

**The Environmental
Consequences of
Urban Growth in
Portugal**

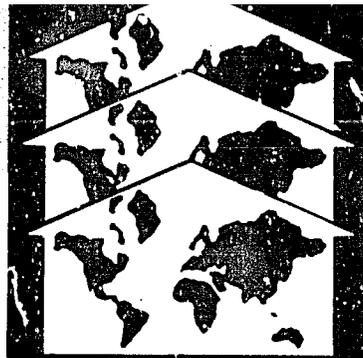
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The Environmental Consequences of Urban Growth in Portugal

December, 1991

Prepared by:

**Alison Kenning Massa
and
Robert Macleod**

For the:

**U.S. Agency for International Development Mission
in Lisbon, Portugal**

**Abt Associates, Inc. ■ Hampden Square, Suite 500 ■ 4800 Montgomery Lane ■
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*The views herein are those of the authors and do not necessarily reflect those of the Office of
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LIST OF ACRONYMS

AIA	Environmental Impact Assessment
AML	Lisbon Metropolitan Area
CCR	Regional Coordinating Commission of the Ministry of Planning and Land Management
CCRLVT	Coordinating Commission of the Lisbon and Tagus Valley Region
CINIA	Environmental Impact Assessment Research Center of the New University of Lisbon
EEC	European Economic Community
EIA	Environmental Study
ELIPS	Estudo de Localização Industrial na Península de Setúbal (Industrial Site Suitability Study)
ETARS	Wastewater treatment plants
FLAD	Fundação Luso-Americana para o Desenvolvimento (Luso-American Development Foundation)
JAE	Junta Autónoma das Estradas (Portuguese Highways Department)
NERSET	Business and Industry Group of the Setúbal Region
OID	Integrated Development Operation for the Setúbal Peninsula (Portugal/EEC-funded program for economic development and environmental improvement projects)
PDM	Municipal Development Plan
PROT	Regional Development Plan

PREFACE

This report represents the efforts of a team of individuals and agencies dedicated to the idea that economic development can be planned in a manner that is beneficial to the long-term economic well being and environmental quality of a region.

The focus of the study, the Setúbal Peninsula, comprises the southern portion of the Metropolitan Area of the City of Lisbon. The peninsula is an area whose beauty, abundant resources, and strategic location make it a prime target for both industrial growth and associated residential and commercial development. Key industrial and transportation location decisions that will set the course of growth for good or ill are being made or studied now. This study grew out the need for a common approach among the various public and private entities with the potential to influence the direction and quality of growth.

This document is a first step towards development of a concerted program that will eventually involve all major government and private sector development interests in taking actions designed to achieve common goals for sustainable, environmentally-sound development. As such, while the effort is specific to one region and one country, it represents a practical example of an emerging approach towards sound planning of the urban environment in Portugal and elsewhere.

**John Miller
Abt Associates Inc.**

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This study was initiated through the impetus of several key individuals, Enga. Ana Maria Martins of the Portuguese Ministry of the Environment and Natural Resources, Eng. José Trindade of the U. S. Agency for International Development's Regional Housing Office in Lisbon, and Mrs. Bonnie Walter of its Office of Housing and Urban Programs. They had the foresight to recognize the need for improved understanding of the environmental consequences of urban and industrial development and the urgent need to create a framework for future land use decisions that would integrate environmental and land use interests. All three were central to the conceptual organization and conduct of the study.

Professor Dr. Leonel Canelas of the Environmental Impact Assessment Research Center of the New University of Lisbon, and his assistant Eng. Pedro Coelho, provided invaluable support throughout the study, compiling and preparing a dossier of historical, environmental and economic background data, offering a depth of insight into the extent and causes of environmental problems on the Setúbal Peninsula that provided the necessary framework for effective field observations, and providing a sounding board for our ideas. Mr. Edward Robbins, as a consultant to the Regional Housing Office, is also thanked for his thoughtful assistance, both in coordinating several aspects of the study and in reviewing the draft report.

In addition, the authors wish to thank the many representatives of government and industry, at the Ministry of the Environment and Natural Resources, the Coordinating Commission of the Lisbon and Tagus Valley Region (CCRLVT), and throughout the Setúbal Peninsula, for their cooperation and assistance and for their enthusiastic participation in the concluding seminar. The support of Eng. João Teixeira and Dr. Calejo Monteiro of the CCRLVT and of Professor Dr. Jorge Gaspar of the Center for the Study of Urban and Regional Development is particularly acknowledged. Mr. Charles Buchanan and the Fundação Luso-Americana para o Desenvolvimento also deserve special thanks for hosting the seminar.

Finally, thanks go to John Miller for his support and perceptive reviews during the preparation of the report and to Natalie Macris and Andrea Willett for their assistance, respectively, with the text and graphics.

Alison Kenning Massa

EXECUTIVE SUMMARY

Report Purpose. This report describes the findings and recommendations of a U.S. Agency for International Development technical assistance assignment to the Portuguese Ministry of the Environment and Natural Resources. The assignment called for a rapid assessment of the environmental consequences of the urban and industrial development that has occurred to date on the Setúbal Peninsula, south of Lisbon.

The purpose of the assignment was to outline an approach and methodology, based on the integration of planning, economic and environmental considerations, which the Coordinating Commission of the Lisbon and Tagus Valley Region (CCRLVT) can follow in making land use and development decisions. A two-week field study was conducted that included review of various planning and environmental documents, meetings with key actors involved in the management and planning of the peninsula's development, and first-hand observations. The findings were viewed in the context of experience with areas of rapid growth in the United States and elsewhere. The study brought into sharp focus the character of the peninsula, the challenge of future changes, and the urgent need for coordinated management.

Recommendations. Specific recommendations for integrating environmental issues into orderly and sustainable economic development activities include:

- o A dramatic increase in agency coordination and cooperation, horizontally among the municipalities and between the Ministries, and vertically between the two levels of government;
- o Emphasis on public-private partnerships, technology transfers, and training exchange programs to address the financial and institutional capacity constraints on effective environmental protection and urban growth management activities;
- o Preparation of timely Environmental Impact Reports for all projects which require them under the law, so as to expand agency, industry and public understanding of the growth-shaping potential of major projects;
- o Identification of shared regional goals, as a matter of urgency, to focus attention on key issues and achieve integration between the regional and municipal plans and development strategies; and
- o Completion and adoption of municipal plans with streamlined regulatory review procedures, recognizing that while gaps in knowledge of existing and past conditions certainly exist, they are of far less importance than the need for clear goals, priorities, and speedy action.

Actions Needed to Achieve Recommendations. The report suggests several specific actions to help achieve the recommendations:

- o Create an interdisciplinary/interagency committee or a series of regular seminars to identify or revise development objectives in light of the peninsula's needs and natural resources;
- o Consider holding a forum sponsored by the regional planning agency and the municipalities to help speed the formulation of a vision and identification of key goals and priorities;
- o Set up regular intergovernmental meetings to delineate and coordinate departmental functions to avoid duplication of effort and to ensure broad notification of all significant peninsula development proposals;
- o Prepare some form of agreement that distinguishes regional planning responsibilities from municipal planning functions, and sets a timeframe to allow for plan integration; and
- o Expand the industrial site suitability study being prepared for the regional plan to cover all land uses, building on the already-assembled data base and data available from various environmental studies.

The most important first step in the effort to integrate economic and environmental concerns in planning for urban expansion and industrial development on the peninsula has already been taken with the seminar hosted by the Fundação Luso-Americana para o Desenvolvimento on June 11, 1991. Participants included leading representatives of national, regional and local government, industry, development planning, and environmental interests. The breadth of the seminar was generally recognized as unprecedented in the history of planning for the peninsula and priority should now be given to maintaining the debate on a regular basis.

Why the Actions are Needed. The Setúbal Peninsula possesses a natural environment of striking richness and fragility. The variety of natural resources and related processing industries is unusual in such a relatively small region. Protecting that variety is important to assuring the long-term balance and sustainability of the regional economy.

Some of the traditional balance was lost several decades ago in a period of heavy industrial development. That period resulted in problems of pollution, obsolescence and economic decline that peaked in the early 1980s. Other severe environmental problems, such as pollution of the peninsula's aquifer, one of the largest in Europe, can be attributed to explosive and unregulated growth that followed construction of the bridge over the River Tagus.

Impressive efforts to remedy the economic and environmental problems are being undertaken but are far from complete. Meanwhile, most of the growth in the Lisbon Metropolitan Area over the next decade is expected to occur in the Setúbal Peninsula. In addition, ten major

infrastructure and industrial projects are being planned by various government, public and private entities and are likely to induce further growth on the peninsula.

These major planned projects, described in Annex C, were initiated as a result of national economic development policies, and have the potential to bring unprecedented prosperity to the peninsula. The various agencies are capable of preparing for the growth through careful site selection and advance planning for their effects. With such preparation, the peninsula is undoubtedly large enough to accommodate the accompanying growth without detracting from the existing quality of the environment, risking further economic destabilization, or diminishing the quality of life.

Possible Effects of Unmanaged Growth. In the absence of advance planning and effective growth management, however, the projects have the potential to unleash a new round of growth pressures and environmental degradation of perhaps unimaginable proportions. Possible effects of the unmanaged growth scenarios described in the report could include:

- o The loss of productive agricultural and forest land under an almost continuous expanse of urban uses in the central Almada-Setúbal-Alcochete triangle;
- o Erosion of the agricultural, environmental and scenic value of both the western and eastern parts of the peninsula as land and housing price increases lead to longer commutes by workers in the new industries;
- o Increasing sources of groundwater contamination and loss of recharge potential and removal of buffers around the peninsula's protected areas; and
- o Growing conflicts among fisheries, port activities and heavy industry, and tourism for use of the shoreline and protection of coastal resources.

These environmental changes would have significant economic implications. Emphasis on a shift to light and high technology industry would leave the peninsula vulnerable to potential technological obsolescence and loss of cost competitiveness. Such a shift could eventually lead to a repeat of the problems of industrial obsolescence experienced in the early 1980s. This possibility reinforces the need to protect the traditional resource-based produce and processing industries for stability and sustainability. Similarly, loss of environmental quality would add to already substantial renovation costs and reduce the peninsula's attractiveness to continuing economic expansion.

Action to prepare for growth is needed urgently. The major projects, if they are all approved, are scheduled for construction within a very few years. At the same time, the municipalities and the region are poised between the data gathering and plan preparation phases of their respective programs. This is the critical opportunity to examine the potential effects of growth and to articulate a vision of the environmental and economic future desired for the Setúbal Peninsula. Without a clear vision of what the peninsula should look like five, ten or twenty years from now, growth will likely follow the scenarios described in the report.

1. INTRODUCTION

Since joining the European Economic Community (EEC) in 1986, Portugal has adopted an aggressive and accelerated economic development agenda. One principal target of this agenda is the Setúbal Peninsula, a geographically-distinct region of nine municipalities located south of Lisbon across the Tagus River, shown in its regional context in Figure 1.

The proposed level of infrastructure and industrial investment in the Setúbal Peninsula is unprecedented and, in terms of its potential environmental effects, alarming. To gain economic parity with other community members, Portugal has been a recipient of the EEC's Structural Fund for regional development programs. Through this fund, the Integrated Development Operation (OID) was created to stimulate economic growth and promote social stability in the peninsula. Over the period 1989-1992, the OID will disburse \$420 million dollars in matching grants for small and medium-sized infrastructure and other development-related projects.

During this same period, the peninsula's industrial base will be expanded by the scheduled construction of a \$3.2 billion automobile manufacturing plant and the development of a high technology "Silicon Valley" industrial estate, as well as other smaller light industrial parks. To further encourage industrial development on the peninsula, the OID is promoting the construction of a state-of-the-art industrial waste treatment and disposal facility.

Additionally, over the next decade, the Portuguese government may locate a range of large-scale transportation infrastructure projects in the Setúbal region. These include a second bridge (or tunnel) linking the peninsula with Lisbon, a new expressway linking Lisbon with Madrid, a new international airport, and the expansion of the port of Setúbal.

The socioeconomic and environmental consequences of this infrastructure- and industry-led investment strategy will be dramatic. This report addresses the likely impacts of economic development and increased urbanization on the Setúbal Peninsula and provides recommendations to guide decision-makers in anticipating and minimizing those impacts in what will surely be a challenging decade.

1.1 Study Objective

In light of the government's economic development agenda for the Setúbal Peninsula, and the explosive urban growth that is anticipated to accompany it, the Ministry of the Environment and Natural Resources requested technical assistance to identify and evaluate key environmental issues associated with rapid economic development. This request evolved from the Ministry's recognition of the peninsula's significant and fragile natural resource base and also from an awareness of the region's history of chaotic urbanization.

The objective of this study is to prepare an assessment of the environmental consequences of industrial expansion and urban development in the Setúbal Peninsula. It focuses on providing the Ministry of the Environment and Natural Resources and other interested parties with practical, action-oriented recommendations to meet the challenge of managing urban growth.

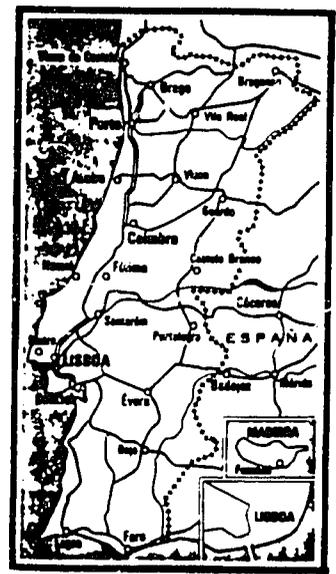
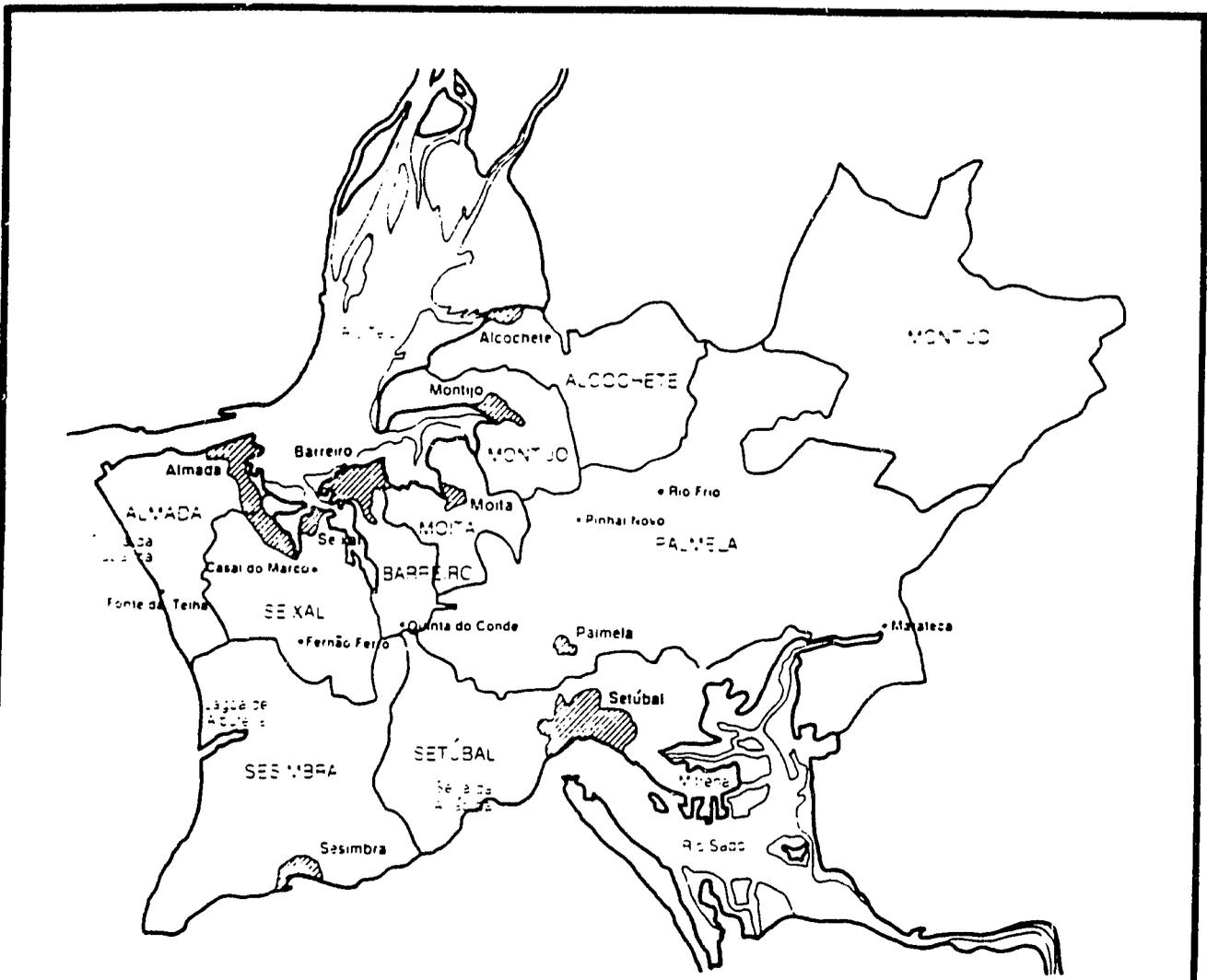


FIGURE 1.
Setúbal Peninsula — Regional Setting and Municipal Boundaries

1.2 Study Methodology

In response to the Ministry of the Environment and Natural Resources' request, the Agency for International Development's Regional Housing Office contracted the services of two consultants to perform a two-week study. The consultants' sources of information on the Setúbal Peninsula included available documents and reports, interviews with public officials and private individuals, and personal observations from field visits. In formulating its recommendations, the team drew both on a synthesis of this information and on experience with similar environments and development scenarios elsewhere. Technical support was provided to the consultants by the Environmental Impact Assessment Research Center (CINIA) of the New University of Lisbon.

1.3 Contents of the Report

Chapter 2 presents a history of the development of the Setúbal Peninsula, its traditional economic activities, and the key infrastructure and industrial development factors that have influenced the pace and pattern of growth during this century. Chapter 3 examines the types of social, economic, and environmental changes that have resulted from poorly managed growth. The sources and types of potential future growth pressure are explored in Chapter 5 and the final chapter suggests an approach and priority actions which may be of assistance in managing that growth.

2. DEVELOPMENT HISTORY OF THE SETÚBAL PENINSULA

An understanding of past development trends is essential to formulating future growth scenarios as an aid in anticipating and managing the effects of change. The following narrative first describes the Setúbal Peninsula's natural resource heritage, traditional economic base and settlement patterns, and then looks at urbanization trends since 1966 when the first major change in the peninsula's accessibility, completion of the Tagus Bridge, occurred.

2.1. Natural Resource Heritage

The Setúbal Peninsula comprises an area of approximately 150,000 hectares (375,000 acres). Despite its relatively small land area, the peninsula nevertheless is characterized by an unusually rich array of natural features and productive resources. (See Figure 2.) These resources are related to its geology and soils and to its privileged position between two navigable rivers, the Tagus and the Sado.

Underlying the region's predominantly sandy soils is the largest reservoir of groundwater on the Iberian Peninsula and one of the largest in Europe. Historically and today, groundwater is the peninsula's sole source of potable water and a primary source of water for industrial and agricultural uses. As such, the Setúbal Aquifer constitutes one of Portugal's most valuable and fragile natural resources.

The Tagus and Sado estuaries shape portions of the peninsula's northern and southern shores. Both estuaries are bounded by extensive saltmarshes, one of the most complex and ecologically productive habitats in the world. The nutrients found at the interface of fresh water and sea water provide ideal nursery areas for fish and shellfish which, in turn, support waterfowl and other shoreline fauna.

The geomorphology of the peninsula's southwestern quadrant offers a spectacular coastline plus two distinct, internationally renowned natural landmarks: the Serra da Arrábida and the Albufeira Lagoon.

The Serra da Arrábida, with its shallow limestone soils and proximity to the sea, supports endemic Mediterranean-like vegetation. The Albufeira Lagoon is a large, shallow inland body of water surrounded by extensive wetlands and pine forests. Both landmarks have intrinsic value as natural resource laboratories and commercial value as tourist destinations.

2.2 Traditional Economic Activities and Development Patterns

Given its rich and diverse natural resource heritage, the Setúbal Peninsula's economy was originally based upon a mixture of agriculture, forestry, fishing, and mineral extraction. Early settlement patterns clearly recognized the economic value of the peninsula's land, sea, and river resources. For example, compact villages developed along the shores of the Tagus in response

to natural constraints. Almada, Seixal, Barreiro, Moita, Montijo, and Alcochete were relatively densely built enclaves bounded to the north by the sea and elsewhere by productive agricultural land.

In the center of the peninsula, Palmela developed around a castle situated on a limestone outcrop in a similarly compact pattern, as much for the conservation of agricultural land as for defense. Other agriculture-based villages like Santana, in the vicinity of Sesimbra, show a similar original compactness. In contrast, Setúbal and Sesimbra on the more rugged south coast were relatively isolated from good agricultural land and developed exclusively as fishing villages.

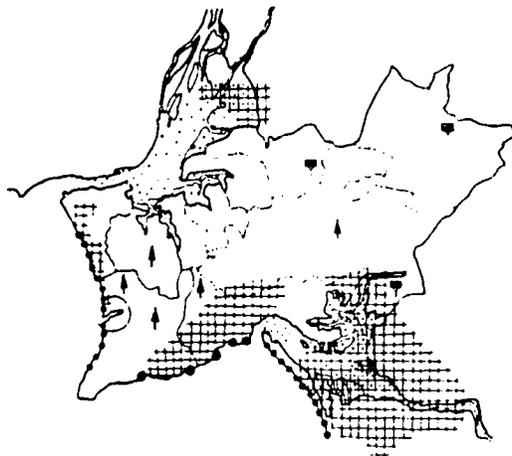
The first major change in the level of development seems to have occurred around the turn of the century with the construction of a railroad connecting the peninsula with Lisbon via a rail ferry. This new accessibility to the Lisbon market brought in the first wave of economic prosperity based on fish processing (cod drying for bacalhau using local salt gleaned from the nearby estuaries), cork harvesting and processing, and agricultural produce such as olives and wine. In the early years of the century, the peninsula appears to have enjoyed a stable, resource-based economy.

But improved accessibility also brought with it more intense industrialization. In the 1900s, the Companhia União Fabril industrial complex was established at Barreiro and thereafter the peninsula's northern shore became home to other heavy industry facilities, especially those related to chemical manufacturing. In the wake of this industrial development came additional prosperity and urban growth. A second major growth wave was triggered on the north coast by the expansion of the chemical and other industries in the 1920s, resulting in relatively steady population and urban growth through the 1950s, averaging just over two percent annually for the peninsula as a whole. (See Tables 1 and 2.) However, it was the construction of the April 25th Bridge over the Tagus River in 1965 that brought about the most radical change in the peninsula's traditional economic activities and settlement patterns.

2.3 Urbanization Trends: 1966 to the Present

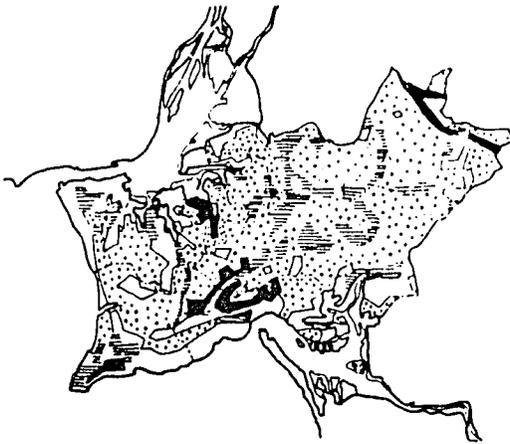
Completion of the bridge in 1966 opened up less expensive land to workers in Lisbon and, as a result, the municipalities of Almada and Seixal experienced heavy pressure for residential development, an urban growth scenario for which they were totally unprepared. Also, accompanying this greatly improved accessibility and a now resident labor force, came a second wave of industrialization with the establishment of the national steel manufacturing works, the Lisnave ship building facility, and several automobile assembly plants. In response to this investment in infrastructure and industry, the Setúbal Peninsula's annual average growth rate jumped to 3.24 percent during the 1960s. (See Table 2.)

The great majority of explosive urban growth in the 1960s occurred in Almada, Seixal, and Barreiro, communities that were closest to the bridge and the north shore industrial zones. In the 1970s, construction of the expressway connecting Lisbon with the Municipality of Setúbal was completed, thereby opening the way for further industrial development and urban expansion



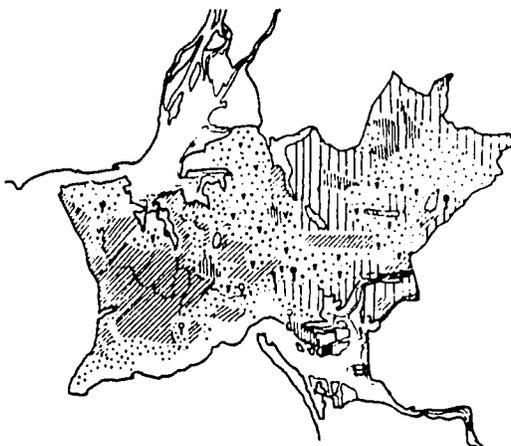
NATURAL PATRIMONY

-  Parks, Reserves and Protected Landscapes:
 A - Tagus Estuary Natural Reserve
 B - Fossil Arrabida da Costa da Caparica
 Protected Landscape:
 Beach/Pine Forest Natural Reserve
 C - Arrabida Natural Reserve
 D - Sado Estuary Natural Reserve
-  Lagoon  Beaches, Dunes  Estuaries
 Pines  Cork Oaks
- Principal Natural Values:
 1 - Vegetation 2 - Wildlife 3 - Landscapes



SOIL CAPABILITY

-  A, B Very High and High Capacity for Intensive and Moderate Agriculture
 C Suitable for Low Intensity Agriculture
 D Low Agricultural Capability; Suitable for Grazing, Forestry
 E Generally Unsuitable for Agriculture or Forestry



USE OF SOILS

-  Forestry (Pines)
 Forestry (Eucalyptus)
 Agriculture / Forestry (Cork Oaks)
 Agriculture / Orchards
 Olives  Vines  Apples
 Agriculture / Crops
 Uncultivated

FIGURE 2.
Setúbal Peninsula — Natural Resources
 Source: CINIA, Adapted by the Authors

along the peninsula's south shore and to a lesser degree in Palmela in the interior. Again, improved access and industrial development spawned another round of urban expansion.

Combined with the new accessibility, the after-effects of the revolution of April 25, 1974, brought another critical element of urban change to the peninsula: a surge in unregulated land subdivision for the construction of clandestine first and second homes. The areas most affected by this activity were the Costa da Caparica, the Albufeira Lagoon, and the pine forests south of Seixal and east of Moita. The combined result of the bridge, expressway, and industrial development was a doubling of the peninsula's population between 1960 and 1980. (See Table 2.)

Figures 3 and 4 show the dramatic comparison in urbanized area between 1960 and 1990, as the original village and town centers gained first a dense ring of medium- and high-rise residential development and then suburban and exurban development, shown in greater detail in Figure 5. Since 1980, these growth patterns have intensified. As shown in Table 2, the highest rates of growth have occurred in the municipalities of Seixal and Moita, where continuing clandestine development appears to reflect increased mobility and hence the greater accessibility of the pine forest areas to commuters.

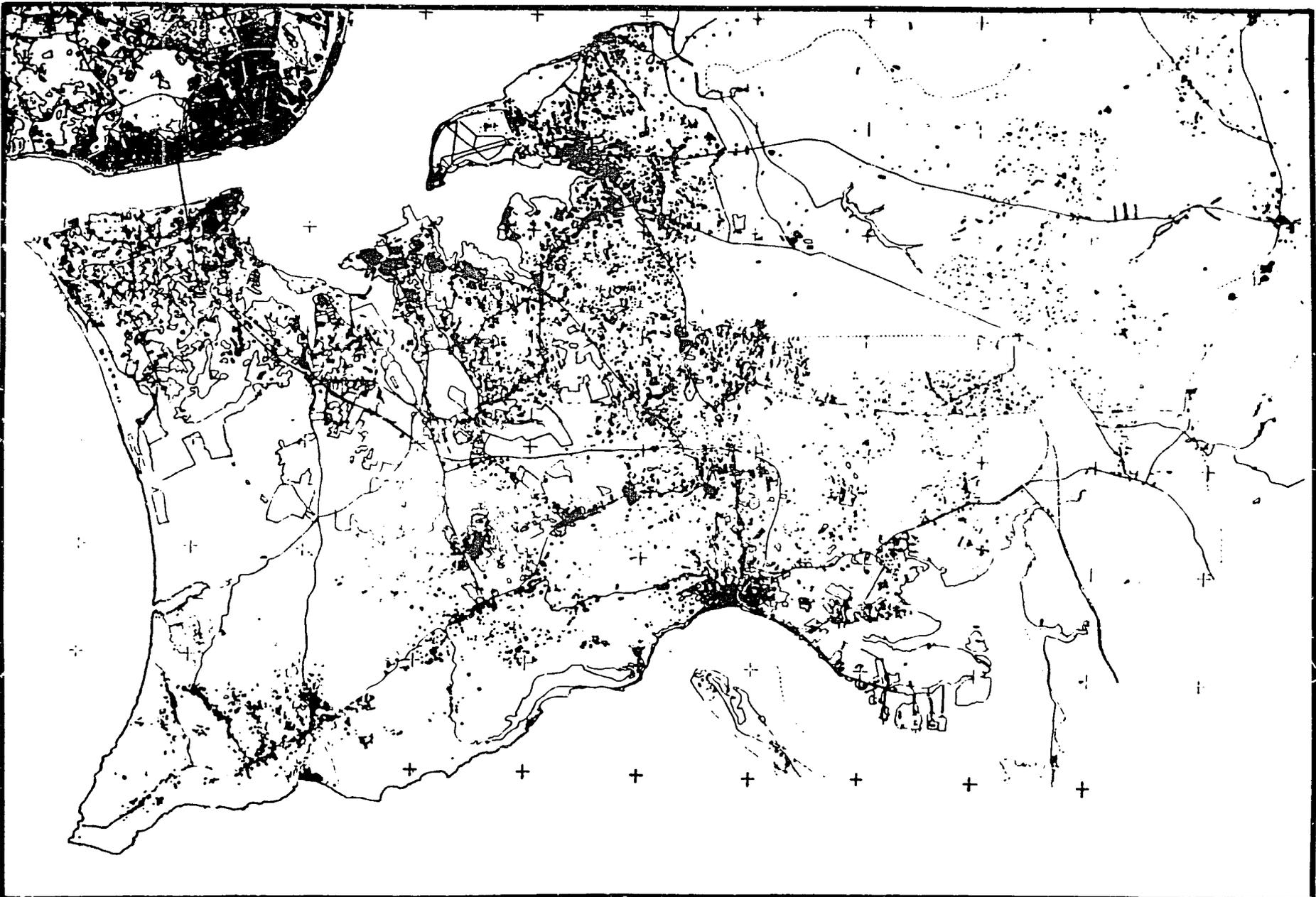


FIGURE 3.
Setúbal Peninsula — Extent of Urban Development, Pre 1970

Source: PROTAML, Vol. IV, April 1991



FIGURE 4.
Setúbal Peninsula — Extent of Urban Development, 1990

Source: PHOTAML, Vol. IV, April 1991

TABLE 1. POPULATION CHANGE BY DECADE, SETÚBAL PENINSULA,
1900-1989

MUNICIP- ALITY OR REGION	PERCENT CHANGE IN CENSUS POPULATION BY DECADE								ESTIM ATE	TOTAL & CHANGE	ANN. AVE. CHANGE
	1900- 1911	1910- 1920	1920- 1930	1930- 1940	1940- 1950	1950- 1960	1960- 1970	1970- 1981	1981- 1989	1960- 1981	1960- 1981
ALMADA	14.7	12.3	16.8	24.7	48.1	62.1	51.6	37.3	24.2	108.1	1.604
BARREIRO	55.8	24.4	40.2	24.1	13.8	18.1	67.4	49.9	22.7	150.9	2.018
MOITA	-3.7	15.4	34.3	30.6	57.2	49.6	32.4	38.1	25.3	82.9	1.320
MONTIJO	5.7	12.3	19.0	19.2	48.9	14.7	37.6	-11.3	24.3	21.9	0.432
PALMELA	21.8	8.0	34.3	12.0	7.7	2.7	7.4	48.5	24.8	59.5	1.019
SEIXAL	28.1	12.8	4.9	28.2	23.2	28.4	77.2	145.8	26.2	335.6	3.247
SESIMBRA	17.4	8.0	15.7	0.0	12.5	12.6	-1.1	38.7	28.6	37.2	0.689
SETÚBAL	26.3	28.1	22.7	-1.4	10.6	2.4	17.6	48.5	23.6	74.6	1.217
AVERAGE	21.3	-11.6	27.0	12.7	19.1	-0.8	9.9	27.6	2.4	40.2	0.735
LISBON METRO.	22.6	11.2	22.9	18.0	17.5	16.3	21.0	36.2	8.0	64.9	1.092
CCRLVT	18.2	8.5	18.7	15.1	14.6	10.8	11.7	28.3	2.7	43.3	0.784
PORTUGAL	10.8	1.5	11.8	14.0	9.7	4.7	-2.2	15.2	5.1	12.6	0.258

Source: PROTAML, 1991

TABLE 2. AVERAGE ANNUAL POPULATION CHANGE ON THE SETÚBAL PENINSULA,
BY DECADE, 1950 - 1985

MUNICIP- ALITY	1950		1960		1970		1981		1985 (*)	
	No.	40- 50	No.	50- 60	No.	60- 70	No.	70- 81	No.	81- 85
ALCOCHETE	7864	1.68	9270	1.66	10408	1.16	11246	0.76	11793	1.09
ALMADA	43768	4.01	70968	4.95	107581	4.25	147690	3.15	159654	1.79
BARREIRO	29719	1.31	35088	1.67	58728	5.29	88052	4.04	95418	1.84
MOITA	29465	4.63	29110	4.11	38547	2.85	53240	3.21	63013	3.90
MONTIJO	25887	3.88	30217	1.56	41565	3.24	36933	-1.71	39389	1.53
PALMELA	22993	0.94	23155	0.07	24866	0.72	36933	3.95	40138	1.91
SEIXAL	15937	2.11	20470	2.53	36282	5.89	89169	9.20	107012	4.23
SESIMBRA	14947	1.19	16837	1.20	16656	0.11	23103	3.20	25500	2.27
SETÚBAL	55037	1.01	56344	0.23	66243	1.63	98366	3.95	107936	2.13
SETÚBAL PENINSULA	235617	2.21	291459	2.15	400876	3.24	584648	3.76	649853	2.43
LISBON METRO.*	1,222.5	1.49	1,383	1.24	1,577	1.32	2,002	2.69	2,210	1.50
PORTUGAL*	7,922	0.93	8,293	0.46	8,108	-0.23	9,337	1.39	10,068	1.73

Source: O.I.D.P.S., 1990

*: Population figures in 1,000s



ALMADA
AND SURROUNDINGS ¹



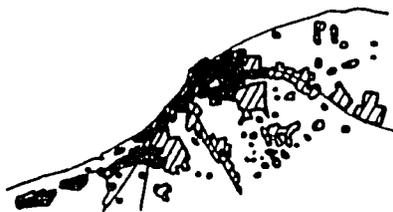
SEIXAL
AND SURROUNDINGS ²



BARREIRO
AND SURROUNDINGS ²



MONTIJO
AND SURROUNDINGS ²



ALCOCHETE
AND SURROUNDINGS ²

	1916	MILITARY MAP 1:25,000	¹
	1937	MILITARY MAP 1:25,000	²
	1957/8	MILITARY MAP 1:25,000	²
	1970	MILITARY MAP 1:25,000	¹
	1990	ORTHOPHOTO MAP	^{1,2}

FIGURE 5.
Urban Expansion of Selected Communities on the Setúbal Peninsula

Source: PROTAML, Vol. IV, April 1991

3. ENVIRONMENTAL CONSEQUENCES OF INDUSTRIAL EXPANSION AND URBANIZATION: SUMMARY OF EXISTING CONDITIONS

The under-regulated or uncontrolled urbanization of the Setúbal Peninsula over the past 30-40 years has resulted in the degradation of the region's natural resource base and, by extension, its economic sustainability. The following discussion highlights those areas of the environment that have been most affected by rapid urban growth.

3.1. Socioeconomic Implications

The stability of the Setúbal Peninsula's economy, originally based on resource extraction and the value added by resource processing, was upset between the mid-1950s and the mid-1970s as heavy industry expanded beyond a level desirable for diversity and sustainability. By the early 1980s, the combined effects of industrial obsolescence, a worldwide recession, and a slump in domestic demand for steel and related products led to a disastrous level of unemployment on the peninsula and revealed an unhealthy overdependence on the more footloose manufacturing industries. In addition, the peninsula had become a dormitory for Lisbon and structurally more dependent on Lisbon for many types of services.

It is apparent from Tables 3 and 4 that not only were the steel, shipbuilding, automobile and chemical sectors in crisis, but the number of workers in the traditional sectors such as agriculture and fishing had also declined. It appears that the decline in primary and resource processing employment may also have been accompanied by a decline in production, as suggested for fishing in Setúbal by the final table in Annex B. However, additional time-series data would be necessary to confirm such changes. Certainly, while modest reductions in agricultural land made way for high density urban expansion, much more significant losses of productive agricultural and forest land have resulted from clandestine development and, more recently, suburban sprawl. So far, the team understands that these losses may have been felt most severely in the forest industry, at a time when demand for the peninsula's pulp and paper products is rising dramatically.

In addition to a diminished economic balance and increased vulnerability to unemployment, the peninsula is still struggling to deal with the effects of the rates of population growth that in some localities reached five percent to as much as nine percent annually between 1960 and 1985. Maintaining a strong sense of community socially, aesthetically, and functionally, becomes almost impossible at such rates, especially in the absence of advance planning.

3.2 Degradation of Groundwater and Surface Water Quality

Recent water quality studies indicate that the upper layers of the peninsula's aquifer are subject to contamination from a variety of sources such as leachate from concentrated, improperly constructed or maintained septic systems, landfills, and industrial waste storage sites. Additionally, overdrafting of the upper aquifer is resulting in salt water intrusion. At the same time, as more and more land is converted from agriculture and forest to urban uses, the

permeable surface area is being reduced, thereby reducing the potential for aquifer recharge. It is not clear whether the upper and deeper layers of the aquifer are interconnected. However, if a connection exists, the consequences of continued contamination will be particularly grave.

The discharge of untreated wastewater (raw sewage and effluent from industrial and commercial activities) into the peninsula's two estuaries and other water courses may have significant negative consequences for long-term environmental quality and public health. Almada, Seixal, Barreiro, Moita, and Montijo all discharge untreated municipal wastewater directly into the Tagus Estuary. Similarly, less than half of the wastewater collected in Setúbal, Sesimbra, and Palmela is treated. Only Alcochete, the least urban and least populated municipality on the peninsula, manages to provide primary treatment for over 75 percent of its collected sewage. (PROTAML, Vol. 5, 1991.)

3.3 Loss of Productive Agricultural Land and Wildlife Habitat

Among the most visible and often irreversible consequences of urbanization is the indiscriminate consumption of land. While changes in land use are an inevitable part of economic development, unplanned growth can result in the loss of valuable natural resources. The Setúbal Peninsula was most severely affected by this process during the mid-1970s when clandestine development activities escalated and consumed or interrupted the productivity of large tracts of agricultural land and pine forests surrounding Almada, Seixal, Barreiro and Moita, made accessible by the A-2 expressway. (The affected areas, including several large blocks of land, are evident in Figure 4 but do not appear to have been accurately quantified.)

Natural areas of high species diversity, including the Albufeira Lagoon, Serra da Arrábida, and the intertidal marshes of the Tagus and Sado estuaries, have all been threatened in one way or another by industrial development and urban expansion. Specific activities that have contributed significantly to the degradation of wildlife habitat on the peninsula are: unregulated land developments in sensitive watersheds and coastal zones, the discharge of untreated municipal and industrial wastewaters, and the improper use of pesticides.

3.4 Geographic Distribution of Environmental Degradation

The areas of the peninsula that have suffered from severe environmental degradation are generally identified on Figure 6. These include:

- o The River Sado estuary, polluted by industry on the Mitrena Peninsula, domestic wastes, and agricultural wastes (fertilizers from the upstream wetland ricefields);
- o The River Tagus estuary, polluted by industrial and municipal wastes;
- o Areas around industrial plants;

TABLE 3. INDUSTRIAL EMPLOYMENT,
SETUBAL PENINSULA, 1981-1985

SUBSECTORS	WORKING POPULATION, 1981		ESTABLISHMENTS WITH 5+ EMPLOYEES 1985	EMPLOYMENT 1984		VALUE ADDED % OF NATION	% CHANGE IN EMPLOYMENT	
	#	% OF NATION		#	% OF NATION		SETÚBAL 1981	PORT. 1985
FOOD, BEVERAGES, TOBACCO	7323	6.9	167	5616	6.1	6.2	5.1	7.1
TEXTILES, LEATHER CLOTHING	8059	2.6	113	4042	1.5	1.5	5.6	17.8
MADEIRA, CORK	7145	6.1	136	5224	6.5	11.1	-7.5	-0.9
PAPER, PUBLISHING	3798	7.7	37	2200	4.7	11.2	-0.4	-4.5
CHEMICALS	10832	14.3	47	10443	15.6	17.9	-3.9	-2.4
METALLIC MINERALS	2936	4.5	70	2451	3.8	6.9	-31.2	-3.5
METALLURGY	3925	12.9	8	5337	21.9	36.8	-1.8	-1.2
MACHINERY/TRANSP. EQUIPMENT	33375	15.2	236	27925	14.1	13.8	-13.1	-5.2
MISCELLANEOUS PROCESSING	2755	8.4	7	97	0.9	-	-29.0	-6.8
TOTAL	80148	7.9	821	63335	7.5	10.7	-8.2	-4.4

Source: O.I.D.P.S., 1990

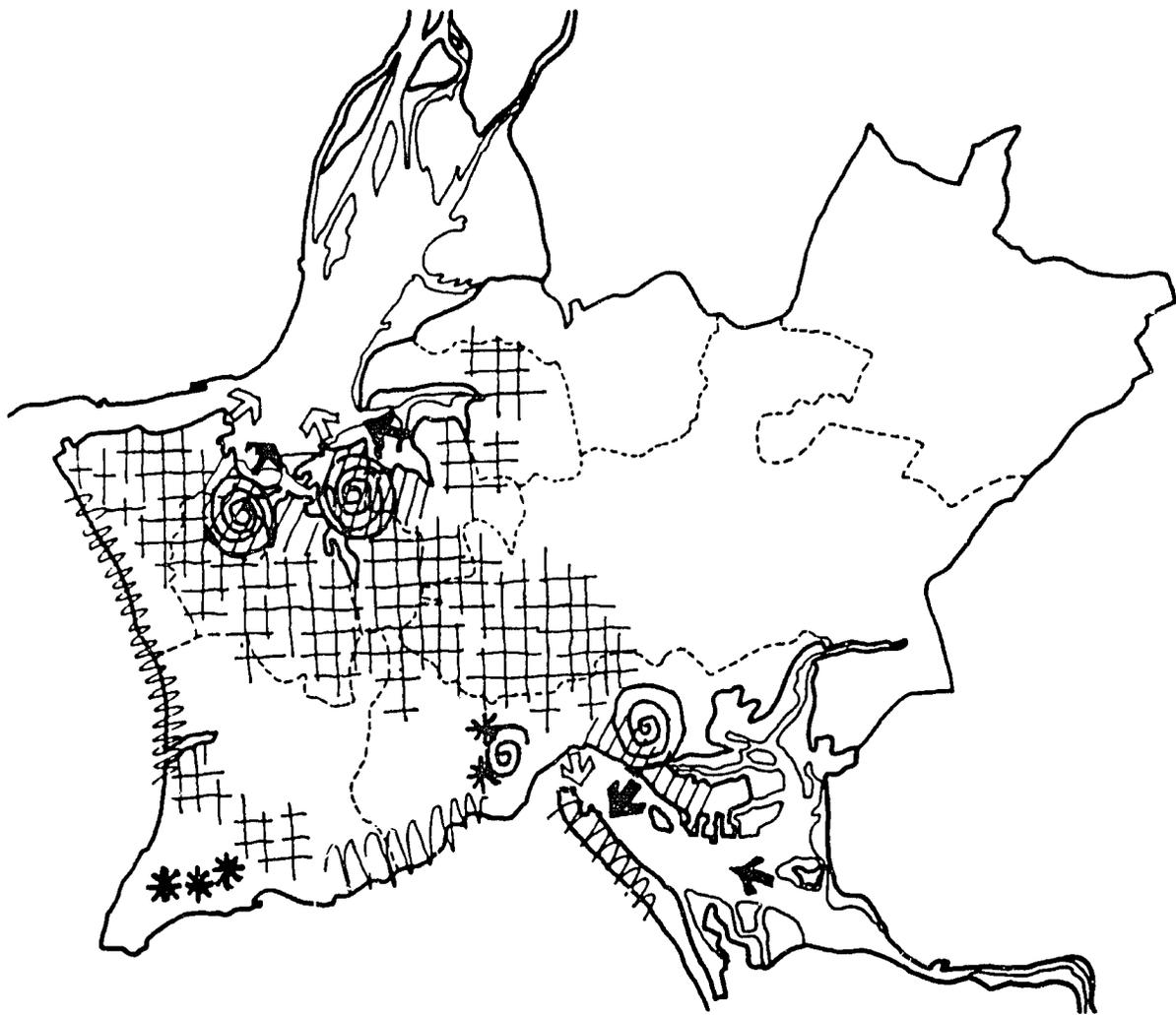
TABLE 4. EMPLOYMENT BY MAJOR SECTORS, SETÚBAL PENINSULA, 1960-1981

SECTOR	1960	%	1970	%	1981	%	60/81 %
AGRICULTURE & FISHERIES	37944	23.7	22280	13.9	14980	6.4	-46
EXTRACTIVE INDUSTRY	589	0.5	300	0.2	476	0.2	-19
MANUFACTURING INDUSTRY	42649	36.1	54885	34.3	80148	34.3	88
UTILITIES (Elect., Gas)	749	0.6	1080	0.7	2648	1.1	254
CONSTRUCTION	10486	8.8	16340	10.2	23424	10.0	123
COMMERCE	10472	8.9	20080	12.8	33692	14.6	222
TRANSPORT/COMMUNICATIONS	8454	7.2	13155	8.2	18258	7.8	116
FINANCE/INSURANCE	1487	1.3	3975	2.5	7548	3.2	408
SERVICES	15146	12.8	27435	17.3	52923	22.4	243
TOTAL - SETÚBAL PENINSULA	117976	110.0	159830	100.0	233097	100.0	98
PORTUGAL	3109782		2988170		3679467		18

Source: O.I.D.P.S., 1990

- o Areas affected by extractive industries and processing activities, such as those around the Secil and Calhariz quarries and cement plants in the Arrábida Natural Park;
- o Areas affected by clandestine development around the Costa da Caparica, Fernão Ferro, Casal do Marco, Albufeira Lagoon, and Almada; and
- o The area between Setúbal and Palmela where leapfrog residential, commercial and industrial development is seriously eroding productive agricultural land and has the potential to create an unbroken urban corridor between the two cities.

The most seriously degraded regions are reported to be Barreiro, the Fonte da Telha area, the Mitrena Peninsula, and the Quinta do Conde area.



Areas of Industrial Concentration



Principal Sources of Air Pollution



Areas of Unplanned Development

Sources of Water Pollution:



Areas Affected by Recreational Activity



Agricultural Origins



Areas of Mineral Extraction



Industrial Origins



Urban Origins

FIGURE 6.

Areas of Environmental Degradation

Source: CINIA, Adapted by the Authors

4. FUTURE DETERMINANTS OF CHANGE

At present, the Setúbal Peninsula is in what might most accurately be termed the "calm before the storm." The regional economy appears to have stabilized. Unemployment has dropped from a high of 20 percent in 1985 to a more manageable 5.5 percent in 1991. Much of the credit for changing the depressed conditions and degraded image of the peninsula must go to the initiative of the EEC and the administrators of the Integrated Development Operation (OID), the EEC-funded program of economic development and environmental improvement projects.

A major effort to produce a regional plan for the Lisbon Metropolitan Area is underway and peninsula municipalities are preparing local plans under an EEC funding mandate. In addition, progress has been made on some important environmental fronts. For example, the Ministry of the Environment and Natural Resources has recently worked out a phased pollution control agreement with the pulp processing facility in Setúbal, thereby beginning to curb the flow of untreated wastewater into the Sado estuary. Similarly, some of the more severe sources of pollutants, including sulfuric acid manufacturing plants along the River Tagus, have closed, resulting in lower sulfur dioxide and other toxic emissions. Another excellent demonstration of the commitment to environmental protection and improvement is the removal of clandestine structures near the entrance to the Albufeira Lagoon.

Despite such successes, or more accurately, because of them, the level of domestic and international investment targeted for the peninsula has the potential to change the region's demographic and environmental configurations more radically than any of the previous changes. The following section describes the major motivators and potential shapers of future growth.

4.1 Proposed Infrastructure and Development-Related Projects

Through consultations with public officials and private individuals, ten projects have been identified that are likely to alter the Setúbal Peninsula's demographic patterns and natural environment significantly. While the focus of attention recently has been on the successes of the OID program, these major projects have far greater potential to bring change than most of the OID projects and represent a level of investment ten times greater than the OID program. Moreover, they are all scheduled to be constructed, if approved, within a very short time period.

Of the ten proposed projects, four would increase accessibility to the peninsula and localities within it. These include a second bridge (or tunnel) across the River Tagus, a possible second airport, a new railroad spur, and the IP7 expressway extension from Palmela to Marateca and on to Madrid. Major industrial projects include: the Ford-Volkswagen plant and a high technology industrial estate in the vicinity of Palmela, and a major expansion of the Port of Setúbal. The other major infrastructure projects are a natural gas terminal and pipeline, a water import line, and an industrial waste treatment and disposal plant. Figure 7 shows the locations of the projects. Their characteristics, to the extent defined or made public, are summarized in Annex C.

4.2 Potential Growth Scenarios and Likely Impacts

Based on past experience on the peninsula and elsewhere, it is possible to anticipate the types of changes in development patterns, environmental and natural resource quality, and economic conditions that could accompany these major projects in the absence of well-coordinated plans and regulations. Some of these changes would occur as a direct consequence of the projects themselves while others would result from secondary development.

Even though the precise timing and location of several projects remains uncertain, it is nevertheless possible to use the announced schedules of some projects to construct potential development scenarios that look ahead five, ten, and fifteen years.

The first period, 1991 to 1996, could see completion of the Ford-Volkswagen plant, the IP7 Expressway, and the gas terminal. Based on the speculative development that has already begun in connection with the Ford-Volkswagen plant, a considerable amount of similar speculative activity can be anticipated as the planning and construction of other major projects begins later in the period.

In the second period, 1996 to 2000, not only would the population growth on the peninsula already projected by the Ministry of Planning be augmented by the new projects (especially as a result of the Ford-Volkswagen plant and the expressway) but increasing disposable income would also be reflected in expanding car ownership. It is probable that the existing traffic bottleneck created at the single Tagus River bridge would intensify to a degree generating tremendous pressure to construct a second Tagus crossing.

By the third period, 2001 to 2006, all the projects should be in place, according to current projections, and the focus would likely shift to the effects and infrastructure needs of secondary development.

Figure 8 illustrates, hypothetically, the potential for further urban expansion in the three time periods based on trends and assumptions described below. Refinement of the mapped growth scenarios would require more complete knowledge of project schedules, effective local planning policies, and, most particularly, land ownership patterns.

Potential Transportation Project Effects. As a result of the well-documented effects of the first bridge, it is relatively easy to foresee the growth effects that would accompany a second river crossing. If Alcochete were to be selected as the southern anchor, for example, the historic squares and buildings that confer such a strong sense of identity could be overpowered and perhaps obliterated. In their place would be rows of largely identical high and mid-rise residential blocks such as now make up Almada. The areas of high density development that currently surround Montijo and Moita would be substantially expanded. Beyond the high density band, suburban development would expand within a reasonable commuting distance of Lisbon. The pine forests to the southeast of Montijo, already the location of clandestine residential development and "paper" subdivisions (with a grid of streets but no development or services), would be a likely focus of renewed development pressure.

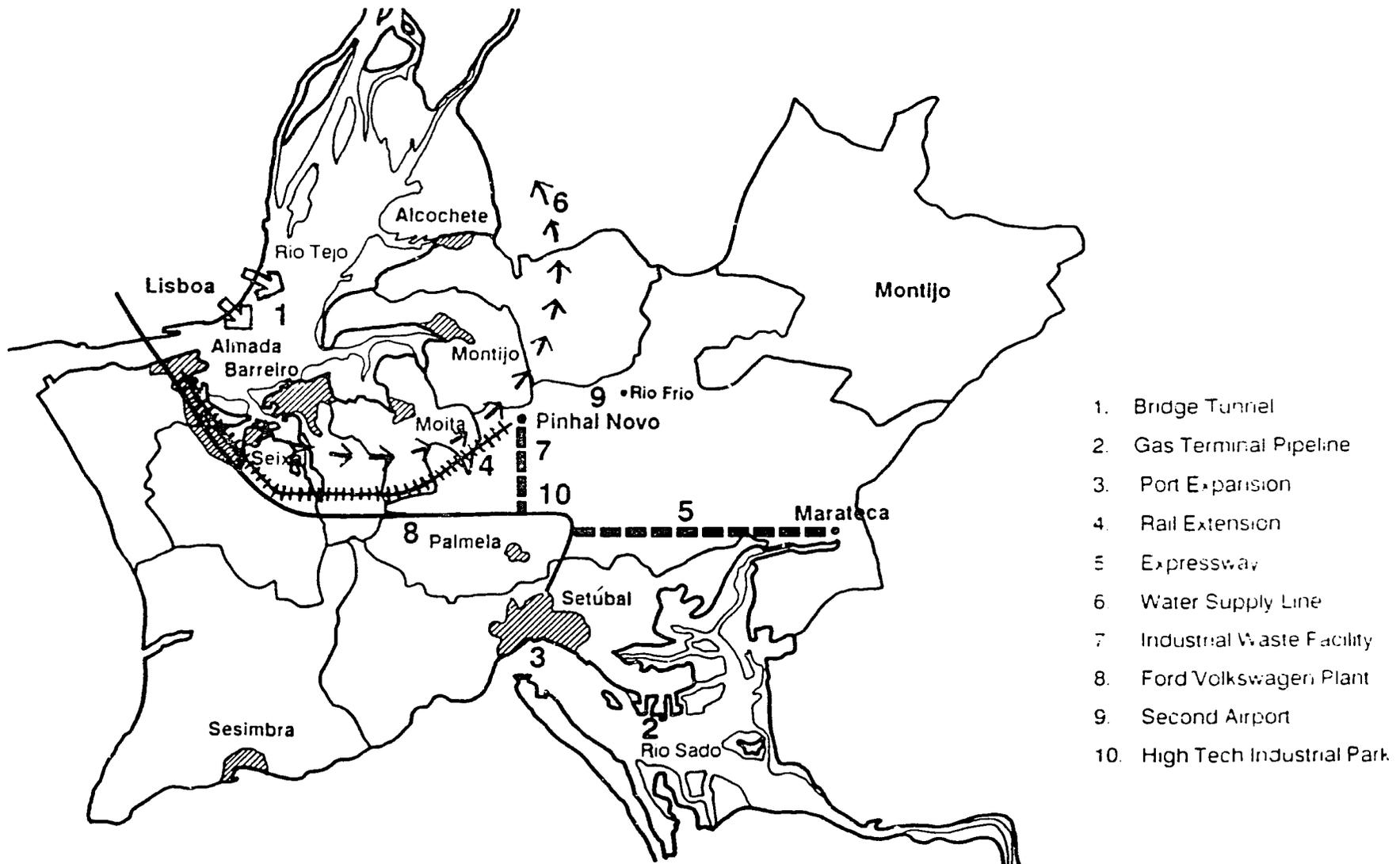


FIGURE 7.

Location of Proposed Major Projects on the Setúbal Peninsula

Source: CID, CCRLVT, and the Authors

The potential effects of the other major transportation projects or growth shapers do not have such clearly comparable precedents. However, the proposed railroad would certainly induce further high density commuter residential development in Pinhal Novo and at other station locations. At the same time, suburban subdivisions could be expected to push further into the agricultural lands that surround Palmela and Setúbal as more mobile families could live within driving distance from stations.

The extended IP7 highway from Palmela to Marateca would likely attract commercial development aimed at serving the new international traffic. Development of a new center could be expected to occur at the interchange with the existing highway to Setúbal. The sprawling mix of industrial, commercial and residential development north of Setúbal would intensify, gradually eliminating the residual agricultural parcels and expanding northwards along both the Palmela-Lisbon expressway and the IC3 highway to Pinhal Novo (an OID improvement project).

If Montijo, one of two potential peninsula sites under consideration for the second airport, were finally selected, the effect, at a minimum, could be extensive commercial and office development. A Rio Frio location, because of its relative isolation, could become the focus of an entirely new town and would remove the remaining pine forest in that area.

While the transportation projects would induce more commuting and dependence on Lisbon, each would also support local industrial development projects, of which some 40 to 50 are reportedly being planned. With the opening up of the less accessible parts of the peninsula to modern transportation facilities, the new industry would tend to occupy agricultural land, bypassing obsolete old industrial areas. As a result, municipalities would be faced with fewer opportunities for the clean-up and productive reuse of contaminated sites.

Potential Effects of Light Industrial Projects. The new industrial development would tend to have different types of residential demands from those of earlier rounds of industrial development. The Ford-Volkswagen plant, on which a firm decision has already been made, provides one example of those probable demands.

Specifically, the Ford plant will employ approximately 5,000 workers, reportedly of a uniformly high skill level. Unless the proposed local training programs exclusively target local workers, many of these employees will be in-migrants to the peninsula. Because of the anticipated high salary levels, these new workers will likely demand higher quality housing than currently exists in the Palmela area, as well as stretch the local home-building resources of the region. (EGF-Sage, Volume 2, 1991.) Additionally, if existing development patterns continue, much of the new housing will occur in scattered subdivisions.

As a result of this type of spatial development, the relatively intact expanses of farmland in the Palmela region would be subject both to direct removal and to the indirect disruption of agricultural production that accompanies such development (i.e. interference with farming operations, increase in land values, and reduction in the markets and services needed for efficient farm operation). Further east, the new residential demand would add to the development pressure imposed by the new expressway in the already chaotic landscape to the

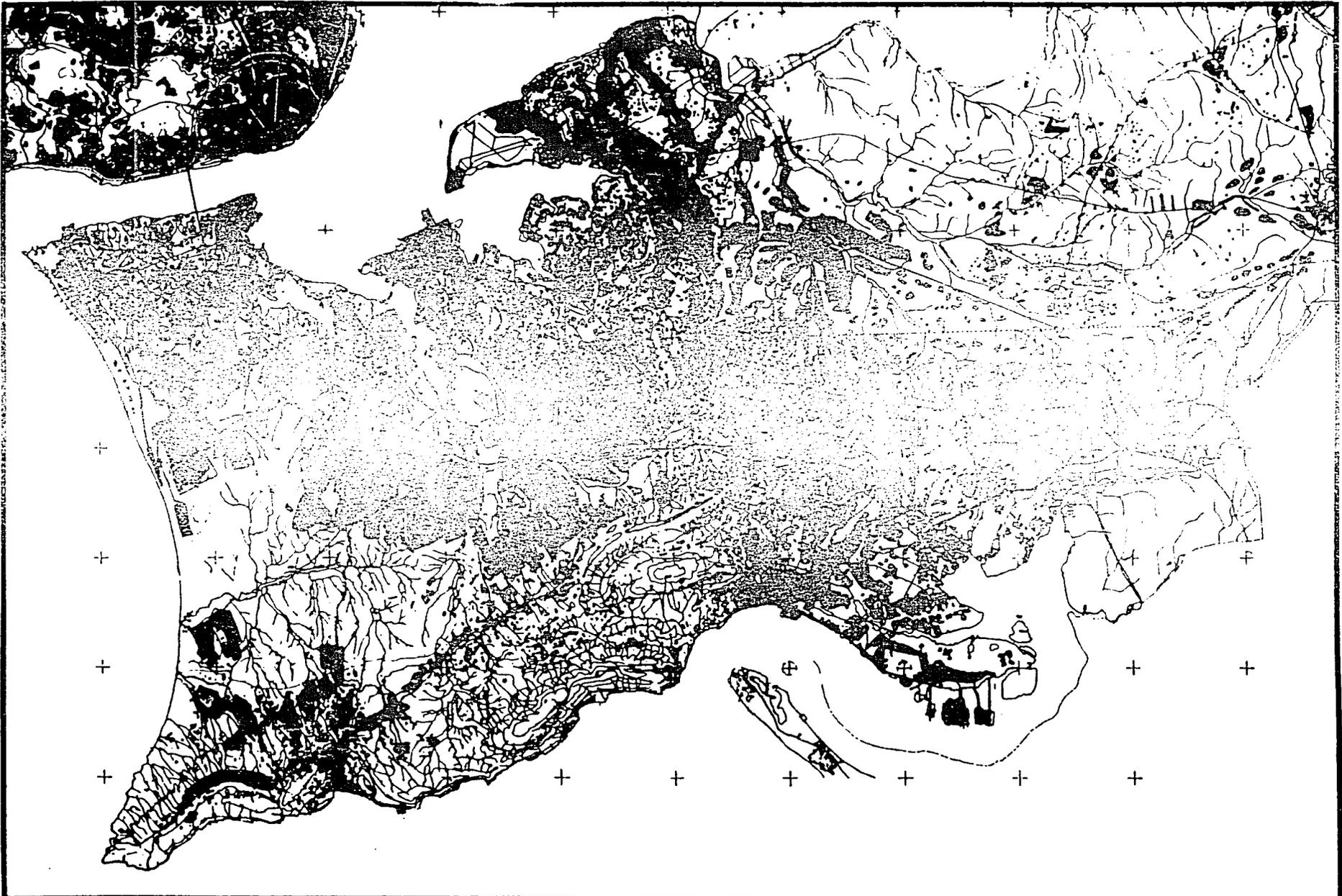


FIGURE 8.

Potential Urban Expansion Related to the Major Projects

Source PROTAML, Vol. IV, April 1991, Adapted by the Authors

north of Setúbal. As a result, the farmland that now survives as temporary buffers between residential and other types of development would disappear at an accelerated rate.

Without a carefully orchestrated effort to achieve a balance of jobs and housing in each major new employment location, the new industrial projects, combined with the transportation facilities, could lead to a disastrous scenario. Productive farmland, forests and open space could disappear under a blanket of industry and housing in the triangle formed by Almada, Montijo and Setúbal.

In addition, as has happened in California's Silicon Valley, Santa Clara County, the growing demand for housing associated with a major concentration of high technology industries in the Palmela area would affect land values and housing prices. Many workers would be forced to commute from further and further away in order to find affordable homes. This would spread the demand for the conversion of more distant agricultural land, including the more valuable vine-growing areas, bringing with it a significant and possibly degrading alteration in the image and economic health of the region. This situation is similar to trends experienced in Marin and Sonoma Counties north of San Francisco, where pressures for affordable housing development have continually threatened productive agricultural land and other important natural resources. In those counties, successful growth management systems have been in place for many years that attempt to respect environmental limits and encourage the availability of affordable housing.

Potential Effects of Waterfront Industrial Projects. Another important driver of residential and industrial growth will be the expansion of the Port of Setúbal and the Mitrena Peninsula industrial area. While many of this expansion's effects would take the form of indirect industrial growth elsewhere on the peninsula, the Port Administration anticipates a fifty percent increase in direct employment. With limited developable land between the boundaries of the Serra da Arrábida and Sado Estuary protected areas on either side, development pressure can be expected to accelerate towards the north and northeast. With that expansion, there could be increased potential for pollution of the Sado Estuary, since the boundaries of the preserve protect the tidelands and the shoreline but not the drainage basin.

Proposed port and industrial expansion and construction of the proposed natural gas terminal will require a minimum of 15 and up to 50 hectares of land reclamation, using local fill materials. However, as a result of past industrial activities, the local sediments are likely to contain heavy metals and other contaminants. Without adequate environmental studies, the port expansion project and the massive amounts of dredging and filling that would be required could result in contamination of the tidal mudflats and waters of the estuary. The result could adversely affect the fishing industry and the related fish processing, boatbuilding and incipient tourist industries in Setúbal. The effects could also be felt along the coast in Sesimbra, targeted by OID and the Port of Setúbal for major fishing and tourist industry expansion.

A related concern is the use of the substantial portion of the Setúbal waterfront set aside exclusively for industrial activities under the expansion plan. The city is confined by protected areas on either side, making it important to make maximum and, wherever possible, multiple

use of available developable land. At least a portion of the industrial waterfront could be improved to accommodate some joint, publicly-accessible uses.

To achieve an appropriate balance among competing interests and land uses in this and other parts of the peninsula's shoreline and estuaries will require pooling the available knowledge and plans of several agencies and disciplines. The San Francisco Bay Conservation and Development Commission was established to manage a similar shoreline and estuarine environment and could be considered as a model.

Specific Development Issues. The last three of the major projects raise special environmental issues that require additional thought before proceeding with their design and implementation.

- o The EPAL Water Import Line. Consideration is being given to importing water to the peninsula to combat the problems of overdrafting, contamination and saltwater intrusion affecting the Setúbal aquifer. The project appears to be an essential short-term measure. However, the availability of imported water would also tend to reinforce the growth-inducing effects of the other major projects. Moreover, the major investment proposed could be seen as limiting the opportunity to upgrade the primary wastewater treatment plants being funded by OID. A high level of treatment by these plants could make aquifer recharge a feasible alternative through reinjection of treated water. The peninsula would then have the potential to be self-sufficient in terms of water supply. In addition, the region would gain greater control over the location and type of development through greater control of water availability and would be obliged to manage development to protect recharge areas.

Once again, the San Francisco region offers examples of the effects of both poor management and good management. In Santa Clara County, a rich aquifer has been neglected beneath the industrial and residential development that has paved over a once rich agricultural valley. Inadequately regulated high technology industry has contaminated the aquifer with highly toxic chemicals, while years of overdrafting have left the aquifer depleted and resulted in severe structural settlement problems. In Marin County, a decision to avoid the import of water and to allow development within the natural capacity of the area have protected both the quality of the environment and the quality of life.

- o The Industrial Waste Treatment and Disposal Project. This project illustrates the farsightedness of the OID planners in attempting to avoid the environmental contamination potentially associated with new industrial development. Project designers should consider the special characteristics of high technology industry in order to avoid the dangerous and costly environmental damage, such as that caused by esoteric chemicals in the Santa Clara Valley, California. A coordinated program of strict regulation as well as chemical treatment and disposal or recycling would be desirable.
- o The Mitrena Natural Gas Terminal and Pipeline. The site proposed for the natural gas import terminal will require removal of an abandoned pyrites plant and treatment of

contamination, in addition to probable dredging and filling activities. Moreover, pipeline construction across the Setúbal Peninsula will involve a unique set of potential environmental impacts that should be considered in selecting a route and approving the project. Once again, without adequate environmental studies, the terminal and pipeline project could have adverse effects on the fragile environment of the Sado Estuary and its shoreline wetlands and beaches.

4.3 Summary of Potential Project Effects

The overall effects of the scenarios can be summarized as follows:

- o A significant loss of permeable soils, with attendant consequences for aquifer recharge;
- o Potential permanent loss of some of the peninsula's most productive agricultural soils and forest lands;
- o Erosion of an important visual and functional buffer around the Serra da Arrábida Natural Park and potential for continued contamination of the drainage basin of Albufeira Lagoon;
- o A significant reduction in the peninsula's agricultural, fisheries and forest production and consequent loss of direct and indirect processing employment and income;
- o A reduction in the attractiveness of the peninsula as a recreational destination and loss of the opportunity to build a tourist industry based on the presence of extensive vineyards and fishing harbors close in to the center of the metropolitan area;
- o Loss of economic sustainability and increased vulnerability to economic and technological shifts affecting manufacturing industries;
- o Greatly increased costs to provide infrastructure and services to sprawling areas of urbanization; and
- o Growing traffic congestion and reduction in the quality of life, leading eventually to a decline in the peninsula's competitive position as an industrial center.

The scenarios that have been described are not inevitable accompaniments of the proposed projects. Maintaining a balance, however, between economic growth and natural resource conservation is essential to the peninsula's long-term prosperity. Short-term employment gains should not come at the expense of natural resource-based activities that offer an important type of low to middle skill level employment. To achieve and maintain long-term prosperity for all income groups, it would be dangerous to rely on short-term construction projects to redress unemployment projects and just as dangerous to rely on a wholesale conversion to high technology industry. Long-term costs of future boom-bust cycles could be avoided or minimized by investing now in the effort required to achieve an appropriate balance. The time during

which project decisions would be made is very short and perhaps no more than one year remains in which to guide the critical choices.

The scenarios presented above assume an absence of effective controls. The government of Portugal is now putting controls in place that meet two critical requirements for effective environmental protection and development control policies: legal standing and institutional support. Refer to Annex D for an overview of this regulatory framework.

5. IDENTIFICATION OF KEY ISSUES

Analysis of previous trends, existing conditions, and proposed growth-inducing activities reveals a number of key issues that need to be addressed now to avoid further environmental degradation and chaotic urban development of the Setúbal Peninsula. These include:

(A) Intragovernmental Coordination

One important discovery of this study was the identification of the ten major infrastructure projects targeted for the peninsula. This information was collected from a variety of sources, rather than a single source. While most agencies knew about one or more of the ten proposals, no one office was aware of all of them, or their scale, timing and potential impacts. Given the magnitude of these projects and the significant, long-term impacts of each, better coordination among public agencies is required to ensure that environmental and land use planning concerns are addressed early in the project design stage and that overall planning can address cumulative impacts.

(B) Institutional Capacity to Manage Environmental Protection Activities and Urban Growth

Discussions with environmental and planning officials at both the national and local levels suggest that current staffing patterns are inadequate to meet existing workload demands. This lack of qualified technicians and managers results in time-consuming bottlenecks which in turn encourage circumvention of regulatory procedures. As development pressures build, this problem will be exacerbated.

(C) Mitigation of Existing Environmental Problems

The lack of industrial and municipal wastewater treatment facilities, sanitary landfills, and hazardous waste disposal sites has posed serious threats to the peninsula's natural resource base and in particular to the Setúbal Aquifer and the Tagus and Sado estuaries. The protection of these resources depends on the development and implementation of a mutually adopted regional strategy, and on adequate funding. Wastewater treatment plants (ETARS) proposed by OID provide only primary treatment. However, even these projects are beyond the means of some municipalities, since they require a local 30 percent match.

(D) Lack of Integration between PROTAML and the PDMs

Regional and municipal land use development plans ought to be complementary documents that provide the spatial framework and performance guidelines to achieve common goals and accommodate various growth scenarios. Currently, both levels of

planning are occurring simultaneously, yet is unclear when and how the two will be integrated to reflect shared economic, social, and environmental objectives. Furthermore, it is unclear which plan takes precedence in the event of conflicts among individual Municipal Development Plans (PDMs) or between the PDMs and the Plan for the Lisbon Metropolitan Area (PROTAML).

So far a good beginning has been made with the PROTAML Part I documents and with the basic data and analysis for PDMs, based on review of the first volumes of the Palmela PDM. The latter includes a study of the potential effects and housing and service requirements of the Ford-Volkswagen manufacturing plant, prepared prior to signing of the agreement. In an example of the need for greater early coordination, it appears that preliminary plant specifications, and labor and other requirements were available to Palmela but not to the CCRLVT and the preparers of PROTAML.

(E) Inconsistent Implementation of the AIA Law

To the team's knowledge, of all ten projects, only the expressway and the new bridge have received environmental assessments and site studies before project approval. Based upon an examination of the documents prepared for the IP7 expressway and upon discussion with the Commission Chairperson, studies were insufficiently broad, in that consideration of the socioeconomic impacts of the facility on the region is not required by law. Inadequacies in the law, coupled with inconsistent and in some cases inadequate enforcement, has meant that the AIAs are not appropriately timed and are often not of adequate quality to promote effective decision-making. Further, the process tends to omit a comprehensive and public search for candidate sites or routes, beginning instead with predetermined candidates. While this may be reasonable in the case of the expressway, given specific origin and destination requirements, a wider range of options presumably exists in the case of other projects, such as the bridge and the airport. Perhaps of most concern is the fact that the team was unable to identify any evidence of studies or public debate regarding the justification for these projects.

6. RECOMMENDATIONS FOR INTEGRATING ENVIRONMENTAL ISSUES INTO SUSTAINABLE ECONOMIC DEVELOPMENT ACTIVITIES

With care, the Setúbal Peninsula is undoubtedly large enough to accommodate the growth that will accompany the various major projects without detracting from the existing quality of the environment, risking further destabilization of the peninsula's economy, or diminishing the quality of life.

Recommended Activities

As indicated in Chapter 5, the mechanisms for achieving an appropriate integration of environmental quality and sustainable economic development activities already exist. The following recommendations aim to increase their effectiveness.

(A) Increase Intragovernmental Coordination

The single most important environmental need for the future of the Setúbal Peninsula is full and regular communication among all governmental agencies regarding proposed plans and projects. Government ministries, especially the Ministry of Public Works, the Ministry of Industry and Energy, and the Junta Autónoma das Estradas (JAE), as well as the Ministry of the Environment and Natural Resources, the Ministry of Planning and Land Management, and the nine municipalities should take steps to increase communications horizontally at each level and vertically between the two levels. The following approaches may be considered.

- o Establish an environmental clearinghouse which would require notification of peninsula planning proposals (similar to the California state environmental clearinghouse which collects and distributes environmental impact reports);
- o Reconstitute and formalize the regional association of municipalities which the team understands was active in the early 1980s (José Luis Lopes Pereira, personal communication); and
- o Conduct a regular series of intergovernmental meetings and seminars.

(B) Increase Institutional Capacity to Manage Environmental Protection Activities and Urban Growth

As development pressures increase throughout the peninsula and new or revised environmental regulations are adopted, the demands on public sector employees in the areas of planning, environmental protection, and provision of services will increase significantly. Given the constraints of macroeconomic structural adjustments, the prospects for higher staffing levels in the near future are not bright. The peninsula has already been adversely impacted by the past absence of management controls. It has the

potential to be further impacted by the effects of future projects that have been conceived in the absence of an overall plan and the articulation of shared goals.

- o As a matter of urgency, identify a shared regional vision and establishing goals and priorities to focus attention and levels-of-effort on key issues. Incorporate the goals into the PROTAML and PDMs (see also under (D) below);**
- o Clearly delineate departmental functions and responsibilities to avoid duplication of effort; and**
- o Complete and adopt PDMs and streamline regulatory review procedures to facilitate compliance.**

(C) Mitigation of Existing Environmental Problems

Another troubling aspect of current financial constraints is the inability of the municipalities to meet the matching requirements for EEC/OID funding of large-scale projects such as landfills, wastewater treatment plants and hazardous waste disposal sites. National government funding for such projects is also unavailable and public and private industries lack technical facilities for effective industrial waste treatment. Alternative methods to acquire pollution control technologies are listed below.

- o Investigate public-private partnerships for the provision of municipal services. Increasingly, local governments are contracting private firms to operate services; and**
- o Facilitate appropriate technology transfers, industry to industry and municipality to municipality, through seminars and technical personnel exchange programs.**

Selection of the appropriate course or courses of action in this as in other areas of planning for the peninsula's future rests on the choice of priorities and should be the subject of concerted and coordinated examination by all affected interests.

(D) Prepare and Integrate Regional (PRCTAML) and Municipal (PDM) Land Use Plans and Development Strategies

Experience shows that effective land use planning and implementation requires a clear understanding of the desired type and pattern of future growth. At present, there is no clear vision of what the Setúbal Peninsula will or should look like five, ten or twenty years from now. The role of the PROTAML is to articulate this shared vision and provide regional economic development and environmental protection goals as well as urban growth scenarios which can be used in preparing the PDMs. The role of the

PDMs is to contribute to formulating the vision and then to incorporate regional objectives into municipal land use plans and development guidelines and standards.

Suggestions to rationalize the relationship between the PROT and the PDMs include the following:

- o Create an interdisciplinary/interagency committee to identify or revise development objectives in light of the peninsula's rich natural resource base;
- o Expand the ongoing industrial site suitability study (ELIPS) to cover all land uses, building on the PROTAML data base and data available from EIAs and special purpose research agencies (see Annex E);
- o Consider holding a regional forum of the CCRLVT and the municipalities to help speed the formulation of a vision and identification of key goals and priorities; and
- o Prepare a Memorandum-of-Understanding or similar document which distinguishes regional planning responsibilities from municipal planning functions, and sets a logical timeframe to allow for plan integration.

(E) Improve Comprehensiveness and Effectiveness of Environmental Impact Review

Environmental Impact Reports (EIAs) should ensure full disclosure and public debate of major projects and, ideally, should be prepared within a consistent framework of goals, plans, and base data. That regional framework is not yet in place. In the meantime, EIA preparation and review offers the chance to contribute to an overall understanding of the growth-shaping potential of major projects and to focus the information exists regarding growth patterns and socioeconomic and environmental conditions. The following are some recommendations for increasing the effectiveness of EIAs:

- o Ensure that Environmental Impact Reports are prepared for all projects which require them under the law and that they are prepared early enough, in stages if necessary, to allow a review of the need for the project as well as alternative project types and locations;
- o Ensure that all agencies, organizations and interested citizens are adequately informed and enabled to comment on projects (see clearinghouse recommendation in (A) above); and
- o Require analysis of the potential dynamic effects of major projects on ecological systems, induced urban growth and economic conditions (see Annex E).

Priority Areas for Further Action

The most important and urgent of the recommendations are to set goals and establish mechanisms for increased communications. They should receive priority attention and would be facilitated by continuing the kind of seminar held at the end of this technical assistance program in June 1991 which drew together government, industry, and university participants representing a diversity of disciplines and public and private interests. The debate thus initiated on the integration of environmental and economic development interests and issues set the stage for an expanded and intensified effort.

An independent coordinating body might be an appropriate sponsor of future seminars, in the manner that the Fundação Luso-Americana para o Desenvolvimento (FLAD) sponsored the June 1991 seminar. However, establishment of a special coordinating group may be appropriate to represent the Ministries, the municipalities, agencies and organizations such as OID and NERSET, and others, on an on-going basis. In any event, some type of forum is needed soon and on a frequent basis if the future of the peninsula is not to happen by default.

The second priority is to complete the integrated set of regional and local plans, even if data are incomplete. Refinements can be incorporated later once a broad and commonly agreed-upon framework is in place. Meantime, the need to deal with the effects of existing environmental problems, managing current development proposals and preparing advance plans are placing huge simultaneous demands on all the affected agencies. In these circumstances, all possible sources of competent assistance, such as the universities and private industry, need to be drawn on to augment the capacity of the regional and municipal agencies over the next year.

ANNEX A

INDIVIDUALS AND SOURCES CONSULTED

Individuals and Agencies

Regional Housing Office/Lisbon, U.S. Agency for International Development (AID)

Mr. David C. Leibson

Eng. José Trindade

Mrs. Bonnie Walter

Mr. Edward H. Robbins

Comissão de Coordenação Regional de Lisboa e Vale do Tejo (CCRLVT)

Dr. José Salter Cid, Presidente

Dr. Calejo Monteiro, Director Regional do Ambiente e Recursos Naturais

Eng. João Teixeira, Director Regional do Ordenamento do Território

Eng. Margarida Fonseca

Eng. Pereira da Silva

Direcção-Geral da Qualidade do Ambiente

Eng. Artur M. Ascenso Pires, Director-Geral

Eng. João Luís Villa-Lobos, Subdirector-Geral

Enga. Ana Maria Martins, Inspectora do Ambiente

Dra. Maria Vitória Bruno da Costa

Instituto Nacional de Habitação (I.N.H.)

Dr. José Manuel Nunes de Carvalho, Presidente

Eng. João Paes Vasconcelos, Vogal do Conselho Directivo

Eng. Hermano Silveira Vicente

Arq. Vasco Folha

Fundação Luso-Americana para o Desenvolvimento (FLAD)

Mr. Charles A. Buchanan, Jr., Administrador

Núcleo Empresarial Regional de Setúbal (NERSET)

Eng. Fidélio José Cavaco Guerreiro, Presidente

Eng. Lemos Vieira

Dr. Carlos Corvelo, SISMET

Dra. Guadalupe Madeira, Electricidade de Portugal

Eng. Antonio Costa Reis, SOLISNOR

Eng. Raul Figueiredo, SOLISNOR

Eng. José Bravo Ferreira, SECIL

Eng. José Maria de Oliveira Sérgio, SECIL

Eng. Eduardo Antonio Machado da Silva, Papéis Inapa

Com. José Encarnação Coelho, Parque Industrial da Quimigal, Barreiro

Ministério do Planeamento e da Administração do Território, Operação Integrada de Desenvolvimento de Setúbal (O.I.D.)

Eng. Rui Mil-Homens, Director

Arq. Eduardo Carcajeiro

Câmaras Municipais da Península de Setúbal

Sra. D. Jacinta Ricardo, Presidente da Câmara Municipal do Montijo

Sr. José Luís Lopes Pereira, Presidente da Câmara Municipal de Moita

Sr. Eufrásio Filipe Garcês José, Presidente da Câmara Municipal do Seixal

Arq. João Carlos Antunes, Câmara Municipal de Palmela

Vereador Elídio Ferreira, Câmara Municipal de Setúbal

Arq. Bernardino Ramalhete, Câmara Municipal de Sesimbra

Eng. Fernando Nunes da Silva, Câmara Municipal de Almada

Universidade Nova de Lisboa, Departamento de Ciências e Engenharia do Ambiente, Faculdade de Ciências e Tecnologia

Prof. Doutor Fernando Santana, Director do Departamento de Ciências e Engenharia do Ambiente

Prof. Doutor Leonel Canelas, Director do Centro de Investigação de Impactes Ambientais (CINIA)

Eng. Pedro Coelho

Centro de Estudos e Desenvolvimento Regional e Urbano, Lda. (CEDRU)

Prof. Doutor Jorge Gaspar, Director

Hidrotécnica Portuguesa (H.P.)

Eng. Fernando Abecassis

Arq. Leopoldo Castro Neves de Almeida

Administração do Porto de Lisboa

Arq. Fernando Morgado

Administração dos Portos de Setúbal e Sesimbra

Eng. José Arnaldo da Piedade de Noronha, Director de Produção

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ANNEX B

BACKGROUND SOCIOECONOMIC DATA FOR THE SETÚBAL PENINSULA

An Edited Selection of Data Assembled and Prepared by CINIA, the Environmental Impact Assessment Research Center (Centro de Investigação de Impactes Ambientais) of the New University of Lisbon.

TABLE B-1 GENERAL SOCIAL AND ECONOMIC INDICATORS,
SETÚBAL PENINSULA, 1981 & 1985

GENERAL INDICATORS	SETÚBAL PENINSULA	C.C.R.L.V.T.	PORTUGAL
AREA (Km2)	1522	13183	88826
No. OF MUNICIPALITIES	9	53	275
RESIDENT POPULATION 1981	585	3.292	9337
RESIDENT POPULATION 1985 (ESTIMATE)	650		9665
POPULATION DENSITY 1981	385	250	105
POPULATION DENSITY 1985	427		108
WORKING POPULATION 1981 (x1000)	256	1478	4003
EMPLOYMENT RATIO	20	44.9	42.9
UNEMPLOYMENT 1981 (x1000)	7.8	95	277
UNEMPLOYMENT RATIO 1981	20.1	6.5	6.9
UNEMPLOYMENT RATIO 1986 (ESTIMATE)	20.1		10.3
WORKING POPULATION	233	1367	3660
PRIMARY SECTOR (%)	6.4	8.6	8.6
SECONDARY SECTOR (%)	45.4	35.5	35.5
TERTIARY SECTOR (%)	48.2	55.9	55.9

TABLE B-2 TOTAL AREA AND PERCENTAGE OF AGRICULTURAL
AND FOREST LAND, BY MUNICIPALITY

MUNICIPALITIES	TOTAL AREA (km2)	AGRIC. AREA. (%)	FOREST AREA. (%)
ALCOCHETE	9449	91.4	5.9
ALMADA	6998	62.3	35.6
BARREIRO	3381	53.9	37.9
MOITA	5508	84.0	9.9
MONTIJO	34736	31.1	60.6
PALMELA	46182	40.6	48.9
SEIXAL	9358	65.8	32.9
SESIMBRA	19498	23.0	67.0
SETUBAL	17058	49.3	8.8
TOTAL	152160	44.3	43.8

TABLE B-3 GENERAL INDICATORS OF AGRICULTURAL AND AGRICULTURAL/FORESTRY ACTIVITIES ON THE SETÚBAL PENINSULA

INDICATOR	VALUE	% OF PORTUGAL
AGRICULTURAL POPULATION:		
- AGRICULTURAL WORKERS (1981)	11281	1.7
- AGRIC. POPULATION (1979)	32915	1.2
FARMS:		
- NUMBER	10952	1.4
- TOTAL SURFACE AREA (ha)	100089	1.9
- AGRICULTURAL/FORESTRY (ha)	91224	1.9
- AGRICULTURE (ha)	40413	1.4
PRODUCTION VALUE (1,000 Escudos) (Average 1979/80/81)	5211767	4.4
- CROPS	3649891	4.8
- LIVESTOCK/DAIRY	1009619	4.2
- FORESTRY	552257	2.7

TABLE B-4 AGRICULTURAL AREAS AND BLOCKS
IN THE SETÚBAL PENINSULA, 1979

MUNICIPALITY	NO.	AREA	NO. OF BLOCKS	AREA/BLOCK
ALCOCHETE	719	2334	1056	2.21
ALMADA	389	2638	120	5.55
BARREIRO	426	1312	488	2.69
MOITA	751	2838	926	9.32
MONTIJO	1950	28848	3095	9.32
PALMELA	3458	39479	5693	6.94
SEIXAL	527	4203	598	7.03
SESIMBRA	1322	12547	2969	4.23
SETÚBAL	1107	5815	1316	4.42

TABLE B-5 AGRICULTURAL PRODUCT VALUE BY PRINCIPAL COMMODITIES BY MUNICIPALITY
 PERCENT OF CROP AND LIVESTOCK/DAIRY VALUE, 1981

MUNIC.	POTATOES & VEGS.	FRUITS	WINE	BEEF	COW MILK	GOAT SHEEP MILK	PIGS	CHICKEN EGGS
ALCOCHETE	56.2	4.3	12.5	8.2	0.5	0.8	7.7	1.0
ALMADA	72.6	4.6	1.3	7.3	4.2	2.9	1.1	1.3
BARREIRO	45.4	19.5	4.4	17.1	5.2	0.9	1.8	2.8
MOITA	49.8	7.3	5.3	18.6	3.3	1.3	8.2	2.1
MONTIJO	35.3	9.6	23.7	7.3	0.9	1.2	12.8	2.0
PALMELA	17.2	10.1	49.1	6.6	1.0	1.5	5.9	2.2
SEIXAL	25.2	38.7	11.6	6.0	3.3	3.8	2.2	8.4
SESIMBRA	31.1	14.3	15.8	14.4	5.1	5.4	2.8	6.6
SETÚBAL	28.0	25.4	19.3	5.2	3.7	3.7	1.9	4.1

TABLE B-6 GENERAL COMPOSITION OF AGRICULTURAL PRODUCTION VALUE
PERCENT BY MUNICIPALITY

MUNICIPALITY	CROPS	LIVESTOCK/DAIRY	FORESTRY
ALCOCHETE	81.2	18.3	0.5
ALMADA	79.4	16.1	4.5
BARREIRO	69.1	26.8	4.1
MOITA	66.0	33.2	0.8
MONTIJO	64.2	20.7	15.1
PALMELA	73.4	15.3	11.3
SEIXAL	71.2	22.2	6.6
SESIMBRA	47.3	24.9	27.8
SETUBAL	78.1	17.0	4.9

TABLE B-7 FOREST PRODUCT VALUE PERCENT BY TYPE AND MUNICIPALITY, 1979 - 1981

MUNICIPALITY	PINE	EUCALYPTUS	OTHER WOODS	CORK	RESIN
ALCOCHETE	2.4	20.9	10.3	63.8	1.1
ALMADA	10.4	0.6	26.8	19.8	5.0
BARREIRO	35.4	27.1	13.4	7.0	17.0
MOITA	36.2	13.9	13.2	17.9	17.4
MONTIJO	1.2	34.4	12.3	50.2	0.6
PALMELA	5.0	7.6	11.6	72.2	2.4
SEIXAL	35.4	27.1	13.4	7.0	17.0
SESIMBRA	50.5	3.0	14.3	7.7	24.2
SETUBAL	22.8	7.0	26.8	21.8	10.9

TABLE B-8 PERCENT CHANGE IN AGRICULTURAL POPULATION
BY MUNICIPALITY BETWEEN 1969 AND 1981

MUNICIPALITY	TOTAL	MALE	FEMALE
ALCOCHETE	-53.5	-72.8	200.0
ALMADA	-66.5	-75.8	200.0
BARREIRO	-60.9	-73.1	60.4
MOITA	-52.0	-71.9	46.2
MONTIJO	-33.8	-56.0	13.6
PALMELA	-30.4	-55.1	17.1
SEIXAL	-70.9	-78.0	29.0
SESIMBRA	-72.8	-80.0	431.4
SETUBAL	-68.4	-55.1	177.1

TABLE B-9 CHANGE IN FISH PRODUCTION BETWEEN 1970 AND 1989 (THOUSANDS OF TONS)

B-10

	1970	1980	1982	1984	1986	1988	1989
LISBON METROPOLITAN AREA - NORTH	53.3	40.8	20.6	25.8	11.5	6.6	7.4
LISBON	49.8	39.4	19.5	24.6	9.6	4.9	5.9
SETÚBAL PENINSULA	33.5	17.3	18.5	17.5	24.4	22.7	23.1
SESIMBRA	4.0	7.2	7.8	7.4	12.9	14.4	16.0
SETÚBAL	29.5	10.1	10.7	10.1	11.5	8.3	7.1

ANNEX C

DESCRIPTION OF PROPOSED INFRASTRUCTURE, TRANSPORTATION AND INDUSTRIAL PROJECTS FOR THE SETÚBAL PENINSULA

Transportation Proposals

Second Bridge. A second bridge over the River Tagus was first proposed in the mid-1980s but has only recently received official consideration. Three sites are being considered. The first is adjacent to the existing bridge, the second is a longer crossing to a location in Montijo, and the third site is an even longer crossing to a location in Alcochete. The two latter options may involve a tunnel rather than a bridge. Estimated cost of the project is currently projected to be in the neighborhood of \$700 million.

Railroad. A new rail line is proposed between Pinhal Novo and Almada with a connecting spur to the Ford-Volkswagen plant. It is not known whether there are plans eventually to provide a rail link to Lisbon. In any event, the new route would give increased accessibility to the northern part of the Palmela Municipality.

Expressway Extension. The Portuguese Highways Department (JAE) is planning an extension of the IP7 Expressway from Palmela to Marateca, at the eastern edge of the Setúbal region, and connecting on to Madrid and the rest of Europe. An improved IC3 link between Palmela and Montijo is also being planned with OID funding.

Second Airport. A relief airport or replacement for Lisbon International Airport has been under discussion for the past two decades. The two possible sites, both located on the Setúbal Peninsula, are at Montijo, reusing the military airport, and at Rio Frio.

Industrial Projects

Ford-Volkswagen Automobile Plant. Final agreement was reached recently between the Portuguese government and Ford-Volkswagen officials on the selection of a site northwest of the City of Palmela for the construction of a state-of-the-art automobile manufacturing plant. This high technology plant will directly employ 5,000 skilled workers to manufacture a multi-purpose vehicle, one of the fastest-growing segments of the European car market in the 1990s. The cost of the plant is estimated at \$2.5 to 3.2 billion, representing the largest single foreign investment in Portugal.

Industrial Parks. Light industrial and high technology parks have been proposed or included in municipal development plans at some 40 to 50 locations throughout the peninsula. The most extensive of these appears to be a high technology industrial estate planned for a site between the cities of Pinhal Novo and Palmela. An example of the type of industrial activity anticipated

so far is the Sapec proposal, with Brazilian financing, for "Silicon Bay," where agricultural and small aircraft manufacturing industries would be established. (Diario de Noticias, May 11, 1990.)

Port of Setúbal Expansion. The Administration of the Ports of Setúbal and Sesimbra is planning a major expansion of the Port of Setúbal. The plan includes an expanded container terminal near the Setnave shipbuilding facility, scheduled for completion by 1995, a 15-hectare, 14 meter deep roll-on roll-off facility to support the Ford-Volkswagen Plant to be completed in 1993/4, and a 5-10-hectare container facility at the existing port. In addition, the Port Administration may construct a bulk terminal next to the proposed natural gas terminal. Each of these components of the expansion plan will require dredging for channels and terminal areas and fill, using dredge spoils, for shoreside facilities. (Eng. António Duvera, personal communication.) These projects will add approximately 70 workers to the Port's present 200 employees.

In the longer term, the Port is considering a 50-hectare container facility, five kilometers to the east of the present port, capable of handling 200,000 containers a year. (Lloyd's List, 5.13.91.)

The Port Administration is also planning a major expansion of the fishing port facilities at Sesimbra, which it considers now to be a more important fishing center than Setúbal.

Other Infrastructure Projects

Natural Gas Import Terminal. The Mitrena Peninsula has been selected as the site of the terminal for the import of natural gas to provide a less costly source of fuel for domestic consumers and for power generation in Portugal. The cost of the proposed 6000K cubic meter terminal and regasification facility at a former pyrites plant is estimated at \$700 million. (Lloyd's List International, March 11, 1991; Oil and Gas Journal, December 3, 1990.) Construction is scheduled for 1995 and would be followed by a five-year, \$800 million project to construct a pipeline to northern Portugal via a route paralleling highways north from Setúbal or via a coastal route.

EPAL Water Line. In response to problems of Setúbal Aquifer pollution, overdraft, and saltwater intrusion, the Lisbon Water Agency (EPAL) is considering the import of water from a reservoir 150 kilometers to the northeast of the peninsula. The line would also serve the City of Lisbon via the April 25th Bridge.

Industrial Waste Treatment Facility. The last of the major projects will serve industrial users on the peninsula and will provide treatment of hazardous industrial waste and disposal of solid waste.

ANNEX D

REGULATORY FRAMEWORK FOR ENVIRONMENTAL PROTECTION AND URBAN GROWTH MANAGEMENT

Presented below is an overview of the existing regulatory and institutional frameworks that have been established to date to analyze, monitor and enforce environmental quality and land development policies and standards.

Laws and Institutional Responsibilities

Environmental Protection. To be eligible for EEC Funds, the government of Portugal is required to adopt environmental legislation and regulations pursuant to the EEC's Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment. This requirement identifies environmental parameters that must be addressed during project design and implementation. While some environmental laws, such as those establishing natural parks and protected areas, pre-date Portugal's membership into the EEC, the majority have come on line as a direct result of this funding requirement. The following is a chronological listing of the environmental laws enacted to date:

- o The Environmental Act, 1987;
- o Noise Law, 1987;
- o Water Law, 1990;
- o Air Law, 1990;
- o Environmental Impact Assessment Law, 1990; and
- o Industrial Licensing Law, 1990.

The Ministry of Environment and Natural Resources was established in 1989 to expand the range of environmental protection activities performed by the national government. (Prior to its founding, most environmental concerns were handled by the Ministry of Planning.) The three major responsibilities of this new Ministry include (1) drafting and implementing legislation and regulations; (2) preparing, reviewing, and approving Environmental Impact Assessments; and (3) identifying and managing the nation's system of natural parks and conservation areas.

Land Use Planning and Development Control. The legal authority enabling municipalities to prepare and implement land use plans and development regulations is provided under national municipal planning laws.

The Ministry of Planning is responsible for the review and approval of both regional and municipal development plans. The Coordinating Commission of the Lisbon and Tagus Valley Region (CCRLVT) is the arm of the Ministry that is charged with the long-range planning of the Metropolitan Area of Lisbon (AML), including the nine municipalities that constitute the Setúbal Peninsula. Although the CCRLVT reviews and approves each municipal development plan, final approval of the plan (and the authority to implement it) rests with local residents and officials.

Management Tools

National, regional, and local government authorities have four existing policy implementation mechanisms at their disposal for managing environmental protection and land development. Two of these are the responsibility of the Ministry of the Environment and Natural Resources. They are the Environmental Impact Assessment (AIA) and wastewater discharge and air emission permits. The remaining two management tools fall under the domain of the Ministry of Planning and include the regional development plans (PROT) and municipal development plans (PDMs). A summary of each is given below:

- o Environmental Impact Assessment (AIA). This law requires an evaluation of the effects of certain types of public and private projects on human well being, flora, fauna, soils, water, air, the landscape, natural resources and cultural heritage. A two-stage procedure is required, beginning with an environmental study (EIA) which, together with the project description, is made available for public comment. Following satisfactory EIA review, the full AIA is prepared. The law provides a more extensive list of project types requiring an AIA than the EEC list but only applies to major projects. Many smaller projects, which may have significant environmental or growth-inducing impacts are therefore not yet subject to assessment. The law contains no requirements or guidelines regarding the content of an AIA, such as the treatment of alternatives. However, it does empower the lead government agency to levy fines on project sponsors who violate the terms of its final determination.
- o Wastewater Discharge and Air Emission Permits. Wastewater discharge is now being managed under the Water Quality Law, perhaps the most developed of all the land use and environmental laws. The law defines detailed standards for the quality of various types of water, including potable water, wastewater discharge, irrigation water discharge, streams supporting fish, waters used for contact recreation, and general surface water bodies. The law provides analytical methods and outlines the responsibilities of all affected government agencies. The Ministry of the Environment and Natural Resources is responsible for working out remedial treatment agreements with all the industrial and municipal generators of water pollutants within a reasonable time frame.
- o Regional Development Plans (PROTs). The Ministry of Planning and Land Management is responsible, through its Regional Coordinating Commissions (CCRs), for preparation of comprehensive plans for the regions of Portugal. The PROTAML is still in process.

However, based on a review of the recently adopted PROT for the Algarve region, as outlined in the regulating law, No. 11/91, enacted on March 21, 1991, indicates that PROTs provide a comprehensive spatial framework for land use but are not legally binding.

- o Municipal Development Plans (PDMs). The plans of each municipality are the instruments that are intended to control land use. While only Moita has a formally adopted plan, the other peninsula municipalities report that their plans, which are now being updated, are generally being followed. However, the apparent weakness of implementation mechanisms and monitoring may limit overall effectiveness.

ANNEX E

TOOLS FOR GROWTH AND ENVIRONMENTAL MANAGEMENT

Three techniques are described in this annex, the trend growth model, ecological models, and land suitability mapping. They are suggested as ways of organizing available land use and environmental information to support the recommendations for more effective growth and environmental management presented in the body of the report.

Trend Growth Model

The potential effects of the major growth shapers, including the hypothetical growth scenarios described in Chapter 4 and located in Figure 8 of the report, should be checked more carefully by the CCRLVT and the peninsula municipalities. The following general types of information will allow preparation of a trend growth map:

- o land already identified as programmed expansion areas in the localities with approved or effective plans;
- o land designated for non-residential and non-industrial development that is:
 - essentially developable (i.e., free from extreme constraints such as very steep slopes);
 - in large ownerships with potential for subdivision;
 - land within the area of existing or proposed basic services; and
 - within easy access of existing and proposed major roads and expressways.

Examination of these factors, municipality by municipality would allow identification of those areas most susceptible to change, allowing a general identification of the probability of growth under existing conditions and as a result of the major projects.

Key Ecological Models

As a longer-term set of tools, we would suggest that the various sources and types of data that exist about the peninsula be compiled and synthesized in a more integrated manner than has been achieved to date. There is an excellent existing model that could be followed, prepared by the U.S. Fish and Wildlife Service; the Ecological Characterization of the Pacific Northwest Coast was prepared in 1978 for a coastal zone with similar traditional and highly valuable natural resource-based industries that were undergoing change as a result of economic crisis and the introduction of new types of industrial development. The Ecological Characterization of the Central and Northern California Coastal Region was prepared in 1980 for a similar region that was also under pressure for coastal residential development.

The Characterizations, which are available from the U.S. National Technical Information Service, begin with a series of diagrammatic models of the various physical, biological and socioeconomic systems at work in each region. The Characterizations also present:

- o Information on habitat requirements of both commercial species and the species on which they depend;
- o Description of each of the key ecosystems.

Information is then organized by drainage basin and referenced to the models and ecosystem and habitat descriptions. The advantage of this approach to organizing information is that it allows planners to understand the importance of particular elements of the environment to the health of many aspects of the economy.

A substantial amount of relevant data for the Setúbal Peninsula is understood to exist as a result of the work of such bodies as the Tagus-Sado Institute. Making a synthesis of that information more readily available would be of great mutual benefit to science, environmental interests, government, and industry.

Land Use Suitability Mapping

The work that is currently being undertaken for the PROTAML to identify the relative suitability of areas within the Setúbal Peninsula for industrial development (the ELIPS study) is a most appropriate effort. It would be desirable to expand this effort to identify relative suitabilities for other uses, including, for example:

- urban development;
- suburban development;
- rural residential development;
- agriculture and forestry, by type:
 - vines; crops; vegetables;
 - pines; cork oaks;
 - other, eucalyptus, etc.;
- open space for:
 - avoidance of natural hazards;
 - protection of scenic beauty;

- protection of surface and ground water quality, including aquifer recharge;
- protection of critical areas (wetlands, etc.);
- buffers around critical areas or areas and features of cultural or tourist interest;
- active recreation.

Identification of suitability for each use will require knowledge of the technical requirements of each use. Use of the suitability maps and resolution of competing suitabilities will require agreement on the relative importance of each type of use, from both economic and environmental viewpoints. This activity should receive priority at the regional level, drawing on values and available detailed information from the municipalities.

The resulting suitability synthesis would provide a sound and defensible basis for making land use planning decisions from the point of view of dynamic systems. The ELIPS industrial location study that is an ongoing part of the PROTAML could and should be expanded to cover all land uses. Because the CCRLVT uses a geographic information system, Intergraph, it should be relatively easy to prepare the suitability mapping once the requirements of the priority uses are identified.

Summary and Sequence of Studies

To recapitulate, the key recommended tools include, in sequence:

- o Analysis of historic growth trends, especially in relation to identified growth shapers,
- o Projection of future growth trends in the absence of controls,
- o Establishment of economic development and environmental quality goals and identification of priorities among resources,
- o Identification of the environmental or ecological requirements of those resources, and
- o The use of data assembled in the current planning efforts to prepare maps of the relative suitability of different parts of the peninsula for all of the uses and critical environmental elements.