals by the LBC to have the spoil deposited in the Marston Vale, in the belief that it would result in a more rapid reclamation of the excavations. The LBC, at this time, feels that the proposals will not be accepted by the Secretary of State. (Rayne, 1982)

Without the definite availability of the colliery spoil to be transported to Marston Vale, there are two major concerns associated with the reclamation strategy: the

availability of fill material and the timescale. The LBC has an existing backlog of void space of 80 m.cu.m. and is creating an additional 3 m.cu.m. annually. (See Fig. 4.3) The amount of landfill deposited presently is between 600,000 and 700,000 cubic meters annually and it is clear that fill material will continue to be scarce in the future. (See Table 4.1) It may take as much as 20 years to restore an excavation with fill material. Although generally felt that filling to original ground level is the best form of reclamation, the uncertainty of whether sufficient fill material can be obtained and the length of time to achieve reclamation, suggests that alternative methods are undertaken as well.

Table 4.1

Quantities of current and potential filling materials available in the Marston Vale

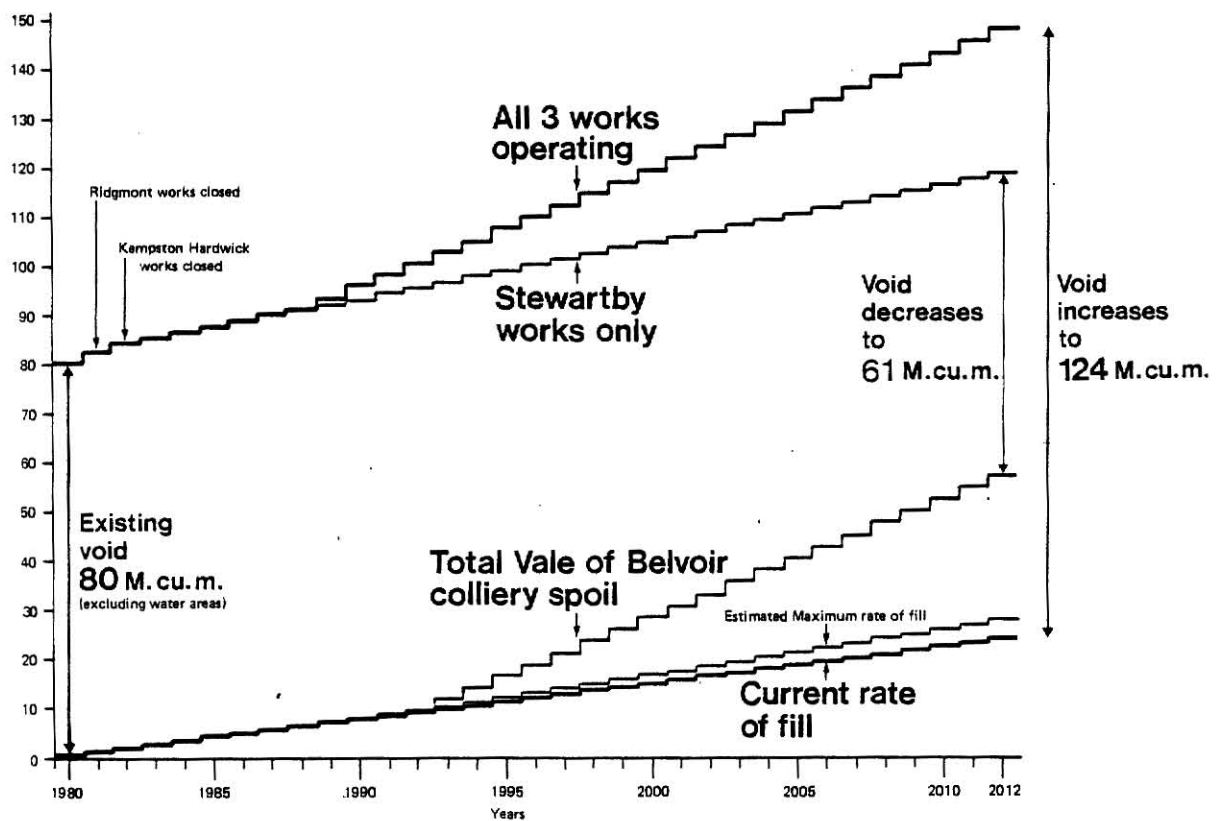
WASTE	CURRENT	1991
Local Arisings	166,000	160,000
Current imported waste	584,000	584,000
Possible future imports: colliery spoil (maximum)		1,500,000
Possible future imports: other waste		151,000
Minimum		744,000
Maximum	750,000	2,695,000

NB Quantities are expressed in cubic meters per year. 1991 Figures for possible imports are approximate. Source: Oxford Clay Subject Plan 1982.

Fig. 4.3

Brickfields
Estimated net shortage
of fill (cumulative)

Void-Million
Cubic Meters



Source: Oxford Clay Subject Plan - May 1982

4.3.3 Alternate Methods

There has been a dependence on landfill as the main means of reclamation of the clay workings because the land is returned to original ground level, enabling the after-use to be agricultural. The fundamental problems of the shortage of fill material and the length of time involved suggests that landfill is not always possible or perhaps the best method of reclamation. To avoid reserving space indefinitely for fill material to become available, other methods of reclamation need to be implemented. Alternate methods of reclamation could bring the land into use in a reduction of time and at least temporarily alleviate the uncertainty of obtaining large quantities of fill materials. Two alternate methods under development by the County Council and the LBC are reclamation at reduced levels, and progressive reclamation.

Reduced level reclamation

The relatively shallow nature of some of the clay workings lend themselves to the appropriate conditions of reclamation at a reduced level. The two main factors are the depth of the workings and the quantity of overburden or other material available for grading the pit. The technique of reclaiming the clay workings at a reduced level involves the strategic placement of the overburden to integrate the site into the landscape and drain the site properly. In the past, soil layers and overburden have been haphazardly dumped into the

worked-out portion of the pit creating an uneven surface on the floor. Recently, planning permissions have changed the disposal methods, now requiring the overburden to be stripped and stored. The walls of the excavations are extremely steep because of the nature of the extraction methods, and create a landform not in keeping with the surrounding undulating landscape, making it aesthetically important to integrate it as quickly as possible.

The reclamation of the workings at a reduced level under development by the County Council involves the grading of the walls and floor to a gentler slope either directly or with the use of the overburden. The grading should produce an interesting variety of slopes to avoid a monotonous landform and provide for adequate drainage of surface water, and include the use of cut-off ditches to minimize the amount of water flow into the pit. Because of the impermeable nature of the clay, the design will require the provision for a holding pond with an adequate balancing outlet to control water levels although pumping may also be required. The design of the pond should incorporate their use as a wildlife habitat or appropriate water recreation facility.

The County Council places a high priority on the development of techniques for reclaiming clay workings at reduced levels because of the shortage of fill material and timescale of filling, recognizing that the possibility of further reclamation to ground level is not ruled out. The LBC has developed techniques for reduced level reclamation with the view to

reclaim to ground level but are in favor of progressive reclamation as an alternative method. (See Figs. 4.4-4.7)

Progressive Reclamation

Progressive reclamation involves a program of reclamation that follows closely behind, and in conjunction with, extraction. The method of progressive reclamation the LBC is developing involves filling the worked out area of the pit while extraction is still in progress. The advantages of a progressive system are: less land is taken out of beneficial use at any one time; large areas of derelict land do not accumulate; less handling and storage of topsoil, subsoil and overburden; and land is returned to ground level.

The sequence of steps developed by the LBC are as follows:

1. Once working face has progressed approximately 200m or through 6 cuts, space is available for storage and filling operation to begin. Topsoil and overburden (callow) are removed and overburden is placed in the pit bottom for storage (See Fig. 4.8)
2. Each overburden cut is stored in the pit bottom and topsoil is placed on the previous cut of overburden stored.
3. Landfill procedures are in progress at opposite ends of the pit.
4. As landfill terraces reach final capping level, overburden is used to cover and cap material and topsoil is spread.

Fig. 4.4

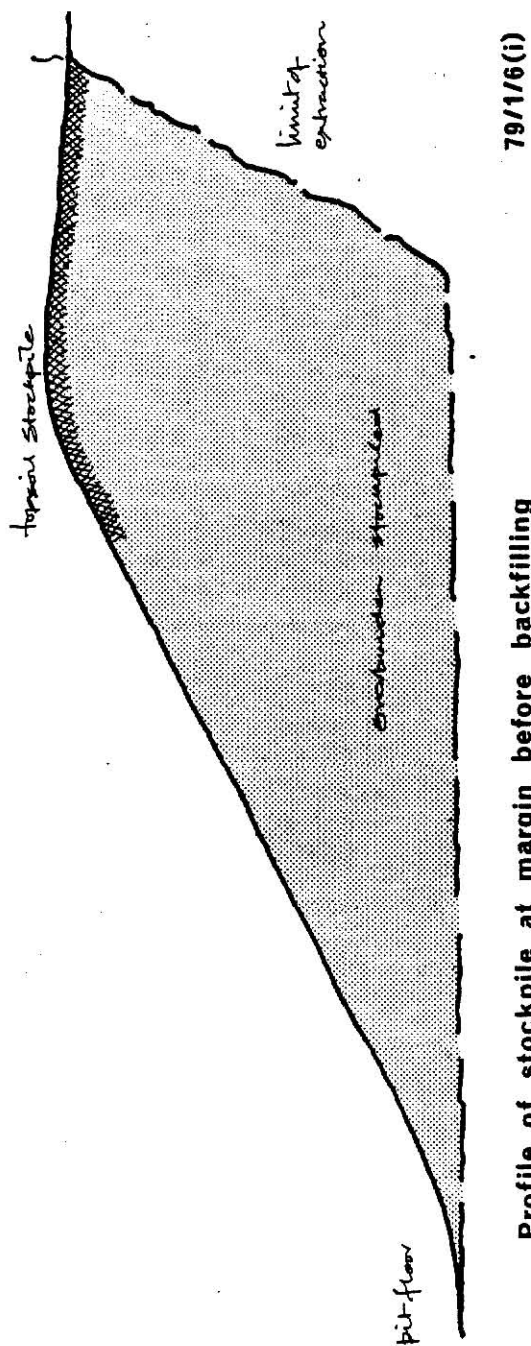
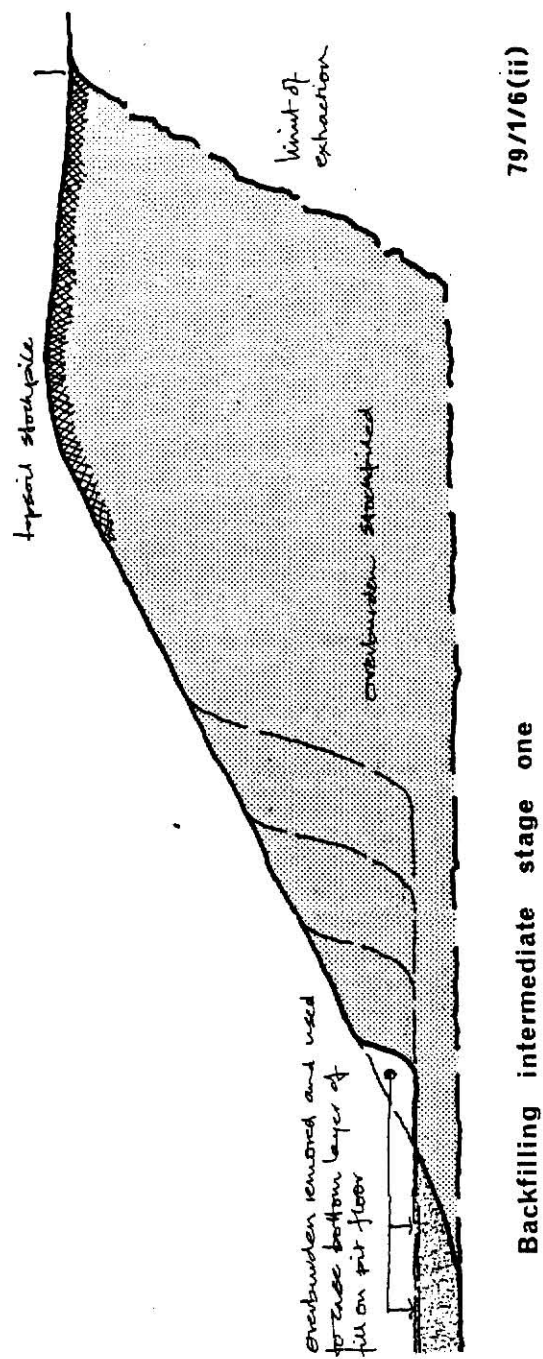
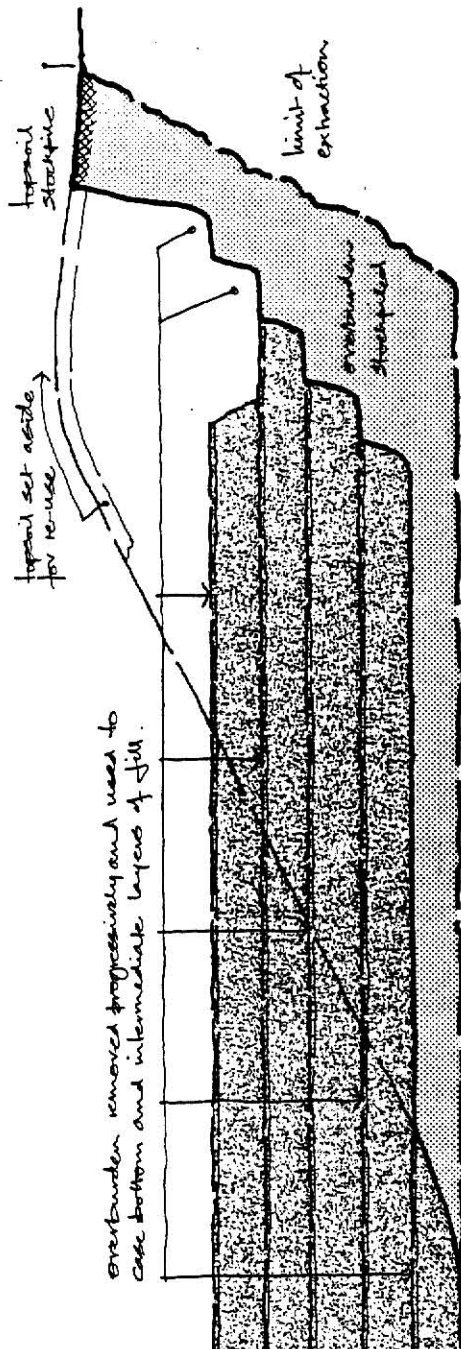


Fig. 4.5



Source: London Brick Company Estate Department 1982

Fig. 4.6

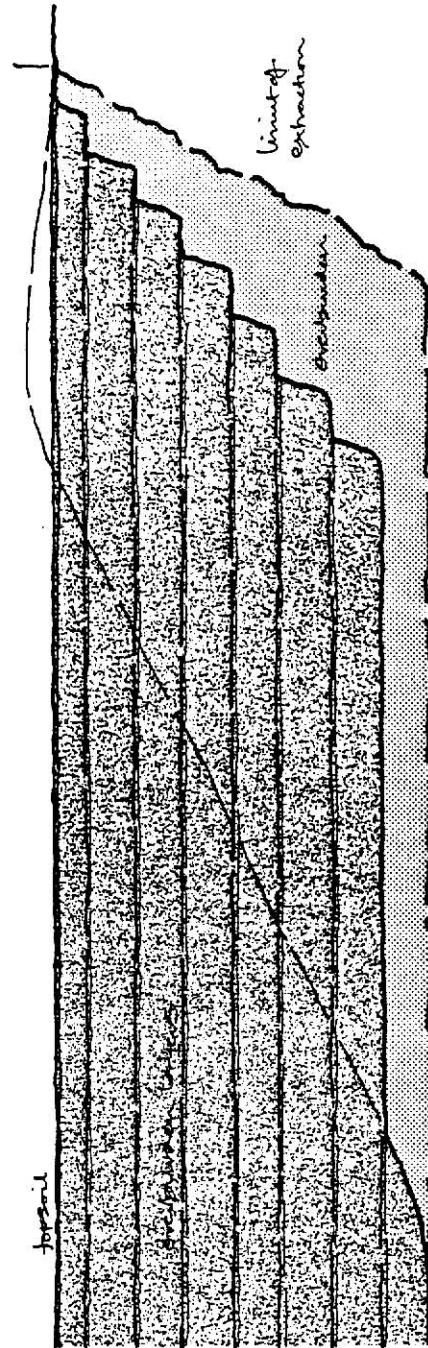


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Backfilling intermediate stage two

filling completed with intermediate layers of overburden and topsoil spread over surface at former existing levels

Fig. 4.7



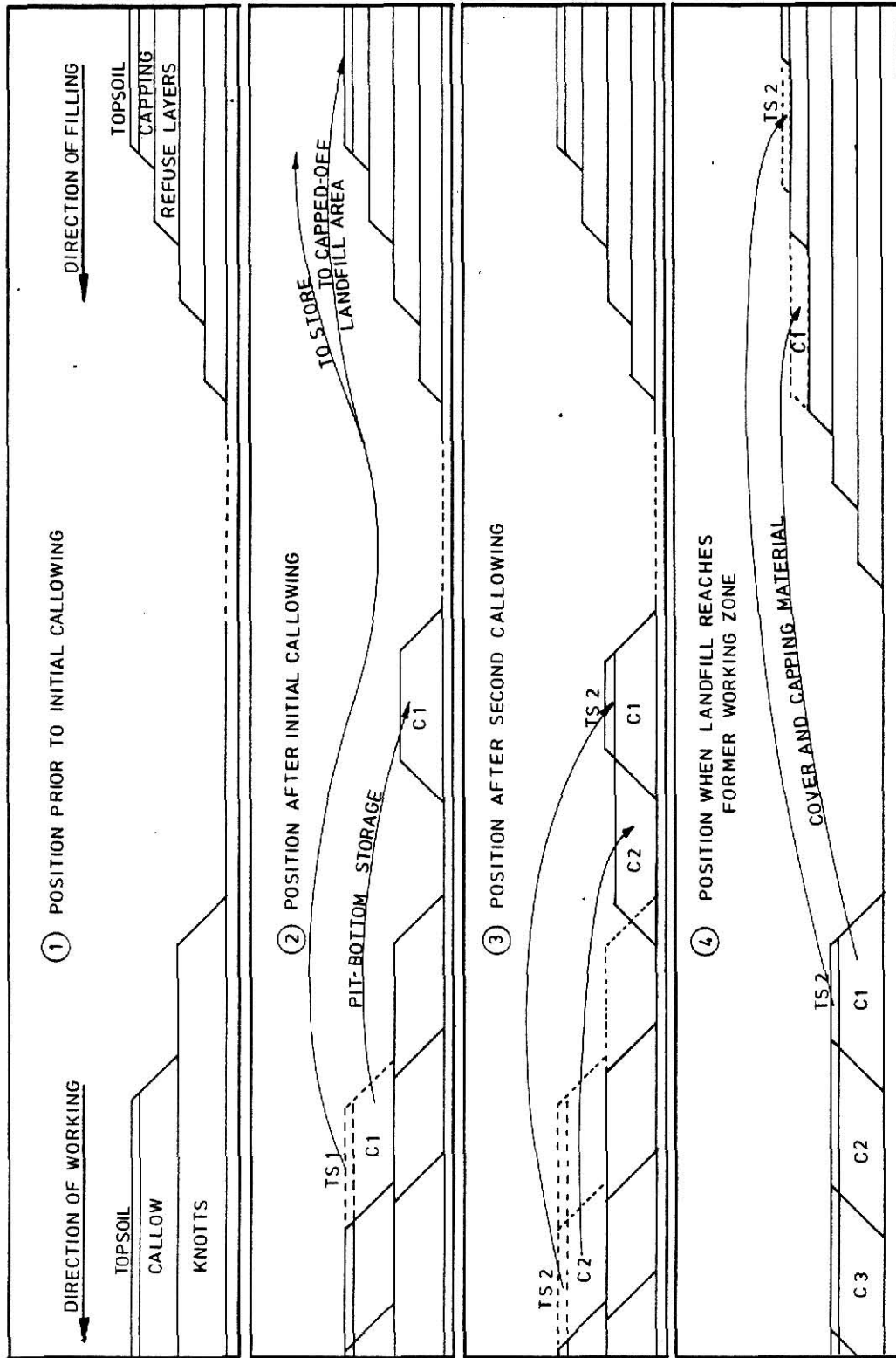
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Backfilling and restoration completed

Source: London Brick Company Estate Department 1982

Fig. 4.8

TOPSOIL AND CALLOW—REMOVAL, STORAGE AND RESTORATION SEQUENCE



London Brick Company Estate Department 1982

Alternate methods of reclamation can greatly reduce the length of time, decrease the volume of land that is derelict, and remove the need for large quantities of fill material.

4.4 Summary

This chapter has looked at the excavation methods and how the overburden, particularly in the past, has been disposed of in a haphazard manner creating the dereliction for which the Marston Vale is recognized. The reclamation methods; landfill, flooding and low level reshaping of the land, used by the London Brick Company were briefly outlined. The next chapter will examine the after-use preferred by the London Brick Company and the Bedfordshire County Council and the methods of reclamation to achieve the after-uses. Secondly, the chapter will examine and evaluate the policies and needs of the county. Finally, the chapter will conclude with a synthesizing of the factors discussed in the first parts of the chapter.

CHAPTER FIVE - PREFERRED ALTERNATIVE LAND-USES FOR THE BRICKFIELDS

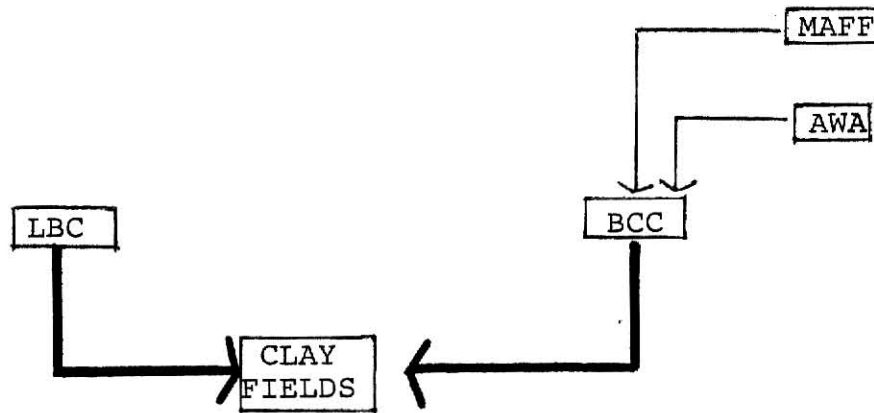
5.1 Introduction

This chapter first examines alternative after-uses for the extracted areas of the Marston Vale and, second, discusses the policies of the parties directly influencing the alternate proposals (London Brick Company, Bedfordshire County Council, Ministry of Agriculture, Fisheries and Food, and Anglia Water Authority). (See Dia. 5.1) Finally, the alternatives are evaluated using the policies of the agencies, and other factors such as local needs, cost of reclamation, and conservation. (See Dia. 5.2)

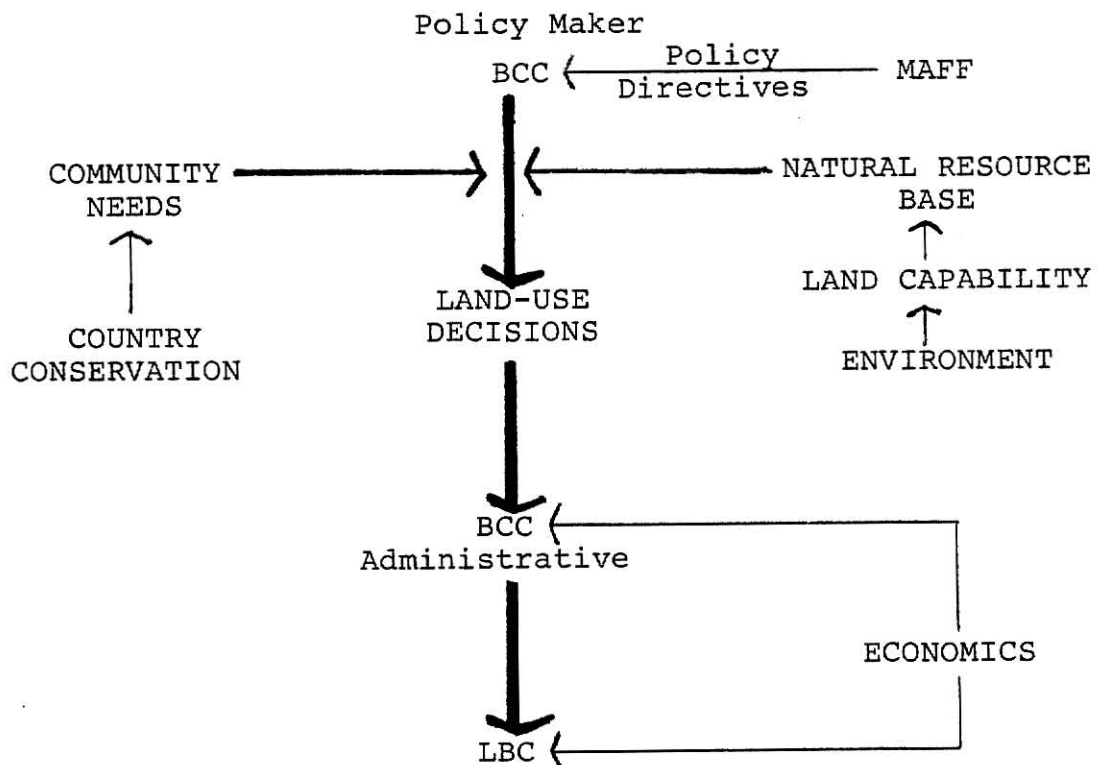
The first section of this chapter deals with the alternative land-uses considered by the County Council to be appropriate for after-uses -- agriculture and recreation. The first part discusses the agriculture option, considered by the county to be the preferred option for after-use. To begin, a brief introduction of recent history of agriculture in Great Britain is necessary to understand the convictions of the nation to preserve all its agricultural land. Next is an overview of the agricultural character of Bedfordshire, narrowing specifically to the Marston Vale. Finally, the methods of achieving agricultural re-use are discussed.

The second option for after-use is recreation. There is an increasing demand in England for recreational areas because the public has more leisure time and modern society is more mobile.

Relationship Diagram 5.1



Land-Use Diagram 5.2



The derelict land of the Marston Vale could be potentially valuable as a recreational area, relieving pressures on more valuable agricultural land to serve recreational purposes. Finally, this part looks at the methods of achieving reclamation for recreation which includes landfill, low-level, and water-filling the excavations. Section two of this chapter is concerned with policies of the parties involved. The main parties are the operator, (The London Brick Company) and the planning authority, (Bedfordshire County Council). The LBC must work in conjunction with Bedfordshire County Council, the local planning authority.

The County Council may find it necessary to consult other agencies, including the Ministry of Agriculture, Fisheries and Food, and the Anglia Water Authority.

Finally, other policies and desires of the county are analyzed and evaluated and their relationship to policies for mineral workings are examined. This includes policies affecting housing, industry and recreation. Conservation, cost of reclamation and environmental impact issues are also studied.

The section concludes with an overview of the entire chapter, synthesizing the factors influencing the decision of end use on the Marston Vale.

5.2 Discussion of preferred alternative land-uses for the clay pits

5.2.1 Agriculture

The British are firmly committed to preserving all agricultural land. This conviction was stimulated after the 1940s, when World War II brought threats of a naval blockade of imported foods on which the country relied. Prior to 1939, agriculture had been declining due to the flood of cheap imported food from overseas: the population no longer needed to be fed from its own land. The downward trend in agricultural land was also accelerated by the competition for land by urban development. Urban land had doubled its extent in the first half of this century, reaching its high point in the 1930s. (Best, 1981) After the war, transfer of farmland to urban use was cut back and agriculture has prospered due to the belief that it is a strategic necessity. Productivity has been on the increase, due to government programs for farmers and new farming techniques.

Bedfordshire, which is essentially an agricultural county, shares the national conviction for preservation of all agricultural land. As a major agricultural county, it has felt the changes in the landscape brought about by new farming methods. Much of the agricultural land in the county is of high quality and considered a valuable national asset. Under the MAFF land classification system, 44% of the agricultural land in Bedfordshire is Grade 1 or 2 (as defined in Chapter 1) and is designated

as an Agricultural Priority Area (APA). (Bedfordshire County Structure Plan, 1980) About half of the land in the county is classified as Grade 3, and the better quality (Grade 3a) is also protected against other use. (Bedfordshire County Structure Plan, 1980)

The Marston Vale area is predominantly land classified as Grade 3b. Agriculture is the dominant land use in the area, aside from the clay extraction. Since World War II, grazing land in the area has been progressively converted into arable cropland. The predominant arable crops are wheat, barley, and rape seed for oil. Many of the small fields have been enlarged to be more suitable for modern cultivation techniques. Larger fields have been created at the expense of hedgerows, trees, woods, and ponds. In the past, the agricultural land in the Marston Vale was also used for cattle ranching, but it decreased in importance when fluorosis was found in livestock on a number of farms in the area. (Cowley, 1967) The damages were severe enough to create economic losses, causing some of the grazing land to be converted to arable farming. Much of the agricultural land has also been lost to mining.

With mineral workings, it is felt that "the land is capable of being restored to its original quality." (Bedfordshire County Structure Plan, 1980) Because of the view of the MAFF that the preservation of all agricultural land is important, agriculture is the preferred primary after-use for all reclamation proposals in Bedfordshire. The after-uses

in reshaping the clay excavations should be appropriate to a rural area, according to the County Council.

The County Council and the LBC both believe that landfill is the optimum method of returning the land to a beneficial after-use because: 1) it enables the land to be returned to original ground level; 2) the widest choice of after-uses are possible; and 3) it offers the best opportunities for obtaining financial assistance from the revenue gained from tipping charges. (Griffin, 1982) The two major hindrances of landfill proposals are the time frame involved and uncertainties in obtaining the filling materials. The time required to fill a pit depends on its size and the rate of filling. As an example, 'L' Field which is now being filled, will not be back to original ground level until around 1998. (Griffin, 1982) Secondly, if the colliery spoil proposals are enacted, no spoil would be available before 1991, and the mined area could not be completely returned to ground level for another 55 years. (Griffin, 1982)

Because of the uncertainties of obtaining the fill material and the length of time necessary to return the land to ground level, an alternate option is to reshape at a reduced level. This method would also enable an agricultural re-use. The major possible problem of low level reclamation could be drainage. The major expenses would be earthmoving and the cost of constructing a drainage system. The benefits would include less time to return the land to a beneficial use, and smaller quantities of filling material when compared to

reshaping the land to ground level.

The general opinion in Great Britain is that the preservation of agriculture is extremely important, particularly in Bedfordshire. However, the majority of agricultural land taken by the mineral workings in the Marston Vale is of average quality. Perhaps the emphasis on the return to agriculture should not be the primary concern and other alternatives to fill other needs, such as recreation, should be examined.

5.2.2 Recreation

While returning the land of the Marston Vale to agricultural use is considered the optimum choice, another potential after-use is recreation. Bedfordshire has no extensive area of countryside used primarily for recreation because of the intense agricultural land use of the county. Recreational land is in short supply in Bedfordshire and throughout the Midlands. (Fairbrother, 1970)

More people have more leisure time than ever before, increasing the demand for recreational facilities. This trend is expected to grow. With the current mobility of modern society, recent years have seen an increase in the use of the countryside for recreational activities. According to the Countryside Review Committee "80% of recreation in the countryside originates from towns." (Leisure and the Countryside, 1977) The more popular rural recreational areas are already showing symptoms of over-use. The large areas of the

clay workings could be particularly valuable for recreation if they are renovated, but first the public must accept the presence of industry near a recreational area. The Brickfields lie relatively close to major urban areas, enhancing the potential after-use for recreational activities. According to the County Council "the use of these areas for such a purpose will reduce pressure for the use of agricultural land for recreational purposes." (Bedfordshire County Structure Plan, 1980)

The methods of reclaiming the claypits to recreation include landfill, low-level methods and waterfill. Reclamation by landfill, as discussed previously, is considered the optimum method to reclaim the workings. The preferred after-use is agriculture, although once reclaimed, the land could also be used for recreational activities. Once again, the major concerns associated with landfill are time and availability of filling materials so a high priority has been placed on the development of techniques for reclaiming at a low level.

According to the County Council, low-level reclamation would enable recreation to be established as an appropriate after-use. It would also enable a satisfactory integration of the recreation area into the surrounding landscape. Reduced-level reclamation would probably require a drainage pond that could be designed for recreational use and wildlife conservation. The length of time to achieve low-level reclamation, about two to three years, is considerably less than landfill.

The third method of reclamation , water-filling, can also be achieved in two to three years. Two of the excavations that have already been waterfilled, are considered reclaimed and are in active recreational use. Some of the other clay excavations contain water and are used for recreation areas but are not considered reclaimed by the County Council. There are not any definite plans to retain these derelict pits for recreational use and will probably be landfilled if material becomes available. The County Council feels that waterfilling "represents a change in the character of the landscape." (Oxford Clay Subject Plan, 1982) The Lakes were not planned but were allowed to fill with water and were not designed for recreational purposes. The County Council's opinion is that the Lakes have failed to meet their potential recreational use. As a result, the reclamation by waterfilling will not normally be considered acceptable by the county unless it can be demonstrated that there is a need for water-based recreation, or it is not possible to reshape by other alternatives.

Where water areas are permitted, a wide variety of potential uses can be planned. Water areas can provide habitats for many native plants and wildlife in areas of passive recreation activities such as walking trails or fishing. Active recreational uses such as boating and waterskiing are now enjoyed at Stewartby Lake. In water reclamation, diverse opportunities exist for creating a wide range of uses and wildlife environments. In addition, a variety of environments could be created in the careful planning and management of

water courses and drainage ditches in the area.

Many opportunities are available for recreational after-use in all categories of reclamation methods and may be more beneficial to the county than returning all the land to agriculture.

5.3 Policies of parties concerned

5.3.1 London Brick Company (LBC)

The London Brick Company advocates a wide range of after-uses for the excavations of the clay workings. The range includes new works constructed on the floor of the pit, country parks, golf courses or other leisure facilities, wildlife conservation areas, residential and light industry developments and return to agriculture. Although they suggest many alternatives, the LBC's primary intention for landfill reclamation is "to turn full circle, and return to agriculture," with the "aim to restore land by careful technique using waste." (Inside London Brick)

The LBC is most in favor of reclamation by landfill because it offers opportunities for financing the proposals. The LBC looks at the excavations as assets where a profit can be made from waste disposal in conjunction with reclamation of the land. They are opposed to low-level reclamation because of the possibility of drainage problems and the cost of implementing a permanent, sophisticated, drainage system; problems with erosion control; and possible frost problems. (Rayne 1981)

Although the LBC is opposed to low level reclamations for the above reasons, the County Council feels there are no real overriding technical reasons why this approach cannot be developed and applied to the clay workings. There is no existing comparison between profitability of landfill compared to reclamation by water filling or low level reclamation.

Some individuals question the ethics of making a profit from dereliction the company inflicted itself, but perhaps the more crucial issue is choosing a method which leads to a rapid and a satisfactory solution to the problem. Because of the government's definition of dereliction, there are no grants available to the LBC or BCC for reclamation purposes because land that is still part of an active industrial site is not eligible for grant aid.

Perhaps the LBC should not be faulted for encouraging a reclamation program that pays for itself. At the same time, the company should not ignore other approaches because the solution offers no profit to the LBC.

5.3.2 Bedfordshire County Council (BCC)

The winning and working of minerals, for planning control purposes, is defined as a 'county matter' according to the Local Government Act 1971. Bedfordshire County Council has set out their general policies on mineral extraction in their County Structure Plan 1980. The Structure Plan, as discussed in Chapter Two, is basically a set of policy statements with

a land use diagram and are meant to provide strategic guidance for development of the county. The general policies include guidelines for reclamation and appropriate after-uses of mineral workings. It is the county's function to evaluate applications for mineral workings as outlined in Policy 63 of the County Structure Plan 1980. Policy 63 outlines the following guidelines:

"When considering applications for new, or extensions to existing, mineral workings, particular regard will be paid to the following considerations:

- (i) the extent and quality of any agricultural land which would be taken, and any other disruptive effect upon agriculture,
- (ii) the visual impact of the proposed workings on the landscape, especially when in, or adjacent to, areas defined as of great landscape value, or on areas popular for recreation,
- (iii) the impact on woodlands, or sites of known scientific interest,
- (iv) the traffic likely to be generated by the proposed workings and their relationship to the County highway network, including satisfactory local access arrangements,
- (v) the effect on, and relationship to, sensitive nearby land uses by reason of noise, dust, fumes and general disturbances,
- (vi) the existence of known archeological features, ancient monuments or other buildings of architectural or historic interest,
- (vii) the effect workings on water supply or other drainage considerations." (County Structure Plan 1980)

Before permission is granted, the County must be satisfied that a workable mineral deposit exists; of the method of extraction; that adequate visual screening proposals with plant materials exist; and that there exist "proposals for the rapid and effective

reclamation of the workings on a progressive basis to a condition such as to make possible an appropriate after-use."

(Bedfordshire County Structure Plan 1980) Before reaching a decision on an application, it is often necessary for the County to consult interested parties, in this case, the Ministry of Agriculture and the regional water authority.

The County considers the options for reclaiming to be tipping of refuse, reclamation for agriculture, recreational or nature conservation purposes, or the flooding of pits for recreation or nature conservation purposes.

Due to the general attitude in Britain towards the loss of potentially productive agricultural land, return to agriculture is a number one priority. The county is determined to concentrate waste disposal activities in the exhausted clay pits of the Marston Vale because of the priority and economics of reclaiming mineral workings and the need to develop plans for controlled tipping on landfill sites. The County has declared intentions "to encourage and support the brick industry in its efforts to secure reclamation through the importation of suitable wastes from other parts of the country, subject to satisfactory arrangements being agreed with the County Council for its transportation." (Oxford Clay Subject Plan 1982) With the reclaiming of the clay workings through landfill, bringing the land back to original ground levels, enables the land to be returned to agricultural use, in keeping with national policies.

The County Council feels that a primary issue is establishing

appropriate after-use and that the choice of reclamation methods and the proposed after-use are interrelated. The widest choice of land-use exists with the landfill or low level methods of reclamation, which enable the land to be used for agriculture, forestry, recreation or wildlife conservation. Water filled reclamation is limited to recreation or wildlife conservation.

The attitude of the County Council has been strongly influenced by the national conviction of the need to promote national production of food. The fears that encourage this attitude are perhaps no longer valid due to the vast improvement of the technology of farming. The County has set out well-defined guidelines for the extraction and reclamation of minerals. The emphasis of after-use is limited to primarily agriculture and, secondly, recreation. Later in the chapter, the County policies on housing and industry will be examined with the intent to view them as possible alternative after-uses.

5.3.3 Ministry of Agriculture, Fisheries and Food (MAFF)

The MAFF is responsible for administering government policy for agriculture, horticulture, and fishing industries in England. One of the powers held by the MAFF is the payment of production grants and subsidies. The grants that most affect the landscape have been those for hedge removal, for ploughing grassland, and for land drainage. These grants have aided in the enlargement of fields, hedge removal in arable areas, and also allowed arable systems to be developed on land

previously too poor to cultivate due to limitation of slope, drainage or climate.

Although the consultation by the County Council with concerned parties is optional, the MAFF holds a unique position. If agricultural need can be demonstrated, and is supported by the MAFF, the planning authority is almost powerless to oppose the development. The MAFF is in a uniquely powerful position as arbitrator of agricultural needs and in influencing the development of rural areas.

The MAFF favors returning the land to agricultural use and considers the primary option to be a return to original ground level by means of landfill. One of the major concerns of the Ministry is the storage and eventual replacement of subsoil and topsoil to the sites. The MAFF does not inherently disagree with low level reclamation but does not encourage arable crops to be the final land use. (Hawkworth, 1981)

5.3.4 Anglia Water Authority (AWA)

The reorganization of local government in England in 1974 resulted in the development of regional water authorities with boundaries based on river catchment areas. The members are generally appointed by the County Council to ensure a good relationship between the two different agencies. The regional water authority has responsibility over water supply and conservation; river pollution control and river management; sewage disposal; fisheries; land drainage; and reservoir planning.

The water authorities also have the responsibility for developing water areas for recreational and amenity purposes. The authorities are financed by a direct charge on all households.

The regional water authority associated with Bedfordshire is the Anglia Water Authority. The Anglia Water Authority is in the process of completing a proposal plan for the Marston Vale Area. Their evaluation, when contacted, was a preference of return to agricultural use. Landfill is their preferred option, as long as due concern and care is taken to not penetrate the underlying aquifer and that no toxic waste is dumped. (Thomas, 1981) Due to the possibility of chemical leaching, the water authority would prefer that water filling not be used as a method of reclamation. The water authority was unable to provide any information concerning the water table of the Marston Vale.

Further investigation uncovered that the water table information is unavailable since it has never been measured for this area study and therefore never has been recorded. According to Mr. Monkhouse, from the Hydrogeology Department of the Institute of Geological Sciences, there has probably never been a need to make boreholes in the area and the data for Water Table Maps has never been developed. His evaluation of the area shows rainfall is between 577-634 mm per year with an evaporation rate of between 428-456 mm per year. There is very slow seepage through the clay and little or no groundwater or run-off.

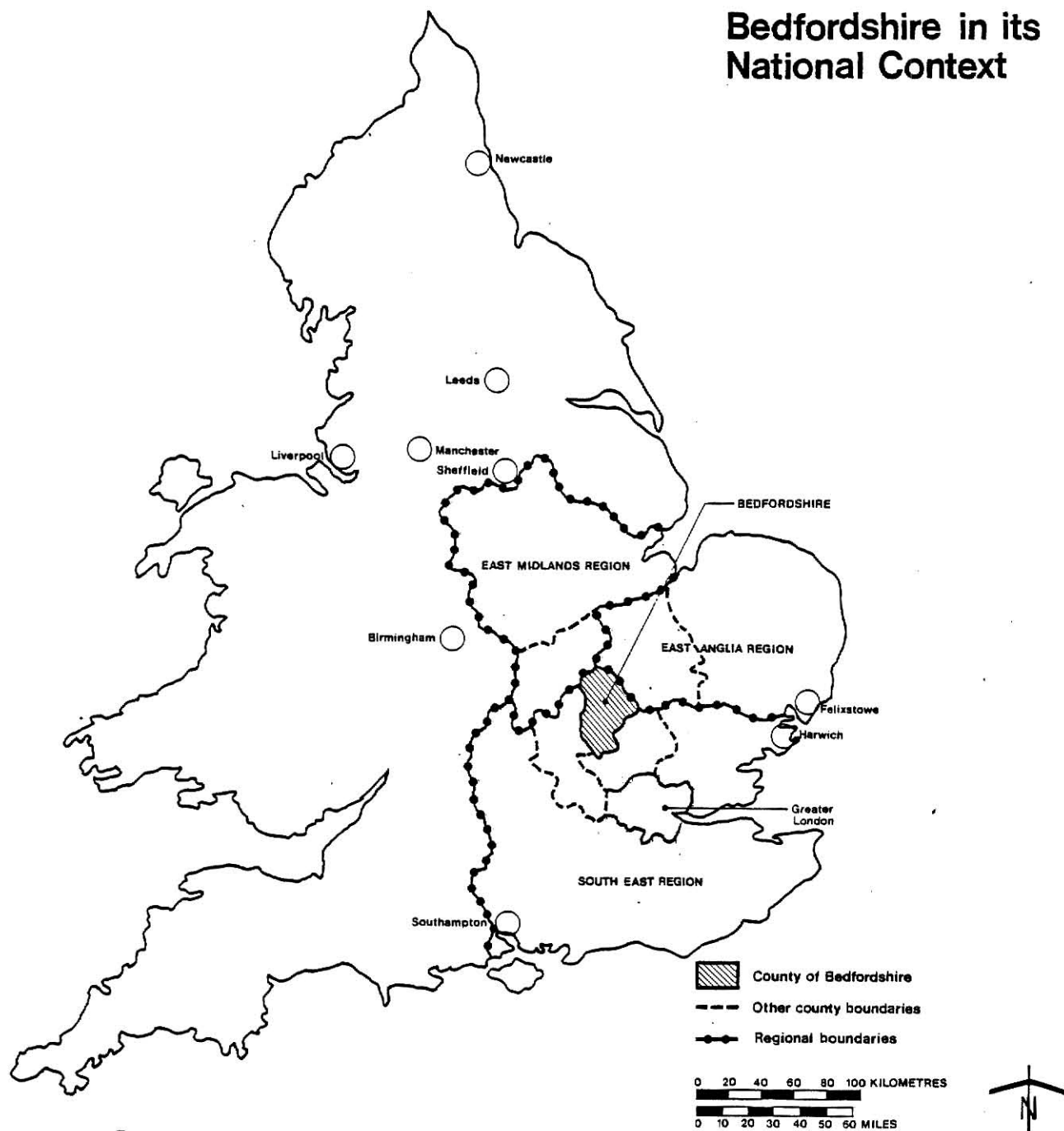
Considering that the County Council consults the water authority before reaching a decision on a planning application, the Anglia Water Authority's unhelpful attitude could prevent rapid progress in restoration of the sites.

5.4 Analysis: Evaluation of the above information

The final section of this chapter evaluates the preferred alternative land-uses considering the policies of the concerned parties. First, an assessment of the needs of the County, costs of reclamation, conservation of the natural resources, and impact on the environment from the mineral industry must be examined.

5.4.1 Needs

To understand the needs of Bedfordshire County, it is necessary to study the larger region that includes the county. For planning purposes, Bedfordshire is included in the South East Region. (See map 5.1) The Strategic Plan for the South East (the S.P.S.E.) describes Bedfordshire as an area of restrained population growth. Bedfordshire has had one of the highest growth rates in the region in recent years. The intention of the South East Region is to slow down the rate of population growth. The regional policies are: 1) development of regional growth areas, e.g. Milton Keynes; 2) redevelopment and rehabilitation in London; 3) expansion of medium sized employment centers; and 4) the preservation of extensive areas of open country.



The County Structure Plan provides strategic guidance for needs of the county in an overall context including housing, employment, transportation and the environment. Bedfordshire has developed a policy of reduced rate of population growth due to the: 1) concern for the rate of job creation versus growth of the number of people for the jobs; 2) the need to protect the county's agricultural land; and 3) the public preference for 'low growth' strategy. (Bedfordshire County Structure Plan 1980) The location of new housing is a fundamental point, with the majority of needs arising in the main urban areas (Luton/Dunstable and Bedford/Kempston). The County Council has determined a need for approximately 29,700 dwellings over the period ending in 1991. This figure is based on the population growth rate of an annual average growth of 1.0%. (Bedfordshire County Structure Plan 1980) Table 5.1 shows the population growth from 1956 to 1976 and Table 5.2 shows the projected growth of the county population through 1991. Housing policies are directly related to the growth of local employment and the aim of the County to maintain its industry.

The second concern of the County is that of industry. Generally, Bedfordshire has experienced a low rate of unemployment in the County compared to the national average. But more recently, with the rapid growth of the county population, high rates of unemployment have prevailed. The County has adopted policies aimed first at the expansion of existing firms in Bedfordshire and second, the emergence of new firms within

Table 5.1 Population Growth 1951-76

Year	Population	Average Annual Change	% change per year		
			Bedfordshire	England & Wales	South-East England
1951	313,434				
1961	382,706	6,927	2.02	0.52	0.73
1971	464,277	8,157	1.95	0.53	0.52
1976	491,700	5,484	1.16	0.13	-0.12

Table 5.2 Projected Growth in County Population

Year	Natural Increase Only	Natural Increase + Migration
1971	464,300	
Est 1976	496,000	
1981	512,000	524,000
1986	533,000	562,000
1991	557,000	602,000

Source: Oxford Clay Subject Plan, May 1982

the county. The County feels that the existing firms should make contributions to maintaining and increasing job opportunities. New firms should be geared to develop in the major employment areas of Luton/Dunstable and Bedford/Kempston. The aim at the regional level is to develop new industries in new towns such as Milton Keynes rather than Bedfordshire. The County policies discourage development in rural areas unless the development is appropriate to the area. However, development associated with mineral workings or agriculture is acceptable as long as the development does not have adverse affects on housing, transportation or the environment (Bedfordshire County Structure Plan 1980) Finally, the county will allocate land for industrial purposes and will not grant planning permission for any use other than industrial use on the land.

Assessment of transportation needs are in direct relationship to residential development and industry. Transportation can influence housing and industry location and, conversely, housing and industry can influence transportation needs. Transportation needs cannot be sufficiently assessed until development of the area has been decided.

The environmental policies are significant in determining appropriate land uses for the Marston Vale. The aims of the County Council in relation to the physical environment are "to improve the social and physical environment, and to conserve the county's natural resources." (Bedfordshire County Structure Plan 1980) Location and size of future development clearly

affect the physical environment. The overriding goal in the county is the preservation and improvement of the existing environment through prohibiting large scale urban development and noise-generating uses and to protect the agricultural land. The environmental considerations have been a factor in developing the strategy of restrained population growth in the county. Among the factors considered are the extensive areas of the countryside, high quality of the agricultural land, the need to conserve the distinctions of the villages and towns, and the recreational and wildlife values. (Bedfordshire County Structure Plan, 1980) There is a notable lack of informal recreational areas according to the County Council's survey report. The most attractive areas and existing facilities in the County are already very popular and, in some cases, over-used. Bedfordshire does not have any extensive area used primarily for recreational purposes. The county policy states that new opportunities for countryside recreation areas should be concentrated around major urban areas.

To summarize, the county policies show:

1. a need for new residential development particularly in the main urban areas of Luton/Dunstable and Bedford/Kempston;
2. a need for industrial expansion and development, particularly near the main urban areas; and
3. a need for new countryside recreation particularly around the main urban areas.

5.4.2 Costs of Reclamation

The cost of reclamation is an important issue. The intention of this section is meant only to outline factors and not to develop a comprehensive cost estimate.

The cost of reclamation may be very high and the cost of any reclamation alternative is inevitably an influence on the project. The costs will include preliminary site work, demolition and site clearance, earthwork, drainage, surface treatment and landscaping, fencing, fertilizer, and seeds and plant materials. The major expense is earthworks which could account for 50% of the costs. Estimates of the cost for reclamation proposals are beneficial because they can provide a comparison of costs for different alternatives. An estimate will give an indication of expenditure and allow an assessment of cost versus after-use benefits. Certainly the aim of all reclamation projects must be to keep costs as low as possible while meeting the county's quality standards. An enormous quantity of statistical data is available from various sources in the building industry, which aids in quickly determining probable costs. Site location and planning requirements generally determine the after-use requirements, which will be an important factor in determining the costs.

Although varying from region to region, costs of reclamation in England were estimated at £1600 per ha pre-1966; £3200, 1968-9; and £6400 in 1976. (Bradshaw, 1980) Cost of reclamation may appear well above what is the normal value

of the land but it might be sold after reclamation at a price to cover the cost of reclamation.

The London Brick Company has developed their landfill operation to cover the costs of reclamation of the clay workings. They charge for the service of waste collection and disposal and seek a profit on the capital investment. As has been suggested earlier, the profit the LBC makes from dereliction is not an issue as long as the council does not ignore other alternatives which may be more valuable to the community.

5.4.3 Conservation

Environmental conservation is a concern for the saving of natural resources and wildlife. The countryside is changing but the change is not a new phenomenon. Change is inevitable and the landscape has been changing throughout history. Conservation should not be considered a resistance to change but an acceptance of necessary change with management and direction. Conservation implies a recognition that resources are limited and this influences the way in which changes occur.

To many British their countryside is the most beautiful in the world. The landscape represents a national heritage which is unique and irreplaceable. The former landscape of small fields and substantial hedges created an image of a patchwork quilt over the English countryside. In the past,

farming created and maintained a landscape rich in wildlife and recreational opportunities. But now, farming has done more to change the character of the English countryside over the past 30 years than anything else. In recent years the rate of change in Bedfordshire has been dramatic; as a major agricultural county, Bedfordshire has felt the full effect.

The small fields enclosed by hedgerows have given way to a landscape of large open fields. What has been lost in the richness and diversity of the landscape has been replaced by a vast featureless expanse of rolling acres. The new uniformity of the changing countryside turned into a vast expanse of prairie comparable to the kind of countryside the people of Kansas live in without complaint, as described by one author. (Shoard, 1980)

The removal of hedgerows is the most obvious change to the Bedfordshire landscape. Hedgerows were planted to define fields and territorial boundaries, and to control the movement of livestock. The hedgerows were expensive to maintain, enclosed fields too small for new machinery, occupied valuable land, and shaded out crops. Hedgerows also provided abundant cover for wildlife, which has been lost. The loss of hedgerows has also destroyed many ancient landmarks and field boundaries, some of them unchanged for a thousand years or more.

The Marston Vale is an area of flat farmland. It has never been heavily wooded, but due to the changes in agricultural practice, it is now very open. This is mainly a farming

area and the fields have been enlarged and hedgerows removed. The loss of hedgerows and trees has opened up views of the Vale resulting in its domination by the workings of the London Brick Company. The most important feature of the Vale is now the brick industry.

5.4.4 Pollution, Noise and Visual Impact of the Brickfields

Air Pollution

Pollution from the Bedfordshire brickfields has been a concern for a number of years. It is not the purpose of this study to evaluate the problem of pollution from the brickworks, but to recognize that the problem exists and must be resolved. The pollution is a result of the smoke and sulphur dioxide which are emitted from the chimneys when the bricks are fired. Probably more important is the smell created by the emissions which at times is so offensive that it must be considered a constraint against housing development unless it is removed. (Report of Survey, 1976) The areas primarily affected by the odor are Wootton and Kempston in the northeastern part of the Marston Vale. There has been substantial research on the effects of the pollution, and at present research is being conducted at two London universities into methods of removing sulphur dioxide and other offensive smells from the chimney smoke. Sound, factual evidence is still limited; however, there is no intention of this study to judge the issue.

Noise

Noise is probably the most obvious pollutant for most people. The brickworks could create potential noise problems-- first, from equipment involved in the extraction and conveyors that transport the clay, and second, from the brick distribution vehicles.

The three main sources of noise from working pits are: 1) dragline excavators which are generally quiet; 2) scrapers which remove topsoil, which are used for short term operations; and 3) conveyors which are also generally quiet. The noise of the extraction process can be intrusive but generally the County has experienced little complaint from residents.

The second potential source of noise disruption is from the delivery vehicles. At present, a majority of the bricks is delivered by road. The problems caused by vehicular traffic are basically noise, vibration and visual intrusion. The problem of noise does not seem to be severe according to the County Council. Conditions to protect the residents with acoustic barriers such as plant materials and mounding for noise sensitive areas, and strategic routing of brick vehicles, are required of the LBC by the County Council.

Visual Impact of the Brickworks

The brickworks and the claypits are a dominating feature in the landscape of the Marston Vale. The Marston Vale is generally accepted as the worst landscape in the county due to the combination of the vast pits, brickworks and tall chimneys that dominate the skyline. The Marston Vale area is flat but

is bounded on two sides by the higher ground of the Greensand Ridge in the southeast and the boulder clay ridge on the west. The clay pits are not generally noticeable from the floor of the Vale but become devastatingly apparent from the high ground surrounding the area. The chimneys make an impact because of their heights which range from 100 ft. to about 230 ft. The problem of the visual impact of the brickfields is one that can only be dealt with by long term replanting of the hedgerows that were removed to enlarge the fields.

5.5 Summary

This chapter shows that the preferred alternatives for after-uses of the claypits in the Marston Vale are agriculture and recreation. The County Council's policies toward reclamation and after-use of the claypits are strongly influenced by the conviction of national food production. Return to agriculture is the primary alternative for after-use of the claypits and this policy is upheld and encouraged by the LBC, MAFF and the AWA. The fear of starvation created by the threats of a naval blockade in World War II, that encouraged this policy, however, is no longer valid. The Marston Vale is not classified as an Agricultural Priority Area nor is it even of the better quality Grade 3a land which is also protected from other use. The land is classified Grade 3b - only average quality.

The policies of the County in areas other than mineral workings have also been examined. The structure plan shows a need for new residential development, particularly in the main urban areas. One of the two major areas, Bedford/Kempston

is at the northeastern extreme of the Vale. The policies of the structure plan also demonstrate a need for industrial expansion and development, particularly near the main urban areas. Finally, the structure plan stresses a notable lack of countryside recreational areas which are needed, in particular, near the main urban areas. Of these three needs - housing, industry and recreation areas -- only recreation is considered by the County Council to be an appropriate alternative for the re-use of the Marston Vale. The Marston Vale already has some recreational use, villages, and the mineral industry besides agricultural use now. Perhaps the general needs of the county should not be dismissed so quickly when considering alternative after-uses for the Marston Vale.

Conservation is a concern of the County Council because so much of the natural resource base have been lost through the demands of modern-technology farming and because of the mineral workings. The Marston Vale is described as an area of flat farmland and is commonly acknowledged to be the least attractive in Bedfordshire. The area is bounded on two sides by higher ground, the Greensand Ridge to the southeast and the boulder clay region to the west. The Vale is considered unattractive due to the lack of relief range, the open treeless nature of the area, and the intrusion of the brickworks. The area is described as having a rural nature due to the dominant existing agriculture use, except for the mineral workings. The appropriate after-uses should not change the rural character of the land, but one may question whether or not the Marston

Vale is actually rural in character. The Marston Vale stretches southwestwards from Bedford for about 8 miles to the M1 Motorway, which is the busiest major highway in England and is dominated by the brick industry with its vast pits, brickworks, and tall chimneys.

The preferred alternative for after-use of the clay pits is agriculture. The preferred means of achieving reclamation is landfill. The main issue influencing landfill is the availability of the filling material and the length of time it would take to fill, to return the pits to ground level for agriculture. There is uncertainty in obtaining fill at this time to accomplish the return to agriculture for all the pits in the Vale.

The land taken by the clay extraction was of only average quality when previously in agricultural use. In light of the needs identified by the County Council as residential development, industrial and commercial development, and countryside recreation areas, these other needs deserve serious consideration as other potential uses. Low-level reshaping of the land offers the best option because it offers the greatest flexibility in planning for future land-use. First, by providing the opportunity to create visual interest which is currently lacking in the Vale. Secondly, it can be accomplished in a time frame of two to three years. Finally, it retains the option of fill if the material becomes available.

The next chapter will look at the reasons why improvement of the Marston Vale is important and the conditions which need to be met for reclaiming the land.

CHAPTER SIX - CONCLUSIONS AND RECOMMENDATIONS

6.1 Why improvement of the Marston Vale is important

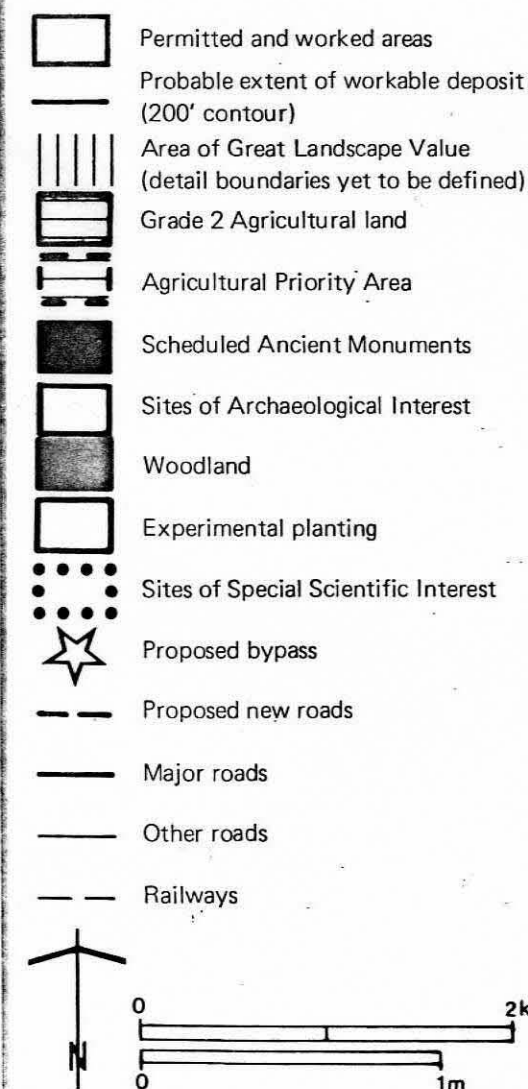
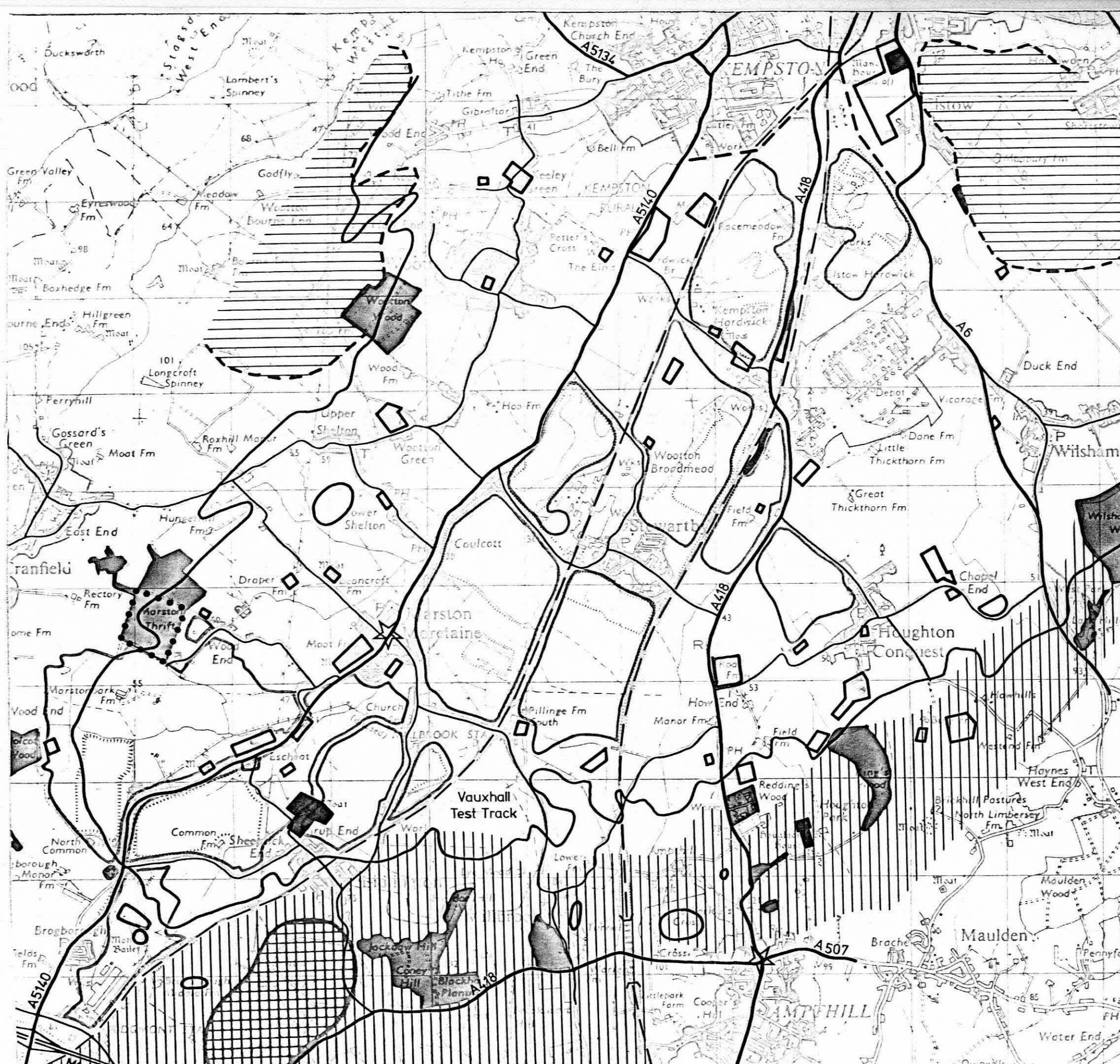
The Marston Vale, with its combination of vast pits, brickworks, and tall chimneys in the flat plain, constitutes what is generally accepted as the bleakest landscape in Bedfordshire. The Marston Vale, broadly described as an area of flat farmland and brickworks, is a landscape with little variety. The main reasons the Vale is considered a poor quality landscape are that it is treeless, with little terrain relief, and many man-made intrusions such as the unrestored brick pits. The commanding feature of the Vale is the brick industry. (Landscape Technical Volume, 1980)

The flat plain ends abruptly under the Greensand Ridge to the southeast, creating a distinct change in height and open views over the Vale. The Greensand Ridge is an Area of Great Landscape Value (G.L.V.) and is a recognizable and beautiful area of landscape. (Landscape Technical Volume, 1980). The mining of the Marston Vale allows an opportunity to enhance the landscape. (See Map 6.1)

Disturbance of the land by clay extraction wipes the slate clean. At the conclusion of extraction new, preferable land uses may be possible. The mined-out excavations provide an opportunity to reshape the landscape of the Marston Vale. This is an opportunity to reshape the

Oxford Clay Constraints

Source: Minerals Appraisal and Issues. March 1978



landscape and recreate the image of the Marston Vale. The reshaping of land requires imagination and sensitivity.

Unquestionably, the Marston Vale has great potential for improvement. However, considerable attention and treatment will be required to achieve any significant change.

The reclamation of the brick pits to some acceptable after-use is one of the major issues facing the County Council at the present time. (Oxford Clay Subject Plan, 1982). The need to conserve the most basic resource, the land, is only too obvious. The intrusion of the chimneys and claypits into the landscape is unavoidable, but these can be played down or screened, and, if the future potential of the area has been effectively planned, the disturbance can be minimized.

6.2 Conditions to be met

6.2.1 Appropriate to the Area

The strategy plan should be appropriate to the area, incorporate the present needs of the county, and be versatile to meet the needs of the future. One fundamental issue of the reclamation of the claypits is that the after-use should be appropriate to the rural area and for which there is a proven need. (Oxford Clay Subject Plan, 1982) The character of the area is described by the County Council as farmland but is dominated by the brickworks and industrial use. Indeed, one fundamental reason why new landscapes are unsatisfactory is that, for much new development, there is no appropriate setting.

There is a need for the integration of the industrial character into the so called rural character of the Marston Vale and this can best be achieved through reshaping the land at a low level. The real need is to integrate the land-uses which already exist - and new developments - into the surrounding area to be compatible with other forms of land-use that occur nearby. There is a need to develop the whole scene and create good landscape for every kind of use, thereby uplifting the poor quality image of the area.

6.2.2 Needs of the Area

The policies of the London Brick Company, the Bedfordshire County Council, the Ministry of Agriculture, Fisheries and Food, and the Anglia Water Authority all point to agriculture as the preferred after-use. The previous chapter points out that the original reason for boosting food production is no longer valid. New farming technology has provided increased productivity of the better quality agricultural land. The quality of the agricultural land in the Marston Vale is only average and therefore not vitally important to be returned to agriculture.

The needs of the County, as ascertained by the County Council in the Bedfordshire County Structure Plan, 1980, are summarized as: 1) residential development near main urban areas; 2) industrial expansion and development near urban areas; and 3) countryside recreation near urban areas. The County Structure Plan states that there is a need for housing,

industry, countryside parks and conservation, particularly near the major urban area of Kempston/Bedford. The needs have been proven and the landscape character has been described by the County Council.

6.3 The Options

The methods of reclaiming the claypits to an appropriate after-use are landfill, waterfill, and low level. Reclamation by landfill is considered the preferred method to reclaim the excavations because it enables the land to be restored to original ground level and it offers opportunities for financing the proposals. The two major hinderances of landfill proposals are the time-frame involved and uncertainties in obtaining the filling materials. Landfill offers a wide choice of after-uses: agriculture, forestry, recreation or wildlife conservation.

The second method, waterfill reclamation, can be achieved in two to three years. Waterfilled reclamation is limited to recreation or wildlife conservation. The main drawback to waterfill reclamation according to the County Council is that waterfilling "represents a change in the character of the landscape." (Oxford Clay Subject Plan, 1982)

The final method of reclamation is low level. Low level offers the same diversity of after-uses as landfill, with the benefit of less time to return the land to after-use and smaller quantities of filling material required. The disadvantage is the expense of earthmoving and the cost of constructing a drainage system.

Landfill is considered the preferred method of returning the land to a beneficial after-use. Presently, the main drawbacks to landfill are the uncertainties of obtaining filling materials and the length of time to fill the claypits. In the future, the excavations may be a valuable asset if there is an over-abundance of fill materials, and time may be on the side of the London Brick Company. However, at present, proposals, such as transporting colleiry spoil from the Vale of Belvoir, are economically prohibitive.

6.4 Low Level Solution

The reshaping of the Marston Vale can be achieved through progressive and low level reclamation. A strategic plan for the entire Vale should include the reshaping of land left derelict, progressive reclamation of the pits as they are worked and a comprehensive master plan for after-use.

Reshaping the land at a low level offers the broadest range of alternative after-uses: agriculture; forestry; land and water-based recreation; conservation; building sites; and for landfill in the future. These choices are not exclusive. The range of alternative land-uses can also be used in combination. Reshaping the land at a low level with a temporary use in mind, (temporary to the extent that one hundred or more years may pass before there is an appropriate need or land-use for large pits) is also an option with this method of reclamation.

The character of the area is described by the County Council as rural although the dominant feature is actually the brick industry. One is led to question the description, which necessitates agriculture as the only end use. The low level solution enlarges the appealing landscape and offers the county's residents a versatile environment both now and in the future.

Low level can be achieved in less time (two to three years) than landfill. The existing conditions of the planning permissions include a temporary stage of reclamation which requires grading of the sides, leveling of the floor, drainage and spreading of topsoil. The conditions also include final stage reclamation and require a master plan proposal for after-use, landscaping and drainage. Planning conditions should give the County Council the opportunity to consider phasing of extraction. The phasing of extraction, as researched for the National Sand and Gravel Association in the USA, should include development guidelines throughout the life of the operation including after-use designs. The pattern of excavation should be pre-arranged to help creation of useful landforms while the equipment is still available. "Through the process of planning and design, initiated before extraction begins, the producer can:

1. make more efficient use of the material and equipment in creating functional land areas;
2. reduce earth-moving costs by intelligent use of equipment and placement of overburden;
3. reduce visual, noise, and dust conflicts by controlled movement of equipment; and proper siting of machinery and structures with intelligent use of natural and manmade screens; and

4. in general, improve the opportunity to make the land development effort an investment rather than an expense."
(Landscape Architecture 1966)

These phases could include design of the edges of the excavation with the intention of leaving an interesting and valuable landform and also lessening the cost of grading and creation of fill material, to provide a smooth integration into the landscape. The steps are: 1) determine the extent of the mineral deposit; 2) design excavation procedure to remove a majority of material while increasing or providing for the accepted planned after-use; 3) implement simultaneous extractions/reclamation plan; and 4) implement after-use. One reason for the preference for filling to ground level as a means of reclamation, is that no expense is incurred while reclaiming the land.

Finally, low level allows opportunities for change if future generations decide that another land-use is more appropriate or desirable.

While landfill may cover the costs of reclamation and returning the land to ground level and may offer the same range of alternative land-uses as low level, it does not offer the widest opportunities for enhancing the landscape of an area much in need of improvement at a rapid and satisfactory rate. Reshaping the clay extractions at a low level will provide opportunities to integrate the needs of the County into an area that is not only rural, but also industrial in character and with established recreational use. The needs of the county -- housing, industry and recreation --

are all land-uses currently incorporated in the Marston Vale. Now it is necessary to develop and enhance the current uses and extend them to their optimum potential.

6.5 Concerns for the Future

The realization that advanced societies make many essential demands upon the land is not new. Minerals have to be worked; the clay must be worked. On the other hand, extending the areas of amenity to cover the whole of our scenery and develop a green-urban environment is essential and most likely the landscape of the future. (Fairbrother, 1970) There has never before been such opportunities to reshape the landscape.

In the seventeenth and eighteenth centuries, the land was shaped, created and made by landscape gardeners like William Kent, Capability Brown and Henry Repton. Brown manipulated square miles of the landscape and created a new lake at Blenheim Palace in Oxfordshire. Since the industrial revolution there have been few changes in the countryside that have enhanced the landscape. In fact, according to Hoskins, "Every single change in the English landscape has either uglified it or destroyed its meaning, or both. Of all the changes in the last two generations, only the great reservoirs of water for the industrial cities of the North and Midlands have added anything to the scene that one cannot contemplate without pain." (Hoskins, 1955)

Yet in spite of these examples, the County Council suggests that lakes in the Marston Vale represent a change in character of the landscape. Indeed it does represent a change in the character but a positive change -- change that begins to suggest a better environment and perhaps improve the poor image of the area. There has never before been such an opportunity to reshape the landscape.

The image of the Marston Vale is in dire need of improvement. The development of a visual analysis system which includes adequate criteria for the impact the brickworks chimneys have on the landscape and their historical significance for the future is needed. The brickworks will be historically significant in the future and perhaps the best example should be preserved. Visual analysis should aid in demonstrating how site planning could be effective in enhancing and improving the image of the Marston Vale in the eyes of the public.

The problem is that mining operations to date have not been part of an integrated program to reshape the excavation to accommodate future use. Furthermore, planning for future uses was never accomplished before mining operations began. The London Brick Company should continue to produce their products but develop the excavation methods so the land can be progressively adapted for future use. The pressing need to strongly consider in the future is the early determination of future land-uses so that they may be anticipated and planned for in the excavation process. The planning should

capitalize on the assets of the area and utilize operating potential of the equipment throughout the mining process. In the future, the excavation procedure should remove a majority of the clay deposit but leave what is necessary of the material to provide for the better reshaping and integration of the excavation into the surrounding landforms. This would begin to eliminate the 80 year backlog of dereliction in the Marston Vale.

Long term possibilities for these vast holes are endless. One possibility is the development of New Towns much like the past when bricks were made on the building sites, thus avoiding transportation costs. Another possibility is the development of hydrocultures in the water areas for plants or fishfarming. The possibility of further investigating the use of the pits for reservoirs is an option in light of using extraction procedures that would incorporate after-use design with the excavation methods. These are just a few of the possibilities to consider for the future of the clay pits and all these options are viable by reshaping the land at a low level.

Supporting future research should investigate ultimate land use and the improvement of the image of the Marston Vale. The major objectives should be to identify typical site requirements for any given land-use and demonstrate how the characteristics can be applied to the procedure of excavation of the clay pits. Along with this should be further investigation of overburden as a growing medium for crops and vegetation, which has been initiated in a research project by Lillian Harrison in 1980.

This research could be applied to other surface mining industries, particularly aspects of the sand and gravel, coal, other brickclays, or ironstone mining. More important is the need to apply existing reclamation methods developed by the other surface mining industries to the clay pits. In conjunction, is the need for an examination of the development of a system of levies charged on all brick clay industries for the extraction of clay using the money for reshaping the derelict land similar to the Ironstone Restoration Fund.

In conclusion, the clay must be dug and the backlog of dereliction must be resolved, but the clay pits are an asset to the future.

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APPENDIXES

Appendix 1 - Conversion of Weights and Measures

Metric units are now being adopted universally and should be used wherever possible

To convert to get	multiply by divide by	to get to convert
inches	25 4	millimetres (mm)
feet	30 48	centimetres (cm) (10 millimetres)
yards	0 914	metres (m) (100 centimetres)
square feet	0 0929	square metres (m ²)
square yards	0 836	square metres
acres	0 405	hectares (ha) (1000 m ²)
ounces	28 3	grammes (g)
pounds	0 454	kilograms (kg) (1000 g)
hundredweights (112 lbs)	50 8	kilograms
tons (2240 lbs)	1 016	tonnes (t) (1000 kg)
short tons (2000 lbs)	0 907	tonnes
gallons (Imperial)	4 55	litres (l)
gallons (US)	3 79	litres
cubic feet	28 3	litres

Source: The Restoration of Land by A.D. Bradshaw and
M.J. Chadwick, 1980.

Appendix 2

Table 1 An estimate of land uses by country 1976

Land uses	England			Wales			Scotland			Northern Ireland			United Kingdom		
	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%
Crops and fallow	4021	9936	31.0	107	264	5.2	595	1470	7.7	79	196	5.9	4802	11866	19.9
Temporary grass	1201	2968	9.3	172	425	8.3	670	1656	8.7	271	668	20.0	2314	5717	9.6
Permanent grass	3240	8006	25.0	775	1915	37.5	450	1112	5.8	485	1199	36.0	4950	12232	20.5
Rough grazing	1194	2950	9.2	599	1480	29.0	4765	11775	61.8	210	520	15.6	6768	16725	28.1
Other land	238	588	1.8	33	82	1.6	-	-	-	41	100	3.0	312	770	1.3
<i>Total agriculture</i>	9894	24448	76.3	1686	4166	81.7	6480	16013	84.0	1086	2683	80.5	19146	47310	79.4
Urban	1427	3526	11.0	103	254	5.0	275	680	3.6	40	98	2.9	1845	4558	7.7
Forestry and woodland	767	1895	5.9	204	504	9.9	750	1853	9.7	62	154	4.6	1783	4406	7.4
Miscellaneous	885	2187	6.8	71	175	3.4	210	519	2.7	160	397	12.0	1326	3278	5.5
<i>Total land^a</i>	12973	32056	100.0	2064	5100	100.0	7715	19065	100.0	1348	3332	100.0	24100	59552	100.0
Inland water	71	175		13	32		160	395		63	157		307	759	

^aNot all figures add due to rounding.

Table 2 An estimate of agricultural land by grade 1976

Grade ^a	England			Wales			Scotland			Northern Ireland			United Kingdom		
	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%	Hectares 000s	Acres 000s	%
1	327	806	3.3	3	8	0.2	20	49	0.3	-	-	-	350	863	1.8
2	1652	4083	16.7	39	96	2.3	155	383	2.4	36	89	3.3	1882	4651	9.8
3	5343	13203	54.0	295	729	17.5	880	2175	13.6	457	1128	42.0	6975	17235	36.4
4	1553	3838	15.7	745	1842	44.2	660	1631	10.2	531	1313	49.0	3489	8624	18.2
5	1019	2518	10.3	604	1491	35.8	4765	11775	73.5	62	153	5.7	6450	15937	33.7
<i>Total^b</i>	9894	24448	100.0	1686	4166	100.0	6480	16013	100.0	1086	2683	100.0	19146	47310	100.0

^aMAFF grades for England and Wales, Scottish and Northern Ireland equivalents.^bNot all figures add due to rounding.

Source: Agriculture EDC. Agriculture in the 1980's - Land Use. 1977

Appendix 3 - Conditions Attached to Bedfordshire County
Council Planning Permission No: 2/1981

Conditions of permission and reasons for conditions.

- (a) Permission is granted in respect of Phase I of the proposed brickworks, (i.e. 4 kilns, 1 chimney, 8 loading sheds, 2 press sheds, pan sheds and associated maintenance, transport and administrative buildings occupying the southern part of the site) but excluding the details of the site layout and the detailed plans, sections and elevations of this phase of the brickworks which were submitted with the application other than the chimney and kilns, subject to the following conditions:-
1. In respect of the site layout shown on drawing no. 9683/2 and the buildings and structures shown on drawing numbers 79/52 and 79/53A, 9780/1, 9780/2 and 9780/4 of the application, revised plans sections and elevations shall be submitted to and approved by the County Planning Authority before the construction of Phase I of the brickworks commences.
 2. No goods, waste or other materials may be deposited or stored in the open outside the buildings on the site, except on any areas designated for such purposes on a plan or layout to be submitted to and approved by the County Planning Authority.
 3. Details of the surface water drainage of the site shall be agreed in writing by the County Planning Authority prior to the commencement of the development.
 4. All planting included in the landscaping scheme for the new works (plans nos. 79/1/3 and 79/66) shall be carried out to the satisfaction of the County Planning Authority within the period specified in the scheme. Thereafter the trees and shrubs shall be adequately maintained for a period of five years from the date of planting and any which die during this period shall be replaced and maintained until satisfactorily established.
 5. Noise from operations carried out on the site shall not exceed levels (as measured along the boundaries of the site) to be agreed in accordance with a scheme for the control of noise arising from the site. Such a scheme shall be agreed in writing by the County Planning Authority prior to the commencement of the development.
 6. Application for the approval of matters referred to in conditions numbers 1, 2, 3 and 5 shall be made not later than 6 months from the date of this permission.

- (b) Permission is granted in respect of Phase II of the proposed brickworks, (i.e. 4 kilns, 1 chimney, 8 loading sheds, 2 press sheds, pan sheds and associated maintenance transport and administrative buildings occupying the northern part of the site) but excluding the details of the site layout the kilns and the detailed plans, sections and elevations of this phase of the brickworks which were submitted with the application, subject to the following conditions:-

1. Before the construction of Phase II of the brickworks is commenced the approval of the County Planning Authority shall be obtained in respect of the following matters:-
 - (a) The layout of the site, including the disposition of roads and buildings, and access arrangements to the site and buildings.
 - (b) The surface water drainage of the site.
 - (c) Plans and elevations of all buildings and other structures.
 - (d) The colour and type of facing materials to be used for all external walls and roofs.
2. All planting included in the landscaping scheme for the new works (plans Nos. 79/1/3 and 79/66) shall be carried out to the satisfaction of the County Planning Authority within the period specified in the scheme. Thereafter the trees and shrubs shall be adequately maintained for a period of five years from the date of planting and any which die during this period shall be replaced and maintained until satisfactorily established.
3. Before construction commences on the kilns and plant comprised in the proposed new brickworks in this phase there shall be submitted for the approval of the County Planning Authority plans, sections and drawings showing their layout and detailed engineering construction. The kilns shall be tunnel kilns so designed as to be capable of incinerating the organic components of the gases given off in the brick firing processes. This last requirement shall cease to be binding if within 6 months prior to the submission of such plans, drawings and sections the Health and Safety Executive or such other governmental body as may in future discharge their statutory responsibilities have certified in writing that after the conduct of a research programme by the applicants in accordance with the requirements of the planning agreement dated 10th April 1980 between the Bedfordshire County Council and the applicants, the use of such kilns would not at the date of the Certificate constitute the best practicable means of eliminating or minimising the odours which derive from the said organic components.
4. No goods, waste or other materials may be deposited or stored in the open outside the buildings on the site, except on any areas designated for such purposes on a plan or layout to be submitted to and approved by the County Planning Authority.

5. Noise from operations carried out on the site shall not exceed levels (as measured along the boundaries of the site) to be agreed in accordance with a scheme for the control of noise arising from the site. Such a scheme shall be agreed in writing by the County Planning Authority prior to the commencement of the development.
 6. Application for the approval of matters referred to in conditions numbers 1, 3 and 4 shall be made not later than 10 years from the date of this permission.
- (c) Permission is granted in respect of the proposed mineral workings and the associated mineral landscaping proposals subject to the following conditions:-
1. Planning permission shall only extend to the application as amended by letters dated 29th October 1979 and 7th December 1979.
 2. Excavations shall be confined to the hatched areas only on the attached plan.
 3. No excavations shall take place within 20 metres of the Bletchley-Bedford line, and no materials shall be deposited or building erected in the intervening strip without the written approval of the County Planning Authority.
 4. No excavations shall take place within 30 metres of any highway boundary.
 5. The sides of any excavation adjacent to the railway shall be worked to a slope not steeper than one vertical to two horizontal through the overburden (clay) and not steeper than one vertical to one horizontal through the brick clay. A bench of 4 metres width shall be provided between the toe of the overburden and the top of the slope of the brick clay.
 6. No excavations or ancillary operations may be carried out except in accordance with a scheme(s) in respect of each working area. The scheme(s) shall be submitted to the County Planning Authority for approval and thereafter strictly adhered to. In the case of those excavations being worked at the date of this permission (or commenced within twelve months of that date), the scheme shall be submitted for approval not later than 12 months from the date of this permission, and pending the approval of such a scheme the planning conditions annexed to any planning permission in force on the date of this permission shall be deemed to be such a scheme.

The submitted scheme shall include provision for:-

- (a) the working of the pit in phases of approximately 5 years duration;
- (b) the order, direction, method and depth of working, and the slope of the sides of the excavations;

- (c) the separate removal and storage of topsoil and overburden for use in the restoration and landscaping of the applicant's brick pits in the Marston Valley, unless otherwise agreed in writing by the County Planning Authority;
 - (d) the natural and artificial drainage of the land;
 - (e) the diversion of water courses, footpaths and bridleways;
 - (f) the location, height and profile of the screen banks;
 - (g) the location of the main haul roads, conveyors, etc.;
 - (h) details of the trees and hedgerows to be removed.
7. No trees or hedgerows situated within the application site shall be lopped, topped or felled except in accordance with the agreed scheme submitted under condition 6 above or as may be agreed in writing by the County Planning Authority.
8. Restoration of the site(s) shall take place in accordance with a scheme or schemes to be agreed with the County Planning Authority and shall relate to the working phases referred to in condition 6(a) above. The scheme(s) shall make provision for 2 stages of restoration, Stage 1 (temporary or immediate) and Stage 2 (final or ultimate) in accordance with the following requirements:-

Stage 1 (Temporary or immediate) restoration

- (a) That in respect of those excavations that have been exhausted of mineral, or are being worked at the date of this permission, a scheme shall be submitted to the County Planning Authority for approval within 18 months of the date of this permission. The scheme shall be carried out and subsequently completed within the period specified in the scheme and shall include provision for the general landscaping, and where practicable the levelling of the quarry floor or the flooding of the excavation.
- (b) That in respect of those areas unworked at the date of this permission (excepting where excavation commences within 2 years of that date) the Scheme of short term restoration shall be submitted to the County Planning Authority for approval not later than 12 months prior to the commencement of excavations.

Where excavation commences within 2 years of the date of the permission the scheme of short term restoration shall be submitted to the County Planning Authority for approval prior to the commencement of excavations, which pending formal approval, shall be carried out in accordance with the submitted scheme.

The short term restoration schemes shall include provision for:-

- (i) the battering of the sides to a slope not steeper than one vertical to two horizontal using overburden from the excavations, and the levelling of the quarry floor;
 - (ii) the arrangement for storage, spreading and treatment of topsoils and overburden and/or flooding of the excavations;
 - (iii) the natural or artificial drainage of the site;
 - (iv) the detailed phasing of the operation.
- (c) Completion of short term restoration of any phase referred to in condition 6 shall be carried out within the period specified in the approved scheme.

Stage 2 (final or ultimate) restoration

- (d) Within 2 years of the date of this permission an overall master scheme for the proposed ultimate restoration of all clay workings covered by this permission shall be submitted to the County Planning Authority for approval. Such scheme shall take into account the requirements and proposals of the Minerals Subject Plan and shall include provision for:-
- (i) the backfilling of the excavations dependent upon the availability of suitable filling materials, or the permanent flooding of the pits, or details for restoration at a reduced level;
 - (ii) the proposed after-use of the restored areas;
 - (iii) landscaping proposals;
 - (iv) the natural or artificial drainage of the site;
 - (v) any proposed access to the site, and, where appropriate the re-instatement of public footpaths;
 - (vi) the phasing of these operations.
- (e) Insofar as its provisions have not by then been carried out and so certified by the County Planning Authority the scheme required by paragraph (d) above, shall be reviewed and submitted to the County Planning Authority for approval not less than once every 5 years from the date of approval, and within 18 months of a request by the County Planning Authority following an unforeseen change in circumstances, having particular regard to:-
- (i) the availability of suitable filling materials;

- (ii) the then current provisions and any proposed changes to the County Structure Plan and Minerals Subject Plan;
 - (iii) further areas of land that may have received planning permission for clay extraction.
- 9. Landscaping of pit margins and stand-off areas shall be carried out in accordance with the proposals incorporated in the application (plan nos. 79/66 and 79/1/1), and within nine months of the date of this permission a detailed landscaping scheme in respect of these areas shall be submitted to the County Planning Authority for approval. This scheme shall include details of the species and number of trees to be planted, and the proposed phasing and programming of such planting. Once approved all landscaping shall be carried out in accordance with the scheme or such revisions as may be agreed in writing by the County Planning Authority from time to time.
 - (a) All trees and shrubs planted in accordance with the landscaping or restoration schemes (referred to in conditions 8 and 9) shall be adequately maintained for a period of 5 years to the satisfaction of the County Planning Authority, and any which die during that period shall be replaced and maintained until satisfactorily established.
 - (b) Where land is to be restored for agricultural use, the contouring drainage and initial cultivation must be sufficient to achieve and maintain the best practical agricultural use for a period of not less than five years.
- 10. The location of any new vehicular access to each pit and the layout, design and materials to be used in the construction of such access shall be as approved in writing by the County Planning Authority. Such access shall not be used for the purposes of the development hereby permitted until its construction has been completed to the satisfaction of the County Planning Authority.
- 11. All vehicles, plant and machinery on the excavation area shall be used with efficient silencers and no vehicles, plant or machinery shall be used except in accordance with a scheme for the control of noise arising from operations authorised or required under this permission which has first been submitted to and agreed with the County Planning Authority.
- 12. No cranes or equipment shall operate immediately adjacent to the railway so as to endanger rail traffic and they shall not swing or work over any part of the railway land.

13. Within one year of the cessation of mineral extraction in any pit all plant, machinery and foundations shall be removed from the excavation area.
14. Notice shall be given to the County Planning Authority of the date when the topsoil shall have been removed from the excavation area whereupon the County Planning Authority may within seven days of receipt of such notice specify in writing to the developer a period (not exceeding four months) from the date of the notice. During such a specified period the overburden and minerals in such area shall not be disturbed except by persons authorised by the County Planning Authority who shall be permitted to inspect and excavate the same for the sole purpose of recording any features of historic or archaeological importance.
15. Notwithstanding the provisions of the Town and Country Planning General Development Order 1977, planning permission shall be obtained under Part III of the Town and Country Planning Act 1971 for the erection of any fixed plant, fixed machinery or permanent buildings, not including belt conveyors or such other minor developments as may be excepted from this condition from time to time by written notice on behalf of the County Planning Authority.
16. Access to the workings shall be allowed to persons authorised by the County Planning Authority during normal working hours.
17. The development hereby permitted shall be begun not later than 5 years from the date of this permission.

DEMOLITION AREAS

18. The buildings and structures referred to in the written statement forming part of the application shall be demolished and the sites cleared in accordance with the specifications and programme set out on page No. 15 of the said statement, subject to such modifications as may be agreed in writing by the County Planning Authority.
19. A detailed scheme for the treatment and afteruse of each of the demolition sites referred to in condition 18 above, shall be submitted to the County Planning Authority for approval prior to the scheduled date of the demolition. Such schemes shall include provisions for the short or long term afteruse of the site for the purposes of agriculture, forestry or amenity tree-planting.

THE REASONS FOR THE COUNCIL'S DECISION TO GRANT PERMISSION SUBJECT TO COMPLIANCE WITH THE CONDITIONS HEREINBEFORE SPECIFIED ARE:-

- (a) 1 & 2 To enable the County Planning Authority to exercise control over the layout and appearance of the site.
- 3 To secure the satisfactory drainage of the site.
- 4 To enhance the appearance of the proposed development.
- 5 To protect local amenity.
- 6 To prevent the accumulation of unimplemented planning permissions.
- (b) 1 To enable the County Planning Authority to exercise control over the layout and appearance of the site. To secure the satisfactory drainage of the site. To enhance the appearance of the proposed development.
- 2 To enhance the appearance of the proposed development.
- 3 To improve the environment of the Marston Vale and to eliminate any possible harm to humans, animals and crops.
- 4 To enable the County Planning Authority to exercise control over the layout and appearance of the site.
- 5 To protect local amenity.
- 6 To prevent the accumulation of unimplemented planning permissions.
- (c) 1 To avoid confusion.
- 2 & 3 To define the working area, and to ensure the maintenance of boundaries.
- 4 To protect the highway.
- 5 To define the working area and to protect the railway.
- 6, 8 To ensure a satisfactory method of working and to provide & 13 for the eventual restoration of the site.
- 7, 9 To protect local amenity.
- & 11
- 10 To minimise danger, obstruction and inconvenience to users of the highway and of the site.

- (c)
- 12 To ensure the safety of rail traffic and property.
 - 14 To enable the recording of crop marks or hitherto hidden archaeological features before destruction.
 - 15 To enable the County Planning Authority to exercise control over any new development.
 - 16 To enable the County Planning Authority to carry out inspections.
 - 17 To prevent the accumulation of unimplemented planning permissions.
 - 18 To enhance local amenity.
 - 19 To provide for the restoration and after-use of the site.

EVALUATING ALTERNATIVES FOR RESHAPING EXCAVATED LAND:
A STUDY OF THE BEDFORDSHIRE BRICKFIELDS

by

LOUISE STEWART

B.S., Kansas State University, 1977

AN ABSTRACT OF A MASTER'S THESIS

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MASTER OF LANDSCAPE ARCHITECTURE

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ABSTRACT

This thesis evaluates the reclamation of excavated land and the opportunities for improvement. The specific study area was the Oxford Clay mineral workings in the Marston Vale, Bedfordshire, England. The methodology included a study of literature on reclamation in England, general reclamation techniques, land conservation and British planning laws; personal interviews with the London Brick Company, Bedfordshire County Council Planning Department, the Ministry of Agriculture, Fisheries and Food, the Anglia Water Authority and professionals in the fields relating to reclamation; and a study of the policies and needs of the surrounding region and the county. The three methods of reclamation in practice are landfill, waterfill and low level reclamation. The landfill method is preferred because it: 1) returns the excavation to original ground level; 2) provides opportunities for domestic waste disposal; 3) returns land to agricultural use; and 4) offers opportunities to finance the reclamation procedure. The interviews established the preferred after-use to be agriculture. However, analysis of the alternatives for after-use and of the policies and needs of the County led to the conclusion that the reshaping of the land at low level is a better solution because it can be achieved in less time, offers the broadest range of after-uses and allows for opportunities for change in the future.