The spatial impact of the hydrocarbon industry on land and sea use in Qatar.

Al-Thani, Fahd Abdul Rhman Hamad

The Spatial Impact of the Hydrocarbon Industry on Land and Sea Use in Qatar

Fahd Abdul Rhman Hamad Al-Thani

This thesis is submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy
Department of Geography
University of Durham
1992

Abstract

It could be argued that land use studies are primarily a product of the experience of Western Europe and North America where dense populations compete for land of high value, and where land use conflict is commonplace. Whilst it is true that much of the literature on land use is of Western origin, there is increasing need for a thorough understanding of land use concepts in the Third World. Although Qatar has a small population, very little cultivation, and large areas of land in which there appears to be no productive activity, it already has some pressing problems of land use competition requiring careful analysis. Some of these are associated with the hydrocarbon industry.

The thesis demonstrates why study of the effects of the hydrocarbon industry on land use and sea use in Qatar is both appropriate and timely.

Qatar can no longer be categorised as a sparsely populated state. In certain areas of the country, such as in the Doha area and around the Umm Said industrial area, there is evidence of growing land use competition.

The hydrocarbon industry occupies much land, and indirectly affects considerably larger areas. The thesis offers a detailed, descriptive analysis of hydrocarbon industrial land use.

Attention is drawn to the gradual decline in area and quality of unoccupied land in Qatar. Overall present land use by the hydrocarbon industry is considerable. This is seen most clearly in the Dukhan region. As an oil production region, the Dukhan field is expected to continue for several more decades, and perhaps longer as a strategic reserve for the North Dome gas field. Within a few decades, as production from the North Dome gas field continues to stimulate growth of petrochemical and associated industries, it is likely that land use competition, particularly between the industrial and leisure sectors, will intensify in most coastal locations. Coastal land adjacent to deep water will soon be at a premium.

The spatial impact of the offshore hydrocarbon industry has a major impact on the sea use of Qatar, affecting fishing, transport, security and leisure uses of Qatar's inshore waters. The oil fields and the North Dome gas field directly occupy sizable, if limited, areas of offshore Qatar, but indirectly control considerably larger areas.

Three hydrocarbon gathering points are identified. These topological nodes are the focus of pipelines which transfer hydrocarbons downstream from the production regions to Umm Said, Doha and Halul island.

Doha, capital city of Qatar, is identified as the centre for hydrocarbon administrative and support services. Whilst land direct occupation by these services is small, key sites are occupied. Trip generation related to these services is significant. The effect of oil revenues from the hydrocarbon industry have resulted in huge (132- fold) urban growth.

A clear distinction has been identified between land occupation and land influenced by hydrocarbon activities. The term 'shadow' land use has been adopted to describe this situation, which may extend to apparently empty land. Another approach which may prove fruitful in future research is the automatic inclusion of 'sea use' studies alongside land use.

In the name of God, most gracious, most merciful

Supervised by: ______________________

Dr G.H. Blake

Prepared by: ______________________

Fahd Abdul Rhman Hamad Al-Thani

Dedications

Dedicated to the virtuous spirit of my father, and my mother, brothers and sisters, my wife and children

Acknowledgements

I am greatly indebted to H.H. Sheikh Khalifa H. Al-Thani, the Emir of Qatar, and to H.H. Sheikh Hamad K. Al-Thani, Heir Apparent.

I am also greatly indebted to my principal mentor in this work, whose door was always wide open for me at any time, for any sort of assistance regarding this thesis, my supervisor Dr G. Blake, Director of the International Boundaries Research Unit, Department of Geography, University of Durham; to Professor R. Hudson, shadow supervisor, with all his sound advice and helpful comments which helped to enhance this work; and to Mr A. Corner (Cartography Unit, Department of Geography) who assisted me in drawing and developing all figures and maps which are contained in this thesis. I am also grateful to all of the lecturers and personnel of the Department of Geography, the Library and the other sections of Durham University where I received very generous assistance.

I am also greatly indebted to To H.H. Sheikh Khalid H. Al-Thani, former Minister of Internal Affairs, H.H. Sheikh Mubarak A. Al-Thani, former General Chief of Staff, H.H. Sheikh Abdullah K. Al-Thani, Minister of Internal Affairs, Deputy Minister of Finance and Petroleum, H.H. Sheik Hamad A. Al-Thani, former Director of the Ministry of Trade and Commerce, Sheikh Abdullah A. Al-Thani, Manager of the Planning Department in the Ministry of Industry and Public Works, Sheikh Abdulaziz A. Al-Thani.

I am also greatly indebted to Mr A. Al-Mukhlafi, Qatari businessman and special thanks to Dr K. Idris from whom I received much assistance in this work, Dr B. Nassar and all of the lecturers and personnel of the Department of Geography in Qatar University where I obtained my B.A. Degree in Geography and Planning, Professor H. Saleh, my supervisor for my M.A. Degree, and all of the lecturers and personnel at the Department of Geography at Jordan University, Dr I. Al-Kuwari, Minister of the Palace and Mr M. Al-Atea', Doha Palace Document Office.

I am also indebted, for the assistance I received to: Qatar General Petroleum Corporation (Q.G.P.C.); Dr J. Al-Marri, General Managing Director of Q.G.P.C.; Mr M. Al-Duleamy, Manager of Q.G.P.C. Offshore Operations; Mr A. Al-Kuwari, Manager of Q.G.P.C. Onshore Operations; Mr H. Al-Timimi, Production Superintendent, Dukhan; Mr K. Al-Mansouri; Mr A. Mohammad, Senior Petroleum Engineer; Mr K. Al-Sohoti; Mr A. Al-Utabi; Mr H. Al-Nauimi; Mr A. Abdul Rhman, Deputy General Manager of Qatar Petrochemical Co. Ltd.; Mr S. Hasan, Senior Technologist NGLs and Gas Plants; Mr A. Al-Buainain, Public Co-ordinator Manager; Mr I. Al-Ansari, Deputy Senior Project Manager - North Field Development Project; Sheikh K. Al-Thani, Ras Laffan Team Leader, Qatar gas utilisation; Mr B. Martinot, General Manager of Qatar Petrochemical Co. ltd.; Mr H. Al-Muhandi, National Oil Distribution Company; Mr A. Al-Marry, Qatar Petrochemical Co. Ltd.; Mr A. Fakhroo, Public Relations Co-ordinator in Qatar Fertilizer Company; Mr K. Al-Swadi, Senior Engineer, Qatar Fertilizer Company Ltd.; Mr J. Al-Buainain, Q.G.P.C. HQ Personnel Manager; Dr S. Malaty, Bechtel Planning Director; Mr M. Al-Qa'try, Manager of Q.G.P.C. Onshore Operations Services; Mr N. Bassiso, Petroleum Engineer; Mr M. Al-Airq, Trade Relations Department; Mr D. Ruckaler, Senior Planning Engineer; Mr A. Riza, Petroleum Engineer; Mr N. Jaidah, Technical Manager; Mr J. Sexton, Marine Superintendent;

Mr M. Shaw, Technical Manager of Platform 3, Bulhanine Oil Field; Mr H. A'sheer, Public Co-ordinator on Halul island; Mr Yonis, Halul island; Mr I. Mubarak, Senior Staff; Mr N. Fakhroo, ex-QGPC employee; Mr A. Al-Marzoqi, ex-QGPC employee.

I owe much to the respected, elderly Qatari people who gave me a lot of information about the beginning of the hydrocarbon industry: H.H. Sheikh Ahmed M. Al-Thani, Doha; Mr H. Al-Quraisi (Al-Murah tribe), Al-Khar'ana village; Mr H. Al-Sha'er, Wakrah; Mr M. Al-Khaerein (Bani Hajir tribe), Al-Waynah village; Mr A. Bin Zaben Al-Dwaseri, An Nasraniyah village.

I am also indebted to: Dr Quttub Hamad, General Health Corporation (Laboratory); Mr F. Al-Hajiri, Manager of Jumayliyah Municipality Mr A. Al-Sayed, Manager of Umm Said Municipality; Mr A. Al-Khater, Manager of Doha Municipality; Dr A. Al-Buainain, Director of the Construction Planning Department in Doha Municipality; Mr A. Abdu Rahim, the Qatari Navy; Professor M. Haruni, Consultant for Industrial Technical Centre (I.D.T.C.) for Chemical and Petrochemical Industries; Mr G. Ghanky, Director of Doha Port; Mr M. Al-Malki, Director of industrial Department, Ministry of Industry and Public Works; Mr M. Al-Nauimi, Manager of the General Statistical Organisation; Mr A. Mostafa, Central Statistical Organisation; Mr H. Al-Kubaisi, Qatar Amiri Navy; Mr A. Abdul Rahim, Qatar Amiri Navy; Mr M. Safar, Helicopter Airport; Mr A. Akbar, Geology Department, Qatar University (who assisted me with Landsat Images); Mr A. Fakhroo, Chargé d'affaires, State of Qatar Embassy in Abu Dhabi, U.A.E.; Mr R. Al-Swadi, Director of Exploration and Production, Abu Dhabi National Oil Co. (A.D.N.O.C.); Mr M. Al-Manai, Cultural Attache, State of Qatar Embassy in London; Mr Halton, B.P.

Exploration (Wytch Farm Oil Field); Mr T. Al-Khawri, Qatari businessman in land speculation; Mr S. Al-Muhandi, Qatari businessman from Al-Khawr city; Dr H. Smith, Marine Department, Cardiff University.

Thanks also to Mr M. Al-Far and Mr A. Muftah of the Qatar National Museum.

Special thanks to my fieldwork team: Mr I. Al-Rashdi, Mr H. Al-Quraisi and Mr A. Al-Darwish, Senior staff at the Construction Planning Department, Doha Municipality; Mr A. Al-Uqalli, Computer Section, Doha Municipality; Mr S. Al-Muslemani, from whom I received great assistance in organising the distribution of questionnaires to fishermen as well as interviews with fishermen; Dr W. Khalief, Mr A. Al-Mudfa'h, Mr A. Hussein and Dr Kushkesh, of the Qatar Environmental Protection Committee; Mr A. Al-Ansari, Qatar National Manufacturing Company; Mr A. Al-Khazeen, Senior Staff, Umm Bab Cement Plant.

I should like to thank the staff of Alpha Word Power, Durham City, for helping to make the manuscript into a presentable thesis.

I apologise to those people who assisted me whose names are not mentioned here. Please accept my thanks in helping me to produce this work. Good luck to you all.

I am especially and personally indebted to my wife, Umm-Sarah, for her patience and support through my many years of research, and to the best gift I received from God in my life my two daughters Warroud and Sarah.

Table of Contents

List of Figures

A list of Figure sources can be found in Appendix II

List of Tables

List of Plates

Chapter 1

Introduction

Figures

Tables

1.1 Land use - Concepts and Studies

It has often been said that land is the basic natural resource. Over the span of human history, people have drawn most of their sustenance and much of their fuel, clothing and shelter from the land. Land has been mankind's habitat and living space; land has been a matter of life and death, of survival and starvation.[1]

Perhaps the best example of ancient land use and its utilisation is discussed in a book written by Dale, P.F. and Maclaughlin, J.D., *Land Information Management*, 1988, which argued that the management of land information systems have been in existence since humankind first began to practice non-migrant agriculture. When Babylonians occupied the lands between the Tigris and Euphrates, and the Egyptians cultivated the fertile regions of the Nile, the need for orderly land management was recognised. This in turn led to the development of rudimentary land information systems.[2] That the use of land should have been of major importance to man is, therefore, not surprising.

What is more surprising is that man's attachment to land and his concern for it have persisted into the industrial (and post-industrial) age. In the economically-developed West, and increasingly in other parts of the world, man has become separated from the land, in terms of his sustenance at least, if not of his living space. His food comes from the supermarket rather than directly from the soil. Much of his clothing is of synthetic fibre. In place of firewood he uses fossil fuels from deep below the land surface. Days, weeks, or months may pass when his only landscape is townscape. Yet he is still concerned about the use of the land from which he has become largely separated. Should farmland around the edges of a town be built over? Should open moorland be forested? Should native woodland be cut down? How should residential and commercial land uses be related to each other within a city? The number of people directly involved in land use issues such as these is small, but the controversies that surround them may be both fierce and sustained.[3] Many may live in the city, but have a general concern for the use of both rural and urban land. The use of most natural resources, minerals, fossil fuels, water, and power invariably evokes concern, but the use of land seems to stand out in attracting special attention. Perhaps even urban man remembers that he is a terrestrial creature, and that his roots reach back to the land. According to Mather, A.S., there is no clearer identification of land with man than in the Hebrew language in which 'man' is *adam* and 'land' is *adma*.[4]

The concepts and definition of land use is an amply broad issue for study, as each researcher or planner of land use may have a different approach and a different scale, e.g. rural land use, urban land use, and land study on the national or international scale. This study discusses land use concepts and definitions as far as they are relevant to the theme of this thesis.

The first concept of land use presented is that land is simply a form of property that may be traded at will. Alternatively, land is regarded as much more than just personal private property, and its possession is not just a matter for market forces to determine. In this second view, a sense of stewardship attaches, and land is a form of common property, either in the sense of succeeding generations or, by extension, in the wider sense that the community has an interest in it. This basic contrast in attitudes is of fundamental importance, and it lies at the roots of many issues and conflicts in the use of the land. It underlies public controls or constraints on the extent to which the individual may use land as he pleases, and it may have a bearing on how he manages the land under his control.(5)

Various concepts of land use are reflected in different definitions of land use, e.g. one of the earliest was given in connection with the first land use utilisation survey of Britain from 1931 onwards. It stated quite simply that the object of the survey was to discover 'for what purposes the surface of the country is used'(6), and Marion Clawson gives more prominence to this situation by confining the terms land use specifically to "man's activities on land which are directly related to the land."(7) Dudley Stamp goes further than this. He defines land use or land utilisation as "Literally the use which is made by man of the surface of the land but in sparsely populated areas including the natural or semi-natural vegetation."(8)

Definition of land use

What, then, is meant by the term 'land use'? At first sight the term may seem to be self-explanatory. This apparent simplicity is deceptive. An urban area, for instance, is a complicated entity to define. Quite frequently, the administrative boundary of a town in Britain under the old local government divisions before 1974 was taken as defining the extent of urban land, but this definition soon ran into serious trouble for, in Britain at any rate, it has usually been found that a considerable part of the administrative urban area is composed of land in agricultural use.(9)

As Best, R.H. said, a general definition of the subject can be given in the following way:

> *Land use deals essentially with the spatial aspects of all man's activities on land and the way in which the land surface is adapted to serve human needs.*(10)

The above definitions of land use point towards an explanation of the means of obtaining land use data. Without a clear understanding of the nature of the phenomenon it is singularly unlikely that we can subsequently say much of value about it. Now we turn our attention to how data pertaining to it may be collected, checked and compiled, up to the stage where some map or set of land use statistics or computerised data file has been produced.

The methods commonly used for obtaining land use data may be summarised as:

1. Data from lists and texts. Such lists provide the earliest land use records which exist in most countries.(11)

2. Data from maps. Maps are a common form of data storage. Maps resemble data lists and information on land use culled from texts and books.(12).

3. Data from remote sensing. Remote sensing strictly covers all aspects of earth observation which can be carried out without intimate contact with their subject. In the context of land use survey, however, the most relevant techniques are aerial photography and satellite-based digital methods.(13).

Aerial photography: Aerial photography has a long history as a source of land use information, stemming from the development of the technique for purposes of military reconnaissance in 1915-18. High-resolution stereoscopic photography is now routinely used by national mapping agencies in updating topographic maps, and aerial photography has been widely exploited as a source of information on land cover and, to a lesser extent, on land use in both urban and rural environments. More recently, aerial photography has been used as a primary tool for assessing land use change in Britain from 1945 to 1982.[14]

Satellite remote sensing: There are now a large number of earth observation systems, involving different satellites carrying a variety of sensors, each intended for specific applications (e.g. meteorology, oceanography, vegetation mapping and monitoring). The system which is most relevant for land use mapping, the U.S. Landsat Series of satellites, carrying the multispectral scanner (M.S.S.), was launched in 1972; the Thematic Mapper (T.M.) was launched in 1982; and the French Spot.1 was launched in 1986.[15]

4. Field surveys. The use of field surveys of land use has a long history in Britain and Ireland. There was a town survey of Ireland between 1654 and 1658.[16] All the data locked into Stamp's 1930s land utilisation survey, and Coleman's 1960s second land utilisation survey of Britain (both discussed below), were collected thus. In practice, it is almost impossible to produce accurate aerial summaries of land use without a good topographic base map. In urban areas where no appropriate topographic map exists, it is possible to carry out surveys over limited areas by noting adjacency of buildings as well as their use; a crude map may be compiled from such observations. In principle, approximate maps of rural areas can also be reconstructed from recording which fields are adjacent to each other.[17]

5. Cadastral surveys have been compiled for many years, often as a part of land registration procedures. In Denmark, for instance, land registration has been

monitored by cadastral surveys since 1806; and in Belgium a national cadastral has been maintained since 1850. In Britain the nearest equivalent is the annual agricultural returns, which provide a wealth of information on farm properties and land use and have been carried out since 1866.[18]

The first part of this section took a brief look at land use concepts, definitions, and the methods used for obtaining land use data. Below, some land and sea use studies are briefly discussed to show the context in which this thesis arises.

Land use studies in general may be seen as comprising three major themes: (1) rural land use, (2) urban land use and (3) national scale land use (physical planning or physical master planning of national land use). Urban and rural land use studies overlap most of the time. This may create tension between geographers and other land use scientists as their definitions of rural and urban areas differ, especially at the interface between zones. More precise land use studies, e.g. industrial land use and leisure land use, etc., often follow from initial surveys, as explained below.

1.1.1 Rural Land Use

Rural land use studies are the oldest form of land use study, as they go back into the ancient history of mankind, among the Babylonians and Egyptians. Since the beginning of the 19th century, rural studies have seen a new approach by some scientists. For instance, there is a famous model devised in 1803 by a German economist land owner John Heinrich Von Thünen.[19] Some rural studies were based on this model, e.g. Abler, R., Adams, J.S. & Gould, P. in 1972 suggested: "imagine an isolated homogeneous agricultural region consisting of a market town surrounded by a farming region. All farm output is sold in the single market town. Let us say that a hectare of land devoted to fresh milk production yields an output per year that brings revenue of $100 at the town market. The hectare's output generates some production costs, say $30 per year. The net profit is $70 per hectare per year. This is for a dairy farm at the edge of town. The further the farm is located from its market, the larger is the proportion of gross profits that must be paid out in transport costs per hectare of outputs, and the smaller is the net profit per hectare per year."[20] The above example concerns Von Thünen's model and the rural studies derived from it in the second half of the nineteenth century.

From the beginning of the twentieth century to the Second World War, rural geography was associated with the study of rural settlements and field systems, using a largely historical approach. This was stimulated by the work of Vallaux, 1908, examining the origin, structure and patterns of rural settlements, and was continued primarily by the French geographers Vidal de La Blache, 1918 and Demangeor, 1935.[21]

Turning to land use surveys in twentieth century Britain, L.D. Stamp performed the first land utilisation survey of Great Britain, which came into existence in October 1930.[22] This survey was first performed for England and Wales, and the survey paid a great deal of attention to the rural areas, as shown in the maps as follows, e.g. meadow and permanent pasture, light green, and arable or tilled land, brown, etc..[23]

In 1939, Stamp produced a study of productivity, fertility, and classification of land in England and Wales. The survey classified the land, e.g. A1, first class arable land, capable of intensive cultivation and A2, good arable land, suitable for crop production, etc..[24]

The land use survey used for England and Wales was extended to Scotland. A new coloured map was prepared, showing a simple division of Scotland into five predominant farming types, e.g. arable with livestock feeding, and live rearing with arable.[25]

The above land use survey was followed by the world land use survey. Each survey was commissioned by the International Geographical Union, with Stamp as its first chairman. The first survey had been directly encouraged by Stamp as a second look at the Britain of his first survey in the early 1930s. The world land use survey classification was adopted in 1949, oriented towards agricultural interests, but it was always subdivided to suit local circumstances.[26]

A second land use survey was carried out in Britain under Alice Coleman in the 1960s. Not only had the printing plates of previous surveys been destroyed by enemy action during the Second World War, but also the boom conditions after the war, and big strides in technological progress, all combined to weave a pattern of British agriculture different from that of the 1930s when slump conditions prevailed.[27]

The second land use survey of Britain was presented in a coloured map scaled 1:25,000, e.g. derelict land - black stipple, grassland - light green, and arable land - light brown etc.[28]

Other classic land use surveys have been performed elsewhere in the world. For instance, the remarkable agricultural survey of Malta under Bowen-Jones of Durham Universtity in 1955, which concluded with some crucial recommendations, notably that Malta cannot be economically self-sufficient and present and future stability and living standards depend on the maximum utilisation of all resources. Water and soil scarcity make it essential that all fertile and irrigated land is intensively utilised.[29]

A good example of a rural land use survey in the economically developing world is that of Key, G. conducted in the eastern province of Northern Rhodesia (Part 1, *Settlements and Land use in the North Charterland Concession 1895 to 1963*). This work discussed conservation and land improvement, concluding that "Resettlement was never intended as a substitute for agricultural improvement". The main objects were to reduce the agricultural problem to practical properties, to relieve acute land shortage, and to give time for experiment and the introduction of new methods.[30] Another example of a rural land use survey in the economically developing world is reported in Chris Dixon's *Rural Developments in the Third World*, 1990, which offer an explanation regarding the problems of rural lands in Kenya:

> *In Kenya, the traditional agriculture system is widely reported as being under a serious pressure. Soil erosion, deforestation, overgrazing, and falling per capita land holding were depicted as the result of very rapid population growth (3.4 per cent a year) and inappropriate cultivation techniques.*[31]

Almost all of the classic rural land use studies give attention to three aspects; rural society, rural economy and rural planning. These are summarised briefly below.

Rural society has been greatly affected by population decline related to the increased mechanisation of agricultural production and increased specialisation associated with industrialisation. These familiar developments can be recognised as having had significant social and spatial consequences for communities in the countryside, especially through their influence upon the migration of people from rural areas; with the pull factor of available jobs in towns and the push factor of a declining number of jobs in agriculture. So one element in the urbanisation process has been rural depopulation[32] as shown in Table 1.1.

Table 1.1: The decline in the proportion of labour force employed in agriculture 1950-86

Country	% of working population working in agriculture			% change 1950-70	% change 1970-86
	1950	1970	1986		
Greece	52.2	47.2	29.9	-5.4	-17.3
New Zealand	14.3	7.2	5	-7.1	-2.2
USA	12.2	4.3	2.6	-7.9	-1.7
UK	6.1	2.9	2.7	-3.2	-0.2

Source: Robinson, G.M., *Conflict and Change in the Countryside*, Belhaven Press, London, 1990, p.61.

A fine example of the examination of a rural economy is that by Guy Robinson, 1990, *The Advantages and Disadvantages of Rural Locations for Industry.*[33] Robinson argues that ever since the development of factory organisation and the coming of the railways, rural areas have lost their traditional craft industries as well as suffering from a decline in their local services. In many countries this long-term demise has been met in recent decades by attempts to reverse the trend through government-encouraged introduction of new manufacturing and tertiary activities. In Britain, the advantages of such policies were pointed out in 1942, but awareness of problems associated with the rural locations for industry has also been apparent. For example, disadvantages include the loss of productive farmland, dislocation of agriculture activities, the introduction of noxious fumes and effluents, the removal of labour from traditional rural work as shown in Table 1.1., and the possibilities of undesirable social changes associated with a new industrial workforce.[34]

Despite these problems, many countries have sought to encourage industry to locate in rural areas, especially in regions of long and continuing depopulation. Two examples in the U.K. are the policy of the Highlands and Islands Development Board for Scotland and the Development Board for Rural Wales. In the U.S.A. there have also been substantial efforts to channel industry into economically depressed rural areas on the assumption that this will increase economic opportunity and improve the quality of life.(35)

A more precise example of land use as an economic activity, is discussed by Mather, A.S.:(36)

> *Economics is usually an important factor in land use, and is a major influence in competition between potential land users for the use of land. A key concept is that of economic rent. The concept of the economic rent refers to the net value of the returns arising from the use of land in a given period of time. It is similar to the net income in that it is the balance remaining after production costs are subtracted from gross income, but it differs from net income in that all cost of production, including opportunity costs, are calculated at their full economic values. Economic rent is not necessarily the same as the actual or contract rent paid for the use of land, but there will usually be at least some relationship between the two concepts.*(37)

Found, W.C., in his book, *A Theoretical Approach to Rural Land Use*, 1991, discussed input-output relationships, economic rent, and land use competition.

Inputs are normally subdivided into three types - land, labour and capital. To these, management is often added, although in a slightly different category. 'Land' refers to all naturally-occurring phenomena which can be used in the production process. These include: size of area, soil quality (unmodified by man), other factors of the topography which affect productivity (such as slope or drainage), surface and sub-surface water, precipitation, and air. 'Land' includes so many types of input at a particular location that one could say that it refers to the entire ecosystem. 'Labour' refers to the physical input that man himself adds to the production process. 'Capital', which has characteristically been the most difficult input to define, includes all inputs resulting from an earlier combination of land and labour, such as tools, machinery, fences, buildings, domesticated animals, or currency. 'Management' is the decision-making process through which the farmer selects the types and intensities of land use to be carried out, and the types and quantities of inputs to be used. It refers to his ability to operate his farm successfully, given certain production objectives.

Output normally refers to the physical quantities of the products of land use. Sometimes it refers loosely to the value of such output. For clarity, however, the latter characteristic should be clearly designated as the 'value of output' or 'income'.(38)

Various approaches are applied regarding rural planning, depending on perspective and purpose. Different planners and commentators are concerned with different aspects of rural planning, e.g. planning for development, planning for conservation, planning for rural services, and village planning. In this study one type of planning, village planning, will be taken as an example. Two theories concerned with settlement planning, within rural areas will be summarised. Firstly, the concept of an hierarchical settlement pattern, based initially on the work of Christaller and Losch. With the hierarchy are two concepts which have proved central to settlement planning - threshold and complementary region or hinterland.(39) The threshold of a particular good or service refers to the number of people required to support it. Certain functions such as a hospital service require larger numbers of consumers than other functions, e.g. sale of groceries.(40)

Christaller's notion of complementary regions refers to the area from which a service draws it customers. Therefore, a service with high population threshold will tend to drawn its custom from a wider area than one with smaller threshold. The settlement hierarchy reflects the variation in thresholds and complementary regions such as those settlements or central places at the top of the hierarchy which offer both higher order and lower order goods, thereby serving a wider complementary region than settlements at the lower end of the hierarchy where only lower goods are available.(41)

The second is growth centre theory. This incorporates the notion of two opposing forces governing economic prosperity: backwash forces and spread effect. Backwash forces, as described by Myrdal (1957) and Hirschmann (1958),(42) refer to the ability of central places to attract factors of production from their surrounding areas. For planners this notion has been used as a basis for concentrating growth at particular centre which can act as a growth pole for a region.(43)

The spread effect concerns forces which transmit economic prosperity from a central node or region to the periphery. Thus spread effects might be viewed as complementary to backwash forces as growth at designated centres might be transmitted outwards by such effects.(44)

The very recent change in the patterns of land use in the European Community can be explained from the study of David Briggs and Barry Wyatt, *Rural Land-use Change in Europe*, 1988.(45)

> *It would appear that between 1970-79, there has been a slight decline in the total area of utilisable agriculture land, on the average of about 0.4 per cent per year, e.g. the Netherlands indicates that the total agricultural area (excluding forestry and natural areas) fell from 69.7% of the total area in 1970 to 65.1% in 1979. Indeed only Ireland experienced an increase in the*

area of agricultural land between 1974 and 1984, apparently as a result of the reclamation of peatland for farming.[46]

In the main, the decline in the area of agricultural land seems to reflect losses to forestry and urban extension, and abandonment of marginal farmland. In Italy, between 1961 and 1970, for example, an estimated 1.5 million ha. of agricultural land was abandoned, and by 1977 a total of over 2 million ha. of 'reverted' land was believed to exist in the country.[47] Losses to urbanisation, most notably in the Netherlands, where the urban area rose from 6.0% of the national territory in 1970 to 7.2% in 1979. It seems, however, that the rate of urbanisation is slowing down in most areas of Europe, the main exceptions perhaps being tourist regions on the Mediterranean coast, where the pressure for resort extension remains.[48]

On the other hand, the increase of the forest areas in many southern areas of Europe is much less, largely due to the pressures from forest fires, urban growth and agricultural extension. In these areas the rate of forestation may not even keep pace; it is estimated that in Greece, between 25,000 and 120,000 ha. of land are damaged each year, while reforestation covers no more than 3,000 - 4,000 ha. per annum.[49]

1.1.2 Urban Land Use

Whilst the above-mentioned study (Briggs and Wyatt) clearly shows the connection, and the conflict, between rural and urban land use, attention needs to be focused on urban land use. An explanation demonstrating the connection between rural and urban land use is offered by Chris Dixon, *Rural Development in the Third World*, 1990:

Urban Centres generally operate as the transmitters of the change to the rural areas. In recent years, the degree of urban-rural areas interaction has increased dramatically. The development of communications and commercialisation have resulted in the distinctiveness of rural areas being broken *down. Aspects of metropolitan life and world events now impinge directly on most third world rural communities. High levels of temporary and permanent migration are major influences on bringing rural and urban areas closer together in terms of their characteristics.*[50]

In ancient times, certain cities had evolved which had considerable human populations. It has been estimated that Nineveh may have had a population of 700,000 and that Augustine Rome may have had a population of around one million. Such cities would have already exercised a considerable influence on their environs, but this influence especially since the late seventeenth century, has witnessed the transformation of, or revolution in, culture and technology - the development of major industries. This, like domestication, has reduced the space required to sustain each individual and has increased the intensity with which resources are utilised. Modern science and modern medicine have compounded these effects, leading to accelerating population increase, even in non-industrial societies.[51] For example, 259 out of every 1,000 children born, died within the first year in Liverpool in 1840-41, and for the early 1870s the average was still 219 (the corresponding figure for Liverpool in 1970 was 21 out of every 1,000 children who died).[52] This brings us to the subject of modern urban and regional planning, which has arisen in response to specific social and economic problems, which in turn were triggered off by the industrial revolution from the end of the eighteenth century,[53] e.g. London doubled from approximately 1 million to about 2 million people between 1801 and 1851; doubled again to 4 million by 1881, and then added another 1.5 million to reach 5.5 million in 1911.[54]

The parallel with the cities of the developing world is, in several ways, only too exact. The people who flooded into the burgeoning nineteenth century industrial and port cities of Britain were overwhelmingly coming from the countryside. They tended to be drawn from the poorer section of the rural population - those who had least to lose and most to gain by coming to the city.[55]

The result of urban growth, and the city's attraction to rural people, was reflected in the growth of the cities, e.g. London. The impact on urban growth was profound, as in 1801 it was still a remarkably compact city, mainly contained with a radius of about 2 miles from the centre. In 1851 the radius had not increased to much more than 3 miles with higher densities in the inner areas. By 1939 London had assumed a completely different shape: growth areas much more even in any direction, producing roughly a circular city with a radius of about 12 to 15 miles. The basic reason for this was a change in the technology of transportation. First electric trains were much more efficient carriers than the steam trains. Secondly, and even more importantly, the motor bus allowed a fairly rapid urban transport service to penetrate in any direction from these stations, along existing roads.[56]

The same process was repeated around the provincial cities too; it was merely on a smaller scale, and dependent on tram or bus rather than the train. For example, in Manchester, Liverpool and Leeds, the local authorities themselves contributed to the process of urban spread. They re-housed many thousands of slum dwellers and other people in need of public housing by developing new estates of single family homes - generally at distances from 4 to 7 miles from the city centre, in the case of the biggest cities, and connected to it by rapid, frequent and cheap public transport.[57] This process to a certain extent was employed in Doha Capital of Qatar in the 1970s, as explained in Chapter Six, (Section 6.2).

The above examples describe a country less economically developed than now. Were the matter left without any serious planning control, many cities throughout the world will become inconceivably large and crowded. For example, by the year 2,000, it is projected that Mexico City will have more than 30 million people, Greater Cairo, Jakarta and Seoul are each expected to be in the range 15 - 20 million.[58]

This discussion leads naturally towards urban and regional planning. Space prevents anything but a brief discussion, but the major differences in planning between the Anglo-American and the Continental Europeans are highlighted.

By the 1920s and 1930s American cities were served first by public transport and then, increasingly, by the private motor car. (Private motor cars accord with the idea of single family homes). This was a tradition which, by and large, writers and thinkers in both the U.K. and U.S.A. accepted as the starting point. By way of contrast, when the Continental Europeans began to think about urban planning, they tended to accept as a starting point density apartment living within the city.[59]

One of the pioneer thinkers of urban planning was Ebenezer Howard (1850-1928). Peter Hall[60] said that Howard was the first and, without doubt, the most influential of all thinkers in the Anglo American group. In his book, *Garden City of Tomorrow* (first published, 1898 under the title *Tomorrow*, and republished under its better-known title in 1902),[61] Howard argued that a new type of settlement - town-country, or Garden City, could uniquely combine all the advantages of town by way of accessibility, and all the advantages of the country by way of environment, without any of the disadvantages of either. This could be achieved by planned decentralisation of workers and their places of employment, thus transferring the advantages of urban agglomeration *en bloc* to the new settlements. (In modern economic jargon, this would be called 'internalising the externalities'). The new town so created would deliberately be outside normal commuting range of the old city. It would be fairly small. Howard suggested 30,000 people - and it would be surrounded by a large green belt, easily accessible to everyone. Howard advised that when the town was established, 6,000 acres should be purchased: of this no less than 5,000 acres would be left as green belt, the town itself occupying the remainder.(62)

As mentioned above, the industrial revolution and post industrial revolution resulted in the expansion of the size of the cities. This expansion was paralleled by emergence of urban economic theories. Modern urban land use theory, which forms the core of urban economics, is essentially a revival of Von Thünen's Theory (1826) of agricultural land use. Despite its monumental contribution to scientific thought, Von Thünen's theory languished for more than a century without attracting the widespread attention of economists. During that time, cities grew extensively and eventually outpaced the traditional concepts of urban design. The resulting rise in urban problems since the late 1950s has manifested an urgent need for a comprehensive theory of modern urban systems, and in particular, has helped to re-focus the attention of location theorists and economists on the seminal work of Von Thünen. Following the pioneering work of Isard (1956), Beckman (1957), and Wingo (1961), Alonso (1964) succeeded in generalising Von Thünen's central concept of bid rent curves to an urban context. Since that time, urban economic theory has advanced rapidly, inspiring a great deal of theoretical and empirical work. Prominent among the efforts in this area are the works of Muth (1969), Mills (1972), Henderson (1977), Kanemoto (1980) and Miyao (1981).(63)

Masahisa Fujita, in *Urban Economic Theory: Land use and City Size*, 1989, presents in a unified manner, the state of the art of the economic theory of urban land use and city size, including both positive and normative aspects of the theory.[64]

Grant I. Thrall, in *Land Use and Urban Form: The consumption theory of land rent*, 1987, explained that the central theme of his study of the consumption theory of land rent methodology is how certain things determine land use and affect the spatial form of the city.[65]

Economic Activity and Land Use, 1991, edited by Michael J. Healey, is a study comprising of three parts: Part One deals with measuring economic activity and land use. Philip Kivell in Chapter 6 for example on urban land use states that a distinction may initially be made between, on the one hand, land form or cover, and on the other hand, function or activity. Form or cover is essentially the nature of the elements in the landscape, for example, types of buildings structure or open spaces, whereas function or activity concerns what the land is actually used for. The distinction is important because it affects the methods of gathering information. For example, land cover may be discernible from remote sensing imagery but because cover does not give a reliable guide to activity, the latter normally requires a ground survey or documentary evidence.[66]

Part Two of Healey's study concerns 'Monitoring Economic Activity and Land Use'. In Chapter 9 Peter Dale explores land and property information systems which includes, among others, the land market. The size of the potential land market in the UK is unknown. Her Majesty's Land Registry deals only with those properties in

England and Wales which have been registered. By 1988 approximately 11.5 million titles had been registered out of an estimated total for the country of 22 million.

At present private land is brought onto the Register only when subject to the transfer of its freehold, or when a lease of more than 21 years is given on it. Under existing legislation, some privately held properties may never be brought onto the Register and hence a comprehensive pattern of private land ownership in England and Wales is not possible.

The extent and value of central and local government-held land is also uncertain. In 1989 the Audit Commission [1989:2] reported that no-one knew how much local government property was worth, but it was probably more than £100 billion, excluding Council housing. A typical county may have a portfolio worth some £600 million; a typical metropolitan authority may have a [non-housing] portfolio worth £400 million.(67)

Part Three of the study is concerned with the Economic Sector. In Chapter 16 Michael Healey explains that of all sectors of Britain's economy, manufacturing has received the most attention from local and regional researchers. Although the number of people employed in manufacturing in the UK was estimated in 1990 to be 5.1 million, a fall of 3.4 million, or 40% from its peak in 1966, the sector remains paramount as a generator of wealth and a source of technological innovation. Moreover, despite the growing recognition that shifts in the location of several service industries may influence spatial trends in manufacturing and population as well as responding to them, variations from place to place in the changing level of manufacturing activity are still the most important contributor to spatial variations in economic change. Even during a period when British manufacturing was in crisis at the end of the 1970s and early 1980s, "the pattern of urban and regional growth depends more than ever on what happens to manufacturing employment".[68] Other land use studies have concentrated on land use patterns inside the city. For example, within a city location affects human activity and human activity modifies locational arrangements. A crucial question to be asked is: how did the various space-using activities come to be located where they are in the city? Prevailing urban land use theory argues that a tract of urban land ends up supporting the activity that will pay the highest rental at tract. If no user comes along, the highest rental is zero and the tract remains vacant. If several potential users are interested, the one who is willing to pay the highest rental will get the tract and put it to what is called the tract's highest and best use.[69]

1.1.3. National Scale Land Use

The best example of a physical master plan of the national land use is the recent study of the Netherlands, mapped in about 1985, and showing the physical planning of rural and urban areas: areas with agriculture as their main land use; areas with mixed agriculture and other land uses (in large and small land units); areas left to nature; city regions; expanding urban and suburban areas, etc.. [70]. Some countries have gone further than the Netherlands in drawing up a physical master plan in great detail - some as detailed as to show land use for every half a square metre and even every square foot.

1.1.4. Sea Use

There is increasing interest in sea-use, which is a relatively new concept. H.D. Smith, in *Sea Use Management in the North Sea: Managing and Planning*, 1988, explained that the development of sea uses in the North Sea can be considered on two broad but inter-related perspectives from a management context. The first perspective relates primarily to spatial organisation of activities, and thus to the overall regional development patterns in Europe. Included are coastal settlements, manufacturing industries and coastal engineering, together with navigation and communications, strategic uses, aspects of mineral extraction and fisheries, waste disposal and marine recreation. The second perspective is that of the environmental impact of such activities, especially including rural coastal uses, mineral and energy extraction, fisheries and fish farming, waste disposal, marine science and conservation [71].

Another writer who has done considerable research on sea-use is F.C.F. Earney. *Marine Mineral Resources*, 1990, examined present and future prospects for ocean mining, especially for hard minerals, and considered programmes directed at expanding our ability to exploit the oceans' mineral wealth. It also identified economic, political and technical problems which are presently hindering or preventing ocean mining [72].

Also prominent in this field are Stella Vallego, who in *The Development and Management of Coastal and Marine Areas*, 1991, explained the evolution of the concepts of coastal area management and ocean management [73]; and Herman L. Boschken, who in *Land Use Conflicts*, 1982, discussed nuclear plants on the Sanonfre coast, and examined the impact on marine ecology of coolant systems. He found destruction of up to 0.7 mile of bluffs and beaches due to the effect of these systems. The Sanonfre opposition argued that 142,000 pounds of fish per year and ten times that weight in plankton would be killed by the 'heat shock' [74].

This thesis, with its focus on Qatar, concentrates on land use on the national scale. It is an integrated study of land and sea examining basic industries (explained in Figure 1.1) from production through to export and including all the back-up services, and in this sense it is unusual. The study examines land use in the hydrocarbon industry, some of which is located in off-shore areas, for example, the Halul region, some of which is located in urban areas, for example Doha, and some of which is in rural areas, for example Dukhan and its pipelines.

The subject is approached in sequence: the oil producing region of Dukhan; the rural land use occupied by pipelines; the oil processing region of Umm Said; and the administrative headquarters and support services of Doha.

1.2 Definitions and Terms

1. Direct Land Use

This includes any land occupied permanently by the hydrocarbon industry and comprises hydrocarbon installations, processing plants, buildings and infrastructures, and services dedicated directly to the activities of the hydrocarbon industry. Most of this land use was planned, constructed and financed by the hydrocarbon industry itself and it is unlikely this category of land use will revert to other types of land use without great expense, or land so intimately associated with such infrastructure that they are wholly given over to the functions of built up areas.

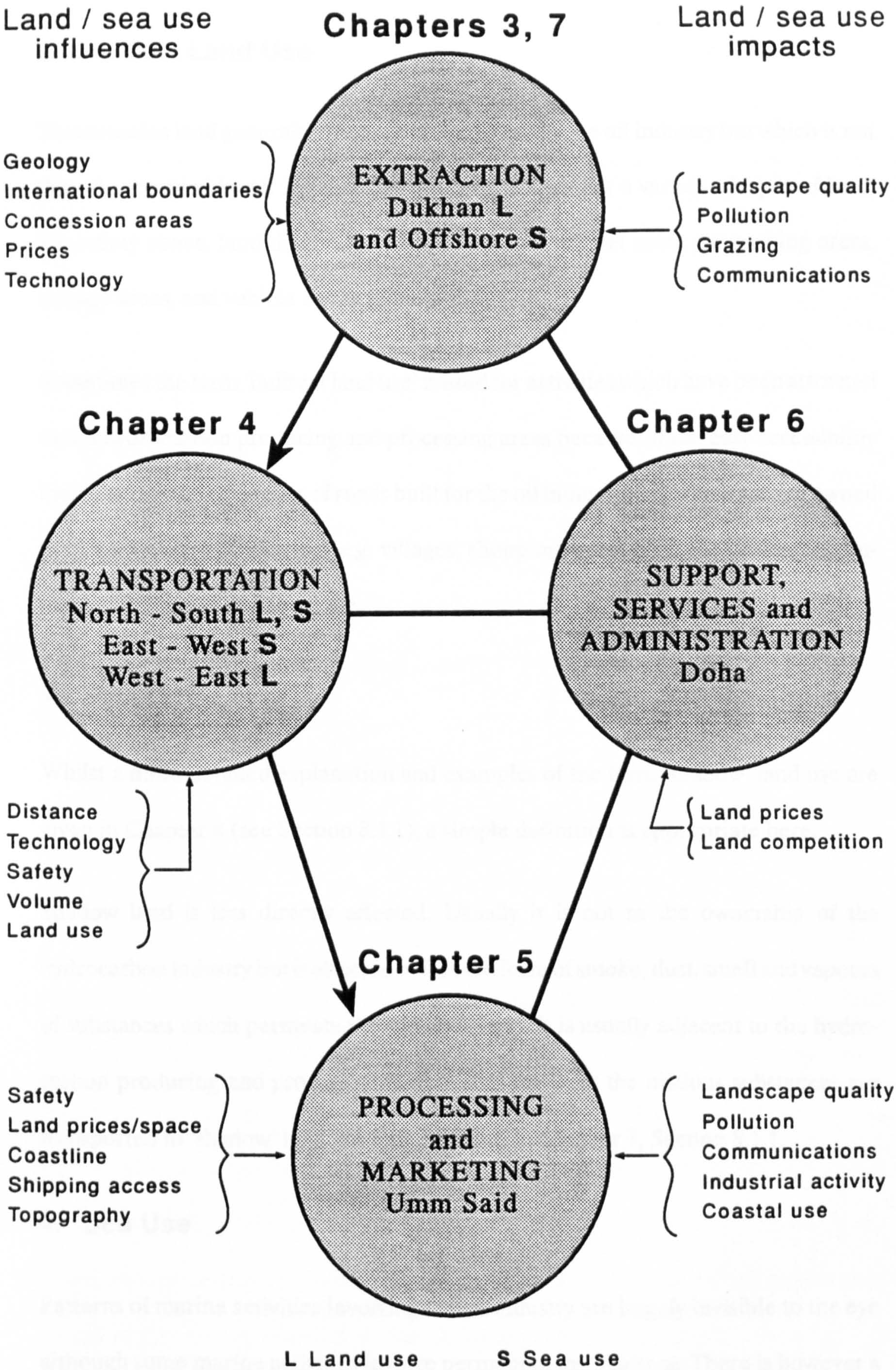


Fig. 1.1 Land use and hydrocarbons in Qatar; model of their structure

2. Indirect Land Use

This includes land generally owned and controlled by the oil industry but which is not directly occupied by oil installations as above. It includes a variety of types of land, e.g. safety zones, land designated for building but not yet used, car parking areas, storage areas, and vehicle tracks in the desert.

Sometimes the term 'indirect land use' is used for activities which have been attracted to the hydrocarbon producing and processing areas because of the easy accessibility into these regions (because of roads built for the oil industry) but which are not owned by the hydrocarbon industry, e.g. villages, shopping areas, banks, quarries, government and security buildings, etc..

3. 'Shadow'

Whilst a more detailed explanation and examples of the term 'shadow' land use are given in Chapter 8 (see Section 8.1.1), a simple definition is appropriate here.

Shadow land is less directly affected. Usually it is not in the ownership of the hydrocarbon industry but is affected by it in the form of smoke, dust, smell and vapours of substances which permeate the 'shadow' land. It is usually adjacent to the hydrocarbon producing and processing regions and the ways the noxious substances are transported to 'shadow' land are fully explored in Chapter 8, Section 8.1.1.

4. Sea Use

Patterns of marine activities involving the oil industry are largely invisible to the eye although some marine activities involve permanent installations. There is however a clear spatial division between a variety of marine activity, some of which overlap and some of which compete with each other. They include extractive activities, shipping and leisure activities. In crowded and busy seas it is essential that such activities are carefully planned for and controlled, in the same way as they are on land.

5. Dedicated

The term 'dedicated' is used widely in this thesis to describe land associated with the hydrocarbon industry where this land use is indirect, such as the sites of villages or chalets. These land uses are permitted as temporary measures but when any of these sites are required for the industry the QGPC (Qatar General Petroleum Corporation who act on behalf of the government in oil industry matters in Qatar) has the right to order the people who have occupied the site to evacuate it for QGPC development.

1.3 Aim of the thesis

This thesis sets out to answer some questions.

The subject is the effect of the hydrocarbon industry on land use in Qatar. The questions are as follows. To what extent does the hydrocarbon industry affect land use? To what extent is its impact direct or indirect? In what ways? By what processes? What is the extent of its environmental effect? Are these patterns of land use in the various stages of hydrocarbon production and processing closely connected or are they free standing? Are production, transport, processing and administration quite separate activities or are they interconnected? In what ways are the land uses in each sector of the industry affected or dictated by those in other sectors?

It is pertinent to question whether land use study in Qatar is an essential issue. It can be amply justified for the following reasons:

Qatar is a small state and although there is little intensive agriculture, there is competition for land use as Qatar has an enormous rate of population and urban growth, beginning with the oil era in the 1950s (discussed in detail in Chapter Two, Section 2.6). Qatar signed a water agreement with Iran in November 1991 (discussed in detail in Chapter Eight, Section 8.2) and the glut of gas production in Qatar from the North Dome (discussed in Chapter Seven, Section 7.4) makes it easier for the government to increase the process of water distillation, e.g. the proposed al-Wusayl plants (Figure 5.7). The information in Figure 5.7 should alert the land use planners in Qatar that consideration needs to be given to the rational use of land for the various activities that will be competing for it in the near future, i.e. population growth, urban growth, agriculture, forestation, industrial uses. Examples of new schemes requiring more land use are the new industrial town of Ras Laffan (discussed in Chapter Five, Section 5.7.3) and the increased laying operations of pipelines in Qatar (shown in Figures 4.1 and 5.7).

1.4 Thesis Structure

This thesis has eight interconnected chapters, and no one chapter can be taken in isolation. For example, Chapter 3 dealing with the production region and Chapter 4 the hydrocarbon pipelines (transport) and Chapter 5 the hydrocarbon processing regions, all have areas of overlap and clear linkages. In other words, it is an integrated and compact study.

Chapter One introduces the history and general review of land use concepts and studies. It also deals with the aims of the thesis, thesis structure, and methods used.

Chapter Two deals with the history of oil concessions in Qatar which resulted in the exploration of the hydrocarbon producing regions and, furthermore, how the only onshore oil terminal, the offshore oil terminal, and site of the hydrocarbon processing settlements were chosen, and gives a background of the oil era in Qatar.

Chapter Three examines the only hydrocarbon producing region of onshore Qatar (Dukhan), and deals with low intensity land use and the dynamic patterns occurring through oil exploration and exploitation: wells are dug, others are closed down, pipelines are built and abandoned, etc.

Chapter Four concentrates on pipelines, and shows their relatively light use of land but which, nevertheless, because of their physical presence, has quite an impact indirectly on land use. In this chapter the connection is established between the producing and processing regions.

Chapter Five deals with Umm Said, a dynamic, intensive area with tremendous capital invested in it. It examines the population patterns and shows how Dukhan has a sparse population over a large area, while Umm Said which is a small area, is heavily populated.

Umm Said is less subject to change, its buildings and plant are there for many years to come whilst, in contrast, the pattern of land use in Dukhan changes. Although geology broadly delimits the pattern of operations, wells are sunk and exploited for a period of time, then abandoned and others sunk, the landscape changes due to the hydrocarbon industry. A glimpse into the future is offered with the brief examination of the proposed new industrial town of Ras Laffan.

Chapter Six examines Doha and the hydrocarbon supporting and administrative services it houses. The land occupied directly and indirectly in the capital by the hydrocarbon industry is not really all that intensive but it is distributed widely throughout the town and whilst in one sense the land use of the oil company does not have a great impact on the landscape, in another sense its extent is surprising.

Chapter Seven deals with sea use. The activities in land use can be mapped but those at sea are more difficult. Zones of activity in sea use often overlap (the same space can support a number of activities). As on land, there is competition for space.

Chapter Eight: Conclusion. Each chapter of the thesis has a fully explained and detailed conclusion. The final chapter therefore highlights the main points which have been revealed during the study, with some emphasis on the hydrocarbon 'shadow'. Methodological comments are made. The thesis closes with some recommendations and a proposed research agenda.

1.5 Methods Used

This thesis has been heavily dependent on data collection. Since December 1987, over 20 months have been spent collecting material by ground survey. One reason for the arduousness of this task is that there is a dearth of information. Sometimes maps of the various regions are not clear or accurate or need updating.

The work started in Doha (capital of Qatar) with visits to all the ministries to obtain the information needed for this thesis. These included the Ministry of Finance and Petroleum, that of Municipal Affairs, Public Works, Industry and Agriculture, Economy and Commerce, Communications and Transport, Health, Information, etc..

In Doha information was collected from the Diwan Amiri (Doha Palace Document Office), all QGPC offices, Qatar university, the Central Statistics Office and the Industrial Development Technical Centre (IDTC), and the Gulf Industrial Consulting Organisation.

Fieldwork surveys for this thesis were undertaken in the areas of Dukhan and Umm Said. The whole area of the pipeline network was surveyed, including the entire Qatar coastline, Doha, offshore areas, Halul island and Bulhanine oil field. This fieldwork encompassed all the regions included in the study. I was joined for one week in May 1990 by my supervisor, Dr. G. Blake.

The tools used in fieldwork were: camera, measuring tape, cassette recorders, notebooks, and when measuring large areas a Range Rover odometer was used to confirm the accuracy of the measurements of maps.

The main maps used in this survey are:

1. Qatar Reference System, scale 1:1000 (for information on Ras Abu Abaud (QGPC offshore headquarters);

2. Qatar Area Reference System, Public Information System, Phase 1, Doha, scale 1.5 cm : 250 m.

3. Doha City Street Map, scale 1:18,000 m.

4. QGPC (offshore operations) Doha: Location of (offshore) Staff Accommodation, scale 1.5 cm : 250 m.

5. Map of Qatar (4 sheets), scale 1:100,000.

6. Map of Qatar 1:200,000.

The main charts used were:

7. Admiralty charts for the offshore area along the coast opposite to Doha and Umm Said, scale 1:50,000.

8. Admiralty chart for the area opposite to the Khawr al-Udeid coast, scale 1:50,000.

9. Admiralty chart for the area of Halul island and surrounds, scale 1:50,000.

10. Admiralty chart for the area along the coast opposite to Ras Laffan and Umm Said, scale 1: 50,000.

11. Admiralty chart from Hormuz to Qatar, and showing the whole offshore area of Qatar, scale 1:75,000.

12. Arabian Gulf Oyster Bed map, scale: each graduation represents 5 nautical miles.

13. Geological maps of the whole of Qatar, scale 1:200,000.

14. Maps from the Atlas of Qatar, from 'Landsat' images.

15. Dukhan Field: Surface Contours and Installations 'field map', scale 1:50,000.

16. For comparison with the Dukhan Field Map I used the Asab Field Map, scale 1:50,000, (Abu Dhabi, UAE) was used.

17. Dukhan camp map, scale 1:6000.

18. Dukhan camp map, scale 1:2000.

19. Map of Qatar in Offshore QGPC Areas of Operation, scale 1:500,000. (This was very valuable in obtaining data regarding pipeline in offshore areas.)

20. Umm Said Industrial Complex, 1:20,000.

Other materials used were:

21. Aerial photographs.

22. Master Plan of Umm Said Residential Area, scale 1 cm: 50 m.

23. Master Plan of Proposed Ras Laffan Industrial Town.

Not all the information obtained from fieldwork was detailed; some was not satisfactory. The same can be said of the maps. However, by collecting documents, and by consulting and interviewing the people of each geographical area and sector of the industry, information was amassed not generally available in print, even in QGPC publications. These consultations were: with decision-makers, people in executive positions, academic and technical specialists, workers, and also some local people from each region were interviewed as well as some elderly people (of whom some were Bedouins) to fill in the gaps of information not available in the historical records of each area of study. The personal opinion of fishermen was also sought to show the impact and conflict offshore between the hydrocarbon industrial zones and those for fishing.

Fieldwork also included the distribution, collection and analysis of questionnaires for each region: Dukhan, Umm Said, Doha, and also for fishermen. Up to date information (from correspondence, bulletins, articles, books, maps, etc..) was collected by faxing Doha, Abu Dhabi and Saudi Arabia and frequent telephone calls were made to Qatar, Abu Dhabi and Saudi Arabia. There was detailed correspondence with the cultural attaché of Saudi Arabia (at the Embassy of Saudi Arabia in London), the Omani cultural attaché (Embassy of the Sultanate of Oman, London), directors of the Bahrain Oil Company, the Dubai Oil Company, and a director of the Chamber of Commerce and Industry in Dubai, the Ministry of Petroleum and Minerals in Abu Dhabi, UAE, the directors of ADNOC (Abu Dhabi National Oil Company), offshore and Penwell in New York.

Visits and consultations took place in the UK as follows:

- London Public Record Office: to obtain documents regarding the oil industry in Qatar and various agreements about land use.
- India Office: to collect documents regarding the oil industry in Qatar and various agreements about land use.

- Royal Geographical Society: modern books, periodicals, bulletins, etc., regarding land use.
- Institute of Petroleum, London, for information about the oil industry in Qatar and other oil producing states.
- King's College (University of London): modern textbooks, periodicals, bulletins, etc., regarding land use.
- Cardiff University (Maritime Studies Department): for consulting specialist publications regarding sea use.

Among the printed materials used were: books, theses, documents, reports, conference papers, periodicals, journals, magazines, newspapers, bulletins and government of Qatar publications.

References

1. Mather, A.S., *Land use*, Longman, London, 1986, p.1.
2. Dale, P.F., McLaughin, J.D., *Land Information Management (An Introduction to Coastal Problems in the Third World Countries)*, Clarendon Press, Oxford, 1988, p.4.
3. Op.cit., Mather, A.S., p.1.
4. Ibid., p.2.
5. Ibid., p.2.
6. Best, R.H., *Land Use and Living Space*, Methuen, London, 1981, p.19.
7. Ibid., p.19
8. Ibid., p.19.
9. Ibid., p.18.
10. Ibid., p.20.
11. Rhind, D., Hudson, R., *Land Use*, Methuen, London, 1980, p.53.
12. Ibid., p.57.
13. Briggs, D., Wyatt, B., 'Rural land use change in Europe', e.d. Whitby, M., Ollerenshaw, J., *Land Use and the Environment*, Belhaven Press, London, 1988, p.12.
14. Ibid.
15. Ibid., p.14.
16. Ibid., p.10.
17. Op.cit., Rhind, D., Hudson, R., p.89.
18. Op.cit., Briggs, D., Wyatt, B., p.11.
19. Abler, R., Adams, J.S., Gould, P., *Spatial Organisation*, Prentice Hall International Inc., London, 1972, p.346.
20. Ibid., pp.346, 347.
21. Robinosn, G.M., *Conflict and Change in the Countryside*, Belhaven Press, London, 1990, pp.17, 18.
22. Stamp, L.D., Willats, E.C., *The Land Utilisation Survey of Britain*, University of London, 1934, p.3.
23. Ibid., pp.5, 6, 7.
24. Stamp, L.D., *Fertility, Production and Classification of Land in England and Wales*, pp.10, 11.
25. Stamp, L.D., *Predominant Farming Types in Scotland*, Explanatory Bulletin, 1941, pp.1, 3.
26. Op.cit., Rhind, D., Hudson, R., p.35.

27. Coleman, A., *Land Use Survey (of Britain)*, Handbook, Fifth Edition, 1968, pp.1, 2.

28. Ibid., pp.8, 10.

29. Bowen-Jones, H.B., *Agriculture in Malta; A Survey of Land Use*, (Agriculture Report part 1), Durham University, 1955, p.1.

30. Jey, G., *Changing patterns of settlement and land use in the Eastern province of Northern Rhodesia*, University of Hull, No.2., 1967, pp.29, 30.

31. Dixon, C., *Rural development in the Third World*, Routledge, London, 1990, p.44.

32. Op.cit., Robinson, G.M., p.63.

33. Ibid., p.241.

34. Ibid.

35. Ibid.

36. Op.cit., Mather, A.S., p.15.

37. Ibid., pp.15, 16.

38. Found, W.C., *A Theoretical Approach to Rural Land Use Patterns*, Edward Arnold Ltd., London, 1971, p.12.

39. Op.cit., Robinson, G.M., p.374.

40. Ibid.

41. Ibid.

42. Ibid., 376.

43. Ibid.

44. Ibid., p.377.

45. Op.cit., Briggs, D., Wyatt, B., p.7.

46. Ibid., p.19.

47. Ibid., p.20.

48. Ibid.

49. Ibid.

50. Op.cit., Dixon, C., p.9.

51. Goudie, A., *The Human Impact on the Natural Environment*, Third Edition, Basil Blackwell Ltd., Oxford, 1990, pp.22, 23.

52. Hall, P., *Urban and Regional Planning*, Unwin Hyman, London, 1989, p.26.

53. Ibid., p.19.

54. Ibid., p.23.

55. Ibid.

56. Ibid., p.32, 36.

57. Ibid., p.36.

58. Op.cit., Goudie, A., p.23.

59. Op.cit., Hall, P., pp.43, 44.

60. Ibid., p.44.

61. Ibid.

62. Ibid., p.51.

63. Fujita, M., *Urban Economic Theory, Land Use and City Size*, Cambridge University Press, Cambridge, 1989, p.1.

64. Ibid., p.2.

65. Thrall, G.I., *Land Use and Urban Form (The Consumption Theory of Land Rent*, Methuen Inc., New York and London, 1987, p.1., (Preface).

66. Kivell, P., 'Urban Land Use', in Healey, M.J. (ed.), *Economic Activity and Land Use*, Longman, Essex, 1991, p.107.

67. Dale, P., 'Land Use and Property Information Systems', ibid., p.158.

68. Healey, M.J., 'Manufacturing', ibid., p.333.

69. Op.cit., Abler, R., Adams, J.S., Gould, P., pp.354, 355.

70. Van Lier, H.N., 'Land use planning on its way to environmental planning', op.cit., ed., Whitby, M., Ollerenshaw, J., p.91.

71. Smith, H.D., *Sea Use Management and Planning in the North Sea*, issued by the Department of the Environment of the United Kingdom, April 1988, p.314.

72. Earney, F.C.F., *Marine and Mineral Resources*, Routledge, London, 1990, p.xviii.

73. Vallejo, S.M.A., *The Development and Management of Coastal and Marine Areas (An Environmental Perspective)*, ed., Smith, H.D., Vallega, A., Routledge, London, 1991, p.17.

74. Boschken, H.L., *Land Use Conflicts*, University of Illinois, USA, 1982, p.111.

Chapter 2

The Pattern of Oil Concessions in Qatar

2.1 The Aim of the Case Study

2.2 Oil Concessions in the Gulf Region

2.2.1 The Pre First World War Rivalry in the Gulf Region

2.2.2 The Impact of Oil Concessions on the Boundary Dispute of the Gulf States

2.2.3 The Postwar (World War I) Rivalry in the Region and the Redline Agreement

2.3 Oil Concessions in Qatar 1935-52

2.3.1 Discussions Regarding Onshore Oil Concessions Between Qatar and APOC

2.3.2 The Offshore Oil Concession

2.4 The Oil Concessions in Qatar from 1953 to 1989

2.4.1 Al Bundiq Co Ltd

2.5 The Creation of the National Oil Organisation in Qatar

2.6 Background to the oil era in Qatar

2.6.1 Oil revenues

2.6.2 Population growth

2.6.3 Urban growth

2.6.4 Occupation structure

2.7 Conclusion

Figures

Tables

2.1 The Aim of the Case Study

The aim of this chapter is to study the impact of the oil concessions agreement on land and sea use in Qatar. It is appropriate first to examine the Arabian Gulf region in the context of two types of conflict: between more developed countries in their attempts to control the region's resources for their own oil companies; and between Gulf states over the delimitation of political boundaries - the oil concessions revived the issue of the final settlement on political boundaries which enlarged some states and left others with less land. Oil concessions are a necessary prelude to the discovery and exploitation, by oil companies, of the region's hydrocarbon deposits both on and offshore in Qatar. An examination of the pattern of oil concessions will help to show the spatial impact of the hydrocarbon industry on the use of the land and sea of Qatar, and these will be further explored in the following chapters.

2.2 The Gulf Region Oil Concession

The first oil concession in the area was won by the British company, Darcey, in Southern Iran in 1901 (Figure 2.1). Darcey (APOC, 1909), Anglo-Persian Oil Company, undertook the first oil exploration in 1908 in the area of Southern Iran called Masjid Suliman (1) (Figure 2.1).

The findings of the Masjid Suliman oilfield exploration fired British determination to monopolise the oil industry in the region. They first obtained promises from the rulers of the Arabian Gulf areas that no oil concessions would be granted without the consent of the British government (Kuwait 1914, Bahrain 1914 (2), Saudi Arabia 1915

[3], the Ruler of Qatar 1916). The conditions of this consent were laid down in Article V of the Protectorate Treaty:

> *"I (Sheikh Abdullah) without the consent of the British government will not grant any concession to anyone whomsoever"* [4].

The rulers of the Trucial Coast states gave the same promise in 1922, and the Sultan of Muscat and Oman in 1923 [5]. However, even before 1914, the other superpowers did not like this state of affairs in the region, with the British having a free hand over oil concessions.

Key to Figure 2.1		
Zone	**Year**	**Company Name**
1.	1901	Darcey
2.	1908	Masjid Suliman - first oil field explored in the Gulf
3.	1925	Iraq Petroleum Company (IPC)
4.	1930	Socal (BAP Co.) Bahrain
5.	1932	Mosul Petroleum Co. Ltd.
6.	1933/4	Socal (Saudi Arabia)
7.	1934	Kuwait Oil Co. (Gulf USA)
8.	1935	Petroleum Development of Qatar (P.D.Q.) Ltd. (IPC)
9.	1937/45	Petroleum Developments (Trucial Coast)
10.	1937	IPC
11.	1949	Basrah Petroleum Co. Ltd.
12.	1949	American Independent Oil Company
13.	1952	Shell Oil Co. Ltd.

2.2.1 Pre World War I Rivalry in the Gulf

From 1875 onwards, Britain faced an enormous challenge in the region from rival powers, e.g. France in Muscat, Russia in Iran, Germany in Iraq, and the Ottoman Empire [6]. However, by utilising the particular circumstances of the Gulf region, the British government managed to control the region's oil and defend its situation against the other superpowers, for instance:

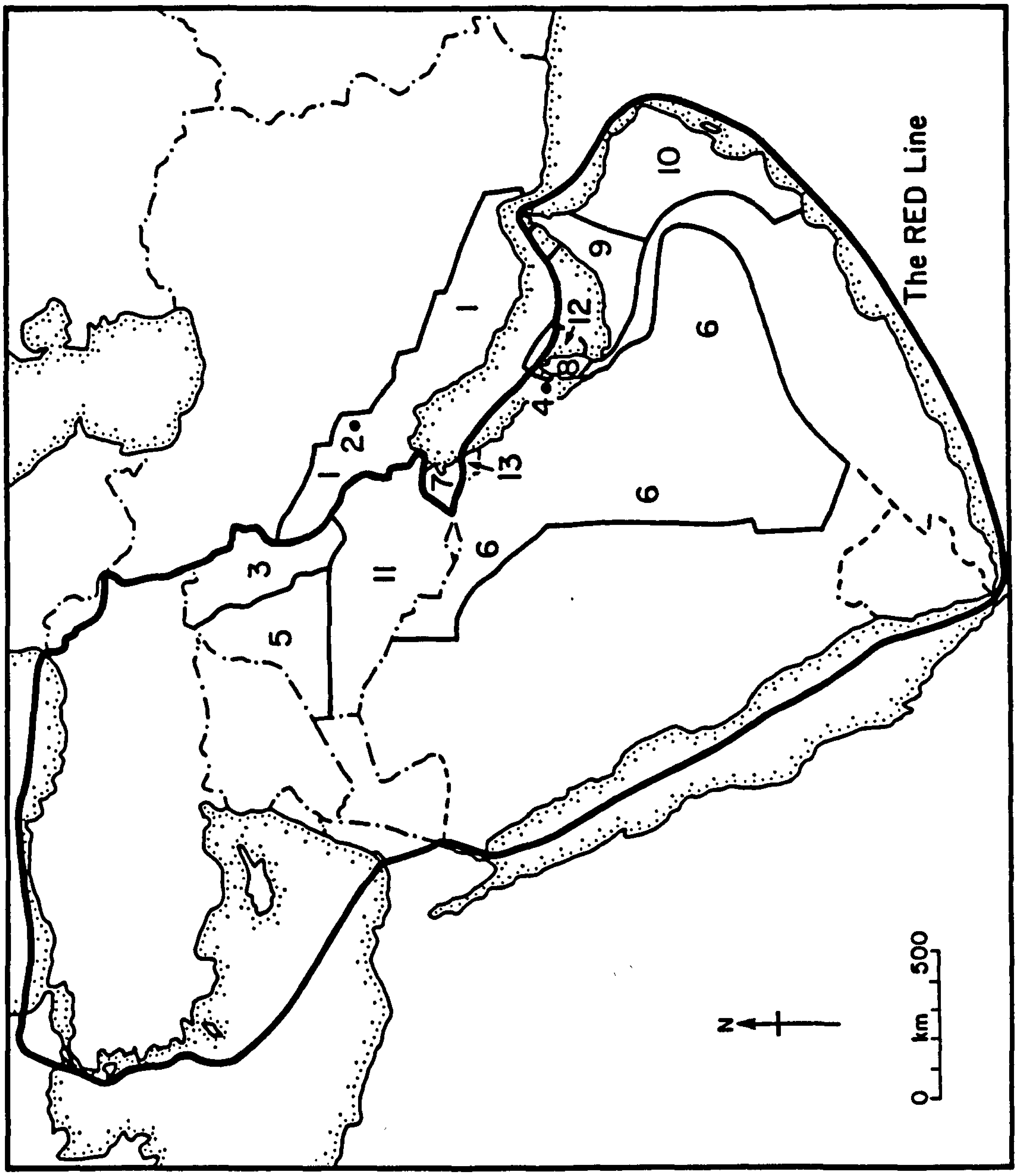


Fig. 2.1 The RED line region and concession areas in the Gulf, 1901–1952

- Britain signed an agreement with the Sultan of Oman in 1905 which excluded the interests of France who was hoping to establish there;
- in a 1907 tripartite agreement, Iran was divided into three areas - the north for Russia, the middle to be neutral, and Southern Iran for Britain.
- in 1913, after the decline of the Ottoman Empire, withdrawing from the Middle East the Turks signed an agreement with Britain;
- the defeat of Germany in the First World War meant that Germany too lost its influence in the region (7).

Having resolved the international problems over supremacy in the oil concessions in the region, before the oil concession could be exploited, Britain had to turn its attention to internal Gulf problems: political boundaries in the Gulf region.

2.2.2 Impact of Oil Concessions on the Boundary Disputes Between the Gulf States

It became apparent to Britain that, to make the oil concession work, the question of the political boundaries of the Gulf States had to be resolved. In an effort to resolve this problem, the British arranged conferences with members of the Gulf states. An example of these is the 1922 Al Uqair Conference attended by Ibn Saud, Sir Percy Cox, the British Political Resident in the Gulf, and other representatives of Gulf states. This conference helped the different parties to reach a temporary agreement over the settlement of political boundaries, and its main achievement was the creation of the Neutral Zone between Kuwait and Saudi Arabia and the delimitation of the Saudi-Iraqi bounary (Figure 2.1).

However, the various conferences held in the region at this time did not result in any final boundary settlement, e.g. the Trucial Coast Oil Co (APOC) annexed the al-Burami (Southern U.A.E.) concessions and two other states - Oman and Saudi

Arabia - objected. After a protracted period of negotiation, the three states reached a unanimous agreement over the disposition of the al-Burami region (8) (Figure 2.1).

Qatar was involved in some of these conferences and the boundary disputes and oil concessions involved will be discussed in the following sections.

After the First World War other factors arose which, eventually, challenged and defeated British control over oil concessions in the region.

2.2.3 Britain's Post World War I Competitors in the Gulf and the Redline Agreement

The British government had achieved a monopoly in the region but this did not remain unchallenged. The USA and France were strong rivals for the concessions and, after a long struggle between the three powers, Britain was eventually defeated.

In November 1927 the British monopoly over oil concessions was broken by reviving the old Redline Agreement which had been established in 1914 for the shareholders of the Turkish Petroleum Company. The revival of the Agreement brought in new shareholders (Table 2.1), upsetting the British monopoly. In 1928 the Turkish Petroleum Company was re-established under the name, the Iraq Petroleum Company (IPC) (Figure 2.1). The Agreement covered the whole of the Middle Eastern region except Kuwait and Egypt, and none of the shareholders were now able to act individually at negotiations for oil concessions. The British wanted to keep Kuwait as its monopoly zone, and in Egypt there was already a British firm operating.(9)

At first the British government thought the Redline Agreement was serving its purposes by keeping its allies happy but, in reality, the Agreement weakened the British position in the Middle East and enabled American companies to win the richest areas of oil, e.g. Bahrain 1930, Saudi 1933, Kuwait 1934, and the Neutral Zone (between Saudi Arabia and Kuwait) in 1949. The Redline Agreement was applied in Oman in 1937, the Trucial Coast 1937-45, and Qatar in 1935.

As the Agreement had a tremendous impact on Qatar's oil concessions, regarding land use, it is appropriate to examine its terms below.

Table 2.1 Shareholders of the Redline Agreement:

Company	%
(APOC) Anglo-Persian Oil Company (UK)	23.75
(Shell) Anglo-Saxon Oil Complany	23.75
New East (USA)	23.75
France de Petrol (France)	23.75
Sarkis C. Gulbenkian	05.00
Total	100.00

Source: Othman, N, *With their bare hands*, Longman, London, 1984, pp.15-16.

2.3 Oil Concessions in Qatar 1935-52

During the period 1935-52 Qatar granted three oil concessions to foreign companies - an onshore oil concession to APOC in 1935, the 1949 offshore oil concession to the Superior Oil Company, and the 1952 offshore oil concession to Shell (S.C.Q.) which was granted after the Superior Oil Company withdrew from Qatar.

2.3.1 Negotiations between Qatar and APOC for Onshore Oil Concessions in 1935

The first official mention of an oil concession in Qatar is in a letter sent by APOC to the British government in February 1921 asking for permission for APOC to set up negotiations with Qatar for the oil concession (10).

However, in 1922 the al-Uqair Conference was held in Saudi Arabia. The British representative noted that Frank Holmes, the representative of the Syndicate, was trying to persuade the Saudi king to grant the Syndicate the Saudi Arabia oil concession, and the name of Qatar was mentioned in this context. The British representative stood firm over the oil concession stating,

> "*Qatar is linked with the UK by a protectorate treaty signed in 1916.*" (11)

The British government would allow no interference in the territory of Qatar.

In 1923 the Syndicate approached the British representative requesting permission to begin negotiations with Qatar for its oil concession, and a similar request was made by APOC. Both demands were referred to the British government, and the reply to both was that the time was not yet convenient for negotiations for oil concessions in Qatar (12).

In October 1925 APOC again approached the British representative requesting permission for negotiations with Sheikh Abdullah for the oil concession and on 14 December, the British agreed. In March 1926 APOC's geologists arrived in Qatar and the ruler of Qatar promised them,

> "*the Sheikh will give APOC 18 months for their preliminary survey*" (13).

The period came and went without any practical steps being taken by APOC.

During the 1920s and 1930s, British policy was to freeze the oil concession of Qatar. This changed when the USA succeeded in beating the British to the oil concessions of Bahrain. In 1925 the Syndicate signed the Bahrain Oil Concession and in November 1927 it sold the Bahraini concession to Gulf Co (USA). However, the oil concessions in the Gulf Company was tied up by the Redline Agreement and in an effort to overcome this for the Bahraini concession, the concession was transferred to Socal (USA) on 21 December 1928. The two American companies then formed a new subsidiary which was registered in Canada to operate the oil concession. The subsidiary was called BaPCo (Bahrain Petroleum Company).

In July 1933 Socal scored another victory over British oil companies by winning the oil concession of Saudi Arabia (Figure 2.1).

At this stage the Americans were in a position to approach Qatar from both sides: through Bahrain and Saudi Arabia. The Americans were able to make use of the close relatives and friends in Bahrain and in Saudi Arabia of the Sheikh of Qatar in an effort to persuade him to grant the oil concession to an American company.

On 11 June 1932 the Syndicate followed the course which had been successful with Bahrain and sent Hussein Yateem to Qatar to try to persuade Sheikh Abdullah to grant the Syndicate the oil concession of Qatar. However the Sheikh informed the British government of the Syndicate's action and it reacted quickly (14). On 20 August 1932 APOC sent Mr Mylles to Qatar to renew the former promise with the Sheikh given in 1926. The result was that on 25 August 1932 the Sheikh signed a two year oil concession agreement with APOC. In return APOC was to pay the Sheikh 1500 Indian Rupees per month during the two year period.

The British government was always trying to protect and preserve the Redline Agreement as this strengthened its position in the region. After finalising the oil concession of Qatar with its ruler, it decided to transfer the concession to the Iraq Petroleum Company (IPC) and on 26 May 1933, the representative of IPC, Mr Simpson, was allowed to visit Qatar to supervise negotiations of the Qatari oil concession. In July 1934 Mr Mylles, the representative of APOC, visited Qatar and both sides agreed to extend the 1932 oil agreement for a further eight months. In return APOC would pay the Sheikh 2500 Indian Rupees monthly during the extension period (15). By postponing the oil concession of Qatar and by signing a temporary agreement with the Sheikh, the British government kept its monopoly over Qatar until APOC persuaded Qatar to sign the oil concession agreement in 1935.

1. The 1935 Oil Agreement between Qatar and APOC

The 1935 Oil Agreement was crucial for Qatar. Qatar was urging Britain to offer Qatar protection against any external aggression, to resolve the state's financial problems, to secure a British decision on the succession, and to supply the country with arms. Britain, on the other hand, was trying to strike a bargain over the Qatari demands - if the sheikh signed the oil concession for the British oil company, the sheikh's demands would be met.

Fowle, the British representative in the Gulf sent a letter to Sheikh Abdullah on 11 May 1935,

> *"confirming the British government's adoption of the appointment of Sheikh Hamad as heir apparent, with the proviso that Sheikh Hamad accept the 1916 Protectorate Treaty."* (16)

On the same day Sheikh Hamad sent a letter to the British representative which read, *"I promise when I become ruler of Qatar that I will respect all articles of the 1916 Treaty."* (17)

In a letter sent by the British representative to the Secretary of State for India, dated 9 May 1935, it was recommended that,

"Article III of the 1916 Treaty promises the Sheikh an annual quota of 500 rifles, machine guns and armoured cars from the British government. So Fowle is persuaded that there is no objection, the more arms the Sheikh has, the better able will he be to defend his country." (18)

However, apart from a few rifles, Qatar never received the arms which Fowle recommended, even after signing the agreement.

A letter of 11 May 1935 from the British representative in the Gulf to the Secretary of State for India, stated that

"the British government agreed to offer the Sheikh external protection against unprovoked aggression." (19)

On 17 May 1935 the oil concession of Qatar was signed by Sheikh Abdullah on behalf of Qatar and Mr Mylles on behalf of APOC (Figure 2.2 shows the Qatari concession area in 1935).

The period of the concession was 75 years. The concession did not last that long because Qatar eventually decided that it would prefer to control its own oil operations itself. By 1976, only 55% of the period of the agreement having expired, both sides had reached a mutual agreement and the Company withdrew from Qatar.

In the 1935 oil concession agreement the company undertook to pay the Sheikh 400,000 Indian Rupees at the time the agreement was signed and 150,000 Rupees annually from the first to the sixth year, and from then on 300,000 Rupees annually in return for granting the concession.

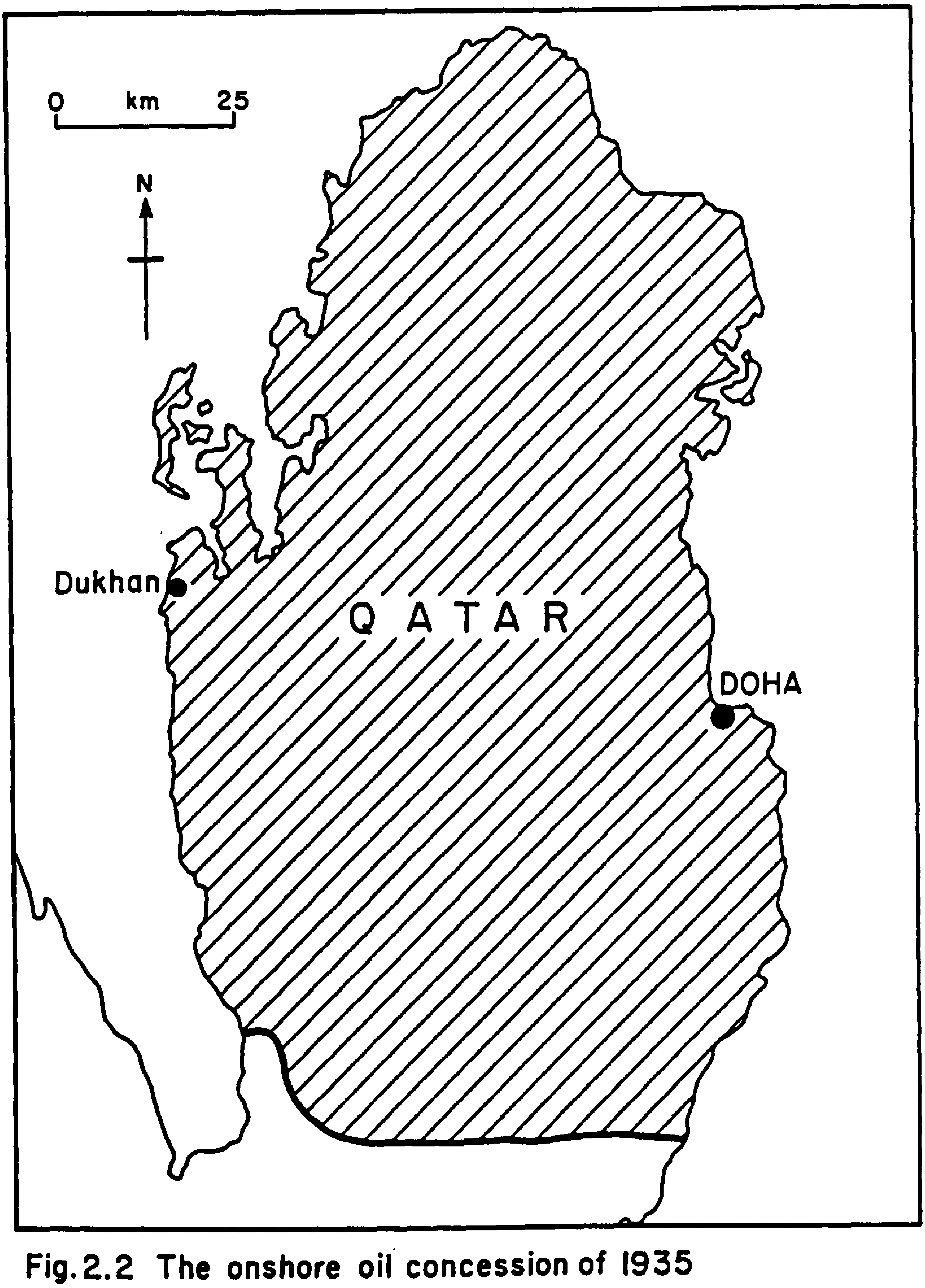


Fig. 2.2 The onshore oil concession of 1935

The first instalments enabled the Sheikh to begin to resolve the state's financial problems. It was expected the discovery of oil which would follow would provide a more permanent solution.

The main articles of the agreement were concerned with the land use and there were also articles protecting the land, as follows:

Article 2 "The Company may operate in any part of the peninsula except places of religious significance, cemeteries, and places of residence."

Article 6 "The Company may construct, maintain, and operate roads, refineries, and ordinary ports situated at Doha, pipelines, pumping stations etc., and the Company may choose the most appropriate sites for exporting its substances."

The above article could be called the official permission for the Company to utilise Qatari land, especially after the Company explored an oil field at Dukhan in the western region of Qatar (Figure 2.3) and built the port of Zikrit in the north western Dukhan region to receive part of its supplies from Bahrain, e.g. fresh water, frozen food, etc. The Company built pipelines to export oil from the western region of Qatar towards Doha in the east, for domestic use, and at Umm Said for oil exportation (Figure 2.3). An oil terminal was built at Umm Said, and the Company also built roads to link Dukhan with Doha and Umm Said.

Article 7 "The Company has no right to acquire lands in use by their owners for the purpose of business or housing, or lands which their owners decline to sell or to rent." (20)

In Article 7 the government gave protection from the oil industry to private properties.

On 17 May 1935 the Sheikh received confirmation from APOC, as follows:

"The land which surrounds the Castle of the Sheikh in Doha is exempt from all operation and also the land which surrounds Riyan." (21)

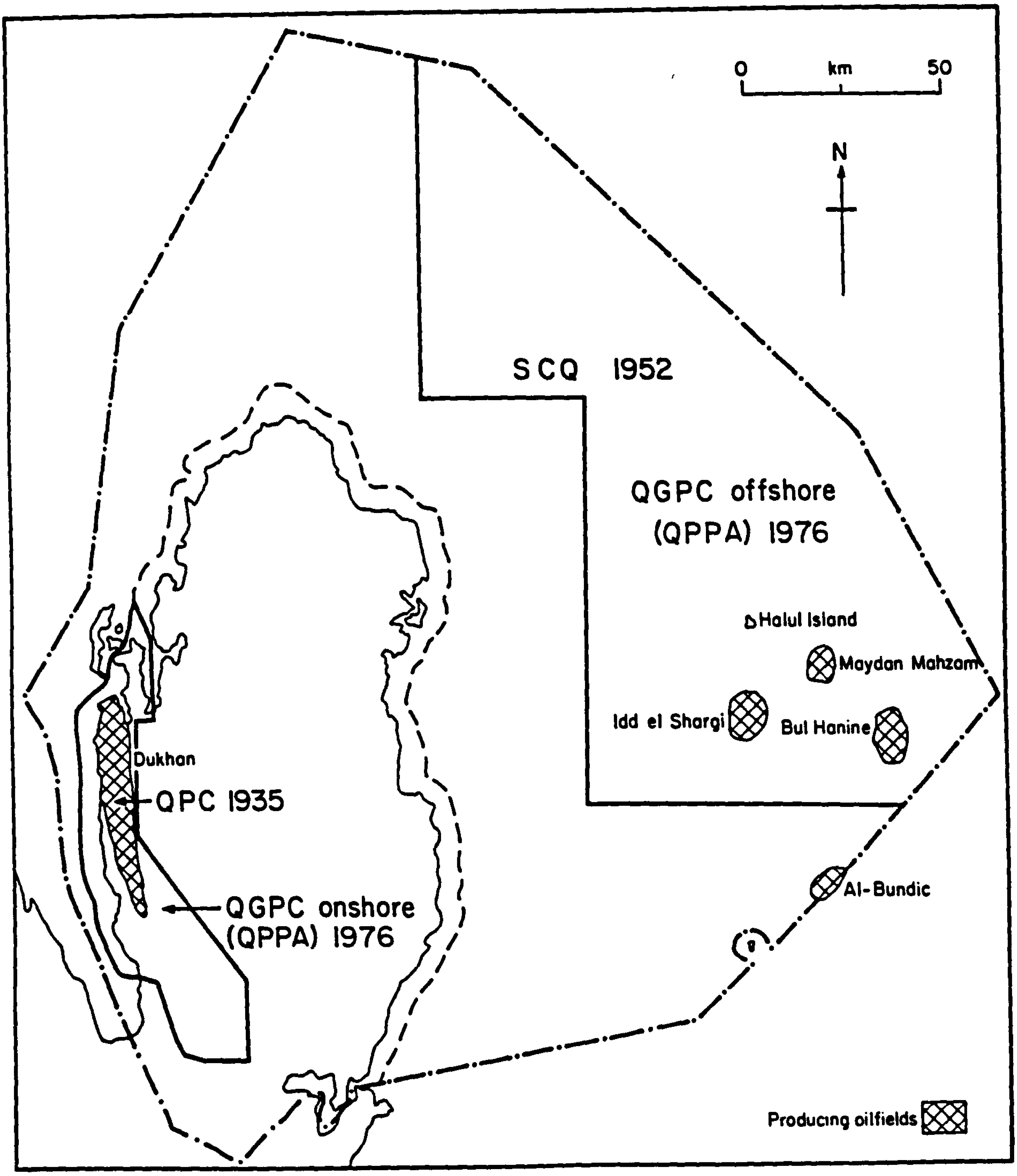


Fig. 2.3 Concession areas in Qatar, 1935-1976

This letter was written confirmation from the Company that they would not interfere with the Sheikh's own land which he wanted to keep intact for his own use.

However, this posed the question, what would happen were oil discovered on the exempted land? It was agreed that in that case the agreement could be altered with adequate compensation being paid and that in such a case priority would be given to the interests of the oil industry.

Article 8 "The Company can take any earth, mud, gravels, lime, gypsum and stones from its operations free of charge, but the Company has no right to export these materials".

This article gave the Company the right to encroach upon grazing areas, natural landscapes, etc..

Article 15 "The Sheikh shall not hold the Company responsible if a default should occur on the part of the Company in fulfilling the provisions of the Agreement" (22).

Article 15 was exploited by the Company from June 1942 to 1946 when it suspended its operations due to World War II.

The 1935 Agreement was signed by APOC and then transferred to IPC to keep in line with the Redline Agreement (Figure 2.1) and the IPC formed a new subsidiary called Qatar Petroleum Development Limited (PDQ Ltd).

On 27 June 1935 formal approval to the Agreement was received from the British government (23). This approval was required before the concession was considered legally valid, as Britain held the Sheikh to his promise contained in the 1916 Treaty - that he would grant no concession in his territory without British consent. It was this promise which helped the British government to prevent the Qatari government making any concession with a company that would go against British interests.

Whilst the 1935 Oil Agreement gave APOC permission to exploit Qatari land, the agreement also benefited Qatar in enabling it to resolve some of its financial problems. At the same time, Qatar received British assurance that it would provide Qatar with adequate protection against any unprovoked aggression.

However, whilst the oil agreement resolved some of Qatar's problems, it engendered others, such as the boundary disputes between Qatar and its neighbours, Bahrain and Saudi Arabia.

2. The Impact of the 1935 Oil Agreement on Political Boundaries

Even before the era of oil exploitation, the dispute between neighbouring Gulf states about political boundaries in the Gulf - from Northern Iraq to South Oman - were far from settled. There was some recognition by the rulers about the range of each state, but boundaries were not finally settled, and the issue of oil concessions can be seen as the flame which lit up the fire in the Gulf about political boundaries and border settlement.

The 1935 Qatar oil agreement revived an old dispute between Qatar and Bahrain over Zubara, in the north western part of the Qatar peninsula, which had previously been thought to have been resolved by the British government in 1875 (Figure 2.4). In April 1937 the oil company was surveying Qatar for a good port site, and included Zubara in its survey. News of the visit reached the Bahraini ruler. The visit of the APOC delegation to Zubara in April 1937 was followed by trouble amongst the Nauim tribe of Zubara, some of whom were Bahraini subjects.(24) The Qatari government intervened in the skirmish when some Nauim tribesmen appealed to the

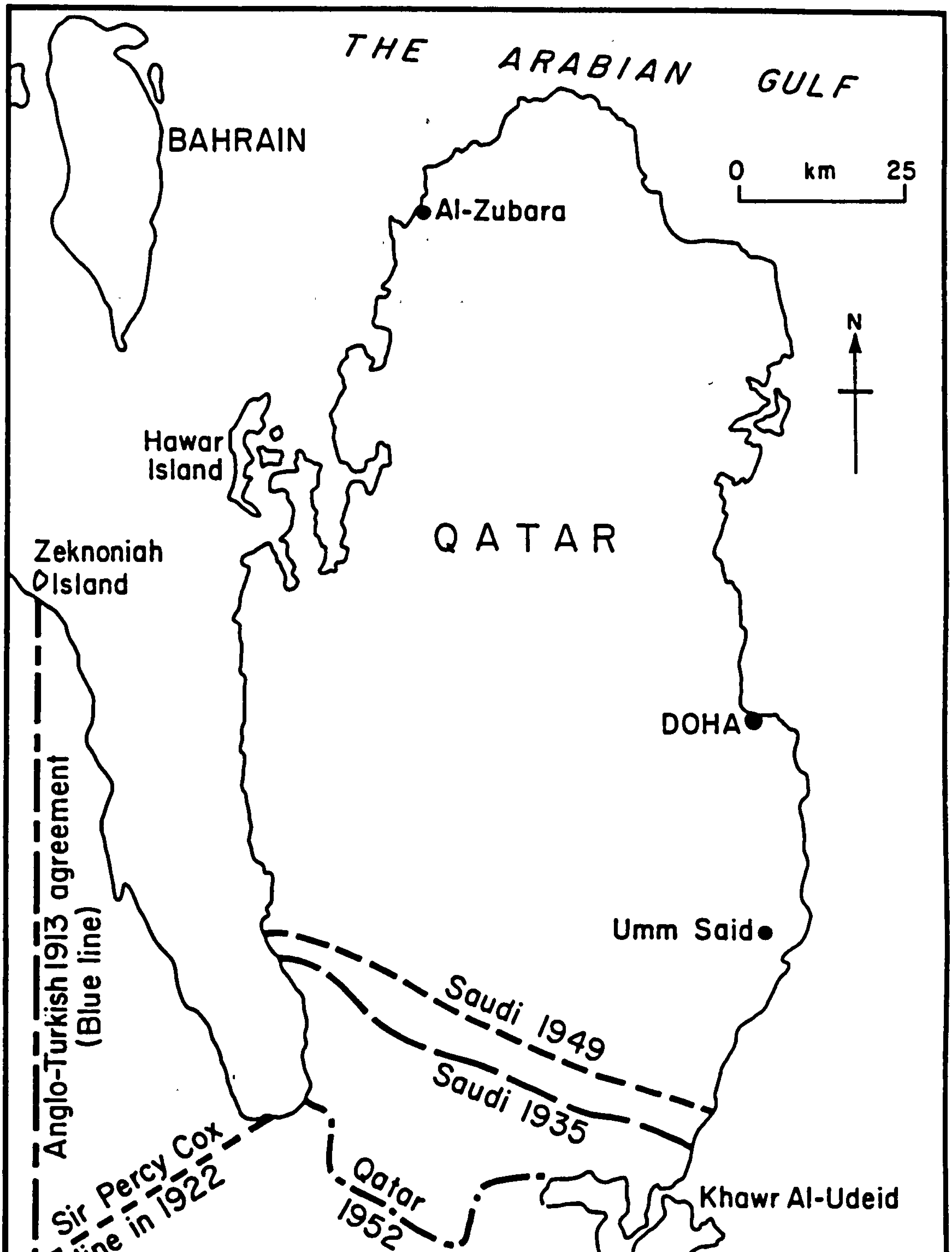


Fig. 2.4 Land boundary disputes between Qatar and Saudi Arabia

Qatari Sheikh to intercede and resolve the dispute. Sheikh Abdullah's intervention created strong opposition from the Bahraini ruler who said,

"*The ruler of Qatar had no right to interfere in the affairs of my subjects.*" (25)

The issue was exacerbated by the ruler of Bahrain but as both nations were British protectorates the dispute was soon defused by the British government who told the Sheikh of Bahrain that Zubara was officially part of Qatar according to the ruling of the British government in 1875 (26).

However, the Zubara affair was not the end of the Qatar-Bahrain boundary dispute. In 1937 the ruler of Bahrain claimed the Hawar Islands (Figure 2.4) for his state. The islands are located about 3 km off the west coast of Qatar. This issue posed a huge problem for the British government which was forced to mediate between the two sheikhs, wishing to offend neither. Finally, the British tried to compensate the Sheikh of Bahrain in July 1939. Fowle, the British representative, judged that the Hawar Islands belonged to Bahrain but this decision was not accepted by Sheikh Abdullah of Qatar.

After Fowle's ruling that the islands belonged to Bahrain, BapCo (the American oil company operating in Bahrain) felt able to annex the islands into its area of oil concession (27). At this move, the British felt that the ruling to give the Hawar Islands to Bahrain had been a wrong decision as the islands are located only 4 km from the Dukhan oil field operated by Britain in Qatar and it was possible that the Dukhan oil field extended to the islands. This led the British government to reconsider its decision, and on 19 November 1941 the British government returned the sovereignty of Hawar Islands to Qatar. The decision was made by the Secretary of State for

India.[28] In 1947, however, in another strange decision, the British awarded the islands to Bahrain.[29]

British arbitration between Qatar and Bahrain over the Hawar Islands had left the issue hanging in the balance, and both states continued to maintain their claim to the islands and demand that the British give a ruling in their favour over sovereignty of the islands. In 1986 the problem escalated and the two states were on the verge of taking military action over the islands and the continental shelf between the two countries. The Gulf Co-operation Council (GCC) defused the threat by mediation. In 1988 the two states, through the GCC, agreed to transfer the issue to the International Court in The Hague but no decision was taken. Neither state feels it can afford to lose the islands and the dispute has meant that exploitation of the islands' resources has been halted. Hawar Island is approximately 40 km^2 and is expected to have a good reserve of oil and gas. The dispute has also meant that neither state can exploit the seabed between Qatar and Bahrain for oil exploration.

Possible solutions to the issue would be for a median line between Qatar and Bahrain to be agreed or for a joint Qatar-Bahrain exploration with each state contributing to the cost and sharing the profits equally on a 50/50 basis (discussed in Chapter 7, section 7.6).

Another political boundary dispute which was expected to be resolved as a result of the 1935 oil agreement was that between Qatar and Saudi Arabia. The Saudi's protested about the 1935 oil agreement, saying

> *"the oil concession in Qatar could not be valid without resolving the political boundary dispute between Qatar and Saudi Arabia".*

The British Government initiated negotiations with the Saudi government regarding the Saudi-Qatar political boundary, Saudi Arabia presented the 1935 line (Figure 2.4) claiming about 1600 km^2 of the southern part of the Qatar peninsula. Britain disagreed with the 1935 line because the line claimed for Saudi Arabia a sizeable tract of Qatari territory, Qatar standing to lose: grazing areas; parts of its southern coast around Khawr-al-Udeid, a rich fishing area and a good site for a port; and parts of its south western coast around the Gulf of Salwa, also a rich fishing area. (Figure 2.4)

The boundary dispute between Qatar and Saudi Arabia was frozen during World War II, and negotiations resumed in 1949 when Saudi Arabia presented the 1949 line (Figure 2.4). This line claimed more land and coastline from the Qatar peninsula, but showed that Saudi Arabia was unsure about its claim.

With advice from the British government, the Sheikh of Qatar presented a new proposal in 1952 (Figure 2.4) presenting a boundary starting from the Gulf of Salwa at the south west of the peninsula, curving southwards, then gradually curving around towards the north east until reaching a southerly point at Khawr al-Udeid. At the 1952 meeting the two states were able to agree. A further meeting in 1965 maintained the 1952 boundary delimitation. [30]

The 1952 line gave Qatar an additional 2025 km^2, which is about 17% of the Qatar peninsula. This area, added to Qatar as a result of the 1952 agreement, is very important for Qatar as it has some of the best grazing areas in Qatar (e.g. al-Urayq), some excellent fishing (e.g. Khawr al-Udeid and the Gulf of Salwa), and some parts of the area (e.g. Ghar al-Baried and Khararah) are expected to harbour oil reserves although these are not confirmed.

3. The impact of 1935 oil agreement on land use.

In 1939/40 the QPC explored the Dukhan oil field in the western part of the peninsula (Figure 2.3). The Dukhan oil field is about 70 km long, 6 km wide and covers an area about 420 km^2. The first oil exported from Qatar was in December 1949 through 85 km of pipeline from Umm Bab in the west to Umm Said on the eastern side of the peninsula, where the oil terminal was built.

The Qatar Petroleum Company concession was orginally 11,437 km^2, but was subsequently reduced to 2000 km^2, keeping only the production region (Figure 2.3). Thus the 1935 oil agreements kept a concession area representing only about 18% of the Qatari peninsula.(31)

2.3.2.The Offshore Oil Concession.

Questions relating to offshore political marine demarcation in the Gulf in general, and for Qatar in particular, had been subjected to neither deep nor precise consideration until 1949 when the Gulf States proclaimed their proximate marine limit. The 1949 declaration did not settle the matter, although it became the basis for marine demarcation in the Arabian Gulf in the 1950s and 1960s.

1. The Offshore Oil Concession in 1952 between Qatar and Shell Company of Qatar (S.C.Q):

On 3 April 1952 Shell received confirmation that QPC had no interest in the offshore area of Qatar. This information encouraged Shell to chase the finalisation of the offshore concession in Qatar.(32)

On 29 November 1952 S.C.Q. signed the offshore oil agreement with Qatar:

> *"The agreement was signed on the Qatar behalf by Sheikh Ali (Ruler) who succeeded his father in 1949 and on the S.C.Q. behalf was Mr Higgins."*

On signing the agreement, S.C.Q. paid the Sheikh £363,952, which was unreturnable under any circumstances. The agreement was followed by British approval for Shell's oil concession.(33)

As with an earlier concession, the period of this concession was 75 years, and as with the earlier concession the company stayed in Qatar for a shorter period: 24 years i.e. 32% of the period. The National Oil Company and Shell reached a mutual agreement, in which the National Company took over from Shell, similar to APOC's withdrawal agreement.

The main articles concentrate on marine exploitation:

Article 1 "The concession covered all the seabed and subsoil underlying the spring tide of the waters of the Arabian Gulf which fall within the jurisdiction of the Sheikh of Qatar and which are beyond territorial waters, i.e. islands, shoals, etc.."

The company was compelled to respect the other sea users:

Article 14 "The company shall conduct its operations with due regards to the laws and customs governing the high seas and navigation, and the safety of shipping, and air craft, fishing and pearling operations in and on the water which covers the concession area."

Article 27 "Failure on the part of the Company to fulfil obligations under this agreement shall not give the Sheikh any claim against the company, when such failure arises by *force majeure*".(34)

This article protected S.C.Q. when a violent storm destroyed their drilling operation in 1955, suspending work until 1959.

Whilst accidents are to be expected in hydrocarbon industry operations, the accidents usually have a severe and lasting detrimental effect on the environment. As the oil leaks into the sea, all sea life is killed, e.g. fish, birds, etc.. Damaged plant is also dangerous to marine life, but companies tend to remove such plant only if they obstruct operations, or if they are forced to do so by the government.

2. The area occupied by 1952 offshore oil concession

When it took the Qatar offshore oil concession in 1952, S.C.Q. was uncertain about the offshore limit, although that did not prevent Shell from carrying forward its operations.

The concession (Figure 2.3) covered an area of about 25,600 km^2, but Shell clearly concentrated its offshore exploration to the east of Qatar, as marine demarcation between Qatar and the Abu Dhabi was reasonably well established. Further, the sea area under Qatari sovereignty on the eastern side of the Qatar peninsula is about 22,600 km^2, whereas that under Qatari sovereignty on the western side is only about 3,000 km^2. Moreover, some parts of the latter have been a matter of dispute between Qatar and Bahrain since 1937. Consequently, S.C.Q. concentrated its exploration on the eastern side of the peninsula and in 1960 Shell explored the al-Idd Elshaji oil field covering an area about 110 km^2. In 1963 exploration was undertaken of the Maydan Mahzam oil field which covered an area about 47.5 km^2. In 1969 the Bulhanine oil field was included in the Shell concession area, as S.C.Q. had agreed with Qatar in the 1952 agreement that, within the demarcation of Qatari waters, any area identified as oil-bearing as a result of exploration in the Qatari marine area would be included in the Shell area of concession. The Bulhanine oil field covers an area of 96 km^2 (Figure 2.3. and Table 7.2). In order to operate in the above offshore oil fields S.C.Q. occupied Halul Island 1.5 km^2 (figure 2.3). In 1970 S.C.Q. explored the North Dome gas field on the north eastern side of Qatar. The North Dome covers an area about 6000 km^2 (Figure 2.5B).

In 1970 S.C.Q. relinquished most its concession to the Qatar offshore area, and kept only 5000 km^2. The area on which the company concentrated its operations is about 19.5% of the Qatari offshore areas, which is today the offshore producing region (35) (Figure 2.3.).

In 1989 the old Shell oil producing area was reduced by another 56% (Figure 2.5B) reducing the area of that offshore concession to its current 2200 km^2.

There are two remaining old Qatar oil concession areas: the 1935 onshore concession area and 1952 offshore areas. In 1969, two years before gaining independence on 3 September 1971, Qatar changed its way of granting oil concessions, no longer feeling forced to grant oil concession only under British supervision. (Table 2.2.)

2.4 The Oil Concession in Qatar from 1953 to 1989

Qatar oil exploration remained for a long period controlled by the two companies: Q.P.C. onshore, and S.C.Q. offshore. In 1965 Qatar became aware of the desirability of making better use of its oil industry wealth, leading to fresh negotiations between Qatar and the two foreign companies who were operating in Qatar. These negotiations forced the two companies to alter some of the articles in the old agreements e.g. area of concession, and the period of concession, etc.. Qatar found itself negotiating with another foreign company for oil exploration (Figure 2.5) and at this stage Qatar felt free in granting the oil concession to a foreign company of any nationality to suit Qatari interests without British approval (Table 2.2). These new oil concessions

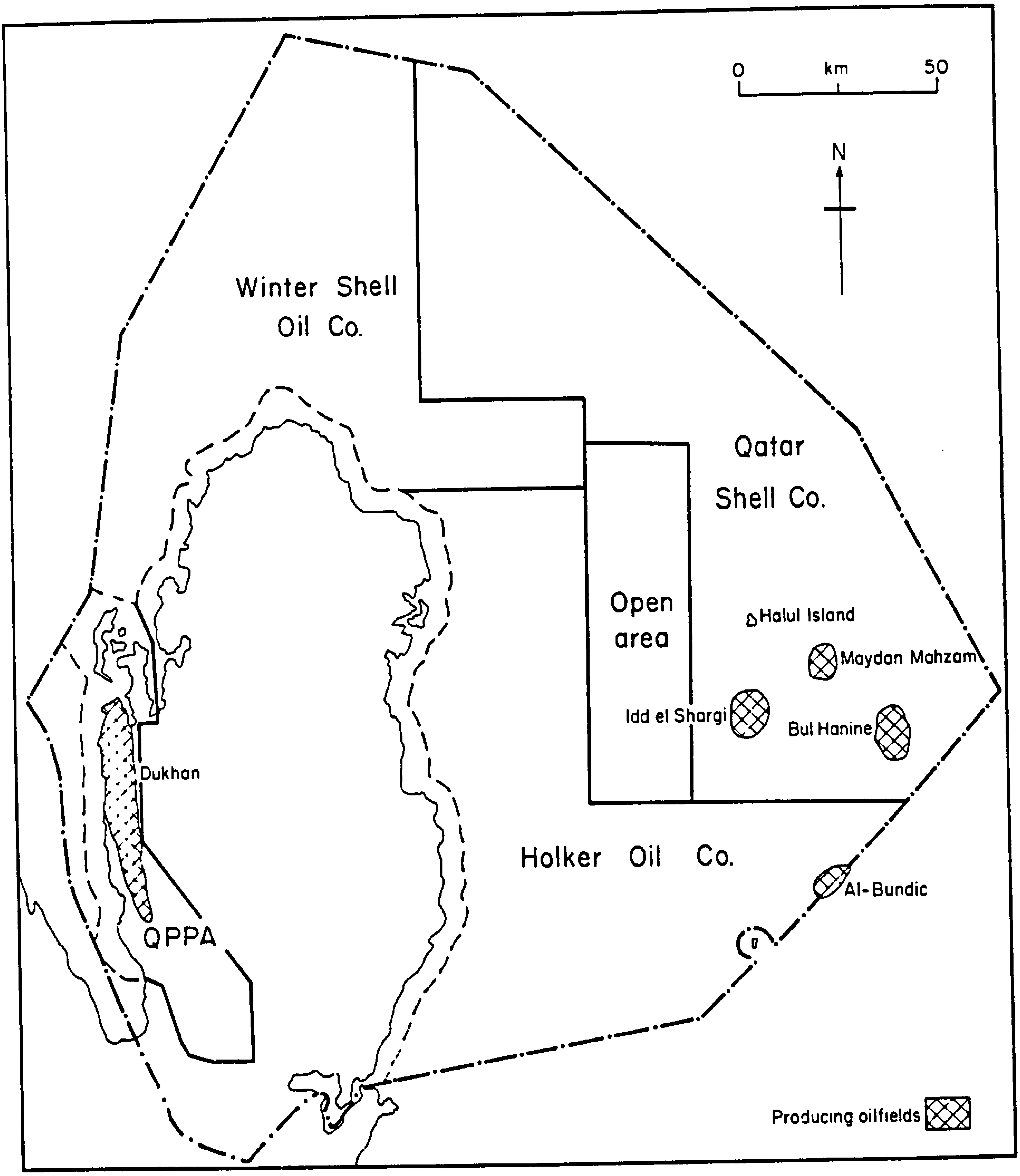


Fig. 2.5A Concession areas in Qatar, 1970's

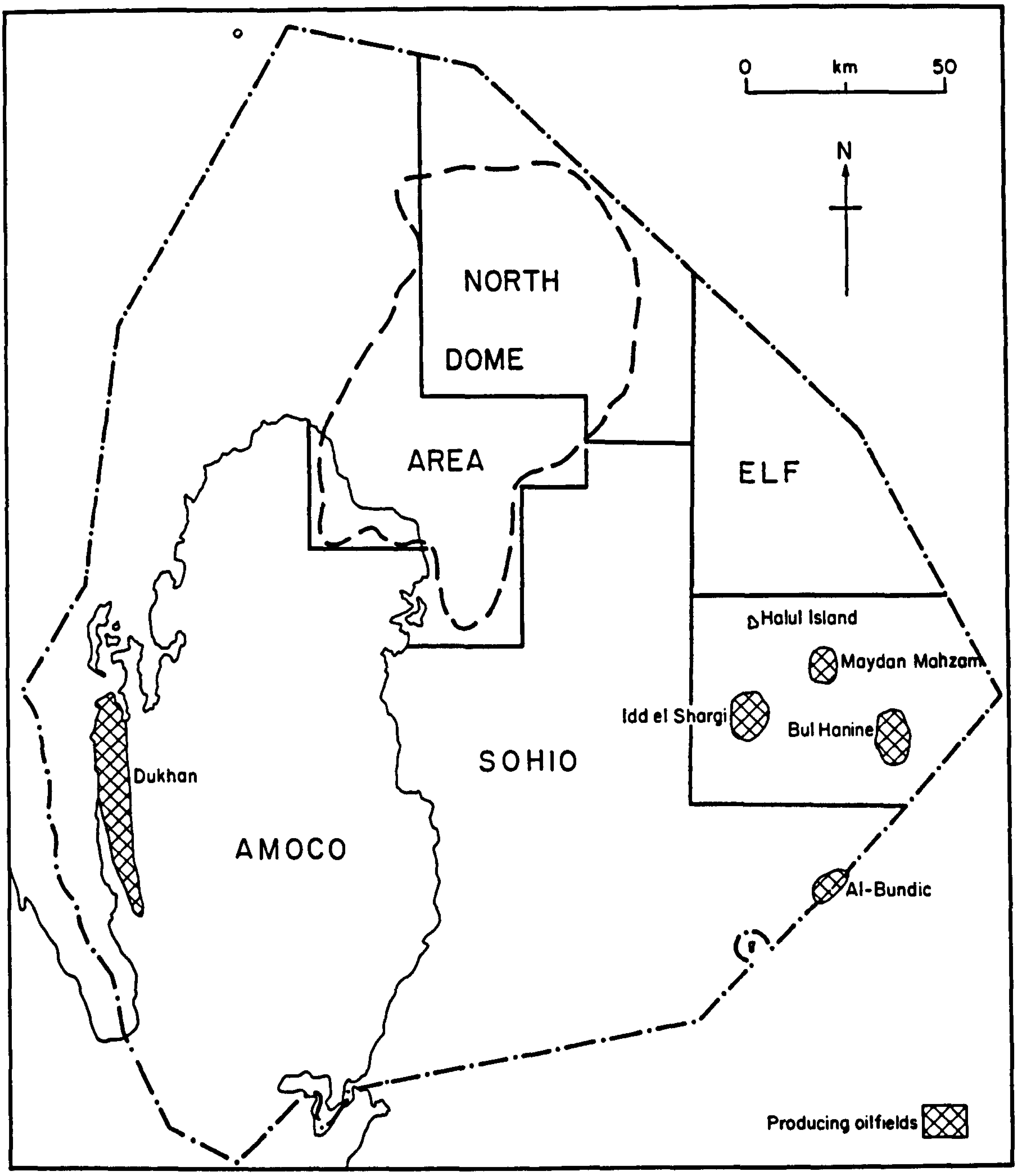


Fig. 2.5B Concession areas in Qatar, 1980's

(Figure 2.5) have no impact on land use and sea use, as Qatar still depends on the production from the old concession areas.

Table 2.2 The Oil Concessions in Qatar since 1953/89

Date	Nationality	Company name	Area of Concession km^2
1969	Japanese	Q.O.C.S.	offshore 7600
1973	West Germany	Winter shell	offshore and onshore 9000
1976	U.S.A.	Hollkar	offshore and onshore 8700
1984	British	Sohio (Bp)	offshore 12000
1986	U.S.A.	Amoco	onshore 8937
1989	France	Elf	offshore 2800

Sources: A. Ministry of Finance and Petroleum Oil Industry in Qatar 1976. p. 15,19.
B. Economic Intelligence Unit (E.I.U.) Bahrain, Qatar, Oman and Yemen, Country reports, No.3. 1989, p.23.

2.4.1 Al-Bundiq Company Ltd :

In March 1969 an agreement was signed between Qatar and Abu Dhabi defining the marine boundaries between the two states. As a result of this settlement Qatar shared 50% of the al-Bundiq oil field, the other half going to Abu Dhabi (Figure 2.5). A.D.M.A. was operating in the al-Bundiq field which had been awarded in the ratio BP: two thirds and CFP (a French company): one third. In 1970 BP gave up half of its interest in al-Bundiq to a group of Japanese oil companies. (36)

2.5 The Creation of the National Oil Organisation in Qatar

Before 1935, pre-oil Qatar had no modern administration and had no modern education. Qatar's weakness in handling the oil concession negotiations was its lack of expertise. Once income from oil started to make an impact on the state, Qatar joined the International Oil Organisation, made up of states in circumstances similar to Qatar. The government of Qatar started to plan for its oil industry by itself, consulting experts from elsewhere when it needed advice or faced a problem.

However, in order to take over from the foreign companies, the Qatar government followed a lengthy procedure. The effect of joining OPEC in 1961, and OAPEC in 1970 was to make Qatar aware of its need to control its own oil wealth, thus leading Qatar into a gradual take over from the foreign companies Q.P.C onshore and S.C.Q. offshore.

- 10 January 1973 Qatar won a participation of 25% of Q.P.C. shares
- 5 June 1973 Qatar won a participation of 25% of S.C.Q. shares
- 20 February 1974 Qatari participation in S.C.Q. shares increased to 60%
- 20 February 1974 Qatari participation in Q.P.C. shares increased to 60%.
- 8 February 1975 Decree No. 1 declares Qatari ownership of the remaining 40% shares in each company.
- 11 October 1976 the first agreement was ratified with Q.P.C in law No. 100.
- 2 March 1977 the second agreement was ratified with S.C.Q. by law No. 10. (37)

The take over of the Qatari oil industry by the government parallelled the creation of national oil companies. The Qatar National Petroleum Company (QNPC) was created by law No. 13, signed on 22 April 1972. Decree No. 10 subsequently created Qatar General Petroleum Corporation (Q.G.P.C.) to replace Q.N.P.C..

Q.G.P.C. was set up as an independent corporate entity with its headquarters and legal domicile in Doha, boosting the state capital as the administrative centre for the Qatar oil industry. This would be reflected in the land use of Doha, particularly in terms of the conflict between the demands of administrative and supporting services of the hydrocarbon industry and the demands made on land use by other activities in Doha (Figure 2.4). Q.G.P.C. has the authority to act on behalf of the government throughout the entire hydrocarbon sector, both inside and outside Qatar. (38) This is illustrated in Table 2.3.

Table 2.3 Q.G.P.C. Subsidiaries within and outside Qatar

	Company	% QGPC
A. in Qatar	QPPA offshore - Qatar Petroleum Producing Authority	100
	QPPA onshore - Qatari Petroleum Producing Authority	100
	NODCo. - National Oil Distributing Company	100
	QAP Co. - Qatar Petro Chemicals Company	84
	Qaf Co. - Qatar Fertiliser Company	75
	The Gas Company Ltd	77.5
	N.G.L. - Natural Gas Liquification	100
B. Abroad	The Arab Marine Transportation Company Kuwait	13.6
	The Arab Shipping and Repairs Yard Bahrain	18.8
	The Petroleum Co Services Libya	10
	The Petroleum Investment Co. Saudi Arabia	10
	The Arab Pipelines Oil Company (Sumid) Egypt	5
	The North Petro Chemical Co. France (Copenor)	40
	The Consulting Engineering Co. Abu Dhabi	11.4

Source: Q.G.P.C. Annual Report Qatar, 1987, p.13

2.6 Background to the oil era in Qatar

The oil industry in the state of Qatar has precipitated a thoroughgoing economic revolution, as well as a revolution in land use. Due to oil, the lifestyle of the people has changed in many ways.

Qatar, along with other oil producing states in the Gulf, has not passed through all the stages of economic development in the same way as Western Europe and North America. There, the energy sources used in industry began with steam (via coal mining), then gradually converted to oil, and more recently to nuclear power. The West has also experimented with other sources of energy such as solar, air, etc., and scientists are still busy developing alternatives to hydrocarbon as a source of energy.

Out of this background an attempt has been made to pinpoint the main issues, thus dealing with the above on a very broad base, including information on other oil-producing states in the Middle East and elsewhere. Four major issues in Qatar were chosen to be examined briefly below.

2.6.1 Oil Revenues

Before discussing the oil revenues of Qatar it is perhaps wise to take a brief look at Qatar's pre-oil revenues. Qataris earned their income in very traditional ways before the advent of the oil industry. The whole of the modern system of planning has come in with the oil era but this does not mean that pre-oil Qatar gave no prominence to industry as an economic activity. The state had a pearl industry, and fishing and livestock grazing were also actively pursued. The pearl industry provided enormous amounts of money but many of the Qatari people working in the industry earned very poor wages (see Section 2.6.4.). It was mainly the merchants (Tawasheen) who gained wealth from the industry rather than those employed in its various activities. However, Sheikh Jassim bin Mohammed Al-Thani, the ruler of Qatar until 1913) also gained valuable revenue at the beginning of the 20th century from the pearl industry. The Sheikh had a total of about 3.6 million Rupees (39) from the industry (a Rupee equals approximately one shilling and sixpence) (40). Unfortunately this industry gradually declined, and the introduction of Japanese cultured pearls in the 1920s and early 1930s, coupled with the worldwide recession after World War I which affected luxury items such as pearls especially, heralded its final decline. A glut in pearls and disagreement among pearl merchants about prices added to the problems experienced by the declining industry (41). (A similar set of factors affecting oil prices occurred in 1980.) The above factors resulted in the pearl industry's demise by the 1940s. However, as the saying goes, as one door closes, another opens and as one way of earning a living for the Qatari people ceased, Allah provided another and more prolific source of income, the oil industry.

Qatar signed the onshore oil concession agreement with the Anglo- Persian Oil Company (APOC) in 1935, then transferred to the Iraq Petroleum Company (IPC) in respect of the Red Line Agreement. This company formed a subsidiary called Petroleum Development (Qatar) Limited (PDQ) and in 1953 its name changed to the Qatar Petroleum Company (QPC) which is now called the QGPC onshore operation (42). The above names are significant when reading the history in this thesis and the 1935 oil agreement and other oil concessions in Qatar discussed in Chapter 2.

At this stage, during what can be called the first stage of the oil era - 1935 to 1948, Qatar's income depended on what the QPC paid for the concession area, that is, as follows (taken from Art.4):

1. 400,000 Indian Rupees on the day the Agreement was signed.

2. 150,000 Rupees per annum for the first 5 years from the date of signature.

3. From the sixth year of the concession up to the end of the concession (the concession period was 75 years) the QPC to pay the Sheikh 300,000 Rupees.

4. Royalties of £2240 UK per ton shall be paid when the Company extracts oil and puts it into storage but no royalties are payable for materials used within the state of Qatar by the Company or its employees (43).

The above figures show that the major source of income for Qatar up to December 1949 when it was first exported was oil. Qatar earned approximately 5,916,108 Indian Rupees from oil in 1949 (44) and in 1950 exports of oil exceed $15 million US (Figure 2.6 shows in detail oil production and revenues from 1950-1990).

By 1955 oil revenues had increased dramatically. By then Qatar was earning about $25 million US (Figure 2.6) and almost the whole of the area of Dukhan, the only onshore oilfield had been developed: the Khatiyah Commissioned in 1949, Fahahil in 1954 and Jalehah in 1955 (45). The second reason why oil revenues increased between 1950 and 1955 was that a new element was introduced in the form of revenue sharing (50/50) between Qatar and the Petroleum Development (Qatar) Limited (PDQ) (46).

In 1960 oil revenues earned by Qatar totalled about $54 million. Qatar should have earned more than the above in 1960, as its production was too high in comparison with the year 1955 (Figure 2.6). However, the increase in the oil revenues was restricted by the international oil companies' role in reducing the oil prices or in other words were flooding the international market with oil, which resulted in depressing oil prices in 1959. In 1959 the international oil companies (i.e. Western oil companies) reduced the oil prices between 10 and 18 cents per barrel, and that was followed by

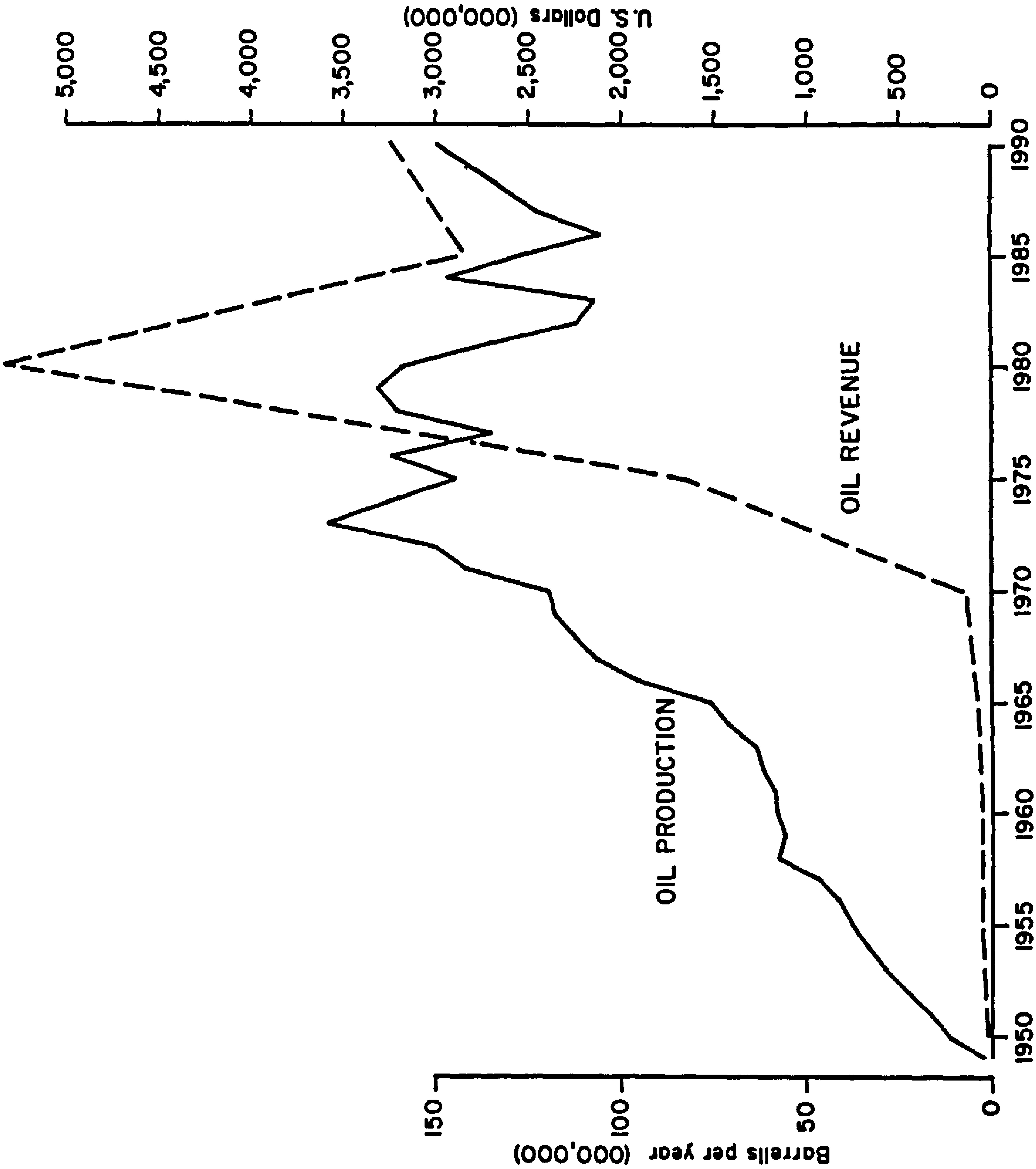


Fig.2.6 Growth of oil production and revenues

another reduction in August 1960 of between 10 and 20 cents per barrel.[47] The result of the oil price reduction, the main oil- producing countries (Saudi Arabia, Kuwait, Iraq, Iran and Venezuela), met in Baghdad on 10 September 1960, and after 5 days from this conference, they agreed to establish an organisation (OPEC) to protect these countries in the oil industry's interest against the foreign oil companies who were operating in their territory. The state of Qatar joined OPEC in 1961. One of the main goals of OPEC was to co-ordinate and unite the oil industry for its member states, and decide the best method for protecting their interest individually and collectively.[48]

The OPEC roles during the 1960s in controlling the oil prices were limited, in spite of the fact that through this decade (1960-70), Qatar and the other OPEC states established a serious negotiations with the foreign oil companies, to alter some of the terms of the old oil concessions (pre-1960). Qatar and the OPEC states (post-1960) signed new oil concession agreements to serve their interests better than the old ones. As mentioned above, before 1970, OPEC's role in protecting oil prices was limited. This is illustrated by Qatar's oil revenues. In 1965 Qatar exported oil from both on-shore and offshore, i.e. the Idd El Sharji offshore oil field, which has a participation to a certain extent in raising the Qatar's oil production and revenues from oil, and, earned $69 million. By 1970, production had increased massively, but oil revenues amounted only to $122 million. (shown in detail in Figure 2.6). In 1971, OPEC demonstrated its influence on oil prices. Qatar earned $10 million more in 1971 than it earned in 1970. The feature behind this price increase was the famous Tehran agreement in 1971. Before the agreement, OPEC states were fighting to increase their share in the profit from the oil revenues. In 1971 the oil producing states became more assertive, and decided to participate in setting their oil prices with the foreign oil companies operating in their territories.[49]

The 1970s could be called the golden age for the oil producing states (OPEC), as in Qatar and the other OPEC states, the takeover from the foreign oil companies had begun, and they were being replaced by national oil companies, e.g. Q.G.P.C. in Qatar. Qatar has enjoyed full national control over its oil industry since 1977 (discussed in Section 2.5). Another factor leading to increasing oil prices was the Arab-Israeli War of October 1973, when the Arab oil states declared a temporary oil embargo and reduction to the states who supported Israel in the War. Qatar benefitted additionally by bringing on-stream for export in 1972 two offshore oil fields, (discussed in Section 7.3 in detail). The above factors participated largely in increasing the oil prices and revenues between 1974 and 1980, as Qatar received, in 1975, from its oil exportation, about $1.65 billion. In 1980 Qatar's oil revenues climbed to $5.324 billion (Figure 2.6). In the 1970s, and early 1980s, Qatar was the eleventh largest producer in OPEC, and ranked fifteenth in world output. On the other hand, the small population of Qatar in comparison with its oil revenues made Qatar's people in 1980, to be counted as receiving the third highest per capita income in the developing world.[50]

This incredible leap in oil prices, on the other hand, had a catastrophic impact on the oil-consuming nations, mainly the economically developed world. It is important to examine this event, both from a Western view, and the OPEC response. Diplomatic relations became strained, and the possibility of a military solution was examined, but appears to have been rejected mainly because it would have required unacceptable collusion with the former Soviet Union. The idea of overthrowing OPEC and/or individual members of the organisation ought not to be opposed, from the West's point of view. However, the individual close bilateral deals were negotiated between some of the developed states and some of OPEC states, to break the OPEC quota and to export more oil than their quota. This did work and participate to a certain extent in reducing oil prices.(51) Other precautionary measures were taken by the economically developed world, including a reduction in the use of oil: in the U.S.A., Western Europe and Japan, the rate of reduction on average over the six year period, 1979-85, was about 5 per cent per annum.(52) The Iraq-Iran War of the 1980s played a significant role in the oil price slump of the 1980s.(53) The OPEC states tried to respond by reducing their oil export quantities. This did not work, and prices remained low. Qatar's oil revenues in 1985 were about $2.845 billion (Figure 2.6). This figure was 47% less than the revenues of 1980, which resulted in postponing and cancelling some of the main projects, that Qatar was targeting to implement, and made the state to move into a harsh economic deficit from which it is still suffering in 1992. As shown in Figure 2.6, the 1980s oil price slump resulted in an economic recession in Qatar, as the Qatar government was forced to take precautionary measures to control its budget deficit. In Qatar the 1980s are considered the years of austerity.

Oil prices (revenues) and export picked up in Qatar in 1990, reaching $3.249 billion, an increase of about 12.5% in comparison with 1985 (Figure 2.6). This did not, however, mean that there was a revival in the oil market. Rather, it was because of the Iraqi invasion of Kuwait on 2 August 1990. The invasion made the oil market nervous, as they worried the Iraqi occupation of Kuwait could result in a war between the G.C.C. states (Gulf Co-operation Council) and Iraq, which could have banned the export of oil for an unknown period (G.C.C. exported about 40% of the world's oil)[54]. This resulted in a sharp rise in oil prices. After the G.C.C. states received worldwide support and military support from NATO, tension in the region was diffused and brought the oil price down to its 1980's level.

Oil revenues in Qatar amount to about 90-95 per cent per annum of the state's total revenues, and this may be is not very strange for Qatar and the other G.C.C. states to earn the majority of their revenues from the crude oil exportation. It is more peculiar for a state such as Iraq to finance the investment expenditure of the central government 90% (2390.2 Iraqi million dinars) from oil revenues during the period 1951-74).[55] Iraq has many resources and can earn their revenues in other ways besides oil, e.g. agriculture and tourism.

Oil producing countries, such as Qatar, are rich as a result of their oil revenues, but as Atif Kubursi (*Oil, Industrialisation and Development in the Arab Gulf States*, 1984) points out, their problems are not over yet:

> *"The dramatic increase in the national incomes of the G.C.C. states as oil prices increased, still left their economies - outside the oil fields - in a relative state of underdevelopment. Levels of living in the region have certainly risen, but essentially and primarily through a form of capital consumption, namely the depletion of oil reserves.*[56]

Qatar is aware of the problems, and in the 1970s, Qatar began to develop the hydrocarbon processing industries, depending on the non and associated gas supply in the on/offshore fields (discussed in Chapter 5), and in the 1980s embarked on a major project in the North Dome Offshore Gas Field, off the north-eastern coast of Qatar, and one of the world's largest non- associated gas fields (discussed in Chapter 7, Section 7.4). This may provide Qatar with some income beside oil revenues. However, it should be approached with very precise studies as three problems seem to emerge from Qatar's future reliance on natural gas. First, the amount of worldwide resources of natural gas available is uncertain. The long-term future market for natural gas and its by-products appears fruitful, yet discoveries in the North Sea, Siberia, Alaska and the Canadian Arctic and the end of the Communist world mainly the former Soviet Union, could place those sources closer to potential industrialised consumers. The result would be that Qatar's natural gas could find it difficult to compete in the market place at a future date. Second, Qatar has received a series of setbacks, first in April 1977 when its N.G.L. (Natural Gas Liquification) plant was destroyed through an explosion and fire, and the second in the early 1980s, in its offshore gas pipelines.[57]

How else could Qatar earn revenue (hard currency) other than from oil? This section examines briefly other economic opportunities as yet undeveloped in Qatar. They are:

1) Raise duty on imported goods above the present rate of 2.5 per cent,[58] mainly of non-essential goods, as well as imposing very high import duty on the goods similar to those produced locally.

2) Tax expatriate manpower, at least to cover some of the free services provided to them by the government.

3) Impose some fees on water and electricity which are now provided free of charge to Qatari people.

4) More serious plans for developing agriculture and fisheries.

5) Encourage tourism.

6) Encourage the domestic manufacturing industries in all sectors, e.g. furniture, cosmetics, etc..

7) Re-invest some of the oil revenues in the developed world, similar to the Kuwait investments in the West.

8) Re-organise foreign aid to Third World countries and other friendly states from donations into investments in the states, e.g. encouraging agriculture, building of dams. This could focus on some industries for mutual benefit. However, emergency aid may still be required.

Qatar's oil revenue has participated in the tremendous growth of many sectors, some of which are examined below.

2.6.2 Population Growth

As mentioned at the beginning of Section 2.6.1, Qatar's economy prior to 1950 (the pre-oil era) was very traditional. This traditional way expanded to the various sectors of life, including population growth. In about 1905, Lorimer estimated Qatar's population to be about 27,000 people.(59) This remained roughly accurate, albeit with fluctuations, until the early 1950s. This pattern was repeated throughout the Arabian Gulf region, as their annual population growth never exceeded 0.8%, e.g. the authors of Islamic Atlas published in 1955, estimated the Qatar's people in the region of 20,000, and in the statistics of the U.N. in 1952, estimated Qatar's population to be around 25,000 people.(60) The above estimates show, firstly, the lack of the proper population information on which to base an estimate. Secondly, the fluctuation of the population estimate between 1905 and the early 1950s averages around the 1905 estimate. The nature of Qatar's environment prevented it from supporting a larger population. Infertile land, poor water resources, and the dearth of opportunities for paid employment made Qatar a harsh place for subsistence. As a result, the mortality rate was high, especially amongst women and children. In the period 1900-1950, the birth rate is estimated to have been around 50 in 1,000, and the mortality rate around 40 in 1,000. Each of the above factors changed in the 1950s when Qatar began to receive oil revenues, as shown in Figure 2.7. The population of Qatar in 1950 was estimated to be 30,000 people.(61) From this year onwards, when Qatar began to yield the crop of its oil revenues, net emigration fast turned into net immigration. Most of the Qatari people who emigrated out of Qatar in the poverty era between 1900- 1950, came back to their homeland. Qatar became a focus for manpower recruitment from throughout the world, although mainly from the Arab world and south east Asia. This workforce was drawn from all categories of people.

The 1950s witnessed the cornerstone of Qatar's change from a traditional state, to a new country planning for its future, and to catch up with a modern rank in all possible sectors, e.g. in 1951 Qatar opened its first modern educational school, in 1956 it opened the al-Rumeila Hospital, the first hospital in Qatar's history. Population growth in the period 1950-1960 was about 8% per annum. This brought the people of Qatar to about 60,000 (Figure 2.7) and in the period 1960-70, Qatar kept the same trend as above in terms of growth rate, as the first official census has been done in Qatar in April/May 1970, and the total population in this census was 111,133 people.(62) (Figure 2.7). Population growth accelerated to 9% in Qatar during the period 1970-1980, mirroring the high oil revenues of the 1970s (discussed in Section 2.6.1). In 1980 the population was estimated at between 244,534 and 260,000 people(63) (Figure 2.7). Population growth slowed during the 1980s to 6.6% per

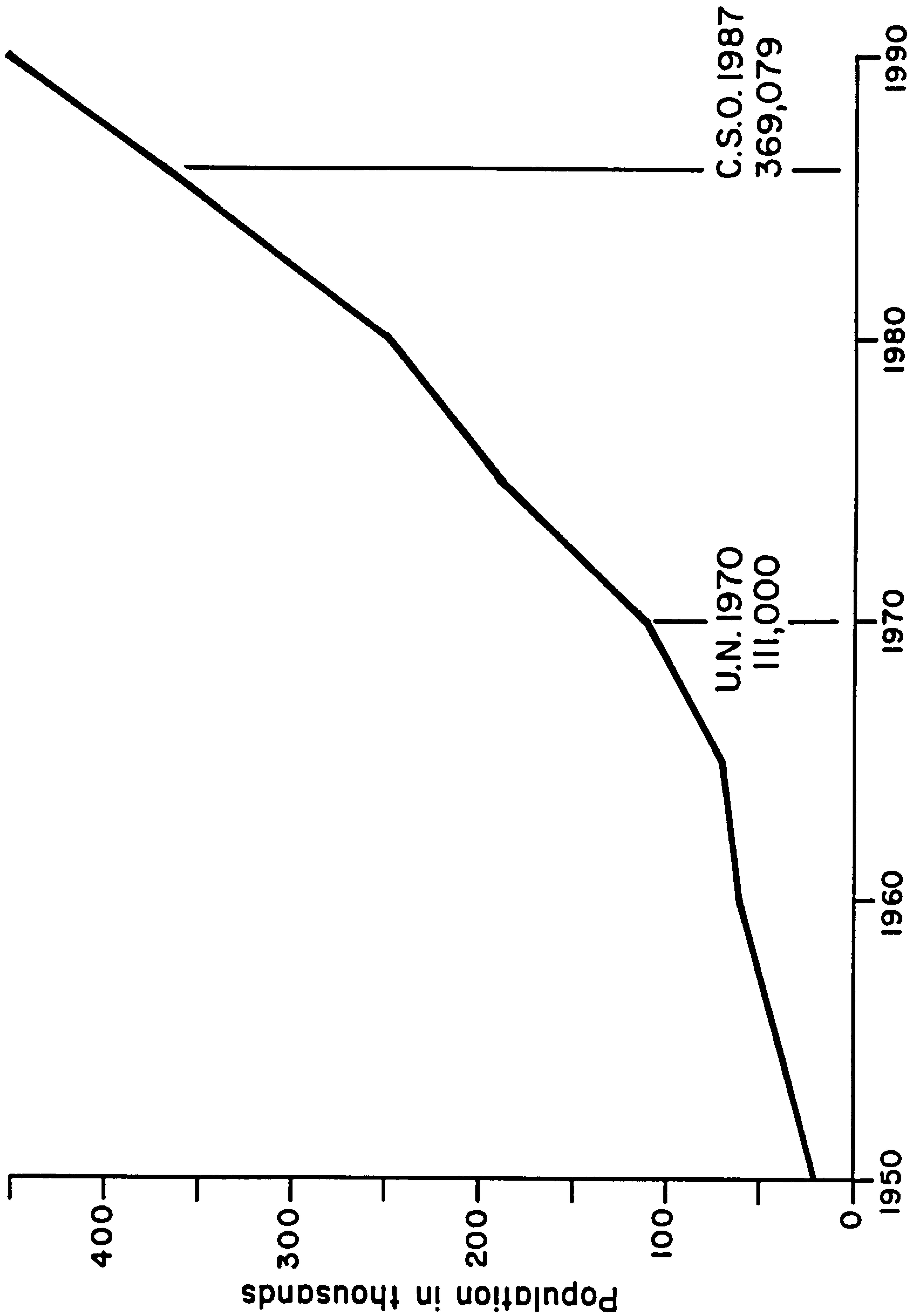


Fig.2.7 Graph of population growth

annum. In the 1986 census, Qatar's second national census, the population was 369,079[64] (Figure 2.7). In 1990 the Qatar population was estimated at about 452,000 people[65] (Figure 2.7).

The trend of the population growth in Qatar may appear peculiar, although typical of the G.C.C. states. The high revenues earned from oil facilitated a modern state with all first class services and infrastructure. To build these, Qatar had no alternative but to recruit a huge number of expatriates. It is these expatriates who form the enormous annual population growth in Qatar. The annual growth of the Qaṭari national population is high, at about 3.8% per annum.[66] However, this rate was easily overtaken by the growth rate of the expatriate population: in 1980 expatriates comprised about 74% of the total population,[67] and in 1990 more than 75%.[68] Along with other members of the G.C.C., Qatar imposes immigration procedures, and terms are signed by each expatriate who enters the country, concerning, for instance, period of stay.

Figure 2.8 gives a population age profile. This shows an interesting shape. The base of the pyramid is normal for a Third World country. The apex of the pyramid is also normal for a Third World country: sharp. However, there has been a sizeable increase in the older age cohorts over the past two decades. If Qatar maintains this trend, it will face problems similar to those of the economically developed world: a large group of economically inactive elderly people who require considerable amounts of expensive support.

The most notable shape (Figure 2.8) is in the economically active years between ages 15-69 years. There is a big augmentation to the male side. This is not because something abnormal with Qatar's national population growth as the percentage of

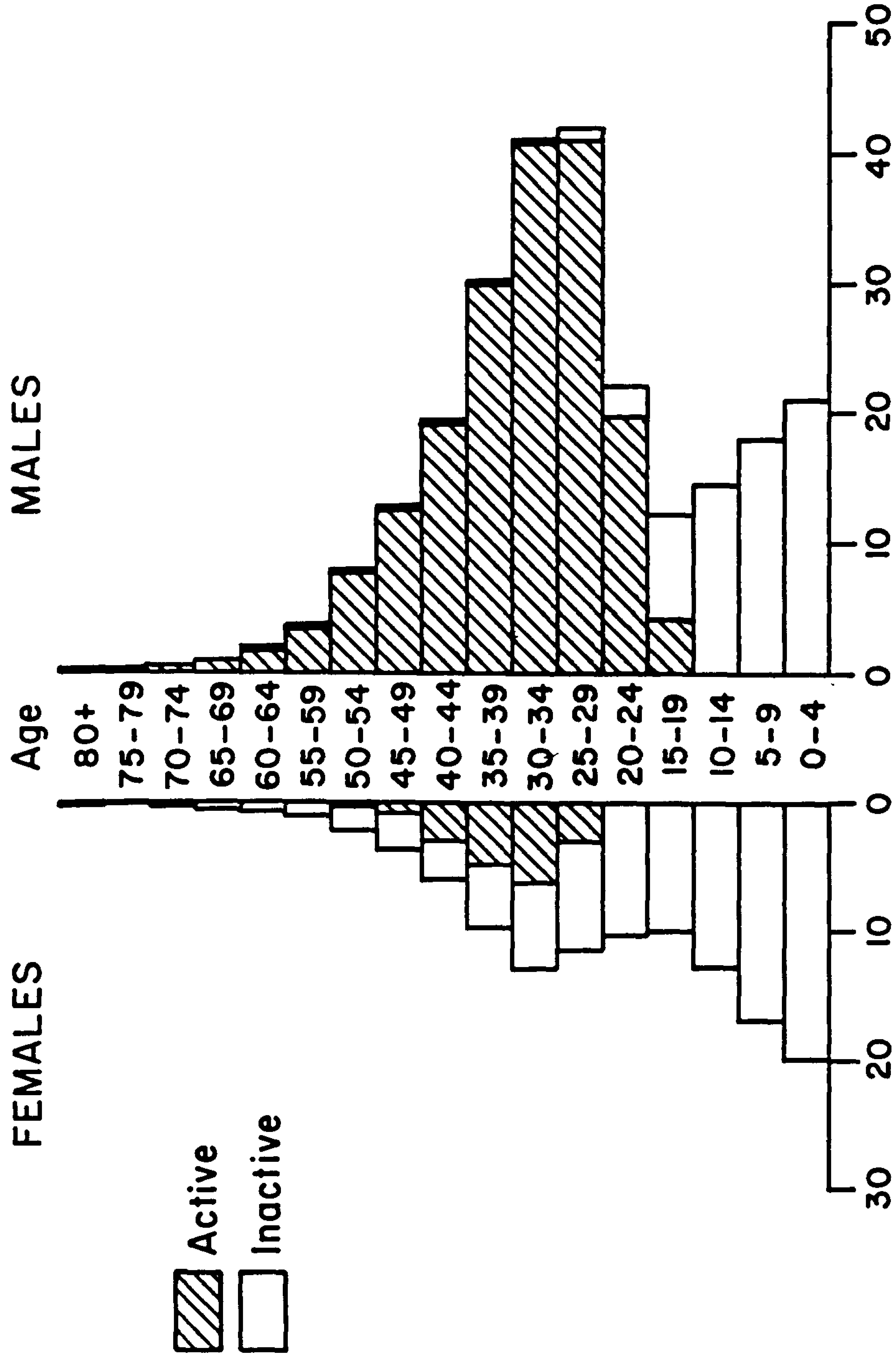


Fig. 2.8 Population pyramids

males to females (sex ratio) is 101- 3[69], and the percentage of expatriate males to females (sex ratio) is 287-7.[70]

The total sex ratio for Qatar is about 152.[71] The above is because most expatriates are males, and the law in Qatar as well as in the G.C.C. (to participate in reducing or controlling the foreign manpower flow in the rich GCC region, and to reduce the pressure on public services) is "the expatriates are not allowed to be accompanied by their families except in specific cases"[72], ('specific cases' meaning high status expatriates or those who earn high revenues). So in the census in Qatar in 1970 in the age group between 10-74, the masculinity ratio was 70% [73], and in the second census of 1986, the masculinity ratio in the age group between 15-69 was about 71.6%.[74]

Oil revenues in Qatar have had a positive impact in all development sectors. Regarding the population, the oil revenues have been instrumental in reducing the rate of illiteracy. In the 1970s, the illiteracy rate in Qatar was 66% for the age group 15 and over.[75] By 1986, this figure had been slashed to 22.4% for the age group 10 and over.[76] This is because the government invested broadly in the educational sector all over the peninsular of Qatar.

It has been appropriate to focus attention on the population and demographic studies in Qatar and the G.C.C., as they are a somewhat unusual model in comparison with the rest of the world.

2.6.3 Urban Growth

Urban growth in Qatar during the oil era is clearly a broad topic. This section gives a measure of urban growth, by studying the population movement and distribution in each town pre-1950 and post-1950 as shown in Tables 2.4, 2.5 and Figure 2.9.

Table 2.4 Population distribution in Qatar in 1905

Town or village	Population	Percentage of total Qatar
Doha	12000	44.4
Al Wakrah	8000	29.6
Sumaysmah	200	0.7
Dhakirah	900	3.3
Al Da'yn	1400	5.2
Al Khwar	500	1.9
Fuwayrat	1400	5.2
Al Ruwais	650	2.4
Abu Duluf	650	2.4
Al Wusayl	500	1.9
Al Khuwair	800	3.0
Total	27000	100

Source: Estimated from Lorimer, J.G., *The Gulf Gazetteer*, The Geographic Section, part 6, 1906, Translated to Arabic and published by Doha Palace, pp.1986, 1987.

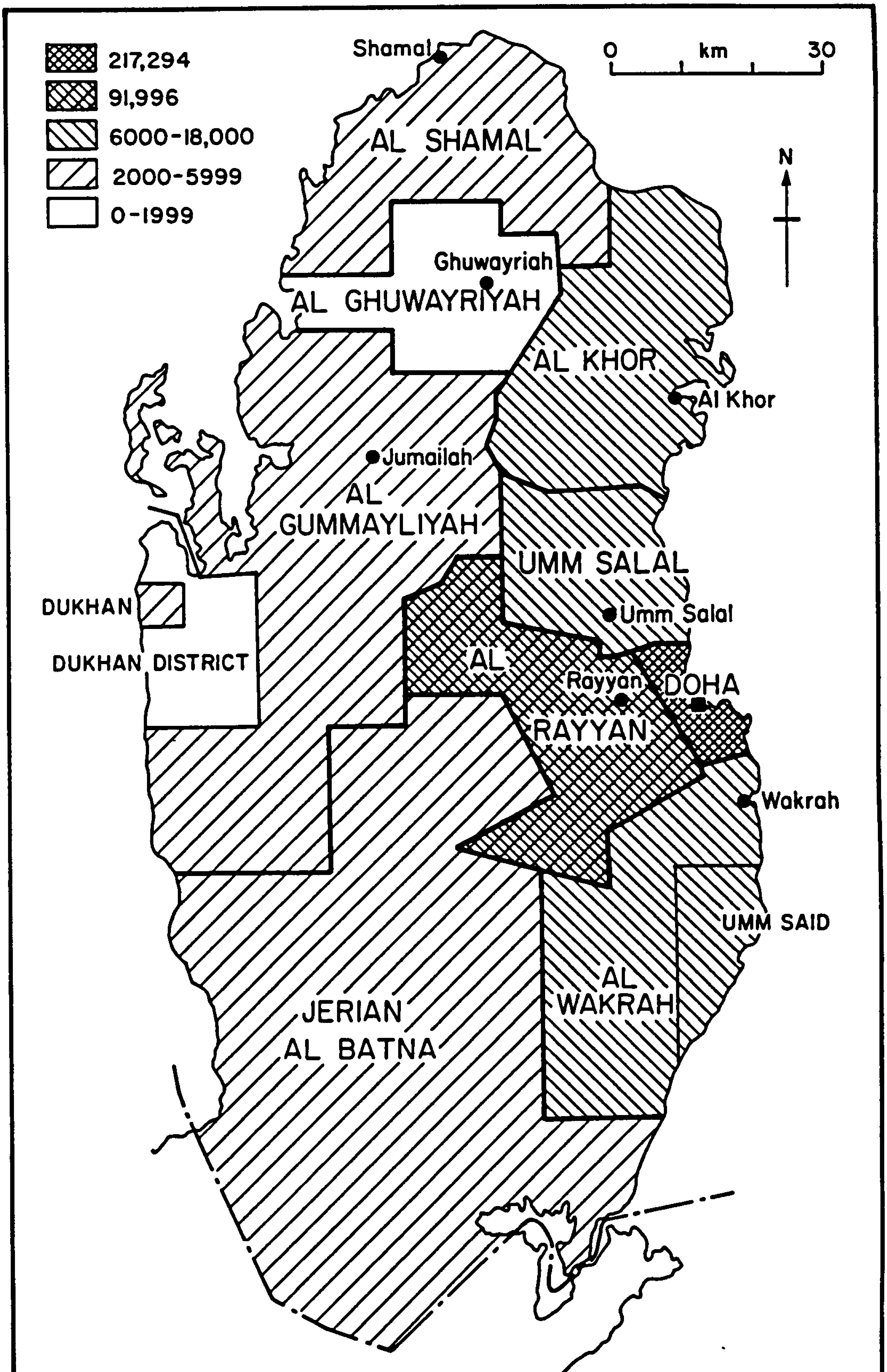


Fig.2.9 Population distribution and chief towns

Table 2.5 Population distribution in Qatar in 1986

Town or administrative region	Population	Percentage of total Qatari	Density per km^2
Doha	217294	59.0	1649
Rayyan	91996	25.0	103
Wakrah	23682	7.0	21
Umm Salal	11161	3.0	23
Al-Khawr	8993	2.0	9
Al-Shamal	4380	1.0	5
Al-Ghuwyriyah	1629	0.3	3
Al-Jumayliyah	7217	2.0	3
Jerian Al Batra	2727	0.7	1
Total	369079	100	

Source: State of Qatar, Presidency of The Council of Ministers, Central Statistical Organisation, Annual Statistical Abstract, 11th Issue Qatar July 1991, pp.12, 14, 15, 16.

The influence of Doha in Qatar as the main town both prior to and during the oil era is clear (Table 2.4) (as discussed in Chapter 6, Section 6.2) In the pre-oil era, this influence was shared by other towns, e.g. Wakrah had about 29.6% of Qatar's population, and Khawr and Dhakirah each had 5.2% of Qatari population (Table 2.4). This means that prior to the oil era, although Doha exerted influence on the other towns and villages in Qatar, this influence was shared albeit to a lesser extent, with other towns in Qatar. The situation changed after the discovery of oil. Greater Doha (Doha and its conurbation 'Rayyan), now holds about 84% of the total Qatari population (Figure 2.9). This is for three reasons:

1. The majority of the oil revenues have been spent in Doha.

2. Most of the expatriates who came to Qatar in the oil era reside in Doha.

3. The movement of Qatari nationals from their original towns to Doha (discussed in Chapter 6, Section 6.2).

These have resulted in increasing the population of Doha at the same time as depleting other towns of their populations. For instance, in 1986 Wakrah had only 7% of the Qatari people, and the Khawr region had only 2% of the total Qatari people (Table 2.5) (Figure 2.9). However, the increased influence of Doha does not mean the other towns in Qatar have not grown in population and occupied a considerable amount of land. For example, in 1905 Wakrah had 29.6% (8,000 people) of the total Qatar population (Table 2.4), and in 1986 Wakrah has only 7% of total Qatar's people (23,682 people) (Table 2.5). This means that the Wakrah population in 1986 had increased by three times in comparison with its population in 1905.

The major part of oil revenues have been spent in Doha. Equally, the other towns have benefited in some minor way from the oil revenues, not least involving new technology. The other towns in Qatar have grown considerably in direct and indirect land use occupation.

The second field of attraction in Qatar in the post-1950 oil era, are the oil regions (Dukhan, Umm Said, Chapter 3, Chapter 5 respectively). These two towns appear able to attract nationals and expatriates, albeit to a lesser extent than Doha. Doha exerts a strong influence on the oil towns, and a considerable number of Qatari nationals who work in the oil towns prefer to live in Doha, and commute daily or weekly. Some commute to other towns in Qatar.

The foregoing may raise the question: why have the other towns and villages in Qatar not increased their percentage population pro rata in the oil era? The reasons are simple: 1) The people in pre-oil Qatar were scattered along the coastline mainly the eastern coastline up to the tip of the peninsula, and the north-west, i.e. Wakrah, Doha, Sumaysmah, Al-Da'yn, Al-Khawr, Fuwayrat, Al-Ruwais, Abu Duluf, Al-Wusayl, and Al-Khuwair. These towns and villages were chosen for settlement, because of the availability of reasonable water resources (water wells), good grazing areas around them, and above all, for close contact with the sea as the people almost entirely depended on the sea for fishing, transportation, pearling, etc.. In other words, before oil, the Qatari people were directly or indirectly earning their living from the sea. 2) The second area of settlement in Qatar pre-oil, was in the desert (relatively away from the coastline). These settlements mainly were established by some Sheikhs (Royal Family) or by some Qatari Bedouins Tribes, e.g. Rayyan, Umm Silal, Al-Wykair, and Gauwayriyah. The establishment of these villages were dependent on the availability of reasonable water resources (water wells), and good adjacent grazing areas. At the same time, most retained a strong connection with the sea, participating directly or indirectly in the pearling seasons. 3) The third reason are the Bedouin people. Before the oil era, these people needed no permanent settlement, as the good grazing area for their livestock, was used to settle in only temporarily. They mainly occupied tracts of the Qatari desert in the south, west, and some parts of northern Qatar. In bad seasons they moved beyond the borders of Qatar into the Saudi eastern province desert; into south Saudi Arabia; into the Abu Dhabi desert (U.A.E.); and even into the adjacent Oman. Everything has now changed. The pearling industry has vanished. Animal products can easily be bought from the market. Most of the water is desalinated sea water. The people can easily earn their living from the various occupations structures mainly available in Doha, or in the oil towns. This is what gives

Doha influence over the other urban (towns) areas in Qatar (discussed in detail in Section 6.2).

2.6.4 Occupation Structure

Before the oil industry began to pour revenues into Qatar (pre-1950), there was no occupational structure in Qatar according to modern concepts. There was not even permanent, organised work by which Qatari people could earn their living, apart from the pearling industry as shown in (Table 2.6). Pearling was seasonal, its main season was during the summer, mostly from May to October. Beyond that, the people remained mostly unemployed until the next season. The oil era brought a more modern occupation structure, (Table 2.7).

Table 2.6 The category and income of the on-board pearling industry workforce in pre-oil Qatar

	Category	Shares
1.	(Al-Naukhdah) The Captain	3
2.	(Al-Ga'di) The Captain's Assistant	3
3.	(Al-Maqdemi) Foreman	3
4.	(Al-Gaees) Diver	3
5.	(Al-Saeeb) Person who pulls in the diver from the sea bottom to the ship	2
6.	(Al-A'zal) Person joining in the trip but not a member of the ship's crew, and who dives on his own account. All the pearls he finds belong to him and he has to pay one-fifth of his catch to the Captain, as well as all expenses incurred on the ship.	
7.	(Al-Razef) Apprentice	1
8.	(Tabab) A small boy working on the ship as an apprentice learning to work on the sea. He usually receives a tip from all the ship's crew.	

Source: Al-Shamllan, S.M., *Pearling Industry in Qatar*, Qatar Historical Committee, Researches presented the the Conference of Studies for the History of the Eastern Arabia Peninsula, Part 2, Doha 21-28 March 1976, pp.572, 573.

Table 2.7 Occupation structure in Qatar for years 1970, 1980 and 1986

		1970(1)	1980(2)	1986(3)
	Economic Activity	% of labour force	% of labour force	% of labour force
1.	Agriculture and Fishing	4.3	1.3	3
2.	Mining, Quarrying, and Manufacturing	15.4	15.5	9.4
3.	Electricity, Gas, and Water	-	3.6	2.6
4.	Building and Construction	16.0	24.5	20.25
5.	Trade, Restaurants and Hotels	16.3	13.4	11
6.	Transport and Communications	6.7	-	3.7
7.	Finance, Insurance and Real Estate	0.6	7.4	1.6
8.	Social and Community Services	12.8	33.0	48.2
9.	Other	17.9	1.3	0.25
Total		100	100	100
Labour, numbered in thousands		48	113	200
% of total Qatari people		43.5	43.5	54.25

Sources:

1. United Nations, *The Population Situation in the ECWA Region (Qatar)*, United Nations Economic Commission for Western Asia, Beirut, 1980, pp.10-17.

2. Al-Khyat, H., *Population Balance for the Arabian Gulf States*, Qatar University, 1982 (Arabic), p.296.

3. State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, Annual Statistical Abstract, 11th issue, Qatar, July 1991, p.36.

In 1970, the primary industrial sector (agriculture and fishing) employed 4.3% of the workforce. By 1980 this had fallen to 1.3%, but by 1986 had risen again to 3% (Table 2.7). (These percentages are drawn from the 1970 and 1986 censuses; the 1980 figure is an estimate). The primary industrial sector in Qatar plays only a minor role for the workforce in Qatar. This gives Qatar a sector profile different from many Third World countries. The fact is that, before oil, the arid Qatar environment was unable to support agriculture, apart from some small unorganised farms. With the coming of the huge oil revenues, more attention was paid to agriculture. This brought the Qatari land under greater pressure, as a new sector of economic activity joined the ranks, and necessarily required tracts of land. Even so, whilst agricultural efforts are able to supply some fresh produce for the Qatar market, such as seasonal vegetable, the majority of products are imported. There is room for improvement in Qatar agriculture, and it needs to be paid more attention. (Fishing is discussed in Chapter 7, Section 7.5).

In 1970, the secondary industrial sector in Qatar (mining, quarrying, manufacturing, electricity, gas, water, building, and construction) occupied 31.5% of the workforce. By 1980 this had risen to 43.6%, and by 1986 had declined again to 32.25%. (Table 2.7). This sector expanded between 1970-1980. Figure 2.6 shows the growth of this sector parallelling the boom era of the oil revenues. This resulted in revolutionary growth in the Qatari urban areas, which required an enormous manpower to cope with the new buildings and construction. Examination of the relation between the secondary industrial sector and oil revenues shows a strong connection between them, as in the recession years of the 1980's (Figure 2.6), when employment in the secondary industrial sector fell from 43.6% in 1980 to 32.25% in 1986. This was partly because the major construction projects, e.g. public services and infrastructure, had mostly been completed, and also, importantly, because of the economic recession in Qatar.

Employment in Qatar's tertiary sector (trade, restaurants, hotels, transport, communications, finance, insurance, real estate, social and community services) has shown a different pattern. This sector has continued to expand: in 1970 it employed

36.4% of the workforce; 1980, 53.8% and in 1986, 64.5%. The main reason why Qatari nationals are attracted to this sector is that they can earn a good income under comfortable working conditions (mainly office work). As a result, there is massive over- staffing. This raises the issue of planning, as it is perhaps time for Qatar to consider a full economic plan, which would reduce the deadweight of service sector overstaffing towards the primary and secondary industrial sectors.

It is interesting to reflect that despite the overwhelming economic domination of the Qatar economy by the oil industry, and its massive occupation of land on/offshore, the hydrocarbon producing and processing industry employs the only a small minority of the workforce: not more than 4.4%.

This final section has examined briefly the background to the oil era in Qatar, including oil revenues, population, urban growth and occupation structure. The oil era has heralded extraordinary growth in Qatar. For this growth to continue, Qatar must adopt land use planning at all levels: national, urban and rural.

2.7 Conclusion

The old oil concessions in Qatar have left some areas still occupied by the oil industry. The major impact on land use and sea was as a result of the oil concessions awarded before 1953 i.e. Q.P.C. onshore 1935, S.C.Q. offshore 1952. The onshore area in the western region of Qatar explored by Q.P.C. between 1938 and 1940 still has a dedicated area of about 2000 km^2, and is called the Dukhan oil field concession area. This represents 18% of the total area of Qatar. However, the geographical area of the Dukhan oil field proper is about 420 km^2. The S.C.Q. offshore oil concession still has a concession area of about 2200 km^2 off the eastern coast of Qatar, and represents about 8.6% of Qatar's offshore area.

The oil concessions brought with them vast demands on the utilisation of land in Doha. The Qatari government insisted that the headquarters of the companies be in Doha, thus drawing land use in the capital into conflict between the hydrocarbon administrative and supporting services, and the other activities in Doha (e.g. residential areas, transportation, etc.).

The oil concession in Qatar subsequent to 1953 has had no impact on the land and in the sea, as no serious further exploration has taken place. It is clear that Qatar is now more skillful than before it was prior to 1953 in handling the oil concessions negotiations: the 1952 Shell oil concession consisted of the entire offshore area, about 25,600 km^2, but by way of contrast the 1989 Elf offshore concession area was only 2,800 km^2, reserving the other offshore areas for other oil companies, or for non-oil purposes. A disturbing feature of the new agreement is that the question of environmental risks are not seriously raised. Q.G.P.C. employees readily claim that environmental impact is taken into consideration, but unfortunately no serious measures for the protection of the environment have yet been demonstrated by Q.G.P.C..

This chapter has given the oil concessions an historical perspective, and has laid out the principal spatial features of the areas for this study. In summary: the Dukhan region is the onshore producing area; oil pipelines run from the west to the east; Umm Said is the hydrocarbon processing town and oil terminal; Doha the hydrocarbon headquarters for oil administrative and supporting services; Halul is the offshore oil producing region; there is the North Dome offshore non-associated gas area; and Ras Laffan is a prospective industrial town. The oil concessions have permitted exploration of the above areas, and the hydrocarbon industry has occupied some of the land and sea, making use of them both.

The next chapters will discuss the spatial impact of the hydrocarbon industry in land and sea use of these explored areas.

References

1. Al Abdullah. Y. *A study of Qatari - British Relations 1914-1945*, Orient publishers, Translation, Qatar 1981.p.14,15.

2. Othman, N., *With Their Bare Hands*, Longman, London 1984, p.13,14.

3. Al Aqa'd, S., *The Political Trends in the Arabian Gulf*, Anglo Egyptian Lib., Cairo, 1983 (Arabic) p. 225.

4. Doha palace, *1916 Protectorate Treaty of Qatar* p. 259.

5. Othman, N. Op cit, 1984, p.13,14.

6. Al Aqa'd, S., Op cit, 1983, p.202

7. Al Aqa'd., S, Ibid, 1983, p.203,214,218.

8. Shahdad, M, *The progress of the relationship between the oil companies and the Arabian Gulf states since the beginning of the oil concession in the region up to 1973*, Publisher, Qatar National Prints, Qatar, 1985 (Arabic), p.23.

9. Othman, N., Op cit, 1984, p.15,16.

10. India office, *Arabian Gulf Oil Concessions 1911/53*, Qatar Vol (I) London Archive Editions 1989. p.12.

11. Al Mansaur, M, *The Political Progress in Qatar 1916/49*, Dar al-Salsil, Kuwait, 1979 (Arabic), p.172, 173.

12. India Office, *Arabian Gulf Oil Concessions 1911/53*, Qatar vol (1) London, Archive editions 1989, p.9,11.

13. Al-Aha'd Book, *Qatar and Its Oil Wealth*, Qatar 1984, p.88.

14. Al-Mansaur, M, Op cit 1979, p.178.

15. Al-Abdullah, Y, Op cit, 1981, p.74.

16. I.O.L.R., London, a letter from Fowle to Sheikh Abdullah, 11 May 1935.

17. I.O.L.R., R15/1/632.

18. I.O.L.R., *Arabian Gulf Oil Concessions 1911/53*, Qatar Vol (11) Archive editions 1989 p.345.

19. I.O.L.R., *Arabian Gulf Oil Concessions 1911/53*, Qatar Vol (II), Archive editions 1989, p.346.

20. Doha Palace, Documents Office, 1935, Oil Agreement, Articles, 2,4,6 and 7.

21. P.R.O., F.O. 371/18914/170308, p.143.

22. Doha Palace, Documents Office, 1935 oil agreement Articles 8,9 and 15.

23. I.O.L.R., Ref 15/1/632, p.221

24. Zahlan, R.S., *The Creation of Qatar*, Croom Helm, London, 1979, p.86.

25. I.O.L.R., 10R R15/1/370.

26. Ibid.

27. I.O.L.R., 10R R15/2/547 p. 289.

28. Al-Abdullah, Y.A., Op cit, p.61.

29. Schofield, R., *Islands and Maritime Boundaries of the Gulf*, Vol.12, 1942-1947, Melksham, Oxford.

30. Metwalli, M, *The Arabian Gulf Basin*, Anglo Egyptian Lib, Part Two, Cairo, 1981 (Arabic), p. 568,569.

31. Ministry of Finance and Petroleum, *Oil Industry in Qatar*, Qatar, 1979, p.9.

32. P.R.O., F.O. 371/98431/170 320.

33. P.R.O., 371/98434.

34. Doha Palace, Document Office, the 1952 Shell oil agreement Articles 1,2,14 and 27th.

35. The Ministry of Finance and Petroleum, *The Oil Industry in Qatar* 1976,p.9, 15.

36. Ministry of Finance and Petroleum, *Oil Industry in Qatar* 1972, p.35-36.

37. Othman, N., Op cit 1984, p.107, 108.

38. Q.G.P.C., Annual Report 1987 p.12.

39. Al-Shamllan, S.M., *Pearling industry in Qatar*, Qatar Historical Committee, Researches presented to the Conference of Studies for the History of the Eastern Arabian Peninsula, Part 2, Doha, 21-28 March 1976, p.579.

40. Nafi, Z.A., *Economic and Social Development in Qatar*, Frances Pinter (Publishers) Ltd., London, 1983, p.84.

41. Op.cit., Al-Shamllan, S.M., p.610, 611.

42. El Mallakh, R., *Qatar Energy and Development*, Croom Helm, London, 1985, pp.22, 26.

43. Qatar Oil Concession between Qatar - Anglo Persian Oil Company (APOC), 7 May 1935, Article 4, p.67-68.

44. Othman, N., *With Their Bare Hands*, Longman, London, 1984, p.36.

45. Longrigg, S.H., *Oil in the Middle East*, Second Edition, Oxford University Press, London, 1961, p.315.

46. Op.cit., Nafi, Z.A., p.49.

47. Op. cit., Shahdad, M., 1985 (Arabic), p.207.

48. Ibid., pp.208, 210, 211, 213.

49. Ibid., pp.236, 237, 249.

50. World Population Datasheets, Population Reference Nureau Inc., Washington D.C., 1991.

51. Odell, P.R., *Oil and World Power*, Eighth Edition, Penguin Books Limited, Harmondsworth, Middlesex, 1986, pp.236, 248.

52. Ibid., p.250.

53. Ahrari, N.E., *OPEC, the hyper-pluralism of the oil market in the 1980's*, pp.272, 273.

54. Kubursi, A.A., *Oil Industrialisation and Development in the Arab Gulf States*, Croom Helm, London, 1984, p.41.

55. Al-Eyd, K.A., *Oil Revenues and Accelerated Growth (Absorptive Capacity in Iraq)*, Praeger Publishers, New York, 1979, p.32.

56. Op.cit., Kubursi, A.A., p.45.

57. Op.cit., El Mallakh, R., p.35.

58. Ibid., p.55.

59. Lorimer, J.G., *The Gulf Gazetter*, The Geographic Section, Part 6, 1906, Translated to Arabic and published by Doha Palace, p.1987.

60. Al-Jabbir, M.H., *The Human Geography of Qatar*, M.A. Thesis, Cairo University, 1976 (Arabic), p.142.

61. Dr., Al-Khyat, H., *The Population Balance for the Arabian Gulf States*, Qatar University, 1982 (Arabic), p.69.

62. United Nations, *The Population Situation in the ECWA Region (Qatar)*, United nations Economic Commission for Western Asia, Beirut, 1980, p.10-4.

63. Op.cit., Dr. Al-Kyat, H., *The Population Balance of for the Arabian Gulf States*, p.95.

64. State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, Annual Statistical Abstract, July 1991, 11th Issue, Qatar, p.12.

65. Interview with Mr A. Mostafa, Central Statistical Organisation, Doha, 1 January 1992.

66. Ibid.

67. Dr Al-Salem, F., Dr Dhaher, A., *Expatriate Labour in the Gulf*, Published by Al-Salasel, Kuwait, ca. 1981 (Arabic), p.25.

68. Personal contact in January 1992 (confidential).

69. Op.cit., Al-Jabbir, M.H., p.151.

70. Ibid., p.152.

71. Op.cit., Al-Khyat, H., *Population Balance for the Arabian Gulf States*, p.128.

72. Dr Quttub, I., Abu A'Yash, A., *The Growth, Urban Planning of the Arabian Gulf States*, Wukalat Al-Matbua't, Kuwait, First Edition, 1980 (Arabic), p.183.

73. Op.cit., *Population Situation in ECWA*, p.10-4.

74. Op.cit., State of Qatar, Presidency of the Council of Ministers, p.21.

75. Op.cit., *Population Situation in ECWA*, p.10-14.

76. Op.cit., State of Qatar, Presidency of the Council of Ministers, p.23.

Chapter Three

Land use in a hydrocarbon producing region: Dukhan

Figures

Tables

3.1 Aims of the Case Study

Dukhan is the only hydrocarbon producing region on mainland Qatar. It is located along the west coast of the peninsula. The oil-field was first explored during the period 1938-1940 by the Qatar Oil Company [QPC] who held the oil concession for the whole of onshore Qatar (Figure 2.2). Oil was first produced and exported from Dukhan in December 1949.

The main purpose of this chapter is to study the spatial impact of the hydrocarbon industry on land use in the Dukhan region and the indirect effects of the industry - many other economic activities have been attracted to the region because of the availability of good roads and other services provided to serve the oil industry.

It is proposed to examine here the effects of industry on the area's natural flora and environment; to determine whether the region has been turned over completely to the hydrocarbon industry, or whether this industry and other human activities co-exist equally; to estimate the area of land which has been affected by the industry and other land uses in the region.

3.2 Land Use in the Dukhan Region before the Development of the Oil Industry

The purpose of this section is to study the land use of Dukhan before the oil industry (i.e. pre-1940). If it is possible to ascertain how much land was in use in the region before the hydrocarbon industry was established, this will be of assistance in demonstrating the difference in land use before and after oil development and will enable assessment of the extent of damage and additional occupation created by the oil industry.

3.2.1 The Pre-history of the Dukhan Region

In the past, human settlement depended on whether the resources of a particular area provided the means for subsistence. Development of a community and a culture depended upon the resources available [(1)]. In 1967 Herr Holger Kapel conducted an archaeological survey in the area to ascertain the above. A British archaeological expedition conducted a similar survey which confirmed some of the findings of Herr Kapel. These archaeological excavations covered the whole of Qatar and showed that the western region - Dukhan - was the most populous region in Qatar's pre-historic period. Archaeological evidence shows that Dukhan's people engaged in a variety of industries in prehistory as shown in Figure 3.1. These industries included the manufacture of the first hand axes of the Early Stone Age; the heavier-bladed axes of the Late Stone Age; black arrow heads dated to the Middle Stone Age; scrapers from the Middle and New Stone Age; pressure flaking in the Middle Stone Age; and contact with the pottery making Ubied culture in the New Stone Age. Archaeological evidence has been found at the Cairn Field at Ras Abrouq, the Seleucid pottery site at Ras Uwainat Ali, fishing at Ras Abrouq, cairn burials at Mezruah [(2)] (Figure 3.1).

One initial effect of the oil industry in the region was the destruction of archaeological sites (Figure 3.2, A and B). It was impossible for the government to preserve these sites in a region dedicated almost entirely to the hydrocarbon industry.

The next section examines the more recent history of the region before the development of the oil industry.

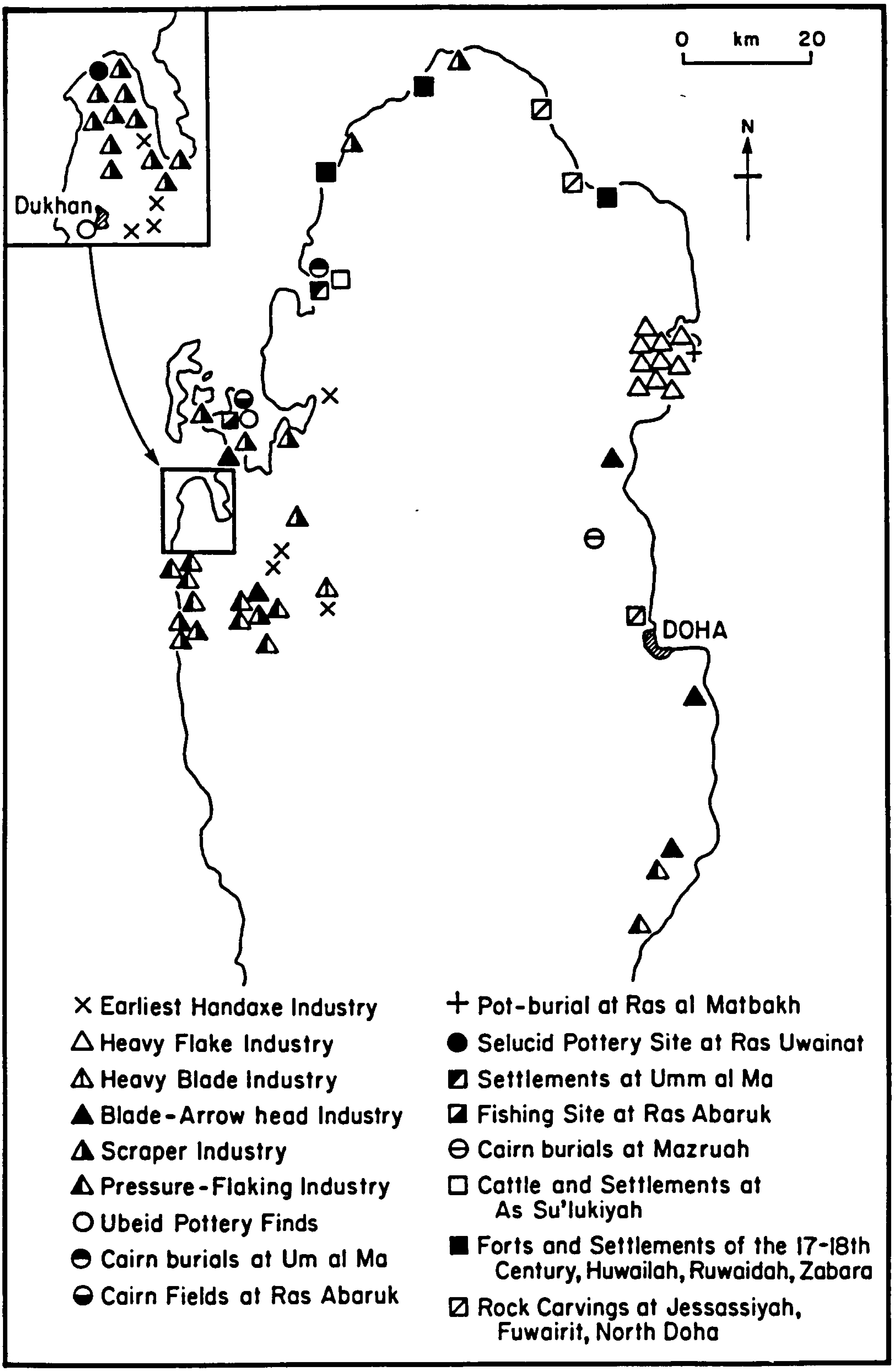


Fig. 3.1 Archaeological sites of prehistoric Qatar

3.2.2 Nomadic/Pastoral land use in Dukhan before the oil industry

Qatar's recent history shows that the importance of the western region declined and that of the eastern was much increased. Up to 1940 human settlement in Qatar was concentrated in the eastern region of the country, along the eastern coastline of Qatar, starting from Khawr al-Udeid in the southern tip of the peninsula, and extending northwards via Wakrah, Doha, al-Wusayl, Sumaysmah, al-Khawr, Al-Dakirah, al-Huwaylah, Fuwayrat, al-Ghariyah, and to Ruwais on the northernmost part of the peninsula. There were also settlements at Abu-Dluf and Zubara in the north west of the peninsula (Figure 7.2). The estimated population of the eastern coast of Qatar before 1940 was about 25,500 (3), comprising a majority of the population, mainly living in towns and villages.

The western and southern region of Qatar were very sparsely populated before 1940 being mainly inhabited by Bedouin tribesmen who grazed their flocks throughout the region in the rainy seasons. These tribes were mainly Bani Hajir, al- Murah, and al-Manaseer. The total Bedouin population in the region before 1940 was between 400 and 500 people. Fluctuations in numbers can be accounted for by the variation in rainfall - e.g. a good rainy season would support more animals and people.

The importance of the eastern region of Qatar in recent history is due to the variety of facilities it offered which acted as a magnet attracting many different kinds of people. Doha, the capital of Qatar, in the middle of the east coast offered people essential supplies and security against desert raids. The eastern coast is also the main area for pearl fishing and offers excellent marine transport facilities. It is better placed than the western part of Qatar, being nearer the Strait of Hormuz (discussed in Chapter 6, Section 6.2.1).

This description above of the towns in Qatar in the eastern region and their main activities shows why that particular region was more popular for settlement than the west coast before 1940.

The only land use in the western region before 1940 was grazing. Bedouin tribesmen grazed their livestock. However, this land use did not result in permanent settlements - except for the Bani Hajir tribesmen, those grazing their camels roamed the whole region rather than staying in any one place.

In the summer and dry seasons, the main places for Bedouins where water could be found were "*al-Jumayliah, al-Waynah, al-Qaiyah, Umm-Wishah, Umm Taqah and others*" (4). All of these watering places are in the eastern part of the Dukhan region. (Other watering places for Bedouins in the pre-oil era are discussed in Section 3.5.2).

3.2.3 The Physical Geography of the Dukhan Region

The physical geography of the region shows contrasting features. A series of hillocks of Eocene limestone extends parallel to the western coast of the Salwa Gulf. Parts of south-east Dukhan have an elevation of about 60 m, whereas other parts are 6.0 m below sea level. This low-lying land is mainly covered with Sabkha deposits (Naslat Umm-Hadidah) (Figure 3.2B).

The eastern part of Dukhan is a vast flat plain covered with rocky fragments. Small dry valleys intersect the plain (see Figure 3.2B) south east of al-Khursa'h. The topographical features of Dukhan continue into al-Hamelah in the form of hillocks

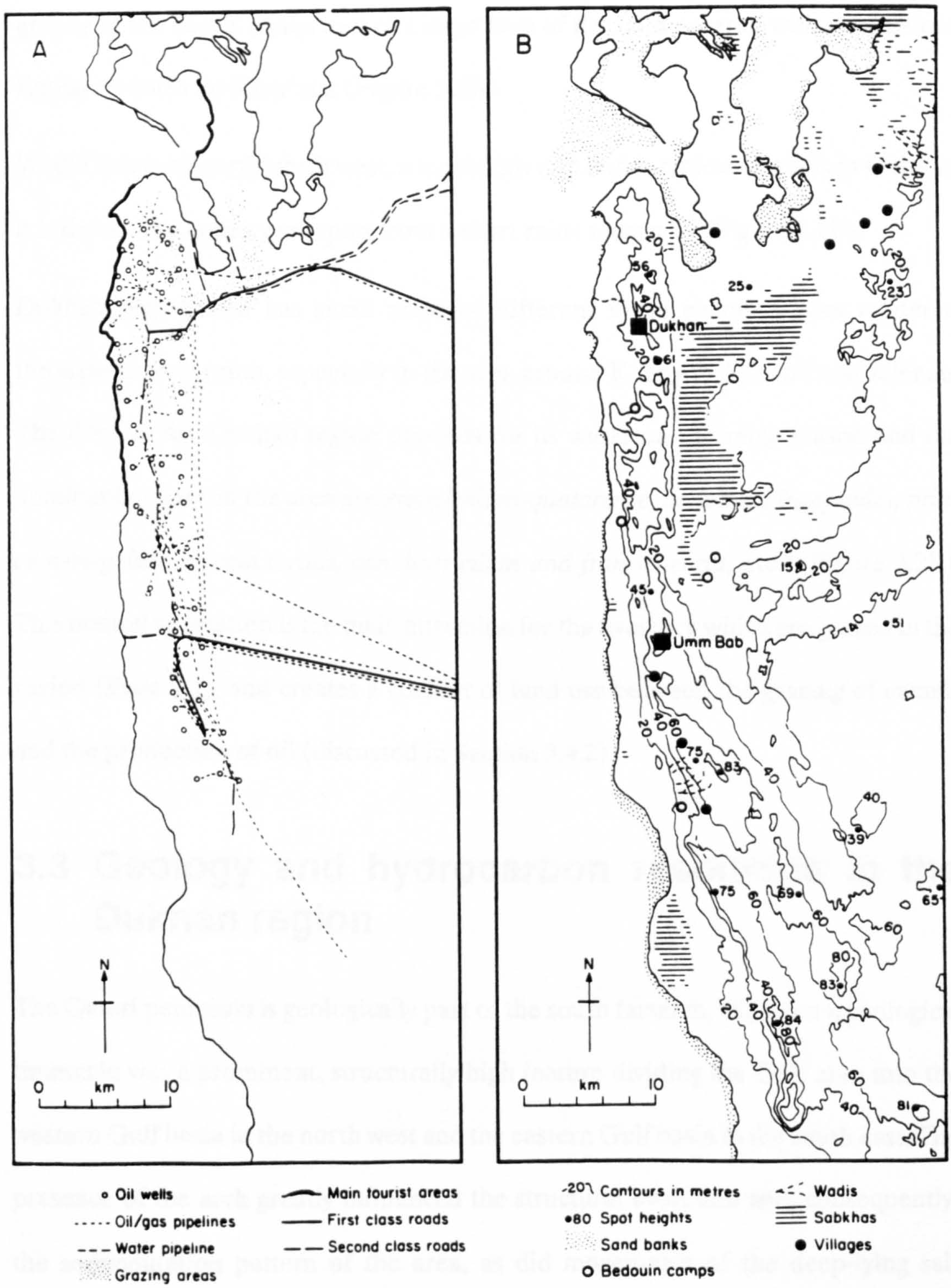


Fig. 3.2 Land use in the Dukhan oilfield region
A Land use; B Physical geography

(jabal) (Figure 3.2B) which average 80 m in elevation and extend parallel to the coast of the Gulf of Salwa, as in Jalehah and Magrin Umm-Tumaym. The physical geography of the east is comprised of a large area of flat land covered with depressions similar to north Al-Khar'ana (Figure 3.2B).

Wadi Diab runs north/north west, south/south east and is typical of wadis in Qatar as it is dry for the entire year apart from a short rainy season [5] (Figure 3.2B).

Dukhan region also has small areas of different floral characteristics scattered throughout the region, especially in the area around Khatiyah, Fahahil and Jalehah. The flora in the Dukhan region depends for its water on the rainy season and the dominant grasses in the area are *zygophyllum-quatarense, aeluropus ingopoides, princum-turgidum, acacia tortilis, conchrus cilian and fram-coeuria*, etc." (Figure 3.2B). This natural vegetation is the main attraction for the livestock which are grazed in the region (Plate 3.1), and creates a conflict of land use between the grazing of camels and the production of oil (discussed in Section 3.4.2).

3.3 Geology and hydrocarbon resources in the Dukhan region

The Qatari peninsula is geologically part of the south farsarch, which on a geological timescale was a prominent, structurally high feature dividing the Gulf area into the western Gulf basin in the north west and the eastern Gulf basin in the south east. The presence of the arch greatly influenced the structural evolution and, consequently, the sedimentation pattern of the area, as did movements of the deep-lying salt formations.

Plate 3.1: *The road between Dukhan and Umm Bab. Below is shown some of Dukhan's grazing areas, some camels and some oil elements.*

In the west basin area a large elongated salt pillow underlies the Dukhan oil-field. The Uwainit formation of the Middle Jurassic period shows a distinctive rhythmic layering of pack-wackstones and mudstones and in the Upper Jurassic period the most prolific oil reserves in the world were laid down - the Arab formation, consisting of limestones and dolomites with alternating anhydrite beds, was deposited. The most important reservoirs of Lower and Middle Cretacious are the Shuaiba, a chalky limestone, and Nahr Umr formations, and, at the base, Kharaib limestones.

There are three oil-producing reservoirs and one gas producing reservoir in the Dukhan oil-field, as will be explained below.

3.3.1 The No.3 limestone reservoir:

The No.3 limestone reservoir is an anticline structure at a depth of around 1300 feet. The formation is an astratified sequence of limestone and dolomite with a thickness of 85 feet, average porosity of 18%, average permeability of 30 md, dip angle range of 3.8°, average oil viscosity of 0.5 Cp and an average oil gravity of 37° API (Figure 3.3A).

3.3.2 The No.4 limestone reservoir:

The No.4 limestone reservoir lies below the No.3 reservoir, the two limestone strata being separated by anhydrite, with an oil column around 700 feet. The reservoir consists of limestone and dolomite. It is about 185 feet thick with average porosity and permeability of 19% and 70 md respectively. The reserve has an original gas cap and an active water aquifer (Figure 3.3B).

3.3.3 The Uwainate Reservoir

This reservoir lies at a depth of around 700 feet. It consists of 1800 feet of crystalline compact limestone. The upper 140 feet has an average porosity of 18% and an average permeability and low porosity in the bottom 40 feet. The reserve contains a relatively thin oil rim at 270 feet, with an overlying gas cap [6] (Figure 3.4A).

3.3.4 The Khuff Non-Associated Gas Reservoir

The Khuff reservoir lies at an average depth of 10,000 feet below the Dukhan oil-field. The Khuff formation is about 1800 feet thick and productive only in its upper strata in the Khatiyah and Fahahil areas of the oil-field. The Khuff reservoir is small by

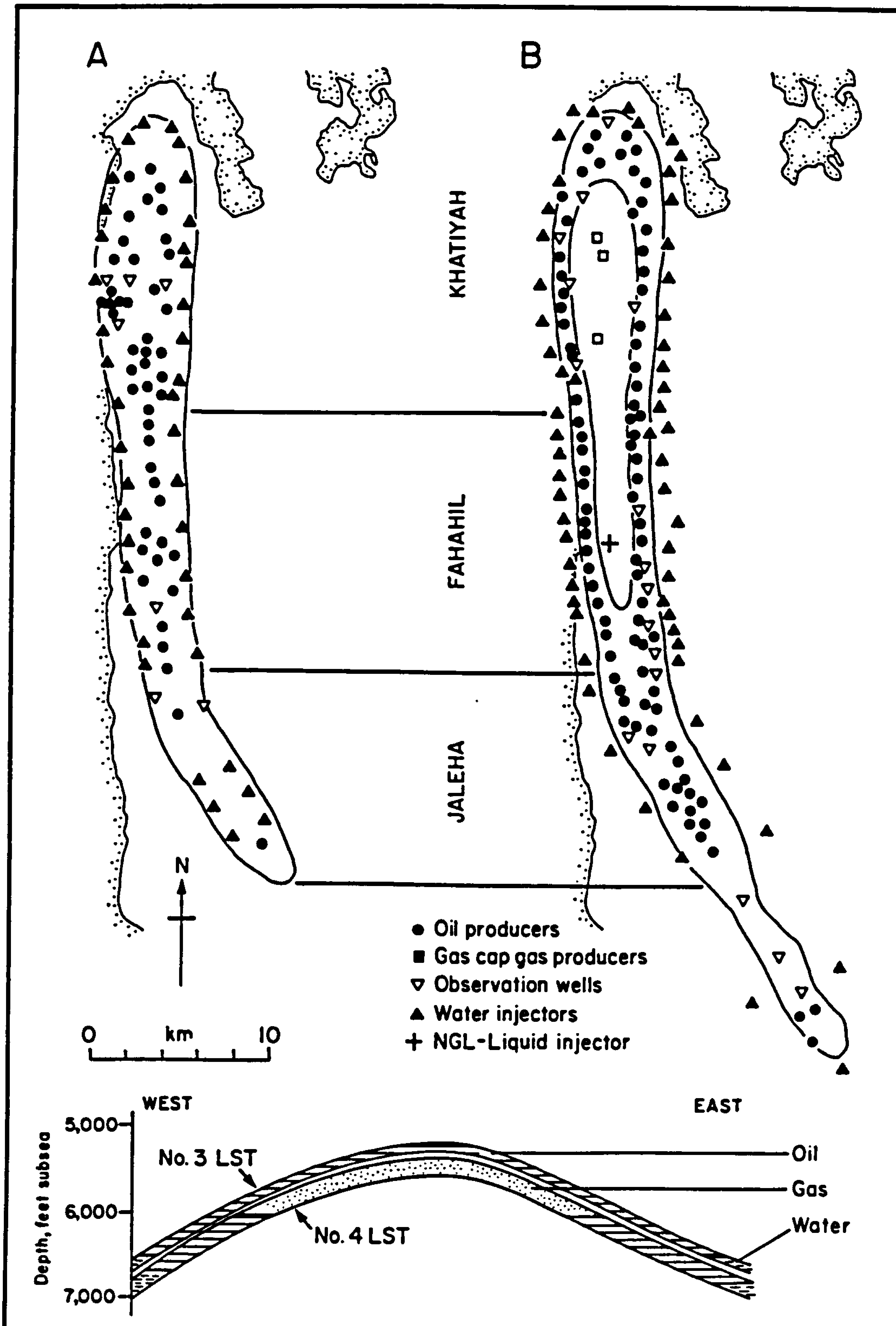


Fig. 3.3 The geological structure of Dukhan oilfield
A No. 3 Limestone Reservoir; B No. 4 Limestone Reservoir

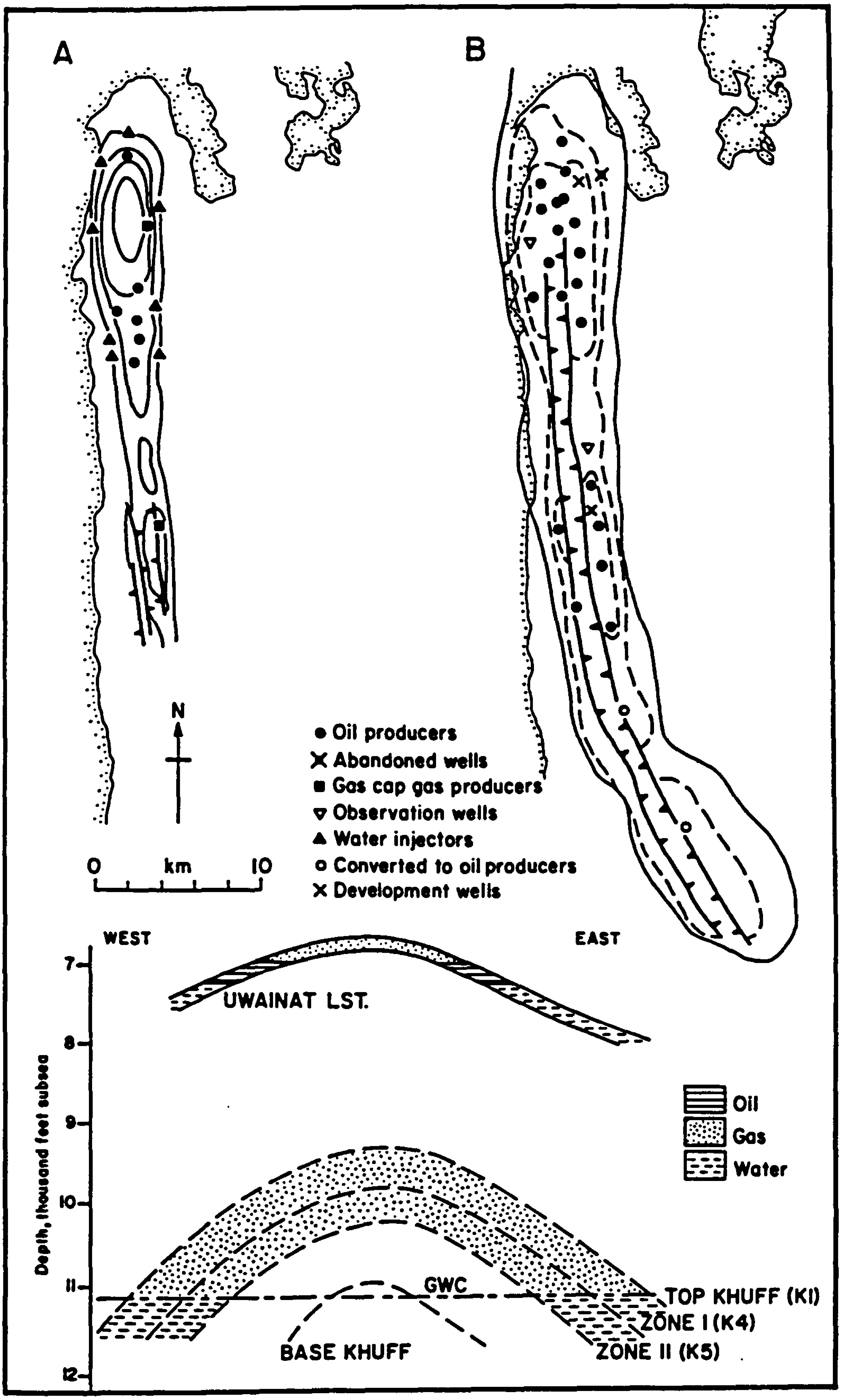


Fig. 3.4 Dukhan oilfield : geology
A Uwainat Limestone Reservoir; B Khuff Reservoir

Middle East standards, being comparable to a medium-size reservoir in the European North Sea (7) (Figure 3.4B).

The geology described above is reflected in the land use of the region, as the oil elements on the ground connect with the oil reservoirs underground (shown in Figures 3.3 and 3.4 and discussed in Section 3.4.1).

3.4 Analysis of land use in the hydrocarbon industry in Dukhan

The purpose of this section is to study the land use of the area which has been directly occupied by the oil industry (i.e. the oil industry itself and the various services which serve the industry), and their effect on the land.

3.4.1 Elements of Oil and Gas

The Dukhan field (oil and gas) covers an area approximately 70 km by 6 km i.e. the geographical area of this field is about 420 km^2 (see explanation in geological section). Although the Dukhan field is small by Middle Eastern standards, it is the largest in Qatar and is the only onshore oilfield in the country and it takes up a sizable proportion of Qatar (Figure 3.5). Comparison in size between Dukhan oil field and other Middle Eastern fields shows the intensity of land occupation by oil elements in the Dukhan field in comparison with, for instance, the Asab field. However, Dukhan oil field is considerably larger than any western European onshore oil field, the largest of which is the Wytch Farm oil field in southern England, the geographical extent of which is only 40 km^2.(8)

The function of the oil and gas infrastructure in Dukhan is to exploit the hydrocarbon resources of the field. To convert the raw material from the ground into a product ready for domestic use or export, various processes must take place. The Dukhan field houses various installations required for oil and gas processing. The area occupied by the oil infrastructure can be calculated by adding up the area occupied by each of the five elements below which comprise the industry in the Dukhan fields.

1. Hydrocarbon wells

In 1989/90 there were about 380 wells scattered throughout the region, and for the purposes of this study we can divide these into three groups:

- oil producing wells - of which there are about 141;
- gas producing wells - totalling about 20 wells;
- wells for water injection and other hydrocarbon uses - totalling about 219 wells. (Table 3.1)

The above wells, representing the first direct land use of the hydrocarbon industry in the region, are scattered around the region. Surprisingly, they occupy an area of 0.34 km^2 (Table 3.1), or approximately 0.08% of the Dukhan region. For comparison, there are about 248 wells in Asab oil field of Abu Dhabi (U.A.E.), occupying an area of 0.22 km^2, or about 0.02% of the Asab field geographical area.[9] This shows that wells in the Dukhan field occupy relatively more land than wells in the Asab field. The reason for this is that the Dukhan field is older than the Asab field, the latter being discovered only in 1965, and in order to keep the rate of production of each field the companies have to drill new wells continuously (discussed below). Secondly, the geographical extent of the Asab field is about 768 km^2,[10] which is much larger

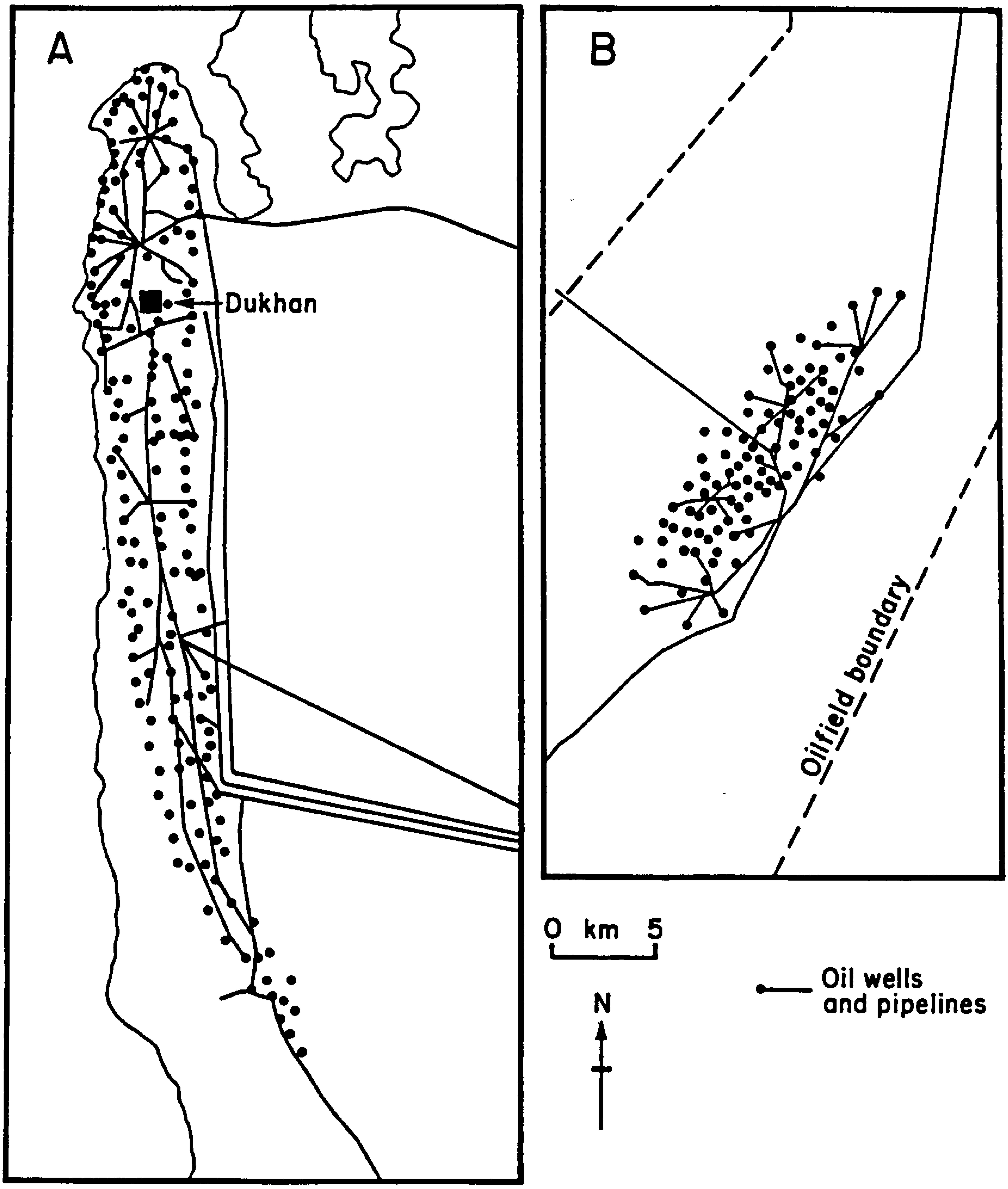


Fig. 3.5 Comparison of land use patterns in Dukhan (A) and Asab, Abu Dhabi (B) oilfields, 1990

than the geographical extent of the Dukhan field (shown above). Figure 3.5 shows that the intensive land occupation by oil elements in Dukhan is much greater than that for the Asab oil field.

Table 3.1 The Oil Elements in Dukhan region:

Elements	Area occupied by km^2	% of Dukhan region
wells 380	0.34	0.08
pipelines length (204.5 km)	0.41	0.1
total	0.75	0.2

Sources: 1. Author. Field work on 21st May 1990.

2. QGPC onshore operation (Dukhan oilfield) official maps.

In fact, the total area affected by each oil well in Dukhan is much larger than the area directly occupied. This is shown in Plate 3.2. There is a fence around the oil well, a fence around the water injection well, the oil well discharge pit, usually for the chemical discharge from the oil well (the two connected by pipeline), the guard's room, and all the land in between these elements, which has often been substantially polluted with oil (Plate 3.3). This shows that whilst the well itself occupies only a limited area, the oil elements in the region occupy a greater area, and the direct and indirect influence of the operation occupies a sizeable piece of land.

2. Pipelines

The second major land use in the Dukhan region is occupation by pipelines. The pipeline network transfers the hydrocarbon products from the wells to the pumping and degassing stations (Figure 3.2A) and for further hydrocarbon processing. From

Plate 3.2: *This shows the area of an oil well in Khatiyah, a water injection well and the guard room.*

Plate 3.3: *The spatial impact of an oil well after an accidental leakage. This commonly occurs.*

these stations pipelines carry the hydrocarbon products from the Dukhan field in the west of the country to the east from where it is exported (Figure 4.1).

On first analysis the pipelines on the Dukhan field appear to have little effect on the land. However, if the total length of pipeline throughout the field (Table 3.1) is calculated, its total length is 204.5 km which occupies an area of 0.41 km^2 (Table 3.1), which is about 0.1% of Dukhan. The pipeline network constitutes the second major land use in the region [11]. The pipelines affect other activities in the region, e.g. the camels cannot cross the pipelines for grazing from one area to another (discussed below, Plate 3.4).

Plate 3.4: *Camels grazing north of the pipeline in the Dukhan region. They cannot cross to the other side because they are restricted by the line.*

3. Pumping, Degassing and Booster Stations

Pumping stations constitute a third element of major land use in the Dukan field. They carry out the processing operations which convert the raw materials. Figure 3.6 shows the total land occupied by pumping stations. Each pumping station is complete in itself and able to process the oil.

The different stations in the region are as follows:

- Seven degassing stations in the Dukhan region ranging from that in North Khatiyah to Jalehah in the south;
- Two pumping stations - one in Khatiyah and one in Fahahil (Figure 3.6).
- The Umm-Bab booster station at which the oil and gas is collected before being exported by pipeline to Umm Said, the oil terminal and industrial town, and to Doha for power stations and water distillation plants on Qatar's east coast [12]

The above occupy 0.5 km^2 of land which is about 0.12% of the Dukhan region (Table 3.2). Although the direct land use of these stations is relatively small, their indirect effect is much greater. For security reasons nobody is allowed to approach these stations which means that a lot of land surrounding each station is needed to provide a security zone and a radius of land up to 200 m can be taken up providing this zone. There is no set limit for the security zone, however, and, usually, a radius of about 100 m is designated - security zone areas are agreed by the oil company and the police who have responsibility for security. The area of the zone is subject to change in cases of state alert, e.g. the Gulf Crisis which started in August 1990 when Iraq invaded

Kuwait. Such crises can mean the security zones are even wider than 200 m and thus more land is used or more land will be dedicated for the security zone.

Table 3.2 Land occupied via pumping station and degassing station

Elements	Area occupied km^2	% of Dukhan region
Khatiyah North degassing station	0.03	0.007
Khatiyah main degassing station and pumping station	0.18	0.04
Khatiyah South degassing station	0.03	0.007
Fahahil North degassing station	0.023125	0.0055
Fahahil main degassing station and pumping station	0.115625	0.03
Fahahil South degassing station	0.025	0.006
Jakhah degassing station	0.07135	0.02
Umm Bab booster station	0.025	0.006
Total	0.5	0.12

Sources: 1. Interview with Mr. H. Al-Tamimi (senior staff) in QGPC (Dukhan) on 21 May 1990.

2. Measured by Mr. H. Al-Tamimi at Dukhan on 20 November 1990.

3. The Measurement checked by Arthur Corner at the Geography Dept. Durham University on December 3rd 1990.

The second effect of these stations in the region is their effect on the environment. In an interview on 21 May 1990, Mr H. Al-Tamimi said "*as these stations are very noisy, sound pollution is high, and the workers must wear cotton earplugs. A second environmental problem caused by these stations is that of oil and chemical refuse dumped in pits close to every station*" (13) (Figure 3.7). These materials do not readily break down organically, and therefore pose a major pollution problem - threatening to destroy the natural vegetation in this area. In addition the pollution could seep into the

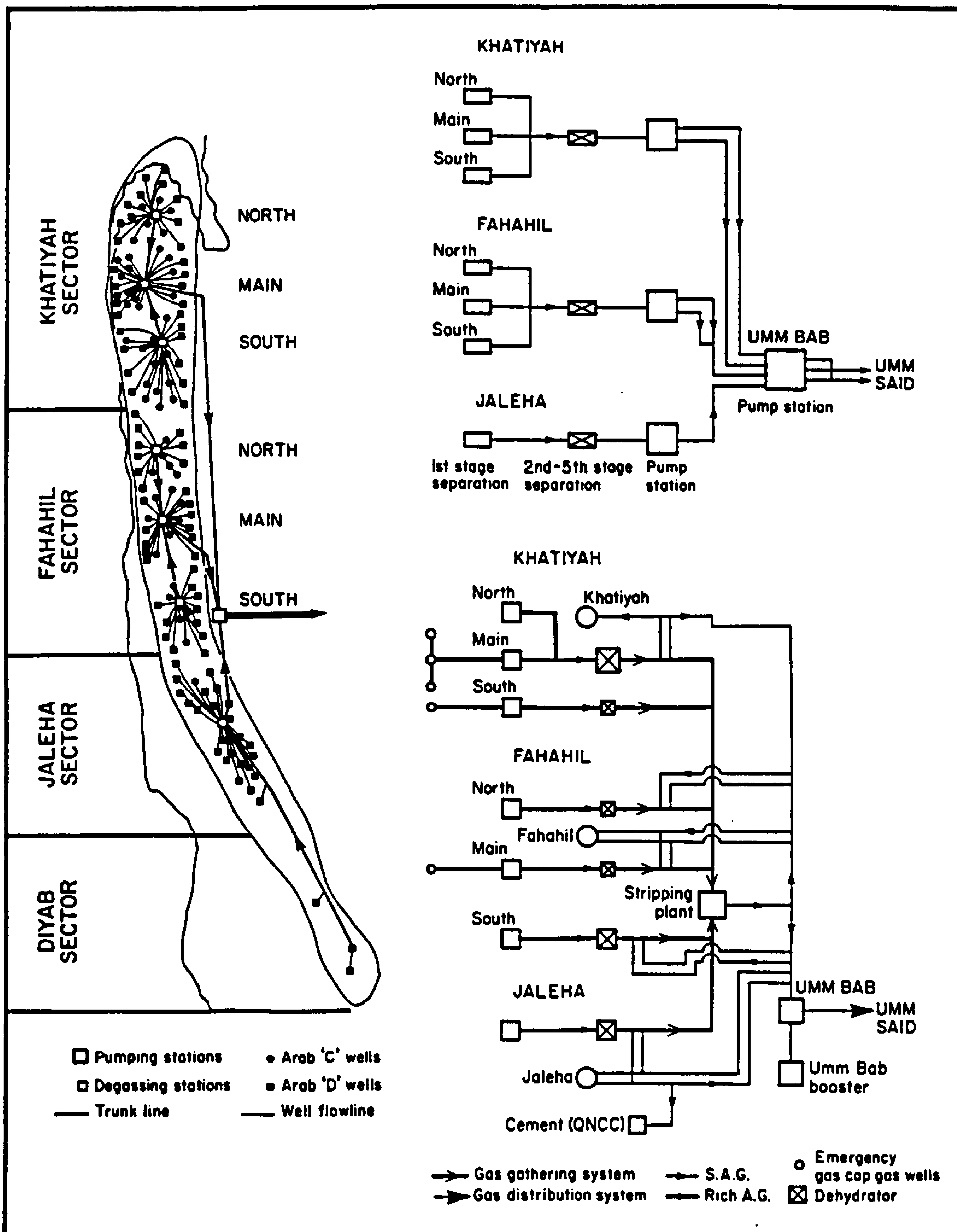


Fig. 3.6 The oil elements in Dukhan Field and oil and gas flow charts

underlying strata causing pollution of the underground water table. There are usually very strong odours in the areas adjacent to stations because of the dumped refuse.

Further, as Dukhan has a very hot climate, there could be some danger that dumping of chemical waste in open pits exposed to the sun might produce evaporation of chemicals which in turn would cause a certain degree of air pollution. This matter deserves further scientific investigation.

Whilst, as we have stated earlier, the direct land use of stations is only approximately 0.5 km^2 (Table 3.2), because there is indirect land use - of security zones, chemical and other dumps, they occupy a much larger area - approximately 3-4 km^2 and this area is even larger if we take into account the environmental effect of the stations - especially that of pollution.

This section concludes with the results of what fieldwork revealed of land use of the area. Whilst direct land use is only about 1.25 km^2 (about 0.32% of the Dukhan region) (total of Tables 3.1 and 3.2), if the indirect land use and the amount of land required for future development of the hydrocarbon industry is also taken into consideration, much more land is occupied and/or affected. Taking both direct and indirect land use into consideration, the effect of the hydrocarbon industry on the area is very considerable.

The lifespan of the field is about 25 years at the present rate of production (the field has reserves of approximately 1.9 billion barrels of oil and 718 billion cu ft of non-associated gas) [14]. To continue production at the present rate new wells needs to be sunk continuously. This means that the effect on the land is growing all the time. In 1975 the area occupied by wells was only about 0.1 km^2 but by 1979 wells occupied

0.18 km^2, and in 1990 0.34 km^2. As the company continues to drill new wells, the field becomes increasingly exhausted of its fossil fuels, and drilling and other operations become more complex. More and more wells will be needed to keep up the present production rate, and therefore the effect on the land is likely to be more widespread in the future. It is estimated that by the year 2000 the direct land use of the oil elements will be about 2 km^2 - about 0.48% of the Dukhan region.

The effects of the hydrocarbon industry in the region can be seen - not only in the visible signs of the plant and machinery, but also in the signs of environmental changes created by the industry in the region. During fieldwork on 15 June 1990 it was observed that the flame from the plant could be seen 16 km away from the Dukhan region in the daytime and, at night, this distance can be doubled. A subjective view is that the amount of fossil fuel and chemical waste produced and dumped by the industry in the field could cause a certain degree of air pollution. During fieldwork the smell of the hydrocarbon was observed to be strong, especially on calm days and when humidity was high. As well as the region affected by soil pollution (as described above), there is also pollution from accidental leakage of pipelines, wells (Plate 3.3) and also shortcomings in maintenance can cause oil spillage, both of which damage the land [15].

The impression given by this section is that the Dukhan region is dedicated to the hydrocarbon industry, and whilst the direct land use is relatively small, the effect on the region as a whole is more far reaching. In the next section, activities linked directly with the hydrocarbon industry will be studied.

3.4.2 The Infrastructure of Dukhan Town

The purpose of this section is to study the service industries which have been attracted to the region by the hydrocarbon industry, some of which are linked directly, and some indirectly with the industry. These also occupy land. At the end of this section I shall try to estimate the amount of land occupied by these services. This is not too difficult to prove as none of these activities below existed in the region before 1940 when operations first began in the oilfield. (The other indirect land use occupation is discussed in Section 3.5.2).

With the beginning of operations on the oil-field in 1938/40, a residential area was established in Dukhan. The oil company met with no difficulties or opposition and could choose to establish wherever it wanted as the government already owned the land. The company had already received government permission in the 1935 Oil Concession Agreement (see Chapter 2, Article 6 of the 1935 oil agreement), whilst QPC easily chose their sites in the region for residence and other oil operations, in comparison the situtation in Western Europe is quite different, for the land is in intensive use. For instance, Wytch Farm in southern England started production in 1979. Since the operation began, BP has been in conflict with many other land use activities e.g. (i) first well was drilled in a tennis court; (ii) local residents had visions of their benign untrammelled acres of countryside, with its precious heathlands and saltmarshes, intimate little rivers and secret creeks, and its chocolate box villages, being despoiled; (iii) Naturalists and conservationists feared this rural treasure chest of nature reserves and the habitat of hosts of endangered wildlife species, would be put under seige. The holiday industry and the local fishermen worried over the effects on their future livelihood. The above points sometimes led to court action, e.g. BP has received the go- ahead from Dorset County Council to boost production to 60,000 b.d. but to do so it requires additional rights to bore more wells and extend its gathering station on the 4,700 acre Rempstone estate.

BP's counsel, Michael Essayman, told Mr. Justice Peter Gibson that the company had been unable to obtain those rights by negotiation with estate trustees. As a result, it is now asking the Court to make an order granting the rights under the Mines [Working Facilities and Support] Act 1966.(16)

The evidence above shows the good fortune of QPC in being able to choose their various sites for residency or oil operations without any conflict as Dukhan has no permanent settlement. Additionally, the above Article is working in QPC's favour, and the case of Dukhan could almost be applied to other oil fields in the Gulf.

As most land in Qatar is flat, choosing a site posed few problems. The company chose the residential site near the first well drilled in Dukhan in the 1938/40 period. The first residential area was more of a camp than a permanent settlement but it was here that the town of Dukhan was to grow (Figure 3.7). There was no difficulty in constructing the camp as much of the equipment needed was already available to QPC. The example of oil companies choosing to establish their administrative base on the site where the first prospected for oil is a common phenomenon in the Gulf region, e.g. the geologists of Aramco in Saudi's eastern province in September 1933 found a domed geological structure in a hilly area, a feature which indicated the possible presence of oil. They called the structure Dammam Dome. Owing to the structural similarity of the Dammam Dome to the one already yielding oil on Bahrain

Island, and that led the geologists to establish their first camp near Jabal Dahahran.(17) The camp at Dahran was then developed into Dahran City which boasts not only an international airport, but also one of the Middle East's most famous universities: King Fahd University. Dukhan has not become a large city like Dahahran for several reasons: (i) Dahran City serves an area which has the worlds richest oil reserves; (ii) Saudi Arabia is a large country in which daily commuting by employees and labourers is sometimes impossible; (iii) the oil towns in Saudi e.g. Dammam and al- Khobar in 1951 were developed through co-operation between the Saudi government and Aramco in a project called the Private Ownership Program in the oil towns. The above factors contribute to the steady and organised growth of oil cities in Saudi Arabia,(18) and the growth of the above cities is also reflected in attracting the Saudi manpower from their regions, e.g. Ihsa and Qatif Oases, as well as the decline of the domestic manpower in agriculture.(19)

However, in Qatar, several factors have limited the growth of Dukhan Town: (i) Dukhan is reasonably close to Doha (only 80 km away) and therefore the local manpower can commute daily and some of them weekly as discussed below; ii) there is no private land ownership in Dukhan Town; (iii) Qatar is a small country and the influence of Doha is very clear (discussed in Chapter 6, Section 6.2). The growth of Dukhan Town is discussed below.

The town evolved from the company camp. The original site was surrounded by a fence for security reasons and to prevent livestock entering the camp. This original fenced area was dedicated wholly to providing services for the QPC (see Figure 3.8) and even government offices were within the fenced enclosure, serving both the company and the company's employees. The fenced area consisted of eight residential zones, each housing a different category of employee (Plate 3.5), stores and work-shops, and the various administration buildings needed to supervise and operate the industry. Also included within the fence were a wide range of social and welfare facilities including hospital, two English schools, the Dukhan Club, a cinema, football pitch, basketball and volleyball courts, a golf course and other recreational activities. There were also within the enclosure two mosques, a church, military barracks, a helicopter airport and government buildings (Figure 3.8).

The comprehensive nature of the facilities provided meant that the company camp in the region covered a comparatively large area 3.3 km^2 (Table 3.3) which comprises almost 0.8% of the Dukhan region. The creation of a camp for company personnel also meant that, in fact, the infrastructure was laid down for a town and the camp eventually became the town of Dukhan. As well as roads, sewage, and all the facilities mentioned above, the gas supply from the Dukhan field provided energy for Dukhan power station, and from al-Sunu provided the other essential for a community - water. In an interview on 15 May 1990, Sheikh al-Thani said, "*before the company occupied the land enclosed in the fenced area* (discussed above), *there was no human settlement in this particular part of Qatar*".[(20)] This confirms the writer's findings that the foundation of the settlement in Dukhan was made by the QPC (Plate 3.5).

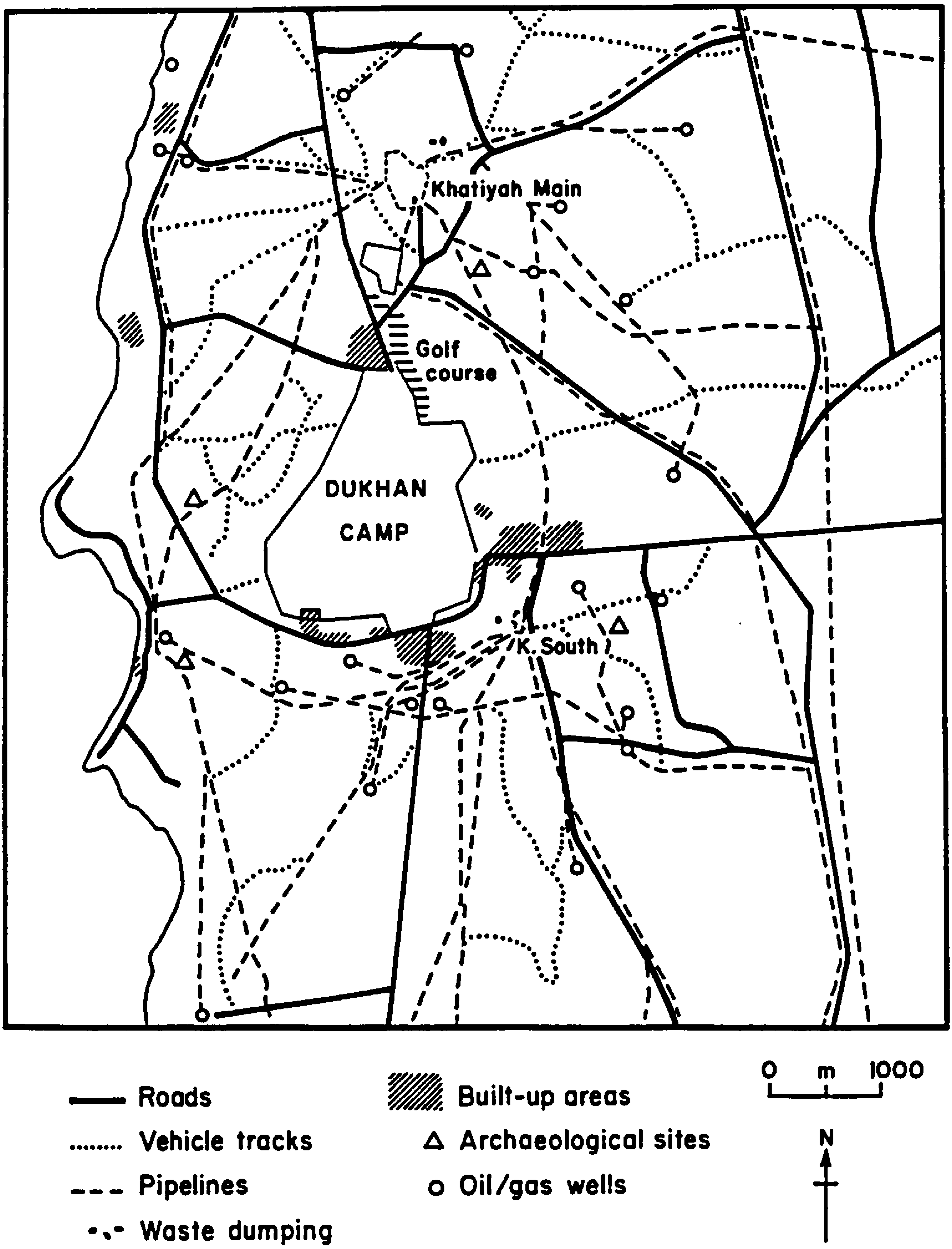


Fig. 3.7 Dukhan town land use

Table 3.3 Land occupied by Dukhan Town and regional infrastructure

Area	Land occupied km^2	% of Dukhan region
Dukhan Town	3.3	0.8
Dukhan Town outside the fence	3.0	0.7
Water pipelines	0.012	0.003
Dumping areas	0.05	0.012
Total	6.362	1.51

Sources: 1. Interview with Mr. F. al-Hajiri at Al- Jumayliyah Municipality, on May 31st 1990.

2. Field work by author, between the 1st and the 15th of June 1990, and 27 December 1991.

3. QGPC's official maps and reports about Dukhan region.

The camp had been planned to accommodate only the company's own personnel, and it was soon found that it could not provide enough accommodation and services for the personnel of contractors of the company and temporary labourers. This resulted in land occupation outside the camp (Figure 3.7) outside the control of the company. The suburb of Khatiyah in eastern Dukhan camp is an example of this unorganized settlement (Plate 3.6). It grew up along the Doha Road, near the camp's main entrance and was created by Qatari and foreign labourers: some permanent employees, engaged in the hydrocarbon industry; some temporary, settling there. Thus the first expansion outside the fence was to accommodate the increasing number of workers engaged in the field (Figure 3.7).

The increasing oil revenues in Qatar in the 1950s enabled the government to consider the development of the region as a whole and as part of this development the social welfare of the scattered tribes of Bedouins in this region was also considered. As the town of Dukhan was by now well established it was made the administrative centre

Plate 3.5: *Shows the QGPC's senior staff residence in the camp area, and the area surfaced by oil on the golf course.*

of the region and given obligations and responsibilities for the whole region, including other settlements.

The government recognised the existence of the part of the town growing outside the fence by building two schools outside the perimeter, one for boys and one for girls. Some government offices, military and police stations were also sited outside the perimeter. The expansion attracted other services such as shops, laundries, banks, petrol filling stations, etc., to the area, both inside and outside the fence. In the area to the north of the perimeter fence offices, contractors' residences and tanks of oil companies were located, and in the south beyond the fence there were contractors'

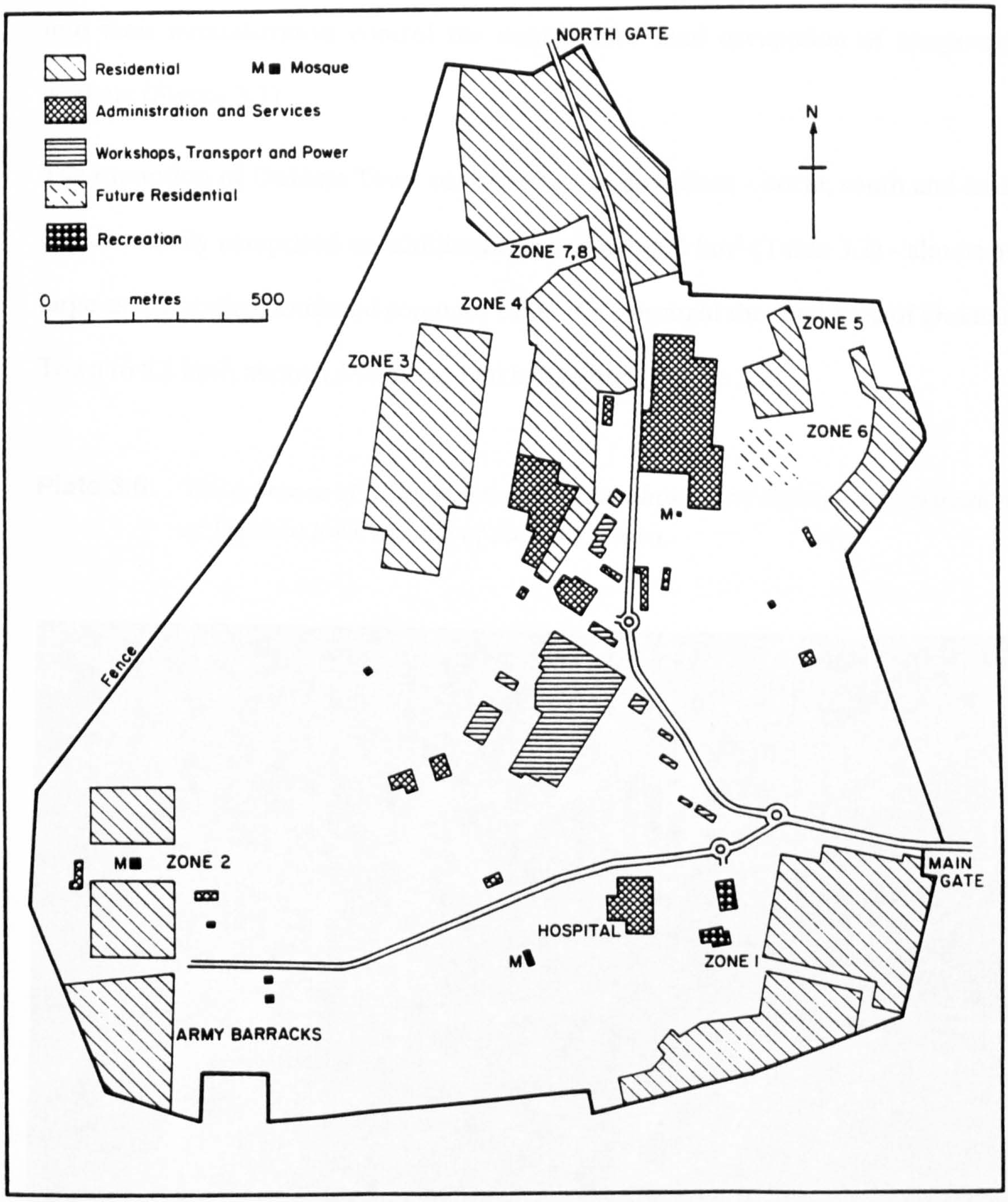


Fig. 3.8 Dukhan town: QGPC's fenced area

offices, residences, a government quarter, sewage treatment plant, abattoir and the sailing club. The intervention of the government and their siting of government agencies such as the police, military outside the enclosure had the effect of drawing into their administrative control the unorganized land occupation of temporary workers (Figure 3.7).

The expansion of Dukhan Town continued in all directions - north, south and east, and eventually comprised an additional area of about 3 km^2 (Table 3.3) - almost as large as the original enclosed company camp. This brought the total area of Dukhan Town to 6.3 km^2, about 1.5% of the Dukhan region (Figure 3.7).

Plate 3.6: *The entrance of Dukhan town. The area shown here is the eastern extension of Dukhan town outside of the fenced area.*

Whilst the amount of land occupied by the town of Dukhan is relatively small, the creation of the town had a great effect on the land and on the environment of the region. The town refuse dump, located beside southern Zikrit Jetty (built in 1939/40 for supplies of food and fresh water from Bahrain for the company employees and abandoned in the mid-1960s) has two dumping areas and occupies an area of about 0.02 km^2 (21) but the indirect occupation is much bigger - the smell in the area around the refuse dump is so bad that much of the land around it is unusable. Flies and insects attracted to the refuse also make the area too unhealthy for it to be used for residential or commercial purposes.

During fieldwork on 29 December 1991, a gas pipeline was noted which had been laid right up to the main dump area of Dukhan southern Zikrit Jetty. This gas pipeline is used to supply the fuel for burning the refuse (Plates 3.7 and 3.8) in order to assist in reducing the smell and the insects. About 2.0 km east of the above dumping area is the second dumping zone. The land between these two could hardly be developed as a residential area or for any other permanent human usage as the dumping areas widely affect this land. The result is a large piece of waste land in Dukhan.(22)

There are other dumping areas in Dukhan region. Two can be found on the road to the Old Dukhan Airport (southern Doha, Dukhan Motorway). The first of these is still in use but, despite the fact that it occupies a considerable amount of land, its effect is less than the above. The second dumping area is on a small hill about 0.6km south of the first and has been abandoned since 1967. However, the effect of dumping can still be seen, as it has given the hill a scattered black colour, changing the beautiful landscape of the hill to an awful view.

Plate 3.7: *The main dumping area of Dukhan town, North Khatiyah. Here is where some industrial refuse is dumped, and the smoke from burning unhealthy materials. The energy is provided by gas pipeline from the field.*

Plate 3.8: *This shows some camels grazing in a refuse area which sometimes results in their death.*

The fifth dumping area is located south east of the QGPC's camp. This is the oldest in Dukhan, first being used in 1940. Although the urban dumping materials should now be taken to the above main dumping area, this one is unfortunately still in use, but with less of an environmental effect than the main dump, and is still an eyesore.

The above dumping areas occupy a piece of land about 0.05 km^2 (Table 3.3). Of course, they indirectly effect a larger area, as discussed above. The other eyesore in Dukhan is the contractor's companies in Khatiyah outside the QGPC's camp, which does not comply with the dumping collection system. They dump some of their refuse in the area adjacent to their camp, which has a bad environmental effect on Dukhan town. This raises the question of whether there should be an independent municipality for Dukhan. Jumayliyah Municipality cannot adequately operate and monitor Dukhan town for two main reasons: 1) Jumayliyah is quite a distance away (about 20 km north east) from Dukhan Town; and 2) The municipality has not enough facilities to protect and monitor the region, although they have good regulations (discussed below).

The above main dumping ground area also receives industrial refuse, which has been effective in destroying not only the area of its site but the surrounding area by pollution. Industrial materials dumped here include oil and chemicals. The effects of this kind of dumping is not only in the area directly occupied but also the natural vegetation of a large area around it has been destroyed, and the natural landscape damaged. We can say that its effect is similar to that discussed in Section 3.4.1..

Like the urban refuse dump, that for industrial waste smells so bad that no-one can work or live in the area and a subjective impression is that there is a degree of air pollution also. In an interview with an ex-employee of QGPC in October 1990, the employee said [about the period 1978-87], "*when we undertook an operation such as drilling wells, a lot of industrial refuse was created. Sometimes, for whatever reason, it was inconvenient to transport this to the main dumping area so we just dug a hole in land nearby and buried the refuse in it*".(23) This comment suggests that intermittent dumping occurred all over the land as wells and other operations connected with the industry multiplied through the region. The effect of dumping, therefore, may well be widespread, affecting the natural flora and fauna in the region.

The study showed that the region is strongly influenced by the hydrocarbon industry. As far as pollution is concerned, the problem has been exacerbated because the government allowed the company complete freedom to develop the industry in the region. The government also instructed the municipal government to give priority to the industry. Accordingly, the municipality endorsed the government's attitude of laissez faire. As a municipal representative testified, "*since 1985 the government ordered that priority of land use be given to the oil industry and they are carrying out this government order.*" (24) It is planned that, sometime in the early 1990s, the residential area of al-Khatiyah (eastern Dukhan camp - Doha Road and the site nearest the entrance of the camp) (Figure 3.7) should be cleared, allegedly because the company want to drill wells in that area, and to enhance the aesthetic appearance of the camp entrance (Plate 3.6). It is expected that instructions will be given in the near future for the contractors located there to evacuate the area (Figure 3.7). In return the municipality will give the contractors an alternative plot of land on the western side of Dukhan - Umm Bab Road (Figure 3.2A) for the relocation of their premises (25). Thus, it appears that when the industry wants a certain piece of land, it is granted it regardless of existing use by others. This confirms that priority is given to the hydrocarbon industry with regard to land use in the Dukhan region. When the oil industry wants land, it is the municipality which compensates the people, demonstrating government involvement and backing for the industry.

The brief history of Dukhan Town given above demonstrates that the town was created wholly to serve the needs of the hydrocarbon industry and that, despite the independent growth of the town to serve other activities, the priority is still the industry.

Expansion of the town has also brought problems - new facilities are needed and existing services are under pressure, e.g. it appears that with increasing demand in the near future, the power station inside Dukhan camp will no longer be able to cope with the demand for electricity. The government plan to build a new power station and a water distillation plant, both located in the coastal area to the north west of Dukhan camp. Commissioning of these is expected in 1992 [26]. It is also expected that the existing facilities laid down for the original QGPC's camp will also be unable to cope with the needs of the expanding town in the near future, forcing the government to provide new services or expand existing ones. This means that whilst Dukhan town now occupies 6.362 km^2, 1.51% of the Dukhan region (Table 3.3), the continuous expansion will increase the proportion of land given over to the hydrocarbon industry, both in terms of industrial premises and urban and commercial land use attracted by the industry's presence.

The municipality thinks that the environmental effect in Dukhan town in general is not wholly bad. The representative of the municipality, in interview, commenting about the municipality said: "*they are very conscientious about keeping Dukhan tidy as far as possible,* *and have introduced fines for anyone found dumping refuse in unauthorised areas. The amount of the fines reflects the amount of damage caused by dumping."* (27)

However, fieldwork in May-June 1990 and in December 1992, revealed a contradiction between what the municipality claim and reality.

Looking at the situation as a whole, despite the efforts of local government, the environment is deteriorating due to the creeping effects of pollution. Accidental leakage alone threatens the environment and, as demonstrated above in this chapter, whilst the actual area occupied by industry and its services are relatively small (7.612 km^2), the effects of the pollution it creates covers a much larger area (total of Tables 3.1, 3.2 and 3.3). The proposed eviction of the unauthorized settlement around the perimeter fence at the main entrance to the town may enhance the town's appearance but destruction of the land has already taken place, and is likely to affect the natural shape of the area for a long time to come. It may be that the natural landscape has been permanently destroyed. Further, the relocation of these activities and land-use will now affect another area. Permanent features of the town, such as the water tanks built on the highest part of the camp (where beautiful trees should perhaps be planted instead), affect the aesthetic appearance of the landscape, and are not likely to be sited elsewhere to improve the appearance of the environment.

In addition to the effect on the land in and around the town of Dukhan of the hydrocarbon industry, the demands of the town have affected other areas. For instance, the water supply comes from al-Sunu approximately 35.5 km to the north east of Dukhan and the pipelines to Dukhan occupy an area of about 0.072 km^2, and are visible over a large area of the region.

In conclusion, it is clear that the town's main function is to serve the oil industry. Although the town provides some services to the people outside the town - in the scattered settlements of the region - as well as to its own citizens, its effect on the land use is more significant than its size would at first indicate. The result of the industry and the town of Dukhan on settlement in the region generally will be examined in greater detail in the section dealing with villages. (Section 3.5.2 and Figure 3.2B).

The next section will deal with roads and transport generally and their effect on the land use of the region.

3.4.3 Roads in the Dukhan region

The roads in the region and in Qatar as a whole have been built as a direct result of the development of the hydrocarbon industry (Figure 3.2A). The first road in the history of Qatar was made by the QPC and ran between Doha and Dukhan. It was built in 1938/39. The second, again built by the QPC in 1947/48, was started when the QPC began laying the pipelines between Umm Bab and Umm Said. In the 1970s these roads were improved to bring them to up to motorway standard and they link the town of Dukhan with Doha, 80 km away and, to the south east of Dukhan town, Umm Bab and Umm Said are linked with Doha by a crossing point along the Salwa Road. This brings the total length of motorway between Umm Bab and Doha of about 110.0 km. These two roads are the main routes linking the western and eastern regions of Qatar.

There are three categories of road in the Dukhan region: 21 km of first class road; 56 km of second class road; and about 143 km of third class road. The total road network in the Dukhan region occupies 2.2 km^2, which is about 0.5% of the total area (Table 3.4). It is anticipated that this figure will increase as the growth of the road network is directly linked with the expansion of the other activities in the region (Figure 3.2A). The expansion of the hydrocarbon industry is paralleled by the extension of the vehicle track network, on which employees can commute, and along which the various industrial plants can be patrolled. Increased demand for manpower results in the expansion of camps, villages and towns, creating a demand for more/better roads leading to Dukhan where the activities of their population are focused. With a growing population, Dukhan's leisure needs create a need for roads, for instance from Dukhan to the nearby beaches. At the moment, there is no control over vehicular access and whilst the increasing road network means easier access to the beach - which is a positive aspect for workers and visitors in the area - there is a negative effect on the environment - the unrestricted vehicular access means the natural landscape of the beaches is being destroyed by vehicles (particularly by four-wheel drive vehicles). It seems that the increase in tracks and roads made by vehicles will, inevitably, have an adverse effect on the environment, destroying the natural landscape and affecting the flora and fauna, and destroying the quality of beaches of the region (Plate 3.9 shows the effects of vehicle tracks on land).

Table 3.4 The other land use in Dukhan region:

Place	Land occupied km^2	% of Dukhan region
Umm Bab Town and Cement plant	2.0	0.5
Umm Bab Jetty and Military barracks	4.0	0.95
Aswan Quarrying	0.01	0.002
Old Zikrit Jetty	0.09	0.02
Ras Abrouk Police Post	0.0025	0.0006
Roads (220 km length)	2.2	0.5
Old airport area	0.01	0.002
Umm Bab dumping area	0.01	0.002
Total	8.323	2

Sources: 1. Field work by the author on the 18th of May 1990.

2. Interview with Mr. A. Al-Khazeen a senior staff at Umm Bab Cement plant on the 18th May 1990.

3. Ministry of information map scale 1: 200.000.

Finally, land use of the hydrocarbon industry in Dukhan will be considered. In fieldwork undertaken between May and June 1990, involving interviews and surveys in the region, and research making use of QGPC reports and maps, the total land occupied by the industry and associated services, and other activities attracted to the region was estimated to be 16.32 km^2, which is approximately 4% of the Dukhan region (total of Tables 3.1, 3.2, 3.3, 3.4, 3.5 and chalets only from 3.6). However, the effect on the environment of the industry was much greater than this figure would seem to indicate and that as well as direct occupation of land, other elements associated with the industry also occupied or adversely affected the land, often resulting in damage or in land being rendered unusable for other purposes (Figure 3.6). The environmental effects of vehicle tracks are scattered throughout the region

Plate 3.9: *Part of Da'sah village, and very clearly shows the land disturbance by vehicle tracks in the desert and the beaches, which is a common problem in Dukhan and mainly around villages.*

(as shown in Figure 3.7), not least on plants. Also, as understood by some employees in Dukhan camp, the site of the camp is not properly situated. If any accident or sabotage should occur, most of the surrounding area could be destroyed, with loss of life and property. It has been suggested that it may be wise to choose another site for the camp e.g. where Zikrit village is at the moment.(28)

Table 3.5 Area occupied by Dukhan region villages:

Village	Date of Establishment	Number of houses	Land occupied km^2	% of Dukhan region
Zikrit	1948/50	60	0.054	0.013
Ghariyah	1975	Camp	0.01	0.0024
Da'sah	1956	70	0.063	0.015
Afjan	1970	20	0.018	0.0043
Umm Bab Village	1947/48	50	0.045	0.01
Zughayn	1950	20	0.018	0.0043
Total		220	0.21	0.05

Sources: 1. Field work by author between the 1-15 June 1990.

2. Interview with Mr K. Al-Mansouri, 12 December 1990.

3. Fieldwork, 27 December 1991.

Table 3.6 Areas dedicated to and occupied via pastoralism and tourism in Dukhan region

Place	Area occupied km^2	% of Dukhan region
Chalets along Dukhan coast	0.17	0.04
The main tourism area in the region	1.35	0.3
The main grazing area in the region	285.00	67.8
Total	286.52	68.14

Sources: 1. Field work by the author in the region between the 1st - 10th of June 1990.

2. Interview with Mr. F. Al-Hajiri at the Municipality of Al- Jumayliyah on 31st May 1990.

3. The Ministry of Information map scale 1:200.000.

3.5 Other Land Uses in the Dukhan Region

As demonstrated above in Section 3.4 analysing land use of the hydrocarbon industry in the Dukhan region, some of land is used directly by the industry and some is used indirectly. The purpose of this section is to study other land uses in the region and the role of the hydrocarbon industry in attracting other land uses. Also in this section the conflict between the hydrocarbon industry and the other land uses will be examined.

3.5.1 Population of the Dukhan Region

As stated above, the population of the Dukhan region before the oil era, i.e. before 1940, numbered 400-500 people, most of whom were not permanently settled in towns or villages but were nomadic. The numbers tended to increase or decrease in direct relation to the rainy season which provided subsistence for the scattered population. Before the oil era, the region could be deserted during dry seasons when the Bedouin found good grazing elsewhere.

However, after the oil industry began, the way of life and the numbers of people living in Dukhan changed dramatically. The Bedouin built and lived in their own villages, scattered throughout the region whilst the Company built a town to house its employees. Sometimes Bedouin were recruited for the company (see Section 3.5.2 on villages for further details). By 1990 the area had a settled population of about 4,956 people in a density of about 11.6 per km^2 (Table 3.7).

Table 3.7 Dukhan region population:

Place	Population	% of Dukhan region	Density per km^2 in Dukhan
1. Dukhan Town, people connected directly with QGPC	3356	67.7	8
2. Umm Bab Town	1000	20.2	2.4
3. Villages	600	12.1	1.2
Total	4956	100	11.6

Sources: 1. QGPC, confidential report from the onshore oil industry, 1990. p. 11.

2. Interview with Mr. A. Al-Khazeen on the 18 May 1990.

3. Interview with Mr. K. Al-Mansouri, 27 December 1991.

The first effect of the industry on the population of the region, therefore was to attract hydrocarbon industry personnel; few other people moved into the region. The population of the oil towns in the Gulf had similar beginnings, e.g. Abqaiq in Saudi Arabia's eastern province, where most of the population of Abqaiq Town are immigrants who moved from other areas within and outside the province.(29) Table 3.8 shows that 3,356 people of the settled population are linked directly with the industry - about 67.7% of the total population (Table 3.8). The QGPC directly employs about 891 people, with employee's wives and children about 1,116 people, so that the total of QGPC employees and their families in Dukhan is about 40% of the region's population. Services contractors and local contractors who work for the company total 1,211 people (Table 3.8), and comprise 24% of the region's population. Some of the population are associated with the other industries in the region, for instance there is a cement plant and a lime-producing plant in the town of Umm-Bab. The population of Umm Bab is about 1,000 people, or 20.2% of the population of the Dukhan region.

The remainder of the population are the indigenous inhabitants, mainly Bedouin, scattered throughout the desert, the majority of whom now work for the Company as well as continuing in their old way of life and traditional work grazing their livestock. Whilst these people are now settled in villages throughout the region (which, like the towns in Dukhan, have all the facilities and services of modern technology) they continue to graze their livestock in the region as before. The number of Bedouin now settled in small villages in the region is about 600, comprising about 12.1% of the region's total population.

Table 3.8 Dukhan oil company personnel

	No. of people	% of total Dukhan people
Senior staff	143	3
Employee level staff	748	15
Wives + children	1116	22.5
Services contractors	205	4.1
Local contractors	1006	20.3
Other	138	2.8
Grand total	3356	67.7

Source: QGPC, Onshore operation's special confidential reports 1990. p. 11.

The number of Bedouin in the region has not increased as would have been expected from evidence of other areas where the development of oil has led to increasing influence and an increase in the population, as explained above in comparison between Dukhan town and Saudi Arabia's oil towns in Section 3.4.2. The reason appears to be that the children of the Bedouin now receive a very high level of education and once qualified emigrate to the capital, Doha, where there are opportunities for work in the various government departments and where they can command good salaries and have a high standard of living. This has meant an imbalance in the population of many villages - there are many old and retired people in the villages. Often Company employees originally recruited from the area return to their villages and take up the traditional lifestyle of grazing camels and sheep once they retire.

The findings of this section are that human settlement in the region of Dukhan is almost wholly associated with the oil industry, linked either directly or indirectly.

On 21 May 1990 a fieldwork questionnaire was distributed to 100 inhabitants of the region who worked for the QGPC, of whom 33 responded. Of those responding to the questionnaire 61% were Qatari, and 39% non-nationals; 64% spent their weekend with their families out of Dukhan - in either Doha or another Qatari town - predictably most of those spending their weekend away from the oil-field were Qatari whilst foreign workers tended to remain *in situ*.

The questionnaire also showed that Qatari nationals tended to commute daily from towns like Doha, Wakrah and al-Khawr to the oil-field, driving anywhere from 160 to 260 km to do so. This indicates access to good road network between the eastern and western parts of the region which makes this commuting possible, and also suggests that Qatari employees of the company have not made permanent links with the area which would have resulted in their settling in Dukhan itself. In other words they still think of their original home town or village as home despite the many facilities offered by QGPC in Dukhan.

The questionnaire revealed that 80% of company employees preferred to shop at Doha and 82% visited the capital for social facilities, 27% visiting Doha for business purposes (most of their time otherwise being taken up working for the oil company in Dukhan), 27% for recreation, and 27% for medical purposes - it is presumed these latter figures are low as Dukhan is provided with such good facilities. The questionnaire also revealed that 97% of people responding to the sample did not intend to retire in Dukhan.(30)

These figures all seem to indicate that for Company employees and associated workers the area of Dukhan is solely one where they can earn a good living and does not attract them in any other way. The oil industry therefore would seem to be the only attraction offered by Dukhan and thus the end of the oil industry will see a decline of the region's population.

The next two sections will deal with life in the villages and pastoralism in the region of Dukhan and where and how it conflicts with the oil industry.

3.5.2 Villages in the Dukhan Region

As stated above, before the development of the oil industry in 1940, Dukhan had no permanent settlement and the population was mainly Bedouin leading a nomadic existence dependent on the water resources which existed in eastern Dukhan.

In this section the watering places of the Bedouin will be studied. As in the pre-oil era, Bedouin when they did settle temporarily, settled in places where there were water resources. Between 1904 and 1907 there was one well at Ras Da'sah, another at Ras Fahahil, whilst there were 12 wells at Dohat Zikrit, the oldest of which were built by Arhamah bin Jabbir in the early nineteenth century - some of which are now defunct. Al-Ba'th had ten wells and al-Hamelah also had wells and sustained palm trees which the Bedouin tended [31].

The Bedouin depending on the watering places were from the Bani Hajir, al-Murah and al-Manaseer tribes and some from other Qatari tribes. Despite the existence of these watering places in the region the Bedouin were never attracted to establishing permanent settlements before the development of the oil industry. However, after 1940 some of these watering places became permanent settlements. These villages were built by the Bedouin and often the Bedouin continued to graze their livestock while working for the oil company.

Umm Bab village was built in 1947/48 [32] south of what is now the town of Umm Bab. The village was initially built as a residential area for company employees and some local people. In 1960/61 the government opened a boys school in it catering for about a dozen pupils. By 1990 the village had about 50 houses and most of the inhabitants were from the al-Murah tribe, working mainly for the oil company.[33] The school has now closed and children from the village have to travel to the town of Dukhan for their education (the government contract with a private taxi vehicle which transports the children to Dukhan).[34]

The village water supply is mainly via water tankers which come from al-Sunu and power comes from a small generator given to the village by the government [35]. The village occupies an area of approximately 0.045 km^2 (Table 3.5). Some of these villages have small farms of palm trees, and plant some vegetables, and animal grasses such as *Medicago sativa*, e.g. Zikrit and Zughayn villages.[36]

The second village established after the oil industry began in the Dukhan region was Zikrit Village. The original settlement grew up around the jetty at Zikrit which was built in the 1940s to land the company's supplies from Bahrain (similar to a certain extent to the circumstances of al-Khobar Jetty which was built by Aramco for receiving their own supplies).[37] This small jetty was superseded by the Umm Said oil terminal in 1952 and company supplies now come via the port of Umm Said, and closed completely in the mid-1960s. In 1950 some Qataris who had immigrated to the Dukhan region to find work with the company settled near the Zikrit jetty near the water wells. In 1950 there were 450 people in the village - approximately 200 men and 250 women, mainly from the al-Mahandah (originally from al-Khawr), Bani Hajir and Nauim tribes, as well as other Qatari nationals. In 1957 the government opened the first boys school in the region in Zikrit. This catered for approximately 45 pupils and in 1960 this was followed by the opening of a girls school for about 26 pupils [38]. In the 1950s and early 1960s all the children in the region were taught at Zikrit. However, in 1970 both schools were closed, and the children had to commute daily by car to Dukhan Town to receive their education. This was part of the government policy to make Dukhan Town the central focus of the region.

By 1990 the settlement of Zikrit had shrunk and there were only 60 houses in the village but most of its inhabitants still worked for the oil company [39]. The village occupies an area of approximately 0.054 km^2 (Table 3.5).

The third village in the region is al-Zughayn which was built in 1950 mainly by local Bedouin of the Bani Hajir and al-Mannseer tribes when they started to work for the oil company. By 1990 the village had about 20 houses and, like the other villages, the children receive their education in the town of Dukhan [40]. The village occupies 0.018 km^2 of land (Table 3.5).

The fourth village is Da'sah which was built in 1956 and has about 70 houses. Most of the men in the village are associated with the oil company in Dukhan. The village occupies 0.063 km^2 (Table 3.5). They also have other occupations, such as fishing (the fish are taken to Doha fish market to be sold) [41] (Plate 3.9).

The fifth village in the region is Afjan, built in 1970 by the al-Mannseer and Bani Hajir tribes. There are about 20 houses in this village [42] and it occupies an area of about 0.018 km^2 (Table 3.5). Afjan is divided into two sections 2 km apart, one called Eastern Afjan and the other, larger village called Western Afjan.[43]

There are also some Bedouin camps scattered throughout the region, such as Ghariyah, which occupies an area of approximately 0.01 km^2 (Table 3.5), A'Selah and Ibn Sha'eel camps etc.. These are not permanent settlements - being used by tribes moving from one area to another in search of grazing. Their effect on the land and the amount of land use they occupy is difficult to ascertain because of their impermanent nature but it is possible that they occupy as much land and have similar effects as the permanent villages in the region.

All of the villages were built in the region after the oil era began and were mainly to provide accommodation for those company employees who also wanted to rear livestock (see also Section 3.5.3 on pastoralism). Education and other essential services for the villages are provided by Dukhan Town, but each village has its own small generator and receives its water supply from Al-Sunu by water tankers (vehicle).

Thus it can be seen that Dukhan town is not only catering for its own region's residents but also providing services for the small villages in the eastern region of Dukhan. The children of Jumayliyah receive their secondary education in Dukhan, those of al-Waynah and Umm al-Quhab and the other smaller villages and Bedouin camps in eastern Dukhan are educated entirely in Dukhan [44]. They are transported by contractors' cars at the expense of the government.

In conclusion, the total area occupied by the villages of Dukhan is approximately 0.21 km^2, which is about 0.05% of the land of the whole region (Table 3.5 and Figure 3.2B). However as previously demonstrated the villages owe their existence entirely to the industry attracting people to settle in the region. It must also be mentioned that when the industry requires land occupied by a village, priority is given to the industry's needs over that of settlement. Thus their existence is wholly dependent and linked with the industry and it is probable that when, in the near future, the oil industry ceases to exist in the region, the villages will also disappear. Clearly the Bedouin villages and camps around the oil towns are not a unique situation for Dukhan Town, e.g. Abqaiq oil town has about 32 Bedouin villages around it, and those remaining in their villages present a similar case to that of the above study.[45]

The next section deals with pastoralism in the region. As Figure 3.2A shows, the villages of Dukhan are scattered throughout the region - each village needs a certain amount of grazing land, necessitating the villages to be at a distance from each other. Although there are no regulations governing where anyone can graze their livestock, as the land is owned by the government usually each village only grazes in its immediate environs. This has meant that the land around villages has been denuded of natural vegetation as the camels, sheep and goats have overgrazed these areas. In the past overgrazing did not occur as the Bedouin moved from area to area, allowing the vegetation to regenerate. Thus the company has indirectly affected the environment in the region by inducing the Bedouin to settle in permanent locations rather than temporary camps. The next section discusses the conflict between the land needs of livestock and those of the QGPC.

3.5.3 Pastoralism in the Dukhan Region

Pastoralism occurs mainly in al-Khatiyah in the north of the region, and in Fahahil and Umm Bab (Umm Bab is between Fahahil and Julyhah [46] (Figure 3.2A). An area of about 285 km^2 - approximately 67.8% of the Dukhan region - is good for pastoralism (Table 3.6) and this includes the areas shared between the oil industry and grazing livestock (shown in Plate 3.1 and described below).

Before 1940 and the changes that occurred in Qatar after the development of the oil industry, the number of livestock in the region depended wholly on the quality of the season. If the season was good, the number of livestock sustained by the land could increase from 2,400 camels to double, triple or even more, but in bad seasons the number of animals sustained by the land would drop dramatically as the nomadic people moved away in search of grazing, which can be seen even in the oil era post-1940. In bad seasons the only animals in the area were those belonging to the people settled in the region, which totalled approximately 3,500 camels or less [47].

The total number of camels in Dukhan is approximately 3,500 [48] and there are about 4,000 sheep and goats [49]. The density of camels is approximately 8.33 per km^2, compared with 2.0 per km^2 for Qatar as a whole [50]. The high density of camels in the area compared with the number in the rest of Qatar is because Dukhan oil-field is the only onshore field in Qatar and in the 1940s the QPC was the only official employer in Qatar which offered permanent employment for nationals. This promise of a well-paid steady income attracted Bedouin to settle in the region and these people received work and good income while grazing their livestock in the region. The change in lifestyle from nomad to life in the scattered villages of Dukhan benefitted the Bedouin in three ways:

- the village served as a convenient local base from which to work for the oil company, and they were able to take advantage of the services set up by the QPC and the government in the nearby town of Dukhan and in the region as a whole;
- they still had grazing land for their livestock in one of the best grazing regions in Qatar.

The above meant that Dukhan was highly attractive - it provided modern facilities and material benefits yet enabled the Bedouin to retain their traditional form of livelihood. However, the two activities do not always co-exist successfully. For instance, camels sometimes die because their legs sink into the mud caused by oil and gas seeping into the soil and sometimes camels are poisoned by drinking from water near oil and gas wells which has been polluted by chemicals used in the hydrocarbon industry. Mr K. Al- Mansouri, on 27th December 1991, reported "*camels often eat from the urban dumping area, sometimes they eat some deadly materials, e.g. once I saw a dead camel which had swallowed a big plastic bag full of some junk which she couldn't digest, and that resulted in her death. I even saw the plastic bag penetrating from her stomach.*"(51) (Plate 3.8). Camels in the region also face the obstacle of pipelines preventing them from moving between grazing grounds (Plate 3.4).

Thus the oil industry poses a threat to the livestock. However, the livestock have also caused problems for the industry and its employees: dead beasts decaying near the oil installations cause a stench which company employees find intolerable and this has sometimes caused delay in work on the oil elements until the corpses are removed. Camels may graze uncontrolled near wells scratch themselves on wells and fences, sometimes causing switches to be thrown and the wells to be turned on or off, resulting in leakage of oil,[52] etc; and camels straying onto the roads have caused serious accidents. On 21 May 1990 senior staff at the Dukhan plant commented to the writer, *"they [the camels] have meant the loss of some of our best friends and colleagues on the motorways from Dukhan to Doha, Dukhan to Umm Bab and Umm Bab and Doha. Their vehicles collided with camels, often at night, on the roads causing the death of the occupants".* [53]

In the past when camels were killed or injured for any of the above reasons, their Bedouin owners have looked to either the QGPC or the government for compensation but, since 1985, the QGPC and the government have declined to compensate, stating that livestock are the responsibility of their owners and would not be involved in accidents if their owners looked after them properly.

As stated above, government policy is that the QGPC operations take priority and, when the company needs to operate in areas, where there are villages with grazing for livestock, company interests take priority. As the government owns all the land in the region, this means the region is dedicated to the interests of the hydrocarbon industry even though grazing of livestock manages to survive alongside it.

Plate 3.10: *Umm Bab Cement Plant in Southern al-Khatiyah, clearly showing the dust from the plant which badly affects the surrounding area.*

3.5.4 Cement Manufacture and Quarrying

The cement industry was established in 1965 in the western region of Qatar between Fahahil and Julyhah and production started in 1969. The cement industry provided the first manufacturing plant apart from oil refining in Qatar. The location was chosen because of the availability of raw materials south of the Dukhan region and power necessary to quarry and process the raw materials was provided by the gas from the field. The raw materials of clay and limestone are found 19 km to the south of Umm Bab. A further reason for this location of the cement industry was that a good road network already existed in the area, built to serve the oil industry. The area was relatively uninhabited - the only settlements being Umm Bab town and village approximately 8 km away.(54)

The plant occupies approximately 0.05 km^2 of land and the total area of plant, and associated facilities such as residential area and shops, etc., occupies approximately 2 km^2 (Table 3.4 and Plate 3.10), about 0.5% of the total area of Dukhan.

To the east of the cement plant is a lime plant occupying an area of 0.01 km^2. It is envisaged that in the near future the gypsum manufacturing industry will also be established near Umm Bab and it is expected it will occupy about 0.01 km^2. To the south east of Umm Bab are the Aswan Quarries occupying an area of about 0.01 km^2. These industries are located near Umm Bab and the location is attractive because of the existing facilities such as roads provided for the oil industry could also be used by other industries like the manufacture of cement. The raw materials for the cement factory come from as far away as Umm Silal (limestone) (Figure 2.9) north west of Doha, about 120 km from Umm Bab, but also from south of Umm Bab (clay), approximately 19 km away[(55)] (Figure 3.2B).

The cement plant and other industries around the town of Umm Bab occupy only a small area of land in the region but they indirectly affect a much larger area. There was, for example, a complaint from Umm Bab village people, which is about 8 km south of the cement plant, in which they said that they are leading an extremely unpleasant life in the village as the dust from the cement plant is always disturbing them, and they were worried that the dust in the future could result in a dangerous disease. They requested people in the government who would be responsible for finding a solution to this issue.[(56)] (Figure 3.2B and Plate 3.10). The cement plant produces dust and gas pollution, and the quarrying of its raw materials scars the landscape. Quarrying affects adversely the natural flora, and the great scars left on the landscape are irreversable.

The area used for dumping refuse is about 5 km south east of the town of Umm Bab (57) and directly occupies about 0.01 km^2 (Table 3.4). However the smell from the dump and flies and insects attracted by the refuse affects the surrounding area making it unhealthy and unusable. Thus actual land use is much more than the area of the dump. Umm Bab town occupies 2 km^2, but affects an area of land considerably in excess of this as explained above.

The other industries using materials such as limestone, gypsum are likely to have a similar effect on the landscape. As these industries have all been attracted to the same area as the oil industry because of the existence of facilities and infrastructure, the effect on land use in the Dukhan area is significant.

3.5.5 Tourism in the Dukhan Region

Neither central nor municipal government have as yet become directly involved in the tourist industry in the region but its natural resources are attracting a local tourist trade. These resources include some very fine beaches on the western coast of Dukhan (Figure 3.2A). In the general planning study of Qatar, undertaken by Llewelyn, Davies, Weeks, Forster, Walker and Bor on 11 April 1973, 4 coastal sites in Qatar were chosen in order to be developed as tourist beaches. Two of these beaches are located in Dukhan region(58) (shown in Figure 7.2). We could use the above study as evidence that the western region is one of the most attractive places in the peninsula for tourism, and the increase of tourism will also increase the conflict between industry and other activities as discussed below.

Tourists in the region can be divided into two categories: the employees of QGPC in Dukhan and other people from Dukhan and other Qatari towns attracted to the facilities of the region. The QGPC provides a sailing club for its employees to the south of the Dukhan town fence. There are also many other facilities - the questionnaires distributed in May 1990 (mentioned above) showed that 49% of employees enjoyed fishing, swimming and sunbathing along the Khatiyah coast to the west of the Dukhan camp (Figure 3.2A) in their leisure time. The questionnaire showed that non-Qatari employees preferred to spend their leisure time along the coastal areas to the north and south of the camp whilst Qataris preferred the more remote coastal area around Zikrit, Ras Abrouq, Ghariyah and Dukhan, and enjoyed fishing and swimming at Dukhan and Umm Bab (59) (Figure 3.2A).

Other tourists visit Dukhan at weekends to enjoy the long Dukhan coast. The areas near the town and the camp are popular because of the beauty of the beaches there but also because of the proximity of roads, availability of shops, and petrol stations and because security is better near towns than in the more remote coastal areas. However, research showed that tourists frequent the whole coastline (Figure 3.2A).

Fieldwork in the first weekend of June 1990 showed that along the coast of Dukhan there were about 102 cars, with an estimated 408 people visiting the beach. These were people spending their weekend on the beaches, concentrated in the area by Dukhan (Figure 3.2A). The weekend of my fieldwork, however, coincided with final examinations in Qatar which meant that the numbers on the beaches were lower than normal - parents tend to stay at home helping to prepare children for their examinations at this time. The writer estimates that the number on beaches after examination time could be triple that of early June (60).

A third category of tourist is being attracted to the coast of Dukhan: owners of holiday homes. Holiday homes or chalets are built, after government permission has been granted, and these are scattered along the coast from the north to the south, and at present occupy an area of approximately 0.17 km^2 [61] (Table 3.6).

Whilst the tourist industry is attracted by the coastal beauty and facilities of the region, the priorities of the hydrocarbon industry again take precedence. If and when the industry requires those areas being occupied by tourists - either temporarily or permanently (in the form of holiday homes), it is clear that the government will give priority to the hydrocarbon industry.

The main effects of tourists on Dukhan beaches is that the unorganised tourists resulted in disturbing the sand of the beaches, similar to that shown in Plate 3.9 and dumping litter and surplus materials along the beaches, resulting in some unpleasant views.

Tourists also face a certain degree of danger on Dukhan's beaches. Some people have drowned in the deep water off Dukhan[62], and the environmental effect of the oil industry, and its effects on innocent people, must be considered carefully. For instance, at Wytch Farm in Dorset, England, restrictions on drilling to the winter months avoids potential conflict with tourist amenities and the use of the beaches,[63] and for environmental reasons, BP were not allowed to install normal flare stacks on the Wytch Farm development, and so had to use special flare boxes.[64] Although, unlike Dorset, Dukhan is not broadly occupied by other land use activities, environmental measures should still be taken, to protect the other activities in the region such as tourism, health of the people, protection of grazing areas, and some protection of land in the region in general.

3.5.6 Other land uses in the Dukhan Region

Other land uses in the region are attributed mainly to the high security arrangements required by the government and the QGPC throughout the oil field. Security can be divided into three categories: military, police, and QGPC security services. Police and military stations are scattered along the western coast of Dukhan from north to south.[65] Ras Abrouk police post covers an area of approximately 0.0025 km^2 (Table 3.4), the police post at the old jetty of Zikrit occupies an area of approximately 0.09 km^2 (Table 3.4) and that at the Umm Bab jetty and the military barracks together occupy an area of approximately 4.0 km^2 (Table 3.4).

The above areas are direct land use by the security services but there is also a large area of indirect land occupation by security. The regions have to be patrolled 24 hours a day, 7 days a week and patrols are not limited to the immediate area around plant and machinery nor to the road system. The vehicles of the security services patrol throughout the desert of Dukhan protecting the various elements of the hydrocarbon industry and the impact of vehicles on unsurfaced land results in some deterioration. The wheels of vehicles erode the land's topsoil affecting the natural flora and scarring the landscape and have also affected the archaeological sites of the region (Figure 3.7).

Another land use of the region is that by people who are attracted to the area for hunting. The animal hunting season is from September to April, and it is mostly migrant birds and rabbits which are killed. The indiscriminate use of four wheel drive vehicles by hunters has also affected the natural flora and the environment generally as well as destruction of archaeological sites. Mr K. Al-Mansouri said, on 27 December 1991, that, once they had a strange accident during the night as one of the hunters was chasing a rabbit and he collided with an oil pipeline. Luckily there was no explosion as a result of the accident.(66) This example shows the hazards of mixed land use in the Dukhan region.

One interesting point is shown in Saudi Arabia's oil field in the eastern province where there are many flare-stacks, known individually by their respective number. The flare-stacks tend to be made use of for navigation purposes, and the flare stack numbers are used to describe the location of places in the desert.(67)

3.6 Conclusion

The Dukhan field situated along the western coast of the Qatari peninsula is the only onshore hydrocarbon producing region in Qatar. The area of concession for QGPC in the region is 2000 km^2, about 18% of the total onshore area. The oil field is 420 km^2, or about 21% (68) of the concession area and about 4% of the total area of Qatar. This study deals entirely with the oil field area. The QGPC has a monopoly in the concession area in the western part of Qatar, both for future exploration, development and expansion.

The actual area occupied by the oil field and other activities in the region at present is about 16.32 km^2, or about 4% of the Dukhan region (Total of Tables 3.1, 3.2, 3.3, 3.4, 3.5 and the chalets only from 3.6). This area accommodates all the various elements making up an oil field, services and facilities provided by either the QGPC or the government, and also villages which have come into being to house those associated with the industry or attracted by the trade they provide.

Whilst the area given over to direct land use is only 4% of the total area of Dukhan, it generates an indirect land occupation which monopolises almost the whole region. This indirect land use is mainly due to its effect on the environment - the structures connected with the oil industry are visible throughout the region, flames can be seen 16 km away from Dukhan in the daytime and even farther away at night. A subjective impression suggests that the oil field generates a degree of air pollution over the whole region also. The region is permeated by the bad odours of hydrocarbon processing and sound pollution is also very high - company employees told the writer that no-one could enter stations without having cotton earplugs (69).

As well as air and noise pollution and the visual impact upon the environment, there is, of course, the pollution of the earth which increases the indirect land occupation of the industry. Each plant dealing with oil or gas has a dumping ground in close proximity (70) and the dumps contain chemicals in liquid form which, of course, easily seep into the soil and underlying strata (discussed in Section 3.4). Thus the dumping pits affect an area much larger than that directly occupied by them and the danger is that, sooner or later, if unchecked, they could contaminate the underground water reserves as well as the natural flora of the region. From my fieldwork and other research I could see no evidence of any serious attempts being made by the QGPC to prevent pollution.

The second major land use in the region apart from the direct land occupation by the plant and machinery of the oil field is that of villages and security posts scattered throughout the area but in direct assocation with the oil industry. The villages house workers of the company, and the barracks and police posts have been established to provide security for the field. There is also land occupied by the holiday villas and livestock grazing, both of which have come to the area following the development of the oil industry. Each village has its dumping ground also occupying and damaging additional areas of land and concentrated grazing of livestock in an environment which is relatively infertile has seriously depleted the natural flora. It is likely that this will have a long term effect on the vegetation of the area. As in other sparsely vegetated areas supporting livestock, a nomadic lifestyle of the pastoralists allowed for regrowth of vegetation but now vegetation is being utterly destroyed by the more intensive grazing of village people. An alternative to the nomadic lifestyle which also preserves the environment has been followed in other grazing regions like Australia where a very low density of grazing animals per acre enables regrowth of vegetation, but here again, the affluence created by employment with the oil industry has encouraged a higher rather than a lower density of livestock (see section 3.5.3 above).

The above human and animal settlements are scattered throughout the area and thus their effect on the land is under rather than overestimated by looking at the size of their actual land occupation. As well as the pollution caused by their refuse, their scattered existence in the area also brings with it damage to the landscape in the form of vehicle tracks churning up and destroying the top soil and vegetation. In conclusion, it appears from this study that the life of the region is limited - restricted to the lifespan of the oil industry. Research showed that 97% of oil company employees had no intention of retiring in the region.[71] This fact, taken with the estimated lifespan of the industry at its present rate of production, gives the area a future life-span of about 25 years. Thus in 25 years time the Dukhan region could once again be as deserted as it was before the oil era began. It would be expected that the Bedouin who have always grazed their livestock in the region would continue to do so, but the numbers of

Bedouin are declining and their presence in the area has always been dependent upon the existence of good grazing.

The next chapter examines the effects of the Dukhan hydrocarbon industry outside of the region. The industry in Dukhan occupies substantial areas of land outside Dukhan - pipelines transferring the oil from the Dukhan oil-field to processing plants outside the region. An estimate will be made of the amount of land occupied by pipelines from the Dukhan oil-field to locations throughout the Qatar peninsula, and other pipelines which come from the offshore hydrocarbon regions (Figure 4.1).

References

1. Mather, A. S., *Land use*, Longman, London, 1986, p6.
2. Qatar National Museum (correspondence regarding details contained in *The Atlas of Stone Age Culture in Qatar*, by Herr Holger Kapel 1967 and point 3, 7, identified by the British Archaeological Expedition).
3. Lorimer, J. G., *The Arabian Gulf Gazette*, Geographic Section, Vol 6, 1907, Arabic copy translated by Doha Palace.
4. Interview with Mr. H. al-Quraisi on 11 May 1990 (Mr. al-Quraisi is an elderly Bedouin from the al-Murah tribe).
5. Diab, M. *The Physical Geography of Qatar*, al-Jablawy, Cairo, 1980 [Arabic], p110.
6. OPEC, *Proceedings of the Seminar on Enhanced Oil Recovery*, Qatar, 26 November to 1 December 1983, pp 173-175.
7. QGPC, Onshore Operations, 1985, p21.
8. Personal contact with Mr Halton on 17 January 1992, BP Operation Exploration Ltd. (Wytch Farm oil field).
9. Map of Asab oil field, Abu Dhabi Company of onshore oil operations, AD Co., February 1988, Scale 1:50:000.
10. Institute of Petroleum, London, U.A.E., Abu Dhabi, File (II).
11. Interview with Mr. H. al-Tamimi, Production Superintendent QGPC Onshore Operations, Dukhan Region, on 21 May 1990.
12. Ibid.
13. Ibid.
14. Correspondence with QGPC Onshore Operations, Dukhan Region, 10 May 1990.
15. Interview with Mr. A. Mohammad, Senior Petroleum Engineer, in Dukhan on 21 May 1990.
16. Institute of Petroleum, Oil and Gas of Wytch Farm oil field (File), Dorset.
17. Al-Elawy, I.S., *The influence of oil upon settlement on al-Hasa Oasis in Saudi Arabia*, Ph.D. thesis, Durham University, 1976, p.85.
18. Ibid., p.95.
19. Al-Shuaby, A.M., *The development of Eastern Province with particular reference to urban settlement and evolution in Eastern Saudi Arabia*, Ph.D. thesis, Durham University, 1976, p.55.
20. Interview with Sheikh A. Al-Thani on 15 May 1990 (an elderly man from the ruling family in Qatar).

21. Interview with Mr. F. al-Hajiri (Manager of the Municipality of Jumayliyah) on 31 May 1990.
22. Fieldwork by author on 31 December 1991.
23. Personal contact in October 1990.
24. Interview with Mr F. al-Hajiri, Op.cit.
25. Ibid.
26. Interview with Mr. K. al-Sohoti, QGPC senior staff, in Dukhan on 21 May 1990.
27. Interview with Mr. F. al-Hajiri, Op.cit.
28. Interview with Mr K. al-Mansouri, and Ali al-Utabi on 27 December 1991, (QGPC employees in Dukhan).
29. Al-Shuaiby, A.M., Op.cit.
30. Field work questionnaires were distributed amongst the QGPC's employees in Dukhan on 21 May 1990.
31. Lorimer, J.G., Op.cit., Vol 6, pp.1951, 1959, 1963, 1967.
32. Interview with Mr. K. al-Mansouri on 12 December 1990.
33. Al-Dabbaq, M., *Qatar Past and Present*, Dar al-Tallea'h, Beirut, November 1961 (Arabic), p.107.
34. Interview with Mr. K. al-Mansouri, Op.cit.
35. Ibid.
36. Fieldwork by author on 27 December 1991.
37. Al-Elawy, I.S., Op.Cit, p.284.
38. Al-Dabbaq, M., Op.cit.pp.90-91.
39. Interview with Mr. K al-Mansouri, Op.cit.
40. Ibid.
41. Fieldwork by author on 27 December 1991.
42. Interview with Mr. K. al-Mansouri, Op.cit.
43. Fieldwork by author on 27 December 1991.
44. Interview with Mr. K al-Mansouri, Op.cit.
45. Al Shuaiby, A.M., Op.cit., p.72.
46. Interview with Mr. F. Al-Hajiri, Op.cit.
47. Ibid.
48. Interview with Mr. K al-Mansouri, Op.cit.
49. Ibid.
50. State of Qatar, Presidency of the Council of Ministers, Central Statistical Organization, Annual Statistical Abstract, 9th issue, July 1989, p267.

51. Interview with Mr K. Al-Mansouri, Op.cit.

52. Interviews with QGPC Senior Staff, Mr. H. al- Tamimi and Mr. A Mohammad on 21 May 1990.

53. Ibid, Mr. H. Al-Tamimi and Mr. A. Mohammad.

54. Interview with Mr. A. Al-Khazeen at Umm Bab Cement plant on 18 May 1990.

55. Ibid, Mr. A. Al-Khazeen.

56. *Arrayah* Newspaper, issue No. 3716, Qatar, 5 December 1991, p.8.

57. Interview with Mr. F. Al-Hajiri, Op.cit.

58. Lleyelyn Davies, Weeks, Forster, Walker and Bor, *Qatar Developmetn Plan*, 11 April 1973, p.13.

59. Field work questionnaires, Op.cit.

60. Field work by author, 1 June 1990.

61. Ibid.

62. Interview with Mr K. Al-Mansouri, Op.cit.

63. BP Exploration, Poole Bay Appraisal Drilling Volume Two, *Environmental Review*, January 1990, p.26.

64. Institute of Petroleum, Oil and Gas Field at Wytch Farm (File).

65. Fieldwork by author, 1 June 1990.

66. Interview with Mr. K. Al-Mansouri, Op.cit.

67. Personal experience in Saudi Arabia Eastern Desert.

68. Ministry of Finance and Petroleum, *Oil Industry in Qatar*, Qatar, 1979, p.9.

69. Interview Mr. H. Al-Tamimi, Op.cit.

70. Field work by author, 21 May 1990.

71. Field work questionnaires, Op.cit.

Chapter 4

Land Use and Onshore Pipelines

Outline

Figures

Tables

4.1. Aim of the Case Study

The study in the previous chapter was on the land use of the onshore hydrocarbon producing region in Dukhan (a region dedicated to the oil industry) and on Qatari settlement patterns (along the eastern coast), which are on opposite coasts (Figure 4.1.). The company therefore constructed a pipeline linking the western region with the eastern region. Pipeline laying was facilitated by the following:

- Qatar is flat apart from some modest hills and high ground to the south and west: the physical geography places few if any natural obstacles before a pipeline.
- Qatar has only small areas of sabkhas, and therefore avoiding their abrading effect demands few precautionary measures in laying a pipeline overground.
- The geological structure of Qatar is uncomplicated and causes few if any difficulties in laying a pipeline underground. (Plate 4.1).
- Most of the land outside the towns boundaries belongs to the government. As QGPC acts on behalf of the government the issue of compensation for land occupied by the pipeline is generally avoided.

The necessity of linking the western region with the eastern region by pipeline for oil export at Umm Said terminal is obvious. The pipeline also supplies energy and feedstock for the other industry at Umm Said. A pipeline runs from Dukhan to Doha in order to supply energy for the power station and water distillation plants in Doha. The pipeline link between the western and the eastern region reflects modern land

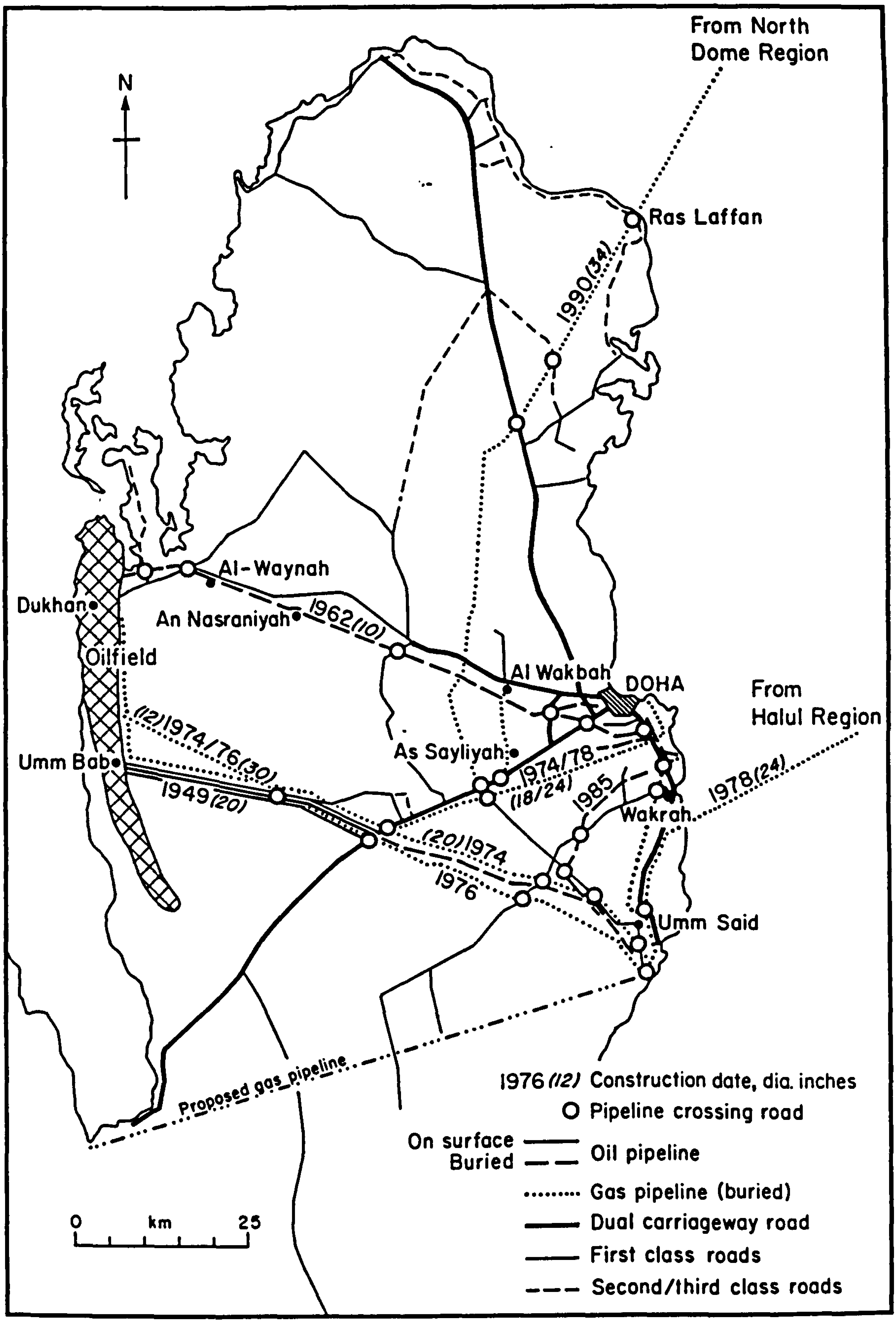


Fig. 4.1 The national pipeline network

Plate 4.1: *This shows the Raslaffan pipelines, buried underground. The small pipes on the width of the pipeline are to keep the water flowing from the small desert valley during some rainy seasons. Both sides of the pipelines are destroyed by vehicle tracks.*

use throughout the peninsula: the land occupied by pipelines creates some conflict with the other activities on the land such as grazing animals, living in villages and driving along roads, as explained elsewhere in this text.

The creation of Umm Said as a hydrocarbon processing town attracted other hydrocarbon pipelines from offshore hydrocarbon regions (Halul region and North Dome). From Umm Said, pipelines carry refined oil to Doha (Figure 4.1).

The main aim of this chapter is to show that the effect on the land of the hydrocarbon industry is felt not only in the hydrocarbon regions but throughout Qatar (Figure 4.1).

4.2. The Pattern of Onshore Pipelines

The onshore pipelines in Qatar can be identified in groups (as clearly shown in Figure 4.1). One group of pipelines rise in the southern part of the Dukhan oil field bearing for Umm Said on the south eastern coast of Qatar (Plate 4.2). A second group rise in the northern part of Dukhan, bearing for Doha in the middle of the eastern coast of Qatar (Plate 4.3). A third group rise offshore in the Halul region, coming ashore at a point south of Wakrah, bearing south along the eastern coast towards Umm Said (Plate 4.4). A fourth group rise offshore in the North Dome, come ashore at a point in Ras Laffan on the north eastern coast of the Qatar peninsula, take on the shape of the zone from Ras Laffan, and cross the middle of the peninsula towards Umm Said in the south east of Qatar (Plate 4.5). A fifth group of pipelines rise in Umm Said bearing for the southern part of Doha (Figure 4.1.). A sixth group of pipelines rise in the western part of Doha, flow round to the south, and thence to the south eastern side of the city (Figure 4.1.). Each pipeline has a different function (oil, gas and NGL) and diameter. They contain very high levels of H_2S, discussed below. The next part of the study concentrates on the types of pipeline found in Qatar.

4.3. Types of Pipeline in Qatar

In this section the diameter and functions of the pipelines used is examined. For this purpose, the pipelines will be divided into four groups (Figure 4.1.).

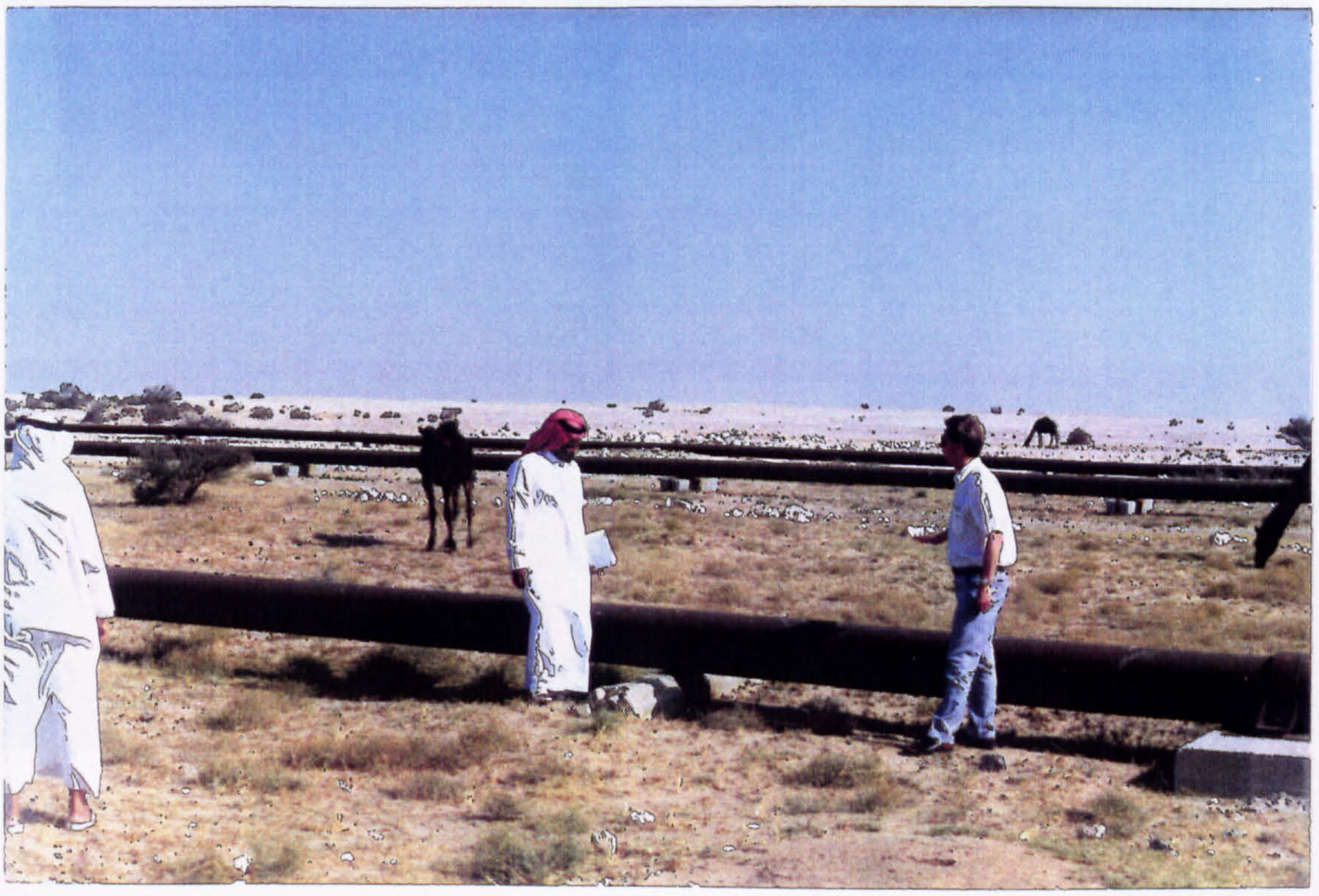
1. **Dukhan to Umm Said**

- 20 inch oil line commissioned in 1949
- 12 inch NGL line commissioned in 1974
- 24 inch gas line commissioned in 1974, from the middle of which two pipelines divide off towards Doha: 18 inch gas line started in 1974; 24 inch gas line started in 1978. (Figure 4.1)
- 30 inch gas line commissioned in 1976. (Figure 4.1)

2. **Dukhan (Khatiyah) to Doha**

- 10 inch gas line commissioned in 1962, and in 1970s converted to oil. (Figure 4.1)

Plate 4.2: *Pipelines between Umm Bab and Umm Said. Also shown between the lines is a good grazing area in comparison with Qatar's desert. The only camels allowed to graze this area are the Feral camels.*



3. **Halul Offshore to Umm Said**

- 24 inch gas line laid in 1978.
- 12.75 inch NGL line laid in 1978. [1] (Figure 4.1)

4. **North Dome Offshore (Ras Laffan) to Umm Said**

- 34 inch gas line commissioned in 1990.
- 12 inch NGL line commissioned in 1990. [2] (Figure 4.1)

Plate 4.3: *Pipeline from Dukhan to Doha. At this point the line reached Rayyan in western Doha. The line is also buried completely below the ground for safety. If, however, anything went wrong with this line, all of the area (residential etc.) could be destroyed. The fenced area below is a booster station, which occupies about 0.0004 km^2. The booster stations are scattered throughout the area of pipelines in Qatar. If we totalled the area of land occupied by them, a significant amount would be reached.*

Plate 4.4: *The point where pipelines from the Halul region offshore reach the onshore area of Qatar. The pipelines are firstly received by three booster and monitor stations similar to that below. These stations each occupy an area of about 0.07 km². Pipelines from the North Dome region offshore to onshore Raslaffan have similar elements, and share the same effect on land.*

4.4. Land Use Analysis

This land use analysis will examine the amount of land occupied by pipelines, their length, their safety zone and the overall area occupied by pipelines.

4.4.1. Pipeline Length

The length of a pipeline depends on the distance between the hydrocarbon producing region and the hydrocarbon processing region, and the chosen route.

- For a pipeline to cross from Umm Bab to Umm Said is about 85km.
- For a pipeline to cross from the North Dome (Ras Laffan) to Umm Said about 130km (Table 4.1).

Sometimes a pipeline must be laid following an indirect and therefore longer route, in order to avoid residential areas or some other land occupation. Such is the case of the pipelines between Ras Laffan and Umm Said) (Figure 4.1).

Plate 4.5: *Pipelines from Raslaffan towards Umm Said, with a burial height of about 2.0 m. This point is at a crossing with al-Khawr road. This crossing could cause serious accidents because it represents a blind crossing for drivers (see Range Rover, right).*

Table 4.1: The total land occupied by hydrocarbon pipelines in Qatar

Route	Line length (oil or gas) (km)	Area occupied (km^2)
Umm Bab to Umm Said	127.75	38.3
Gathering point after crossing Salwa road to Doha	41.0	10.5
From northern Dukhan to Al-Wakbah	60.0	6.0
From Al-Wakbah-Al Sayliyah to southern gathering place with Doha pipelines	14.0	2.8
From southern Wakrah to Umm Said	28.0	5.6
Umm Said refinery to Doha	50.0	10.0
Ras Laffan to Umm Said	135.0	27.0
From Al-Wakbah cross Doha	17.0	1.7
Total	472.75	101.9
% of Qatari land	-	0.89%,

Sources: 1. Fieldwork by author, May & June 1990.
2. Correspondence with Q.G.P.C. onshore operation, June 1990.
3. Company Map, the Ministry of Information Maps scale 1:200,000.

The four pipelines from Dukham to Umm Said total 343km, the pipelines from Halul to Umm Said total an onshore length of 56km, the pipelines from the North Dome to Umm Said total an onshore length of 270km.

From Umm Said, hyrocarbon products and surpluses are piped to other Qatari regions. A refined oil line runs 50km from Umm Said towards the southern part of Doha at Abu Hamour. Surplus North Dome gas will be piped 90km in a 20 inch line from Umm Said westward to the Dukhan field for reinjection; more than half of this line had been laid by 18 May 1990. (3)

Being the capital city, Doha needs energy for its power stations, and water distillation plants. The first pipeline Doha received was from Dukhan in 1962. This 97.5km line showed the first uses of gas in Qatar, supplying Ras Abu Abaud power station and water distillation plants with gas. [4] In the 1970s this line was converted from gas to being able to supply Doha's power station with oil in the event of anything going wrong with the gas supply.[5]

Doha receives its gas supply from Umm Said pipelines at a point to the south of the town. Two derived pipelines enter Doha. The total length is 82km (Figure 4.1).

The above-mentioned lines are the principal lines into Doha from the Dukhan region, but there are around Doha secondary lines derived from the main lines. Secondary lines totalling 28km feed Al-Wakbah and Al Sayliyah power stations respectively.

Whilst the total line length in Qatar outside the hydrocarbon regions is 1005.6km, length alone does not show the area of land occupied by pipelines. The pipelines occupy not only the area on which they are laid, but also extends to land to each side of the line as a safety zone (explained below).

4.4.2. Land Occupied by Pipelines

The total area occupied by a line is calculated by multiplying the length of the line by its overall width. This overall width of the line is the width of the safety zone: 200m (i.e. 100m on each side of the line)[6] multiplied by the number of pipes in the line. This figure is multiplied by the length of the group of pipelines to give the total area in km^2, as shown below. The safety zone, imposed by the company and backed by the government, may not be put to any other permanent usage. (Figure 4.1).

Total land occupied by lines to Umm Said:

from Dukhan:	38.3 km^2;
from southern Wakrah:	5.6 km^2
from Ras Laffan:	27.0 km^2
Total:	70.9 km^2 (Table 4.1)

The area occupied by lines to Umm Said is 70.9 km^2 excluding the Umm Said region itself.(7) The official area of Umm Said is 189.9 km^2. Therefore, the area occupied by these lines represents 37.3% of the official boundary area of Umm Said. However, the area occupied by the lines to Umm Said is in fact much larger than the built up area of Umm Said. Therefore, the lines serving Umm Said occupy a land area much greater than the land occupation area of Umm Said.

About 70% of land occupied by pipelines in Qatar concerns lines with some relation to Umm Said (Table 4.1.).

Total land occupied by lines to Doha:

from Dukhan:	6.0 km^2
from Umm Said:	10.0 km^2
secondary lines from Umm Said:	10.5 km^2
other secondary lines around Doha:	4.5 km^2
Total:	31.0 km^2 (Table 4.1)

About 30% of land occupied by pipelines in Qatar concerns lines which enter Doha. Throughout the peninsula, 101.9 km^2 of land is occupied by the hydrocarbon industry: 0.89% of Qatar outside the hydrocarbon regions themselves (Table 4.1).

In the next section the effect of those pipelines on the other activities (i.e. pastoralism, villages, roads, environment and land prices) will be examined.

4.5 The Effect of Pipelines on Land

The previous section established that the pipelines occupy 0.89% of the Qatari land. The effect of the pipelines on the land extends far beyond the area already occupied by pipelines, for the pipelines have created a conflict with other land uses, such as grazing areas, villages, roads, land prices and environment (discussed below).

4.5.1 The Effect of Pipelines on Pastoralism

The pipelines' occupation of the land has created a struggle with the pastoralism in grazing areas in two ways

- the pipelines prevent livestock (camels, sheep and goats) crossing from one grazing area to another except at crossing places;
- operational service vehicles need tracks on which to travel the length of the lines in order to lay, operate, maintain and patrol the pipelines (Plate 4.1).

Interviews with Bedouin tribesmen (15 May 1990 - 15 June 1990) about the effect of pipelines on their livestock, established that although they hold a variety of points of view regarding the effect of the pipelines, they are generally agreed that the pipelines are affecting movement of their livestock from one grazing area to another (Figure 4.2). To cross the pipeline, they have to follow it along until a pipeline crossing place is reached [(8)] (Figure 4.3). Distances between pipeline crossing places vary from one pipeline to another: from every 0.5 km to more than 5.0 km (as is the case with the

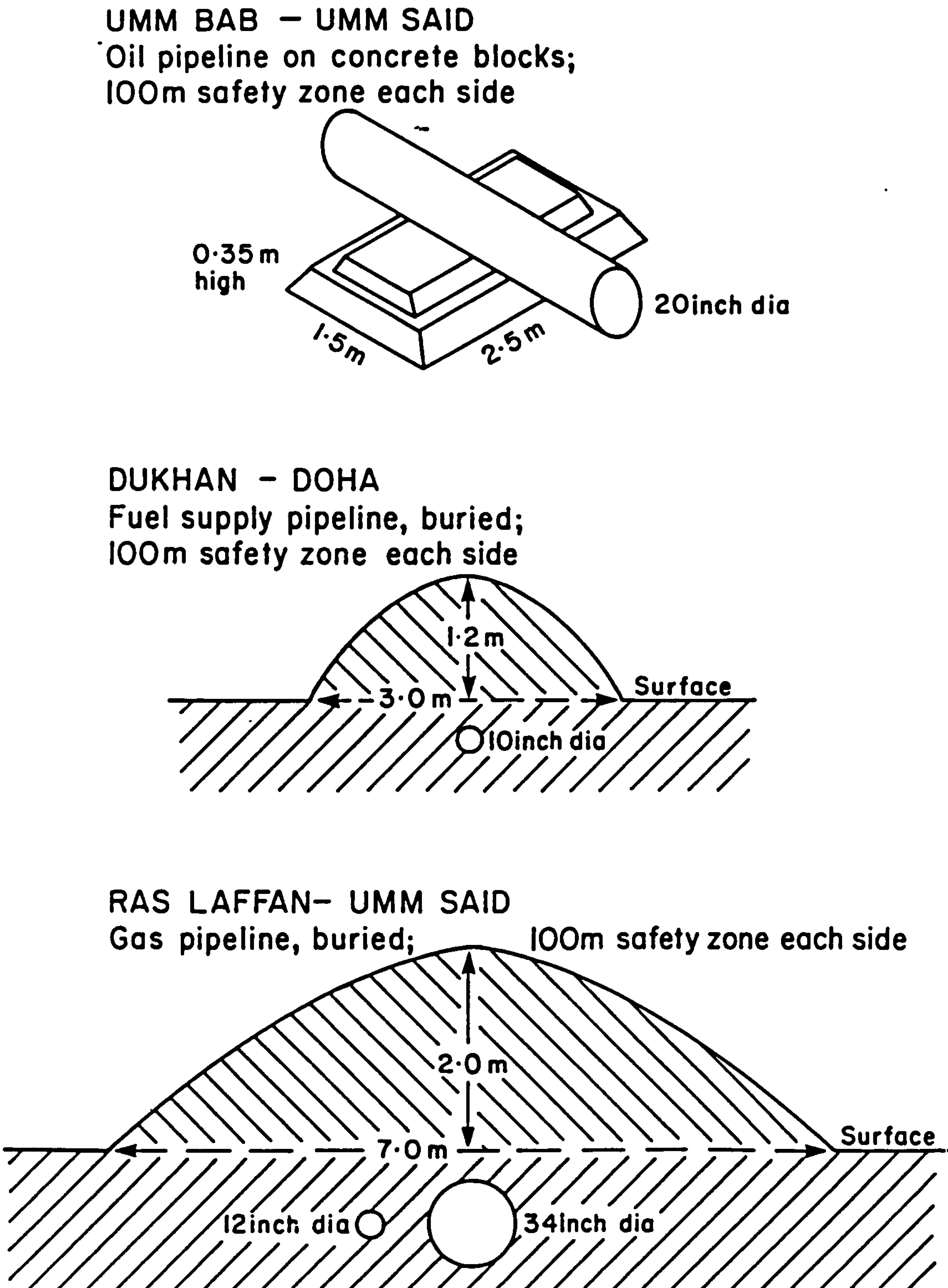


Fig. 4.2 Cross sections of types of pipeline

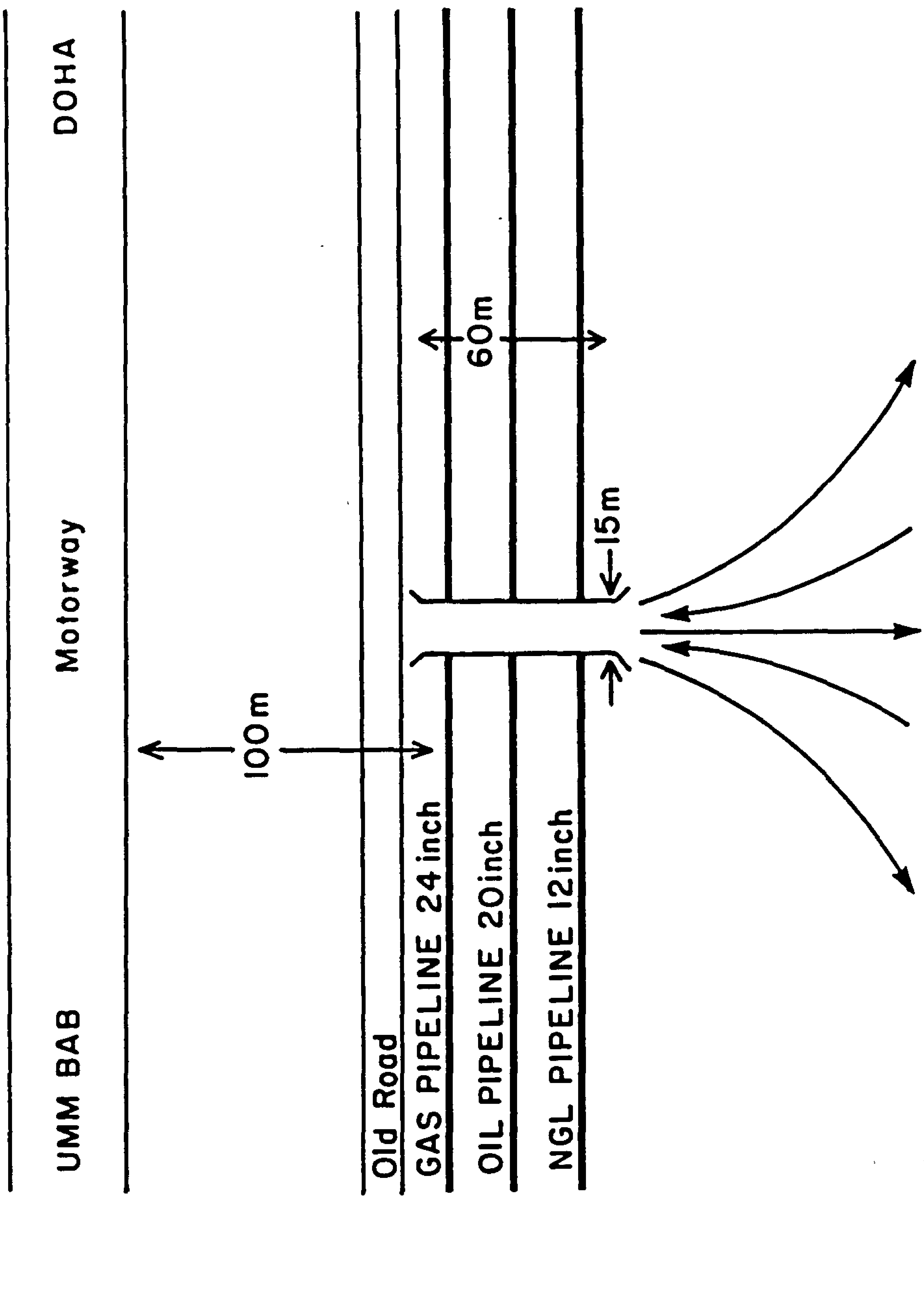


Fig. 4.3 Micro study of a pipeline crossing beside the Umm Bab – Doha motorway

North Dome pipelines).[9] As a result, Bedouin herders wishing to graze their livestock several hundred metres to the other side of a pipeline may have to travel 5 km or more (2.5 km to the nearest crossing place, and 2.5 km back). A consequence of the continuous use made of the land along the pipelines for travel is the creation of camel tracks, sheep tracks and people tracks. Near some villages, such as Al-Waynah, which are close to the pipelines, these tracks have degraded the land on both sides of the pipeline to the extent that, even in a good rainy season, grass will not grow on the degraded land [10] (Plate 4.6).

However, not all pipelines are an obstacle to all livestock. The pipelines between Umm Bab and Umm Said are 0.5m in height. Feral camels (that is, camels which have escaped or which their owners have deliberately left in the desert) easily cross the pipeline and even graze in the area between the pipelines. (Plate 4.2)

Between the pipelines there may be good grazing areas (Plate 4.2), enjoyed by feral camels. Herders prefer to graze their animals in open areas with easy access for all their livestock. Sheep are prevented from entering this grazing area because they are unable to cross the pipeline, thus demonstrating the full effect of the pipelines as an obstacle to grazing.

Vehicle tracks both sides of pipelines are destroying the structure of the earth, which even in the rainy season is unable to grow natural grass (Plate 4.1). The North Dome pipelines show on one side more than 100m width of damage to the grazing area, whilst on the other side of the line (outside the safety zone) the grazing area still exists, even that side of the grazing area will eventually be destroyed. People roaming the desert by vehicle depend on the pipeline crossing places in order to cross from one

Plate 4.6: *Mosque in al-Waynah village. This village is mainly inhabited by factions from the Bani Hajir tribe, who have some camels and a small farm in the village. The pipeline passes adjacent to the village from the north side.*

area to another thus concentrating vehicle tracks at pipeline crossing places, e.g. a crossing place on the Umm Bab to Umm Said pipeline (Figure 4.3). This results in soil structure degradation. The same can be applied to all pipeline crossing places throughout Qatar (Figure 4.1).

Another process of land destruction by pipelines is the removal of soil and stones for pipeline burial, rendering the ground barren. This results in serious damage to the land structure, for example along the North Dome pipelines.

In summary, the pipelines represent a significant obstacle to grazing. The pipelines themselves, the service vehicle tracks (surveying and laying operations involve vehicle tracks along the line, thus tearing up the soil), the safety zone (100m each side of the line), pipeline burial and the crossing places all destroy the grazing area (Figures 4.3). The livestock and human tracks along the pipelines degrade the soil structure.[11]

The effects of the pipelines are not limited to grazing areas, they also create a conflict on land with the villages which the pipelines pass close by or through. The people who settle in these villages usually have many camels and sheep. The pipelines affect not only their livestock, but also invade some part of their village's land.

4.5.2 The Effect of Pipelines on Villages

The effect of pipelines on villages vary from one group of pipelines to another. A principal factor is the proximity of the pipelines to the village (Figure 4.1). At certain pipeline crossing places, such as at Al-Waynah, the pipeline constrains entrance to the village from the northern side (Figure 4.1), whereas the entrance to Qatari desert villages not near a pipeline is usually unconstrained from any direction.

An effect of pipelines passing through the middle of a village, for example at An Nasraniyah (Plate 4.7), is restriction on the growth of the village to beyond 50m each side of the pipeline. Only two villages in Qatar have been affected by pipelines in this way: Al-Waynah, which has existed as a temporary place for some factions of the Bani Hajir tribe since late the 1800s and now is a permanent settlement (Plate 4.6 and Figure 4.1); and Nasraniyah, which was built in 1955 by Mr. A. BinZaben from a faction of the Al-Dwaser tribe (Figure 4.1). Pipelines came to these villages in 1962 and 1972 respectively. Study of the two villages makes it possible to envisage the future effect of pipelines throughout Qatar (Figure 4.1). The study proves that pipelines have an enormous role in restricting the growth of a village, e.g. An Nasraniyah, preventing the village from growing as one unit, confining growth to

Plate 4.7: *Pipeline passing through the centre of An Nasraniyah village, explained in Section 4.5.2.*

either side of the pipeline (Plate 4.7). The same point about restricted growth applies to the other villages which the pipelines pass near, such as Al-Waynah (Figure 4.1).

Several other factors have a direct effect on villages. Apart from the safety zone, land is wasted either side of the pipeline. The natural view from the village may be diminished (Plate 4.7), especially in the case of buried pipelines, the height of which sometimes exceeds 2m, such as the Ras Laffan-Umm Said pipelines. Although the pipelines are buried, the mound of covering rises high above ground level. When the pipeline passes through built up areas, the local inhabitants cannot see the area beyond the pipelines. Also, to the south and east of the above line, there are large piles of rubble and debris as a result of digging operations during the laying of the pipeline. Whilst some of the excavated material was subsequently used for line burial, the rest was simply left in ugly heaps, as explained above. This leaves an unpleasant view along the line [12] (Figure 4.2 and Plate 4.1). The sand and gravel used to bury the pipelines is unsightly, creating a generally poor view from the village (Plate 4.7). The existence of a pipeline in a village is an environmental hazard. When the pipelines are being laid, considerable noise pollution is generated. Prior to oil or gas coming on stream, water treated with chemicals is used to flush the pipelines. Sometimes this treated water is discharged onto the land, or it is directed into a lagoon and left to evaporate. [13] So the laying of pipelines has a bad environmental effect on land, air, sound and smell, thus reflecting badly on the villages.

Pipeline laying is unlikely to take more than two months. After this period, their environmentally deleterious effects tend to diminish. Even when pipeline laying operations are completed, their hazard persists. Were an explosion to occur the village could be destroyed, and the villagers poisoned by the high concentration of H_2S. The pipelines undergo continuous maintenance. When accidents occur which cause leakage from the pipelines, the village environment suffers.

Accidents and maintenance of the pipelines carry with them a greater environmental impact on the villages than the pipeline laying operation. In an interview on 6 June 1990 one of Q.G.P.C. senior staff employee said:

> *"the government gave Q.G.P.C. the full authority to remove the village or farm when they became an obstacle in front of pipelines operation and the people of the village could be compensated if they prove that their ownership of the village or the farm".* [14]

This interview demonstrates the high priority accorded to the hydrocarbon industry, for when a pipeline needs land occupied by a village the whole village or part of it could be removed (discussed in Section 4.5.4). When the government order people to evacuate a village they will be compensated with other land on which to build a new village. Therefore, notwithstanding the destruction of their natural landscape of the old village, further land destruction has to take place in order to build a new village. The root cause of this destruction is the desire for pipelines.

Those people in Qatar who have no pipelines pass through or near their villages are indeed fortunate. However, the effects of pipelines on Qatari land are not limited to villages and pastoralism, but have an effect on roads and land prices (discussed below).

4.5.3 The Effect of Pipelines on Roads

All pipelines have pipeline service vehicle tracks along them (Plate 4.1). Examples of such are from laying and patrolling pipelines. The first road built in Qatar for servicing the pipelines was in 1947/48 between Umm Bab and Umm Said (Plate 4.8). The longest pipeline servicing vehicle tracks are those which run along the North Dome pipelines from Ras Laffan to Umm Said (135 km) (Plate 4.1). A benefit, therefore, of the existence of the pipelines in Qatar is the provision of roads and vehicle tracks throughout the peninsula for servicing the pipelines and the public.

However, these tracks are not beneficial in all respects. They occupy much land and cause earth destruction. All the pipelines are buried apart from those between Umm Bab and Umm Said. Pipeline cover can exceed 2 metres in height (Figure 4.2). In the absence of a fully developed road system, people tend to drive their vehicles across the desert. At night a buried pipeline is difficult to see, and a vehicle colliding with one could cause a serious accident (Plate 4.9 and Figure 4.8).

Plate 4.8: *This road was built in 1947/48 for laying, maintenance and patrolling the first regional pipeline in Qatar's history, between Umm Bab and Umm Said.*

Accidents also occur along the pipeline service tracks. On reaching a crossroads, visibility may be poor because the pipeline obscures 180^{o} of vision (Plate 4.5). Pipelines tend to dive underground at intersections with trunk roads (Figure 4.1). For instance, of the Umm Bab pipelines, some of them cross the Umm Bab road underground, and all of them cross the Salwa road to Umm Said underground; of the North Dome pipelines, they cross the Al-Shamal road, the Dukhan road and the Salwa road, etc. underground (Figure 4.1).

Underground crossing are costly to build. After a pipeline has been laid, accidents or maintenance may demand that the pipeline is uncovered. Uncovering an underground pipeline at a road crossing blocks part or all of the road. Traffic diversion is

Plate 4.9: *An accident with the buried pipelines from Raslaffan to Umm Said.*

then necessary. This results in further land destruction by the wheels of vehicles travelling over the land which had been used as a diversion from the trunk roads. After the underground section of the pipeline has been serviced, and the road at the pipeline crossing place is reconstructed, the road never returns to its condition of before the operation. Drivers can feel there is something wrong with the road when they pass over the crossing place.(15)

The pipelines also influence the direction of roads, such as the Umm Bab road and the Dukhan road (Figure 4.1). When the Ministry of Transport plans to build a new road, it tries to avoid or reduce the crossing places over the pipelines. When planning a new road they thus try to keep the road parallel to the pipelines and keep a distance of 100 metres between the roads and pipelines (Figure 4.3). This results in the utilisation for roadbuilding of more land and making the roads longer than they would otherwise be.

Pipelines may thus delay traffic, cause accidents, lengthen the journey time, and consequently destroy more land.

4.5.4. The Effect of Pipelines on Land Prices

The effect of pipelines on land prices varies from region to region in Qatar. As in the case of villages and farm (rural areas) when the QGPC needs the land of one of those places totally or partly, the QGPC or the government compensates those people with money or another piece of land, or sometimes both. So in Qatar as a whole the effect of pipelines on land prices is limited to the phase of laying a new pipeline. In laying a new pipeline, the government prefers that private property and built-up areas are avoided, e.g. along the North Dome pipelines (Figure 4.1), obviating the need for compensation and protecting more densely populated areas from the hazard of pipelines.

The effect of pipelines on land prices in Qatar is not a big issue. Governmental Decree 13 of 1988, Article 11, is very clear and states that all land in Qatar, outside the administrative boundaries of towns and cities, is counted as government property, and any claim of ownership, other rights, or compensation for the people from the government will be rejected.[16] So, as most of the pipelines in Qatar are situated outside of the towns and cities, except for the hydrocarbon regions (where the land wholly belongs to the government), the decree makes clear that pipelines can have no real effect on land prices. There is some private ownership in Qatar outside the town and city boudaries, such as farms and chalets, but these count as special cases for which permission from the Minister of Municipality must be given.[17]

By way of contrast, the situation in the United Kingdom is quite different. Conflict would be inevitable, as on 21 February 1990, when Esso planned the 50km spur which is to run from the existing pipeline that links Esso Fawley Refinery in Southampton Water with the West Midlands. The spur is planned to run south of Birmingham to Birmingham International Airport, and continue north to the Esso fuel distribution terminal at Bromford. Engineers, surveyors and land agents will be contacting landowners and tenants who are located along the proposed route. At the same time, a full environmental impact assessment will be carried out by consultants which will be submitted to the Department of Energy as part of the Esso application for construction authorisation. Throughout the process, all interested parties will be consulted and given ample opportunity to express their views on the routing of the pipeline. Given all the required approval, Esso is expected to be constructing the pipeline during the period March-October 1991.[18]

The above shows us two things. Firstly, Qatar has so far faced no real conflict about the effects of the pipelines on land prices, except for minor instances of land compensation (discussed in Chapter 6, Section 6.3.3). Secondly, the effect of pipelines on land prices is seen in highly populated countries, with good agricultural and tourist areas, with land intensively in use, e.g. the U.K., as the example above shows, where the company concerned must go through complex procedures before starting their operation.

4.6. Conclusion

This chapter has shown that there is land occupation in Qatar by the hydrocarbon industry outside the hydrocarbon regions by pipelines which run across much of Qatar, linking the hydrocarbon producing regions with the hydrocarbon processing regions. The length of pipelines is growing (as shown in Table 4.2) which means that the effect of pipelines in Qatar is increasing and will result in greater land occupation, discussed below and in Chapter 5, Section 5.7.3.

4.6.1. A Neglected Area of Land Use Study

The land which has been occupied by pipelines in Qatar is about 101.9 km^2 (Table 4.1), i.e. about 0.89% of the total Qatari land surface area. There is also minor land use by C.P. rooms which are for monitoring pipeline operations (explained and shown in plate 4.10). Land occupation by pipelines could increase considerably in the future.

Table 4.2 The Development of Pipelines in Qatar, 1950-1990 (Figure 4.1)

Year	Total number of Pipelines	Pipeline from/to
1950	1	Dukhan - Umm Said
1962	2	Dukhan - Doha
1980	5	Western region - Eastern region
1990	6	Western region - Eastern region

Extension of the pipeline network in Qatar clearly means an increase in land occupation by pipelines. Phase Two of the North Dome Project concerns the export of gas reserves, supplying the GCC states with natural gas from Umm Said (Figure 4.1). Onshore pipelines being cheaper to construct and maintain than offshore pipelines, whenever the oil company lays a pipeline offshore, it tries to connect it to the nearest point onshore, e.g. North Dome with Ras Laffan. Thus there is a sense in which all hydrocarbon exploration, whether onshore or offshore, invades the small Qatar peninsula. Continued exploration, development and exploitation of hydrocarbon resources adds to the concentration of pipelines in Qatar, creating an environmental conflict, as shown in Figure 4.1. The proposed southward export of natural gas reserves involves crossing Qatari land at Salwa Gulf, close to Saudi Arabia. This pipeline would be 84.0 km in length, and would occupy 18.48 km^2. Along its route, the pipeline will encounter the difficult terrain of southern Qatar: the sabkha and sand dunes of southern Umm Said. When it meets roads (Sawda - Nathil; Salwa; and other second class roads in southern Qatar), the pipeline will dive underground, thus avoiding a conflict with road traffic. The pipeline will disrupt various grazing areas of southern Qatar, such as southern Al-Urayq (Figure 4.1). The environmental impact of this pipeline network extension on Qatar is not insignificant (Figure 4.1).[19] Other proposed pipelines in Qatar are discussed in Chapter 5, Section 5.7.3.

The conflict between pipelines and other land use activities (e.g. pastoralism, roads, etc.) is growing. An abandoned pipeline is left *in situ* until a salvage company wants to buy it. The salvage company then dismantles the pipeline at its own expense. The land suffers for a long time from the effect of the pipeline.

4.6.2. The Importance of Studying the Hydrocarbon Pipelines

The study above has shown that pipelines occupy land in Qatar, and that land use conflict results. In countries which have a highly populated areas, fertile agricultural land, lush grazing pastures, attractive tourist haunts and areas of conservation of natural beauty, as well as a concentration of a variety of land use activities such as roads and settlements, the effects of gas and oil pipelines would be marked. On the other hand, in arid, under-populated regions of the world, the environmental impact is not as great, but it can be expected to increase. Sections 4.6.3 and 4.6.4 will discuss the effects of the pipelines in the Gulf Co-operation Council (GCC) region. Examples below show some of the land use conflict with pipelines in the countries which have very intensive land use activities.(20)

1. A British example shows the conflict which can occur during preparation for laying of a pipeline. In December 1986, BP proposed to build an oil pipeline through the New Forest. This proposal was disputed. Lord Mountevans, in the House of Lords on 5 December 1986, said that the above line would leave permanent damage on the landscape, hedges and trees would be destroyed, no matter how careful the restoration. A permanent scar would be left for a utility with a thirty year lifespan at most.

2. Another British example shows that disaster could be caused by oil pipelines. For example, in August 1986, on Merseyside, an oil slick stretching for thirty miles threatened the teeming wildlife of the Mersey estuary after 150 tonnes of crude oil escaped from a Shell UK pipeline under the river. It was feared that thousands of migrating birds which spend the winter in mudflats and sandbanks in the estuary could find their normal food supplies devastated by the pollution.(21)

3. Deadly accidents have been caused by pipelines, as in the Ural's pipeline disaster in about 1988. In a large clearing by a railway line, some fifty miles from the Ural town of Ufa, there was an ecological catastrophe, and one of the world's

worst train disasters in which two trains were engulfed, and their passengers were killed. One kilometre east of the main line from Cheyabinsk Ufa ran a pipeline of liquified gas, which one night began to leak. Workers at the control point noticed the drop in pressure but instead of shutting off, they made a stupid mistake and turned up the pumps to push more gas through the line. The leak increased and drifted towards the railway line.

At 2:00 a.m. the two unfortunate trains were passing, mostly full of holiday makers on their way to or from the Black Sea. It took a single spark from one of the electric trains to cause a terrific explosion in which half of the passengers, 645 people, died including 181 children. Most of the others were terribly burned and scarred.(22)

The above examples show the necessity of precise procedures being carefully followed, and careful consideration given to all possibilities before laying pipelines.

Usually, as stated above, companies and governments try to lay the line to minimise the possible effects on areas all along the line. Sometimes, however, events take place which may not allow planners to choose the best areas, especially in the case of international pipelines. International pipelines may be politically and strategically located as well as economically determined.

In the Iran-Iraq War during the 1980s, Iran was holding one of the strongest cards by threatening to close down the Strait of Hormuz. The consequences made other Gulf states give serious consideration to other routes for exporting their oil. Some of these were already constructed, such as Saudi Arabia's 1213 km Petroline which opened in 1981, connecting the eastern oil fields with Yanbu on the Red Sea. This line made the Saudis capable of exporting their oil out of the Middle East without having to go through the vulnerable Hormuz, and Bab al-Mandeb Straits. The Saudis also studied the possibility of a second line from Ras Tannurah to the Gulf of Oman.[23] Abu Dhabi also had the same idea.[24] In the late 1980s, Iraq opened an international line across Saudi Arabia to avoid the Strait of Hormuz. This line linked up with, and then parallelled Petroline to Yanbu on the Red Sea. Before that, in 1977, Iraqi oil began flowing through a 86 km line through Turkey to Yumurtalik on the Mediterranean.[25]

Both lines put both Saudi Arabia and Turkey in a dilemma when Iraq invaded Kuwait, especially after the UN sanction of the oil embargo against Iraq. The Saudis feared an Iraqi military attack if they suspended the Iraqi oil exportation, and Turkey was worried about the loss of transit fees. Finally Saudi Arabia and Turkey complied with the above sanction, after Saudi Arabia received the Superpower military support (USA and Western Europe), and Turkey received economic compensation.

The international lines (political lines) are very sensitive, e.g. Trans Arabia Pipeline (Tapline) (discussed in Section 4.6.3) passes through Jordan, Golan Heights and Syria, to Sidon in Lebanon.[26] However, Tapline has been vulnerable to closure because it passes through a major war zone, and has been the subject of frequent disputes over transit fees which resulted in no oil being exported from the region through the Tapline for several years.[27]

The above show that even when a state has a hydrocarbon producing region, and a very good procedure for laying pipelines, this would not be forever, as politics plays a great role in changing the direction of the lines e.g. the Saudi's firstly depended on the Tapline, then Petroline to Yanbu, and are now considering a line to the Gulf of

Oman. So, the continuous change of the direction of the lines could increase land use conflict both positively and negatively (discussed in Section 4.6.3).

4.6.3. Comparative Study of the Effect of Pipelines Between Qatar and Saudi Arabia

Having examined the evidence in some detail, it is necessary to put it into perspective. The net effect on Qatari land is small. The Qatari population is only about 452,000, [28] and more than 84% of them live in Doha and its environs. The other 16% mostly live in small towns along the eastern coast of Qatar, and only a few live elsewhere in the peninsula scattered in tiny villages. The Qatari people are concentrated in Doha. The nomadic life has all but vanished in Qatar, apart from a few people who graze livestock throughout the peninsula, most of whom depend on hired herders, though the Qatari desert makes poor grazing. The desert is sizeable (11,437 km^2), giving a low population density, and therefore for all the environmental conflicts, few are much affected by them. Furthermore, the pipelines have been well planned, especially in the case of the North Dome pipelines (Figure 4.1). In all, the effect of pipelines on the Qatari land and people is currently not very great.

Elsewhere, pipelines have had greater impact. In the Saudi desert the Tapline has contributed to the concentration and settlement of nomadic people in certain areas for grazing, with environmental impact consequences (discussed below):

> *"One unplanned and unforeseen side effect of the oil industry in Saudi Arabia has been settlement of many Bedouins. In numerous instances, but not all, the new way of life has been both satisfying to the people and productive for the country. However, permanent domestic watering points in the oil fields and along the trans-Arabian pipelines have fostered year-long grazing of sensitive desert vegetation. Areas of vegetational destruction as much as 60 to 75 km in radius around the watering points commonly occur."* [29]

The second effect is probably a strange, but positive, one. In 1945 Aramco began laying the Tras-Arabia Pipeline (Tapline), which was completed in 1950. The small towns of Turaif, Ar'ar, Al-Qaisuma and Nuayria sprang up along the Tapline. Before 1950 they did not exist. They were originally built as pumping stations along the Tapline, which stretches for 1712 km from the oilfields in the eastern province to the Mediterranean port of Sidon in Lebanon.

The construction activities between 1945 and 1950 attracted the Bedouins who were roaming the desert, not only to work on the construction project, but also to fetch water from the pumping stations for themselves and their livestock as the Tapline crosses arid and empty country, with a very limited indigenous population. One stipulation in the contract agreement provided that the Tapline company should supply water to any passing Bedouins and their camels (discussed above). Consequently, the company dug deep wells at each of its pumping stations to provide water for its employees and the passing Bedouins. Interestingly, the centres developed from mere pumping stations in 1950 to considerable towns in 1967, some with as many as 20,000 inhabitants. One of them, Ar'ar, has been developed sufficiently to become the capital of the northern region, taking this position from Al-Juwf, which had a long history, but is now more than 150 km from the Tapline.[30]

Whilst in Chapter Three it was shown that a Bedouin settlement was attracted by the industry to a hydrocarbon-producing region of Qatar, in comparison with Saudi Arabia, the impact of pipelines in Qatar has been weak.

4.6.4. A Comparative Study in Land Occupation by Pipelines between Qatar, Abu Dhabi (U.A.E.) and Oman

In introducing this chapter, it was stated that the pipelines in Qatar have few natural obstructions especially in the case of the physical geography and the geological structure. In Oman the situation is different, there are many natural obstructions to the pipelines (mountains, deep wadis, etc.) making the pipeline laying operations very complicated. Oman's pipelines rise from a different onshore oil field (from southern and south eastern Muscat) and run towards Fahal port in Muscat, because the only oil refinery in Oman is at Fahal port, which is also the oil terminal. [31] The Omani pipeline is 1081.25 km in length (Table 4.3), although land occupation by the pipeline is only 0.072 % (Table 4.3) of Omani land surface area.

The physical geography of Abu Dhabi is easier than that of Oman, but it still has some sabkhas which could affect the pipelines laying operation onshore. Pipeline length in Abu Dhabi is 540.22 km (Table 4.3) and the area occupied by pipelines onshore is 108.044 km^2, which is about 0.15% (Table 4.3) of Abu Dhabi land surface area.

Oman and Abu Dhabi (U.A.E.) have many onshore oil field areas, and therefore the length of their respective pipeline networks, from their oil fields to their oil terminals, is much greater than that of Qatar, and therfore occupy a much greater land area than the Qatari pipelines: the Abu Dhabi pipelines occupy only 0.15% of Abu Dhabi land, and the Omani pipelines occupy only 0.072%. (Table 4.3) of Omani land. By way of contrast, the Qatari pipelines occupy 0.89% (Table 4.3) of Qatari land, Qatar being small compared to Abu Dhabi and Oman. Qatar also receives pipelines from offshore hydrocarbon regions (Halul region and North Dome) which come onshore and consequently increase pipeline land occupation.

In conclusion, some land is occupied by hydrocarbon pipelines in the GCC states, but this land is not valuable as most of it is desert. The population density throughout the entire GCC is low.

The next chapter will examine the impact of the hydrocarbon industry on Qatar's hydrocarbon processing region: the industrial town of Umm Said, to where the pipelines transfer the hydrocarbons.

Table 4.3 Comparative areas occupied by pipelines case of Qatar, Abu Dhabi and Oman

Country	Total area (km^2)	Pipeline length (km)	Area occupied (km^2)	% of total area
1. Abu-Dhabi (U.A.E.)	73,000	540.22	108.044	0.15
2. Oman	300,000	1081.25	216.25	0.072
3. Qatar	11,437	472.75	101.9	0.89

Sources 1. *U.A.E. Map*, G.E.O. Projects, Beirut, Lebanon, Scale 1:750,000.

2. *The Oxford Map of the Sultanate of Oman*, G.E.O. Projects, Beirut; scale 1:1,320,000, 1980.

3. Same references as in Table 4.2.

Plate 4.10: *An example of a C.P. Room for monitoring pipelines and occupies an area of about 0.0006 km^2. This one is located about 20km east of al-Khatiyah (Dukhan). There are 6 C.P. Rooms between Dukhan (Doha and Umm Said) and the total area occupied by these rooms would be significant. New technology is now being used to monitor the various operations of the pipelines by remote control. This makes it easier for QGPC to monitor the operations of pipelines e.g. in the event of accidental leakage.*

References

1. Correspondence with Q.G.P.C., Onshore H.Q. Qatar May 1990.

2. Q.G.P.C. the Qatari North Field Development Project, presented to Annual Convention, Gas Processors Association, San Antonio, Texas, 13-14 March 1989, p.7.

3. Fieldwork, 18 May 1990.

4. Q.G.P.C., *Onshore operation* 1985, p.23.

5. Interview with Mr. H. Al-Nuaimi, Q.G.P.C. H.Q. of Onshore Operation (Doha) and the Q.G.P.C. official maps, 9 June 1990.

6. Interview with Mr. M. Al-Airq, Trade Co-ordinator, Public Relations Department, Q.G.P.C. in May 1990.

7. State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, *Annual Statistical Abstract*, Qatar, issue 11, July 1991, p.16.

8. Personal contact with Bedouin tribesmen, May-June 1990.

9. Fieldwork by author, May-June 1990 and December 1991.

10. Fieldwork by author in May-June 1990.

11. Fieldwork by author in May-June 1990.

12. Fieldwork by author in May-June 1990.

13. Interview with Mr. A. Al-Mudfa'h, Environment Protection Committee, Doha, 6 June 1990.

14. Interview with Mr. A. Al Buainain, Public Co-ordinator Manager, Q.G.P.C., H.Q., 7 June 1990.

15. Fieldwork by author, May-June 1990.

16. Government of Qatar, Land Acquisition Decree (13), 1988, Article 11, p.5.

17. Personal contact, 10 March 1991.

18. Institute of Petroleum, Onshore pipes, Britain File 1991.

19. The Economist Intelligence Unit, *Qatar*, No.2, 1989, p.20. Also the official maps of QGPC's potential gas exports.

20. Institute of Petroleum, Op.cit., Onshore pipes, Britain File 1991.

21. Ibid.

22. Institute of Petroleum, Environment File, No.2, 1991.

23. Drysdale, A., Oil fields and pipelines, e.d. Blake, G., Dewdeney, J., Mitchell, J., *The Cambridge Atlas of the Middle East and North Africa*, Cambridge University Press, 1987, pp.66, 67.

24. Ibid., pp.66, 67.

25. Ibid., pp.66, 67.

26. Ibid., pp.66, 67.

27. Ibid., pp.66, 67.

28. Interview with Mr A. Mostafa (Central Statistical Organisation, Qatar), 27 November 1990.

29. Heady, H.F., 'The Ecological Consequences of Bedouin in Settlement in Saudi Arabia', *The Careless Technology*, Washington, (Tom Staley) 1968, p.683.

30. Al-Elawy, I.S., *The influence of oil upon settlement in Al-Hasa Oasis in Saudi Arabia*, Ph.D. thesis, Durham University, 1976, pp.89-91.

31. *International Petroleum Encyclopedia*, Penwell, 1990, p.129.

Chapter 5

Downstream Land Use: Umm Said

Figures

Tables

5.1 Aims of the Case Study:

In Chapter 4, the broad effect of hydrocarbon pipelines on the land use of the Qatar peninsula was discussed. As explained, the function of the pipeline network is to transfer hydrocarbon from the producing regions of onshore Dukhan, and Halul and North Dome offshore, to the processing areas of Umm Said and Doha (Figure 4.1).

As recorded above, 70% of Qatar's pipelines are connected with Umm Said, being Qatar's only onshore oil terminal, and its only industrial town, and also being wholly dependent on hydrocarbon as a fuel and feedstock for its industry. The other 30% of Qatar's pipeline network is linked with the capital, Doha, and supplies the town with energy for its power stations and water distillation plants.

The purpose of this chapter is to study the spatial effect of the hydrocarbon industry on the land use of the hydrocarbon processing region around Umm Said, and the latent land use conflict between industry and other activities of the region. We shall also examine the attraction of Umm Said as an industrial site and summarise its growth and evolution in relation to the hydrocarbon industry. A secondary objective of this chapter is to try to assess whether, without the oil industry, the town has sufficient attractions to encourage people to settle there.

5.2 Location, Topography and Climate*

Umm Said is located on the south eastern coast of Qatar (Figure 2.9) approximately 40 km south of the capital city of Doha; 24 km south of Wakrah; and 46 km north of Khawr al-Udeid. The distance between Umm Said and the west coast of Qatar is about 84 km.

Geologically, the area comprises firm ground but is flanked by an area of sabkha which is frequently flooded by sea water in spring, and by storm tides produced by easterly winds[(1)] (Figure 2.9). The sabkha is about 60 km long, and 5-12 km wide, starting from north west of Umm Said and extending to Khawr al-Udeid in the south. About 370 km^2 of the south eastern region is sabkha. The whole area is low-lying, being between zero and two metres above sea level. Sabkha in the region of Umm Said accounts for 52.9% of the total sabkha in Qatar. By way of contrast, sabkha represents only 3.23% of the total land area of Qatar[(2)]. Not all the land is low-lying: some parts of the south eastern region reach 7 metres above sea level, and the sand dunes to the south of Umm Said have an elevation of 40 metres above sea level in parts[(3)].

There are two areas where the topography differs from that described above. One is the sand dunes, a sizable feature of the terrain which is difficult to cross, except for

* Whilst other material has been made use of, and duly referenced, Dr M. Al-Kubaisi's 1984 research concerning Umm Said, has been of considerable value, especially in the approaches of Section 5.2.

four wheel drive vehicles. Due to the prevailing winds, these dunes are unstable, having an average annual movement towards the south of about 8 metres[4].

The second typical feature is the sandy knoll about 10 km to the north east of the oil terminal. This is covered by sandy lithosols only 10-20 cm deep overlying limestone bedrock. The knoll has a maximum height of 7 metres above sea level and its suitability for residential development is one of the reasons why the town of Umm Said was located there, away from the coastline. Other smaller sandy knolls are found close to the coast. They are of white oolitic sand of marine origin, with an average height of 1-3 metres. These minor features were critical in determining the detailed layout of industrial installations in the area[5].

The offshore side of Umm Said is relatively well served with deep waters close to the shore. The 5 fathom line (9.14 metres) lies less than 2 km to the east of the shore, and the 10 fathom line (18.3 metres) is only 4 km offshore. The seabed near Umm Said consists of materials which, are amenable to channel improvement and navigation. Quartz sand and muddy quartz sand extends off-shore to the east for some 4 km, followed by a zone of mud about 10 km wide. This mud is, in turn, followed by another zone of muddy sand formations. To the north of the first two zones lies the Fesht al-Arif coral reefs which protect the bay of Umm Said from sea swell driven by the north easterly winds. A natural channel leading to the high seas runs northwards through the coral formation (Figure 5.1). The offshore area of Umm Said will be discussed in Section 5.5.1.

The above illustrates some of the reasons why first the Qatar Petroleum Company (QPC) and later the government chose the area of Umm Said as the most suitable for

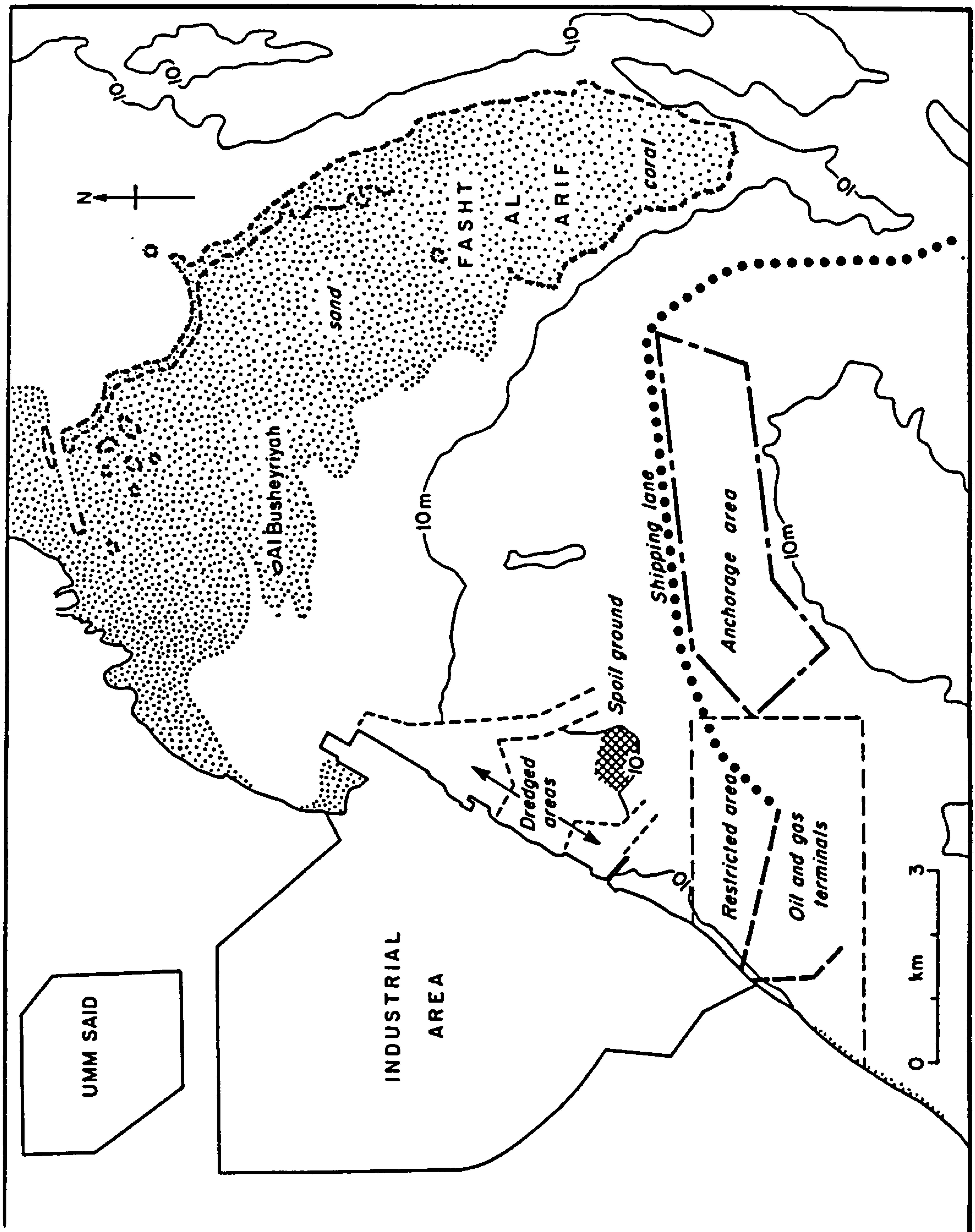


Fig. 5.1 Umm Said: offshore sea use

industrial development in Qatar. The deep waters at Umm Said are a major advantage for the port. The area also benefits from favourable climatic conditions - for most of the year the wind direction in the peninsula is north westerly, northerly and north easterly. Umm Said, located in the south eastern part of the peninsula, is therefore relatively free from the pollution- carrying winds which are an environmental hazard to populated areas of Qatar.

Umm Said has a climate similar to other areas of Qatar: arid, with long, hot, humid summers. The winters are comfortable, sometimes even cold, with light rainfall. From November to April the average annual rainfall is 50-70 mm, but some years it is as little as 1 mm(6). The southern region of Qatar is poorer in rainfall than the middle and northern parts of the peninsula. From May to October daytime temperatures rise to between 30°C and 50°C, and are accompanied by relatively high humidity which can reach to 100%. From November to April the temperature range is 16.02°C to 26.13°C(7).

The climate of Umm Said has some positive benefits which have led to the location of industry in this region. However, the weather of the region also has some disadvantages for industry - for example it can seriously affect storage and some functions of production such as machinery. Corrosion of machinery is made worse by the high salt content in the atmosphere, producing a significant reduction in plant life expectancy. Many factories in the area discharge chloride which collects in the dust formations and this, together with the high humidity of the region and the very hot weather, increases corrosion(8). However, experts in Umm Said maintain that although corrosion is a problem it is one which is contained by continuous maintenance in each installation and by special painting of equipment with anti-corrosion materials(9).

Some researchers, including Dr. M. Al-Kubaisi (1984), suggest that the reason why the Qatari people are in the minority of the population of Umm Said is related to the adverse weather of the region which reduces the capacity of the individual to perform energetically.(10) However, it is more probably because Qataris can easily find jobs in Doha with good incomes requiring less effort and which are less hazardous. This is reflected in the slow growth of Umm Said Town, discussed in Section 5.6.

In order to assist in understanding the present land use and possible future trends, the next section concerns the pre-1949 land use of Umm Said before the oil industry.

5.3 Brief History of the Land Use in Umm Said Before the Oil Industry

The pre-1949 history of Umm Said before oil exploration, is sketchy because there was little or no human settlement in the area before the oil era. Although the vicinity of Umm Said possesses some natural attractions for settlement these were counteracted at the time by adverse environmental conditions which, until the economic attraction of the oil industry, meant that people were not tempted to settle there.

However, there was some human settlement in the south east of Qatar, mainly to the north and south of present day Umm Said. One settlement in the south east of the peninsula is al-Wakrah - about 24 km north of Umm Said. Wakrah was the second most important town after Doha, with a population of approximately 8,000 in 1905. The main resources of the settlement before the oil era were from the sea, and were supplemented by husbanding livestock. The pearl industry, fishing and sea transport were the main occupations, with 150 boats involved in pearl fishing, 20 boats for trade, and 30 fishing boats. In Wakrah there was a farm called A'yn al Wakrah owned by Sheikh Abdul Rhman Al-Thani, the representative of the Ruler of Qatar in Wakrah. The farm had about 80 palm trees and some *Medicago sativa* for feeding livestock in poor seasons. Before the oil era in about 1905 the Wakrah area had about 15 water wells providing the town's water supply, 150 camels, about 40 horses, and a market with approximately 75 shops serving al-Wakrah and the south and south east of Qatar(11). Wakrah is a good example of the pattern of land use in the south east part of the peninsula before the oil era. Between Wakrah and Umm Said was an area where grazing was good, dominated by some varieties of *Anabasis stifera, Lycillm shawii* and *Acacia tortilis*, and other seasonal grasses. The people of Wakrah were primarily dependent on this area for grazing their livestock, but they also grazed their animals in other parts of the peninsula.

Grazing was one of the first activities to be affected by the oil industry. The laying of pipelines affected grazing land and the environment was changed by the taking of sand and stones for the development of Umm Said(12). Sea-based activities were also affected - the area along the coast between Wakrah and Umm Said had been popular for inter-tidal fish traps but, during the 1980s, the government bought these inter-tidal traps in order to keep the coastline clear between Wakrah and Umm Said for laying pipelines and other industrial uses (Figure 4.1). The coastal waters were also used for pipelines (commissioned in 1978) which ran from the Halul region offshore to a point south of Wakrah, then along the coast towards Umm Said.

Other pipelines also connected Umm Said with Doha, coming from the western side of Wakrah (Figure 4.1). Pipelines were laid for many different purposes - to carry refined hydrocarbon from Umm Said to Doha, to carry water from Doha to Umm Said, as well as the electricity cables from Doha to Umm Said - all contributing to the occupation of land. The motorway linking Umm Said with Doha was built through the middle of the town of al-Wakrah. Security points and police posts appeared along the coastline between Wakrah and Umm Said, to enable the patrolling of the oil and gas installations which quickly came to dominate the area. The land became criss-crossed with the tracks of vehicles. The above, together with the taking of sand and gravels for the making of the town of Umm Said, had a dramatic impact on the grazing land and on the landscape generally. Grazing areas were destroyed, pipelines hindered the moving of livestock from one area to another (see Chapter 4 for more details) as did highway traffic. These features affected the whole region and diminished grazing resources considerably. Patrol vehicles and other vehicles created desert tracks randomly over the area, and the coastal area between Wakrah and Umm Said was especially affected. Security buildings and police posts also inhibited the free roaming of livestock and people in the area(13). The result has been that the nomadic people have preferred to graze their livestock in other parts of the peninsula (as discussed below). It could be said that the exodus of the nomadic people who inhabited the area was the first impact of the hydrocarbon processing of Umm Said and its surrounding area.

The second settlement in the south eastern part of Qatar was at a small village called Khawr al-Udeid, which flourished for a relatively short time between 1856 and 1880. The village had approximately 100 houses, with a water supply from wells about 1.6 km from the village. The tribes settling here were the al-Qubaysat and the Bani Ha'mad who were entirely dependent upon the sea for their living(14). However, the settlement was short-lived, the village being evacuated in 1880. The inhabitants travelled to different areas to relocate - the Bani Ha'mad mainly emigrating to the Persian side of the Gulf with a few settling in Qatari towns, whilst the al-Qubaysat emigrated to al-Wakrah - about 24 km north of Umm Said, to Abu Dhabi and to other Qatari towns[15].

The historical view of the area raises the question as to why there were settlements in the area to the south of Umm Said and to the north, and yet none in the Umm Said area itself before the oil industry. The coastal waters near Umm Said are very rich in fish, and also have good oyster beds producing fine pearls. The offshore area has sand banks, coral reefs and some small islands and yet in comparison with other Qatari coastal areas has deep waters. Why then, with these advantages, did the area of Umm Said not attract settlement? One reason was the lack of a water supply.

Before the oil industry created the wealth to finance desalination plants, Qatar generally depended on underground water supplies which around Umm Said were very poor. Also a substantial part of the land is sabkha (see Section 5.2) which in its natural state is difficult land to be developed for settlement. It requires technological resources which, before the oil industry, the country could not afford. Thus the people found it very difficult to develop the area. Before oil, the people of Qatar were dependent entirely on traditional methods of building houses using mud, stones and logs. Income was derived mainly from the pearl industry. The people preferred to live in areas with good grazing, with a readily accessible water supply and with terrain more suitable for building houses.

Thus, the occupation of Umm Said can truly be said to start with the oil era. In 1937 preliminary oil surveys were carried out in Qatar and from these followed more comprehensive surveys in 1938/40 of the Dukhan oil field. The survey findings also meant there would be a need for a good port to exploit the extensive oil resources fully, and surveys were undertaken to find a suitable site[16], which led the QPC to look at the east coast and the area of present-day Umm Said. The survey findings resulted in the decision to have an oil terminal on Qatar's east coast rather than on the west coast even though the company had already established a jetty at Zikrit in the northern part of the Dukhan field. Although Zikrit was already in operation supplying the many needs of the field from Bahrain and other areas (Figure 7.1) it was obvious that Zikrit and the western coast would be unsuitable for development as a major oil terminal because of the shallowness of the waters on this coast and the coral reefs. There was also a political reason for the choice - the offshore boundary between Qatar and Bahrain was, and still is (1992), in dispute.

These considerations meant that the western coast was unattractive as a location for the oil terminal and port of Qatar. Thus attention turned to the eastern coast of Qatar. At this stage the company (APOC) already had the permission of the government in the oil treaty of 1935 for a suitable site of their choice, apart from other land use connected with the oil industry. This permission was outlined in Article 6:

> *"The Company has the right to choose the site of the port most suitable for exporting its substances".*

(discussed at length in Chapter 2).

The above phrase is part of Article 6 of the original agreement for the oil concession which was signed on 17 May 1935 but its power is limited by Article 7 of the same agreement in which:

> *"the Company has no right to acquire land occupied by the enterprise of the owners thereof also houses, places and land which their owners decline to sell or to rent"*(17).

So the QPC at this stage had to choose a port site which was not in the hands of the private sector, and had no other land use already developed on it. This made QPC in 1947 choose Umm Said for the location of its oil terminal. The reasons were as follows:

1. The area of Umm Said was free from settlement and industry and thereby the QPC was not inhibited by existing land use.

2. The coastal waters are very deep in comparison with the other coastal areas of Qatar.

3. It was feasible to deepen the coastal waters by dredging.

4. Topographically Umm Said was suitable for a port - it was naturally protected (Figure 5.1) and did not need the construction of breakwaters.

5. The direction of the prevailing winds at Umm Said (north west) (Figure 5.2) meant that any environmental effects of industry would be carried away from the settlement, although this was only fully appreciated after the oil company had chosen the site and begun to build. Research on 20 December 1989 by the Ministry of Industry and Public Works(18) proved that Umm Said, being in the

south of the peninsula, was the best region for the hydrocarbon processing industry as the air pollution created by the industry is carried away from the settlement (Figure 5.2). The factors of choosing industrial locations in Qatar are discussed in section 5.7.3.

The location and site of Umm Said accords with Hamilton's industrial location model (New York, 1967, *Models of Industrial Location*). The model describes four essential factors in the choice of industrial location:

1. When choosing an industrial site a suitable piece of land for plant, storage and other construction must be found which lends itself to easy access between these elements and upon which future expansion enhances those plants.

2. The plant site should be chosen for its nearness to water.

3. There should be good standards of transportation for materials and workforce, and these should be well planned by the government.

4. The site should have the minimum environmental impact [19].

Almost all these conditions were to be found in the Umm Said region.

The next section examines land use evolution of Umm Said from the start of the oil exporting era to the early 1970s (discussed in Chapter 2) when the government officially took over the industry from the QPC oil company.

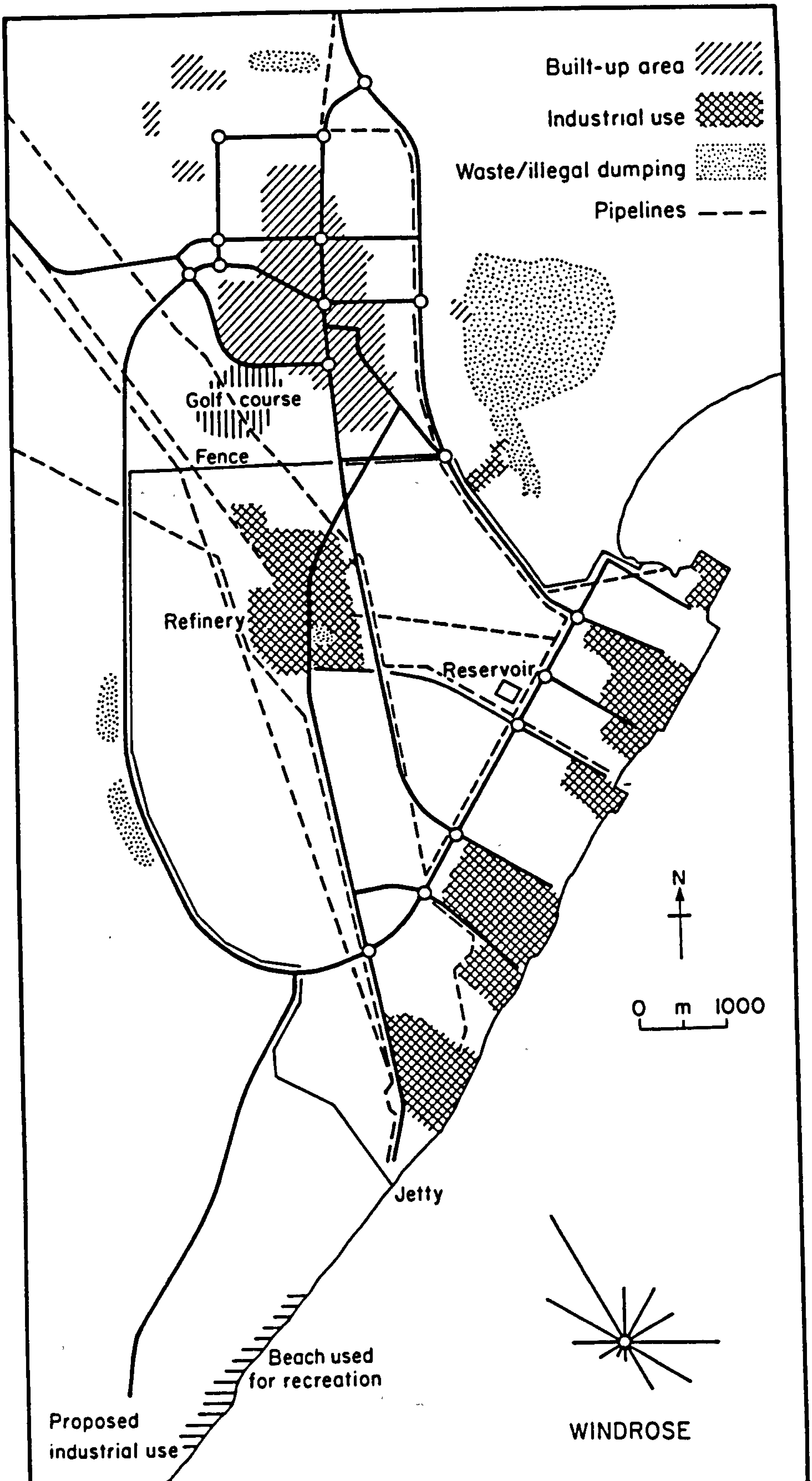


Fig. 5.2 Umm Said: land use

5.4 The Land Use of Umm Said 1949-1970

The purpose of this section is to study the effect of the hydrocarbon industry on the land use of Umm Said from the beginning of the oil industry in 1949 up to 1970, covering the period when the land use of Umm Said was under the control of the QPC. The section is divided into two parts - the first is concerned with the industrial zone and the second with the urban land use of Umm Said.

5.4.1 The Industrial Zone of Umm Said 1949-1970

In late 1947 the company started its preparations to make Umm Said the onshore oil terminal for Qatar by laying the oil pipelines between the Dukhan region and Umm Said (for further details, see Chapter 4), and by constructing a road between Dukhan and Umm Said (Figure 4.1). At this stage the road was neither properly laid nor levelled, and followed every bump across the desert terrain. It was unmetalled, but merely drenched in crude oil to compact the loose surface sand[20]. The road linking Umm Said and Doha was similarly constructed in the 1950s. At the same time as the pipelines and road were being constructed, the company was erecting oil storage tanks to form the oil terminal (Figure 5.3).

In 1949 the oil terminal was ready to export oil. The terminal was the first visible land occupation by the hydrocarbon industry in Umm Said. It occupied 0.12 km^2 of land (Table 5.1) with pipelines offshore of approximately 3 km, feeding the oil tankers offshore at three S.B.M.s[21]. From this terminal the first oil tanker was loading oil in December 1949 and sailed with cargo for the international market. In 1952 the port of Umm Said started to provide another function by supplying food and equipment needed by the country generally. Goods were unloaded at the port of Umm Said and then transferred by small boat (owned by Qatari contractors) to Doha. Thus, in 1952, Umm Said became the major port of the country as well as its only oil terminal at that date.

Table 5.1 Umm Said land use occupation 1949 - 1968

Item	Area Occupied km^2	Percentage of 1974 planning area occupied in 1968
Tank farm and oil refinery	0.455	0.85
The residential area of Umm Said	0.405	0.76
Umm Said port	0.4	0.75
Roads in Umm Said	0.28	0.5
Umm Said oil terminal	0.12	0.2
Pipelines in Umm Said	0.04	0.07
Umm Said old airport	0.0144	0.027
Afjat Umm Said village	0.012	0.02
Total	1.73	3.2

Sources: Calculated from maps:

1. Saqr, A, *The Qatari Geographical Gazette*, Beirut, about 1959 (Arabic), pp.116-117
2. Al-Dabbagh, M, *Qatar Past and Present*, Beirut, 1961 (Arabic), pp. 82-83
3. Map of Qatar by Ministry of Information press, Publication Department. Photogrammetic survey, compilation and cartography by Hunting Surveys Ltd., Elstree Way, Boreham Wood, Hertfordshire, England, 1980. Scale 1:200,000
4. Fieldwork in January 1991 for Afjat Umm Said.
5. Map of Umm Said, Sheet No. 1750/510, 570, 630. Photogrammetic survey from air photographs taken in October 1968 by Hunting Surveys Ltd, Elstree Way, Boreham Woods, Hertfordshire, England.

The main port of Umm Said in 1952 had the second largest land occupation after the oil terminal, as it occupied an area of about 0.4 km^2 (Table 5.1), and the area of the port contained a police station, power and distillation plants, customs office, and an administrative office for the port authority(22).

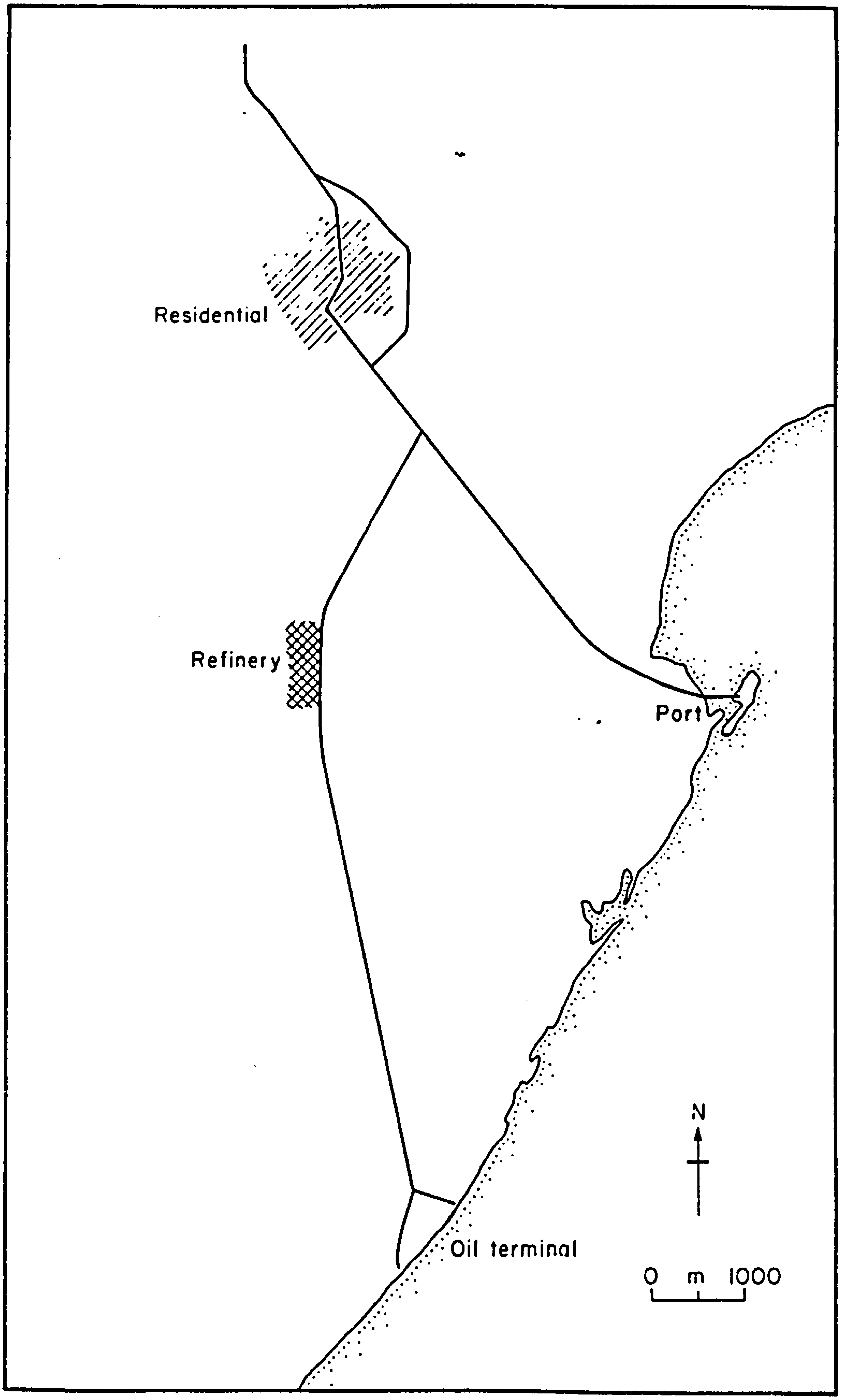


Fig. 5.3 Umm Said: during the QPC era, 1968

In 1953 the company built the first oil refinery at Umm Said and also the first manufacturing plant in the history of Qatar, a topping plant with a daily production of around 600 barrels of kerosene, petrol and diesel[23]. The refinery was mainly constructed to provide the company's needs, the surplus being sold on the domestic market. The refinery and the oil tanks occupied an area of approximately 0.455 km^2 (Table 5.1 and Figure 5.3).

Oil pipelines were also being extended around Umm Said (in 1949). Originally the oil pipelines had run from Dukhan to Umm Said oil tanks and refinery, then towards the oil terminal and by 1949 the land occupied by pipelines in Umm Said was approximately 0.04 km^2 (Table 5.1). At this stage we can see the beginning of the industrial zone in Umm Said as the port in the north eastern part of the coast of Umm Said, the oil terminal approximately 9 km south of the port and the tanks and oil refinery approximately 4 km south west of the port and 6 km north west of the oil terminal midway between the coast and the residential area of Umm Said (Figure 5.3).

Thus, in the first half of the 1950s the land occupied in Umm Said was approximately 1.73 km^2 (Table 5.1). In the period 1949-1955 the industrial zone was greatly extended. The expansion continued at a modest rate between 1955 and 1970 as the company had been concentrating on marketing crude oil on the international market before developing the refining industry further in Qatar. This meant that for a time the relatively small refinery and port were more than sufficient to supply the QPC's needs.

In 1965 the government of Qatar began to challenge the QPC for land use in Umm Said although previously the government had agreed that the QPC could have full control over the area. This control had been granted for the area containing the oil terminal, storage tanks, topping plant, QPC offices and the residential area for QPC employees. In addition, the QPC had specified that no future land use be adopted that would hinder the free traffic to and from Umm Said[24].

One example of the government's commercial interest in Umm Said which posed a challenge to the industrial dominance of QPC was the 1967 feasibility study for a chemical fertiliser plant. This study was undertaken by Gibb-Ewbank who strongly recommended Umm Said as a location for the plant. However, QPC indicated that they wished to preserve exclusive rights to the area of the marine terminal at Umm Said for their oil tankers. This example illustrates QPC's attitude to other industry - any challenge for land in the area would be strongly opposed and, given the rights originally granted to them by the government - rejected. Presumably it considered Umm Said a prime industrial site too valuable to share.

However, the QPC's control over the Umm Said area is not total and some new factors have appeared. The following factors have somewhat diminished the monopoly of the QPC company in Umm Said:

1. The rapid development of the offshore oil fields and their greatly expanding contribution to the revenue of the state since 1965;

2. The state of Qatar purchased the topping plant at Umm Said from the QPC in 1968;

3. The establishment of full independence of the state of Qatar from British control on 3 September 1971 which gave the government greater control over QPC activity;

4. The ambitious plans of the new ruler of Qatar - who succeeded his cousin on 22 February 1972[25] - for developing the nation's industry. The following statement from the ruler given in 1974 in a newspaper interview illustrates his policy: he said that in the Umm Said area one could see Qatar's future[26].

The ruler and his government consider that to maintain a steady income in a country whose land is unsuited to agriculture and the possibilities for tourism are slim, an alternative means for Qatar to secure adequate revenues for the present and future generations is to develop industry.

Umm Said was wrested from the QPC by the Qatar government between 1972-1976. The government gradually gained control over the town of Umm Said in order to develop Umm Said as the main Qatari hydrocarbon processing town (the take over is discussed in Chapter 2). Tables 5.2, 5.3, 5.4 and 5.5 show the facilities provided by the government of Qatar in Umm Said for encouraging industry. The above contributed, to a certain extent, to attracting various industries to Umm Said (industries discussed in Section 5.5)

Table 5.2 The services which the government offer in Umm Said

Service		Price (US Dollars)	Unit
Natural Gas	Industries in which the government owns more than 70%	0.22	1000 Cubic metres
	Industries backed by foreign investors	1	
	Power and water distillation plants	0.22	
Power	The government offers power to all industrial sectors	0.0164	Kilowatt hours
Water	The cost of water to all sectors in Umm Said	1.20	Cubic metres

Sources: State of Qatar, Ministry of Industry and Public Works, Department of Industrial Affairs, 20 December 1989, p.1-2

Table 5.3 The Rent of the industrial sector in Umm Said

Service		Price (US Dollars)	Unit
The rent of the whole of the industrial sector		0.274	$1m^2$
Wharves	The government built 11 wharves which could receive 4.5 tonnes per m^2. The government rent 3 of them of 800m length, 15.5m depth and two wharves of 510m length and 13m depth	1040	Per metre per annum

Sources: Ministry of Industry and Public Works, Department of Industrial Affairs, 20 December 1989, p.2

Table 5.4 Other services in Umm Said and their cost

Service		Price (US Dollars)
Monthly rental for government-let accommodation	Flats: 3-4 rooms	548-685
	Villas: 2-3 bedrooms	548-685
	Labourers blocks: 8 bedrooms	219-274
Note:	The government permits the various companies in Umm Said to build their own houses in Umm Said. These companies can make use of the land without charge for 15 years. After 15 years all of the land and the whole of whatever is on it returns to the government which rents them back to the various companies.	

Sources: State of Qatar, Ministry of Public Works and Industry, Department of Industrial Affairs, 20 December 1989, p.3

Table 5.5 Fuel and other services

Service		Price (US Dollars)
Fuel	Premium gasoline	0.15
	Super gasoline	0.16
	Diesel	0.15
	White kerosene	0.11
	LPG	0.24
Other public services offered free by the government	• Fire brigade	
	• Environmental protection	
	• Full offshore safety	
	• Net of roads,lights,drainage	
	• Security	
	• Health (Hospital)	

Sources: State of Qatar, Ministry of Industry and Public Works, Department of Industrial Affairs, 20 December 1989, p.3

5.4.2 Urban Land Use of Umm Said 1949-1970

The residential town of Umm Said was originally built as a company camp to serve the company's employees. Since 1949 the growth of the town has been very slow - between 1949 and 1955 the total population of the town did not exceed 400-500 people. However, there was a dramatic change in 1956 when the company's headquarters were transferred from Dukhan to Umm Said and this increased the residential land use and was also reflected in an increase in the population of the region of Umm Said. In 1960 the population had increased to approximately 2,500 people[27].

In 1960 the town of Umm Said had four categories of houses:

1. Villas for senior staff. These were residences of a high standard, each surrounded by walls to preserve privacy and with modern services such as surfaced roads, electricity, water supply, and garages.

2. Housing for middle-ranking staff employees. Like the above, these houses were grouped together although they were not so extensive nor of such a high quality in terms of furniture and other facilities.

3. Bachelor housing. This housing consisted of single rectangular shaped rooms for single persons and accommodated the labourers.

4. Contractors' camps. This housing was scattered throughout the town and housed labour for the many contractors attracted to Umm Said, such as the Mothercat Company.

5. In addition there was a fifth category of housing located in the small village of al-Afjaht, 4 km north west of Umm Said. This housing was built in the 1950s by Qataris from various Qatari tribes working for the company - the al-Madid, Bani Hajir, Muza'reaa and Manaseer. The reason for the Qatari employees settling away from the QPC camp was so that they could pursue their own lifestyles and to enable them to graze their livestock on the land around the village. The village had approximately 6 houses, a mosque(28), 2 livestock yards, a room housing a small electric generator and Majlis (guest room). In 1970 these people were evacuated from their village, the government paid them compensation(29) It occupied an area of about 0.012 km^2 (Table 5.1), whereas the urban area of Umm Said occupied an area of about 0.405 km^2 in the 1950s. The fact that al'Afjaht was the only village attracted to the region of Umm Said contrasts with several small Bedouin settlements which had been attracted to the Dukhan region (Chapter 3 - villages Section 3.5.2). One reason for this lack of settlement is that the Umm Said region has less favourable grazing.

In the 1950s Umm Said received its water supply by pipeline from wells at al-Jumayliah and al-Sunu. This is an example of the multiplier effect of industry on land use - the occupation of land not only by hydrocarbon activities but of other services for the town and industry. This is also well illustrated by the growing complexity of the services and transport networks in Umm Said in the 1950s and 1960s:

1. In the 1950s Umm Said had a water distillation plant and a power station generating up to 4520 kW(30).

2. Road transport: roads linking Umm Said with Doha and Dukhan. The roads occupied an area of about 0.28 km^2 in Umm Said (Table 5.1).

3. Air transport: Umm Said had a small airport serving the essential QPC needs and its employees. The area occupied by the airport was about 0.0144 km^2 (Table 5.1). The airport was subsequently abandoned in 1959 because of the opening in the 1950s of Doha international airport. Doha airport serves the entire Qatar peninsula, and especially Umm Said which is only 35 km away, and has been connected to Doha by road since the 1950s.

4. Sea transport: see section 5.4.1 regarding the port of Umm Said. In the 1950s and 1960s Umm Said's function was not only as an oil terminal but also as the main Qatari port, as Umm Said received goods for the whole of Qatar. These were then transferred to Doha (the capital) in the boats of local contractors. The area dedicated and occupied by the port of Umm Said in the 1950s and 1960s was about 0.4 km^2, 0.3% of the present Umm Said (Table 5.1, Figure 5.2). The capacity of Umm Said port was more than sufficient for the QPC to receive its supplies which resulted in the abandonment in the mid-1960s of Zikrit jetty in the Dukhan region.

5. In the 1950s the health services in Umm Said were very good in comparison with other Qatari towns and included a hospital with approximately 40 beds[31].

Leisure facilities in Umm Said in the 1950s and 1960s were poorly developed; the sea and beach provided the main leisure facility for the foreign workers. The main recreation area was the beach south of the oil terminal[32].

As with the industrial zone, the QPC was the beginning of the present town of Umm Said (Figure 5.2), whose contemporary functions are discussed in Section 5.6.

After 1960 the QPC was reluctant to invest money in Umm Said as it had done when Umm Said was under its control because QPC considered that what it had constructed in Umm Said during the period 1949-60 was sufficient to achieve its goals in Umm Said. At the time Umm Said occupied an area of about 1.73 km^2 (3.2% of the present Umm Said) (Table 5.1), most of which was settled between 1949 and 1960. Between 1960 and 1970 there was no major development of Umm Said until, in the 1970s the government gradually started to take control of Umm Said from QPC in order to develop Umm Said as Qatar's leading heavy industrial town.

5.5 Industrial Area - Land Use Analysis Between 1970 and 1991

The purpose of this section is to examine the spatial impact of the industry on the land use of the industrial zone after Umm Said came under government control.

5.5.1 Offshore preparation in Umm Said

Parallel with the government takeover in the early 1970s the choice had fallen on Umm Said as the industrial centre for Qatar. Offshore preparation was a necessity for enhancing Umm Said so it could cope with the major industry proposed for the region. Offshore dredging was necessary to provide a suitable channel for major shipping to enter and leave the new industrial zone.

The new projects were very different from the old oil terminal in Umm Said. Previously the oil was stored in tanks onshore and then piped 3 km offshore to the SBMs from which the tankers loaded oil before taking it to the international market. This method meant that shipping had no need to dock on the coast of Umm Said (SBMs are explained in more detail in section 5.4.1)

The modern oil processing industry required shipping to come in close to the coast in order to load and unload the various cargoes and this led to a major dredging operation in Umm Said between March 1975 and January 1978 (see Table 5.6). The dredging meant the wharves were served by a deep channel linking them with the main eastern water channel to international waters (Figure 5.1).

Table 5.6 The distribution of wharves in Umm Said industrial zone

Wharf Number	Designation	Length (metres)	Depth (metres)
1	Unloading iron ore	350	15
2	Unloading iron ore	190	15
3	Unloading iron ore	190	15
4	Export of iron and steel products, some unloading	190	13
5	Export of iron and steel products, some unloading	190	13
6	Export of iron and steel products, some unloading	190	12
7	Berthing of Cement Carriers	200	10
10	Berthing of Cement Carriers	200	10
18	Petrochemical plant (QaPCo) and Qatar Fertilizer Co. (QaFCo)	225	13
19	Petrochemical plant (QaPCo) and Qatar Fertilizer Co. (QaFCo)	225	13
Southern	Handling ammonia	212	11.8
Northern	Handling Urea	212	12

Sources: Ministry of Communication and Transport, Department of Ports, *Ports of Qatar*, (no date) Doha, p.20

Dredging was parallelled with construction of various industrial sites in Umm Said and also with the building of wharves. As well as providing deep channels for modern shipping, the dredging operation was useful for reclamation purposes (for further detail see Section 5.2). Much of the land around Umm Said was sabkha and, in order to exploit the land, especially the coastal region, the government had to undertake a major reclamation programme to provide suitable land for industrial sites. The discharged material (sand, stones, etc.) from the dredging operations provided reclamation material. Material from the dredging operation amounted to 26.0 million m^3, enough to reclaim an area onshore of 5.5 km^2 at Umm Said[33].

The direct effects of changes in land by industry at Umm Said were parallelled by changes offshore. Industry occupied not only onshore land (Section 5.5.3) but also extended offshore. This is supported by figures relating to offshore Umm Said: the area dredged was about 3.57 km^2 (Table 5.7)(Figure 5.1); the protection zone for the oil terminal had an area of approximately 8.24 km^2 (Table 5.7) dedicated to it. The total offshore area dedicated directly for serving the purposes of industry is approximately 11.81 km^2 (Table 5.7). However, this was not the only area offshore affected by the industry in Umm Said. In the next section the indirect effect of industry in Umm Said on the offshore area will be examined.

Table 5.7 The area dredged or occupied along Umm Said offshore.

Item	Area km^2
Restricted offshore areas around the oil terminal	8.24
The dredged area offshore Umm Said	3.57
Total area occupied or affected offshore directly by Umm Said industry	11.81
% of offshore area in Qatar	0.046

Sources: Umm Said Offshore Area, Admiralty Chart, Taunton, 10 September 1971 under the supervision of Rear-Admiral G.P.D. Hall D.S.C., Hydrographer of the Navy. Crown Copyright 1981. Scale 1:50,000.

5.5.2 The Supervision of the Industrial Zone in Umm Said

This section will discuss the land affected by industry in Umm Said. First it will be helpful to mention the means of industrial supervision in the early stages of development which is undertaken by the Industrial Development and Technical Centre (IDTC) which was established by Government Decree 3 in 1973[34].

Until 1989, the IDTC was the state of Qatar's technical and advisory authority in major industrial projects and diversification activities, and the direct link of IDTC with the Emir of Qatar[35]. It provided continuous industrial surveys and studies and supervised major projects in Umm Said, and in Qatar as a whole. Its greatest achievement was the five year industrial development plan which covered the period 1974 to 1978. Thus we may call 1974 the year when the industry really became established in Qatar. The plan contained new projects - for steel and petrochemical plants, and some expansion of existing projects - fertiliser, cement, oil refineries and NGLs[36]. In 1989 the IDTC merged with the Department of Industry to form the Ministry of Industry and Public Works. Most of its former functions were transferred to QGPC to avoid duplication.

The spatial impact of the above projects on land and sea use of Umm Said will be discussed in the next section.

5.5.3 Major Industry in Umm Said

This section will examine land use associated with the hydrocarbon processing industry, to indicate the considerable spatial impact of the industry on land and sea use in the Umm Said region (Figure 2.9). Um Said was created by the hydrocarbon industry, and has grown in response to its expansion and diversification. Once Umm Said was established, there was no serious alternative bastion for associated industrial activity as long as the sources of oil were from Dukhan and from the eastern offshore fields.

1. NODCo: National Oil Distribution Company

The history of NODCo has been summarised above in Section 5.4.1. NODCo was taken over by the government from the Qatar Petroleum Company in 1968 (see Table 2.3 for details of ownership) to undertake the domestic distribution of petroleum products. A second refinery was built between January 1972 and September 1974 on the same site adjacent to the old oil refinery (Figure 5.4). The second refinery produced 6,200 b.d of oil. In 1977, after the addition of some improvements to the refineries, production reached 9,500 b.d.[37]. When the need for petroleum products in Qatar increased, the government built a new refinery on land dedicated for NODCo in Umm Said (Figure 5.4) located adjacent to the existing refineries and crude oil tanks. The last refinery was commissioned on 15 October 1983. This brought the total capacity of refineries in Qatar to 62,000 b.d.[38] and the total land occupied by refineries in Umm Said to approximately 1.82 km^2 (Table 5.8), or approximately 4.2% of Umm Said's industrial zone (Figure 5.4). This, however, is only the direct land use affected by the refineries; the indirect effect is much greater. NODCo refinery and storage tanks discharge chemical substances and industrial waste ib liquid form into waste pits. Some of this liquid discharge allegedly finds its way into underground sediments while some evaporates into the air. It is possible that the sedimented material poses a danger to the underground water system in what is an area of very scarce water supplies - the effluent could damage the aquifer. The sea could also be affected, as the refinery is only a few kilometres from the shore (Figure 5.4) and percolating materials could find their way into coastal waters.

There is an additional aspect of pollution from the refineries whose flare pipes can be seen 17-20 km away from Umm Said in daylight. A subjective impression suggests that there is a degree of air pollution in Umm Said caused by NODCo, especially from the flames and from the evaporation of material in open pits(39). This evidence indicates that the indirect effect on the environment of NODCo's activities is more widespread than the direct land occupation. Significantly, NODCo is gradually expanding its land use. A study of Qatar provisionally indicates that a new refinery will be needed by 1995 or at least an expansion of the existing ones(40). This also suggests that the direct land occupation by NODCo may grow.

Table 5.8 The area occupied in the industrial zone of Umm Said by plants in 1990

Plants		Area Occupied km^2	Percentage of Umm Said industrial zone fenced area
A.	Natural Gas Liquification (NGL)	3.09	7.15
B.	Oil refinery and tank farm (NODCo)	1.82	4.2
C.	Qatar Steel Co. (QaSCo)	1.045	2.4
D.	Qatar Petrochemical Co. (QaPCo)	1.0	2.3
E.	Qatar Fertilizer Co. (QaFCo)	0.7	1.6
F.	Flour Mill (FM)	0.08	0.185
G.	Al-Shaollah cement plant	0.08	0.185
G.	Ship repair yard	0.08	0.185
	Total	7.892	18.205

Sources:. A. Mr. S. Hasan, NGL, 19 May 1990 and September 1991.

B. Mr. H. Al-Muhandi, NODCo, 5 June 1990.

C. IDTC, *Qatar Achievement in Industrial Development*, Qatar, 1981, p.42

D. Mr. A. Al-Marry, QaPCo, 19 May 1990.

E. Mr. A. Fakhroo on 19 May 1990, public relations coordinator in QaFCo.

F. Mr. G. Salmeen, Flour Mill, 4 June 1990

G. Map of Umm Said Industrial Complexes, Scale 1:20,000, October 1987, Sheet USIAP-002. Drawn by Ahmad Iut.

2. NGL: Natural Gas Liquid

In 1971 Qatar started a major project for the processing and export of NGL based on the associated gas produced at the only onshore oil field at Dukhan. This project started production in 1975 but the plant was destroyed in 1977 by an enormous fire which claimed a number of lives (as well as a large number of other casualties). Here we have a clear example of the effects of the hydrocarbon processing industry on a

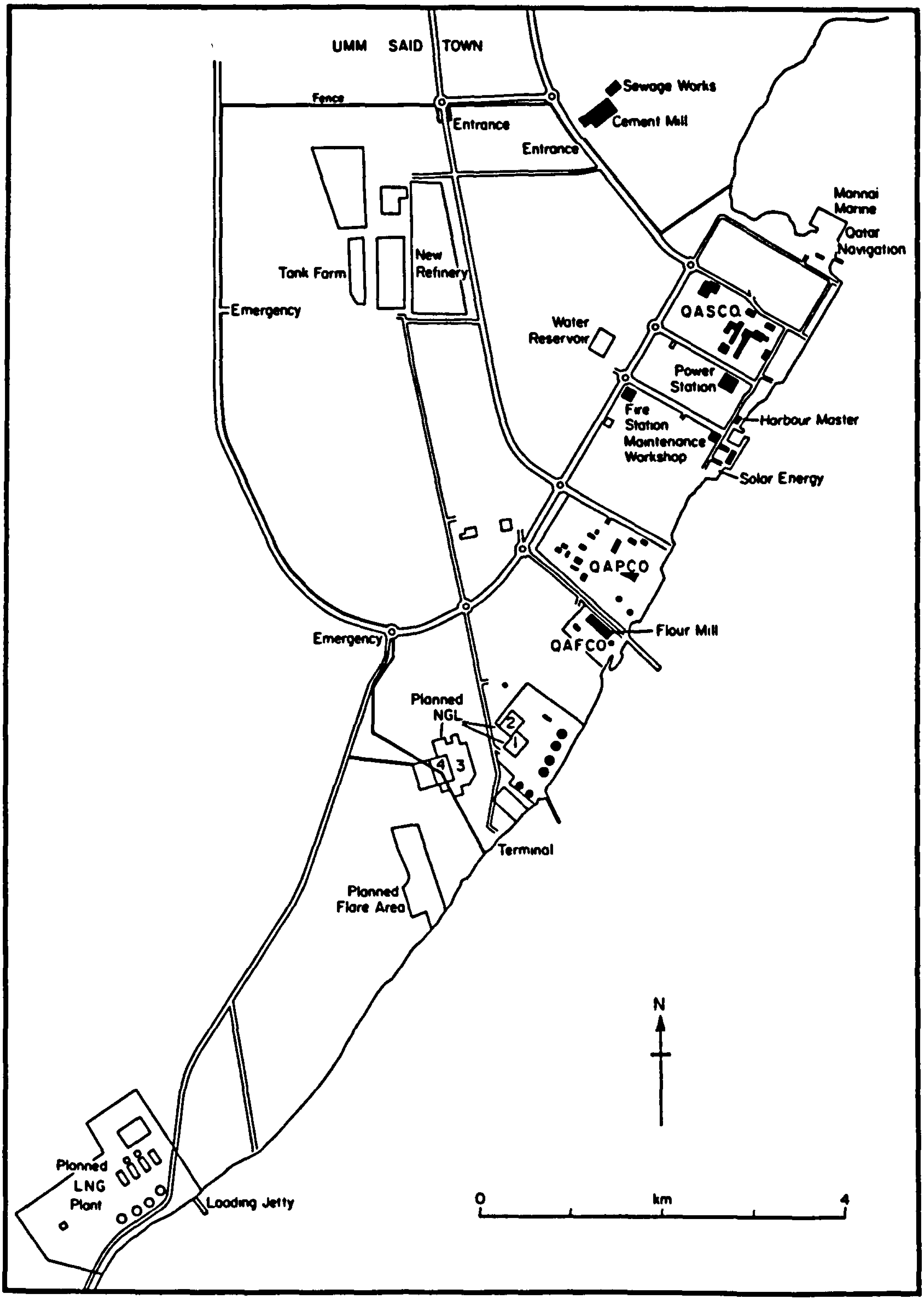


Fig 5.4 Umm Said: industrial land use

piece of land. The land occupied by the plant is not very great but the land around the plant is now useless and it would be very dangerous to use it for any civilian purpose.

Qatar found itself in 1977 under pressure to build another NGL plant to provide for domestic needs and the international demand for NGL products. Also the production of NGL utilises the gases associated with the production of oil which, otherwise, would be flared. If it cannot be processed to form NGL the associated gases from the oilfield must be burnt immediately as burning reduces the deleterious effects of H_2S on the air. The NGL plant is a safer and more useful way of dealing with these gases. In the period 1949-75 the associated gas produced by the oil fields was burnt in the air which could have had some effect on both onshore and offshore areas in Qatar.

Consequently the government built a new plant called NGL.1 in 1978 which was put into commission on 23 February 1981. This depends for its feedstock on the Dukhan oilfield (Figure 5.4). It has a daily production capacity of 740 tons of propane, 470 tons of butane, and 310 tons of condensates as natural gasoline. In addition, the plant is capable of producing 2.3 million cubic metres of ethane-rich gas per day and 4 million cubic metres of methane-rich gas. The ethane rich gas is utilised in the petrochemical complex.

In the same year (1981) a second NGL plant - NGL.2 was built in Umm Said. This depended for its supply of associated gases from the Halul region offshore (Figure 5.4). NGL.2 has a daily production of 220 tons of propane, 730 tons of butane, 73 tons of condensates, 0.9 million cubic metres of ethane-rich gas and 3 million cubic metres of methane-rich gas. These plants are the backbone of the hydrocarbon processing industry in Umm Said (Figure 5.4). The ethane-rich dry gases are sold to Qatar Petrochemical Company (QaPCo) as feedstock for the production of ethylene, propane and butane. When liquified it is referred to as liquified petroleum gas (LPG) and is mainly exported. Natural gasoline is also exported and residual gas is sold as fuel for other industries including Qatar Steel Company (QASCO) [41]. In the area adjacent to NGL.1 and 2, and according to an interview with Mr Shahid Hasan on 3 September 1991, a new gas plant has been commissioned, which will depend on the North Dome gas supply, and makes the area dedicated to the NGL's, gas plants and oil terminals about 3.09km^2 or about 7.15% of the industrial zone [42] (Table 5.8 and Figure 5.4).

The indirect influence of the NGLs on land is much more than its direct land occupation. The area around the plants is pervaded by strong smells which are unpleasant and the flames continuously discharge various chemical materials into the atmosphere affecting the area around. The noise of the plants has a tremendous effect on labourers at the plant. A subjective visual impression suggests there is a high degree of air pollution and it is hardly surprising to find that the land affected indirectly by the NGL.1 and 2 is a much larger area than that taken up by its direct land occupation [43].

3. QaFCo: Qatar Fertiliser Company

QaFCo is the third hydrocarbon processing industry in the region. QaFCo's first nitrogenous fertiliser plant began production in late 1973 with a capacity of 900 tons per day of ammonia and 1,000 tons per day of urea. The first plant was built by the company in co- operation with Gibb-Ewbank, UK, Davy Power Gas UK and Hamborns Bank UK. The high demand for the company's products encouraged the shareholders to embark on an expansion programme to increase capacity. New plants for ammonia and urea production were commissioned in 1979, and total design capacity is now 1,800 tons a day for ammonia and 2,000 tons a day urea[44] (Figure 5.4).

In an interview on 19 May 1990, Mr. K. al-Swadi stated that half a day's production of urea is sufficient for Qatar's needs for a whole year.[45] This means that QaFCo and the associated industries depend almost entirely on selling their products on the international market.

As QaFCo has expanded (see above), the land it occupies has also increased. The company began with one plant in 1973 and expanded in 1979 bringing the total land occupation to 0.7 km^2 - about 1.6% of Umm Said's industrial zone (fenced area)(Table 5.8 and Figure 5.4). This direct occupation may be increased again in the near future as a feasibility study is currently underway for a new plant which is a joint venture of QaFCo and QGPC. It is anticipated construction of this plant will begin in the 1990s and will depend on the North Dome gas supply[46] and will increase the direct land occupation by QaFCo. The indirect effect of QaFCo on land and offshore will be discussed at the end of this section.

4. QaPCo: Qatar Petrochemical Company

The construction of QaPCo began in 1977 and the project was complete in 1981. The plant features ethylene and low density polyethylene (LDPE) units. Its feedstock - ethane-rich gas - is provided by the NGL plant some distance to the south. The ethylene plant has a design capacity of 280,000 tons/year of technical propylene. A desulphurisation unit utilising the claws process is used to remove sulphur from the feedstock gas. The unit can recover between 50,000 and 60,000 tons of sulphur per year[47].

This project brought about 1 km^2 (Table 5.8) of land into direct land occupation, about 2.3% of the total industrial zone. It is anticipated that the extent of this land occupation will increase in the 1990s as a new plant, at present under the joint feasibility study of QaPCo and QGPC, is started. The new plant will be located adjacent to the existing one[48] and will increase direct land occupation by QaPCo in the region (Figure 5.4). The indirect effect of QaPCo on and offshore will be discussed at the end of this section.

5. QaSCo: Qatar Steel Company

Construction of QaSCo began in 1975 and experimental production commenced in March 1978 with commercial production in April 1978[49].

Most of the raw material for the plant is imported in the form of iron oxide pellets which are unloaded at Umm Said wharf (Figure 5.4) and transported by belt conveyors to the storage area and from there, when required, to the direct reduction unit. A small portion of the raw materials is in the form of iron scrap and is handled by cranes and trucks from Qatar. In the direct reduction furnace raw materials are converted to 'sponge iron' by a reducing gas containing hydrogen and carbon monoxide. The sponge iron is then cooled and discharged to the electric arc furnace in which scrap and sponge iron is melted at 1680°C. The molten steel is then collected in ladles from where it goes on to the continuous casting shop where it is moulded into 150 mm^2 billets. Production capacity of the shop is 526,800 metric tonnes per year. Most of the billets produced are sent to the rolling mill - the final stage in the process. The mill produces 330,000 metric tonnes per year of 10-32 mm steel bars. The bars are automatically bundled and shipped to customers[50](Figure 5.4).

The above summary gives an idea of the operation of the steel plant. Although it is not crucial to know how the plant operates for this study, it will help to estimate the spatial effect of the plant at the end of this section.

It has been noted that the administration of QaSCo dislike visitors inside their plant and it has been suggested that this may be because QaSCo is one of the most environmentally dangerous plants in the region. QaSCo's direct land occupation is approximately 1.045 km^2 (Table 5.8), which is about 2.4% of the total industrial zone of Qatar. QaSCo, like other factories in the region, has also reserved land adjacent to their existing plant for future expansion. This expansion will depend on the demand of the international market for QaSCo's products.

There is an agreement between the newly commissioned manufacturing Qatari companies for the establishment of a factory producing transformers and it is anticipated QaSCo will build a small plant adjacent to the existing one to produce materials to be used in the protection of steel products from corrosion. QaSCo will share the undertaking on a 50-50 basis[51]. This indicates that existing heavy industry in the region makes the area attractive for other industry to establish here. One reason is the availability of energy, and another the availability of feedstock, both of which are by-products from neighbouring plants. The availability of land already utilised for industrial purposes was an added advantage. The facilities shown in Tables 5.2, 5.3, 5.4 and 5.5 contribute in attracting the various local and international companies to invest in industry in Umm Said.

As well as the anticipated industrial use for the land adjacent to the QaSCo plant, an aluminium plant will shortly be built near QaSCo. This plant, depending on the North Dome gas supply, will also increase the direct land occupation in the region.

6. Other Industries

The other industries occupying land in the Umm Said industrial area are:

1. Flour Mill

The privately owned flour mill (FM) was opened in 1972 in an area adjacent to QaFCo. The existence of the flour mill in this heavy industrial location created a dispute as some people suggested that the product could be contaminated by industrial pollution.

However, during fieldwork in May and June 1990, many people directly involved with this issue were interviewed. On 26 May Dr Quttub from the General Hamad Hospital Laboratory in Doha who is dealing with this issue commented:

> *"Although there was some doubt of the advisability of having the flour mill located in a heavy industrial area which could pollute the product and which would be reflected in the health of the people, scientifically these doubts could not be confirmed"*.[52]

The Environmental Protection Committee in Doha gave a similar opinion. However, all the other people contacted said they would prefer to see the flour mill on another site (Figure 5.4).

In June 1990 Mr. G. Salmeen, the director of the flour mill said:

> *"There have been three years of intensive studies on the effects of the environment on the flour mill and all results proved negative. The plant is very well equipped with the latest technology."* (53)

The Director emphasised that similar plants exist in West Germany and Switzerland. Surprisingly, Mr. G. Salmeen concluded by saying,

> *"Although there isn't any environmental effect on the plant, it has been decided that by 1992/3 the operation will be removed to another site away from Umm Said and adjacent to the port of Doha".* (54)

This removal is probably to silence the continuous argument regarding this issue.

The attractions for the flour mill in Umm Said are the availability of suitable land, existing port facilities, and the fact that the area as a whole is dedicated to industrial use which has meant that the necessary infrastructure for the flour mill was available and much cheaper than in Doha (shown in Tables 5.2, 5.3, 5.4 and 5.5).

The area occupied by the flour mill is approximately 0.08 km^2 (Table 5.8), about 0.185% of the total industrial zone (Figure 5.4).

2. Other Industries

The al-Shoa'llah Cement Plant occupies an area of approximately 0.08 km^2 (Table 5.8) or about 0.185% of the total industrial zone.

The ship repair yard also occupies an area of approximately 0.08 km^2 (Table 5.8) or about 0.185% of the total industrial zone.

The above are shown in Figure 5.4.

This brings the total area directly occupied with the various industrial activities of Umm Said to approximately 7.895 km^2 (Table 5.8) which is about 18.205% of the total industrial area of Umm Said within the fenced area (fenced area - Figure 5.4) and about 4.1% of the greater administrative Umm Said region (Figure 2.9).

3. The Port of Umm Said

Being the Qatar's main port, Umm Said's port shares similarities with Doha. Its history is explained in section 5.4.1. The area occupied by the port of Umm Said is still the same as it was originally - 0.4 km^2 (see Table 5.1). No major expansion of the original port took place because most industrial plants in the region have their own jetties (Figure 5.4 and Table 5.6). Further, whilst the port's function was envisaged as serving the whole of Qatar, which it still does, the pressure on its facilities was somewhat reduced in the 1960s by the expansion of port facilities at Doha (discussed in Chapter 7, Section 7.5.2).

Other land uses in the Umm Said industrial zone are shown fully in Table 5.9 and occupy approximately 0.3 km^2, or about 0.7% of the total industrial area (fenced area Figure 5.4). These uses consist of shipping, the various laboratories, services and security which serve the industry of the area (Figure 5.4).

Table 5.9 Other land use in the industrial zone of Umm Said.

Item	Area Occupied km^2	Percentage of Umm Said industrial zone fenced area
Umm Said main port	0.4	0.9
Water reservoir	0.06	0.14
Main landing jetty	0.06	0.14
Solar Energy (SE)	0.04	0.09
Qatar Navigation	0.04	0.09
Power station	0.04	0.09
Sewage treatment station	0.02	0.046
Meteorological Station	0.01	0.02
Fire Control Unit	0.01	0.02
Hourbour Master tower	0.01	0.02
Main maintenance workshop	0.01	0.02
Total	0.7	1.6

Sources:
1. Umm Said Industrial Complexes, Scale 1:20,000, October 1987, Sheet USIAP-002. Drawn by Ahmad Iut.
2. Fieldwork by the author in the region between 15 May and 30 June 1990.

Two tables - 5.8 and 5.9 give details of the area occupied by the industrial zone. The area occupied by plants in the industrial zone (Figure 5.4, Table 5.8) is 7.895 km^2, 18.205% of the industrial zone, and the other land uses in the industrial zone (Table 5.9, Figure 5.4), about 0.7 km^2 or about 1.6% of the industrial zone, and the total of the two tables is 8.595 km^2, about 19.805% of the industrial zone.

This section has not examined the workforce of the area, but Table 5.10 gives information on this. It is worth noting that the total number of workers in the major plants is only 4014. In relation to the size of the industrial area this is surprisingly low, suggesting capital-intensive rather than labour intensive activity.

The structure of shareholdings of the various hydrocarbon processing companies, is shown in Table 2.3. Table 5.10 is significant for studying the urban area, as is Sections 5.6 and 5.7.1.

Table 5.10 Employment in the major plants in Umm Said.

	Plant or place	Employment	Percentage of Qatari
A.	NODCo	600	33
B.	QaFCo	770	15
C.	QaSCo	1172	15
	NGLs and Gas plant and oil terminal	350	43
D.	QaPCo	600	18
E.	Flour Mill	85	07
F.	Al-Shallah Cement Plant	437	7.5

Sources: A. Mr. H Al-Mohandi, NODCo, 4 June 1990
B. Mr. K. Al-Swadi, QaFCo on 19 May 1990
C. IDTC, *Qatari Achievement in Industrial Development*, Qatar, 1981, p.45
D. Mr. Martino, QaPCo, 19 May 1990 and Hamed Al- Mohani, 23 September 1991
E. Mr. G. Salmeen, Flour Mill, June 1990

5.5.4 Indirect Spatial Influences of Industry.

A major environmental effect of the industrial plants in the area is its impact on the offshore area and on marine life. Hydrocarbon processing plants depend on two cooling systems:

1. The cooling system using fresh water

This system is controlled in a closed circle which is linked by pipes and pumps of different sizes. This system has some leakage through the various joints which could result in a degree of pollution. This water is changed once every year and is usually discharged into the sea, or else into a small pond in the fenced area of each plant. Some of this water evaporates, and the rest percolates into the underground water which will find its way to the sea, as the pond is located on the coast.(55)

2. The continuous cooling system (sea water)

In this system, sea water is continuously cycled. Hydrochloric acid and sodium chloride are added to the water to prevent the growth of bacteria, etc., in the water which could cause blockage in the various pipes and pumps. This water is continuously circulating and at the end of the cycle is returned to the sea, and replaced with fresh sea water. The water which is returned to the sea is usually at a temperature below 10°C, and contains chemicals and some polluted material from the closed cooling system and from grease from the machinery in the various plants(56). All the plants discussed above used both systems, apart from the oil refineries which used an air cooling system.(57)

3. Power stations and water distillation plants

Some of the plants which process hydrocarbon products have associated power plants and water distillation plants. For example, QaFCo produces more than enough for its own use and sells the surplus water and power to the flour mill. QaPCo also has its own station, as does QaSCo. The other plants in the area buy their water and power supply from Ras Abu Fintas and Ras Abu Abaud in Doha.(58)

It has already been shown that the effect of this industry is not limited to onshore but also extends offshore. As stated above (Section 5.5) the offshore area dedicated for Umm Said is about 11.81 km^2 (Table 5.7), but its indirect spatial impact is enormous, and cannot be precisely delimited. There is evidence of the decline in the environmental quality of the former, as, for example, Mr K. Al-Swadi said on 19 May 1990:

> *"When QaFCo first came to their site the water under QaFCo's jetty was rich with fish but these fish have since vanished"*(59).

The Municipality also claims that in July 1988 they found many tons of dolphin and fish of different sizes dead on the coast. The Municipality suggested that some of the industrial plants accidentally or intentionally dumped some poisonous material in the sea causing the marine disaster(60).

> *"We could not find out from which plant the deadly material came, and concluded that none of the plants in the region would confess that they dumped anything in the sea."*(61)

On 6 June 1990 the Umm Said Municipality also told us that they had received a lot of complaints from fishermen in the region - fish were ill and weak - and this could be related to the effects of pollution discussed above.(62)

The Arabian Gulf already has a very high salinity - reaching 40 parts per 1,000 on average compared with that globally for seas of 35 parts per 1,000. The Gulf is also very shallow, with an average depth on the Arabian side of the Gulf of only 35 m.(63) The high salinity of the water in the Gulf is attributable to the high temperature of the air over the water which causes high rates evaporation. The industrial plants at Umm Said undoubtedly contribute in some degree to the pollution of the Gulf, as water which is used from some of their operations finds its way, with its charge of toxic chemicals, into the sea. Sea water is also used in cooling systems, carrying heat away from the industrial plants into the sea. Not only does this result in the pollution of local water, as explained above, but the elevated temperature of the water reduces its oxygen content, an effect which is exacerbated by the disposal of water containing toxins into the sea(64).

4. The effect of the industry on land

The fenced area of the industrial zone is about 43.2 km^2 (Table 5.11) which is about 22.7% of the Umm Said administrative region, but of this zone the area occupied is only about 8.595 km^2 (totals of Tables 5.8, 5.9), which is about 19.805% of the industrial zone, leaving about 80% of the area unutilised, which seems very wasteful.

Table 5.11 The total land for the industrial and urban areas of Umm Said.

Item		Total area km^2	% of Umm Said region
A.	Industrial zone, fenced area	43.2	22.7
B.	Umm Said planned urban area	10	5.3
	Total	53.2	28

Sources: A. Umm Said Industrial Complexes, scale 1:20,000, October 1987, Sheet USIAP-002. Drawn by Ahmad Iut.

B. Correspondence with QGPC on 17 May 1990.

In June 1990, Mr A. Al-Buainain QGPC Public Co-ordinator said:

> *"The IDTC made a very bad mistake in the industrial zone, as the hydrocarbon processing industry was supposed to be close to the coast for its cooling system. They did not build seawater channels within the onshore area which could have enabled it to handle three or more times as much as the existing industry, and would have reduced the waste land behind the coastline."(Figure 5.4) (e.g. like the seawater channels in Jubail and Yanbu)* (65)

In an interview on 1 January 1992, however, Mr I. Al-Ansari criticised the above statement, arguing that undeveloped land in Umm Said industrial zone could still be developed by constructing water pipelines, distributing water all over the Umm Said industrial zone (Figure 5.4). The pipeline network could have two ends, one for drawing the water from the sea, and the other to return used water to the sea. This method would be much better than the water channels used in al-Jubail (discussed in Section 5.7) as the pipelines keep the water cooler than the water in the channels.[66] The above shows that the land in the industrial zone of Umm Said which is away from the coast could be developed for industrial purposes by building a water cooling using a pipeline network (discussed in Section 5.7.3).

A recent study by the Department of Industrial Affairs (Ministry of Public Works and Industry) on 20 December 1989, concluded that Umm Said exploited only 50% of its capacity[67] (roads, port facilities, land, and other infrastructures as shown in Tables 5.2, 5.3, 5.4 and 5.5). The Department is now preparing a five year plan for expanding some of the hydrocarbon processing industry plants in Umm Said and Umm Said will accommodate some new industries, depending on Phase 1 of the North Dome gas supply (opened 3 September 1991). This gas will be used as feedstock and as an energy supply for some of the industries in Umm Said and as energy suppliers for other industries in Umm Said. The start of the five year plan coincided with the completion of Phase 1 of the North Dome.

The above means that growth of Umm Said's industries will be continuous during the 1990s, increasing its spatial impact on land use which could be doubled or more. As seen in Figure 5.4, some of the new areas planned for the development of Umm Said will be outside the industrial fenced zone, in the south along the coast, e.g. a proposed flare area and LNG plant (Figure 5.4).

There is another sort of undeveloped land in the area which is in the form of a buffer zone preserved partly for purposes of security and safety, between the industrial and urban areas and comprises about 23 km^2 (Table 5.12). This undeveloped land was measured from the sites of the industrial plants to the fence which surrounds the industrial area (Figure 5.4). If the undeveloped land north of the fence is included, the total undeveloped land could be as much as 25.2 km^2, or about 47.1% of the whole of the Umm Said industrial and urban areas - the urban part will be discussed in Section 5.6.

Table 5.12 Other land uses in Umm Said industrial zone.

Item		Area occupied km^2	% of Umm Said used, planned areas for industry and urban expansion
A.	Undeveloped land between the industrial sites and the fence of the Industrial Zone	23.0	43
B.	Undeveloped land between the urban area and the industrial fence	2.2	4.1
A.	Area occupied by roads	0.46	0.86
	Total	25.66	48

Sources: A. Umm Said Industrial Complexes, October 1987, Scale 1:20,000, Sheet USIAP-002. Drawn by Ahmad Iut.

B. Umm Said residential area [QaFCo Confidential], Scale 20cm:1km, 17 January 1982. Updated by author's fieldwork in Umm Said in May 1990.

5. Environmental hazards

Industry creates environmental hazards in the region Figure 2.9). The people to suffer from them most obviously are the workforce of the various plants who have to wear cotton wool in their ears continuously to protect them against the tremendous noise generated by the plants. There is also a very bad smell in the area, especially close to the plants and this too makes life unpleasant in the vicinity of the plants. The smell can be detected throughout the region. In addition, the various plants continuously emit dust, especially QaFCo and QaPCo. Flames which continuously discharge into the sky leave a smoke plume visible throughout the industrial area and far beyond. There is also a degree of evaporation of the toxic-laden water from the ponds in the various plants where chemical liquids are discharged. The whole of the above undoubtedly causes a degree of air pollution.

On 19 May 1990 Mr K Al-Swadi commented as follows:

> *"there is a wind direction monitor in each plant and when the people hear the alarm they have to run against the wind to help them to reduce the number of casualties in an unpleasant event."* (68)

6. Dumping areas

Fieldwork in the Umm Said region in May-June 1990 identified six dumping areas (Figure 5.2), only one of which is permitted by the Municipality. The first is north of the industrial area on the eastern side of the main road which links Doha with the main entrance to the Umm Said industrial zone (Figure 5.2). This unsightly dumping area can be seen from the coast road; a bad smell can be detected in this area. The effect of this dumping ground is evident both onshore and offshore. The materials deposited are various but appear to contain chemicals.(69)

A second, smaller, dumping area is north west of the Umm Said industrial zone and is easily visible. Some of the land of this area has also been used for reclamation purposes (Figure 5.2).

A third dumping area is to the south on the Khararah Road.(70) This area was used for industrial refuse. In June 1990 the Municipality admitted that "some chemicals were dumped in the area" but they did not have adequate authority from the Government to prevent this.(71)

A fourth dumping area is south west of the town of Umm Said and west of the industrial zone where there are dumped piles scattered along the road which goes to the Umm Said beach in the south silin.[72] The Municipality have suggested that these dumped materials were from the NGL plant burnt in 1977, and also from construction waste of the town of Umm Said and other projects[73] (Figure 5.4).

A fifth can easily be seen, as it is opposite the above at the fence of the industrial zone.[74] Some of it is from the debris of the NGL plant which was destroyed in 1977 and discussed above (Figure 5.4).

A sixth dumping area is the only area permitted officially for the purpose in the region and is located about 8 km south west of the town of Umm Said and about 3 km south west of the industrial area[75] (Plate 5.1). Large quantities of refuse are dumped by a convoy of trucks from the industrial plants and from the town itself (Figure 5.4).

The Municipality takes some of the refuse from some of the plants to the dumping area; they carry only ordinary refuse and the industrial plants have to carry their own dangerous refuse up to the dumping area. The Municipality digs pits to bury certain types of refuse but in other respects the Municipality exercises little control [76] as confirmed by Mr A Al-Sayd on 6 June 1990:

> *"in the mornings between 6 am and 1 pm, we can control the dumping operation and we could force the various plants to dump their refuse in the main dumping area, but this dumping by the various plants often happened after 1 pm as the Municipality is closed at that time, and the plants dump their refuse in the easiest way they can."* [77]

This clearly demonstrates the weakness of the Municipality in Umm Said which needs strengthened powers to cope with local industry.

Plate 5.1: *A small part of Umm Said dumping area. This area has an extremely unpleasant odour and is plagued by flies and other insects. This occupies a significant amount of land but, because of its unpleasant aspects, badly affects an even larger area.*

The main dumping area is affected by flies, insects and bad smells, rendering life unbearable in the vicinity. The dumping areas are also very unsightly, especially those near the town, spoiling the general view and negatively affecting the urban environment (see Section 5.6). The dumping areas in the region probably occupy an acceptable amount of land but their indirect influence (explained above) is capable of affecting the whole region, and probably beyond. A potential solution to the problem of industrial waste may be to consider certain types of waste as a by-product. In an interview with Mr K Al-Swadi 29 May 1990 he revealed that waste is:

> "... *sold to some foreign companies in Saudi Arabia as they buy from some plants, especially QaFCo, to utilise for other industries.*" (78)

5.6 Urban Area: Land Use Analysis

Umm Said town was established in 1949 to serve the oil industry in the region, but in the 1970s the Qatari Government took over the town from the oil company (discussed in Section 5.4.2).

Thus the first impression for a visitor to Umm Said town is of a European-style settlement (Figure 5.5) because the first planners and occupants were the British company, QPC. Also, after the Government took over Umm Said, the town was left under the supervision of IDTC and the Ministry of Public Works, whose supervision of Umm Said was backed by Western professional planning companies. Those, like the Shankland Cox Partnership, who were doing full-scale planning for Qatari land use did not make any major recommendations concerning Umm Said. Another Western company, William L Pereira Associates, produced a new plan for Umm Said town in March 1983. This plan suggested that Umm Said land use should have a residential capacity totalling 5,304 dwelling units. This housing capacity could meet the residential requirements of an ambitious housing construction programme to 1990. At an average of 5.5 persons per household, the residential areas indicated could accommodate a population capacity of almost 30,000 people[(79)], but this figure never became reality; the population of Umm Said in 1990 was only 6,094 people (Table 5.13), nor did Umm Said experience major housing construction in the period 1983-90 (Plate 5.2). The reason is that Umm Said is linked by first class roads to Wakrah and Doha, and the journey to Doha is no more than 30 minutes. This has meant that as many as half of those who work in Umm Said during the daytime, prefer not to reside in the town but to commute. Details on people's places of residence were obtained from fieldwork questionnaires distributed in Umm Said on 19 May 1990 (100 forms were distributed and thirty-six were answered by the people in Umm Said), and from some interviews in Umm Said made between 15 May and 30 June 1990. Those people who responded to the questionnaire were about 56% Qatari and 44% non-Qatari. Fifty-two percent of the sample were living in Umm Said, of whom about 21% were Qatari and 76% non-Qatari; but surprisingly, none of the sample expected to retire in Umm Said,(80) which gave us much the same result as the Dukhan region. Apparently the new hydrocarbon industrial towns in Qatar have little personal or emotional attraction, for Qatari and non-Qatari people(discussed in Chapter 6, Section 6.2).

Table 5.13 The population of Umm Said.

	Year	Population
A.	1950/54	400-500
B.	1960	2500
A.	1976	2000
A.	1982	5800
C.	1990	6094

Sources: A. Mr. Al-Kubaisi, M., *Industrial developments in Qatar 1950-1980*, PhD 1984, Durham University, pp.238-239

B. Al-Dabbagh, M., *Qatar past and present*, Beirut, 1961, p.82

C. Correspondence with the Central Statistical Organisation, 24 May 1990.

5.6.1 The residential area of Umm Said

Umm Said town represents a different style and quality of residential area of the region as it is more or less of western design (Figure 5.5). The total planned area in

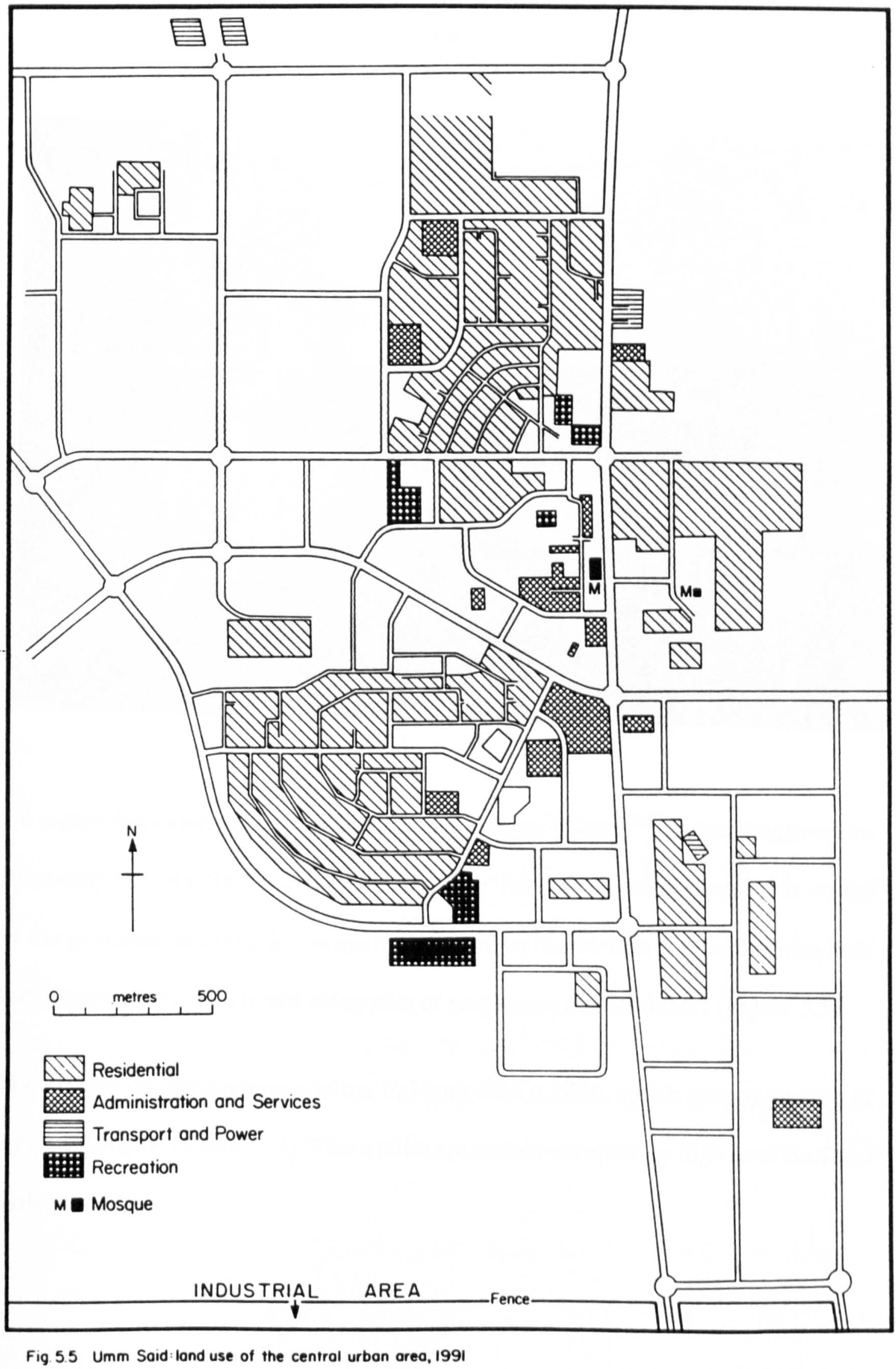


Fig. 5.5 Umm Said: land use of the central urban area, 1991

Plate 5.2: *In the background is Umm Said urban area which clearly shows how much land has been developed in the planned urban area. One of the unauthorised dumping areas which are a feature of the whole of the Umm Said area is shown in the foreground.*

the region dedicated for residential purposes is about 10 km^2 (81). Regarding property ownership in Umm Said (explained in detail in Table 5.14), some property is owned by the government and other property is owned by the various companies who built accommodation for different categories of employees and labourers (Figure 5.5).

The highest quality accommodation in Umm Said is villas, which occupy an area of about 1.034 km^2 (Table 5.14). These villas are mainly occupied by high level staff and their families.

Table 5.14 The residential areas of Umm Said.

Item		Area Occupied km^2	% of Umm Said urban area
	Villas	1.034	10.34
A.	Shanty houses	0.07	0.7
	Blocks and Bachelors	0.0613	0.613
A.	Bechtile Camp	0.0301	0.301
	Palace	0.0268	0.268
	Old houses	0.00045	0.0045
	Total	1.223	12

Sources: Umm Said Residential Area, [QaFCo Confidential Map], Scale 20cm:1km, 17 January 1982 and updated by author's fieldwork in May 1990

The second style of accommodation in the town is that of blocks of bachelor accommodation situated away from the town area on the eastern and north western sides of the town; these blocks occupy an area of about 0.0613 km^2 (Table 5.14).

The third level of accommodation is the shanty houses which have been built by the various contractors' companies in Umm Said for their labourers. These shanty houses occupy an area of about 0.07 km^2 (Table 5.14) and are located directly on the eastern side of the villas and the town centre (Figure 5.5) giving a poor impression of the town. Where the shanty houses are, the picture of the town dramatically changes to that of a depressed townscape. These shanty houses should be demolished to be replaced by acceptable low rent accommodation for their inhabitants e.g. the old houses of Umm Said.(82) Such improved housing would at least enhance the external view of Umm Said (Figure 5.2).

The other major tract of land used for residential purposes in Umm Said is Bechtel Camp, a company which assists QGPC in technical planning. Bechtel camp occupies an area of about 0.0301 km^2. Other land occupation in Umm Said is clearly shown in Table 5.14 and Figure 5.5.

These bring the total area occupied for residential purposes in Umm Said to about 1.223 km^2 (Table 5.14); or about 12% of the Umm Said urban area.

5.6.2 The town centre

The master planning study by William L. Pereira Associates for Umm Said in 1983 devised three major areas:

1. Town Centre,

2. Neighbourhood Centres, and

3. Local Centres.

The gross commercial floor space programmed for Umm Said totals one square metre per person, distributed between local centres, neighbourhood centres and the town centre.

Amongst other proposals, the study declared that

1. commercial facilities should include several convenience shops and one or two larger stores, with total gross floor area up to 1500 m^2 and a site area of about 3500 m^2. Sites for four neighbourhood centres are reserved in the land use plan.

2. the town centre should provide neighbourhood commercial needs for the adjacent residential area as well as city-wide needs. In addition to retail fa-

cilities, the town centre should include a cinema, park, plazas, a Jumma Mosque, commercial offices and parking.

3. gross retail space programmed for the town centre, including neighbourhood land services, totals 22,500 m^2, while the site allows for open space landscaping and adequate parking. Commercial office space in the town centre is programmed at 0.5 m^2 per resident, resulting in an ultimate capacity of 15,000 m^2 of private office space to serve a population up to 30,000[83].

The above proposals remain only a study. Most of the proposed facilities do not exist. In common with master plans for cities the world over, not all the proposals of the master plan will be fulfilled. For example local and neighbourhood centres do not exist, apart from small shops scattered in an unorganised fashion around the town.[84] In the case of the town centre, this exists but not all the facilities which were suggested by William Pereira Associates have been built. As revealed by fieldwork in May-June 1990 in Umm Said, the facilities which do exist in Umm Said town centre are: the labour office, Doha Bank, Qatar National Bank, the Post Office, Qatar Cold Store, a travel bureau, Gettco, camp office, cinema, food centre, tyre repair shop, Jabco laundry, the Jumma Mosque and others (Figure 5.5). In total, these occupy about 0.082 km^2 (Table 5.15), which is only about 25% of the land dedicated for Umm Said Centre and about 0.82% of Umm Said urban area which is about right for actual population (Table 5.15).

Table 5.15 Areas occupied in centre of Umm Said.

Item	Area occupied km^2	% of Umm Said Centre
Jab Co. Laundry	0.018	5.5
Cinema	0.0033	1.006
Main Store	0.003	0.91
Main Mosque	0.003	0.91
Qatar National Bank, Post Office, Qatar Cold Store and Travel Bureau	0.00123	0.375
Doha Bank	0.0012	0.367
Gett Co.	0.00063	0.192
Food Centre	0.0006	0.183
Labour office	0.0004	0.122
Tyre Repair Shop	0.00023	0.07
Camp Office	0.000113	0.034
Other	0.05	15.244
Total	0.082	25

Sources: Umm Said residential area [QaFCo Confidential], scale 20cm:1km, 17 January 1982 and updated by author's fieldwork in May 1990.

One reason for the slow growth of Umm Said Centre is the influence of Doha's shopping areas on Umm Said. The questionnaires distributed in Umm Said on 19 May 1990, show that 100% of the sample prefer to shop in Doha(85), as the capital provides them with all the facilities they need and the first class network of roads between Umm Said and Doha makes the trip easy for people. The journey takes no more than 30 minutes. A second reason is that the population of Umm Said is quite small, and cannot support a full range of facilities. Other reasons for the slow growth of Umm Said Centre will be discussed below in Section 5.7.1.

5.6.3 Recreation and other activities

The recreation activities in Umm Said are provided by each company for its senior and middle-ranking staff. Al-Banush Club is for QaFCo and NODCo senior staff; Al-Danah Club for QaPCo and QaSCo senior staff; Al-Maha Club for QaFCo middle-ranking staff; and the NGL Club plus golf course for senior staff[86] (Figure 5.2).

These clubs provide excellent leisure facilities for high level staff, e.g. swimming pools, table tennis, tennis courts, social room, theatre, restaurants and other social amenities. Lower grades of workers do not have access to similar facilities. That brings the total area occupied by leisure facilities in the urban zone to about 0.8177 km^2, which is about 8.2% (Table 5.16) of Umm Said urban area. Due to the marked cultural and traditional differences between the Qatari and the non-Qatari, the majority of the recreation facilities in Umm Said are used by the non-Qatari population - Qatari men prefer to keep their women at home and participating in social activity with other women only. Qatar is, of course, an Islamic country so religious buildings have a proportion of Umm Said urban land use. There are about 5 mosques in the urban area, two of which are Jumma (Friday) prayer mosques.[87]

Table 5.16 Recreation, clubs, golf course and other leisure uses.

Item	Area km^2	% of recreation facilities in the urban area
Club and Golf course	0.81	8.1
Tennis Courts	0.005	0.05
SS Mess	0.0023	0.023
Other	0.0004	0.004
Total	0.8177	8.2

Sources: Umm Said residential area [QaFCo Confidential], scale 20cm:1km, 17 January 1982 and updated by author's fieldwork in May 1990.

5.6.4 Public services

Public services in the Umm Said urban area do not match requirements. Even employees of some of these services stated in interviews (on 6 June 1990) that, for example, the Municipality cannot cope with the needs of the Umm Said administrative region(88) (Figure 2.9).

The people of Umm Said (in fieldwork surveys in May-June 1990) were also complaining about the health services provided in Umm Said town.(89) These examples give us some evidence of the poor quality of some of the public services in the region (this will be discussed further in Section 5.7).

The total area occupied by the public services in the Umm Said urban area is about 0.51 km^2, which is about 5.1% (Table 5.17) of Umm Said urban area (Figure 5.5).

Table 5.17 Umm Said land occupied by the public services in planned urban area.

Item	Area occupied km^2	% of Umm Said urban area
Main road around the town	0.287	2.9
Water, power station	0.16	1.6
Schools	0.0275	0.275
Police quarter, police HQ	0.014	0.14
Fire Brigade	0.008	0.08
Other security buildings	0.006	0.06
Cable wireless	0.0045	0.045
Substation	0.00383	0.0383
Hospital	0.0023	0.023
Municipality	0.00063	0.0063
Drainage office	0.00025	0.0025
Total	0.51	5.1

Sources: Umm Said residential area [QaFCo Confidential], scale 20cm:1km, 17 January 1982 and updated in by author during fieldwork in May 1990.

5.6.5 Light industry

The urban area in Umm Said also has some light industry, some of which needed to be near the residential area to provide services for it. Light industry can operate independent of hte main industrial area of Umm Said. A prime example is the grainplant.

Mr A. Sadiq, the Director of the grain plant, in an interview on 25 May 1990, said:

> *"We import grain from abroad and we receive imported goods from QaFCo and the flour mill wharf, and sometimes use the wharf of the Navigation Department. Our main suppliers of grain are Argentina and Australia. Our main tasks are to receive grain from abroad, clean it up and prepare it with our machines, then distribute it in Doha and other Qatari towns by trucks.*

The total number of our workforce is about 15, and none of them are Qatari. This plant also has some environmental impact on the urban area as dust which usually discharges from this plant, especially when the prevailing wind is towards the residential area, can cause annoyance to people. On the other hand, I would prefer to have this plant away from this region which is occupied by the hydrocarbon processing industry and any industry which is associated with food products should be away from this region, because food products can be polluted in a heavy industry region." [90]

This grain plant occupies an area of about 0.004 km^2 (Table 5.18).

Another example is the automatic bakery which supplies Umm Said as well as Doha with bread and occupies an area of about 0.005 km^2 (Table 5.18). Other light industries are the Qatar Insulation Company, Qatar Styropor factory, AKC Catering Company for Bechtel and QaPCo, Golden Star Co. and the Gulf Insurance Co.[91]. These occupy about 0.045 km^2 (Table 5.18 and Figure 5.5).

One of the light industries in Umm Said which should have been established is a salt plant, the source being easily available (shown in Plate 5.3), but this, as yet, has been overlooked.[92]

Table 5.18: Land occupied by other industries in Umm Said urban area

Item	Area occupied km^2	% of the industries in the urban area
Petrol pump and garage	0.0125	0.12
Bakery	0.005	0.05
Grain plant	0.004	0.04
Other	0.045	0.45
Total	0.067	0.7

Sources: Umm Said Residential Area [QaFCo Confidential Map], Scale 20cm:1km, 17 January 1982 and updated by author during fieldwork in May 1990.

Finally, the built up area of Umm Said is about 2.7 km^2, which is about 27% (total of Tables 5.14, 5.15, 5.16, 5.17 and 5.18) of the designated urban area and about only

Plate 5.3: *This is east of the Umm Said - Doha motorway, showing salt which might be developed for salt products. Dumping is evident in the foreground.*

5.3% of the Umm Said administrative region occupied, dedicated and planned for the urban zone (Figure 5.2). The high percentage of open space and land in reserve is characteristic of most industrial towns in the GCC states, such as Yanbu.[(93)] The residential area of Umm Said is smaller than the industrial zone which it supports, which is the reverse of most industrial towns in Europe.

In correspondence with QGPC on 14 May 1990, the company stated that the area occupied in the proposed Umm Said urban zone was about 4 km^2, which is about 40% of the urban area[(94)] but in May-June 1990, reference to some official, up-to-date maps produced by IDTC who were supervising Umm Said to late 1989, confirmed by fieldwork showed that the land occupied in the urban area is in reality only about 27% of the urban area[(95)] (total of Tables 5.14, 5.15, 5.16, 5.17 and 5.18).

There is considerable undeveloped land between the town and the industrial area as noted above. All the planners working on the Umm Said urban zone prefer that expansion of Umm Said should be towards the north and west away from the effects of industry and to reduce the environmental effects on the town as much as possible.

Mr A. Al-Buainain, the Public Co-ordinator Director of QGPC, was interviewed in June 1990 and asked why QGPC were planning Ras Laffan as the new industrial town in Qatar. One of his comments was that when IDTC planned the industrial zone of Umm Said, they did not leave enough distance between the industrial and urban zones and the effects of industry easily reached the urban area. Mr A. Al-Buainain added that there should be a buffer zone between industrial and urban areas of not less than 8 km.(96) However, there is only about 4.4 km separating the industrial and urban areas of Umm Said, and the distance between the oil refinery and the urban area is only about 1.9 km. It is certainly true that the the Umm Said urban zone is affected environmentally by the industry. There is a pervasive smell and smoke is easily visible from the urban area(97) (Figure 5.2). The Government could separate the industrial zone from the urban area by planting trees around the fence of the industrial zone (Figure 5.4) which would reduce the environmental effect on the urban area.

The above outlines all the services which exist in the urban area. The slow growth in Umm Said urban area, its population, and the environmental effect on the urban area will be discussed below in Section 5.7.

5.7 Conclusion

As shown in Figure 2.9, the area of the Umm Said administrative region, according to the Central Statistical Organisation in Qatar, is about 189.9 km^2, about 1.7% of the Qatar peninsula[98] (Figure 2.9), and the density of the population in the region is about 32 people per km^2. In Qatar as a whole, the density is about 39.5 people per km^2. The total area surrounded by the industrial fence in Umm Said is about 43.2 km^2, 22.7% of the Umm Said administrative region (Table 5.11). As explained in Section 5.5, this fence encloses a security zone around the industrial complexes to protect them against sabotage (Figure 5.4), and to protect the public and livestock from a dangerous hydrocarbon processing zone. The total area dedicated for the urban zone of Umm Said is about 10 km^2 or roughly 5.3% of the Umm Said administrative region (Table 5.11), but not all of it is yet occupied by urban construction. The total land occupied by industry and urban in the region, either directly, for safety, or reserved for future expansion, is about 53.2 km^2, which is about 28% (Table 5.11) of the Umm Said administrative region.

The environmental impact of the industrial plants on future expansion in Umm Said needs to be considered (Figure 5.4). The prevailing wind direction in Qatar being northerly and north westerly (Figure 5.2) means that the area to the south of Umm Said is unsuitable for permanent settlement as smoke and dust are carried southwards from the industrial plants (Figure 5.2). The impact of Umm Said is not only on land, but also offshore. Umm Said directly affects an area of about 11.81 km^2 offshore (Table 5.7), which is about 0.046% of the total Qatari offshore area. As was shown in

Section 5.5, the spatial impact of the industry on the offshore area is almost as much as on the onshore area of Umm Said.

Clearly the Umm Said administrative region (Figure 2.9) is fundamentally influenced by the oil industry in both its land use and offshore areas, and the effect of Umm Said could reach more than its region in terms of environmental pollution.

The hydrocarbon processing industry has given birth to other, similar, industrial towns throughout the Arabian Gulf region, e.g. Arrauays in Abu Dhabi (U.A.E.), Fahal port in Oman, Salman port in Bahrain, Al- Ahmadi in Kuwait (destroyed February 1991 by Iraqi military forces during their occupation of the state of Kuwait), and Al-Jubail in Saudi Arabia. These industrial Gulf towns are all capable of having similar effects on land and sea, especially Al-Jubail which is an enormous industrial town dominated by the hydrocarbon processing industry, whose effect on land and offshore could be six times as great as Umm Said's impact on its environs.

Jubail is a clear example of the spatial impact of the hydrocarbon processing industry on land and sea use of the Arabian Gulf (its masterplan was prepared in 1975, and construction on the city started in 1977).(99) The extensive harbour facilities at Jubail include an industrial port for dry liquid bulk cargo with a 10 km long causeway and a commercial port for general cargo(100). Earthmoving for the initial foundation stage of Jubail construction programmes also affected land use in the region.(101)

The Jubail site is low-lying coastal plain consisting of sabkha and sand dunes, similar to most of the coastline in the Gulf. Most of the area designated for development had to be raised a full 2.5 m to place it above the marine flood threshold. Raising the site also increased the ground water depth, thereby reducing the effects of salinity on plant growth and protecting the underground utilities from salt water infiltration.

The sea water cooling system at Jubail is enormous, although its design is straightforward enough. Cool Arabian Gulf water is drawn into an intake structure located just north of the industrial port causeway and is then pumped at a rate of 10 cubic metres per second via a network of canals and pipes throughout the entire industrial area. The industries take what they need, then return the used water into a separate but parallel canal system that discharges it back into the Gulf, south of the causeway. This way, water is used only once, and intake and outflow never mix. In 1985, the system's 20,000 horsepower pumping station and canal network could supply a volume of water equal to two-thirds the combined annual flow of the Tigris and Euphrates rivers[102].

Waste treatment and disposal is an unglamorous but necessary city service. At Jubail it is made more challenging by the need to cope with large amounts of industrial waste. Pipelines have been installed in Jubail to collect sanitary and industrial waste water. Separate treatment plants reclaim large quantities of waste water which is then used to irrigate landscaping throughout the communities. Much could be learnt from Jubail about disposal of solid waste which goes to sanitary landfills located on the outskirts of the city. Hazardous wastes receive special handling. All waste disposal operations aim for the least possible impact on the existing ecology[103]. Jubail demonstrates the effect not only in land use occupation but also sea use occupation, and the construction of Jubail could easily be called a thorough revolution in the land and sea use of its region and its indirect effect is surely much greater. In comparison with the Jubail industrial town, Umm Said's hydrocarbon industrial processing is small scale, as is the effect of Umm Said's direct and indirect land and sea use. At this point if we compare the environmental effect of the hydrocarbon processing towns on the two sides of the Gulf (Arabian and Persian) we find an enormous effect on the Gulf's land and water generated by the hydrocarbon industry in general[(104)].

Jubail town was opened in the 1980s with a population of more than 30,000 and with an estimated population of more than 280,000 by the year 2010. The investment in Jubail City already amounts to more than $8,000 million. The current primary industries in Jubail are the manufacture of heavy industrial products such as gasoline, naphtha, diesel oil, fuel oil, lubricating oils, steel, ethylene, ethylene glycol, styrene, high-density polyethylene, methanol, urea and prilled sulphur. Such industries to date total eleven primary industries, and more than sixty support and light manufacturing industries, with many more plants under construction[(105)]. The town has the largest capacity of water distillation and power generation in the Gulf region, if not in the world, and also has modern public services and infrastructures serving both parts of the town - the urban and the industrial[(106)].

Its land occupation is probably very small in comparison with the huge Saudi desert in the eastern province but its location on the Arabian Gulf coast is significant, especially when we consider that the total length of the Gulf coast is 3,219 km[(107)], and that most of the settlement in the Gulf area is along the Gulf coastline historically and at the present time (discussed in Chapter 6, Section 6.2.1).

Because most of the settlements in the Gulf region are along the coastline, this increases the significance of leaks, by accident or sabotage, from the hydrocarbon processing industry sited along the coast. The hydrocarbon processing industry could conceivably have a spatial impact on the whole of the land and sea use of the Gulf countries. A recent example of this were the acts of sabotage in the Gulf perpetrated by the Iraqi military during their occupation of Kuwait of August 1990-February 1991. The Iraqis deliberately released oil from the Al-Ahmadi oil terminal into Gulf waters on 30 January 1991 and from the Umm-Qasir Iraqi oil terminal. About 9,000,000 barrels of oil were released from the above two terminals and this event proved to be a major problem for all the Gulf states, particularly as about two-thirds of Saudi Arabia's water supply comes from the distillation plants in the eastern province, and other Gulf states depend even more heavily than the Saudis on distilled water. The impact of the huge oil slick was far-reaching, damaging the Gulf coastline, especially, between Saudi Arabia and Kuwait, killing many birds, fish and other species in the Gulf Sea. The resources needed to combat the oil slick far exceed those of the Gulf states and Saudi Arabia and other Gulf countries have received assistance in their fight against this grave pollution hazard from the U.S.A., Western Europe, and Japan[(108)]. The crucial point of the example shown above is to demonstrate the vulnerability of the region vis-à-vis pollution, and with the Gulf being occupied by hydrocarbon production both offshore and onshore, with hydrocarbon towns located along its coastline, any accident or sabotage at any one of these installations poses a distinct threat which could have an enormous spatial impact on land and sea use, not only in the immediate vicinity but for all Gulf states.

The next section will discuss the turning point in Umm Said's history and concerns the reason why the development plan drawn up by William L. Pereira Associates in March 1983 has not achieved all it set out to do in Umm Said. If it had, Umm Said would now be one of the foremost towns in Qatar.

5.7.1 Umm Said town at a turning point

In this section, the reasons for the slow growth of Umm Said town will be examined. Firstly, it needs to be stressed that most of the residents of the town are not Qatari. People of about 30 different nationalities live in Umm Said. For example, in QaPCo alone there are people of 23 or so nationalities amongst the workforce of the plant[109]. Most foreigners depend on the various companies to supply them with accommodation, either in or out of Umm Said, as well as supplying them with full recreation activities in the town. The temporary nature of the contact with Umm Said by contractors contributes to the town's slow growth. For example, CCIC, a sub-contractor for Bechtel, came to Umm Said in March 1991 to build a second gas plant, and located their residential camp in Umm Said urban area (Plate 5.4). Of 800 employees, 700 live in the camp and 100 reside in al-Wakrah. In an interview with a senior employee of CCIC on 28 December 1991, it was made clear that CCIC do not need apartment residence for they will be in Umm Said only for a year and then they will move to another site, taking their camp with them.[110] This impermanence exacerbates the slowness of growth of Umm Said's urban area, as one contractor after another comes for a limited period of time and then strikes camp. This also contributes to the fluctuation of Umm Said's population (Table 5.13).

Another factor which discourages the private sector from investing in housing in Umm Said is that all the land in the region is owned by the Government (Table 5.4), which makes any investment in the region under the control of the public sector, which the private sector usually tries to avoid.

Plate 5.4: *This is CCIC camp in the residential area of Umm Said. CCIC came here to participate in building a new gas plant in March 1990, and are expected to leave the area with the camp in late 1992.*

Secondly, Umm Said is linked by a first class road with Doha (discussed in Section 5.6), which makes commuting to Doha very easy for the employees, as shown by a study revealing that 100% of them visit Doha for shopping, 33% for business, 80% for social contact, 61% for recreation, and 58% for medical treatment[111]. These results give a strong indication of reasons for the slow growth of Umm Said town and centre which is clearly influenced by the main town, Doha being only about 40 km north of Umm Said.

Thirdly, fieldwork in May and June 1990 revealed that not only the Qataris prefer to live in Doha and in other Qatari towns, but also some of the non-Qatari workforce choose to live in Doha and Wakrah. Allowing the workforce of Umm Said to reside in Doha indicates the failure of the Qatari Plan to reduce the pressure on Doha's residential area. Some residential areas in Doha and Wakrah accommodate the Umm Said workforce which commutes daily by contractors' buses and private vehicles. Mr Shahid Hasan, the Director of the NGL himself gave an example of this in an interview on 19 May 1990:

> *"I live in Doha and for recreation prefer to go to Dukhan beach because I believe the area of Umm Said is unhealthy for residence and also unhealthy for recreation because the environment of Umm Said is influenced by the hydrocarbon processing industry".* (112)

This shows that not only the Qatari prefer not to live in Umm Said, but even common for the non-Qatari, when they are able to live away from Umm Said, do so. The second reason why more than about 50% of the workforce in Umm Said live out of town is the shortage of accommodation in the Umm Said urban area, despite the fact that some of the directors in Umm Said would prefer their workforce to live in Umm Said near the industrial plants. One reason for this is the need to assemble their workforce quickly in the case of an emergency.(113)

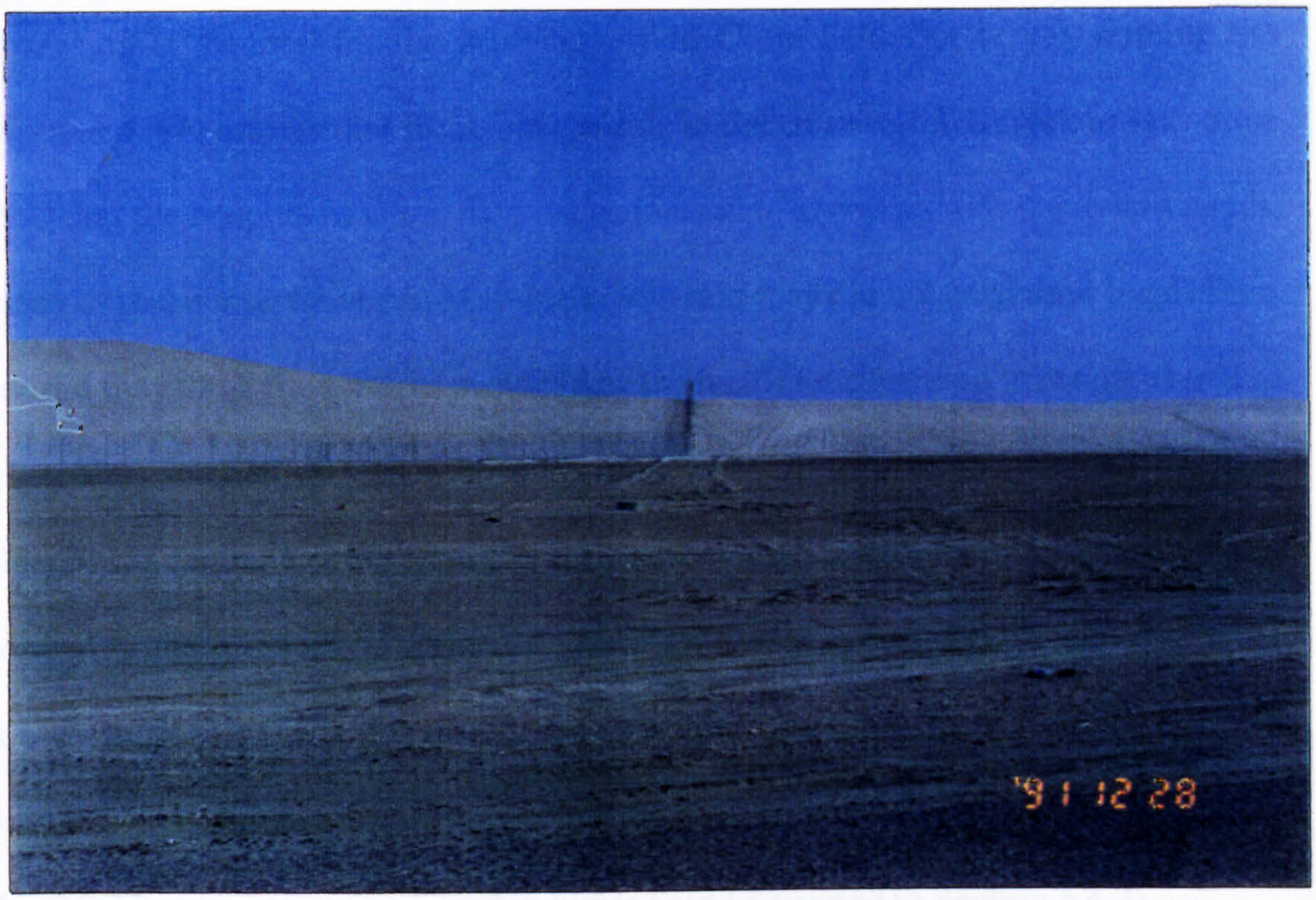
The people of Wakrah also suffer from the daily commuting of the Umm Said workforce. As Mr A. Muftah, a Wakrah resident, revealed on 29 May 1990:

> *"the road from Umm Said to Doha passes through the middle of Wakrah town, and when people are late going to work they drive at very high speeds through the middle of Wakrah, and the same when they leave work, and also the daily trip which is made by the heavy trucks for supplying the capital with some of the Umm Said products. The road shuttle causes an enormous noise pollution in the town of Wakrah and a lot of horrifying accidents are caused in Wakrah as a result of the daily commuting between Doha and Umm Said."* (114) *(Figure 2.9)*

A further, less tangible, factor is that people have no emotional ties with Umm Said as the township was established by the industry in 1949 as a company camp (explained in Section 5.3), and before that there was no settlement in Umm Said. Not only do the foreigners have no emotional ties with Umm Said, but neither do the Qataris as all of them prefer to keep in touch with their towns of origin. As shown in fieldwork questionnaires on 19 May 1990, none of the 36 people who responded in the sample expect to retire in Umm Said, which further confirms that Umm Said is a company town, and its function is to serve the industry in the region. People are in contact with the region for work only, and apart from that, e.g. social, shopping and other activities, the people of Umm Said generally look outside the region. These reasons give some explanation for the slow growth of Umm Said town and centre, as only about 27% (total of Tables 5.14, 5.15, 5.16, 5.17 and 5.18) of the designated urban area is occupied, and only 25% (Table 5.15) of the area dedicated for the town centre is occupied (Figure 5.5).

One clear result of the land use analysis of Umm Said is that the industrial zone could accommodate still more industry. However, the government plans a major new industrial town at Ras Laffan (Figure 5.6). This decision seems strange when we know the industrial zone (Figure 5.4) in Umm Said could accommodate twice as many industries as now (115) (Plate 5.5, which shows an example of the possibility of expansion in the Umm Said Industrial Zone). Also, for new plants which come to Umm Said, there would already be some infrastructure in existence which would make new development cheaper than in Ras Laffan (Tables 5.2, 5.3, 5.4 and 5.5). Umm Said would also be better than Ras Laffan in terms of environmental effects as the site of Ras Laffan is north of the majority of Qatari settlements, and the wind direction in Qatar is usually from the north west (Figure 5.2) which means pollution could affect the settlements of Qatar. In terms of security, it is difficult to see any strategic value in Ras Laffan - the distance between Ras Laffan and Umm Said is only

Plate 5.5: *This is the new extension of the industrial zone (fenced area) in the south in Silin which was built during the Gulf Crisis between August 1990 and February 1991. This fence includes a new area to the industrial zone of about 0.56 km².*



about 110 km and, if anything, the Umm Said site is more strategically secure than Ras Laffan. This does not mean that another industrial site in Qatar should not be developed in the future, but, Umm Said could fulfil all demands for the next 10 or 15 years. Once work starts on the new industrial town of Ras Laffan, it is likely to result in the vacant sites in the Umm Said urban and industrial zones remaining unoccupied. The Ras Laffan project is discussed in section 5.7.3 (Figure 5.6).

The essential public services in Umm Said require careful analysis (Table 5.17). It is clear that not all of them can cope with the town's needs, as was confirmed by

Municipal officials in June 1990.(116) Their ability to cope with the town's needs is limited, and they cannot prevent the various plants dumping in various places on land and offshore. They have been promised by the Ministry of Municipality that a major expansion is planned for the Municipality of Umm Said, but as yet, nothing has happened. We understood from local people in the course of fieldwork in May-June 1990 that the hospital in Umm Said is also incapable of coping with the town's needs. Many of those interviewed in May-June 1990 said they did not trust their local clinic, nor did they think the services provided by the local clinic were up to standard so that when they needed to visit a hospital, they went directly to the Hamad General Hospital in Doha.(117) Surprisingly, for a town which due to its nature may have to cope with major industrial accidents, Umm Said has very poor health facilities. What is even more strange is that during the 1950s and 1960s, the health service in Umm Said was probably the second best, if not the best in Qatar. This was the period when the QPC headquarters was based in Umm Said (discussed in Section 5.4.2).

Further evidence for Umm Said's slow growth can be studied through the fluctuation in the growth of population. In Table 5.13 the population of Umm Said between 1950 and 1955 is shown as about 400-500; in 1960 this figure had jumped to 2,500 people; in 1976, the population decreased to 2,000 people, at the time when the government took over from QPC; in 1982 the population jumped to 5,800, but by 1990 the population had increased only to 6,094, representing an increase of only 294 people in 8 years. The reason for the big increase in population between 1976 and 1982 is that this is the period when most of the projects in Umm Said came into production, and the slow growth between 1982 and 1990 can be attributed to the fact that there were no new projects undertaken in Umm Said in that period, thereby accounting for the very small increase in population in this period.

The fluctuations in population figures also reflect on the town growth, as town planners were unsure as to future demands of the town.

The next section deals with the landscapes and land use conflict in Umm Said.

5.7.2 Land use conflicts

Surprisingly, perhaps, in a region where there is plenty of land, there is conflict between the oil industry and other activity for land. The area between Wakrah and Umm Said is good grazing land, whilst its offshore area provides good fishing. The local people along the coast built intertidal traps. In the 1970s the Government laid pipelines (shown in Figure 4.1) from south of Wakrah towards Umm Said and other activities also increased in this area, e.g. QGPC's maintenance and monitoring of pipelines, security patrols, etc. These activities increased the vehicle tracks in the region which encroached on the grazing area. The effect has also been seen on the coast, as, in order to secure the offshore areas, the Government has introduced a scheme to buy intertidal traps from the local people, offering attractive prices. The conflict between industry and other local activities, therefore, has resulted in a loss of grazing area and reduction of fishing activities in the sea (discussed more in Section 5.3).

The landscape of the Umm Said region in general has changed to a view of the pipeline network entering the Umm Said region from the western and northern sides of the town (Figure 5.2, discussed in Chapter 4), giving the town a poor appearance. However, these pipelines are unavoidable as the region of Umm Said as a whole is dedicated to processing the products which are transferred by these pipelines. However, the effect could be improved if trees were planted along the sides of the pipelines, especially where pipes enter or leave the Umm Said urban area and such a tree planting scheme would greatly enhance the general view of the town.

The second point which prevents Umm Said from having an attractive landscape is the shortage of green areas in the region. The planning study of William L Pereira Associates for Umm Said in March 1983 suggested an increase in the green areas,[118] but this suggestion has not yet been taken up, and in the case of the town of Umm Said despite the well-planned built-up area, the shortage of green areas gives the town an arid character.

The availability of a first class road made accessibility to Umm Said very easy which resulted in attracting a lot of activities as discussed below. In my fieldwork in May-June 1990, we noticed an unattractive abandoned quarry belonging to Mr Batti Salim on the north Kararah Road. This quarry was attracted indirectly to the region by the industry, as the availability of good roads provided for industry also meant it would be a good site for a quarry. Although it is now abandoned, its effect on the landscape adds to the already arid desert the additional eyesore of decaying buildings and parts of abandoned machinery. The quarry's effect is not restricted to its site alone but also to the region generally as trucks carried stone and gravel from various places in the region to the quarry for further processing. As well as the loss of stones and gravels taken to the quarry denuding the landscape in various places this has resulted also in the tracks of heavy vehicles used to take materials to the quarry creating desert tracks further defacing the landscape. The second quarry developed in the region is Abu Zuaer quarry near the western Umm Said to Doha Motorway about 3 km north of the entrance established in 1976. It directly occupies about 0.25 km^2 and is adjacent to a lot of scrap vehicles belonging to the above owner. This quarry serves not only Umm Said, but the whole of Qatar.(119) Its effect on land is probably similar to, if not worse than, the abandoned quarry (Plate 5.6).

Plate 5.6: *Abu Zuaer Quarry on the western Umm Said - Doha road which was brought to the region by the easy accessibility made by roads in the region.*

The Umm Said region is one of the richest areas of sand dunes in Qatar. Due to the availability of roads generated by industry, some contractors have obtained Government permission to remove sand from this area to Doha and other Qatari towns. This sand is used in the construction industry or for improving the quality of soils in some farms in Qatar. Huge quantities of sand have been taken from the region which, of course, has affected the dune structure and destroyed the aesthetic appearance of the sand dunes. The land is also affected by the heavy trucks used to carry the sand which have created random tracks in the desert resulting in changing the natural appearance of the earth.

South of the industrial zone, the dunes have also been structurally destroyed by youths who come from Doha and other Qatari towns in the region in enormous numbers, in 4-wheel drive vehicles to challenge each other in driving over the sand dunes (Plate 5.7). On 30 May 1990 Dr B. Nassar of the Geography Department, Qatar University, stated:

> *"the effect of the vehicles is destroying the surface of the sand dunes, killing the grass on those dunes, and also creating disassembly of the sand which will make it prone to be taken up by the wind in large quantities. The area near the dunes is also greatly destroyed by vehicle tracks."* [120] *(Plate 5.7)*

Leisure activity is an important part of social life, but every activity must be controlled in the interests of safety and to protect the national resources.

The beach at Umm Said is exactly opposite the sand dunes and only separated from them by a road. These beaches, being of high quality, attract large numbers of people in Qatar who come to the region for fishing, swimming, sunbathing, camping and other activities. These beaches are unprotected from damage and driving over the sand destroys their beauty (Plate 5.7). Refuse is also dumped along these beaches which besides further defacing them, is dangerous as it often contains sharp material such as broken glass which could harm visitors. Food and other refuse dumped on the beach also creates bad smells and attracts flies and other insects (Plate 5.8). On 6 June 1990, Mr A. Al-Sayd, Director of Umm Said Municipality, commented on this issue:

> *"We put dustbins along the beach, but most people do not put their refuse in these bins; also some bins have been destroyed and others taken away. Because of the lack of powers of the Municipality and their feeble ability, the Municipality could not prevent these acts - most of them occurred at weekends and unfortunately the Municipal offices are closed at weekends and even during the week does not have enough staff to monitor the beach."* [121]

The Municipality seems incapable of meeting the needs of the region; the Ministry must give the Municipality of Umm Said more authority and wider powers to enable it to cope with its responsibilities.

There are other aspects to the conflict between industry and tourism in the region. The availability of scenic sand dunes and beaches in the region, of shops and services in Umm Said town, and of roads brought to the region to serve industry, are all factors which attract visitors to the Umm Said region. The region is, however, also very badly affected by the hydrocarbon industry (Figure 5.2), negating some of its attraction. Smoke can be seen over the area of the beaches and also sometimes the bad industrial smells pervade the beaches (Plate 5.9). This gives a subjective impression that there could be a degree of air, water and smell pollution in the region, affecting especially the tourist sites which are located south of the industrial area (Figure 5.2). Most of the time the prevailing wind in the region is northerly or north westerly which brings pollution continuously towards the beach area. Also, the beach is located almost midway between the industrial zone and the main dumping area of Umm Said and

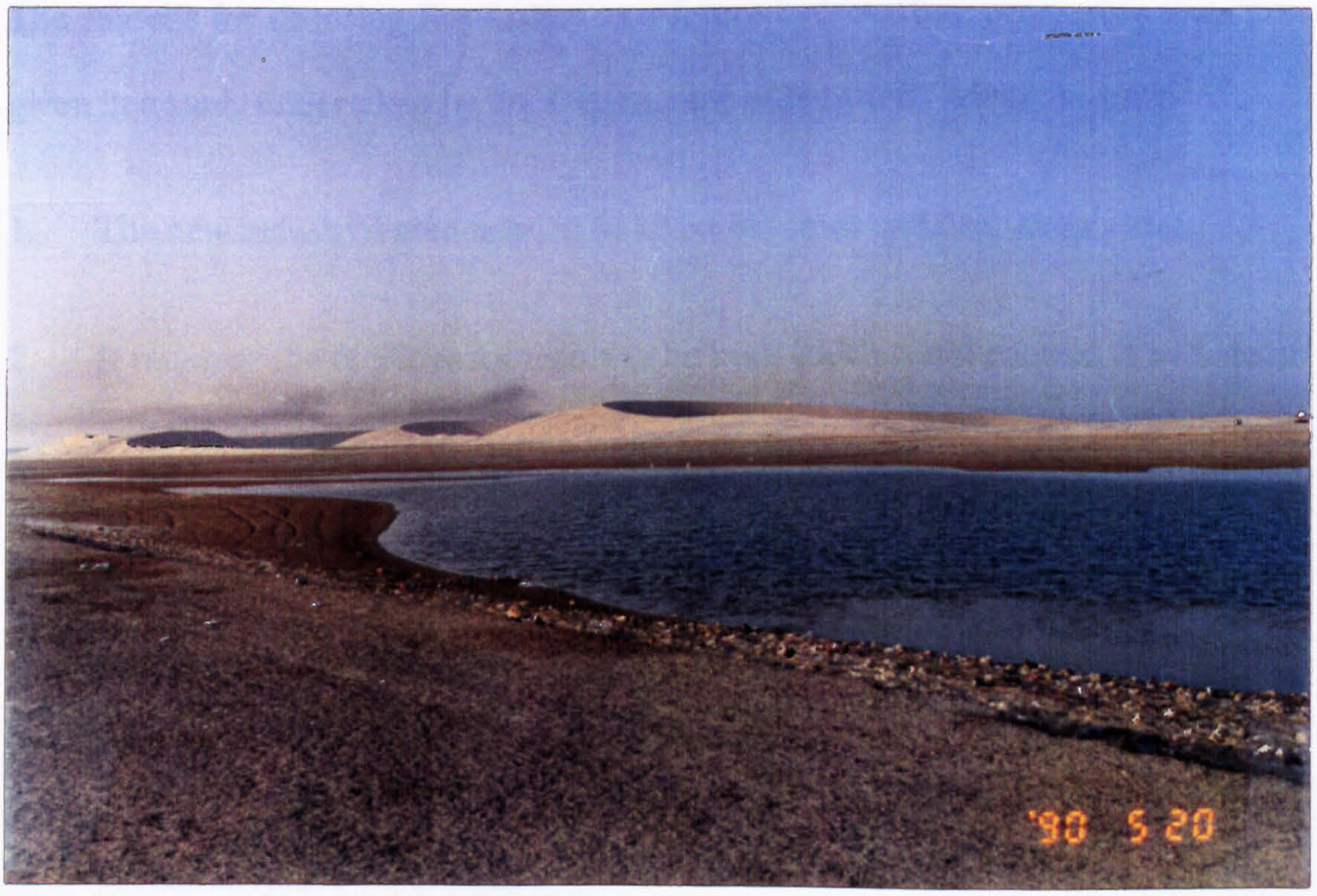
Plate 5.7: *Silin beach and sand dunes, south of the industrial zone. The uncontrolled tourism can clearly be seen, reflected by the destruction of the beauty of the beach by vehicle tracks, which are also clear on the sand dunes. Young people come here at weekends for competitions by their four wheeled vehicles over the sand dunes.*

Plate 5.8: *Some of the unauthorised dumping by tourists in the Silin beach area.*

this means that even some Umm Said residents who want to visit the seaside, prefer to travel to other beaches in Qatar (discussed above), probably because they know better than people from other areas of Qatar who visit the beaches near Umm Said, the effect that industry has had on Umm Said beaches. These beaches cannot be recommended for tourism without a full environmental assessment of the region before any project is proposed. If the Government had evidence that they could not be used for tourism, they might then be considered for industrial use, especially as there are a lot of areas recommended in Qatar as tourist sites which are better than Umm Said.

Dr B. Nassar, a geomorphologist, also expressed concern about the removal of the sand dunes for use on industrial sites;

Plate 5.9: *This smoke comes from the industrial zone towards the south where Silin, the main tourist site in Umm Said, is located.*



"those sand dunes are very expensive to remove; it is an area of sand assembly, which means that even when you remove one of the sand dunes and built a plant on its site, that site will be continuously encroached upon by newly formed sand dunes". (122)

But if the government to introduce a major project for tree planting throughout the region, suited to the Qatari climate, concentrating especially on the areas on and around the sand dunes, and the beaches, the movement of sand dunes would be reduced, thus enhancing the aesthetic appearance of the region and producing a lively environment. After such a project, a major study for enhancing tourism in the region would also be feasible.

5.7.3. The Future Ras Laffan Projects

The major impression gained from this project is that the hydrocarbon industry, both on and offshore, has considerable land under occupation in Qatar (discussed below).

The reasons for choosing Ras Laffan as a future hydrocarbon processing town are given in a study undertaken by the Department of Industrial Affairs in 1989(123).

1. The new industrial area needed to be on the coast and near deep water.

2. It required the facilities for a port to be built which could connect it with deep water and international marine lanes.

3. It required a location preferably close to the national road network, state services and infrastructure.

4. The site chosen had to have enough land available both for present needs and predicted future expansion.

5. The location had to be close to an energy supply and network available to connect it to the new town.

6. It was important to avoid, as far as possible, encroachment on privately-owned land.

7. For manpower requirements, it was considered preferable for the new town to be located near an existing residential area.

8. A site was required which would be easy and suitable to prepare for industrial plant.

9. Consideration had to be given to the environmental effect of an industrial town on settlement areas in the locality, taking into especial consideration wind directions.

10. The site had to be one where sea water was readily available (for cooling systems) and where, after use, it could be returned easily to the sea.

11. A comprehensive and accurate estimate of the cost of establishing the new industrial town had to be made [124].

A comprehensive survey was undertaken by the Department of Industrial Affairs in Qatar, looking mainly in and around the northern coast of the peninsula, and taking the above factors into consideration, the second best site in Qatar (after Umm Said in the south east) for an industrial town proved to be Ras Laffan. These findings were supported by the QGPC's specialists: Bechtel (an American Company) and Dar al-Handasah Company (an Arab engineering company) [125]. The above two companies were, with the Department of Industrial Affairs, closely involved in the selection of the site for the new industrial town.

Mr Ismail al-Ansari, Deputy Senior Project Manager, North Field Development Project, on 1 January 1992, explained that direct export of gas from offshore platforms is not feasible from the North Dome (Figure 7.2). In the event of a storm this could mean disaster as tankers could collide with the offshore terminal. Ras Laffan had been chosen as the area for the gas terminal and downstream town, therefore, (126) based upon the following information:

1. The nearest place for North Dome platforms is Ras Laffan, and proximity is important as laying of pipes offshore is very costly and therefore, the shorter the distance, the cheaper the cost.

2. The site of Ras Laffan has no private land ownership except for the area to the south of the Masterplan (Figure 5.6) along the coastline (private land ownership is discussed further below).

3. The site of Ras Laffan needs very little land reclamation - except in the area for the tank farms (Figure 5.6).(127)

4. If the site is not developed, the alternative will be the continuous increase in pipelines from the North Dome to Umm Said. Not only would this be very costly, but also as the pipelines contain high concentrations of poisonous H_2S, a leak of which is capable of causing significant fatalities (128), the risk of an accident would be increased by a greater length of pipeline.

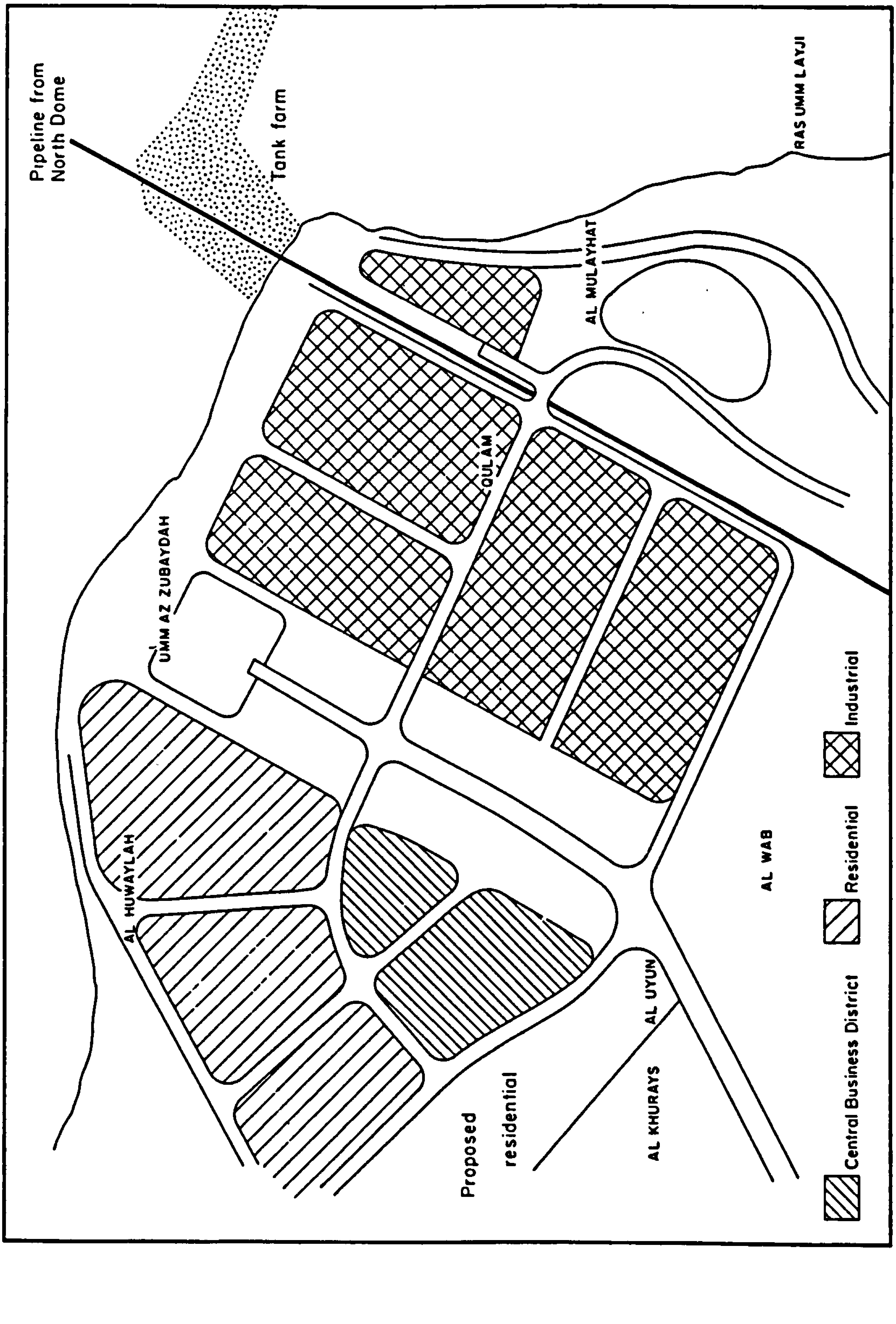


Fig.5.6 Project master-plan for Ras Laffan region

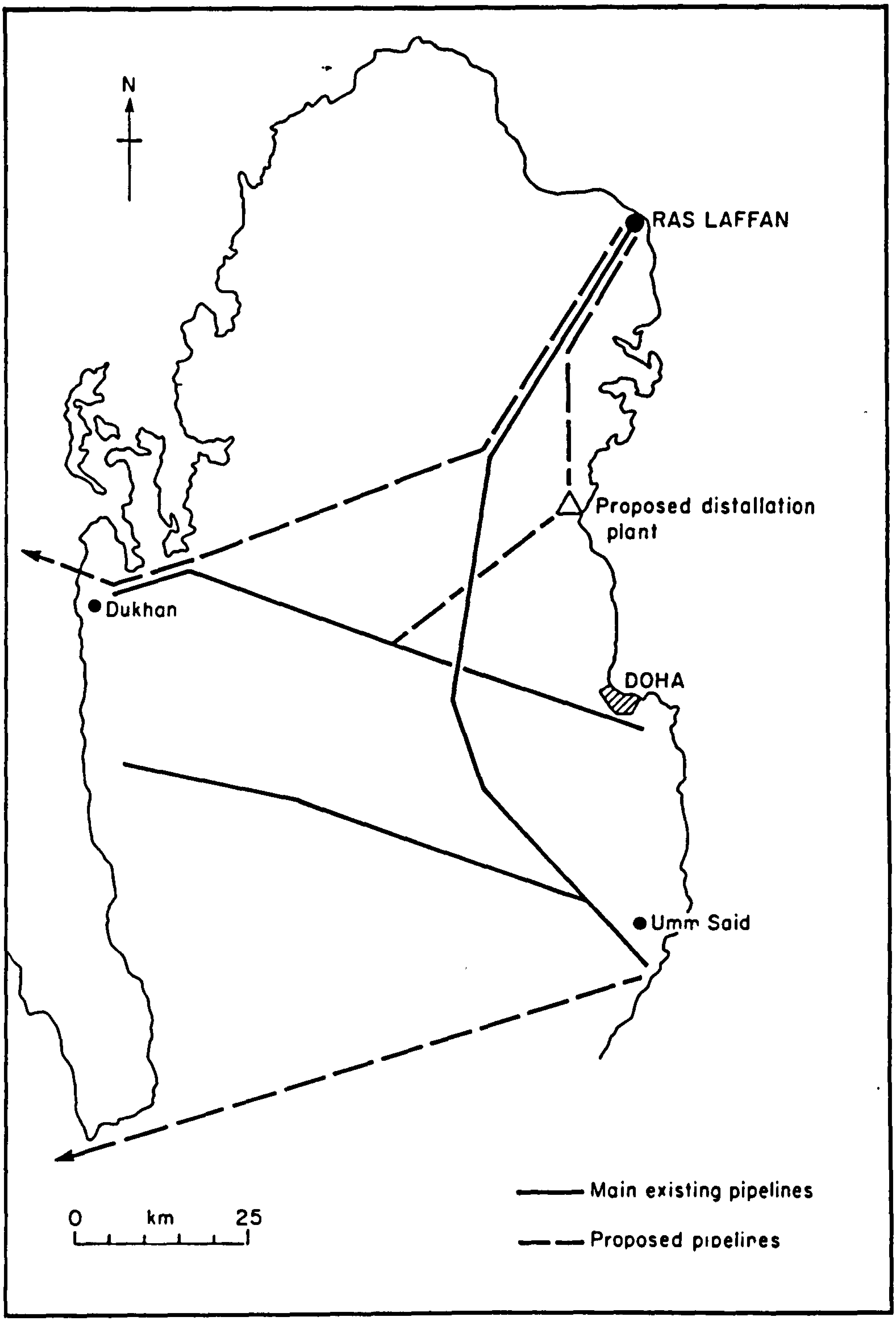


Fig. 5.7 Proposed pipeline network in Qatar

5. Were Ras Laffan not developed, and gas from the North Dome continued to be processed at Umm Said, two channels would be required to be dredged from the tip of the peninsula to Umm Said (one in each direction). This would be very costly and create much conflict over competing sea uses along Qatar's eastern coast [(129)].

6. Ras Laffan - situated as it is in the north of the peninsula - is expected to be able to attract more Qatari manpower than Umm Said is capable of [(130)].

The question of choosing a site in Qatar for processing and exporting the second phase of the North Dome gas field has already been examined - the first phase was commissioned on 3 September 1991 (discussed in Section 5.5). On 7 September 1991, an agreement for establishing the second phase of the North Dome gas field was signed. Qatar was represented by Sheikh Abdulla al-Thani, the Minister of Internal Affairs, who acted on behalf of the Minister of Finance and Petroleum on the one hand, and Mr Zonzo Rosi, General Managing Director of an Italian design and building company - Condoti ACWA, on the other [(131)].

Sheikh Abdulla said that the budget for the project would be several hundred millions US dollars, and the project is expected to be commissioned in 1996 [(132)].

The agreed plan for Ras Laffan provides for an area for the port of 8.0 km^2, which is to include a protected water basin 2.0 km^2 and with a depth of 13.5 m, for around the clock reception of the largest tankers for liquefied natural gas (LNG) [(133)]; port construction will include two windbreaker walls to protect the port from storms and sea currents. One will be to the north of the port, projecting 6 km into the sea, with a height of 8 metres above sea level, and the second will be 4 km long, with a height of 6 metres above sea level [134]. (This contrasts with the port area of Umm said which does not need such sea walls as it is naturally protected.); the plan for the project is to include a dredged channel, 5 km in length with a depth of approximately 15 metres, to connect the port with international marine lanes [135]; the first phase of the plan will consist of 5 wharves which will make the port capable of receiving annually 360 tankers and ships, and there will also be a site four times as large as that of the first phase, to be held in reserve for future port expansion [136].

The above operation will require the removal of 15 million tons of seabed stone and gravel [137] (Plate 5.10 shows the stones in Ras Laffan, gathered during the digging operation which was part of the laying of 'Phase One' North Dome pipelines - underground from Ras Laffan to Umm Said (Figure 5.7). The stones were collected from the hard areas and brought to Ras Laffan [138] (Plate 5.10). These stones and gravels will be used for construction purposes, e.g. windbreaker walls, and reclaimed shallow areas close to the coast (1.0 km^2 for tanks farm, and storage for other products) (Figure 5.6) [139].

The area designated for industrial use in Ras Laffan will be 80 km^2 - mainly for processing and exporting the gas of the North Dome (Figure 7.2). The proposed plants in the above area are: gas plants, NGLs, fertilisers, petrochemicals and others [140].

Plate 5.10: *Stones collected at Ras Laffan during pipelaying for the gas lines between Ras Laffan and Umm Said. The stones will be used for land reclamation.*

Planners are at present examining two possible methods of cooling systems for the above plants: firstly the channel cooling system, e.g. like that at Jubail (discussed in Chapter 5, Section 5); and secondly, the pipeline cooling system which is considered to be better than the former, as the pipelines will be underground which will keep the seawater required for cooling at a lower temperature than that in water channels. The pipeline network cooling system has two separate networks - one for intake of sea water, and one for outflow back to the sea [141].

The first phase of construction of Ras Laffan will not include a residential area.[142] Mr al-Muhandi, a business man from al-Khawr city, commented on 27 December 1991 that the government had promised to rent available accommodation from al-Khawr city for Ras Laffan employees and labourers. Al-Khawr is located about 24 km south of Ras Laffan (Figure 2.9) [143]. This could mean rapid urban and population growth of al-Khawr, as well as stimulating its various economic sectors to provide supplies for the new residents.

In examining the proposed Masterplan for Ras Laffan (Figures 7.2 and 5.6), we will see a great overlap between the proposed site and the areas of coastal fisheries, and thus the probable effect will be conflict of land and sea use between good fishing areas, leisure areas and industrial development.

Mr I. Al-Ansari insisted the project would avoid areas in private ownership [144] but the Masterplan (Figure 5.6) shows that the area between Ras Laffan and al-Huwaylah contains much land in private ownership, e.g. chalets,[145] and this is a consideration that will have to be looked at by project planners. The Masterplan (Figure 5.6) does not show another factor which must be taken into consideration - that of tree-planting between the industrial and residential areas.

Finally, yet another factor will need to be examined: the reason for choosing this particular site is to minimise the dangerous effect of hydrocarbon pipelines on the peninsula [146] but Figure 5.7 shows these to be inevitable - there are four proposed pipelines:

1. From Ras Laffan to al-Wusayl in order to supply energy for the proposed site and for the water distillation plant; and

2. From al-Wusayl to the west and south - to connect with the re-injection pipeline from Umm Said to Dukhan;

3. From Ras Laffan to the Dukhan field - to export gas to other GCC states and for re-injection in Dukhan field;

4. From Umm Said to the south west to export gas to or across GCC states (Figure 5.7).

The above lines could have an effect at least similar to that of the pipeline discussed in Chapter 4, as some of the proposed lines pass very close to the main settlement areas of Qatar (Figure 5.7).

References

1. Photogrammetric survey, compilation and cartography by Hunting Surveys Limited, Elstree Way, Borehamwood, Hertfordshire, England (Scale 1:200,000), Editiion 1982
2. Diyab, M. *The physical geography of Qatar*, Cairo University, 1980 (Arabic), p 118
3. Yehia, M.*Atlas of Qatar from "Landsat" images*, Centre of Scientific and Applied Research, Qatar University, 1983, p 91
4. Imbabi, N. and A'shoor, M. *The sand dunes in the Qatari peninsula*, Qatar University, 1985 (Arabic), p 150
5. Al-Kubaisi, M. *Industrial Development in Qatar 1950/80: a geographical assessment*, (PhD) Durham University, 1984, p 228
6. Al-Majid, A. *The Climate of Qatar*, The Ministry of Transport and Communication (Dept of Meteorology), ca. 1983/84, p 44
7. Ibid (The temperature averages done by myself, depending on the figures from the same book)
8. Interview with Mr A. Abdul Rahman, Deputy General Manager of Qatar Petrochemical Co Ltd (QaPCo), 24th January 1991
9. Ibid
10. Op.cit., Al-Kubaisi, M., p.229.
11. Lorimer, J.G. *The Gulf Gazetteer : Geographic Section*, Part 7, 1904, 1907, Translated to Arabic via Doha Palace, p 2553
12. Interview in June 1990 with Mr H Al-Sh'aer, an elderly Qatari man in Wakrah.
13. Fieldwork Survey by author between 1st and 25th June 1990
14. Lorimer, J.G. *The Gulf Gazetteer : Geographic Section*, Part 5, 1904, 1907, Translated to Arabic by Doha Palace, p 1736
15. Interview with Mr H Al-Sha'er, an old man from Wakrah, whose age exceeds almost 100 years, on 3rd June 1990
16. Zahlan, R.S., *The Creation of Qatar*, Croom Helm Ltd., London, 1979, p.86.
17. Doha Palace 1935 oil agreement between the State of Qatar and the Anglo-Persian Oil Company APOC) (Article 6)
18. Ministry of Public Works and Industry (Industrial Affairs), Report about the Qatari experience in choosing, constructing and developing the industrial towns, 20th December 1989, p.5
19. Saleh, H., *Introduction to Industrial Geography*, Dar al-Sharooq, Ammam, 1985 (in Arabic), p230
20. Al-Othman, N. *With their bare hands*, Longman, London, 1984, p 35

21. Saqr, A. *Geographical Gazetteer*, Dar al- A'bad, Beirut, ca. 1959 (Arabic), p 117
22. Al-Dabbagh, M. *Qatar past and present*, publisher Dar al-Atalea'h, Beruit, 1961 (Arabic), p 82
23. IDTC (Industrial Development Technical Centre) *Environmental assessment of the State of Qatar*, December 1983, p 8
24. Op.cit. Al-Kubaisi, M. 1984, p 226
25. Ibid, p 227
26. Al-Kubaisi, M., op. cit., 184, p.229
27. Op cit, Dabbagh, M. p 82
28. Fieldwork by author in June 1990
29. Op cit, interview Mr H. Al-Sha'er, in June 1990
30. Op cit, Al-Dabbagh, M. p 83
31. Ibid, p 83
32. Op cit, Saqr, A. p 117
33. IDTC, *The Industrial Development in Qatar*, April 1978, p.88
34. Ibid, p 27, 28
35. IDTC, *Qatar Achievement in Industrial Development*, 1981, p 7
36. IDTC, *The Role of the Emir in Developing the Industrial Sector in Qatar*, February 1988, p.22-23
37. IDTC, *The Industrial Development in Qatar*, April 1978, p 54
38. QGPC, *Umm Said Refinery*, ca. 1983/84
39. Fieldwork by author in the region on 1 June 1990
40. IDTC, *The Industrial Development in Qatar*, April 1978, p 75
41. IDTC *Environmental Assessment of the State of Qatar*, December 1983, p 7, 8
42. Interview with Mr S. Hasan, Senior Technologist at NLGs and Gas Plants in Umm Said, 3 September 1991.
43. Fieldwork by author in May 1990
44. *QaFCo Bulletin*, undated, p.8, 9
45. Interview with Mr. K. al-Swadi, Senior Engineer, Qatar Fertilizer Company, Umm Said, 19 May 1990.
46. Op. cit., Interview with Mr A. Abdul Rahman, Deputy General Manager, Qatar Petrochemical Company Ltd., 24 January 1991
47. Al-Mudfa'h, A. *The Role of the Environment in administrating the natural resources*, Report, Doha, December 11/12 1989, p 3
48. Interview with Mr A. Abdul Rahman, Op.cit.

49. Op Cit, IDTC, 1981, p 42

50. Op.cit., IDTC, 1983, p 2,3

51. Interview with Mr A. al-Ansari, Qatar National Manufacturing Company, Doha, 26 November 1990

52. Interview with Dr Quttub, Hamad General Health Corporation Laboratory, 26 May 1990.

53. Interview with Mr. G. Salmeen, Manager of the Flour Mill, June 1990.

54. Ibid.

55. Op cit, Al-Mudfa'h, A., p.5

56. Ibid.

57. Op.cit., interview with Mr S. Hasan.

58. Ibid.

59. Op.cit., al-Swadi, K.

60. Interview with Mr A. Al-Sayd, Manager of Umm Said Municipality, 6 June 1990

61. Ibid

62. Ibid.

63. Khalif, M.R., al-Aseiry, Arabian Gulf Oyster Bed Map, (Scale: each graduation represents 15 nautical miles), publisher Ministry of Information, Qatar (in about 1983).

64. Dr. Al-Khyat, H., *The Arabian Gulf City*, Qatar University, Qatar, 1988 (Arabic), p.411, 414

65. Interview with Mr. A. al-Buainain, QGPC Public Coordinator Manager, June 1990.

66. Interview with Mr I. al-Ansari, Deputy Senior Project Manager, North Field Development Project, 1 January 1992.

67. Ministry of Public Works (Industrial Affairs), p.7.

68. Op.cit., Interview with Mr K. al-Swadi.

69. Fieldwork by author in Umm Said, May-June 1990, December 1991.

70. Ibid.

71. Op.cit., interview with Mr A. al-Sayd.

72. Op.cit., fieldwork.

73. Ibid

74. Ibid.

75. Ibid.

76. Op.cit., Interview with Mr A. al-Sayd.

77. Ibid.

78. Op.cit., Interview with Mr K. al-Swadi.

79. William L Pereira Associates, Qatar Planning Studies, *Development Plan of Umm Said*, March 1983.

80. Fieldwork questionnaires, one hundred forms were randomly distributed in Umm Said, and 36% of them were returned to by Umm Said people, May 1990.

81. Correspondence with QGCP HQ, on 14th May 1990

82. Fieldwork by author, 28 December 1991.

83. Op cit, William L Pereira Associates, p 26

84. Op.cit., Fieldwork, May-June 1990.

85. Op.cit., fieldwork questionnaires.

86. Op.cit., Interview with al-Swadi, K.

87. Ibid.

88. Op.cit., Interview with Mr al-Sayd, A.

89. Interview with Mr B. Martinot, General Manager of Qatar Petrochemical Company Ltd., in Umm Said, 19 May 1990.

90. Interview with Mr A. Sadiq, Manager of the Grain Plant, 25 May 1990.

91. Op.cit., fieldwork, 28 December 1991.

92. Ibid.

93. Shaqlieahm A.R., *The Arab Oil Processing and Refining*, Jeddah, publisher Tuhamah, first print, 1981 (Arabic), p.407.

94. Op.cit., QGPC correspondence, 14 May 1990.

95. Op.cit., fieldwork.

96. Op.cit., Interview with Mr. A. al-Buainain.

97. Op.cit., fieldwork.

98. State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, *Annual Statistical Abstract*, Qatar, issue 11, July 1991, p.16.

99. The Royal Commission for Jubail and Yanbu, *Jubail and Yanbu Industrial Cities: Ten Years of Accomplishments*, Madinat Yanbu al-Sinaiyah Printing Facilities, (n.d.) p.14.

100. Mike Kelly, *Investment Opportunities at Jubail and Yanbu*, [Article] (n.d.).

101. Op.cit., The Royal Commission, p.48

102. Ibid, p.56

103. Ibid, p.54

104. The Kingdom of Saudi Arabia, a special sponsored section reprinted from *Institutional Investor*, [n.d.].

105. Op.cit., Mike Kelly.

106. Ibid.

107. Aw'ad, T.M., *The international boundary for the offshore areas: Applied study for the Arabian Gulf*, Alexandria University Ph.D. thesis, 1974 (Arabic), p.277.

108. British Sky Broadcasting Network, Sky News, 30 January 1990.

109. Op.cit., Interview with Mr B. Martinot.

110. Op.cit., fieldwork.

111. Op.cit., Fieldwork questionnaires.

112. Op.cit., Mr. S. Hasan.

113. Op.cit., Mr B. Martinot.

114. Interview with Mr A. Muftah, Wakrah resident, 29 May 1990.

115. Op.cit., fieldwork.

116. Op.cit., interview with Mr A. al-Sayd.

117. Op.cit., Mr B. Martinot.

118. Op.cit., William L. Pereira Associates, p.43.

119. Op.cit., fieldwork.

120. Interview with Dr B. Nassar, B., Department of Geography, University of Qatar, 30 May 1990.

121. Op.cit., Interview with Mr A. al-Sayd.

122. Op.cit., interview with Dr B. Nassar.

123. Ministry of Industry and Public Works, Department of Industrial Affairs: *'Qatar's experience in choosing, constructing and developing industrial areas'*, Qatar, 20 December 1989, p.3.

124. Ibid, p.3.

125. Correspondence with QGPC headquarters in Doha regarding Ras Laffan projects on 14 May 1990.

126. Interview with Mr I. al-Ansar, Deputy Senior Project Manager, North Field Development project, QGPC headquarters in Doha, 1 January 1992.

127. Ibid.

128. Interview with Mr A. Abdul Rahman, specialist of QGPC at Doha headquarters 3 January 1992.

129. Ibid.

130. Ibid.

131. *Arrayah newspaper*, issue no 3640, 8 September 1991, p.4.

132. Ibid.

133. Ibid.

134. Ibid.

135. Ibid.

136. Ibid.

137. Ibid.

138. Op cit - interview with Mr I. Al-Ansari, during author's fieldwork 27 December 1991.

139. Op cit interview with Mr I. al-Ansari and *Arrayah* issue 3640.

140. Op cit, *Arrayah* issue 3640, p.4.

141. Op cit Mr I. al-Ansari.

142. Ibid.

143. Interview with Mr S. al-Muhandi, businessman from al-Khawr city, 27 December 1991.

144. Op cit Mr I. al-Ansari.

145. Fieldwork by author during May-June 1991, December 1991.

146. Op cit, interview with Mr A. Abdul Rahman.

Chapter 6

Administrative and Supporting Services: Doha

Figures

Tables

6.1 The Aim of the Case Study

The direct effect of the hydrocarbon industry on land use has already been studied in previous chapters. Many aspects of the subject, such as the spatial impact of the Dukhan oil field, the network of hydrocarbon pipelines in Qatar, and the hydrocarbon processing town of Umm-Said, have been explored. The chapter following this will expand the study further by exploring in detail the spatial impact of the hydrocarbon industry on Qatar's sea use.

This chapter, however, differs somewhat from others because of the context in which the hydrocarbon industry's administrative and support services are located in the capital city of Qatar, Doha, and where the majority (84%) of the country's population live (see Table 6.1). To study in depth the land use of the area of Doha would alone require a thesis. Much scientific research on Doha has already been carried out. It may be useful to cite some examples of high quality research on land use of the capital. In 1985, *A Social Field Work Study for the Pattern of Urbanism in Doha, the City State*, by Dr Al-Issa and Dr Mojahid, was published. The study was concerned with the phenomenon of urbanisation and its problems in Doha City. In his book *The Arabian Gulf Cities*, published in 1988, Dr Al-Khyat examined in detail the urban geography of Doha City. In addition to books on the subject, many reports and studies have been prepared. For example, the firm Llewellyn-Davies Weeks Forester and Bor was commissioned to undertake a thorough and comprehensive study on Doha and in 1977 published detailed planning reports (the Doha Housing Study), and in August 1981 the Shankland Cox Partnership undertook a major research project on land use planning in Doha, published as *The Qatar Planning Studies Summary*. In September 1981 William L. Pereira Associates published the results of their research in *The Doha Development Plan*. This chapter also differs from the research of other writers concerning the impact of the various activities on land use, e.g. Herman L. Boschken, who discussed organisation and resources management in his book *Land Use Conflicts*, 1982; Al-Elawy, in his 1976 Ph.D. thesis 'The Influence of Oil upon Settlement in Al-Hasa Oasis in Saudi Arabia', discussed the role of oil and population movement in creating some new towns and expanding and shrinking the old towns, and its general impact on rural settlement. Some of the above planning reports are still used to date for planning in Doha City.

Table 6.1 The population growth of Doha

Year	Population of Qatar	Population of Doha	% of Doha population from Qatar	Period and rate of growth	
				Period	Annual Rate of growth
1905 [A]	27,000	12,000	44.4		
1949 [B]	25,000	12,500	50	1949/1960	8.0
1970 [B]	111,133	88,500	80	1960-70	8.0
1980 [B]	260,000	208,000	80	1970-1980	9.0
1986 [D]	369,079	309,290	84	1980-1990	6.6

Sources:

A. Lorimer, J.G., *The Gulf Gazetteer*, The Geographic Section, part 6 - 1906, translated to Arabic and published by Doha Palace, pp. 1986, 1987

B. United Nations, *The Population Situation in the ECWA Region*, Qatar chapter (10), Beirut, 1980, pp. 8, 12, 13

C. Al-Jabbir, M., *The Human Geography of Qatar*, Master's degree thesis, Cairo University, Cairo, 1977 (Arabic), pp. 149, 150

D. State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, 8th issue, July 1988, p.10

Notes for Table 6.1

1. 1970 was the year that the first official census was carried out in Qatar in collaboration with the British Middle East Development Division (n.d.).
2. 1986 was when the second official census was carried out, by the Central Statistical Organisation in Doha. The above figure includes the suburbs of Doha [Greater Doha].

3. The rate of population growth includes the total growth of people in Qatar, but if we want the natural growth of the pure Qatari population amongst the total, this will be between 3-8% per annum.
4. 1986 (Greater Doha) i.e. Rayyan is included.

Despite the extensive body of research previously undertaken ranging from books and major government-sponsored reports to Ph.D. theses, very little work has been done on the spatial impact of the hydrocarbon administrative and supporting services on land use in capital cities of the world. Administrative and supporting services include offices, employees' housing, recreation, laboratories, storage, etc.. The chapter will briefly review the overall spatial effect of the oil revenue on Doha's land use and then concentrate on the growth of the elements of the above, which are connected with administrative and supporting services of the oil industry in Doha. The main goal of this study is to examine in detail land in Doha dedicated to supporting services, its conflict with other land uses of the capital, and to evaluate its overall significance.

6.2 Oil Revenue and Land Use in Doha

The main purpose of this section is to examine the spatial effect on Doha of oil industry revenue to provide a general context for the subsequent study of land use by the services supporting the hydrocarbon industry.

6.2.1 The Influence of Doha In Pre-Oil Qatar

Before oil revenues started pouring into Qatar, Doha was already the state's capital (Figure 6.1) and provided many civic functions (shown in Table 6.2, and discussed further below). Since 1850, when Sheikh M. Al-Thani, the first ruler of Qatar of the Al-Thani family, settled in the Al-Bidda area of Doha, it has had the highest population concentration in Qatar (Figures 6.1 and 6.2). It is not certain whether the Al-Thanis controlled all the Qatari peninsular in 1850 when their rule from Doha began (1). The reasons why Doha was chosen by the Al-Thanis as their capital were as follows:

1. For security and defence. Between 1850 and 1940 there was continuous conflict between Qatar and Bahrain over Zubara on the western coast of Qatar (Figure 2.4) and Doha provided an administrative centre away from the conflict zone.

2. The Doha area is fortunate in having a good supply of fresh underground water (2), e.g. Aien Walad Sa'id, 0.83 km south of Doha; the Musheireb wells 1.7 km west of Doha; the al-Jadidah wells about 5 km from Doha; and, near the capital to the west of Doha, the Nuaija wells (3).

3. The site of Doha is a good strategic and administrative location, halfway along the eastern coast of Qatar and between previously-existing Qatari settlements (Figure 2.9).

4. Doha was located at the end of the road connecting Qatar with Ihsa and Nejid (4)

5. Before the advent of the hydrocarbon industry in Qatar, as in many Gulf states the sea provided the backbone of the state's economy in pearling, trading and fishing, and thus it was natural that the location of the capital should be on the coast (Table 6.2).

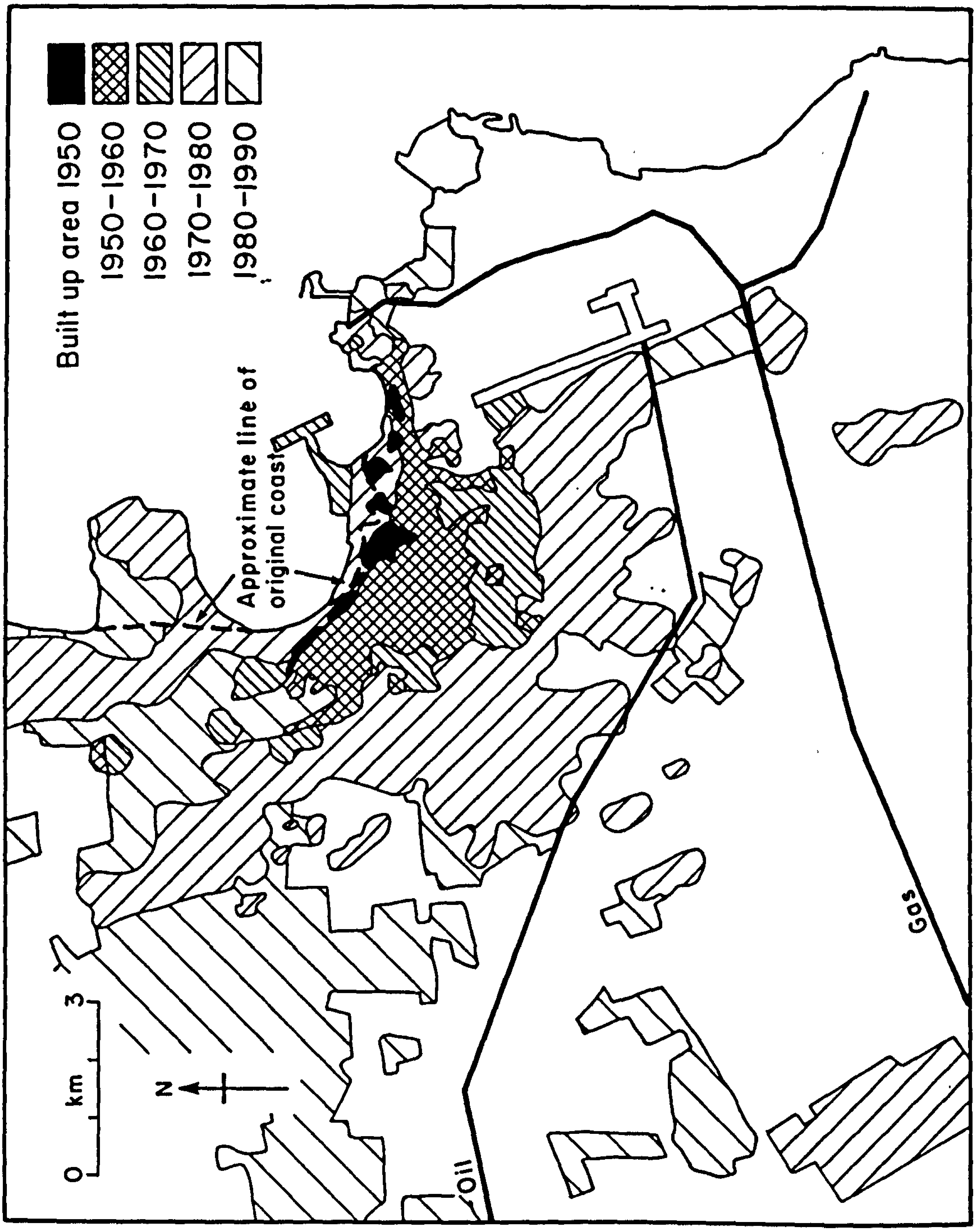


Fig. 6.1 Spatial growth of Doha, 1950–1990

Table 6.2 The economic influence of Doha in 1905

Item	Total in Doha	% of Qatar
Pearling Boats	350	43
Other Boats	60	43
Fishing Boats	90	36
Camels	800	56
Horse	150	60

Source: *Lorimer, J.G., The Gulf Gazetteer, The Geographic Section, Part 6 - 1906, (translated to Arabic and published by Doha Palace, p.1989, 1990).*

If one looks at the location of other, older, Gulf cities it can be seen that the above determinants for the location of Doha are often repeated. For example, Manammah was chosen as the capital of Bahrain because the Gulf is widest at this point, there is a good supply of fresh underground water in its vicinity, and its site was strategic for the conflict with Qatar over Zubara (5).

The majority of the state's population has always been in Doha - in 1905 the population of Doha comprised 44% of the people of Qatar (Table 6.1) and since then has progressively come to dominate the urban scene as primate city. By 1949 about 50% of the Qatari population lived in Doha (Table 6.1). This city state pattern can be seen in other Gulf states; for example Kuwait City, even before the advent of oil, mirrored Doha - in 1905 about 94.5% of Kuwait's population resided in its capital city (6).

Although the Qatari population in 1949 was smaller than in 1905 (Table 6.1), the influence of Doha can obviously be seen as the proportion of the population living in Doha in 1949 was greater than in 1905. This means that, even during the pre-oil industry era, Doha was an attractive place to Qataris. The cause of the population decrease in Qatar is attributable to two factors. Firstly, the decline of the pearling industry during the 1920s, especially after the exploration of the Japanese cultured pearl industry. This precipitated the emigration of many Qataris to other Gulf states.(7)

A second reason for the population decrease in Qatar was the suspension in 1942, during World War Two, of operations in Qatar by the Anglo-Persian Oil Company (APOC). As a result, many Qataris emigrated, and many found a better life in Saudi Arabia, where the Aramco oil company provided work (8).

Before the oil industry, the growth rate of Qatar's population was low and sometimes possibly in decline. Low population growth rates in predominantly subsistence economies, such as that of pre-oil Qatar, can be attributable directly and indirectly to economic under-development. The environmental limitations of water resources, soil fertility and other similar restrictions concerned with the feeding and watering of a population can be overcome only by investment. Similarly, social amenities, such as those relating to public hygiene and modern health facilities require public investment in the social infrastructure. Qatar had few modern health facilities and consequently there was a high mortality rate, especially amongst women and children. Limits on water, food, health and hygiene are basic factors which directly limit population growth. Before 1950, Qatar's economy was based on traditional activities (Table 6.2), and was incapable of providing jobs and opportunities for more than 25,000 - 30,000 people.

However, despite many adverse factors affecting population growth, Doha also possessed natural advantages which attracted the existing Qatari population to settle there. For example, Doha is ideally located as a trading port, being a deep port in comparison to the draft of the traditional *dhows* which were used even into the first half of the twentieth century. Doha could receive *dhows* with up to a 15 foot draft [9] (there was a major dredging project in Doha's offshore area in 1963, discussed in Chapter 7, Section 7.5.2). The offshore area of eastern Doha is also rich in fish and pearls (Table 6.2 and Figure 7.2), providing a fishing and pearling industry. As the administrative centre of government, the capital also had the best educational facilities and many scholars, after graduating from their studies, would be inclined to settle in the capital. The first multiple-subject school in Qatar was the Al-Athrea School, opened in 1913 by Mohammad Al-Mana in Doha (the first modern school was established in Qatar in 1951). The Al-Athrea School taught the sciences of Islamic religion and the Arabic language. The establishment of the first Qatari school in the capital was followed by the first Customs Office in 1913 [10] and the first Islamic Court, in 1915.[11] Such institutions meant Doha became a focus for the state. It also provided the principal market for the Bedouin and the settled people of Qatar as it had about fifty shops in 1905.[12]

The above short history of Doha demonstrates something of the early influence of the city upon the state, providing a political, economic, legal, and educational centre, as well as being the most strategically secure place in the state before the oil era. Doha's background and determinants of urban growth are thus quite different from those of other urban areas in Qatar which came into being solely due to the oil industry, e.g. Dukhan and Umm Said.

In the next section the huge changes in land use in Doha during the oil era are examined (Figure 6.1).

6.2.2 Land Use in Doha during the Oil Era

Doha's pre-1950 built-up areas extended about 3.2 km along the coastline (Table 6.3) and the main settlements were nine hamlets strung out along the coast (Figure 6.2): Al-bin-Ali, Al- Salata, Al-MirQab, Al-Sharji, Doha, Dowihah, Qalat Al-A'skar, Al-Mirqab Al-Gharbi, Al-Bidda, and Rumaiela [(13)]. These tiny settlements influenced the shaping of Doha before oil revenue poured into the city, changing it dramatically. The high expenditure possible with oil revenues meant a great expansion of Doha which will be discussed below. In 1950 Doha occupied only 1.25 km^2. The first ten years of oil revenue saw the city expand to seven times its previous size (Table 6.4 and Figure 6.1). The second major spatial expansion of Doha occurred in the 1970s when the urban areas grew to 16.25 km^2, or approximately 13 times the size of Doha in 1950. The period 1970-1985 saw the third major expansion of the city - 1974-1982 were boom years for oil prices (Figure 2.6). By 1985 the urban land use reached 165 km^2 (This figure is quoted from Dr Al-Khyat, while the administrative boundary of Doha

Key to Figure 6.2

Doha's Districts

Zone No.	Zone Name	Zone No.	Zone Name	Zone No.	Zone Name
1	Al-Jasra	22	Bin Mahmoud (North)	42	Al Hilal (East)
2	Al Diwan	23	Bin Mahmoud (South	43	Al Nualja (West)
3	Mohammed Bin Jasim	24	Al Muntazah	44	Al Nualja (East)
4	Al Asmakh	25	Al Mansoura/Bin Dirhem	45	Al Matar al Qadeem
5	Al Najada	26	Najma	46	Doha International Airport
6	Al Ghanim al Qadeem	27	Umm Ghuwailina	47	
7	New Markets	28	Al Khulaifat	48	
10	Wadi Al Sail	29	Ras Abu Abboud	49	
11	Al Rumeila	31		56	Al Khulaifat Jadeeda
12	Al Bidda	32	Madinat Khalifa (North)	60	New District of Doha (West Bay)
13	Musheireb	33	Al Markhiya	61	Diplomatic District
14	Abdul Aziz	34	Madinat Khalifa (South)	62	New District of Doha (West Bay)
15	Al Doha al Jadeeda	35	Kulaib	63	New District of Doha (West Bay)
16	Al Ghanim	36	Al Murour	64	New District of Doha (West Bay)
17	Al Hitmi	37	Bin Omran/Al Hitmi al Jadeed	65	New District of Doha (West Bay)
18	Al Salata	38	Al Sadd	66	New District of Doha (West Bay)
19	Doha Port	39	Al Mirqab al Jadeed/Al Nasr	67	New District of Doha (West Bay)
20	Wadi al Sail (West)	40	Al Asir/Al Salata al Jadeeda		Qatar University
21	Al Rumeila Hospital	41	Al Hilal (West)		

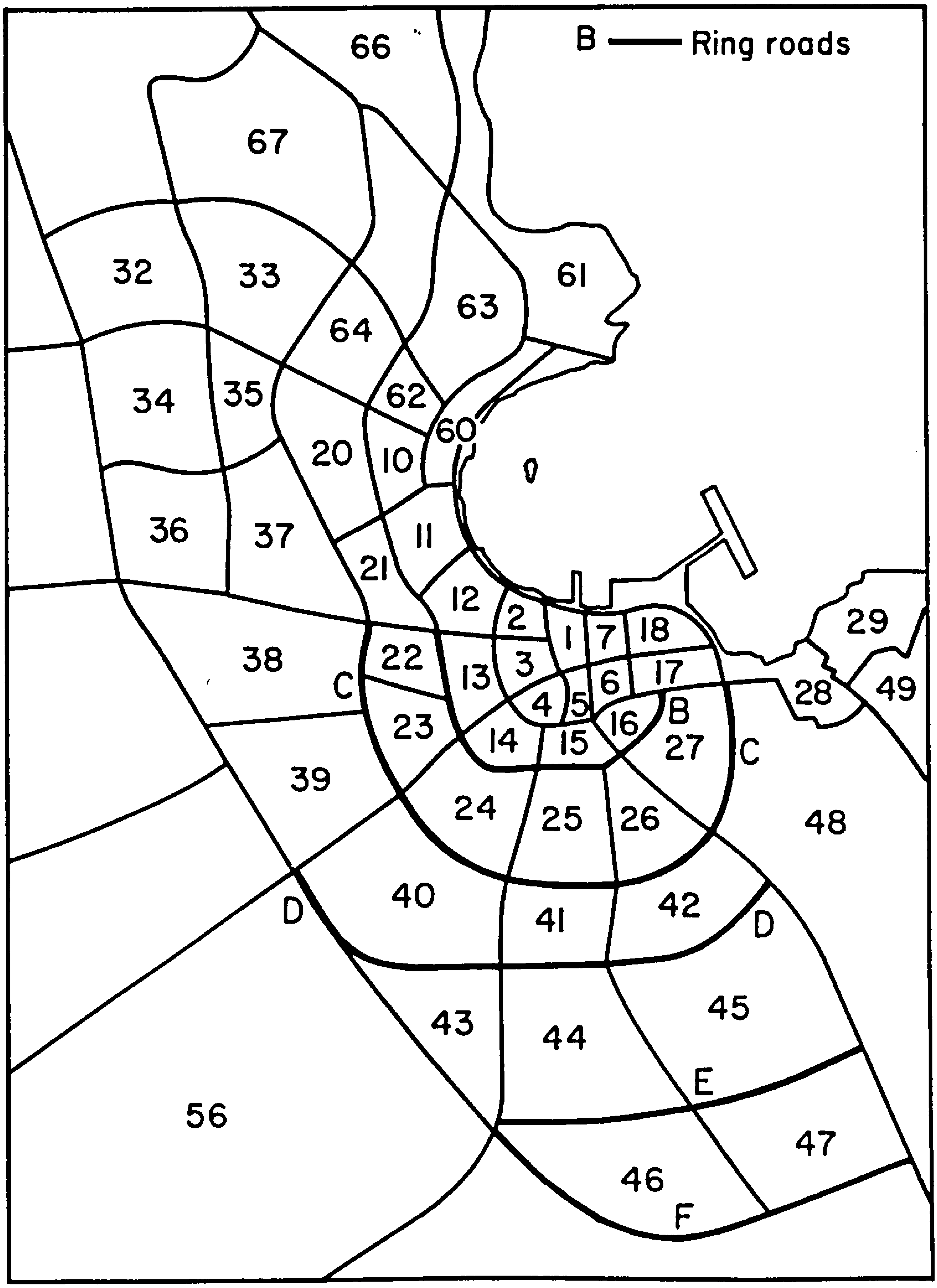


Fig. 6.2 Doha's administrative districts and ring roads

in 1990 was 131.77 km^2) (Table 6.4 and Figure 6.1) making Doha 132 times the size of the city in 1950 (Figure 6.3).

Table 6.3 Doha built-up coastline 1950 and 1990

Year	Coast (km)
1. 1950	3.2
2. 1990	35.0

Source: *From Doha map scale [1:18000], map date. on 20 March 1991.*

Table 6.4 The urban growth of Doha and Kuwait Cities from 1950-1990 by km^2

Doha		Kuwait	
Year	Growth by km^2	Year	Growth by km^2
1950 [A]	1.25	1950 [B]	9.60
1960 [B]	9.20	1960 [A]	81.00
1970 [B]	16.25	1970 [A]	325.50
1985 [A]	165.00	1985 [A]	1000.00

Sources: A. Dr. Al-Khyat, H., *The Arabian Gulf City*, Qatar University, Qatar, 1988, pp.232, 233, 310.

B. Measured by Arthur Corner, Cartography Office, Geography Department, Durham University, from Doha map scale [2.4 cm: 4 km] and Kuwait map scale [1 cm: 2 km].

Such a large and rapid expansion after 1950 is shared with other towns and cities in the Gulf Co-operation Council (GCC) region and is matched by Kuwait City, which in 1950 occupied only 9.6 km^2, in 1960 had risen to 81 km^2, and by 1985 had expanded to cover more than 1000 km^2 (Table 6.4). The result of oil revenues being spent on Kuwait City between 1950 and 1985 had meant it was 104 times larger than it was before the oil came to the area.

Parallel with land use expansion in Doha, came land acquisition. In the 1950s when the government first began to receive oil revenues, land was very cheap in Doha and some land was actually worthless. A comment by a Qatari businessman, Mr Talib

B. 1987

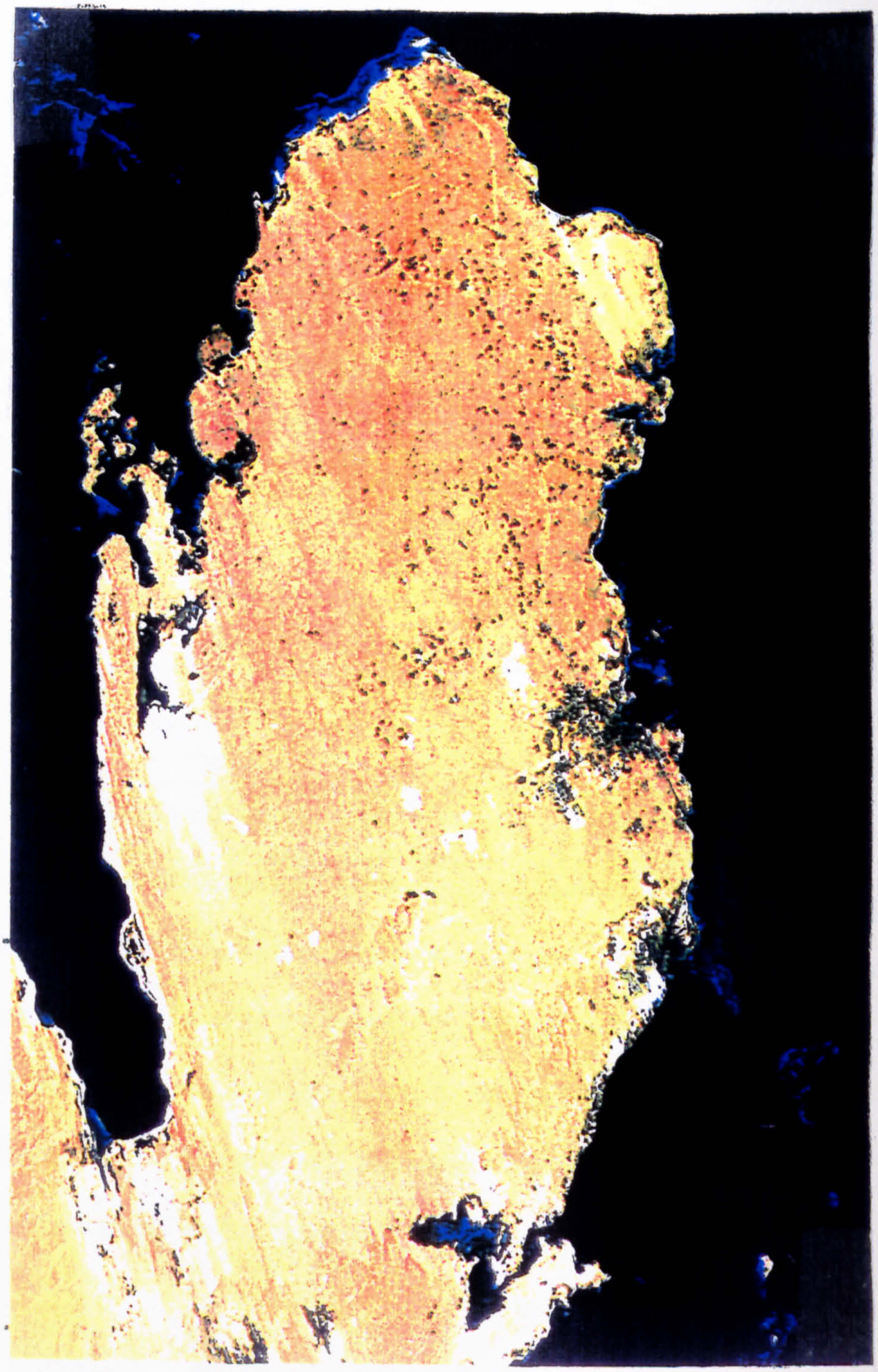
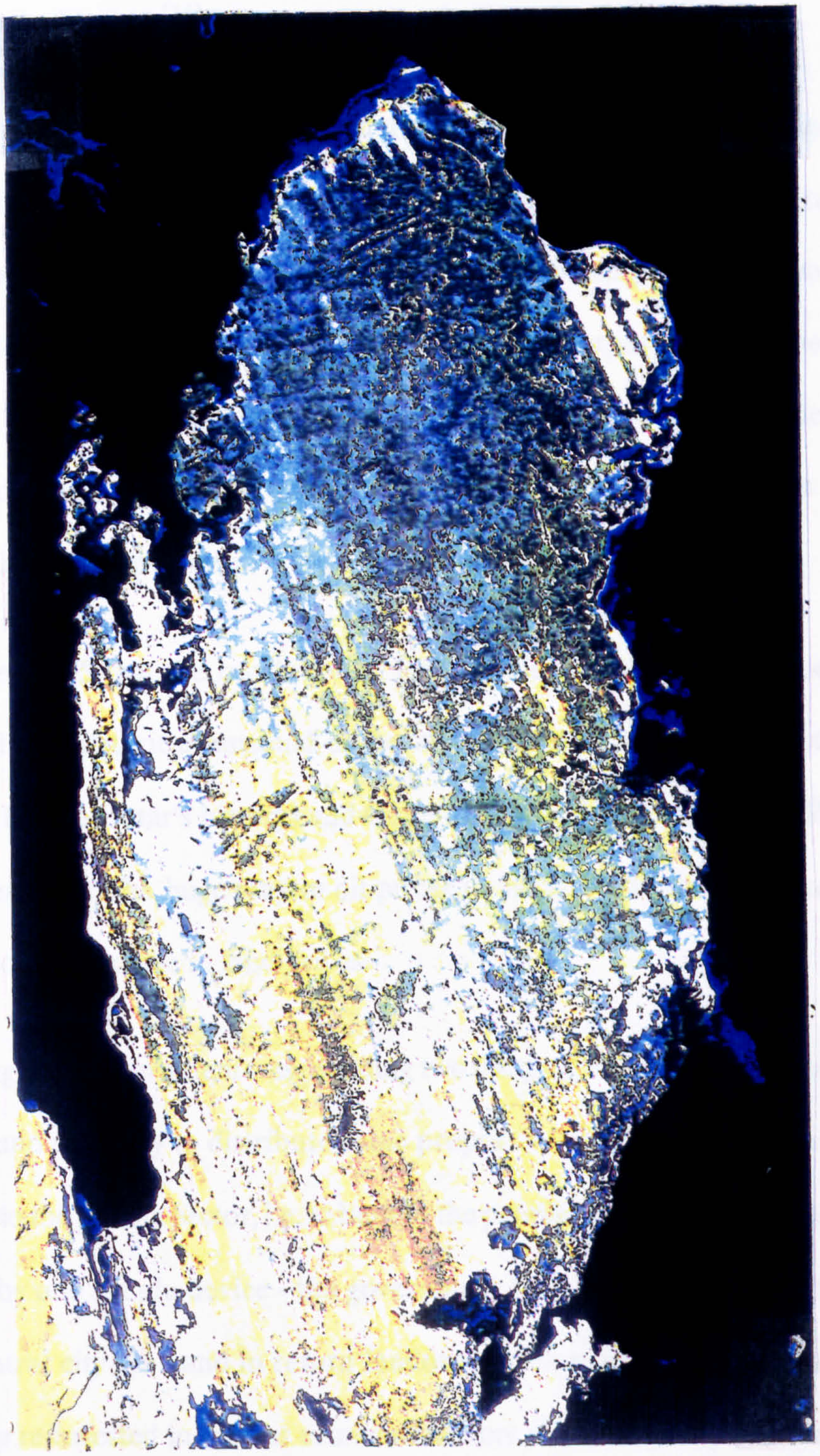


Figure 6.3: Comparative Landsat images of Qatar: 1973/1987, showing the urban growth of Doha.

A. 1973



Al-Khawri testifies to this: "*during the 1950s and 1960s when you wanted a piece of land in Doha, you just went and chose an empty piece of land, delimited it, and went to a member of the royal family who would confirm that that piece of land was yours by a letter from the Sheikh*" (14).

However, when the government began to receive huge oil revenues, especially after 1965, land prices began to change in Doha. In 1966, the government instituted a plan for developing the old, traditional, inner city of Doha and purchased two parcels of land totalling 5138 ft^2, for \$48540 (Figure 6.4) for this purpose. During the late 1960s and early 1970s however, the government buying of land from the private sector for the development of Doha progressed slowly (Figure 6.4) as during the 1950s and 1960s Qatar had no proper government administration.

It was after 1975 that the revolution in land acquisition and prices came to Qatar, associated with historic events such as the institution of a Cabinet of Ministers in June 1970 (the first in Qatar's history) and Qatar's independence granted by Britain on 3 September 1971. The huge leap in oil prices in 1973/74 was also, of course a major stimulus to the increase in land prices.

At this stage the government was planning two things: firstly to enhance the inner city of Doha, and secondly to distribute some proportion of the huge oil revenues it was receiving to the private sector, i.e. to benefit the people. These two aims were partially achieved by one simple device - the government bought up most of the private land in the central city area and in return landowners received huge amounts of money which they re-invested in various economic sectors of the economy and for residential purposes in the capital. This process was mirrored in other GCC states, e.g. Kuwait [(15)]. For non-landowners, the government built what are called 'limited income houses'.

The government having overcome a number of obstacles, revived its 1966 scheme to enhance the inner-city of Doha, e.g. in 1974 the Qatari government bought 723 parcels of land, comprising 8,488,079 ft^2, and compensation of \$146,010,580 was paid to the private sector. In 1980 the government bought 969 parcels of land, totalling 4,377,639 ft^2, paying \$361,731,500 (Figure 6.4). The above two instances exemplify the huge amounts of money paid to the private sector in the era of oil boom revenues and the result was that the price of land in Doha, and in all central city areas of GCC states rose dramatically. For example, in some areas of central Doha land reached \$2,198 per ft^2, while in Kuwait City it reached \$3,434, and in Dammam \$1,374. Land prices decreased radially from the city centre [(16)].

In 1983 when oil prices began to fall there was a corresponding decline in the massive amounts paid for land and this has continued with the continuing slump in oil prices to the present day (1992). The fluctuation in oil prices was followed by an economic recession in Qatar and in the GCC area as a whole (Figure 2.6). This is reflected in land prices and land compensation which have fared badly recently. In Qatar in 1989 the government bought only 11 parcels (153,257 ft^2 of land) for which it paid \$778,611 - approximately \$5 per ft^2 (Figure 6.4) - demonstrating the surprisingly small cost of land in Doha today (Figure 6.4 shows all of the above in detail).

The decline in oil revenues (Figure 2.6) has discouraged the private sector from selling land to the government for two reasons:

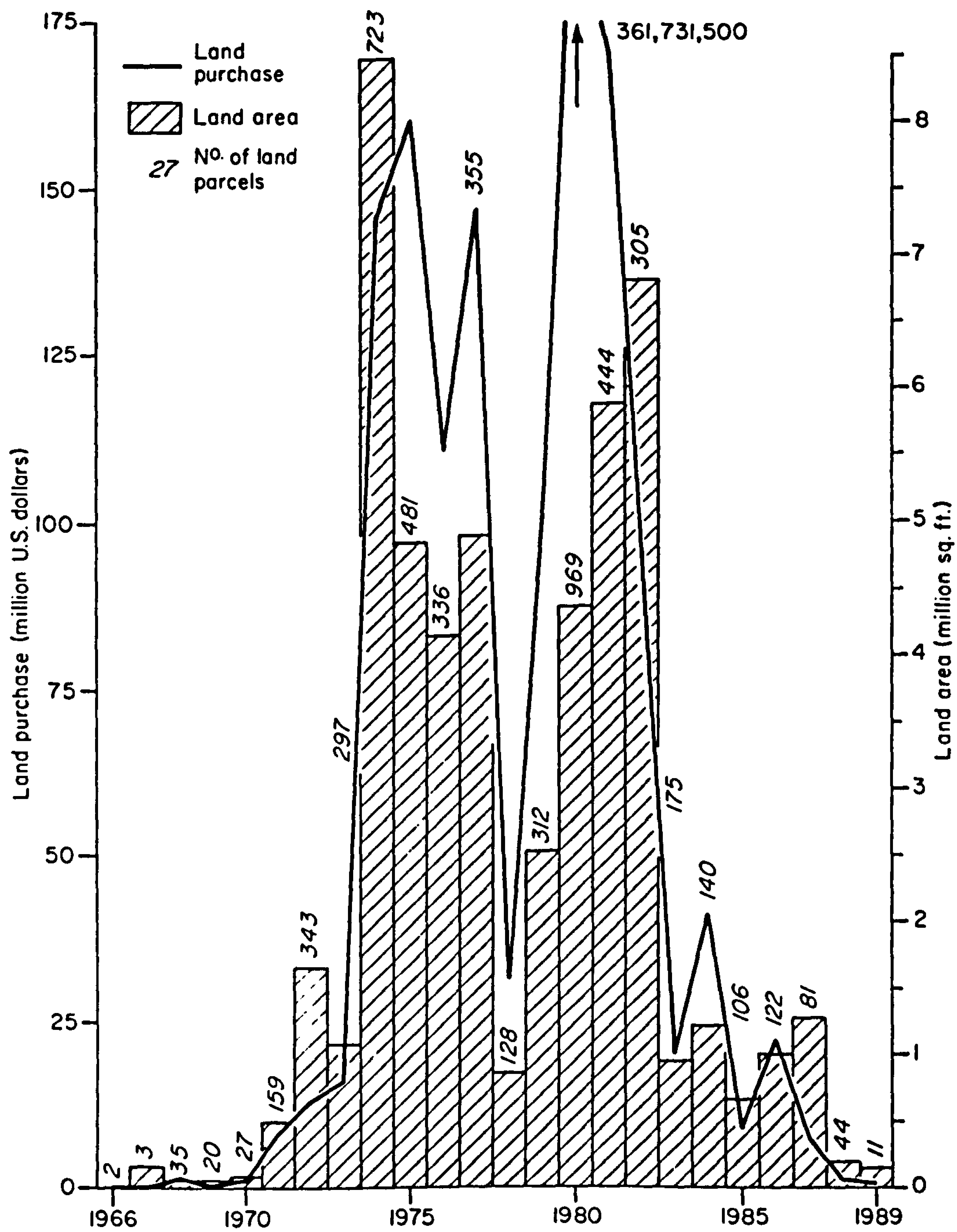


Fig. 6.4 Parcels of land sold in Doha between 1966-1989 and compensation in U.S. dollars

1. The government expected to buy land more cheaply than in the late 1970s and early 1980s (Figure 6.4).

2. By 1990 the government had bought almost all the essential sites inside the central areas as well as around Doha and had almost completed the building of the basic infrastructure and services for Doha city which reduced the government's requirements to buy new pieces of land in the capital.

Thus we can see two reasons for the fall in land prices in Doha in the 1980s: firstly (Figure 6.4 and Table 6.5) the decline in demand for land in the various districts of the capital; and secondly the economic recession in the GCC region as a whole which reflected badly on the property market. In the 1980s a lot of foreign workers were made redundant and as they left to return to their own countries, many of the properties they had occupied were left empty, resulting in a decline in demand and subsequently in rents in Doha and other GCC cities (17). This also resulted in a slowing of the urban growth in GCC cities during the 1990s with less land use expansion.

In 1980 a government decree was issued for compulsory land purchase in areas of Qatar where land was needed in the public interest (18) and this decree was enforced once again in 1988 (19). Despite these statutory measures the government has almost never used them in compulsory purchase.

Table 6.5 Doha land prices by district in the 1980s

Land prices in U.S.A. dollars per ft²			
District	1981	1984	1988
Al-Jasra	171.7	137.4	60
Al-Ghanim Al-Qadeem	103	82	48
Al-Bidda	103	82	55
Doha Jadeeda	70	56	19
Al-Ghanim	6	55	20.6
Wadi Sail	39	31.6	11
Al-Rumeila	88	70	35.7
Najma	45	35.7	11
Umm Ghuwailina	58.5	47	16
Bin Omran	34	26	12.4
Al-Sadd	34	27.5	11

Source: The Ministry of Municipal Affairs, *Doha, List for Land Prices in 1981, 1984 and 1988.*

Increase in demand and cost of city centre land was one major effect of the oil revenue on land use in Qatar. Another has been the extension and intensification of land use along the Doha coastline. The Doha conurbation before oil extended to about 3.2 km of the coastline (Table 6.3)(Figure 6.1) and during the oil era this has extended continuously until the longest part of the city is along the coast, measuring 35.2 km in 1990 (Figure 6.1). The coastal side of the city is the most beautiful part of Doha and thus is an attractive place to live and subsequently the most fashionable and expensive. The best built-up area starts in northern Dafnah (Figure 6.3B) and continues to southern Ras Abn Abaud (Figure 6.1). The coast of Doha accommodates most of the city's new development and major renewal projects designed to revitalise important buildings of the old city, e.g. Qatar Museum, the Aimiri Palace, government ministry offices, banks, tourist and recreation sites (discussed in Chapter 7), as well as the QGPC offices (discussed in Section 6.3).

The main reasons for the recent intensive use of Doha's coastal land are:

Doha's overall shape in the oil era more or less resembles a semi-circle with its diameter along the coastline (Figure 6.2). The general morphology of Doha is a radial concentric plan focusing on the old pre-oil hamlets (Figure 6.2 and Table 6.3) of the Doha area. Around the old hamlets are five rings of motorway and a sixth is proposed. Figure 6.2 shows these motorway-ringed hamlets. The concentric design of Doha has determined the shape of the new zones, each group of new districts belongs to one of the rings, e.g. the old city and Bidda are in ring A (Zone A). Figure 6.2 shows the various zones of Doha, each with their districts. (Although the radial concentric plan dominates external and internal Doha, other urban shapes can also be seen. For example, Madinat Khalifa conforms to a grid plan).[20]

When Doha's main urban growth took place there were no natural obstacles hampering expansion as most of the land in and around Doha is flat desertland. In addition, there was nothing significant which needed protecting from urban expansion. This is in contrast to many other cities in the GCC where huge oil revenues and high government expenditure on urban development created conflict with other land uses. For example, the implementation of Kuwait City's first urban plan of 1952 resulted in the destruction of the historically precious city wall. This was strongly opposed by the local people who appealed to the government to retain the wall which represented a symbol of the City's history [21]. The third urban plan of Kuwait City came into conflict with land used in the hydrocarbon industries (22) because it encroached upon the Burgan oilfield which lies directly to the south west of Kuwait City and is one of the world's largest oilfields (23). This conflict resulted in Kuwait City's urban development being deflected to the coastal area (24).

Another example of land use conflict in the Gulf is that of Saudi Arabia's eastern province where in 1953 the demands of urban growth conflicted with other land use resulting in the change of the province's capital from Hofuf to Dammam (25) and in the demolition of the traditional town walls of Hofuf due to demands for urban growth in the late 1950s and early 1960s. Thus urban land use conflicted with that of the country's historical heritage and an important ancient monument was lost (26).

Another important area of land use conflict is often between urban expansion and agricultural land. The high revenues derived from oil have led to urban encroachment on the best agricultural land of the GCC at Qatif and Ihsa Oasis. Many built up areas have grown to eat up former date gardens and, in addition, many date gardens which in the past co-existed harmoniously with residential land use previously in towns and cities have now been demolished and their land used for building purposes (27).

Comparing the urban growth of Doha with the above massive conflicts and encroachments in other parts of the GCC it can be seen that Doha has seen relatively little conflict in land use. In fact Doha's urban growth has tended to enhance the landscape in and around the city - now streets are wider and tree-lined, there are many green areas, and beautiful buildings and villas adorn the city.

Whilst even before the oil industry Doha was the capital of Qatar and the centre for its main public and private activity (see Section 6.2.1), nevertheless land use has dramatically changed due to the oil revenues which have meant a huge growth in urban population. As well as increasing in population, the capital has increased in importance since the advent of the oil industry. Doha has attracted workers from other Qatari towns as well as expatriates from all over the world, brought into Qatar to supervise and work on the new structures and in the new occupations in the wake of oil revenues. The availability of excellent medical facilities has helped the natural population growth in Qatar. The many different reasons given above have all contributed to the growth of Qatar's population which more than doubled in a decade from the 1960s to 1970s. This trend is also seen in other GCC states such as the U.A.E. [28].

In 1949 the population of Doha was only about 12,500 people (Table 6.1) and this was about half of the total Qatari population. By 1970 the population of Doha had reached 88,500 - about 80% of Qatar's population (Table 6.1) and seven times the 1949 total. Such urban population growth is probably very high even by Third World standards (Table 6.6). Qatari nationals, however, do not represent the majority of the population in Doha - in 1970 they comprised only 40.5%[29] of the total population and in 1986 were 25%[30] (Table 6.1).

Table 6.6 A comparative table of population growth since 1950

Region	Population growth %
Developed world [A]	1
Developing world [A]	more than 2
Qatar domestic [B]	3.8
Qatar total growth including immigrants	8

Sources: A. compiled from: 1) World Population Datasheet 1991, Population Reference Bureau Inc., Washington D.C., April 1991; 2) Dr. Abu Aiianah, F, *Population Geography*, Second edition, Beirut, 1980 (Arabic), p.264.

B. United Nations, *The population in the ECWA region: Qatar*, Beirut 1980, pp.9-10

Doha's continuous growth has however been the lion's share in terms of total population growth in Qatar (as shown in Table 6.1). This, in turn, resulted in the slow growth of other urban areas, e.g. Al-Khawr, and the evacuation of others, e.g. Ghariyah, and also affected the lands outside Qatar.

The above shows the influence of Doha on Qatar and how the capital has shaped the city state. As government investment gave priority to Doha it became the centre for all public and private sector activities in Qatar. Its huge population growth gave Doha a positive asset in providing the manpower required for the various land uses open to the city but also provided a drawback for nationals in that they now comprised a minority in their own capital city (about 25% of total population in Doha are Qatari).(31) However, it is very difficult to see how the major projects and land expansion in the town could be undertaken at the same time as limiting the flow of immigrants. A positive aspect of the recession which occurred in the 1980s when there was an oil slump is that it meant some projects were cancelled and others postponed which led to a reduction in foreign manpower (Table 6.1).

As discussed above, the shaping of the city state in Qatar was mirrored in other Gulf cities, such as Kuwait City where about 90% of the Kuwaiti population reside (Table 6.7). So the influences bearing upon one Gulf city are also to be seen in shaping other urban areas more widely in the GCC region, and many cities share similar circumstances and post-1950 historical development. For example, between 1968 and 1980 the population increase of Doha and Kuwait City was in excess of 200% and that of Dubai City over the same period 400%. This phenomenal rate of growth placed Qatar, Kuwait and the U.A.E.'s degree of urbanisation at a higher level than that of the industrial and developed world. The developed world took 200 years to reach a similar level of urbanisation, as that achieved in only 25 years in the oil era [32].

Table 6.7 Percentage of total population in Gulf capitals (1978)

Capital City	Kuwait	Dubai	Sharjah	Umm al Qaiwan	Doha	Abu Dabi	Ajman	Ras al Khaimah	Manamah
Percentage	90	90	88	88	80	76	67	60	60

Source: Quttub, I., Abu A'yash, A., *The growth and urban planning of the Arabian Gulf states*, Wakalat al-Matbua't, Kuwait, 1980 (Arabic), p.106.

Thus it can be seen that the revolution brought about by oil revenues in Doha, and in other GCC states, resulted in very high population concentrations in one urban area in each state (Table 6.7), and consequently a regional imbalance in many GCC states. However, these concentrations of population have not caused major problems, for the following reasons:

1. From each capital to the furthest settlement in each state (Kuwait, Qatar and Bahrain) the distance is never more than 200 km.

2. There are few attractions to induce people to live away from their capital cities. For example, there is little good agricultural or grazing land nearby. An excep-

tion, however, is the attraction of employment in hydrocarbon producing and processing regions. Even so, the majority of workers reside in these areas only during the working week.

3. The availability of good transport and communication systems means that people can live in the capital at the same time as keeping in touch with other parts of their country.

4. Politics and history are also factors determining the power base of the states being located in GCC cities and this has resulted in much oil revenue being spent on such cities.

The high concentration of population in the capital cities of GCC countries has created an imbalance in their regional settlement. However, population change and regional imbalance have been more evident in countries which have a very good agricultural and grazing land. For instance, in Britain many rural parishes had fewer people in 1901 than in 1801. One of the main reasons for this depopulation, both in this century and the last, was the decline in agricultural employment simultaneous with an increasing concentration of industrial employment in urban areas. Even after 1945, the decline in agricultural employment has continued to foster rural migration in Britain. [33] In Qatar on the other hand there was no large reservoir of rural population from which migrants were drawn.

6.3 Land Use Elements

Land use elements comprise the main topic of this chapter. The proportion of land of the capital city occupied by the activities of the QGPC will be detailed. As mentioned in Chapter 2, Section 2.5, QGPC was established by Amiri Decree No 10, 1974 and is embodied in Article No 2 of the decree which gave the order for "*QGPC to have its main offices in Doha with branches and agents throughout Qatar and abroad where required*" (34). This decree officially authorises QGPC to occupy land in Doha and stipulates that the Qatari headquarters must be located in the capital, as explained in Section 6.2.

6.3.1 Offices and Services

The reason for discussing administrative offices and services in the same subsection is that both functions are usually located on the same sites, such as in the case of Ras Abu-Abaud (Figure 6.5). Tracing the history of land use occupation by oil companies in Doha, it is found that the first company premises in Qatar were at Ibn Jelmood House, established in 1935 in Jasra (Plate 6.1). These premises were rented by APOC (Anglo Persian Oil Company) as a base for its activities in Doha. This is one instance of many which demonstrates the importance of Doha in the early stages of the oil industry in Qatar. The second land occupation by APOC in the capital was in Saleh bin Suleiman Al-mana's House, used as the employment office for the company (35) These two premises were the first land occupation by the oil industry in the capital, established in the period 1938-40 when APOC was intensifying its exploratory operations in the Dukhan oil field, and in effect established its administration in Doha

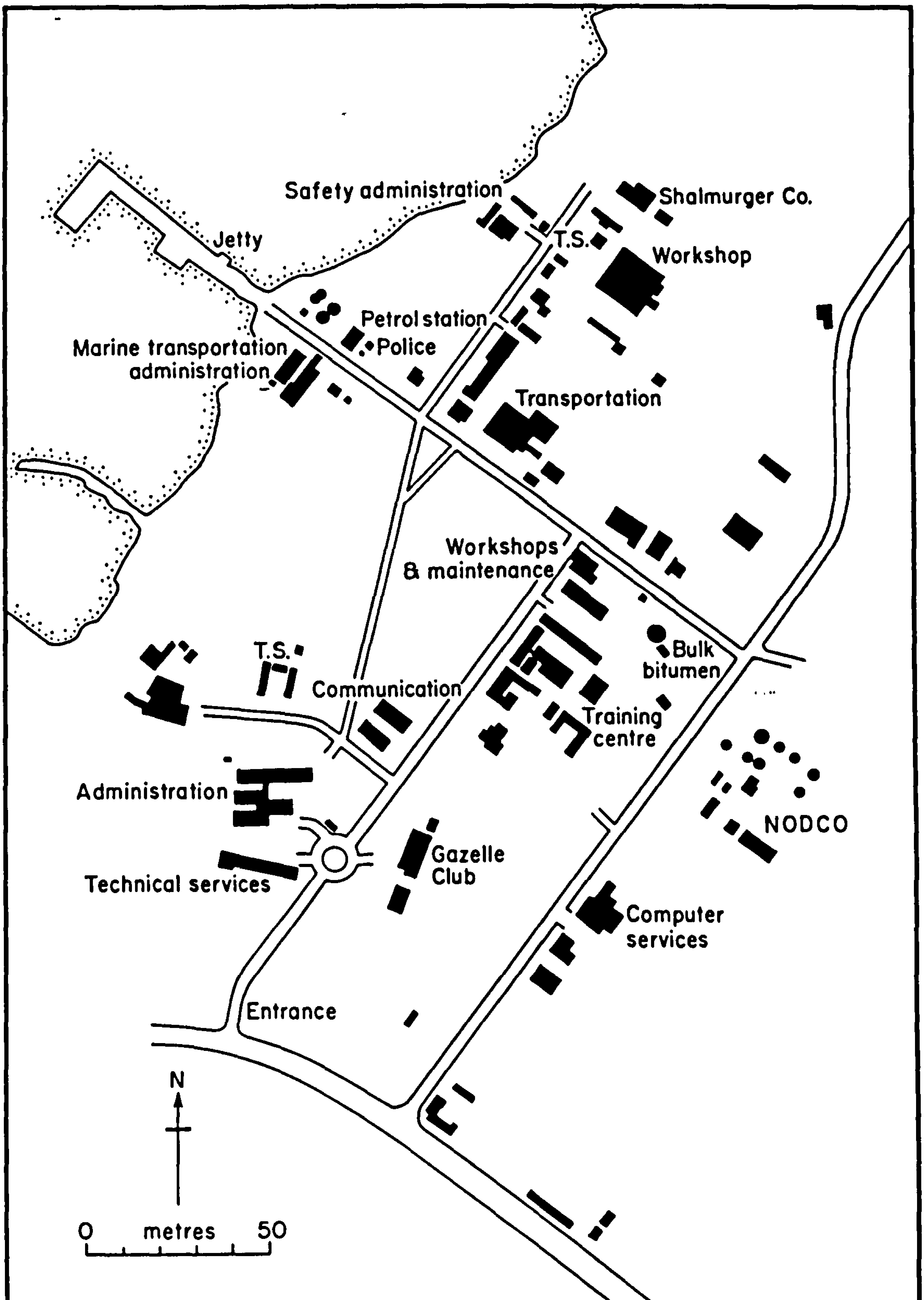


Fig.6.5 Land use in Ras Abu Aboud 1990, the offshore headquarters area of QGPC

while the main operational fields were in Dukhan, and later Umm Said where the oil terminal is sited. It might have been expected that the building of the oil terminal would have prompted the Company to relocate at Umm Said but in fact the main administrative offices continued to be in the capital. In 1945 APOC moved its offices from Ibn Jelmood House in Al-Jasra to a larger administrative complex in Al-Rumeila (Figure 6.6B). Since then APOC (QGPC's onshore operation since 1976) has occupied some of the most expensive land in Doha - Al-Rumeila at the peak of the oil boom in 1981 reached a cost of \$88 per ft^2 (Figure 6.2, Table 6.5 and Plate 6.2). The onshore headquarters occupied about 0.05 km^2, about 0.04% (Table 6.8) of the whole of Doha (Figure 6.6B). The percentage land use looks small but QGPC occupied a most prestigious site in one of the most expensive districts of the capital (Figure 6.2 and Table 6.5). Onshore headquarters is continuously expanding in Al-Rumeila and the construction of a complex of 20 offices in Al-Rumeila in the vicinity of the existing onshore headquarters is said to be under review.[(36)]

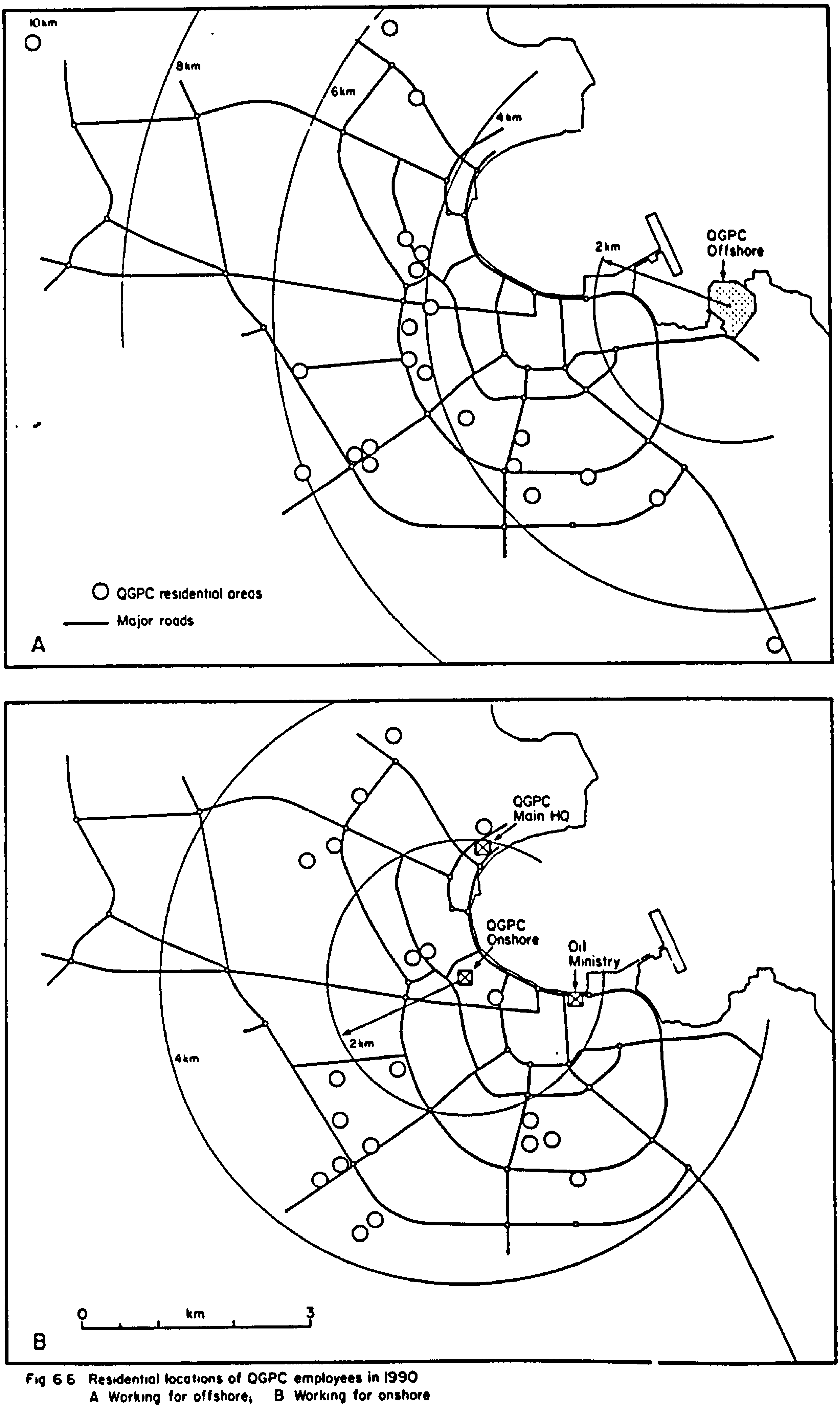


Fig 6 6 Residential locations of QGPC employees in 1990
A Working for offshore; B Working for onshore

Plate 6.1: *The first land occupied by the Anglo-Persian Oil Company (APOC) in Qatar in 1935 (Ibn Jelmood house).*

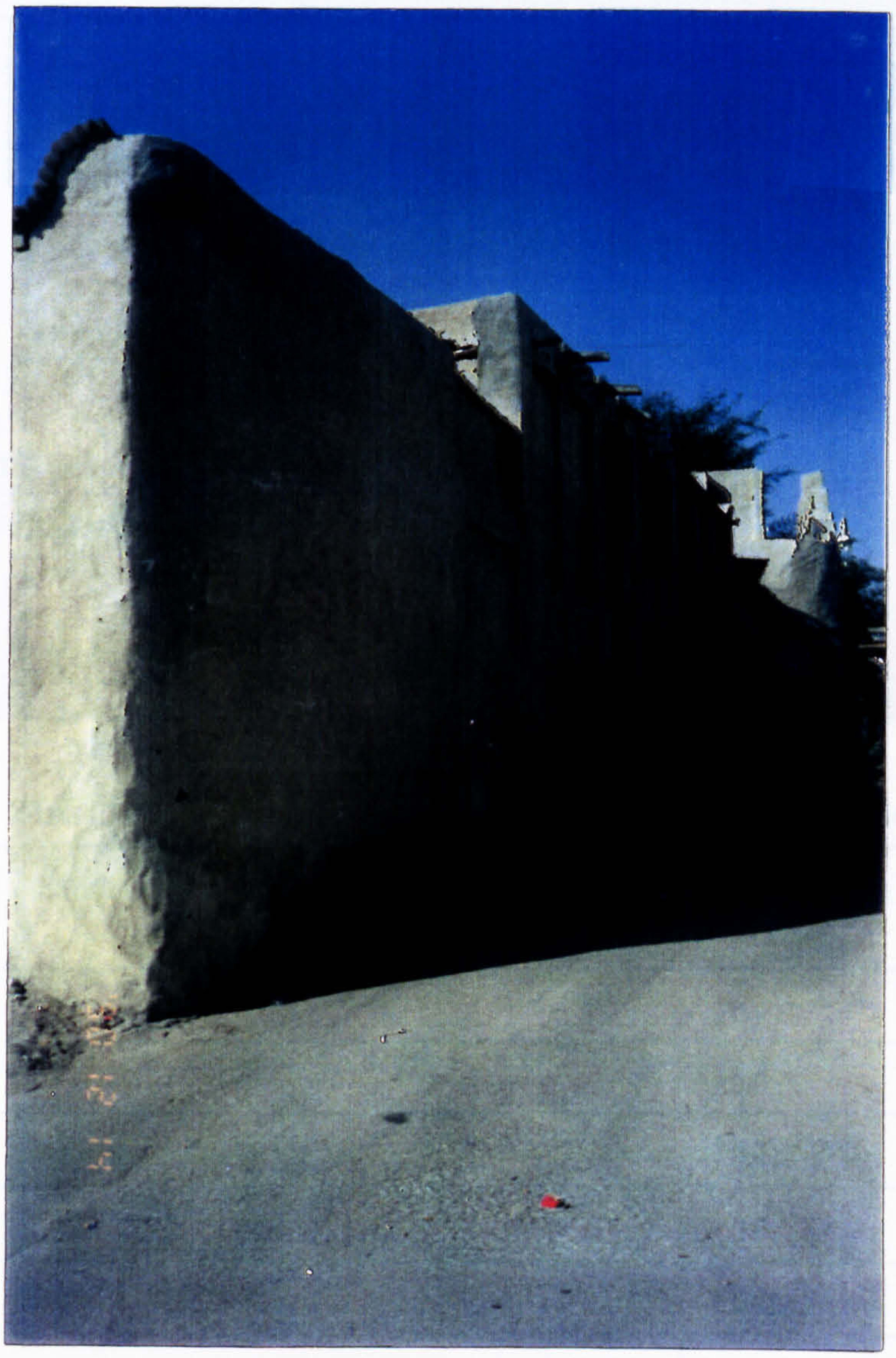


Plate 6.2: *The onshore headquarters (QGPC) in Doha in 1945, showing the third land occupation by QPC in Doha after Ibn Jelmood house and al-Mana house, QPC's employment offices.*

Table 6.8 The Oil Industry Administrative and Support Services in Doha

Item	Land occupied km^2	% of Doha
Offshore HQ	0.44	0.33
Onshore HQ	0.05	0.04
QGPC HQ	0.015	0.011
Oil storgae	0.8	0.6
Storage	0.12	0.09
Associated services - Helicopter airport	0.11	0.08
Employee accommodation	0.6	1.1
Total	2.14	1.6

Sources: 1. Fieldwork by author in Doha 14 May up to 29 June 1990.

2. Measured from maps of Doha scale [1:18000] by Arthur Corner, Cartography Office, Geography Department, Durham University on 20 March 1991.

The second land occupation by hydrocarbon supporting services was made by Shell Qatar Oil Company (SCQ). In 1952 SCQ occupied one of the best sites in Doha at Ras Abu Abaud for its offshore headquarters - since 1976 this has been the headquarters of QGPC offshore. At the time no-one considered this site as important as the land area occupied by Doha in the early 1950s was only 1.25 km^2 (Table 6.4)(Figure 6.1) and land was plentiful and the site was some way from the main settlement of Doha. Today, the site is considered one of the most favourable and valuable in Doha (discussed below). The offshore complex is one of the largest complexes of QGPC supporting services in Doha, occupying about 0.44 km^2, or 0.33% of Doha (Table 6.8), almost a district in itself (Figure 6.5). The offshore headquarters in Ras Abu Abaud has about 11 administrative buildings, a maintenance shop, storage, training centre and health centre [(37)] (Figure 6.5) plus a jetty for QGPC offshore headquarters for linking offshore operations (Figure 6.5 and Plates 6.3 and 6.4). The offshore headquarters in Ras Abu Abaud serves the whole QGPC workforce in Doha for recreational and social welfare purposes, through the Al-Gazal Club, the Sea Club, Dutch school and kindergarten [(38)] (Figure 6.5). Spatial expansion of the offshore headquarters' premises is continuous at Ras Abu Abaud and in May 1990 QGPC reportedly had plans for a further complex of 60 offices at Ras Abu Abaud.[(39)] QGPC has other recreational facilities elsewhere. For instance, at Al-Rumiela there is the Falcon Club which serves the needs of executive staff.[(40)]

As the above demonstrates, offshore and onshore headquarters' administrative complexes and other elements, such as recreational facilities, occupy a considerable amount of land, and whilst the offshore headquarters at Ras Abu Abaud was originally

Plate 6.3: *QGPC's Medical Centre at Ras Abu Abaud (offshore headquarters) which serves all of QGPC's employees.*

Plate 6.4: *Offshore Operations Jetty at Ras Abu Abaud.*

(1952) a low value site being away from the main conurbation of Doha, it has since become one of the most desirable locations in Doha.

This is partly due to the major land reclamation project undertaken by the government on the western bay (al-Dafnah) of Doha commissioned in 1980 (Figures 6.1 and 6.3B shows the reclaimed part of Doha coast). The headquarters sites now rubs shoulders with some of the best hotels in Qatar, e.g. the Oasis Hotel, the Gulf Hotel, as well as the Doha Social Club. The hotels were the first five-star hotels in Qatar. To the southwest of the offshore headquarters is Doha International Airport (Figure 6.7). The Planning Study undertaken by Janet Forster Walker in April 1973 (State of Qatar Development Plan) chose the south eastern coast, south of the offshore headquarters, as the main tourist site in Doha (Figure 6.7).

The above detail reveals that the original site of the oil industry's supporting services has now become not only much more extensive but increased significantly in importance to become one of the prime sites of the state. It is safe to say that if this area were not being used by the SCQ (Shell Oil Company of Qatar) it would be snapped up by developers. Whilst for its oil operations in Qatar the SCQ required a coastal site for its jetty and to keep continuous contact with its offshore activities, any piece of land on the northern or southern coast of Qatar would have sufficed. As Qatar is a peninsula it has a long coastline - about 700 km in length. Equally, Doha airport which is to the southwest of the Shell location, could have been located elsewhere. This prime location is on land allocated by the government, even though the empty Qatari desert would have sufficed, and may potentially have been safer and more comfortable for people on the ground, e.g. hotels and residences in the area are not

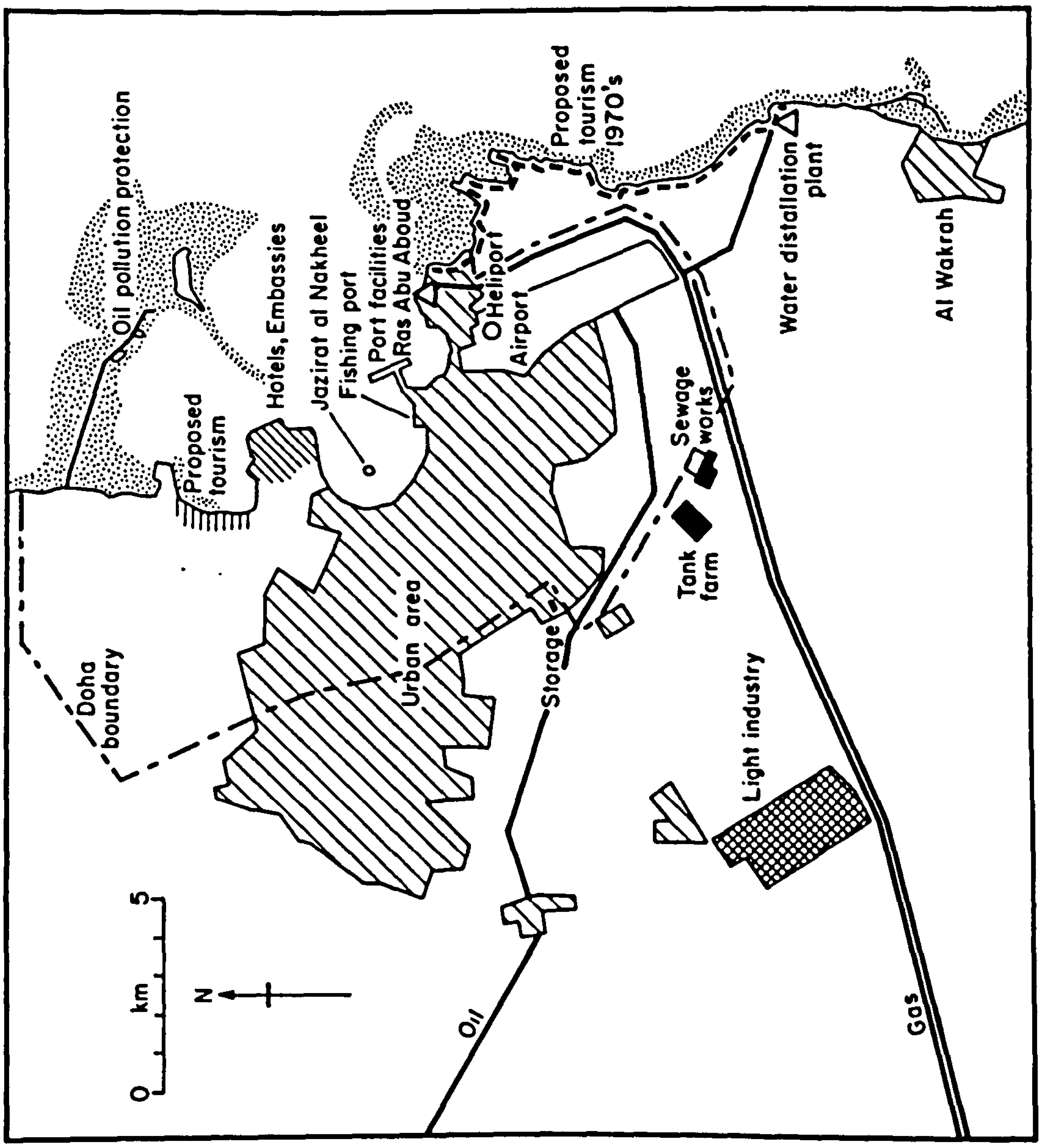


Fig.6.7 Oil industry in Doha and other coastal activities

only at risk from air accidents, but also suffer from sound pollution from the airport. Airport security also would be easier were the airport away from inhabited areas[41] (Figure 6.7).

It could thus be argued from the above that the locations of airport and supporting services were a mistake that, if avoided, could have saved the government enormous amounts of money (the figure for reclaiming the west bay of Doha has, so far, been unobtainable). In this case, efforts to develop Ras Abu Abaud as a tourist centre at Doha would have been greatly facilitated, as well as releasing a most suitable site for the major ambassadorial and quality residential land use requirements and perhaps even other urban land uses. In other words, Ras Abu Abaud could provide a similar land use function as those currently being performed by the western bay of Doha.

The decision to locate SCQ headquarters at Ras Abu Abaud in the 1950s is understandable when we consider the lack of planning expertise at that time in Qatar, while the subsequent expansion of Doha could not have been foreseen. Modern planning for the capital only began in the early 1970s, almost two decades after the Ras Abu Abaud's site was established, and this too must bear some of the blame for the modern land use conflict at this site.

The third land occupation at Doha of hydrocarbon supporting services was at Al-Dafnah, the reclaimed area in the western bay of Doha (discussed briefly above in comparing its land use with those of Ras Abu Abaud). This area was originally reclaimed by the government to provide a new (and unique) district of Doha serving tourist and recreational needs as well as providing more land for government offices, and for buildings for diplomats. Some of the land was also given to the private sector

Plate 6.5: *QGPC HQ in al-Dafnah, clearly one of the prominent features of the district.*

with the stipulation that it be developed for commercial or shopping purposes and it was envisaged that it should include a large shopping complex. The area now houses the Al-Slam shopping centre. The general plan of Al-Dafnah is radial concentric and similar to the general plan of greater Doha [42].

As QGPC headquarters already occupied some of the most sought after land and the best coastal sites in Doha for its onshore and offshore supporting activities, as well as land in the western bay (Figure 6.6b) and at Al-Dafna (QGPC headquarters in 1981) land use competition with the development of residential, government, diplomatic and tourist needs of the capital are clear. The government gave two buildings at Al-Dafnah to QGPC headquarters, and QPGC rented an adjacent, third building. These three buildings occupy an extensive plot of land comprising about 0.015 km^2, being 0.011% of Doha (Table 6.8) (Al-Dafnah is the new western bay district of Doha). These buildings occupy a prominent site in Al-Dafnah and are a landmark, being visible from all approaches to Al-Dafnah (Plate 6.5). As well as QGPC headquarters occupying the most prominent site, the location is also environmentally attractive, being beside the sea with palm trees, wide pavements and green spaces for people to enjoy their leisure at the coast. The most beautiful hotel - the Sheraton - is also in this vicinity, as well as other prestigious buildings.

The fourth land use area of the QGPC is in south western Doha near the Salwa Road and is used for storage of QGPC equipment. This warehouse occupies an area of about 0.12 km^2, about 0.09% of the total area of Doha City (Table 6.8).

There is also the Gulf helicopter port which serves QGPC on the site of Doha International Airport (Figure 6.7). The heliport is dedicated almost completely to servicing the offshore hydrocarbon industry. It occupies about 0.11 km^2 of land (Table 6.8), about 0.08% of Doha City (Figure 6.7).

The above brings the area occupied by QGPC offices and associated services in Doha to about 0.735 km^2, about 0.56% of Doha City (Table 6.8). In the next section the land use devoted to oil storage and pipelines in the southern part of Doha City will be examined (Figure 6.7).

6.3.2 Oil Storage and Pipelines

The oil storage and pipelines are located in southern Doha, which forms the southern boundary of Doha. The tank farms are located at Abu Hamour, and the pipeline crosses the Salwa Road in south western Doha and then travels towards the south east of the capital up to the coast. This pipeline provides the energy to supply the Ras Abu Abaud and Ras Abu Fintas power stations and distillation plants (Figure 6.7).

The effect on land use of the hydrocarbon pipelines on the whole of the Qatari peninsula have already been examined in Chapter 4 but detailed examination of pipelines entering southern Doha are discussed below, as well as land occupied by the tank farm.

The tank farm was first commissioned about 1985. The main function of the tanks is to receive petroleum products by pipeline from the refineries of Umm Said (Figure 4.1) for distribution by tanker throughout the capital, and to other Qatari towns. There are 13 tanks in southern Doha, two each for super gasoline, premium gasoline, and diesel, three for jet fuel, and a further four for surplus energy - two above ground and two underground (43). These tanks in southern Doha occupy a comparatively large amount of land of about 0.8 km^2, or 0.6% of the total city area (Table 6.8). This land is not, on the whole, deemed to be expensive, in contrast with that in the central and northern areas of Doha. The price for this land is $2.7 per ft^2 or less (44).

The tanks were studied to measure their effect on land use in Doha.

Dr A. Al-Buianain, the Director of the Construction Planning Department of the Municipal Ministry in Doha stated:

> *"The site of Ras-Abu Hamour tanks farm has been wisely chosen as there are no residential areas around the tanks farm, the nearest residential area being about 3 km north. Most of the land around the tanks farm is used by different ministries for storage purposes, e.g. the Ministry of Education, Police, etc. There is in addition a buffer zone around the site of about 100 m on every side."* (45)

Thus it seems clear that the tank farm has little effect on residential land use, and field work in June 1990 confirmed Dr al-Buianain's opinion. The buffer zone, for safety purposes, is not very extensive, but it may be possible for it to be developed as a green area which might improve the landscape around the Abu Hamour tank farm and help reduce the environmental hazard posed by the tanks should they catch fire or leak.

It is also arguably less risky having the tank farm on the southern edge of Doha than the alternative which is the daily transport by tanker of refined hydrocarbon products from Umm Said to Doha. This alternative would mean the daily hazard of a convoy of trucks travelling 45 km from Umm Said, putting at risk other road traffic and people and towns along the way, e.g. in Wakrah (Figure 2.9). By receiving the refined hydrocarbon by pipeline from Umm Said (Figure 4.1), the hazard is greatly reduced - tankers transport the dangerous material only a short distance to supply the capital and other inhabited areas.

As to future expansion in the southern part of Doha, although it has essential services such as roads, it may not be the ideal area for expansion. In August 1981 planning bodies working in Doha, headed by the Shankland Cox Partnership, suggested that the best direction for Doha to expand might be towards the south. However, the decision was taken by the government for Doha to expand firstly towards the north.(46) This does not necessarily mean that the southern part of Doha will see no development in the future - some residential areas are already being developed there, e.g. the Nauija. It remains to be seen whether the fact that land in the northern part of Doha is more expensive (averaging \$6.9 per ft^2) (47) than in the south (averaging

\$2.7 per ft^2) [48] will be a deciding factor in the direction in which the capital expands. The north is more attractive than the south of the city and thus, the tank farm is unlikely to create land use conflict in the foreseeable future (Figure 6.7).

The second part of this section examines the effect of the hydrocarbon pipelines on the southern fringe of Doha. The pipelines, running from the Dukhan and Umm Said regions (discussed in detail in Chapter 4 and shown in Figure 4.1), traverse, and thereby to some extent occupy, land on three sides of Doha. Areas of land have been dedicated by the government for the use of pipelines along the south western, southern and south eastern boundaries of Doha, and occupy a surprisingly large area totalling: 5.04 km^2 [49].

The southern part of Doha is occupied partly by the Abu Hamour tank farm, and delimited by hydrocarbon pipelines. Decree 16 of September 1988 states that the western and southern boundary of Doha *"starts from a point at Al-Shamal Road, then towards D ring until it reaches Salwa Road, then along Salwa Road in the west and when it reaches the Central Market roundabout, turns towards the south, up to the maintenance station of the Department of Electricity at Abu Hamour, then veers to the east, by the gas pipelines, across the Western Road, and then continues parallel to the hydrocarbon pipelines to the east, till it reaches the Al-Mahraqah roundabout."* [50] (shown in Figures 4.1, 6.7 and Plate 6.6).

Mr A. Ali Darwish and four other engineers from the Construction Planning Department of the Municipal Ministry in Doha on 10 March 1991 stated that, as they understand it, the southern limit of Doha's boundary is still the pipelines, as described (Figure 6.7).[51]

Plate 6.6. *Gas booster station, west of Mahraqah roundabout. to serve the pipelines before they cross underground at Mahraqah roundabout in Doha. This station occupies a small piece of land, but the safety area around it is quite significant. The signs below explain more.*

The pipelines, taken with the tanks farm, have other, indirect, effects within Doha. For instance, roads were laid about 1983 in the southern part of the capital near the pipelines, and these usefully connect the southern edge of Doha with the central area, even though they were built primarily to serve the tanks farm and to facilitate patrolling the area along the pipelines. Thus the pipelines and tanks farm brought to this part of the capital other land uses.

During the period 1975-1980 the government bought up much of the old residential area of the city centre, compensating the existing owners. Those who received compensation looked for other land - to the south - upon which to build new houses and this resulted in the growth of new residential areas, e.g. Nuaija district (Figure 6.2) only about 2 km away from the pipelines. It is apparent that were the same rate of growth as in the 1970s and 1980s to continue, the residential area would eventually reach the pipelines. A study published in March 1991 by the Construction Planning Department recommends prohibition of any construction closer than 80 m to the pipeline.[(52)] Part of the land forming the 80 m buffer zone is in private ownership [(53)] and as the owners cannot use this land for any purpose, the Government Decree 13 of 1988 [(54)] has promised reasonable compensation. Whether 80 metres is a reasonable buffer zone has to be questioned; QGPC recommends 100 metres, and even this seems minimal.

It is predicted that Doha will expand across the land occupied by the pipeline some time after the year 2000 (Figure 6.7). If this happens, the visual effect of the pipelines will detract from the new development. Doha's modern development is usually well planned, well provided with services, and landscaped to provide a pleasing aspect. Whilst the pipelines are covered with gravel and stones [(55)], their height is between 1.5 and 2 m, and thus their appearance could give the new districts an odd and unpleasant aspect.

Planners must, therefore, consider the pipelines seriously if they are not to disfigure the urban landscape. Perhaps the best solution would be to use the buffer zone as an expanded green area which would enhance the nearby residential areas, at the same time as reducing the environmental hazards of the pipelines in the event of leakage, fire, etc..

The hydrocarbon industry thus has some impact on the capital's land use even though the hydrocarbon production and processing plants are located neither in nor even near the city. The capital's considerable requirements for petroleum products has in effect brought the hydrocarbon industry's land use to the capital, if only in a moderate way (Figure 6.7).

To some degree these features of the landscape would occur in Doha even if Qatar were a non-oil producing state. The need for hydrocarbon products and the resultant pipelines and storage facilities are not unique to Doha but can be found in most major cities, although they may be better disguised in some cities.

A useful example of a capital city where hydrocarbon land use is apparently in conflict with other uses is London. As well as being the capital of the UK, London is one of the world's commercial capitals and land prices are amongst the highest in the world. London also has a very high pollution rate. Despite all this, London needs land dedicated to the storage of hydrocarbon supplies. For example, the 233 km pipeline commissioned in March 1991 commences at the Lindsey Oil Refinery on South Humberside (in the north of England) and terminates at the Hertfordshire Oil Storage plant in north London is thus a major distribution point for petroleum products for various parts of the capital itself and also for the south east of England generally [(56)]. This pipeline delivers products quickly and safely into one of the fastest growing markets in Europe. It even pumps jet fuel by direct link to Heathrow, the biggest and 'thirstiest' airport in the world [(57)].

6.3.3 Employee Accommodation

This section examines the services provided for their employees in Doha by QGPC's offices. Compared with many other companies operating elsewhere in the world (with the exception of oil companies in other GCC states) such services are generous. Companies in the rest of the world may sometimes provide their foreign employees with a company house when such employees sign a contract of employment. QGPC goes further and also provides employees who are Qatari nationals with accommodation. The reason is that QGPC is government owned and its residential policy is the same as that of the government, which also provides its senior Qatari staff with accommodation. The government provides Qatari employees with accommodation, and in return a housing allowance is deducted from their salaries (about $322 a

Plate 6.7: *One of QGPC's houses in Doha, and shows the front door of the Services Section for QGPC's Onshore Operations at QGPC Onshore HQ.*

month). There is a also housing list. Qatari employees have to wait until their turn comes when the government provides them with about $165,000 and a piece of land. The worker then has to build his own house and once that house is ready, must vacate the government property and move to the new house. The government then gives the employee a period of 25 years to pay back the loan and the amount repayable is about $132,000. Qatari nationals are exempted from paying back about 20% of the money and the land is a gift from the government.[(58)]

QGPC accommodation can easily be identified as there is a mark in front of each QGPC residence. These marks make it easy for the company's maintenance workers to find the company's houses [(59)] (Plate 6.7). The above only applies to QGPC employees working at branches of the company located in Doha.

The total number of houses belonging to the QGPC in Doha is 461 [(60)], spread throughout the city and there is virtually no district of the capital which does not have a group of houses belonging to the company (Figure 6.6). The total land occupied by the company houses in Doha is about 0.6 km^2, about 0.45% (Tables 6.8 and 6.9 show the distribution of QGPC houses in Doha) of Doha, including a significant area of valuable urban land (Table 6.9 and Figure 6.6) Thus, the QGPC participates significantly not only in the commercial and industrial areas of the capital but also in the residential quarters (Table 6.9 and Figure 6.6). In addition, QGPC can be said to have a minor secondary impact on land use in Doha through the requirements of commuting workers travelling from their homes to QGPC workplaces in Doha. The total contribution to the commuter traffic is small, but their journey to work patterns are of some interest.

Table 6.9 The distribution of QGPC houses in Doha in 1990

Districts	Number of houses
Salwa Road	136
Al-Mansaura	61
Al-Rumeila	54
Old Airport	40
Al-Muntazah	34
Fariej Ibn Mahmoud	28
Al-Sadd	24
Al-Hilal	17
Al-A'Seri Al-Jadid	16
Al-Bidda	13
Al-Dafnah	11
Fariej Kaulieb	11
Ras Abu Abaud	6
Kalifa Town	4
Fariej Al-Nasar	3
Rayyan Road	2
Fariej Al-Sudan	1
Total	461

Source: 1. Fieldwork by author in May, June 1990.
2. Correspondence with QGPC on 14 May 1990.

6.4 The Journey to Work

QGPC employees' journeys to work were measured by a sample of fieldwork questionnaires which were distributed to various QGPC offices in Doha in May 1990. The total number of questionnaires was about 120, with the response being 24 (20%) from the offshore headquarters and 18 (15%) from onshore headquarters, i.e. about 35%

in all. In March 1991 20 questionnaires were also distributed at QGPC headquarters at Al-Dafnah of which 15 (75%) were returned. Thus, unfortunately, the sample was small, representing only ca 3% [(61)] of QGPC's employees but it was nevertheless valuable in that employees residing in most districts of Doha responded (Figure 6.6, Tables 6.10, 6.11, 6.12). It thus represented a good sample in terms of location even though numbers were small. The total number of QGPC employees residing in Doha is 1,821 (0.6% of the capital's total population), about 44% of whom are Qatari nationals [(62)].

The questionnaires revealed that about 55% QGPC employees working at the onshore Rumaielah headquarters visited the Doha offices daily, and a similar proportion was revealed for QGPC offshore operations (Figure 6.6). About 27% of the Al-Dafna sample visited onshore headquarters or offshore headquarters (Figure 6.6).

About 33% of workers at the offshore headquarters in Ras Abu Abaud needed to visit QGPC onshore headquarters (Figure 6.6).

The percentages above show that QGPC employees travel frequently between the various offices. QGPC in Doha also has the various up-to-date telecommunication facilities such as telephones and fax machines, etc.[(63)]. This maintains a strong connection with QGPC offices and participates in reducing the need of the number of journeys made by employees between various offices.

Table 6.10 Journey to work for offshore headquarters in Ras Abu Abaud

Number of people responded	Place of residence	Distance to work by km	Time to work in minutes	Percent of employees from each place
5	Al-Dafnah	11.4	16.6	21
3	Al-Hilal	5.3	9	12.5
2	Al-Mansourah	6.5	9	8.3
2	Al-Nasar area/ Al-Murgab Street	8.7	16	8/3
2	Fariej Ibn Mahmoud	5.75	16	8.3
2	Khalifa Town	15	20	8.3
1	Rayyan	16	25	4.2
1	Al-Sa'd	10	20	4.2
1	Al-Khawr	60	45	4.2
1	Al-Khulaifat	15	20	4.2
1	Old Doha airport	8	12	4.2
1	Abdulla Ibn Thani St.	6	8	4.2
1	Umm Ghwalenah	6	10	4.2
1	Fariej al-Sudan	12	20	4.2
Total: 24				100

Source: *Questionnaires distributed in QGPC offices in Doha during fieldwork on 15 May 1990. The total number of forms distributed were 120, and about 20% of responses came from the offshore headquarters in Ras Abu Abaud.*

Table 6.11 Journey to work for the onshore headquarters in Rumaielah

Number of people responded	Place of residence	Distance to work by km	Time to work in minutes	Percent of employees responding from each place
3	Al-Hilal	16.3	18.3	16.7
2	Al-Montazah	4.7	17.5	11.1
2	Rayyan	22.5	17.5	11.1
2	Al-Mansourah	8.5	10	11.1
2	Al-Sa'd	3	10	11.1
1	Al-Dafnah	9	15	5.6
1	Redco area near T.V.	8	8	5.6
1	Kulaifat	10	15	5.6
1	Al-A'smakh S.T.	4	7	5.6
1	Fariej Ibn Omran	5	15	5.6
1	J.B.K. Salwa Road	7	15	5.6
1	Doha Jadidah	4	10	5.6
Total: 18				100

Source: *Questionnaires distributed in QGPC offices during fieldwork in May 1990. The total number of forms were 120, and 15% were returned from the onshore headquarters in Rumaielah.*

Table 6.12 Journey to work for QGPC main headquarters in Al-Dafnah

Number of people responded	Place of residence	Distance to work by km	Time to work in minutes	Percent of employees from each place
2	Al-Hilal	13	15	13.3
2	Airport area	9.5	15	13.3
2	Al-Amir Street	15	15	13.3
2	Al-Sa'd	5	11.5	13.3
1	Al-Dafnah	1.5	5	6.7
1	Doha Central	5	15	6.7
1	Al-Mansourah	10	15	6.7
1	Al-Nasar	8	10	6.7
1	Najma	10	20	6.7
1	Murgab Al-Khadeem	10	20	6.7
1	Fariej Ibn Omean	3	10	6.7
Total: 15				100

Source: *Questionnaires distributed in QGPC main headquarters in Al-Dafnah during fieldwork on 16 March 1991. The number of forms were 20, and 75% of them were completed.*

6.5 Conclusion

This chapter has examined the spatial impact of administrative and supporting services on land use in the capital. The various elements of land use in the capital have been examined separately.

1. Taking the evidence of this chapter as a whole, it is clear that whilst there is a significant proportion of land being used in providing the supporting services for the hydrocarbon industry - about 2.14 km^2, 1.6% of the capital's total area (Table 6.9), nevertheless it is the spending of oil revenues on the capital which

has had a much greater spatial impact than the services themselves. Figure 6.1 shows the rapid growth of land use in Doha during the oil era (discussed fully in Section 6.2), and thus the oil industry can be seen to have had more of an indirect rather than a direct impact on land use in the capital.

2. Hydrocarbon supporting services have also had a direct land use, most notably the pipeline (discussed in Section 6.3.2) (Figure 6.7) which forms a barrier to expansion.

3. Accommodation provided for QGPC employees occupies land in the capital. However, as company houses are scattered throughout the various districts, rather than concentrated in residential complexes, company housing is not too obvious. It is government policy that a proportion of the oil revenue be distributed to the private sector (through rents) which helps promote economic liquidity throughout the country and encourages the private sector to invest in projects [(64)].

4. Land is used for the QGPC headquarters, well away from the main base of production and processing operations. Whilst this may at first appear a misuse of erstwhile central land, there are historical reasons for it (discussed in Section 6.3, Government Decree 10) and it has the benefit of providing a base for this most important industry in the vicinity of government offices, airport and other useful facilities [(65)]. Because of the excellent transport and communication facilities in Qatar, the company does not experience any inconvenience in not being geographically close to its main operations. A similar situation exists in other GCC states, e.g. Abu Dhabi City houses the main headquarters of ADNOC, the state's government-owned oil company, and is a prominent

landmark there [66]. The Commission headquarters of Jubail and Yanbu industrial towns in Saudi Arabia, is located in Riyadh [67].

5. QGPC's spatial growth in Doha is continuous despite the vagaries of the oil industry - the North Dome project phase 1 was commissioned on 3 September 1991, and it is proposed that work on a new industrial town at Ras Laffan will begin in 1994/5. This will mean QGPC will need more offices and supporting services in Doha to serve these projects, all increasing the land use of QGPC headquarters at Doha.

The next chapter discusses the effect of the industry on the sea use, exploring the connection between sea use and land use.

References

1. Al-Jabbir, M., *The Human Geography of Qatar*, Master degree thesis, 1977 (Arabic), Cairo University, p.23.
2. Dr Al-Khyat, H., *The Arabian Gulf City*, Qatar University, 1988 (Arabic), p.97.
3. Lorimer, J.G., *The Gulf Gazetter*, geographical section, second part, translated to Arabic, published by Doha Palace, 1906, p.632.
4. Al-Khyat, H., op cit, p.97.
5. Ibid, pp.97-98.
6. Lorimer, op cit, fourth part, p.1341.
7. Al-A'had Book, *Qatar and its Oil Wealth*, ca 1983 (Arabic), pp.76-77.
8. Personal contact with elderly working for Aramco in Saudi Arabia in December 1991.
9. Lorimer, J.G., Op cit, geographical section, second part, p.627.
10. Naji, K., *The History of the Education of the Population in Qatar from late 1800s to 1950*, Qatar History Committee, second part, 21/28 March 1976 (Arabic), pp.514, 516, 521.
11. Al-A'had, Op cit, p.177.
12. Ibid, p.73.
13. Lorimer, J.G., Op cit, geograhical section, part 2, p.627.
14. Interview with Mr T. Al-Khawri, 14 June 1990.
15. Dr Quttub, I., Abu A'yash, A., *The Growth and Urban Planning of the Arabian Gulf States*, Wukalat Al-M- atbua't, Kuwait, lst edition, 1980 (Arabic) , p.228.
16. Al-Khyat, H., Op cit, 1988, pp.274-275.
17. Ibid, p.293.
18. Interview with Dr A. Al-Buainain, Director of the Construction Planning Department, Doha Municipality, May 1990.
19. Land Acquisition Decree 1988, Decree 13, Government of Qatar.
20. Al-Khyat, H., Op cit, 1988, pp.310-312.
21. Dr Quttub, I. Abu A'yash, A., Op cit, p.229.
22. Ibid, p.232.
23. Map of Petroconsultants S.A., International Energy Services, January 1988, Scale 1:1,000,000.
24. Al-Khyat, H., Op cit, 1988, p.184.
25. Al-Elawy, I., *The Influence of Oil upon Settlement in Al-Hasa Oasis in Saudi Arabia*, Ph.D. Thesis, Durham University, 1976, p.89.

26. Ibid, p.353.

27. Al-Shuabi, A., *The Development of the Eastern Province, with particular reference to urban settlement and evolution in eastern Saudi Arabia*, Ph.D. thesis, Durham University, 1976, p.57.

28. Quttab, I. Abu A'yash, A., Op cit, pp.40-41.

29. United Nations, *The population situation in ECWA region*, Qatar, Chapter 10, Beirut, 1980, p.4.

30. Interview with Mr A. Mostafa, Central Statistical Organisation, Doha on 1 January 1992.

31. Ibid.

32. Op.cit., Dr Al-Khyat, H., *The Arabian Gulf City*, pp.105, 107.

33. Robinson, G. M., *Conflict, Change in the Countryside*, Belhaven Press, London, 1990, p.59.

34. State of Qatar, QGPC, Establishment Decree No 10, 1974, p.5.

35. Al-Othman, N, *With their Bare Hands*, Longman, 1984, p.53.

36. Correspondence with QGPC headquarters on 14 May 1990.

37. Ibid.

38. Ibid.

39. Ibid.

40. Ibid.

41. Fieldwork by author, May-June 90.

42. Op.cit., Dr Al-Khyat, H., p.313.

43. Op.cit., Correspondence with QGPC.

44. Ministry of Municipality Affairs, Land List Prices, Doha, 1988.

45. Op.cit., Interview with Dr A. al-Buainain, Director of the Construction Planning Department.

46. Ibid.

47. Op.cit., Ministry of Municipality, Land Prices List.

48. Ibid.

49. Map of Qatar published by the Ministry of Information, Scale 1:200,000, 1982.

50. Ministry of Justice, *Department of Legal Affairs Official Journal*, periodical No 10, Doha, 1 September 1988, pp.1, 3, 5.

51. Personal contact with the Construction Planning Department of the Ministry of Municipality, 10 March 1991.

52. Ibid.

53. Ibid.

54. Op.cit., Land Acquisition Decree 13, Article 2.

55. Fieldwork by author in southern Doha May-June 1990.

56. The Institute of Petroluem, (File, Britain Onshore Pipes), "Wakeham Opens New Fina Line", 16 May 1991.

57. Ibid.

58. Op.cit., personal contact with Department of Construction Planning.

59. Op.cit., personal fieldwork.

60. Op.cit., correspondence with QGPC.

61. Ibid.

62. Ibid.

63. Correspondence with QGPC Offshore Headquarters at Ras-Abu-Abaud, May 1990.

64. Correspondence with QGPC, March 1991.

65. Ibid.

66. Personal contact with Abu Dhabi National Oil Company.

67. Mike Kelly, Investment Opportunities at Jubail and Yanbu (ca 1985).

Chapter 7

Hydrocarbon Offshore: Pattern of Sea Use

Figures

Tables

7.1 Aim of the Case Study

As demonstrated in previous chapters the effect of the hydrocarbon industry on land use has been significant. Although there is only one onshore oilfield in Qatar, this has stimulated much industry, which has, in turn, affected the land use and the landscape. For example, the oilfield has meant the land is crossed by a network of pipelines which transfer the hydrocarbon to Doha and Umm Said (Figure 4.1), and the construction of a hydrocarbon processing town and oil terminal at Umm Said. In addition to the land occupied by the industry, land has been required in the capital for administration purposes and services connected with the industry (Figure 6.5).

This chapter will deal with another effect of the industry on land use in Qatar - not that created by the onshore oilfield discussed previously, but the effect of the four offshore oilfields and one gas field (Figure 7.1). These will be discussed in sections 7.3 and 7.4.

Since 1978 the fields of the Halul region have been linked with the peninsula by pipelines (Figure 4.1) and thus since that date have occupied land onshore. The pipelines feed the hydrocarbon processing industry in Umm Said. On land, the offshore operation mainly occupies land in Doha: the offshore headquarters in Ras Abu Aboud was discussed in Chapter 6, Section 6.3. Pipelines also come onshore from the offshore North Dome gas field (Figure 4.1), feeding the hydrocarbon processing industry in Umm Said. These pipelines occupy land in Qatar (discussed in Chapter 4).

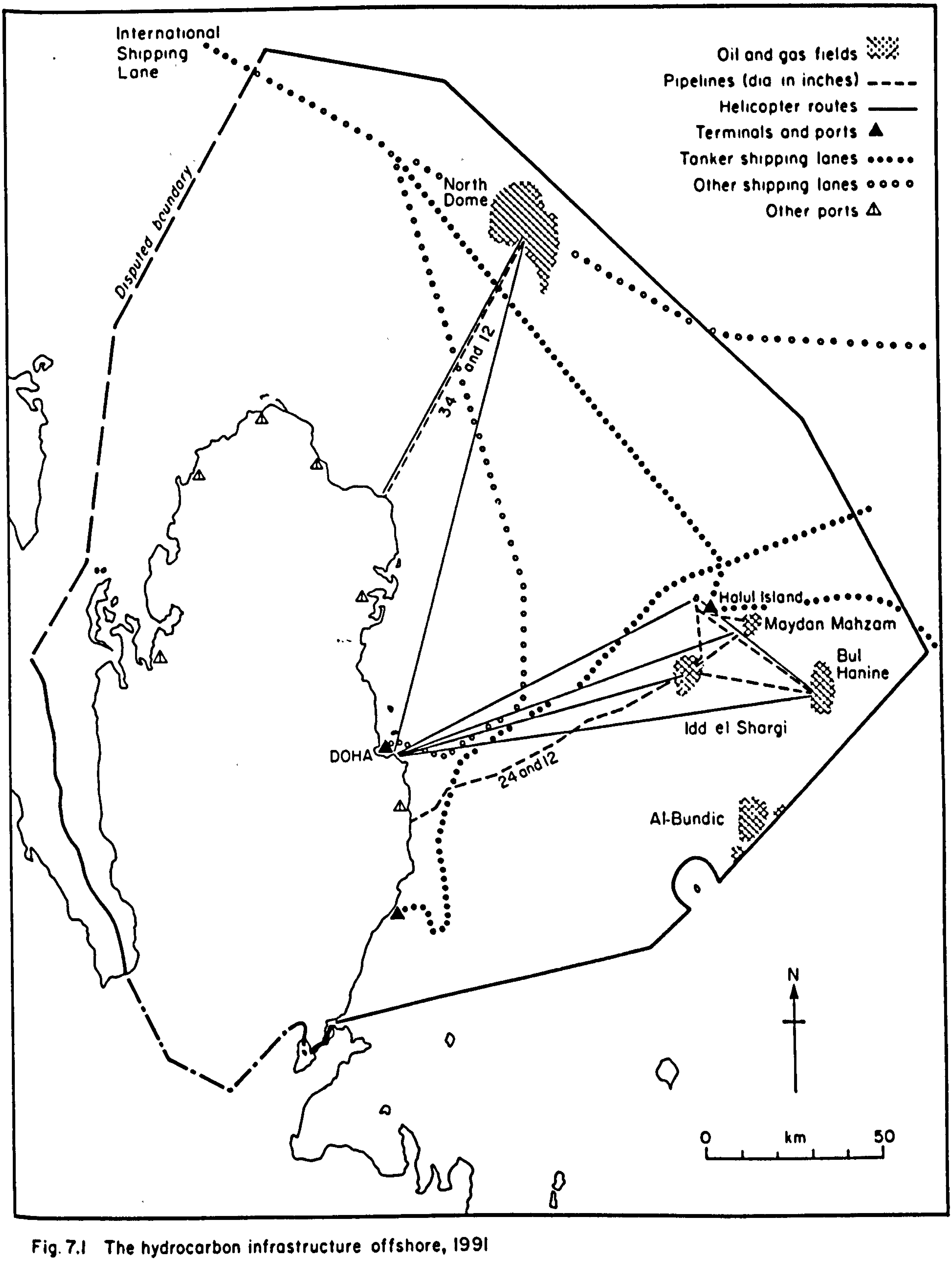


Fig. 7.1 The hydrocarbon infrastructure offshore, 1991

The purpose of this chapter is firstly to study the spatial impact of the hydrocarbon industry on other sea uses, secondly to examine the connection between sea use and land use, and thirdly how each of them affects the other.

7.2 Concept of Sea Use

This section will focus on the general concept of sea use, and then examine the concept in more detail for the purposes of providing a background for this study about the hydrocarbon industry in offshore Qatar (pattern of sea use).

In a way similar to that in which the industry occupies land, and creates competition and sometimes conflict for its use, so the industry creates similar problems for sea use. For instance, regarding incompatibility of onshore uses - residential areas cannot be sited near industrial refuse areas; regarding offshore uses, oil operations are incompatible with fishing activities, sponge banks, corals, marine parks and leisure facilities. Offshore activities also affect the coastline. Planners for the sea use must take into account the other uses of the sea and ensure that the various zones of activity do not overlap or encroach on each other in any way (Figure 7.2). Thus the concept of sea use by the oil industry is similar to that of the land use.

Little attention appears to have been paid by geographers to sea use by the oil industry, especially in the Gulf, and in the Middle East generally. However, there is a considerable body of information of sea use by industry from studies undertaken in other parts of the world - notably the coastal countries of the Western world and it will be useful to present some of this information.

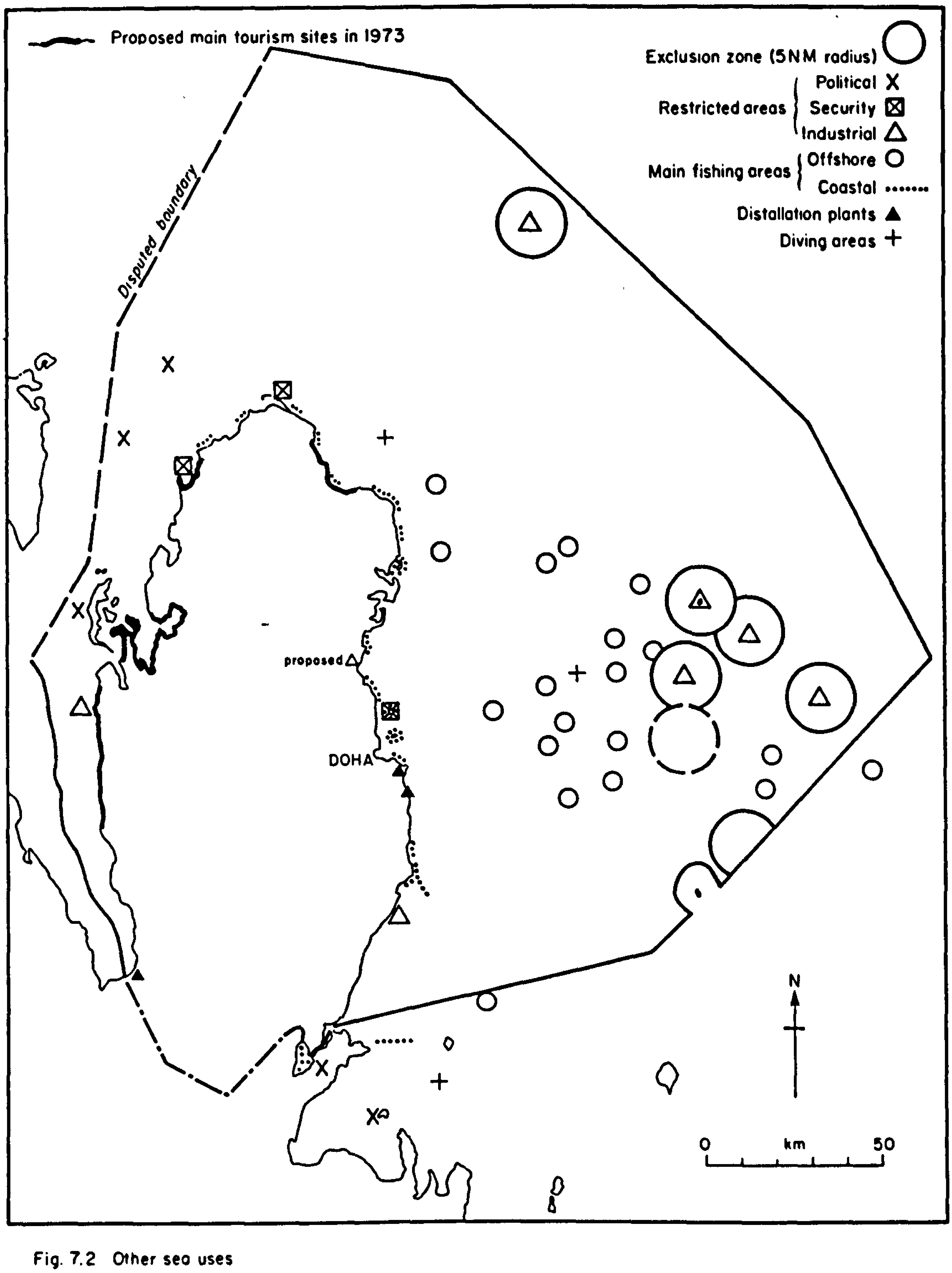


Fig. 7.2 Other sea uses

A brief explanation of the physical geography of the Gulf region is a useful starting point. The sea of the Arabian Gulf is marginal, located between latitude 24°-33°30' north, longitude 48°-56° east, shaped like an arm the shoulder of which is the Gulf of Oman. The only entrance and exit is the Strait of Hormuz which is about 60 km wide. The Gulf is about 1,000 km long, with an average width of 200-300 km. Its total area is about 226,000 km^2 [(1)] of which Qatar's area offshore is about 25,600 km^2 [(2)]: 11% of the Gulf Sea. That gives Qatar a land area per length of coast of 27.5 km^2/km which gives Qatar the third longest coastline in the Middle East in comparison with its land area.[(3)] The total coastline in the Gulf is 3,219 km long and the Qatari coast is about 700 km long, including the coasts of Qatari islands, which makes up about 22% of the Gulf coastline. The amount of water in the Gulf is approximately 6,000 km^3. There are about 400 kinds of fish in the Gulf, despite the fact that the salinity is higher than the Indian Ocean. The reasons for this high salinity are that the Gulf is shallow, semi-enclosed by land, and has a high rate of evaporation. Some scientists suggest that what prevents the Gulf sea from becoming a 'dead' sea is the continuous feeding of fresh water it receives from Shatt Al-Arab and some of the small Iranian rivers.[(4)]

The Gulf has many islands, the largest being Bahrain and Qishm. Some islands have become very useful sites for oil industry operations and terminals (in the oil era), for example the islands of Kharj, Dass and Halul (Halul is discussed in Section 7.3).

The continental shelf generally extends to a depth of 200 m. The Gulf, however, is basically a shallow sea - its maximum depth is about 100 m (at the Strait of Hormuz), with an average depth of about 35 m. The water is deeper along the Iranian coastline than on the Arabian coastline. The Gulf could be described as a shallow depression dividing two geological sectors: the Arabian sector which has stable geology and the Iranian which has an unstable mountain range. This geology is also reflected in the structure and formation of the sea bottom of the Gulf. The Iranian coastline is well-defined and distinguished by deep but small gulfs along the coast, and the coastal land gradually rises to hills and mountains behind these deep gulfs, with level land along the coast and in small valleys.

The Arabian Coast, on the other hand, is low-lying, with the only higher land being Ra's al-Khaymah, the peninsula of Massandam and Dukhan in Qatar (discussed in Chapter 3). Because of its physical geography the Arabian coastline affects the water currents. The unstable geological character of the Gulf area is due to the relative immaturity of the area, and the differences in sea levels in the last geological era which created sabkhas and coral reefs opposite each other, e.g. Umm Said's sabkha and Fesht (coral) al-Alaref (Figure 5.1) in Qatar. Both these features occupy land and sea. The sabkhas are continuously fed by the high tide which results in high levels of evaporation and a high salinity in the Gulf, especially at a point between Qatar and the U.A.E. - Khawr al-Udeid - where the salinity reaches 100 of one thousand.

The only deposits from the land to reach the Gulf sea are from Shatt al-Arab and some small rivers of Iran. The Gulf floor contains lime along most of the Arabian coast which is washed from the sands.

The peninsula of Qatar juts out from the Arabian coast into the middle of the Gulf and affects the sea currents and sedimentation in the south-western part of the Gulf (Figure 7.1). On the eastern side of Qatar is a wide sector of shallow water between 10 and 20 m in depth (Table 7.1), full of coral reefs and islands which although they are formed as a result of the salinity of the water have a volcanic shape, e.g. Halul Island [5] (Figure 7.3).

Table 7.1: The relative proportion of different depth ranges occurring in Qatar water

Water depth	% of Qatar water
0-5 fathoms	17
5-10 fathoms	18
10-20 fathoms	43
20-30 fathoms	17
more than 30 fathoms	5

Source: Sivasubramaniam, K. and Ibrahim, M., *Fisheries in Qatar*, Qatar, 1984, p.9.

The water of the Gulf enters by the Strait of Hormuz, travels north along the eastern coast, and from the northern tip of the Gulf it turns to flow towards the southern part of the Gulf along the western coast. This circular route takes about 2 years to complete and thus this is the timescale for the water of the Gulf to be changed.[6]

In presenting this brief description of the Gulf Sea, interesting questions are raised, such as whilst there have been individual efforts of conservation why, until recently, have there been no co-ordinated efforts among the coastal states along the Gulf Sea to protect the waters which they all share. The situation is exacerbated by the fact that there are territorial disputes over some of the waters of the Gulf's continental shelf (discussed in Section 7.6). As with the situation globally, the main problems of the sea are marine pollutants, of which oil and hydrocarbons generally are recognised as the most destructive. The problem is especially acute in the Gulf as the sea is small and semi-closed, which makes dispersal of pollutants extremely slow, and it is bor-

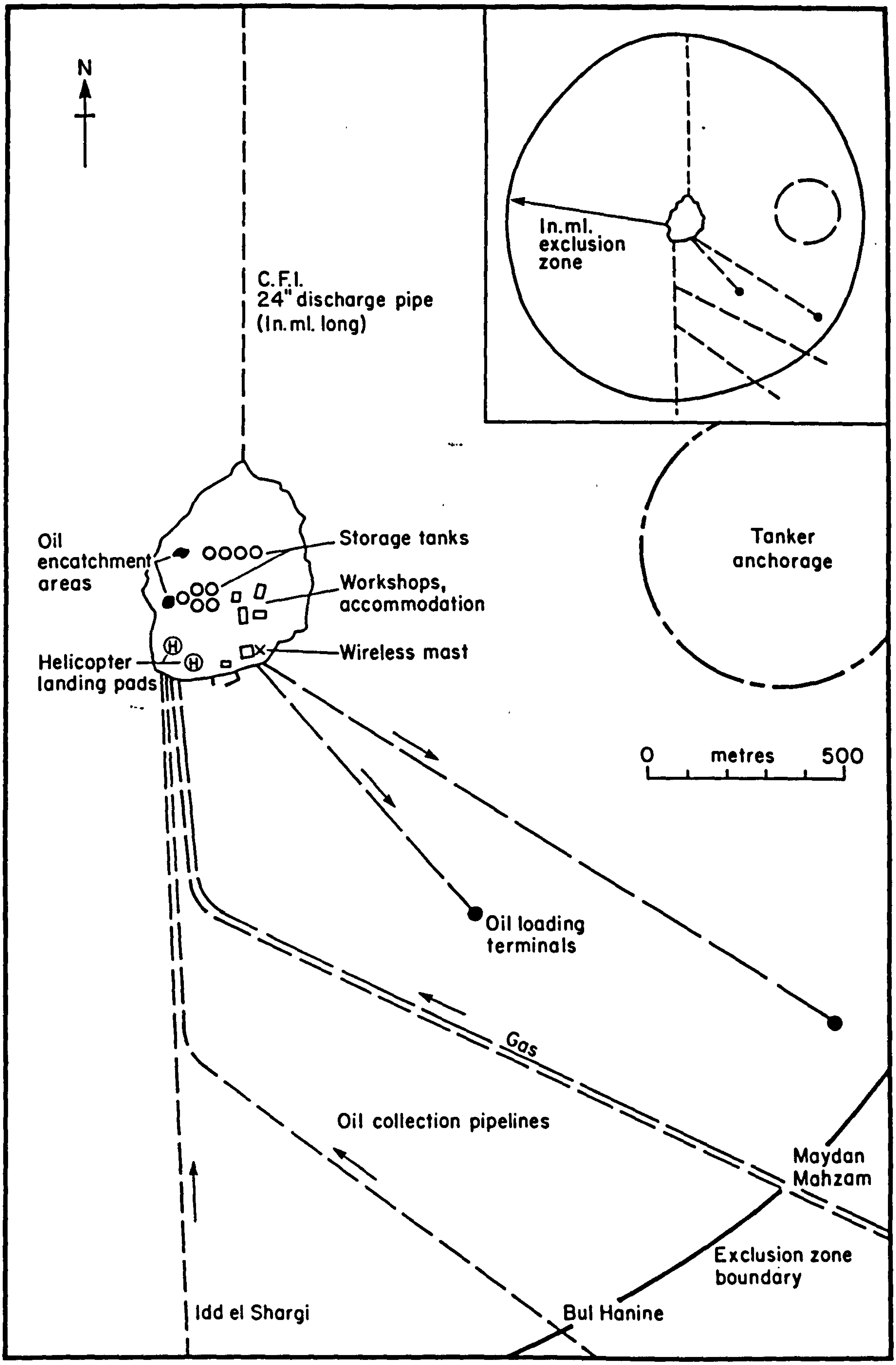


Fig. 7.3 Halul island, land use in 1990

dered by eight oil-producing states which export about one billion tons of oil annually. Thus there is a risk of oil pollution not only from transporting oil but also, from the early 1970s, directly from sea wells. In the 1970s there were 300-400 sea wells in operation in the Gulf, since when this figure has increased. Approximately one-tenth of the total production of crude oil in the Gulf comes from offshore wells and these wells constitute a major pollution risk. Despite these facts there is no co-ordinated regulatory framework in force within the Gulf region to control oil pollution.

As the Gulf is a semi-enclosed sea and its waters are constrained by the narrow strait of Hormuz at the outlet to the open sea, so the possibility of cleansing by sea flow is restricted. As a result the waste pumped out from factory cooling units in increasing quantities is not flushed away; any collision of oil tankers in the shallow waters of the Gulf causes serious harm to marine and coastal areas. Another principal source of pollution in the Gulf is ballast discharge from tankers loading at oil terminals around the Gulf. Pollution, resulting from offshore petroleum operation is the second worst offender.

On a global scale, oil entering the seas from offshore exploration and exploitation is estimated to be approximately 0.08 million tons. This means that only 2.04% of the oil entering the seas is the result of offshore operations. The percentage must be far greater in the shallow waters of the Gulf. With this in mind, it is perhaps strange that the offshore oil concessions, granted by the Gulf states lack any provisions regarding oil pollution, especially as this is contrary to the practice of the developed oil-producing states which provide ample anti-pollution regulations in their exploration and exploitation permits, e.g. the UK incorporates 'model clauses' into each exploration and production licence. These clauses place an obligation on licensees to ensure that the conditions of operation are such as to minimise the risk of pollution. Again, the Offshore Pollution Liability Agreement (1974) obliges operators to provide orderly means for compensation [7].

Qatar only seriously considered instituting protective measures against pollution from the hydrocarbon industry in 1980 as a direct response to an explosion in offshore pipelines near Bahrain in August/September 1980. This resulted in oil leakage which badly affected the Bahraini coastline and sea water. The slick drifted towards the Qatari coast.

The second disaster in Qatari waters which prompted the government to take protective measures was an oil well explosion near Ras Tanura on the Saudi coastline on 2 October 1980. Oil poured into the sea for 9 days and the oil spillage reached 80,000 barrels, and covered an area of about 10,800 km^2 in the small sea of the Gulf. About 80% of the Qatari coastline was affected by this slick (Figure 7.4 and discussed in Section 7.5). The Ras Tanura disaster was one of the main factors which made the Qatari government declare the establishment of the Qatari Environmental Protection Committee on 8 October 1980 at the 36th meeting of the Council of Ministers. This Committee was charged with co-operating with the ministries of ten government institutions, and other involved government administrations [8]. (Pollution is discussed in Section 7.5).

Although Qatar established an Environmental Protection body, this was relatively late in the day - Qatari oil production onshore began in 1949, and offshore in 1964.

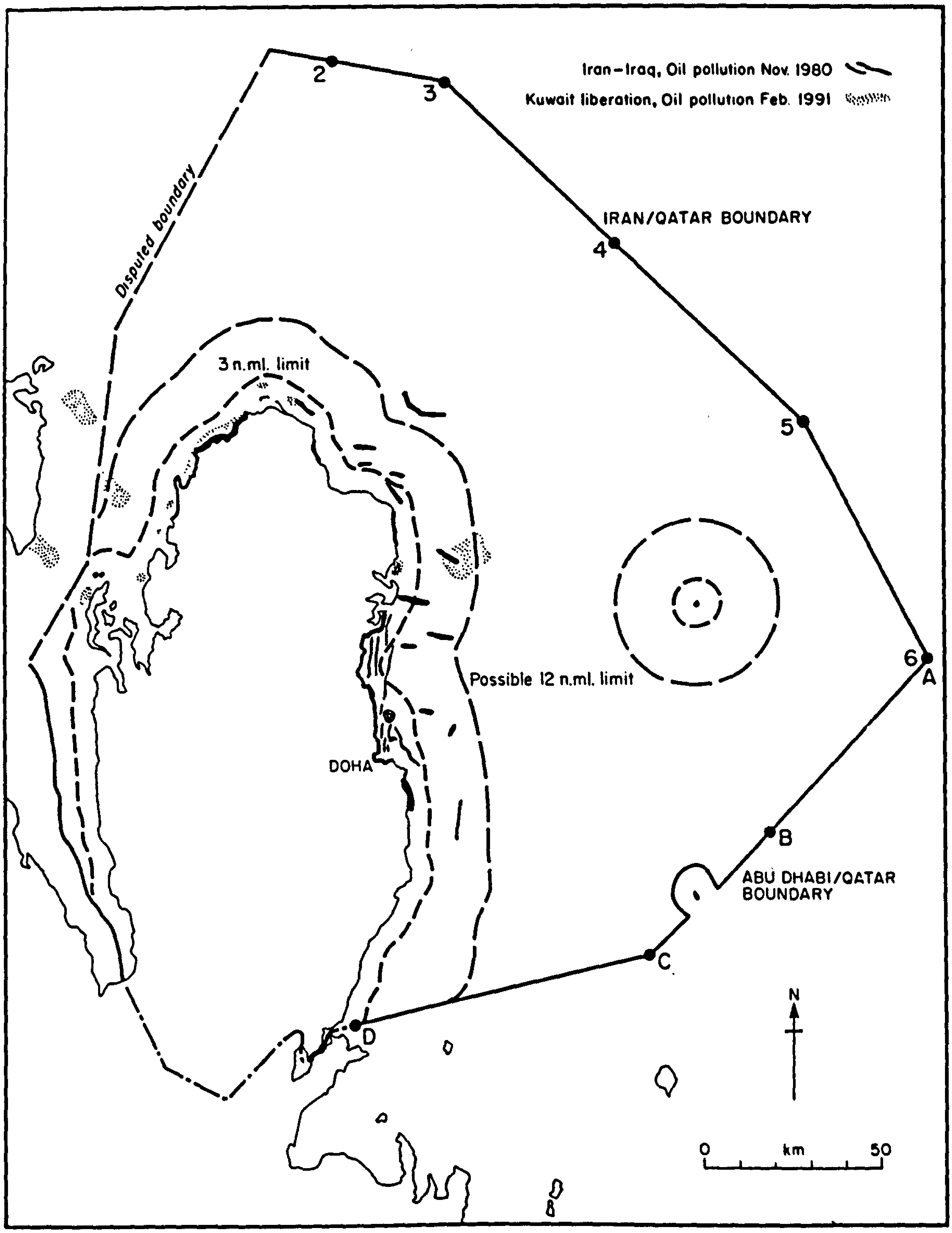


Fig. 7.4 Qatar's offshore zones and oil pollution areas, November 1980 and February 1991

Onshore oil production has, as its final destination, the Umm Said terminal. Before loading their tanks at the terminal oil tankers often clean their tanks by discharging their residue into Qatari water. This means that regardless of whether the oil is pumped from onshore or offshore wells, there is a danger to the marine environment. If these offshore and onshore oil activities are left unsupervised, in the long run they will have a more significant impact on the Qatari marine environment than the pollution caused by Bahrain and Saudi leakages (see Sections 7.3, 7.4).

In focusing on Qatari marine pollution, therefore, it is necessary to study the uses made of the sea by the hydrocarbon industry, particularly as the sea could be much more affected by the hydrocarbon industry than the land. One reason why marine pollution is not perceived as a danger is that it is less noticeable to ordinary people than that occurring on the land around them. Activities at sea are often less well supervised than those on the land.

Before we discuss the activities at sea in the Qatari oil industry, it will be useful to give some examples from other parts of the world. We shall present some studies of sea use in the UK, paying special attention to those linked directly with the effect of the hydrocarbon industry:

> *"Provided good industrial practice and a high standard of safety are maintained, it would seem, on present evidence, that the exploitation of offshore oil deposits in the North and Celtic seas will pose little long-term danger either to the health of the fish and shellfish stock themselves, or to the health of the consumers of sea foods. However, in the short term there are a number of conflicts of interest between the fishing and oil industries which cannot be entirely eliminated, but can be minimised provided that they are recognised early.*
>
> *Seismic surveys are a minor problem which fishermen can allow for in planning their trips, provided adequate notice is given. However, the dumping of drilling mud and rubbish from fixed installations and supply vessels can*

have unpleasant consequences for individual fishermen and all possible steps should be taken to prevent these malpractices.

The consequences of a blowout at a well head or other major oil spillage could have unpleasant short-term repercussions for the fishing industry." (9).

For comparison, selected European measures for protecting the marine environment against oil pollution will be discussed, e.g. U.K. measures:

Action following spillage, the operators themselves constitute the first line of defence, the second line of defence is the Department of Trade's national oil spill clean-up arrangements which can be called upon if serious coastal pollution is threatened. There is close liaison between the Department of Trade and the UK Offshore Operators Association.

The Department of Trade's responsibilities cover oil pollution at sea. Oil clearance from beaches and inshore waters within a mile of the coast is the responsibility of the local authorities. (10)

The Department of Trade's organisation is based on its nine marine survey districts which cover the whole coastline of the UK, and the principal officer of each district is responsible for oil spill clearance within the area he/she covers. The primary communication network is provided by the coast-guard and offshore operators have agreed to report escapes of oil to them as soon as possible. Ships and aircraft are also asked to report any oil spills they see.

The Ministry of Defence supports the Department of Trade by making helicopters and other aircraft available for oil spill surveillance and, when possible, ships for dispersal operations. The Ministry of Defence would be prepared to provide additional help in major emergencies. Regular exercises are held around the coast of the UK to test the effectiveness of the organisation and offshore operators' arrangements are included where appropriate.

The Warren Spring Laboratory (WSL) of the Department of Industry has a research programme on the pollution by oil of seas, harbours, rivers and coastal areas.

The fisheries research laboratories of the Ministry of Agriculture, Fisheries and Food carry out assessment of the biological effect of dispersants and other methods of removing oil. The Dumping at Sea Act 1974 requires the users of dispersants to obtain licences for their use. In granting licences the *effect of dispersants on marine life will be taken fully into account and the dispersants already approved by WSL and MAFF are being further tested to identify those most suited to inshore and offshore use respectively.*

On the international front the Hamburg Agreement came into force in 1969. The Agreement divides the North Sea into a number of zones, in each of which a contracting party is responsible for assessing incidents and observing oil slicks; in the English Channel and Dover Strait special technical arrangements have been made between the UK and France, and the UK and Belgium ensure that this is carried out. Contracting parties are also required to do their best to assist each other, if required, in clearing oil at sea." (11)

A further example of protection for fishing zones is the 'Exchange of notes between the governments of the UK and of Iceland - a Proposal for Settlement of Fishing Limits' on 11 March 1961. This prohibited British fishing vessels from coming within 6 miles of the Icelandic coast for the 3 years following the agreement, after which vessels would stay more than 12 miles from the Icelandic coast. (12). (The situation regarding territorial waters is discussed in Section 7.6.)

We return to the subject of marine pollution in the case of the small semi-enclosed sea such as the Gulf. The Organisation for the Protection of the Marine Environment Committee has members from all the Gulf states, including Qatar, and is under the aegis of the UNEP, based in Kuwait (established in 1978). Further protocol was established in Bahrain with the creation of the Marine Emergency Mutual Aid Centre to co-ordinate action against oil spillage in the region (13).

Although there are some regional and national environmental committees in the Gulf, e.g. the Qatari Environmental Protection Committee, unfortunately these have not been as effective as Western measures against pollution. There are no zones with government and operators responsible to protect the areas in question, nor any bilateral agreements between interested parties, such as that between the UK and

France to protect the English Channel and the Strait of Dover from pollution. Unlike the North Sea States of Europe, the Gulf's Environmental Committee does not have a multilateral agreement by which each state is under an obligation to fight marine pollution.(14)

However, the Qatari government has made serious efforts in the 1980s to combat oil pollution from the Iran-Iraq war and from other activities in the area. Sadly, that effort is insufficiently well organised to be truly effective, due to lack of experience and planning (discussed in Section 7.5). To examine pollution threatening activities around Qatar, one must look at the Gulf region as a whole, for an environmental problem in one part of the Gulf can reach the furthest parts of the Gulf in a short period (Figure 7.4). Because of its central location, a pollution hazard for the Gulf in general is also a hazard for Qatar. The above context of the effect of marine commercial and industrial activities must be borne in mind in the following sections.

7.3 Qatar's Offshore Oilfields

Qatar's offshore oilfields have had an impact on sea use similar to the impact of the onshore oilfield on land occupation and land use. To begin, the study below discusses the geological structure of the oil fields (Figure 7.5), as how the geology of these fields is reflected in sea bed occupation (e.g. oil elements). An enormous area of the sea is dedicated to these fields for safety, security and other purposes (discussed below).

In the offshore area, carbonate sediments were deposited on a stable, broad platform which was bounded on the north-east by the open Tethys Ocean. The platform

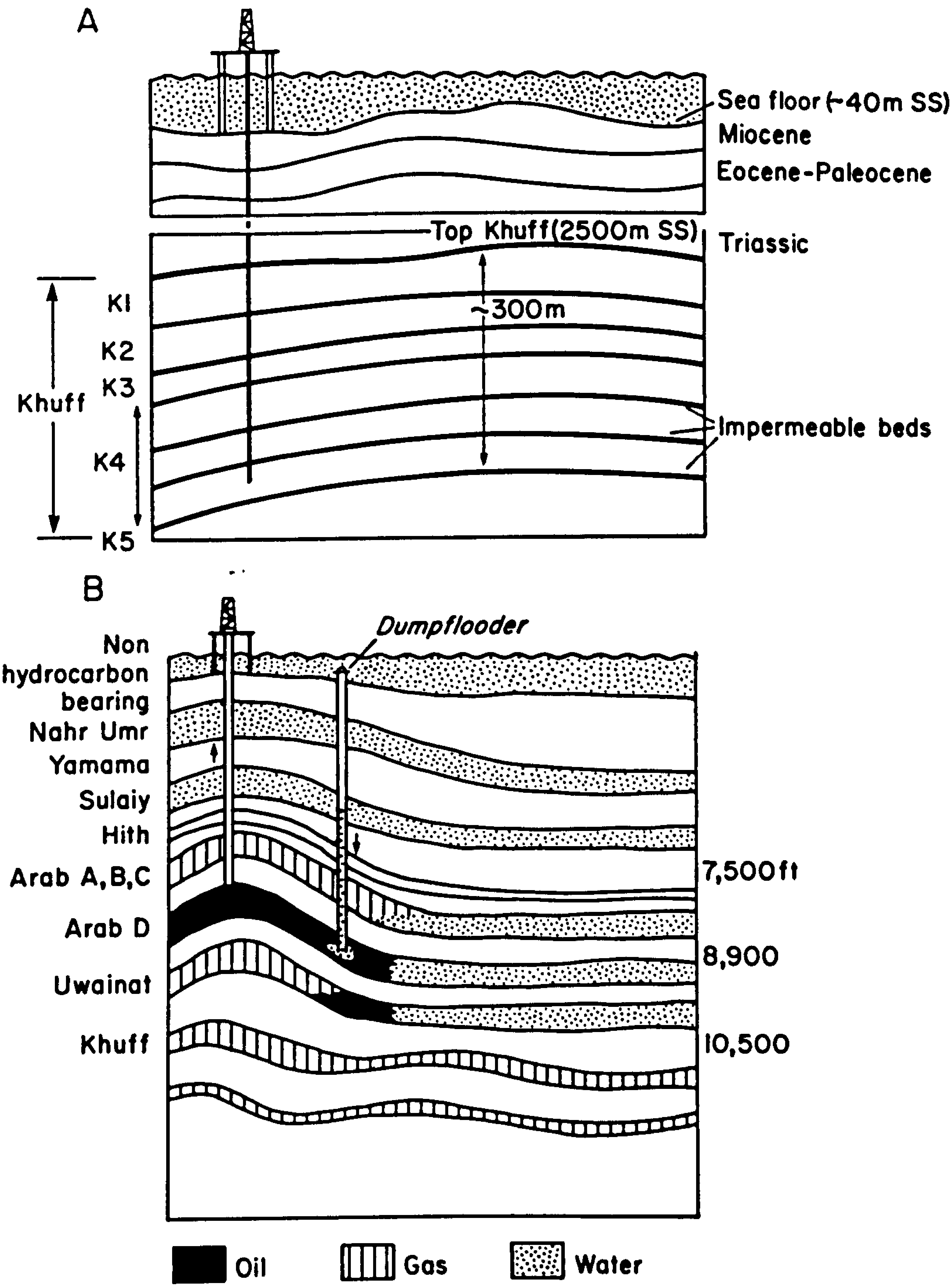


Fig. 7.5 Cross sections of offshore gas and oil fields
A North Dome structure; B Halul structure

contains a shallow basin in which the offshore producing fields (Idd El Sharji, Maydan Mahzam and Bulhanine) had been developed due to halokinetic tectonic movements. The hydrocarbon-bearing reservoir rocks in the offshore field consist mainly of shallow marine carbonates (11 feet thick of Mesozoic and Cainozoic Sequence). Each of these reservoirs derived hydrocarbons from source rocks and was overlain by capping rocks which kept the hydrocarbons trapped within the reservoir.

Cavity and seismic surveys were used in discovering the Idd El Sharji field while the other fields were discovered by seismic survey alone.[15] Of further interest in the study is that the Qatar oilfields are close to the Qatar coast, as are other oil fields in the Gulf (Figure 7.1). This was beneficial for Qatar in that the oilfields are conveniently located, cheaper to run, and a round-the clock helicopter shuttle between Halul region and the offshore area could be operated (Figure 7.1). From Doha to the furthest point in the Halul region's fields is 120 km, or between 2:30 hours and 6:00 hours by boat depending on the kind of boat.

On the other hand, the offshore oilfields have also created multiple conflicts of sea use, being close to the leisure areas, shipping lanes, fisheries and other sea users near the coast (discussed in Section 7.5).

The main part of this section studies the offshore oilfields and Halul Island (as we called the whole area of the Halul region) (Figure 7.3).

7.3.1 Idd El Sharji Oilfield

Idd El Sharji field is situated on the eastern flank of the Qatar arch, some 80 km offshore from Qatar, 20 km south of Halul Island. Together with a network of connecting pipelines from other oilfields, pipelines from this oilfield converge on Halul Island oil terminal. This gives an intial impression that the Halul region is utterly dedicated to the hydrocarbon industry directly or indirectly (as discussed in Section 7.3.6)(Figure 7.1). This oilfield was discovered in 1960 by the Shell Company of Qatar and oil production was started in 1964. The size of the field is about 110 km^2 (Table 7.2).

Table 7.2 Areas occupied by the oil industry

Date of exploration	Place Name(1)	Size Km^2 (1)	Exclusion zone - Area occupied Km^2 (2)	Exclusion zone - % of Qatar seabed
1960	Al-Idd Al-Shargi	110	270	1.05
1963	Maydan Mahzam	47.5	270	1.05
1964	Al-Bundiq	20	135	0.5
1965	Bul Hanine	96	270	1.05
1965	Halul Island	1.5	13.7	0.05
1971	North Dome	6,000	270	1.05
	Halul region pipelines		17.8	0.07
	North Dome pipelines		16	0.06
	Total		1262.5	5.0

Sources: 1. Ministry of Finance and Petroleum, *Oil Industry in Qatar*, 1976, Qatar, pp.9, 10, 11.

2. Interview with Mr A. Abdul Rahim, The Qatar Navy, 7 April 1991 (the full safety zone around each platform is 5 nautical miles).

The structure of the field is north-south oriented, elongated and characterised by two culminations (the North and South Domes) (Figure 7.2). The two culminations are linked by a pronounced saddle area. The crest of the South Dome at the Shuaiba level is some 200 feet deeper than in the North Dome. As in the Maydan Mahzam and Bulhanine oilfields, the Idd El Sharji structure appears to have grown during the fairly continuous uplift of the deep-seated salt plugs throughout the Mesozoic and Caino-zoic, with periods of increased activity during the Triassic and Cretaceous.

Oil is produced from the North Dome from the following reservoirs:

- The Shuaiba reservoir is around 330 feet thick of chalky lime mudstones; packstones with some occurrence of *orbitulina* and coral reef batches in the top part of the reservoir. The Shuaiba is bounded by shales and marls.

- The Arab A, B and C reservoirs (Figure 7.5) consist of several anhydrite/carbonate cycles deposited in shallow marine to sabkha depositional environments.

- The Araej upper and the Uwainat are members of the Araej formation. Oil production from these reservoirs is less than from the Arab D. The restricted oil offtake from the Uwainat is mainly due to the high water cut.

In the South Dome, oil has been found in the Shuaiba and the Arab reservoirs.[16] The South Dome has 5 wells (Table 7.3) but they are not connected with the production station (PS1). Although the oil reserves in the South Dome are about 25,000,000 barrels (Table 7.2), it proved not to be commercial as the cost of production for each barrel was higher than 2.5 dollars per barrel[17], which was much more expensive than the cost of production in other offshore oilfields. Whilst offshore oil is more expensive to produce than onshore oil (for which the cost of production does not exceed 1.5 dollars per barrel), offshore production costs are much lower than those for the South Dome and others which are undeveloped. Worse, oil from the South Dome and other abandoned oilfields contain high concentrations of sulphur in the form of hydrogen sulphide (H_2S), which contaminates the oil and is an additional pollutant, and would probably reduce the market price of South Dome oil compared with oil from other fields.(18) However, it is possible that modern technology could be employed to solve the problem of sulphur contamination and to reduce production costs. In which case it need not be far in the future when oil could be flowing from the South Dome. Were this to come about, it would add a new exclusion zone to the existing ones (Figure 7.2), creating further sea use conflict with the other sea users (discussed in Section 7.5).

The North Dome is the producing section of the Idd El Sharji, its oil reserve is about 156,000,000 barrels (Table 7.3) and its production about 30,000 b.d.. Its life span is expected to be 40 years, and the total number of wells is 34, of which about 28 wells produce oil. Whilst in 1984 in the Idd El Sharji North Dome there were 23 potential producing wells, the South Dome has 2 potentially producing wells. Producing wells have individual nett oil production rates which vary between 120 b.d and 2100 b.d. and also the depth of those wells vary from 4650 feet and 8000 feet.(19)

Table 7.3: Overview of offshore oil operation (Barrels)

	Oil reserve 000,000 barrels	Expected oil reserve 000,000 barrels	Expected life span for each field	Number of wells	Producing wells
Idd Al-Shargi North	156	658	40	34	28
Idd Al-Shargi South	25	108	25	5	-
Maydan Mahzam	179	316	40	38	25
Bulhanine	380	576	30	37	22
Total	740	1658		114	75
% of Qatari	30				

Source: Correspondence with QGPC, Offshore Operations on 14 May 1990.

It is clear that the number of wells in the oilfield is increasing, resulting in ever faster rates of production. The drilling operation for each new well must be accompanied by laying pipelines to link the well with the production station (Figure 7.1) which comprises separators, surge vessels, and pump sets installed on marine platforms (Figure 7.1). The oil is then taken by trunk-line to the storage/export terminal at Halul Island.[20] All this serves to amplify the deleterious effects the offshore oil industry has on sea use in general, and on natural marine life in particular (discussed in Section 7.3.6 and in Section 7.5). The longer the oilfield remains in production, the greater the environmental impact it will have. Confirmed oil reserves are calculated to give the oilfield a lifespan of 40 years. Expected oil reserves (about 658,000,000 barrels) (Table 7.3), on the other hand, increase the lifespan of the oilfield to more than a century. Oil production over a longer period of time would extend and increase offshore and coastal environmental damage and sea use conflict (fisheries, recreation, etc.). Some of the employees of offshore operations told us that they constantly expect and occasionally witness accidental oil leakage, confirming for them that there must already be a degree of sea pollution caused by the offshore oil industry in the Halul region. Further, companies leave abandoned wells and pipelines on the sea bed unless they obstruct a new operation because a dismantling operation is very expensive.[21]

Environmentally, the most hazardous stage is when new wells are being drilled. Despite efforts at control, disposal of refuse containing chemical materials occurs. A similar effect could be produced when laying new pipelines, as these must be cleaned using chemically treated water, and leaks of treated water can occur. In view of the growing number of offshore oil wells, there could be pollution in the Halul region. This is certain to affect badly the natural marine life and interfere with leisure activities.[22]

If this method of operation continues, it will result firstly in the sea bed being occupied by pipelines and other oil installations and secondly, environmental effects which could easily affect the Qatar coastline considering that the distance between the coast and the field is only about 80 kms. Therefore the effect will not only be on sea use (discussed in Section 7.5), but also any damage to the offshore installations could affect land use, water distillation plants, power stations, the most popular recreation areas in Qatar (Figure 6.7); the most beautiful side of the Qatar coastline and some of the best coastal fishing areas (Figure 7.2). Such despoliation would not be unfamiliar to Qatar as the country has already experienced the effects of sea pollution: during the 1980s as an effect of the Iran-Iraq war, and in 1991 as a result of the Iraqi military occupation of Kuwait (Figure 7.4 and Plate 7.1). These are examples of the hazards of the offshore oil industry threatening the region by acts of sabotage or by accidental damage.

Another factor contributing to sea pollution by the industry was the fact that, until 1970, production stations were unmanned. From 1970 the company required that production stations in each oilfield were manned because full production processing installations for separating the oil from the water and other gases were required at each production station. Therefore full accommodation is provided for the employees at production stations (platforms) in each oilfield, and each platform has a safety capsule for the safety of employees in unforseen events.(23) Idd El Sharji platform (PS1) (Figure 7.1) accommodates about 45 personnel overnight, but that figure could be much larger during daytime operations as the platform receives more workers from the island by boat and workers from Doha by helicopter. However, this platform will be expanded in the near future to accommodate more personnel overnight. The expansion could increase the environmental impact of the platform due to the expansion of oil equipment and the increasing number of people (workforce of offshore operations shown in Table 7.4). (24) This matter is examined in greater depth below.

Leisure facilities for the workforce on the platform are provided by the company, e.g. TV, videos, newspapers, magazines, and playing cards.(25) In addition some of the workforce fish in their leisure time. One of the workforce confessed that nobody could prevent domestic refuse from being dumped into the water from these platforms in the offshore areas. He gave the example that they had sometimes found disposed materials in the stomach of the fish (a razor was found in the stomach of one fish).(26) This tends to confirm the belief that much offshore pollution comes from the oil industry. Whilst these are minor effects around platforms (Figure 7.1) in the short term, they could have major consequences in the future unless it is better organised.

Plate 7.1: *The effects of oil poured into the Gulf by Iraq in January 1991, which ruined some of Qatar's north eastern and north western coasts. The picture below shows the oil slick on the north eastern coast of Qatar. A Japanese team are also shown, assisting Qatar's Environmental Protection Committee in combating the pollution on 13 November 1991.*

This is despite the fact that the platforms have a periodic refuse collection system, the refuse being taken by boat to the final disposal area.(27)

Other facilities provided in each offshore platform are bedrooms, offices, various operational rooms for the different oil and gas operations before the oil is piped to Halul Island and the gas to the onshore area (Figure 7.1). There is also other oil production equipment, a small jetty at each platform, helicopter landing space, and lounge to allow some social contact among the workforce.(28)

Each oil or gas well installation has a prohibited zone, about 500 metres(29) from each well to protect these installations from any deliberate or accidental damage to fishing, leisure, shipping and other factors. All wells exist in the area of the safety zone (exclusion zone) with a radius of 5 nautical miles from each platform, making the diameter of this zone 10 nautical miles[30] (Figure 7.2). This means that the total area occupied by or dedicated to each of these oilfields could reach up to 270 km^2 (Table 7.2). This brought the area which was occupied by and dedicated to the Idd El Sharji to 1.5% of the Qatari offshore area. This is an enormous area to be occupied by only one oilfield, and points to an interesting study (Section 7.5) of the conflict between these zones and other sea users. This will be even more interesting once the total area occupied by or dedicated to the oil industry in the Halul region has been examined, providing a full model of the area influenced by the industry directly (discussed in Section 7.3.6).

Table 7.4: Total number of offshore workers in the operational sites, and in the Headquarters in Doha

Nationality	Number of workforce	% of different nationality
Qatari	543	38
Arab	307	21
Other	582	41
Total	1432	100

Source: Correspondence with QGPC offshore operation on 14 May 1990 (the workforce figures for 31 April 1990).

The next part of this section will cover the other oilfields in the Halul region; most of the details are similar to the El Idd El Sharji, especially in the context of the effects of the oilfield on the region, and are not repeated.

7.3.2 Maydan Mahzam

The Maydan Mahzam offshore oilfield was discovered in 1963 (Table 7.2) and started production in 1965. The size of the field is approximately 47.5 km^2 (Table 7.2), with known oil reserves of 179,000,000 barrels. The field is capable of producing gas at approximately 65 million cubic feet (b.d.), and oil at a maximum of 155,000 b.d. Expected oil reserves could reach 316,000,000 barrels, with the expected lifespan of the field approximately 40 years (Table 7.3).

The field is situated 95 km east of the Qatari coast (Figure 7.1) and about 16 km south east of Halul Island. The major axis level reaches around 1150 feet. The first reflection seismic surveys in the Maydan Mahzam area were shot in 1965, followed by the discovery of the structure. The oil is produced from the Arab and Uwainat reservoirs. The Arab D is the most prolific reservoir in this field (Figure 7.5).

- The Arab A, B and C consists of alternative carbonates (mainly dolomites) and anhydrites. The Arab C is the second largest reservoir in Maydan Mahzam and has no primary gas cap. The reservoir is strongly stratified and heterogeneous.

- The Arab D is mainly produced from the permeable shoal grainstones and sucrosic dolomites which occur in the upper 100 feet of the reservoir.

- The Uwainat oil rim production is restricted as in the other offshore fields, to improve the ultimate recovery. The large gas cap in the Uwainat is utilised to lift the oil with high water cut from the Arab C reservoir.

Other non-producing hydrocarbon reservoirs occur in the Maydan Mahzam field, but are not in production, such as the Araej upper and Izhara.[31]

Since 1978, the gas from this field has been utilised and sent to Umm Said by pipeline (Figure 7.1), thus by utilising the gas from the Maydan Mahzam field,[32] there has been increased seabed occupation by pipelines. The pipelines occupy onshore land between South Wakrah and Umm Said (discussed in Chapter 4). This confirms that the offshore industry is occupying not only the sea, but also the land (onshore) in Qatar.

The oil reserve in this field is greater than Idd El Sharji and is the Qatari second offshore field. In 1984 the field had 19 naturally flowing wells, and reservoir pressure was maintained by water injection at an outer ring of 10 dumpflood wells. Nett oil production per well varied from 550 b.d. to 18,000 b.d.[33]

In 1990 the total number of wells was 38, of which 25 wells were producing oil (Table 7.3). The increasing number of wells between 1984/90 confirmed that as at Idd El Shari, in order to keep the present rate of production or enhance the rate of production, the company must continually drill new wells, reflecting increasing seabed occupation by the various industrial installations, thus increasing the effect on sea use. (This effect on the sea use was discussed with regard to the Idd El Sharji field).

This field has a platform similar to the one at Idd El Sharji, with facilities similar to those on the Idd El Sharji platform, and consequently has a similar effect on sea use. The Maydan Mahzam can accommodate overnight only 45 personnel. In the near future, however, the new project will enlarge the platform which could then accommodate overnight a larger number of personnel, thus increasing the impact of the platform on sea use (discussed above).

7.3.3 Bulhanine Oilfield

Bulhanine oilfield (Figure 7.1) is the most prolific oilfield in the Qatar offshore area with oil reserves of 380,000,000 barrels (Table 7.3). The field was discovered in 1965 (Table 7.2) and explored by ADMA oil company, a company acting on behalf of the Emirate of Abu Dhabi. Development was delayed until 1969 when Qatar and Abu Dhabi reached the final settlement regarding their offshore political boundary (discussed in Section 7.6) and the field was then annexed to the area of concession of Shell Oil Company, as agreed in Article 1 which authorised Shell Company to annex any delimited part of the Qatari Continental Shelf to its area of concession after the date of 6 August 1952.[34]

Shell started developing the field in 1969 and oil production from Bulhanine started in 1972.[35]

The Bulhanine field (Figure 7.1) is situated some 120 km east of the Qatari coast and about 45 km south of Halul Island. The structure is an elongated dome with its major axis trending south, south west and north, north east. The total size of the field is 96km^2 (Table 7.2). The field is approximately parallel to the axis of the Qatar arch. As in the Idd El Sharji and Maydan Mahzam fields, Bulhanine is dissected by a system of normal faults affecting mainly the Cretaceous and Jurassic formations.

The main producing reservoirs are:

- Arab C. This is a relatively thin oil rim reservoir; lithologically it is similar to the Arab C in Idd El Sharji and Maydan Mahzam fields (Figure 7.5).

- Arab D. As in Maydan Mahzam field, the best reservoir quality (lime grainstones) occur in the upper part of the reservoir. Over the field's area, the Arab D reservoir is capped by 20-30 feet of anhydrite which acts as a seal for the oil accumulation.

- The Uwainat Member is gas and oil bearing; the oil production is restricted.

Oil has been discovered in other less important structures and stratographic traps within the offshore area, these are:

- A - structure : structural/stratigraphic trap

- Central Area : structural traps

- North Area : stratigraphic/hydrodynamic traps.

In addition, gas was found in the Khuff reservoir in the large, low dip North Field structure.[36]

In 1984 Bulhanine had about 15 potential producers wells, supported by nine dump-flooders, with individual oil production rates of up to 29,500 b.d. which are among the highest rates of production per well in the world.[37] This field shared the same status as other fields in the region; by 1990 the field had increased to 37 wells, of which about 22 wells are producing oil. As was mentioned in the discussion of the previous field, to keep the flow of oil or to enhance the rate of production, the company continuously has to drill new wells, which in turn increases both the sea bed occupation by the industry and the effects of the industry on other sea users (discussed below).

Field platform PS3 is much more sophisticated than the previous field platform in the region. Although its daily production does not exceed 160,000 b.d. of crude oil, it can handle up to 220,000 b.d. and 160 million cubic feet of gas per day.[38] PS3 is the only station that has old and new accommodation which means it could accommodate a greater number of personnel than either of the other two stations. Platform 3 can accommodate overnight about 85 personnel, and has more amenities and facilities for the workforce and for oil operational equipment. On 22 May 1990 at PS3, Mr. M. Shaw told us "*They are doing their best to control the oil pollution in the region, but sometimes there are accidental leakages of oil, and chemicals go into the water. Sometimes they dump oil in the sea when they have no elsewhere to get rid of it.*" [39]

Although the offshore oil industry takes precautions to protect the sea, this does not mean that there is no threat from industrial pollution e.g. accidental oil leakage, as the industry has developed no discharge facilities apart from using the sea.

The human impact on the water around PS3 could be more than the other stations, as the number of people at this station is greater than the other two stations. However, the effect (around each platform) is likely to be muted by the refuse collection system.[40]

This field, besides oil, is the largest producer of gas in the Halul region. Since 1978, gas has been piped from Bulhanine to a gathering point at Idd El-Sharji, and then pumped through pipelines towards the onshore area. As shown in Figure 7.3, this gives a model for the connection between the various platforms and Halul Island. The overwhelming impression is that the sea bed in the region is heaviliy occupied by platforms, oil wells, pipelines and other oil installations. Environmental effects of this occupation are seen first in the immediate vicinty of the installations, and then later spreading widely to other parts of the sea and on the coast (Figure 7.2).

Like other oilfields in the region, oil is transported from Bulhanine and from PS3 by 20 inch diameter pipelines to Halul Island for oil storage, and then is piped to the SBMs which lie 2.75 to 3 nautical miles east of the island for export to the international market (Figure 7.3).

The next part of the study concerns Halul Island which could be termed the centre of the offshore oil industry.

7.3.4 Halul Island

Halul is the largest Qatari island off the east coast of the peninsula (other Qatari islands are discussed in Section 7.5), is the most significant island, and the only inhabited island, in Qatari waters. Since 1965 it has served the oil industry in a number of functions (discussed below).

The island is 1.5 km long, and 1 km wide, and its total area is about 1.5 km^2. It lies some 90 km north east of Doha (Figure 7.1).

In 1908, Lorimer stated that the political historical position of Halul appears to be indeterminate. It does of course, share the same status of the other islands around the waters of the Gulf in that sea users use the Gulf for pearling, fishing, and marine transportation, etc.. The appearance of the hydrocarbon industry and its huge revenues prompted the Gulf states to try to define their offshore political limits, with each state trying to include in its political boundary zone as much as it could. Therefore, in the era of the hydrocarbon industry, the dispute between Qatar and Abu Dhabi over the boundaries regarding Halul was intensified following offshore oil exploration in its vicinity (Figure 7.1). Finally, because both states were British protectorates, the problem was solved by the British. In 1962 two British experts judged that Halul should belong to Qatar. Following this decision, the ruler of Qatar issued a decree declaring his concurrence with this decision regarding the establishment of Qatari right of ownership over Halul Island, and noting the British Government had approved the extension of Qatar's sovereignty to this island.[41] (Boundary discussed in Section 7.6). In the 1960s, Qatar claimed a 3 nautical mile zone around Halul Island.[42]

Prior to the Company using Halul as an oil terminal, they were using floating oil storage (The 38,000 tons tanker Zenatia) which was moored to a single point buoy (SBM) just outside the Idd El Sharji field. The crude oil produced from the wells flowed to a marine production platform and from there was pumped through a tankline through the centre of the buoy and a floating hose to the Zenatia. At regular intervals cargo was transferred from the Zenatia into export tankers berthed alongside. However, after the discovery of the Maydan Mahzam field in 1963, the Company found that the floating terminal would not be adequate to serve these two fields. In

1965 Halul was chosen to be a permanent oil terminal for these fields and a 14 inch diameter trunkline was laid between Maydan Mahzam and Halul, and a further 12 inch diameter trunkline was laid between Idd El Sharji and Halul in order to export the oil from the fields to the oil terminal (Figure 7.3). In 1965, the production facilities on Halul Island consisted of a tank farm (4 tanks) with a total capacity of 1.3 million barrels. From that tank farm, the crude oil is pumped through a thirty inch line to the SBM about 1.5 miles to the south east of the island, and from this SBM the oil is loaded for export into the oil tankers. All of these operations are to a great extent supported from the island. Bachelor accommodation, together with necessary ancillary and recreational facilities, accommodates approximately seventy employees who work on a shift basis, their homes being in Doha.(43)

The brief history outlined above gives an idea of the exploitation of the island. Since 1965 hydrocarbon industry land use on, and sea use around, the island has had a growing impact. In 1969, when Bulhanine oilfield was annexed to the Shell area of concession (Figure 7.3), this also increased the land occupation on the island. Another five storage tanks were built on Halul Island which increased the number of oil storage tanks on the tank farm to 9, a total storage capacity of 4.5 million barrels of oil.(44) The Bulhanine field is linked with Halul by an oil trunkline of 20 inch diameter (Figure 7.3). This made Halul Island a strategic site, the distance from the whole oilfield was from 16 up to 45 km which meant that the island could easily serve the three fields as an oil terminal and provided all other services. All of which reflected a huge land use occupation and the effect on the island and in the water around it.

In fieldwork on the island on 22 May 1990, two oil encatchments were noted on the island (Figure 7.3), each of which occupies an area about 0.01 km^2, (1.3% of the island occupied between them).[45] These encatchments created a very bad smell and an unhealthy environment on the island, as both of them contained some chemical materials following the continuous washing of the tanks with the oils and waste from the tanks discharged to those uncovered encatchments. The first impression for any visitor to the island is that the island is influenced greatly by the hydrocarbon industry, and it was felt that some land and air (smell) pollution on the island was specifically from those two encatchments. There are streams from these encatchments which go towards the coast of the island for discharging the tanks' waste into the water. The effects of these encatchments is not only on land use, but also on sea use, as the dumped chemicals run directly into the water, which in the long term could affect the sea life around the island and damage the coast line around the island. Another feature of these encatchments is that they are uncovered, which means some parts of the waste materials evaporate freely, creating a stench which is especially noticeable on calm days, indicating that their could be some air pollution in and around the island caused by the encatchments.[46]

In an interview with Mr. H. A'Sheer on the island on 22 May 1990, he stated that:

> *"There is some sedimentation from these encatchments to the underground water, with the time passing the average of the sedimentation is increasing and that made QGPC to abandon the old encatchment and operate only in the new encatchment which has the same problem as the old one. This sedimentation could erode the limestone formation of the island. So the solution for this problem is that the company will lay a 24 inch pipeline, which goes about 1 km from the northern coast of the island, to discharge the tanks disposal to the sea directly, and this project will cost them about 8.2 million dollars. And if they see this project has a great effect on the marine life and sea use, they will drill a well in the seabed for reinjecting the disposal in the*

formation of the sea bed. The second project if needed will cost the company around 22 million dollars".[47]

The first project of laying a pipeline and dumping the waste directly into the sea will undoubtedly have a devastating effect on marine life, polluting the water around the island, and polluting the island coast, especially when both the wind and the sea current are mostly from the north. With time, the effect of dumping this waste could reach the peninsula coast, the most beautiful gift Qatar posseses. So the safest way to dispose of those materials is the second project: beneath the sea bed.

Other oil installations on the islands are: two pumping stations from which there is not inconsiderable noise pollution, and anyone working close to them is likely to suffer, a control room, workshops, an oil laboratory, and in 1987 a small refinery was built on the island for supplying the island with the essential energy it needed. There is also a six megawatt power station (energy distribution on the island reached to 11 kilowatts) and a water distillation plant. In 1986 a new storage room was built on the island, and another storage room which could resist the possibility of fire in gas containers.[48] It is clear that the pipelines have a major effect on land use on the island. There are also 2 SBMs off the eastern shore of Halul which are for oil export from the island. One of these SBMs is 5.6 km from the island and linked by 48 inch diameter pipeline. The second SBM is about 5 km from the island and linked by a pipeline of about 30 inch diameter. These two pipelines occupy an area of approximately 2.12 km^2. Nobody is allowed to approach this area apart from the oil operators (Figure 7.3).

These SBMs are the final destination for the offshore Qatari oil before export to the international market. The oil is pumped from the oilfields into oil storage tanks on the island, and then pumped from the island to the SBMs. As shown in Figures 7.1 and 7.3, we have a full picture of an area occupied by oilfields, the island, and SBMs, which gives a total area of 823.7 km^2 in the Halul region associated with the oil industry. This totals a surprising 3% of Qatar's offshore area (Table 7.2).

The island has a population of between 300 and 400, of whom less than 50% are Qatari people. The QGPC has 21 accommodation blocks on the island, 3 for land personnel, and one for the senior staff, totalling 160 rooms. As there is a good network of roads on the island, transportation depends on vehicles: there are about 20 cars on the island, about 14 of them owned by QGPC. The workforce on the island, like the workforces of other oil fields, work one week on and one week off. They are provided with full leisure and social activities, i.e. a club, a cinema (now suspended as they have replaced the cinema with a central video system), a mosque which can hold up to 300 people, a staff mess, a volleyball ground, tennis courts, a squash court, and a tent especially for Ramadan for the employees to spend the night in[(49)] (Figure 7.3).

For security on the island, there is an army barracks and an army post in each of four quarters of the island, as well as the coast guard who comes around the island every now and then. The island has a nurse and first aid facilities, and in emergency the injured person can be transferred to Doha by helicopter.[(50)] There are two jetties on Halul Island mainly to serve QGPC boats, and two heliports (Figure 7.3). There are some company offices on the island, and the island is connected by modern communications, e.g. telephone and fax. These communication facilities are also available on the platforms. Communication from the island with tankers, boats, helicopters, offshore platforms, and offshore HQ in Doha is maintained by a modern radio and microwave system. There is some accommodation and offices for the contractors who work with QGPC on the island and in the offshore oil company. Examples of such contractors include: HBK which is responsible for painting the offshore installations and carrying out excavation; CBC which works entirely on platform maintenance, vessel cleaning, engineering works and painting; CCM which is responsible for the electricity on the island and in the region; Mecon which works with the heavy equipment, e.g. laying and replacing the pipelines and other service facilities on the platforms. There are also other contractors working in the offshore industry and which occupy some land on the island, e.g. Trags and Sodasco which between them are responsible for catering on the island. These contracting companies have won contracts for a fixed period of time and the duration of the contract depends on the timescale of each project. Some companies have residential camps on the island, e.g. HBK, Mecon, and CBC. Even if they do not win the next contract, they leave their camps on the island and usually let them to the new contractors. The duration of these camps on the island depends utterly on QGPC, e.g. QGPC has the power to ask those contractors to demolish those camps if needed.[51]

Lastly refuse and pollution on the island must be considered. The island was threatened with water pollution during the 1980s war between Iran and Iraq. Fortunately, the island was not significantly affected by pollution caused by the war. However, Halul is always affected by the dumping of the oil tankers, and other shipping, disposing of refuse into the sea. Some of this waste is carried by the sea current towards the island's coasts. However, company employees in Halul make an effort to clean the coast every four to six months. In addition, they have special disposal facilities for untrashable materials that are brought to the island. Waste is first burned, and the cans and the hard materials are crushed and sent to Doha where scrap companies buy them from QGPC.[52] Liquid waste is kept initially in septic tanks. Later, municipal employees from Doha come and dig a pit on the island for disposal of the solid waste, and the liquid waste is release directly into the sea which does create some minor effects on sea use, as well as smell pollution.

Interestingly, ibix were brought to the island by Sh. Ahmed, the former ruler of Qatar in 1969. The small hills of the island suit the ibix and their numbers in 1990 were 100. This sort of conservation might be applied to other Qatari islands, which could be utilised for the protection of wild animals. The land of the island is very fertile, and in 1990 the company planted trees on the island. By 1991 the trees looked in good shape.[53]

Sea gulls visit the island regularly, and there is now a large pigeon population, originally brought to the island in small numbers by QGPC employees, and the environment has suited them.[54] With the above explanation, it is confirmed that were the island not so completely occupied by the hydrocarbon industry, it might have developed economically in other ways, e.g. tourism, wild animals, bird protection, etc..

In summary, study of Halul Island has shown that the island is occupied directly and largely by the hydrocarbon industry, which has badly affected the people who live on Halul. Some of the time they consider life on the island is unbearable because of the smell pollution from the hydrogen sulphide, especially from the oil encatchments, and the water around the island is also affected by the industry. There is also an exclusion zone around the island, and no unauthorised person is allowed to approach within 1 nautical mile[55] in any direction. This latter makes Halul Island alone occupy and affect an area of 13.7 km^2 (Table 7.2) as this area is utterly dedicated to the industry and all other sea users are restricted (Figure 7.3).

The next oil field to be examined will be the Al Bundiq oilfield which is not a part of the Halul region oilfields, but Qatar shared about 50% of this field as half of it is located in the Qatari water (Figure 7.2).

7.3.5 Al Bundiq Oilfield

This field demonstrates the benefits of settling amicably the political boundary between two states (discussed in Section 7.6). Prior to 1969, the boundary between Qatar and Abu Dhabi had not been settled finally, although both states knew pretty much the limit of the other (Figure 7.2). The exploration of the Al Bundiq field was begun after the government of Abu Dhabi granted the oil concession in 1953 to Abu Dhabi Marine Areas Company (ADMA).[56] The government of Qatar granted the same area of concession in 1969 to Qatar Oil Co (Table 2.2), and in 1964 ADMA explored Al Bundiq oilfield. However, the development of this field was frozen until both states reached the final settlement of their offshore boundary. After the agreement of 1969 between the two states for settling the boundary of their continental shelf, both states reached an agreement for developing the Bundiq field, as both states shared fifty-fifty the field revenue and cost. In July 1970 the Bundiq Co was formed and all ADMA rights in the field were assigned to the new company (discussed in Chapter 2, section 2.4.1). Nine wells were drilled, of which seven are producing wells. Average production from the field reached 30,000 b.d. of 40 ApI gravity during 1976, but owing to sharp decline in the reservoir pressure caused by the high rate of production it was limited to a rate of 10,000 b.d. because of technical problems in the field. However production has been suspended since July 1979 until the water injection project is completed.

Drilling activities were continued on the one offshore drilling rig until July 1982 when another drilling rig was introduced to the activities. To the end of 1982, 21 wells were drilled.[57] In the 1980s, production in the field resumed at a rate of about 30,000 b.d., but it has a very high hydrogen sulphide content, which could cause a bad effect on the environment.[58] This field also affected sea use in a way similar to the other fields previously discussed. The field is linked with Das Island by pipelines for oil exportation, as Qatar shared about 50% of the field revenue, and also about 50% of the field area is located in Qatari water. The field size is about 20 km^2, and 50% of the exclusion zone of the field is located in Qatari water (Figure 7.2), approximately 135 km^2 (Table 7.2), which has an effect on other sea users similar to that of the other oilfields (discussed in Section 7.5).

7.3.6 The Spatial Influence of Offshore Oilfields

In the above section of the study we found the total area dedicated to, occupied by and affected by the hydrocarbon industry to be 958.7 km^2 (Table 7.2), which is 4% of Qatar waters. Other uses of this area, e.g. fishing, leisure, etc., are not entirely restricted from it, apart from those areas where the various oil installations are located, especially around the safety zone around each oil field (270 km^2). As Malcolm Shaw the manager of PS.3 said on 22 May 1990:

> *"If those safety zones were restricted, so that we needed buoys around all these zones to forbid anybody, except the oil operators, to enter the area, that would*

be very expensive. But these zones are safety for the oilfields and the other people, especially against major shipping from entering this area, for the safety of the people and the safety of our oil installations. When we see anybody roaming around in our area, we just call the Navy who take them away from our zones." [59]

However, the area of Halul region and the other offshore fields sometimes become an utterly restricted area. As Mr. A. Abdul Rahim said in an interview on 7 April 1991:

"the restricted area around Halul region about 2747.2 km^2 about 10% of the Qatari water. And the reason for that is a protection for the offshore oil industry against any sabotage during the war of Kuwait's liberation from Iraq. And this restriction is only for the crisis in the Gulf but after four months the life could come back as it was before the war." [60]

That means that if there were a continuous hazard in the Gulf, the fishermen and the leisure activities, and the other people of Qatar could be prohibited from the richest fishing area in Qatar, as well as face restrictions on their other offshore activities.

There are other prohibited offshore areas. Those are the Halul region pipelines which transfer gas and NGL to Umm Said (Figure 7.1) where the shipping is not allowed to anchor, the fishermen not allowed to fish and no other exploitation is permitted.[61] The pipelines area occupied about 17.8 km^2 (Table 7.2) about 0.07% of Qatar waters.

There are also some effects from the offshore industry made by the drilling operation. There are two drilling units operating offshore, Rig Dana and Trident VI. The two rigs are mobile, jack-up and self contained units capable of operating in water depths of up to 250-300 feet. Their sophisticated handling abilities provide for all aspects of drilling work as well as for the needs of the people on board.[62]

The drilling units are provided with fully air conditioned quarters to accommodate up to 100 personnel and crewmen each together with other facilities such as galleys, mess halls, recreation rooms, laundries, communications, sick quarters and offices for operators and contractors personnel. Both rigs have three legs and are capable of drilling wells over a wide variety of configurations.[63] These rigs have facilities similar to those of the oil platforms, and have similar industrial effects upon the water, as there must be some accidental leakage of chemical materials into the water. They also have a similar effect to platforms offshore in the terms of human refuse. Being mobile, their spatial impact can, through time, be spread over a much larger area.

As well as discussion on the drilling operations, it is worth mentioning the dumpflooding procedure regarding the oil found in limestone reservoirs at depths between 5000 and 9000 feet. In order to maintain the pressure in the major producing reservoirs and thereby ensure maximum oil recovery, water from a shallower formation is injected into the deeper-producing zones. The dumpflooding technique is successfully employed to optimise the offtake rates in both Maydan Mahzam and Bulhanine Oilfield[64] (Figure 7.5B).

Lastly there is the ongoing problem of accidental leakage from the various oil installations in the Halul region and Al Bundiq oilfield waters. For example, in 1987 there were 2000 welding operations of the pipelines for small holes on them, some of which measured up to 20 inches.[65] These holes release oil into the environment, albeit only a small quantity, but in time this leakage could have serious consequences for the Halul region: the offshore industry thus affects the sea adversely. Repairs can be costly. For example, in April 1990 there was a leakage between PS1 - PS2, and the company which repaired the accident was paid $85,000 per hour for three days work.[66] There are occasional collisions between QGPC's boats and the oil installations, sometimes causing oil leakage into the water.[67] Such collisions are costly to the oil industry, and may badly affect other sea users. There are human accidents too. The Corporation lost two people in fatal accidents in 1982 and 1983, and contractors lost 5 people between 1980 and 1983 in fatal accidents offshore, as explained in Tables 7.5 and 7.6.

Table 7.5: Contractors' accidents on offshore operations

	1980	1981	1982	1983	1984,
Fatal accidents	1	0	3	1	0
Temporary total disability	9	15	12	26	14
First aid injury	0	0	0	0	7
All injury frequency rate	0	0	0	0	7.8
Disabiling injury frequentcy rate	0	0	0	0	5.2

Source: QGPC, *Safety Offshore Operations*, 1984, p.15

Table 7.6: The QGPC's offshore workforce accidents

	1980	1981	1982	1983	1984
Fatal accident	0	0	1	1	0
Permanent total disability	0	0	0	0	0
Temporary total disability	46	37	30	24	11
Total disability and fatal cases	46	37	31	25	25
First aid injuries	34	29	24	29	17
Total number of injuries	80	66	55	54	28
% of total manpower of offshore operation	5.2	4.2	3	3.2	1.7

Source: QGPC, *Safety Offshore Operations*, 1984, p.15

Weathering by sea water action is sometimes costly to QGPC. For example, in December 1986, some parts of the jetty of Halul were destroyed by a storm which meant that the Corporation in 1987 had to do some maintenance on the jetty and build a shield to protect the jetty from the storms and strong sea currents.(68)

Oil production in the Halul region during the 1980s was about 158,000 b.d., which is about 60% of the total Qatari oil production from off-onshore.(69) This underlines the importance of the oil industry offshore. Sea use planners nevertheless have to try to limit its spatial influence on other sea use activities (Figure 7.2).

The next section will examine the North Dome Gas field of Qatar as this field undoubtedly increases the potential for sea use competition in Qatari waters.

7.4 Gas fields of offshore Qatar

In this section, two sorts of gas field are under discussion: associated gas produced from the Halul region oilfields; and the non-associated gas field in the north-east of the peninsula (Figure 7.1), called the North Dome, which will be studied mainly in this section.

Firstly, as with oil in the Halul region in Section 7.3, we shall examine gas production in this region.

Until 1980 associated gas had been flared off the three offshore production stations (Figure 7.1). However government plans for the utilisation of natural resources resulted in the construction of a major gas recovery project. Within this framework, integrated offshore and onshore facilities for an NGL project were built and brought into operation at the beginning of 1981 (discussed in Chapter 5). The construction of the project involved a major installation replacement, and modification of the existing offshore production stations. Each of the three platforms in Halul region now has facilities for the compression and liquefaction of gas. These involve a large compressor, glycol containers and regeneration units, fuel gas and cooling water systems, liquid pumps and power generators. The NGL facilities on platforms PS1, PS2 and PS3 are designed to handle a total of 240 million cubic feet of associated gas per day. At each of three locations gas is recovered from the separators, compressed and dehydrated. The gas and NGL liquids formed by compression and cooling are then conveyed by separate pipelines to the plant ashore for further processing. Two pipelines of 24 inch and 12 inch (Figure 7.1) diameter are used for the transfer of gas and liquid respectively, over a distance of some 88 km along the seabed.[70] (The effect of these pipelines on the sea use were discussed in section 7.3 and will be discussed in section 7.5). The main gas producing fields in Halul region are Maydan Mahzam and Bulhanine fields, and about 13% of the gas in the Halul region is used for the various operational work in the region.[71]

A more significant impact on the use of Qatar waters could be made by the North Dome (non-associated) gas field. This field is the only independent gas field in Qatar offshore or onshore, and was discovered by the Shell Oil Company in 1971. Its development was delayed until 1987 chiefly because Qatar was well provided for by huge revenues from oil during the previous period while the demand for gas was weak in the international market, as well as cheap. On the other hand the development of the North Dome required large capital investment. Moreover, the country depended for its gas supplies for various uses from the Dukhan field onshore and from the Halul region. As expected, the non-associated gas formation in Dukhan field experienced a major decline in gas production in 1988.[72] That could be one of the reasons which made the government of Qatar develop the North Dome as soon as possible. The North Dome field is considered to be the largest single non-associated gas deposit in the world. Its probable gas reserves are conservatively estimated at 380 trillion cubic feet, with recoverable reserves exceeding 150 trillion cubic feet. Such gas reserves, 4% of the world's total, place Qatar among the gas rich nations, ranking it fourth or fifth in the world.

The North Dome field size is about 6,000 km^2 (Table 7.2) in water depths ranging from 15 to 70 metres. Potential reservoirs are found in the Khuff formations at depths between 2470 and 2830 metres[73] (Figures 7.1).

Although the main concern of this study is the spatial impact of the North Dome on sea and land life, it is worth mentioning some of the development plans of the North Dome, as the sea use occupation growth from the North Dome runs parallel with the achievements of the development plans.

The development plans of the North Dome will go through various stages:

- Stage 1 - to meet domestic requirements.
- Stage 2 - for export as LNG by gas pipeline, and manufactured value-added products based on the use of gas as fuel or raw materials, (e.g. chemicals, fertilisers, minerals, liquid fuels).[74] These development plans are discussed in Chapter 5.

Stage 1 of the North Dome development, the cost of which will be $1300 million, was started in mid 1987, as the project was launched with a design capacity of 800 million cubic feet of gas to supply domestic gas requirements. On completion at the end of 1990, Stage 1 will produce 750 million cubic feet of gas per day for power generation/water desalination and industrial sectors, and about 50 million cubic feet per day of liquids (propane, butane and naphtha) to be extracted from the well head stream.[75]

Stage 1 facilities comprise six offshore platforms (Figure 7.6) and connecting bridge, over 500 km of pipelines and gas and liquid separation and process facilities. One of the platforms holds the living quarters which could accommodate up to 75 people, and the this platform has a helicopter landing pad for connecting the North Dome with operational headquarters in Doha (Figure 7.1). The second is the utilities platform, the third the riser treatment platform from which the pipelines go to a platform in the Peninsula. There are two pipelines, one of which is a 34 inches diameter gas line, the other pipeline is a 12 inch condensate line (Figure 7.1). These two pipelines are layed on the sea bed across a distance of about 80 km up to the Peninsula (shown in Figure 7.6). It occupies the sea not only in the field region, but also areas of sea outside its region, as these pipelines occupied an area about 16 km^2 (Table 7.2) offshore, which is about 0.06% of the Qatari offshore area (discussed in Section 7.5 and the onshore effects of the pipelines was discussed in Chapter 4). The fourth and fifth platforms are well head platforms, and the sixth platform a flare platform. There are two platforms as bridge support platforms (Figure 7.6). All these platforms are connected by bridges for the various hydrocarbon operations. Personnel travel to the platforms by helicopter, equipment by boat from Doha.[76]

These platforms and their bridges give us a good idea of the extent of sea occupation by the hydrocarbon industry in the sea in the field region, the various installations effectively forming a small industrial village in offshore Qatar (Figure 7.6). Occupation of the field is also due to the wells which are drilled in the sea bed. There were 13 experimental wells drilled in the period between 1971 and 1988, and 16 producing wells drilled for Stage 1 of the North Field between 1987 - 1990.[77] Those wells already occupied some part of the sea bed and undoubedly have some environmental

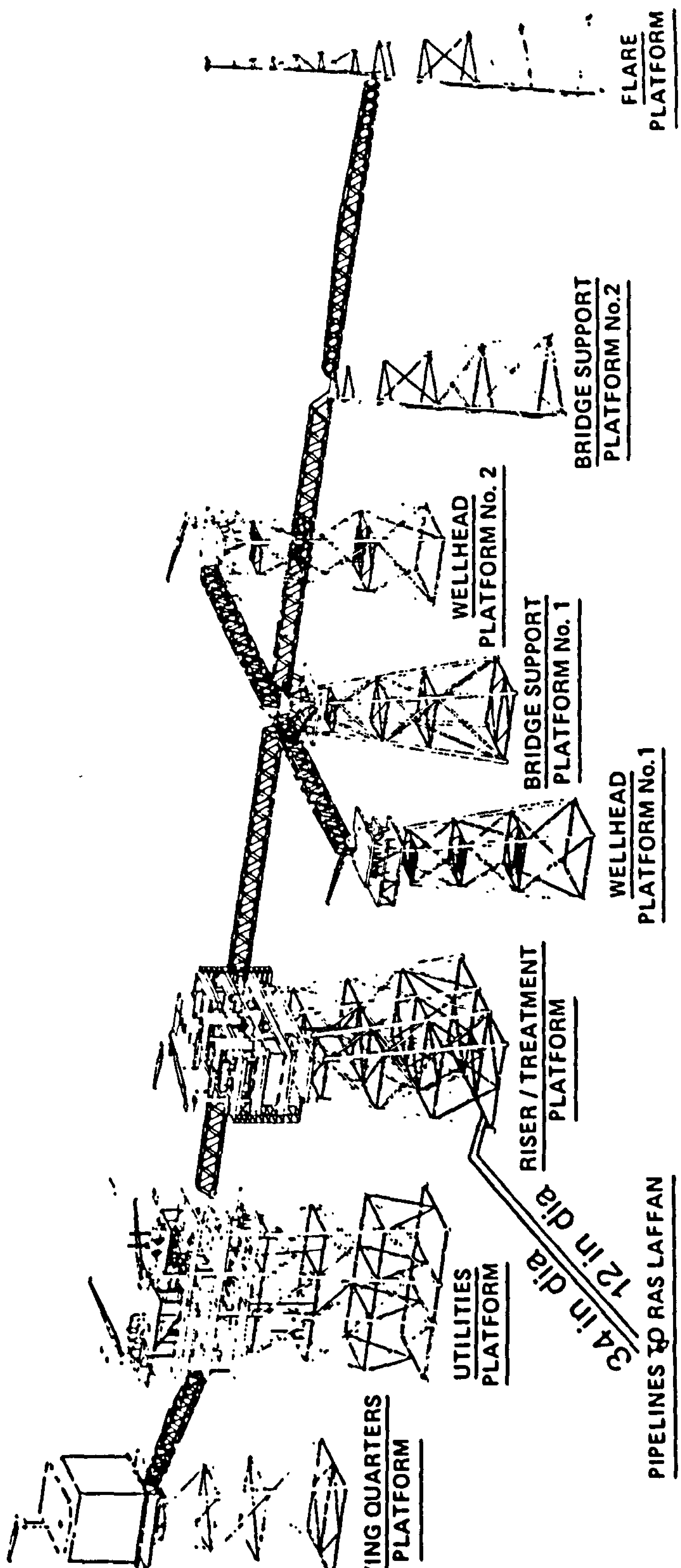


Fig. 7.6 North Dome field, platforms

impact, especially during the drilling operation as there must be some chemical discharge from the well drilling operations, some industrial and some other uncontrolled which could have a minor effect on marine life, especially around the operation areas. The long-term effects of this could be serious, especially in the small semi-closed sea of the Gulf. For example, during the construction period of the North Dome in January 1991, there was a leakage of gas, which had been bubbling to the surface for several months. QGPC hired a U.S. company, Neal Adams Firefighters, to stop the leaking gas. The company reported that the reasons for the leak have been identified and expected to present a suitable solution to the QGPC soon, involving the use of special cement to plug the side of the gas wells.

If unchecked, the flow could accelerate and crater the sea bed, putting at risk the offshore production platform and releasing quantities of flammable and toxic gas into the atmosphere.[78] In a seminar in London during early 1991, experts suggested that QGPC should drill a relief well into the field to disperse any sudden build up of gas pressure by flaring.[79] However, this is almost ended and the first phase of the project officially opened on 3 September 1991 (discussed in Chapter 5).

The North Dome field had no exclusion zone up to January 1991. However, Mr. A. Abdul Rahim, of the Qatari Navy stated on 7 April 1991 that during the war to liberate Kuwait from Iraqi occupation between 15 January 1990 and 27 February 1991, the Qatar Navy set a temporary exclusion zone around the North Dome field for security purposes. The exclusion zone extended to a five nautical miles radius from the platforms.[80] This zone made the field control an area about 270 km^2, about 1.05% of Qatari waters (Table 7.2). However, as an International Shipping Lane passes just north of the field, the permanent maintenance of an exclusion zone which overlaps a shipping lane could be an embarassment to Qatar (Figure 7.2).

The North Dome field is Qatar's window into the future, as the expected life span of the field is 200 years.

In the next section, the sea use conflict created by the industry and other sea users in offshore Qatar will be examined. An attempt will be made to investigate whether industry has the same conflict with sea use as with land use.

7.5 Other Sea Uses

This section discusses the conflict between the offshore hydrocarbon industry and the other sea uses in Qatar.

7.5.1 Fishing

Fishing is one of the few traditional activities that is still continued by the people of Qatar. There is keen interest in developing this industry, not only to honour tradition, but also because fish stocks are Qatar's only living, natural and renewable marine resource, utilisation of which will increase the production of food and serve as a form of diversified investment. However, fish and fishermen are currently not left as free to roam in Qatari waters as they were thirty years ago. They encounter sea use conflict with the offshore hydrocarbon industry's zones, pollution, political boundary delineation and other security zones (all of which are discussed below).

The offshore physical geography of Qatar has several major characteristics. The wind from the north west has a significant impact on the oceanography of the area, and though it is experienced throughout the year, it is stronger during the cooler months. On average, a wind force of over 20 knots is experienced five days per month on the inshore waters, although this seldom exceeds 35 knots. In the offshore ranges, such strong winds may occur during 10-12 days per month during the cooler part of the year and may reach gale force for about 5 days per month.

Frequent occurrence of Shamal (a northerly wind) contributes to high turbidity and mixing of the shallow water around Qatar. The wave height in the inshore waters is generally around 30 cm, occasionally reaching 1.5 m. In the offshore waters, it is frequently between 30 cm and 1.2 m and may occasionally reach as high as 5 m. Tidal variation is in the range of 1.6 m and results in the exposure of large stretches of tidal flats around Qatar.

The location of Qatar plays an enormous role in the fishing industry, especially in the fish migration seasons, and on the methods used to catch fish (discussed below).

The inshore water temperature varies from a low mean of 15°C in January/February to a high mean of 35°C in August. In offshore waters the surface temperature varies between 22°C and 33°C, and the bottom temperature, close to the boundaries on the northern and north eastern sides, varies between 18°C and 22°C.

The shoreline of the mainland is irregular and has many bays and (Khors) lagoons which also affects temperature locally.[81]

In 1915, there were 11 fishing centres: Dha'yn, Al Dhakirah, Abu Duluf, Doha, Fuwayrat, Khawr Hassan, Wusayl, Ruways, Khawr Shaqiq, Sumaysmah and Wakrah.[82] Qatar depended upon the sea for marine transportation, for pearling and for fishing. However, the number of fishing centres has decreased to only four:

- Doha fishing Jetty - about 800 m long, with 151 boats.
- Al-Khawr Jetty - about 1200 m long and 6 m in width, with 132 boats
- Al-Wakrah Jetty - about 1000 m long and 4 m wide, with 48 boats.
- Ruways Jetty - about 700 m long and about 6 m wide, with 13 boats. [83] (Figure 7.1).

Although there has been a significant decline in the number of fishing centres, there has been a major growth in the number of fishing boats. In 1915 there were about 250 boats and in 1989, 344 fishing boats. The efficiency of the present boats is much higher than the previous ones as all boats are mechanised, although the dhows have kept their outer shapes, and have adopted up-to-date technology, e.g. a freezing system and storage. This has permitted the dhows to cover wider areas of the sea around Qatar.

The fishing methods in Qatar are:

1. Traps (Gar goor): wire mesh cages. These traps are placed mainly in the offshore water. Trap fishing is conducted throughout the year, but more actively in the warmer seasons.

2. Gill nets

3. Fish trawl. This gear is used only by the commercial scale fishing vessels of the National Fishing Company.

4. Shrimp Trawling

5. Handlines

6. Trolling Lines

7. Set Nets

8. Intertidal traps. These are generally constructed at locations which are rocky in the intertidal zone. These can be mainly seen at Al-Wakrah, Ruways and Abu Duluf, as these locations are frequented by fish like the spinfeet, which feed on the algae and other organisms living on the rocky surface. However this method is losing popularity because of low efficiency and the damage caused by the deposition of oil residues on the surface of rocks,[84] especially during the Iran - Iraq war 1980 - 1988 (Figure 7.4). Some of these traps have already been bought by the government (discussed in Chapter 5).

The above presentation introduces the main theme, which is the conflict in the sea use between the offshore oil industry and the coastal fisheries.

1. Coastal fisheries

The main areas of coastal fisheries in Qatar are Dohat Um Jahaf, Ras Bullmais, Khawr Al-Udeid, Al Busheyriyah Island, Ras Al-Allaj, Um Al-hol, Ras Abu Abaud, Al-Safilia Island, Al-Alia Island, Qtifan, Wusayl, Al-Da'yn, Sumaysmah, Umm Saa, Milji, Laffan, Qurtas, Al-Maruna, Al-Ghariyah and Al-Mafjar. These coastal fishing areas are off the eastern coast up to the northern tip of the peninsula(85) (Figure 7.2). This is further conformation that the richest fishing areas in Qatari waters is off the eastern coast of the peninsular (Figure 7.2). The coastal fishing areas off the north western coast are Abu Duluf, Khawir, and Al-Arish(86) (Figure 7.2). In modern times, coastal fisheries face a variety of restricted and prohibited areas, these are:

Politically restricted areas: In the south eastern part of the peninsula, there is an area called Khawr Al-Udeid (Figure 7.2). The area is very rich in fish and the Qatari fishermen were regular visitors to this area. However, in the 1980s, the fishermen were almost banned by the Saudis from fishing in that area, especially on the claimed Saudi side of the political boundary.(87) (Figure 7.2) These restrictions on the Saudi side also include Dohat Um Jahaf, as it is located in the south of Khawr al-Udeid on the claimed Saudi side of the boundary (Figure 7.2). A second restricted area is Gaga Island, located in the eastern Khawr al-Udeid, through the political boundary delimitation between Qatar and Abu Dhabi, on the Abu Dhabi side of the continental shelf boundary (discussed in Section 7.6). The Abu Dhabi authorities now forbid Qatar from fishing around the island (Figure 7.2). The areas around Fesht Al Dibel and Fesht Al-Azham(88) are politically restricted areas. These two areas are located on the north western side of the Qatari peninsular (Figure 7.2) and as the offshore political boundaries between Qatar and Bahrain have not been settled there, the effect of this is reflected in the fact that the Qatari fishermen have been prohibited from approaching the above two feshts. The dispute between the two states also covers another area: the Hawar Islands on the western coast of the Qatari peninsular

(Figure 7.2) and again the Qatari fishermen are forbidden from fishing around this disputed area (discussed in Section 7.6).

Other restricted areas for fishermen in Qatar include some sites in Qatari water and at the Qatari coast line which restrict the fishermen from approaching them for **national security reasons.** These are, firstly Al-Alia Island north east of Doha. This island has a rich fishing area around it but the Qatari are restricted from fishing around this island. Secondly, Ras Reckn (Figure 7.7) on the northern tip of the peninsula. The fishermen are forbidden to fish around this island. The third prohibited area for the fishermen in Qatar is Al-Zubara on the north western coast of Qatar[89] (Figure 7.2).

There are also **industrially restricted areas.** Despite the fact that our study in this section is mainly on the effect of the industry on the fishermen in Qatar, we cannot ignore the other restricted areas for fisheries in Qatar water as all of them participate in the same activity which forbids the fishermen from utilising those zones. However, politically or security restricted areas have no effect on marine life in those zones and once restrictions are lifted, these areas will be found to be rich in fish, and probably better than in the pre-restriction period. In other words, these could be called informal fishing exclusion zones. However the industrially restricted areas on the Qatar coast could have a major effect on their restriction zone (discussed in Chapter 5). Luckily there are only two industrial restricted areas on the Qatari coast, these are Umm Said on the eastern coast of Qatar south of Doha (Figure 7.2), and Dukhan where the only onshore oilfield in Qatar is situated along the Qatari western coast. There are some points from where the fishermen have been banned from approaching for the security of the oil installations in the region (Figure 7.2). Also there is the

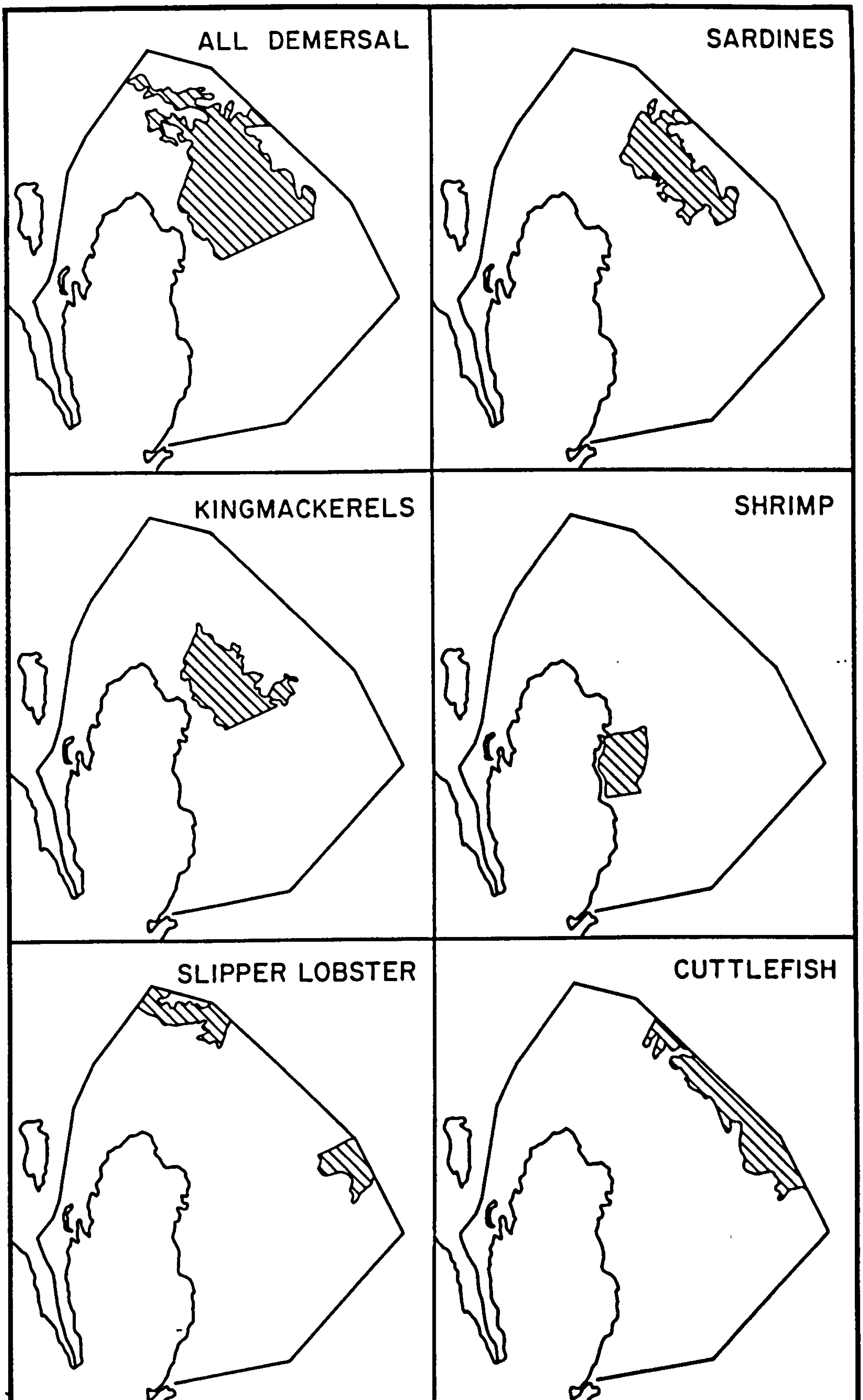


Fig. 7.7 Important fishing areas for selected species

proposed industrial town at Raś Laffan (Figure 5.6) in the north east of the peninsula (The proposed site is discussed in Chapter 5). If this proposed project is accomplished, that would add a new restricted area for the Qatar inshore fishermen as the new industrial town must have its security zone similar to the other industrial areas, and also this town will have a similar if not a greater effect on the marine life species as Umm Said. (Figure 7.2) The effect of the oil pollution on the coastal fisheries of Qatar is discussed below.

When there is a major oil leak into Gulf waters, the pollution and effects of this oil leak will not only damage sea use but will also be transferred to the coastal areas of the Gulf (the movement of the water is explained in Section 7.2). This is especially the case in Qatar, where the chief Qatari towns are concentrated along the eastern and the northern coasts of the peninsula (Figure 2.9). Such a disaster would inflict enormous damage not only on the coastal fisheries, but also on other coastal activities in the peninsula (discussed in Section 7.5.3). The main point in this section is to discuss the spatial impact of the oil industry on the coastal fisheries.

During the Gulf War between Iraq and Iran from 1980 to 1988, many people suffered from the war without participating directly. The disaster of the Gulf War lashed them as both sides in the war began to bomb the economic interests of each other. These interests were mainly the scattered oil installations, oil platforms, oil terminals, and oil tankers. The result was that there was a large quantity of oil pouring into the semi-closed waters of the Gulf, affecting mainly the Qatari coastal areas (Figure 7.4). The strategic location of Qatar in the Gulf exposes it to unpleasant events (Qatar's location is explained in Section 7.2). In fact, this pollution was damaging not only to the coastal areas, but also inflicted marked damage on the offshore fisheries, the polluted areas are shown in Figures 7.4. The effect of the Gulf War in the 1980s (pollution) was clear in the size of fish catches. Before the war, fish catches were between 250-300 kg per day, but during the 1980-88 war this fell to 40-60 kg per day[90]. Even on these amounts there were fears that those fish were contaminated and could damage the health of the consumers. In this way the effects of pollution spread to incorporate onshore and offshore areas.

In the case of the inshore fishing also, the pollution destroyed some of the traditional fish catching methods of the Qataris, i.e. the intertidal traps (discussed above). The oil slick also covered more than 80% of the Qatari coast which tremendously affected the coastal fisheries [91] (Figure 7.4) in Qatar. The effects of the pollution were fought by a team comprising members of the Ministry of Health, the Ministry of Oil and Finances, Ministry of Defence, Ministry of Agriculture and Industry, Ministry of Internal Affairs, Ministry of Transportation and Communications, Ministry of Public Works, Ministry of Municipality, QGPC, Qatar University and the IDTC, all of which were working under the umbrella of one Committee (Environment Protection Committee). This committee received the assistance of the other public and private sectors and other volunteers.[92] This team was fighting inshore pollution and were mainly cleaning and protecting the Qatar coastal areas. In an interview with Mr. A. Al-Mudfa'h on 6 June 1990, he said:

> *"Up to now we are still fighting the oil pollution of the 1980s war, although we have done a great job so far. We are also still fighting the effect of the pipeline which was laid between Saudi Arabia and Bahrain. Our operation is now mainly concentrated on the northern and north west of Qatar near Abu Duluf and Zubarah. Our procedures involve cleaning the coast, collecting the oil slick, and dumping it in a pit in the Qatari desert."* [93]

Two points are clear from this interview: that the pollution of the 1980s was still affecting some of the Qatari coastline; and even after cleaning those coasts, the oil was dumped in special pits in the desert which made those pieces of land occupied by the pits useless as these are already polluted by the oil slicks and cannot be developed for any other land uses, especially in the short term. Therefore this activity links sea use and land use, as the effect on the land finally will reach the sea and the effect on the sea will finally reach the land. This pollution also had a major destructive impact on the sea, as it killed many fish, dolphins, and other species including birds, and destroyed some of the coasts in the Gulf and mainly in Qatar.[94]

As Professor M. Haruni, a consultant for IDTC in Doha for chemical and petrochemical industries, said on 24 May 1990:

> *"That almost all the pollution which could be seen in the Gulf have almost ended, but we can't depend on that at all, as the various responsible departments in the government must have a precise studies for the various life species in the Gulf water and to check if they have any effect on the human consumption."* [95]

On 26 May 1990, Dr. Quttub at Hamad Medical Corporation in Doha said:

> *"We haven't banned any fish from the market yet, although some of the fish proven in our laboratory that the rate of pollution in them higher than the international standard rate of pollution. And after the end of the 1980s war in 1988, the rate of pollution in fish expected to be declined and especially if the Qatari kept the same efficiency of 1980s for fighting the oil pollution."* [96]

The other factor that could contribute to the rate of coastal fish catching is seasonal. In the winter months the fish migrate closer to the coast to find warmer water for laying their eggs and that results in the highest rate of catching for the coastal fisheries during winter, and in the summer the fish like to stay in deep water. Thus, like the birds, they have their migration seasons.[97]

There are also some human restrictions placed on fisheries during certain seasons as correspondence with the National Fishing Company in Qatar on 20 May 1990 states:

> *"We fish by the trawling method and the Qatari law allows us to use this method in a water depth not less than 25 m, the fish breeding areas, during the breeding time everybody is banned from fishing on them, and especially the breeding season for the shrimps as it is banned from February up to June every year, during their breeding time (Figure 7.7) and they are still studying the other breeding sites for the fish and probably after they finish their studies, they will ban some more areas during the breeding time."* [98]

So the fish protection seasons can sometimes be seen as yet another obstacle to the fishermen, especially the old Gulf's people who roamed freely in the Gulf less than 20 years ago without any restrictions and are now facing a different method of restriction, e.g. industrial, security, political, disputed areas, pollution and sometimes, the breeding seasons.

2. The Offshore fisheries

The offshore fisheries in Qatar are mainly in the south east of the peninsula, Al-Majaseb, Um-Uwaired and around Halul region Bal Ghamaghim, Um Al-Khash Khash (discussed below) north western Halul region, Bugria, southern Halul region, Bu Graa, Bal Masan, Hadet Mijbel, Um Al-Jeteb, Um Khart, Al-Dayer. Other fisheries on the eastern coast of Qatar are Krays, Um Al-Izam, Al-A'd Al-Gharibi, Balsalabikh, Niwat Ali, Niwat Lehdan, Sufan, Um Elijash[99] (Figure 7.2).

There are some areas restricted for the offshore fisheries, these are mainly the offshore industrial zones (the Industrial zones discussed in Section 7.3, 7.4)(Figure 7.2). The area of Halul region (the island and the oilfield) is 823.7 km^2, and the fishermen almost banned from this area, although it has some very rich areas in fish in Halul region, e.g. Bulhanine oyster bed, Bul Ghamaghim, and Um Al-khash Khash. These three fishing sites (Figure 7.2) are situated between Halul region oilfields and Al-Bundiq oilfield which has its safety zone of 135 km^2 (Table 7.2) (Figure 7.2). This means that fishermen are almost banned from those sites as the distance understood amongst the fishermen to keep away from the oilfields is between 6 and 8 miles, [(100)] and those fishing sites are very close to the restricted limit. However these sites are still visited by some fishermen who have to be careful not to cross the safety zones of the oilfields. Fishermen intentionally crossing into the safety zones of the oilfields, and caught fishing in an area close to the oil installation, are punished: for a first offence, the fishing boat can be impounded for a short period of time; for a second offence, the boat would be impounded, and the crew would be jailed for a short period of time; for a third offence, the boat would be impounded, the crew jailed, and a fine imposed upon them of an amount determined by the government.[(101)] This is a direct effect on fisheries by the offshore oil industry. It would be reasonable to say that all fishing sites in the offshore areas are vulnerable to the damage of the oil industry as most of the offshore fishing rich sites are situated between Halul region and the Qatari peninsula, and the average distance between the industrial region and the coast is only about 90 km. That means that a major accident or sabotage of these installations would have a serious consequences for the fishing sites and for the coast of Qatar (Figure 7.2).

The Qatari Navy, following an interview with Mr. A. Abdul Rahim on 7 April 1991 stated:

> *"Fishermen are not allowed to fish in their vicinity of pipelines. There are two sets of pipelines, the first one from Halul region to the south of Wakrah, and the second from the North Dome to Ras Laffan. They occupy an area about*

17-18 km^2 and 16 km^2 respectively (Table 7.2 and Figure 7.1). That means the offshore hydrocarbon industry not only affects the industrial regions, but also prohibits the fishermen from an area about 33.8 km^2 about 0.13% of the Qatari water." (102)

The other restriction the fishermen face offshore is the political boundary as they are not allowed to cross those boundaries for fishing and any other purposes unless officially permitted. Other fishermen (non Qatari) are also banned from crossing the political boundary for fishing and if any of the non-Qatari fishermen crossed the Qatari boundary for fishing in the Qatari water they would receive a punishment which could include jail when the individual has committed more than one offence.(103)

Mr. A. Abdul Rahim, at the Qatari Navy HQ in Doha on 7 April 1991 stated in connection with permission for foreign fishermen to fish on the Qatari continental shelf that:

"Non-Qatari fishermen are allowed to fish on the Qatari continental shelf except in the restricted areas and the territorial waters of the peninsula and the islands (3 nautical miles)".(104)

There is thus some contradiction between what we have been told by fishermen, and the Qatari Navy. What we have been told by the fishermen could be attributed to the fact that they were confused between territorial waters and the other offshore areas.

The fishermen cannot use all their fishing methods in the shipping and tanker lanes (Figure 7.1), as they would have to use only the easy fishing methods which would help them to evacuate the area as soon as possible when they see any tankers or ships. The fishing method they use in the shipping lanes are handlines and trolling lines.

The islands which are visited by the Qatar fishermen mainly are Al-Isshat, Sharao, Al-Saflia and Al-Alia, the latter of which the fishermen are now banned for security reasons.(105)

The recent pollution in the Gulf was a deliberate act of the Iraqi's Military during their occupation of Kuwait when they poured the oil from Al-Ahmedi terminal directly into the water of the Gulf, an act which has created the largest amount of oil pollution in the world, already claiming the lives of about 20,000 birds (106). The huge number of fish which have been affected has not been estimated up to now. The Qatar government when they received the news of the pollution in the Gulf which occurred on 26 January 1991 prepared themselves to combat this pollution by the use of modern equipment. They contacted the international experts to assist them to fight this pollution. In late January 1991, Qatar bought equipment from Germany to help combat pollution at a cost of $3.3 million. However, that did not prevent the pollution from reaching the Qatari coast as the north western coast of Qatar was already polluted by the 1991 pollution (Figure 7.4 and Plate 7.1) and other small oil slicks have already been seen scattered in Qatari water. It has to be said that the early precautions that Qatar has taken to combat the 1991 oil pollution have helped the country to reduce the expected disaster on the fisheries and other sea users from this pollution despite the fact that we have to wait for a certain period of time to estimate the damage which could be caused by the 1991 pollution on the Qatari sea users.

In addition, during the 1991 war, all fish production was decreased in Qatar as the authorities forbade the fishermen to go offshore to ensure their safety from mines which the Iraqis had thrown in the Gulf. This restriction operated between 15 January and 27 February 1991 although there was some minor fish catching in some days (between 10-20 kg per fisherman per day, but there were some days without fish catching in Qatar waters.(107)

A National Fishing Company has been established in Qatar since 1966 with a capital of $961,538. In 1980 the government bought all the shares in the company. In Doha, the company owned two shrimp plants, for freezing the shrimps and the daily capacity of this plant reached 10 tons. The company also owned two specialised boats for catching shrimps.(108) The company was exporting some of its shrimps to the international market by the Ross Group, but the export stopped in 1979.

The company's boats have their berths within the main harbour in Doha.(109) The fish production of the company in 1989 reached 915.5 tons of fish, 19.6% of the Qatar local consumption, and 19.6% of the total fishing production in Qatar. That gave us the impression that the government does not want to challenge the local fishermen in fish catching, although the government has the capability of presenting a highly modern fleet for the fishing company. Our recommendation is that the government could expand the company fishing fleet and concentrate on the international market, leaving the domestic market for the local fishermen production.

In 1989 the local fish catches reached 3456.5 tons 73.8% of the local consumption, the production of Qatar Fishing Company 19.6% of local consumption (discussed above) and the imported fish from neighbouring states reached 309.9 tons, about 6.6% of the local consumption. The total production of fish in Qatar reached 4374 tons, 93.4% of the local consumption. The total consumption in 1989 in Qatar reached 4683.9 tons, which included fish imported from other Gulf States, mainly Oman.(110)

The importing of fish into Qatar does not mean that the Qatar waters are incapable of supplying fully the needs of local demand. The reason for the undersupply is the ability of the local fishermen and company to catch the fish. The shortfall is made up by importing from the neighbouring states market. Fish catching also depends on the seasons as usually there is an increase in the fish catching in April, May, June, September, October and November and fish prices also depend on the season.[111]

Finally, straightforward though fishing may appear to be to those who have no contact with the sea, that fishermen are free to fish where they like in the sea, the reality is less straightforward. Fishing is a sea use which must compete with other activities. As was shown in the study above, about 5% (Table 7.2) of Qatari waters are restricted, excluding fishing for safety and security reasons. This demonstrates that offshore fishing is not easy, as they have to cope with all the rules of the offshore water (Figure 7.2).

The next section examines the shipping in Qatar and we will try to show another sort of conflict affecting sea use and affected by the sea nature (Figure 7.2).

7.5.2 Shipping

Ships using Qatari waters fall into four categories. First, small vessels such as naval patrol boats, fishing boats, and QGPC tenders which have no set routes. They can visit everywhere in the offshore area except the restricted zones. As these boats have a shallow draft, short of lacking permission to do so, they can berth at all the Qatari small jetties, i.e. Zikrit, Ruways, Zubara, Wakrah and Khawr (Figure 7.1). The Navy also has its own jetty in Doha.

Secondly, the ships which come to the Doha main port and Umm Said port (Figure 7.1). Those ships have a fixed shipping lane by which to enter Qatari waters. As discussed in Section 7.2, Qatar waters are not deep enough for commercial shipping, therefore these ships have to go through certain lanes to reach Doha port (Figure 7.1). Eventually the ships must get close to the coast for loading or unloading cargo, for which purpose the government created a special channel for ships to sail to Doha's port. In an interview with Mr. G. Ghanky, Director of Doha port on 9 June 1990, he said:

> *"The work started in the dredged area on 17 March 1963 and was finished in 1966. The channel length is 3.5 miles, and the width about 350 feet. The water depth in the channel zone between 7-8 and 8.5 metres, and the project cost about 7,700,000 dollars".*[112]

The significance of this project is to make the operation of the channel for commercial shipping easy, as through the channel they can reach Doha Port. The maximum tonnage to ship to berth at Doha's port is 20,000 tonnes. This channel shows us two things, the first that there is a special zone for the channel as it has its buoys for showing the ships their way. There is thus an area offshore dedicated to Doha's port. Secondly, the dredging operation has changed the nature of the sea bed in that area.

The ships have some effect on the sea use in the terms of pollution, but this could be classed a minor pollution. Some of them dispose their refuse directly into the water and the current often brings this refuse to the peninsula coastline. This has a minor danger in terms of pollution on people or the other sea users, and it affects the aesthetics of the beaches (as shown in Plate 7.2).

The other effects of these ships on sea use is already discussed in Section 7.5.1.

The third type of shipping in Qatari waters is the one which goes to Umm Said Port (Figure 7.1). Umm Said port receives two sorts of shipping: commercial shipping, and oil tankers. The effect of commercial shipping will be similar to the shipping into Doha port. The oil tankers are larger, and they have to take a route deeper than that used by other ships to reach Umm Said Port. The channel which they followed runs parallel to the Qatari coast, and is deeper than Doha's dredged channel. The lane of Umm Said has a depth of between 11- 13 metres and is dependent on the Qatari tidal system. The heaviest tankers Umm Said SBM could receive is 275,000 tonnes, but a vessel of this weight can use the Umm Said path only with a half load.(113) These tankers are potential polluters: when empty of oil, water is used in their tanks as ballast. Prior to loading with oil at the terminal, they discharge the water directly into the sea. This water is usually mixed with some chemicals and cause oil slicks, which can have a deleterious effect, especially if the water is disposed of over a coral formation or an oyster bed where the fish have a grazing area, this could cause a natural disaster. The water disposed from the tankers could affect the Qatari coasts badly, especially in the long term.(114) There are regulations in the Gulf to forbid these acts, but a very close eye has to be kept on these ships and tankers in order to execute these regulations. (Umm Said Port and Umm Said oil terminal discussed already in Chapter 5).

The fourth type of shipping in the Qatari water is to service Halul Island Oil Terminal (Figure 7.4). Halul's terminal is different from the other two ports mentioned previously as it could receive any oil tankers, as the terminal area could receive up to 550,000 tons dead weight.(115) The effect of these tankers on the sea use and the coastal areas are similar to Umm Said's tankers.

All ships and oil tankers have to respect the offshore industry safety zones, and are forbidden to anchor in the vicinity of any pipelines (Figure 7.1).

This section shows us the actual and potential effects of ships and tankers in the Gulf. The next section examines the leisure areas in offshore Qatar.

7.5.3 Leisure Uses

It is no exaggeration to say that the main leisure areas in Qatar are the offshore and coastal areas, as the Qatari's only natural gift for recreation and tourism is the sea. When the people of Qatar want to enjoy themselves, the first thing that springs to mind is to visit the coast or to go out in a boat. When, in the public sector, plans to encourage tourism in Qatar are drawn up, the first thing to come to mind is to utilise the coastal areas. In this section the discussion will centre around two aspects of the use of the sea for leisure: the private sector; and the public sector (Figure 7.2).

Although there is no organised leisure area on the Qatari coast, Qatari people like to visit areas on the coast of Qatar, especially Silin south of Umm Said (Discussed in Chapter 5), Wakrah, throughout the coast of Doha especially Doha's Cornish, Al-Huwaylah, al-Maruna, Fuwayrat, Al-Gharia, Al-Mafjar, Ruways, and Dukhan (discussed in Chapter 3), Khawr Al-Udeid and almost all the Qatari coastal areas. The people go there to spend weekends and other holidays and some of them camp for a few days. The recreation activities include fishing, swimming, spending some time near the beach, sunbathing, especially for some foreign tourists. Some have their own boats and they go for activities like fishing or driving motorboats close to the coast. Some people enjoy riding their cars along the coast, and in Doha especially people water ski. For enjoyment, some of those with boats visit Al-Saflia island, north east Doha. Some people walk along beside the sea. Those leisure areas are not well organised and people just visit these areas under their own steam. They take with them all they need when they go to coastal areas as there are no chalets or restaurants or any organised places for receiving people. This results in vehicle tracks affecting most of Qatar's beautiful and naturally made beaches. Refuse is usually left scattered along the beach areas, and this may contain some sharp materials like broken glass (Plate 5.8). Refuse is discarded on the beach which makes some beaches smelly and infested by insects. Therefore the government should institute a procedure to control beach tourism, and provide facilities to absorb people at certain points along the coastal areas, for example by developing some of the areas suggested by Llewelyn Davies Weeks Forester Walker & Bor on 11 April 1973[(116)] (Figure 7.2). This will make the control of tourism easier and make the cleaning operation of the beaches much easier along the Qatari coast (Figure 7.2).

There is also another sort of coastal recreation. Some affluent people are given land by the government on the coast, and they build their second home along the coastline. This phenomenon can be seen clearly along the north eastern coast in Qatar. Those beaches were hit badly by the 1980s pollution, and for a time kept people away from these beaches. However this problem has almost vanished after the major clean-up operation against the pollution, discussed in Section 7.5.1.

This phenomenon can be seen along the eastern coast of Qatar especially during the warm weather and the holidays.[(117)] Some people in Qatar also go offshore for diving and there are three main diving areas offshore Qatar (Figure 7.2), one of them owned by the Qatar Submarine Club in south east Qatar.(118)

Those are the chief leisure sea uses in Qatar today. It is clear that the concentration of the leisure areas along the eastern coast and in the eastern part offshore Qatar (Figure 7.2) makes them vulnerable to the effects of the offshore industry which, on average, is only about 90 km away (Figure 7.2). An accident could affect the leisure areas. It could also affect the Qatari main water supply at Ras Abu-Abaud and Ras Abu Fintas water distillation plants, the proposed Wusayl distillation plant and other small distillation plants (Figüre 7.2) although there are a lot of precautions taken for the protection of those plants from any oil pollution. In the event of a major pollution however, unfortunately these methods do not work.

In this section it has been shown that sea use is as important as land use, and even the water supply is taken from the sea on the Gulf of Qatar.

The proposed tourism sites in Qatar are the Palm Tree Island (Jazirat al-Nakheel)(Figure 6.7) in Doha, a reclaimed island in the adjacent water of the Doha's western bay where various recreation facilities will be provided.(119) The second proposed tourism site is the north western bay of Doha, and the project will have a fun fair, restaurants and other facilities.(120) (Figure 6.7). The third proposed tourism site is in Umm Said, as explained below.

> *"There is a third proposed project for developing the tourism facilities at Umm Said beach in Silin. This project would include beach cabins, situated 12 km from the town. This development, covering an area of 50,000 metres^2 would include boat berths, a motel, shopping area, and car maintenance shops.*
>
> *At the start the project would consist of 20 large beach cabins and 20 smaller ones".*(121)

Plate 7.2: *The coastline of northern Raslaffan. The picture below shows some of the direct connection between sea and land, as some of the materials dumped by ships in the sea eventually find their way onshore, giving the coastline an unpleasant appearance and endangering holidaymakers.*

(All the proposed projects will be supervised by the public sector, and as regards Umm Said is examined in Chapter 5, Section 5.7.2).

Lastly, Qatar has another marine resource not yet developed: these are the Qatari islands as Qatar has Jinan, Sharao, Al- Isshat, Al-Safliya, Al-Alia, Al-Busheyriah, Ras Rekn and Hawar islands.(122) Those islands could be developed for recreational activities, wild animal conservation, some experimental agriculture which would suit the Qatari climate and the offshore environment. As shown previously in Halul Island (Section 7.3) trees have successfully grown in a short period and that would indicate that some of the other Qatari islands could be fertile in the same way as Halul Island or even better. Islands could also be developed for Navy or Military training if needed.

Finally this section has shown us the growing competition in sea use of Qatar. The next section examines another sort of conflict revived mainly by the hydrocarbon industry in the Gulf.

7.6 Offshore Zone claimed by Qatar and maritime boundaries

The main point of this section is to show the effect of politics in sea use. Until 1949, the Gulf was an open sea in that it was open to all peoples of the Gulf - for fishing, pearl-diving, sea transport, etc.. Then Gulf states began to consider the limits of their political marine boundaries. This concern with marine boundaries coincided with the Gulf states starting to grant oil concessions in Gulf waters. The declaration by king Abdul Aziz of Saudi Arabia on 28 May 1949 is an example of the trend in political opinion on the subject:

> *"As the world's need for natural resources which are the gift of God to the people increases, and it is possible that there are enormous resources in offshore areas near Saudi Arabia, and that advanced technology makes the utilisation of these resources practical and possible, so the boundaries of such areas will be determined in accordance with equitable principles by our government in agreement with other states having jurisdiction and control over the subsoil and seabed of adjoining areas"* (123).

After this declaration was made, other Gulf states followed with similar declarations. The declaration mainly demonstrates two things: firstly that the Gulf states began to consider their offshore limits seriously as long ago as 40 years ago, and secondly, the offshore oil concessions were one of the main issues in the final settlement of offshore boundaries of the Gulf states. As internationally understood, there are three basic motivating factors behind the establishment of national claims to offshore political control: (1) Resources; (2) Enforcement of national laws; and (3) Defence (124). The main factor for the political boundaries delimitation for the Gulf states and Qatar is the exploitation of their natural resources offshore - mainly oil.

Other states of the world, such as some in north west Europe, had considered some of their offshore limits centuries before the Gulf states. (1) The first historical indication of English claims to control the waters surrounding the British Isles was in an ordinance issued by king John in 1201 which required all ships at sea to lower their sails when so ordered by English war vessels. The ordinance was designed to prevent pirate ships from attempting to escape once a boarding party had put out from a war ship.(125) In 1609 a royal proclamation was issued from England requiring foreign vessels fishing anywhere off the British coast to obtain an annual fishing licence. In 1598 the Danes proclaimed an eight mile zone around Iceland for exclusive fishing rights and, in 1736 the British adopted the first customs zone of twelve miles around its coasts.(126)

The introduction of the three mile limit is frequently credited to the Italian jurist, Galiani, who, in 1782 published a treatise in which he suggested that 3 miles was the maximum range of cannon shot. Eleven years after Galiani's publication appeared, the USA proclaimed a provisional three mile offshore zone. The American position gradually gained acceptance in Britain, particularly after a British judge in 1805 ruled in favour of an offshore belt of sovereignty about 3 miles from shore. With the maritime supremacy of Britain which followed the victory of the battle of Trafalgar in 1805, the three mile principle began to be accepted by other countries as well. At the North Sea Fisheries Convention in 1882 six states signed an agreement providing for a three mile limit for exclusive fishing rights off the North Sea coasts for the signatories.[127]

The above agreements demonstrate that, as with the Gulf, almost nobody considered political limits and zones until resources prompted action. From the early 1950s, interest in fish and marine resources such as oil prompted the people of the Gulf to set limits. Until then they had roamed freely. Before the oil era, the population of the Gulf, especially on the Arabian side, was not high and thus the living resources of the sea were more than ample for their needs without the introduction of zones, but the coming of the oil changed the situation.

The next part of this section will focus in the main on the territorial waters and the continent shelf of Qatar (Figure 7.4). It was felt that it was appropriate to discuss the concept of territorial waters and the continental shelf briefly before entering into the main theme of this part of the study - the waters of Qatar.

Before 1982, three main international conferences had provided the basis for the demarcation of the offshore waters. These were the 1930 Hague Conference, the 1958 U.N. Geneva Conference, and the 1960 U.N. Geneva Conference.[128] It could be said that these conferences established the present law of the sea. The agreements reached were adopted by other states who were not represented at the conferences, amongst which were some of the Arabian Gulf States, including Qatar. Although the Gulf states were not party to the 1958 Geneva Convention, they adopted Article 6 of the Agreement, to solve their offshore boundary disputes by agreement based on equidistance, taking account of special circumstances [129].

These conferences were followed up by other conferences concerned with establishing the laws of the sea, particularly the conferences held in the 1970s and 1980s, which led to the important U.N. Convention on the Law of the Sea in 1982. This will enter into force after the sixth ratification. All the Gulf states have signed the Convention but only Bahrain has ratified it. Article 123 (a) of the Convention provides that states bordering an enclosed or semi-enclosed sea should co-operate with each other to co-ordinate the management, conservation, and exploitation of the living resources of the sea.[130] It also stipulates a maximum 12-mile territorial sea and a 200 mile exclusive economic zone. The limits of territorial waters adopted by Gulf states are three miles and twelve miles. The three mile limit was first adopted in the Gulf by Britain in 1904 [131] as the Arabian Gulf states, excepting Saudi Arabia, at that time were British protectorates (Qatar joined the British protected zone in 1916).

The concept of territorial waters can be defined as the sovereignty of the coastal state extending over its adjacent sea as well as the air space above and the seabed beneath.

Foreign vessels may pass through it provided they are engaged in innocent shipping.[132]

An early definition of the continental shelf can be taken from the US Declaration of 1945: "*The shallow water can be counted as a geological part of the continent, that gives the US government the right to exploit the seabed around its coastal areas up to 300 metres depth in the ocean*".[133]

An alternative definition is that of Mexico which counted its continental shelf by distance; the range of the continental shelf of Mexico reached up to 200 miles from the coast.[134] Coastal states have the exclusive right to exploit the resources of their own continental shelves. [135]

It was impractical to define the continental shelf in accordance with water depth in the Gulf because it is so shallow or in terms of distance because the widest part of the Gulf is less than 200 miles. Instead, agreed boundaries have had to be negotiated on the basis of equitable principles. In most cases this has meant a modified median line.

1. Qatari Territorial Waters

As previously stated in this section, Qatar was a British protectorate up to 4 September 1971 and the British claimed sovereignty over a three mile limit offshore. This limit continued to apply for Qatar after independence and, as yet, Qatar has not claimed an extension to its territorial sea [136] (see Figure 7.4). It could be argued that even this modest three mile limit is disputed by Qatar's neighbour, Bahrain. Bahrain and Qatar are in dispute over the islands of Hawar which are in Qatari territorial sea along the western coast (Figure 7.4). (This point is discussed in Chapter 2, Section 2.3.1).

On 2 June 1974 Qatar made a declaration regarding the contiguous zone beyond its territorial waters:

1. *"The state of Qatar alone has the exclusive sovereign rights over the natural resources and the marine resources and fishing in the zones contiguous to the territorial sea of its coasts, and the coasts of its islands, and without prejudice to the freedom of international navigation, maritime and aerial, in accordance with the established rules of international law.*

   The outer limits of these zones shall be defined according to bilateral agreements already concluded or to be concluded. Where no such agreement exists, the limit shall be defined by reference to the outer limits of the continental shelf of Qatar or to the median line, every point of which is equidistant from the base lines from which the territorial seas of Qatar and the states concerned are measured in accordance with the rules of international law.

2. *Qatar alone has, in the aforementioned Qatari zone, the right of prospecting, exploration, exploitation, development, fishing, construction of installations and safety and control zones, and the conservation of marine wealth and natural resources, whether situated on, under, or over the seabed.*

3. *Fishing and all related activities, exploitation of marine wealth, and natural resources, and the undertaking of any type of research by non-Qatari's in the aforementioned zone are prohibited unless by prior permission from the government of Qatar in accordance with any regulations that might be established in this regard.*

4. *The right or exercise of any of the activities mentioned in this declaration do not depend on occupation, effective or notional, or on the issue of special declarations or permits.*

   The outer limits of the zones provided for in this declaration shall be drawn on the official maritime charts of the state of Qatar".[137]

This declaration is the only official document available regarding the legal position of offshore Qatar. But, during my fieldwork in Qatar up to June 1990 and in various contacts with some of the officials and those involved with fishing rights in Qatar during the first half of 1991, there was no evidence, formal or informal, that demonstrated that the declaration had been applied. It is probably because there are a lot of issues which must still be decided before the declaration is put into practice in Qatar, for instance the disputed islands and seabed in the western part of the peninsula (Figure 7.4).

In the case of territorial water limits, Qatar is preparing a formal draft claim to twelve miles although, according to international law, Qatar is effectively already exercising this limit [138] (Figure 7.4). By 16 April 1992, the government of Qatar felt that it was time to claim its territorial waters and contiguous zone by Decree No.40, Article (1) 16 April 1992 which claimed its 12 mile territorial water limits according to international law [139] (Figure 7.4). Article (3) of the same Decree claimed a contiguous zone of 12 miles beyond territorial waters.[140] This was followed by a declaration from the U.S. Foreign Office on 18 April 1992 which placed emphasis on the disputed areas between Qatar and Bahrain and that these should be settled by a peaceful solution [141].

2. The Continental Shelf

The first declaration made by Qatar concerning continental shelf was on 8 June 1949 [142]; it was almost identical to that of the Saudi declaration (explained above). This declaration did not define the exact limit of the Qatari seabed but formed the legal basis for the discussions between the Gulf states to decide the limits of their offshore boundaries later in the 1960s and 1970s.

Despite the fact that the 1949 declarations by Qatar and other Gulf states was respected by all the states, they did not give a final settlement for the disputed areas, e.g. islands claimed by one state but situated near another state (Hawar, for example).[143] However, the eventual continental shelf delimitation was agreed by Qatar and its neighbouring states in 1969.

1. The Continental Shelf between Qatar and Abu Dhabi

An agreement between the above states was signed on 20 March 1969, delimiting their continental shelf and the sovereignty of the islands between the two states. Both states have conformed to the agreement from the date of its signature. The agreed political line offshore between the two states is 226 km in length and has four turning points, with an average distance between the points of 38.3 nautical miles (Figure 7.4). The shape of the political line is straight, apart from a zone of 15 nautical miles given as territorial waters for Dayyinah island which itself was given to Abu Dhabi - the depth of the water along this line is between 5 and 20 fathoms.

The delimitation of the boundary line between Qatar and Abu Dhabi was not made on the principle of median line, as the points C and B in Figure 7.4 show. Sometimes the delimitation diverges from the theoretical line, as points D and A show.

The designation of territorial waters for Dayyinah island was part of the agreement made between Qatar and Abu Dhabi on 20 March 1969. At the same time, the islands of Al-Isshat and Sharao were assigned to Qatar [144]. The three islands were some of the disputed areas between Qatar and Abu Dhabi. This agreement was the final settlement for the disputed areas between the two states and clearly facilitated the development of the offshore for sea use for both states (Figure 7.4).

2. *Qatar and Iran*

The agreement between these two states was signed in Doha on 20 September 1969, and first put into force on 10 May 1970 after an exchange of official documents by the two states. The length of the agreed line was 270 km with five turning points in the straight line, the average distance from the points is 32.75 nautical miles, the average depth at these points being about 30.8 fathoms. Agreement over the exact location of the line between points 1 and 2 remain unsettled until a final settlement (discussed below) between Qatar and Bahrain. The main points of the agreement worked on the principle of equidistance between the parties. Despite this, the line sometimes deviates from the equal distance principle (Figure 7.4). This agreement did not consider the islands between the two states, presumably tacitly assuming that the islands located in a state's continental shelf belonged to that state. An interesting feature of the agreement is that if in future, oil field exploration reveals exploitable deposits, or any other resources are found near the political boundary zone, both sides must follow an agreed procedure for exploiting such reserves:

1. Neither of the two states are allowed to drill within a distance of 125 metres on either side of the boundary line;

2. The two states must discuss and reach agreement on the operation in the zone of the political line.

The above two points worked on the principle of special circumstances[(145)]. Iran tried to exploit the above agreement when the Iranian Oil Minister claimed that the main gas reservoir of Qatar's North Field extended at least 20 km into Iranian waters and that, on this basis, about 30% of the field lies in Iranian territory. Stating that there was no legal reason why Iran should not exploit the field, he said that the exploratory drilling would be undertaken to determine how much gas was in Iranian waters and that Iran wished to develop the field very soon.[146] There has been no official Qatari reaction to the Iranian claims. However, according to oil industry reports, the part of the field which Qatar is currently exploiting is wholly within Qatari waters and it therefore seems unlikely that the Qatari plans will be altered [147] (Figures 7.1 and 7.4).

3. Qatar and Saudi Arabia

Qatar has an offshore boundary line with Saudi Arabia 112 km from the western side of the peninsula (Figure 7.4). (see also the Qatar-Saudi boundary dispute discussed in chapter 2, section 2.3.1. It has not been possible to acquire a copy of the final agreement (if there is one) for the political boundary between both these states, but as both states have amicable relations, these boundaries are understood between them.

The south eastern side of the peninsula of Qatar has also been the subject of a boundary agreement between Abu Dhabi and Saudi Arabia. On 21 August 1974 an agreement was signed delimiting their onshore and offshore limits. This agreement gave Qatar and the Saudi state a maritime boundary of about 5 km off south eastern Qatar, in waters which previously belonged to Abu Dhabi. The Saudi territorial waters on the eastern side of Qatar was agreed at three nautical miles. After the Saudi-Abu Dhabi agreement of 1974 (see above), Qatar put forward a proposal to Saudi Arabia [148] for the political boundary but, as far as is known, nothing has been officially published as yet.

4. Qatar - Bahrain

Both states dispute a line offshore about 210 km in length (Figure 7.4) which has frozen the use of the offshore area between their states. The dispute between the states is not only over that line but also over an area of the territorial waters of Qatar occupied the islands of Hawar (Figure 7.4) in Qatari territorial waters, but claimed by Bahrain.

At the beginning of this section the proposed twelve mile limit of Qatar was discussed and it was found that there was overlap with disputes regarding the political line of the two states' continental shelves (Figure 7.4). The best solution for this dispute might be worked out according to the principle of equidistance for both states as discussed in in Chapter 2, section 2.3.1.

The above issue will hopefully reach a final conclusion in the 1990s, as Qatar transferred the case of all disputed areas between Qatar and Bahrain (Hawar Islands, Fesht al Dibel, Garadah, and the offshore boundary between both states) to the International Court of Justice in The Hague on 8 July 1991. Qatar also presented the Court with some bilateral agreements made with Bahrain to solve the issue in December 1987 and December 1990. Bahrain, in its two letters to the Court on 14 July and 7 August 1991, contested the documents which Qatar presented (discussed above). The Court told the representatives of both states on 2 October 1991 that Qatar has to present its case with all its documents on 10 February 1992, and Bahrain has to present its defence case on 11 June 1992.(149)

Despite courting the risk of this section being too long, it was felt appropriate to give a brief background to some of Qatar's international offshore zones. Discussion of Qatari offshore political zones cannot be viewed in isolation - they must be linked to those of Qatar's neighbouring states.

Secondly the oil industry participated to a great extent in the discussions regarding Qatar's offshore political zones and were prime movers in reaching a quick solution so as to exploit the offshore hydrocarbon reserves as soon as possible, not only in the waters of Qatar but also as regards those of all the Gulf states.

7.7 Conclusion

The study above shows the wide spatial impact of the hydrocarbon industry in offshore Qatar. In the study below, we shall discuss the analysis of the various zones offshore, and the competition amongst various activities in the sea use of Qatar, along with some recommendations.

7.7.1 Analysis

The Gulf is now very different from what it was four decades ago, being now 48 times more polluted than any other waters in the world(150). This is because 40% of the world's oil supply comes from the offshore and onshore fields of the Gulf (151) and almost all of it is exported by oil tankers which load in Gulf waters for the international market (see Section 7.5.2).

Qatar has three legally recognised offshore zones. The *territorial waters* extend 12 nautical miles from the coast of the peninsula and its islands. The *contiguous zone* extends a further 12 miles beyond the territorial waters. The *continental shelf* political boundary has a length of 822 km. Over 200 km of this boundary is disputed by Bahrain, which also disputes Qatar's territorial waters and contiguous zone (discussed in section 7.6) (Figure 7.4).

Within the above legal zones, the offshore waters of Qatar are those where the hydrocarbon industry is located. These hydrocarbon exclusion zones cover a total area of 1262.5 km^2 (Table 7.2) and whilst they comprise about 5% of the offshore area of Qatar, their indirect effect on Qatar is significant and serious, affecting a much bigger area (discussed in section 7.3). A new zone is expected to be included in the Qatari offshore area. This is the Elf exploration area in their area of concession between the North Dome and Halul region (Figure 2.5B). Elf, in June 1991, have an oil well producing 1650 b.d. in their area of concession. A second well, 1200 m deep, is located in this area, tapping a reservoir in a limestone formation(152), could confirm that oil is present in commercial quantities, which would increase the sea use competition in Qatari waters.

The other zones in Qatari waters are security restricted zones, industrial restricted areas, political restricted areas, fishing areas, in- and offshore leisure areas and shipping lanes. In- and offshore areas are discussed in section 7.5 and are shown in Figures 7.1, 7.2 and 7.4. The result of studying these various zones shows they are as important as the land use - just as we found a lot of competition for land use, so there is a lot of competition for sea use, each of which could have a good or bad effect.

7.7.2 Competition for sea use

As discussed in section 7.5, the sea is viewed by the Qatari people as a gift from God - many of Qatar's resources come from the sea. These include its source of renewable fresh food (fish), marine transportation, leisure activities and fresh water supply - distillation plants. More than 60% of the state's revenue is derived from the offshore hydrocarbon industry. At the moment the offshore oil fields are not working to their full potential and it is envisaged that after the development of the North Dome gas field (Figure 7.1), there will be even more revenue from the offshore hydrocarbon industry. The above demonstrates how important the Qatari waters are for the state, and it follows that attention must be paid to preserving this resource. Planners need to check that the various zones of activity do not overlap with each other (Figure 7.2) especially in the case of the industrial zones. While having oil and gas fields close to the coastline is very convenient in many ways, it also could be a disaster if anything went wrong with these oil fields. This means that the highest standard of maintenance and equipment is necessary for the oil fields and they need to be closely monitored at all times to ensure there is no pollution which could affect the other sea uses.

In addition, the marine transport needs close scrutiny, especially the oil tankers. These need to be monitored all the time, especially when they are in Qatar waters, and they must be punished when they dump their refuse in the waters, especially when it is oil refuse. As shown in Table 7.3, the Halul region oil field's maximum lifespan could be about 40 years. This raises the question, what would Qatar do with the oil installations after the oil runs out from these fields? There are some similar studies worldwide regarding the above issue. There was a controversial study for the North

Sea installations, which said that when the North Sea oil runs dry, the platforms could be transformed into marine observation areas, after providing them with some alterations and cleaning operations. An existing example of this is Mexico, which, after the oil ran out at some of its offshore oilfields, transformed these installations into be marine park management areas. The above methods also seem to be successfully employed in Japan, as they built large installations in their offshore area, alongside the Japanese coastline, to attract fish to live in these manufactured environments. Fishing experts commented that the artificial installations offshore help to increase fish stocks by providing food and protection for the fish.[153]

Finally it must be said that protection of the sea uses cannot be achieved by each state in isolation in the Gulf: Thus, if Qatar follows a very advanced protective procedure for its waters but the other Gulf states do not take similar protective measures, Qatar cannot protect its sea use from the effects of nearby pollution and even if a small area of the Gulf waters are polluted, such pollution may affect Qatar and other parts of the Gulf. An example of this danger was demonstrated with the pollution that occurred in the 1980s, and more recently in 1991 (Figure 7.4). It follows that for enhancing the Gulf and keeping it clean there must be full co-operation amongst all Gulf states. Unfortunately, however, the Gulf Protection Committee in Kuwait does not achieve effective co-operation amongst the Gulf states. At the end of the Gulf war between Iraq and Iran there was a conference held by the Gulf states regarding the cleaning of the Gulf waters from the effects of the war (Figure 7.8). The above operation was cancelled because the concerned states felt that the cost of the operation would be too high, which shows the weakness of the Gulf Protection Committee.[154]

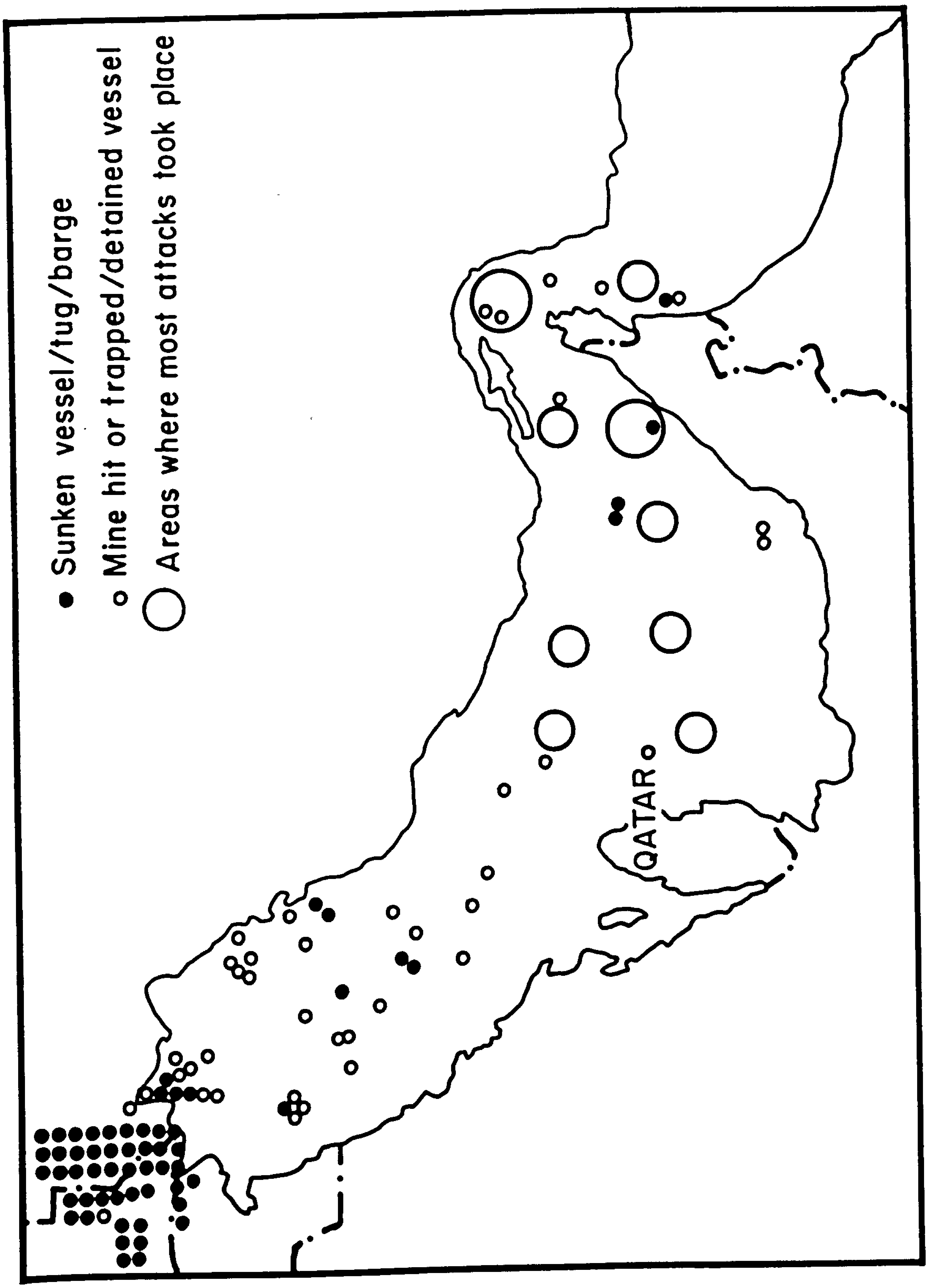


Fig. 7.8 Effects of the Iran-Iraq war on the Arabian Gulf, 1980-1988

References

1. Dr Riyadh, M, *The Gulf and the Gulfers pre 1930*, The Magazine of the Gulf and the Arabian Peninsula Studies, Kuwait, issue 36, October 1983, pp227-229.
2. Industrial Development and Technical Centre (IDTC), State of Qatar, Doha, 1981, p16.
3. Drysdale, A. and Blake, G., *The Middle East and North Africa*, Oxford University Press, 1985, p.111.
4. Awa'd, T M, *The international boundary for the offshore areas: Applied study for the Arabian Gulf*, Al-Exandria University Ph.D., 1974 (Arabic), p.277.
5. Op.cit., Dr Riyadh, M, pp228-229.
6. *Arrayah* Newspaper, issue No. 3479, Qatar, 14 March 1991, p.3.
7. Amin, S H, *International and Legal Problems of the Gulf*, Cambridgeshire, Amenas, 1981, pp201-202.
8. The Final Report of the Environmental Committee on 12 December 1980, pp2-3 and Appendix (letter establishing the Committee).
9. Shelton, R G J, Effect on Fisheries, ed. Cole, H.A., Petroleum and the Continental Shelf of North West Europe, Vol. 2, *Environmental Protection*, Essex, 1975, p80.
10. Molyneux, J A, The Government Viewpoint on Pollution from Offshore Oil, Activities and Emergency Plans, ed. Cole, H.A., Petroleum and the Continental Shelf in Nort West Europe, Vol.2, *Environmental Protection*, Essex, 1975, p59.
11. Ibid.
12. Alexander, L M, *Offshore Geography of North-Western Europe*, Chicago, 1963, p141.
13. Op.cit., Amin, S H, p210-211.
14. Interview with Mr A. Hussien, Qatar Environmental Protection Committee, 31 December 1991.
15. Correspondence with offshore Head Quarters, QGPC, Qatar, 23 June 1990.
16. Ibid.
17. Interview Mr. N. Jaidah, Technical Manager, QGPC Offshore operation on 16 May 1990.
18. Ibid.
19. QGPC, offshore operation, January 1985, p.9.
20. Ibid.
21. Interview with Mr M. Shaw, Technical Manager of Platform 3 (PS3), Bulhanine oil field, 22 May 1990.

22. Interview with Mr A. al-Mudfa'h, Manager of the Qatar Environmental Protection Committee, 6 June 1990.
23. Op.cit., interview with Mr. N. Jaidah.
24. Interview with Mr. H. A'Sheer, Public Co-ordinator in Halul Island, QGPC, 22 May 1990.
25. Ibid.
26. Personal contact with X, QGPC employee, 15 February 1990.
27. Op.cit., Interview with Mr M. Shaw.
28. Field work in Halul region, 22 May 1990.
29. Dr Al-Nauimi, N., *The legal regime for marine resources in the Arabian Gulf*, Ph.D. thesis, Dundee University, September 1987, p.268.
30. Interview with Mr A. Abdul Rahim, The Qatar Navy, 7 April 1991.
31. Op.cit., Correspondence with QGPC offshore operation.
32. Ibid.
33. Op.cit., QGPC, January 1985.
34. Doha palace, Document Office, Qatar Shell Oil Agreement of 1952.
35. Ministry of Finance and Petroleum, *Oil Industry in Qatar*, 1976, p.9.
36. Op.cit., Correspondence, QGPC, 23 June 1990.
37. Op.cit., QGPC, offshore operation, 1985, p.10.
38. Op.cit., Ministry of Finance and Petroleum, 1976, p.10.
39. Op.cit., Interview with Mr M. Shaw.
40. Ibid.
41. EL. Hakim, A, A, *The Middle Eastern States and the brim of the sea*, Manchester University Press, 1979. p.97.
42. Op.cit., Interview with Mr A. Abdul Rahim, The Qatar Navy.
43. The Shell Company of Qatar Ltd, *Oil Offshore*, Qatar 1969 p.4,9.
44. Op.cit., Ministry of Finance and petroleum, 1976, p.9.
45. Op.cit., field work.
46. Ibid.
47. Op.cit., Interview with Mr H. A'Sheer.
48. QGPC, Annual Report, 1987, p.24.
49. Op.cit., Interview with Mr H. A'Sheer, and field work.
50. Op.cit., field work.
51. Op.cit., Interview with Mr H. A'Sheer, and field work.

52. Op.cit., Interview with Mr H. A'Sheer, H.
53. Ibid.
54. Ibid.
55. Op.cit., Interview with Mr A. Abdul Rahim.
56. Sukar J.G, *The delimitation of the offshore ranges, for the coastal states in the Arabian Gulf*, Baghdad, 1980 (Arabic), p.330.
57. Ministry of Finance and Petroleum *Oil Industry in Qatar*, 1982, p.30, 31.
58. Op.cit., Interview Mr N. Jaidah.
59. Op.cit., Interview with Mr M. Shaw.
60. Op.cit., Interview with Mr A. Abdul Rahim.
61. Ibid.
62. Op.cit., QGPC *Offshore operations*, 1985, p.16.
63. Ibid.
64. Ibid p.10.
65. Op.cit., QGPC, 1987, p.27.
66. Confidential interview on 22 May 1990.
67. Op.cit., Interview with Mr A. A'Sheer.
68. Op.cit., QGPC, 1987 p.27.
69. Ibid, p.29.
70. Op.cit., QGPC, 1985, p.14.
71. Op.cit., Correspondence offshore H.Q, 14 May 1990.
72. El Mallak, *Qatar Energy and Development*, Croom Helm, London 1985 p.33.
73. Advertisement QGPC published in the *Herald Tribune* (South East Asia), 5 September 1989, p.2.
74. Ibid, p.3.
75. Ibid, pp.2-3.
76. Correspondence with QGPC H.Q in Doha, North Field project, 14 May 1990.
77. Ibid.
78. Institute of Petroleum, Qatar File 2.
79. Ibid.
80. Op.cit., Interview with Mr A. Abdul Rahim.
81. Sivasubtamaniam, K., Ibrahim, M., *Fisheries In Qatar*, Qatar, 1984 pp.9,10.
82. Lorimer, J.G., *Gazeteer of the Arabian Gulf*, Volume 6, 1908 (published and translated to Arabic by Doha palace), pp.1989, 1990.

83. Ministry of Municipal Affairs & Agriculture, Fisheries statistics, Qatar 1989 p.129.

84. Op.cit., Sivasutramaniam, K., Ibrahiam, M.

85. Field work questionnaire answered by 22 fisherman, 16 May 1990.

86. Ibid.

87. Personal contact with the fishermen in Qatar, 27 March 1991.

88. Ibid.

89. Ibid.

90. Ibid.

91. Final Report, Environmental Protection Committee, Qatar, 12 December 1982, p.3.

92. Ibid.

93. Op.cit., Interview with Mr A. al-Mudfa'h.

94. Ibid.

95. Interview with Professor M. Haruni, Consultant for IDTC for chemical and petrochemical industries in Doha, 24 May 1990.

96. Interview with Dr Quttub, Hamad Medical Corporation in Doha, 26 May 1990.

97. Op.cit., personal contact with fishermen in Qatar.

98. Correspondence with National Fishing Company in Qatar, 20 May 1990.

99. Op.cit., fieldwork questionnaire.

100. Op.cit., personal contact with fishermen in Qatar.

101. Ibid.

102. Op.cit., interview with Mr A. Abdul Rahim.

103. Op.cit., personal contact with fishermen in Qatar.

104. Op.cit., interview with Mr A. Abdul Rahim.

105. Op.cit., personal contact with fishermen in Qatar.

106. *Arrayah* newspaper, issue No. 3529,Qatar, 1 May 1991, p.8.

107. Op.cit., personal contact with fishermen in Qatar.

108. Ministry of Information, *The Development of the Industrial Sector in Qatar*, 1983, p.154.

109. Op.cit., Sivasubramaniam, K., Ibrahim, M.

110. Ministry of Municipal Affairs and Agriculture, Fisheries Statistics, 1989 p.13.

111. Ministry of Industry and Agriculture, Fisheries Statistics, 1980/81, p.21.

112. Interview with Mr G. Ghanky, Director of Doha Port, 9 June 1990.

113. Interview with Mr J. Sexton, QGPC, Marine Superintendent, 2 June 1990.

114. Ibid.

115. Op.cit., QGPC, *Offshore Operations*, 1985, p.11.

116. Llewelyn, Davies, Weeks, Forester, Walker and Bor, *Qatar Development Plan*, 11 April 1973, p.13.

117. Field work by author along the Qatari coastline, May-June 1990 and December 1991.

118. Op.cit., interview with John Sexton.

119. *Gulf Times* Newspaper, Vol x. issue No.2363 19 May 1990 Qatar, p.1.

120. *Arrayah* newspapers March 13 1991, p.10.

121. Op.cit., *Gulf Times*, p.1.

122. Op.cit., Ministry of Information, *The Development of the Industrial Sector in Qatar*, p.11.

123. Op.cit., Awa'd, T.M., p.306.

124. Op.cit., Al-Exander, L.M., p.3.

125. Ibid., p.7

126. Ibid., pp.10, 12

127. Ibid., pp.10, 112, 14, 16.

128. Ibid., p.59.

129. Op.cit., Sukar, J.G., p.353.

130. Op.cit., Dr al-Nauimi, N., *The Legal Regime for Marine Resources in the Arabian Gulf*, pp.254, 255.

131. op.cit., Awa'd, T.M., p.299.

132. Op.cit., Al-Exander, L.M., p.46.

133. Al Jabbir, M.H., *The Human Geography of Qatar*, M.A., Cairo University, 1977 (Arabic), p.290.

134. Ibid., p.291.

135. Op.cit., Al-Exander, L.M., pp.68, 69.

136. Op.cit., Awa'd, T.M., p.396.

137. Op.cit., El Hakim, A.A., p.202.

138. Dr Al-Nauimi, N., Legal experts - Government of Qatar (Fax on April 1st 1991).

139. *Arrayah* newspaper, (*Arrayah* weekly of Friday), issue no. 263, Qatar, 17 April 1992, pp.1, 2.

140. Ibid.

141. *Arrayah* newspaper, issue no. 3832, Qatar, 19 April 1992, p.1.

142. Op.cit., Awa'd, T.M., p.307.

143. Op.cit., Al Jabbir, M.H., p.293.

144. Op.cit., Sukar, J.G., p.326,329,330.

145. Ibid., Sukar, J.G., p.338,341,342.

146. The Economist Intelligence Unit, *Country Report No. 2*, 1989, p.18.

147. Ibid.

148. Op.cit., Al Jabbir, M.H., p.293.

149. *Al-Khaleej* newspaper, issue No. 4540, U.A.E., 13 October 1991, pp.1,17.

150. Op.cit., *Arrayah* newspaper, issue No. 3479, p.3.

151. Ibid.

152. Institute of Petroleum, Qatar File No.2.

153. *Arrayah* newspaper, issue No. 3197, Qatar, 10 April 1990, p.16.

154. Op.cit., interview with Mr A. Hussien.

Chapter 8

Conclusions

Tables

8.1 Hydrocarbon Land and Sea Use in Qatar

It could be argued that land use studies are a product of the experience of Western Europe and North America where dense populations compete for land of high value, and where land use conflict is commonplace, and that the concept of land use may be inappropriate in Qatar. Unlike the highly industrialised and intensively cultivated lands of much of Europe, Qatar has a small population, very little cultivation, and large areas of land in which there appears to be no productive activity, and therefore no land use problems.

The thesis demonstrates why study of the effects of the hydrocarbon industry on land use in Qatar is both appropriate and timely.

Qatar can no longer be categorised as a sparsely populated state. In certain areas of the country, such as in the Doha area and around the Umm Said industrial area, there is evidence of growing land use competition. The nature of this competition needs to be understood, and long term decisions need to be made regarding guidelines for future land use planning in the area. The Dukhan oil production region has a number of natural assets such as an attractive coastline, some moderate topography, and good vegetation for grazing. It would be a grave mistake to destroy these assets to a point where the region could never recover from the environmental ravages of the oil era.

The hydrocarbon industry occupies much more land than is generally appreciated, and indirectly affects considerably larger areas, from Dukhan on the west coast, stretching across to Umm Said and Doha on the east coast. The thesis offers a detailed, descriptive analysis of hydrocarbon industrial land use.

Attention is drawn to the gradual decline of unoccupied land as one of Qatar's great assets. Overall present land use by the hydrocarbon industry is considerable. This is seen most clearly in the Dukhan region. As an oil production region, the Dukhan field is expected to continue for several more decades, and perhaps longer as a strategic reserve for the North Dome gas field. Within a few decades, as production from the North Dome gas field continues to stimulate growth of petrochemical and associated industries, it is likely that land use competition, particularly between the industrial and leisure sectors, will intensify in most coastal locations. Coastal land adjacent to deep water will soon be at a premium.

An important feature of the thesis is to show the connections between the land use and sea use of the Qatar hydrocarbon industry.

The spatial impact of the offshore hydrocarbon industry has a major impact on the sea use of Qatar, affecting fishing, transport, security and leisure uses of Qatar's inshore waters. The oil fields and the North Dome gas field directly occupy sizable, if limited, areas of offshore Qatar, but indirectly control considerably larger areas. The effects of an accident or disaster in one of these fields could easily reach the Qatari coastline, as the average distance which separates them is short: only 90 km.

There are three hydrocarbon gathering points. These topological nodes are the focus of pipelines which transfer hydrocarbons downstream from the production regions. The onshore production region (Dukhan), and the offshore production regions

(Halul region's oil fields, North Dome gas field), have an onshore hydrocarbon gathering point: Umm Said downstream industry, and onshore oil terminal. A second gathering point for the onshore hydrocarbon pipelines is Doha. Pipelines also transfer hydrocarbons from the offshore oil fields to the offshore oil terminal on Halul island. Whilst these lines directly occupy only small areas of offshore Qatar, they have the potential to exert considerable influence.

Closer examination reveals that indirect land occupation is even more widespread, in that pipelines hinder the free movement of livestock and people in the desert. Pipelines pass near settlements and as the pipes carry a high rate of H_2S, they pose a potential threat to such settlements. Were this threat ever realised, indirect land occupation by the industry could be greater, and more terrain either side of the pipelines would be considered unsafe for human settlement and the industry would extend its occupation still further.

The hydrocarbon processing town of Umm Said, which has an onshore oil terminal, occupies land both directly and indirectly. The siting of the hydrocarbon industry at Umm Said has entailed the construction of first class roads which in turn have attracted other industries to the region, e.g. quarrying. Land occupation by such industries results from the existence of the oil industry in the region, and can therefore be considered as indirect occupation be the oil industry. Land despoiliation by the oil industry is a form of indirect land occupation.

Downstream from the town of Umm Said is a gas plant whose pipelines extend from the Halul region and from offshore (the North Dome region) to Umm Said. The gas plant provides energy and feedstock for the processing industry in Umm Said. This is an instance of the connection between other industries in Qatar and the hydrocarbon industry.

Doha, capital city of Qatar and where the majority of population lives, is the centre for hydrocarbon administrative and support services. Although direct land occupation by these services is small, key sites are occupied. The hydrocarbon pipelines also participate in delimiting some of Doha's southern boundary. The most significant factor relating land use in Doha to the oil industry is the massive urban expansion which was made possible by the oil revenues.

The choice of Qatar as a case study has enabled some interesting methodological advances to be made. A clear distinction has been identified between land occupation and land influenced by hydrocarbon activities. The term 'shadow' land use (see below) has been adopted to describe this situation, which may extend to apparently empty land. Another approach which may prove fruitful in future research is the automatic inclusion of 'sea use' studies alongside land use.

Discussed below are some further points which require more emphasis. These concern the hydrocarbon 'shadow' land occupation. An evaluation of the thesis in general, recommendations and research agenda also follow.

8.1.1. General Comments: The Hydrocarbon 'Shadow'

In Section 1.2, it was stated that the thesis uses five terms for measuring the effect of the hydrocarbon industry in land and sea use in Qatar: the direct and the indirect land occupation, sea use, land dedicated, and the shadow of the hydrocarbon industry.

The direct and indirect land occupation of the industry in Qatar is about 178.65 km^2, or about 1.56% of Qatar. The direct and indirect sea occupation by the offshore industry is about 1262.5 km^2, or approximately 5% of Qatar's waters (discussed in Chapters 2, 3, 4, 5, 6, 7).

During my fieldwork in the various regions which house elements of the hydrocarbon industry, both on and offshore, there was difficulty in obtaining any scientific assessment of the effects of the 'shadow' upon the environment. A few writers have paid some attention to the problem and below is a brief resumé of this work:

- Dr Al-Khyatt: *The Arabian Gulf City*, 1988, chapter 10, discusses pollution of water, air, noise pollution, pollution caused through transport and waste in the hydrocarbon industry, as well as exploring pollution in relation to urban growth.(1)

- The Industrial Development Technical Centre (IDTC) in Qatar has drawn up a report entitled *Environmental Assessment of the State of Qatar*, December 1983. This discusses air and water pollution in the state(2).

- Al-Mudfa'h, A., *The Role of the Environment in Administering Natural Resources*, Report 11/12 December 1989 discusses the methods of dumping liquid waste in the Umm Said industrial zone, with special emphasis on the cooling system(3).

The 'shadow', as defined throughout this thesis, has five major elements: evaporation, sedimentation, smell, noise and smoke. These are discussed below.

1. Evaporation

Evaporation is a common occurrence in Qatar which is an arid desert land with a climate that is very hot almost the whole year round and especially in the summer months (May to October). Consequently fieldwork was planned for the months of May and June 1990. Evaporation arose from two sources: firstly, during pipeline laying operations and also when the lines needed to be cleaned, chemically treated water is used (containing some noxious substances) which is subsequently discharged into the open lagoon from where it evaporates[4]. The second major source of hydrocarbon-loaded evaporation occurs on the land adjacent to oil and gas plants, hydrocarbon processing plants, and tank farms. These all use ponds for discharging liquid refuse which is a waste product of hydrocarbon production and the liquid usually contains some noxious materials[5]. In the hot climate, the discharged liquid evaporates into the atmosphere.

The second source of evaporation, described above, will continue as long as there are hydrocarbon producing and processing plants in Qatar, whilst the first source is a temporary event which ceases when the pipelines are in use. A subjective impression suggests that both sources of evaporation of hydrocarbon-laden materials could cause a certain amount of air pollution in Qatar.

2. Sedimentation.

As previously mentioned, the waste liquid which is produced during hydrocarbon production and processing runs into ponds around the plants and sedimentation occurs. Some of the liquid evaporates (see 1. above) and some soaks away to the underground water table. A subjective impression suggests that there could be a danger of pollution of the precious underground water reserves upon which Qatar largely depends especially for irrigation purposes.

3. Smoke and Dust

Smoke is a dominant feature of the hydrocarbon producing and processing industry in the regions both on and offshore(6), as shown in Plates 3.1 and 5.9. Again, as with evaporation, this could carry the threat of a degree of air pollution.

Dust is also a feature of hydrocarbon processing plants and other industries attracted indirectly to the area by the presence of the hydrocarbon resources are also conducive to dust formation in the atmosphere(7), e.g. the cement plant in Umm Bab (Dukhan region) (8) and the grain plant in the urban area of Umm Said (a residential area) (9) (discussed in Chapters 3 and 5).

4. Noise:

The noise caused by the hydrocarbon producing and processing plants is considerable, to the extent that in some plants the workers have to wear earplugs to reduce the effect (discussed in Chapters 3 and 5). In fieldwork during May and June 1990, it was found that whilst the noise was considerable, and constituted noise pollution, this pollution was restricted to the area of the plants(10).

5. Smell

The shadow of the pollution of smell is one of the main features of the hydrocarbon industry, both on- and offshore. The main areas suffering pollution are Dukhan, Umm

Said and Halul island (offshore)[11] and the main factors are described above, i.e. evaporation, smoke, etc. which contain some H_2S, whose smell (bad eggs at low concentration) makes life unpleasant in the regions of hydrocarbon industry, especially during hot, calm, humid weather.

The above demonstrates the many ways that the shadow of the hydrocarbon industry makes itself felt and seen in Qatar. Recommendations for ameliorating the problem are discussed in Section 8.2.

8.1.2. Methodological Comments

Undertaking this thesis, although there are many studies concerning land and sea use worldwide, some of which are discussed in Chapter 1, it became clear that there was little literature regarding the subject under examination and it became apparent that there was a need for such work. It is perhaps time for geographers to look seriously at the effects of extractive industry on land and sea use. This is particularly important as oilfields come to the end of their natural life (Table 8.1).

Table 8.1:
Comparative Table of Oil Field Reserves for Qatar and some GCC States

States	Oil reserve by million barrels	Maximum production of oil b.d.	Life span by years
Qatar	2640	570,000	33
Oman	4,075	597,000	19
Bahrain	180	42,000	15

Sources:

1. Correspondence with QGPC on and offshore operations on 14 May 1990.
2. *Arab Oil and Gas Directory*, published by the Arab Petroleum Research Centre, Paris, 1989, pp. 64-65, 297, 315.

To date, little study appears to have been given to the consequences of oilfields whose resources have run out. Even after an oil field has run out, the abandoned wells can sometimes still have a bad effect on the surrounding area. For example in Texas, an oil well beside agricultural land used to be a blessing, but after the oil well is abandoned, the oil well can turn into a curse. When the well is first sunk, it may pass through a brackish aquifer. During the period of extraction, pressures are maintained to keep everything under control. After the well dries up, it is usually plugged with concrete. However, the concrete plug does not prevent the seepage of brackish water to the surface.[12] This can result in the destruction of agricultural land in the immediate vicinity of the well. This is an issue which needs to be addressed in Qatar when abandoning an oil well.

It is time serious consideration were given to this subject - see Table 8.1. In order to take this subject further, the author tried to visit some GCC oil fields and also oilfields onshore in England but, for security reasons and because of the fear of criticism about the adverse environmental effects, permission was not granted for fieldwork in either case.

During this research, existing land use theories have not proved of particular relevance, despite the fact that an extensive literature search was undertaken on the subject, e.g. Found, W.C., *A Theoretical Approach to Rural Land Use Patterns*, 1971, in which chapter 2 examined the 'normative economic models of optimum land use at particular locations'. Funnel D.C. discussed the role of small service centres in regional and rural development with particular reference to Eastern Africa. (ed. Gilbert, A). *Development Planning and Spatial Structure*, Whyte, R.O., 1976, *The*

Spatial Geography of Rural Economies 1982 has as its objective a study of present discreet and contrasting examples of various areas, namely monsoon and equatorial Asia, and examines the subject from the point of view of agriculturalists concerned with promoting and sustaining growth in farming enterprises.

In 'The Urban Land Use Question', Roweis, S.T., and Scott, A.J., in *Urbanisation and Conflict in Market Societies*, (ed. Cox, K.R.), 1978, discuss 'the phenomenon of contemporary urban land development and the characteristics of the problems with which it is associated.' Nevertheless, some of the above have been valuable and have some relevance to the urban study of Doha City (hydrocarbon administrative and supporting services).

Sea use theory appears to be at a very early stage of development, despite the fact there has been a large amount of work already done on sea use in general, and relating to Western Europe and North America in particular. A pioneer work by Smith, H.D., *The Application of Maritime Geography* has two main areas of study: the integration of human activities in the management of the sea; and an examination of the overall structure and operation of management in the wider social context (here termed 'general management'), Vallega, A., in Smith, H.D., (ed.) *The Development of Integrated Sea Use Management* 1991.

There are strong arguments for the approach taken in this thesis which was to study integrated land use, relating closely to the various phases so that each sector/section goes some way to explaining the land use in other sections (these are: Chapter 3: Dukhan - the producing region; Chapter 4: land use and onshore pipelines; and

Chapter 5: Umm Said - downstream land use). It was difficult to find time to examine each sector in the detail it deserved (discussed in Section 8.3).

It is hoped that this thesis alerts decision-makers, managers and planners to the importance of land use evaluation, especially taking into consideration the future pressures of population, economic change and environmental problems.

At the same time it is recognised the research conducted on the scale and in the detail necessary for this thesis alone may not permit detailed land use decisions, especially as the absence of first class detailed maps of the urban areas, in particular Dukhan and Umm Said, impeded my research. Several maps of the land studied for this thesis had to be built up painstakingly from inadequate sources (air photographs) and from my own fieldwork (discussed in Section 8.2).

8.2 Recommendations

1. Qatar should have a first class national land use Master Plan at a scale not less than 1:50,000.

2. Many accidents between motorists and camels resulting in many fatalities have occurred on the roads between Dukhan and Doha, Dukhan and Umm Bab and Umm Bab and Salwa (Figure 4.1). Accordingly, it is time to fence these roads, especially known blackspots. Fencing could also be applied to other areas in Qatar.

3. Dumping areas are scattered throughout the region, notably in Dukhan which is a major hydrocarbon producer, and in Umm Said where processing of hydrocarbon materials is a major industry. To reduce the environmental impact of the above industries, the government should take firm action to control dumping.

4. The processing plants in Umm Said should be under continuous scrutiny in order to protect the land and sea from non-authorised dumping of noxious materials, such as chemicals. For example, when the Qatar Fertiliser Company in Umm Said released a large quantity of ammonia into the sea in 1989, the result was the death of a large number of fish [13]. A law is required with heavy punishments to discourage such activities.

5. There is a conflict of different uses of the sea zones (Figure 7.2). Uses are now overlapping and it is time to examine this problem - the various zones need studying, e.g. oil industry zones, fisheries and leisure activity zones. Protection of the Gulf can only be achieved with full co-operation from all Gulf States.

6. The Qatar-Iran agreement. News of the agreement was first revealed in November 1991. The agreement concerns the drawing of water from the Qaroun river (in Ahwaz province) by pipelines, some 770 km long, approximately 560 km of which is in Iranian territory, and the remaining 210 km along the seabed of the Gulf between Iran and Qatar. The amount of water piped will be approximately 2.5 cubic metres per second. There was no prior intimation of the agreement[14] until it came into effect and it is important that clear, precise and comprehensive details of the agreement are published, e.g. the economic cost, rights of both

states, etc.. If the project is successful, Qatari land will increase in value considerably as surplus water would be available to enable the state to develop agriculture and to aforest tracts of land, as well as other land uses which become possible with a water supply.

7. Some of the huge levels of production of gas from the North Dome could be utilised to provide energy for new water distillation plants. If this proved cost-effective, Qatar could employ some of the water for developing agriculture and could even consider the possibility of re-injecting surplus distilled water to top up the levels of fresh water in the underground water tables. This would not only serve to increase this water reserve but would reduce the salinity of well water.

8. Qatar is a relatively small state, with a small population but its population density is very high - 44 people per km^2 (15) which makes is the third highest density in the Arabian peninsula states (16). The implications of this need to be seriously considered for the future.

9. The proposed Ras Laffan project should incorporate a large area or areas of green such as a forest around it, especially in the south as the dominant winds in Qatar are northern and north western and such a forest would help to minimise the industrial effects of the project on Qatar's other settlements (17) (Figure 2.9).

10. The proposed Ras Laffan project needs to be considered seriously not only as another industrial location is needed, but also in terms of reducing Doha's urban population. Concentration of the population in one urban area - the secondary settlements of Qatar are in the towns of the northern part of the peninsula

(Figure 2.9) - is undesirable and the project could defuse the adverse effects of overpopulation for Doha. This could mean a degree of decentralisation and more balance in land planning in the peninsula.

11. It was very evident during fieldwork and interviews with QGPC specialists, and other specialists, and from documents in Qatar and abroad that Ras Laffan has the potential to be developed in a similar way to Jabal-Ali in Dubai. In fact, Qatar has more favourable factors than Jabal-Ali, such as a readily available energy supply. Serious consideration should be given to co-operation with Jabal Ali to avoid duplication. The results might benefit both states.

The above points lead inevitably to the conclusion that it is now time for Qatar to have a landuse planning organisation on a national, urban and rural scale, as has already been done by some Middle Eastern states where land use is planned not only as a whole but in great detail - the land use of every square foot being considered carefully in the national interests.

It is possible that with the help of government the Dukhan region could still survive after the oil era if industry is created which does not depend on the hydrocarbon industry. Power of some sort, of course, would be required but it is possible that non-associated gas could be re- injected in the Khuff formation in Dukhan field from Umm Said by pipelines (Figure 4.1).

The development of tourism also offers possibilities for future development for the area, but requires investment in restaurants, services and the building of holiday villas, or chalets, for rent, etc..

To attract tourists and also to improve the environment and provide some means of livelihood, more vegetation needs to be introduced to the area. For instance, the planting of trees appropriate to the climate and soil, such as palm trees, would improve the appearance of the land, prevent loss of top soil and provide food and employment for people. It is obvious that the environment also needs protecting from uncontrolled grazing and indiscriminate use of four wheel vehicles. The government could also introduce some very good fishing method for the region.

At the moment the government owns all the land and this lack of private ownership inhibits private investment. Were the government to sell land to the private sector this would encourage permanent settlement and commercial investment in the area. The government must make the purchase of land contingent upon its commercial or residential use and a time limit must be set upon the owners within which development must take place. The Private Ownership Programme has been successfully employed in Saudi Arabia's oil towns (18) and the same could be applied to Dukhan, after a thorough study of Dukhan because each country has different circumstances. Also, as shown in Plate 8.1, Dukhan's abandoned airport is the first airport built in Qatar's history. This building should be well looked after and developed as an air museum.

As has been shown above, the effect of the hydrocarbon industry is far reaching, both in terms of its future effect on the landscape and on land directly and indirectly occupied by the industry's plant. Regarding land use generally in the Umm Said region, the area is still capable of major industrial expansion, possibly to more than twice its present level but the Government would have to allow private land ownership in the region to encourage the workforce to settle locally.

In addition, the Government could build public sector houses and let them at nominal rents which would encourage the various plants to accommodate their workforce in the region, e.g. such as the old houses rented in Umm Said.[19] This would be a positive step in many ways for it would reduce the pressure on the demand for housing in the capital and also be economical in energy terms as commuting daily is expensive on fuel. It would reduce the pressure on the Doha-Umm Said road which has many accidents on it (discussed in chapter 5, section 5.7.1). It would be much cheaper for the various companies and the government to have the workforce reside in Umm Said rather than in the capital, Doha, or Wakrah.

Thirdly, it would be a good idea if the Government enhanced public services in the region to encourage an increase in investment by the private sector in Umm Said.

Plate 8.1: *Dukhan Airport, built in the late 1930s by QPC. This was the first airport in the history of Qatar, abandoned in 1959 after the opening of Doha International Airport. The building could become an air museum.*

8.3 Research Agenda

As previously discussed, not all the themes in this thesis received the attention they deserved, and further research is required. For instance, the villages in the Dukhan region would bear more study, a full grazing survey of the Dukhan region would be useful, and a full environmental study of the impact of the hydrocarbon processing plants of the town of Umm Said upon both land and sea would be valuable. Future research could take the form of a comparative land use study in the area of Umm Said and Ras Laffan. In addition, Greater Doha would provide enough material for a full thesis on urban land use in itself. There is also much that needs to be examined on the various sea uses in Qatar, and in the Gulf region as a whole.

References

1. Dr. Al-Khyat, H., *The Arabian Gulf City*, Qatar University, Qatar, 1988 (Arabic), pp.410, 416, 421, 422, 424, 425.
2. I.D.T.C. Environmental Assessment of State of Qatar, December 1983, pp.9, 12.
3. Al-Mudfa'h, A., *The Role of the Environment in Administering the Natural Resources*, Report, Doha, 11/12 December 1989, p.5.
4. Interview with Mr Al. al-Mudfa'h, Manager of Qatar's Environmental Protection Committee, Doha, 6 June 1990.
5. Fieldwork by the author in the hydrocarbon regions, May and June 1990, and December 1991.
6. Ibid.
7. Interview with Mr A. Abdul Rahman, Deputy General Manager, Qatar Petrochemical Company Ltd, Umm Said, 24 January 1991.
8. Interview with Mr A. al-Khazeen, senior staff member of the Umm Bab Cement plant, 18 May 1990.
9. Interview with Mr A. Sadiq, Manager of the grain plant, Umm Said, 25 May 1990.
10. Op cit, fieldwork.
11. Ibid.
12. CBS News, 25 May 1992.
13. Interview with Mr A. Hussien, of the Environmental Protection Committee, 31 December 1991.
14. *Arrayah* newspaper, issue no 3699, 16 November 1991, pp.8-9.
15. World Population datasheet, Population Reference Bureau Inc., Washington D.C., 1991.
16. Dewdney, J., 'Population', ed Blake, G., Dewdney, J., Mitchell, J., *The Cambridge Atlas of the Middle East and North Africa*, Cambridge University Press, 1987, p.45.
17. Ministry of Industry and Public Works, Department of Industrial Affairs, '*Qatar's experience in choosing and developing industrial areas*', Qatar, 20 December 1989, p.10.
18. Al-Elawy, I.S., 'The Influence of Oil upon Settlement on Al-Hasa Oasis in Saudi Arabia', Ph.D. thesis, Durham University, 1976, p.95.
19. Op.cit., fieldwork.

Appendix 1

Questionnaires used in the study

إستمارة مدينة دخـــان
DUKHAN QUESTIONNAIRE

TIME ....الزمان PLACE..........المكان

١] اسئلة شخصية .... Personal Questions

الحرفة .... Occupation

الجنسية .... Nationalty

مكان السكن .... Place of residence

مكان السكن في الإجازة الإسبوعية اذا كان مختلـف ....
....
Place Of Weekend Residence If different ....
....

٢] الرحلة الى العمل Journey To The Work

مقـر العمل .... Place Of Work

المسافة التي تقطعها الى العمل ----- كـم ----- ميل
The Distence To Work Km.( ) Mil.( )

الوقت الذي تحتاجه للوصول الى العمل ( ) ساعة و ( )دقيقة
What is the time you may need to reach work H.( ) M.( )

٣] هل تزور الدوحه تكراراً ؟ ( ) نـعـم ( ) لا
Do you vist DOHA frequently YES ( ) NO ( )

٤] ما هو الغرض من زيارتك للدوحه ؟ Purpose of visting DOHA

التسوق ( ) Shopping

اعمال تجاريـة ( ) Bussines

زيارات إجتماعية ( ) Social

التسـليـة ( ) For Recreation

لزيارة المستشفيات و العيادات ( ) Hospitel & Clinc

٥] هل تتوقع بعد التقاعد ان تقيم في مدينة دخـــان ؟
Do you expect to stay after retired in DUKHAN ....
نعـم ( ) YES لا ( ) NO

٦] هـل تمارس هـواية صيد السمك ؟ Do you go for fishing

YES ( ) نعم NO ( ) لا

اذا كان نعم ما اسم المكان الذي تتردد عليـة و اين موقعة ؟
If Yes please name the place that you go to and the location

إستمارة مدينة ام سعيد
UMM SAID QUESTIONNAIRE

TIME ....الزمان   PLACE............المكان

١] اسئلة شخصية
Personal Questions ....

Occupation .... الحرفة

Nationalty .... الجنسية

Place of residence .... مكان السكن

مكان السكن في الإجازة الإسبوعية اذا كان مختلف ....
....
Place Of Weekend Residence If different ....
....

٢] الرحلة الى العمل
Journey To The Work

Place Of Work .... مقر العمل

المسافة التي تقطعها الى العمل   ----- كم   ----- ميل
The Distence To Work   Km.(   )   Mil.(   )

الوقت الذي تحتاجه للوصول الى العمل (   ) ساعة و (   )دقيقة
What is the time you may need to reach work H.( ) M.( )

٣] هل تتوقع بعد التقاعد ان تقيم في مدينة ام سعيد ؟
Do you expect to stay after retired in UM SAID ....
نعم (   ) YES   لا (   ) NO

٤] هل تزور الدوحه تكراراً ؟   (   ) نعم   (   ) لا
Do you vist DOHA frequently   YES (   )   NO (   )

٥] ما هو الغرض من زيارتك للدوحه ؟
Purpose of visting DOHA

Shopping (   ) التسوق

Bussines (   ) اعمال تجارية

Social (   ) زيارات إجتماعية

For Recreation (   ) التسلية

Hospitel & Clinc (   ) لزيارة المستشفيات و العيادات

٦] هل تمارس هواية صيد السمك ؟
Do you go for fishing

YES (   ) نعم   NO (   ) لا

اذا كان نعم ما اسم المكان الذي تتردد علية و اين موقعة ؟
If Yes please name the place that you go to and the location

إستمارة مدينة الدوحة
DOHA QUESTIONNAIR

TIME ....الزمان   PLACE...........المكان

١] اسئلة شخصية .... Personal Questions

الحرفة .... Occupation

الجنسية .... Nationalty

مكان السكن .... Place of residence

مكان السكن في الإجازة الإسبوعية اذا كان مختلف ....
....
Place of Weekend Residence If different.....................
....

٢] الرحلة الى العمل   Journey To The Work

مقر العمل .... Place Of Work

المسافه التي تقطعها الى العمل   ----- كم ----- ميل
The Distence To Work   Km.(   )   Mil.(   )

الوقت الذي تحتاجه للوصول الى العمل (   ) ساعة و (   )دقيقة
What is the time you may need to reach work H.( ) M.( )

٣] هل تتوقع بعد التقاعد ان تقيم في مدينة الدوحة ؟
Do you expect after retired to stay in DOHA
) YES   نعم (   ) NO   لا (

٤] هل تحتاج الى زيارة الادارات الاخرى التابعة للمؤسسة في الدوحة   نعم (   )   لا (   )
(اذا كانت الاجابة بنعم حدد اسماء الاماكن)

Do you need to go to the other QGPC Offices at DOHA
Yes (   )   No (   )
If Yes Please name the places .

٥] هل تمارس هواية صيد السمك ؟   Do you go for fishing

YES (   ) نعم   NO (   ) لا

اذا كانت الاجابة بنعم حدد اسماء الاماكن و موقعها ؟
If Yes please name the place that you go to and the location

إستمارة منطقة المناعات الهيدروكربونية البحرية
Hydrocarbon Industrial Area QUESTIONNAIRE

TIME ....الزمان   PLACE............المكان

١] اسئلة شخصية
Personal Questions .... اسئلة شخصية
Occupation .... الحرفة
Nationalty .... الجنسية
Place of residence .... مكان السكن
مكان السكن في الإجازة الإسبوعية اذا كان مختلف ؟..........
....
Place Of Weekend Residence if different ....
....

كم المدة التي تقضيها في العمل داخل البحر ؟

How long do you stay at work Offshore

٢] الرحلة الى العمل
Journey To The Work

Place Of Work .... مقر العمل

المسافة التي تقطعها الى العمل   ----- كم   ----- ميل
The Distence To Work   Km.(   )   Mil.(   )

الوقت الذي تحتاجة للوصول الى العمل (   ) ساعة و (   )دقيقة
What is the time you may need to reach work H.(   ) M.(   )

ما وسيلة الانتقال التي تستخدمها للعمل ؟

What kind of transportation do you use to get to the work ؟

٣] اين ستقيم بعد التقاعد ؟
Where do you expect to stay after retirement
لا (   ) NO   نعم (   ) YES

٤] هل تمارس هواية صيد السمك ؟
Do you go for fishing

YES (   ) نعم   NO (   ) لا

اذا كانت الاجابة بنعم حدد اسماء الاماكن و موقعها ؟
If Yes Please name the place that you go to and the location

General Questionnaire for Fishermen

1. Do you go fishing?

   Yes ☐ No ☐

2. Do you go fishing in the sea or on the coast only?

   ____

   ____

   If you fish on the sea, can you name the places and locations?

   ____

   ____

   ____

   ____

   If you fish on the coast can you name the places and locations?

   ____

   ____

   ____

   ____

استمارة عامة لهواة صيد السمك

١ - هل تذهب لصيد السمك ؟ ( ) نعم ( ) لا

٢ - هل تذهب الى الصيد داخل البحر او على الساحل فقط ؟

اذا كان في البحر هل من الممكن ان تصف موقع المكان واسمة ؟

اذا كان على الساحل هل ممكن ان تصف موقع المكان واسمة ؟

Appendix II

Table of Figure Sources

Table of Figure Sources

Figure 1.1	Drawn by Arthur Corner, Department of Geography, University of Durham, 1992
Figure 2.1	Redline obtained from Doha Palace, Documents Office, May 1990.
	The Areas of Concessions
	Shahdad, M., *The progress of the relationship between oil companies and the Arabian Gulf states since the beginning of the oil concessions in the region up to 1973*, Qatar National Prints, Qatar, 1985 (Arabic), pp.28, 61, 87, 106, 123, 151, 158, 160.
	Longrigg, S., *Oil in the Middle East*, Second Edition, Oxford University Press, London, 1981, Map between pages 236 and 237.
Figure 2.2	Doha Palace, Documents Office, *The Area of 1935 Oil Agreement.*
Figure 2.3	The Administration of Petroleum Affairs, Qatar Petroleum Map, scale 1:750,000.
Figure 2.4	Metwalli, M., *The Arabian Gulf Basin*, second part, Anglo Egyptiam Publishers, Egypt, 1981, p.568.
	Public Records Office, Foreign Office, May 1955.
Figure 2.5A	The Administration of Petroleum Affairs, Qatar Petroleum Map, Scale 1:750,000.
Figure 2.5B	QGPC, Annual Report, 1987, p.32 and updated by correspondence with QGPC in May 1990.
Figure 2.6	Ministry of Finance and Petroleum, *Oil Industry in Qatar*, 1982.
	QGPC, *Annual Report*, 1987.
	Sukar, J.G., *The Delimitation of the Offshore Ranges for the Coastal Gulf States in the Arabian Gulf*, Baghdad, 1980 (Arabic), p.391.
	Correspondence with QGPC, 5 June 1991.
	Al-Dabbagh, M., *Qatar Past and Present*, published by Dar al-Atalea'h, Beirut, 1961 (Arabic), p.196.
Figure 2.7	Al-Jabbir, M., *The Human Geography of Qatar*, M.A., Cairo University, 1977 (Arabic), p.143.
	United Nations, *The Population Situation in ECWA Region (Qatar)*, United Nations Economic Commission for Western Asia, Beirut, 1980, p.10-4.
	State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, *Annual Abstract*, July 1983, issue 3, and July 1991, issue 11.
	Interview with Mr. A. Mostafa, Central Statistical Organisation, Doha, 1 January 1992.
Figure 2.8	State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, *Annual Abstract*, issue 11, July 1991, p.20.
Figure 2.9	State of Qatar, Presidency of the Council of Ministers, Central Statistical Organisation, *Annual Abstract*, issue 11, July 1991, p.12.
Figure 3.1	State of Qatar National Museum.
Figure 3.2	State of Qatar, Ministry of Public Works, Sheet No.1530, 1535, 1540, 1545, scale 1:100,000, 1980. Updated by author's fieldwork in Dukhan in May, June 1990 and December 1991.
Figure 3.3	QGPC, *Onshore Operation*, Petroleum Engineering Department, Dukhan Field, Dukhan, 1 July 1980, pp.24, 28, 33.

Figure 3.4	QGPC, *Onshore Operation*, Petroleum Engineering Department, Dukhan Field, Dukhan, 1 July 1980, pp.24, 36, 39.
Figure 3.5	(A) QGPC, Petroleum Operations Department, Dukhan Field, scale 1:50,000, 12 March 1990.
	(B) Map of Asab Oil Field, Abu Dhabi Company of Onshore Oil Operations (ADCO), February 1988, scale, 1:50,000.
Figure 3.6	QGPC, Onshore Operations, Confidential Report, 12 August 1989, pp.19, 21, 23.
Figure 3.7	State of Qatar, Ministry of Public Works, sheet no. 1535, 1540, in 1980. Updated by aerial photograph, 1987 and by author's fieldwork in May, June 1990 and December 1991.
Figure 3.8	QGPC, Onshore operations, scale 1:2000, May 1989, Dukhan Camp, scale 1:6000, July 1989, and for future constructions, interview with Mr K. al-Sohoti, QGPC Senior Staff, in Dukhan, 21 May 1990.
Figure 4.1	QGPC, Offshore Area of Concessions, scale 1:500,000, January 1988, correspondence with QGPC in May 1990 and author's fieldwork in May, June 1990, and in December 1991.
Figure 4.2	Author's fieldwork in May 1990.
Figure 4.3	Author's fieldwork in May 1990.
Figure 5.1	Admiralty Chart, Umm Said and Doha, scale 1:50,000, sheet no. 3787, in 1987
Figure 5.2	Umm Said Industrial Complex, scale 1:20,000, October 1987, updated by author,s fieldwork in May, June 1990, December 1991.
Figure 5.3	H.H. The Ruler of Qatar, sheet no. 1750/570, 1750/510 and 1730/630, scale 1:10,000, photograph survey from aerial photographs by Hunting Survey Limited, October 1968.
Figure 5.4	Map of Umm Said Industrial Complex, scale 1:20,000, October 1987, sheet USIAP-002, drawn by Ahmad Iut, October 1987.
Figure 5.5	Umm Said Residential Area (Qafco Confidential), scale 20cm:1km, 17 January 1982 and updated by author's fieldwork in May, June 1990 and December 1991.
Figure 5.6	Collected from QGPC, North Field Development Project Office, January 1992.
Figure 5.7	Collected from QGPC, North Field Development Project Office, January 1992.
Figure 6.1	Dr Al-Khyat, H., *The Arabian Gulf City*, Qatar University, p.233 (Arabic).
	State of Qatar, Ministry of Municipal Affairs and Agriculture, Doha City Street Map, approximate scale 1:18,000m, 1990.
Figure 6.2	State of Qatar, Ministry of Municipal Affairs and Agriculture, Zone and Street Guide - Doha City, 1990, p.14. 15.
Figure 6.3	Landsat maps for Qatar in 1973, 1987.
Figure 6.4	State of Qatar, Ministry of Municipal Affairs and Agriculture, List of Land Purchase, Land Area and No. of Land Parcels.
Figure 6.5	QARS (Qatar Area Reference System), sheet no. 2340/3925, 2350/3920, 2350/3925, 2350/3930, scale 1:1000, 1985. Updated by aerial photographs of Doha and by author's fieldwork in May 1990.
Figure 6.6	QGPC, Offshore Operations, Map of Doha, Location of QGPC (Offshore) staff accommodation, scale 1.5cm:250m, 1985; author's fieldwork in Doha City, May, June 1990.
Figure 6.7	QARS, Doha Map, scale 1.6cm:250m; authors fieldwork, May, June 1990; Admiralty chart Umm Said to Ras Laffan, scale 1:50,000, 1989; Ministry of Justice, Department of Legal Affairs, Official Journalm periodical no.10, Doha, September 1988 (Arabic),

p.5; Llewelyn Davies, Weeks, Forster, Walker and Bor, *Qatar Development Plan*, 11 April 1973, p.19.

Figure 7.1 Admiralty chart, Strait of Hormuz to Qatar, scale 1:75,000, sheet no.2837, in 1982; Ministry of Communication and Transport, Department of Ports, *Ports of Qatar*, (n.d.), pp.14, 21, 22; Interview with Mr J. Sexton, QGPC Marine Superintendent, 2 June 1990.

Figure 7.2 Interview with Mr A. Abdul Rahim, The Qatar Navy, 7 April 1991 (Safety Zone around each platform is 5 nautical miles); 20 Fieldwork questionnaires distributed to professional fishermen in May 1990, of which 16 were returned; interview with Mr J. Sexton, QGPC Marine Superintendent, 2 June 1990.

Figure 7.3 Admiraly chart, Jazirat Das and Jazirat Halul, scale 1:50,000, sheet no.3953 in 1980; author's fieldwork on Halul island in May 1990; QGPC Annual Report, 1987, p.28.

Figure 7.4 Sukar, J.G., *The Delimitation of the Offshore Ranges for the Coastal States in the Arabian Gulf*, Baghdad, 1980 (Arabic), pp.321, 327, 339, 351; Dr Al-Nauimi, N., *Legal Experts - Government of Qatar*, fax on 1 April 1991; *Arrayah Newspaper*, issue no. 3506, 4 April 1991, p.4; Final Report, Environmental Protection Committee, Qatar, 12 December 1982, pp.1, and some maps between pages 21-22.

Figure 7.5 *Qatar, A Major Gas Producer*, Qatar Gas (n.d.), p.12, QGPC Offshore Operations, January 1985, p.32.

Figure 7.6 QGPC, Annual Report, 1987, p.44-45.

Figure 7.7 Sivasubramariam, K., Ibrahim, *Fisheries in Qatar*, M.A., Qatar University, 1984, pp.125-130.

Figure 7.8 Provided by Mr Ahmed Hussien, Qatar Environmental Protection Committee, 31 December 1991.

Bibliography

Books

Abdo, S., *The Basis of Transport Geography*, Anglo Egyptian Library, Cairo, 1988 [Arabic].

Dr. Abdul Hakim, M., Dr. Khalil, Y., Dr. Grease H., Dr. Al- Sa'bai, A., *The Arab World [Land - People - Resources]*, Anglo Egyptian Library, Cairo, 1983 [Arabic].

Abler, R., Adams J.S., Gould, P., *Spatial Organization*, Prentice/Hall International Inc., London, 1972.

Dr. Abu Ai'anah, F., *Population Geography*, 2nd Ed., Dar Al-Hahzah Al-Arabiah, Beirut, 1980 [Arabic].

Dr. Abu al-Ila', M., *The Geography of the Arabian Peninsula*, Part One, Anglo Egyptian Library, Cairo, 1981 [Arabic].

Dr. Abu al-Ila', M., *The Geography of the Arabian Peninsula*, Part Two, Kingdom of Saudi Arabia, 5th Ed., Anglo Egyptian Library, Cairo, 1986 [Arabic].

Al-Abdullah, Y.A., *Study of Qatari-British Relations, 1914-1945*, Orient Publishers, Translation, Qatar, 1981.

Al-A'had Book, *Qatar and Its Oil Wealth*, Al- A'had, Ca., 1983 [Arabic].

Dr. Al-Ali, A., *Energy and the Petroleum and Gas Industry in the Arab Gulf Countries Present and Future*, University of Basrah, Basrah, 1985 [Arabic].

Al-Aqa'd, S., *The Political Trends in the Arabian Gulf*, Anglo Egyptian Library, Cairo, 1983 [Arabic].

Dr. Al-Betar, N., *The Economic Theory, and the way to the Arab Unity*, Ma'had Al-Enma' Al-Arabi, 1st Ed., Beirut, 1978 [Arabic].

Al-Dabbagh, M., *Qatar Past and Present*, Dar al- Ata Lea'h Publishers, Beurit, 1961 [Arabic].

Al-Eyd, K.A., *Oil Revenues and Accelerated Growth*, Praeger Publishers, New York, 1979.

Dr. Al-Issa, J., *Qatari Society*, Qatar University, 1st Ed., Qatar, 1982 [Arabic].

Dr. Al-Kurdi, M., Dr. Al-Issa, J., Dr. Mojahid, H., *Doha: The City State*, Qatar University, Qatar, 1985 [Arabic].

Dr. Al-Kuwari, A., *The Role of the Public Projects in The Economic Development*, Al-Majles Al-Watani Lil-Sakafah, Fi- non, and Adab, Kuwait, 1981 [Arabic].

Dr. Al-Khyat, H., *The Population Balance for the Arabian Gulf States*, Qatar University, Qatar, 1982, [Arabic].

Dr. Al-Khyat, H., *The Arabian Gulf City*, Qatar University, Qatar, 1988 [Arabic].

Dr. Al-Leethy, M., *The Economic Development*, Dar Al-Gama't, Alexandria, 1979 [Arabic].

Al-Mansaur, M., *The Political Progress in Qatar, 1916/1949*, Dar al-Salsil, Kuwait, 1979 [Arabic].

Al-Misand, S., *The Development of Modem Education in the Gulf*, Ithaca Press, London, 1985.

Al-Noor, Book, *The Economic and Social Structure in Qatar*, Advertising, Translation, Publication, Qatar, 1984 [Arabic].

Al-Noor, Nook, *Industry in the Gulf Co-operation Council States*, Advertising, Translation and Publication, Qatar, 1986 [Arabic].

Al-Othaman, *With Their Bare Hands*, Longman, London, 1984.

Al-Salem, F., Dhahar, A., *Expatriate Labour in the Gulf*, That Al-Salasel Publishers, Kuwait, c.1981 [Arabic].

Dr. Al-SaQar, F., *The Industrial Geography in the World*, Wukalata Al-M'atbua't, Kuwait, 1980 [Arabic].

Dr. Al-Sharief, A., *The Geography of The Kingdom of Saudi Arabia*, Part One, Dar Al-Mariekh, Riyadh, 1984 [Arabic].

Ala'm, A., *The Fundamental of the General National Planning*, Al-Nasher Al-Arabi, Cairo, 1977 [Arabic].

Alexander, L.M., *Offshore Geography of North Western Europe*, The Association of American Geographers, Chicago, 1963.

Amin, S.H., *International and Legal Problems of the Gulf*, Menas Press Ltd., 1981.

Batanouny, K.H., *Ecology and Flora of Qatar*, Qatar University, Qatar, 1981.

Best, R.H., *Landuse and Living Space*, Methuen, London, 1981.

Boschken, H.L. *Landuse Conflicts, Organization Design and Resource Management*, University of Illinois Press, 1982.

Bredo, W., *Industrial Estates*, The Free Press, Glencoe, Illinois, 1960.

Burchell, R.W., Listokin, D., *The Environmental Impact Handbook*, The State University New Brunswick, New Jersey, 1975.

Burchell, R.W., Listokin, D., *Future Land Use*, The State University New Brunswick, New Jersey, 1975.

Callow, Allexander B. Jr., *American Urban History*, Oxford University Press, New York, London, 1973.

Chambers, R., *Rural Development, Putting the Last First*, Longman, 1983.

Chapman, J.D., *Geography and Energy*, Longman, Burnt Mill, Harlow, England, 1989.

Chapman, K., Walker, D., *Industrial Location*, Casil Blackwell, Oxford, 1987.

Chisholm, M., *Agricultural Settlement and Landuse*, Hutchinson University Library, 1962.

Clawson, M., *The Federal Lands Revisited*, John Hopkins University Press, Baltimore and London, 1983.

Clout, H.D., *The Land of France, 1815-1914*, Gorge Allen & Unwin, London, 1983.

Cole, H.A., *Petroleum and the Continental Shelf of North-West Europe*, Volume 2, The Institute of Petroleum, Applied Science Publishers Ltd., London, 1975.

Collins, L., Walker, D.F., *Locational Dynamics of Manufacturing Activity*, John Wiley and Sons, London, New York, 1975.

Cox, K.R., *Urbanization and Conflict in Market Societies*, Methuen, London, 1978.

Dale, P.F. McLaughlin, J.D., *Land Information Management [An Introduction with Special Reference to Cadstral Problems in Third World Countries]*, Clarendon Press, Oxford, 1988.

Diab, M., *The Physical Geography of Qatar*, al- Jablawy, Cairo, 1980 [Arabic].

Dick, W., *Urban Geography: Models and Concepts*, Holmes McDougall, Edinburgh, 1980.

Dickenson, R.W., *Environments of America*, Vantage Press, New York, 1974.

Dixon, C., *Rural Development in the Third World*, Routledge, London, 1990.

Dormer, P., *Land Reform in Latin America*, University of Wisconsin, Madison, 1971.

Drysdale, A., Blake, G.H., *The Middle East and North Africa [A Political Geography]*, Oxford University Press, Oxford, 1985.

Duly, L.C., *British Land Policy At the Cape, 1795- 1844*, Duke University Press, Durham N.C., 1968.

Earney, F.C.F., *Marine Mineral Resource*, Routledge, London, 1990.

El-Hakim, A.A., *The Middle Eastern States and the Law of the Sea*, Manchester University Press, 1979.

El Mallakh, R., *Qatar Energy & Development*, Croom Helm, London, 1985.

Estall, R.C., Buchanan, R.O., *Industrial Activities and Economic Geography*, Hutchinson, London, Melbourne, Sydney, 1980.

Ford, T.R., *Man and Land in Peru*, University of Florida Press, Gainesville, 1955.

Fox, A.F., *The World of Oil*, Pergamon Press, Oxford, London, Paris, Franfurt, New York, 1964.

Friedrichs, J., Goodman, A.C., *Th Changing Downtown*, Walter de Gruyter, Berlin, New York, 1987.

Fujita, M., *Urban Economic Theory*, Cambridge University Press, Cambridge, 1990.

Farvar, M.T., Milton, J.P., *The Careless Technology*, Tom Stacey, London, 1973.

Gilbert, A., *Development Planning and Spatial Structure*, John Wiley & Sons, London, 1976.

Goodchild, R., Munton, R., *Development and Landowners*, George Allen & Unwin, London, 1985.

Goudie, A., *Environmental Change*, 2nd Ed., Clarendon Press, Oxford, 1983.

Goudie, A., *The Human Impact on the Natural Environment*, 3rd Ed., Basil Blackwell, Oxford, 1990.

Grigsby, W.G., Rosenburg, L., *Urban Housing Policy*, APS Publications Inc., New York, 1975.

Haffar, S.M., *Towards A Better Environment*, Dar Al-Sakafah, Qatar, 1985 [Arabic].

Hall, P., *Urban and Regional Planning*, Unwin Hyman, London, 1989.

Hamilton, F.E.I., Linge, G.J.R., *Spatial Analysis: Industry and the Industrial Environment*, Volume 1, Industrial Systems, John Wiley and Sons, Chichester, New York, 1979.

Healey, M.J., *Economic Activity & Landuse*, Longman, Burnt Mill, England, 1991.

Hoyle, B.S., *Seaports and Development (The experience of Kenya and Tanzania)*, Gordon and Brench Science Publishers, New York, London, Paris, 1983.

Imbabi, N., A'shoor, M., *The Sand Dune in the Qatari Peninsula*, Part One, Qatar University, Qatar, 1983 [Arabic].

Dr. Illeas, Y., *The Legislation of Work in the Arab Gulf States*, 1st Ed., The Council of the Ministers of Work and Social Affairs in the Arabian Gulf States, Bahrain, 1984 [Arabic].

Imbabi, N., A'shoor, M., *The Sand Dunes in the Qatar Peninsula*, Part Two, Qatar University, Qatar, 1985 [Arabic].

Jaidah, A.M., *An Appraisal of Opec Oil Policies*, Longman, London, 1983.

Johnston, R.J., *The Future of Geography*, Methuen, London, 1985.

Kasperson, R.E. and Kasperson, J.X., *Nuclear Risk Analysis in Comparative Perspective*, Allen and Unwin, London, Sydney, Wellington, 1987.

Khathy, G., Lavans, P., *The Rural Middle East*, Birzeit University, Zed Books Ltd., London and New Jersey, 1990.

Kennedy, J.L., *Oil and Gas Pipeline Fundamentals*, Pennwell Books, Oklahoma, 1984.

Key, G., *Changing Patterns of Settlement and Landuse in the Eastern Province of Northern Rhodesia*, University of Hull, No.2, 1967.

Kubursi, A.A., *Oil Industrialization and Development in the Arab Gulf States*, Croom Helm, London, 1984.

Lake, R.W., *Resolving Location Conflict*, The State University of New Jersey, 1987.

Laurence, I., Hewes, J., *Japan Land and Men [An account of Japanese Land Reform Programme, 1945-52]*, The Iowa State College Press, 1955.

Leng, L.Y., *Population and Settlement in Sarawak*, Asia Pacific Press, Singapore, 1970.

Lewis, N.M., *Nomads and Settlers in Syria and Jordan, 1800-1980*, Cambridge University Press, London, 1987.

Listokin, D., *Land Use Controls: Present Problems and Future Reforms*, The State University of New Jersey, New Brunswick, 1974.

Longrigg, S.H., *Oil in the Middle East*, Oxford University Press, London, 1961.

Lonsdale, R.E., Seyler, H.L., *New Metropolitan Industrialisation*, A Holstead Press Book, John Wiley and Sons, Toronto, London, Sydney, 1979.

Manners, G., *The Geography of Energy*, Hutchinson University Library, London, 1971.

Mather, A.S., *Land Use*, Longman, London, 1986.

McCormick, J., *British Politics and the Environment*, Earthscan Publications Ltd., London, 1991.

McMichael, P., *Settlers and the Agrarian Question*, Cambridge University Press, 1984.

Dr. Metwali, M., *The Arabian Gulf Basin*, Part One, Anglo Egyptian Library, Cairo, [n.d.] [Arabic].

Dr. Metwali, M., *The Arabian Gulf Basin*, Part Two, Anglo Egyptian Library, Cairo, 1981 [Arabic].

Dr. Metwali, M., Dr. Abu Al'Ala', M., *Gulf Geography*, Al-Fllah, 1st Ed., Kuwait, 1982 [Arabic].

Dr. MoJahid, H., Dr. Al-Kurdi, M., Dr. Badir, G., Dr. Al-Nansri, Q., *Al-Khawr City [Social Survey Study]*, Qatar University, Qatar, 1985 [Arabic].

Mountjoy, A., [Translated to Arabic by Dr. Al-Hussainy], *The Industry in the Third World*, 2nd Ed., Dar Qatari bin Al-Faja'h, Qatar, 1986 [Arabic].

Mubarak, F., *The Economic Relationship Amongst the Western Coastal States of the Arabian Gulf*, 1st Ed., Dar Nasher Al-Sakafah, Cairo, 1982 [Arabic].

Murata, K., *The Industrial Geography of Japan*, Bell and Hyman, London, 1980.

Nafi, Z.A., *Economic and Social Development in Qatar*, Frances Printer, London, 1983.

Obudho, R.A., Walker, P., *Periodic Markets, Urbanisation and Regional Planning (A case study from Western kenya)*, Greenwood Press, Westport, Connecticut, London, 1976.

Odell, P.R., *Oil and World Power*, 8th Ed., Penguin Books, Middlesex, England, 1986.

Ollerenshaw, J., Whitby, M., *Landuse and the European Environment*, Belhaven Press, London, 1988.

Open University, *Occupation Structure and Placement*, The Open University Press, Walton Hall, Milton Keynes, 1976.

Dr. Quraiesh, M., *The Dynamic Move of Transmitting Technology in the Arab States*, Dar Al-Sakafah, Qatar, 1986 [Arabic].

Dr. Quttub, I., Abu A'yash A., *The Growth and Urban Planning of the Arabian Gulf States*, 1st Ed., Wukalat Al-M- atbua't, Kuwait, 1980 [Arabic].

Rhind D. Hudson R. *Landuse*, Methuen, London, 1980.

Robinson, G.M., *Conflict and Change in the Countryside*, Belhaven Press, London, 1990.

Rudel, T.K., *Situations and Strategies in American Land Use Planning*, Cambridge University Press, Cambridge, New York, 1989.

Russell, J., *Geopolitics of Natural Gas*, Ballinger Publishing Company, Cambridge, 1983.

Sale, L.H., *Introduction to Industrial Geography*, Dar al-Shrooq, Amman, 1985 [Arabic].

Saqr, A., *Geographical Gazetteer*, Dar Al-A'had, Beirut, c.1959, [Arabic].

Schofield, R., *Islands and Maritime Boundaries of the Gulf*, Vol.12, 1942-1947, Melksham, Oxford.

Shahdad, M., *The Progress of the Relationship between the Oil Companies and the Arabian Gulf States, since the beginning of the Oil Concession in the region up to 1973*, Qatar National Prints, Qatar, 1985 [Arabic].

Shaqlieahm, A.R., *The Arab Oil Processing and Refining*, Tuhamah Publishers, 1st Ed., Jeddah, 1981 [Arabic].

Dr. Sharaf, A., *Offshore Geography*, 1st Ed., Maktabat Al-Kherigi, Riyadh, 1984 [Arabic].

Sivasubramanian, K., Ibrahim M.A., *Fisheries in Qatar*, University of Qatar, Qatar, 1984.

Slesser, M., *Brazil: Land without limit*, George Allen and Unwin Ltd., London, 1969.

Smith, H.D., Vallega A., *The Development of Integrated Sea-Use Management*, Routledge, 1991.

Smith, J.W., *The Control of Oil Pollution*, Graham & Trotman, London, 1983.

Sukar, J.G., *The Delimitation of the Offshore Ranges, for the Coastal States in the Arabian Gulf*, Baghdad, 1980 [Arabic].

Taylor, R.N., *Whose land is it anyway?*, Turnstone Press, Northamptonshire, 1982.

Thorne, W., *Land and Water Use*, American Association for the Advancement of Science, Washington D.C., 1963.

Thrall, G.I., *Landuse and Urban Form*, Methuen, New York and London, 1987.

Tiratsoo, E.N., *Oil Field of the World*, 3rd Ed., Scientific Press Ltd., Beaconsfield, England, 1984.

Van Doren, C.S., Priddle, G.B., Lewis, J.E., *Land and Leisure. Concepts and Methods in OUtdoor Recreation*, Methuen and Co. Ltd., London, 1979.

Walker, D.F., *Planning Industrial Development*, John Wiley & Sons, New York, 1980.

Watson, J.W., *The American Environment: Perceptions and Policies*, John Wiley and Sons, London, New York, 1976.

Watts, H.D., *Industrial Geography*, Longman, New York, 1987.

Whyte, R.O., *The Spatial Geography of Rural Economies*, Oxford University Press, Delhi, 1982.

Williams, A.M., *Western European Economy*, Hutchinson, London, 1987.

Zahlan, R.S., *The Creation of Qatar*, Croom Helm, London, 1979.

Theses

Abdo, M., *The Urbanization of Kuwait Since 1950, Planning Progress and Issues*, Ph.D. thesis, University of Durham, 1989.

Al-Elawy, I.S., *The Influence of Oil Upon Settlements on al-Hasa Oasis in Saudi Arabia*, Ph.D. thesis, University of Durham, 1976.

Al-Jabbir, M., *The Human Geography of Qatar*, M.A. thesis, Cairo University, 1977 [Arabic].

Al-Kubaisi, M., *Industrial Development in Qatar, 1950- 80, A Geographical Assessment*, Ph.D. thesis, University of Durham, 1984.

Al-Kuwari, A., *Oil Revenues in the Gulf Emirates*, Ph.D. thesis, University of Durham, 1978.

Al-Nauimi, N., *The Legal Regime for the Marine Resources in the Arabian Gulf*, Ph.D. thesis, Dundee University, September 1987.

Al-Rakeiba, A., *Movement and Transport of Pilgrims in the Hajj Region, Saudi Arabi, A Geographical Study*, Ph.D. thesis, University of Durham, 1991.

Al-Shuaby, A.M., *The Development of Eastern Province with Particular Reference to Urban Settlement and Evolution in Eastern Saudi Arabia*, Ph.D. thesis, University of Durham, 1976.

Al-Tarazi, A., *Population of the Economic Activities in Irbid Gowernorat*, Ph.D. thesis, Cairo University, 1979 [Arabic].

Al-Thani F., *The Population Change in Irbid Gowernorat* M.A., University of Jordan, 1986 [Arabic].

Ashwan, M., *The Population Growth of Riyadh City in Saudi Arabi*, Ph.D. thesis, University of Durham, 1990.

Atherden, M., *A Contribution to the Vegetation and Landuse of the East Central North Yorkshire Moors*, Ph.D. thesis, University of Durham, 1972.

Aw'ad, T.M., *The International Boundary for the Offshore areas: Applied study for the Arabian Gulf*, Ph.D. thesis [Two Volumes], Alexandria University, 1974 [Arabic].

Batson, J., *The Residential Development Process and Its Impact on Agriculture Land*, Vols. I and II, Ph.D. thesis, University of Durham, 1990.

Birch, B., *Characteristics of Rural Settlements in The Corn Belt of North American mid-west* [Text and Maps], Ph.D. thesis, University of Durham, 1965.

Brock, C., *Settlement Studies in S.E. England with special reference to the Outer London Conurtations*, M.A. thesis, University of Durham, 1961.

Brown, J., *A Geographic Study of the Evolution of the Cities of Tehran and Isfhan*, Ph.D. thesis, University of Durham, 1965.

Crill, N., *Urbanization in Arabian Peninsula*, M.A. thesis, University of Durham, 1977.

Ghiassi, M., *Land Reform and Output, The Iranian Case*, M.A. thesis, University of Durham, 1972.

Hajjai, S., *The Landuse Patterns and Rural Settlement of Benghazi Plain* [2 volumes], Ph.D. thesis, University of Durham, 1969.

Hajrah, H., *Public Land Distribution in Saudi Arabia*, Ph.D. thesis, University of Durham, 1976.

Hill, A., *Aspects of the Urban Development of Kuwait*, Ph.D. thesis, University of Durham, 1970.

Idris, K., *Industrial Location of Sudan*, University of Durham, 1980.

Kayed, F., *The Impact of Development Variables Upon the Geographical Distribution of Population*, M.A. thesis, University of Jordan, 1984 [Arabic].

Documents

P.R.O.: Public Record Office

I.O.L.R.: India Office Library and Records

Ref: Reference

Doha Palace, Document Office, 1935, *Oil Agreement Between State of Qatar and the Anglo Persian Oil Company.*

Doha Palace, Document Office, 1952, *Oil Agreement Between State of Qatar and Shell Oil Company.*

I.O.L.R., Ref. 15/1/369.

I.O.L.R., Ref. 15/1/370.

I.O.L.R., Ref. 15/11632.

I.O.L.R., Ref 15/11631.

I.O.L.R., Ref. 15/2/547.

I.O.L.R., *Arabian Gulf Oil Concessions, 1911- 1953*, Qatar I, Archive Editions, 1989.

I.O.L.R., *Arabian Gulf Oil Concessions, 1911- 1953*, Qatar II, Archive Editions, 1989.

Institute of Petroleum, *Oil and Gas of Wytch Farm Oil Field* [File], Dorset.

Institute of Petroleum, *Onshore Pipes, Britain* [File], 1991.

Institute of Petroleum, *Environment*, File No.2, 1991.

Institute of Patroleum, *Qatar*, File No.2.

Institute of Petroleum, *Offshore Pipes, Britain* [File].

P.R.O., Ref. FO 371/98431/170320.

P.R.O., Ref. FO 371/74998.

P.R.O., Ref. FO 371/18913/170308.

P.R.O., Ref. FO 371/18914/170308.

P.R.O., Ref. FO 371/18915/170308.

P.R.O., Ref. FO 371/98434.

[Qatar 1916 Protectrate Treaty], Compiled by Aitchison, C., *A Collection of Treaties, Engagements and Sanads, Relating to India and neighbouring countries*, Vol. XI [Revised and Continued up to the end of 1930 under the authority of the Government of India], Kraus Reprint, Delhi, 1933.

Articles, Conference Papers and Official Publications

Q.G.P.C.: Qatar General Petroleum Corporation

I.D.T.C. Industrial Development Technical Centre

ADMA, Annual Report, Abu Dhabi, 1989.

Dr. Abdo, S., *U.A.E. Ports*, Issue No.124, Kuwait University, April 1989 [Arabic].

Ahrari, M.E., Opec, *The Hyperpluralism of Oil Market in the 1980's.*

Al-Khallej Newspaper, Issue No.4540, U.A.E., 13 October 1991 [Arabic].

Al-Majid, A., *The Climate of Qatar*, The Ministry of Transport and Communication [Dept. of Meteorology], c.1983 [Arabic].

Al-Mudfa'h, *The role of the environment in administering the natural resources*, Report, Doha, 11/12 December 1989.

Dr. Al-Marri, J., [Managing Director of Q.G.P.C.], Qatar Oil and Gas Priorities, presented to the 16th International Energy Conference, Boulder, Colorado, 20 - 22 March 1989.

Dr. Al-Seremni, M., *Holy Mecca, A Study in the Urban Growth*, Issue No.87, Kuwait University, March 1986 [Arabic].

Arab Oil and Gas Directory, Arab Petroleum Research Centre, Paris, 1989.

Arab Organization for Agricultural Development, Ministry of Industry and Agriculture, *Wild Plants of Qatar*, 1983.

Aramco World Magazine, Vol.15, No.6, Washington D.C., November, December 1964.

Aramco World Magazine, Vol.33, No.6, Washington D.C., November, December 1982.

Aramco World Magazone, Vol. 39, No.3, Washington D.C., May, June 1988.

Arrayah Newspaper, Issue No.3197, Qatar, April 1990 [Arabic].

Arrayah Newspaper, Qatar, 13 March 1991 [Arabic].

Arrayah Newspaper, Issue No.3479, Qatar, 14 March 1991 [Arabic].

Arrayah Newspaper, Qatar, Issue No.3511, 10 April 1991 [Arabic]

Arrayah Newspapers, Issue No.3529, Qatar, 1 May 1991 [Arabic].

Arrayah Newspaper, Issue No.3604, Qatar, July 1991 [Arabic].

Arrayah Newspaper, Issue No.3640, Qatar, 8 September 1991 [Arabic].

Arrayah Newspaper, Issue No.3645, Qatar, September 1991 [Arabic].

Arrayah Newspaper, Issue No.3648, Qatar, 17 September 1991 [Arabic].

Arrayah Newspaper, Issue No.3699, Qatar, 16 November 1991 [Arabic].

Arrayah Newspaper, Issue No.3716, Qatar, 5 December 1991 [Arabic].

Arrayah Newspaper, Qatar, (*Arrayah* weekly of Friday), Issue No.263, 17 April 1992

Arrayah Newspaper, Qatar, Issue No.3832, 19 April 1992.

Asharq Al-Awsat Newspaper, Vol.14, No.4668, 9 September 1991 [Arabic].

B.P., Exploration, *Oil Under Poole Bay*, Dorset, [n.d.].

B.P., Exploration, *An Island in The Bay in Dorset*, [n.d.].

B.P., Exploration, *Poole Bay Appraisal Drilling*, Volume One, Environmental Assessment, February 1989.

B.P. Exploration, Poole Bay Appraisal Drilling, Volume Two, *Environmental Review*, January 1990.

B.P., Exploration, *Understanding Poole Bay [The Marine Biology]*, Dorset, October 1991.

B.P., Petroleum Development Ltd., *Wytch Farm Oil Field Development, Environmental Impact Assessment*, Volume 3, Production Facilities, Megran Press Ltd., Bournemouth, February 1986.

Blake, G., Dewdrey, J., Mitchell, J., *The Cambridge Atlas of The Middle East and North Africa*, Cambridge University Press, Cambridge, 1987.

Bowen-Jones, H.B., *Agriculture in Malta, A survey of Landuse*, University of Durham, 1955,

Cavelier, C., *Geological Description of The Qatar Peninsula*, Bureau de Recherches Geologiques et Minieres, Paris, August 1970.

Coleman, A., *Landuse Survey of [Britain]*, 5th Ed., 1968.

Department of Petroleum Affairs, Oil Industry In Qatar, Qatar, 25 April 1970.

Diaruna W.A.L.A.L.A.M., A monthly Magazine concerned with oil and Finance in the Arab Countries and World, Qatar Issue No. 97, January 1984, Issue No. 98, February 1984, Issue No. 100, April 1984, Issue No. 108, December 1984 [suspended since 1986]

Economic Intelligence Unit, Qatar No.2, 1989.

The Economist Magazine, December 21st 1991, January 3rd 1992

Environmental Protection Committee, Final Report, Qatar, 12 December 1982.

Dr. Fakhroo, A., *People and Development in the Arabian Gulf*, Doha, 24 May 1982 [Arabic].

Financial Times, 22 February 1990

Geographical Magazine, Volume LIII, Number 1, London, October 1980.

Geographical Magazine, Volume LIII, Number 3, London, December 1980.

Geographical Magazine, Volume LIII, Number 4, London, January 1981.

Geographical Magazine, Volume LIII, Number 6, London, March 1981.

Geographical Magazine, Volume LIII, Number 8, London, May 1981.

Geographical Magazine, Volume LIII, Number 13, London, October 1983.

Geology of Qatar, Extracted from [Abu Dhabi Well Evaluation Conference Book], November 1981.

Government of Qatar, Land Acquisition Decree, 1988, Decree 13.

Guide to Qatar, Qatar Petroleum Company Ltd., [n.d.].

Gulf Organization For Industrial Consulting, *Arab Gulf Industry, G.C.C. [Information Centre]*, Volume 1, No.1, Issue No.0268-909-X, Lyme Books Ltd., January 1986.

Gulf Times Newspaper, Vol.X, Issue No.2363, Qatar, 19 May 1990.

I.D.T.C., *The Industrial Development In Qatar*, April 1978.

I.D.T.C., *Qatar Achievement in Industrial Development*, 1981.

I.D.T.C., *Environmental Assessment of State of Qatar*, December 1983.

I.D.T.C., *The Role of The Emir in Developing The Industrial Sector in Qatar*, February 1988 [Arabic].

Idris, K., The Gulf Co-operation Council: Industrial Co- operation in "A Gulf of Difference", D. Reidd Publishing Company, Dordrecht and Boston, 1986.

Industrial Co-operation in the Arab Gulf, A Quarterly Journal, Issue No.31, Eighth Year, Qatar, January 1988 [Arabic].

International Boundaries Research Unit, *Boundary Bulletin No.2*, University of Durham, July 1991.

International Petroleum Encyclopaedia, Penwell, 1990.

Journal of The Gulf and Arabian Peninsula, Kuwait University, Vol.IX, No.36, October 1983 [Arabic].

Journal of The Gulf and Arabian Peninsula Studies, Vol. XIV, No.53, Kuwait University, January 1988 [Arabic].

Kelly, Mike, Investment Opportunities at Jubail and Yanbu [Article], [n.d.].

Kingdom of Saudi Arabi, a special sponsored section reprinted from Institutional Investor, [n.d.]

Llewelyn Davies, Weeks, Forster, Walker and Bor, *Qatar Development Plan*, 11 April 1973.

Llewelyn Davies, Forester, Walker & Bor, Town Planning Progress Report, Ministry of Municipal Affairs, Qatar, February 1976.

Llewelyn Davies, Weeks, Forester, Walker & Bor, *Doha Housing Study*, London, 1977.

Lorimer, J.G., *The Gulf Gazetteer* [7 Geographic volumes and 7 Historical volumes], 1906. Translated to Arabic, Doha Palace [Arabic].

Ministry of Communication and Transport, Department of Ports, *Ports of Qatar*, [n.d.].

Ministry of Education, *Annual Abstract*, Qatar, 1986-1987 [Arabic].

Ministry of Economy & Commerece, Department of Economic Affairs, *Economic Development, Qatar, 1972- 1981.*

Ministry of Finance and Petroleum, *Oil Industry in Qatar*, 1976.

Ministry of Finance and Petroleum, *Oil Industry in Qatar*, Qatar, 1979.

Ministry of Finance and Petroleum, *Oil Industry in Qatar*, 1982.

Ministry of Industry & Agriculture, *Agricultural Statistic Year Book*, 1982, Doha, December 1983.

Ministry of Information, *The Development of The Industrial Sector in Qatar*, 1983 [Arabic].

Ministry of Industry and Agriculture, *Fisheries Statistics*, 1980/81.

Ministry of Justice, *Department of Legal Affairs, Official Journal*, periodical No.10, Doha, 1 September 1988 [Arabic].

Ministry of Municipal Affairs & Agriculture, *Fisheries Statistics*, Qatar, 1989.

Ministry of Municipal Affairs and Agriculture, *Zone and Street Guide - Doha City*, 1990.

Ministry of Municipal Affairs, Doha Municipality, Grand Hamad Avenue, [n.d.]

Ministry of Municipal Affairs, Doha, *List of land prices in 1981, 1984 and 1988.*

Ministry of Municipality, *Land List Prices*, Doha, 1988.

Ministry of Public Works and Industry [Industrial Affairs] Report about the Qatar Experience in choosing, constructing and development of the industrial towns, 20 December 1989 [Arabic].

Morrison, I., Up-Dating Of the Qatar Petroleum Company Terminal, Umm Said, Fifth Arab Petroleum Congress, The Secretary- General of The League of Arab States, Cairo, 16 - 23 March 1965.

OPEC, Bulletin, June 1985.

Organization of Arab Petroleum Exporting Countries [Oapec], proceedings of the Second Petroleum Exploration Seminar, Kuwait, 7 - 12 November 1981, Kuwait, 1982.

Pereira, William L., Qatar Planning Studies, *New District of Doha, Development Plan*, State of Qatar, 16 September 1981.

Pereira, William L., Associates, Qatar Planning Studies, *Development plan of Umm Said*, March 1983.

Q.G.C.P., Onshore Operation, Petroleum Engineering Dept., The Dukhan Field, Dukhan, 1 July 1980

Q.G.P.C., *Qatar Oil Operation Offshore*, July 1981.

Q.G.P.C., 1982.

Q.G.P.C., *Umm Said Refinery*, c.1983.

Q.G.P.C., *Offshore Operations, Safety*, 1984.

Q.G.P.C., *Onshore Operations*, 1985.

Q.G.P.C., *Offshore Operation*, January 1985.

Q.G.P.C., Annual Report, 1987

Q.G.P.C., The Qatar North Field Development Project, presented to Annual Convention Gas Processor Association, San Antonio, Texas, 13 - 14 March 1989.

Q.G.P.C. [Onshore Operations] Confidential Report, 12 August 1989

Q.G.P.C. Advertisement, *The Herald Tribune* [South East Asia] on 5 September 1989.

Q.G.P.C., *Natural Gas Liquids*, [n.d.].

Qatar Gas, *Qatar, A Major Gas Producer* [N.D.]

Qatar Historical Committee, *Researches presented to the Conference of Studies for History of the Eastern Arabian Peninsula* [Parts I and II] [Arabic].

Qatar Petroleum Company Limited, Review for 1966.

Qatar Petroleum Company Ltd., Review for 1967.

Qatar Petroleum Company Ltd., Review for 1968.

Qatar Petroleum Company Ltd., Review for 1969.

Qatar Petroleum Company Ltd., Review for 1971.

Qatar Petroleum Company Ltd., Review for 1970.

Qatar Petroleum Company Ltd., Review for 1973.

Royal Commission for Jubail and Yanbu Industrial Cities: Ten years of Accomplishments, Madinat Yanbu al-Sinaiyah Printing Facilities, [n.d.]

Dr. Seccombe, I., Dr. Lawless, R., *Migrant Labour and The Early Oil Industry in the Arabian Gulf, 1930-1950*, University of Durham, [n.d.]

Shell Oil Company of Qatar, *Oil Offshore*, Qatar, 1969.

Smailes, E., Population Changes in the Colliery Districts of Northumberland and Durham, Reprinted from *The Geographical Journal*, Vol XCI, No.3, March 1938.

Smith, H.D., *Sea Use Management and Planning in the North Sea*, issued by the Department of the Environment of the United Kingdom, April 1988.

Stamp, L.D., Willates E.C., *The Land Utilization Survey of Britain*, University of London, 1934.

Stamp, L.D., *Fertility, Production and Classification of Land in England and Wales*.

Stamp, L.D., *Predominant Farming Types in Scotland, Explanatory Bulletin*, 1941.

State of Qatar, Q.G.P.C., Establishment Decree No.10, 1974 [Arabic].

State of Qatar, Ministry of Municipal Affairs, Qatar Planning Studies, Summer Report, Shankland Cox Partnership, August 1981.

State of Qatar, Ministry of Municipal Affairs, Doha Municipality [City of Doha], *Doha Building Codes*, Volume I, May 1983.

State of Qatar, Presidency of The Council of Ministers, Central Statistical Organization, *Industrial Survey 1983*, March 1985.

State of Qatar, Presidency of The Council of Ministers, Central Statistical Organization, 6th Issue, *Foreign Trade Statistics, 1986 [Imports]*, July 1987.

State of Qatar, Presidency of Council of Ministers, Central Statistical Organization, *Bulletin of Statistics of Buildings, Houses*, Chapter 4, October, November and December 1987.

State of Qatar, Presidency of the Council of Ministers, Central Statistical Organization, *Annual Statistical Abstract*, 9th Issue, 1989.

State of Qatar, Presidency of The Council of Ministers, Central Statistical Organization, *Annual Statistical Abstract*, 1st Issue, July 1991.

United Nations, *The Population Situation in E.C.W.A. Region [Qatar]*, United Nations Economic Commission for Western Asia, Beirut, 1980.

World Population Datasheet, Population Reference Bureau Inc., Washington D.C., 1991.